Part 64. Foraminifera
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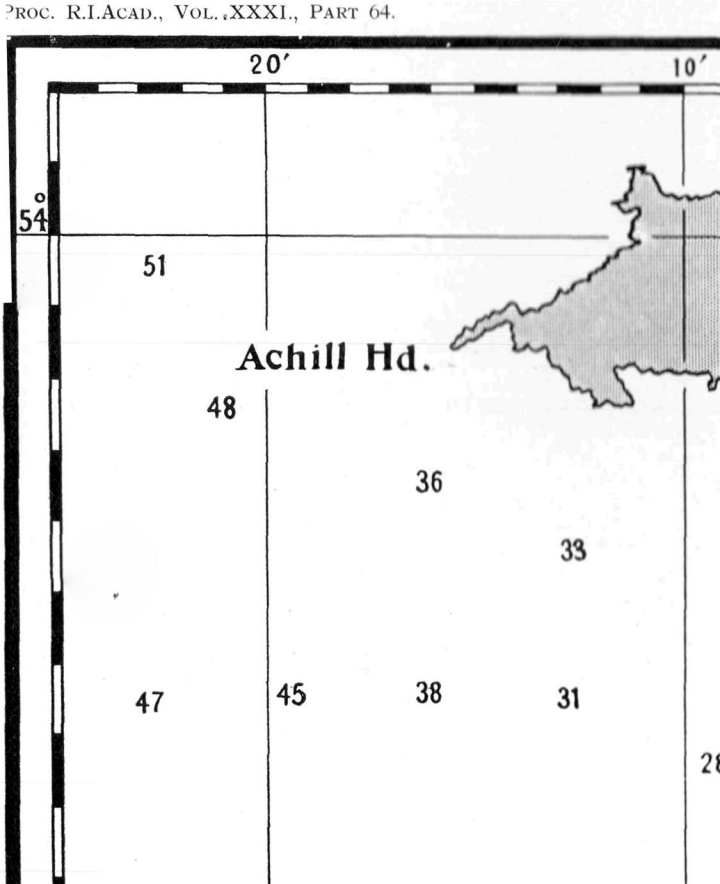

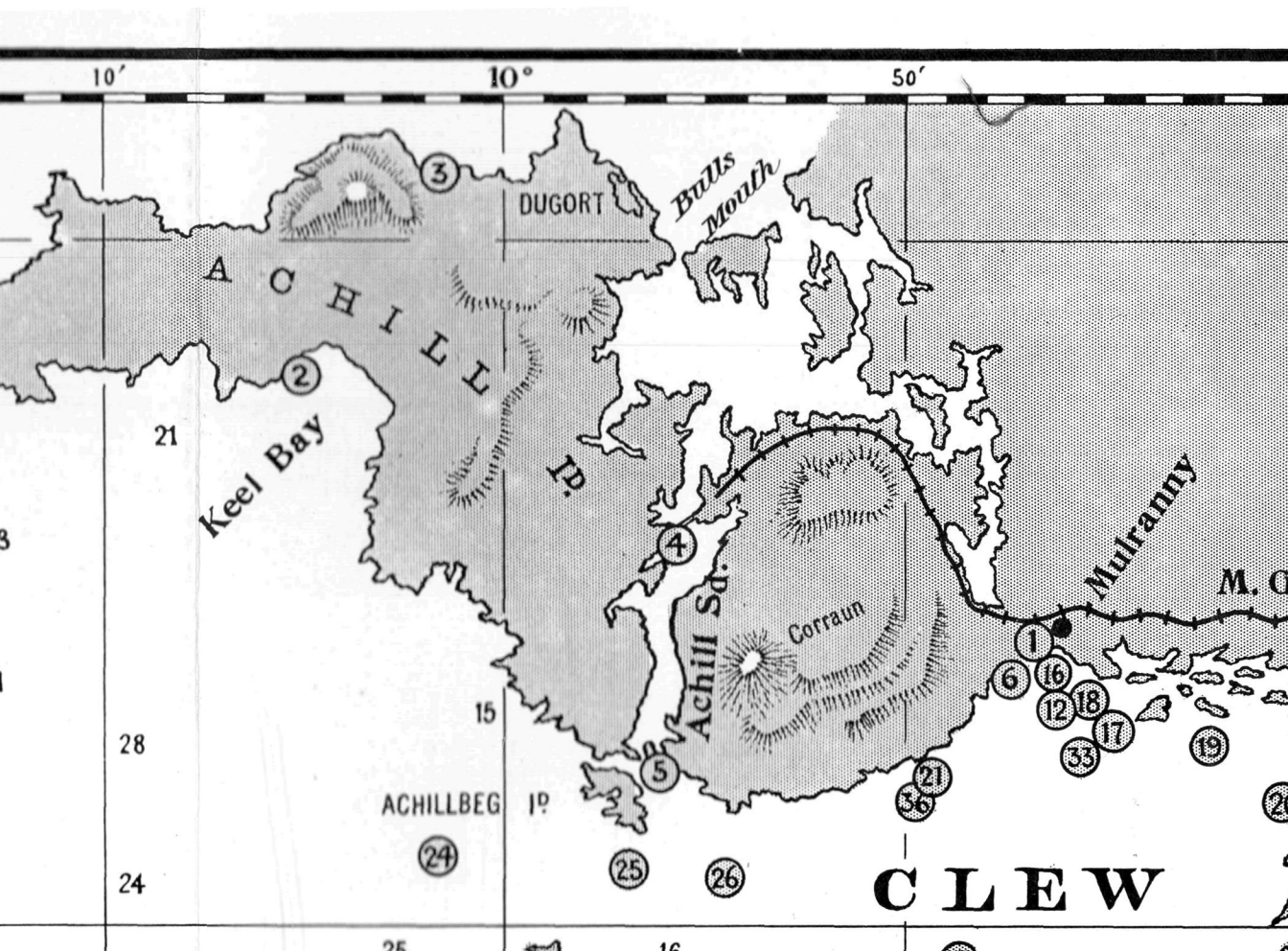

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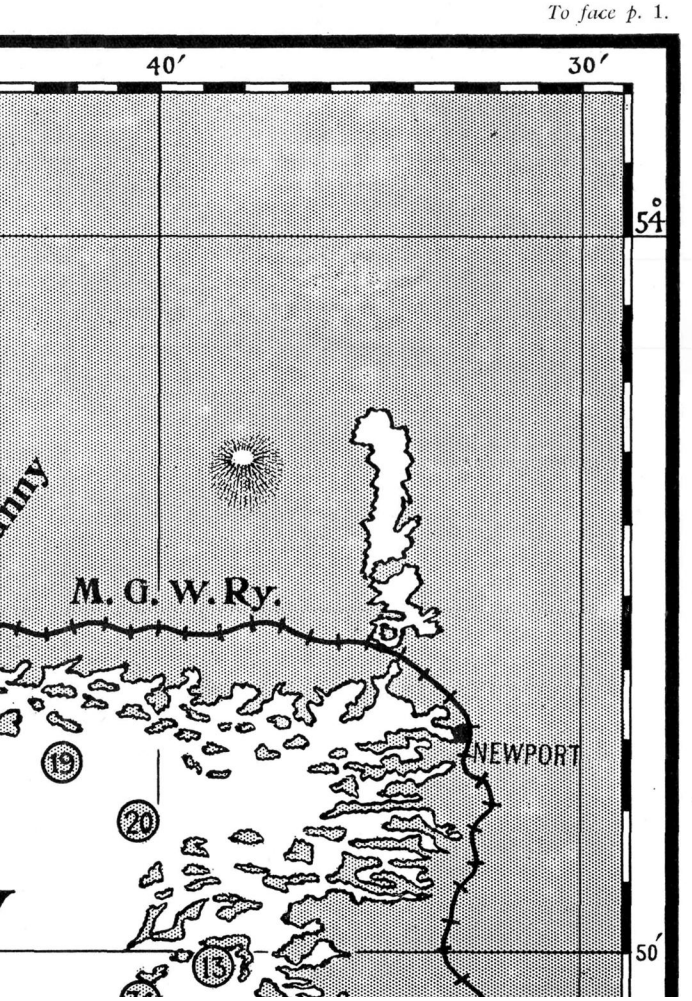
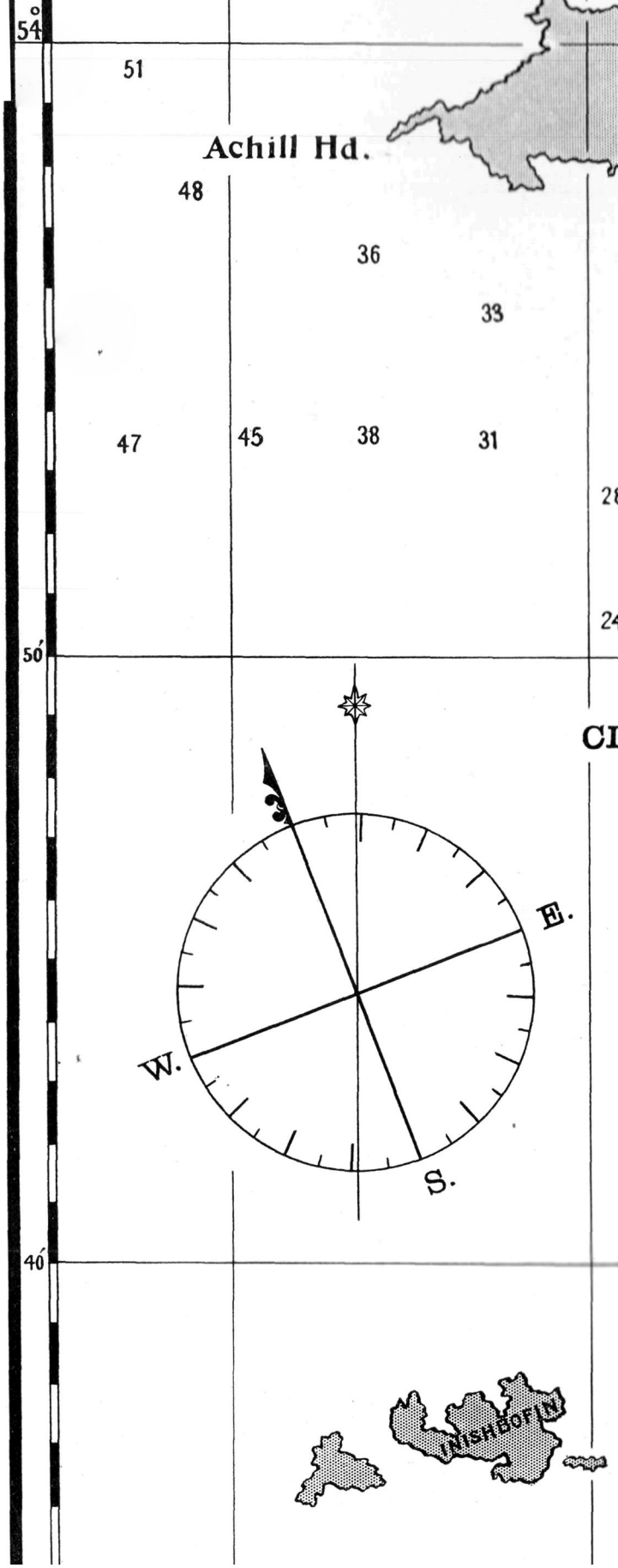
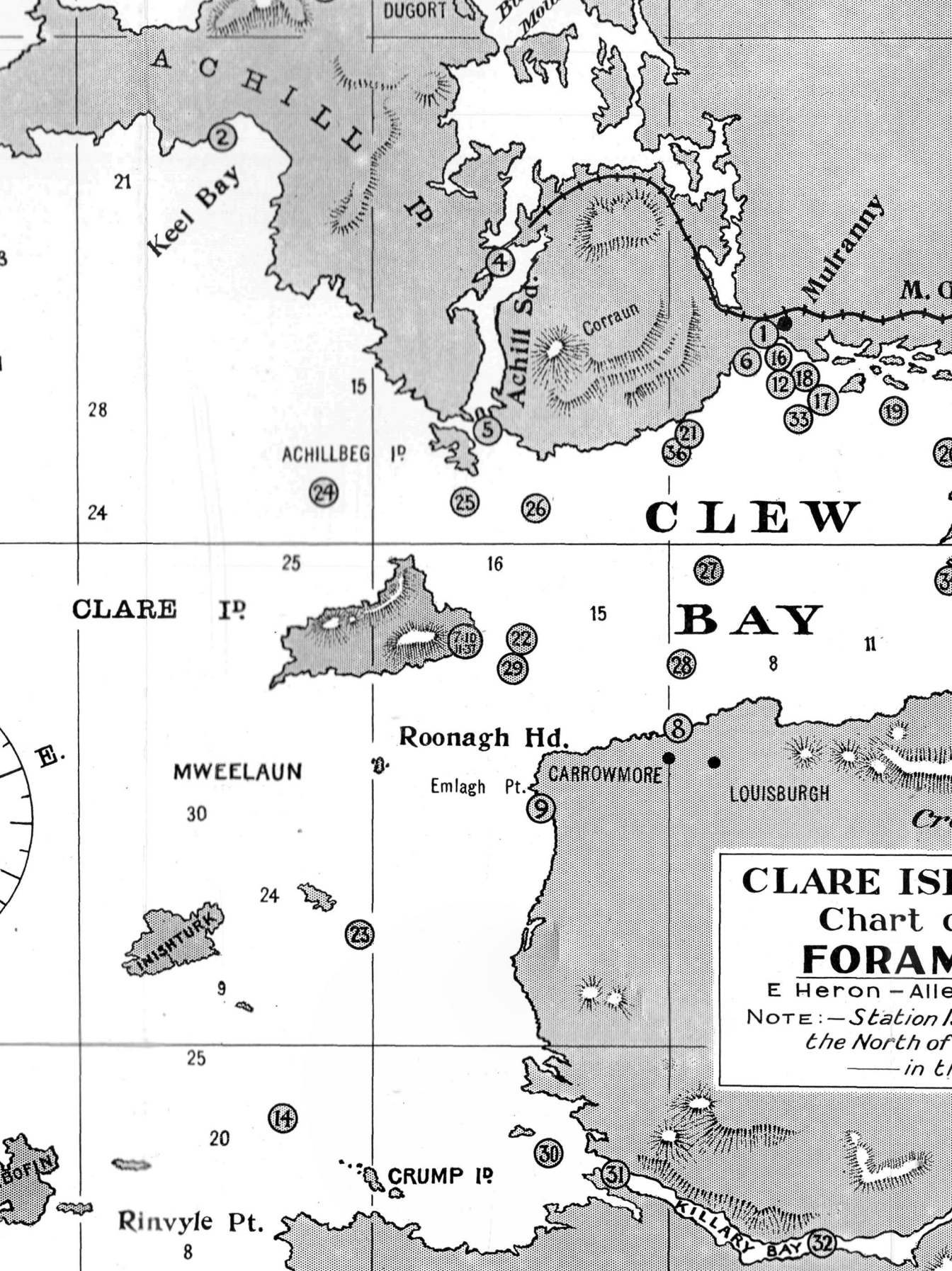
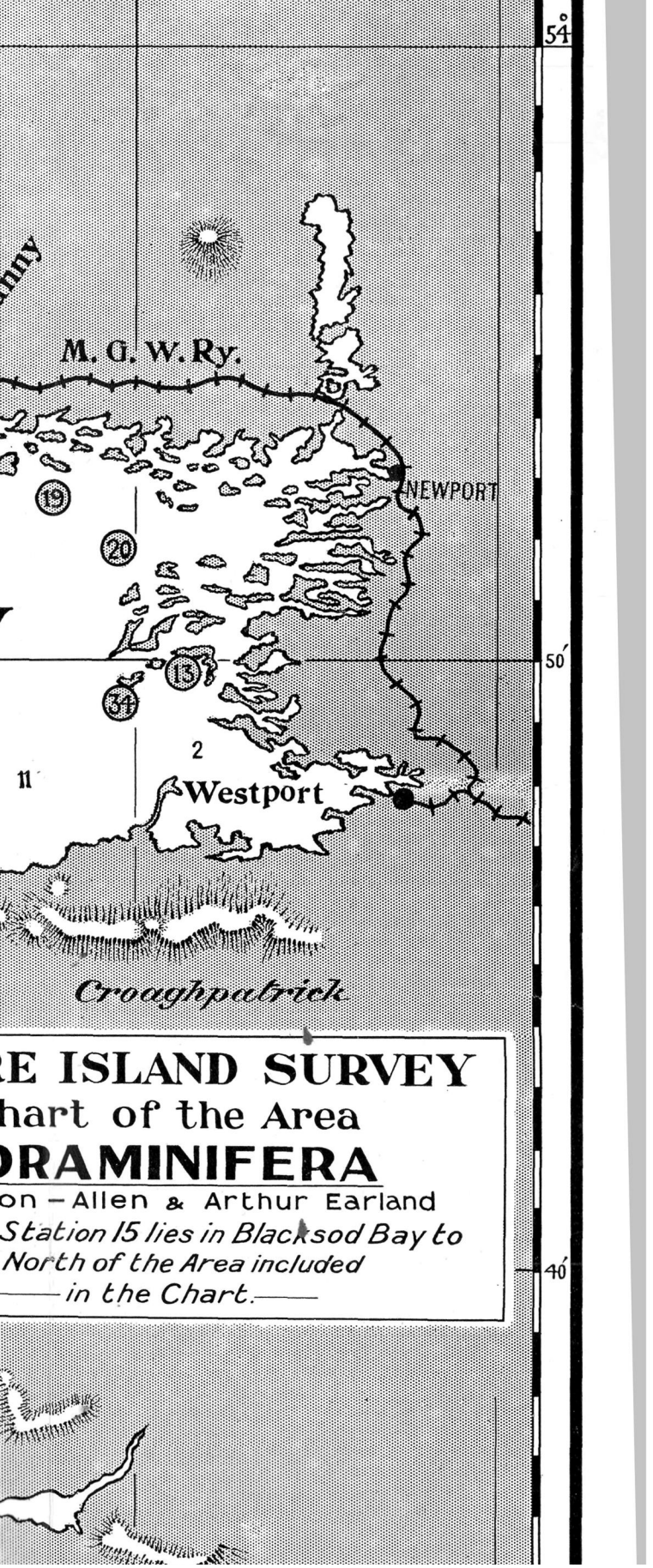
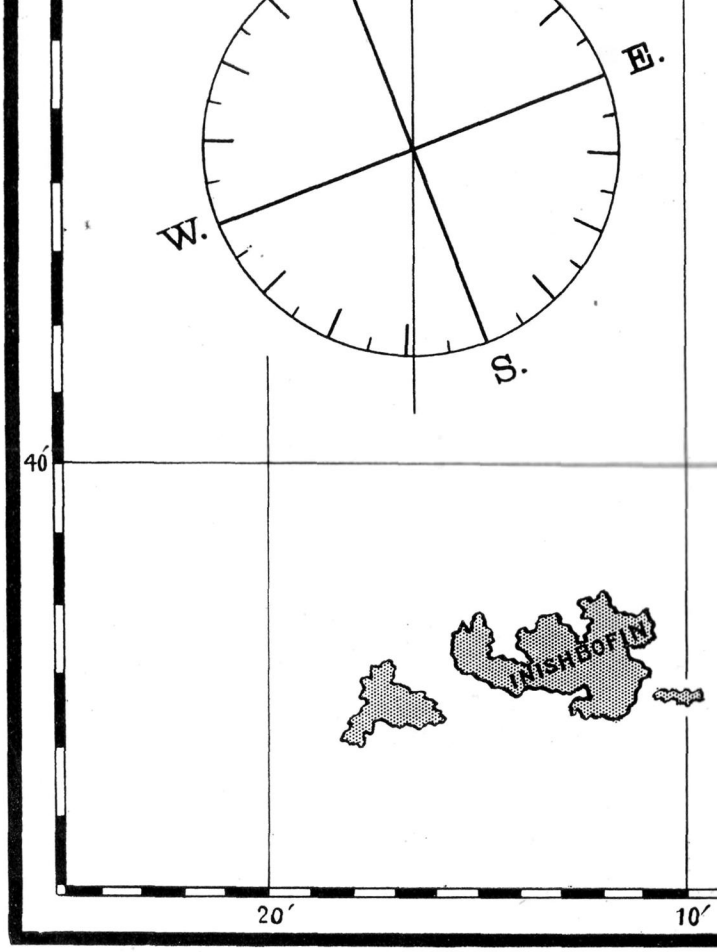
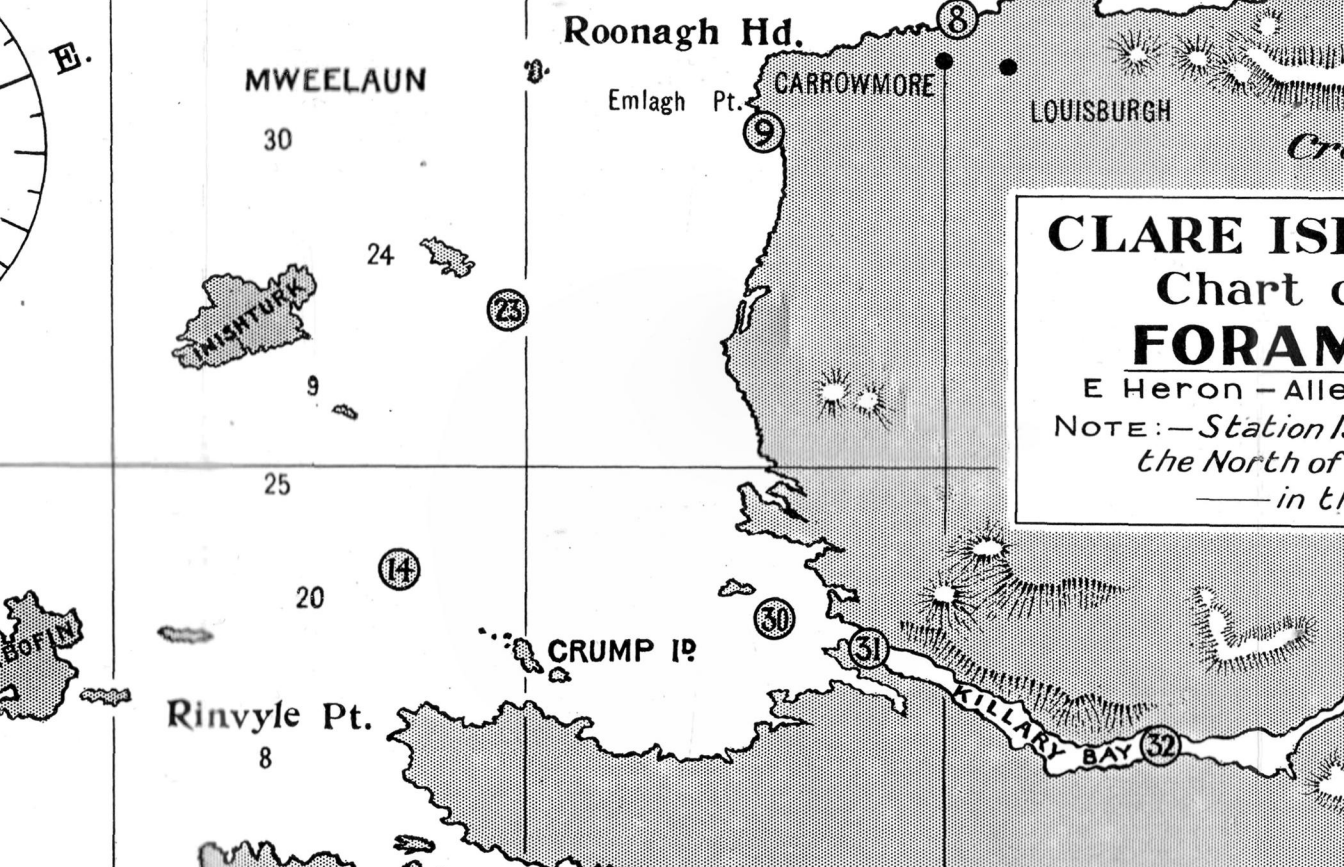




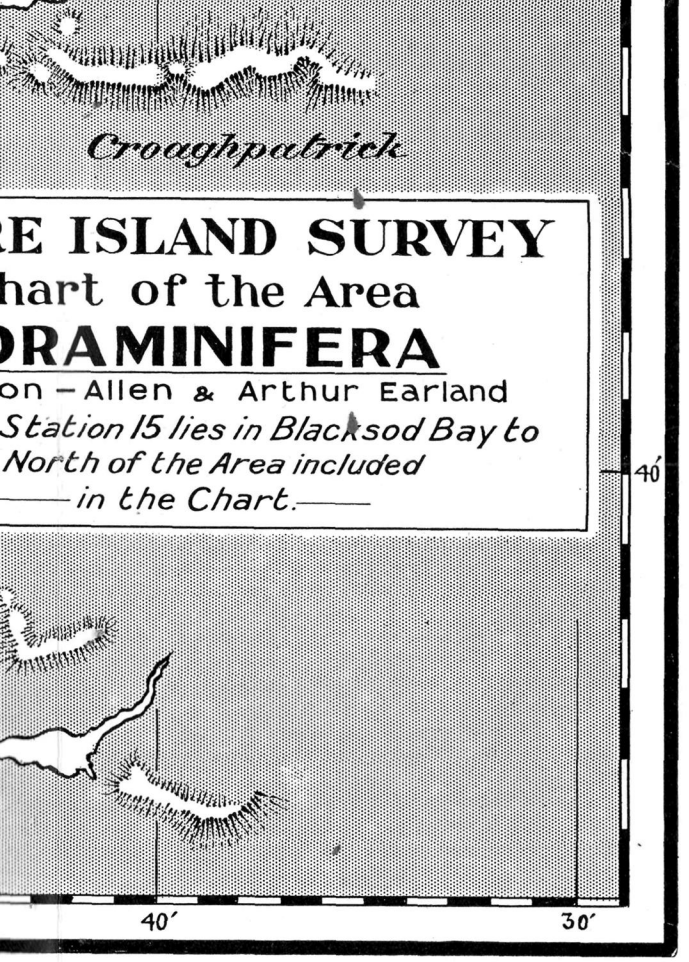








CLARE ISLAND SURVEY.—HERON-ALLEN & EARLAND : FORAMINIFERA.



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64.

FORAMINIFERA.

By EDWARD HERON-ALLEN, F.L.S., F.G.S., F.R.M.S., AND ARTHUR EARLAND, F.R.M.S.

PLATES I–XIII.

Read JUNE 9. Published NOVEMBER 21, 1913.

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INTRODUCTION.

LEAVING London on the 13th August, 1911, we travelled direct to Mulranny, where we made our headquarters at the hotel of the Midland Great Western Railway Co. The first few days were devoted to the beaches of the north shore of Clew Bay and the shores of Achill Island, and gatherings were made at suitable stations round the coast as far as Dugort Bay on the north side of Achill. Dredgings were also made from a small boat at several points among the islands at the eastern extremity of Clew Bay, and a quantity of Laminaria, &c., was obtained from the reefs at Minish Spit and examined, resulting in the discovery of Haliphysema.

After exhausting the shore stations on the mainland within the area of the Clare Island Survey, we crossed to Clare Island; and a series of shore gatherings were made on the "Strand" and in the rock-pools, supplemented by excursions by boats to Carrowmore Strand and Emlagh Bay, at both of which localities shore-sand material was collected. Dredgings were also made from the boat between Mulranny and Clare Island, and again between Clare Island and Carrowmore.

The splendidly appointed Fisheries Cruiser "Helga" having been placed at our service by Mr. E. W. L. Holt, through the kind offices of Mr. R. Ll. Praeger, a series of dredgings in deeper water were made. These were

To the generosity of the authors the Academy is indebted for the plates which accompany this report.

extended as far to the south as Killary Bay, which we have made the southern limit of the area included in our report. A separate excursion was made by car from Clifden to the famous beach at Dog's Bay near Roundstone, and extensive gatherings were obtained there; but we prefer to exclude this material from consideration in the present report, although we hope at some future time to deal with that district at some length, and to supplement Mr. Joseph Wright's publications on the area.

Our material thus becomes divided naturally into two classes, shore-sands and shallow-water dredgings. There is no deep water anywhere within the area embraced by the Survey, the 100-fathom line being about forty-five miles to the west of Clare Island, while the edge of the Continental Shelf is in this latitude quite 200 miles west of the coast-line.

Dealing first with the shore-sands, there are very few points on the shores of Co. Mayo which are not precipitous or rock-bound; but in these few bays where shore-sand accumulates, it stretches in broad, smooth sheets, often bounded at one or both ends by alga-covered rocks from which the tide recedes gently and slowly, leaving a rich strewing of shell debris and Foraminifera on the surface of the sand. Moreover, the bays lie open as a rule to the south or west, *i.e.* in the direction of the prevalent winds, to which we may ascribe the presence in our gatherings of numerous species not commonly found in shore-sands. The conditions for the collection of shore material could, therefore, hardly be improved upon, but for the fact that molluscan debris forms a larger percentage than usual of the shore scrapings, and the difficulty of separating this debris from the Foraminifera has rendered the examination of the material a very lengthy and arduous task. The presence also in most of the shore-sands of large and heavy forms which do not "float" (such as *Textularia gramen, Gaudryina rudis, Truncatulina refulgens,* and large masses of *Gypsina inhaerens*) imposed on us the labour of examining quantities of unfloated material, with results compensating but poorly for the time involved.

On Clare Island itself the only sandy beach lies adjacent to the harbour at the eastern extremity, the rest of the shore being rock-bound and precipitous. This eastern strand is rich in material which is doubtless deposited there, as in an eddy, by the tidal currents which sweep round the northern and southern shores of the island.

As regards the dredged material, the sea-bottom within the area of the Survey falls naturally into three categories. All round Clare Island and westwards for a great distance, towards the edge of the Continental Shelf, is rough ground with a fairly uniform depth of from 15 to30 fathoms. Dredging operations cannot be carried out on such a bottom save with great

difficulty and risk of loss and damage to gear, but there are occasional patches of sand and gravel between the submarine reefs, and Stations 23, 25, 26 represent the fauna obtainable from such localities.

There is little doubt that wave-action extends to the bottom over the greater part of this area in rough weather. This factor and the absence of algae, owing to depth, would to some extent militate against rhizopodal life. But the rough ground doubtless contains a rich fauna of its own, largely composed of adherent forms, and, with the zones of alga-covered rocks in the shallower water, is probably the chief source of origin of the Foraminifera found in the shore deposits.

Inside Clew Bay, between Clare Island and the islands at the head of the bay, the bottom is covered more or less uniformly with a grey-brown sand, largely composed of organic debris (Mollusca, Echinodermata, and Foraminifera). It varies in coarseness according to depth and distance from the shore, and here also there are patches of rough ground; but, speaking generally, the bottom deposits of the bay are surprisingly uniform in appearance and in the facies of their fauna over the whole area. There is no great range of depth, which varies between 5 and 15 fathoms.

Among the islets which constitute a veritable archipelago at the head of the bay there is, on the other hand, great variety of bottom conditions, ranging from rough ground and gravel to quartz-sands and shell-sands and deep mud. Unfortunately we were unable to work in these waters from a ship of such dimensions as the "Helga," and the distance from Mulranny made dredging from a small boat a long and tedious business. Several dredgings were, however, made among the islets at the north-west extremity of the bay; and it has proved a matter for subsequent regret that we were not able to devote more time to this area, as the material obtained has yielded results of surprising interest. Numerous species of great rarity have been found at these stations, including many not previously recorded in Great Britain and not a few that are new to science.

The Killary Bay dredgings vary from mud to muddy sand, and differ considerably in the nature of their fauna from those of other stations, bearing a close resemblance to some of Mr. Joseph Wright's dredgings from the south-west of Ireland.

The Clare Island area has not previously formed the subject of any rhizopodal study beyond the scanty list of species recorded by Brady in 1870 from brackish water in the neighbourhood of Westport (B. 1870, FTR, p. 281). It is to be regretted that we overlooked the existence of this list until after our return to London. It would have been very instructive to have made fresh collections from Brady's localities, if they are still available

for collecting, and so to have verified his lists, especially with the view of recording any changes of the fauna which may have arisen during the interval of more than forty years. Southwards Mr. Joseph Wright has published an exhaustive list of Foraminifera from Dog's Bay in the Roundstone district,[1] all of which, with the exception of *Biloculina irregularis* d'Orbigny, have been found at Clare Island. Mr. Welch has visited the somewhat similar beach-deposit of Narin, Co. Donegal, to the north,[2] but has not furnished any list of species or precise observations on the deposit. The most important contribution to the literature of the rhizopodal fauna of the district is Messrs. Balkwill and Millett's "Foraminifera of Galway," 1884, and Revision, 1908. We trust that our researches, which may be regarded as fairly exhaustive for Clew Bay and the adjacent coasts, may therefore prove of interest as a contribution to the rhizopodal fauna of Ireland.

In an area so restricted in its zoological capacities by depth and the uniform character of the sea-bottom, it was not to be expected that any discoveries of a startling character would be made. But the results appear to us to help to confirm the theory that many southern species, hitherto regarded as almost sub-tropical, are gradually extending their range into the North Atlantic and North Sea by way of the west coast of Ireland. Definite proof of this has long been forthcoming in the case of some of the higher organisms; but the first evidence in support of the theory as regards the Foraminifera was supplied by Earland some years ago when he dredged in the Moray Firth and Orkneys *Nubecularia lucifuga, Lingulina pellucida*, and other southern species, some of which were then known only from the Mediterranean. It is with considerable satisfaction, therefore, that we now record these same species from the Clare Island district; and we anticipate that they will be found in suitable material from other points on the west coasts of Ireland and Scotland as soon as they are especially sought for.

Most of the stations have yielded long and interesting lists of species. There is of course a great similarity between the faunas of all the stations, as might be expected in such a limited area, and between fifty and sixty species are common to practically all the stations worked. But nevertheless nearly every station presents some feature of special interest, or peculiar to itself, either in the presence in considerable numbers of some species absent or comparatively rare elsewhere, or in the occurrence of some typical species in great numbers, sometimes in an ultra-typical form, and at other times in the form of a definite local variety.

[1] "The Foraminifera of Dog's Bay, Connemara." Irish Naturalist, 1895, vol. iv, p. 252; and 1900, vol. ix, p. 51.

[2] "Narin Foraminiferous Strand, Co. Donegal, West Coast, with some Notes on Dog's Bay." Trans. Micr. Soc. Manchester, 1908, p. 71.

The subjoined list of stations contains references to the dominant types observed in each gathering, as well as a record of the rarer or more interesting species noted. With the exception of stations 12–15, which are dredgings made by the "Helga" prior to our visit (the material from which was kindly placed at our disposal by the Fisheries authorities), all the stations represent our own gatherings, and as an exhaustive examination of the floatings from about a quart of material was made in each instance, besides about 350 cc. of heavy washings, the subjoined lists may be regarded as fairly representative and probably final. Among the islands only is it likely that further dredgings would add much to our lists. The examination of the material has occupied us without intermission for some eighteen months.

We desire to take the present opportunity of recording our thanks to the Secretary of the Survey Committee, Mr. R. Lloyd Praeger, for much valuable advice, and also for procuring the loan of dredging apparatus, &c.; also to Mr. E. W. L. Holt and the Fisheries Branch of the Department of Agriculture and Technical Instruction for extending to us the privilege of making dredgings from the "Helga," and to Captain Thompson and the scientific staff of the ship, Messrs. G. P. Farran and R. Southern, for their hospitality and the facilities they so heartily granted for our work.

New or rare Species obtained.

In the List of Species identified from the 37 stations from which we gathered and examined material, it will be observed that there are 14 species new to science, 32 new to the British Islands, and 20 of which only a single previous British record exists, whilst of the specimens new to the British Isles 7 are recorded for the first time as living Foraminifera, having been already recorded as British fossils, for the most part post-Pliocene or sub-Recent. A tabular list of these species is appended.

Species and Varieties new to Science.

Planispirina Cliarensis.
Bathysiphon argenteus.
Bolivina inflata.
Lagena chrysalis.
Lagena unguis.
Lagena forficula
Lagena cymbula.
Lingulina quadrata.
Frondicularia translucens.
Discorbina Praegeri.
Discorbina baccata.
Discorbina pustulata.
Discorbina Chasteri var. bispinosa.
Rotalia perlucida.

SPECIES AND VARIETIES NEW TO THE BRITISH ISLES.

Nubecularia depressa *Chapman.**
Spiroloculina grata *Terquem.*
Miliolina vulgaris *d'Orbigny* sp.
circularis var. sublineata *Brady.*
pygmaea *Reuss* sp.
stelligera *Schlumberger* sp. (not *Terquem*).
laevigata *d'Orb.* sp.
Massilina annectens *Schl.*
Hippocrepina indivisa *Parker.*
Bolivina gramen *d'Orb.* sp.
limbata *Brady.*
Lagena ovum *Ehrenberg* sp.
laevis var. distoma *Silvestri.*
Stewartii *Wright.**
marginata var. semi-carinata *Sidebottom.*
formosa *Schwager.*
Lingulina carinata var. bicarinata *Sideb.*
armata *Sideb.*
pellucida *Sideb.*
Frondicularia pygmaea *Sideb.*
spathulata *Brady.*
Cristellaria acutauricularis *Fichtel & Moll.* sp.*
Globigerina cretacea *d'Orb.**
Spirillina Groomii *Chapman.**
obconica *Brady.*
var. carinata *Halkyard.*
limbata var. denticulata *Brady.**
Discorbina irregularis *Rhumbler.*
Araucana *d'Orb.* sp.*
Pulvinulina punctulata *d'Orb.* sp.
Brongniartii *d'Orb.*
crassa *d'Orb.* sp.

SPECIES HERE RECORDED FOR THE SECOND TIME AS BRITISH.

Miliolina valvularis *Reuss* sp.
rotunda *d'Orb.* sp.
Cornuspira diffusa *H.-A. & E.*
Selseyensis *H.-A. & E.*
Psammosphaera Bowmanni *H.-A. & E.*
Cassidulina nitidula *Chaster* sp.
Seabrookia Earlandi *Wright.*
Lagena falcata *Chaster.**
Malcomsonii *Wright.**
marginato-perforata *Seguenza.**
Lagena (*continued*).
protea *Chaster.*
Rizzae *Seguenza* sp.
Lingulina biloculi *Wright.**
Truncatulina tenuimargo *Brady.*
Discorbina Millettii *Wright.**
polyrraphes *Reuss.* sp.*
Pulvinulina vermiculata *d'Orb.* sp.
haliotidea *H.-A. & E.**
Nonionina pompilioides *Fitchel & Moll* sp.

Discorbina minutissima Chaster now becomes *D. Chasteri* H.-A. & E. (vide p. 128), and *Pulvinulina nitidula* Chaster becomes *Cassidulina nitidula* Chaster sp. (vide p. 70).

The following species of Discorbina have been revived under our scheme :—

D. Mediterranensis *d'Orb.* sp.
D. Peruviana *d'Orb.* sp.
D. mamilla *Will.* sp.
D. planorbis *d'Orb.* sp.

* Signifies that the species has been recorded previously as a fossil.

CATALOGUE OF STATIONS AND NOTES UPON THE MATERIAL EXAMINED.

No. 1. MULRANNY (Mallaranny), Clew Bay. Shore gathering No. 1. Inside the harbour.

A large enclosed natural bay or cove, protected by harbour-works to the S.W. with an entrance and bar half a mile from the inner shore. Dry at low tide with stretches of quicksand and banks of mollusca and shell-detritus Several fresh-water streams come in from the land at various points, forming channels of brackish water to the harbour-mouth. Sample: a rather dirty fawn-coloured sand.

Coarse siftings:—Large tests of *Massilina secans, Truncatulina lobatula* and *variabilis,* and *Polystomella crispa.*

Noteworthy species:—*Marginulina costata* (1), *Ophthalmidium carinatum, Gaudryina rudis* (c.), *Polymorphina myristiformis* (c. a typical bilobate and compressed form), *Gypsina vesicularis* (1), *Pulvinulina haliotidea* (1), *Bulimina subteres* (1).

No. 2. KEEL BAY, Achill Island. Shore gathering No. 2.

A broad open bay with a wide stretch of smooth sand. Alga-covered rocks at west end. Rich foraminiferal deposits above and between tide-marks. Sample: a brilliant white fine sand with much mica. Floatings, principally *Truncatulina lobatula,* with some molluscan fragments.

Coarse siftings:—Large tests of *Massilina secans, Truncatulina lobatula, Gypsina inhaerens, Discorbina globularis, Pulvinulina auricula, Polymorphina gibba, Gaudryina rudis, Miliolina bicornis* and *Brongniartii.*

Noteworthy species:—*Discorbina globularis* and *rosacea,* typical, and all intermediate forms (v.c.); *Ammodiscus gordialis* (r.), *Lagena marginata* (r.), *Haplophragmium globigeriniforme* (c.), *Gypsina vesicularis* (1), *Lagena squamosa* var. *Montagui* (1). (See Addenda, p. 187.)

No. 3. DUGORT BAY, Achill Island (north). Shore gathering No. 3.

A small bay of rather sharp, reddish sand. Foraminifera few, thinly spread and in isolated patches. Gatherings made at half-tide. Floatings fairly pure. Sample: a reddish yellow (flesh-coloured) sand with much mica.

Coarse siftings:—Enormous tests of *Massilina secans* and pieces of *Gypsina inhaerens* (v.c.), large *Truncatulina lobatula* (c.), *Discorbina globularis* (c.), *Miliolina subrotunda* (c.), *Pulvinulina auricula* (f.), *Polystomella crispa* (f.)

Noteworthy species:—*Gypsina globulus* (1), *G. vesicularis* (f.), *Polymorphina compressa* (f.), *Polystomella macella* (f.), *Vaginulina legumen* (1).

No. 4. ACHILL SOUND. Tidal mud-banks S.W. of bridge. Shore gathering No. 4. Mud-flats with patches of sand with much land and house drainage coming down. Sparse strewings of Foraminifera on the mud, not collectable.

Sample: muddy, baled from ridges of tide-washed shells just below the water-line. Few species of Foraminifera and a notable absence of brackish-water or estuarine forms. A good deal of coal-dust.

Coarse siftings:—Large *Truncatulina lobatula* and *Rotalia Beccarii, Nubecularia lucifuga, Massilina secans, Miliolina Brongniartii,* large *Gypsina inhaerens.*

Noteworthy forms:—*Gypsina globulus* (c., of all sizes), *Trochammina squamata* and *ochracea* (1), *Bulimina elegantissima* (1), *Polymorphina compressa, Pulvinulina repanda* (r.), *Discorbina rosacea* (flat, irregular and domed types).

No. 5. CURRAUN STRAND, opposite Achillbeg. East shore of south end of Achill Sound. Shore gathering No. 5.

Patches of rock-bound sand, in land-locked bays. Foraminifera very scarce and thinly strewn on a coarse sharp flesh-coloured sand mixed with shell-detritus and coal-dust. Sample: about 125 cc. obtained by elutriation of a large quantity of surface-scrapings.

Coarse siftings:—Large tests of *Rotalia Beccarii, Massilina secans, Gaudryina rudis, Polymorphina gibba, Pulvinulina auricula* and *repanda, Gypsina inhaerens* and *vesicularis, Truncatulina lobatula.*

Noteworthy forms:—*Reophax Scottii* (1), *Trochammina ochracea* (r.), *Cristellaria crepidula* (r.), *Lagena ornata* (1), *Discorbina Chasteri* (1), and *Pulvinulina haliotidea* (r.).

No. 6. MULRANNY (Mallaranny), Clew Bay. Outside the harbour. Shore gathering No. 6.

A narrow stretch of smooth sharp yellow sand, outside the harbour works, extending to the N.W. Rather steep, and confined by an artificial dyke of rounded boulders. Thick deposits of Foraminifera and molluscan fragments. Sample: bright yellow-grey. Principally *Truncatulina lobatula* and a vast range of *Discorbinae,* from *D. globularis* through *rosacea* (all forms) to *Wrightii.* Some coal-dust and a little mica.

Coarse siftings:—Very large tests of *Gypsina inhaerens* (c.), *Polymorphina gibba* (c.), *Pulvinulina auricula* (c.).

Noteworthy forms:—*Orbulina universa* (with enclosed Globigerina, 1), *Textularia agglutinans* (1), *Truncatulina refulgens* (f.), *Gypsina vesicularis* (f.), *Polymorphina myristiformis* (f., bilobate and compressed), *Nubecularia lucifuga* (r.).

No. 7. CLARE ISLAND. The Strand. Shore gathering No. 7. First gathering made 16th August, 1911.

No. 10. CLARE ISLAND. Shore gathering No. 10. Light elutriated material, baled from wave-ripples as they broke upon the sand, 17th August, 1911.

No. 11. CLARE ISLAND. Shore gathering No. 11. Scraping made 23rd August, 1911, at low spring-tide.

The only sand-beach on Clare Island, a smooth stretch of clean white sand, facing east, bounded on the north by alga-covered rocks, and with coral-lines growing in the pools. Sample: The three gatherings washed and floated separately. A second floating made from the remainder of the samples mixed together. A third floating made from the same remainders, after re-washing. 5 cc. of each floating (25 cc. in all) mixed together and examined.

Coarse siftings:—*Nubecularia lucifuga* (f.), *Truncatulina lobatula* and *variabilis*, *Miliolina bicornis*, *Gypsina inhaerens*, *Massilina secans*, *Biloculina depressa*.

Noteworthy forms:—*Spiroloculina excavata* (f.), *Polymorphina compressa* (f.), *Cristellaria crepidula* (2), *Nodosaria pyrula* (1) and *scalaris* (1), *Trochammina ochracea* (1), *Truncatulina Ungeriana* (1), wild-growing forms of *Discorbina rosacea* (c.), *Lagena squamosa* var. *Montagui* (1), *Spiroloculina limbata* (r.).

No. 8. CARROWMORE STRAND. Louisburgh, Clew Bay, S.E. of the pier. Shore gathering No. 8. A broad bay of smooth yellow sand, interspersed with alga-covered rocks. Sample: a typical shore-sand, largely consisting of molluscan fragments and *Truncatulina lobatula*. Much mica.

Coarse siftings (small proportion of sample):—*Massilina secans* (c.), *Gypsina inhaerens*, large *Polystomella crispa*, *Miliolina subrotunda* (r.); principally *Truncatulina lobatula*.

Notable forms:—*Spiroloculina limbata* (1), *Bulimina marginata* (1), *Discorbina parisiensis* (1), *Nonionina asterizans* and *stelligera* (r.), *Bulimina subteres* (1), wild-growing *Truncatulina variabilis* (f.), *Gypsina vesicularis* (f.) and *globulus* (1), *Pulvinulina crassa* (1).

No. 9. EMLAGH BAY, Co. Mayo, south of Emlagh Point. Shore gathering No. 9. A broad smooth stretch of white sand, facing W.S.W. Rich layer of Foraminifera above and between tide-marks. Sample: a typical brilliantly white Foraminiferal shore-sand. Floatings, pure Foraminifera, largely *Truncatulina lobatula*, with Echinoderm spines and debris, &c. Some mica.

Coarse siftings:—Large masses of *Gypsina inhaerens* (c.), *Massilina secans* (c.), *Truncatulina lobatula* and *Discorbina globularis*, *Miliolina bicornis* and *Brongniartii*, large and wild-growing *Miliolina subrotunda* (all f.)

Noteworthy forms:—*Discorbina globularis* of all sizes and types, *Nubecularia lucifuga* (f.), *Cristellaria crepidula* (1), *Truncatulina refulgens* (f.), *Biloculina depressa* (f.), *Polymorphina compressa* (f.), *Gypsina vesicularis* (c.), *Orbulina universa* (1, with enclosed Globigerina).

No. 12. CLEW BAY. Dredging s.s. "Helga" W. 106 (23rd August,

1909), 53° 52′ 30″ N., 9° 49′ W., 0·7 mile south of Mulranny pier. 5½–11 fms.

Three oz. of very fine light fawn-grey sand, with very little coarse material. Much mica. Foraminifera of all the smaller types abundant.

Coarse siftings:—*Massilina secans, Gaudryina rudis, Textularia gramen, Pulvinulina repanda* var. *concamerata, Discorbina globularis, Truncatulina lobatula, Rotalia Beccarii, Gypsina inhaerens.*

Noteworthy forms:—*Discorbina Chasteri* (f.), *Ophthalmidium carinatum* (1), *Miliolina fusca* (r.), *Ammodiscus incertus* (r.), *Reophax Scottii* (r.), *Ammodiscus Shoneanus* (1), *Seabrookia Earlandi* (1), *Cassidulina nitidula* (r.), *Discorbina Millettii* (r.) and *Wrightii* (v.r.), *Frondicularia spathulata* (1), *Clavulina obscura* (v.r.), *Cristellaria crepidula* (r.), *Lagena gracilis* (r.), *Lingulina biloculi* (v.r.), and many other rare forms.

No. 13. Clew Bay. Dredging s.s. "Helga" W. 108 (25th August, 1909), 53° 51′ 30″ N., 9° 38′ 20″ W. Inishgowla Harbour (among the islands), 4 fms.

About 2 oz. of tenacious grey sandy mud with molluscan shells and fragments. Much algal debris and filamentous material. Diatoms abundant. Much mica.

Coarse siftings:—*Spiroloculina planulata* and *excavata, Miliolina bicornis* and *seminulum, Haplophragmium pseudospirale, Truncatulina lobatula, Rotalia Beccarii.*

Finest siftings consisted almost entirely of clean Lagenidae.

Noteworthy forms:—*Biloculina elongata* (1) and *ringens* (v.r.), *Miliolina fusca* (r.), *Reophax Scottii* (c.), (r.), *Frondicularia spathulata* (r.), and *pygmaea* (1), *Lagena hispida* (1), *gracilis* (1), *ornata* (f.), *marginato-perforata* (f.), &c., *Nodosaria soluta* (1), *pyrula* (r.), *plebeia* (r.), *Lingulina biloculi* (c.). *pellucida* (v.r.), *Pullenia sphaeroides* (1), *Cristellaria acutauricularis* (1), *Operculina ammonoides*, and many other rare forms.

No. 14. Clare Island. Dredging s.s. "Helga," W. 84 (2nd April, 1909), 53° 38′ 30″ N., 10° 3′ W., 1–4 miles NW. & N. of Corwell, off Crump Island, 24 fms.

A flesh-coloured coarse mixture of shell-gravel and sand. Much molluscan detritus.

Coarse siftings:—*Biloculina depressa, Pulvinulina auricula* and *repanda, Textularia gramen, Gypsina inhaerens, Truncatulina lobatula.*

Noteworthy forms:—*Nubecularia lucifuga* (1), *Biloculina bulloides* (r.), *Miliolina Candeiana* (f.), *Valvulina fusca* (r.), *Ammodiscus incertus* and *gordialis* (r.), *Bulimina subteres* (1) and *aculeata* (r.), *Reophax moniliforme* (r.), *Saccammina sphaerica* (1), *Spirillina obconica* var. *carinata* and *S. limbata*

var. *denticulata* (r.), *Gypsina vesicularis* (r.), *Psammosphaera fusca* (1), *Crithionina mamilla* (1).

No. 15. Blacksod Bay (Feorinyeo Bay). Dredging s.s. "Helga," W. 181 (15th March, 1911), 54° 8′ 30″ N., 10° 3′ W. 3 fms.

A fine grey-fawn muddy sand with coarse molluscan fragments.

Coarse siftings :—Large tests of *Miliolina seminulum, bicornis, subrotunda, sclerotica, Massilina secans* and var. *tenuistriata, Polystomella crispa, Truncatulina lobatula, Discorbina globularis.*

The next grade of siftings consisted of 95 per cent. *Polystomella crispa* and *Rotalia Beccarii.*

Noteworthy forms :—*Spirillina Groomii* (1), *Ophthalmidium carinatum* (1), *Miliolina fusca* (f.), *Reophax moniliforme* (r.), *Trochammina rotaliformis* (f.), *Bulimina minutissima* (v.r.), *Psammosphaera Bowmanni* (1), *Gaudryina filiformis* (v.r.), *Cristellaria cultrata* and *crepidula* (v.r.), *Lagena marginato-perforata* (r.), *bicarinata* (1), *fimbriata* (1), &c., *Discorbina Chasteri* (r.), *Millettii* (r.), *Bertheloti* (1), *Operculina ammonoides* (1), *Nodosaria pyrula* (1), *Hyperammina vagans* (1), *Hippocrepina indivisa* (1).

No. 16. Clew Bay. Dredging s.s. "Helga," W. 215 (21st August, 1911), $2\frac{1}{2}$ S. × W., $\frac{1}{4}$ W. (true) of Mulranny pier, 9–11 fms.

The dredge came up without any sand or bottom-material, but full of Laminaria, on whose roots were found *Haliphysema ramulosa* and *Tumanowiczii.*

No. 17. Clew Bay. Off Long Point, Minish Island. Roots of Laminaria with Haliphysema, gathered from the boat.

No. 18. Clew Bay. Dredging H.-A. and E. No. 1. Between Mulranny and Long Point, Minish Island, 6 fms.

A fine elephant-grey muddy sand, with much mica, but no molluscan fragments, and very little coarse material, yielding *Massilina secans* and large tests of *Textularia gramen.*

Noteworthy forms :—*Biloculina ringens* (1), *Miliolina pulchella* (r.), *Haplophragmium pseudospirale* (r.), *Gaudryina filiformis* (f.), *Textularia agglutinans* (r.) and *concava* (r.), *Reophax fusiformis* (r.), *moniliforme* (r.), *findens* (v.r.), *Nodosaria scalaris* (f.), *Bulimina subteres* (1), *Lagena squamosa* var. *Montagui* (r.), *Lyellii* (v.r.), *protea* (v.r.), *Discorbina Millettii* (1), *Cristellaria crepidula* (v.r.).

No. 19. Clew Bay. Dredging H.-A. and E. No. 2. Among the islands. 12 fms.

A fine sandy grey mud with much algal debris and molluscan fragments. Very little coarse material, yielding *Massilina secans* and *Truncatulina lobatula* (c.), *Haplophragmium pseudospirale* and *Reophax scorpiurus.*

The finest siftings almost pure clean Foraminifera.

The material mixed with large molluscan shells, Turritella, Scrobicularia, Nassa, Pecten, &c.

Noteworthy forms:—*Nubecularia lucifuga* (r.), *Spiroloculina acutimargo* (1), *Miliolina fusca* (r.) *pygmaea* (1) and *tenuis* (1), *Reophax scorpiurus* (1) and *difflugiformis* (r.), *Psammosphaera Bowmanni* (1), *Trochammina rotaliformis* (f.) and *macrescens* (v.r.), *Reophax Scottii* (f.), *Clavulina obscura* (f.), *Bulimina marginata* (f.), *subteres* (v.r.), *minutissima* (f.), *Ophthalmidium carinatum* (f.), *Cassidulina Bradyi* (v.r.), *Spirillina obconica* var. *carinata* (1), *Discorbina Araucana* (1), *Millettii* (v.r.), *Pulvinulina haliotidea* (1), *Lagena formosa* (r.), *ornata* (v.r.), *lagenoides* var. *tenuistriata* (f.), *Frondicularia spathulata* (v.r.), *Nodosaria calomorpha* (1), and many other rare forms.

No. 20. CLEW BAY. Dredging H.-A. and E. No. 3. Among the islands. 8 fms.

A coarse dark grey muddy shell-sand, from a submerged shell-bank. Half the sample, shells and fragments of mollusca, Turritella, Cardium, Scrobicularia, Pecten, &c.

Coarse siftings, large tests of *Biloculina depressa*, *Spiroloculina excavata*, *Massilina secans*, *Miliolina bicornis* and *sclerotica*, *Textularia gramen*, *Gaudryina rudis*, *Polymorphina gibba*, *Technitella legumen*, *Psammosphaera fusca*, *Truncatulina lobatula*, *Gypsina inhaerens*, and *vesicularis*.

Every type of *Discorbina globularis* and *rosacea*, all sizes.

Noteworthy forms (in addition):—*Miliolina pulchella* (1), *Haplophragmium pseudospirale* (f.), *Reophax fusiformis* (r.), *moniliforme* (r.), *Scottii* (f.), *Gaudryina filiformis* (f.), *Lingulina quadrata* n. sp. and *biloculi* (1), *Polymorphina gibba* (fistulose, r.), *Pulvinulina vermiculata* (1), and many other rare forms.

No. 21. CLEW BAY. Dredging H.-A. and E. No. 4. Between Mulranny and Clare Island. Approximate bearings by compass: Doogh Beg 60°–70° N.E., Croaghpatrick summit 160°–170° S.E.

A medium (fine and coarse) pink-fawn-coloured sand with much molluscan detritus and mica. Little or no coarse material, yielding *Gypsina inhaerens* (1), *vesicularis* (1), *Truncatulina lobatula* (1).

Noteworthy forms:—*Miliolina Candeiana* (1), *Pulvinulina haliotidea* (1), *Discorbina Parisiensis* (1) and *polyrraphes* (1), *Globigerina cretacea* (r.), *Spirillina lucida* (1), *Cristellaria cultrata* (1).

No. 22. CLEW BAY. Dredging H.-A. and E. No. 5. Between Clare Island and Carrowmore pier. Bearings (approximate): Mweelaun 255° S.W., Clare I. lighthouse 330°–340° N.

A bright yellow shell-sand, chiefly composed of molluscan fragments. few Foraminifera, chiefly in the finest siftings. Species usually

represented by a single specimen. The sand very rich in particles of amethyst presumably from amethyst beds at Keem.

Noteworthy forms:—*Spiroplecta sagittula* (fine, c.), *Truncatulina refulgens* (c.), *Gypsina inhaerens* and *vesicularis* (f.), *Trochammina rotaliformis* (f.), *Gaudryina rudis* (c.), *Pulvinulina concentrica* (1).

Coarse siftings:—*Massilina secans, Miliolina bicornis, Spiroloculina excavata, Truncatulina lobatula, Gypsina inhaerens* and *vesicularis, Polystomella crispa* and *macella.*

No. 23. Clew Bay. Dredging s.s. "Helga" W. 204 (20th August, 1911), 53° 42′ 15″ N., 10°0′ W. Near Inishturk, 11 fms.

A brilliant white coarse shell-gravel, almost entirely composed of molluscan fragments. One-third of the bulk, broken shells. Ordovician and siliceous pebbles, and debris of Echinoderms.

Coarse siftings:—*Miliolina bicornis, Gaudryina rudis, Pulvinulina repanda* and *auricula, Gypsina inhaerens, Truncatulina lobatula.*

Noteworthy forms:—a great range and series of Lagenidae, *Spiroloculina nitida* (1), *Miliolina Candeiana* (v.r.), *Reophax moniliforme* (c)., *Scottii* (1), *Ammodiscus incertus* and *gordialis* (r.), *Nonionina pauperata* (1), *Pulvinulina punctulata* (v.r.), *Lingulina quadrata* n. sp. (f.), *Cristellaria crepidula* (v.r.), *Lagena Malcomsonii* (v.r.), *marginata* var. *inaequilateralis* (v.r.), *lagenoides* var. *tenuistriata* (v.r.), *marginato-perforata* (r.), *Spirillina obconica* var. *carinata* (c.), *Gypsina vesicularis* (r.), *Polystomella arctica* (f.), *Vaginulina legumen* (r.), *Planispirina Cliarensis* n. sp. (f.), and other rare forms.

No. 24. Clew Bay. Dredging s.s. "Helga" W. 205 (21st August, 1911), 53° 51′ N., 10°1′ W. Off Clare Island, 23 fms.

A fine yellowish (flesh-coloured) sand strongly coloured with red and yellow mineral fragments and dark-grey rock-detritus.

Coarse siftings (very limited):—*Massilina secans* (1), *Pulvinulina auricula* (1), *Gypsina inhaerens* and *globulus, Truncatulina lobatula, Gaudryina rudis.* All very rare.

Noteworthy forms:—*Miliolina oblonga* (r.), *Truncatulina refulgens* (c.), *Reophax findens* (r.), and *moniliforme* (v.r), *Pulvinulina elegans* (1), *Cristellaria rotulata* and *cultrata* (v.r.), *Operculina ammonoides* (v.r.).

No. 25. Clew Bay. Dredging s.s. "Helga" W. 210 (21st August, 1911), 53°50′ 30″ N., 9°54′ W. Off south entrance to Achill Sound, 21 fms.

A coarse gravel of small rounded black and red pebbles (2–10 mm. diam.) with attached arenaceous forms. Very little sand or finer gravel.

Coarse siftings:—*Biloculina depressa, Miliolina seminulum* and *bicornis, Gaudryina rudis* (v.c.), *Reophax scorpiurus, Psammosphaera fusca* (attached), *Marginulina glabra* (large), *Textularia gramen, Gypsina inhaerens* and *vesicularis, Pulvinulina auricula.*

Noteworthy forms (in addition) :—*Spiroloculina grata* (1), *Webbina hemisphaerica* (1), *Crithionina mamilla* (v.r.), *Haplophragmium pseudospirale* (r.), *Jaculella obtusa* (v.r.), *Reophax findens* (1), *moniliforme* (f.), *difflugiformis* (1), *Cristellaria cultrata* (1), *Vaginulina legumen* (f.), *Discorbina Millettii* (1), *Technitella legumen* (1), and other rare forms.

No. 26. CLEW BAY. Dredging s.s. "Helga" W. 211 (21st August, 1911), 53° 50′ 30″ N., 9° 54′ 30″ W. Off south entrance to Achill Sound, 15 fms.

A coarse dark and reddish gravel very similar to No. 25, with very little light or small material or floatings. Some attached forms, but not so rich as No. 25.

Coarse siftings :—*Spiroloculina planulata* (1), *Gaudryina rudis* (f.), *Gypsina vesicularis* (1).

Noteworthy forms :—*Reophax moniliforme* (v.r.), *Gaudryina filiformis* (f.), *Lagena clathrata* (v.r.), *lagenoides* (1), *Discorbina Millettii* (v.r.), *Wrightii* (v.r.), *Pulvinulina haliotidea* (v.r.), *Nonionina Boueana* (2), *Operculina ammonoides* (1).

No. 27. CLEW BAY. Dredging s.s. "Helga" W. 215 (21st August, 1911), 53°49′30″ N., 9°49′ W. Between Louisburgh and Mulranny, 18 fms.

Grey-pink sandy mud (coarse and fine). Half the bulk large pebbles, mollusca and worm-tubes. Very rich in Foraminifera, principally Textularians.

Coarse siftings :—*Textularia gramen, conica,* and *agglutinans, Gaudryina rudis,* large tests of *Miliolina seminulum* and *bicornis, Massilina secans* (v.r.), large *Pulvinulina auricula* and *Polymorphina gibba,* large *Marginulina costata* (f.).

Noteworthy forms :—*Spiroloculina excavata* (rounded and carinate forms), *Biloculina depressa* (c.), *Gypsina globulus* and *vesicularis* (f.), *Reophax fusiformis* (c.) and *difflugiformis, Haplophragmium globigeriniforme* (c.), *Ammodiscus incertus* (v.r.), large fistulose Polymorphinae, *Cristellaria crepidula* (f.), *Spiroloculina acutimargo* (f.), *nitida* and *grata* (r.), *Reophax findens* and *moniliforme* (f.), *Haplophragmium pseudospirale, Reophax scorpiurus* (f.), *Psammosphaera fusca* (1), *Vaginulina legumen* (1), *Lagena formosa, quadrata, bicarinata, gracillima, Spirillina obconica* var. *carinata, Pulvinulina haliotidea, Gaudryina filiformis, Polymorphina oblonga, Trochammina squamata* and *rotaliformis, Nonionina stelligera,* and other rare forms.

No. 28. CLEW BAY. Dredging s.s. "Helga" W. 217 (21st August, 1911), 53°47′30″ N., 9°50′ W. Off Louisburgh, 10–14 fms.

A fine white sand, principally molluscan fragments, with highly coloured mineral grains and mica. Most species represented by one or two specimens only.

Coarse siftings (very small) :—*Massilina secans* (1), *Pulvinulina auricula*

(1), *Truncatulina lobatula* (r.), *Gypsina inhaerens* (f.) and *globulus* (1), *Gaudryina rudis* (c.).

Noteworthy forms :—*Discorbina rosacea* (high-domed var., c.), *Praegeri* n. sp., *Gypsina globulus* (v.r.), *Haplophragmium pseudospirale* (1), *Ammodiscus gordialis* (r.), *Trochammina rotaliformis* (1), *Reophax findens* (f.) and *moniliforme* (f.), *Discorbina Millettii*, *Pulvinulina concentrica* and *haliotidea*, *Operculina ammonoides* (1), *Vaginulina linearis* (1).

No. 29. CLARE ISLAND. Dredging s.s. "Helga" W. 218 (21st August, 1911), 53° 48′ 15″ N., 9° 54′ 30″ W. Off the harbour, 6–7 fms.

A brilliant white, fine and coarse shell-sand, principally composed of molluscan fragments and rock-detritus, much mica and quartz grains, with bright mineral (gem ?) particles. Very little floatings, with few Foraminifera.

Coarse siftings :—*Gypsina inhaerens* and large *Polystomella crispa*.

Noteworthy form :—*Discorbina Millettii*.

No. 30. KILLARY BAY. Dredging s.s. "Helga" W. 224 (23rd August, 1911), 53°38′ N., 9°54′ W. Outside the harbour, 12 fms.

An elephant-grey sandy mud with much mica, very rich in Foraminifera. Floatings pure Foraminifera; all siftings equally rich in species.

Coarse siftings :—*Biloculina depressa* and *ringens*, *Miliolina seminulum*, *subrotunda*, and *bicornis*, *Gypsina inhaerens*, *Truncatulina lobatula*, *Pulvinulina auricula*.

Noteworthy forms :—*Haplophragmium pseudospirale* (r.), *Gaudryina filiformis* (r.), *Trochammina rotaliformis* (r.), *Bulimina fusiformis* (c.), *Truncatulina refulgens*, *Cristellaria crepidula* and *rotulata* (r.), *Discorbina Parisiensis* and *turbo* (v. r.), *Nonionina turgida* (f.) and *scapha* (r), *Discorbina rosacea* (of all types and sizes), *Reophax Scottii* (r.) *Nodosaria simplex* (1), *Bathysiphon argenteus* n. sp. (r.), *Lagena striato-punctata* (1), *Rizzae* (r), *Cornuspira diffusa* (r.).

No. 31. KILLARY BAY. Dredging s.s. "Helga" W. 225 (22nd August, 1911), 53° 37′ 15″ N., 9° 51′ 30″ W.

A coarse elephant-grey to fawn shell-sand with much mud. Principal bulk large and small molluscan fragments (Ostrea, Cardium, Turritella, and worm-tubes).

Coarse siftings :—*Spiroloculina excavata*, *Massilina secans*, *Miliolina bicornis* and *sclerotica*, *Textularia gramen* and *agglutinans*, large *Verneuilina polystropha*, *Gaudryina rudis*, *Discorbina globularis*.

Noteworthy forms :—*Biloculina depressa* (1), *Miliolina Candeiana* (f.), *Brongniartii* (r.), *circularis* var. *sublineata* (1), *Cornuspira foliacea* (r.), *Haplophragmium glomeratum* (1) *Reophax Scottii* (c.), *Psammosphaera Bowmanni* (1), *Trochammina inflata* var. *macrescens* (r.), *Clavulina obscura* (v.r.),

Pulvinulina crassa (f.), *Globigerina pachyderma* (v.r.), *rubra* (r.), *Lingulina biloculi* (f.), *Ophthalmidium carinatum* (f.), *Uvigerina Canariensis* (1), *Lagena quadrata* (f.), *Millettii* (v.r.), *formosa* (f.), *unguis* n. sp. (f.), *lagenoides* (v.r.), *bicarinata* (r.), *ovum* (1), *ornata* (r.), *curvilineata* (1), *Pulvinulina punctulata* (v.r.), *haliotidea* (c.), *Karsteni* (v.r.), *Cristellaria crepidula* and *rotulata* (r.), and many other rare forms.

No. 32. KILLARY BAY. Dredging s.s. "Helga" W. 227 (23rd August, 1911), 53° 35′ 45″ N., 9° 46′ 30″ W. Off Derrynasliggan, 6–7 fms.

A foul and putrid mass of greenish-black slimy mud, full of nematode worms and fragments of Ophiothrix. Residue after washing about 1000 cc. on 150-mesh sieve, about 100 cc. of dark grey-black muddy sand.

Coarse siftings, practically nil, yielding 1 *Pulvinulina auricula* and 2 *Truncatulina lobatula.*

Noteworthy forms:—*Spiroloculina excavata,* round and acute-edged (c.), *nitida* (1), *Bathysiphon argenteus* n. sp. (f.), *Reophax fusiformis* (c.), *Scottii* (f.), *Gaudryina filiformis* (f.), *Clavulina obscura* (r.), *Trochammina Robertsoni* (1), *Lingulina biloculi* (f.), *Cristellaria crepidula* (v.r.), *acutauricularis* (1), *Ophthalmidium carinatum* (r.), *Pulvinulina Karsteni* (v.r.), *haliotidea* (f.), *Rotalia orbicularis* (f.), *Nonionina scapha* (r.), *umbilicatula* (v.r.), *Operculina ammonoides* (1), *Nodosaria pyrula* (1).

No. 33. CLEW BAY. Dredging s.s. "Helga" W. 229 (23rd August, 1911), 53° 52′ N., 9° 46′ 15″ W. Off Minish Spit, Mulranny, 15 fms.

A fine elephant-grey sandy mud with much mica and molluscan fragments. Very rich in Foraminifera with rare Miliolids, Arenacea, and Lagenidae.

Coarse siftings:—*Miliolina bicornis, Haplophragmium pseudospirale* (c.), *Truncatulina lobatula, Gypsina inhaerens.*

Noteworthy forms:—*Spiroloculina acutimargo* (1), *grata* (1), *limbata* (r.) and *nitida* (r.), *Reophax fusiformis* (f.), *difflugiformis* (v.r.), *Trochammina inflata* (1), *plicata* (f.), *ochracea* (f.), *Gaudryina filiformis* (f.), *Psammosphaera fusca* (1), *Ammodiscus incertus* (1), *Haplophragmium glomeratum* (1), *Cassidulina Bradyi* (1), *Nodosaria pyrula* (1), *Lagena squamosa* var. *Montagui* (r.) *gracillima* (f.), *marginata* (r.), *lucida* (f.), *Lyellii* (1), *protea* (1), *Marginulina glabra* (1), *Spirillina obconica* var. *carinata* (v.r.), *Discorbina turbo* (r.), *Millettii* (v.r.), *Bertheloti* (2), *Nonionina pauperata* (f.), *turgida* (c.), *Virgulina Schreibersiana* (r.), *Bolivina nobilis* (r.), *aenariensis* (f.), *Uvigerina pygmaea* (1), and many other rare forms.

No. 34. CLEW BAY. Dredging s.s. "Helga" W. 230 (23rd August, 1911), 53° 51′ N., 9° 41′ 30″ W. Near Inishgowla, 8–10 fms.

A coarse dark grey shell-gravel similar to No. 20, but coarser. Half the bulk, large broken mollusca (Cardium, Turritella, &c.), with worm-tubes and

small pebbles. Finer material full of algal debris and small molluscan fragments. The whole held together with a dark grey tenacious mud.

Coarse siftings:—*Massilina secans, Miliolina bicornis, Textularia gramen, Haplophragmium pseudospirale, Pulvinulina auricula, Discorbina globularis, Truncatulina lobatula* and *variabilis.*

Noteworthy forms:—*Planispirina celata* (v.r.), *Biloculina bulloides* (r.), *Spiroloculina grata* (r.), *nitida* (v.r.), *Miliolina circularis* var. *sublineata* (v.r.), *Cornuspira foliacea* (1), *Haplophragmium anceps* (v.r.), *Reophax fusiformis* (f.) *Scottii* (1), *Cassidulina nitidula* (v.r.), *Nodosaria scalaris* (r.), *Lingulina carinata* (1), *biloculi* (r.), *Frondicularia spathulata* (v.r.), *Lagena marginato-perforata* (r.) *lagenoides* var. *tenuistriata* (v.r.), *Pulvinulina concentrica* (1), *Discorbina Millettii* (v.r), *Pulvinulina haliotidea* (f.), *Nonionina umbilicatula* (1), *pauperata* (v.r.), and many other rare forms.

No. 35. (Label lost). CLEW BAY. Dredging s.s. "Helga."

This dredging appears, from its facies and from the date of its collection, to have been made in Clew Bay. A yellowish-grey "gem-sand" exactly similar to No. 28, largely molluscan fragments with many shore-forms. Probably a duplicate bag from the same station. Floatings, 95 per cent. *Truncatulina lobatula.*

Coarse siftings:—*Massilina secans, Gypsina inhaerens, Truncatulina lobatula, Pulvinulina auricula.*

Noteworthy forms:—*Biloculina bulloides* (v.r.), *Animodiscus gordialis* (r.), *Cristellaria cultrata* (1), *Orbulina universa* (with enclosed Globigerina, 1), *Nonionina turgida.*

No. 36. CLEW BAY. Dredging s.s. "Helga" W. 213 (21st August, 1911), 53 51′ 30″ N., 9°49′ W. Off Mulranny, 11–12 fms.

A small sample washed from a few shells and stones which came up in the trawl, otherwise empty. Whole sample, 13·3 cc. Floatings, ·3 cc., very rich in species (75). All the material very small. No coarse siftings.

Noteworthy forms:—*Spiroloculina acutimargo* (1), *Bolivina aenariensis* (r.), *Nonionina pauperata* (1) and *umbilicatula* (1), *Spiroplecta biformis* (r.), *Pulvinulina crassa* (1), *Haliphysema ramulosa* (1), *Globigerina rubra* (1).

No. 37. CLARE ISLAND, Strand.—Tufts of living *Corallina officinalis* from the rock-pools.

A considerable quantity of this very 'difficult' material examined in the living state (for Haliphysema, which was not found). Nearly all the species were found growing attached to the Coralline, particularly the Discorbinae, Truncatulinae, and Gypsinae. Others were found adhering to the Coralline in the positions of life, by their dried pseudopodial extensions.

The most noteworthy feature was the prevalence of a very large and deep

brown *Discorbina Mediterranensis*, of very turgid and robust form. One of these when broken open at the base (some hundreds were thus treated) was found to be full of young shells, already composed of two to three chamberlets. (See p. 119 and Plate X, fig. 1.)

Bibliographical Note.

In the Bibliography appended to the present report (p. 149) an effort has been made to save space and to assist memory in preparing the references and synonymy in the subjoined list.

Excepting where any real confusion exists, or the importance of a species discovered since 1900 renders some extension of the references and synonymy desirable, we have contented ourselves with giving—

(i) The original author of the species and a reference to the work in which it has been first described and figured.

(ii) One more recent reference: in the case of synonyms, the reference to the author who first gave the species its modern-accepted name, and in the other cases one fairly important reference where the species is discussed and figured.

(iii) To these, in the case of the older species, we have added references to the admirable and exhaustive lists of synonyms and references given in his "Challenger" report by Dr. H. B. Brady (1884 FC) and in the continuation of Dr. Brady's lists by Mr. Millett in his articles on the Malay Foraminifera (1898 &c MFM). Where further references have seemed desirable, we have referred to our own lists published in our Selsey Bill papers (1908 &c SB).

These references might be enormously extended, but we think the student will find all that he wants, if he makes use of the plan we have adopted, to assist him in finding the really important references to any species.

In the bibliography we have abandoned the usual plan of merely referring to the volume and page and plates of a vast number of Proceedings of Societies, and have modelled our list on those of Dr. Brady and Mr. C. D. Sherborn, giving in all cases the titles of the articles referred to. We have then indicated that title by initial letters in the references suffixed to each species. The initial of the author's name, and the year of publication of the article cited, will give the student on a glance at the bibliography the name of the author, the title of his article, and full particulars of where it may be found.

Thus, for example, "B 1884 FC" will give, in its proper chronological place, full bibliographical particulars of Dr. Brady's Report of 1884 on the "Challenger" Foraminifera.

"J & P 1860 RFM" will give particulars of Jones and Parker's "Rhizopodal Fauna of the Mediterranean" of 1860. And so on.

In the case of long series of articles such as our own (Selsey Bill), Mr. Millett's (Malay Archipelago) or Mr. Sidebottom's (Delos) the year of the first paper is given, and, after the title-initials, the year of the particular article of the series referred to. Thus (e.g.) *Truncatulina variabilis* will have the reference "S 1904 &c RFD 1909, p. 2." A vast amount of repetition and consequent waste of space is thus avoided.

It only remains to be observed that in the bibliography itself, the titles of well-known publications are still further abbreviated. Thus :—

AMNH = Annals and Magazine of Natural History.
QJGS = Quarterly Journal of the Geological Society of London.
JQMC = Journal of the Quekett Microscopical Club.
JRMS = Journal of the Royal Microscopical Society.
MASIB = Memorie della Reale Accademia delle Scienze dell' Istituto di Bologna.

SYSTEMATIC LIST OF SPECIES.

Sub-kingdom PROTOZOA.

Class RHIZOPODA.

Order FORAMINIFERA.

Family MILIOLIDAE.

Sub-family NUBECULARINAE.

NUBECULARIA Defrance.

1. Nubecularia depressa Chapman.

Plate I, figs 1–3.

Nubecularia depressa C 1891 &c GF 1891, p 8, pl ix, fig 1.
Nubecularia lucifuga Defrance. G 1906 PLL, p 3, pl i, fig 1.

(*New to the British Isles**)

Attached to shell debris and sand grains at stations 15 and 25 numerous specimens were found of a little Nubecularia which we have referred to Mr. Chapman's species, originally described from a single specimen found adherent to a fish-scale in the Gault of Folkestone. His description of the species was as follows :—

"This form consists of six more or less flask-shaped chambers disposed in a curved line : slightly depressed, and adherent . . . The test has the true porcellanous appearance, being milky white."

In his paper (*ut suprâ*) Mr. Gough figures and records for the first time as an Irish Foraminifer, *Nubecularia lucifuga* Defrance. His figures, especially fig. 2, which he describes as the young form, are much more applicable to Mr. Chapman's species than to British specimens of *N. lucifuga*, and we have no doubt that his specimens were identical with ours. The advisability of separating this little organism from the larger and more robust species *N. lucifuga* might be considered doubtful in view of the extreme variability of that species; but as the habit of growth, the form, and the method of arrangement of the chambers in the most typical specimens of *N. depressa* are very characteristic and constant, their separation under a distinctive specific name appears to be justified. Indeed the affinities of *N. depressa* are probably nearer to *N. tibia* Parker & Jones, than to *N. lucifuga* Defrance, growth being effected by the formation of separate chambers, connected by stoloniferous tubes, and arranged in a more or less curved sequence, rather than by the rotaline, and subsequently acervuline, plan on which *N. lucifuga* proceeds.

2. Nubecularia lucifuga Defrance.

Nubecularia lucifuga D 1825 Dict. Sci. Nat. (Strasburg 1816–1830), vol xxxv, p 120; Atlas Zooph, pl xliv, fig 3.
„ „ „ Earland 1905 FSB, p 191, pl xi, figs 1–3, pl xiv, fig 2.
„ „ „ Heron-Allen and Earland 1908 &c SB 1909, p 309; 1910, p 404, pl vi, figs 1, 2.

(See also FC, p 134; BS, p 878; H-A and E 1909, p 309.)

Occurs at twelve stations, both shore-sands and dredgings, but sparsely at all of them. The scarcity of this species round the Irish coast is one of the curious anomalies of rhizopodal distribution. The genus was not recorded as Recent in Ireland at all (the "List" in the Report of the British Association in 1896 refers to C 1892 CS) until 1906, when Mr. Gough discovered it in Larne Lough, and even this solitary Irish record lies open to some doubt, as, of the two figures with which he illustrated his paper, one at least (described as the "young form") is *N. depressa* Chapman, and the other figure is quite possibly an advanced stage of the same form. All his specimens were apparently adherent. *N. lucifuga* is essentially a warm-water and tropical species; but it has extended its range as far as the English Channel, where it is abundant in the shore-sands of Bognor and Selsey (*ut suprâ*), and it might have been expected to have been found in equal abundance in shallow water round the Irish coast. Probably its migrations in this direction have been limited by the deep water between the English Channel and the Irish coast. It has extended its range via the North Sea (where a few specimens have been found by us in various dredgings made by the Fisheries Cruisers

"Huxley" and "Goldseeker") at least as far as the Moray Firth, the Great Fisher Bank, and the seas round Orkney. These records may perhaps mark the northernmost distribution of the species. Of the Clare Island specimens the best were observed at stations 4 and 9. It is noticeable that at station 15, where the allied species *N. depressa* is frequent, the record of *N. lucifuga* depends upon a single unsatisfactory specimen.

Sub-family MILIOLININAE.

BILOCULINA d'Orbigny.

3. Biloculina ringens Lamarck sp.

Miliolites ringens L 1804 AM, vol v, p 351, No 1; vol ix, pl xvii, fig 1; L 1835 ASV, vol xi, p 289, No 1.

Biloculina ringens (L) d'Orbigny 1826 ASN, p 297, No 2.

(See also BS, p 878; FC, p 142; H-A & E 1909, p 309.)

The species is infrequent (four stations), and none of the specimens can be described as strongly marked or typical, showing as a rule a tendency towards variation in the direction of *B. elongata*.

Balkwill and Millett in their paper on the Foraminifera of Galway (B & M 1884, p 4) call attention to the absence of *B. ringens* from that locality.

The species is also recorded as "very rare" at Dog's Bay, Roundstone, by Mr. Wright (W 1900 DBC, p 52).

4. Biloculina bulloides d'Orbigny.

Biloculina bulloides d'O 1826 ASN, p 297, No 1, pl xvi, figs 1–4, Modèle No 90.

„ „ „ Brady 1884 FC, p 142, pl ii, figs 5, 6.

(See also FC, p 142.)

Occurs with moderate frequency (seven stations) both in dredgings and shore-sands. The specimens are all somewhat small; and at some stations (notably station 32), where the species is abundant, the specimens, though small, are very thin-shelled, so that the internal structure of the earlier chambers can be observed. These earlier chambers show great differences in their arrangement, and the specimens exhibit considerable variety of external structure, passing imperceptibly into *Miliolina circularis* Bornemann sp. It is recorded from the SW of Ireland by Mr. J. Wright (W 1889 SWI, p 447, and W 1891 SWI, p 462–494).

5. Biloculina elongata d'Orbigny.

Plate I, fig 4.

Biloculina elongata d'O 1826 ASN, p 298, No 4.
„ „ „ Brady 1884 FC, p 144, pl ii, fig 9.
„ „ „ Fornasini 1908 SO, p 47, pl iii, figs 10, 11.

(See also BS, p 879; H-A & E 1911, p 301.)

The species occurs at nine stations, all dredgings, and is common in some of them. As a rule the specimens belong to the regular oval type as figured by Brady (*suprâ*) and Schlumberger (Mem. Soc. Géol. France, 1891, vol iv, p 184); but at one or two stations a few specimens were found closely resembling d'Orbigny's original type, in which the outline of the shell is more or less quadrangular, *i.e.* the two marginal edges are almost parallel throughout the greater length of the shell, the corners only being rounded off. In these quadrangular specimens the aboral "process" referred to under *B. depressa* is often to be observed.

6. Biloculina depressa d'Orbigny.

Plate I, figs 5, 6.

Biloculina depressa d'O 1826 ASN, p 298 No. 7, Modèle No 91.
„ *ringens* var. *carinata* Williamson 1858 RFGB, p 79, pl vii, figs 172–174.

(See also FC, p 145.)

This species occurred at eighteen stations, both dredgings and shore-sands, and at many of them reached large dimensions. All the specimens belong to the regular depressed type. Two distinct forms are noticeable, one circular, the other oval in outline. In many cases the oval type is characterized by the presence of a produced flap or tongue at the aboral extremity. This is apparently the foundation of the next chamber to be formed, and not, as would seem at first sight probable, the remains of a later chamber that has been broken away; such a "process" is very well shown in Brady's fig 2, pl iii (FC), but in many of the Clare Island specimens the "process" is much more marked, and extends considerably beyond the base of the shell. Similar processes have been figured in connexion with other species of Biloculina, e.g. *B. simplex* d'Orbigny and *B. Sarsi* Schlumberger (see also Chapman (C 1909 NZ, p. 314)), but so far as we are aware no one has hitherto suggested any reason for the occurrence of this feature, although Professor Fornasini, in figuring similar specimens from the Pliocene of San Pietro in Lama (F 1898 PS, p. 207), states that he regards the feature as

merely incidental to a fracture of the last chamber of the shell. This is evidently the case in respect of d'Orbigny's and Fornasini's figures (cf. F 1900 FA, p 358); but in the case of the Clare Island specimens there is no evidence of a fracture of the test.

SPIROCULINA d'Orbigny.

7. Spiroloculina planulata Lamarck sp.

Miliolites planulata L 1804 AM, p 352, No 4; L 1816 &c ASV, 1822, vol vii, p 613, No 4.

Spiroloculina planulata (L) Parker Jones & Brady 1866 &c MCF, 1895, p 103, pl iii, figs 37, 38, wood-cut, fig 1.

(See also FC, p 148; H-A and E 1911, p 302.)

Fairly generally distributed all over the area (22 stations). Typical specimens are to be found, also many variations linking it with *S. limbata*, *nitida*, and *excavata*.

8. Spiroloculina excavata d'Orbigny.

Spiroloculina excavata d'O 1846 FFV, p 271, pl xvi, figs 19–21.

" " " Heron-Allen and Earland 1908 &c SB 1909, p 310; 1910, p 404, pl vi, fig 3.

(See also FC, p. 151; **MFM**, 1898, p 264.)

Universally distributed all over the area (28 stations), both shore-sands and dredgings. All varieties are present, but the finest and most distinctive specimens are of the variety figured and described by Williamson as *Spiroloculina depressa* (W 1858 RFGB, p 81), which is characterized by rapid increase in the thickness of the chambers, so that the marginal edges of the shell are considerably raised above the earlier portions. The marginal edges also fall away in a neatly rounded curve from the sharp border of the last two chambers. Typical forms agreeing with d'Orbigny's original figure (*suprâ*) occur frequently, and variation proceeds (in the opposite direction to *S. depressa* Williamson) towards *S. planulata*, with which this species imperceptibly merges through transition forms.

9. Spiroloculina limbata d'Orbigny.

Spiroloculina limbata d'O 1826 ASN, p 299, No 12.

" " " Brady 1884 FC, p 150, pl ix, figs 15–17.

(See also FC, p 150.)

Occurs at ten stations, both shore-sands and dredgings. The general characteristics of this species closely resemble those of *S. canaliculata*, but the specimens differ in having a square-edged, instead of an excavate, periphery.

10. Spiroloculina canaliculata d'Orbigny.

Spiroloculina canaliculata d'O 1846 FFV, p 269, pl xvi, figs 10–12.
„ „ „ P J & B 1866 &c MCF, p 16, pl iii, figs 39, 40.

Two specimens, both worn and broken, from station 12, which exhibit the marked characteristics of this type, viz.: the excavation of the surface of each chamber, and also of the marginal edges of the shell, into a groove.

11. Spiroloculina acutimargo Brady.

Plate I, fig 8.

Spiroloculina acutimargo B 1884 FC, p 154, pl x, figs 12–15.
„ „ „ Balkwill and Wright 1885, DIS, p 323, woodcut, fig 1.

(See also MFM 1898, p 264.)

A few specimens of this very distinctive form were found at four stations. The specimens are well marked, and probably the best yet recorded in British waters, previous records being Lambay (Ireland) 45 fms, described as "small and poor," and the estuary of the Dee (B 1887 BS, p 879).

12. Spiroloculina nitida d'Orbigny.

Spiroloculina nitida d'O 1826 ASN, p 298, No 4.
„ „ „ Brady 1884 FC, p 149, pl ix, figs 9, 10.

(See also H-A & E 1911, p 302.)

Occurs at eight stations, but uncommon, and not very strongly marked. The specific feature in *S. nitida* is that the chambers are tubular and round in section, thus giving sunken sutural lines and a rounded periphery. None of the Clare Island specimens present these characteristics in a marked form, the tendency to variation being in the direction of *S. planulata* with rounded peripheral margin.

13. Spiroloculina grata Terquem.

Plate I, fig 7.

Spiroloculina grata T 1878 FIR, p 55, pl x, figs 14A–15B.
„ „ „ Brady 1884 FC, p 155, figs 16, 17, 22, 23.
Spiroloculina nitida d'Orbigny (striate var) Millett 1898 &c MFM 1898, p 266.

(*New to the British Isles.*)

A few minute and weakly marked specimens at six stations. This is normally a tropical and sub-tropical species common in the shallow water of coral-reefs.

MILIOLINA Williamson.

14. Miliolina oblonga Montagu sp.

Vermiculum oblongum M 1803 TB, p 522, pl xiv, fig 9.
Miliolina seminulum var. *oblonga* Williamson 1858 RFGB, p 86, pl vii, figs 186, 187.
Miliolina oblonga (M.) Millett 1898 &c MFM 1898, p 267, pl v, fig 14.
„ „ „ Terrigi 1880 SGP, p 173, pl i, fig 2.
(See also FC, p 160; BS, p 881; H-A & E 1909, p 312.)

Generally distributed all over the area, abundant at many stations and very variable. The specimens may be divided into several groups:—(i) Typical *M. oblonga*, in which the apex and base of the shell are symmetrically and evenly rounded off, and one or more earlier chambers exhibited, as it were, "framed" by the ultimate and penultimate chambers. The axis of these early chambers is parallel to the length of the shell. (ii) Similar forms in which a number of early chambers are visible in the centre, their axes running transversely to the long axis of the shell: this variety equals *Quinqueloculina Bosciana* d'Orbigny (d'O 1839 OFC, pl xi, figs 22-24). (iii) A square variety in which the inflation of the ultimate and penultimate chambers and the broad truncate mouth give a characteristic quadrangular appearance to the test. The early chambers in this type appear to be always arranged on the plan of variation (i). (iv) A sub-variety of var. (i) in which the neck of the ultimate chamber is somewhat produced, and the tooth is capped with a kind of operculum, the aperture of the shell being a narrow slit between the operculum and the final chamber. This last variety is comparatively rare in the Clare Island area, and was only noted from six stations. It appears to be entirely confined to the elongate and rounded type of shell.

This "stopper" or operculum is well figured in Williamson (RFGB, pl vii, figs 186, 187). In the text, referring to *M. oblonga*, he states that "the tooth in the septal aperture is often large. In some specimens common at Brixham it is so much developed at its upper extremity as to appear like a large operculum or lid, closing the orifice of the shell."

15. Miliolina rotunda d'Orbigny sp.

Triloculina rotunda d'O 1826 ASN, p 229. No 4.
„ „ (d'O) Schlumberger 1893 MGM, p 206, pl i, figs 48-50.
Miliolina rotunda „ Millett 1898 &c MFM, 1898, p 267, pl v, figs 15, 16.
„ „ „ Sidebottom 1904 &c RFD, 1904, p 8.

This species, which may be described as a triloculine form of *M. seminulum*, occurs in great abundance at Stations 13 and 15, sparingly at Station 21, and

appears to be strictly limited to those stations. It is characterized by a large massive shell, in which three chambers only are visible, all rounded in outline. The aperture is large, sometimes furnished with a tooth, sometimes simple. The only variation appears to lie in the extent to which the two final chambers include the earlier portion of the shell. In some cases hardly any portion of the earlier chambers is visible. The surface of the test in all the specimens is rough and dirty, and entirely lacking the high porcellanous glaze which so strongly characterizes *M. seminulum* and *M. oblonga* at most of the stations.

First recorded as British by us from the shore-sands of Selsey Bill (H-A & E 1908 &c 1911, p 303).

16. Miliolina circularis Bornemann sp.

Triloculina circularis B 1855 FSH, p 349, pl xix, fig 4.
Miliolina circularis (B) Brady 1884 FC, p 169, pl iv, fig 3; pl v, figs 13, 14 (?).
(See also MFM 1898, p 499.)

This is universally distributed both in shore-sands and dredgings. It sometimes reaches a very considerable size, the chief variation lying in the apertures which range between the normal curved and lipped slit, and a wide denticulate opening. As is always the case where the species is abundant, it passes imperceptibly into *M. subrotunda* (Montagu).

17. Miliolina circularis var. **sub-lineata** Brady.

Miliolina circularis var. *sublineata* B 1884 FC, p 169, pl iv, fig 7.
" " " " Millett 1898 &c MFM 1898, p 501, pl xi, fig 4.
(See also MFM 1898, p 501.)
(*New to the British Isles.*)

Specimens found at four stations present the characteristic features of this somewhat doubtful variety as figured by Brady, i.e. the fine costae, which in the commoner species *M. seminuda* Reuss, are confined to the peripheral margin of the chambers, are here apparent over the whole surface of the shell.

18. Miliolina subrotunda Montagu sp.

Vermiculum subrotundum M 1803 TB, pt 2, p 521.
Miliolina subrotunda (M) Brady 1884 FC, p 168, pl v, fig 10.
(See also FC, p 168; MFM 1898, p 502.)

Universally distributed both in shore-sands and dredgings, very abundant and extremely variable. The variations may be classified under three headings. (i) APERTURE. This ranges from a narrow curved slit between raised lips, to a wide circular and denticulate opening, usually situate close

to the base of the penultimate chamber, but occasionally on a prolongation of the final chamber. (ii) DEGREE OF INFLATION. Normally the chambers are inflated and round in section, but they may be flattened, in which case the whole shell may assume a flat and, in extreme cases, a hauerine structure, more than two chambers being observable round the periphery of the shell. (iii) NUBECULARINE GROWTHS. At some stations the specimens attain a comparatively large size. While the small individuals are regular and typical, the large ones are nearly all very wild-growing and irregular, the chambers being inflated, irregular in shape and arrangement. Such specimens when furnished with a lipped aperture constitute the *Triloculina labiosa* of d'Orbigny. (d'O 1839 OFC, pl x, figs 12–14.)

19. Miliolina valvularis Reuss sp.

Triloculina valvularis R 1851 FSUB, p 85, pl vii, fig 56.
Miliolina valvularis (R) Brady 1884 FC, p 161, pl iv, figs 4, 5.
(See also MFM 1898, p 501.)

A few undoubted examples of this form, in which the aperture is narrowed to a slit by the presence of an enlarged plate, instead of the usual tooth, were observed at station 36. Specimens of *M. subrotunda* exhibiting a tendency towards *M. valvularis* were observed at six or seven other stations. It has previously been recorded from British waters only by Mr. Pearcey from the Faröe Channel. (P 1888 FFC, p 175.)

20. Miliolina seminuda Reuss sp.

Quinqueloculina seminuda R 1865 FABS, p 125, pl i, fig 11.
Miliolina seminuda (R) Earland 1905 FBS, p 195.

This species, in which the peripheral margin of the chambers is decorated with a varying number of longitudinal striae, is generally distributed over the area (23 stations), but is never very abundant. The strength of the peripheral marking is very variable, in some cases being limited to one or two keels, whereas in others they cover more than half the face of the chamber. In some instances there is a tendency for the costae to run transversely from the marginal edge towards the middle of the chamber, where they gradually disappear..

21. Miliolina tricarinata d'Orbigny sp.

Triloculina tricarinata d'O 1826 ASN, p 299, No 7, Modèle, No 94.
Miliolina tricarinata (d'O) Brady 1884 FC, p 165, pl iii, fig 17.
(See also FC, p 165; BS, p 880; MFM 1898, 502.)

Occurs at seven stations, fairly common in some of the dredgings, and presenting no especial features.

22. Miliolina trigonula Lamarck sp.

Miliolites trigonula L 1804 AM, vol v, p 351, No 3; L 1835 ASV, vol xi, p 290, No 3.

Miliolina trigonula (L) Brady 1884 FC, p 164, pl iii, figs 14–16.

(See also FC, p 164; BS, p 880; MFM 1895, p 503.)

Fairly widely distributed (15 stations), but, except at station 13, not very abundant. All the specimens are characteristic.

23. Miliolina seminulum Linné sp.

Serpula seminulum L 1767 SN (Ed xii), p 1264, No 791; L 1788 SN (Ed xiii), p 3739, No 2.

Miliolina seminulum (L) Brady 1884 FC, p 157, pl v, fig 6.

(See also FC, p 157; BS, p 811; H-A & E 1909, p 311.)

Occurs at practically every station, and is exceptionally well developed in some of the dredgings.

24. Miliolina vulgaris d'Orbigny sp.

Quinqueloculina vulgaris d'O 1826 ASN, p 302, No 33.

„ „ „ Terquem 1878 FIR, p 66, pl vi, figs 20, 21.

„ „ „ Schlumberger 1893 MGM, p 207, pl ii, figs 65, 66, and woodcuts 13–14.

(*New to the British Isles.*)

One specimen at station 34, closely resembling Schlumberger's figure, but with a subarenaceous white test.

This appears to be a very unsatisfactory species. d'Orbigny's figure in the "Planches Inédites" (F 1902 FLR, p 23) does not possess any very well-marked specific features. It is merely a quinqueloculine miliolid of somewhat irregular outline. Brady referred it to *Massilina secans* d'Orbigny sp. Terquem in his monograph of the Isle of Rhodes (*suprâ*) figures a quite dissimilar form, which was properly referred by Brady to *Miliolina seminulum* Linné sp. Schlumberger takes yet another form, which, however, is much nearer to d'Orbigny's original figure. It is apparently an intermediate form between *Miliolina Auberiana* (d'Orb.), and *Massilina secans* (d'Orb.). Professor Fornasini has dealt very fully with this matter in the paper above referred to.

25. Miliolina Auberiana d'Orbigny sp.

Quinqueloculina Auberiana d'O 1839 OFC, p 193, pl xii, figs 1–3.

Miliolina Auberiana (d'O) Goës 1894 ASF, p 109, pl xix, fig 844.

(See also BS, p 881; H-A & E 1909, p 312.)

Generally distributed (24 stations), but never very common. Judging the paucity of the British records, the distribution of this species is very

much localized. It is one of the commonest species in the shore-sands of Swanage (Dorset).

26. Miliolina Candeiana d'Orbigny sp.

Plate II, figs 1–4.

Quinqueloculina Candeiana d'O 1839 OFC, p 199, pl xii, figs 24–26.
" " " Brady 1870 FTR, p 287, pl xi, fig 1.
Miliolina Candeiana (d'O) Brady 1887 BS, p 882.

Occurs at 11 stations among the dredgings. The species is recorded with some reservation under d'Orbigny's specific name, chiefly on the strength of Brady's identification and figure, which, it must be confessed, does not bear any very striking resemblance to d'Orbigny's drawing. But we prefer to record our specimens under this name rather than to erect a new species for their accommodation. Brady suggests that "too little importance can hardly be attached to the minute morphological variations of the Miliolae, as specimens pertaining to the groups are to be found presenting every possible modification of contour and relation of parts consistent with a certain general plan of growth."

Brady's specimens from the fens of the River Cam at Ely are described as "more outspread than d'Orbigny's figure. The margin is expanded with a wide, delicately thin carina, and the exposed edges of the inner chambers are acute." Brady considered that the peculiarities of his specimen, though noteworthy, were quite within what might be considered as the specific limits of *Quinqueloculina* (*Miliolina*) *seminulum*. d'Orbigny's figure, on the other hand, suggests an etiolated and carinate form of *M. bicornis*, and resembles Brady's figure only in the star-like shape of the chambers when the shell is viewed end-ways. The Clare Island specimens, though resembling both d'Orbigny's and Brady's in general contour and carination of the chambers, seem more nearly allied to *M. Brongniartii* in the method of arrangement of the chambers, and may possibly represent an extremely starved condition of that type, in which the surface-markings are wanting.

The only British records, apart from Brady's, are from the estuary of the Dee (Siddall), and Mount's Bay (Millett), but no figures are available for purposes of comparison.

27. Miliolina pygmaea Reuss sp.

Quinqueloculina pygmaea R 1849 FOT, p 384, pl i, fig 3.
Miliolina pygmaea (R) Brady 1884 FC, p 163, pl cxiii, fig 16.
(See also H-A & E 1909, p 312.)
(New to the British Isles.)

A single specimen from Station 19.

28. Miliolina contorta d'Orbigny sp.

Quinqueloculina contorta d'O 1846 FFV, p 298, pl xx, figs 4–6.
Miliolina contorta (d'O) Brady 1887 BS, p 881.

(See also H-A & E 1909, p 315.)

The perennial difficulty of separating *M. contorta* and *M. sclerotica* is present in all its force in the Clare Island material. Both species are generally distributed in the area, and occur abundantly at some stations. Broadly speaking, to *M. contorta* should be referred those specimens which are (i) smooth and porcellanous, and (ii) angular at the marginal edges; while to *M. sclerotica* should be assigned the sandy forms with rounded edges to the chambers. But *M. contorta* frequently occurs with rounded chambers, and also assumes a sub-arenaceous texture; while *M. sclerotica* occasionally presents angular marginal edges. *M. sclerotica*, however, is always coarsely sandy, and of a darker tint than the sandy forms of *M. contorta*, which are nearly always white and often brilliantly so, presumably owing to the fact that the layer of sand-grains is merely superficial and imbedded in the porcellanous shell-substance, and not incorporated in cement, as in the case of *M. sclerotica*. The variations in *M. contorta* appear to be constant wherever the species occurs (cf E 1905 FBS; S 1904 RFD; and H 1889 RFJ).

29. Miliolina sclerotica Karrer sp.

Quinqueloculina sclerotica K 1868 MFKB, p 152, pl iii, fig 5.
Miliolina sclerotica (K) Balkwill and Millett 1884 FG, p 24, pl 1, fig 2.

Generally distributed. For remarks on this species see under *M. contorta*.

30. Miliolina Ferussacii d'Orbigny sp.

Quinqueloculina Ferussacii d'O 1826 ASN, p 301, No 18, Modèle No 32.
Miliolina Ferussacii (d'O) Brady 1884 FC, p 175, pl cxiii, fig 17.

(See also FC p 175; MFM 1898, p 507.)

Occurs at ten stations evenly distributed between shore-sands and dredgings, but never very abundant. Most of the specimens are small compared with the development to which it attains in the North Sea.

31 Miliolina agglutinans d'Orbigny sp.

Quinqueloculina agglutinans d'O 1839 OFC, p 195, pl xii, figs 11–13.
Miliolina agglutinans (d'O) Siddall 1879 CBRF, p 4.

(See also FC, p 180; MFM 1898, p 508; H-A & E 1909, p 316.)

A very few specimens found at two stations only.

32. Miliolina fusca Brady.

Quinqueloculina fusca B 1870 FTR p 286, pl xi, fig 2.
Miliolina fusca B., Brady 1887 BS, p 883.

(See also H-A & E 1909, p 316.)

Occurs at nine stations, but is never common. The species presents the usual variety of triloculine and quinqueloculine forms, as at Bognor (E 1905 FBS). Two well-defined variations in colour are also noticeable, the typical brown (*fusca*) and a whitish variety which may possibly represent an intermediate stage between this and *M. contorta*. It is noticeable that the majority of the records are from stations at which the salinity would probably be below the normal, owing to the influx of fresh water. *M. fusca* was originally described from brackish water, and most of the records are from similar gatherings. Brady records the occurrence of this species (*ut suprâ*) from Westport in Clew Bay, near our Stations 19 and 20.

Messrs. Balkwill and Millett (B & M 1884 FG, pp 4, 6) call attention to the rarity of this species in the Galway shore-sand; and it does not appear in Mr. Wright's list from Dog's Bay, Roundstone (W 1900 DBC).

33. Miliolina stelligera Schlumberger sp.

Plate I, figs 14, 15.

Quinqueloculina stelligera S 1893 MGM, p 210, pl ii, figs 58–59.
Miliolina stelligera S., Sidebottom 1904 &c RFD 1904, p 14.

(*New to the British Isles.*)

Professor Schlumberger describes this species as follows:—"Shell fusiform; very elongate, about three times as long as broad. In median section star-like, composed of triangular chambers with a large keel, often double. Section obscure, the walls of the chambers slightly dark in tint, contrasting with the white colour of the keels. Aperture round, at the extremity of a cylindrical neck. I have not been able to confirm the presence of a tooth."

We have specimens from six stations which appear to agree fairly closely with Schlumberger's diagnosis except as regards the colour, which in our shells is of the normal milioline hue. Our specimens have no tooth in the oral aperture, which is oval. The species has not been hitherto recorded north of the Mediterranean. (See Addenda, p. 187.)

34. Miliolina tenuis Czjzek sp.

Quinqueloculina tenuis C 1847 FWB, p 149, pl xiii, figs 31–34.
Miliolina tenuis (C) Siddall 1878 SFD, p 46.
„ „ „ Balkwill & Wright 1885 DIS, p 324, pl xii, figs 3–5.

A good many specimens were noted at seven stations. At six of them

the individuals are quinqueloculine, at the other they assume the spiroloculine form, resembling Czjzek's original figure. Brady in his synopsis (BS) has referred to the ambiguous characters of this species, and states that there may be some doubt whether such forms are better placed among Miliolinae or Spiroloculinae.

Czjzek's species, though usually included in the genus Spiroloculina, is hardly a satisfactory type of that genus, inasmuch as the chambers even in the most spiroloculine examples are rarely all in the same plane. There is always a certain progressive tilting of the plane of arrangement visible; and it is easy to imagine that this, when carried to an extreme, may end in such quinqueloculine forms as are found in our dredgings, and as have been figured by Wright under the name of *Miliolina tenuis* (Czjzek). At the same time it is hardly satisfactory that specimens so widely differing in external appearance as the figures of Czjzek and Wright should be combined under one name, and the problem is not solved if the species is transferred to Schlumberger's sub-genus Sigmoilina. It would, perhaps, be more satisfactory if Czjzek's specific name were reserved for the complanate types as originally figured, while the rounded milioline types were aggregated under another name—for example, the *Quinqueloculina parvula* of Schlumberger (Mem. Soc. Géol. France, vol. vii, 1894, p. 255), which has somewhat similar characteristics.

35. Miliolina laevigata d'Orbigny sp.

Plate I, figs 12, 13.

Quinqueloculina laevigata d'O 1826 ASN, p 301, No 6.
" " " d'Orbigny 1839 FIC, p 143, pl iii, figs 31–33.
Adelosina laevigata (d'O), Schlumberger 1886 GA, p 96, pl xvi, figs 19–21.
Miliolina laevigata (d'O), Sidebottom 1904 &c RFD 1904, p 12, pl iv, figs 1–3 and woodcut.

(*New to the British Isles.*)

Generally distributed over the area (14 stations), but never very abundant. The species can best be described as a smooth, delicate, elongate form of *M. bicornis* with strongly carinate marginal edges to the chambers.

36. Miliolina bicornis Walker & Jacob sp.

Plate II, figs 5, 6.

Serpula bicornis W & J 1798 AEM, p 633, pl xiv, fig 2.
Miliolina bicornis (W & J) Williamson 1858 RFGB, p 87, pl vii, figs 190–198.

(See also FC, p 171; MFM, 1898, p 509; H-A & E 1909, p 313.)

The difficulty in separating this species from the closely allied *M. Brongvrtii* has been dealt with at some length by Brady in FC 1884, p 171.

Briefly, however, the specific name *M. bicornis* may be taken to include those specimens with an elongate test, with somewhat deeply segmented chambers, and furnished with a produced neck bearing the aperture. The striae in such specimens are extremely variable; they may be fine and regular and evenly distributed over the surface of the chambers, or they may assume the form of strong costae, in which case the shell passes imperceptibly into *M. pulchella* and *M. Linnaeana*. In *M. Brongniartii* the shell is typically oval or nearly circular in outline; the aperture is broad and practically flush with the periphery; and the sutural depressions between the chambers are very slightly marked. The outline of the test as seen in section would be lenticular. The striae are fine, and follow the outline of the chambers in curved parallels.

Transition forms, linking *M. bicornis* and *M. Brongniartii*, are usually abundant where the two species occur together. *M. bicornis* occurs at nearly all the stations, and is often extremely abundant. Adelosine forms are of frequent occurrence at some of the stations.

Among the young specimens of *M. bicornis* there are many sharply keeled individuals closely resembling the *M. gracilis* of d'Orbigny (1839 OFC, pl xi, figs 10–12), which is probably only a starved or immature form of *M. bicornis*.

Among the abnormal specimens of *M. bicornis* there is sometimes a tendency for the later chambers to separate from the body of the shell. We figure such in a specimen (Plate II, fig 6), which is practically identical with the specimen figured and described by Terquem (T 1878 FIR, p 64) under the name *Quinqueloculina elegans* d'Orbigny (F 1905 SOM, p 65). There is, of course, no specific value whatever in such abnormal growths.

37. Miliolina Brongniartii d'Orbigny sp.

Triloculina Brongniartii d'O 1826 ASN, p 300, No 23.
„ „ (d'O), Parker, Jones & Brady 1859 &c NF 1871, p 250, pl viii, fig 9.

Typical specimens of the regular, circular, and finely striate type occur at twenty stations.

At some of the stations where the species occurs in a weak and starved condition some of the young shells exhibit the compressed outline of d'Orbigny's *M. Boueana*. (d'O 1846 FFV, p. 293, pl xix, figs 7–9.)

38. Miliolina pulchella d'Orbigny sp.

Quinqueloculina pulchella d'O 1826 ASN, p 303, No 42.
Miliolina pulchella (d'O) Brady 1884 FC, p 174, pl vi, figs 13, 14, pl iii, figs 10–13.
(See also FC, p 174; BS, p 883.)

Only a few specimens were observed (4 stations), but these were large

and well developed. The adelosine stage is also well represented by strongly marked specimens.

Sub-Family HAUERININAE.

MASSILINA Schlumberger.

39. Massilina secans d'Orbigny sp.

Quinqueloculina secans d'O 1826 ASN, p 303, No 43 ; Modèle No 96.
Miliolina secans (d'O) Brady 1884 FC, p 167, pl vi, figs 1, 2.
Massilina secans (d'O) Schlumberger 1893 MGM, p 218, woodcuts, figs 31–34, pl iv, figs 82, 83.

(See also FC, p 167 ; MFM 1898, p 608.)

Occurs at nearly all the stations. Most abundantly and of enormous size in many of the shore-sands. The uniformity of the type all over the area, and the rarity of marked variations (*cf.* vars. *tenuistriata, denticulata,* &c), is noticeable, and is probably referable to the absence of those starved conditions, which would appear from our experiments at Selsey (H-A & E 1908, &c SB 1910, p 693) to have some influence in the production of secondary markings, and of such growths as are considered in our paper referred to.

40. Massilina secans var. **tenuistriata** Earland.

Massilina secans var. *tenuistriata* E 1905 FBS, p 198, pl xi, fig 5.
" " " " Heron-Allen & Earland 1908 &c, SB 1910, p 693, and 1909, p 317.

A few specimens at two stations, all rather weak.

41. Massilina annectens Schlumberger.

Plate I, figs 9-11.

Massilina annectens S 1893 MGM, p 200, pl iii, figs 77–79.
" " d'Orbigny [*sic*, error for Schlumberger] Sidebottom 1904 &c RFD 1904, p 18, pl v, figs 2–4.

(*New to the British Isles.*)

A few specimens found at station 34 which appear to be referable to Schlumberger's species, which, however, appears to us externally at least to have little claim to differentiation from an angular sub-arenaceous form of *Miliolina contorta*, under which name such specimens have probably been frequently recorded.

OPHTHALMIDIUM Kübler.

42. Ophthalmidium carinatum Balkwill & Wright.

Ophthalmidium carinatum B & W 1885 DIS, p 326, pl xii, figs 13–16.
Ophthalmidium inconstans Brady. B 1887 BS, p 884.

Occurs at six stations, both shore-sands and dredgings, and is abundant

at Station 31 (Killary Bay). All the specimens are very true to type, and show very little variation, and we are unable to agree with Brady in his conclusion that Balkwill and Wright's species is merely a depauperate form of *O. inconstans* Brady.

PLANISPIRINA Seguenza.

43. Planispirina Cliarensis sp. nov.

Plate II, figs 7, 8.

Test minute, compressed, highly polished, with two chambers visible on the inferior surface and three to four on the superior or oral surface. Periphery acute, and, in young specimens, carinate. Aperture a large, edentate, circular or ear-shaped opening at the termination of the final chamber, opening laterally upon the flat surface of the test, surrounded in most instances by an everted and rounded lip. The earliest chamber is an unseptate spiral coil. Length ·15 – ·25 mm.; breadth ·12 – ·18 mm.

This minute but distinctive little form occurs in considerable numbers at Station 23, but not elsewhere. Its affinities are not very distinctly marked, but we have little hesitation in referring it to Planispirina. Its nearest relative in that genus appears to be the little *Planispirina auriculata* (Egger), from the Mauritius and Western Australia, which closely resembles our form, but differs from it in the greater size of the apertural orifice and in the greater degree of convexity of the test (E 1893 FG, p 245). *Planispirina exigua* (Brady), so common in tropical shallow-water gatherings, and which is itself subject to a good deal of variation in shape and development, is also nearly related to our species. In the nature of its aperture, however, the species bears considerable resemblance to the abnormal form figured by Brady, and described by him (with reservations) under the name of *Spiroloculina? convexiuscula*. *P. Cliarensis* differs from Brady's species in the absence of the costae which are typical in that species, and in the comparative distinctness of the septation. The two species agree in the form of the orifice, and on that account alone it would seem that Brady's form is incorrectly placed in the genus Spiroloculina, and should be transferred to Planispirina.

44. Planispirina celata Costa sp.

Spiroloculina celata C 1855 FFMV, p 126, pl 1, fig 14; C 1853 &c PRN, pl xxvi, fig 5.

Planispirina celata (C) Wright 1886 SWI, p 208

(See also FC, p 197.)

Two specimens only, found at Station 34, small, but quite typical in all respects. This is normally a deep-water species and is common all over

the North Atlantic at depths from 230 to 1000 fms., but there are several British records in shallow water, two from the west of Scotland, and several from the S.W. of Ireland ranging from 48 to 120 fms.

Sub-Family PENEROPLIDINAE.

CORNUSPIRA Schultze.

45. Cornuspira foliacea Philippi sp.

Orbis foliaceus P 1844 EMS, p 147, pl xxiv, fig 25 [error for 26].
Cornuspira foliacea (P) Brady 1884 FC, p 199, pl xi, figs 5-9.
(See also FC, p 199; MFM 1898, p 612.)

Rare typical specimens were found at Stations 30 and 31, all of which are microspheric. Another specimen recorded from Station 34 is with some hesitation assigned to this species. In the general character of its shell it is more closely related to *C. Selseyensis*, and may possibly be merely an evolute variety of that species. All the specimens are small; the species appears to attain its maximum development in Arctic seas, where it reaches a very large size. Specimens nearly $\frac{1}{4}$-inch diameter have been found in some of the northernmost dredgings made by the "Goldseeker" in the North Sea. These large individuals are always of the highly-compressed and rapidly-widening variety figured by Brady (1884 FC, pl xi, fig 5); but our Clare Island specimens are of the type in which the width of the tube increases very gradually. This is the original type figured by Phillippi, and agrees fairly closely with Brady's second figure (*loc. cit.*, fig 6).

46. Cornuspira involvens Reuss sp.

Operculina involvens R 1849 FOT, p 370, pl xlvi, fig 30.
Cornuspira involvens R 1863 KTF, p 39, pl i, fig 2.
" " " Brady 1884 FC, p 200, pl xi, figs 1-3.
(See also MFM 1898, p 612; H-A & E 1909, p 318.)

The species is widely distributed over the area (24 stations), and occurs in most of the shore-sands and dredgings. The specimens are all rather small, and nearly all of the megalospheric form, in which the primordial chamber is large, and the succeeding whorls are few in number, and of practically even diameter throughout. In the microspheric form the primordial chamber is minute, and is followed by numerous convolutions of gradually increasing diameter. The proportion of megalospheric to microspheric tests out of those examined was 149 megalospheric and 3 microspheric. At some of the stations where the species was most abundant, specimens of a coarse variety were observed, passing imperceptibly into *C. Selseyensis*.

47. Cornuspira Selseyensis Heron-Allen and Earland.

Cornuspira ? Earland 1905 FBS, p 199, pl xiii, figs 2–4.
Cornuspira Selseyensis H-A & E 1908 &c SB 1909, p 319, pl xv, figs 9–11.

The species occurs at 28 stations, and abundantly at many of them. Both megalospheric and microspheric specimens have been observed, the proportions in the specimens observed being 136 megalo- and 3 microspheric.

48. Cornuspira diffusa Heron-Allen and Earland.

Cornuspira diffusa H-A & E 1912 &c NSG 1913, p 272–276, pl xii.

Two fragments have been observed at Stations 27 and 30 respectively, which are unquestionably referable to this species recently described by us (*ut suprâ*) from the North Sea. We have previously noticed occasional fragments in some of Mr. J. Wright's dredgings from the south-west of Ireland, and also in a shore-sand from Llanfihangel-y-Traethau (Merioneth), so that there can be no doubt that this curious type is widely distributed round the British Islands, but the infrequency of its occurrence both in the Clare Island area and elsewhere in Ireland would seem to point to the fact that it has not yet become established in these waters. In the North Sea, on the other hand, it is of quite common occurrence, and, as we have already pointed out, it diminishes in frequency in the direction of the Moray Firth. The west of Ireland, so far as we know at present, constitutes the outlying limit of its distribution.

Family ASTRORHIZIDAE.

Sub-Family PILULININAE.

TECHNITELLA Norman.

49. Technitella legumen Norman.

Technitella legumen N 1878 GH, p 279, pl xvi, figs 3–4.
" " " Heron-Allen and Earland 1909 TNS, pp 406, 408, 412, pl xxxiv, fig 10.
" " " Heron-Allen and Earland 1912 &c NSG 1912, p 382, pl v, figs 1–2.

(See also MFM 1899, p 251.)

One typical specimen was found at Station 25, which is particularly rich in the arenaceous forms, and a damaged one at Station 20.

The species has been recorded by Mr. Wright in hauls between Belfast and Port Patrick (Irish Nat., 1893, vol ii, p 27.)

BATHYSIPHON Sars.

50. Bathysiphon argenteus sp nov.

Plate III, figs 1–3.

Test free, minute, tubular, of a silvery lustre when viewed as an opaque object, flexible when living, rather brittle in the dry condition. Consisting of a very thin chitinous tube of nearly even diameter throughout, but sometimes exhibiting a slight increase in diameter with growth. The tube is open at both extremities, which are somewhat constricted and rounded. Viewed as a transparent object (in balsam) under a high magnification, the wall of the tube is seen to contain large numbers of extremely minute rod-shaped bodies, which are, as a rule, laid more or less at right angles to the long axis of the tube. The characteristic metallic lustre of the tube when viewed as an opaque object is apparently due to the diffraction of the rays of light falling on these parallel layers of spicules. The tube is not affected by boiling in nitric acid for a few seconds, so the spicules cannot be calcareous.

Length of tube ranges up to 2·0 mm.

External diameter from ·030 to ·050 mm.

Thickness of tube wall from ·002 to ·004 mm.

Spicules vary from ·001 to ·006 mm. in length.

A few fragments of this curious form were observed at Stations 30 and 32 (Killary Bay).

We have been familiar for several years with this beautiful species, which occurs in many of the dredgings made by the Fisheries cruiser "Goldseeker" round the Scottish coast. It appears to be confined to very muddy dredgings, but has a considerable range in depth, records extending from 10 to 200 fathoms at least. The finest specimens have been obtained from comparatively shallow water (10 fathoms) off Millport in the estuary of the Clyde; but it occurs at intervals all round the Scottish coast and in the North Sea right across to the Norwegian coast wherever suitable conditions exist.

A somewhat similar form was described by Mr. F. G. Pearcey from the Clyde area under the name *Bathysiphon minuta* ("On some Deep Sea Rhizopods found in the Clyde Area," Millport Marine Biol. Stat. Communications, I, 1900, p 39, pl ii, figs 1–5), and we were at first under the impression that our "Goldseeker" specimens were referable to his species, in spite of several obvious discrepancies.

Thus *B. minuta* is described as having "a long, thin, very narrow, gradually tapering tube with finely arenaceous walls consisting of fine mineral particles loosely cemented to a chitinous lining. When dried or

mounted in balsam, the walls of the tube collapse at intervals. Colour, light grey to white."

In *B. argenteus*, on the other hand, the tube is normally of equal diameter throughout, though occasionally there is a slight tendency to taper. Moreover, sand-particles are *never* utilized in the construction of the tube, which is always built up of the minute spicular bodies, and these give so much strength to the thin wall of the tube that it rarely collapses when drying, although it kinks when bent.

The question of identity was, however, settled by submitting a series of specimens to Mr. Pearcey, who kindly examined them, and informed us that our species is quite distinct from his. He added that a few of his specimens of *B. minuta* had *sponge* spicules incorporated in the tube, but the spicules were few in number.

The nature of the rod-like bodies incorporated in the tube of *B. argenteus* is doubtful. Their extremely minute size and absolute uniformity of shape point to their being secretions specific to the organism itself. *Bathysiphon filiformis* Sars, which utilizes spicules largely in the construction of its tube, is, of course, a comparatively enormous organism when compared with *B. argenteus*. The spicules in that species are derived from sponges, and exhibit great variety of shape: indeed, Brady mentions that Canon Norman obtained nineteen different kinds of sponge spicules from a single specimen, not one of which could be said to be predominant.[1]

The secretion of a peculiar spicule, assuming such to be the case in *B. argenteus*, would not be unique, as *Carterina spiculotesta* Carter sp. builds a rotaline test of calcareous spicules secreted by the animal itself.

Sub-family SACCAMMININAE.

PSAMMOSPHAERA Schulze.

51. Psammosphaera Bowmanni Heron-Allen & Earland.

Psammosphaera Bowmanni H-A & E 1912 &c NSG 1912, p 385, pl v, figs 5, 6.

Six specimens observed, one each at Stations 15, 19, 20, and 31, and two at Station 33. The specimens from Stations 19 and 33 are quite typical, being built up entirely of mica-plates, as in the original type-specimens. Of the other two specimens, one employs flat shell-fragments similar in shape and size to the normal mica-plates, and is no doubt referable to our species, while

[1] Professor A. Dendy, F.R.S., who was so kind as to examine specimens of *B. argenteus* at our request, does not consider that the spicular bodies are derived from sponges, and suggests that they may be of crystalline origin. Viewed under polarized light with $\frac{1}{8}$" objective and crossed Nicols, they exhibit a faint luminosity.

the third has utilized both mica and sand-grains, and forms a connecting link between *P. Bowmanni* and *P. fusca*.

52. Psammosphaera fusca Schulze.

Psammosphaera fusca S 1874 R, p 113, pl ii, fig 8.
„ „ „ Brady 1884 FC, p 249, pl xviii, figs 1-8.
„ „ „ Heron-Allen & Earland 1912 &c NSG 1913, p 1, pls i–iii.

(See also FC, p 249 ; BS, p 887; MFM 1899, p 251.)

Occurs at six stations, only a few specimens observed at each, but these represent a complete series of the free and attached forms described by us *ut suprâ*. The attached specimens comprise individuals both wholly arenaceous, and composed of the finest sand cement.

SACCAMMINA M. Sars.

53. Saccammina sphaerica M. Sars.

Saccammina sphaerica S 1868 LUHD, p 248.
„ „ „ Brady 1884 FC, p 253, pl xviii, figs 11–17.
„ „ „ Heron-Allen & Earland 1908 &c SB 1909, p 322, pl xv, figs 12, 13.
„ „ „ Heron-Allen & Earland 1912 &c NSG 1913, p 1, pls i and ii.

One abnormal and deformed specimen found at station 14. It is at the stage at which the neck that bears the orifice in the adult shell has not yet begun to form; and the aperture is large and irregular. *Saccammina sphaerica* being normally a deep-water species, this single specimen lies open to some suspicion. It may have drifted in from deep water, or its presence may perhaps be due to the dredge having been previously used by the "Helga" in deep water, and not thoroughly cleaned afterwards.

CRITHIONINA Goës.

54. Crithionina mamilla Goës.

Crithionina mamilla G 1894 ASF, p 15, pl iii, figs 34–36.
„ „ „ Millett 1898 &c MFM 1899, p 250, pl iv, fig 2.
„ „ „ Rhumbler 1903 ZRF, p 230, fig 56.
„ „ „ Heron-Allen & Earland 1912 &c NSG 1913, p 9, pl iii.

A doubtful specimen, which may be the young form of this species, occurs Station 14, and a few typical specimens attached to shells at Station 25.

The species has been very exhaustively figured and described by us recently in the JRMS *ut suprâ*.

Sub-Family RHABDAMMININAE.

JACULELLA Brady.

55. Jaculella obtusa Brady.

Jaculella obtusa B 1882 BKE, p 714.
„ „ „ Goës 1894 ASF, p 20, pl iv, figs 87–89, pl v, figs 90, 91.
„ „ „ Pearcey 1888 FFC, p 179.

A few fragments probably referable to this species were observed at Station 25, and one at Station 27.

HYPERAMMINA Brady.

56. Hyperammina vagans Brady.

Plate II, fig 9.

Hyperammina vagans B 1879 RRC, p 33, pl v, fig 3.
„ „ „ 1884 FC, p 260, pl xxiv, figs 1–9.
(See also H-A & E 1911, p 306.)

One small specimen from Station 15, and many from Station 27 attached to pebbles and shell-fragments. The species was first recorded from Oban by Canon Norman, and subsequently from the shore-sands of Bognor, where it occurs frequently, by Earland (E 1905 FBS, p 199). These appear to be the only British records; but the species would probably be found elsewhere if search were made in suitable situations, such as gravel deposits from moderate depths. It occurs abundantly in moderately deep water round the Scottish coast.

HALIPHYSEMA Bowerbank.

57. Haliphysema ramulosa Bowerbank.

Haliphysema ramulosa B 1864–66 Monogr. Brit. Sponges, vol ii, p 79; vol iii, p 33, pl xiii, fig 1.
„ „ B. Brady 1884 FC, p 283, pl xxvii a, fig 6.
(See also FC, p 283.)

Occurs plentifully on zoophytes at Station 16, and was also found at Station 36, also abundantly on Laminaria roots at Station 17. It has previously been recorded from Roundstone Bay, Co. Galway, by Canon Norman. The species may probably exist under similar conditions all over the area; but we had not many opportunities of examining suitable material.

58. Haliphysema Tumanowiczii Bowerbank.

Haliphysema Tumanowiczii B 1862 Phil. Trans. Roy. Soc. Lond., p 1105, pl lxxiii, fig 3; and Monogr. Brit. Sponges, vol i, 1864, p 179, pl xxx, fig 359; vol ii, 1866, p 76.
" " " W. Savile Kent 1878, The Foraminiferal nature of Haliphysema Tumanowiczii (Bow.) demonstrated. AMNH, ser 5, vol ii, p 68, pls iv, v.
" " " J. E. Duerden 1894 MIR, p 231.

A single specimen was observed growing with *H. ramulosum* at Station 16. This species has not been previously recorded from the west coast of Ireland, the only previous Irish record being by Mr. Duerden (as above) from Co. Dublin, as "abundant on *Crisia* and *Scrupocellaria*."

Family LITUOLIDAE.

Sub-Family LITUOLINAE.

REOPHAX Montfort.

59. Reophax difflugiformis Brady.

Reophax difflugiformis B 1879 &c RRC 1879, p 51, pl iv, fig 3.
" " " Brady 1884 FC, p 289, pl xxx, figs 1–5.

(See also BS, p 888; MFM 1899, p 252.)

A few specimens observed at six stations. They exhibit a great range in size and structure of the shell, the small individuals being largely composed of ferruginous cement, whilst the larger ones are entirely composed of coarsely agglutinated sand-grains.

60. Reophax fusiformis Williamson sp.

Proteonina fusiformis W 1858 RFGB, p 1, pl i, fig 1.
Reophax fusiformis (W) Siddall 1879 CBRF, No 4.

(See also FC, p 290; MFM 1899, p 253.)

Occurs at seven stations, at which it is for the most part of frequent occurrence. The specimens are all quite typical, except that at Station 32 they exhibit less than the usual tendency to incorporate large flakes of mica in the test. The specimens in this dredging are uniformly built up of fine grey sand, with a few coarser grains embedded,

61. Reophax scorpiurus Montfort.

Reophax scorpiurus M 1808 CS, vol i, p 330, 83e genre.
„ „ „ Brady 1884 FC, p 291, pl xxx, figs 12–17.
(See also FC, p 291; MFM 1899, p 254.)

Occurs at three stations, fairly typical. A few adherent specimens, similar to the shell figured by Brady as "*Saccammina sphaerica*, polythalamous adherent specimen" (FC, pl xviii, fig 16), were also seen.

62. Reophax moniliforme Siddall.

Plate II, fig 12.

Reophax (?) sp. Balkwill & Wright 1885 DIS, p 328, pl xiii, figs 9, 22–24.
Reophax moniliforme Siddall 1886 LMBC, p 54, pl i, fig 2.
Reophax sp. (?) (Balkwill & Wright), Halkyard 1889 RFJ, p 66, pl 1, figs 8, 9.
Reophax moniliforme Siddall, Heron-Allen & Earland 1908 &c SB 1909, p 322.

Fairly well distributed throughout the dredgings, and frequent at some stations, attaining, especially at Station 27, exceptionally fine proportions. As usual, the majority of the specimens are fragmentary, consisting of the oral extremity and a few chambers only; but many perfect tests have been found, and from these it is quite evident that Siddall's species is quite distinct from *R. findens* (Parker sp.), with which Brady merged it (BS, p 889). *R. moniliforme* commences with a turgid initial chamber, which is generally broader than any subsequent portion of the test. In extreme instances this initial chamber almost forms a bulb at the extremity of the shell. The subsequent chambers throughout the growth of the test are of practically uniform diameter, or they may show a tendency to narrow in width with the growth of the shell, so that the ultimate chambers are smaller than their predecessors. The shell is always of a distinctive ferruginous tint, whether it is constructed of fine sand and cement, or, as is often the case, largely of sponge spicules, laid evenly in the direction of the long axis of the shell. The septation is often very obscure. Mr. Siddall's original figure gives a very misleading impression on this point.

It is not at all clear why perfect specimens of *R. moniliforme* should be so uncommon, or why the broken fragments which are of frequent occurrence wherever the species is found should all represent the ultimate chambers of the shell. Messrs. Balkwill and Wright's suggestion that these broken fragments represented portions of a sessile organism was a very plausible explanation of the difficulty so long as only imperfect specimens had been found, but has of course been discarded since Mr. Siddall discovered perfect

shells. We have been unable to convince ourselves that the early chambers are more fragile or thinner than the rest of the test.

63. **Reophax findens** Parker sp.

Plate II, fig 13.

Lituola findens P 1870 GStL, p 177, p 180, fig 1.
Reophax findens (P) Brady 1884 FC, p 299, pl xxxii, figs 10, 11.
„ „ „ Brady 1887 BS, p 889.

A few specimens of this extraordinary little form were found at six stations. Only one perfect specimen was found, but many fragments showing the characteristic furcate initial portion. It is rather curious that in this species the ultimate chambers are the ones which become most easily destroyed, while in *R. moniliforme* they are the most constantly preserved. Other minute points of difference are noticeable in the structure of the shell, which is much rougher and less finished than is the case with *R. moniliforme*. Further, *R. findens* appears never to use sponge spicules as building-material, although living in the same locality as *R. moniliforme*, which makes free use of them.

R. findens was recorded in Great Britain by Mr. Siddall from the estuary of the Dee, and the original record from Gaspé Bay (Gulf of St. Lawrence) is the only other locality known to us. There are further records by Chaster from Southport, and Scott and Pearcey from the Firth of Forth, also by Wright from the Irish Sea, but in all these cases it is probable that the authors were accepting Brady's identification of *R. moniliforme* Siddall with *R. findens* Parker sp., and that the specimens were really *R. moniliforme*, the commoner species.

64. **Reophax Scottii** Chaster.

Reophax nodulosa (?) Scott 1890 8th Ann. Report of the Fisheries Board of Scotland, pt iii, p 314.
Reophax Scottii C 1891 CS, p 57, pl i, fig 1.
„ „ „ Millett 1898 &c MFM 1899, p 255, pl iv, fig 13.

Was observed at at least ten stations, and probably occurs at many others. The extreme fragility of the shell in the dried condition renders it very liable to destruction in the process of cleaning material. *R. Scottii* occurs more or less abundantly all round the British coast on muddy bottoms. The largest specimens which we have seen were dredged off Millport in the Clyde area, where it attains exceptionally fine dimensions. It is one of those foramini-

[1] species which exhibit marked selective power. Balsam-mounted

specimens, when examined under polarized light, are seen to be almost entirely composed of extremely minute flakes of mica, attached to a chitinous membrane.

HAPLOPHRAGMIUM Reuss.

65. Haplophragmium pseudospirale Williamson sp.

Proteonina pseudospiralis W 1858 RFGB, p 2, pl i, figs 2, 3.
Haplophragmium pseudospirale (W) Siddall 1879 CBRF, p 4.

(See also MFM 1899, p 358.)

The species occurs at many of the stations and abundantly in the muddy dredgings among the islands at the head of Clew Bay. As is always the case when this species is common, specimens present great variety of outline, passing imperceptibly from small involute specimens with but little tendency to assume the crosier habit of growth, into evolute and prolonged dimorphous varieties. In these the final chambers may either continually increase in breadth, or may narrow and become inflated, in rare instances assuming a Nodosarian habit of growth.

66. Haplophragmium Canariense d'Orbigny sp.

Plate III, fig 5.

Nonionina Canariensis d'O 1839 FIC, p 128, pl ii, figs 33, 34.
Haplophragmium Canariensis (d'O) Siddall 1879 CBRF, p 4.
„ *Canariense* „ Brady 1884 FC, p 310, pl xxxv, figs 1–5.

(See also FC, p 310; MFM 1899, p 359.)

The species is generally distributed, and abundant at some of the stations. There is considerable variety, but the dominant type at most of the stations is a thin evolute form, in which the final convolution leaves parts of the penultimate convolution exposed in the umbilical region. A small and more inflated and regularly nautiloid type occurs in its company at some of the stations, in which the final convolution covers the whole umbilical region. At Station 15 an emaciated variety of the evolute type occurs in which the shell-wall is so thin that it collapses irregularly in the process of drying. This variety may be compared with the var. *macrescens* of *Trochammina inflata* Most of the specimens of *H. Canariense* in the area of the Survey are of typical ferruginous colour; but light-coloured grey specimens are to be found at most stations, whilst at Station 13 the species is normally devoid of ferruginous colouring and uniformly grey. Plastogamic specimens, one of which we figure, were observed at one or two of the stations.

67. **Haplophragmium latidorsatum** Bornemann sp.

Plate II, figs 15, 16.

Nonionina latidorsata B 1855 FSH, p 339, pl xvi. fig 4.
Haplophragmium latidorsatum (B) Brady 1884 FC, p 307, pl xxxiv, figs 7–10, 14

(See also MFM 1899, p 360; H-A & E,1911, p 308.)

Three minute specimens were found at Station 23. The occurrence of this deep- or cold-water form in such shallow water is noticeable. In the cold water of the Faröe Channel and in the Norwegian Deep it occurs in such enormous numbers as to form the principal constituent of the ooze, and the specimens attain a comparatively gigantic size. The Clare Island specimens are very small, but in the general arrangement of the chambers and the lateral twist of the central axis they are quite typical.

68. **Haplophragmium glomeratum** Brady.

Plate II, fig 14.

Lituola glomerata B 1878 RRNP, p 433, pl xx, fig 1.
Haplophragmium glomeratum B. Brady 1881 HNPE, p 100, No 21.
„ „ „ Brady 1884 FC, p 309, pl xxxiv, figs 15–18.

(See also BS, p 890.)

Two specimens from Station 31 and one from Station 33. This is normally a cold-water form, but it has been recorded previously from Ireland.

69. **Haplophragmium globigeriniforme** Parker & Jones sp.

Lituola nautiloidea var *globigeriniformis* P & J 1865 NAAF, p 407, pl xvii, figs 46, 47 (pl xvii, figs 96–98).
Lituola globigeriniformis (P & J) Wright 1877 RFDA, p 103, pl iv, fig 6.
Haplophragmium globigeriniformis (P & J) Siddall CBRF, p 4.

(See also MFM 1899, p 361.)

The species occurs in nearly all the dredgings and in some of the shore-sands (22 stations). At some stations it is quite common. There is little variation except in the degree of development, at some stations the specimens being of much larger size than at others. Throughout the area the shells are of a single type in which the superior face is almost flat, the early convolutions not being raised in a trochoid spire. It is thus more nearly isomorphous with *Globigerina inflata* than with *G. bulloides*.

70. Haplophragmium anceps Brady.

Plate III, fig 4.

Halophragmium anceps B 1884 FC, p 313, pl xxxv, figs 12–15.
„ „ „ Chaster 1892 CS, p 57, pl i, fig 2.
„ „ „ Millett 1898 &c MFM 1899, p 361, pl v, fig 10.

Four specimens were noticed, two each from Stations 15 and 34. One of the specimens is fairly large and well developed, the others minute but regular and typical. Only two previous records exist for Great Britain, one specimen having been found by the late Dr. Chaster (*ut suprâ*) at Southport, and several by Earland at Bognor (E 1905 FBS, p 200): it is also included on the authority of Dr. Chaster (*suprâ*) in the "List" of Foraminifera from the Irish Sea (British Association Report, 1896, p 427). The species is normally a deep-water one, Brady's records ranging between 390 and 2200 fms., but Mr. Millett records it as numerous and well distributed in the shallow water of the Malay Archipelago.

PLACOPSILINA d'Orbigny.

71. Placopsilina vesicularis Brady.

Placopsilina vesicularis B 1879 &c RRC 1879, p 51, pl v, fig 2.
„ „ „ Brady 1884 FC, p 316, pl xxxv, figs 18, 19.

A few small and somewhat obscure specimens from Station 27 (18 fms.). The occurrence of this species in such shallow water is very noticeable. The "Challenger" records, which, with one exception, were from the N.W. of Ireland, range between 630 and 1443 fms. The species is extremely abundant attached to stones and other Foraminifera at many of the "Goldseeker" stations in the Shetland-Faröe Channel, often at depths considerably less than the "Porcupine" and "Challenger" records.

Sub-family TROCHAMMININAE.

THURAMMINA Brady.

72. Thurammina papillata Brady.

Thurammina papillata B 1879 &c RRC 1879, p 45, pl v, figs 4–8.
„ „ „ Earland 1905 FBS, p 201, pl xi, figs 6, 7, pl xiv, figs 1, 3.

(See also FC, p 321; H-A & E 1909, p 323.)

Two specimens, one each from Stations 15 and 33. The specimen from Station 33 is of the normal neat sandy type, but with hardly any trace of

tubules. That from Station 15 is of a dark colour with a shell-wall of translucent chitin, and is studded with minute tubular apertures.

The shell-wall of Thurammina is extremely variable in structure and texture. We have a complete series of specimens from deep-water stations in the North Sea dredged by the "Goldseeker," and propose to deal with the variations shortly in one of our series of papers now in course of publication in the JRMS.

HIPPOCREPINA Parker.

73. Hippocrepina indivisa Parker.

Plate II, figs 10, 11.

Hippocrepina indivisa P 1870 GStL, p 176, fig 2.
" " " Brady 1881 HNPE, p 101, pl ii, figs 3, 4.
" " " Rhumbler 1903 ZRF, p 274, fig 124.

(*New to the British Isles.*)

A single specimen from Station 15, somewhat truncate in form, light grey in colour, and metallic in lustre, due probably to the use of minute flakes of mica in the construction of the test.

The occurrence of this extremely rare and peculiar form at Clare Island is very noteworthy. It is normally an arctic or sub-arctic species, the original records being from specimens found by Dr. Dawson in Gaspé Bay in the Gulf of St. Lawrence at depths of 16–20 fms. Canon Norman subsequently dredged it off Greenland in 10 fms., and Brady also records it from Novaya Zembla, 10–15 fms. Until recently these constituted the sole records of its occurrence; a few years ago, however, Earland dredged it in some abundance in the muddy gully off Burghead in the Moray Firth ("Goldseeker," Haul 73, Burghead S. ½ W. 3 miles, 55 metres) in material which contained *Botellina labyrinthica* and many other normally deep-water species. It would therefore appear that the species occurs as a survivor of an arctic fauna in localities where conditions have since altered, unless we are to presume that it is an arctic species now extending its range into warmer waters. From the absence of specimens in intermediate localities, it would seem much more probable that the southern records represent survivals of, rather than extension of the range of, the species.

The Clare Island and Moray Firth specimens possess all the features of the arctic types, but differ in the construction of the test, which is very thin-walled and fragile, whereas the arctic specimens are of comparatively stout build.

AMMODISCUS Reuss.

74. Ammodiscus incertus d'Orbigny sp.

Operculina incerta d'O 1839 OFC, p 49, pl vi, figs 16, 17.
Ammodiscus incertus (d'O) Brady 1884 FC, p 330, pl xxxviii, figs 1–3.

(See also BS, p 891; MFM 1899, p 362; H-A & E 1909, p 324.)

The species is well distributed in the dredgings (11 stations). The specimens vary considerably in size from very minute up to the average dimensions for the species in shallow water. Two distinct types are to be found in nearly all the dredgings in which the species occurs, one the ordinary ferruginous type commonly associated with the arenaceous Foraminifera, and the other a pale grey form showing no trace of ferruginous cement. The absence of ferruginous colouring matter in the cement in the Arenacea has been put forward by Dr. Rhumbler and others as evidence that the light-coloured specimens are young and immature (H-A & E 1912 &c NSG 1913, p 12); but, as in many other dredgings which we have examined, the light-coloured specimens are here found of all sizes, and frequently exceeding in size the largest ferruginous examples. This would seem to indicate that colour is merely a racial distinction in the composition of the cement substance, and has not necessarily any direct bearing upon the age of the individual.

75. Ammodiscus gordialis Jones & Parker sp.

Trochammina squamata gordialis J & P 1860 RFM, p 304.
Ammodiscus gordialis (J & P) Brady 1884 FC, p 333, pl xxxviii, figs 7–9.

(See also BS, p 891; H-A & E 1909, p 324.)

The species is well distributed throughout the gatherings (9 stations), mainly in the dredged material. The specimens are, as a rule, of the irregularly contorted type, but a few, notably at Station 27, are of the fairly regular type similar to those figured in the "Challenger" Monograph (FC *suprâ*).

Messrs. Balkwill and Millett report this species as of moderate frequency in the Galway shore-sand (B & M 1884 FG, p 26). It does not appear in Mr. Wright's list of species from Dog's Bay.

76. Ammodiscus Shoneanus Siddall sp.

Plate III, fig 6.

Trochammina Shoneana S 1878 SFD, p 46, woodcuts 1, 2.
Ammodiscus Shoneanus S, Brady 1884 FC, p 335, pl xxxviii, figs 17–19.

(See also FC, p 335.)

This very rare and minute species was found at three stations only among the dredgings. It was first described by Siddall from the estuary of the Dee,

and has been recorded by Balkwill and Wright from various Irish localities, and also by Robertson from Loch Fyne in 105 fms. Apart from these British records, it occurs in "Challenger" dredgings at Kerguelen Island (120 fms.) and in the North Pacific (3250 fms.). All the Clare Island specimens have the initial chamber of a markedly megalospheric type, showing as a transparent vesicle of almost equal diameter to the subsequent convoluted tube. In this feature our specimens agree with the original woodcut of Siddall (*ut suprâ*); one at least of the figures (fig 18) in the "Challenger" Monograph shows, on the other hand, a test beginning in a sharp triangular point. This would probably be referable to the microspheric form of the species.

TROCHAMMINA Parker & Jones.

77. Trochammina squamata Jones & Parker.

Plate III, figs 7–10.

Trochammina squamata J & P 1860 RMF, p 304, Table.
" " " Brady 1879 &c RRC 1879 p 57.

(See also FC, p 337; BS, p 891; MFM 1899, p 362.)

Almost universally distributed in the area (24 stations), often very abundant, and exhibiting a considerable amount of variation, mainly in the degree of inflation of the chambers, or in the amount of compression exhibited by the shell. The usual tint of the specimens is an ochreous grey; but the more inflated varieties tending towards *T. rotaliformis* assume a ferruginous tint. Plastogamic specimens were observed at several stations.

The synonymy of this species is somewhat confused. Jones and Parker originally assigned the specific name *squamata* to a shell "divided throughout into lunate and flattened chambers, several in a whorl, and regularly increasing with the progress of growth. It much resembles those flatter varieties of *Rotalia turbo* which are intermediate between *R. globularis* and *R. rosacea*. *T. squamata* may easily be confounded with little conical scale-like varieties of *Valvulina triangularis*; but the latter (more nearly allied to the Verneuiline Textulariae) have never more than three chambers in a whorl and are more coarsely sandy." Subsequently (in 1865) Parker and Jones (P & J 1865 NAAF, p 407) published a figure of *T. squamata* which they identified in the text with their previous description. Later, in the "Challenger" Monograph, Brady discarded both figure and description, on the ground that they represented Williamson's *Rotalina ochracea* (W 1858 RFGB, p 55), and applied the specific name *T. squamata* to a three-chambered form which was apparently the actual variety from which Parker and Jones had taken

the trouble to distinguish and discriminate their specimens. This three-chambered variety, which is isomorphous with *Valvulina fusca*, Brady figured in the "Challenger" Monograph (FC) as *T. squamata*. We are of opinion that the two forms are entirely distinct. The Clare Island specimens, though so numerous, and showing so much variation in other directions, exhibit no tendency towards Brady's type. They all conform to Jones and Parker's description, and to Parker and Jones's figure; and the variations they exhibit, linking them with *T. ochracea* (Williamson), only serve to accentuate the specific features of Parker and Jones's species, which is unquestionably closely related to Williamson's type.

78. **Trochammina ochracea** Williamson sp.

Rotalina ochracea W 1858 RFGB, p 55, pl iv, fig 112, pl v, fig 113.
Trochammina ochracea (W) Balkwill & Millett 1884 FG, p 25, pl i, fig 7.

(See also BS, p 892; MFM 1899, p 363.)

This little species occurs, for the most part abundantly, at 26 stations, and at some stations attains quite unusual development both as to size and substance. Typically the species is thin and scale-like, and almost translucent, but under favourable circumstances it secretes a much thicker wall, and passes almost imperceptibly into *T. squamata*, from which such robust specimens are hard to separate. The curved radiating sutures on the under surface are, however, a fairly constant feature, and present the only means of distinguishing this species from the closely allied *T. plicata* of Terquem, which also occurs abundantly all over the area. Sessile specimens of *T. ochracea* were noted, and also instances of true plastogamy. In all the plastogamic specimens observed there was great difference in the size of the conjugated individuals.

79. **Trochammina plicata** Terquem sp.

Patellina plicata T 1875 &c APD 1876, 2nd fasc, p 72, pl viii, fig 9.
Trochammina plicata (T) Balkwill & Millett 1884 FG, p 26, pl ii, fig 8.
" " " Halkyard 1889 RFJ, p 69, pl i, fig 11.

This occurs almost invariably in the same material as *T. ochracea*, though it is never so abundant as that species. It is difficult to distinguish the species when viewed from the superior side, but the characteristic wrinkled under-surface of *T. plicata* is a perfectly constant specific feature.

80. **Trochammina inflata** Montagu sp.

Nautilus inflatus M 1808 TB Suppl, p 81, pl xviii, fig 3.
Trochammina inflata (M) Brady 1884 FC, p 338, pl xli, fig 4.

(See also FC, p 338; MFM 1899, p 364; H-A & E 1909, p 324.)

A few specimens at each of six stations, quite characteristic. All these stations are at localities where a greater or less amount of fresh water comes into the sea. This doubtless accounts for the occurrence of the species, which is normally an inhabitant of waters of low salinity.

81. **Trochammina inflata** var **macrescens** Brady.

Trochammina inflata var *macrescens* B 1870 FTR, p 290, pl xi, fig 5.
„ „ „ „ Brady 1887 BS, p 892.

A few specimens at four stations generally accompanying *T. inflata*. There is very little doubt that specimens classed under the varietal name *macrescens* are merely individuals of *T. inflata* which have not been able to secrete sufficient cement and sand to render their chitinous test even as rigid as it is found in the parent species. They are invariably associated with starved conditions of habitat, induced by a low salinity.

82. **Trochammina rotaliformis** J. Wright MS.

Plate III, figs 11–13.

Trochammina inflata (Montagu) var., Balkwill & Wright 1885 DIS, p 331, pl xiii, figs 11, 12.
Trochammina rotaliformis J. Wright, Heron-Allen & Earland 1908 &c SB 1911, p 309.

(See also H-A & E 1911, p 309.)

Occurs sparingly at 15 stations, the most typical and characteristic specimens being found at Station 27. At the others the form shows a tendency towards *T. squamata*, the individuals being depressed, and wanting in that rich ferruginous tint which characterizes the true *T. rotaliformis*. The average dimensions of typical specimens are from ·3 to ·45 mm. broad and ·15 mm. high.

Halkyard figures and records specimens of this form from Jersey shore-sands under the name "*Trochammina inflata* B & W" (H 1889 RFJ, p 66).

83. Trochammina Robertsoni Brady.

Trochammina Robertsoni B 1887 BS, p 893.
„ „ „ Wright 1891 SWI, p 469, pl xx, fig 4.

One specimen from Station 32. This differs from the type in the structure of its test, which is more coarsely arenaceous than is usually the case. In shape and arrangement of chambers, however, it is quite typical. *T. Robertsoni* is moderately common in dredgings round the Scotch and Irish coasts, and is one of the most characteristic and easily recognized species, owing to its rich colour and highly polished ferruginous shell. The Clare Island specimen is, however, constructed of very minute sand-grains without excess of cement. This may be due to the shallowness of the water in the Clare Island area; most of the specimens we have seen hitherto have been from depths of 100–400 fms. The name *T. Robertsoni* was first used by Brady in 1876 (Carbon. Perm. Foram., Palaeontographical Soc., p 80, pl iii, figs 6, 7) for a minute form of quinqueloculine appearance, and quite distinct from the recent species to which he subsequently attached the same specific name. In ordinary circumstances the second name would lapse; and Dr. Robertson himself proposed (AMNH, ser 6, vol vii, 1891, p 388) that the recent species be renamed *T. Bradyi* after the author. But the fossil form is almost certainly a miliolid, and, as such, would be more correctly known as *Miliolina Robertsoni* Brady sp., so that the specific name *Robertsoni* can be retained for the recent Trochammina with less fear of confusion than if it was renamed as Dr. Robertson suggested.

WEBBINA d'Orbigny.

84. Webbina hemisphaerica Jones, Parker and Brady.

Webbina hemisphaerica J P & B 1866 &c MCF 1866, p 27, pl iv, fig 5.
„ „ „ Brady 1884 FC, p 350, pl xli, fig 11.
„ „ „ Heron-Allen and Earland 1908 &c SB 1909, p 325, pl xv, fig 14.

(See also H-A & E 1909, p 325.)

Three typical specimens from Station 25, one attached to a large molluscan fragment, another in the concavity of a small bivalve shell, and a third which has become detached. This well-marked type, originally described as a fossil from the Crag, and subsequently recorded from the coast of Durham, is probably much more widely distributed than was at one time believed. We have quite typical specimens from several localities round the British coast, and have also met with it in dredgings from the Hauraki Gulf in New

Zealand. It is usually found in coarse shell-sand or gravel containing few other Foraminifera, and this perhaps accounts for the paucity of records.

Family TEXTULARIDAE.

Sub-Family TEXTULARINAE.

TEXTULARIA Defrance.

85. Textularia concava Karrer sp.

Plecanium concavum K 1868 MFKB, p 129, pl i, fig 3.
Textularia concava (K), Brady 1884 FC, p 360, pl xlii, figs 13, 14, pl xliii, fig 11.

(See also MFM 1899, p 559 ; H-A & E 1911, p 309.)

A few good and characteristic specimens found at four stations. The species has been previously recorded from Dog's Bay and from the south-west of Ireland by Mr. Wright (W 1889 SWI, p 447, and W 1891 SWI, p 471 &c) as well as from the Estuarine Clays of the North of Ireland.

86. Textularia sagittula Defrance.

(For references see also under *Spiroplecta Wrightii*).

Textularia cuneiformis (*typica*) ? Williamson 1858 RFGB, p 75, pl vi, figs 158, 159.
Textularia sagittula Defrance, Balkwill and Wright 1885 DIS, p 332, pl xiii, figs 15–17 (*pars*).

A few specimens answering in every way to the Textularian type were found at 3 stations. Messrs. Balkwill and Wright figure similar specimens from the Irish Sea. We have discussed the co-existence of *Spiroplecta Wrightii* and *Textularia sagittula* under the heading of the former species, for which we have adopted Professor Silvestri's name *S. Wrightii*, for reasons there set forth at length (*cf.* also Fornasini, Boll. Soc. Geol. Italiana, vol. vii, 1888, pl iii, figs 2–4).

87. Textularia agglutinans d'Orbigny.

Textularia agglutinans d'O 1839 OFC, p 144, pl i, figs 17, 18, 32–34.
„ „ „ Göes 1894 ASF, p 35, pl vii, figs 281–4 and 294–303.

(See also FC, p 363 ; MFM, 1899, p 562.)

A few typical specimens at eight stations, but the species is not of common occurrence, although specimens presenting features intermediate between *T. agglutinans* and *T. gramen* are common at many stations.

88. Textularia gramen d'Orbigny.

Textularia gramen d'O 1846 FFV, p 248, pl xv, figs 4–6.
„ „ „ Brady 1884 FC, p 365, pl xliii, figs 9, 10.
(See also MFM 1899, p 563; H-A & E 1909, p 326.)

Almost as universally distributed as *T. conica* (24 stations), with which, and with *T. agglutinans*, it is connected at many stations by intermediate and transitional forms.

89. Textularia conica d'Orbigny.

Textularia conica d'O 1839 OFC, p 143, pl i, figs 19, 20.
„ „ „ Brady 1884 FC, p 365, pl xliii, figs 13, 14; pl cxiii, fig 1.
(See also MFM 1889, p 563.)

Universally distributed throughout the area, exhibiting all variations of size, from the very small compressed and truncate form, up to specimens which form a connecting link with *T. gramen*. Although *T. conica* does not appear in BS, it is widely distributed round the British coast, and is often one of the most abundant Foraminifera to be found in shallow-water dredgings.

VERNEUILINA d'Orbigny.

90. Verneuilina pygmaea Egger sp.

Plate IV, fig 10.

Bulimina pygmaea E 1857 MSO, p 284, pl xii, figs 10, 11.
Verneuilina pygmaea (E) Brady 1884 FC, p 385, pl xlvii, figs 4–7.
(See also MFM 1900, p 11; H-A & E 1909, p. 327.)

One specimen from Station 13, presenting all the characteristic features, including the loop-like orifice, but with a hyaline instead of the usual arenaceous test. Mr. Millett in MFM records a somewhat similar little form, also hyaline, as scattered all over the Malay Archipelago; but in his specimens no aperture was visible.

91. Verneuilina polystropha Reuss sp.

Plate IV, figs 1–5.

Bulimina polystropha R 1845 VBK, pt ii, p 109, pl xxiv, fig 53.
Verneuilina polystropha (R) Brady 1884 FC, p 386, pl xlvii, figs 15–17.
(See also FC, p 386; MFM 1900, p 11.)

Almost universally distributed (26 stations), often very abundant and finely developed, and showing the usual range of variation in length, breadth, degree of inflation, and colour. At a few stations a minute variety occurs in

very small numbers, which we have observed at many other localities where the larger type is abundant. It exactly resembles the common types, but is normally only one-eighth of their size, though often possessing a far greater number of chambers than the larger specimens. The average length of these dwarf specimens is from ·17 to ·3 mm., and their average breadth ·07 to ·1 mm. It is possible that these minute individuals may represent the microspheric form, but, owing to the difficulty of observing the primordial chamber in this species, we are unable to make any definite pronouncement on this point.

Curiously enough, this species, one of the most abundant in the Clare Island area, is recorded by Messrs. Balkwill and Millett as "very rare" in the adjacent Galway shore-sands (B & M 1884 FG, p 24).

SPIROPLECTA Ehrenberg.

92. Spiroplecta biformis Parker & Jones sp.

Textularia agglutinans var. *biformis* P & J 1865 NAAF, p 370, pl xv, figs 23, 24.
Spiroplecta biformis (P & J) Brady 1884 FC, p 376, pl xlv, figs 25–27.

(See also FC, p 376; MFM 1900, p 8; H-A & E 1911, p 310.)

A few well-marked and characteristic specimens at 5 stations.

This is one of the species which raise the question as to the value of a sub-arenaceous investment in the diagnosis of specific characteristics. *S. rosula* Ehrenberg is identical in structure and shape, but possesses a perforate hyaline shell, whereas that of *S. biformis* is invariably sub-arenaceous. If the arenaceous integument possesses no special zoological significance (and there are several species of the Textularidae in which the sandy covering varies in development according to local conditions), the two species should be merged, and Ehrenberg's specific name would be entitled to priority. But the sub-arenaceous type is certainly the more widely distributed and characteristic of the two forms; and on this account it is perhaps advisable to keep them separate, or at least to consider *S. rosula* as a hyaline variety of the sandy form.

93. Spiroplecta Wrightii Silvestri.

Textularia sagittula Defrance 1824, Dictionnaire des Sciences Naturelles, vol xxxii, p 177; vol liii, p 344; Atlas Conch, pl xiii, fig 5.
Spiroplecta sagittula (Defrance) Wright 1891 SWI, p 471.
" " " Wright 1902 FRI, p 211, pl iii.
Spiroplecta Wrightii Silvestri 1903 S, pp 1–5, woodcuts.

(See also FC, p 361; MFM 1899, p 560; H-A & E 1809, 331.)

Almost universally distributed in the area (28 stations), and often very common. Two well-marked forms are present, and usually in associa-

tion, one a round, blunt-ended form showing a large spiroplectine commencement very plainly marked by sutural lines on the initial portion of the test, the other a sub-acutely pointed form in which the spiroplectine chambers are with difficulty distinguishable. Mr. Halkyard noted the same feature in specimens from the Channel Islands, and called attention to their significance (H 1891 FGHJ, p 21). They represent the megalospheric and microspheric forms of the species; and the relative frequency of the two types confirms this explanation, the pointed or microspheric form being very rare compared with the rounded or megalospheric type.

Professor A. Silvestri has published a paper (*suprâ*), in which he analyses the relationship of the spiroplectine specimens to the original *Textularia sagittula* of Defrance. He does not accept Mr. Wright's suggestion that the forms are specifically identical (*suprâ*), and proposes to substitute a new species *S. Wrightii* for the spiroplectine specimens heretofore referred to *S. sagittula*, and to retain *Textularia sagittula* for those individuals which do not present any spiroplectine arrangement of the initial chambers. It appears to us that far too much stress is often laid upon the specific value of variation in the initial chambers of certain genera of the Foraminifera—variations which, in the case of some genera, are not to be ascertained save by sectioning and consequent destruction of the specimen. We are not inclined to attribute much more value to variation in the earliest chambers of a shell than we are to eccentric or wild-growing or abnormal developments in the later stages of its growth. The general characteristics of growth are in our opinion the most reliable features for the discrimination of species, but in the present uncertain condition of our knowledge of the life-history of the Foraminifera and the relationship of the various genera, it is perhaps advisable to separate the two forms into their respective genera according to the initial plan of growth.

GAUDRYINA d'Orbigny.

94. Gaudryina filiformis Berthelin.

Plate IV, figs 7–9.

Gaudryina filiformis B 1880 EAM, p 25, pl xxiv, fig 8.
" " " Wright 1882. Proc Belfast Nat Field Club (1880–1881), App, p 180, pl viii, figs 3A, B.
" " " Brady 1884 FC, p 380, pl xlvi, fig 12.

The species occurs in one shore-sand (No. 1) and nine dredgings, abundantly and very well developed in some of the stations among the islands at the head of Clew Bay (Stations 18, 19, 20). The Gaudryine earlier chambers are better developed in specimens from these stations than is usually

the case in shallow-water specimens. Variation occurs in two directions: a large form in which the sides are nearly parallel and the number of chambers is considerable, and a shorter form in which the gaudryine chambers are inconspicuous and the marginal edges diverge at an acute angle, owing to the rapid broadening of the chambers.

95. Gaudryina rudis J. Wright.

Plate III, figs 14–17.

Gaudryina rudis W 1900 DBC, p 53, pl ii, fig 1.

This very variable species occurs at 29 stations, at some in great profusion. It is unquestionably one of the most characteristic and dominant types of the shallow-water deposits in the area of the Survey. It is also widely distributed around the Irish coast; Mr. Wright records it as occurring in thirty of the Lord Bandon gatherings from the S.W. of Ireland, ranging from between tide-marks down to 110 fathoms; as frequent off Belfast Lough (30–60 fathoms), and common in the shore-sands of Dog's Bay, Connemara. Outside the Irish area we have numerous records of its occurrence on the west coast of Scotland (shallow water), at several Welsh stations, and also in the Orkneys and in the Moray Firth on the east coast, but it does not appear to have been found in the English Channel or in the English North Sea.

Typically the species is conical and regularly tapering, but at least two well-marked varieties can be separated, (i) specimens in which the long axis of the shell is comparatively short and the shell increases rapidly in breadth, giving a Valvuline appearance to the organism, (ii) a long conical shell with smooth sides in which the septation is very obscure, closely resembling *Textularia turris*. When the test is perfect, such specimens could easily be confused with *T. turris* or *T. trochus*; and it is quite possible that some of the British records of them should more correctly have been assigned to Wright's species. It seems hardly possible otherwise to account for the fact that such a common and widely distributed form as *G. rudis* should have been entirely overlooked until Mr. Wright first drew attention, in 1900, to its occurrence in the shore-sands of Dog's Bay. In the majority of specimens, identification is rendered easy by the fact that the initial chambers are broken open, and so render visible the gaudryine nature of the test.

VALVULINA d'Orbigny.

96. Valvulina fusca Williamson sp.

Rotalina fusca W 1858 RFGB, p 55, pl v, figs 114, 115.

Valvulina fusca (W), Brady 1884 FC, p 392, pl xlix, figs 13, 14.

(See also FC, p 392.)

Occurs sparingly at Stations 14 and 25. Williamson records this as

"found on almost all parts of the coast," but in our experience this is not the case. We have seldom met with it in shore-sands or shallow dredgings; but it is very common in some of the "Goldseeker" dredgings in moderately deep water off the west coast of Scotland, and usually in the attached form with extended pseudopodial processes masked in white cement-substance. The Clare Island specimens are all free.

CLAVULINA d'Orbigny.

97. Clavulina obscura Chaster.

Plate IV, fig 6.

Verneuilina polystropha (Reuss) "dimorphous form." Wright 1886 BLP, p 320, pl xxvi, fig 2.

Clavulina obscura C 1892 CS, p 58, pl i, fig 4.

This minute and obscure form occurs sparingly at 9 stations, and is very variable within certain limits; indeed, it appears to us questionable whether the specimens should not rather be regarded as starved forms of two well-recognized tropical species, *C. Parisiensis* and *C. communis*, for some individuals of *C. obscura* present the marked triangular initial portion which is the characteristic feature of *C. Parisiensis*, while in others the initial chambers form a rounded mass as in *C. communis*, and nothing but the minute size of the organism appears to separate them from those forms. Such dwarfing might, of course, be expected in a tropical species which had extended its range into northern seas.

C. obscura occurs with like rarity in dredgings from shallow water all round the British coast, but is common off Torbay (30–50 fathoms). As in many arenaceous Foraminifera, two distinct types of coloration are noticeable. Normally the species, especially in the earlier stages, is of the typical ferruginous tint; but we have numerous specimens of equal dimensions and growth in which the test is of a light grey colour throughout.

Sub-family BULIMININAE.

BULIMINA d'Orbigny.

98. Bulimina pupoides d'Orbigny.

Bulimina pupoides d'O 1846 FFV, p 185, pl xi, figs 11, 12.
„ „ „ Brady 1884 FC, p 400, pl l, fig 15.
(See also MFM 1900, p 273; H-A & E 1909, p 333.)

The species occurs at 23 stations, both shore-sands and dredgings, and presents, as with *B. elegans*, a long series of linked varieties. Brady (*loc. cit.*)

groups the form with *B. affinis* and *B. ovata*; but we have not ourselves observed much tendency to vary in this direction.

99. Bulimina elegans d'Orbigny.

Bulimina elegans d'O 1826 ASN, p 270, No 10, Modèle No 9.
„ „ , Brady 1884 FC, p 398, pl l, figs 1-4.

(See also BS, p 898; MFM, p 274.)

B. elegans, which is one of the most abundant and widely distributed of British species, occurs at practically all the stations, and at some is to be found in enormous numbers and infinite variety. The difficulty of drawing sharp lines of distinction between such closely allied species as *B. elegans*, *elongata*, *pupoides*, and *marginata* in a dredging where the genus exists in such profusion as is often the case in shallow muddy deposits on the Irish and Scotch coasts, can only be appreciated by those who have worked over such gatherings. Typical specimens of *B. elegans*, i.e. those in which the three series of chambers are inflated and separated from each other by deep grooves running the whole length of the shell, are of somewhat infrequent occurrence. The majority of specimens are more or less smoothly conical in shape, the chambers being but slightly inflated, and the tendency to variation runs largely in two directions, producing (*a*) a short and broad, and (*b*) a long and narrow form. Abnormal specimens due to the fusion (non-plastogamic) of two or more individuals by their initial chambers, or to the fission, and subsequent development on separate lines of growth, of a single individual, are of fairly frequent occurrence in the Clare Island area, as in most dredgings where the species abounds.[1]

100. Bulimina elongata d'Orbigny.

Bulimina elongata d'O 1846, FFV, p 187, pl xi, figs 19, 20.
„ „ „ Brady 1884 FC, p 401, pl li, figs 1, 2.

(See also H-A & E 1909, p 333.)

Specimens fulfilling in all essentials the conditions under which d'Orbigny separated the species *B. elongata* are of not infrequent occurrence at those stations at which *B. elegans* is a dominant form.

[1] In this connexion we may refer to the very beautiful drawings by Prof. C. Fornasini in MASIB (Ser v[a], vol ix, p 371, pl 0), which give practically a complete series of the transitional stages between these closely allied forms.

101. Bulimina squamigera d'Orbigny.

Bulimina squamigera d'O 1839 FIC, p 137, pl i, figs 22–24.
„ „ „ Earland 1905 FBS, p 207.

(See also H-A and E 1909, p 333.)

This species occurs in dredged material in 13 stations, fairly abundant and well developed, especially at Nos 13 and 18. At some of these specimens have been observed of a very narrow and elongate type, forming a connecting link with the genus Virgulina.

102. Bulimina fusiformis Williamson.

Bulimina pupoides var *fusiformis* W 1858 RFGB, p 63, pl v, figs 129, 130.
Bulimina fusiformis W, Millett 1898 &c MFM, 1900, p 275, pl ii, fig 2.

(See also H-A & E 1911, p 312.)

This species occurs abundantly in nearly all of the dredgings and some of the shore-sands (24 stations). It is extremely variable; two principal forms are noticeable, one consisting of comparatively few inflated chambers forming a short broad shell, the other consisting of a greater number of elongate compressed chambers forming a long spindle-shaped test. Advanced specimens of the former variety are with difficulty separable from minute specimens of *B. ovata*, while the latter, or elongate variety, forms a link with *Virgulina Schreibersiana* Czjzek.

103. Bulimina ovata d'Orbigny.

Bulimina ovata d'O 1846 FFV, p 185 pl xi, figs 13, 14.
„ „ „ Egger 1899 KOA, p 49, pl xv, fig 45.

(See also BS, p 897; MFM 1900, p 275.)

The species is very rare, one single large and typical specimen having been taken at Inishgowla harbour in 1–4 fms. At six other stations minute specimens have been observed; and, as already remarked, are with difficulty separated from the broader varieties of *B. fusiformis*. The rarity of this species in the area of the Survey is somewhat noticeable. Typical specimens are recorded by Brady (BS, p 897) as very abundant in some of Mr. J. Wright's material from the south-west of Ireland; and in the North Sea the species is not only abundant, but attains a size and beauty superior to any specimens we have observed elsewhere. Brady (*loc. cit.*) places *B. ovata* midway between *B. pupoides* and *B. pyrula*.

104. Bulimina pyrula d'Orbigny.

? *Bulimina caudigera* d'O 1826 ASN, p 270, No. 16, Modèle No. 68.
Bulimina pyrula d'O 1846 FFV, p 184, pl xi, figs 9, 10.
„ „ „ Chapman 1895 FWS, p 326, pl xii, fig 11.
(See also FC, p 399; MFM 1900, p 275.)

This species occurs at only two stations (Nos. 26 and 31), small and not typical.

105. Bulimina elegantissima d'Orbigny.

Bulimina elegantissima d'O 1839 FAM, p 51, pl vii, figs 13, 14.
„ „ „ Brady 1884 FC, p 402, pl l, figs 20–22.
(See also FC, p 402; MFM 1900, p 276.)

The species occurs at 15 stations, in both shore-sands and dredgings. In some of the latter the specimens are very finely developed, and present two well-marked types, one with a depressed and almost concealed spire, the final whorl of inflated chambers almost enveloping the earlier convolutions, another in which the chambers are narrower and less inflated, and the spire is drawn out so as to form two or three convolutions.

106. Bulimina minutissima J. Wright.
Plate IV, figs 11, 12.

Bulimina minutissima W 1902 GFL, p 163, pl xiii, figs 9–12.
„ „ Wright 1910–11 ECM, p 12, pl ii, figs 5, 6.

This minute and rare form occurs in four of the dredgings. Its minute size may have caused it to be overlooked elsewhere, although its characteristic features are sufficiently distinctive to render its identification easy. It appears to be closely allied in structure and arrangement of chambers to *B. elegantissima* var. *seminuda* Terquem, first described from the Eocene of Paris, and may perhaps be regarded as a northern modification of that form. Mr. Wright describes the species as common in the Estuarine Clays of Magheramorne and Limavady Junction (*ut suprâ*), but very rare in the Boulder-clay of Woodburn, Carrickfergus (Proc. Belfast Nat. Field Club, 1901–2, p 111.) He mentions that in his experience it is sparingly distributed as a recent species round the Irish coast.

107. Bulimina subteres Brady.
Plate IV, figs 13, 14.

Bulimina subteres B 1879 &c 1881 RRC, p 55.
„ „ „ Goës 1894 ASF, p 46, pl ix, figs 445–453.
(See also MFM 1900, p 277; H-A & E 1911, p 314.)

Occasional specimens of this very handsome species have been found at

eight stations, the species being large and well-developed at some of them. At two stations (Nos. 1 and 13) the specimens were minute, regularly ovate-cylindrical, and, but for the presence of *B. subteres* at contiguous stations, might have been attributed to *B. subcylindrica* Brady, which species, however, has not so far been recorded among British recent Foraminifera.

108. **Bulimina marginata** d'Orbigny.

Bulimina marginata d'O 1826 ASN, p 269, No 4, pl xii, figs 10–12.
„ „ „ Goës 1894 ASF, p 46, pl ix, figs 439–444.

(See also MFM 1900, p 277; H-A & E 1911, p 312.)

Typical specimens are not particularly abundant, but the species occurs in most of the dredgings and some of the shore-sands (23 stations). At the majority of stations the specimens are what can best be described as marginate forms of *B. elegans.*

109. **Bulimina aculeata** d'Orbigny.

Bulimina aculeata d'O 1826 ASN, p 269, No 7.
„ „ „ Flint 1899 RFA, 291, pl xxxvii, fig 4.

(See also FC, p 406; MFM 1900, p 278; H-A & E 1909, p 332.)

No very pronounced specimens of *B. aculeata* occur in the area, but at four stations specimens were found hispid over the whole of the initial portion of the test, and so separable from *B. marginata*, in which the spines are normally confined to the marginal edges of the chambers. The spines on some of the specimens are short, but extremely fine and closely set, so that the apex of the shell is clothed with a prickly felt, somewhat similar to the external surface of *Lagena hispida* Reuss. Our specimens appear to be identical with those described by Mr. Millett from the Malay Archipelago (MFM 1900, p 278).

110. **Bulimina convoluta** Williamson.

Bulimina pupoides var. *convoluta* W 1858 RFGB, p 63, pl v, figs 132, 133.
Bulimina convoluta W, Millett 1898 &c MFM, 1900, p 279, pl ii, fig 9.

(See also MFM 1900, p 279.)

A single well-marked specimen of this extremely rare species was found in a dredging in Blacksod Bay (3 fms.), the outlying northernmost point of our area of the Survey. Wright (W 1891 SWI, p 473) regards *B. convoluta* as an abnormal form of *B. subteres*, but it appears to us to be quite distinctive and separate in its structure.

B. convoluta is of not infrequent occurrence in some of the "Goldseeker" dredgings from the shallower areas of the Shetland-Faröe Channel, but it is elsewhere in our experience an extremely rare species, although apparently of wide distribution.

VIRGULINA d'Orbigny.

111. Virgulina Schreibersiana Czjzek.

Virgulina Schreibersiana C 1847 FWB, p 147, pl xiii, figs 18–21.
„ „ „ Goës 1894 ASF, p 48, pl ix, figs 459, 461–472.

(See FC, p 414; MFM 1900, p 280.)

Occurs occasionally at six stations, but is never very abundant.

BOLIVINA d'Orbigny.

112. Bolivina punctata d'Orbigny.

Bolivina punctata d'O 1839 FAM, p 63, pl viii, figs 10–12.
„ „ „ Goës 1894 ASF, p 49, pl ix, figs 475–478, 480.
„ „ Heron-Allen & Earland 1908 &c SB 1909, p 336; and 1910, p 409, pl vii, fig 3.

(See also BS, p 899; MFM 1900, p 540; H-A 1909, p 336.)

The species occurs in many of the dredgings (18 stations) but in none of the shore-sands. The specimens are as a rule small, but in a few instances they reach normal dimensions. It cannot be regarded as one of the common species of the area, although minute specimens are fairly abundant in some of the muddier dredgings. They vary considerably in comparative relations of length to breadth, and specimens intermediate between *B. punctata* and *B. variabilis* (Williamson) are of frequent occurrence.

113. Bolivina nobilis Hantken.

Bolivina nobilis H 1875 CSS, p 65, pl xv, fig 4.
„ „ „ Brady 1884 FC, p 424, pl liii, figs 14, 15.

(See also MFM 1900, p 541; H-A & E 1909, p 335.)

The species occurs in fifteen of the dredgings. This is merely a striate or costate variety of *B. punctata*; and its variations lie in the strength of the parallel costae and the length to which they extend from the initial portion of the shell. The final chambers are always smooth. Many of the smaller specimens exhibit stronger markings than the larger ones.

114. Bolivina textilarioides Reuss.

Bolivina textilarioides R 1862 NHG, p 81, pl x, fig 1.
„ „ „ Heron-Allen & Earland 1908 &c SB 1911, p 316, pl x, figs 10-12.
(See also MFM 1900, p 542 ; H-A & E 1911, p 316.)

B. textilarioides in its typical form is very scantily represented, but small and weak specimens intermediate between this species and *B. punctata* are of moderately frequent occurrence in some of the dredgings (8 stations). Brady (in BS) groups Reuss's species with Williamson's *B. laevigata*, and records the joint form as "rare off Ireland and Mounts Bay." We have already separated the two forms in our Selsey monograph (*ut suprâ*), and have given our reasons for such a course. So far as our experience goes *B. textilarioides* is of far less frequent occurrence in the shallow-water gatherings and dredgings round the British Islands than *B. laevigata*; but with increasing depth of water, especially on the Atlantic coasts, *B. laevigata* dies out and *B. textilarioides* increases in frequency, becoming one of the typical Bolivinae of the ooze.

115. Bolivina laevigata Williamson sp.

Textularia variabilis var *laevigata* W 1858 RFGB, p 77, pl iv, fig 168.
Bolivina laevigata (W) Brady 1887 BS, p 900.
(See also H-A & E 1909, p 335.)

The species is well represented in the dredgings (16 stations), and many of the specimens are larger and better developed than we have met with elsewhere, running to as many as eight to ten pairs of chambers. Two different types are recognizable, one very long, increasing slightly in breadth, the other short and uniformly broad throughout the length of the shell. As, however, there appears to be no difference in the size of the primordial chamber, these differences cannot be regarded as evidence of dimorphism. The initial chamber in all the specimens is large, and frequently placed on one side of the longitudinal axis, so as to give a spiroplectine appearance to the earlier portion of the shell. The shells present an extremely polished, hyaline surface, which distinguishes this species from all the other Bolivinae. It is one of the most distinctive and easily recognized species among the Foraminifera, and never presents any variations linking it with other forms.

116. Bolivina difformis Williamson sp.

Textularia variabilis var *difformis* W 1858 RFGB, p 77, pl vi, figs 166, 167.
Bolivina difformis (W) Brady 1887 BS, p 899.

This species occurs at 28 stations, both dredgings and shore-sands. It

exhibits considerable variation in the depth of the serrations and in the prominence of the marginal spines. In one or two instances specimens have been observed in which the marginal spines are entirely absent, and the serrations hardly noticeable. Such variations connect the species with *B. dilatata.*

117. Bolivina dilatata Reuss.

Bolivina dilatata R 1849 FOT, p 381, pl xlviii, fig 15.
„ „ „ Brady 1884 FC, p 418, pl lii, figs 20, 21.
(See also BS, p 900; MFM 1900, p 542; H-A & E 1909, p 334.)

This species occurs at 23 stations, and is often very abundant, presenting remarkable variations in size, length, and breadth, and linking up *B. punctata* and *B. aenariensis.* The specimens also present considerable range in stoutness of the shell, varying from a thick (= *Textilaria plana* d'Orb. (see F 1902 TPI, p 45)) to a flattened diamond shape when viewed in section, and in some instances the marginal edges, which are nearly always acute, are produced into a narrow but well-defined keel. There is also considerable variation in the sutural markings, which are sometimes depressed and at others slightly limbate. The longer specimens are frequently twisted as in *B. aenariensis. B. dilatata* is one of the most frequent and widely distributed of the shallow-water Foraminifera round the British Islands.

118. Bolivina tortuosa Brady.

Plate V, fig 1.

Bolivina tortuosa B 1879 &c RRC 1881, p 57.
„ „ „ Egger 1893 FG, p 298, pl viii, figs 43, 44.
(See also H-A & E 1911, p 317.)

Three specimens were found, one from Clew Bay (5½–11 fms.), the others from off Inishturk (11 fms.), and outside Killary Harbour (12 fms.). The first is an absolutely typical specimen, the second and third less marked. *B. tortuosa* is normally a tropical and sub-tropical species, but it has already been recorded from Bognor (E 1905 FBC, p 209) and Selsey (H-A & E 1908 &c SB, 1911, p 317) in Sussex. The presence of numerous Eocene and Cretaceous fossils in the shore-sand of these localities may have rendered the inclusion of the species in lists of recent British Foraminifera of somewhat doubtful value, though the Sussex specimens were typical and recent. The finding of undoubted specimens in an area where no such possibilities of error exist is therefore to be welcomed. There can no longer be any reason to doubt the occurrence of *B. tortuosa* as a recent British form, and we shall

expect to find other records wherever shore-sands and shallow-water dredgings are carefully examined along the southern and western coasts.

119. Bolivina limbata Brady.

Plate V, figs 2, 3.

Bolivina limbata B 1879 &c RRC 1881, p 57.
„ „ „ Brady 1884 FC, p 419, pl lii, figs 26–28.

(See also MFM 1900, p 543.)

(*New to the British Isles.*)

One specimen was found in a dredging in Clew Bay (5½–11 fms.), which may be tentatively assigned to the above species. The limbations are not very strongly marked, but there is a thickening of shell-substance in the sutural lines. In the curvature of the shell, the general arrangement of the chambers, and terminal aperture, the specimens agree with Brady's species. *B. limbata* is normally a tropical shallow-water species, and in the Pacific it attains a larger size than any other member of the genus, but it also extends its range for some distance north and south of the Equator. Brady records it from Japan in the Pacific, and from the Cape Verde Islands in the Atlantic.

120. Bolivina aenariensis Costa sp.

Plate IV, fig 15.

Brizalina aenariensis C 1856 PRN, p 297, pl xv, fig 1.
Bolivina aenariensis (C) Brady 1882 BKE, p 711, table.

(See also MFM 1900, p 544; H-A & E 1902, p 234.)

Costa's *Brizalina aenariensis* cannot be regarded as a satisfactory species, for the two internal siphons which he uses as specific characters (and which, as Brady points out, were almost certainly external costae), and the aboral initial spine, are of that description of markings which are usually signs of prolific growth of shell-substance rather than specific features. Judging by the external appearance, and the relative number and shape of the chambers, *B. aenariensis* is but a strongly marked and thick variety of the commoner species previously described by Reuss under the name of *B. dilatata*. Among the abundant specimens of *B. dilatata* observed in the Clare Island material, where it is one of the commonest and most typical species, specimens are constantly to be found bearing all the characteristics of Costa's species, except the external costae, and we must therefore regard these specimens as referable to Costa's type. We figure one of these specimens. It is noticeable that many of these shells have a marked lateral twist which is also observable in some specimens of *B. dilatata*.

121. Bolivina plicata d'Orbigny.

Bolivina plicata d'O 1839 FAM, p 62, pl viii, figs 4–7.
„ „ „ Goës 1894 ASF, p 51, pl ix, figs 487, 488.
(See also BS, p 899; MFM 1900, p 545; H-A & E 1909, p 335.)

This species, which is universally distributed over the area of the Survey (25 stations), and indeed all round the British coasts, presents little variation except in the comparative abundance and strength of the plicate costae. In some instances these are so strongly developed that the septation of the chambers is altogether masked, and the exterior surface resembles a series of irregular pits.

122. Bolivina variabilis Williamson sp.

Textularia variabilis (*typica*) W 1858 RFGB, p 76, pl vi, figs 162, 163 (incorrectly numbered 161, 162 on the plate.)
Bolivina variabilis (W), Chaster 1892 CS, pp 59, 69.

This species occurs in abundance at nearly every station (27) in the area of the Survey. As is always the case when a species is abundant, not merely variations are found in the comparative length and breadth of the shell, but also intermediate forms linking it with *B. plicata*, *textilarioides*, and *punctata*. A few abnormal specimens were also obtained in which the individual, after completing about half its growth, has budded at the side, and the protoplasm thus extruded has proceeded to form a series of textularian chambers on its own account. Such double shells, which must not be confused with true plastogamic pairs, are of far more frequent occurrence in the allied genus Bulimina. Brady (BS, p 895) adumbrates the transference of Williamson's species from Textularia to Bolivina.

123. Bolivina inflata sp. nov.

Plate IV, figs 16–19.

Test wedge-shaped, consisting of five to nine pairs of chambers rapidly increasing in breadth and thickness, so that the terminal portion of the shell is comparatively inflated. Marginal edges rounded, sutures slightly depressed. Aperture somewhat variable, at times regularly textularian, but usually bolivine, situate at the extremity of the terminal chamber. Surface hyaline, coarsely punctate, somewhat rough. Average breadth, ·12 – ·15 mm. Average length, ·17 – ·25 mm. Average thickness of oral extremity, ·1 mm.

This little shell, which occurs in many of the dredgings and is comparatively frequent and sometimes common, is no doubt closely allied to the common and widely diffused species *B. plicata* and *variabilis*, but differs from them in its more regular textularian arrangement and in the rapid expansion of its later chambers.

124. Bolivina gramen d'Orbigny sp.

Plate V, figs 4, 5.

Vulvulina gramen d'O 1839 OFC, p 148, pl i, figs 30, 31.
„ „ d'O 1846 FFV, p 251, pl xxi, figs 46, 47.
„ „ „ Carpenter, (C P & J) 1862 IF, p 190, pl xii, fig 15.

(*New to the British Isles.*)

The occurrence of this beautiful little form at Clare Island is one of the most noticeable features of our report. The specimens agree quite closely with d'Orbigny's original figures, except that the aperture, which is large and arched, is placed in the normal position on the face of the ultimate chamber, and not at the extremity of the shell as in d'Orbigny's figure. The turgid chambers and sunken sutural lines are quite distinctive, as also is the clearly marked serrate marginal edge. Our specimens all exhibit a large spherical primordial chamber, whereas d'Orbigny's were apparently microspheric. His figure has consequently a larger number of pairs of chambers, nine, as against five or six in the Clare Island specimens.

The species was originally described as recent from Cuba, and subsequently as a Miocene fossil from Vienna. So far as we know there are no subsequent records of the species in the recent condition. Brady in his description of *B. Beyrichi* Reuss, (B 1884 FC, p 422) compares that species with d'Orbigny's *Vulvulina gramen*, and points out the difference between these closely allied forms. In doing so he for the first time transfers d'Orbigny's species to its proper genus Bolivina.

CASSIDULINA d'Orbigny.

125. Cassidulina laevigata d'Orbigny.

Cassidulina laevigata d'O 1826 ASN, p 282, No 1, pl xv, figs 4, 5.
„ „ „ Williamson 1858 RFGB, p 68. pl vi, figs 141, 142.

(See also FC, p 428; MFM 1901, p 1.)

Universally distributed in both shore-sands and dredgings, and abundant in some of the latter. In this species variation lies principally in the direction of the thickness of the shell in median section. The thinner varieties tend to become carinate, and the carina is frequently serrate. These serrato-carinate specimens were separated by d'Orbigny (d'O 1839 FAM) under the specific name *C. pulchella*, which was recognized by Brady and Siddall in their Catalogue (S 1879 CBRF); but we do not attach specific value to this modification. In the thick non-carinate forms the external edge is sometimes slightly lobulate—a feature which is, as a rule, much more strongly marked in *C. crassa*.

126. Cassidulina crassa d'Orbigny.

Cassidulina crassa d'O 1839 FAM, p 56, pl vii, figs 18–20.
" " " Wright 1900 FLMB, p 100, pl v, fig 11.
(See also FC, p 429; MFM, 1901, p 2.)

Occurs at practically all (26) of the stations and plentifully at many of them.

127. Cassidulina subglobosa Brady.

Cassidulina subglobosa B 1879 &c RRC 1881, p 60.
" " " Brady 1884 FC, p 430, pl liv, fig 17.
" " " Egger 1893 FG, p 304, figs 41, 42, 52, 53.
" " " Chapman 1907 TFV, p 33, pl iv, fig 84.

The species occurs with moderate frequency at 23 stations, both shore-sands and dredgings. The specimens are as a rule minute, but at some stations attain a normal size for shallow-water specimens. Previously recorded as British, and recent, only by Mr. Pearcey from the Faröe Channel and the Firth of Forth (P 1888 FFC, p 190; and Trans. Nat. Hist. Soc. Glasgow 1900, vol vi, p 245).

128. Cassidulina Bradyi Norman.

Cassidulina Bradyi (Norman MS) J. Wright 1880 NEI, p 152.
" " " Brady 1884 FC, p 431, pl liv, figs 6–10.
" " " Goës 1894 ASF, p 44, pl viii, figs 423–426.

A few specimens were observed in two dredgings (Stations 19 and 33). Their presence in such shallow water is noteworthy, as the species, which is fairly common in depths from 100 fms. downwards on the Atlantic Slope, does not appear to have been previously recorded from lesser depths.

129. Cassidulina nitidula Chaster sp.

Plate V, figs 6–9.

Pulvinulina nitidula C 1892 CS, p 66, pl i, fig 17.
" " " Sidebottom 1904 &c RFD 1909, p 9, pl iv, fig 2.

This pretty little species was originally described by the late Dr. Chaster from Southport as a Pulvinulina. Previous to the publication of his paper he showed his specimens to Earland, who suggested at the time that it was more correctly referable to the genus Cassidulina. Dr. Chaster was unable to agree with the suggestion, but included in his description of the species

a reference to the fact that the shell had "a pseudo-cassiduline appearance." At this time Earland had no knowledge of the species except from Dr. Chaster's specimens; but he subsequently dredged it at many localities in the North Sea, where the species is of common occurrence and strongly developed, and, working on the material so obtained, he is in a position to confirm his original diagnosis. We have now also found it as a common form off Torbay (30–50 fms). The cassiduline nature of the shell can be readily demonstrated if specimens are examined in balsam immediately they are mounted, and before the balsam has time to displace the air from the chambers. The original description as furnished by Dr. Chaster was as follows:—"Test small, much depressed, highly polished; convolutions about two in number, there being seven or eight segments in the last; superior surface slightly convex; sutures not depressed; inferior surface concave; aperture large and oblique; periphery acute. Diameter 1·25 mm. The test is so thin that the sutures on the inferior surface are seen through the shell, and give it a pseudo-cassiduline appearance. Shore mud and in shallow water. Very rare."

As an amendment of the original description it may be pointed out that the inferior surface is occupied by a stellate group of minute chambers which alternate with those of the superior surface, parts of which are also visible on the inferior side of the shell. These inferior chambers are narrow and pointed, the extremity of each extending almost, or sometimes actually, to the peripheral margin. They are much more pronounced in some specimens than in others, and occasionally quite turgid and prominent. Each inferior chamber as it is added to the shell closes up the large oblique aperture of the previous superior chamber. The connexion between the inferior chamber and the next formed superior chamber is very obscure, but is apparently effected by means of a small aperture on the inner margin of the whorl. This spot is frequently but not invariably marked by a pair of stout blunt spines which are well shown in the optical section of a balsam-mounted shell figured in Plate V, fig 6.

The curious "engine-turned" appearance of the test, which is well exhibited in this figure, and also in Mr. Sidebottom's figure (*ut suprâ*) is not due to the "sutures of the inferior surface" being seen through the shell, as suggested by Dr. Chaster, or to the "sutures on the superior and inferior surfaces being curved in opposite directions" (Millett, 1894, Trans. R. Geolog. Soc. Cornwall), but to the existence of the inferior series of chambers. For greater clearness the chambers of the superior surface have been tinted in figs. 6 and 7, the inferior chambers being plain.

Cassidulina nitidula represents the most compressed and evolute type of

the cassiduline plan of growth, and is not closely allied to any other species in the genus. Its nearest ally would probably be *C. laevigata* or *C. crassa*; but even the weakest individuals of these species exhibit some portion of both series of chambers on one face of the shell.

The species occurs at six stations, all dredgings, and is of moderate frequency at some of them. It is exceptionally well developed at Station 31 (Killary Bay), and possibly occurs in muddy dredgings all round the western shores of Ireland, but, owing to its small size, may hitherto have been overlooked. It is probably widely distributed, as it has been recorded from the Mediterranean and Iceland (Sidebottom, *ut suprâ*), and by Mr. Millett as a fossil from the Pliocene of St. Erth in Cornwall.

Family CHILOSTOMELLIDAE.

SEABROOKIA Brady.

130. Seabrookia Earlandi J. Wright.

Plate V, figs 10–12.

Seabrookia Earlandi Wright 1891 SWI, p 477, pl xx, figs 6, 7.

A single quite typical specimen from station 12. This was first recorded as *Millettia Earlandi* (W 1889 SWI, p 448) by Mr. Wright from the S.W. of Ireland (345 fms.). Also recorded by him from 37½ fms. (Castletown). It is much more abundant in some of the deeper "Goldseeker" dredgings in the North Sea and the Norwegian fjords, and is undoubtedly a deep-water form; as such therefore its occurrence in the Clare Island area is noteworthy.

Family LAGENIDAE.

Sub-Family LAGENINAE.

LAGENA Walker & Boys.

131. Lagena globosa Montagu sp.

Serpula (*Lagena*) *laevis globosa*, Walker & Boys 1784 TMR, p 3, pl i, fig 8.
Vermiculum globosum M 1803 TB, p 523.
Lagena globosa (M.) Brown 1844 RCGB, p 126, pl lvi, figs 37 and 40.
„ „ „ Brady 1884 FC, p 452, pl lvi, figs 1–3.
(See also FC, p 452; MFM 1901, p 3.)

The species occurs in more or less abundance at a great many (21) stations, and as usual is subject to extreme variation in all directions. First, as regards size; at some stations abnormally large specimens are fairly plentiful; the question of the identity of such specimens as true *L. globosa* or as primordial

chambers of Nodosaria or Polymorphina is always an open one; but we have no reason to suppose that many of the specimens are other than true *L. globosa* of abnormal dimensions. Second, as regards shape; every modification is to be found, from the strictly globular to the pyriform, sub-globular, and oval, and specimens intermediate between *L. apiculata* and *L. globosa* are not infrequent. Third, as regards the nature of the orifice; this varies from the simple aperture to the stellate, and it may be either normal or fitted with an entosolenian tube, which, in turn, may be either free or attached. The specimens with a stellate aperture are usually produced to a pyriform shape at the oral end. Fourth, as regards the thickness of the shell-wall; this varies from an extremely thin hyaline texture, with no visible perforations, through increasing substance in which the perforations are visible as fine canals, to thick tests, in which, probably owing to the multiplicity of tubuli, the shell is quite white and opaque.

Abnormal specimens presenting two or more apertures, probably due to the fusion of several individuals, are of frequent occurrence. In one or two instances true double shells have been noted, due apparently to the budding off of an individual.

132. Lagena apiculata Reuss sp.

Oolina apiculata R 1851 Haidinger's Naturw. Abh., vol iv, p 22, pl i, fig 1.
Lagena apiculata (R) Parker Jones & Brady 1866 &c MCF, pt i, p 44, pl i, fig 27.

(See also FC, p 453; MFM 1901, p 5.)

A few weak specimens occurring at two stations only.

133. Lagena ovum Ehrenberg sp.

Plate VI, fig 1.

Miliola ovum E 1843 MMO, p 166; E 1854 M, pl xxiii, fig 2; pl xxix, fig 45; pl xxxi, fig 4.
Lagena ovum (E) Marsson 1878 Mitth. naturw. Verein von Neuvorpom. u Rügen, Jahrg x, p 120, pl i, fig 1.
„ „ „ Brady 1884 FC, 454, pl lvi, fig 5.

(See also FC, p 454.)

(*New to the British Isles.*)

One typical specimen found at Station 31 (Killary Bay).

134. **Lagena chrysalis** sp. nov.

Plate VI, fig 4.

Test chrysalidiform, tapering at both extremities, the aboral end much more acute than the oral, which is neatly rounded off. Aboral extremity either pointed or slightly tumescent at the apex; surface smooth, somewhat dull, but girdled at intervals by four to six clear lines in the shell-substance, which enhance the general resemblance of the shell to the chrysalis of a moth. Length, ·21 mm.; breadth, ·08 mm. Aperture simple. There is a slight constriction in the shell-wall on either side of the clear lines.

The general appearance of this little test is glanduline, resembling a minute specimen of *Nodosaria radicula*, but there is no trace whatever of internal septa.

Three specimens found at Station 13 (Inishgowla harbour).

135. **Lagena hispida** Reuss.

Lagena hispida R 1858 FP, p 434.
„ „ „ Flint 1899 RFA, p 307, pl liii, fig 8.

(See also FC, p 459; MFM 1901, p 6.)

A few characteristic specimens have been observed at 3 stations. They show a transitional series between shells with a finely granular surface and those furnished with long and delicate spines, which are always more or less clogged with mud and protoplasmic debris.

136. **Lagena protea** Chaster.

Plate VII, figs 19, 20.

Lagena protea C 1892 CS, p 62, pl i, fig 14.
„ „ „ Sidebottom 1912 LSP, p 427.

This species occurs at four stations, the specimens being large and well developed. As the name implies, no two are alike. Mr. Sidebottom (*ut suprâ*) quotes a letter from the late Dr. Chaster supplementing his original description of the species, and replying to various criticisms to which the species had been subjected. In our opinion this form remains one of the most unsatisfactory with regard to its affinities. There is little doubt that many of the specimens have originally been sessile, a habit which is otherwise unknown in the genus Lagena. Moreover, traces of apparent segmentation are not uncommon, which in itself would remove the species from the genus Lagena to Polymorphina. But the quantity of available material is not at present sufficient for final settlement of this question, and for the present

we prefer to leave the species in the position to which Dr. Chaster assigned it, and in which Mr. Sidebottom, who has had wider opportunities of judging than ourselves, concurs. It may be observed that Messrs. Jones & Chapman include this species among their type-species of Ramulina (J & C 1896 &c 1898, p 342).

137. Lagena lineata Williamson sp.

Entosolenia lineata W 1848 BSGL, p 18, pl ii, fig 18.
Lagena lineata (W) Reuss 1863 FFL, p 328, pl iv, fig 48.

(See also MFM 1901, p 7; H-A & E 1911, p 320.)

Occurs in five shore-sands and fourteen dredgings, generally in considerable numbers. This so-called species may really be considered as a transition type between *L. globosa* and *L. striata*; and the specimens found represent practically every stage in the series connecting these two types. They vary in many directions. (i) THE APERTURE.—This is normally simple, but the shell is often distomous, in which case it may be either entosolenian at both extremities, ento-ectosolenian, or ectosolenian at both extremities. As a rule the Clare Island specimens are furnished with one aperture and a long entosolenian tube which is not attached to the inner surface of the shell, but often extends almost to the aboral end. When furnished with a basal ectosolenian tube, this often extends to a considerable length like the stalk of a flower-bud. (ii) VARIATIONS IN THE STRIAE, which may be either so fine as to require a $\frac{1}{2}$-inch objective for their resolution, or as coarse as may be found in a weak *L. striata*. (iii) SHAPE.—Considerable diversity has been noticed; typically the shell is more or less cylindrical, but compressed varieties are frequent, and there are also many specimens which exhibit the same variety of lateral curvature as we have described under *L. laevis*, one side of the shell being abnormally developed as compared with the other.

138. Lagena costata Williamson sp.

Entosolenia costata W 1858 RFGB, p 9, pl i, fig 18.
Lagena costata (W) Reuss 1862 NHG, p 329, pl iv, fig 54.

(See also FC, p 462; MFM 1901, p 7; H-A & E 1911, p 321.)

This strongly marked Lagena is one of the most typical species of the area (19 stations), as indeed of the whole of the western Irish and Scottish coasts. At some of the stations it reaches a remarkable development in size and shell-substance.

139. Lagena hexagona Williamson sp.

Entosolenia squamosa var. *hexagona* W 1848 BSGL, p 20, pl ii, fig 23.
Lagena squamosa (W) Carpenter Parker & Jones 1862 IF, App, p 309.
(See also FC, p 472; MFM 1901, p 8.

This species, which is very abundant all round the coast, especially in muddy dredgings, occurs at practically all (25) of the stations. There is, as usual, considerable variation in external appearance, due primarily to the degree of elevation of the hexagonal reticulations, and the regularity of their angular outlines. Specimens intermediate between *L. squamosa*, *L. reticulata*, and *L. hexagona* are to be found at every stage of development. These variations have been carefully analysed and figured by Dr. Fornasini (F 1909 LR.)

140. Lagena reticulata Macgillivray sp.

Lagenula reticulata M 1843 HMAA, p 38.
Lagena reticulata (M) Reuss 1862 FFL, p 333, pl v, figs 67, 68.
(See also MFM 1901, p 8.)

Occurs at 14 stations, both shore-sands and dredgings, but never abundantly. The only marked variation observed is in the coarseness of the reticulation.

141. Lagena squamosa Montagu sp.

Plate VII, fig 13.

Vermiculum squamosum M 1803 TB, p 526, pl xiv, fig 2.
Lagena squamosa (M) Brady 1884 FC, p 471, pl lviii, figs 28–31.
(See also FC, p 471; MFM 1901, p 9.)

This species, one of the commonest of all the British Lagenae, occurs at practically every station (30), and is more or less abundant at all of them. As might be expected where a species occurs in such profusion, there is an infinite variety in size and shape of the markings, which are often very irregular. These diversities have been separated under various specific names by different authors, and have been recorded by Dr. Fornasini in his Revision of the reticulated Lagenae (F 1909 LR.)

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

Plate VII, figs 11, 12.

Entosolenia Montagui A 1865 NHC, p 206.
Lagena squamosa var *Montagui* (A) Wright 1900 DBC, p 54, pl ii, fig 2.
" " " " " Heron-Allen & Earland 1908 &c SB 1911, p 321, pl x, figs 14–16.

An occasional specimen at six stations, varying as usual considerably in size and contour.

The exact nature of this curious variety is extremely doubtful. In the ordinary course such distorted specimens would be regarded as "sports" and set aside; but the general uniformity of their nature, and their wide distribution, coupled with the fact that no other species of Lagena presents similar characteristics, make it certain that some zoological significance is attachable to their occurrence. Possibly they represent some stage in the life-history of the species with which we are at present unfamiliar.

We have no data to add to the information already furnished by Mr. Wright (*suprâ*). The most characteristic Clare Island specimens correspond exactly with Alcock's original description of the compressed form "resembling a dried fig."

143. Lagena laevis Montagu sp.

Plate VI, fig 5.

Vermiculum laeve M 1803 TB, p 524.
Lagena laevis (M) Williamson 1848 BSGL, p 12, pl i, figs 1, 2.

(See also FC, p 455; MFM 1901, p 9.)

This species occurs at about half (17) of the stations, often in considerable numbers and in great variety, ranging from specimens with nearly globular bodies and more or less produced neck, to those with quasi-cylindrical tests tapering indeterminately into a produced neck. At many stations a well-marked variety of this latter type is of constant occurrence in which one side of the shell has developed more than the other, resulting in a curvature of the test and neck. These might equally well be regarded perhaps as a variety of *L. botelliformis* Brady, furnished with a neck. Specimens showing transition into *L. semistriata* by the presence of a few weak markings at the aboral extremity of the shell are of constant occurrence. A few abnormal double specimens presenting two apertures, resulting from the fusion of individuals, were noticed.

144. Lagena laevis var. **distoma** Silvestri.

Plate VI, fig 6.

Lagena distoma (Montagu) S 1900 FPNT, p 245, pl iv, fig 43; pl vi, figs 74, 75.
Lagena laevis (Montagu) var *distoma* Silvestri, Millett 1898 &c MFM 1901, p 10, pl i, fig 10.
" " " Silvestri 1902 LMT, p 158, fig 58.

(*New to the British Isles.*)

A few typical specimens of this elegant form were found at Stations 13 and 19. The variety, characterized by an external basal (ectosolenian) tube, bears the same relation to *L. laevis* that *L. Lyellii* bears to *L. sulcata.*

145. Lagena semistriata Williamson.

Lagena striata var *semistriata* W 1848 BSGL, p 14, pl i, figs 9, 10.
„ *semistriata* W, Brady 1884 FC, p 465, pl lvii, figs 14, 16, 17 (? 18, 20).

(See also FC p 465 ; MFM 1901, p 486 ; H-A & E 1909, p 424.)

Occurs at 18 stations, both shore-sands and dredgings, often very abundantly and characterized by great diversity in shape, strength, number, and extent of costae. The type as originally figured by Williamson, *viz.* a long-necked "decanter" with strong costae ranging over the basal half of the test, is very common in the muddier dredgings. Abnormal and distorted specimens are of frequent occurrence.

146. Lagena perlucida Williamson.

Lagena vulgaris var *perlucida* W 1858 RFGB, p 5, pl i, figs 7, 8.
Lagena perlucida W, Heron-Allen & Earland 1908 &c SB 1911, p 320, pl x, fig 13.

Numerous individuals of the weakly marked variety of *L. semistriata* separated under this name by Williamson are of common occurrence in company with *L. striata* and *semistriata* at many of the stations. As we have observed (*loc. cit. suprâ*), there seems no object in perpetuating this unsatisfactory species. Williamson himself in his two figures (*suprâ*) represents specimens which could equally well have been assigned to *L. semistriata* (fig 7) or to *L. striata* or *sulcata* (fig 8).

147. Lagena striata d'Orbigny sp.

Oolina striata d'O 1839 FAM, p 21, pl v, fig 12.
Lagena striata (d'O) Reuss 1862 FFL, p 327, pl iii, figs 44, 45 ; pl iv, figs 46, 47.

(See also FC, p 460 ; MFM 1901, p 487 ; H-A & E 1909, p 423.)

Occurs at 15 stations, shore-sands and dredgings, very common at muddy stations such as No. 32. There is little or no variation in the specimens, except in the degree of rotundity assumed by the chambers.

148. Lagena curvilineata Balkwill & Wright.

Plate VI, fig 7

Lagena curvilineata B & W 1885 DIS, p 338, pl xiv, figs 21–24.
„ „ „ Balkwill & Millett 1884 FG, p 27, pl ii, fig 3.
„ „ „ Halkyard 1889 RFJ, p 67, pl ii, fig 3.

(See also MFM 1901, p 488.)

One perfectly typical specimen of the regular oval type as figured by Balkwill and Wright (*ut suprâ*) was found at station 31 (Killary Bay).

This species first occurs in Balkwill and Millett's paper (*ut suprâ*) published

in 1884, with only a figure and the name. The species had already been described by Messrs. Balkwill and Wright in their paper (*ut suprâ*) which was read before the Royal Irish Academy in June, 1884, although not published until the following year. It had, however, been recorded as a *nomen nudum* in the preliminary paper on the same gatherings published by these authors in 1882 (B & W 1882 RFDW, p 548.) The Galway specimen is of a very rough and irregular type compared with Balkwill and Wright's specimens from deep water in the Irish Sea, and, like Mr. Millett's specimen figured in MFM, can hardly be regarded as satisfactory, being in the coarseness of its markings much nearer to those irregular and distorted examples of *L. sulcata* so frequently found in shore gatherings. The deep-water specimens figured by Balkwill and Wright, like our own from Station 31, are, in the fineness of their markings, more nearly allied to *L. striata*.

149. Lagena sulcata Walker and Jacob sp.

Serpula (*Lagena*) *striata sulcata rotunda* Walker and Boys 1784 TMR, p 2, pl i, fig 6.

Lagena sulcata (W & J) Parker & Jones 1865 NAAF, p 351, pl xiii, figs 28, 29, pl xvi, figs 6, 7.

(See also FC, p 462; MFM 1901, p 488; BS, p 903.)

Occurs at most (22) of the stations both shore-sands and dredgings, often abundantly. In some of the dredgings the specimens are extremely well-developed, the costae being strong and deep. The variety *interrupta* Will., in which alternate costae are discontinuous, occurs at many of the stations in company with the type.

150. Lagena Lyellii Seguenza sp.

Plate VI, fig 8.

Amphorina Lyellii S 1862 FMMM, p 52, pl i, fig 40.

Lagena Lyellii (S) Brady 1870 FTR, p 292, pl xi, fig 7.

„ „ „ Balkwill & Millett 1884 FG, p 27, pl ii, fig 2.

Occurs at four stations, only a few specimens at each, all normal and exactly comparable with Seguenza's original figure. Canon Norman and the late Dr. Brady considered that specimens usually attributed to *L. Lyellii* were merely detached final chambers of *Nodosaria scalaris* var. *separans*; but we agree with Messrs. Balkwill and Wright in rejecting this theory for the following reasons:—(i) Such specimens are sometimes of quite common occurrence, whereas *N. scalaris* var. *separans* is always extremely rare. (ii) They are to be found in gatherings in which neither *N. scalaris* nor its variety occurs; and

(iii) The British specimens of *L. Lyellii* are quite globular in the shape of their chambers, whereas British shallow-water specimens of *N. scalaris* are almost always cylindrical in shape, i.e. the chambers are of a different curvature to *L. Lyellii*. We have no hesitation in regarding *L. Lyellii* as a fixed variety, a distomous form of *L. sulcata* or *L. striata*.

151. Lagena Williamsoni Alcock sp.

Entoselenia Williamsoni A 1865 NHC, p 193.
Lagena Williamsoni (A) Wright 1877 RFDA, App, p 104, pl iv, fig 14.

(See also H-A & E 1909, p 424.)

Occurs abundantly at every station, presenting no variation save in the size and in the development of the costae, and in the relative extent of development of the reticulate markings round the neck, which are the distinguishing mark of this species.

152. Lagena striato-punctata Parker & Jones.

Lagena striato-punctata P & J 1865 NAAF, p 350, pl xiii, figs 25–27.
„ „ „ „ Brady 1884 FC, p 468, pl. lviii, figs. 37 and 40.
„ „ „ „ Sidebottom 1912, LSP, p. 392, pl. xvi figs 7-10.

(See also FC, p. 468; MFM 1901, p. 489.)

Two specimens only observed, one each at Stations 13 and 30. Both specimens are small and of the elongate type with few thin ribs, similar to Mr. Sidebottom's figure (*ut suprâ*) and Parker and Jones's figure (*ut suprâ*).

153. Lagena clavata d'Orbigny sp.

Oolina clavata d'O 1846 FFV, p 24, pl i, figs 2, 3.
Lagena clavata (d'O) Goës 1894 ASF, p 75, pl xiii, figs 725–727.

(See also MFM 1901, p 490; H-A & E 1909, p 423.)

Occurs plentifully at most (20) of the stations. There is as usual considerable variety in form. At many stations it would be easy to obtain a complete series of transition forms ranging through *L. clavata* from *L. laevis* to *L. gracillima*; at other stations nearly all the specimens have a swollen aboral extremity with a short projecting tube.

154. Lagena gracillima Seguenza sp.

Amphorina gracillima S 1862 FMMM, p 51, pl i, fig 37.
Lagena gracillima (S) Brady 1870 FTR, p 292, pl xi, fig 6.

(See also FC, p 456; MFM 1901, p 491; H-A & E 1911, p 319.)

This occurs in some numbers at 12 stations. The specimens vary as usual

in the proportionate length and breadth of the chamber, and in the extent to which the two extremities are produced. Most of the examples are of the somewhat short truncate type resembling Brady's fig 26 (B 1884 FC, pl lvi). Transition specimens between this species and *L. clavata* are of common occurrence at most stations where both species are found together. Some of the longer and more cylindrical specimens might be assigned to *L. elongata* Ehrenberg, if it were considered desirable to perpetuate a specific name for such a trifling variation. There does not appear to us to be sufficient break in the series of graduated specimens to justify their separation.

155. Lagena gracilis Williamson.

Lagena gracilis W 1848 BSGL, p 13, pl i, fig 5.
,, ,, ,, Brady 1884 FC, p 464, pl lviii, figs 2, 3, 7–10, 19, 22–24.

(See also FC, p 464.)

A few specimens were observed at 3 stations. They vary considerably in the strength of the costae.

156. Lagena Stewartii J. Wright.

Plate VI, figs 2, 3.

Lagena Stewartii W 1910–11 ECM, p 12, pl ii, fig 8.

(*New to the British Isles.**)

A few specimens were recorded from Station 13. It is quite possible that specimens may have been overlooked at some of the other stations, as the species has no very marked characteristics, and might easily be confused with compressed forms of *L. globosa*, to which it is probably closely related. Mr. Wright's description of the species is as follows:—"Test circular, compressed, the two faces convex, surface smooth, peripheral edge rounded, short entosolenian tube; aperture oval." Mr. Wright's specimens were from the Estuarine Clay of Limavady Junction, and are recorded as "frequent." The present is the first record of its occurrence in the recent condition.

157. Lagena laevigata Reuss sp.

Fissurina laevigata R 1849 FOT, p 366, pl xlvi, fig 1.
Lagena laevigata (R) Robertson 1883 PTG, p 24.

(See also FC, p 473; MFM 1901, p 493.)

This protean form occurs in greater or less abundance at nearly all the stations, and, in the muddy dredgings, presents every type of that wide varia-

tion of form which it is the practice to refer to Reuss's species. There are few groups which would better repay the tedious labour of separation and systematization than the compressed and smooth-shelled Lagenae which it is customary to classify under this present name. They exhibit modifications which link them indeterminately with compressed individuals of *L. globosa* on the one hand, and *L. marginata* on the other. They range in shape from nearly circular outline, through oval and pyriform, passing insensibly into *L. Malcomsoni* and *L. quadrata*. Trigonal specimens are very common at some of the stations. Messrs. Balkwill and Millett figure an extensive series of trigonal and quadrigonal Lagenae in the Galway paper, while calling attention to the fact that such forms have no zoological significance (B & M 1884 FG, p 80). At present *L. laevigata* is the only species to which one can refer those extremely minute forms, devoid of any characteristic outline or marking, which are to be found in myriads in the finest floatings from such muddy dredgings as Inishgowla and Killary Bay.

158. Lagena acuta Reuss sp.

Fissurina acuta R 1858 FP, p 434; and R 1862 FFL, p 340, pl vii, figs 90, 91.

Lagena acuta (R) Brady 1884 FC, p 474, pl lix, fig 6.

(See also FC, p 474.)

This apiculate form of *L. laevigata* occurs sparingly wherever the type is abundant. No very characteristic specimens were observed.

159. Lagena falcata Chaster.

Plate VI, figs 12, 13.

Lagena falcata C 1892 CS, p 61, pl i, fig 7.

A single specimen from Station 23. This differs from Chaster's figure in the shape of the chamber, which is short, sub-globular, and compressed, as compared with Chaster's compressed oval figure. The neck, as in Chaster's specimen, is a broad, flat extension of the shell, with two strongly recurved hooks, and the neck is of the full width of the body of the shell, both in Chaster's specimen and in our own. Similar specimens of the same short type have been found in "Goldseeker" dredgings off Noss Head, Moray Firth (70 metres), and at other stations round the Scottish coast. For comparison we also figure the normal type of *L. falcata* from one of the "Goldseeker" dredgings in Orkney. (See Addenda, p. 187.)

160. Lagena Millettii Chaster.

Plate VI, fig 10.

Lagena Millettii C 1892 CS, p 61, pl i, fig 10.
Lagena quadrata (Williamson) Sidebottom 1912 LSP, p 405, pl xvii, figs 26–28.
„ „ ? var. Balkwill & Millett 1884 FG, p 21, pl i, fig 11.
Lagena Millettii C, Balkwill & Millett 1908 FG (Revision), p 5, pl i, fig 11.

A few specimens of this pretty little form were observed at 3 stations. They exhibit a considerable amount of variety in shape, ranging from the long oval body, originally figured by Balkwill & Millett as *L. quadrata* ? var., and by Chaster *ut suprâ*, to an almost globular body, with the hood projecting at the apex. The species is sparingly distributed on muddy bottoms round the Scottish coast.

161. Lagena lucida Williamson sp.

Entosolenia marginata var *lucida* W 1858 RFGB, p 10, pl i, figs 22–23.
Lagena lucida (W) Balkwill & Millett 1884 FG, p 80, pl ii, fig 7 ; pl iii, figs 4, 5.
„ „ „ Heron-Allen & Earland 1908 &c SB 1909, p 425 ; and 1911, p 318, pl x, fig 16.

(See also H-A & E 1909, p 425.)

This species occurs at nearly all (27) of the stations, and often in considerable numbers, but on the whole not so frequently as in many British shore-sands. Two well-marked types have been noticed, generally occurring together, one in which the shell is long and narrow, with comparatively parallel marginal edges, the other in which the shell is broad, compressed, and heart-shaped. The broad type is always very much larger than the narrow. Trigonal and abnormal specimens are of moderately frequent occurrence.

162. Lagena fasciata Egger sp.

Oolina fasciata E 1857 MSO, p 270, pl v, figs 12–15.
Lagena fasciata (E) Reuss 1862 NHG, p 323, pl ii, fig 24.

(See also MFM 1901, p 495.)

This species occurs abundantly at most (24) of the stations, and presents considerable diversity of shape and development. Trigonal specimens occur in some numbers at many of the stations, and a pedunculate variety has also been noticed in several of the dredgings. Also a few specimens in which the clear shell-wall is pierced by a comparatively small number of coarse perforations, giving a punctate appearance to the test.

163. Lagena fasciata var faba Balkwill & Millett.

Lagena faba B & M 1884 FG, p 81, pl ii, fig 10.
Lagena fasciata var *faba, Ibid,* Revision 1908, p 6.

The truncate form of *L. fasciata*, so appositely named var *faba* by Messrs. Balkwill and Millett, is extremely common at some of the stations in the area of the Survey. Specimens vary greatly in size, development of the opaque white bands, and in the texture of the shell itself. This is described by the authors as having the surface "rough like that of an orange"; but in the Clare Island specimens the surface varies from rough to glassy and smooth. Trigonal specimens are of frequent occurrence, and a pedunculate variety also occurs.

164. Lagena quadrata Williamson sp.

Entosolenia marginata var *quadrata* W 1858 RFGB, p 11, pl i, figs 27, 28.
Lagena quadrata (W) Brady 1884 FC, p 475, pl lix, figs 3 and 16; pl lx, fig 5.

(See also FC, p 475; MFM 1901, p 496; H-A & E 1911, p 321.)

Occurs at 8 stations, never abundantly, and shows considerable variety in the amount of compression, some of the specimens being somewhat inflated, others absolutely flat, also in the extent of the marginal wing, which occasionally, especially in the flat specimens, attains a moderate width. The aperture, which is usually flush with the marginal edge, is sometimes extended into a minute thick-lipped neck; in other specimens the aperture is large and depressed, and situated at the edge of one face of the shell, the opposite face being produced so as slightly to overshadow it after the manner of a minute hood.

165. Lagena Malcomsonii Wright.

Plate VI, fig 9.

Lagena laevigata var *Malcomsonii* W 1910–11 BCNI, p 4, pl i, figs 1, 2.

A few specimens sparingly distributed over 11 stations. Wright's species is merely *L. quadrata* (Williamson) in which the marginal edges are rounded instead of acute and the aperture is surrounded by a produced lip. Specimens vary accordingly within all the limits usually found in *L. quadrata*. Wright's figures represent a somewhat long shell with practically parallel sides. The range in shape among the Clare Island specimens extends from almost square tests to the outline of Wright's figure, but we have met with specimens in "Goldseeker" dredgings in which the shell is very much longer and narrower, resembling in fact a piece of compressed tubing.

166. Lagena marginata Walker & Boys sp.

Serpula (Lagena) marginata W & B 1784 TMR, p 2, pl i, fig 7.
Lagena marginata (W & B) Brady 1884 FC, p 476, pl lix, figs 21–23.

(See also FC, p 476; MFM 1901, p 496.)

Occurs in two of the shore-sands and nearly all the dredgings, often in great numbers and exhibiting every possible variation in the width of keel, from specimens barely separable from *L. laevigata* to others in which the keel completely encircles the shell, reaching at times to a total width equal to the body of the test. There is also great variety in the convexity of the chamber, which may be either a compressed sphere or merely a slightly inflated, or almost flat-sided cavity. Trigonal specimens were noticed at several stations, but they are less common than trigonal specimens of *L. Orbignyana* and *L. laevigata*.

167. Lagena marginata var **inaequilateralis** Wright.

Lagena marginata var *inaequilateralis* W 1886 BLP, p 321, pl xxvi, fig 10.

An occasional specimen found at 6 different stations. Only a few present the characteristics of Wright's variety in a strongly marked manner. When typical this is one of the most distinctive and interesting varieties we know. The highly convex surface on one side of the shell, strongly contrasted with the flat surface on the other, and the curious aperture situated under a little hood on one side—always the flat side of the test—are features not to be overlooked. The shape of the hood varies considerably, and in some cases almost attains the trumpet-like character of the aperture of *L. Millettii*, but of course on a very much smaller scale.

168. Lagena marginata var **semi-carinata** Sidebottom.

Plate VI, fig 4.

Lagena inaequilateralis var *semi-marginata* and *semi-carinata* S 1904 &c RFD 1906, p 10, pl ii, fig 7.

(*New to the British Isles.*)

We have one specimen from Station 13 which we are inclined to attribute to Mr. Sidebottom's variety, in spite of certain essential differences. In the text of his paper he described the variety under the name of *L. inaequilateralis* Wright var. *semi-marginata* (nov.), no doubt overlooking the fact that his varietal name had already been appropriated by Reuss. In the plate, however, this specimen is described as var *semi-carinata*. Mr. Sidebottom's specimen is described as "an interesting variation of *L. marginata* var. *inaequilateralis* Wright. The mouth is the same as in Mr. Wright's form,

and the test is also inequilateral (*sic*). The keel, however, is confined to the aboral end of the test, and is well developed."

Our specimen differs, inasmuch as the aperture is fissurine and the shell is of the normal equally biconvex type, with an attached entosolenian tube. The marginal keel, however, exactly resembles Mr. Sidebottom's figure in position and extent.

169. **Lagena unguis** sp nov.

Plate VII, figs 1–3.

Test inaequilateral, compressed, extremely hyaline, resembling *L. marginata*, but with a continuous marginal carina, produced considerably at the oral extremity of the shell, and curved like a "filbert-shaped" finger-nail. The aperture is placed in a depressed opening on the outer or convex surface of the "nail" just above the upper edge of the chamber, and is furnished with a curved attached entosolenian tube which runs down the wall of the test on the inner side of the shell, i.e. that opposed to the convex side. Average breadth across wing, ·08–·15 mm.; average length across wing, ·100–·200 mm.; average length of chamber, ·08–·15 mm.; average breadth of chamber, ·07–·14 mm.

This little form, though very distinctive in appearance, is difficult to describe; but it may be compared to a human finger-nail, detached from the flesh, and with a little cyst growing upon its concave surface. It is, no doubt, closely allied to *L. marginata* and Mr. Wright's var *inaequilateralis* of that species, but cannot be confused with either of these. Its nearest affinity appears to be *L. irregularis* Sidebottom (S 1904 &c RFD 1906, p 11), which closely resembles our species in the relation of the chamber to the surrounding carina, but has a bicarinate periphery, and differs also from ours in the position of its aperture, which is situated between the two keels.

The species occurs in many of the "Goldseeker" dredgings in the North Sea and round the Scottish coast, and is quite distinctive in its appearance.

170. **Lagena marginato-perforata** Seguenza.

Plate VII, figs 5, 6.

Lagena marginato-perforata S 1880 FTR, p 332, pl xvii, fig 34.
" " " " Millett 1898 &c MFM 1901, p 621, pl xiv, fig 4.
" " " " Sidebottom 1904 &c RFD 1906, p 10, pl ii, fig 5.

This species occurs at 9 stations among the dredgings, and is quite common in the fine mud of Station 13. There is considerable variety in the specimens,

some having a single keel, the true *L. marginato-perforata,* others a double keel (= *Fissurina punctata* (Seguenza)); while many of the specimens are ornamented with a varying number of minute radiating costae at the two extremities of the shell, which, however, are not produced over the central area of the test. There is usually an attached entosolenian tube, and the coarse perforations from which the species takes its name are generally suppressed in the area of the shell where the tube is attached. This agrees with Mr. Sidebottom's specimen and drawing *ut suprâ*; but in his specimens the internal tube is described as being straight and free. The species is of fairly common occurrence in shallow-water tropical gatherings. Mr. Wright has recently described and figured it under the name *L. laevigata* var. *marginato-perforata,* as a fossil from the Estuarine Clays of Magheramorne, "very common," recent Irish specimens "very few" (W 1910–11 ECM, p 12).

171. Lagena forficula sp nov.

Plate VI, fig 11.

Test free, consisting of a compressed oval chamber, furnished with a long neck, at the extremity of which is a phialine rim produced sideways into two short recurved hooks. The base of the chamber is furnished with two solid spines curving inwards like the pincers of an earwig, from which we have named the species. Total length, including neck and basal spines, ·24 mm; basal spines, ·05 mm in length; chamber, ·12 mm long, ·08 mm broad; neck, ·07 mm long; breadth across apical hooks, ·08 mm; maximum breadth of shell across basal spines, ·09 mm.

A single specimen of this extraordinary little form from Station 13. Broken individuals have been been observed at one or two "Goldseeker" stations in the Moray Firth.

Our species may be compared with that figured by Mr. Millett in MFM 1901, pl viii, fig 21, described as "*L. marginata* (Walker and Boys) var., very rare." It agrees with Mr. Millett's specimens in the long neck with recurved spines at the oral extremity, but differs in the shape of the chamber, which is a compressed oval, whereas Mr. Millett's specimen was a marginate form, and also in the presence of the strongly curved aboral spines. These are entirely wanting in the Malay form, the aboral extremity of which terminated in a short, blunt process, outgrowing from the carina.

The relationships of our species are evidently much closer to *L. laevigata* than to *L. marginata,* to which Mr. Millett referred his specimens. The presence of the long neck with recurved oral spines, common to both forms, is, however, very noticeable.

172. Lagena lagenoides Williamson sp.

Entosolenia marginata var. *lagenoides* W 1858 RFGB, p 11, pl i, figs 25, 26.
Lagena lagenoides (W) Reuss 1862 NHG, p 434, pl ii, figs 27, 28.

(See also FC, p 479; MFM, p 623.)

A few characteristic examples of this beautiful species have been found at 5 stations. They all belong to the typical British shallow-water type admirably figured by Messrs. Balkwill and Millett (B & M 1884 FG, p 82, pl ii, fig 11 [not fig 2].)

173. Lagena lagenoides var. **tenuistriata** Brady.

Plate VII, fig 7.

Lagena tubulifera var. *tenuistriata* B 1879 &c RRC 1881, p 61.
Lagena lagenoides var. *tenuistriata* B, Brady 1884 FC, p 479, pl lx, figs 11, 15, 16.
" " " " " Balkwill & Millett 1884 FG, p 82, pl ii, fig 12.

This species occurs at 7 stations among the dredgings, often in considerable numbers. All the specimens are of the small highly convex type figured by Balkwill and Millett, in which the marginal tubular portion is reduced to a minimum. The striation varies considerably in strength and closeness of the lines; in some specimens the striae are so fine and closely set together that they require at least a $\frac{1}{2}$-inch objective to resolve them. A trigonal specimen was observed at Station 13 (Inishgowla harbour).

174. Lagena formosa Schwager.

Lagena formosa (pars) S 1866 FKN, p 206, pl iv, figs 19A, 19D.
" " " " Brady 1884 FC, p 480, pl lx, figs 10, 18–20, 8?, 17?
" " " " Millett 1898 &c MFM 1901, p 624, pl xiv, figs 10–12

(See also MFM 1901, p 624.)

(*New to the British Isles.*)

This pretty form occurs sparingly at four of the stations.

175. Lagena ornata Williamson sp.

Plate VII, fig 8.

Entosolenia marginata var. *ornata* W 1858 RFGB, p 11, pl i, fig 24 (fragment.)
Lagena ornata (W) Brady 1887 BS, p 907.
" " " Chaster 1892 CS, p 62, pl i, fig 6.

This occurs at 5 stations, never more than a few specimens at each. This

beautiful little species appears to be always constant to type, even in such *minutiae* as the curving of the entosolenian tube.

176. Lagena bicarinata Terquem sp.

Fissurina bicarinata T 1882 FEP, p 31, pl i, fig 24.
Lagena bicarinata (T), Balkwill & Millett 1884 FG, p 82, pl ii, fig 4; pl iii, fig 9.

(See also MFM 1901, p 624; H-A & E 1911, p 318.)

This very distinctive little species occurs very sparingly at 6 stations; a few specimens were noticed possessing a secondary ectosolenian aperture at the base.

177. Lagena Rizzae Seguenza sp.

Plate VII, fig 9.

Fissurina Rizzae S 1862 FMMM, p 72, pl ii, fig 50.
Lagena Rizzae (S) Gough 1906 FLL, p 4, pl i, fig 3.

A few specimens of this little species were observed at 2 stations. It possibly occurs at others, but has been overlooked. *L. Rizzae* can best be described by comparison with *L. bicarinata* Terquem. If the space between the two keels of Terquem's species were filled up so as to leave a flat marginal edge, the specimen would become *L. Rizzae*. This comparison has been made and discussed by Dr. Fornasini (F 1901 NNI, p 51). The species is probably widely distributed, but the records are few, perhaps because it has been confused with *L. bicarinata* and *L. laevigata*. It was added to the British Foraminifera by Mr. Gough (*ut suprâ*), but had been found in Britain and exhibited previously by Robertson.[1] Some of our specimens present the ento-ectosolenian habit which Seguenza regarded as a specific feature, but which we now know to be one of the most inconstant attributes of the Lagenidae.

178. Lagena fimbriata Brady.

Plate VII, fig 14.

Lagena fimbriata B 1879 &c RRC 1881, p 61.
„ „ „ Brady 1884 FC, p 486, pl lx, figs 26–28.

(See also BS, p 907.)

A few specimens at 3 stations, presenting some diversity among themselves. At Station 15 the specimens are small, very hyaline, and furnished with a long entosolenian tube which reaches in a free condition to about the middle of the interior of the shell, is then bent at right angles, becomes

[1] Proc. Nat. Hist. Soc. Glasgow, vol v, 1882–4, p 268.

attached to the shell-wall, and follows the line of the shell-wall round half the equatorial diameter of the test. At Station 13 a single specimen was found (Plate VII, fig 15), resembling Mr. Sidebottom's variety *occlusa*, in which the wings at the base of the shell are closed in at their extremities (S 1912 LSP, 423, pl xx, figs 27, 28).

First recorded as a British species by Messrs. Balkwill and Millett from the Galway shore-sand (B & M 1884 FG, p 15).

179. Lagena Orbignyana Seguenza sp.

Fissurina Orbignyana S 1862 FMMM, p 66, pl ii, figs 25, 26.
Lagena Orbignyana (S) Brady 1884 FC, p 484, pl lix, figs 1, 18, 24–26; winged var, fig 20.

(See also FC, p 484; MFM 1901, p 626.)

Universally distributed over the area and very abundant in most of the dredgings. There is the usual range of variation in the convexity of the chamber, and the strength of the marginal keels. Trigonal specimens are of frequent occurrence, and an occasional quadrigonal specimen has been observed.

180. Lagena clathrata Brady.

Plate VII, fig 10.

Lagena clathrata B 1884 FC, p 485, pl lx, fig 4.
„ „ „ Millett 1898 &c MFM 1901, p 628, pl xiv, fig 23.

(See also BS, p 906.)

One very well-marked specimen from Station 15, and one less typical from Station 26.

This species was first recorded in Britain by Messrs. Balkwill and Millett from the shore-sand of Galway (B & M 1884 FG, p 14.)

181. Lagena cymbula sp. nov.

Plate VII, figs 16–18.

Test oval, depressed, shaped like a punt with rounded ends, the superior face concave, the inferior convex. Aperture situated in the centre of the depression, and furnished with an entosolenian tube which is attached to the interior of the shell, and follows the outline of the shell up the sloping side of the central depression, passing across to the edge and so down the side of the "punt" to the middle of the base. In transverse section *L. cymbula* would resemble an inverted triangle of which the basal angles have

been rounded off, and the inferior or apical portion truncated. Length, ·13–·16 mm; breadth, ·05–·08 mm; depth, ·03–·04 mm; oval central depression averages ·02 × ·04 mm; tube about ·01 diameter.

The affinities of this curious little species lie about midway between *L. cymbaeformis* Millett, which has a test of somewhat similar outline, but is more regularly naviculoid, being sub-acute at both extremities and sloping to a broad keel beneath, and *L. depressa* Chaster, which is more circular than our species, and is of the same breadth on both the oral and the aboral sides. The three species form a very interesting and unique little group, characterized by the presence of the aperture in what would in a normal Lagena represent the middle of one lateral surface of the test.

Mr. Millett's species is described as "rare" from the Pliocene of St. Erth, and Dr. Chaster found three specimens of *L. depressa* at Southport. We have one specimen of *L. cymbula* from Station 13, but have met with others in "Goldseeker" dredgings from Noss Head in the Moray Firth (72 metres) which are larger than the Clare Island specimen. It also occurs in a dredging made by the Fisheries Cruiser "Huxley" in the English North Sea (Haul 869), to which we are referring elsewhere, and in company with *L. depressa* Chaster, in Scapa Flow, Orkney.

Sub-Family NODOSARINAE.

NODOSARIA Lamarck.

182. Nodosaria simplex Silvestri.

Plate VIII, fig 1.

Nodosaria simplex S 1872 NFVI, p 95, pl xi, figs 268–272.
„ „ „ Brady 1884 FC, p 496, pl lxii, figs 4–6.
„ „ „ Gough 1906 FLL, p 4, pl i, figs 4, 5.

One specimen, which we figure, answering to the figure and description given by Mr. Gough *ut suprâ*. Mr. Gough attributes his specimen, perhaps without full authority, to Prof. Silvestri's species, which has been recorded by Mr. Pearcey (P 1888 FFC, p 181) and by Brady (B 1882 BKE, p 712) from the Faröe Channel.

183. Nodosaria calomorpha Reuss.

Nodosaria calomorpha R 1865 FABS, p 129, pl i, figs 15–19.
„ „ „ Brady 1884 FC, p 497, pl lxi, figs 23–27.
(See also FC, p 497; MFM 1902, p 513; H-A & E 1911, p 322.)

One typical specimen consisting of three chambers from Station 13 and a similar specimen from Station 19. There are also three specimens from

Station 13 which assume a linguline form owing to the compression of the test.

184. Nodosaria pyrula d'Orbigny.

Nodosaria pyrula d'O 1826 ASN, p 253, No 13.
„ „ „ Williamson 1858 RFGB, p 17, pl ii, fig 39.
(See also FC, p 497; BS, p 908; MFM 1902, p 514.)

Fragments only of this species were found at seven stations.

185. Nodosaria soluta Reuss sp.

Plate VIII, fig 2.

Dentalina soluta R 1851 FSUB, p 60, pl iii, fig 4.
Nodosaria soluta (R) Bornemann 1855 FSH, p 322, pl xii, fig 12.
(See also FC, p 503; MFM 1902, p 516.)

One minute specimen from Station 13, which is possibly a starved shallow-water variety of this species, or a transition form between *N. radicula* and *N. soluta*. *N. soluta* is typically a moderately deep-water form, and under favourable conditions attains a relatively large size.

186. Nodosaria plebeia Reuss sp.

Dentalina plebeia R 1855 KKM, p 267, pl viii, fig 9.
Nodosaria (D.) plebeia (R) Brady 1884 FC, p 502, pl lxiii, fig 2.
(See also FC, p 502.)

One specimen from Station 13, small, but fairly characteristic.

187. Nodosaria communis d'Orbigny.

Nodosaria (Dentalina) communis d'O 1826 ASN, p 254, No 35.
„ „ „ „ Brady 1884 FC, p 504, pl lxii, figs 19–22.
(See also FC, 504; MFM 1902, p 522.)

Very rare. A few specimens only at three stations.

188. Nodosaria filiformis d'Orbigny.

Nodosaria filiformis d'O 1826 ASN, p 253, No 14.
„ „ „ Brady 1884 FC, p 500, pl lxiii, figs 3–5.
(See also FC, p 500; MFM 1902, p 523.)

Two specimens found at Stations 13 and 33.

189. Nodosaria scalaris Batsch sp.

Nautilus (*Orthoceras*) *scalaris* B 1791 CS, No 4, pl ii, fig 4.
Nodosaria scalaris (B) Parker & Jones 1865 NAAF, p 340, pl xvi, fig 2.

(See also FC, p 510; MFM 1902, p 520.)

Occurs at 15 stations and is fairly common in the muddier dredgings. It is subject to considerable variation, very few specimens presenting that regular increase in the breadth of the chambers usually found in Nodosarian tests. The usual form is of the megalospheric type, in which there is practically no increase in the diameter of the chambers from first to last. In fact, in extreme instances the later chambers are narrower than the earlier. In this variety the neck gradually tapers into the final chamber instead of being a narrow tube fixed into the globular test. Abnormal and deformed specimens are of frequent occurrence, including some in which the apertures of the whole series are placed on one side of the test so as to form a vaginuline type of shell. Similar weak specimens were found at Jersey by Mr. Halkyard (H 1889 RFJ, p 60). The most marked specimens of this type can hardly be differentiated from such weak forms of *Marginulina costata* Batsch, as have been figured by Mr. Sidebottom (S 1904 &c RFD 1907, p 6), and may doubtless be regarded as transition forms. Professor Silvestri has suggested for these forms the somewhat inconvenient name *Lagenonodosaria pseudoscalaris* (Att. P. Acc. N. Lincei, Ann. lvii, 1904, p 144). Dr. Fornasini identifies them with *N. proxima* Silvestri (Boll. Soc. Geol. Ital., vol. vii 1888, pl iii, figs 10, 11).

LINGULINA d'Orbigny.

190. Lingulina carinata d'Orbigny.

Plate VIII, fig 9.

Lingulina carinata d O 1826 ASN, p 257, No 1, Modèle No 26.
„ „ „ Brady 1884 FC, p 517, pl lxv, figs 16, 17.
„ „ „ Sidebottom 1904 &c RFD 1907, p 3, pl i, figs 15–17.

(See also FC, p 517.)

A few specimens found at four stations. They all belong to one variety, in which the perforations are conspicuous, and the aperture is entosolenian and prolonged. For linguline shells possessing such entosolenian apertures Prof. Silvestri has suggested the generic name Ellipsolingulina (S 1907 LI, p 6), but as the presence or absence of an entosolenian tube is of such indifferent occurrence in all the Lagenidae, and appears to have no morphological significance, the creation of a separate sub-genus on such trivial grounds appears to be unnecessary.

191. Lingulina carinata var bicarinata Sidebottom.

Plate VIII, figs 3, 4.

Lingulina carinata var *bicarinata* S 1904 &c RFD 1907, p 3, pl i, fig 20.

(*New to the British Isles.*)

Two or three specimens only, from muddy dredgings. Their extremely minute size renders their certain identification somewhat difficult; but they possess the double marginal keel which is characteristic of Mr. Sidebottom's variety. They are all bilocular, whereas four out of the five specimens found by Mr. Sidebottom were trilocular. Similar specimens occur much more frequently in the "Goldseeker" dredgings, off Noss Head, in the Moray Firth, and at several other stations round the Scottish coast. None possess more than two chambers. They all exhibit a feature which is not brought out in Mr. Sidebottom's figure or description, viz. a deep constriction between the chambers which is bridged by a raised band of shell-substance running from one chamber to the other. Seen as a transparent object under a high power the shell-surface is rough and studded with fine tubercles. The aperture appears to be a simple cleft between the two keels. The shell wall between the keels is thicker than elsewhere. Measurements:—length ·100–·120 mm.; breadth (maximum), ·063–·070 mm.; thickness (maximum), ·012 mm.; thickness at aperture, side view, ·003 mm; thickness at junction of chambers, ·007 mm.; width between basal keels, ·006 mm.

192. Lingulina biloculi Wright.

Plate VIII, figs 5–7.

Lingulina carinata var *biloculi* W 1910–11 ECM, p 13, pl ii, fig 10.

Occurs at 9 stations, most plentifully at Station 13, where it is fairly common. This species, first described by Mr. J. Wright from the Estuarine Clay of Magheramorne, is extremely variable in form, ranging between specimens of almost spherical section to others in which a maximum of compression is noticeable. Mr. Wright's figure represents the suture between the two chambers as somewhat limbate, but with no sign of depression in the marginal edge. It is, however, quite as frequently found with a deep constriction between the two chambers. The sutural line may be simple or limbate, and the entosolenian tube which Mr. Wright gives as the typical feature of the species, is, in the Clare Island specimens, usually reduced to a minimum or altogether wanting. At Station 13 the range of variation is quite as extensive as between *Lagena globosa* and *L. Malcomsoni* in the

Lagenae. Abnormal specimens are of fairly frequent occurrence, and a few are trigonal; but variation never seems to extend to the formation of a third chamber. Mr. Wright describes it as frequent in the clays of Magheramorne and Limavady Junction, but very rare in the recent state, a few specimens only having been found in a muddy shore-gathering at Sheep Haven. We have found it in several "Goldseeker" dredgings, and it will probably be found to occur in muddy shallow-water deposits all round the western coasts of Scotland and Ireland.

Figs. 18 and 19 of Mr. Sidebottom's Plate i (S 1904 &c RFD 1907) "*Lingulina carinata*?" appear to be referable to this species. The secondary orifice at the basal end of the test, to which he refers in the description of these figures, is noticeable in some of the Clare Island specimens.

193. Lingulina armata Sidebottom.

Plate VIII, fig 8.

Lingulina armata S 1904 &c RFD 1907, p 4, pl i, fig 21.

(*New to the British Isles.*)

Extremely rare in the mud from Station 13; previously recorded only from Delos *ut suprâ*; but the species has been found in "Goldseeker" dredgings, at Noss Head (Moray Firth), Scapa Flow (Orkney Islands), and in the Minch.

194. Lingulina quadrata sp nov.

Plate VIII, fig 11.

Test bilocular, highly compressed, quadrate and carinate, the final chamber drawn out sometimes at the apex, which is either simple or furnished with an entosolenian tube. The line of suture between the two chambers is slightly depressed and curved at the marginal edges towards the base of the shell. Length, ·16 mm.; breadth, ·13 mm.

This pretty little species may be regarded as the extreme limit of variation in the direction of compression of the allied form *L. biloculi* or perhaps more strictly as a bilocular form of *Lagena quadrata* (Williamson); it bears the same relation to typical *L. biloculi* that *Lagena quadrata* does to *L. globosa* or *laevigata*.

A few specimens found at Station 19. It occurs also at Noss Head and several other "Goldseeker" stations, always very rare.

195. Lingulina pellucida Sidebottom.

Plate VIII, fig 10.

Lingulina pellucida S 1904 &c RFD 1907, p 4, pl i, figs 22-25.

(*New to the British Isles.*)

Two minute bilocular specimens from station 13, quite typical and characteristic. It also occurs at Noss Head in the Moray Firth, where trilocular specimens have been found.

FRONDICULARIA Defrance.

196. Frondicularia translucens sp. nov.

Plate VIII, fig 13.

Test minute, ovate, compressed, rounded at both ends, and at the marginal edges, showing three to four chambers; the initial chamber large, inflated, lenticular in shape. Sutural lines somewhat obscure, especially in the later chambers. Shell-walls transparent; surface minutely punctate; aperture, a slit furnished with a curved entosolenian tube. The species appears to be allied to the group of *F. laevigata* d'Orbigny. Length, ·14–·16 mm.; breadth, ·100–·120 mm.; maximum thickness, ·07 mm.

A few specimens of this interesting little form were found in a dredging in Inishgowla harbour (Station 13) in 1–4 fms. Recent Frondiculariae are extremely rare, and we now record the genus for the second time as recent and British. (See Addenda, p. 187.)

197. Frondicularia pygmaea Sidebottom.

Plate VIII, fig 14.

Frondicularia pygmaea S 1904 &c RFD 1907, No 9, p 5, pl i, fig 27.

(*New to the British Isles.*)

The single specimen which we figure, dredged at Station 13 (Inishgowla harbour—14 fms), is, in our opinion, the microspheric type of the curious little species figured and described by Mr. Sidebottom from Delos (*ut suprâ*) under the name of *F. pygmaea*. Mr. Sidebottom found two specimens only, both of which, judging from the figure in his paper, were megalospheric. His description of the species was as follows:—"The initial chamber appears to be nearly globular, and the following ones are compressed, narrow, and reflexed. The septa are arched and slightly sunk. The orifice is simple. A small wing, commencing on the last chamber but one, runs on either side of the test, gradually broadening out and terminating as a spine. The initial

chamber is likewise armed with a small spine. Two specimens were found, both consisting of five chambers."

In the Clare Island specimen the initial chamber is extremely minute, and is followed by chambers rapidly increasing in width. The sixth chamber is armed with lateral spines, marking the commencement of the carina which Mr. Sidebottom describes. Only one chamber has been formed beyond this point, and this shows a rapid increase in size. The occurrence of the species in British waters has already been observed by Earland from the Moray Firth where both megalo- and microspheric specimens have been dredged by him off Noss Head.

198. Frondicularia spathulata Brady.

Plate VIII, fig 12.

Frondicularia spathulata B 1879 &c RRC, p 270, pl viii, fig 5.
" " " Brady 1884 FC, p 519, pl lxv, fig 18.

(*New to the British Isles.*)

A few specimens have been found in five of the muddier dredgings which agree with the depauperated type figured and identified by Mr. Sidebottom under Brady's name, *F. spathulata*. Williamson figured a specimen very near *F. complanata* from Sandwich under this name (W 1858 RFGB, p 23, pl ii, fig 50), which therefore lapsed, and could be used again by Brady (see B 1887 BS, p 873). The test is minute, hyaline, compressed, and lobulate along the margins, owing to each chamber being considerably broader at the oral end than at the base. The aperture is simple and often furnished with an entosolenian tube; the sutural lines are depressed. Length, ·2–·35 mm.; breadth of initial chamber, ·08 mm., of final chamber, ·12 mm. These little shells, which we think have been correctly assigned by Mr. Sidebottom, are of fairly frequent occurrence in muddy dredgings from shallow water round the northern and western coasts of Scotland, and in the North Sea, and it is probable that they will be found in other British localities if carefully searched for; but their minute size and delicacy are likely to cause them to be overlooked. (See Addenda, p. 187.)

MARGINULINA d'Orbigny.

199. Marginulina glabra d'Orbigny.

Marginulina glabra d'O 1826 ASN, p 259, No 6, Modèle No 55.
" " " Parker Jones & Brady 1859 &c NF 1865, p 27, pl i, fig 36.

(See also FC, p 527; MFM 1902, p 526; H-A & E 1911, p 354.)

One small specimen found at Station 33, one, fine, at Station 25.

200. Marginulina costata Batsch sp.

Nautilus (*Orthoceras*) *costatus* B 1791 CS, p 2, pl i, fig 1, a-g.
Marginulina costata (B) Brady 1884 FC, p 528, pl lxv, figs 10–13.

(See also FC, p 528 ; MFM 1902, p 526.)

Two very large specimens found at Stations 1 and 27.

VAGINULINA d'Orbigny.

201. Vaginulina legumen Linné sp.

Nautilus legumen L 1758 SN (Ed x) p 711, No 248.
„ „ „ 1788 „ (Ed xiii), p 3373, No 22.
Vaginulina legumen (L) d'Orbigny 1826 ASN, p 257, No 2.
„ „ „ Brady 1884 FC., p 530, pl lxvi, figs 13–15.

(See also FC, p 530 ; MFM 1902, p 527.)

Occurs at 5 stations, two being shore-sands. Exceptionally fine and robust individuals were obtained at Stations 25 and 27.

202. Vaginulina linearis Montagu sp.

Nautilus linearis M 1808 TB, Suppl, p 87, pl xxx, fig 9.
Vaginulina linearis (M) Parker & Jones 1865 NAAF, p 343, pl xiii, figs 12, 13.

(See also FC, p 532.)

A few small and rather weak individuals at Stations 24 and 28.

CRISTELLARIA Lamarck.

203. Cristellaria crepidula Fichtel & Moll sp.

Nautilus crepidula F & M 1798 TM, p 107, pl xix, figs g–i.
Cristellaria crepidula (F & M) d'Orbigny 1839 OFC, p 41, pl viii, figs 17, 18.

(See also FC, p 542; MFM 1903, p 254; H-A & E 1909, 438.)

This species, which is fairly generally distributed over the area of the Survey, is, as a rule, represented by specimens of small size; but at Station 27 the shell attains large dimensions, and passes almost imperceptibly into *Vaginulina legumen*. Both megalospheric and microspheric types were observed, the proportions being 27 megalo- to 10 microspheric tests. The majority of the microspheric specimens were of the evolute sickle-shaped type, but this occurs occasionally among the megalospheric specimens also.

204. Cristellaria acutauricularis Fichtel & Moll sp.

Plate VIII, fig 15.

Nautilus acutauricularis F & M 1798 TM, p 102, pl xviii, figs g–i.
Cristellaria acutauricularis (F & M) Parker & Jones 1859 &c NF 1860, p 114, No 20.

(See also FC, p 543 ; MFM 1903, p 255.)

(*New to the British Isles.**)

Two minute specimens are referred with some doubt to this species, which does not appear to have been hitherto recorded as a British recent form. The species cannot be described as a strongly marked specific type, being merely *C. crepidula* of a thickened ovate variety, linking that species with *C. italica* or *C. gibba.*

205. Cristellaria gibba d'Orbigny.

Cristellaria gibba d'O 1839 OFC, p 40, pl vii, figs 20, 21.
„ „ „ Brady 1884 FC, p 546, pl lxix, figs 8, 9.

(See also FC, p 546 MFM 1903, p 255.)

Two specimens only, from Stations 13 and 23, both megalospheric, and both small, similar to those recorded by Earland from the shore-sands of Bognor. (E 1905 FBS, p 216.) The species as a rule is confined to moderately deep water.

206. Cristellaria rotulata Lamarck sp.

Lenticulites rotulata L 1804 AM, p 188, No 3 ; L 1816 TEM, pl 466, fig 5.
Cristellaria rotulata (L.) d'Orbigny 1840 CBP, p 26, pl ii, figs 16–18.

(See also FC, p 547 ; MFM 1903, p 257.)

Occurs but sparingly in 14 of the dredgings, and all the specimens are small and poorly developed. Out of 39 specimens examined, 32 were megalo- and 7 were microspheric.

207. Cristellaria cultrata Montfort sp.

Robulus cultratus M 1808 CS, vol i, p 214, 54° genre.
Cristellaria cultrata (M.) Parker & Jones 1865 NAAF, p 344, pl xiii, figs 17, 18 ; pl xvi, fig 5.

(See also FC, p 550.)

Sparingly distributed (6 stations), some of the specimens being large and quite typical. Of the twelve specimens found, all were megalospheric.

Sub-Family POLYMORPHININAE.

POLYMORPHINA d'Orbigny.

208. Polymorphina lactea Walker & Jacob sp.

Plate VIII, fig 16.

Serpula lactea W & J 1798 AEM, p 634, pl xiv, fig 4.
Polymorphina lactea (W & J) Brady Parker & Jones 1870 GP, p 213, pl xxxix, fig 1.

(See also FC, p 559; MFM 1903, p 261.)

Universally distributed over the area, but does not attain so fine a development as *P. gibba*. We figure an abnormal double specimen.

209. Polymorphina gibba d'Orbigny.

Polymorphina (*Globulina*) *gibba* d'O 1826 ASN, p 266, No 20, Modèle No 63.
„ „ „ „ Brady Parker & Jones 1870 GP, p 216, pl xxxix, fig 2.

(See also FC, p 561; BS, p 912.)

Widely distributed (20 stations), often very abundant, and exhibiting the complete range of growth up to specimens of remarkable size. Fistulose specimens not uncommon at some of the stations, but none were found in the attached state. As usual there are a great many specimens presenting a complete range of variation between this species and the compressed and nearly allied *P. lactea*.

210. Polymorphina oblonga Williamson.

Plate VIII, fig 17.

Polymorphina lactea var *oblonga* W 1858 RFGB, p 71, pl vi, fig 149.
„ „ „ „ „ Brady Parker & Jones 1870 GP, p 222, pl xxxix, fig 7.
Polymorphina oblonga W. Heron-Allen & Earland SB, 1908 &c 1909, p 430.

(See also BS, p 913; MFM 1903, p 264.)

This most distinctive and well-marked type, which, for reasons furnished by us (*ut suprâ*), we have decided to raise to specific rank, occurs fairly generally all over the area both in shore-sands and dredgings (16 stations), and some of the specimens are the largest and finest we have ever observed. They are all quite true to type in the distinctive arrangement of chambers, the only variation being in size, and in slight modifications of the terminal

chamber, which in a few instances is more produced to an apex than in the type. At Station 23 all the specimens belong to a minute and weak form which we have observed at several "Goldseeker" stations in the North Sea. In this the test is minute and thin-shelled, the internal septa are sometimes more or less absorbed, and the aperture is furnished with an entosolenian tube which, in extreme instances, is prolonged and attached in a long curve to the inner wall of the final chamber. We figure an example of this pauperate form.

211. Polymorphina compressa d'Orbigny.

Polymorphina compressa d'O 1846 FFV, p 233, pl xii, figs 32–34.
„ „ „ Brady Parker & Jones 1870 GP, p 227, pl xl, fig 12.

(See also FC, p 565; MFM 1903, p 262.)

Occurs at 26 stations, shore-sands and dredgings, common at many, and extremely well developed at Station 3. A single attached (but not fistulose) specimen was found at Station 27.

P. compressa is a very variable species, and its varieties have received many different specific names. Dr. Fornasini has dealt with some of d'Orbigny's synonyms in a paper published in the "Rivista Italiana di Paleontologia" (Ann. viii, fasc i, 1902, p 11).

212. Polymorphina communis d'Orbigny.

Polymorphina (*Guttulina*) *communis* and *problema* d'O 1826 ASN, p 266, Nos. 14 & 15, pl xii, figs 1–4, Modèles Nos 61, 62.
Polymorphina communis d'O, Brady Parker & Jones 1870 GP, p 224, pl xxxix, fig 10 A, B.

(See also FC, p 568; MFM 1903, p 263.)

Occurs at 7 stations, shore-sands and dredgings, abundantly at some of them, and presenting the usual range of variation. None of the specimens, however, attain any remarkable size.

213. Polymorphina rotundata Bornemann sp.

Guttulina rotundata B 1855 FSH, p 346, pl xi, pl xvii, fig 3.
Polymorphina rotundata (B) Brady Parker & Jones 1870 GP, p 234, pl xl, figs 19 A–E, and woodcuts.

(See also FC, p 570; BS, p 914.)

Occurs at 2 stations only, and but rarely at those, but one of the specimens is large and absolutely typical. The British records of this species appear to be very few, but it is fairly common in deep water in the North Sea.

214. Polymorphina sororia Reuss.

Polymorphina (*Guttulina*) *sororia* R 1863 FCA, p 151, pl ii, figs 25–29.
„ „ „ „ Brady 1884 FC, p 562, pl lxxi, figs 15, 16.

(See also FC, p 562; BS, p 914; MFM 1903, p 265.)

Occurs at 10 stations, shore-sands and dredgings, and is common at some. The usual range of variation is observable, linking this species with *P. compressa* on the one hand and *P. rotundata* on the other.

215. Polymorphina concava Williamson.

Polymorphina lactea var *concava* W 1858 RFGB, p 72, pl vi, figs 151, 152.
Polymorphina concava W. Brady Parker & Jones 1870 GP, p 236, pl xl, fig 22.
„ „ „ Heron-Allen & Earland 1908 &c SB 1909, pl 431, pl xvii, fig 6.

A single specimen from Station 23, consisting of a single chamber superimposed upon the usual irregularly outlined basal tent. The specimen was detached. In this respect it appears to correspond with Williamson's original type, as he remarks:—"I am disposed to believe that during the formation of the ultimate segment the individuals belonging to this variety may have become parasitic on some other rounded bodies; an opinion to which the variable contour of the peripheral segment, contrasted with the uniform appearance of the central ones, affords some countenance." From this it would appear that Williamson never saw specimens in the sessile condition, which is really the normal method of growth.

Sessile individuals are of fairly constant occurrence in shallow-water dredgings, but the species is never very common. It is rather noticeable that in the only "Goldseeker" dredgings in which the species occurs all the individuals are free and unattached, whereas in all the other localities from which we have obtained it (excepting Selsey Bill) the specimens are sessile on shell fragments, &c.

It seems probable that *P. concava* may be a form of *P. lactea* analogous to the fistulose stage which characterizes some other species of the genus Polymorphina. In this connexion it may be pointed out that *P. lactea*, although so common a species, does not exhibit much tendency to form fistulose outgrowths, as compared with *P. gibba* and *P. compressa*. As to the actual nature of these outgrowths, whether simple as in *P. concava*, or fistulose, we have at present no evidence, but there is little doubt that they represent some resting-stage preceding the reproduction of the species. Mr. Sidebottom

has written at some length upon the peculiar features of this species (S 1904 &c RFD 1907, p 14, pl iii, figs 8, 9). (*Cf.* Dr. Alcock's theory, p 120, *post.*)

216. Polymorphina myristiformis Williamson.

Plate VIII, figs 18, 19.

Polymorphina myristiformis W 1858 RFGB, p 73, pl vi, figs 156, 157.
" " " Brady Parker and Jones 1870 GP, p 240, pl xli, fig 30.

(See also FC, p 571 ; H-A & E 1909, p 434.)

This, which is one of the most typical West of Ireland species, is almost universally distributed (26 stations), and is frequently very abundant, showing great variation in external form and arrangement of chambers. In the shore-sands especially there is a noticeable tendency towards compression of the test and consequent elongation of the chambers. The external costae are also very weakly developed as compared with the normal round type from deeper water. The best specimens of the normal form are from Station 27. A considerable number of specimens exhibit a tendency to exaggeration of the final chamber at the expense of the earlier ones, the final chamber sometimes occupying quite two-thirds of the whole test. Messrs. Balkwill and Millett's figure of the species presents similar characteristics. It is rather noticeable that this species, which is so abundant in the Clare Island area, should have been recorded as "rare" in the adjacent shore-sands of Galway by these authors (B & M 1884 FG, p 84, pl iv, fig 10).

UVIGERINA d'Orbigny.

217. Uvigerina Canariensis d'Orbigny.

Uvigerina Canariensis d'O 1839 FIC, p 138, pl i, figs 25–27.
" " " Brady 1884 FC, p 573, pl lxxiv, figs 1–3.

(See also FC, p 573 ; MFM 1903, p 266.)

Three rather weak specimens from Stations 12 and 31. This appears to be very rare in the few British localities from which it has been recorded.

218. Uvigerina pygmaea d'Orbigny.

Uvigerina pygmaea d'O 1826 ASN, p 269, pl xii, figs 8, 9, Modèle No 67.
" " " Brady 1884 FC, p 575, pl lxxiv, figs 11–14.

(See also FC, p 575 ; MFM 1903, p 269.)

One large and quite typical specimen from Station 12, and one weak one from Station 33. The occurrence of individuals in such shallow waters is extremely noteworthy.

219. Uvigerina angulosa Williamson.

Uvigerina angulosa W 1858 RFGB, p 67, pl v, fig 140.
„ „ „ Brady 1884 FC, p 576, pl lxxiv, figs 15–18.
(See also FC, p 576 ; MFM 1903, p 269.)

Universally distributed over the area, and presenting considerable variation in the relative length and breadth of the shell and in the extent and strength of the superficial costae and marginal carinae.

Family GLOBIGERINIDAE.

GLOBIGERINA d'Orbigny.

220. Globigerina bulloides d'Orbigny.

Globigerina bulloides d'O 1826 ASN, p 277, No 1, Modèles Nos 17 and 76.
„ „ „ Brady 1884 FC, p 593, pls lxxvii and lxxix, figs 3–7.
(See also FC, p 593 ; MFM, p 1903, p 685.)

The species is found at every station, both shore-sands and dredgings. The shore-sand specimens are all large well-developed shells, no doubt drifted from deep water, being noticeably larger in size than the occasional specimens found in English shore-sands.

In the dredgings the form presents a greater variation. There are large numbers of well-developed specimens, probably the result of drift, and at some stations thick-shelled bottom specimens in all stages. At several (10) stations, specimens indistinguishable from *G. Dutertrii* d'Orbigny were noted. We have not attempted to separate this form from the typical *G. bulloides*, intermediate specimens being of such frequent occurrence. At one or two stations the var. *triloba* Reuss was also noticed. Very minute specimens, young shells, are of very common occurrence in all the dredgings.

The numerous variations of *G. bulloides* and other species of Globigerina and their synonymy have been dealt with by Dr. Fornasini in the Proceedings of the Institute of Bologna (NS, vol vii, 1903), and in his monograph of the Adriatic Globigerinae (F 1899 GA).

221. Globigerina cretacea d'Orbigny.

Globigerina cretacea d'O 1840 CBP, p 34, pl iii, figs 12–14.
„ „ „ Brady 1884 FC, p 596, pl lxxxii, figs 10, 11.
(See also FC, p 596.)
(*New to the British Isles.**)

A few specimens of the neat and regular type of *G. cretacea* were observed

at Station 21. They are probably no more than rotaliform modifications of *G. bulloides*, but they closely approximate the typical Cretaceous fossils described by d'Orbigny.

222. Globigerina inflata d'Orbigny.

Globigerina inflata d'O 1839 FIC, p 134, pl ii, figs 7–9.
" " " Brady 1884 FC, p 601, pl lxxix, figs 8–10.

(See also FC, p 601; MFM 1903, p 687.)

The species occurs in all the shore-sands but one, and in most of the dredgings (21 stations). The specimens are all large and well developed, and in the absence of minute individuals from the gatherings must be regarded as probably derived from Atlantic drift.

223. Globigerina pachyderma Ehrenberg sp.

Aristerospira pachyderma E 1873 LMT, p 386, pl i, fig 4.
Globigerina pachyderma (E) Brady 1884 FC, p 600, pl cxiv, figs 19, 20.

(See also H-A & E 1909, p 438.)

Two minute but typical specimens of this little species were found at Station 31. This possibly constitutes a southern record for the species, which is normally of arctic distribution, but occurs abundantly as far south as the Faröe Channel and the northern area of the North Sea.

224. Globigerina rubra d'Orbigny.

Globigerina rubra d'O 1839 OFC, p 82, pl iv, figs 12–14.
" " " Fornasini 1899 GA, p 580, pl ii, fig 11.

(See also FC, p 602; MFM 1903, p 687.)

Small individuals of the minute type commonly referred to this species occur abundantly at many (10) of the stations, and, owing to their minute size, have possibly been overlooked at others. They vary considerably in shape and number of chambers. In the majority of instances the chambers are comparatively few in number, varying but slightly in size; but other specimens have numerous chambers arranged in an elongated spire similar to the individuals figured by Brady (FC, pl lxxxii, figs 8, 9, "*Globigerina* sp. Minute Globigerinae, general contour resembling that of *G. elevata* d'Orbigny and *G. trochoides* Reuss.")

None of the specimens present the red colouring matter which is the distinctive mark of *G. rubra* in typical tropical specimens; but the general

arrangement of the chambers, the presence of secondary apertures along the sutural lines, and the whole appearance of the test in spite of its minute size, are similar, and we have no hesitation in identifying these little forms, which are so abundant in muddy shallow-water deposits, both on the Irish coast and in Scottish waters, with *G. rubra.*

ORBULINA d'Orbigny.

225. Orbulina universa d'Orbigny.

Orbulina universa d'O 1839 OFC, p 3, pl i, fig 1.
„ „ „ Brady 1884 FC, p 608, pl lxxviii and pl lxxxi, figs 8–26; pl lxxxii, figs 1–3, &c.

(See also FC, p 608; MFM 1903, p 690.)

A few specimens at 8 stations, 4 of which were shore-sands. At all but two the specimens were of that undeveloped type in which the Orbuline chamber does not wholly include and mask the Globigerine shell. There can be no doubt that all the specimens are of oceanic origin, and that their presence in the area is due to a coastward drift from the Atlantic. This would in itself account for the larger proportion of Globigerine forms, as these, being in the active living stage, would drift longer than specimens which had already passed through the early stages of their Orbuline existence (ending with the absorption of the Globigerina test), after the completion of which there is no doubt that the resultant Orbuline shell sinks and continues a deep-sea existence.

PULLENIA Parker & Jones.

226. Pullenia sphaeroides d'Orbigny sp.

Nonionina sphaeroides d'O 1826 ASN, p 293, No 1, Modèle No 43.
Pullenia sphaeroides (d'O) Carpenter Parker & Jones 1862 IF, p 184, pl xii, fig 12.

(See also FC, p 615; BS, p 917; MFM, 1903, p 691.)

A single but perfectly typical specimen from Station 13. This appears to have been recorded previously only from the estuary of the Dee by Mr. Siddall, and by Balkwill & Wright from the Irish Sea. Brady records that it is comparatively rare at depths of less than 300 fms., although the records commence from the Laminarian zone. It occurs with moderate frequency in the muddier "Goldseeker" dredgings from the North Sea.

Family ROTALIDAE.

Sub-Family SPIRILLININAE.

SPIRILLINA Ehrenberg.

227. Spirillina vivipara Ehrenberg.

Plate IX, fig 1.

Spirillina vivipara E 1841 SNA, p 442, pl iii, fig 41..

" " " Brady 1884 FC, p 630, pl lxxxv, figs 1–5.

(See also FC p 630 ; H-A & E 1909, p 439.)

Universally distributed (29 stations) and characterized by an extreme variability of shell. In addition to the normal *S. vivipara*, more or less conical varieties are plentiful, connecting the species with Mr. Sidebottom's *S. lucida*, and also numerous individuals with more or less truncate periphery, linking the species with *S. limbata* Brady. Plastogamic individuals are of frequent occurrence in some of the dredgings. We figure one abnormal instance of plastogamy in which the two shells, instead of being superimposed, are joined merely by a prolongation of the apertural ends of the tubes. This may be compared with the plastogamic specimens of *Cornuspira Selseyensis* figured by Earland (1905 FBS, pl xiii, fig 3).

228. Spirillina Groomii Chapman.

Spirillina Groomii C 1900 UCM, p 259, pl xv, figs 1, 10, 11.

Plate IX, figs 2, 3.

(*New to the British Isles.**)

A single specimen from Station 15 which appears to agree with Mr. Chapman's description. The test is shaped like a somewhat flattened bee-hive, being highly domed on the superior, and deeply concave on the inferior, face. It consists of eight narrow convolutions, each separated on the superior, face by slightly depressed sutural lines. Each convolution appears to bear a single line of well-marked foramina. Viewed on the inferior side the primordial chamber appears to project in the centre of the depression as a little pimple. It is isomorphous with *Cornuspira cretacea* Reuss (R 1862 NHG, p 34, pl i, figs 11, 12).

This species, originally described by Mr. Chapman from the Cambrian of Malvern, is doubtless only an extreme modification of the conical type of *S. vivipara*, the reniform shape of the chambers, on which Mr. Chapman lays considerable stress, being merely incidental to the closely coherent convolutions of the test. It is, however, a very well-marked and distinctive form, and its occurrence in the living condition is extremely interesting. It is probably the oldest existing specific form of life.

229. Spirillina lucida Sidebottom.

Plate IX, figs 4, 5.

Spirillina lucida S 1904 &c RFD 1908, p 9, pl ii, fig 9.
„ „ „ Heron-Allen & Earland 1908 &c SB 1911, p 327.

One or two specimens from Stations 21 and Clare Island (7, 10, 11) which answer to Mr. Sidebottom's figure and description, but possess a well-marked aperture. His specimens were from Delos; but the somewhat obscure characteristics of the shell as described by him rendered its relationship somewhat doubtful, and led us in our Selsey papers to express doubt as to whether it was actually a Spirillina or a Discorbina in which the internal chambers had been dissolved during the plastogamic process. From the specimens now observed, we have no longer any doubt that it is a Spirillina and closely related to the more conical forms of *S. vivipara.*

230. Spirillina obconica Brady.

Plate IX, figs 8, 9.

Spirillina obconica B 1879 &c RRC 1879, p 279, pl viii, fig 27.
„ „ „ Brady 1884 FC, p 630, pl lxxxv, figs 6, 7.

(*New to the British Isles.*)

Two specimens, one each from Stations 12 and 23, quite typical. The species has not previously been recorded from Britain, Brady's records being from such widely separated localities as Prince Edward Island, Kerguelen Island, and the Admiralty Islands, depths ranging from 17 to 150 fms. We have excellent specimens from "Goldseeker" dredgings in the Moray Firth (70 metres).

Dr. Haeusler figures some curious abnormal specimens assigned to *Ammodiscus incertus* d'Orb. and *A. gordialis* P. & J., which are isomorphous with *S. obconica* so far as the eccentric form of the spiral goes. (H 1885 LAI, pl iii, figs 6, 7.)

231. Spirillina obconica var. **carinata** Halkyard.

Plate IX, figs 6, 7.

Spirillina vivipara var *carinata* H 1889 RFJ, p 71, pl ii, fig 6.
„ „ „ „ „ Sidebottom 1904 &c RFD 1908, p 8, pl ii, fig 4.

A few specimens at each of 7 stations and fairly abundantly at Station 23.

Brady, in founding his species *S. obconica*, appears to have regarded the conical shape of the test as the chief specific feature, but this feature is of quite frequent occurrence in the common *S. vivipara*, and not always present in *S. obconica*. The true point of distinction between *S. vivipara* and *S. obconica* appears to us to lie in the eccentric or oval shape of the convolutions, which is a feature not presented by any other Spirillina. With this distinction in view, we have removed Halkyard's very plainly marked variety from *S. vivipara* to *S. obconica*, for, although the shell is absolutely flat, the chambers are arranged normally on the eccentric plan.

The records of this variety appear to be few. Halkyard's specimens were from Jersey. Mr. Sidebottom has recorded and figured specimens from Delos which, while presenting the typical carination of the variety, are perhaps less elliptical than is usually the case, and therefore more nearly allied to *S. vivipara* than Halkyard's original specimens. It occurs in many of the "Goldseeker" dredgings in the North Sea and Moray Firth.

232. Spirillina limbata var **denticulata** Brady.

Plate IX, fig 10.

Spirillina vivipara var *denticulata* B 1884 FC, p 632, pl lxxxv, fig 17.
„ „ „ „ Millett 1898 &c MFM 1903, p 694.
(See also MFM 1903, p 694.)
(*New to the British Isles.**)

A few specimens from Stations 12, 14, 27, and 28. The original records are from tropical and sub-tropical waters round the Australian coast.

Sub-Family ROTALINAE.

PATELLINA Williamson.

233. Patellina corrugata Williamson.

Plate IX, fig 11.

Patellina corrugata W 1858 RFGB, p 46, pl iii, figs 86–89.
„ „ „ Brady 1884 FC, p 634, pl lxxxvi, figs 1–7.
(See also FC, p 634; MFM 1903, p 696.)

The species occurs at practically every station (29), often abundantly. The majority of the specimens at all the stations are of the normal type originally figured by Williamson, in which the basal outline is almost circular, and the conical surface of the shell is broken into a series of minute steps, due to the limbation of the sutural lines, or perhaps more strictly to the fact that each successive tier of chambers is slightly narrower at its upper edge

than the base of the preceding convolution. At eight stations, however, a very distinctive variety occurs in which the basal outline is a pronounced oval, and the sides of the cone are quite smooth. There are usually more tiers (or convolutions) of chambers in this oval variety than in the type, and the chambers are more regularly textularian in their arrangement. In Williamson's type the chambers occupy rather less than half a diameter each of the shell, so that the general plan is rather valvuline than textularian. The initial chamber of the oval variety also appears to be constantly smaller than in the circular type, and it seems possible that these two forms may represent the megalo- and microspheric plans of growth in the species. Plastogamic pairs of each variety have been observed.

DISCORBINA Parker & Jones.

The identification and classification of the *Discorbinae* of the Clare Island area have been matters of considerable difficulty, owing to the remarkable development and variation of the specimens. The genus is one of the most abundant and widely distributed in the area, the shallow seas and extensive inshore reefs covered with algae being exceptionally favourable for the development of species having any tendency to the sessile habit of growth.

It would have been an easy task to have disposed of the matter by allotting the majority of the specimens to the two species *D. rosacea* (d'Orb.) and *D. globularis* (d'Orb.), names which in many British lists must often have served for very dissimilar organisms. But inasmuch as reference to the published figures of these species, and especially of *D. rosacea*, reveals a bewildering variety of forms, the extremes of which have little in common but the specific name with which they have been credited, it has seemed to us desirable to revive some other specific names, and to endeavour to separate our specimens under these, while at the same time endeavouring to show their close relationship, and the gradual passage from the simplest to the most complex Asterigerine type of shell.

The genus *Discorbina* was formed by Parker and Jones in 1862, and includes, either partly or entirely, the earlier generic names Rosalina, Trochulina, Asterigerina, Anomalina, and Valvulina of d'Orbigny, also parts of Reuss' genus Rotalina, and of various other genera. Messrs. Parker and Jones defined Discorbina as including those species which present "the characteristic features of the rotaline series in their simplest, as Rotalia does in their most developed, condition. Its shell is typically a turbinoid spire, formed by a succession of vesicular segments . . . The aperture is a large fissure, more or less arched, reaching to the lower edge of the umbilical margin of the septal

plane; and it is nearly always more or less occluded by an "astral flap," which may be a mere projection of the exogenous substance deposited on the umbilicus, or may be part of the more developed 'asterigerine' plates . . . The general form of the shell is conical, with a rather sharp margin and a nearly flat base." (C P & J 1862 IF, pp 203–4.)

The authors selected the *Rotalia turbo* of d'Orbigny as the type of their genus, and in a subsequent scheme (P & J 1865 NAAF, p 385) attempted to divide the genus into three groups representing (i) Conical, (ii) Vesicular, and (iii) Outspread forms. But this arrangement is very unsatisfactory, inasmuch as all three types of construction are to be found in the varieties of a single species. For the purpose of an analysis of the Discorbinae it seems better to start with a simple type of shell, and from this to trace the development of the intermediate stages which lead up to the more complex forms, and so link one (so-called) species with another.

The accompanying chart must, however, be regarded merely as a provisional attempt to elucidate the connexions between the so-called species of Discorbina so far as has been possible with the time and material at our disposal. Allowance must be made for the fact that it has been necessary to set out the chart on a plane scale, with the result that forms which are really quite close together in the zoological relationship may appear widely apart in the plan. Had it been possible to show the lines of development as radii from the surface of a central sphere representing a simple form, this apparent discrepancy would not have been noticeable.

The *Discorbina* (*Rosalina*) *Cora* of d'Orbigny is probably the simplest conceivable type. It consists of a few thin and depressed scale-like chambers only, somewhat coarsely perforated. This appears to be of sparing distribution, but specimens presenting characters between this species and *D. globularis* (d'Orb.) or *D. nitida* (Will.) are sometimes to be found where the latter forms are abundant.

By the limbation of the sutural lines and growth of a marginal keel *D. Cora* passes into *Discorbina* (*Rotalina*) *nitida* (Will.), a well-marked type and one of very constant occurrence in British gatherings. From *D. nitida* as a central variety, variation proceeds rapidly in many directions, as shown in the chart, the growth of basal ornament in the shape of beads forming *D. Millettii* J. Wright, the formation of a central umbilical stud coupled with an increase in the height of the spire giving us *D. Praegeri* H.-A. & E., and an increasing convexity of the basal chambers *D. Isabelleana* (d'Orbigny), &c.

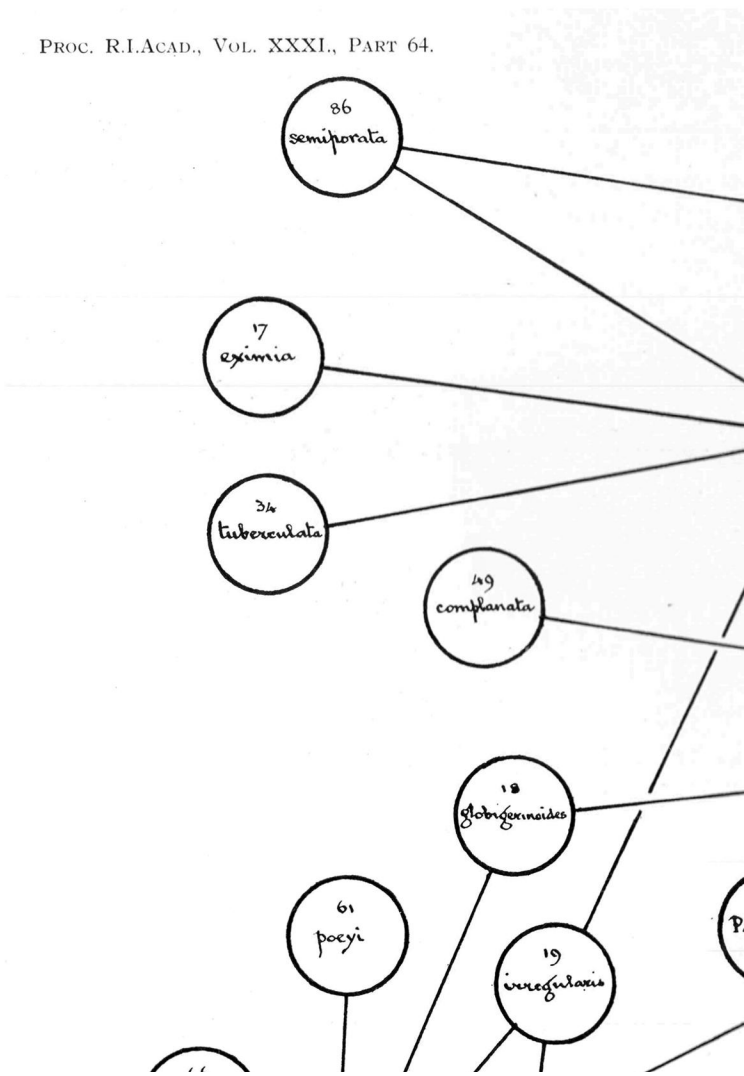
By the inflation of its chambers *D. Cora* starts another line of development, passing through such species as the *Discorbina* (*Rosalina*) *Bosqueti* of Reuss and the *D. sub-Vilardeboana* of Rzehak, into the *D. globularis* (d'Orb.) series

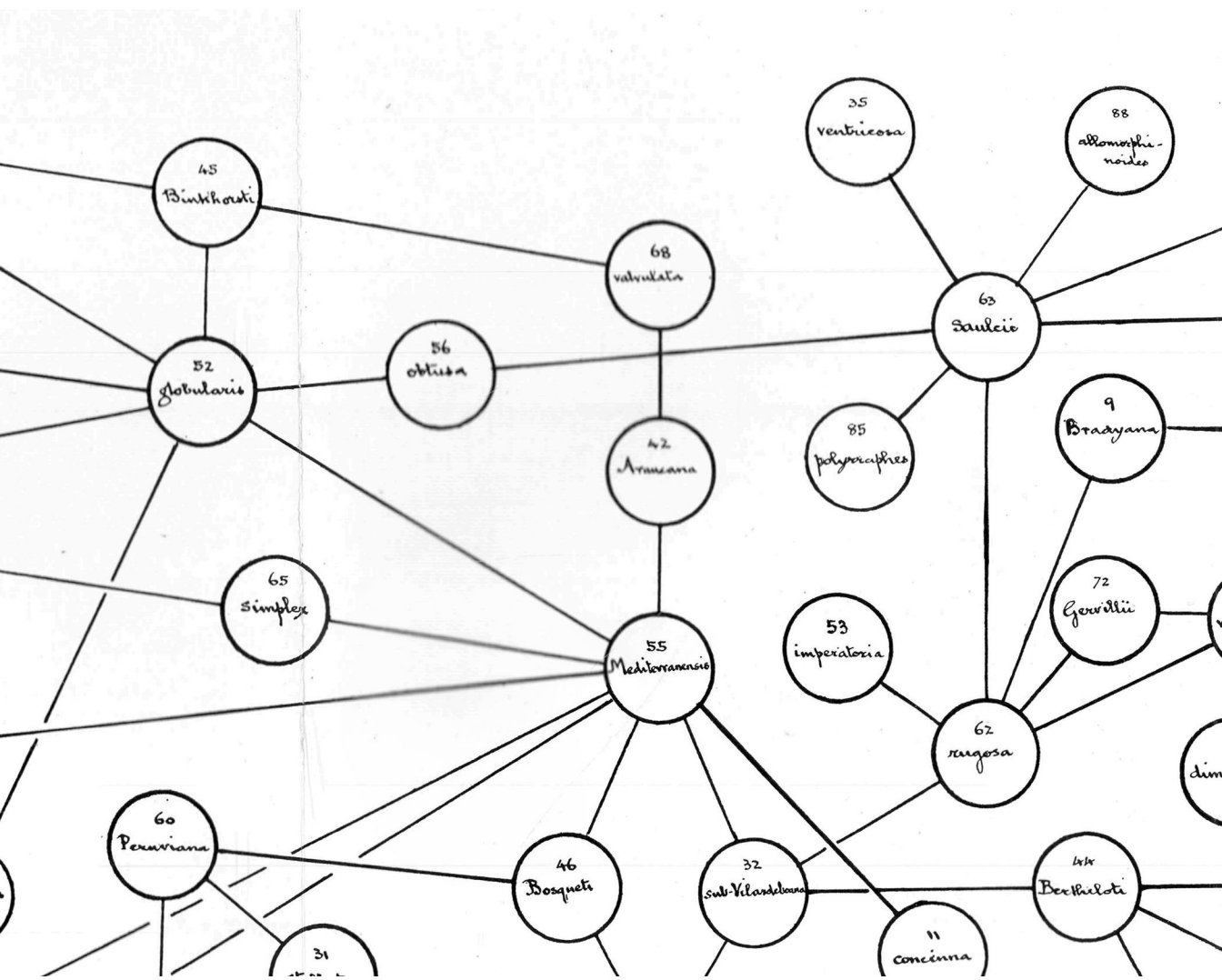
on the one hand, or through *D. Vilardeboana* (d'Orb.), on the other hand, into the typical *D. rosacea* (d'Orb.).

From the sub-inflated *D. sub-Vilardeboana* in turn may be traced the group of *D. rugosa*, passing by development of the umbilical flaps into *D. vesicularis* and its allies.

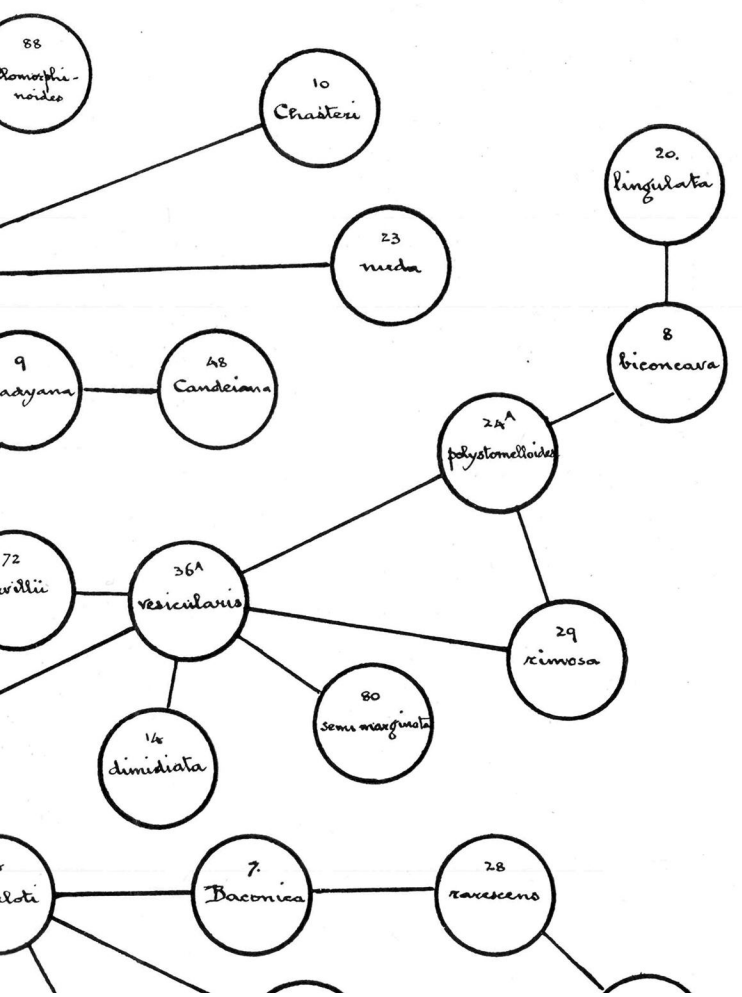
But to detail the various links in the chain of development would occupy more space than is at our disposal. A study of the chart we have set forth, in connexion with the original figures of the various authors, will, we think, make clear many of the points of relationship. It would doubtless be possible to add largely to the number of species shown on the chart, and so to increase its value by showing more intermediate forms; but the difficulty of tracing clearly the connecting lines on a plane table increases with the number of species involved. In connexion with such a chart it is essential that the original figures of the respective authors should be consulted, and not those of subsequent authorities, as in the lapse of years something very different from the original type often comes into acceptance on the authority of some writer carrying exceptional weight.

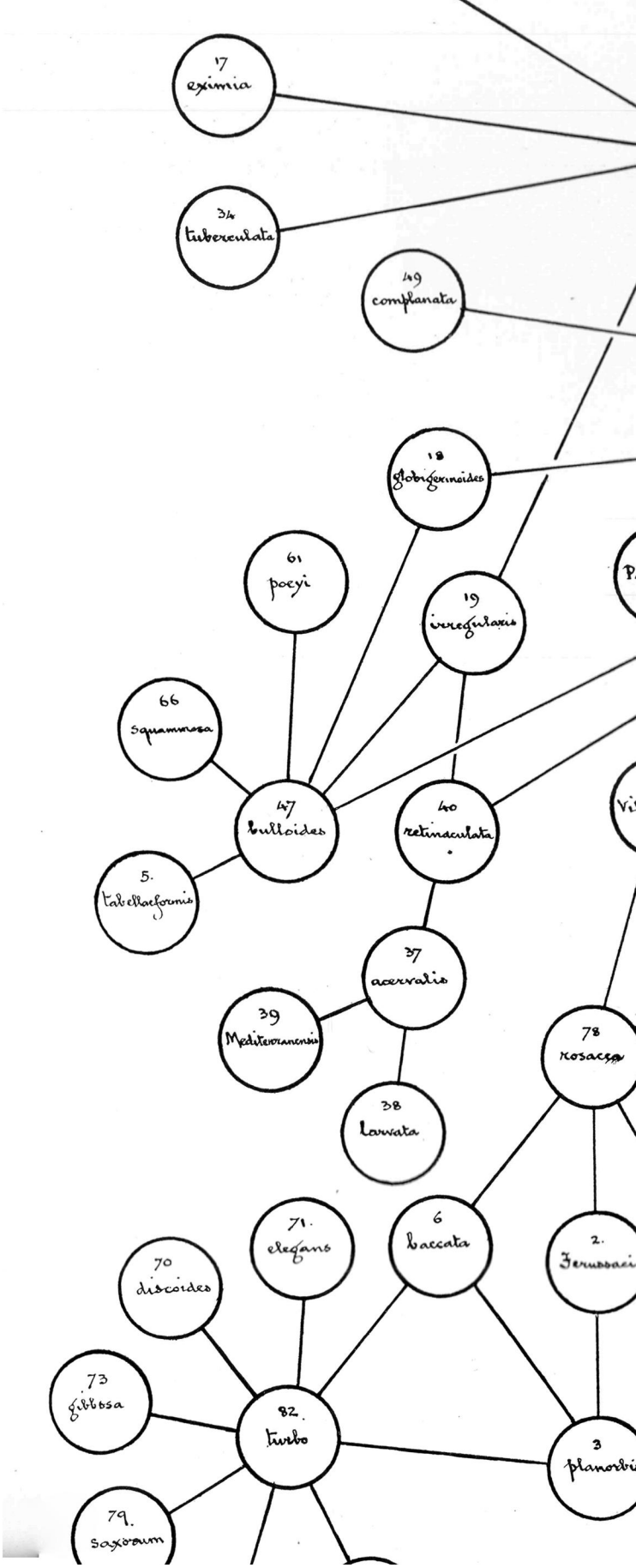
No better instance of this can be quoted than the case of *Discorbina Vilardeboana* (d'Orb.). Brady, in his "Challenger" report, figures three essentially different forms of the *rosacea* group under this name, none of which bears much resemblance to d'Orbigny's original type. Subsequent authors have naturally recorded either of Brady's forms or anything intermediate between them as *D. Vilardeboana*. Of Brady's three figures assigned to *D. Vilardeboana* (d'Orb.) the first (pl lxxxvi, fig 9) represents a very abundant type with simple chambers in a rounded dome, sub-angular edges, and a sunken umbilicus. It may be compared with the *Rosalina Bosqueti* of Reuss (Sitz. Ak. Wiss. Wien, vol. xliv (1862), p 316, pl iii, fig 1) or the *Discorbina sub-Vilardeboana* of Rzehak (Ann. k. nat. Hofmuseums 1888, vol iii, p 263, pl xi, fig 6), neither of which species, however, conveys the impression of the free, unrestrained growth characteristic of this variety. A more satisfactory identification of Brady's figure appears to lie in the *Rosalina Mediterranensis* of d'Orbigny (1826 ASN p 271, No. 2), a species founded by that author on some figures of Soldani's, but not described by d'Orbigny. Messrs. Parker, Jones, and Brady, in their analysis of the Soldanian species of d'Orbigny, relegated the *Rosalina Mediterranensis* to the genus Pulvinulina, basing their opinion on Soldani's figures. But Professor Fornasini has since published for the first time d'Orbigny's own drawings of *Rosalina Mediterranensis*, which were among the "Planches Inédites" (F 1898 RFI, p 264), and these completely modify our idea of d'Orbigny's species. They represent a dome-shaped *Discorbina*, with turgid chambers, coarse perforations, a sunken umbilicus, with large oral

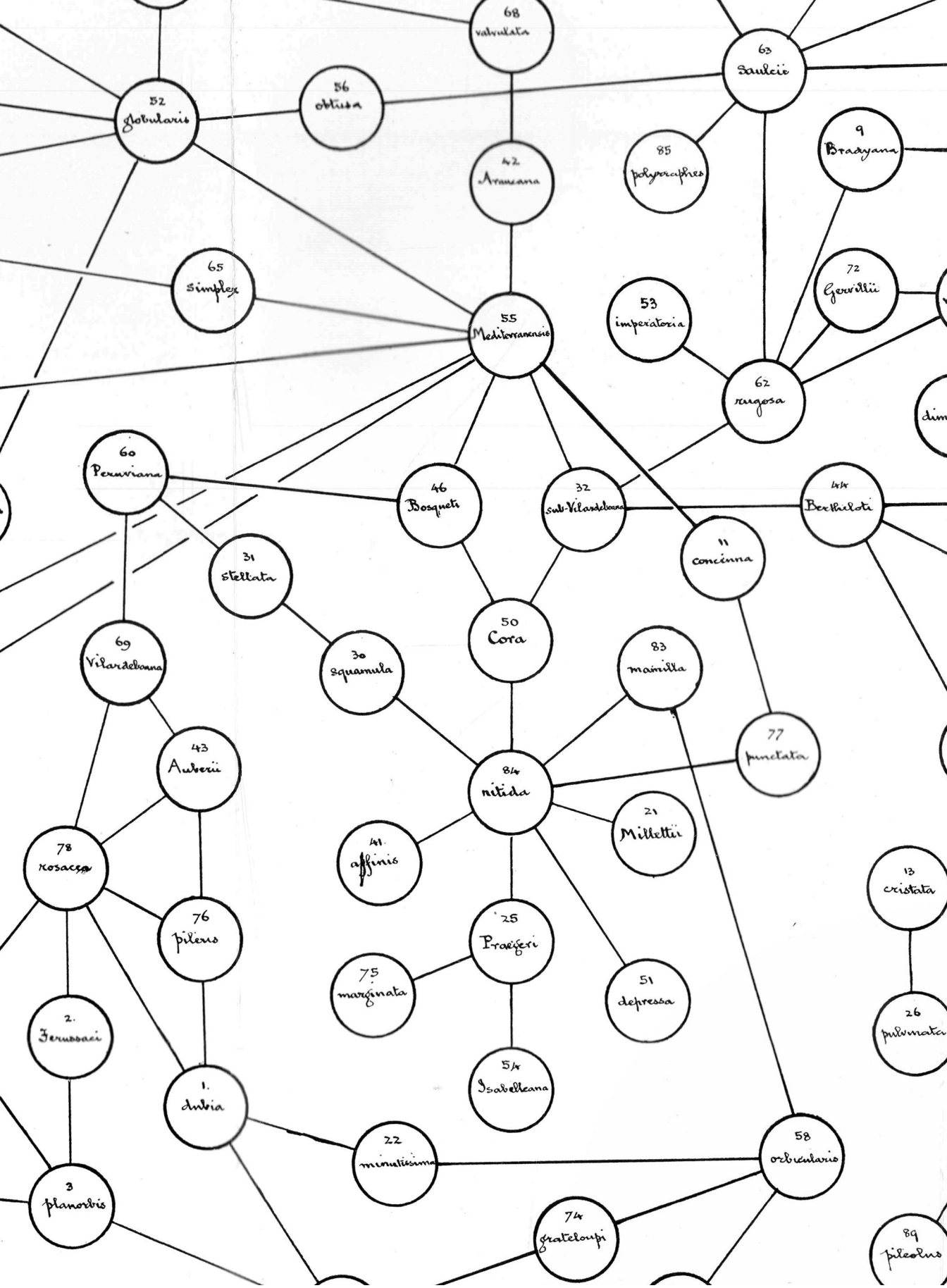


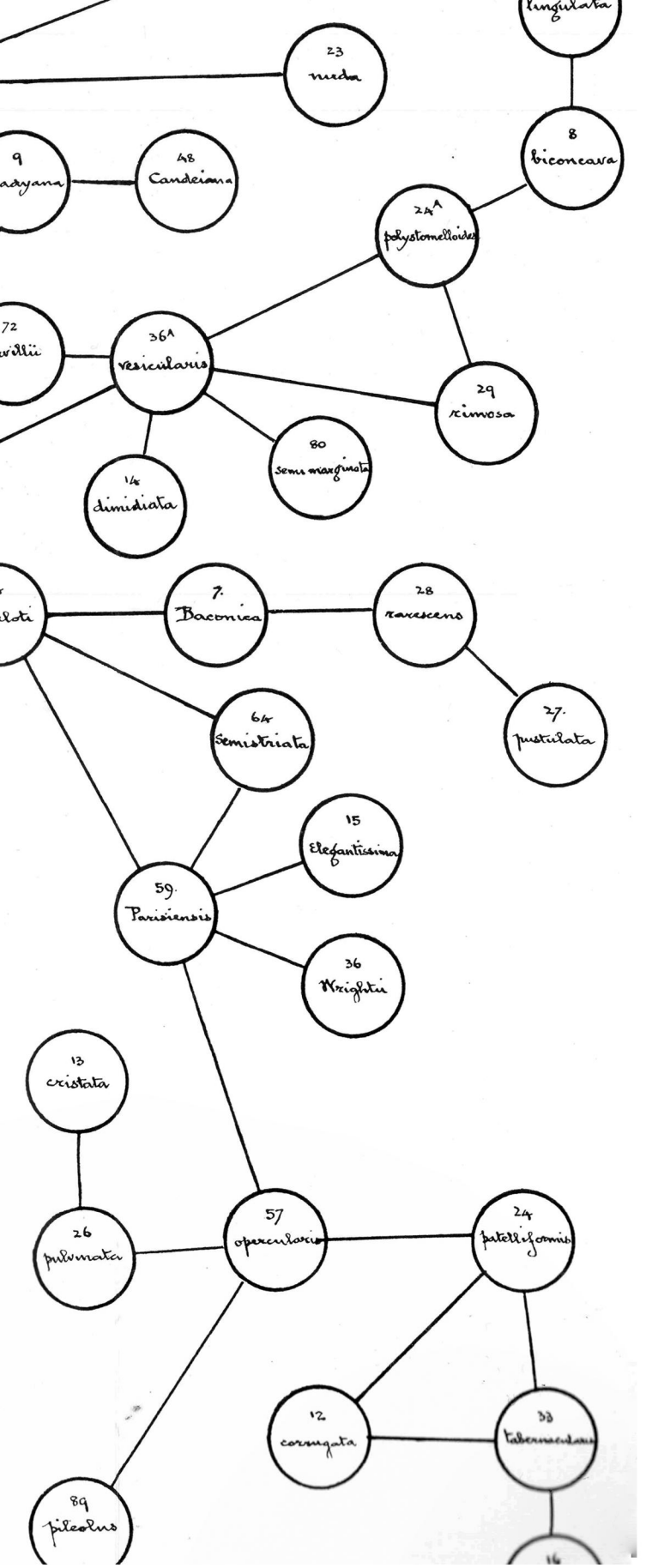


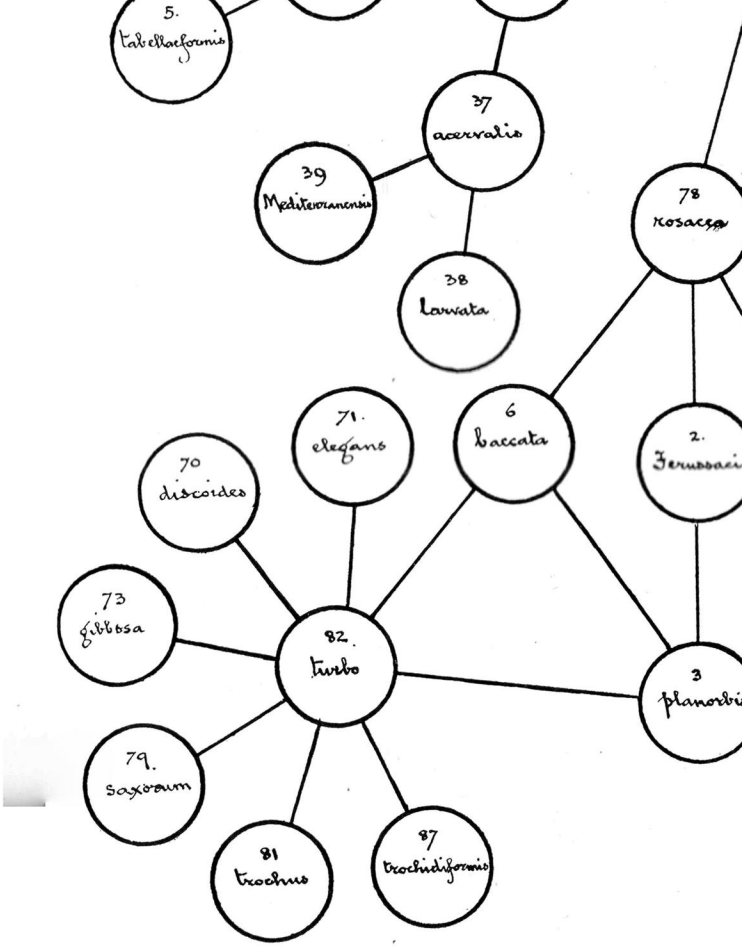
To face p. 113.

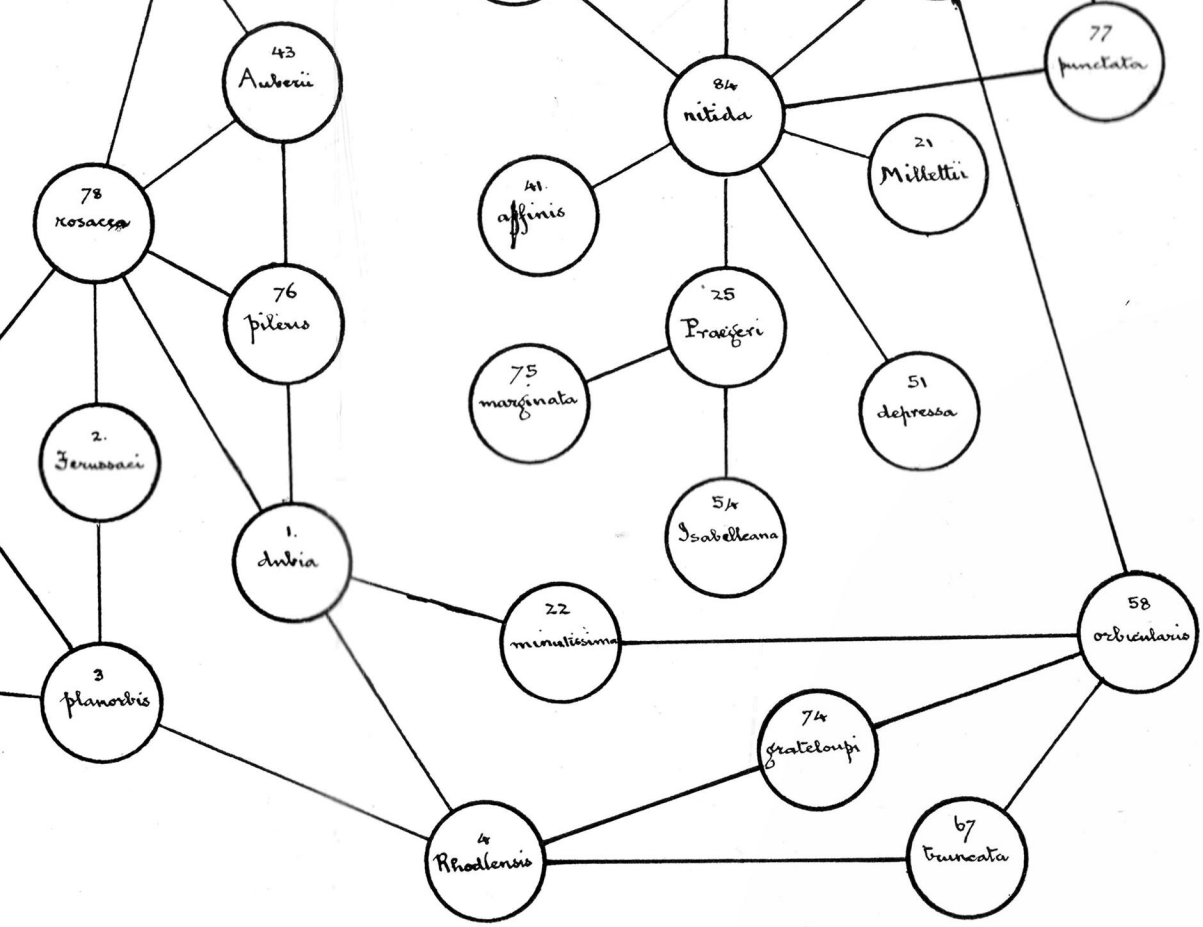






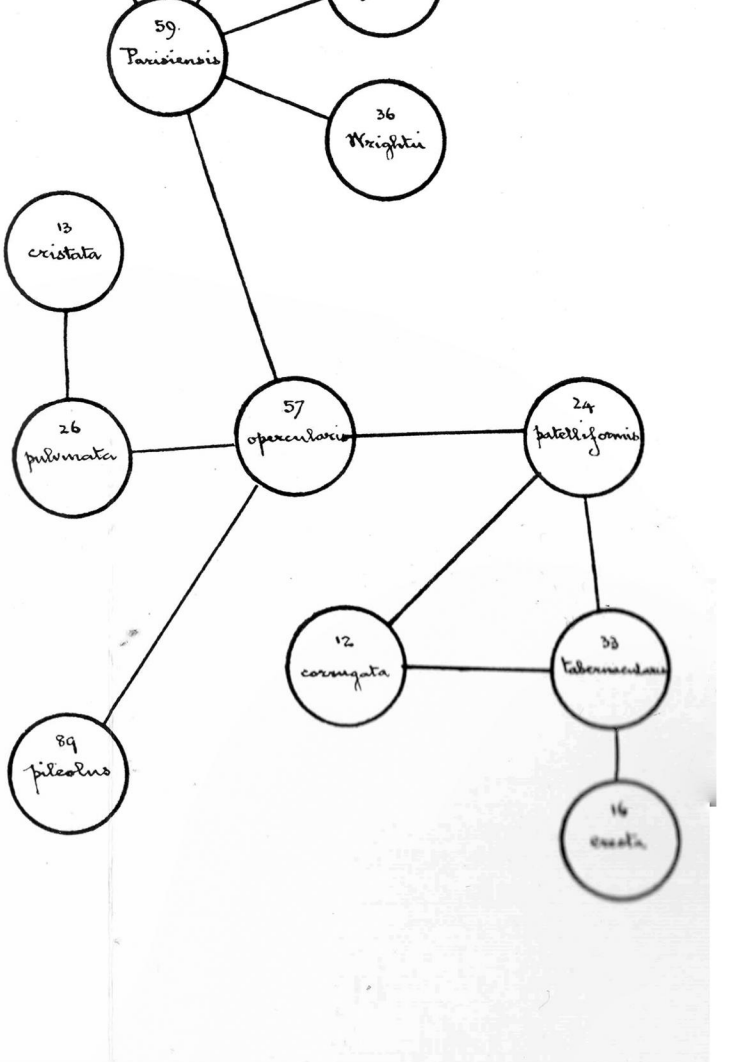






A DIAGRAM OF DISCORBINE AFFINITIES.

CLARE ISLAND SURVEY.—HERON-ALLEN & EARLAND: FORAMINIFERA.



aperture and strongly curved sutural lines; in fact, a development in terms of excessive and exuberant growth of the little form figured by Brady (pl lxxxvi, fig 9); and we shall accordingly separate our Clare Island specimens under this varietal name.

Brady's second figure (pl lxxxvi, fig 12) is a circular dome-shaped type very near to Brady's own species *Discorbina concinna*; while his third figure (pl lxxxviii, fig 2) is a sharp-edged, low-domed type very near to *Rosalina Peruviana* d'Orbigny.

It will thus be seen that Brady's three figures of *Discorbina Vilardeboana* d'Orbigny represent three different forms, closely allied, no doubt, phylogenetically, but still very different in appearance. The actual figure of d'Orbigny represents yet a fourth variation (d'O 1839 FAM, p 44, pl vi, figs 13–15), which differs in essential points from any of the three figures of Brady. It is a somewhat low-domed conical test, with inflated chambers and a nearly flat base, coming in these respects near Brady's second figure (pl lxxxvi, fig 12), which may be regarded as midway between the first and third figures. But it differs from all of them in the possession of well-marked asterigerine chambers, thus showing its near relationship to the typical *D. rosacea* (d'O), from which it differs only in the slightly increased height of its spire and the greater inflation of its segments.

Key to the Species shown in the Diagram of Discorbine Affinities.

Asterigerina d'Orbigny 1839.

1. *Asterigerina dubia* Terquem.
   T 1875 APD, p 36, pl v, fig 7.
2. *Asterigerina Ferussaci* d'Orbigny (*Trochulina* 1826).
   d'O 1847 Prod. de Paléont., vol ii, 1850, p 408, no 1339.
   F 1906 SOR, p 67, pl iii, fig 10.
3. *Asterigerina planorbis* d'Orbigny.
   d'O 1846 FFV, p 205, pl xi, figs 1–3.
4. *Asterigerina Rhodiensis* Terquem.
   T 1878 FIR, p 31, pl iii, figs 1A–4.

Cymbalopora von Hagenow 1850.

5. *Cymbalopora tabellaeformis* Brady.
   B 1884 FC, p 637, pl cii, figs 15–18.

Discorbina Parker & Jones 1862.

6. *Discorbina baccata* sp. n.
7. *Discorbina Baconica* Hantken.
   H 1875 CSS, vol iv, p 76, pl x, fig 3.
8. *Discorbina biconcava* Parker and Jones.
   P & J 1865 NAAF, p 385 & 422, pl xix, fig 10.
9. *Discorbina Bradyana* Fornasini.
   F 1900 FA, p 393, fig 43.
10. *Discorbina Chasteri* = *D. minutissima* Chaster.
    C 1892 CS, p 65, pl i, fig 15.
11. *Discorbina concinna* Brady.
    B 1884, p 646, pl xc, figs 7, 8.
12. *Discorbina corrugata* Millett.
    M 1898 &c MFM 1903, p 100, pl vii, fig 5.
13. *Discorbina cristata* Heron-Allen and Earland.
    H-A & E 1908 &c SB 1909, p 445, pl xviii, figs 8–10.
14. *Discorbina dimidiata* Parker and Jones.
    P & J 1865 NAAF, pp 385 and 422, pl xix, fig 9.
15. *Discorbina elegantissima* Sidebottom.
    S 1904 &c RFD 1908, p 16, pl v, fig 8.
16. *Discorbina erecta* Sidebottom.
    S 1904 &c RFD 1908, p 16, pl v, figs 6, 7.
17. *Discorbina eximia* Hantken.
    H 1875 CSS, p 76, pl xv, fig 8.
18. *Discorbina globigerinoides* Parker and Jones.
    P & J 1865 NAAF, pp 385 & 421, pl xix, fig 7.
19. *Discorbina irregularis* Rhumbler.
    R 1906 FLC, p 70, pl v, fig 57, 58.
20. *Discorbina lingulata* Burrows and Holland.
    P J & B 1866 &c MCF 1896, p 297, and 1895, pl vii, fig 33.
21. *Discorbina Millettii* J. Wright.
    W 1910–11 ECM, p 13, pl ii, figs 14–17.
22. *Discorbina minutissima* Seguenza.
    S 1880 FTR, p 149, pl xiv, fig 1.
23. *Discorbina nuda* Sidebottom.
    S 1910 Mem Manchester Lit and Phil Soc, vol liv, pt 3, p 26;
    1904 &c RFD 1909, p 18, pl v, fig 11.
24. *Discorbina patelliformis* Brady.
    B 1884 FC, p 647, pl lxxxviii, fig 3, and pl lxxxix, fig 1.

24A. *Discorbina polystomelloides* Parker and Jones.
P and J 1865 NAAF, p 421, pl xix, fig 8.
25. *Discorbina Praegeri* sp. n.
26. *Discorbina pulvinata* Brady.
B 1884 FC, p 650, pl lxxxviii, fig 10.
27. *Discorbina pustulata* sp. n.
28. *Discorbina rarescens* Brady.
B 1884 FC, p 651, pl xc, figs 2, 3, 4?
29. *Discorbina rimosa* Parker and Jones.
P & J 1865 NAAF, pp 385 and 421, pl xix, fig 6.
30. *Discorbina squamula* Reuss.
R 1867 Sitz k Ak Wiss Wien, vol lv (1), p 101, pl v, fig 2.
31. *Discorbina stellata* Reuss.
R 1867 Sitz k Ak Wiss Wien, vol lv (1), p 101, pl v, fig 1.
32. *Discorbina sub-Vilardeboana* Rzehak.
R 1888 Ann kk nat Hofmus, vol iii (3), p 263, pl xi, fig 6.
33. *Discorbina tabernacularis* Brady.
B 1884 FC, p 648, pl lxxxix, figs 5–7.
34. *Discorbina tuberculata* Balkwill and Wright.
B & W 1885 DIS, p 350, pl xiii, figs 28–30.
35. *Discorbina ventricosa* Brady.
B 1884 FC, p 654, pl xci, fig 7.
36. *Discorbina Wrightii* Brady.
B 1881 HNPE, p 104, pl ii, fig 6.

Discorbites Lamarck 1804.

36A. *Discorbites vesicularis* Lamarck.
L 1804 AM, p 183, pl lxii, fig. 7.

Planorbulina d'Orbigny 1826.

37. *Planorbulina acervalis* Brady 1884.
B 1884 FC, p 657, pl xcii, fig 4.
38. *Planorbulina larvata* Parker and Jones.
P & J 1865 NAAF, p 380, pl xix, fig 3.
39. *Planorbulina Mediterranensis* d'Orbigny.
d'O 1826 ASN, p 280, No 2, pl xiv, fig 4–6.
40. *Planorbulina retinaculata* Parker and Jones.
P & J 1865 NAAF, p 380, pl xix, fig 2.

Rosalina d'Orbigny 1826.

41. *Rosalina affinis* d'Orbigny.
d'O 1826 ASN, p 271, No 8; F 1906 SOR, p 62, pl i, fig 3.

42. *Rosalina Araucana* d'Orbigny.
    d'O 1839 FAM, p 44, pl vi, figs 16–18.
43. *Rosalina Auberii* d'Orbigny.
    d'O 1839 OFC, p 94, pl iv, figs 5–8.
44. *Rosalina Bertheloti* d'Orbigny.
    d'O 1839 FIC, p 135, pl i, figs 28–30.
45. *Rosalina Binkhorsti* Reuss.
    R 1861 Sitz k Ak Wiss Wien, vol xliv (1) 1862, p 317, pl ii, fig 3.
46. *Rosalina Bosquetti* Reuss.
    Ibid, p 316, pl iii, fig 1.
47. *Rosalina bulloides* d'Orbigny.
    d'O 1839 OFC, p 98, pl iii, figs 2–5.
48. *Rosalina Candeiana* d'Orbigny.
    Ibid, p 97, pl iv, figs 2–4.
49. *Rosalina complanata* d'Orbigny.
    d'O 1846 FFV, p 175, pl x, figs 13–15.
50. *Rosalina Cora* d'Orbigny.
    d'O 1839 FAM, p 45, pl vi, figs 19–21.
51. *Rosalina depressa* d'Orbigny.
    d'O 1826 ASN, p 271, No 6; F 1906 SOR, p 62, pl i, fig 2.
52. *Rosalina globularis* d'Orbigny.
    Ibid, p 271, No 1, pl xiii, figs 1–4.
53. *Rosalina imperatoria* d'Orbigny.
    d'O 1846 FFV, p 176, pl x, figs 16–18.
54. *Rosalina Isabelleana* d'Orbigny.
    d'O 1839 FAM, p 43, pl vi, figs 10–12.
55. *Rosalina Mediterranensis* d'Orbigny.
    d'O 1826 ASN, p 271, No 2; F 1906 SOR, p 61, pl i, fig 1.
56. *Rosalina obtusa* d'Orbigny.
    d'O 1846 FFV, p 179, pl xi, figs 4–6.
57. *Rosalina opercularis* d'Orbigny.
    d'O 1826 ASN, p 271, no 7; d'O 1839 OFC, p 93, pl iii, figs. 24–25; pl iv, fig 1.
58. *Rosalina orbicularis* Terquem.
    T 1875 &c APD, p 75, pl ix, fig 4.
59. *Rosalina Parisiensis* d'Orbigny.
    d'O 1826 ASN, p 271, No 5, Modèle No 38.
60. *Rosalina Peruviana* d'Orbigny.
    d'O 1839 FAM, p 41, pl i, figs 12–14.

61. *Rosalina Poeyi* d'Orbigny.
    d'O 1839 OFC, p 93, pl iii, figs 18–20.
62. *Rosalina rugosa* d'Orbigny.
    d'O 1839 FAM, p 42, pl ii, figs 12–14.
63. *Rosalina Saulcyi*, d'Orbigny.
    Ibid, p 42, pl ii, figs 9–11.
64. *Rosalina semistriata* d'Orbigny.
    d'O 1826 ASN, p 271, No 3 ; d'O 1839 OFC, p 95, pl iii, figs 15–17.
65. *Rosalina simplex* d'Orbigny.
    d'O 1846 FFV, p 178, pl x, figs 25–27.
66. *Rosalina squammosa* d'Orbigny.
    d'O 1839 OFC, p 91, pl iii, figs 12–14.
67. *Rosalina truncata* Terquem.
    T 1875 FPD, p 35, pl v, fig 3.
68. *Rosalina valvulata* d'Orbigny.
    d'O 1826 ASN, p 271, No 4 ; d'O 1839 FIC, p 136, pl ii, figs 19–21.
69. *Rosalina Vilardeboana* d'Orbigny.
    d'O 1839 FAM, p 44, pl vi, figs 13–15.

Rotalia Lamarck 1804.

70. *Rotalia discoides* d'Orbigny.
    d'O 1826 ASN, p 272, No 5 ; F 1906 SOR, p 63, pl i, fig 9.
71. *Rotalia elegans* d'Orbigny.
    Ibid, p 272, No 6 ; F 1906 SOR, p 63, pl i, fig 10.
72. *Rotalia* (*Discorbis*) *Gervillii* d'Orbigny.
    Ibid, p 274, No 36, Modèle No 72.
73. *Rotalia gibbosa* d'Orbigny.
    Ibid, p 272, No 3 ; F 1906 SOR, p 63, pl i, fig 6.
74. *Rotalia Grateloupi* d'Orbigny.
    Ibid, p 272, No 10 ; F 1906 SOR, p 64, pl ii, figs 2 and 3.
75. *Rotalia marginata* d'Orbigny.
    Ibid, p 272, No 9 ; F 1906 SOR, p 63, pl ii, fig 1.
76. *Rotalia pileus* d'Orbigny.
    Ibid, p 272, No 11 ; F 1902 FLR, p 55, fig 54.
77. *Rotalia punctata* d'Orbigny.
    Ibid, p 273, No 13 ; F 1906 SOR, p 64, pl ii, fig 5.
78. *Rotalia rosacea* d'Orbigny.
    Ibid, p 273, No 15, Modèle No 39.
79. *Rotalia saxorum* d'Orbigny.
    Ibid, p 272, No 2 ; F 1906 SOR, p 62, pl i, fig 5.

80. *Rotalia (Turbinulina) semimarginata* d'Orbigny.
Ibid, p 276, No 53; F 1906 SOR, p 68, pl iv, fig 5.
81. *Rotalia trochus* Orbigny.
Ibid, p 272, No 4; F 1906 SOR, p 63, pl i, fig 7–8.
82. *Rotalia (Trochulina) turbo* d'Orbigny.
Ibid, p 274, No 39, Modèle No 73.

Rotalina d'Orbigny 1839.

83. *Rotalina mamilla* Williamson.
W 1858 RFGB, p 54, pl iv, figs 109-111.
84. *Rotalina nitida* Williamson.
Ibid, p 54, pl iv, 106–108.
85. *Rotalina polyrraphes* Reuss.
R 1845–6 VBK, pt i, p 35, pl xii, fig 18.
86. *Rotalina semiporata* Egger.
E 1857 MSO, p 276, pl viii, figs 1–3.

Rotalites Lamarck 1804.

87. *Rotalites trochidiformis* Lamarck.
L 1804 AM, p 184, and 1806, No 1, pl lxii, fig 8.

Valvulina d'Orbigny 1826.

88. *Valvulina allomorphinoides* Reuss.
Reuss 1860 Sitz k Ak Wiss Wien, p 223, pl xi. fig 6.
89. *Valvulina pileolus* d'Orbigny.
d'O 1839 FAM, p 47, pl i, figs 15–17.

234. **Discorbina Mediterranensis** d'Orbigny sp.

Plate IX, figs 12–14. Plate X, fig 1.

Rosalina Mediterranensis d'O 1826 ASN, p 271, No 2.
Discorbina Vilardeboana (d'O) Brady 1884 FC, p 645, lxxxvi, fig 9.
Discorbina rosacea (d'O) Goës 1882 RRCS, p 105, pl viii, figs 251–257.
Discorbina Mediterranensis (d'O) Fornasini 1906 SOR, p 61, pl i, fig 1.

This is one of the most characteristic and abundant forms in the Clare Island area. It occurs at every station but three, and is usually abundant and in great variety.

We have already referred to the difficulty of finding a specific or varietal name under which to index each of the numerous variations of the *rosacea* group of Discorbina. The difficulty is accentuated when a particular variation

itself covers so wide a range of form as do the specimens which we are allotting to *D. Mediterranensis* d'Orbigny sp.

Young specimens are usually quite symmetrical, and consist of two or three convolutions with five to seven chambers in the last whorl. The superior face is but slightly curved, with the margins rounded, chambers somewhat inflated, and sutures depressed. The inferior side shows a depressed umbilical region, usually simple, but sometimes furnished with asterigerine flaps. The colour is brown, and the test is very similar to the early stages of *D. globularis*, the most noticeable point of difference being the minute size of the perforations as compared with that species. In this young stage the specimens might be referred to either *Discorbina* (*Rosalina*) *Bosqueti* Reuss, or to *Discorbina sub-Vilardeboana* Rzehak.

With increasing growth the test becomes more or less high-domed, in outline resembling Brady's *Vilardeboana* (FC, pl lxxxvi, fig 9), and the later whorls of chambers become very irregular. The inferior side of the shell varies enormously in appearance, some specimens having a large umbilical hollow occupying a considerable part of the entire shell, while others are nearly flat. The latter have presumably been living in an attached condition throughout their life.

Wild-growing specimens, in which the later chambers have assumed an irregularly spreading mode of growth, are of frequent occurrence. Similar specimens referable to *D. globularis* also occur. They have been separated for purposes of reference under the specific name *D. irregularis* Rhumbler; but, as we have indicated (*post*), such forms have no specific or zoological significance.

D. Mediterranensis occurs in more or less abundance in nearly all British gatherings, shore-sands, or shallow-water dredgings, and probably a large proportion of the British records of *D. rosacea*, including all those of *D. Vilardeboana*, is referable to this form. We take this opportunity of figuring a very remarkable phenomenon observed in connexion with this species. This (Plate X, fig 1) is the shell referred to on p. 18, the base of which, being broken away, disclosed a brood of young in the cavity left in the shell by the absorption of its internal septa. It will be observed that the young brood, instead of consisting of a single primordial chamber (as is the case in the rare instances in which this phenomenon has been observed in connexion with *D. Parisiensis* and *D. Wrightii*), is already composed of two, and sometimes three, perfectly formed chambers. With the biological significance of this observation we propose to deal elsewhere, but we believe it to have been unique at the time when it was made. Since then we have found a living specimen of *Planorbulina Mediterranensis* (near Hyères, Var),

the under-surface of which, on being planed away, exhibited the same phenomenon; in this case each chamber containing a young shell of one, two, or three chamberlets. (See Addenda, p 187.)

235. **Discorbina irregularis** Rhumbler.

Plate X, figs. 2–4.

Discorbina irregularis R 1906 FLC, p 70, pl v, figs 57, 58.

(*New to the British Isles.*)

We have taken the *D. irregularis* of Dr. Rhumbler as a central type around which to group wild-growing and protean specimens which, while possessing certain recognized specific characters, are yet too irregular in build and development of the later chambers to be relegated to either *D. rosacea* or *D. globularis*. Dr. Rhumbler's figures represent highly developed individuals of a variable type, such as might be anticipated in the more favourable conditions of tropical life. None of the Clare Island specimens attain quite such an exuberance of growth; but at several stations where *D. Mediterranensis* and *D. globularis* are abundant and well developed, many specimens such as we figure are to be found, which, although referable to one or another of these forms, in a strict zoological sense, could not be so assigned save by means of a long series of intermediate specimens.

D. irregularis, like *Truncatulina variabilis*, has, of course, no real specific value, but merely represents exuberance of shell-development, doubtless influenced by the conditions of its environment and growth. Such wild-growing specimens have nearly always continued the early sessile stage common to many Discorbinae, to a period at which the majority of specimens have become free and unattached. It may well be that there is some foundation for Alcock's theory that these wild later growths are the result of a weakening of the vital force of the organism in its advancing age, when it is no longer able to control the outline of the protruded protoplasm, as it secretes its calcareous covering. (Proc. Lit. & Phil. Soc. Manchester, vol iv, 1867, p 86.)

It may be noted that *Carterina spiculotesta* Carter sp. growing attached, also assumes an "*irregularis*" mode of growth in its later stages (AMNH 1877, ser 4, vol xx, p 470, pl xvi). Mr. Cushman in his "Foraminifera of the Wood's Hole Region" (Proc. Boston Soc. Nat. Hist. 1908, vol xxxiv, No 2, p 31, pl v, figs 11, 12) figures *Pulvinulina lateralis* exhibiting a similar wild growth, and remarks that the later-formed irregular chambers lack the bordering carina typical of the earlier ones.

236. Discorbina nitida Williamson sp.

Rotalina nitida W 1858 RFGB, p 54, pl iv, figs 106–108.
Discorbina nitida (W) Wright 1891 SWI, p 490.

(See also H-A & E 1911, p 328.)

Occurs with moderate frequency at 26 stations, both shore-sands and dredgings. Besides the typical form of Williamson, in which the sutures are thick but flush with the outline of the shell, many variations occur, linking the species with *D. Praegeri* on the one hand (the sutures on the inferior side showing a tendency to the formation of umbilical flaps coalescing into a central stud) and with *D. Peruviana* on the other (the umbilical region becoming depressed, and each chamber being furnished with a slightly projecting flap of shell-substance).

The specific description and figures of Williamson appear to be based not on one particular type, but on an entire series of varieties, linking the very flat and hyaline form, the true *D. nitida*, well shown in his figures 106 and 107, with the more conical varieties, passing into *D. Peruviana*, as shown in his side-view fig 108. These he describes as young and mature forms respectively, noting the colourless or "bluish tint" of the "young" forms, and contrasting it with the "pale ferruginous" tint of the mature specimens. But the true *D. nitida* retains this colourless hyaline or "bluish" tint throughout its growth.

237. Discorbina Millettii J. Wright.

Plate X, figs 5–7.

Discorbina Millettii W 1910–11 ECM, p 13, pl ii, figs 14–17.

Occurs rarely in the shore-sands, one record only from station 8, Carrowmore Strand. More frequently in the dredgings, being recorded at 10 stations, never more than a few specimens at each.

This pretty little species is really a decorated form of *D. nitida* (Will.), the base being ornamented with rows of fine beads radiating from the umbilicus. As its superior face has no distinctive feature, it cannot be distinguished, when viewed from above, from *D. nitida* or any of the other depressed and carinate forms of *D. rosacea*, and consequently is easily overlooked in a dredging.

Mr. Wright records it from several Irish dredgings, and also as a post-Pliocene fossil. It occurs sparingly in some of the "Goldseeker" dredgings from the Moray Firth, and is probably co-extensive with the type in its distribution.

238. Discorbina Praegeri sp nov.

Plate X, figs 8–10.

Test free, trochoid and conical, composed of three to four convolutions, in a depressed spire, with five or six chambers in the last convolution. Peripheral edge entire and usually somewhat thickened, occasionally slightly carinate. Still more rarely the marginal edge is lobulate, owing to the slight inflation of the segments. Sutures flush on the superior face of the shell, somewhat depressed on the base or inferior face, which is nearly flat, and furnished in the umbilical region with a solid stud of shell-substance: breadth varies from ·15 to ·4 mm.

This is one of the innumerable types of *D. rosacea*; but as it does not appear to have been specifically described, in spite of its very distinctive appearance, we have thought it advisable to give it a name. It is one of the most characteristic types of the Clare Island area, and occurs in more or less abundance in nearly every dredging, as also in many "Goldseeker" dredgings and other British gatherings. It can hardly be confused with any other type if examined from the under-surface, the solid umbilical stud being a constant feature.

There is no doubt that Williamson was familiar with this form, but he failed to separate it from his *Rotalina nitida*, the description of which, as we have already pointed out under that form, appears to have been based on a series of allied specimens. He states that "in some instances the inferior umbilicus is occupied by a distinct and prominent umbo." These specimens were, no doubt, our *D. Praegeri*. We have never seen any specimens of *D. nitida* presenting this feature, the nearest approach to it being the presence of a small tooth on each chamber projecting into the umbilical depression. By the coalescence of these teeth and a raising of the height of the spire, *D. nitida* passes into *D. Praegeri*.

We have much pleasure in associating this form with the name of Mr. R. Lloyd Praeger, but for whose perseverance and energy the authors would not have been induced to undertake and carry through their somewhat laborious task in connexion with the Clare Island Survey.

239. Discorbina Peruviana d'Orbigny sp.

Plate XI, figs 1–3.

Rosalina Peruviana d'O 1839 FAM, p 41, pl i, figs 12–14.
Discorbina Vilardeboana (d'O) Brady 1884 FC, pl lxxxviii, fig 2.
Discorbina rosacea (d'O) Sidebottom 1904 &c RFD 1908, pl iv, figs 3, 4.

D. Peruviana serves as a centre around which to group the sharply conical

forms of *D. rosacea* with angular or sub-angular periphery, flush or slightly sunk sutures, and a base without either asterigerine chambers or umbilical flaps or studs. The base is generally nearly flat, but somewhat depressed in the umbilical region. The test is usually of a light yellow or brown colour, but often quite clear and glassy. The perforations are very minute. The height of the cone varies considerably, but it is always rather acute at the apex.

Such specimens are abundant throughout the area, occurring in four shore-sands and all the dredgings but four. The best specimens are in the muddy dredgings.

D. Peruviana passes by variation into *D. nitida* on the one side by depression of the cone, and into *D. Praegeri* or *D. rosacea* on the other by the formation of a central umbilical stud, or of asterigerine chambers. *D. Peruviana* is generally distributed in shore-sands and shallow water all round our coasts.

240. Discorbina mamilla Williamson sp.

Plate XI, figs 4–6.

Rotalina mamilla W 1858 RFGB, p 54, pl iv, figs 109–111.
Discorbina rosacea (W) Sidebottom 1904 &c RFD 1908, pl iv, fig 5.

Is generally distributed throughout the area, and often very abundant. It is the typical representative of the group of *D. rosacea* in some of the gatherings. It was recorded from five shore-sands, and all but five of the dredgings.

Williamson's species is one of the most characteristic and easily identified of the Discorbinae, the thick septal walls, curving peripheral edges, and especially the lines of coarse tubuli at the septal margins being features of practically constant occurrence.

Williamson neither figures nor refers to the presence of asterigerine chambers in his species, but they are of frequent occurrence, and by them the form links up with the *D. rosacea* group.

D. mamilla appears to be of somewhat local distribution, but when present is usually an abundant type. It was recorded (as a synonym of *D. rosacea*) by H. B. Brady in G. S. Brady's "Report of dredging operations on the Coasts of Northumberland and Durham in 1863" (Trans. Tyneside Naturalists' Field Club, vol vi, pt 2, 1864, p 194).

241. Discorbina rosacea d'Orbigny sp.

Plate XI, figs 7–9.

Rotalia rosacea d'O 1826 ASN, p 273, No 15, Modèle No 39.
Asterigerina rosacea d'O 1852 Prodrome de Paléontologie, vol iii, p 158, No 2952.

The typical *D. rosacea* has a sharp-edged depressed cone of few whorls, with well-marked asterigerine chambers on the under-side.

Such depressed specimens are not particularly abundant in the Clare Island area. We record its occurrence in four shore-sands and eleven dredgings only. It is thus very sparingly distributed as compared with some of its allied varieties, and the number of specimens observed at the stations where it occurs was small.

By increase in the height of the conical test *D. rosacea* passes through *D. Auberii* d'Orb. sp. into *D. planorbis* d'Orb. sp. Intermediate specimens are of common occurrence at many stations.

242. Discorbina planorbis d'Orbigny sp.

Plate XI, figs 10–12.

Asterigerina planorbis d'O 1846 FFV, p 205, pl xi, figs 1–3.
Discorbina (*Asterigerina*) *planorbis* (d'O) Zittel 1876 Handbuch der Palaeontologie, vol i, p 93, fig 31.

D. planorbis d'Orb. sp. has been selected as the type of the high-domed asterigerine varieties of Discorbina, as *D. rosacea* is of the low-domed shells.

D. planorbis is of much more frequent occurrence in the Clare Island area than *D. rosacea*, having been recorded from all but two shore-sands and five dredgings.

The specimens vary considerably in the height of the spire, and in the extent of development of the asterigerine chamberlets. They are as a rule hyaline and colourless, but some specimens exhibit a tendency to the yellowish colouring of *D. Peruviana*.

243. Discorbina baccata sp. nov.

Plate XII, figs 1–3.

Test free, circular or nearly so in outline, peripheral edge sub-acute, consisting of about three convolutions, the last convolution having seven to nine oblique chambers; superior face conical, rounded at the apex; inferior face almost flat, the central region filled with a raised star-like stud of solid

shell-matter, the short points of the star directed towards the sutural lines, which are somewhat depressed on the base, but flush and hardly recognizable on the superior side of the shell. The surface of the chambers on the inferior side slopes downwards towards the centre, so that the top of the star-like stud is about on the same level as or slightly raised above the peripheral edge.

The entire surface of the shell is shagreened or densely covered with minute beads, between which are the pseudopodial perforations. On the superior or conical side of the test these beads are not very noticeable except under a $\frac{2}{3}$- or $\frac{1}{2}$-inch objective, although their presence gives a characteristic roughness to the surface of the shell. On the base, however, they attain much larger dimensions, and are arranged regularly in radial lines.

In living specimens the shell is polished and of a dull yellowish translucent tint. After death, however, it becomes white and opaque, and appears to be subject to rapid decomposition, the surface becoming rough and eroded. This appears to be commonly the case with Foraminifera in which the surface is covered with exogenous bead-growth, *e.g. Discorbina Parisiensis*, *D. Wrightii*, &c.

Discorbina baccata belongs to the *D. rosacea* group, and occupies a position about midway between *Discorbina* (*Asterigerina*) *rosacea* d'Orb., *Asterigerina planorbis* d'Orb., and *Discorbina* (*Trochulina*) *turbo* d'Orb. It resembles the last form most closely in its flattened base, but differs in its sunken septal lines on the basal surface and in its characteristic basal stud and beaded surface.

Breadth, ·3–·4 mm.; height, ·2 mm. Beads average about ·008. Diameter of umbilical star about ·1 mm.

The species is fairly common in the dredging from Inishgowla harbour (Station 13) and in other gatherings among the islands. Also at Station 15, Feorinyeo Bay. We have the same form from the shore-sand of Swanage, Co. Dorset, where it is frequent, and from Llanfihangel-y-Traethau (Merioneth).

244. Discorbina turbo d'Orbigny sp.

Rotalia (*Trochulina*) *turbo* d'O 1826 ASN, p 274, No 39, Modèle No 73.
Discorbina turbo (d'O) Carpenter Parker & Jones 1862 IF, p 204, App., p 311.

(See also FC, p 642; MFM 1903, p 697.)

No very typical specimens of *D. turbo* occur in the Clare Island material, and the species appears to be very sparingly distributed in the recent condition, except in subtropical gatherings.

Specimens intermediate between *D. turbo* and *D. rosacea* or *D. planorbis* are, however, of frequent occurrence in many of the dredgings and shore-sands.

245. Discorbina orbicularis Terquem sp.

Rosalina orbicularis T 1876 APD, p 75, pl ix, fig 4.
Discorbina orbicularis (T) Balkwill and Millett 1884 FG, p 23, pl iv, fig 13.
„ „ „ Balkwill and Wright 1885 DIS, p 349, pl xiii, figs 31–33.

(See also FC, p 647 ; MFM 1903, p 699.)

Was recorded from three shore-sands and twelve dredgings. As a rule only a few typical specimens were found, but at Stations 20 and 23 specimens were numerous, large, and extremely typical. At Station 23 a minute but quite typical form also occurs.

D. orbicularis is very closely allied to some of the varieties of *D. rosacea*, differing in little except in the narrowness and increasing curvature of its chambers. Transition forms are commonly found at many of the stations.

The form now universally known and recorded as *D. orbicularis* Terquem sp. was instituted as a *nomen nudum* in d'O 1826 ASN, p 273, No 14, as *Rotalia subrotunda* ; but was never described or identified until Dr. Fornasini revived d'Orbigny's name and published for the first time d'Orbigny's original drawing from the *Planches inédites*, in the Rendiconti of the R. Acad. d. Scienze di Bologna, ann. 1897–8, vol ii, p 13. (See also F 1902 FLR, p 54.)

246. Discorbina Araucana d'Orbigny sp.

Rosalina Araucana d'O 1839 FAM, p 44, pl vi, figs 16–18.
Discorbina Araucana (d'O) Brady 1884 FC, p 645, pl lxxxvi, figs 10, 11.

(See also H-A & E 1911, p 327.)

(*New to the British Isles.**)

A few specimens were found in two shore-sands and one dredging which appear to be referable to this species. It is not a very satisfactory type, but serves as a connecting link between the group of *D. rosacea* and *D. globularis*.

247. Discorbina globularis d'Orbigny sp.

Rosalina globularis d'O 1826 ASN, p 271, No 1, pl xiii, figs 1–4.
Discorbina globularis (d'O) Parker & Jones 1865 NAAF, p 386, pl xiv, figs 20–23.
„ „ „ Brady 1884 FC, p 643, pl lxxxvi, figs 8 and 13.

(See also FC, p 643 ; MFM 1903, p 698.)

One of the most abundant and characteristic Foraminifera of the Clare Island area, occurring in every gathering and often in great numbers and variety. The species can always be identified as compared with *D. Mediterranensis* by its coarse foramina.

It is subject to great variation according to its development and method of growth. Specimens which have retained the sessile habit throughout their growth are often quite flat and scalelike in form, while free specimens are often inflated and almost dome-shaped. There is a strong tendency to limbation of the sutures, especially in the later chambers; but no specimens were observed sufficiently marked in this direction to be allotted to *D. Binkhorsti* Reuss sp., under which name specimens with strongly limbate sutures on the superior surface and plain sutures on the inferior side have been separated.

Other specimens show a tendency to develop an angular or carinate periphery, thus approaching *Rosalina Cora* d'Orb.

D. globularis is an abundant species round our coast wherever shallow water and rocks covered with algae or polyzoa afford shelter and a suitable habitat for the living form in its early sessile stage.

248. **Discorbina obtusa** d'Orbigny sp.

Rosalina obtusa d'O 1846 FFV, p 179, plate xi, figs 4–6.
Discorbina turbo var *vesicularis* sub-var *obtusa* (d'O) Parker and Jones 1865 NAAF, p 386, pl xiv, figs 18, 19.

(See also H-A & E 1909, p 442.)

Occurs in two shore-sands and fourteen dredgings. The species reaches its highest development both as regards size and numbers in the muddy dredgings, notably at Stations 19 and 34 among the islands.

Very little variation of any kind is noticeable in this species.

249. **Discorbina tuberculata** Balkwill & Wright.

Discorbina tuberculata B & W 1885, p 350, pl xiii, figs 28–30.
" " " Wright 1903, BCD, p 175.
" " " Sidebottom 1904 &c RFD 1908, p 15, pl v, fig 5.

(*Note.*—Referred to by Mr. Wright in a list of forms published in 1900–1 (Proc. Belfast Nat. Field Club, pp 604, 5) as *D. pustulosa*, amended in MS by him, obviously a slip of the pen).

A single specimen from Station 23. It is possible that, owing to the minute size and somewhat obscure characters of the species, others may have been overlooked.

This specimen is quite typical, agreeing with Messrs. Balkwill and Wright's figure and description in every respect. Its close relationship to *D. globularis* as suggested by them is borne out by the form and construction of the

chambers. Another specimen was found at this station which, on account of differences in construction, we have described under the name *D. pustulata* sp. nov.

250. Discorbina polyrraphes Reuss sp.

Plate XII, figs 10–14.

Rotalina polyrraphes R 1845 VBK, pt i, p 35, pl xii, fig 18.
Discorbina polyrraphes (R) Wright 1910–11 BCNI, p 4, pl i, fig 3.

Was recorded from one shore-sand and seven dredgings. Owing to its minute size, it may have been overlooked elsewhere. At some of the stations specimens were numerous and of exceptionally fine growth. At Station 24 (off Clare Island) one specimen was found in the sessile state growing on a molluscan fragment.

This little species, originally described as a Chalk fossil, does not appear to have been recorded as a recent species except by Mr. J. Wright, who reports it (*ut suprá*) from several localities round the Irish coast, and also from the Boulder Clay. It is quite common in many "Goldseeker" dredgings round the Scottish coast, and probably elsewhere, but has no doubt been overlooked by workers owing to its minute size, or perhaps regarded as an immature form. It is, however, quite characteristic and true to type, seldom varying except in size. Its colour is always a characteristic light-brown tint. It may be regarded as a connecting link between the genera *Discorbina* and *Rotalia*.

251. Discorbina Chasteri Heron-Allen & Earland.

Plate XIII, figs 1–3.

Discorbina minutissima C 1892 CS, p 65, pl i, fig 15.
„ „ „ Wright 1903 BCD, pp 174, 175.

The specific name *minutissima* having been used in 1880 by Seguenza for a *Discorbina* of the *orbicularis* type (Atti. R. Acad. dei Lincei, Ser. 3, vol vi, p 149, pl xiv, fig 1), Chaster's specific name must lapse. We venture to rename his very well-marked species after the author, whose early death was a great loss to zoologists in general, for the single valuable paper which he contributed to the literature of the British Foraminifera was but an illustration of his versatility and general interest in zoology.

A single specimen in shore-sand, Curraun Strand (Station 5) and more plentifully in the dredgings, occurring at nine stations. As is usually the case, it is most abundant and reaches its maximum development in size on muddy bottoms.

Most of the specimens are of the normal type in which the outline of the shell is almost circular. At a few stations, however, a variety occurs in small numbers, which we have noted in many of the "Goldseeker" dredgings in the North Sea, where it sometimes occurs as frequently as the type. In this variety the chambers are longer and set eccentrically so as to give an oval contour to the shell (Pl XIII, fig 1).

This oval variety so closely resembles the little species figured by Mr. Sidebottom under the name of *Pulvinulina simplex* (1904 &c RFD 1909, p 9, pl iv, figs 4, 5), not only in the shape and method of arrangement of the chambers, but also in the presence of the fine radiating striae on the sides of the umbilical depression, that we are inclined to think Mr. Sidebottom's specimens identical with ours. The typical *D. Chasteri* does not occur in the list of species from Delos. In the North Sea transition forms between the circular and oval types are frequent, but the oval form never attains the size and robustness of some individuals of the circular type. Measurements :—circular type varies between ·08 and ·14 mm.; elliptic type, length varies between ·08 and ·12 mm., breadth ·05–·08 mm.

252. Discorbina Chasteri var. nov. **bispinosa.**

Plate XIII, fig 4.

At Inishgowla harbour (Station 13) a few specimens were obtained of a very distinctive variety, in which the surface of each of the last two or three chambers is furnished with a pair of short but stout spines, projecting forwards. The surface of the test is also rough compared with the highly vitreous surface of the type. The spines average ·01 mm. in length.

This spinous variety occurs much more frequently in company with the type at several of the "Goldseeker" stations round the Scottish coast.

253. Discorbina Bertheloti d'Orbigny sp.

Rosalina Bertheloti d'O 1839 FIC, p 135, pl i, figs 28–30.
Discorbina Bertheloti (d'O) Brady 1864 RFS, p 469, pl xlviii, fig 10.

(See also FC, p 650; MFM 1903, p 702; H-A & E 1911, p 327.)

Occurs very rarely in the Clare Island area, a few specimens only having been found at three stations.

254. Discorbina pustulata sp nov.

Plate XII, figs 5–7.

Test free, minute, consisting of about two convolutions. About ten chambers in all, six or seven forming the last convolution.

Each chamber on the superior face is ornamented with raised and perforated tubercles, as many as four to six on the later chambers, arranged in curving lines. The marginal edge is strongly carinate. The inferior face is concave and nearly smooth. The sutural lines are very obscure on the superior face, depressed and plainer on the inferior side. Aperture very obscure, apparently a mere fissure along the edge of the terminal chamber on the inferior side.

Breadth, including carina, ·120–·150 mm.

Diameter of tubercles, about ·012 mm.

This curious little form bears the same tubercular ornament as the *D. tuberculata* of Balkwill and Wright, and might easily be confounded with that species. In the construction of its test, however, it is widely separated. *D. tuberculata* has a trochoid test and is convex on both surfaces. It is closely allied to *D. globularis*, as was pointed out by the authors. *D. pustulata*, on the other hand, is a depressed and plane, or concavo-convex, form, related to the group of *D. Bertheloti*, and may be regarded as a tuberculate form of *D. rarescens*, which itself is but a carinate form of *D. Bertheloti*.

D. pustulata is probably co-existent with *D. tuberculata*, and has been confounded with that species. We have specimens named *D. tuberculata* kindly given to us by Mr. Wright himself which appear to be *D. pustulata*. From this it would seem that the authors were familiar with both types, but their description and figure deal only with the true *D. tuberculata*, allied to *D. globularis*. (See Addenda, p 188.)

Two specimens were found, one each at Stations 12 and 23. It is so minute and obscure that the species has possibly been overlooked at other stations.

255. **Discorbina Parisiensis** d'Orbigny sp.

Rosalina Parisiensis d'O 1826 ASN, p 271, No 1, Modèle No 38.
Discorbina Parisiensis (d'O) Parker Jones & Brady 1859 &c NF 1865, p 25, pl ii, fig 70.

(See also H-A & E 1909, p 443.)

Sparingly distributed. We record its occurrence in four shore-sands and nine dredgings, but never more than a few specimens in each locality. The best specimens were in the shore-sand of Emlagh Point (Station 9) and off Louisburgh (Station 28).

As a rule the specimens are not very typical, but show a tendency to variation in the direction of *D. Wrightii* Brady. Specimens were observed which had been in plastogamic union, but no actual pairs.

256. Discorbina Wrightii Brady.

Plate XII, fig 4.

Discorbina Wrightii B 1881 HNPE, p 104, pl ii, fig 6.
" " " Earland 1905 FBS, p 223.

Occurs in four shore-sands and six dredgings, never with any frequency. The specimens are mostly small, but characteristic, and nearly all of them are either in the actual plastogamic condition, or show signs of having passed through that state, their bases and internal septa having been dissolved. We figure a plastogamic specimen.

This species appears to be particularly addicted to the plastogamic condition of reproduction. In our experience, wherever it occurs a large proportion of the specimens are always to be observed either actively plastogamic, or showing signs of having passed through that condition. Other species of Discorbina exhibiting the same tendency, but usually in a lesser degree, are *D. patelliformis* Brady, *D. pileolus* d'Orb sp., *D. opercularis* d'Orb sp., *D. tabernacularis* Brady, *D. Parisiensis* d'Orb sp. All of these belong to the group of *D. Parisiensis*, and are characterized by a tuberculate base. We do not suggest that there is necessarily any connexion between the two features, but merely record the fact. Plastogamy appears to occur very rarely in the other species of Discorbina.

257. Discorbina vesicularis Lamarck sp.

Discorbites vesicularis L 1804 AM, vol v, p 183 ; 1806 vol viii, pl lxii, fig 7.
Discorbina vesicularis (L.) Carpenter Parker & Jones 1862 IF, p 204, pl xiii. figs 2, 3.
" " " Earland 1905 FBS, p 224, pl xii, figs 9, 10 ; pl xiv, fig 6.

(See also FC, p 651 ; MFM 1903, p 702.)

A fair number of specimens were obtained at Stations 13 and 19, among the islands, one at Clare Island and a few more in three other dredgings.

All the specimens are of the small hyaline type, with lobulate edges and rather flattened superior face, identical with those first recorded in northern waters by Halkyard from the shore-sand of Jersey, and subsequently recorded by Earland from Bognor and by Mr. Wright from Carnlough and Rockport (W 1910–11 ECM, p 13, Pl ii, figs 18–20).

D. vesicularis in the recent condition is a typical warm-water species, and attains an enormous size in the Australian seas.

PLANORBULINA d'Orbigny.

258. Planorbulina Mediterranensis d'Orbigny.

Planorbulina Mediterranensis d'O 1826 ASN, p 280, No 2, pl xiv, figs 4–6, Modèle No 79.
„ „ „ Brady 1884 FC, p 656, pl xcii, figs 1–3.
(See also FC, p 658; MFM 1904, p 489.)

Universally distributed all over the area of the Survey in every stage of development.

TRUNCATULINA d'Orbigny.

259. Truncatulina refulgens Montfort sp.

Cibicides refulgens M 1808 CS, vol i, p 122, 31me genre.
Truncatulina refulgens (M) d'Orbigny 1826 ASN, p 279, No. 5, pl xiii, figs 8–11, Modèle No. 77.

(See also FC, p 659; MFM 1904, p 491.)

Universally distributed throughout the area (28 stations), at several stations extremely abundant and very strongly developed.

260. Truncatulina lobatula Walker & Jacob sp.

Nautilus lobatulus W & J 1798 AEM, p 642, pl xiv, fig 36.
Truncatulina lobatula (W & J), Williamson 1858 RFGB, p 59, pl v, figs 121–3.

(See also FC, p 660; MFM 1904, p 491.)

Universally distributed, and at some stations constituting a large proportion of the floated material. Showing every range of variation from small high-domed, circular, and compact, to broad, flat, and extremely evolute varieties, running into *T. variabilis*.

261. Truncatulina variabilis d'Orbigny.

Truncatulina variabilis d'O 1826 ASN, p 279, No 8.
„ „ „ Sidebottom 1904 &c RFD 1909, p 2, pl i, figs 5, 6; pl ii, figs 1–3.

(See also FC, p 661; MFM 1904, p 492.)

As usual where *T. lobatula* is a dominant species, wild-growing varieties are of frequent occurrence. They have no zoological significance, their bizarre outline being often due to the irregular contour of the surface to which the specimen has been adherent in life. At the same time they have always

attracted a considerable amount of attention from rhizopodists, and Professor Fornasini has gone to the trouble of compiling a list of synonyms and figures of this variety, which includes no less than 33 references, in an interesting paper entitled "A proposito della figura 11, Tavola xxi della Paleontologia del Regno di Napoli, parte 2a (Costa)" published in the *Revista Italiana di Paleontologia* for April, 1896. In another place he suggests *T. variabilis* as the transition form between Truncatulina and Planorbulina (F 1898 RFI, p 283).

262. Truncatulina tenuimargo Brady.

Truncatulina tenuimargo B 1884 FC, p 662, pl xciii, figs 2, 3.
" " " Heron-Allen & Earland 1898 &c SB 1909, p 680, pl xx, fig 2.

This carinate form of *T. lobatula* occurs occasionally, but we have not as a rule separated it from the type.

263. Truncatulina Haidingerii d'Orbigny sp.

Rotalina Haidingerii d'O 1846 FFV, p 154, pl viii, figs 7–9.
Truncatulina Haidingerii (d'O) Brady 1884 FC, p 663, pl xcv, fig 7.
" " " Heron-Allen & Earland 1908 &c SB 1909, p 680; & 1910, p 425, pl ix, figs 6, 7.

(See also FC, p 663; MFM 1904, p 493.)

Occurs at 7 stations, large and typical at Station 25, otherwise rather weak. The British recent records appear to be confined to Shetland (79–90 fms.), the estuary of the Dee, the River Mersey, and Bognor.

264. Truncatulina Ungeriana d'Orbigny sp.

Rotalina Ungeriana d'O 1846 FFV, p 157, pl viii, figs 16–18.
Truncatulina Ungeriana (d'O) Heron-Allen & Earland 1908 &c SB 1909, p 681, pl xx, fig 1; & 1910, p 426, pl ix, figs 8, 9.

(See also FC, p 664; MFM 1904, p 493.)

An occasional specimen at 10 stations and moderately frequent and well developed at Station 34. This record in shallow water at the head of Clew Bay is noticeable, as *T. Ungeriana* is typically a deep-water species, being widely distributed in the deeper oceans.

PULVINULINA Parker & Jones.

265. Pulvinulina repanda Fichtel & Moll sp.

Nautilus repandus F & M 1798 TM, p 35, pl iii, figs a–d.
Pulvinulina repanda (F & M) Brady 1884 FC, p 684, pl civ, fig 18.

(See also FC, p 684; MFM 1904, p 496.)

Fairly frequent at many of the stations, both shore-sands and dredgings. The thick and solid shell of this form, being less easily destroyed than those of most Foraminifera, tends to its preservation under circumstances which would lead to the destruction of ordinary delicate forms, with the result that rolled and worn shells constitute a considerable element in shore-sands and the shallower dredgings. Some of the specimens are of considerable size. There is some difficulty in separating the type from Montagu's variety *concamerata*. The essential points of difference are that in *P. repanda* the upper and under surfaces are almost equally convex, while in var. *concamerata* the inferior surface is less convex to flat, or, in abnormal cases, even concave, owing to the excessive development of the last whorl of chambers. Moreover, the sutures, which are limbate in both forms, are conspicuously so in var. *concamerata*, and the superior surface of the shell is also tuberculate or rough in that variety.

266. Pulvinulina repanda var. **concamerata** Montagu.

Serpula concamerata M 1808 TB Suppl, p 160 (*fide* Williamson).
Pulvinulina repanda var *concamerata* (M) Brady 1884 FC, p 685, pl civ, fig 19.

(See also FC, p 685.)

Typical specimens of this variety occur in company with the type at many of the stations, but, on the whole, less frequently.

267. Pulvinulina punctulata d'Orbigny sp.

Plate IV, figs 20, 21.

Rotalia punctulata d'O 1826 ASN, p 273, No 25, Modèle No 12.
Pulvinulina punctulata (d'O) Parker Jones and Brady 1859 &c NF 1865, p 20, pl iii, fig 82.

(See also FC, p 685; H-A & E, 1909, p 683.)

(*New to the British Isles.*)

Sparingly distributed in the dredgings (8 stations). A few are comparatively large high-domed specimens, but the majority are of a very

compressed type with flush or limbate sutures, and a very thin shell-wall which gives an opalescent appearance to the test. The inferior surface in this small type is rough and in extreme cases papillate. It appears to occupy an intermediate position between *P. punctulata* and *P. concentrica*. We have observed similar specimens, usually of minute size, in shallow-water dredgings round the Scotch coast. In deep water *P. punctulata*, in its typical form, attains very large dimensions; specimens were dredged by the "Goldseeker" in 400 metres to the west of St. Kilda 4–5 mm. in diameter: they were living attached to the surface of a large Geodia, and the shells were surrounded with pseudopodial extrusions which had invested themselves with a sandy covering.

268. Pulvinulina concentrica Parker & Jones.

Pulvinulina concentrica P & J (MS), Brady 1864 RFS, p 470, pl xlviii, fig 14.
" " " Heron-Allen & Earland 1908 &c SB 1909, p 683, pl xx, fig 4 *a–c*.

(See also FC, p 686; MFM 1904, p 497; H-A & E 1909, p 683.)

Two worn but typical specimens from Stations 22 and 34. It occurs fairly commonly in many of the "Goldseeker" dredgings from the Shetland-Faröe area, and when well developed is a very striking and handsome species.

269. Pulvinulina vermiculata d'Orbigny sp.

Planorbulina vermiculata d'O 1826 ASN, p 280, No 3.
Pulvinulina vermiculata (d'O) Carpenter Parker & Jones 1862 IF, p 211, pl xiii, figs 4–6.
" " " Heron-Allen & Earland 1908 &c SB 1909 p 684; and 1911, p 341, pl xiii, figs 1–4.

(See also FC, p 687, H-A & E 1909, p 684.)

A single specimen from Station 20 which answers to the characteristics of this wild-growing species, excepting that the initial spiral portion of the test is domed and somewhat discorbine in structure. It may be an extreme variation of the wild-growing Discorbina for which Dr. Rhumbler has felicitously proposed the specific name *irregularis* (R 1906 FLC, p 70, pl v, figs 57, 58); or it might, in company with the Selsey specimens, be referred to Fornasini's species *Pulvinulina Adriatica*, which he considers to be a connecting link between the normal Pulvinulinae and the extremely aberrant *Planorbulina vermiculata* d'Orbigny (F 1900 FA, p 395). There are no other British records.

270. Pulvinulina auricula Fichtel & Moll sp.

Nautilus auricula var *a*. F & M 1798 TM, p 108, pl xx, figs *a*, *b*, *c*.
Pulvinulina auricula (F & M) Parker & Jones 1865 NAAF, p 393.

(See also FC, p 688; BS, p 922; H-A & E 1911, p 337.)

Universally distributed, the specimens being, as a rule, very large and well developed.

271. Pulvinulina oblonga Williamson sp.

Nautilus auricula var β. Fichtel & Moll 1798 TM, p 108, pl xx, figs *d*, *e*, *f*.
Rotalina oblonga W 1858 RFGB, p 51, pl iv, figs 98–100.
Pulvinulina oblonga (W) Brady 1884 FC, p 688, pl cvi, fig 4.

(See also FC, p 688; MFM 1904, p 497.)

The difficulty of separating *P. oblonga* from *P. auricula* is considerable, there being no well-marked line of demarcation between the two. British specimens truly referable to *P. oblonga* are of infrequent occurrence, whereas *P. auricula* is one of the most widely distributed and typical species in the Clare Island area. *P. oblonga* is included in the list on the strength of a few specimens observed at 3 stations. Specimens with intermediate characteristics are of frequent occurrence.

272. Pulvinulina Brongniartii d'Orbigny sp.

Plate XII, figs 8, 9.

Rotalia Brongniartii d'O 1826 ASN, p 273, No 27.
Pulvinulina Brongniartii (d'O) Millett 1898 &c MFM 1904, p 498, pl x, fig 4.

(See also MFM 1904, p 498.)

(*New to the British Isles.*)

Two specimens, fairly typical, from Station 31.

273. Pulvinulina haliotidea Heron-Allen & Earland.

Pulvinulina haliotidea H-A & E 1908 &c SB 1911, p 338, pl xi, figs 6–11.

This species was observed at 14 stations, two shore-sands and 12 dredgings, often of frequent occurrence. It is a very variable species, and the specimens exhibit the full range of variation between the normal pulvinuline type and an extreme form in which the chambers are evolute, the convolutions being merely attached to one another by the wall which forms the upper surface of the shell.

274. Pulvinulina Canariensis d'Orbigny sp.

Rotalina Canariensis d'O 1839 FIC, p 130, pl i, figs 34–36.
Pulvinulina Canariensis (d'O) Brady 1870 BFE, p 8.

(See also FC p 692 ; MFM 1904, p 500.)

A single specimen from Station 21. The occurrence of this oceanic type in a shallow-water dredging is noteworthy. The specimen, although small and rather feeble, is quite characteristic. The species is widely distributed in deeper waters.

275. Pulvinulina Patagonica d'Orbigny sp.

Plate XIII, figs 5, 6.

Rotalina Patagonica d'O 1839 FAM, p 36, pl ii, figs 6–8.
Pulvinulina Patagonica (d'O) Brady 1884 FC, p 693, pl ciii, fig 7.

(See also MFM 1904, p 500.)

A single specimen in the shore-sand of Station 8 (Carrowmore Strand) doubtless drifted in from deep water.

We think there can be no doubt as to the identification of this specimen, in spite of its unusual occurrence in a shore-sand. It agrees in most respects with d'Orbigny's original figure, which represents a smooth shell, but has a distinctly marked loop-like slit as an aperture, similar to that in small British specimens of *P. Karsteni*. Brady's figure shows a specimen with a rough surface. It agrees with his description as regards the rounded margin and glistening appearance.

P. Patagonica is normally a deep-water form. The Atlantic records range from 90 to 2,435 fathoms.

276. Pulvinulina crassa d'Orbigny sp.

Rotalina crassa d'O 1840 CBP, p 32, pl iii, figs 7, 8.
Pulvinulina crassa (d'O) Owen 1867 SFMO, p 148, pl v, figs 18 (?), 19.

(See also FC, p 694 ; MFM 1904, p 500.)

(*New to the British Isles.*)

Fairly generally distributed over the whole area of the Survey (9 stations). This species being isomorphous with *Globigerina inflata* is not easily distinguished, and may have been overlooked at other stations. It is widely distributed over the deeper Atlantic, but has not apparently been previously recorded from British waters, though it is included, without locality, in S 1879 (p 9). We can find no British record of its occurrence. (See Addenda, p 188.)

277. Pulvinulina truncatulinoides d'Orbigny sp.

Rotalina truncatulinoides d'O 1839 FIC, p 132, pl ii, figs 25–27.
Rotalina Micheliniana d'O 1840 CBP, p 31, pl iii, figs 1–3.
Pulvinulina Micheliniana (d'O) Owen 1867 SFMO, p 148, pl v, fig. 17.
Pulvinulina truncatulinoides (d'O) Rhumbler 1900 NPF, p 17, figs 16–18.
" " " Millett 1898 &c MFM 1904, p 500.
" " " Heron-Allen & Earland 1908 &c SB 1909, p 685.

(See also FF, p 694 ; MFM 1904, p 500.)

The question of the priority of the specific names *truncatulinoides* and *Micheliniana* has been fully discussed by Mr. Millett *ut suprâ*. It is perhaps unfortunate that a long-accepted name like *P. Micheliniana* should be superseded, especially when the dates of publication of the two species by the same author are so close together and at the same time so uncertain. The evidence of priority being apparently in favour of *truncatulinoides*, there seems, however, no option in the matter. This specific name, moreover, has the advantage of roughly describing the species, whereas the personal name *Micheliniana* is open to all the drawbacks of that class of nomenclature. It will be observed that we have given somewhat full references to the literature of the two specific names.

One good specimen only was found, at Station 15, of this species, which has been recorded by Wright from various points to the south-west of Ireland (48–120 fms.).

278. Pulvinulina Karsteni Reuss sp.

Rotalia Karsteni R 1855 KKM, p 273, pl ix, fig 6.
Pulvinulina Karsteni (R) Brady 1864 RFS, p 470, pl xlviii, fig 15.

(See also FC, p 698 ; H-A & E 1909, p 686.)

Occurs at seven stations among the dredgings. This is a northern form, but there are many British records, the majority of which are from much greater depths than are found within the area of the Clare Island Survey. Owing to its minute size, it might easily be overlooked, although its appearance is quite distinctive when once it has been identified.

279. Pulvinulina elegans d'Orbigny sp.

Rotalia (*Turbinulina*) *elegans* d'O 1826 ASN, p 276, No 54.
Pulvinulina elegans (d'O) Parker Jones & Brady 1859 &c NF 1871, p 174, pl xii, fig 142.

(See also FC, p 699 ; MFM 1904, p 501.)

A single weakly marked specimen from Station 18. The British records are very limited, but widely distributed. (See Addenda, p 188.)

ROTALIA Lamarck.

280. Rotalia Beccarii Linné sp.

Nautilus Beccarii L 1767 SN (Ed xii), p 1162.
„ „ „ 1788 „ (Ed xiii), p 3370, No 4.
Rotalia (*Turbinulina*) *Beccarii* (L) d'Orbigny 1826 ASN, p 275, No 42, Modèle No 74.

(See also FC, p 704; MFM 1904, p 502.)

Universally distributed and exhibiting every possible variation from specimens nearly smooth in outline to coarsely tuberculate forms, hardly separable from the *R. punctato-granosa* of Seguenza (R. Acc. Lincei 1880, pl xiii, fig 37). Double specimens (not plastogamic) were observed at several stations.

281. Rotalia orbicularis d'Orbigny sp.

Gyroidina orbicularis d'O 1826 ASN, p 278, No 1, Modèle No 13.
Rotalia orbicularis (d'O.) Brady 1864 RFS, p 470, pl xlviii, fig 16.

(See also FC, p 706; H-A & 1909, p 689.)

No absolutely typical specimens of this species were found in the Clare Island area, but the little form figured by Brady (FC, pl cvii, fig 5) as "a passage form between *R. Beccarii* and *R. orbicularis*," occurs at several stations.

282. Rotalia perlucida sp. nov.

Plate XIII, figs 7–9.

Test rotaliform, extremely hyaline, covered with somewhat coarse perforations; consisting of two or three convolutions, all of which are visible on the superior, and only the last on the inferior face. The superior face varies from dome-shaped to plane. The inferior face has a sunken umbilicus, from which the sutural lines radiate from a deep-sunk vortex, the sides of these furrows being studded with fine tuberculate outgrowths. Peripheral edge lobate, owing to the inflation of the chambers and depression of the sutural lines. Aperture marked by tuberculate secondary shell-growth round the inner margin of the terminal chamber. Breadth, ·3–·5 mm.; thickness, ·15 mm.

This very interesting and pretty shell occurs in some profusion in the muddy dredging at Station 13, and at eight other stations in lesser numbers. Specimens are extremely variable in convexity, the superior surface in some specimens rising in a comparatively high dome, whereas in others the shell is so flat as to be with difficulty distinguished at first sight from *Nonionina depressula*. The peculiarly hyaline character of the shell is, however, a constant feature in all specimens. As usual where a species occurs in abundance,

malformed individuals due to the fusion of two or more shells are of frequent occurrence, but no true plastogamic individuals were observed.

The affinities of the species lie probably with *R. orbicularis*, from which it differs in the fact that the inferior surface has always a depressed umbilicus. It is possible that our specimens are the same as those individuals of *R. Beccarii* thus referred to by Mr. Wright: "a neat thin-shelled variety approaching *R. orbicularis* was frequent in some of the deep-water gatherings in the Irish Sea." (B & W 1885 DIS, p 351).

Sub-family TINOPORINAE.

GYPSINA Carter.

283. Gypsina globulus Reuss sp.

Plate XIII, fig 10.

Cериopora globulus R 1847 Haidingers Naturw. Abh, vol ii, p 33, pl v, fig 7.
Gypsina globulus (R) Brady 1884 FC, p 717, pl ci, fig 8.

(See also FC, p 717.)

Subject to the observations we have made when discussing *G. vesicularis*, *G. globulus* occurs in small typical specimens at 6 stations, three of which are shore-sands. All the specimens are very neat and perfect. At one or two stations, notably Nos. 4 and 27, occasional very large specimens have been found, which in other circumstances might have been referred to *G. globulus*; but we prefer to regard them as abnormally spherical specimens of *G. vesicularis*. It seems possible that the "single specimen reported by Wright from 110 fms. south-west of Ireland," on the strength of which Brady included the species in BS (1887), may have been of a similar nature. If so, our specimens constitute the second undoubted British record. *Cf.* W 1900 DBC, pp 52, 53.

In the "Brady" collection of Foraminifera at Cambridge there is a mount labelled *G. vesicularis* from the neighbouring locality of Dog's Bay, Roundstone, which contains quite typical specimens of *G. globulus* identical with those from Clare Island. They are solid throughout.

284. Gypsina vesicularis Parker & Jones sp.

Plate XIII, fig 11.

Orbitolina vesicularis P & J 1859 &c NF 1860, p 31, No 5.
Gypsina vesicularis (P & J) Carter 1877 AMNH, ser 4, vol xx, p 173.

(See also FC, p 718; MFM 1904, p 598.)

This species occurs at a great many stations (20 at least), both in shore-sands and dredgings, and in such variety as to present great difficulties in

its identification as between *G. vesicularis* and *G. globulus*. Brady, in his "Challenger" Report (FC), has referred to the confusion which exists between these two types. It seems questionable whether there is any real specific difference existing between them; but for purposes of convenience it is desirable to separate the small truly globular and solid specimens (which are also characterized by smaller vesicular chambers) under the name of *G. globulus*, and to assign to *G. vesicularis* the larger and coarser forms, whether their shape be compressed, convex, or biconvex, or even sub-spherical, as is frequently the case. These sub-spherical specimens really constitute the greatest difficulty, for they are practically indistinguishable from *G. globulus* except by their larger size and coarser areolation; but when regarded from the point of view of an extensive series of specimens, such as can be obtained at many stations in the area of the Clare Island Survey, the difficulty of discrimination is diminished by the fact that globular specimens of intermediate size are seldom or never found. *G. vesicularis* appears to commence its growth as a convex boss with a flat base, becoming first lenticular, and subsequently, in the largest specimens, almost truly spherical, whereas *G. globulus* begins with a minute spherical test, and increases in size by the addition of concentric layers. We figure an interesting variety of *G. vesicularis*, specimens of which have been found at many stations, in which the sub-globular test is a mere hollow shell. This variety presumably has its origin as an incrusting layer over some rounded and perishable body such as the terminal joint of a coralline. It is difficult to conceive in what other circumstances this peculiar form can have been assumed. The interior chambers of the sphere are always in a good state of preservation, showing no signs of erosion. Although we have not observed British specimens of *G. vesicularis* in the sessile condition, we have no doubt that the animal frequently assumes this habit, as many individuals are to be found in which the flattened base corresponds in moulding to the shape of molluscan fragments such as are common in the material.

285. Gypsina inhaerens Schultze sp.

Acervulina inhaerens S 1854 OP, p 68, pl vi, fig 12.
Gypsina inhaerens (S) Brady 1884 FC, p 718, pl cii, figs 1–6.

(See also FC, p 718; MFM 1904, p 599.)

The species occurs at almost every station, both shore-sands and dredgings, is generally very common, and at some stations attains a size and presents a development such as we have never observed elsewhere in Great Britain, ranging up to 4 mm. in diameter. As might be expected where a species is present in such profusion, every possible variation in development can be observed,

from thin spreading crusts, limited to a single chamber in thickness and hardly separable from such forms as *Pulvinulina dispansa* Brady, to conglomerated masses, in which the separate chambers are heaped together in an acervuline mass, until the test assumes a hemispherical or even sub-globular shape. Such specimens can only be separated from *G. vesicularis* by the more irregular disposition of their chambers. Many of the specimens show the early rotaline chambers on the inferior side of the test very perfectly. The species was recorded as *Tinoporus lucidus* by Mr. Siddall in 1878 from the River Dee (S 1878 SFD, p 50), and transferred by him to Schultze's species in his later work on the same material (S 1886 LMBC, p. 59).

Family NUMMULINIDAE.

Sub-Family POLYSTOMELLINAE.

NONIONINA d'Orbigny.

286. Nonionina depressula Walker & Jacob sp.

Nautilus depressulus W & J 1798 AEM, p 641, pl xiv, fig 33.
Nonionina depressula (W & J) Brady 1884 FC, p 725, pl cix, figs 6, 7.

(See also FC, p 725; MFM 1904, p 599.)

Occurs universally and abundantly all over the area, and at some stations presents a most bewildering range of form. Very few species are in our experience more subject to variation than this common Rhizopod. The shell varies from depressed to turgid, and the sutures may be either sunken or limbate. The umbilical region is sometimes flush and simple, at other times raised and decorated with secondary growths linking it with *N. asterizans* (F & M), or it may be depressed, or depressed and filled with secondary shell-substance. The sutural lines when depressed may exhibit rudimentary retral processes linking the form with the allied genus Polystomella. This variety is the *Polystomella decipiens* of Costa (F 1897 FIC, p 5, and F 1899 PFJ, p 646).

287. Nonionina umbilicatula Montagu sp.

Nautilus umbilicatulus M 1803 TB, p 191; Suppl, p 78, pl xviii, fig 1.
Nonionina umbilicatula (M) Terquem 1882 FEP, p 42, pl ii, fig 7.

(See also FC, p 726; MFM 1904, p 600.)

Occurs at 5 stations, but, with the exception of Station 27, the specimens are somewhat small and poorly developed. At that station they are large and very typical. This is normally a deep-water form compared with the last species, and consequently would not be expected to occur in typical condition in the shallow area of the Clare Island Survey.

288. Nonionina pompilioides Fichtel & Moll sp.

Nautilus pompilioides F & M 1798 TM, p 31, pl ii, figs a–c.
Nonionina pompilioides (F & M) Parker Jones and Brady 1859 &c NF 1860, p 102; 1865, pl iii, fig 98.

(See also FC, p 727; MFM 1904, p 601.)

One specimen, a dead and discoloured shell from Clare Island strand (Stations 7, 10, 11). As the species is, according to Brady, almost exclusively a deep-water form, ranging from 1000 to 3750 fms. in the North Atlantic, our specimen is probably derived from ocean drift. Mr Wright has recorded a single specimen from the S.W. of Ireland (W 1891 SWI, p 492).

289. Nonionina asterizans Fichtel & Moll sp.

Plate XIII, figs 12, 13.

Nautilus asterizans F & M 1798 TM, p 37, pl iii, figs e–h.
Nonionina asterizans (F & M) Parker & Jones 1859 &c NF 1860, p 101, No 1.

(See also FC, p 728; H-A & E 1909, p 694.)

This species is to us hardly a satisfactory type. The original water-colour drawings of von Fichtel (which are in our possession, and are very well reproduced in their book) represent two quite distinct forms:—(i), fig. f, a plain Nonionina with sunken umbilicus and no external ornament, hardly separable in fact from *Nonionina depressula*, and (ii), fig. g, representing the same structure of shell with a raised umbo in the sunken umbilicus, surrounded with a regular stellate raised ornament. The figures given by Brady (FC 1884, p 728) are quite dissimilar, representing a Nonionina of the *umbilicatula* type with a considerable secondary growth surrounding the umbilical region. In his Synopsis (BS 1887) he refers to the unsatisfactory characteristics of Fichtel and Moll's species, and suggests that the specimens previously recorded under this name might equally well be referred to *N. depressula* or *N. stelligera* according to the extent and character of their ornament. There is, however, a little form of Nonionina occurring abundantly nearly everywhere round the British coasts, which, in its regularity of form and surface-ornament, is very constant to type. This was the type which was separated in Earland's Bognor paper (FBS 1905, p 229) under the name *N. asterizans*, and Mr. J. Wright, after some correspondence with the author, agreed that they were correctly referred to that species, although he had been in the habit of recording such specimens as *N. depressula*. We take the present opportunity to figure this little shell. It will be seen that it differs from *N. depressula* in its size, which is uniformly smaller than that species, in the width of the chambers, which are usually somewhat narrower and more

numerous, and in the presence of secondary growth in the umbilical region. The amount and extent of this secondary growth vary considerably. In extreme cases there is a central umbo surrounded with radial tubercles as in Fichtel and Moll's figure, but the central umbo may be missing altogether, and the whole umbilical region may be filled with secondary shell-growth, consisting of tubercles of varying size and number. In the thickness of the shell our specimens are very much nearer to Fichtel and Moll's edge view (fig h) than they are to typical *N. depressula*; and we think there can be very little doubt that the British form closely resembles the specimens on which Fichtel and Moll based their species. (See B 1887 BS p 924.)

290. Nonionina stelligera d'Orbigny.

Nonionina stelligera d'O 1839 FIC, p 128, pl iii, figs 1, 2.
„ „ „ Brady 1864 RFS, p 471, pl xlviii, fig 19.

(See also FC, p 728; MFM 1904, p 600.)

Occurs sparingly at seven stations, in quantity only at Station 13. The specimens at this station are marked by a considerable variation in the extent of the subsidiary growth, which in extreme cases extends to the marginal edges of the shell. *N. stelligera* is never a common species, but it is widely distributed all round the western coasts of Great Britain. Excellent specimens have been obtained in several of the "Goldseeker" dredgings in the Orkneys and Shetland, and in the Moray Firth.

291. Nonionina pauperata Balkwill & Wright.

Nonionina pauperata B & W 1885 DIS, p 353, pl xiii, figs 25, 26.
„ „ „ Heron-Allen & Earland 1908 &c 1911, p 342, pl xi, figs 16, 17.

This very well-marked species occurs at seven stations, but never in any considerable numbers. It appears to be sparingly distributed all round the British coasts, and is quite distinctive and permanent in its characteristics. We cannot agree with Brady's suggestion that it is only a starved condition of *N. scapha*, the whole character of the shell, including the arrangement and shape of the chambers, being quite different. It has, moreover, always a peculiar ochraceous colour-tinge in the older chambers of the shell, and in dredgings where *N. scapha* occurs abundantly and in all stages of development, none of the depauperated individuals ever assume the colour and other characteristics of *N. pauperata*.

292. Nonionina Boueana d'Orbigny.

Nonionina Boueana d'O 1846 FFV, p 108, pl v, figs 11, 12.
„ „ „ Brady 1884 FC, p 729, pl cix, figs 12, 13.

(See also MFM 1904, p 602.)

A few rather poor specimens from Station 26. This is not a very satisfactory species; it presents characteristics midway between the common British *N. asterizans* and *N. scapha* (Fichtel and Moll), more nearly approaching the latter in the angular peripheral margin.

293. Nonionina scapha Fichtel & Moll sp.

Nautilus scapha F & M 1798 TM, p 105, pl xix, figs d–f.
Nonionina scapha (F & M) Parker & Jones 1859 &c NF 1860, p 102, No 4.

(See also FC, p 730; MFM 1904, p 601; H-A & E 1909, p 694.

A few specimens found at 9 stations, all very small and weak, and of a highly compressed type. (See Addenda, p 188.)

294. Nonionina turgida Williamson sp.

Rotalina turgida W 1858 RFGB, p 50, pl iv, figs 95–97.
Nonionina turgida (W) Brady 1884 FC, p 731, pl cix, figs 17–19.

(See also FC, p 731; MFM 1904, p 602.)

This typical British species occurs at 16 stations, both shore-sands and dredgings. It reaches its best development as regards size in the muddy dredgings from Killary Bay (Stations 30 and 32). The chief variation noticeable in the species lies in the degree of compression of the shell, which is typically somewhat swollen, as the specific name implies, but a variety occurs in which the test is thin and highly compressed. (See Addenda, p 188.)

POLYSTOMELLA Lamarck.

295. Polystomella striato-punctata Fichtel & Moll sp.

Nautilus striato-punctatus F & M 1798 TM, p 61, pl ix, figs a, b, c.
Polystomella striato-punctata (F & M) Parker & Jones 1859 &c NF 1860, p 103, No 6.
„ „ „ Heron-Allen & Earland 1908 &c SB 1909, p 695, pl xxi, fig 2.

(See also FC, p 733; MFM 1904, p 602.)

Universally distributed, occurring at every station, and presenting every stage of variation from the very thick sub-spherical type to the extremely

compressed, complanate, and hyaline forms. Weak types in which the retral processes are very feebly indicated, linking the genus Polystomella with Nonionina, are of constant occurrence. The large and strongly marked form, with secondary structure in the sunken umbilicus, figured and described by us, *ut suprâ*, also occurs at some of the stations, but not abundantly.

296. Polystomella arctica Parker & Jones.

Polystomella arctica P & J (MS) Brady 1864 RFS, p 471, pl xlviii, fig 18.
„ „ „ Parker & Jones, Brady 1884 FC, p 735, pl cx, figs 2–5.

(See also FC, p 735.)

Many large and typical specimens of this northern type were found at Station 23. Its occurrence as a recent form in such a southern latitude is very noteworthy, as the species is typically confined to the sub-arctic region. It is very common within the Arctic Circle, and becomes less and less frequent as its range extends south. A considerable number of specimens have been found at the northernmost "Goldseeker" stations in the North Sea and Faröe Channel, and an outlying habitat occurs in the Buchan Deep of the North Sea, near Rattray Head on the east coast of Scotland. Brady records its southern limit as being on the western coast of Scotland (Ardrossan, 30 fms.). On the east coast of Ireland a single specimen has been dredged on the Kish Bank (24 fms.), and figured and described by Balkwill and Wright under the name *Nonionina Boueana* (B & W 1885 DIS, p 353, pl xiii, fig 27). The occurrence of such northern forms in isolated localities far to the south of their normal range is extremely interesting, and opens up questions of means of dispersal, &c., to which at present there is no definite answer.

297. Polystomella crispa Linné sp.

Plate XIII, fig 14.

Nautilus crispus L 1767 SN (Ed xii), p 1162, 275.
Polystomella crispa (L) Lamarck 1816 &c ASV 1822, vol vii, p 625, No 1; 2nd edn, 1845, vol xi, p 302.

(See also FC, p 736; MFM 1904, p 603.)

Universally distributed and frequently attaining very large and robust dimensions. At Station 15, where the species is extremely abundant and well-developed, the spinous or spurred periphery, which is usually considered

to be an attribute of the immature shell only, often persists throughout the growth. On such specimens, one of which we figure, d'Orbigny's species *P. aculeata* was apparently founded (d'O 1846 FFV, p 131, pl vi, figs 27, 28).

298. Polystomella macella Fichtel & Moll sp.

Nautilus macellus F & M 1798 TM, p 66, pl x, figs *e–g*.
Polystomella macella (F & M) Parker & Jones 1859 &c NF 1860, p 104, No 8.

(See also FC, p 737; H-A & E 1909, p 696.)

Occurs practically at every station where *P. crispa* is found. The omission of this species from BS (1887) is curious, in view of the fact that it is often extremely abundant all round our coasts. Brady apparently failed to discriminate between this species and *P. crispa*—in fact, in FC (1884) he refers to *P. macella* as "a compressed variety of *P. crispa* with acute or sub-acute periphery and somewhat depressed umbilici," and states that "it is not common in the northern temperate zone, the Mediterranean being apparently its boreal limit." This is far from being the case, for *P. macella* extends practically to the Arctic Circle. It occurs in many of the northernmost "Goldseeker" dredgings in the North Sea, whereas *P. crispa* is extremely rare even so far north as the Moray Firth and the Orkneys. In the Clare Island area, besides typical specimens of *P. macella*, there are abundant intermediate examples which could with equal reason be assigned either to *P. crispa* or *P. macella*.

Sub-Family NUMMULITINAE.

OPERCULINA d'Orbigny.

299. Operculina ammonoides Gronovius sp.

Nautilus ammonoides G 1781 ZG, p 282, No 1220, pl xix (Fasc iii, Tab 2), figs 5, 6.
Operculina ammonoides (G) Carpenter Parker & Jones 1862 IF, App, p 310.

(See also FC, p 745; H-A & E 1909, p 697.)

Occurs at 11 stations, but is extremely rare at all, only one specimen having been found at each station, with one exception (Stn. 25). The rarity of this species in the area is noticeable, as it is widely distributed round the British coasts, and in the North Sea is one of the most abundant and striking forms in most of the "Goldseeker" dredgings. It, however, favours somewhat greater depths than occur in the Clare Island area, combined with a muddy bottom, and these factors probably account for its rarity in our dredgings.

The identification of the specimens commonly known under the name of *O. ammonoides* with the type of Gronovius appears to be somewhat unsatisfactory. Reference to the original figure of Gronovius shows a test which nearly resembles some of the costate varieties of *O. complanata*, and the size of the specimen which is shown by Gronovius (*ut suprâ*, fig. 5) is macroscopic. Moreover, in the description of the species, he says: "Horum plures continebat arena e trocho telescopio Bengalensis excussa." Although this tropical origin does not exclude the possibility of Gronovius' figure being correctly identified with the northern species (Brady gives several tropical localities), the size of his specimen renders it much more probable that the shells on which he based his description were *O. complanata* of the costate type, often so abundant in tropical waters. The identification was first made by Parker & Jones in the Key to Williamson's figures, published as an Appendix to C P & J 1862 (*ut suprâ*), but only five years previously the same authors, when dealing with identical specimens from Norway (P & J 1857 FCN, p 289), had referred them to *O. complanata* Basterot (*sic*). It is certainly not desirable that a name like *O. ammonoides*, which has now for so many years been associated with a particularly well-marked type, should be disturbed, but the evidence serves to show the uncertain character of many of the earlier identifications of the Foraminifera. Sticklers for priority in zoological nomenclature would argue that this shell should at this late date be re-named *Operculina balthica* Schroeter sp. (S 1783 C, vol i, p 20), which he separates from *O. ammonoides* Gronovius. This latter, in our opinion, is probably *O. complanata* (cf. PJ & B 1859 &c NF 1861, p 229).

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[Table of Distribution.

Number.	Page.	Species.	Inside Mulranny. 1	Keel Bay. 2	Dugort Bay. 3	Achill Sound. 4	Curraun Strand. 5	Outside Mulranny. 6	Clare Island Strand. 7, 10, 11	Carrowmore Strand. 8	Emlagh Point. 9	"Helga" W. 106. 12	"Helga" W. 108. 13	"Helga" W. 84. 14
		Family **Miliolidae.**												
1	19	Nubecularia depressa *Chapman*, .	—	—	—	—	—	—	—	—	—	—	—	—
2	20	lucifuga *Defr.*, . . .	v r	—	—	r	—	r	f	—	f	—	l	l
3	21	Biloculina ringens *Lamarck* sp., .	—	—	—	—	—	—	—	—	—	—	v r	—
4	21	bulloides *d'O.*, . . .	f	—	r	—	—	—	—	—	—	—	—	r
5	22	elongata *d'O.*, ...	—	—	—	—	—	—	—	—	—	—	l	v r
6	22	depressa *d'O.*, ...	r	f	f	—	—	r	f	—	f	l	—	c
7	23	Spiroloculina planulata *Lam.* sp. .	r	—	v r	—	—	—	r	v r	—	v r	f	v r
8	23	excavata *d'O.*, . . .	r	l	r	r	l	f	f	r	r	v r	c	r
9	23	limbata *d'O.*, . . .	v r	—	l	—	—	—	r	l	l	—	f	—
10	24	canaliculata *d'O.*, . . .	—	—	—	—	—	—	—	—	—	v r	—	—
11	24	acutimargo *Brady*, . . .	—	—	—	—	—	—	—	—	—	—	—	—
12	24	nitida *d'O.*, ...	—	—	—	—	—	—	l	—	—	v r	—	—
13	24	grata *Terquem*, ...	—	—	—	—	—	—	—	—	—	—	l	—
14	25	Miliolina oblonga *Mont.* sp., . .	r	2	r	r	v r	f	r	r	r	v r	f	f
15	25	rotunda *d'O.* sp., . . .	—	—	—	—	—	—	—	—	—	—	v c	—
16	26	circularis *Bornemann* sp., .	c	c	c	v r	r	r	c	c	c	c	v c	f
17	26	var. sublineata *Brady*, .	—	—	—	—	—	—	—	—	—	—	—	—
18	26	subrotunda *Mont.* sp., . .	c	c	c	r	c	v c	c	r	c	c	f	f
19	27	valvularis *Reuss* sp., . .	—	—	—	—	—	—	—	—	—	—	—	—
20	27	seminuda *Rss.* sp., . . .	f	c	f	—	—	v r	f	f	f	f	v r	f
21	27	tricarinata *d'O.* sp., . .	—	—	—	—	—	—	—	—	—	—	f	—
22	28	trigonula *Lam.* sp., . . .	—	—	—	—	—	—	—	l	—	v r	c	r
23	28	seminulum *Linné* sp., . .	c	f	r	r	r	c	c	r	f	v c	v c	f
24	28	vulgaris *d'O.* sp., . . .	—	—	—	—	—	—	—	—	—	—	—	—
25	28	Auberiana *d'O.* sp., . . .	f	l	l	r	v r	f	c	r	r	r	r	f
26	29	Candeiana *d'O.* sp., . . .	—	—	—	—	—	—	—	—	—	f	—	f
27	29	pygmaea *Rss.* sp., . . .	—	—	—	—	—	—	—	—	—	—	—	—
28	30	contorta *d'O.* sp., . . .	—	—	—	r	—	v c	—	r	r	v c	f	v r
29	30	sclerotica *Karrer* sp., . .	c	—		f	f	c	r	r	r	—	—	f
30	30	Ferussacii *d'O.* sp., . . .	r	—	r	—	—	—	r	r	—	—	—	—
31	30	agglutinans *d'O.* sp., .	—	—	—	—	—	—	—	—	—	—	—	—

"Helga" W. 181. 15	H.-A. & E. No. 1. 18	H.-A. & E. No. 2. 19	H.-A. & E. No. 3. 20	H.-A. & E. No. 4. 21	H.-A. & E. No. 5. 22	"Helga" W. 204. 23	"Helga" W. 205. 24	"Helga" W. 210. 25	"Helga" W. 211. 26	"Helga" W. 216. 27	"Helga" W. 217. 28	"Helga" W. 218. 29	"Helga" W. 224. 30	"Helga" W. 225. 31	"Helga" W. 227. 32	"Helga" W. 229. 33	"Helga" W. 230. 34	"Helga" (label lost). 35	"Helga" W. 213. 36	Clare I., Coralline. 37	Number.
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v r	f	r	r	—	—	—	—	f	—	f	—	—	f	l	—	f	—	l	—	—	6
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—	v r	v r	l	l	r	—	—	—	—	f	—	—	—	r	r	r	f	—	1	—	22
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—	—	r	c	r	r	r	f	—	—	—	—	—	r	r	f	f	c	1	—	—	25
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f	f	f	c	f	f	f	v r	—	—	f	f	—	f	f	r	c	c	r	—	—	29
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No.	Page.	Species.	1	2	3	4	5	6	7, 10 11	8	9	12	13	14
32	31	Miliolina fusca *Br.*,	v r	—	—	r	f	—	—	—	—	v r	v r	—
33	31	stelligera *Schlumberger* sp.,	—	—	—	—	—	—	—	—	—	—	v r	r
34	31	tenuis *Czjzek* sp.,	—	—	—	—	—	—	—	—	—	—	v r	—
35	32	laevigata *d'O.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
36	32	bicornis *W. & J.* sp.,	c	f	c	—	r	f	c	f	c	f	c	f
37	33	Brongniartii *d'O.* sp.,	r	f	r	f	f	f	—	—	f	—	c	—
38	33	pulchella *d'O.* sp.,	—	—	—	—	—	—	—	—	—	—	f	—
39	34	Massilina secans *d'O.* sp.	v c	c	c	f	f	v c	v c	c	c	r	v r	v r
40	34	var. tenuistriata *Earland*,	—	—	—	—	—	—	—	—	—	—	—	—
41	34	annectens *Schl.*,	—	—	—	—	—	—	—	—	—	—	—	—
42	34	Ophthalmidium carinatum *Balkwill. Wright*,	v r	—	—	—	—	—	—	—	—	1	—	—
43	35	Planispirina Cliarensis n. sp.,	—	—	—	—	—	—	—	—	—	—	—	—
44	35	celata *Costa* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
45	36	Cornuspira foliacea *Philippi* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
46	36	involvens *Rss.* sp.,	r	f	—	—	v r	—	r	—	—	r	f	r
47	37	Selseyensis *H.-A. & E.*,	c	f	1	r	v r	1	f	r	—	c	—	r
48	37	diffusa *H.-A. & E.*,	—	—	—	—	—	—	—	—	—	—	—	—
		Family Astrorhizidae.												
49	37	Technitella legumen *Norman*,	—	—	—	—	—	—	—	—	—	—	—	—
50	38	Bathysiphon argenteus n: sp.,	—	—	—	—	—	—	—	—	—	—	—	—
51	39	Psammosphaera Bowmanni *H.-A. & E.*,	—	—	—	—	—	—	—	—	—	—	—	—
52	40	fusca *Schulze*,	—	—	—	—	—	—	—	—	1	—	—	1
53	40	Saccammina sphaerica *M. Sars*,	—	—	—	—	—	—	—	—	—	—	—	1
54	40	Crithionina mamilla *Goës*,	—	—	—	—	—	—	—	—	—	—	—	1
55	41	Jaculella obtusa *Br.*,	—	—	—	—	—	—	—	—	—	—	—	—
56	41	Hyperammina vagans *Br.*,	—	—	—	—	—	—	—	—	—	—	—	—
57	41	*Haliphysema ramulosa *Bow.*,	—	—	—	—	—	—	—	—	—	—	—	—
58	42	Tumanowiczii *Bow.*,	—	—	—	—	—	—	—	—	—	—	—	—
		Family Lituolidae.												
59	42	Reophax difflugiformis *Br.*,	1	—	—	—	—	—	—	—	—	—	—	—
60	42	fusiformis *Wilson.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
61	43	scorpiurus *Mont.*,	—	—	—	—	—	—	—	—	—	—	—	—
62	43	moniliforme *Siddall*,	—	—	—	—	—	—	—	—	—	—	—	v r
63	44	findens *Parker* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
64	44	Scottii *Chaster*,	—	—	—	—	1	—	—	—	—	v r	c	—

* Haliphysema ramulosa was found on roots of algae, dredged (c.) at Stn. 16 ("Helga" W. 215)

15	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	No.
f	—	v r	r	—	—	v r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	32
1	r	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	r	—	—	—	33
—	—	1	f	—	—	f	—	—	—	—	—	—	—	f	1	—	f	—	—	—	34
r	r	f	—	—	1	f	r	r	1	f	—	—	r	f	1	c	—	1	—	—	35
1	r	r	f	v r	f	f	—	f	—	c	f	—	r	r	—	c	c	f	r	—	36
v r	—	—	r	v r	—	f	r	—	—	c	r	—	—	r	—	r	r	v r	—	1	37
v r	r	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	38
v c	r	1	c	—	f	r	r	—	—	r	v r	v r	r	r	f	—	f	r	—	f	39
v r	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	40
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	v r	—	—	—	41
1	—	f	—	—	—	—	—	—	—	—	—	—	—	f	1	—	—	—	—	—	42
—	—	—	—	—	—	f	—	—	—	—	—	—	—	—	—	—	—	—	—	—	43
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	v r	—	—	—	44
—	—	—	—	—	—	—	—	—	—	—	—	—	v r	v r	—	—	1	—	—	—	45
f	c	c	c	r	f	f	—	—	v r	r	r	—	c	c	f	f	c	—	v r	r	46
f	c	c	c	r	1	r	1	—	—	r	f	1	v c	c	1	c	c	1	1	—	47
—	—	—	—	—	—	—	—	—	—	1	—	—	f	—	—	—	—	—	—	—	48
—	—	—	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	49
—	—	—	—	—	—	—	—	—	—	—	—	—	r	—	f	—	—	—	—	—	50
1	—	1	1	—	—	—	—	—	—	—	—	—	—	1	—	v r	—	—	—	—	51
v r	—	—	—	—	—	—	—	1	—	f	—	—	—	—	—	1	—	—	—	—	52
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	53
—	—	—	—	—	—	—	—	v r	—	—	—	—	—	—	—	—	—	—	—	—	54
—	—	—	—	—	—	—	—	v r	—	1	—	—	—	—	—	—	—	—	—	—	55
1	—	—	—	—	—	—	—	—	—	f	—	—	—	—	—	—	—	—	—	—	56
—*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	r	—	57
—*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	58
—	—	v r	—	—	—	—	—	1	—	r	—	—	—	—	c	v r	—	—	—	—	59
—	r	—	r	—	—	—	—	—	—	c	—	—	—	v r	c	f	f	—	—	—	60
—	—	1	—	—	—	—	—	c	—	f	—	—	—	—	—	—	—	—	—	—	61
r	v r	—	r	—	—	c	v r	f	v r	f	f	—	—	—	—	—	—	—	—	—	62
—	v r	—	—	—	—	1	r	1	—	1	f	—	—	—	—	—	—	—	—	—	63
—	—	f	f	—	—	1	—	—	—	—	—	—	r	c	f	—	1	—	—	—	64

(c.) at Stn. 17 (dredging H.-A. & E. No. 6) and (r.) at Stn. 36. H. Tumanowiczii (1) at Stn. 16.

No.	Page.	Species.	1	2	3	4	5	6	7, 10 11	8	9	12	13	14
65	45	Haplophragmium pseudospirale *Wmson.* sp.,	—	—	—	—	—	—	—	—	—	—	v c	—
66	45	canariense *d'O.* sp.,	c	f	r	—	v r	r	f	r	—	r	f	c
67	46	latidorsatum *Born.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
68	46	glomeratum *Br.*,	—	—	—	—	—	—	—	—	—	—	—	—
69	46	globigeriniforme *P. & J.* sp.,	v r	c	—	l	l	—	—	—	—	v r	—	f
70	47	anceps *Br.*,	—	—	—	—	—	—	—	—	—	—	—	—
71	47	Placopsilina vesicularis *Br.*,	—	—	—	—	—	—	—	—	—	—	—	—
72	47	Thurammina papillata *Br.*,	—	—	—	—	—	—	—	—	—	—	—	—
73	48	Hippocrepina indivisa *Parker*,	—	—	—	—	—	—	—	—	—	—	—	—
74	49	Ammodiscus incertus *d'O.* sp.,	—	l	—	—	—	—	—	—	—	v r	—	v r
75	49	gordialis *J. & P.* sp.,	—	r	—	—	—	—	—	—	—	—	—	v r
76	49	Shoneanus *Siddall* sp.,	—	—	—	—	—	—	—	—	—	l	—	—
77	50	Trochammina squamata *J. & P.*,	v r	v r	—	l	—	—	—	—	—	f	v r	r
78	51	ochracea *Wmson.* sp.,	f	r	—	l	v r	—	l	—	—	f	r	r
79	51	plicata *Terq.* sp.,	—	—	—	—	v r	—	—	—	—	v r	—	r
80	52	inflata *Mont.* sp.,	f	—	—	—	—	—	—	—	—	—	v r	—
81	52	var. macrescens *Br.*,	v r	—	—	—	—	—	—	—	—	—	r	—
82	52	rotaliformis *Wright*,	r	—	—	—	—	—	—	—	—	—	—	r
83	53	Robertsoni *Br.*,	—	—	—	—	—	—	—	—	—	—	—	—
84	53	Webbina hemisphaerica *J. P. & B.*,	—	—	—	—	—	—	—	—	—	—	—	—
		Family Textularidae.												
85	54	Textularia concava *Karrer* sp.,	—	r	—	—	—	—	r	—	—	r	—	—
86	54	sagittula *Def.*,	—	—	—	—	—	—	—	—	v r	—	—	—
87	54	agglutinans *d'O.*,	—	—	—	—	—	l	—	—	—	—	—	f
88	55	gramen *d'O.*,	l	—	r	v r	—	r	r	—	l	v r	—	c
89	55	conica *d'O.*,	c	c	c	f	c	c	v c	c	c	v c	—	c
90	55	Verneuilina pygmaea *Egger* sp.,	—	—	—	—	—	—	—	—	—	—	l	—
91	55	polystropha *Rss.* sp.,	r	—	v r	—	v r	f	—	v r	—	v c	c	r
92	56	Spiroplecta biformis *P. & J.* sp.,	—	l	—	—	—	—	—	—	—	v r	—	—
93	56	Wrightii *Silvestri*,	c	f	c	c	c	f	c	f	r	c	—	f
94	57	Gaudryina filiformis *Berthelin*,	l	—	—	—	—	—	—	—	—	—	—	—
95	58	rudis *Wright*,	c	f	f	v c	c	c	v c	f	r	v c	—	f
96	58	Valvulina fusca *Wmson.* sp.,	—	—	—	—	—	—	—	—	—	—	—	v r
97	59	Clavulina obscura *Chaster*,	—	—	—	—	—	—	—	—	—	v r	—	—
98	59	Bulimina pupoides *d'O.*,	c	r	—	r	l	f	f	r	—	f	f	—
99	60	elegans *d'O.*,	c	r	r	r	—	—	—	r	r	f	f	f
100	60	elongata *d'O.*,	—	—	—	—	—	—	—	—	—	—	—	—

15	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	No.
—	v r	f	c	—	—	r	—	v r	—	f	l	—	v r	v r	r	c	r	r	—	—	65
f	f	c	c	r	r	v c	l	f	c	f	f	v r	v r	c	v r	r	r	c	r	r	66
—	—	—	—	—	—	r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	67
—	—	—	—	—	—	—	—	—	—	—	—	—	—	v r	—	l	—	—	—	—	68
f	r	r	v r	r	l	c	v r	v r	f	c	l	l	—	f	—	—	r	—	l	—	69
v r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	v r	—	—	—	70
—	—	—	—	—	—	—	—	—	—	v r	—	—	—	—	—	—	—	—	—	—	71
l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	v r	—	—	—	—	72
l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	73
—	—	—	l	—	—	v r	—	l	v r	v r	—	—	—	v r	—	l	v r	—	—	—	74
f	—	l	—	—	—	v r	—	—	—	f	v r	—	—	—	—	—	—	r	—	f	75
v r	—	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	76
f	v r	f	f	—	f	c	l	f	l	v r	f	—	—	f	l	r	f	f	l	r	77
f	f	f	f	r	f	c	—	c	c	f	l	v r	f	c	—	f	f	—	r	r	78
f	f	v r	f	—	f	c	—	c	c	f	—	v r	—	c	—	f	r	—	—	—	79
—	r	v r	—	—	—	—	—	—	—	—	—	—	—	l	—	l	—	—	—	—	80
—	—	v r	—	—	—	—	—	—	—	—	—	—	—	r	—	—	—	—	—	—	81
f	—	f	—	l	f	—	r	f	l	f	l	—	r	—	r	—	r	—	r	—	82
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	83
—	—	—	—	—	—	—	—	v r	—	—	—	—	—	—	—	—	—	—	—	—	84
—	r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	85
—	—	—	—	l	—	—	—	v r	—	—	—	—	—	—	—	—	—	—	—	—	86
v r	r	—	—	—	—	—	—	—	—	v c	l	—	l	r	—	—	—	—	—	—	87
—	f	—	c	c	—	v r	r	c	r	c	r	v r	c	f	l	r	r	r	—	—	88
f	c	f	c	f	c	r	f	c	c	v c	c	r	f	c	c	c	c	f	c	c	89
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	90
f	c	f	c	f	—	l	—	f	r	r	f	r	f	f	c	c	c	v r	r	—	91
—	—	—	r	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	r	—	92
f	—	r	—	f	v c	r	c	c	f	r	c	f	v r	—	—	r	v r	f	f	c	93
v r	f	f	c	—	—	—	—	—	—	l	—	—	r	c	f	f	f	—	—	—	94
—	—	v r	v r	f	c	v c	f	c	f	c	c	l	f	f	—	r	r	f	r	c	95
—	—	—	—	—	—	—	—	v r	—	—	—	—	—	—	—	—	—	—	—	—	96
v r	—	f	r	—	—	v r	—	—	—	—	—	—	—	v r	v r	v r	f	—	—	—	97
f	—	c	c	f	—	r	f	—	v r	f	—	—	c	c	—	v c	c	l	r	—	98
f	c	c	c	v r	r	f	f	v r	r	f	—	l	c	v c	f	v c	c	—	f	—	99
—	r	—	—	—	—	—	l	—	—	l	—	—	l	—	—	f	—	—	—	—	100

No.	Page.	Species.	1	2	3	4	5	6	7, 10 11	8	9	12	13	14
101	61	Bulimina squamigera *d'O.*,	—	—	—	—	—	—	—	—	—	v r	f	—
102	61	fusiformis *Wmson.*,	c	f	—	—	v r	—	v r	—	—	f	c	v r
103	61	ovata *d'O.*,	—	—	—	—	—	—	v r	—	—	—	l	—
104	62	pyrula *d'O.*,	—	—	—	—	—	—	—	—	—	—	—	—
105	62	elegantissima *d'O.*,	r	—	—	l	—	—	—	—	—	f	r	—
106	62	minutissima *Wright*,	—	—	—	—	—	—	—	—	—	l	—	—
107	62	subteres *Br.*,	v r	—	—	—	—	—	—	l	—	v r	l	l
108	63	marginata *d'O.*,	r	v r	l	—	—	—	v r	l	—	r	r	f
109	63	aculeata *d'O.*,	—	—	—	—	—	—	—	—	—	—	—	v r
110	63	convoluta *Wmson.*,	—	—	—	—	—	—	—	—	—	—	—	—
111	64	Virgulina Schreibersiana *Czizek*,	—	l	—	—	—	—	—	—	—	v r	—	—
112	64	Bolivina punctata *d'O.*,	—	—	—	—	—	—	—	—	—	c	f	r
113	64	nobilis *Hantken.*,	—	—	—	—	—	—	—	—	—	l	l	—
114	65	textilarioides *Rss.*,	—	—	—	—	—	—	—	—	—	—	—	—
115	65	laevigata *Wmson.* sp.,	l	—	—	—	—	—	—	—	—	r	v r	r
116	65	difformis *Wmson.* sp.,	f	l	—	r	r	—	r	r	—	c	v r	f
117	66	dilatata *Rss.*,	f	l	—	—	—	—	—	—	—	c	v r	r
118	66	tortuosa *Br.*,	—	—	—	—	—	—	—	—	—	v r	—	—
119	67	limbata *Br.*,	—	—	—	—	—	—	—	—	—	l	—	—
120	67	aenariensis *Costa* sp.,	—	—	—	—	—	—	—	—	—	f	—	—
121	68	plicata *d'O.*,	c	—	—	l	r	—	—	—	—	c	c	f
122	68	variabilis *Wmson.* sp.,	f	r	—	v r	v r	—	f	f	—	c	c	f
123	68	inflata n. sp.,	—	—	—	—	—	—	—	—	—	—	f	—
124	69	gramen *d'O.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
125	69	Cassidulina laevigata *d'O.*,	c	f	r	f	v r	c	c	f	—	c	v r	f
126	70	crassa *d'O.*,	f	f	—	r	l	—	f	r	—	c	r	l
127	70	subglobosa *Br.*,	—	—	—	l	v r	—	—	—	—	c	v r	v r
128	70	Bradyi *Norman*,	—	—	—	—	—	—	—	—	—	—	—	—
129	70	nitidula *Chaster* sp.,	—	—	—	—	—	—	—	—	—	r	v r	—
		Family Chilostomellidae.												
130	72	Seabrookia Earlandi *Wright*	—	—	—	—	—	—	—	—	—	l	—	—
		Family Lagenidae.												
131	72	Lagena globosa *Mont.* sp.,	f	f	—	r	—	—	v r	l	—	r	f	v r
132	73	apiculata *Rss.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
133	73	ovum *Ehrenberg* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
134	74	chrysalis n. sp.,	—	—	—	—	—	—	—	—	—	—	v r	—
135	74	hispida *Rss.*,	—	—	—	—	—	—	—	—	—	—	l	—

15	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	No.
v r	r	r	f	l	—	v r	—	—	—	—	—	—	f	c	f	c	f	—	—	—	101
c	f	v c	c	c	f	c	—	—	c	f	l	—	c	v c	c	c	v c	r	r	—	102
—	r	—	—	—	l	r	—	—	c	—	—	—	—	v r	—	—	—	—	—	—	103
—	—	—	—	—	—	—	—	—	l	—	—	—	—	l	—	—	—	—	—	—	104
f	f	f	v r	—	—	c	—	—	—	v r	—	—	—	c	v r	f	c	—	l	—	105
v r	—	v r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	106
—	l	f	—	—	—	—	—	—	—	—	—	—	—	r	—	—	—	—	—	—	107
r	r	v r	v r	v r	l	r	v r	—	—	r	—	—	r	v c	f	f	c	l	—	—	108
—	—	—	—	—	—	—	—	—	—	—	—	—	—	r	f	—	—	—	r	—	109
l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	110
v r	—	—	—	—	—	l	—	—	—	—	—	—	—	v r	—	r	—	—	—	—	111
—	f	c	l	r	f	f	l	—	—	r	—	v r	f	c	f	f	f	f	—	—	112
—	r	f	v r	v r	f	f	l	—	l	—	—	—	v r	f	f	r	c	—	—	—	113
r	l	—	r	f	—	f	v r	—	—	—	—	—	—	c	—	—	r	—	—	—	114
v r	f	f	—	l	—	f	—	l	l	c	—	—	r	r	—	r	r	—	—	—	115
c	f	c	f	f	f	f	r	f	c	f	—	v r	c	f	r	f	v r	v r	c	—	116
l	r	—	c	f	r	f	v r	l	v r	f	—	l	f	f	v r	c	c	v r	f	—	117
—	—	—	—	—	—	v r	—	—	—	—	—	—	v r	—	—	—	—	—	—	—	118
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	119
—	l	r	r	—	—	r	—	—	l	—	—	—	—	—	r	c	f	—	v r	—	120
c	c	c	f	f	r	c	v r	r	f	r	—	v r	f	c	r	c	v c	v r	f	—	121
c	f	c	f	r	c	c	—	—	r	c	—	l	c	c	r	c	c	f	f	l	122
r	—	v r	—	l	—	f	—	—	—	—	—	—	—	f	f	—	f	—	—	—	123
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	r	—	—	—	—	—	124
c	f	c	f	f	f	v r	c	v r	r	f	f	l	c	r	f	c	v r	r	c	f	125
f	f	c	r	f	f	r	v r	—	c	f	—	l	c	c	f	f	f	—	f	—	126
c	l	—	r	f	f	f	v r	f	l	f	—	v r	c	c	f	c	l	—	f	l	127
—	—	v r	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	128
v r	—	—	—	—	—	f	—	—	—	—	—	—	—	c	—	—	v r	—	—	—	129
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	130
f	r	r	—	l	v r	r	v r	—	—	r	v r	—	f	r	—	f	f	—	—	—	131
v r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	v r	—	—	132
—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	133
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	134
l	—	—	—	—	—	—	—	—	—	—	—	—	v r	—	—	—	—	—	—	—	135

No.	Page.	Species.	1	2	3	4	5	6	7,10 11	8	9	12	13	14
136	74	Lagena protea *Chaster*, . . .	—	—	—	—	—	—	—	—	—	—	v r	—
137	75	lineata *Wmson.* sp., . . .	l	v r	—	—	l	l	l	—	—	r	r	—
138	75	costata *Wmson.* sp., . .	r	—	f	—	—	r	c	—	v r	v r	v r	r
139	76	hexagona *Wmson.* sp,. . .	f	r	—	l	—	—	r	r	—	f	f	f
140	76	reticulata *Macgillivray* sp., .	l	—	—	—	—	—	—	—	—	r	r	—
141	76	squamosa *Mont.* sp., . .	c	c	l	—	—	r	f	f	r	c	f	f
142	76	var. Montagui *Alcock* sp., .	—	l	—	—	—	—	l	—	—	—	—	—
143	77	laevis *Mont.* sp., . . .	r	—	—	—	—	—	—	—	—	v r	c	v r
144	77	var. distoma *Silv.*, . .	—	—	—	—	—	—	—	—	—	—	v r	—
145	78	semistriata *Wmson.*, . .	r	v r	—	—	—	—	—	r	—	r	f	
146	78	perlucida *Wmson.*, . .	l	—	—	—	—	—	—	—	—	—	—	—
147	78	striata *d'O.* sp., . . .	v r	v r	—	—	—	—	—	—	—	v r	f	r
148	78	curvilineata *B. & W.*, . .	—	—	—	—	—	—	—	—	—	—	—	—
149	79	sulcata *W. & J.* sp., . .	f	r	—	—	—	—	r	r	r	r	r	f
150	79	Lyellii *Seg.* sp., . . .	—	—	—	—	—	—	—	—	—	—	v r	—
151	80	Williamsoni *Alcock* sp., . .	c	c	r	r	v r	f	c	f	c	c	f	f
152	80	striato-punctata *P. & J.*, . .	—	—	—	—	—	—	—	—	—	—	l	—
153	80	clavata *d'O.* sp., . . .	f	r	—	—	—	—	—	v r	—	r	c	v r
154	80	gracillima *Seg.* sp., . . .	f	l	—	—	—	—	—	—	—	r	f	—
155	81	gracilis *Wmson.*, . . .	—	—	—	—	—	—	—	—	—	r	l	—
156	81	Stewartii *Wright*, . . .	—	—	—	—	—	—	—	—	—	—	v r	—
157	81	laevigata *Rss.* sp., . . .	—	r	—	—	l	—	l	—	l	v r	c	c
158	82	acuta *Rss.* sp., ...	—	—	—	—	—	—	—	—	—	—	c	—
159	82	falcata *Chaster*,. . . .	—	—	—	—	—	—	—	—	—	—	—	—
160	83	Millettii *Chaster*, . . .	—	—	—	—	—	—	—	—	—	—	l	—
161	83	lucida *Wmson.* sp., . . .	f	—	—	r	l	f	—	v r	l	c	c	v r
162	83	fasciata *Egger* sp., . . .	c	f	—	—	l	—	—	—	—	v c	c	r
163	84	var. faba *B. & M.*, . .	—	—	—	—	—	—	r	—	—	c	—	—
164	84	quadrata *Wmson.* sp., . .	—	—	—	—	—	—	—	—	—	—	v r	—
165	84	Malcomsonii *Wright*, . .	f	—	—	—	—	—	—	—	—	v r	v r	—
166	85	marginata *W. & B.* sp., . .	l	l	—	—	—	—	—	—	—	c	f	v r
167	85	var. inaequilateralis *Wright*,	l	—	—	—	—	—	—	—	—	v r	v r	—
168	85	var. semicarinata *Sidebottom*,	—	—	—	—	—	—	—	—	—	—	l	—
169	86	unguis n. sp., . . .	—	—	—	—	—	—	—	—	—	—	—	—
170	86	marginato-perforata *Seg.*, . .	—	—	—	—	—	—	—	—	—	f	c	—
171	87	forficula n. sp., . . .	—	—	—	—	—	—	—	—	—	—	l	—
172	88	lagenoides *Wmson.* sp., . .	l	—	—	—	—	—	—	—	—	v r	v r	—
173	88	var. tenuistriata *Br.*, . .	—	—	—	—	—	—	—	—	—	v r	f	—

15	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	No.
r	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	136
v r	f	f	r	v r	—	c	—	—	l	r	—	—	v r	c	—	f	c	—	—	—	137
l	—	—	—	l	l	v r	—	—	—	f	—	—	r	v r	l	r	—	r	—	l	138
f	f	f	f	v r	r	c	—	f	v r	f	—	l	c	f	r	f	c	v r	—	—	139
v r	—	v r	v r	—	—	r	—	—	v r	l	—	l	r	f	—	f	l	—	—	—	140
c	f	c	c	r	r	f	f	—	r	f	r	f	c	c	r	c	c	f	r	f	141
v r	r	r	—	—	—	—	—	—	—	—	—	—	—	—	—	r	—	—	—	—	142
c	f	f	—	l	r	v r	—	—	l	r	—	—	r	f	v r	r	f	—	—	—	143
—	—	v r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	144
l	f	f	r	—	—	v r	—	—	—	r	—	—	c	c	f	c	r	v r	—	—	145
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	146
f	c	r	v r	—	—	—	—	—	—	r	—	—	f	f	f	f	f	—	—	—	147
—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	148
v r	c	f	r	—	—	f	—	—	r	f	v r	—	c	f	—	f	f	r	l	—	149
v r	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	150
c	c	c	c	v r	f	f	f	r	f	f	f	r	c	c	r	c	f	r	f	r	151
—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	—	152
c	r	f	f	—	v r	v r	—	—	l	r	l	—	f	r	f	f	r	—	—	—	153
r	f	f	r	—	—	—	—	—	—	v r	—	—	—	l	—	f	v r	—	—	—	154
—	—	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	155
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	156
c	—	c	r	f	—	v c	v r	f	c	f	r	—	—	v c	f	r	v c	l	f	—	157
—	—	r	—	—	v r	—	—	—	l	—	—	—	—	—	—	—	—	—	—	—	158
—	—	—	—	—	—	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	159
l	—	—	—	—	—	—	—	—	—	—	—	—	—	v r	—	—	—	—	—	—	160
f	f	f	f	f	r	c	c	f	f	f	v r	—	f	c	r	f	f	—	f	—	161
c	f	c	f	f	r	c	v r	—	f	l	—	v r	v c	c	v r	f	r	—	f	v r	162
—	—	—	—	—	—	r	—	—	—	—	—	—	c	c	—	—	—	—	—	—	163
l	—	—	—	—	—	r	—	—	l	v r	—	—	l	f	—	—	v r	—	—	—	164
v r	v r	r	—	—	—	v r	—	—	—	l	—	—	—	f	l	—	v r	—	—	—	165
f	r	r	f	r	c	f	—	—	r	f	l	—	r	c	—	v r	v r	l	l	—	166
—	—	v r	—	l	—	v r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	167
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	168
l	—	r	—	—	—	r	—	—	—	—	—	—	—	f	—	—	—	—	—	—	169
v r	—	—	l	—	—	v r	—	—	f	—	—	f	—	c	—	—	r	—	—	—	170
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	171
—	—	—	—	—	—	—	—	—	l	—	—	—	—	v r	—	—	—	—	—	—	172
l	—	f	—	—	—	r	—	—	—	—	—	—	—	f	—	—	v r	—	—	—	173

No.	Page.	Species.	1	2	3	4	5	6	7, 10 11	8	9	12	13	14
174	88	Lagena formosa *Schwager*,	—	—	—	—	—	—	—	—	—	—	v r	—
175	88	ornata *Wmson.* sp.,	—	—	—	—	1	—	—	—	—	—	f	—
176	89	bicarinata *Terq.* sp.,	—	—	—	—	—	—	—	—	—	v r	1	—
177	89	Rizzae *Seg.* sp.,	—	—	—	—	—	—	—	—	—	—	v r	—
178	89	fimbriata *Br.*,	—	—	—	—	—	—	—	—	—	1	1	—
179	90	Orbignyana *Seg.* sp.,	c	c	v r	r	r	c	c	c	c	c	c	c
180	90	clathrata *Br.*,	—	—	—	—	—	—	—	—	—	—	—	—
181	90	cymbula n. sp.,	—	—	—	—	—	—	—	—	—	—	1	—
182	91	Nodosaria simplex *Silv.*,	—	—	—	—	—	—	—	—	—	—	—	—
183	91	calomorpha *Rss.*,	—	—	—	—	—	—	—	—	—	—	1	—
184	92	pyrula *d'O.*,	—	—	—	—	—	—	1	—	—	—	1	—
185	92	soluta *Rss.* sp.,	—	—	—	—	—	—	—	—	—	—	1	—
186	92	plebeia *Rss.* sp.,	—	—	—	—	—	—	—	—	—	—	v r	—
187	92	communis *d'O.*,	—	—	—	—	—	—	—	—	—	—	v r	—
188	92	filiformis *d'O.*,	—	—	—	—	—	—	—	—	—	—	1	—
189	93	scalaris *Batsch sp.*,	r	1	—	—	—	—	1	—	—	v r	f	—
190	92	Lingulina carinata *d'O.*,	—	—	—	—	—	—	—	—	—	—	v r	—
191	94	var. bicarinata *Sideb.*,	—	—	—	—	—	—	—	—	—	—	1	—
192	94	biloculi *Wright*,	—	—	—	—	—	—	—	—	—	v r	c	—
193	95	armata *Sideb.*,	—	—	—	—	—	—	—	—	—	—	1	—
194	95	quadrata n. sp.,	—	—	—	—	—	—	—	—	—	—	—	—
195	96	pellucida *Sideb.*,	—	—	—	—	—	—	—	—	—	—	v r	—
196	96	Frondicularia translucens n. sp.,	—	—	—	—	—	—	—	—	—	—	v r	—
197	96	pygmaea *Sideb.*,	—	—	—	—	—	—	—	—	—	—	1	—
198	97	spathulata *Br.*,	—	—	—	—	—	—	—	—	—	1	v r	—
199	97	Marginulina glabra *d'O.*,	—	—	—	—	—	—	—	—	—	—	—	—
200	98	costata *Batsch.* sp.,	1	—	—	—	—	—	—	—	—	—	—	—
201	98	Vaginulina legumen *Linné* sp.,	—	—	1	—	—	—	—	—	v r	—	—	—
202	98	linearis *Mont.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
203	98	Cristellaria crepidula *F. & M.* sp.,	v r	—	1	—	r	—	v r	—	1	v r	v r	v r
204	99	acutauricularis *F. & M.* sp.,	—	—	—	—	—	—	—	—	—	—	1	—
205	99	gibba *d'O.*,	—	—	—	—	—	—	—	—	—	—	1	—
206	99	rotulata *Lam.* sp.,	—	—	—	—	—	—	—	—	—	v r	v r	1
207	99	cultrata *Montf.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
208	100	Polymorphina lactea *W. & J.* sp.,	f	r	f	r	v r	r	f	f	r	f	r	r
209	100	gibba *d'O.*,	f	c	r	—	1	f	f	—	f	—	—	c
210	100	oblonga *Wmson.*,	v r	r	f	—	—	—	—	—	—	1	1	1
211	101	compressa *d'O.*,	r	r	c	1	v r	r	f	f	f	r	—	c

15	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	No.
—	—	v r	—	—	—	—	—	—	—	v r	—	—	—	f	—	—	—	—	—	—	174
—	—	v r	—	—	—	v r	—	—	—	—	—	—	—	r	—	—	—	—	—	—	175
l	—	v r	—	—	—	—	—	—	—	f	—	—	—	v r	—	—	—	—	—	—	176
—	—	—	—	—	—	—	—	—	—	—	—	—	v r	—	—	—	—	—	—	—	177
v r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	178
c	c	c	f	f	c	f	c	f	f	f	r	l	v c	c	f	c	c	f	c	f	179
l	—	—	—	—	—	—	—	—	v r	—	—	—	—	—	—	—	—	—	—	—	180
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	181
—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	—	182
—	—	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	183
l	—	—	—	—	—	—	—	—	—	l	—	—	—	v r	l	l	—	—	—	—	184
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	185
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	186
—	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	r	—	—	—	—	187
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	188
v r	f	r	v r	—	—	—	—	—	—	—	—	—	v r	v r	r	r	r	—	—	l	189
v r	—	—	—	—	—	l	—	—	—	—	—	—	—	—	—	—	l	—	—	—	190
—	—	—	—	—	—	—	—	—	—	—	—	—	—	v r	—	—	—	—	—	—	191
v r	—	v r	l	—	—	v r	—	—	—	—	—	—	—	f	f	—	r	—	—	—	192
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	193
—	—	v r	—	—	—	f	—	—	—	—	—	—	—	—	—	—	—	—	—	—	194
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	195
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	196
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	197
—	—	v r	—	—	—	l	—	—	—	—	—	—	—	—	—	—	v r	—	—	—	198
—	—	—	—	—	—	—	—	r	—	—	—	—	—	—	—	l	—	—	—	—	199
—	—	—	—	—	—	—	—	—	—	f	—	—	—	—	—	—	—	—	—	—	200
—	—	—	—	—	—	v r	—	c	—	f	—	—	—	—	—	—	—	—	—	—	201
—	—	—	—	—	—	—	v r	—	—	—	l	—	—	—	—	—	—	—	—	—	202
l	v r	r	—	—	—	v r	—	—	—	c	—	—	v r	r	r	l	l	—	—	—	203
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	204
—	—	—	—	—	—	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	205
—	—	v r	l	—	—	v r	v r	—	—	r	l	—	v r	v r	r	v r	v r	—	—	—	206
v r	—	—	—	l	—	—	v r	v r	—	r	—	—	—	—	—	—	—	l	—	—	207
r	f	r	f	l	r	r	l	r	l	f	l	—	r	r	l	c	v r	v r	—	—	208
r	l	—	r	r	—	r	—	v r	r	c	—	—	r	—	—	r	l	v r	—	—	209
r	r	f	l	—	l	v r	—	—	—	v r	—	—	—	r	—	v r	l	—	—	—	210
v r	f	f	r	—	l	v r	l	—	—	f	v r	—	f	r	—	l	r	l	r	—	211

No.	Page.	Species.	1	2	3	4	5	6	7,10 11	8	9	12	13	14
212	101	Polymorphina communis *d'O.*,	l	r	l	—	—	—	—	—	—	—	r	—
213	101	rotundata *Born.* sp.,	—	—	—	—	—	r	—	—	—	—	—	—
214	102	sororia *Rss.*,	r	f	—	—	—	r	—	l	—	—	r	—
215	102	concava *Wmson.*,	—	—	—	—	—	—	—	—	—	—	—	—
216	103	myristiformis *Wmson.*,	c	r	r	—	v r	f	r	l	f	r	l	f
217	103	Uvigerina Canariensis *d'O.*,	—	—	—	—	—	—	—	—	—	v r	—	—
218	103	pygmaea *d'O.*,	—	—	—	—	—	—	—	—	—	l	—	—
219	104	angulosa *Wmson.*,	c	f	f	—	r	c	c	r	f	c	v r	r
		Family Globigerinidae.												
220	104	Globigerina bulloides *d'O.*,	v c	c	c	c	v r	c	v c	c	f	c	c	c
221	104	cretacea *d'O.*,	—	—	—	—	—	—	—	—	—	—	—	—
222	105	inflata *d'O.*,	f	r	c	r	—	f	f	c	r	r	—	v r
223	105	pachyderma *Ehr.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
224	105	rubra *d'O.*,	l	—	—	—	—	—	—	—	—	f	r	—
225	106	Orbulina universa *d'O.*,	r	l	—	—	—	l	—	—	l	—	—	l
226	106	Pullenia sphaeroides *d'O.* sp.,	—	—	—	—	—	—	—	—	—	—	l	—
		Family Rotalidae.												
227	107	Spirillina vivipara *Ehr.*,	f	v r	—	l	v r	l	v c	—	l	c	v r	v r
228	107	Groomii *Chapman*,	—	—	—	—	—	—	—	—	—	—	—	—
229	108	lucida *Sideb.*,	—	—	—	—	—	—	v r	—	—	—	—	—
230	108	obconica *Br.*,	—	—	—	—	—	—	—	—	—	l	—	—
231	108	var. carinata *Halkyard*,	—	—	—	—	—	—	—	—	—	—	—	l
232	109	limbata var. denticulata *Br.*,	—	—	—	—	—	—	—	—	—	l	—	v r
233	109	Patellina corrugata *Wmson.*,	f	r	—	l	v r	—	r	v r	—	f	f	r
234	118	Discorbina Mediterranensis *d'O.* sp.,	c	v c	f	c	f	v c	c	v c	v c	—	f	r
235	119	irregularis *Rhumbler*,	—	r	—	—	f	—	f	—	—	—	—	—
236	121	nitida *Wmson.* sp.,	f	r	—	—	—	—	f	r	r	f	—	f
237	121	Milletii *Wright*,	—	—	—	—	—	—	—	l	—	v r	—	—
238	122	Praegeri n. sp.,	f	r	l	—	v r	r	f	f	f	—	—	f
239	122	Peruviana *d'O.* sp.,	—	r	—	f	—	v r	c	—	—	v c	—	f
240	123	mamilla, *Wmson.* sp.,	c	—	—	—	—	f	r	f	f	f	c	f
241	124	rosacea *d'O.* sp.,	—	—	—	r	v r	—	—	f	f	—	—	r
242	124	planorbis *d'O.* sp.,	c	—	f	r	v r	f	—	f	f	v c	—	—
243	124	baccata n. sp.,	—	—	—	—	—	—	—	—	—	—	f	—
244	125	turbo *d'O.* sp.,	—	r	—	—	—	—	—	—	—	—	—	v r
245	126	orbicularis *Terq.* sp,,	—	—	—	v r	v r	—	—	l	—	—	—	—
246	126	Araucana *d'O.* sp.,	—	—	—	—	f	—	—	—	—	—	f	—

15	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	No.
—	r	—	—	l	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	212
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	213
f	—	—	—	—	—	l	—	—	—	f	—	—	—	—	—	r	—	r	—	—	214
—	—	—	—	—	—	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	215
l	f	—	—	f	v r	f	l	v r	l	f	f	—	r	—	—	l	—	v r	r	l	216
—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	217
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	218
f	f	c	f	f	r	f	c	c	—	r	f	—	f	r	f	r	f	f	r	f	219
c	c	c	c	c	f	c	c	r	f	c	c	v r	c	c	r	v c	f	c	c	c	220
—	—	—	—	v r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	221
r	r	r	—	f	—	v r	v r	—	—	—	r	v r	—	—	—	r	l	v r	—	—	222
—	—	—	—	—	—	—	—	—	—	—	—	—	—	v r	—	—	—	—	—	—	223
c	—	v r	—	—	—	c	—	—	l	—	—	—	—	v r	—	—	v r	—	l	—	224
l	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	225
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	226
r	f	f	r	f	r	f	—	r	f	f	f	—	r	f	v r	c	f	f	r	c	227
l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	228
—	—	—	—	r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	229
—	—	—	—	—	—	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	230
l	—	l	—	—	—	c	—	—	—	l	—	—	—	v r	—	v r	—	—	—	—	231
—	—	—	—	—	—	—	—	—	—	v r	l	—	—	—	—	—	—	—	—	—	232
f	c	c	f	r	l	f	v r	v r	r	r	l	l	f	c	l	f	c	—	f	c	233
c	c	f	v c	v c	f	c	r	—	c	c	c	r	c	c	—	v c	f	f	f	v c	234
—	—	r	—	—	—	—	—	—	f	r	r	—	—	f	—	—	—	—	—	f	235
f	r	c	r	f	r	f	r	f	f	f	v r	—	c	f	—	c	f	f	f	r	236
r	l	v r	—	—	—	—	—	l	v r	—	r	l	—	—	—	v r	v r	—	—	—	237
f	f	f	f	f	f	v r	f	f	f	f	r	v r	f	f	—	—	v r	c	—	f	238
c	c	f	f	c	—	f	r	f	c	l	r	r	c	c	—	v c	c	f	—	—	239
—	—	f	v c	c	f	f	r	f	—	c	r	—	c	c	v r	c	f	—	l	f	240
c	c	f	—	—	—	r	—	f	—	—	—	r	c	—	—	r	f	—	c	—	241
c	c	f	—	—	f	—	r	f	r	l	r	r	c	c	v r	c	f	f	c	—	242
f	—	l	v r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	f	—	—	243
—	r	r	r	—	—	—	—	—	—	—	—	—	v r	v r	—	r	r	—	—	l	244
—	l	l	f	l	l	f	—	r	—	l	l	l	—	v r	—	c	—	—	—	—	245
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	f	246

No.	Page.	Species.	1	2	3	4	5	6	7, 10 11	8	9	12	13	14
247	126	Discorbina globularis *d'O.* sp.,	v c	v c	c	f	v c	v c	v c	v c	v c	v c	r	c
248	127	obtusa *d'O.* sp.,	1	1	—	—	—	—	—	—	—	f	r	v r
249	127	tuberculata *B. & W.*,	—	—	—	—	—	—	—	—	—	—	—	—
250	128	polyrraphes *Rss.* sp.,	—	—	—	—	f	—	—	—	—	f	r	—
251	128	Chasteri nom. nov.,	—	—	—	—	1	—	—	—	—	f	f	—
252	129	var. bispinosa n. sp.,	—	—	—	—	—	—	—	—	—	—	v r	—
253	129	Bertheloti *d'O.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
254	129	pustulata n. sp.,	—	—	—	—	—	—	—	—	—	1	—	—
255	130	Parisiensis *d'O.* sp.,	—	1	—	—	r	—	—	1	v r	—	—	v r
256	131	Wrightii *Br.*,	1	—	—	—	—	v r	r	v r	—	v r	v r	—
257	131	vesicularis *Lam.* sp.,	—	—	—	—	—	—	—	—	—	—	r	—
258	132	Planorbulina Mediterranensis *d'O.*,	v c	r	f	r	v r	f	c	f	f	c	f	c
259	132	Truncatulina refulgens *Mont.* sp.,	r	—	f	r	c	f	f	r	f	—	—	v r
260	132	lobatula *W. & J.* sp.,	v c	c	v c	c	v c	v c	v c	v c	v c	v c	v c	v c
261	132	variabilis *d'O.*,	c	—	—	—	f	r	c	f	c	—	—	r
262	133	tenuimargo *Br.*,	—	—	—	—	—	—	—	—	—	—	—	—
263	133	Haidingerii *d'O.* sp.,	—	1	—	—	v r	—	r	—	—	—	—	—
264	133	Ungeriana *d'O.* sp.,	—	—	—	—	—	—	1	1	—	—	—	1
265	134	Pulvinulina repanda *F. & M.* sp.,	r	r	f	v r	f	—	v r	—	—	—	—	r
266	134	var. concamerata *Mont.*,	r	—	—	—	c	—	—	—	—	v r	—	1
267	134	punctulata *d'O.* sp.,	—	—	—	—	—	—	—	—	—	v r	—	r
268	135	concentrica *P. & J.*,	—	—	—	—	—	—	—	—	—	—	—	—
269	135	vermiculata *d'O.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
270	136	auricula *F. & M.* sp.,	f	c	f	r	v r	f	f	r	f	v r	—	c
271	136	oblonga *Wmson.* sp.,	—	—	—	—	—	r	—	—	—	—	—	—
272	136	Brongniartii *d'O.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
273	136	haliotidea *H.-A. & E.*,	v r	—	—	—	r	—	—	—	—	f	—	—
274	137	Canariensis *d'O.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
275	137	Patagonica *d'O.* sp.,	—	—	—	—	—	—	—	1	—	—	—	—
276	137	crassa *d'O.* sp.,	v r	—	—	—	—	—	—	1	—	—	—	f
277	138	truncatulinoides *d'O.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
278	138	Karsteni *Rss.* sp.,	—	—	—	—	—	—	—	—	—	r	f	—
279	138	elegans *d'O.* sp.,	—	—	—	—	—	—	—	—	—	—	—	—
280	139	Rotalia Beccarii *Linné* sp.,	1	v r	r	c	v r	c	—	r	r	c	v c	1
281	139	orbicularis *d'O.* sp.,	—	—	—	—	—	—	—	—	—	—	v r	1
282	139	perlucida n. sp.,	—	—	—	—	—	—	—	—	—	—	v c	—

15	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	No.
f	c	r	v c	v c	c	f	v c	f	f	c	v c	f	v c	c	r	c	r	c	f	v c	247
r	l	f	v r	v r	—	f	—	—	v r	l	—	—	—	—	v r	—	c	r	—	—	248
—	—	—	—	—	—	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	249
v r	—	f	—	l	—	f	l	—	—	—	—	—	—	—	—	—	—	—	—	—	250
r	l	f	f	v r	—	f	—	—	—	—	—	—	—	c	—	—	—	—	—	—	251
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	252
l	—	—	—	—	—	l	—	—	—	—	—	—	—	—	—	v r	—	—	—	—	253
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—	—	—	—	l	—	v r	l	—	—	—	f	—	v r	v r	—	f	—	—	l	—	255
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—	—	f	—	—	r	v r	—	l	—	—	—	—	—	—	—	—	—	—	—	l	257
f	c	f	c	f	r	r	v r	r	c	f	f	r	v c	r	r	c	f	f	c	f	258
f	—	l	l	f	c	c	c	f	v r	r	c	f	v r	—	l	r	v r	c	r	c	259
c	c	c	v c	c	v c	v c	f	c	c	v c	r	c	c	v c	f	c	v c	v c	c	v c	260
r	f	f	r	—	—	v r	—	—	—	l	—	—	r	f	—	—	c	c	—	—	261
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	r	—	—	—	—	262
—	—	—	—	—	l	l	v r	r	—	—	—	—	—	—	—	—	—	—	—	—	263
l	—	l	—	—	—	l	—	l	v r	—	—	—	—	v r	—	—	f	—	—	—	264
—	—	—	v r	v r	f	f	c	r	—	—	f	v r	—	—	—	—	l	f	—	r	265
—	—	—	—	v r	—	r	r	—	—	—	r	—	—	—	—	—	—	—	—	f	266
l	—	v r	—	—	—	v r	—	l	—	—	l	—	—	v r	—	—	—	—	—	—	267
—	—	—	—	—	l	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	268
—	—	—	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	269
l	r	—	v r	v r	r	f	v r	f	—	c	v r	—	r	v r	l	r	l	l	l	l	270
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	v r	r	—	—	—	—	271
—	—	—	—	—	—	—	—	—	—	—	—	—	—	v r	—	—	—	—	—	—	272
r	—	l	—	l	—	c	—	—	v r	r	r	—	—	c	f	l	f	—	—	—	273
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f	—	—	—	v r	—	—	—	—	—	—	—	—	c	f	—	—	—	—	l	l	276
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l	—	—	—	l	—	r	—	—	—	—	—	—	—	v r	v r	—	—	—	—	—	278
—	l	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	279
v c	f	f	c	v r	r	r	f	v r	—	f	r	v r	v r	f	—	c	c	r	r	—	280
—	r	—	—	—	—	f	—	—	—	f	r	—	—	f	f	—	—	—	—	—	281
—	—	f	r	—	—	c	l	l	—	—	—	—	—	—	f	—	c	r	—	—	282

No.	Page.	Species.	1	2	3	4	5	6	7, 10 11	8	9	12	13	14
283	140	Gypsina globulus *Rss.* sp., . .	—	—	1	c	—	—	—	1	—	—	—	—
284	140	vesicularis *P. & J.* sp., . .	1	1	f	c	f	f	—	f	c	v r	—	v r
285	141	inhaerens *Schultze* sp., . .	v c	c	f	v c	v c	c	v c	c	v c	v c	r	f
		Family **Nummulinidae.**												
286	142	Nonionina depressula *W. & J.* sp., .	v c	—	f	c	r	r	v c	c	r	v r	c	c
287	142	umbilicatula *Mont.* sp., . .	—	—	—	—	—	—	—	—	—	—	—	—
288	143	pompilioides *F. & M.* sp., .	—	—	—	—	—	—	1	—	—	—	—	—
289	143	asterizans *F. & M.* sp., . .	r	—	—	1	—	—	—	r	—	v c	v c	v r
290	144	stelligera *d'O.*, . . .	—	f	—	—	—	—	—	r	—	v r	f	—
291	144	pauperata *B. & W.*, . .	—	—	—	—	—	—	—	—	—	f	r	—
292	145	Boueana *d'O.*, ...	—	—	—	—	—	—	—	—	—	—	—	—
293	145	scapha *F. & M.* sp., . . .	—	—	—	—	—	—	—	—	—	—	—	—
294	145	turgida *Wmson.* sp., . . .	r	r	—	—	—	—	—	—	—	v r	r	—
295	145	Polystomella striato-punctata *F. & M.* sp.	c	v r	c	r	r	r	f	f	r	v c	v c	c
296	146	arctica *P. & J.*, . . .	—	—	—	—	—	—	—	—	—	—	—	—
297	146	crispa *Linné* sp., . . .	v c	f	f	v r	r	c	v c	c	f	c	v c	r
298	147	macella *F. & M.* sp., . .	f	—	c	r	r	f	—	f	f	c	v c	v r
299	147	Operculina ammonoides *Gronovius* sp.,	—	—	—	—	—	—	—	—	1	1	1	—

15	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	No.
—	—	—	—	—	—	—	f	—	—	r	l	—	—	—	—	—	—	—	—	—	283
—	—	—	f	r	f	v r	f	c	v r	f	l	—	—	—	—	—	—	f	—	—	284
l	r	r	c	r	f	f	f	v c	—	c	c	v r	r	v r	—	r	v r	r	v r	c	285
c	c	c	c	f	f	f	r	v r	r	f	c	v r	f	r	f	c	v c	r	r	r	286
l	—	—	—	—	—	—	—	—	—	f	—	—	—	—	v r	—	l	—	l	—	287
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	288
r	f	c	—	f	c	v c	c	—	v r	f	f	—	c	c	l	c	r	r	r	—	289
v r	—	—	—	—	—	v r	—	—	—	r	—	—	—	—	—	—	—	—	—	—	290
l	—	—	—	—	—	l	—	—	—	—	—	—	—	—	—	l	v r	—	l	—	291
—	—	—	—	—	—	—	—	—	v r	—	—	—	—	—	—	—	—	—	—	—	292
l	—	f	—	—	—	l	—	—	—	l	—	—	v r	v r	v r	l	v r	—	—	—	293
r	f	f	f	—	—	—	—	v r	—	—	v r	—	f	c	r	f	v r	l	—	—	294
f	c	c	r	r	f	r	r	r	r	r	r	v r	f	v r	f	c	r	r	f	f	295
—	—	—	—	—	—	f	—	—	—	—	—	—	—	—	—	—	—	—	—	—	296
v c	f	r	f	r	f	f	r	r	l	r	c	v r	r	v r	l	f	r	r	r	f	297
v r	l	f	f	v r	r	v r	—	—	—	—	—	—	—	v r	r	r	r	f	—	f	298
l	—	l	—	—	—	—	l	v r	l	—	l	—	—	l	l	—	—	—	—	—	299

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1–3. Nubecularia depressa *Chapman.* ×75.
4. Biloculina elongata *d'Orbigny.* ×75.
5–6. „ depressa *d'Orbigny.* ×75.
7. Spiroloculina grata *Terquem.* ×120.
8. „ acutimargo *Brady.* ×120.
9–10. Massilina annectens *Schlumberger.* ×75.
11. „ „ „ (Edge view.) ×75.
12. Miliolina laevigata *d'Orbigny sp.* ×35.
13. „ „ „ (Edge view.) ×35.
14. „ stelligera *Schlumberger sp.* ×75.
15. „ „ „ (Edge view.) ×75.

PLATE II.

1–2. Miliolina Candeiana *d'Orbigny sp.* ×120.
3. „ „ „ (Edge view.) ×120.
4. „ „ „ (Oral view.) ×120.
5. „ bicornis *Walker & Jacob sp.* (Abnormal.) ×75.
6. „ „ „ „ ×35.
7–8. Planispirina Cliarensis *sp. nov.* ×120.
9. Hyperammina vagans *Brady.* ×35.
10. Hippocrepina indivisa *Parker.* ×120.
11. „ „ „ (Oral view.) ×120.
12. Reophax moniliforme *Siddall.* ×70.
13. „ fiudens *Parker sp.* ×75.
14. Haplophragmium glomeratum *Brady.* ×75.
15. „ latidorsatum *Bornemann sp.* ×120.
16. „ „ „ (Edge view.) ×120.

Plate III.

1. Bathysiphon argenteus *sp. nov.* (Entire specimen.) ×75.
2. „ „ „ (A portion of the tube.) ×200.
3. „ „ „ („ viewed as a transparent object.) ×650.
4. Haplophragmium anceps *Brady.* ×120.
5. „ Canariense *d'Orbigny sp.* (Plastogamic pair.) ×120.
6. Ammodiscus Shoneanus *Siddall sp.* ×120.

7 and 9. Trochammina squamata *Jones & Parker.* (Superior view.) ×75.

8 and 10. „ „ „ (Inferior view.) ×75

11. „ rotaliformis *Wright.* (Superior view.) ×120.
12. „ „ „ (Inferior view.) ×120.
13. „ „ „ (Edge view.) ×120.

14–16. Gaudryina rudis *Wright.* ×35.

17. „ „ „ (Apical view, showing three initial chambers laid open.) ×35.

Plate IV.

1. Verneuilina polystropha *Reuss sp.* (Normal specimen; long type.) ×120.
2. „ „ „ („ „ short type.) ×120.

3–5. „ „ „ (Minute type.) ×120.

6. Clavulina obscura *Chaster.* ×75.

7–8. Gaudryina filiformis *Berthelin.* ×75.

9. „ „ „ (Edge view.) ×75.
10. Verneuilina pygmaea *Egger sp.* ×120.
11. Bulimina minutissima *Wright.* (Oral view.) ×120.
12. „ „ „ (Superior view.) ×120.
13. „ subteres *Brady.* (Superior view.) ×120.
14. „ „ „ (Oral view.) ×120.
15. Bolivina aenariensis *Costa sp.* ×75.

16–18. „ inflata *sp. nov.* ×200.

19. „ „ „ (Edge view.) ×200.
20. Pulvinulina punctulata *d'Orbigny sp.* (Superior view.) ×120.
21. „ „ „ (Inferior view.) ×120.

Plate V.

1. Bolivina tortuosa *Brady.* ×75.
2. „ limbata *Brady.* ×75.
3. „ „ „ (By dark-ground illumination, showing the central columella.) ×75.
4. „ gramen *d'Orbigny sp.* ×120.
5. „ „ „ (Edge view.) ×120.
6. Cassidulina nitidula *Chaster sp.* (Viewed as a transparent object in optical section. The chambers of the superior series tinted, the inferior series plain.) ×265.
7. „ „ „ (The same in different focal plane.) ×265.
8. „ „ „ (Opaque; superior view.) ×300.
9. „ „ „ („ inferior view.) ×300.
10–11. Seabrookia Earlandi *Wright.* ×120.
12. „ „ „ (Edge view.) ×120.

Plate VI.

1. Lagena ovum *Ehrenberg sp.* ×120.
2. „ Stewartii *Wright.* ×120.
3. „ „ „ (Oral view.) ×120.
4. „ chrysalis *sp. nov.* ×120.
5. „ laevis *Montagu sp.* (Curved type.) ×75.
6. „ „ „ *var.* distoma *Silvestri.* ×75.
7. „ curvilineata *Balkwill & Wright.* ×75.
8. „ Lyellii *Seguenza sp.* ×75.
9. „ Malcomsonii *Wright.* ×120.
10. „ Millettii *Chaster.* ×120.
11. „ forficula *sp. nov.* ×200.
12. „ falcata *Chaster.* (Globose type.) ×120.
13. „ „ „ (Oval type.) ×200.

Plate VII.

1–2. Lagena unguis *sp. nov.* × 120.
3. „ „ „ (Edge view.) × 120.
4. marginata *var.* semi-carinata *Sidebottom.* × 200.
5. „ marginato-perforata *Seguenza.* × 200.
6. „ „ „ „ (Edge view.) × 200.
7. „ lagenoides *var.* tenuistriata *Brady* (Trigonal specimen.) × 120.
8. „ ornata *Williamson sp.* × 200.
9. „ Rizzae *Seguenza sp.* × 120.
10. „ clathrata *Brady.* × 75.
11–12. „ squamosa *var.* Montagui *Alcock sp.* (Compressed type.) × 75.
13. „ „ „ „ „ (Globose type.) × 75.
14. „ fimbriata *Brady.* × 120.
15. „ „ *var.* occlusa *Sidebottom.* × 120.
16. „ cymbula *sp. nov.* (Superior view.) × 200.
17. „ „ „ (Inferior view.) × 200.
18. „ „ „ (Edge view.) × 200.
19–20. „ protea *Chaster.* × 75.

Plate VIII.

1. Nodosaria simplex *Silvestri.* × 120.
2. „ soluta *Reuss sp.* × 120.
3. Lingulina carinata *var.* bicarinata *Sidebottom.* × 200.
4. „ „ „ „ „ (Viewed as a transparent object.) × 200.
5–7. „ biloculi *Wright.* × 200.
8. „ armata *Sidebottom.* × 200.
9. „ carinata *d'Orbigny.* × 200.
10. „ pellucida *Sidebottom.* × 120.
11. „ quadrata *sp. nov.* × 200.
12. Frondicularia spathulata *Brady.* × 200.
13. „ translucens *sp. nov.* × 200.
14. „ pygmaea *Sidebottom.* × 200.

15. Cristellaria acutauricularis *Fichtel & Moll sp.* × 120.
16. Polymorphina lactea *Walker & Jacob sp.* (Double specimen.) × 75.
17. „ oblonga *Williamson.* (Depauperate type.) × 120.
18–19. „ myristiformis *Williamson.* × 50.

Plate IX.

1. Spirillina vivipara *Ehrenberg.* (Plastogamic pair.) × 200.
2. „ Groomii *Chapman.* (Superior view.) × 200.
3. „ „ „ (Inferior view.) × 200.
4. „ lucida *Sidebottom.* (Superior view.) × 120.
5. „ „ „ (Inferior view.) × 120.
6. „ obconica *var.* carinata *Halkyard.* (Superior view.) × 200.
7. „ „ „ „ „ (Inferior view.) × 200.
8–9. „ obconica *Brady.* × 200.
10. „ limbata *var.* denticulata *Brady.* × 120.
11. Patellina corrugata *Williamson.* × 120.
12. Discorbina Mediterranensis *d'Orbigny sp.* (Superior view.) × 75.
13. „ „ „ (Inferior view.) × 75.
14. „ „ „ (Edge view.) × 75.

Plate X.

1. Discorbina Mediterranensis *d'Orbigny sp.* (Laid open, showing young brood.) × 200.
2–3. „ irregularis *Rhumbler.* (Superior view.) × 75.
4. „ „ „ (Inferior view.) × 75.
5. „ Millettii *Wright.* (Superior view.) × 120.
6. „ „ „ (Inferior view.) × 120.
7. „ „ „ (Edge view.) × 120.
8. „ Praegeri *sp. nov.* (Superior view.) × 120.
9. „ „ „ (Inferior view.) × 120.
10. „ „ „ (Edge view.) × 120.

Plate XI.

1. Discorbina Peruviana *d'Orbigny sp.* (Superior view.) × 120.
2. „ „ „ (Inferior view.) × 120.
3. „ „ „ (Edge view.) × 120.
4. „ mamilla *Williamson sp.* (Superior view.) × 120.
5. „ „ „ (Inferior view.) × 120.
6. „ „ „ (Edge view.) × 120.
7. „ rosacea *d'Orbigny sp.* (Superior view.) × 120.
8. „ „ „ (Inferior view.) × 120.
9. „ „ „ (Edge view.) × 120.
10. „ planorbis *d'Orbigny sp.* (Superior view.) × 120.
11. „ „ „ (Inferior view.) × 120.
12. „ „ „ (Edge view.) × 120.

Plate XII.

1. Discorbina baccata *sp. nov.* (Superior view.) × 120.
2. „ „ „ (Inferior view.) × 120.
3. „ „ „ (Edge view.) × 120.
4. „ Wrightii *Brady.* (Plastogamic pair.) × 75.
5. „ pustulata *sp. nov.* (Superior view.) × 120.
6. „ „ „ (Inferior view.) × 120.
7. „ „ „ (Edge view.) × 120.
8. Pulvinulina Brongniartii *d'Orbigny sp.* (Superior view.) × 120.
9. „ „ „ (Inferior view.) × 120.
10–11. Discorbina polyrraphes *Reuss sp.* (Superior view.) × 200.
12. „ „ „ (Inferior view.) × 200.
13. „ „ „ (Edge view.) × 200.

Plate XIII.

1. Discorbina Chasteri *nom. nov.* (Oval type.) × 265.
2. „ „ „ (Circular type ; superior view.) × 265.
3. „ „ „ („ „ ; inferior view.) × 265.
4. „ „ *var.* bispinosa *var. nov.* × 265.
5. Pulvinulina Patagonica *d'Orbigny sp.* (Superior view.) × 120.
6. „ „ „ (Inferior view.) × 120.
7. Rotalia perlucida *sp. nov.* (Superior view.) × 75.
8. „ „ „ (Inferior view.) × 75.
9. „ „ „ (Edge view.) × 75.
10. Gypsina globulus *Reuss sp.* × 120.
11. „ vesicularis *Parker & Jones sp.* (Hollowed specimen). × 75.
12. Nonionina asterizans *Fichtel & Moll sp.* (Side view.) × 120.
13. „ „ „ (Edge view.) × 120.
14. Polystomella crispa *Linné sp.* (Spinous adult type.) × 50.

ADDENDA.

p 7. The references to species of Discorbina in the preliminary list of stations and noteworthy forms must be considered in connexion with our note on the classification of the genus (p 110), as the preliminary lists were drawn up before the revision had been fully considered.

p 31, No 33. *Miliolina stelligera.* Schlumberger's species must not be confounded with the earlier described *Quinqueloculina stelligera* of Terquem (T 1882 FEP, p 183, Pl xx, fig 6), which is merely a variety of *M. saxorum* Lamarck sp characterized by the stellate form of the punctations on the surface.

p 82, No 159. *Lagena falcata.* The species was recorded from the Formby and Leasowe Marine Beds as a Post-pliocene (Post-glacial) fossil by Mr. J. Wright in Mr. T. M. Reade's paper on the borings at Altcar (Proc. Liverpool Geol. Soc., vol ix, 1903–4, p. 359).

p 96, No 196. The record of the genus as recent in Britain up to the present time rests upon a single minute specimen of *F. Millettii* Brady, dredged by Mr. Wright off Portrush (W 1902 FRI, p 211).

p 97, No 198. *Frondicularia spathulata.* This species must not be confused with the almost identically named *F. spatulata* Terquem (Troisième Mémoire sur les Foraminifères du système Oolithique, Metz, 1870, p 215, Pl xxii, figs 11–19), the variability of which has been discussed by Dr. R. Bruckmann (Foraminiferen des litauisch-kurischen Jura, Konigsberg, 1904, p 13, pl i, figs 18–22).

p 120. No 234. *Discorbina Mediterranensis.* Schlumberger has stated ("Feuille des jeunes Naturalistes," No 136, 1882, p 43) that Schulze and Brady have observed this phenomenon in connexion with Rotalia and Cristellaria, but the "Kugeln" described by Schulze (S 1854 OP, p 27) are not, from his description, embryos, nor are they polythalamous, and the embryonic Cristellarians described and figured by Brady (B 1884 FC, p 543, Pl lxviii, figs 1, 2) cannot be described as

perfect polythalamous young. They are rather of the nature of the primordial cells observed and so elaborately described by Mr. J. J. Lister in Lankester's "Treatise on Zoology" (Pt i, fasc. 2, p 68, fig 10), which, in their earliest stage, were essentially monothalamous, and were not yet invested with a calcareous shell. Brady's embryos must, of course, have reached the stage of a calcareous investment. (*Cf.* Heron-Allen and Earland: "Notes on British Foraminifera," Knowledge, 1910, pp 377–8.)

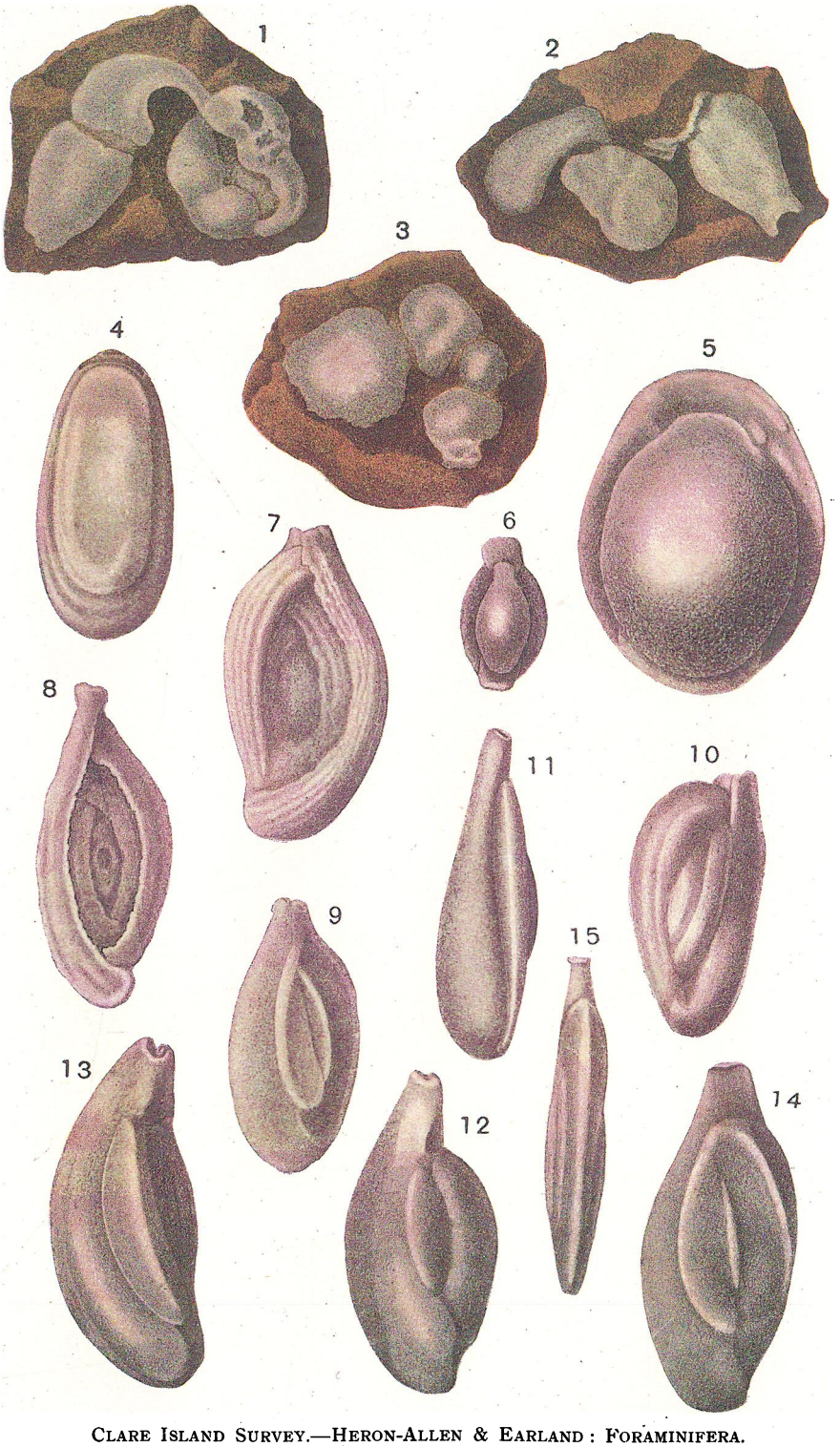
p 130. No 254. *Discorbina pustulata.* Owing to the minute size of both species, and the fact that the superior view is practically identical, it would seem desirable that specimens of *D. tuberculata* in collections should be carefully examined and their nature accurately verified.

p 137. No 276. *Pulvinulina crassa.* It would appear that this species, which was unknown to Mr. Siddall, was included in S 1879 by Brady (and also in the "Edinburgh Catalogue," B 1870 BFE) on the ground of "one or two specimens supposed to be referable to that species obtained from Mr. Jeffreys' Hebrides gatherings." Brady subsequently excluded it from B 1887 BS, on the ground that the specimens were probably *P. truncatulinoides* (B 1887 BS, p 922). Ours would therefore appear to be the first authenticated British record.

p 138, No 279. *Pulvinulina elegans.* This is a typical species in "Helga" dredgings from the deeper waters off the W. coast of Ireland.

p 145. No 293. *Nonionina scapha.* No individuals of the turgid form named by Dawson *N. Labradorica* (Canad. Nat., vol v, 1860, p 191, fig 4) were observed, though they are abundant in "Goldseeker" dredgings from the North Sea.

p 145. No 294. *Nonionina turgida.* The inaequilateral condition of the test is, however, a constant feature.



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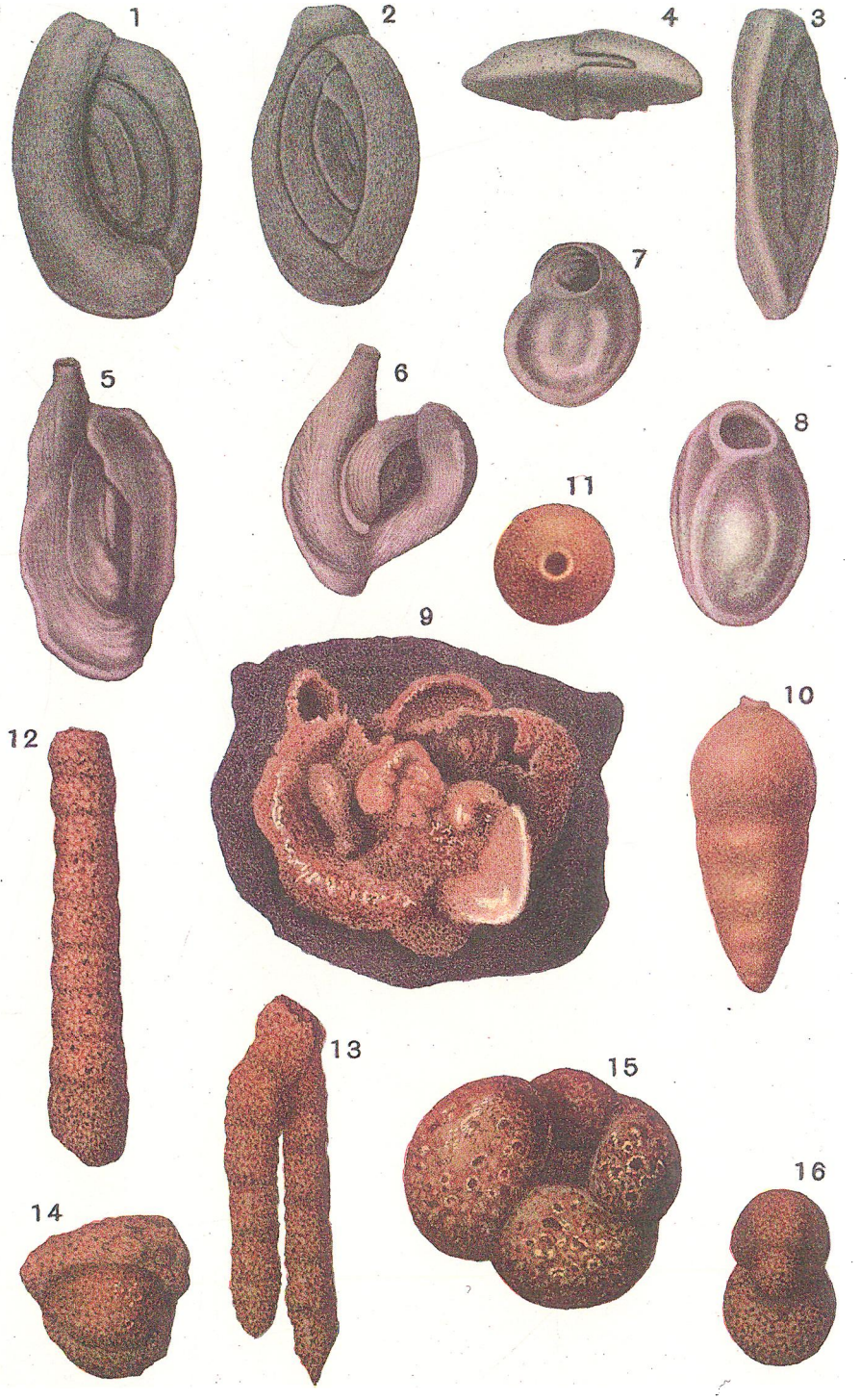

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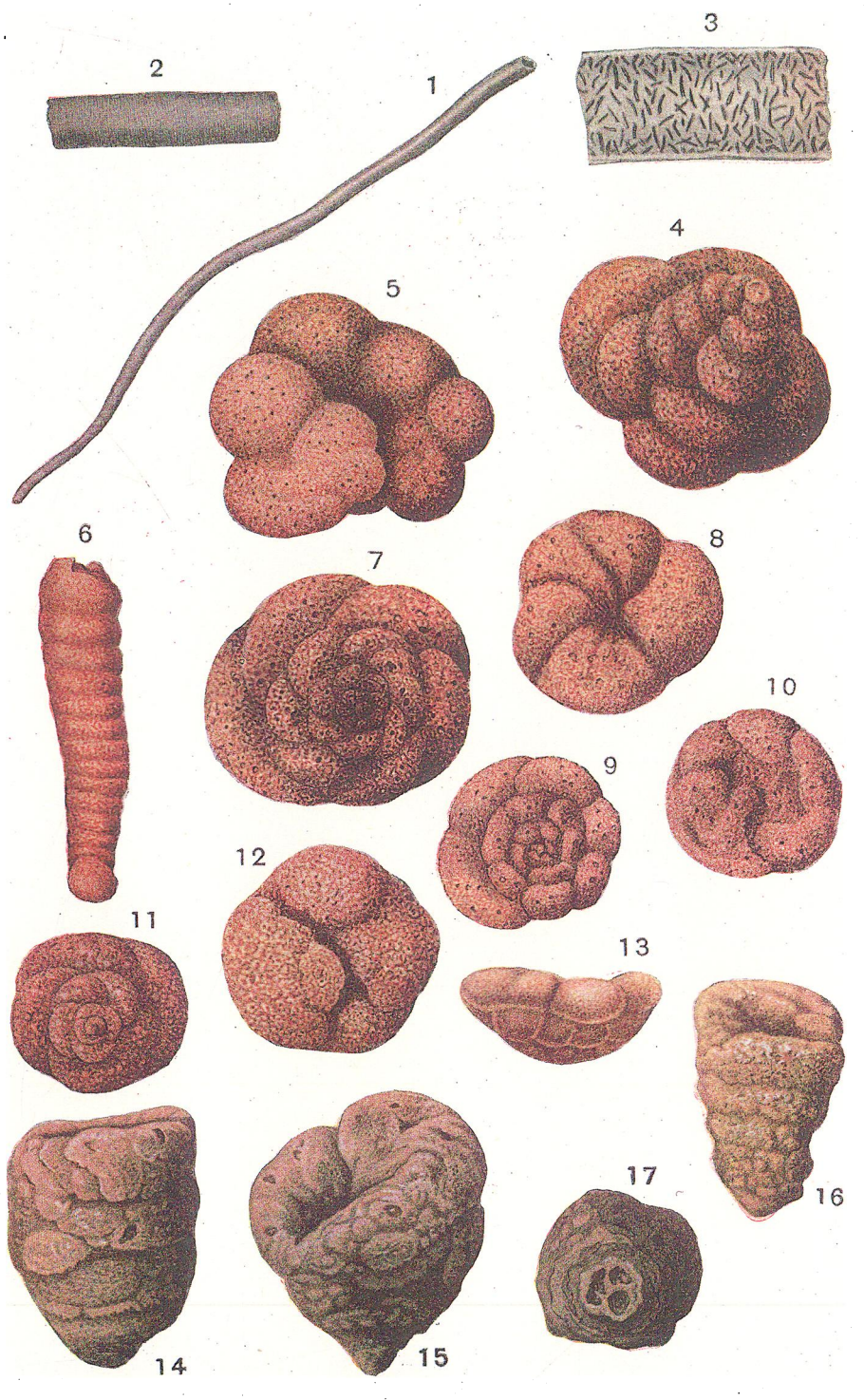

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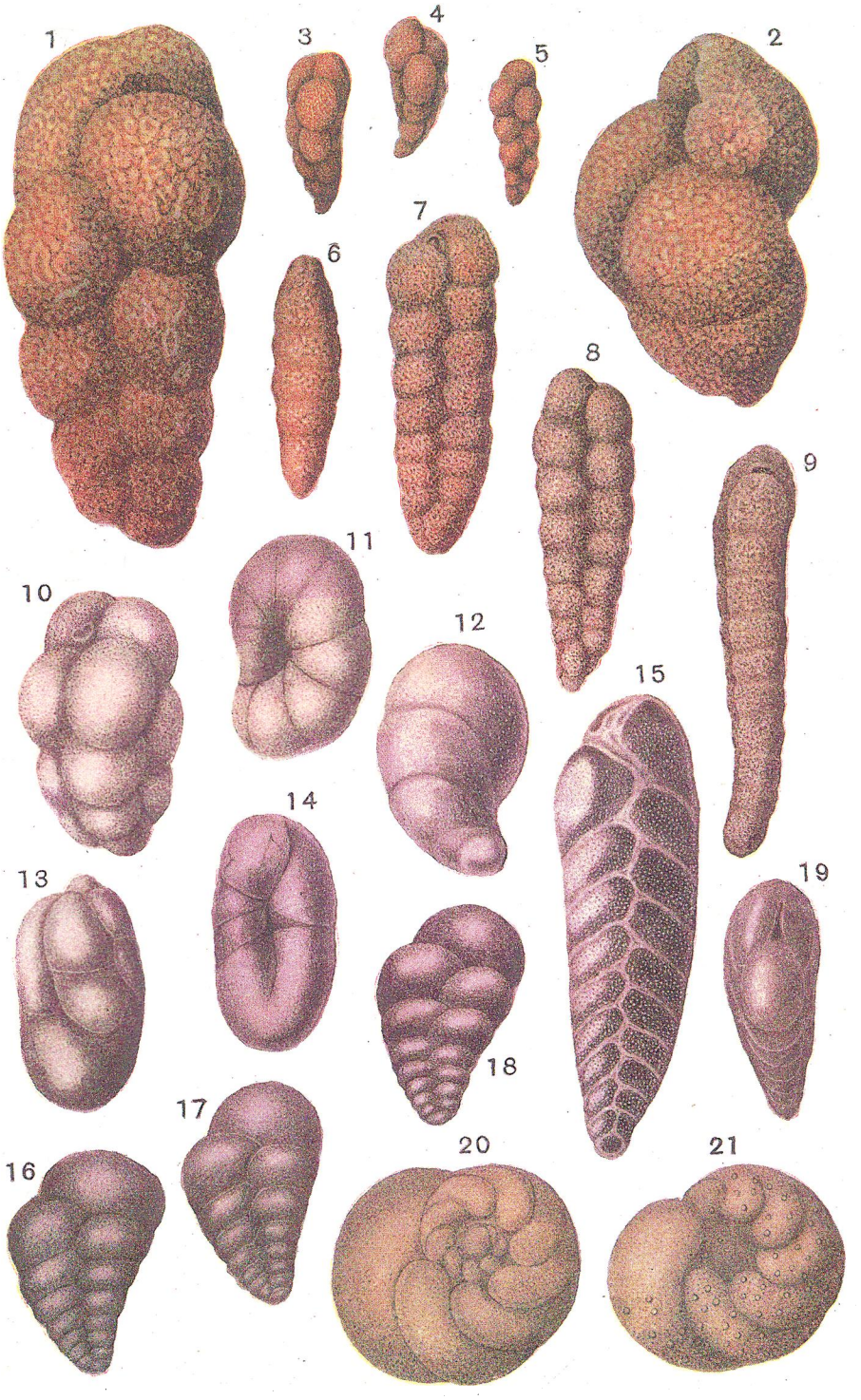

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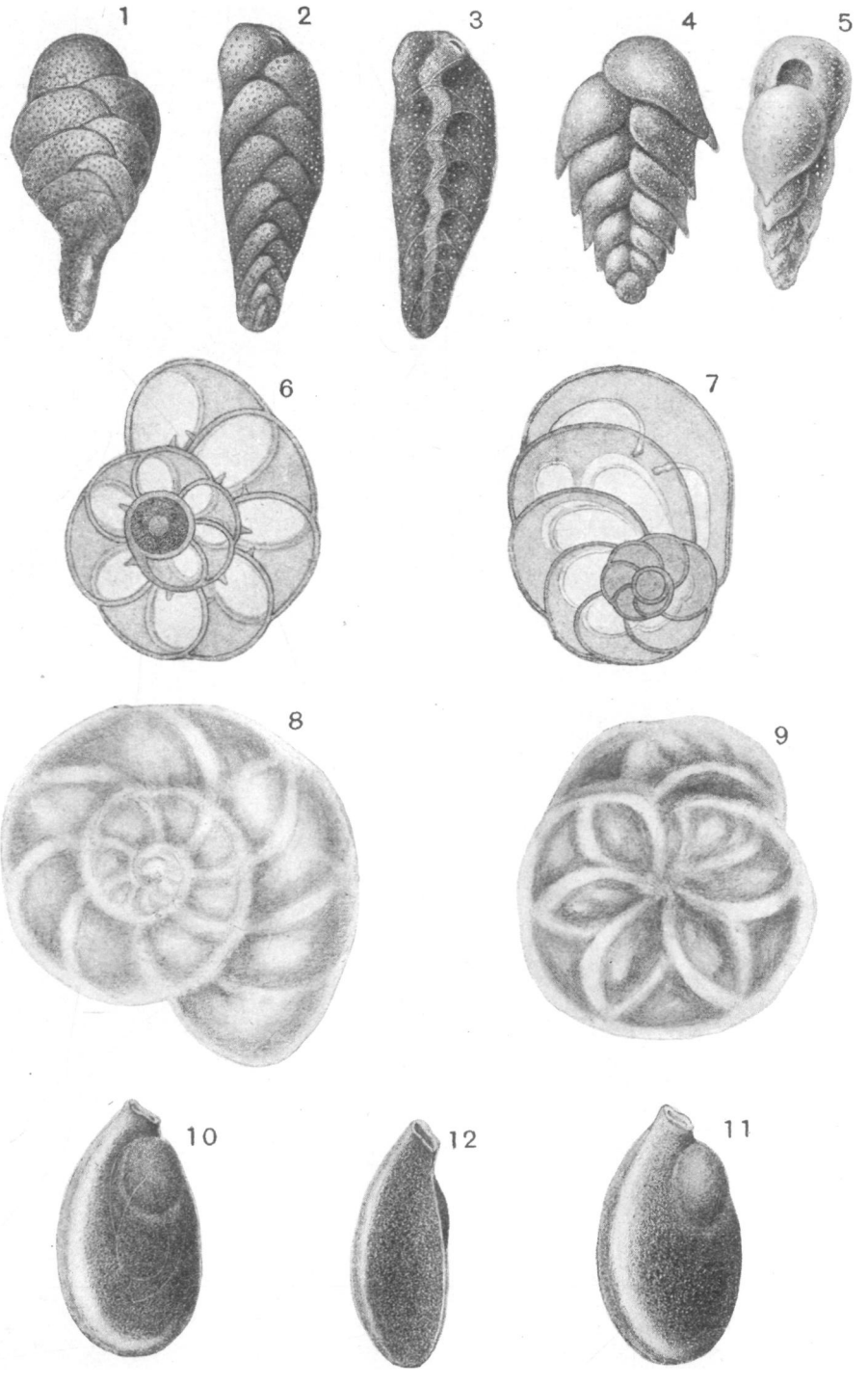

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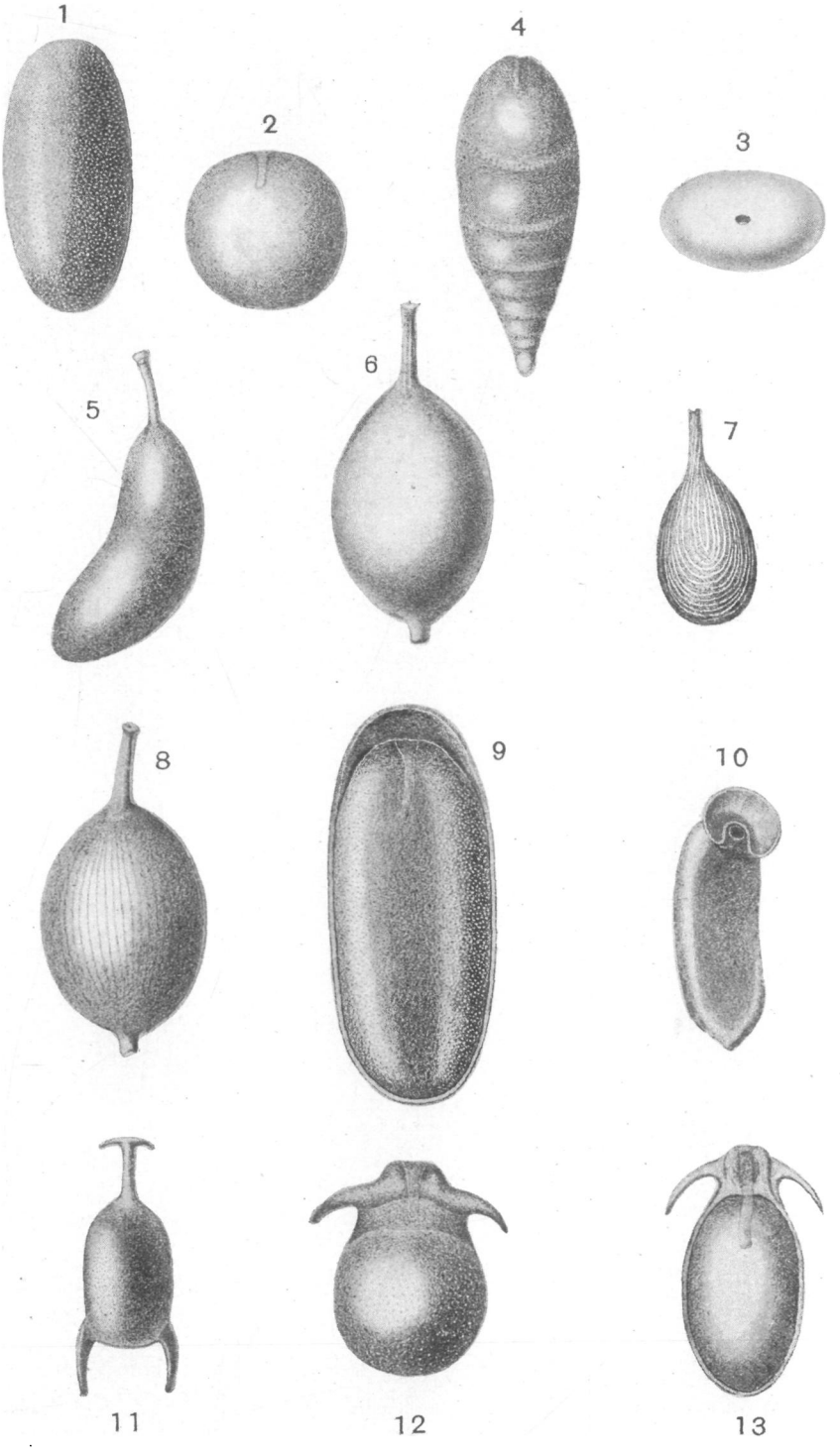

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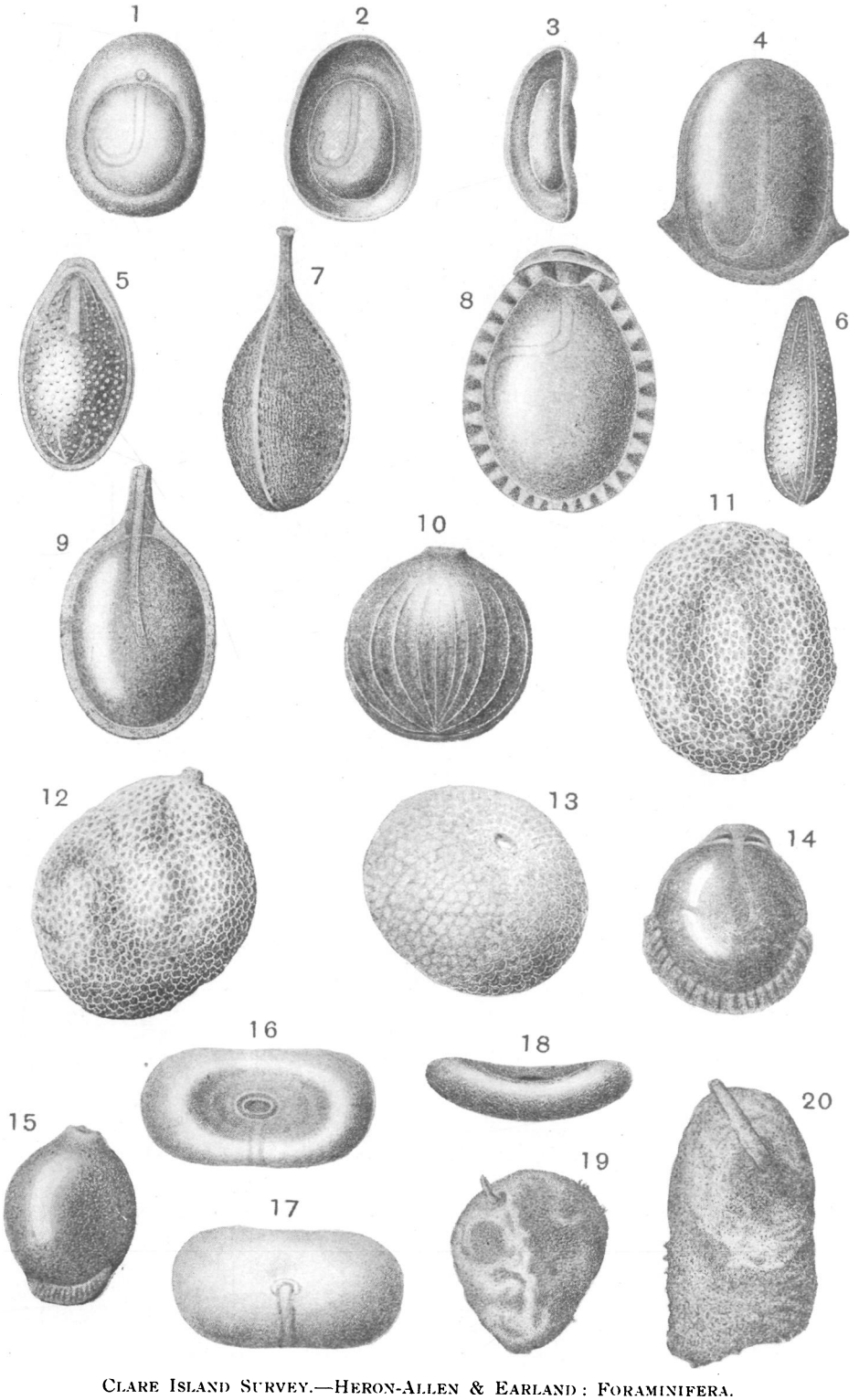

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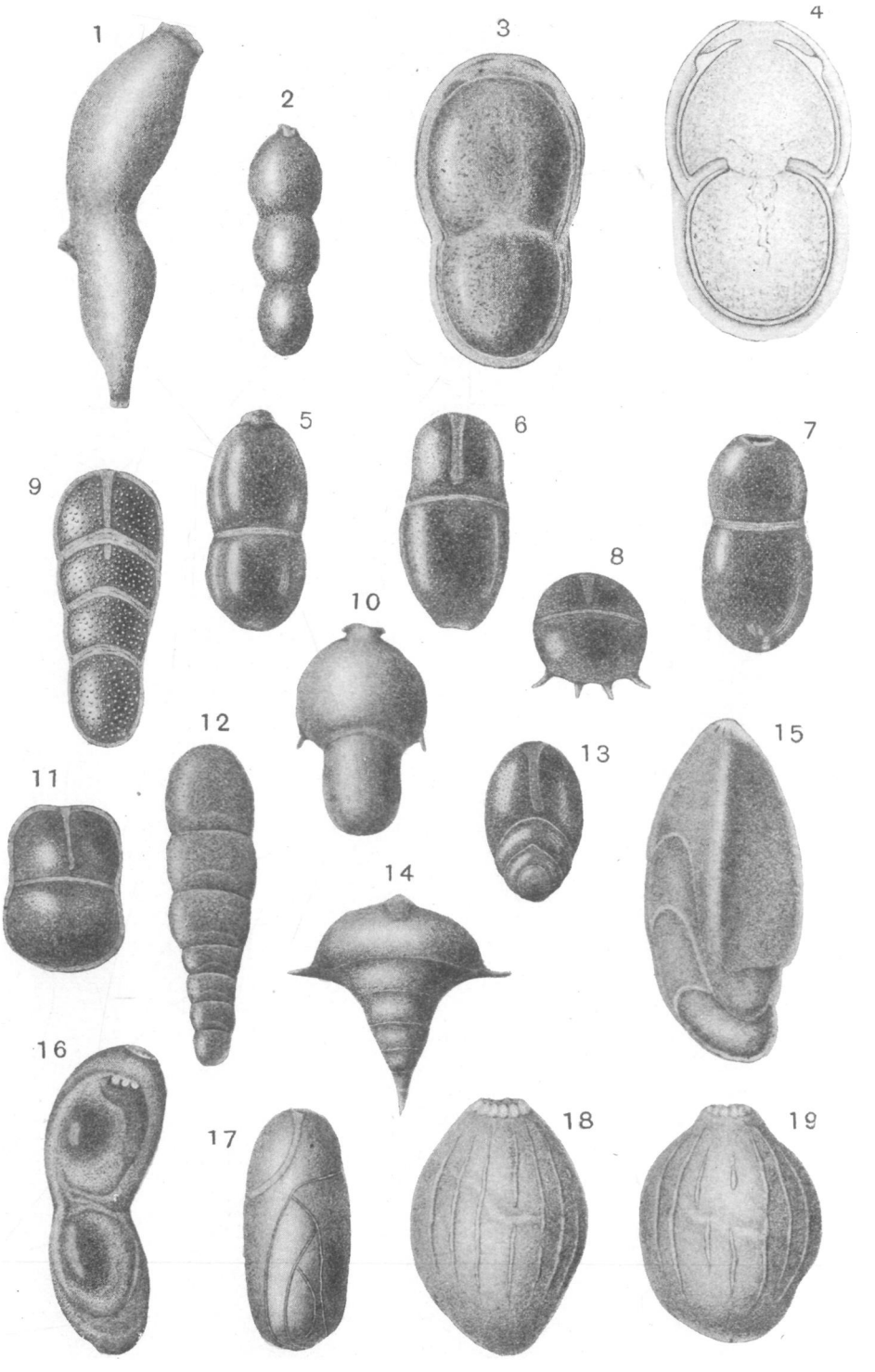

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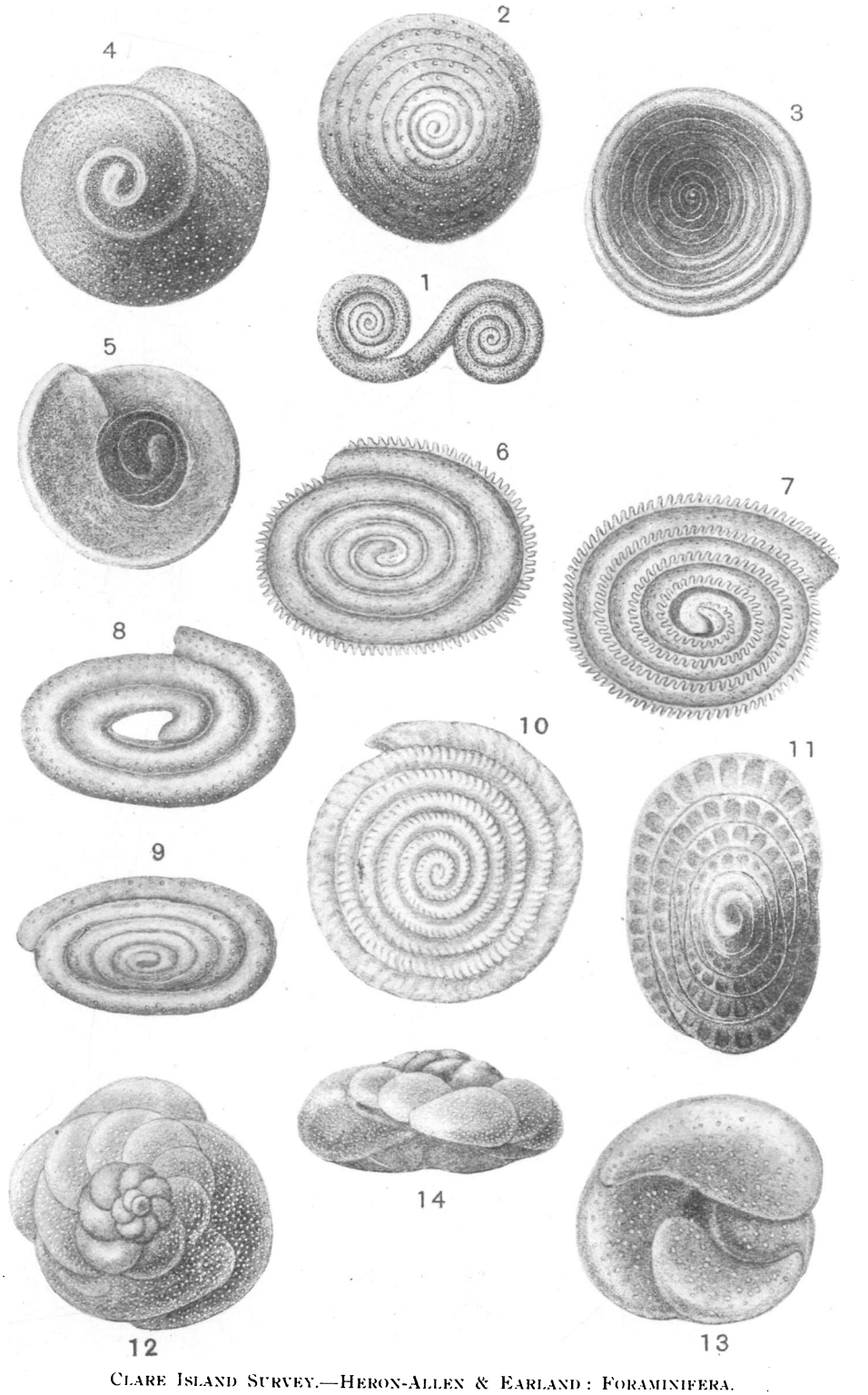

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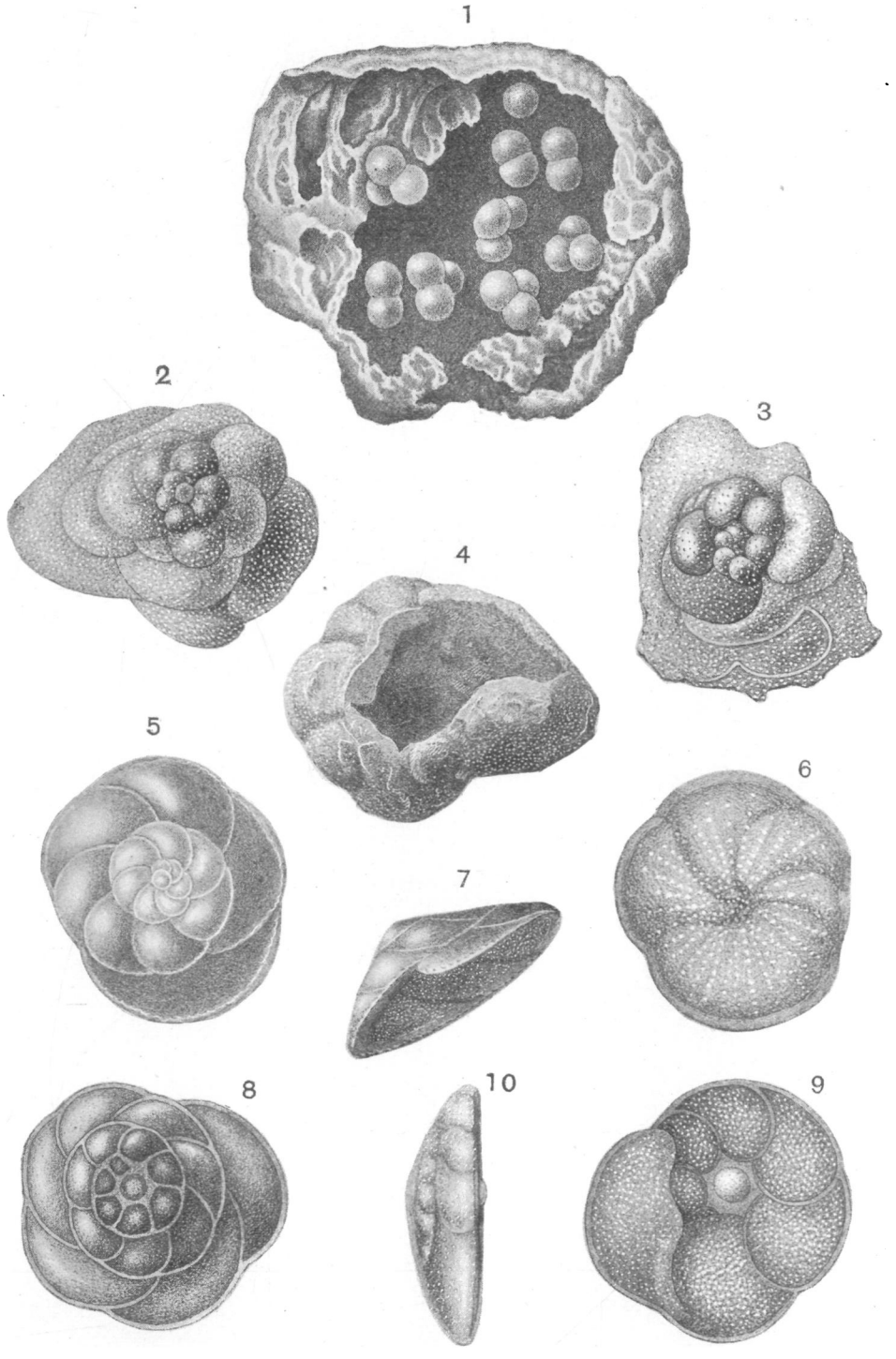

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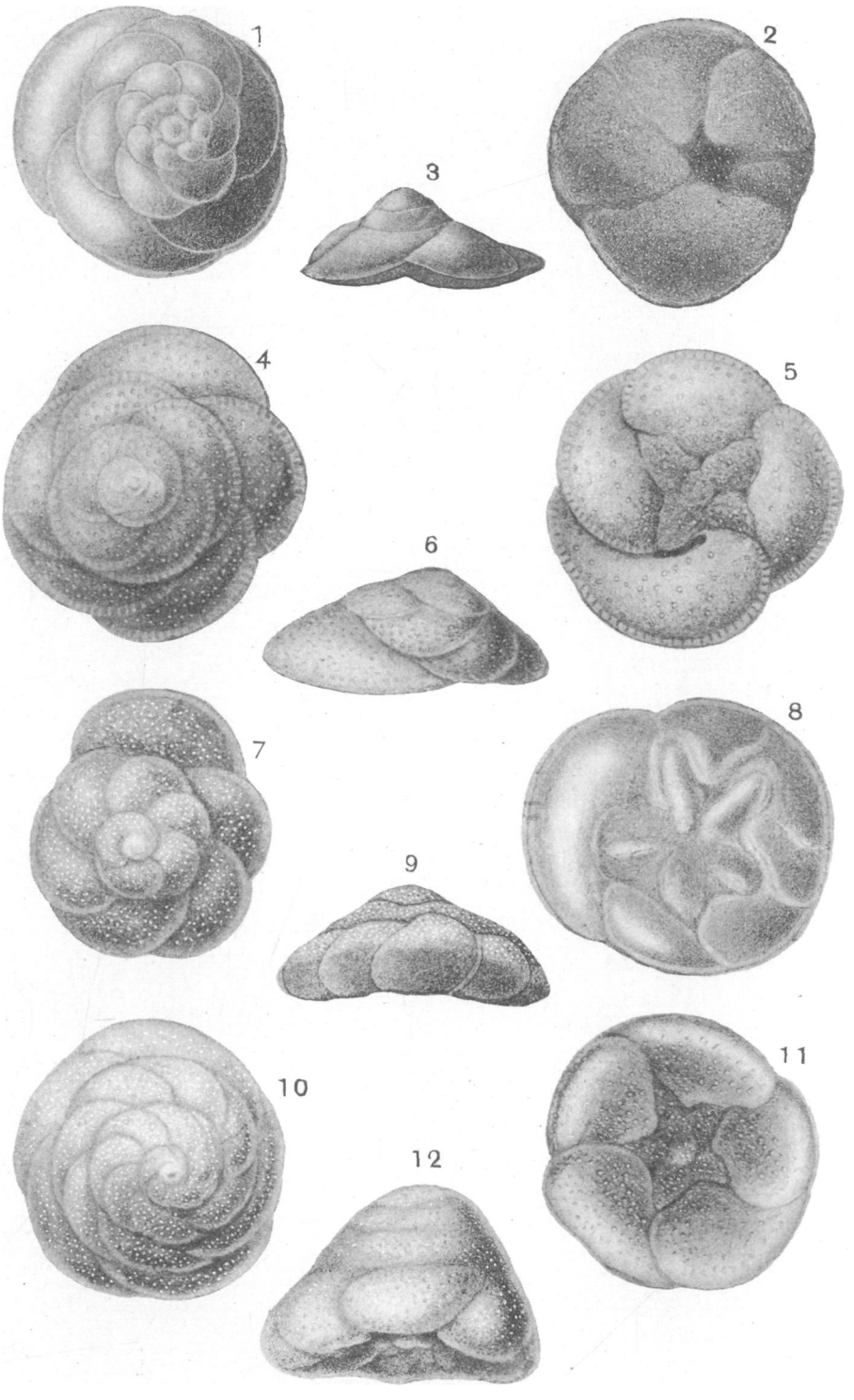

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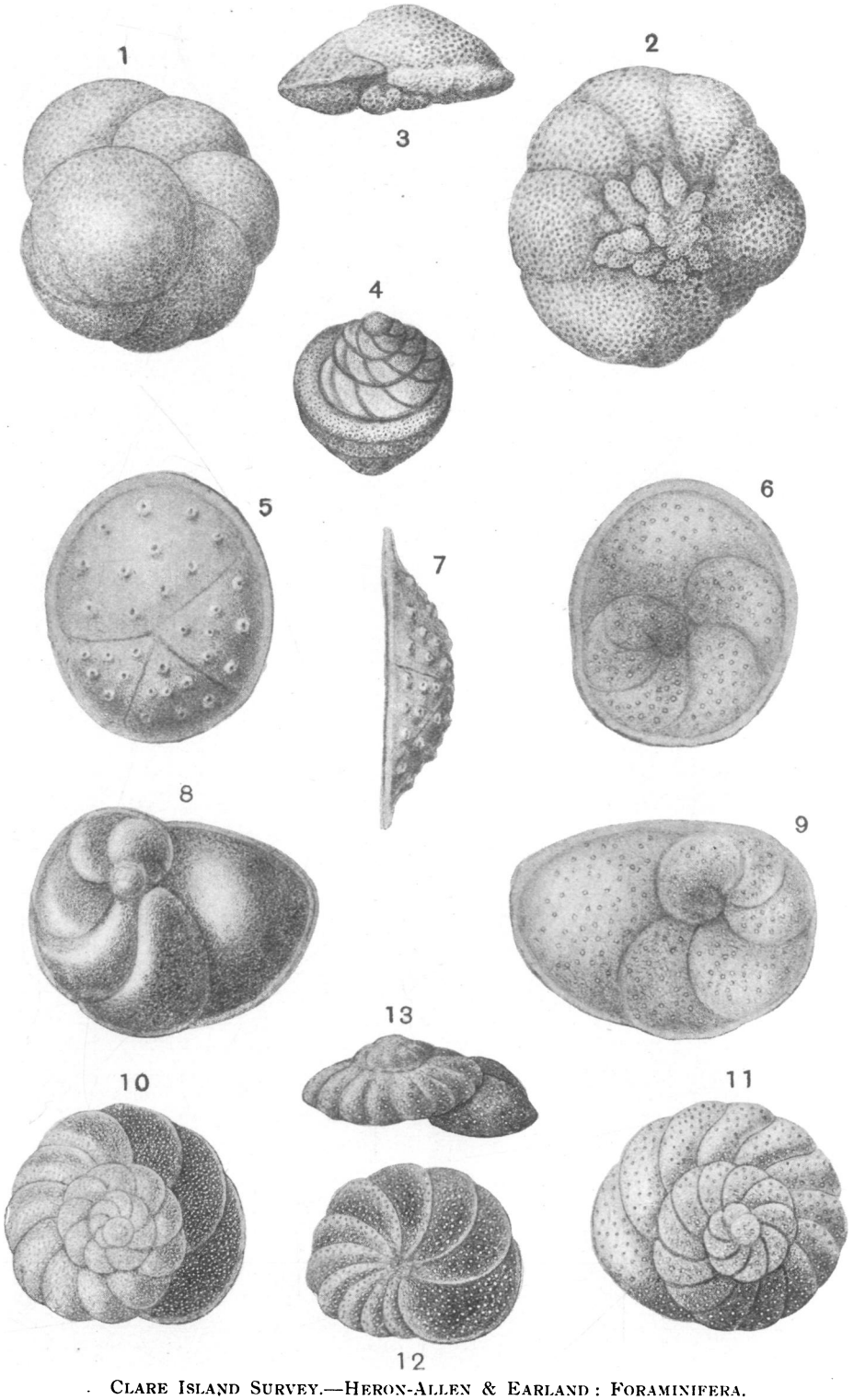

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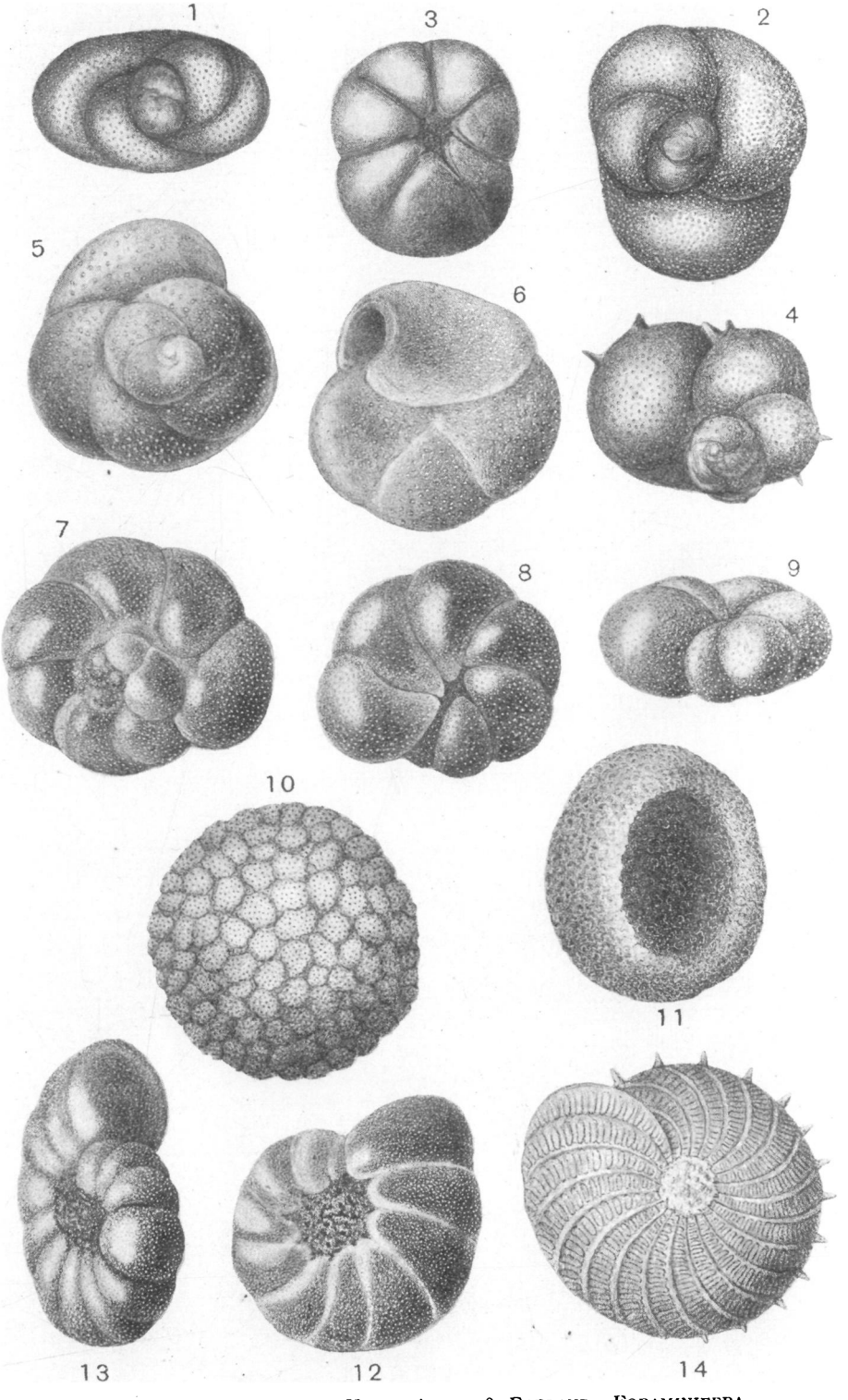

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