VI. *On some Foraminifera from the North Atlantic and Arctic Oceans, including Davis Straits and Baffin's Bay.* By W. Kitchen Parker, *F.Z.S.*, and Professor T. Rupert Jones, *F.G.S.* *Communicated by Professor* Huxley, *F.R.S.*

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Introduction.

The specimens here described are comprised in four collections; namely—

1. From Baffin's Bay, between 76° 30′ and 74° 45′ North Latitude. These specimens are derived from seven deep-sea soundings made during one of the Arctic Expeditions under Sir Edward Parry. These soundings were confided to us by Professor Huxley, of the Museum of Practical Geology, Jermyn Street, to which Institution they had been given in April 1853 by Mr. J. W. Lowry, who received them of Mr. Fisher, Assistant-Surgeon in the Expedition alluded to. The Foraminifera obtained by us from these soundings are tabulated in Tables I., IV., and VII.

This material from the "Arctic Province" of Naturalists is but scanty. None of the Foraminifera here obtained are numerous, except *Polystomella striatopunctata*, *Nonionina Scapha*, *Truncatulina lobatula*, and *Cassidulina lævigata*; the first two of which are at home in Arctic waters: and none have attained here a large size except *Lituolæ*. The material from 150 fathoms yielded these relatively large and numerous specimens.

TABLE I.—Table of the Soundings from Baffin's Bay.

No.		Depth.	Condition of bottom, &c.	Genera and subgenera of Foraminifera.
		fathoms.		
1.	Lat. 75° 10′, Long. 60° 12′..	?	Fine grey syenitic sand, with syenitic fragments $\frac{1}{4}$ inch and less in length.	Nodosarina (Dentalina), Lagena, Planorbulina (Truncatulina), Polystomella (and Nonionina), Cassidulina, Miliola (Quinqueloculina), Lituola.
2.	Lat. 76° 30′, Long. 77° 52′..	150	Greyish muddy micaceous sand, with angular syenitic fragments $\frac{1}{2}$ inch and less in length.	Globigerina, Planorbulina (Truncatulina), Pulvinulina, Polystomella (and Nonionina), Cassidulina, Lituola.
3.	Lat. 74° 45′, Long. 59° 17′..	250	Grey sandy mud; sand, quartzose, angular and rounded.	No Foraminifera.
4.	Lat. 75° 25′, Long. 60°	314	Syenitic sand, with fragments of syenite $\frac{1}{4}$ inch and less in length.	Miliola (Triloculina), Lituola.
5.	Lat. 76° 20′, Long. 76° 27′..	?	.....	No Foraminifera.
6.	Lat. 75°, Long. 59° 40′	230	Grey mud, with quartzose sand, partly rounded, and with several partly rounded fragments of lava-rock.	Planorbulina (Truncatulina), Polystomella (and Nonionina), Miliola (Quinqueloculina), Lituola.
7.	Lat. 76° 10′, Long. 76°	..	Sand from an iceberg. Grey, heavy, fine, micaceous, syenitic sand, with fragments ($\frac{3}{4}$ in. largest); some grains slightly worn.	No Foraminifera.

2. From the Hunde Islands, in South-east or Disco Bay, on the west coast of Greenland (lat. 68° 50′ W., long. 53° N.). Five soundings taken by Dr. P. C. SUTHERLAND (now Surveyor-General of Natal) in 1850, and confided to us by Professor HUXLEY of the Museum of Practical Geology, to which Museum they were given by Dr. SUTHERLAND in 1853.

Dr. P. C. SUTHERLAND'S observations on the Arctic Regions visited by him were published in his 'Journal of a Voyage in Baffin's Bay and Barrow Straits in the years 1850-51,' 2 vols. 8vo, 1852; and in the Quart. Journ. Geol. Soc. vol. ix. p. 296, &c.

See Tables II., IV., VII. for the Foraminifera from the Hunde Islands.

TABLE II.—Table of the Dredgings and Foraminifera from the Hunde Islands, Disco Bay.

No.		Depth.	Character of bottom.	Genera and subgenera of Foraminifera.
		fathoms.		
1.	Hunde Islands ..	25 to 30	Pale-grey micaceous clay; more than half small mica-flakes. With vegetable matter (fucal); Hydrozoa (*Sertularia*); Polyzoa (*Berenicea*, &c.); Entomostraca (*Cythere*, &c.); Bivalve and univalve Mollusks. (About an ounce.)	Polymorphina, Planorbulina (Truncatulina), Pulvinulina, Polystomella (and Nonionina), Nummulina, Cassidulina, Bulimina, Textularia (and Verneuilina), Cornuspira, Miliola (Quinqueloculina, Triloculina), Lituola.
2.	,,	28 to 30	Gravel of hornblende-schist and syenite (largest fragments $1\frac{1}{2}$ inch long). Seaweed (*Fucus*); Nullipores; fragments of *Balanus* (predominant); Crustacea (*Talitrus*, *Cythere*, &c.); spines and plates of *Echinus*; Polyzoa; Univalves and Bivalves. (About 4 ounces.)	Globigerina, Planorbulina (Truncatulina), Pulvinulina, Discorbina, Polystomella (and Nonionina), Cassidulina, Miliola (Quinqueloculina), Lituola.
3.	,,	30 to 40	Shelly sandy mud. Syenitic fragments ($\frac{1}{4}$ inch and less), some rather rounded; fragments of *Balani*; *Serpulæ*; spines of *Echinus*; Bivalves and Univalves. (About 2 ounces.)	Nodosarina (Nodosaria, Cristellaria), Lagena, Polymorphina, Uvigerina, Globigerina, Planorbulina (Truncatulina), Pulvinulina, Discorbina, Polystomella (and Nonionina), Cassidulina, Bulimina (and Virgulina and Bolivina), Textularia (and Verneuilina), Patellina, Trochammina, Miliola (Quinqueloculina), Lituola.
4.	,,	50 to 70	Shelly fine sand (syenitic). *Serpula*; Bivalves and Univalves. (About 1 ounce.)	Lagena, Polymorphina, Uvigerina, Planorbulina (Truncatulina), Pulvinulina, Discorbina, Polystomella (and Nonionina), Cassidulina, Patellina, Miliola (Quinqueloculina), Lituola.
5.	,,	60 to 70	Shelly sandy mud (syenitic). *Serpula*; *Balanus* (predominant); Bivalves and Univalves. (About 1 ounce.)	Nodosarina (Dentalina, Cristellaria), Lagena, Polymorphina, Uvigerina, Globigerina, Planorbulina (Truncatulina), Pulvinulina, Discorbina, Polystomella (and Nonionina), Cassidulina, Bulimina (and Virgulina and Bolivina), Textularia (and Bigenerina and Verneuilina), Spirillina, Patellina, Trochammina, Cornuspira, Miliola (Quinqueloculina, Triloculina), Lituola.

Mr. G. S. BRADY, of Sunderland, has examined the Bivalved Entomostraca from these dredgings, and has determined the following:—

Cytheridea Bradii, *Norman*.
—— setosa, *Baird*.
Cythere costata, *Brady*.
—— protuberans, *Brady*.
—— plicata, *Reuss*.
Cythere clathrata, *Reuss*.
—— septentrionalis, *Brady*.
Jonesia simplex, *Norman*.
Cytherideis pulchra, *Brady**.

* The new species of Entomostraca from the Hunde Islands, from Norway (p. 329), and from the Atlantic (p. 334) are described and figured by Mr. BRADY in the Zool. Soc. Trans. vol. v. part 5.

Shells, &c. from the Hunde Islands, Davis Straits.

(Dredged by Dr. SUTHERLAND, October 1852: named by Dr. S. P. WOODWARD.)

Box I. 28-30 fathoms.

Balanus porcatus, *DC.* } probably: fragments much
—— crenatus, *Brug.* } water-worn.
Mya truncata. Fragment.
Saxicava arctica. Small valve.
Tellina calcaria (=proxima =lata). Fragment.
Echinus, sp. Fragments of plates and spines.

Box II. 30–40 fathoms.

Leda minuta. Odd valve (large) and fry.
Crenella decussata. Small.
Limatula sulcata.
Astarte striata. Young.
—— semisulcata. Young.
Saxicava. Fry.
Rissoa castanea.
—— scrobiculata.
Scissurella crispata.
Turritella lactea. Young.
Margarita undulata.
—— cinerea. Young.
Echinus. Small spine.
Spirorbis. Whorls furrowed.

Box III. 25–50 fathoms.

Saxicava arctica. Adult.
Lyonsia striata. Fry.
Astarte striata. Adult and fry.
Leda truncata. Fragments.
—— pygmæa. Fry.
Crenella decussata.
—— faba
Nucula tenuis. Fry.
Cardium elegantulum.
Natica pusilla (Grœnlandica). Fry.
Cylichna Gouldii. Young.
Rissoa scrobiculata.
Spirorbis.
Echinus. Spine.

Box IV. 50–70 fathoms.

Pilidium fulvum.
Acmæa. Fragment.
Chiton albus? Two valves.
Astarte striata. Fry.
Spirorbis nautilus?
——. Sulcated.

Box V. 60–70 fathoms.

Pecten Islandicus. Fragments.
Mya truncata.
Astarte borealis, var. semisulcata. Young.
—— striata.
Saxicava. Fry.
Crenella decussata.
Limatula sulcata.
Turritella lactea. Fragment.
Rissoa castanea.
—— scrobiculata.
Margarita helicina.
—— undulata. Fragment and fry.
—— cinerea. Fry.
Scissurella crispata.
Litorina obtusata. Fry.
Cemoria Noachina. Fry.
Pilidium fulvum.
Serpula.
Spirorbis.
Balanus porcatus. Tergum, and fragments of parietes.
Echinus. Fragments of spines.

The five specimens of sea-bottom above-mentioned, taken at depths of from 25 to 70 fathoms, and consisting mainly of shelly muddy sands, afford a good local example of the Foraminiferal fauna of the "Arctic Province" of Naturalists, at the "Coralline-zone" (15–50 fathoms) and the "Coral-zone" (50–100 fathoms) of Davis Straits.

Lagenæ abound in these dredgings at from 30 to 70 fathoms; *Polymorphina* is small here and rather common: *Uvigerina* common at from 30 to 70 fathoms, but small. *Globigerinæ* are not rare at the same depths, but are very small. *Truncatulina* flourishes at all the depths (25 to 70 fathoms). *Pulvinulina* is freely represented by the small *P. Karsteni*. *Discorbina* gets more abundant with the greater depth. The simpler forms of *Polystomella*, including the feeble *Nonioninæ*, have their home evidently in

this region. *Cassidulina* abounds, but is not large. A small *Nummulina*, the feeble representative of a once highly potent species, still abounding in some warm seas, is not wanting in the "Coralline-zone." The essentially Arctic form of *Bulimina* (*B. elegantissima*) flourishes at from 30 to 70 fathoms at the Hunde Islands, and other varieties are not wanting, though not abundant. The *Textulariæ* are represented by some small specimens of the type, and by three of its modifications in small but numerous individuals. *Spirillina* is very rare and small. *Patellina* is small and common from 30 to 70 fathoms. *Trochammina* is common, though small, in the deepest sounding. *Cornuspira* is common at the least and the greatest depths. *Quinqueloculina* is common, but not large, throughout. *Triloculina* occurs freely at 25 to 30 fathoms. *Lituola* abounds from 25 to 70 fathoms.

3. From the coast of Norway, between North Cape and Drontheim, from 69° to 63° N. lat. Dredgings made by Messrs. MacAndrew and Barrett in the summer of 1855.

One portion of these materials* was received from the late Mr. Lucas Barrett, in small boxes, numbered, and labelled with the depths and localities of the dredgings; another portion, received from Dr. Woodward, was the sandy refuse from a jar in which specimens of Mollusks, &c. had been preserved in spirits; and, thirdly, Dr. Bowerbank favoured us with a packet of shelly sand obtained when preparing sponges taken in the same dredgings. The latter lots of sand were manipulated and examined together†, no particular depths and localities being noted for these mixed results of dredgings in from 30 to 200 fathoms.

The series of which the exact localities and depths are known comprises seven lots; these with their characters and contents are arranged in the following Table (No. III.).

The Bivalved Entomostraca from these dredgings have been determined by Mr. G. S. Brady, as follow:—

Cythere Minna, *Baird.*
—— spinosissima, *Brady.*
—— clathrata (varieties), *Reuss.*
Cythere catenata, *Brady.*
Cytheridea Bradii, *Norman.*
Cytherella Beyrichi, *Reuss.*

* These Norwegian Foraminifera have already been noticed and illustrated by us in the Annals of Nat. Hist. 2 ser. vol. xix. pp. 273, &c., pls. 10 & 11 (1857); we are, however, desirous of emending some of the descriptions there given, as well as the nomenclature and classification in several points; and these Foraminifers are here brought into association with their allies of the neighbouring ocean.

† The specimens from this mixed material are grouped together in pl. 10 of the Ann. Nat. Hist. 2 ser. vol. xix.

TABLE III.—Table of the Norwegian Dredgings and Foraminifera.

No.	Locality.	Depth in fathoms.	Character of sea-bottom, &c.	Genera, &c.
1.	East of Rolfs Oe, or Bred Sound, Finmark. Lat. 71°, long. 24°.	30	Gravel	Miliola (Biloculina, Quinqueloculina), Lituola, Polymorphina, and Planorbulina (Truncatulina and Anomalina).
2.	Omnoes Oe, Nordland (half-a-mile from the shore; Woodward's 'Manual,' p. 434). Lat. 66° 45′, long. 13° 25′.	40	Gravel	Miliola (Quinqueloculina), Planorbulina (Truncatulina and Anomalina).
3.	West Fjord, Nordland. About lat. 68° 15′, long. 14° 30′.	60	Sand.....	Miliola (Quinqueloculina), Nodosarina (Dentalina), Pulvinulina, Planorbulina (Truncatulina).
4.	Bodoe, Nordland. Lat. 67° 15′, long. 14° 18′.	70–100	Sand.....	Miliola (Biloculina, Quinqueloculina), Planorbulina (Truncatulina and Anomalina).
5.	Vigten Islands (Inner Passage), Drontheim. Lat. 65° 47′, long. 11° 5′.	100	On sponge .	Pulvinulina.
6.	Finmark (half-a-mile from shore: see Woodward's 'Manual,' p. 435).	150	Sand.....	Miliola (Quinqueloculina), Planorbulina (Truncatulina).
7.	Arctic Circle, Nordland. Lat. 66° 30′, long. 12° 45′.	160	Mud.....	Miliola (Biloculina), Nodosarina (Glandulina, Nodosaria, Dentalina, Marginulina, Cristellaria), Planorbulina (Truncatulina and Anomalina).
8.	Various localities between the North Cape and Drontheim.	20–300	Various ..	Miliola (Quinqueloculina), Lituola, Lagena (and Entosolenia), Nodosarina (Dentalina), Nummulina (Operculina), Polystomella (and Nonionina), Discorbina, Spirillina, Planorbulina (Truncatulina and Anomalina), Globigerina, Polymorphina, Uvigerina, Cassidulina, Bulimina, Textularia, Valvulina.

The Norwegian Foraminifera are tabulated with those from Baffin's Bay and Davis Straits in Table IV., and with those from the North Atlantic in Table VII.

Mr. MACANDREW, who has kindly supplied us with latitude and longitude of the localities in the foregoing list, informs us that "these dredgings were all taken in sheltered situations among the islands and near shore; occasionally a mile or two from land, and frequently nearer. That at Omnoes Oe was made from the boat, and *commenced* very near shore. The others in the list were made from the yacht, when we required more room."

Compared with the group of Foraminifera obtained at the Hunde Islands at similar depths, those from the Norway coast present considerable differences; and this is mainly owing to the fact that the specimens given us from the seven Norwegian dredgings were only the larger and more conspicuous of a probably rich fauna; but also, partly, because the coast of Norway (excepting the neighbourhood of North Cape) lies in the "Boreal Province," and is far less under the chilling influence of floating ice than the American coasts to the westward. The dredging from Rolfs Oe was taken within the "Arctic Province." The mixed sands obtained from the shells and sponges of Messrs. MACANDREW and BARRETT'S dredgings, and examined by ourselves, yielded many representatives of the forms native to the Coralline- and the Coral-zone, though chiefly of small size.

The most interesting fact to be pointed out is the relatively great abundance of large

TABLE IV.—Distribution of Foraminifera in the Arctic Ocean, off the Coas

rl. Rather large. *l.* Large. *vl.* Very large. *m.* Middle-sized. *s.* Small. *vs.* Very small. VC.
RR. Rather rare. R. Rare. VR. Very rare.

Genera, Species, and Varieties.	1 Hunde Islands, Davis Straits, 25 to 30 fms.	2 Hunde Islands, Davis Straits, 28 to 30 fms.	3 Hunde Islands, Davis Straits, 30 to 40 fms.	4 Hunde Islands, Davis Straits, 50 to 70 fms.	5 Hunde Islands, Davis Straits, 60 to 70 fms.	6 Baffin's Bay, No. 1. Lat. 75° 10′ N., Long. 60° 12′ W.	7 Baffin's Bay, No. 2, 150 fms. Lat. 76° 30′ N., Long. 77° 52′ W.	8 Baffin's Bay, No. 3, 250 fms. Lat. 74° 45′ N., Long. 59° 17′ W.	9 Baffin's Bay, No. 4, 314 fms. Lat. 75° 25′ N., Long. 60° W.	10 Baffin's Bay, No. 5. Lat. 76° 20′ N., Long. 76° 27′ W.	11 Baffin's Bay, No. 6, 220 fms. Lat. 75° N., Long. 59° 40′ W.	12 Baffin's Bay, No. 7. Sand from an Iceberg. Lat. 76° 10′ N., Long. 78° W.
Glandulina lævigata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..
Nodosaria Radicula, Linn.	..	..	*rl* R	..	..	..	..	..	..	..	..	..
Dentalina pauperata, D'O.	..	..	..	..	*m* R	*m* R						
—— communis, D'O.	..	..	..	..	*l* R	*l* R	..	..	..	..	..	..
—— guttifera, D'O.	..	..	..	..	..	..	..	..	..	..	..	..
Vaginulina linearis, Montag. ..	..	..	..	..	..	..	..	..	..	..	..	..
Marginulina Lituus, D'O.	..	..	..	..	..	..	..	..	..	..	..	..
Cristellaria Crepidula, F. & M. ..	..	..	*s* C	..	*s* C							
—— cultrata, Montf.	..	..	..	..	..	..	..	..	..	..	..	..
—— rotulata, Lam.	..	..	..	..	..	..	..	..	..	..	..	..
Lagena distoma, P. & J.	..	..	..	..	..	..	..	..	..	..	..	..
—— polita, P. & J.	..	..	..	..	..	..	..	..	..	..	..	..
—— lævis, Montag.	..	..	..	..	..	..	..	..	..	..	..	..
—— semistriata, Will.	..	..	..	*m* RC								
—— striatopunctata, P. & J. ..	..	..	*l* RC									
—— sulcata, W. & J.	..	..	*l* C	*m* C	*vl* VC	..	..	..	..	..	..	..
—— Melo, D'O.	..	..	*m* C	*m* C	*m* C	..	..	..	..	..	..	..
—— globosa, Montag.	..	..	*m* C	..	*m* C	*l* R						
—— caudata, D'O.	..	..	*s* R									
—— squamosa, Montag.	..	..	..	*s* RC	..	..	..	..	..	..	..	..
—— marginata, Montag.	..	..	*m* C	*m* C	*m* C	..	..	..	..	..	..	..
Polymorphina lactea, W. & J. ..	*s* C	..	..	*s* RC	*s* C	..	..	..	..	..	..	..
—— compressa, D'O.	..	..	*s* R	..	..	..	..	..	..	..	..	..
—— tubulosa, D'O.	..	..	..	..	..	..	..	..	..	..	..	..
Uvigerina pygmæa, D'O.	..	..	*s* C	*s* RC	*s* C	..	..	..	..	..	..	..
—— angulosa, Will.	..	..	..	..	..	..	..	..	..	..	..	..
Globigerina bulloides, D'O.	..	*s* RR	*vs* C	..	*s* RC	..	*vs* R	..	..	..	..	..
Truncatulina lobatula, W. & J. ..	*s* C	*l* VC	*l* C	*l* C	*l* C	*m* C	*m* C	..	..	..	*s* RC	..
Anomalina coronata, P. & J.	..	..	..	..	..	..	..	..	..	..	..	..
Pulvinulina punctulata, D'O. ..	..	..	..	..	..	..	..	..	..	..	..	..
—— Karsteni, Reuss	*s* R	*s* RC	*m* VC	*s* C	*m* C	..	*s* RC					
—— Micheliniana, D'O.	*s* R											
Discorbina obtusa, D'O.	..	*l* R	*l* RC	..	*l* C							
—— globularis, D'O.	..	..	*s* RC	*s* C	*m* C	..	..	..	..	..	..	..
Polystomella crispa, Linn.	*s* R											
—— striatopunctata, F. & M. ..	*m* C	*m* C	*m* VC	*m* C	*m* VC	*vs* R	*m* C	..	..	..	*vs* VR	..
—— Arctica, P. & J.	*m* C	*l* C	*l* C	*l* C	*l* C							
Nonionina asterizans, F. & M. ..	*s* C											
—— Faba, F. & M.	*m* RR	..	*l* RC	..	*l* C							
—— Scapha, F. & M.	*m* C	..	*l* C	*m* RC	*l* C	*m* R	*m* VC					
—— depressula, W. & J.	*s* C	*s* C	..	*s* C	*m* C							
—— stelligera, D'O.	*s* C	*s* C	*s* C	*s* C	*s* C	..	..	..	..	..	..	..
—— umbilicatula, Montag.	..	..	..	..	..	..	..	..	..	..	*m* R	..
Pullenia sphæroides, D'O.	..	..	..	..	..	..	..	..	..	..	..	..
Nummulina planulata, Lam.	*s* RC											
Operculina ammonoides, Gronov.	..	..	..	..	..	..	..	..	..	..	..	..
Cassidulina lævigata, D'O.	*m* VC	*m* VC	*m* VC	*m* C	*m* VC	*m* R	*m* C	..	..	..	..	..

HE COASTS OF GREENLAND AND NORWAY.

VC. Very common. C. Common. RC. Rather common.

y rare.

Lat. 75° N., Long. 59° 40 W.	12	13	14	15	16	17	18	19	20
	Baffin's Bay, No. 7. Sand from an Iceberg. Lat. 76° 10′ N., Long. 76° W.	Norway, No. 1, 30 fms. East of Rolfs Oe, or Bred Sound, Finmark.	Norway, No. 2, 40 fms. Omnoes Oe, Nordland.	Norway, No. 3, 60 fms. West Fjord, Nordland.	Norway, No. 4, 70 to 100 fms. Bodoe, Nordland.	Norway, No. 5, 100 fms. Vigten Island (Inner Passage), Drontheim.	Norway, No. 6, 150 fms. Finmark.	Norway, No. 7, 160 fms. Arctic Circle, Nordland.	Norway, No. 8, 30 to 200 fms. Var. loc. between Drontheim and N. Cape.
.	..	..	..	..	..	..	..	*l* C	
.	..	..	..	..	..	..	..	*l* C	
.	..	..	..	..	..	..	..	..	*vs* VR
.	..	..	..	*l* R	..	..	..	*l* R	
.	..	..	..	..	..	..	..	..	*s* RC
.	..	..	..	..	..	..	..	*vl* C	
.	..	..	..	..	..	..	..	*l* C	
.	..	..	..	..	..	..	..	*l* C	
.	..	..	..	..	..	..	..	..	*l* RC
.	..	..	..	..	..	..	..	..	*s* RC
.	..	..	..	..	..	..	..	..	*s* R
.	..	..	..	..	..	..	..	..	*m* RC
.	..	..	..	..	..	..	..	..	*m* RC
.	..	..	..	..	..	..	..	..	*s* RC
.	..	..	..	..	..	..	..	..	*s* RC
.	..	..	..	..	..	..	..	..	*s* RC
.	..	..	..	..	..	..	..	..	*s* RC
.	..	*m* R	..	..	..	..	..	..	*m* R
.	..	..	..	..	..	..	..	..	*m* C
.	..	..	..	..	..	..	..	..	*m* C
.	..	..	..	..	..	..	..	..	*s* RR
C	..	*l* C	*l* C	*l* C	*l* C	..	*l* C	*l* C	*m* C
.	..	*l* C	*l* C	..	*l* C	..	..	*l* C	*m* C
.	..	..	..	*vl* R	..	*vl* C			
.	..	..	..	..	..	..	..	..	*m* C
R	..	..	..	..	..	..	..	..	*s* RR
.	..	..	..	..	..	..	..	..	*s* C
R	..	..	..	..	..	..	..	..	*m* VC
.	..	..	..	..	..	..	..	..	*vs* RC
.	..	..	..	..	..	..	..	..	*s* VC
.	..	..	..	..	..	..	..	..	*s* C

Pullenia sphæroides, D'O.	..	..	..	..	..	..	..	..	..	..	..	..
Nummulina planulata, Lam.	*s* RC											
Operculina ammonoides, Gronov.	..	..	..	..	..	..	..	..	..	..	..	..
Cassidulina lævigata, D'O.	*m* VC	*m* VC	*m* VC	*m* C	*m* VC	*m* R	*m* C	..	..	..	..	..
—— crassa, D'O.	..	*s* C	*m* C	*s* C	*s* C	..	*s* C					
Bulimina Pyrula, D'O.	..	..	..	..	..	..	..	..	..	..	..	..
—— aculeata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..
—— elegantissima, D'O.	*m* R	..	*l* C	..	*l* C							
Virgulina Schreibersii, Czjzek	..	..	*l* R									
—— squamosa, D'O.	..	..	*s* R	..	*s* R	..	..	..	..	..	..	..
Textularia agglutinans, D'O.	*s* RC	..	*s* R	..	..	..	..	..	..	..	..	..
—— pygmæa, D'O.	..	..	..	..	..	..	..	..	..	..	..	..
—— biformis, P. & J.	..	..	..	..	*s* C							
Bigenerina Nodosaria, D'O.	..	..	..	..	*s* C							
Verneuilina polystropha, Reuss	*s* C	..	*s* C	..	*s* VC							
Valvulina conica, P. & J.	..	..	..	..	..	..	..	..	..	..	..	..
Spirillina vivipara, Ehrenb.	..	..	..	..	*s* R	..	..	..	..	..	..	..
Patellina corrugata, Will.	..	..	*s* C	*s* RC	*s* C							
Trochammina squamata, P. & J.	..	..	*s* R	..	*s* C							
—— gordialis, P. & J.	..	..	..	..	*s* C							
Cornuspira foliacea, Phil.	*m* C	..	..	..	*s* C							
Quinqueloculina Seminulum, Linn.	*s* C	*m* C	*s* C	*s* C	*m* C	*vs* R	..	..	..	..	*s* R	..
—— Ferussacii, D'O.	..	..	*m* C	..	*m* C							
—— agglutinans, D'O.	..	..	*m* R	..	*m* C	*m* R						
—— subrotunda, Montag.	..	..	..	..	*s* C							
Triloculina cryptella, D'O.	..	..	..	..	..	..	..	..	*m* C			
—— tricarinata, D'O.	*s* C	..	..	..	*s* R							
—— oblonga, Montag.	*s* C											
Biloculina ringens, Lam.	..	..	..	..	..	..	..	..	..	..	..	..
Lituola Canariensis, D'O.	*l* VC	*l* R	*l* C	*s* C	*l* VC	*m* C	*vl* C	..	*m* C	..	*s* R	..
—— globigeriniformis, P. & J.	..	..	*s* C	*s* RC	*s* RC	*s* C	..	..	*s* R	..	*s* R	
—— Scorpiurus, Montf.	*l* C	..	*l* C	..	..	*m* C	*vl* RC					

.	..	..	..	..	..	..	..	..	*vs* RC
.	..	..	..	..	..	..	..	..	*s* VC
.	..	..	..	..	..	..	..	..	*s* C
.	..	..	..	..	..	..	.	..	*l* C
.	..	..	..	..	..	..	..	..	*m* C
.	..	..	..	..	..	..	..	..	*l* R
.	..	..	..	..	..	..	..	..	*m* RC
.	..	..	..	..	..	..	..	..	*m* C
.	..	..	..	..	..	..	..	..	*s* R
.	..	..	..	..	..	..	..	..	*s* R
R	..	*l* C	*l* C	*l* C	*l* C	..	*l* C	*l* C	*m* C
.	..	*l* C	..	..	*l* C	..	..	*l* C	
R	..	*l* R	..	..	..	..	..	..	*s* RC
R									

Nodosarinæ, at 160 fathoms, just within the Arctic Circle,—such forms as are known under the subgeneric names of *Glandulina*, *Nodosaria*, *Dentalina*, *Marginulina*, and *Cristellaria*, and are abundant in some warm seas at less depths, and in the fossil state in the Chalk and other deposits of Secondary and Tertiary age. Where the "Celtic Province" (under the name "Virginian") impinges on the American coast of the Atlantic, between lat. 30° and lat. 50° N., some soundings made by the Coast-survey of the United States, at from 20 to 105 fathoms, yielded to Professor BAILEY'S search several *Dentalinæ*, *Marginulinæ*, and *Cristellariæ* of good size. (See Appendix II.)

The Mollusca obtained by Messrs. MACANDREW and BARRETT at Omnoes Oe, Nordland, at from 30 to 50 fathoms, half-a-mile from shore (the dredging No. 2 in our list above), are enumerated in Dr. WOODWARD'S 'Manual of Mollusca, Recent and Fossil,' p. 434; and a list of the shells from an equivalent dredging to our No. 6 (if not the same) is given at p. 435.

4. From the North Atlantic Ocean, between 52° 25′ and 48° north latitude. Deep-sea soundings in the North Atlantic between Ireland and Newfoundland, made in Her Majesty's Ship 'Cyclops,' by Lieut.-Commander JOSEPH DAYMAN, in June and July 1857. See the Admiralty Report, with map and plates, and an Appendix by Professor HUXLEY, 8vo, 1858. Thirty-nine of these soundings, from 43 to 2350 fathoms, were examined. See Table V. and Map, Plate XII.

The materials confided to us were small portions (about thimblefuls) of thirty-nine selected soundings, from out of a hundred and two.

This collection affords as fair an exposition of the Foraminiferal fauna of the particular tract of sea-bottom examined as the limited amount of material brought up by the sounding-machine can be expected to give. The other materials (organic and inorganic) besides Foraminifera are shown in Tables VI. & XII.

Three soundings, at from 43 to 90 fathoms off the coast of Ireland, at about 30 miles, 60 miles, and 75 miles off shore respectively (Nos. 39 [102], 38 [100], 37 [99]), indicate the Foraminifera there inhabiting the "Coral-zone"; here the *Nodosarinæ* are rare and small; *Lagenæ* rather more common; *Orbulina* still more common; *Globigerina* rare; the *Rotalinæ* (*Planorbulina*, *Discorbina*, *Rotalia*, and *Pulvinulina*) are represented, though not at all abundantly. *Polystomella* has its northern form (*P. striatopunctata*) here and little else; *Cassidulina*, *Uvigerina*, *Bulimina*, and *Textularia* are plentiful; *Miliola* and *Lituola* are comparatively poor both in number and size.

At different depths, ranging from 223 to 415 fathoms further westward along the line of soundings, and nearly to the brink of the marginal plateau, this same fauna, with some exceptions and a few additions, continues; but *Globigerina* increases in size and numbers; and so do *Planorbulina Ungeriana* and *Pulvinulina Menardii*, with its subvariety *Micheliniana*.

Beyond and at the foot of the marginal plateau, the first sounding (15° 6′ W. long.) is at 1750 fathoms, and here we find very few Foraminifera, only *Orbulina*, *Globigerina*, *Pulvinulina Canariensis*, and *Cassidulina*, the two latter being small and rare. Further

westward, however, along the wide abyssal depths (to about 45° 30′ W. long.), even at more than 2000 fathoms, we find a larger fauna, of but few species, among which *Orbulina* and *Globigerina* are characteristically abundant (especially the latter), and are accompanied by *Lagena* (rare), *Discorbina*, *Uvigerina*, *Rotalia Soldanii*, *Pulvinulina Menardii*, *P. Micheliniana*, and *P. Canariensis*, occasional specimens of *Pullenia*, a few *Nonioninæ* and *Polystomellæ* (*P. striatopunctata*), a few *Buliminæ*, very few *Textulariæ*, and scattered small *Miliolæ* and *Lituolæ*. In the western portion of this territory the fauna is somewhat poorer, where naturalists have drawn the southern portion of their "Boreal Province."

Rising the western slope from the abyss (40° 45′ to 49° 23′ W. long., parallel to the northern end of the Bank of Newfoundland), we enter the great southern angle of the "Arctic Province," and the Foraminiferal fauna continues to have much the same elements; but *Globigerina* and *Orbulina* have become rarer; *Miliolæ* are very rare; *Planorbulina* comes in, *Pulvinulinæ* disappearing after the first upslant of the bottom at 45° 45′ W. long.

From 50° 14′ 30″ to 52° 44′ W. long., we are still off the northern edge of the Newfoundland Bank; and, though the depth decreases from 405 fathoms to 161 and then to 112 fathoms, Foraminifera are extremely rare, owing, without doubt, chiefly to the coldness of ice-laden water. *Truncatulina*, *Pulvinulina*, *Polystomella*, and *Uvigerina* seem to struggle for existence here, where "Arctic" conditions are extended southwards.

At 52° 56′ and thence to 53° 57′ 35″ W. long. the line of soundings is in Trinity Bay, with depths varying from 124 to 195 fathoms. Only very scarce *Globigerinæ*, a few *Pulvinulinæ*, some *Nonioninæ*, rather more of the very persistent *Cassidulinæ*, and a very few *Uvigerinæ*, *Buliminæ*, and *Lituolæ* appear to inhabit this unfavourable locality at the depths examined. In fact this region belongs to the "Arctic Province," which is here prolonged southwards towards the Bank of Newfoundland by the influence of cold currents and icebergs.

With the exception of the westerly soundings, these deep-sea gatherings from the North Atlantic illustrate the Foraminifera of the "Celtic Province"; but necessarily lack, as a fauna, the complementary shallow-water forms,—namely, those living in the Coralline, Laminarian, and Littoral Zones, at depths less than 40 fathoms.

The materials from Davis Straits (Hunde Islands) above-mentioned serve to illustrate only for the "Arctic Province" the Foraminiferal inhabitants of the Coralline-Zone; and therefore do not fulfil the requirements of this case. We may take, however, as a term of comparison the list of the Recent Foraminifera of the British Isles, described by Professor WILLIAMSON, but classified (and partly renamed) after the plan here adopted, and augmented by later researches (including those by Mr. H. B. BRADY, F.L.S.); and we thus have before us, in these combined lists, a synopsis of the Foraminiferal fauna of the "Celtic Province." (See Table IX. in Appendix V.)

The deep-sea Foraminiferal fauna of the North Atlantic differs from the fauna of the Coralline, Laminarian, and Littoral Zones of the "Celtic Province" chiefly in having fewer varieties and (generally) smaller individuals of *Nodosarina*, *Lagena*, *Polystomella*

TABLE V.—Table showing the presence of Foraminifera

vl. Very large. *l.* Large. *m.* Middle-sized. *rs.*

Typical Species.	Genera, Species, and Varieties.	Arctic Province (Trini					
		1 Lat. 48° 0′ 30″ N. Long. 53° 27′ 35″ W. No. 53, 195 fms.	2 Lat. 48° 0′ 10″ N. Long. 53° 26′ 36″ W. No. 49, 129 fms.	3 Lat. 48° 9′ N. Long. 53° 15′ W. No. 47, 190 fms.	4 Lat. 48° 15′ 30″ N. Long. 53° 13′ W. No. 39, 124 fms.	5 Lat. 48° 9′ 45″ N. Long. 53° 10′ 50″ W. No. 45, 150 fms.	6 Lat. 48° 11′ N. No. 41, 129 fms.
1. Nodosarina Raphanus, Linn.	Nodosaria Raphanus, Linn.	..	..	..	..	..	.
	—— scalaris, Batsch.	..	..	..	..	..	.
	Dentalina communis, D'O.	..	..	..	..	..	.
	Cristellaria Crepidula, F. & M.	..	..	..	..	..	.
	—— cultrata, Montf.	..	..	..	..	..	.
2. Lagena sulcata, W. & J.	Lagena sulcata, W. & J.	..	..	..	..	..	.
	—— lævis, Montag.	..	..	..	..	..	.
	—— caudata, D'O. striated	..	..	..	..	..	.
	—— caudata, D'O. smooth	..	..	..	..	..	.
	—— globosa, Montag.	..	..	..	..	..	.
	—— squamosa, Montag.	..	..	..	..	..	.
	—— marginata, Montag.	..	..	..	..	..	.
3. Orbulina universa, D'O.	Orbulina universa, D'O.	..	..	..	..	..	.
4. Globigerina bulloides, D'O.	Globigerina bulloides, D'O.	..	..	..	..	*vs* VR	.
5. Planorbulina farcta, F. & M.	Truncatulina lobatula, W. & J.	..	..	..	..	..	.
	Planorbulina Mediterranensis, D'O.	..	..	..	..	..	.
	—— Haidingerii, D'O.	..	..	..	..	..	.
	—— Ungeriana, D'O.	..	..	..	..	..	.
6. Discorbina Turbo, D'O.	Discorbina Berthelotiana, D'O.	..	..	..	..	..	.
	—— rosacea, D'O.	..	..	..	..	..	.
7. Rotalia Beccarii, Linn.	Rotalia Beccarii, Linn.	..	..	..	..	..	.
	—— Soldanii, D'O.	..	..	..	..	..	.
	—— orbicularis, D'O.	..	..	..	..	..	.
8. Pulvinulina repanda, F. & M.	Pulvinulina Menardii, D'O.	..	..	..	..	..	.
	—— Karsteni, Rss.	..	..	..	..	..	.
	—— Micheliana, D'O.	..	..	..	..	..	.
	—— elegans, D'O.	..	..	..	..	..	.
	—— Canariensis, D'O.	..	..	..	*s* VR	..	.
	—— pauperata, P. & J.	..	..	..	..	..	.
9. Sphæroidina bulloides, D'O.	Sphæroidina bulloides, D'O.	..	..	..	..	..	.
10. Pullenia sphæroides, D'O.	Pullenia sphæroides, D'O.	..	..	..	..	..	.
11. Polystomella crispa, Linn.	Nonionina asterizans, F. & M.	..	..	..	..	..	.
	—— Scapha, F. & M.	..	..	..	*m* RC	*m* R	.
	—— turgida, Will.	..	..	..	..	..	.
	—— umbilicatula, Montag.	..	..	..	..	*vs* VR	.
	Polystomella striatopunctata, F. & M.	..	..	..	..	..	.
	—— crispa, Linn.	..	..	..	..	..	.
12. Nummulina perforata, Montf.	Operculina ammonoides, Gm.	..	..	..	..	..	.
13. Cassidulina lævigata, D'O.	Cassidulina lævigata, D'O.	..	*m* RC	..	*m* RC	*s* R	.
	—— crassa, D'O.	..	..	..	..	..	.
14. Uvigerina pygmæa, D'O.	Uvigerina pygmæa, D'O.	..	..	..	..	*vs* R	.

rs. Rather small. *s.* Small. *vs.* Very small. VC. Very common. C. Common. I

	CE (TRINITY BAY).				ARCTIC (NORTH OF NEWFOUNDLAND BANK).										
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Lat. 48° 45′ N. Long. 53° 10′ 50″ W.	Lat. 48° 11′ N. Long. 53° 7′ 50″ W.	Lat. 48° 14′ 22″ N. Long. 53° 1′ W.	Lat. 48° 18′ N. Long. 52° 56′ W.	Lat. 48° 21′ N. Long. 52° 44′ W.	Lat. 48° 28′ 30″ N. Long. 52° 19′ 30″ W.	Lat. 48° 40′ N. Long. 51° 45′ W.	Lat. 47° 57′ 20″ N. Long. 51° 31′ 30″ W.	Lat. 49° N. Long. 50° 48′ 30″ W.	Lat. 49° 2′ N. Long. 50° 14′ 30″ W.	Lat. 49° 23′ 30″ N. Long. 49° 55′ W.	Lat. 49° 26′ N. Long. 49° 48′ W.	Lat. 49° 16′ 30″ N. Long. 49° 17′ W.	Lat. 49° 18′ N. Long. 49° 12′ W.	Lat. 49° 23′ N. Long. 48° 48′ W.	Lat. 49° 33′ N. Long. 48° 5′ W.	Lat. 50° 6′ N. Long. 45° 45′ W.
	s.	No. 41, 129 fms.	No. 61, 167 fms.	No. 59, 133 fms.	No. 55, 112 fms.	No. 65, 102 fms.	No. 69, 146 fms.	No. 63, 145 fms.	No. 73, 161 fms.	No. 33, 405 fms.	No. 77, 221 fms.	No. 78, 329 fms. [330 fms.]	No. 32, 740 fms. [742 fms.]	No. 79, 725 fms.	No. 31, 954 fms.	No. 30, 1203 fms.	No. 80, 1450 fms. [1405 fms.]
	150																
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	*m* VR	..	..	..	..	*m* R
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* R
	..	..	..	..	..	..	..	..	..	..	..	..	*s* R	..	..	..	*m* R
	VR	..	..	*vs* VR	..	..	..	..	..	..	..	*m* R	..	..	..	..	..
	..	..	..	..	..	..	..	*s* R	..	..	..	*vs* VR	*rs* C	*s* RR	*s* C	*s* C	*m* VC
	..	..	..	..	..	..	..	..	..	..	..	..	*m* R	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* R
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	*m* VR	..	..	..	..	*m* RC
	..	..	..	*l* R													
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* R
	..	..	..	*m* RR	..	..	..	..	..	..	..	..	..	..	..	..	*m* RC
	..	..	..	*s* R	..	..	..	..	*s* VR	..	..	..	..	..	..	..	*s* RC
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* R
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	*s* R	..	..	*vs* VR	..
	R	..	..	*m* RR	..	..	..	*m* R	*m* VR	..	..	*m* VR	..	*m* VR	*vs* VR	..	..
	VR	..	..	..	..	..	..	..	..	..	..	*vs* VR	..	..	..	..	..
	..	..	..	..	..	..	..	*s* R	*vs* VR	..	..	..	*m* RC	*s* RR	*s* R	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* VR			
	R	..	..	*m* RR	*m* RR	*m* VR	..	*m* RR	..	..	..	..	*m* RC	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	R	..	..	..	*m* RR	..	..	..	*s* VR	..	..	..	..	..	..	..	..

ALSO THEIR ABUNDANCE OR RARITY, AND THEIR RELATIVE SIZE. [SEE APPENDIX VIII.]

RC. Rather common. RR. Rather rare. R. Rare. VR. Very rare.

	BOREAL (ABYSSAL).						CELTIC (ABYSSAL).						CELTIC (MARGIN			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
	Lat. 50° 6′ N. Long. 45° 45′ W.	Lat. 50° 25′ N. Long. 44° 19′ W.	Lat. 50° 46′ N. Long. 42° 20′ W.	Lat. 52° 11′ N. Long. 31° 29′ W.	Lat. 51° 29′ N. Long. 38° 1′ W.	Lat. 51° 30′ N. Long. 38° W.	Lat. 52° 16′ 30″ N. Long. 29° 28′ 30″ W.	Lat. 52° 25′ N. Long. 28° 10′ W.	Lat. 52° 33′ 30″ N. Long. 21° 16′ W.	Lat. 52° 16′ N. Long. 16° 46′ W.	Lat. 52° 16′ N. Long. 16° 42′ W.	Lat. 52° 21′ 30″ N. Long. 15° 6′ W.	Lat. 52° 16′ N. Long. 14° 30′ W.	Lat. 52° 11′ N. Long. 13° 45′ W.	Lat. 52° 8′ 30″ N. Long. 12° 31′ W.	Lat. 52° 0′ 30″ N. Long. 12° 7′ 30″ W.
	No. 80, 1450 fms. [1405 fms.]	No. 26, 2330 fms.	No. 25, 2250 fms. [2050 fms.]	No. 19, 2035 fms. [2030 fms.]	No. 81, 2350 fms. [Deepest.]	No. 22, 1660 fms. [2250 fms.]	No. 85, 2176 fms.	No. 86, 1950 fms. [2050 fms.]	No. 15, 1776 fms.	No. 90, 2050 fms.	No. 13, 2050 fms.	No. 12, 1750 fms.	No. 93, 200 fms.	No. 95, 223 fms.	No. 98, 415 fms.	No. 7, 338 fms.
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	*rs* R	*s* RR	*s* R	..
	..	..	..	..	..	..	..	..	*vs* R	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	*m* R	..	..	*s* R	..	..	..	..	..	..	..	..	*s* R	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	*l* R		
	m R															
	..	..	..	..	*s* R	..	*s* R									
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*l* R	
	m R															
	m R	..	..	..	*l* RC	..	..	..	..	..	..	..	..	..	*l* R	..
	..	..	..	..	*m* RC	*m* R	*l* R	*m* R	*m* C	*m* C	*m* R	*l* R	..	*m* R	*l* C	..
	m VC	*m* VC	*m* VC	*m* VC	*m* VC	*m* VC	*m* RC	*m* VC	*m* VC	*m* VC	*m* VC	*m* VC	*s* RR	*m* C	*m* C	*l* C
	..	..	..	..	..	..	*s* R	..	..	..	..	..	..	..	..	*s* R
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	*m* R							
	s R	*s* R	*s* R	..	*s* C	*m* RR	*s* C	*s* R	*s* R	*s* RC	..	..	*m* RC	*l* C	*m* C	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	*m* R	*s* R	..	..	..	*vs* R	..	*s* R	..	..	*m* RR	*m* C	..
	..	..	..	..	..	..	..	*vs* VR								
	m RC	*m* RC	*m* R	..	*m* RC	*m* RR	*m* C	*m* RC	*m* C	*m* C	*m* R	..	..	*m* RC	*m* RC	*m* R
	s R	*m* RC	..	*m* R	*m* RC	*m* RR	*m* R	*l* RC	*m* C	*m* C	*m* C	..	*m* RC	*m* RC	*m* C	..
	m RC	..	..	..	..	*s* R	..	..	..	..	..	..	..	..	..	..
	s RC	*vs* C	*s* R	*m* RC	*s* RC	*s* RR	*m* C	*m* RC	*s* RC	*m* C	..	*s* R	..	..	*m* R	*s* R
	m R	..	..	..	..	..	*s* R									
	..	*vs* VR	..	..	..	..	..	..	..	..	..	..	..	*s* R		
R	..	*vs* VR	..	*s* R	..	..	*vs* RR	..	*vs* R	..	..	..	*s* R			
	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* R		
	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* R	..	..
	..	..	..	..	*s* R	..	*s* RC	*m* RC	*s* R	*s* RC	..	..	..	*m* C	*m* C	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* R	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	*s* R	*s* C	*s* C	..
	..	..	..	..	..	..	..	..	..	..	..	*s* R	*s* R	*s* RC	*s* C	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	*vl* VR		
	..	..	..	..	..	..	..	..	..	..	..	..	*l* C	*l* VC	*l* VC	*l* C

(MARGINAL).

36	37	38	39
Lat. 52° 0′ 30″ N. Long. 12° 7′ 30″ W.	Lat. 52° 1′ N. Long. 11° 14′ 40″ W.	Lat. 51° 59′ N. Long. 11° W.	Lat. 51° 57′ N. Long. 10° 30′ 30″ W.
No. 7, 338 fms.	No. 99, 90 fms.	No. 100, 78 fms.	No. 102, 43 fms.
..	..	*s* R	
..	*s* R	*s* R	
..	..	..	*s* R
..	..	*m* R	
..	..	..	*s* RC
..	*s* RC	*s* C	*s* C
..	*m* R	*m* R	
l C	*s* R	*s* C	*s* RC
s R	..	*m* RC	*m* C
..	..	..	*s* R
..	*m* R	*s* RR	*s* RC
..	..	*s* RC	*s* R
..	..	..	*m* RC
..	..	*s* R	
..	..	..	*s* R
m R	..	*s* R	
..	..	*s* R	
..	..	*s* C	
s R	..	*s* C	
..	..	..	*s* R
..	*m* C	*m* C	
..	..	*vs* VR	*s* C
..	*s* C	*s* VC	*s* C
..	*m* C	*m* C	*m* C
l C	*l* VC	*l* VC	*l* VC

12. Nummulina perforata, Montf.	Operculina ammonoides, Gm.	..	..	..	..	..	..
13. Cassidulina lævigata, D'O.	Cassidulina lævigata, D'O.	..	*m* RC	..	*m* RC	*s* R	..
	—— crassa, D'O.	..	..	..	..	..	..
14. Uvigerina pygmæa, D'O.	Uvigerina pygmæa, D'O.	..	..	..	..	*vs* R	..
	—— angulosa, Will.	..	..	..	..	..	..
15. Bulimina Presli, Rss.	Bulimina ovata, D'O.	..	..	..	..	*vs* VR	..
	—— aculeata, D'O.	..	..	..	..	..	..
	—— marginata, D'O.	..	..	..	..	..	..
	—— Buchiana, D'O.	..	..	..	..	..	..
	Virgulina Schreibersii, Czjzek	..	..	..	..	..	..
	Bolivina punctata, D'O.	..	..	..	..	..	..
	—— costata, D'O.	..	..	..	..	..	..
16. Textularia agglutinans, D'O.	Textularia abbreviata, D'O.	..	..	..	..	..	..
	—— Sagittula, Defr.	..	..	..	..	..	..
	—— pygmæa, D'O.	..	..	..	..	..	..
	—— carinata, D'O.	..	..	..	..	..	..
	Bigenerina Nodosaria, D'O.	..	..	..	..	..	..
	—— digitata, D'O.	..	..	..	..	..	..
17. Miliola Seminulum, Linnè	Spiroloculina planulata, Lam.	..	..	..	..	..	..
	—— limbata, D'O.	..	..	..	..	..	..
	Quinqueloculina tenuis, Czjzek	..	..	..	..	..	..
	—— Seminulum, Linn.	..	..	..	..	..	..
	—— triangularis, D'O.	..	..	..	..	..	..
	—— agglutinans, D'O.	..	..	..	..	..	..
	Triloculina oblonga, Montag.	..	..	..	..	..	..
	Biloculina depressa, D'O.	..	..	..	..	..	..
	—— elongata, D'O.	..	..	..	..	..	..
18. Lituola nautiloidea, Lam.	Lituola Canariensis, D'O.	..	..	..	..	..	..
	—— globigeriniformis, P. & J.	..	..	..	..	..	..
		1	2	3	4	5	6

TABLE VI.—Table showing the pres

	Arctic Province (Trinity Bay).							
	1 No. 53, 195 fms.	2 No. 49, 129 fms.	3 No. 47, 190 fms.	4 No. 39, 124 fms.	5 No. 45, 150 fms.	6 No. 41, 129 fms.	7 No. 61, 167 fms.	8 No. 59, 133 fms.
Molluscs—small, with fragments	..	..	..	..	..	..	..	..
Annelids—sand-tubes and Serpulæ	..	..	..	..	..	..	..	..
Polyzoa—fragments	..	..	..	..	..	..	..	..
Entomostraca—valves	..	..	..	..	..	..	..	..
Echinoderms—spines and plates	..	..	..	..	..	..	a trace.	..
Sponges—spicules	..	..	..	..	..	..	..	..
Foraminifera *a.* Globigerina bulloides	..	..	..	..	a trace.	..	..	..
Foraminifera *b.* Other species	..	a few.	..	..	a few.	..	..	a few.
Polycystineæ*	..	..	..	..	..	..	..	..
Diatomaceæ†	..	..	some	..	some.	some.	some.	some.
Whitish mud	..	..	..	..	..	..	..	..
Grey mud	99·	50·5	99·	2·	49·5	60·	1·	..
Sand, mostly quartz *a.* Fine	1·	30·5	1·	96·	49·5	..	49·	..
Sand, mostly quartz *b.* Coarse	..	18·	..	..	..	20·	50·	..
Small gravel stones	..	..	..	..	..	20·	..	..

* In some portions of this Atlantic ooze that Mr. Roper received from Professor Huxley, he met with ma
siliceous organisms a number of *Polycystineæ*, e. g., *Flustrella*, *Eucyrtidium*, *Stylosphæra*, *Haliomma*, &c.; also

R	..	..	*m* RR	*m* RR	*m* VR	..	*m* RR	..	..	..	..	*m* RC	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
s R	..	..	..	*m* RR	..	..	..	*s* VR	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
VR	..	..	..	..	..	..	..	..	..	..	..	*m* R	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	*s* VR	*s* R	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*vs* VR
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* R	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* VR
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* R
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* R	..
..	..	..	*m* R	..	..	..	*vs* VR	..	..	..	..	..	..	*s* VR	..	..
5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

HE PRESENCE AND PROPORTION OF ORGANIC AND INORGANIC SUBSTANCES IN 100 PARTS OF DRY SEA-BOTT

			ARCTIC (NORTH OF NEWFOUNDLAND BANK).											BOREAL (A			
	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
	No. 59, 133 fms.	No. 55, 112 fms.	No. 65, 102 fms.	No. 69, 146 fms.	No. 63, 145 fms.	No. 73, 161 fms.	No. 33, 405 fms.	No. 77, 221 fms.	No. 78, 329 fms.	No. 32, 740 fms.	No. 79, 725 fms.	No. 31, 954 fms.	No. 30, 1203 fms.	No. 80, 1450 fms.	No. 26, 2330 fms.	No. 25, 2250 fms.	
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
	..	..	..	..	..	sand-tube.	..	..	..	..	..	..	..	..	..	..	
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
ce.	..	..	..	..	..	..	..	..	..	..	..	..	a trace.	..	..	..	
	..	a trace.	..	..	..	2 spicules.	..	a trace.	..	..	..	..	..	..	..	..	
	..	..	..	..	..	..	..	..	..	8·	..	0·7	1·5	97·	52·	95·	
	a few.	a few.	1 spec.	..	a trace.	a trace.	a few.	..	a trace.	a few.	a few.	0·3	0·5	1·	1·	a few.	a
	..	..	..	..	..	..	..	..	..	..	a few.	..	..	..	..	..	
e.	some.	some.	..	some.	some.	some.	..	..	..	..	some.	some.	some.	..	..	..	
	..	..	..	..	..	..	..	..	..	..	..	..	49·	a trace.	45·	a trace.	
	..	..	33·	25·	33·	33·	2·5	1·	25·	88·	98·	75·	..	..	..	..	
	..	..	10·	35·	33·	30·	97·5	49·	72·	3·	1·5	12·	49·	1·5	2·	2·	a
	..	49·	23·	40·	33·	36·	..	50·	2·	..	..	12·	..	1·	..	2·	
	..	50·	33·														

; with many varieties of *Polycystinecæ*; and in his Appendix to Commander DAYMAN's Report on the North-Atlantic Sea-bed, Prof
&c.; also the spicular bodies known as *Spongolitharia*, and the doubtful organisms *Codium* and *Rhizosalenia*.

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
..	..	..	..	..	..	..	..	..	..	..	..	*s* R	*s* C	*s* C	..
..	..	..	..	..	..	..	..	..	..	..	*s* R	*s* R	*s* RC	*s* C	..
..	..	..	..	..	..	..	..	..	..	..	..	..	*vl* VR		
..	..	..	..	..	..	..	..	..	..	..	..	*l* C	*l* VC	*l* VC	*l* C
..	..	..	..	..	..	..	..	..	..	..	..	..	*m* C	..	..
..	..	..	..	..	..	..	*vs* R	*vs* RR	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	*m* C		
..	..	..	..	..	..	..	..	..	..	..	..	..	*s* C	*s* C	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	*l* R	..	..	..	..	..	*m* R								
..	..	..	..	..	..	..	..	..	..	..	..	..	*s* RC	*s* R	..
..	..	..	..	..	..	..	..	..	..	..	..	..	*l* R		
..	..	..	..	..	..	..	..	..	..	..	..	..	*s* R	*s* RC	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
vs VR	..	..	*s* R	..	..	..	..	..	..	..	..	..	*m* R	*s* R	*m* R
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	*s* R	..	..	..	..	..	..	*m* R	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	*s* R	..	..	..	..	..	*s* RC	
..	..	..	*s* R	*s* R	..	..	..	*s* R	..	..	..	..	..	..	..
..	*vs* VR	..	..	..	*vs* VR	*s* R	..	*vs* R							
s VR	..	..	..	..	..	..	..	*vs* R	..	..	..	..	..	*m* C	
..	*vs* VR														
m R	..	..	..	*m* R	*m* R	*s* R	..	..	..	..	..	..	..	..	..
..	*s* R	..	..	..	..	..	*vs* VR	..	..	*s* R					
..	..	..	..	..	..	..	..	..	..	..	..	..	*m* R	..	..
..	..	..	..	..	*m* R										
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36

SEA-BOTTOM FROM THE NORTH-ATLANTIC. See also TABLE XII.

OREAL (ABYSSAL).				CELTIC (ABYSSAL).						CELTIC (MARGINAL).						
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	3
No. 25, 2250 fms.	No. 19, 2035 fms.	No. 81, 2350 fms.	No. 22, 1660 fms.	No. 85, 2176 fms.	No. 86, 1950 fms.	No. 15, 1776 fms.	No. 90, 2050 fms.	No. 13, 2050 fms.	No. 12, 1750 fms.	No. 93, 200 fms.	No. 95, 223 fms.	No. 98, 415 fms.	No. 7, 338 fms.	No. 99, 90 fms.	No. 100, 78 fms.	No. 102. 43 fms.
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	frag^{ts}.	shells fragm
..	..	..	..	..	..	..	..	..	..	..	..	..	..	fragments of shells.		
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	frag
..	..	..	..	..	a valve.	a valve.	a valve.	..	..	..	a few.	..	..	..	..	a fe
..	..	..	..	a trace.	a trace.	..	..	..	..	..	a trace.	..	a spine.	frag^{ts}.	5·	15·
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	a fe
95·	97·	95·5	95·	73·5	97·5	83·	53·	49·	97·5	a few.	16·	12·	23·	a few.	4·	7·
a few.	a few.	0·5	a few.	0·5	0·5	1·	1·5	a few.	a few.	5·	32·	8·	10·	5·	10·	20·
..	..	..	..	a few.	a few.											
..	..	..	..	some.	some.	..	..	..	..	..	..	..	..	..	some.	
a trace.	2·	1·5	a trace.	25·	1·5	15·	45·	50·	a trace.	..	..	..	a trace.			
..	..	..	..	..	..	..	..	..	..	..	1·5	40·	..	a trace.	1·	
2·	a trace.	1·5	2·	1·	0·5	a trace.	a trace.	a trace.	a trace.	5·	50·	40·	66·	92·5	70·	25·
2·	..	1·	2·	..	..	..	..	..	..	89·	..	..	..	..	10·	25·

bed, Professor HUXLEY states (p. 64) that, in the grey calcareous mud (ooze) of from 1700 to 2400 fathoms, he noticed among th

† See Mr. ROPER's letter, p. 334.

..	*s* C	*s* VC	*s* C
..	*m* C	*m* C	*m* C
l C	*l* VC	*l* VC	*l* VC
..	..	*m* RC	*s* R
..	..	*s* R	
..	*m* C	*m* C	*l* C
..	..	*s* R	
..	..	..	*s* R
..	*m* RC	*m* C	*m* C
..	..	*m* C	
m R	*s* RC	*s* RC	
..	*s* C	*s* RC	
..	*m* C	*m* C	
..	..	*s* R	
..	..	..	*m* R
..	..	*s* R	
..	*s* R	*s* C	*s* C
..	..	*s* R	*s* R
..	..	..	*s* R
36	37	38	39

38	39
No. 100, 78 fms.	No. 102, 43 fms.
ag[ts].	shells and fragments.
..	frag[ts].
..	a few.
5·	15·
..	a few.
4·	7·5
0·	20·
me.	
1·	
0·	25·
0·	25·

among the

and *Nonionina*, *Rotalinæ*, *Bulimina*, *Textularia*, *Cornuspira*, *Miliola*, and *Lituola*, and no *Polymorphinæ*; and in having more *Cassidulinæ* and *Uvigerinæ*, and far more *Globigerinæ* and *Orbulinæ*, with the addition of *Pullenia*.

The Telegraph-line, in passing the northern end of the Bank of Newfoundland, enters (at about 47° W. long.) the Southern extension of the "Arctic Province"*, where the prevalence of floating ice keeps "Arctic" conditions as far south as 45° N. lat. This western extremity of the line does not belong, therefore, to the "Celtic," but to the "Arctic Province"; and the few Foraminifera occurring there may be regarded as equivalent to those mentioned above as being found at similar depths in Baffin's Bay.

The south-western extremity of the "Boreal Province," bordering the "Arctic," also invades the western part of the line of soundings†; and is coincident with a somewhat impoverished condition of the abyssal fauna common to these soundings (Nos. 21–26) and others (Nos. 27–32) to the East ("Celtic").

The accompanying Map (after Commander DAYMAN'S Chart), Plate XII., illustrates the foregoing remarks. See Appendix VII.

We are fortunately able to compare the deep-sea Foraminifera of the North Atlantic with those inhabiting the shallower water of its western margin at a lower latitude than Newfoundland, where the Telegraph-soundings terminate. The late Professor BAILEY'S examination‡ of some soundings made by the United States Coast-survey on the shores of New Jersey and Delaware, between lat. 50° and lat. 38° N., in 1848, affords us the means of doing this, at least to some extent.

Where the "Celtic Province," crossing the Atlantic from the British Isles, approaches North America, it takes on a modified character, and is known as the "Virginian Province"; and its north and south limits are just those of the series of soundings made by the United States Coast-survey referred to above, and thus yielding us (as far as Professor BAILEY'S figures and descriptions serve) the western equivalents of the eastern margin of the "Celtic Province." See Appendix II., and Table VIII.

As far as Professor BAILEY'S material shows, we find the "Virginian" fauna to be related to the "Celtic" of the Irish coast by *Orbulina universa*, *Cristellaria cultrata*, *Planorbulina Ungeriana* (abundant in the Irish and rare in these American soundings; whilst its congener, *Pl. Haidingerii*, abounds here and is wanting in the soundings off Ireland), *Pulvinulina Menardii*, *Globigerina bulloides*, and *Quinqueloculina Seminulum*. All the recorded "Virginian" forms occur in the British seas, except *Marginulina regularis*, *Verneuilina triquetra*, *Bulimina Pyrula* (represented to the eastward by *B. marginata*) and *Virgulina squamosa*.

* See the Map of the Molluscan Provinces, by E. FORBES, in KEITH JOHNSTON'S 'Physical Atlas'; the Map in S. P. WOODWARD'S 'Manual of Mollusca'; and that in FORBES and GODWIN-AUSTEN'S 'Nat. Hist. of the European Seas.'

† Soundings Nos. 26, 25, 24, 23, 22, & 21. The last is close upon the southern limb of the "Arctic Province."

‡ See the 'Smithsonian Contributions to Knowledge,' vol. ii. 1861.

To the "Arctic" and "Boreal" faunæ the "Virginian" is allied by *Dentalina pauperata*, *Cristellaria cultrata*, *Globigerina bulloides*, *Bulimina Pyrula*, *Virgulina Schreibersii*, *V. squamosa*, and *Quinqueloculina Seminulum*.

Besides *Foraminifera*, the North-Atlantic soundings obtained by Commander DAYMAN have yielded us the organic and inorganic materials indicated in Tables VI. & XII.

Mr. F. C. S. ROPER, F.L.S., F.G.S., has obliged us with the following Note on the Diatomaceæ *.

"3 Carlton Villas, January 7, 1864.

"MY DEAR SIR,—I regret that I have not before this replied to yours of the 24th ult., relating to the Soundings I received from Mr. PARKER. I mounted slides from each packet, but found that they contained so few Diatoms, that I only made cursory notes upon them; and, on referring to these, find they were almost confined to specimens of Coscinodiscus, as you will see by the list enclosed. These Atlantic soundings are so transparent, and the siliceous matter apparently so wasted, that it is very trying to the eyes to hunt over a succession of slides with high powers, to seek the few Diatoms contained in them; and I was compelled from the fear of injury to my sight to abstain from an exhaustive examination of them.

"Believe me very truly yours,

"F. C. S. ROPER."

Clays.

No. 30. A few fragments of Coscinodisci.
No. 31. „ „
No. 61. A large Cocconeis.
A few Coscinodisci, apparently C. radiatus.
A Rhabdonema.
No. 63. A few fragments of Coscinodisci.
No. 85. Coscinodiscus. C. perforatus?
No. 100. Coscinodiscus eccentricus.
Coscinodiscus radiatus.
Orthosira marina.
Actinocyclus undulatus.
Pleurosigma transversale?
No. 41. Coscinodiscus radiatus.
A Nitzschia.
A Rhabdonema.
No. 45. Fragments of Coscinodisci.
No. 69. „ „
No. 73. Large Coscinodiscus.
No. 79. „
No. 86. Coscinodisci, a few.

The remainder little else than Foraminifera and sand.

Sands.

No. 47. Coscinodiscus? sp.
Rhabdonema.
Grammatophora marina.
No. 59. A few Coscinodisci.
No. 64. „

The remainder nearly all sand with Foraminifera.

The following Entomostraca from these soundings have been determined by Mr. G. S. BRADY.

Cythere scabra, *Münster*; 2050 fathoms. Lat. 52° 16′ N., long. 16° 46′ W.
—— rhomboidea *Brady*; 43 fathoms. Lat. 51° 57′ N., long. 10° 30′ W.
—— mamillata, *Brady*; 110 fathoms. Lat. 52° 59′ N., long. 14° 10′ W.
Bairdia Bosquetiana, *Brady*; 470 fathoms; off Ireland.

5. Besides the description and illustration of the Foraminifera obtained from the four sets of soundings and dredgings above mentioned, and the tabulation of the species and varieties, showing their depth of water and relative size and abundance, we also point

* The Diatoms found in the "Virginian Province" are noticed by Professor BAILEY in the memoir above referred to.

out, to some extent, their distribution in other seas (see Table VII.), and their occurrence in the fossil state; thus providing some materials towards a correct knowledge of their distribution in Time and Space.

With this in view, we have endeavoured to simplify the nomenclature of the Foraminifera by adhering as strictly as possible to the plan of study laid down by WILLIAMSON* and CARPENTER†, and followed by ourselves in former memoirs‡.

Using the classification and nomenclature§ proposed in the 'Introduction to the Study of the Foraminifera,' we have, under generic and specific heads, a limited number of Foraminiferal groups, possessing among themselves very different features, whilst the members of each group are formed on one simple plan, almost infinitely modified in its details, and often producing imitations of members of the other groups, just as mimetic resemblances occur in Mollusca, and in other Classes of the Animal and Vegetable Kingdoms.

By recognizing these mimetic resemblances among distinct varieties and species, and laying but little stress on non-essential features, we seem to be able to grasp the multitudinous varieties and subvarieties, modified, disguised, and transitional, with something like satisfactory results; and they fall into natural recognizable groups, having more or less fixed habits and places of growth, instead of escaping from us as an illimitable cloud of differing though related individuals, almost unknown in reality, though nearly each has been endowed by writers with a separate binomial title.

In determining the species and varieties of the Foraminifera under notice, we have, as far as possible, used already published materials; and in comparing our specimens with figured forms, we have been satisfied when a *near* approach to identity is shown; minute differences are ignored, such differences not being of essential value.

There have been many naturalists who have helped on our knowledge of these Microzoa. D'ORBIGNY first classified them sufficiently well to enable himself and others to group their acquired material in an orderly, though artificial manner; and by his care an enormous number of forms, specific and varietal, from different parts of the earth, recent and fossil, have been arranged in good lithograph plates, serving as a museum for reference. Since D'ORBIGNY, few have collected such great stores of Foraminifera, and illustrated them so abundantly, as Professor Dr. A. E. REUSS; providing naturalists with, as it were, available collections of hundreds of forms. Professor REUSS'S latest observations have led him in a great degree to concur with (and in some cases to anticipate, we believe) the classification propounded in the 'Introduction to the Study of the

* On the Recent Foraminifera of Great Britain; by Professor W. C. WILLIAMSON, F.R.S. (Ray Society) 4to. 1858.

† Introduction to the Study of the Foraminifera; by W. B. CARPENTER, M.D., F.R.S., assisted by W. K. PARKER, Esq., and T. RUPERT JONES, F.G.S. (Ray Society) 4to. 1862.

‡ Papers on the Nomenclature of the Foraminifera, in the Annals of Natural History, from 1859 to 1863.

§ The concise and well-digested remarks on classification and nomenclature in Dr. WOODWARD'S 'Manual of Mollusca' are in great part applicable to Rhizopodal studies.

Foraminifera.' To D'ORBIGNY and REUSS, then, references will be continually made in this memoir for illustrations of the species and varieties; and the titles and dates of their works, and of those of other authors treating of Foraminifera, are given in the books and memoirs above mentioned, in which all the species adopted by the older authors (LINNÈ, GMELIN, WALKER, JACOB, MONTAGU, FICHTEL, MOLL, LAMARCK, DE MONTFORT, DE BLAINVILLE, and DEFRANCE) have been critically determined.

If ever the Foraminifera of all seas come to be collected and examined with care, there is little doubt that they will afford to the Naturalist as satisfactory results as the bathymetrical study of mollusks affords; they will be perhaps even more useful to the Geologist, in aiding him to form correct notions as to the depth and other conditions of water in which strata have been formed; whilst the accurate comparison of the long-enduring Foraminiferal species of past and of present time, with their ever-varying modifications, according to climate, depth, and food, cannot fail to be a source of instruction to the Biologist.

II. *Description of Species and Varieties.*

In the following list, the species and varieties described in this memoir are enumerated in their natural order as nearly as their nature permits; the more important of the typical forms not represented in the Arctic and North-Atlantic fauna, but required to complete the series as a natural group, being added in brackets.

List of Genera, Species, and Varieties of Foraminifera from the Arctic and North Atlantic Oceans.

Genus NODOSARINA.

	Arctic.	North Atlantic.
[SPECIES. Nodosarina (Marginulina) Raphanus.]		
Subspecies. N. (Nodosaria) Raphanus	.....	Plate XVI. fig. 1.
Variety. N. (Nodosaria) scalaris	.....	Plate XVI. fig. 2.
N. (Glandulina) lævigata	Plate XIII. fig. 1.	
N. (Nodosaria) Radicula.....	Plate XIII. figs. 2–7.	
N. (Dentalina) communis	Plate XIII. fig. 10.	
Subvariety. N. (D.) consobrina.....	.....	Plate XVI. fig. 3.
N. (D.) pauperata	Plate XIII. figs. 8, 9.	
N. (D.) guttifera	Plate XIII. fig. 11.	
[Subspecies. N. (Vaginulina) Legumen.]		
Variety. N. (V.) linearis	Plate XIII. figs. 12, 13.	
[SPECIES. Nodosarina (Marginulina) Raphanus.]		
Variety. N. (M.) Lituus	Plate XIII. fig. 14.	
[Subspecies. N. (Cristellaria) Calcar.]		
Variety. N. (C.) Crepidula	Plate XIII. figs. 15, 16.	Plate XVI. fig. 4.
N. (C.) cultrata	Plate XIII. figs. 17, 18.	Plate XVI. fig. 5.
N. (C.) rotulata	Plate XIII. fig. 19.	

Genus Lagena.

		Arctic.	North Atlantic.
Species.	Lagena sulcata	Plate XIII. figs. 24, 28–32.	Plate XVI. figs. 6, 7 *a*.
Variety.	L. globosa	Plate XIII. fig. 37.	Plate XVI. fig. 10.
	L. lævis	Plate XIII. fig. 22.	Plate XVI. fig. 9 *a*.
	L. semistriata	Plate XIII. fig. 23.	
	L. striatopunctata	Plate XIII. figs. 25–27.	
	L. Melo	Plate XIII. figs. 33–36.	
	L. squamosa	Plate XIII. figs. 40, 41.	Plate XVI. fig. 11.
	L. marginata	Plate XIII. figs. 42–44.	Plate XVI. fig. 12.
	L. distoma	Plate XIII. fig. 20.	
	Subvariety. L. polita	Plate XIII. fig. 21.	
Variety.	L. caudata	Plate XIII. figs. 38, 39.	Plate XVI. figs. 7, 8, 9.

Genus Polymorphina.

Species.	Polymorphina lactea	Plate XIII. figs. 45, 46.	
Variety.	P. compressa	Plate XIII. figs. 47–51.	
	P. tubulosa	Plate XIII. fig. 52.	

Genus Uvigerina.

Species.	Uvigerina pygmæa	Plate XIII. figs. 53–57.	Plate XVII. fig. 65.
Variety.	U. angulosa	Plate XIII. fig. 58.	Plate XVII. fig. 66.

Genus Orbulina.

Species.	Orbulina universa	.....	Plate XVI. figs. 13, 14.

Genus Globigerina.

Species.	Globigerina bulloides	Plate XIV. figs. 1, 2.	Plate XVI. fig. 15.
Variety.	Gl. inflata	.....	Plate XVI. figs. 16, 17.

Genus Pullenia.

Species.	Pullenia sphæroides	Plate XIV. fig. 43.	Plate XVII. fig. 53.

Genus Sphæroidina.

Species.	Sphæroidina bulloides	.....	Plate XVI. fig. 52.

Genus Textularia.

Species.	Textularia agglutinans	Plate XV. fig. 21.	
Variety.	T. abbreviata	.....	Plate XVII. fig. 76.
	T. Sagittula	.....	Plate XVII. fig. 77.
	T. pygmæa	Plate XV. fig. 22.	Plate XVII. fig. 78.
	T. carinata	.....	Plate XVII. fig. 79.
	T. biformis	Plate XV. figs. 23, 24.	
	T. (Bigenerina) Nodosaria	Plate XV. fig. 25.	Plate XVII. fig. 80.
	Subvariety. T. (B.) digitata	.....	Plate XVII. fig. 81.
Variety.	T. (Verneuilina) polystropha	Plate XV. fig. 26.	

Genus Bulimina.

		Arctic.	North Atlantic.
[Species.	Bulimina Presli.]		
Variety.	B. Pyrula	Plate XV. figs. 8, 9.	
	B. marginata	Plate XV. fig. 10.	Plate XVII. fig. 70.
Subvariety.	B. aculeata	Plate XV. fig. 11.	Plate XVII. figs. 68, 69.
Variety.	B. ovata		Plate XVII. fig. 67.
	B. Buchiana		Plate XVII. fig. 71.
	B. elegantissima	Plate XV. figs. 12–17.	
	B. (Virgulina) Schreibersii	Plate XV. fig. 18.	Plate XVII. figs. 72, 73.
Subvariety.	B. (Virgulina) squamosa	Plate XV. figs. 19, 20.	
Variety.	B. (Bolivina) costata		Plate XVII. fig. 75.
	B. (B.) punctata		Plate XVII. fig. 74.

Genus Cassidulina.

Species.	Cassidulina lævigata	Plate XV. figs. 1–4.	Plate XVII. fig. 64 *a*, *b*, *c*.
Variety.	C. crassa	Plate XV. figs. 5–7.	Plate XVII. fig. 64 *d*.

Genus Planorbulina.

[Species.	Planorbulina farcta.]		
Variety.	Pl. (Truncatulina) lobatula	Plate XIV. figs. 3–6.	Plate XVI. figs. 18–20.
	Pl. Haidingerii		Plate XVI. fig. 22.
	Pl. Ungeriana		Plate XVI. figs. 23–25.
	Pl. Mediterranensis		Plate XVI. fig. 21.
	Pl. (Anomalina) coronata	Plate XIV. figs. 7–11.	

Genus Discorbina.

[Species.	Discorbina Turbo.]		
Variety.	D. rosacea		Plate XVI. fig. 28.
[*Variety.*	D. vesicularis.]		
Subvariety.	D. globularis	Plate XIV. figs. 20–23.	
	D. obtusa	Plate XIV. figs. 18, 19.	
[*Variety.*	D. Parisiensis.]		
Subvariety.	D. Berthelotiana		Plate XVI. figs. 26, 27.

Genus Rotalia.

Species.	Rotalia Beccarii		Plate XVI. figs. 29, 30.
Variety.	R. Soldanii		Plate XVI. figs. 31–33.
Variety.	R. orbicularis		Plate XVI. fig. 34.

Genus Pulvinulina.

[Species.	Pulvinulina repanda.]		
Subvariety.	P. punctulata	Plate XIV. figs. 12, 13.	
Variety.	P. auricula.		
Variety.	P. Menardii		Plate XVI. figs. 35–37.
Subvariety.	P. Canariensis		Plate XVI. figs. 47–49.
	P. pauperata		Plate XVI. figs. 50, 51.
	P. Micheliniana	Plate XIV. fig. 16.	Plate XVI. figs. 41–43.
[*Variety.*	P. Schreibersii.]		
Subvariety.	P. Karsteni	Plate XIV. figs. 14,15,17.	Plate XVI. figs. 38–40.
Variety.	P. elegans		Plate XVI. figs. 44–46.

		Arctic.	North Atlantic.
	Genus Spirillina.		
Species.	Spirillina vivipara	Plate XV. fig. 28.	
	Genus Patellina.		
[Species.	Patellina concava.]		
Variety.	Patellina corrugata	Plate XV. fig. 29.	
	Genus Nummulina.		
[Species.	Nummulina perforata.]		
Subspecies.	N. planulata	Plate XIV. fig. 45.	
[*Variety.*	N. (Operculina) complanata.]		
Subvariety.	N. (O.) ammonoides	Plate XIV. fig. 44.	Plate XVII. figs. 62, 63.
	Genus Polystomella.		
Species.	Polystomella crispa	Plate XIV. fig. 24.	Plate XVII. fig. 61.
Variety.	P. arctica	Plate XIV. fig. 25–30.	
	P. striatopunctata	Plate XIV. figs. 31–34.	Plate XVII. fig. 60.
	P. (Nonionina) Faba	Plate XIV. fig. 36.	
	P. (N.) asterizans	Plate XIV. fig. 35.	Plate XVII. fig. 54.
Subvariety.	P. (N.) depressula.....	Plate XIV. fig. 39.	
	P. (N.) stelligera	Plate XIV. figs. 40, 41.	
	P. (N.) Scapha	Plate XIV. figs. 37, 38.	Plate XVII. figs. 55, 56.
	P. (N.) umbilicatula	Plate XIV. fig. 42.	Plate XVII. figs. 58, 59.
	P. (N.) turgida	.....	Plate XVII. fig. 57.
	Genus Valvulina.		
[Species.	Valvulina triangularis.]		
Variety.	V. conica	Plate XV. fig. 27.	
	Genus Lituola.		
[Species.	Lituola nautiloidea.]		
Variety.	L. Canariensis	Plate XV. fig. 45.	Plate XVII. figs. 92–95.
	L. globigeriniformis	Plate XV. figs. 46, 47.	Plate XVII. figs. 96–98.
	L. Scorpiurus	Plate XV. fig. 48.	
	Genus Trochammina.		
Species.	Trochammina squamata	Plate XV. figs. 30, 31.	
Variety.	T. gordialis *	Plate XV. fig. 32.	
	Genus Cornuspira.		
Species.	Cornuspira foliacea	Plate XV. fig. 33.	
	Genus Miliola.		
[Species.	Miliola (Quinqueloculina) Seminulum]....	Plate XV. fig. 35.	Plate XVII. fig. 87.
Variety.	M. (Q.) agglutinans	Plate XV. fig. 37.	
	Q. Ferussacii	Plate XV. fig. 36.	
	Q. oblonga	Plate XV. figs. 34, 41.	Plate XVII. figs. 85, 86.
	Q. subrotunda	Plate XV. fig. 38.	
	Q. tenuis	.....	Plate XVII. fig. 84.

		Arctic.	North Atlantic.
Variety. M. (Spiroloculina) planulata			Plate XVII. fig. 82.
Subvariety. Sp. limbata			Plate XVII. fig. 83.
Variety. M. (Biloculina) ringens		Plate XV. figs. 42–44.	
Subvariety. B. depressa			Plate XVII. fig. 89.
B. elongata			Plate XVII. figs. 88, 90, 91.
[*Variety.* M. (Triloculina) trigonula.]			
Subvariety. T. tricarinata		Plate XV. fig. 40.	
T. cryptella		Plate XV. fig. 39.	

Genus Nodosarina.

Several of the Nodosarine forms are well represented in the northern seas; but the completion of this group of hyaline, straight, or more or less bent and coiled, uniserial shells, flat, bulbous, cylindrical, or tapering, with simple septal apertures surrounded by radiating fissures, such as are comprised in our great genus *Nodosarina* (with but one true species), must be sought for in other seas. The larger *Nodosariæ* and *Cristellariæ* are wanting here, as well as the *Flabellinæ* and *Frondicularieæ*, the *Lingulinæ* also, and a host of variable *Dentalinæ*, *Vaginulinæ*, and *Marginulinæ*.

Nodosaria Raphanus*, Linnè, sp. Plate XVI. fig. 1 (North Atlantic).

A dwarf sulcate specimen with the septal lines hidden; ridges strong, oblique, and inosculating to some extent. These are not unusual features in similar but larger specimens from the Mediterranean and elsewhere, occurring at from the shore-line to 100 fathoms.

Our specimen is from 78 fathoms, lat. 51° 59′, long. 11°, North Atlantic, to the north of Newfoundland Bank.

Nodosaria scalaris, Batsch. Plate XVI. figs. 2 *a*, 2 *b*, 2 *c* (North Atlantic).

A pretty, common form, neatly striated, subcylindrical, with more or less elongate neck or stolon-tube. This is one of the varieties found by Soldani near Sienna (Testaceogr. vol. i. part 2, pl. 95, figs. *b–m*), and named *N. longicauda* by D'Orbigny (Ann. des Sciences Nat. vol. vii. p. 254, no. 28†. (See also page 353.)

Our figured specimens are from the North Atlantic; rare and small at 78, 90, 200, 222, and 415 fathoms (see Table V.). We have otherwise collected it principally from muds from about 100 fathoms in the northern seas.

Nodosaria (*Glandulina*) *lævigata*, D'Orbigny. Plate XIII. fig. 1 (Arctic).

This is a smooth form, and rather slender compared with that figured by D'Orbigny

* For the relationship of species and varieties in the genus *Nodosarina*, of which *Nodosaria* represents a subgroup, see the list at page 336.

† The priority of the name given by Batsch has been determined since this paper was read: see Ann. Nat. Hist. March 1865, p. 225.

in the 'Annales des Sciences Nat.,' vol. vii. pl. 10, fig. 1–3; the ribbed form (*N. Glans*, D'Orb.) is represented by D'Orbigny's Modèle, No. 51; both of these were from the Adriatic, and were grouped in his subgenus *Glandulina*, characterized by the short and acute-ovate shell, formed of few, close-fitting chambers, rapidly enlarging from the primordial. Similar characters, but with less regularity, are found in many specimens of *Nodosaria Radicula*, and therefore the term *Glandulina* is useful merely for convenience in distinguishing the neatest of a great number of similarly modified forms, and is nothing in a zoological sense.

Our specimens are from Nordland, in the Arctic Circle, at a depth of 160 fathoms (Messrs. MacAndrew and Barrett); and they appear to be not uncommon, on a muddy bottom.

This *Glandulina* occurs also, though never abundantly, in other seas; for instance, on the muddy bed of the Gulf of Suez at 30 to 40 fathoms; in the Mediterranean, at from 30 to 100 fathoms (particularly in the Adriatic); and it has been found by Mr. H. B. Brady in sea-sand from Shetland.

In the fossil state this form is not rare, though of extremely small size, as in several of the fossiliferous clays of the Secondary Period (where it is apt to run, on the one hand, into *Lingulina*, and, on the other, into *Nodosaria Radicula*), as in the Upper Triassic Clay of Chellaston, the Oxford Clay of Leighton, the Kimmeridge Clay of Aylesbury, and in the Chalk-marl; as also in the Tertiary strata of the Mediterranean area.

Nodosaria Radicula, Linn. sp. Plate XIII. figs. 2–7 (Arctic).

This is a Nodosarian variety closely related to the last, passing gradually from the shape of a top to that of a pupa, or from a glandiform to a cylindrical shape, thus comprising *Nodosaria humilis*, Roemer, and many other named subvarieties. These allied forms also lead out from *Nodosaria* proper to *Dentalina*; the aperture being often excentric and the axis curved. The several intermediate modifications of form have received numerous binomial appellations from authors.

Fig. 4 presents, instead of the round aperture, a transverse slit. This is a character supposed to be of generic value by D'Orbigny and special to *Lingulina*, this form of aperture being connected generally with a flattened or tongue-shaped form of shell. Here we have a specimen which dissolves the distinction between *Nodosaria* and *Lingulina*.

Of the specimens here illustrated, figs. 2–6 are from Nordland (MacAndrew and Barrett), 160 fathoms, muddy bottom. They are common (about a dozen specimens), and of relatively large size. Fig. 7 is from Hunde Islands, Davis Straits, from a bottom of shelly sand, at 30–40 fathoms (Dr. P. C. Sutherland).

These and numerous other closely allied forms occur in abundance in the Upper Triassic and Liassic clays, and in the clays of the Oolitic formation, but usually they are of very small size. In the Gault, Chalk-marl, and Chalk of the Cretaceous group, *Nod. Radicula* and *Nod. humilis*, connecting it with *Glandulina lævigata*, are not uncommon,

and often of as large a size as those of the North Sea. In the Maestricht Chalk, also, *N. Radicula* is present and of moderate size.

Nodosaria (*Dentalina*) *communis*, D'Orb. Plate XIII. fig. 10 (Arctic).

This specimen is a dwarf *Dentalina communis** of D'ORBIGNY. The obliquity of the chambers in this shell begins early, and so does the greater excentricity of the aperture. This style of growth is well represented also by *D. inornata*, D'Orb. For. Foss. Vien. pl. 1. fig. 51, and still better by *D. Badenensis*, D'Orb. Ibid. pl. 1. figs. 48, 49; both of which are well-grown specimens of *D. communis*.

Our figured specimen is from mixed shelly sands dredged up at various spots between Drontheim and the North Cape by Messrs. MACANDREW and BARRETT. It is very small, and resembles what is usually found in nearly any muddy sand containing Foraminifera.

Dentalina communis is an extremely common variety wherever Nodosarian forms occur in the clays of the Secondary Formations, but usually it is of small size. It is larger in the Gault than in the Jurassic clays; still larger in the Chalk-marl and Chalk, and in the Maestricht Chalk, as well as in the Tertiary beds that yield *Nodosarinæ*. It is very large in the Crag of Suffolk, and in the Subapennine Tertiaries. Older than the Secondary deposits, however, it is found in the Permian limestones of England and Germany.

It is common in the recent state from the Arctic Circle to the Line; in fact, geographically and geologically, it has a very large range. It occurs in many sandy shore-deposits; but its favourite habitat is mud at 50–100 fathoms; and is continually met with in the deepest soundings, although never abundant there, and generally small.

Nodosaria (*Dentalina*) *consobrina*, D'Orbigny. Plate XVI. fig. 3 (North Atlantic).

Two joints of *Dentalina communis*, subvar. *consobrina*, D'Orb. (For. Foss. Vien. pl. 2, figs. 1–3); the chambers are longish and set on more squarely than in *D. communis* proper; representing a passage into *D. ovicula*, D'Orb. (*D. globifera*, Batsch).

This is small and rare at 1776 fathoms in the North Atlantic, lat. 52° 33′, long. 21° 16′.

Nodosaria (*Dentalina*) *pauperata*, D'Orbigny. Plate XIII. figs. 8, 9 (Arctic).

We have here a very common subvariety of *Dentalina communis*, in which the primordial chamber is relatively large, the septa but slightly oblique, and the aperture almost central; the shell is smooth, nearly cylindrical, and not constricted at the septa in the earlier portion of the shell (as shown in our figures 8 and 9); as the animal advances in growth, the chambers take on a more vesicular shape. *D. pauperata*, D'Orb. For. Foss. Vien. pl. 1. figs. 57, 58, is the same as our figured specimens; and *D. brevis*, D'Orb. Ibid. pl. 2. figs. 9 and 10, and many other named forms, are scarcely distinguishable.

* Annales des Sc. Nat. vol. vii. p. 254, No. 35; Mém. Soc. Géol. France, iv. p. 13, pl. 1. fig. 4.

Somewhat rare; from shelly sand, Hunde Islands, Disco Bay (Dr. P. C. SUTHERLAND), at 60–70 fathoms; also from Baffin's Bay, lat. 75° 10′ N., long. 60° 10′ W. (PARRY'S soundings).

Nodosaria (*Dentalina*) *guttifera*, D'Orbigny. Plate XIII. fig. 11 (Arctic).

Passing out of *Dentalina communis* towards the perfectly moniliform subvarieties of *Nodosaria*, we have this loosely grown Dentaline form (*D. guttifera*, D'Orb. For. Foss. Vien, pl. 2. fig. 13), near *D. Pyrula*, D'Orb. It varies much in the gibbosity of the chambers.

Though curved, this *Dentalina* has an almost central aperture, as shown by a broken terminal chamber not here figured. (See Ann. Nat. Hist. 2 ser. vol. xix. pl. 19. figs. 4, 5).

We have *Dentalina guttifera* from Norway at West Fjord (Nordland), from a sandy bottom at 60 fathoms (MACANDREW and BARRETT); and from a muddy bottom (Arctic Circle) at 160 fathoms. These are two fragments of two large specimens. There is no doubt that in this, as in other instances, the small quantity of materials obtained necessarily limited the number of individuals.

Forms similar or allied to this occur both in existing sea-bottoms and in fossil deposits with much the same range as that of *D. communis*; but they are not so common.

Vaginulina linearis, Montagu, sp. Plate XIII. figs. 12 *a*, 12 *b*, 13 *a*, 13 *b* (Arctic).

The straight varieties of *Marginulina Raphanus* (or the flattened forms of *Nodosaria Raphanus*, with excentric septal apertures) are known as *Vaginulinæ*; a large group, widely extending in time and space; especially abundant in the Gault and Chalk-marl. Of these *Vaginulinæ*, *V. Legumen*, Linn., is the most common among the recent; and the Adriatic Sea may be said to be its home. The subvarieties with linear costation are very variable as to their amount of ornament; but they may be all comprised under MONTAGU'S name *V. linearis*. (See WILLIAMSON'S 'Monograph Recent Foram. Great Britain,' p. 23, pl. 2. figs. 46–28.)

We have two small specimens from the mixed sands dredged up between Drontheim and North Cape (MACANDREW and BARRETT).

This is not an uncommon form, occurring at moderate depths. It does not appear to be so common in the fossil as in the recent state, though it is not without close allies in the clays and other deposits of the Secondary and Tertiary formations.

Marginulina Lituus, D'Orbigny. Plate XIII. figs. 14 *a*, 14 *b* (Arctic).

One of SOLDANI'S figured Foraminifera from the Adriatic, named *Marginulina Lituus* by D'ORBIGNY (Annales des Sciences Nat. vol. vii. p. 259. No. 11), well represents our specimen from the Arctic Ocean. This may be looked at as a passage-form from a simple *Vaginulina*, oval in section and but little altered from *Dentalina*, into *Cristellaria*, through innumerable gentle gradations; or it may be regarded as a medium between *Cristellaria* and *Marginulina*; and so leading to *Nodosaria*, through the flattened forms. Having

the chief Nodosarine characters, the *Marginulinæ* form the central group of the *Nodosarinæ*, and *Nodosarina* (*Marginulina*) *Raphanus* is the type of all.

Very large specimens of *M. Lituus* occur at Nordland, Arctic Circle (MacAndrew and Barrett), on a muddy bottom, at 160 fathoms. These are the largest individuals we have ever seen of this common variety of *Marginulina* or uncoiled *Cristellaria*, which is to be met with wherever the Cristellarians occur, recent or fossil, from the Lower Secondary deposits upwards.

In this case *Cristellaria cultrata* is also present; and an analogous companionship of the Cristellarian and the Marginuline *Nodosarinæ* is to be found in Professor Bailey's "Microscopical Examination of Soundings made by the United States' Coast-survey off the Atlantic Coast of the United States" (Smithsonian Contributions to Knowledge, vol. ii. 1851), where two forms (*Robulina D'Orbignii* and *Marginulina Bacheii*, Bailey), equivalent to the above, accompany each other in soundings of from 51 to 90 fathoms. (See above, page 331, and Appendix II.)

Cristellaria Crepidula, Fichtel and Moll, sp. Plate XIII. figs. 15, 16 *a*, 16 *b* (Arctic); Plate XVI. fig. 4 (North Atlantic).

We have here a very insensible gradation from *Marginulina Lituus* (fig. 14). In fact fig. 15 differs but little from the latter except in size; and fig. 16 is merely somewhat more closely coiled, flatter, and shorter; thus putting on the true Cristellarian form.

These specimens are from dredgings made at the Hunde Islands by Dr. P. C. Sutherland; they are rather common in the sandy mud, rich with shells, at from 30 to 40 and 60 to 70 fathoms.

In recent occurrence *C. Crepidula* is as world-wide as the ordinary *Dentalinæ*. It is a feeble form of *Cristellaria* creeping up from the favourite depth of *Cristellariæ* (50 to 100 fathoms) to shallow water, and downwards to abyssal deeps.

In the fossil state also it has an equally wide range; but, like its congeners, it is met with of a larger size in the Upper than in the Lower Secondary deposits. The largest are to be found in the Subapennine and Viennese Tertiaries; some of these large fossil varieties are extremely thin.

Plate XVI. fig. 4 (North Atlantic).

A pretty little *C. Crepidula*, differing only as an individual from fig. 16 in Plate XI. Small and rare at 43 fathoms, lat. 51° 57′, long. 10° 30′, North Atlantic.

Cristellaria cultrata, Montfort, sp. Plate XIII. figs. 17 *a*, 17 *b*, 18 *a*, 18 *b* (Arctic); Plate XVI. fig. 5 (North Atlantic).

This is *Cristellaria* proper, the most nautiloid form attained by any *Nodosarina*. Here the rod-like chain of chambers seen in the simple forms (*Nodosaria*) has passed into a spiral, discoidal, symmetrical, lens-shaped shell (*Cristellaria*). In this variety, *C. cultrata*, the shell is more or less keeled; this keel becomes more developed and rowelled

in *C. Calcar*, Linn., sp. When the keel is wanting, we have *Cristellaria rotulata*, Lamarck. There are no specific differences in their features.

Fig. 18 shows an irregularity of growth, and a disposition to depart from the nautiloid form towards the simpler varieties in which the greater distinction of the chambers is preserved. Several angles around the periphery of the shells are sometimes formed, rendering their outline polygonal. Other variations of growth are not uncommon; the polymorphism of these simple organisms being very great.

Plate XVI. fig. 5 (North Atlantic).

A smallish nautiloid *Cristellaria* with moderately developed keel, such as fig. 17 of Plate XIII., but differing in the non-essential features of greater obliquity of chambers and more distinct umbilical knob.

Rare at 78 fathoms, lat. 51° 59′, long. 11°, North Atlantic.

Cristellaria rotulata, Lamarck, sp. Plate XIII. fig. 19 (Arctic).

Here the keel is nearly obsolete. This carina is generally all that is left to us in these nautiloid forms of the longitudinal striæ or costæ that so frequently ornament the subspecies of the large *Nodosarina* group. Occasionally, however, the lateral faces of the shell bear raised costæ crossing the chambers, nearly at right angles, as in the ribbed *Nodosariæ* and *Marginulinæ* (typical), and in many *Vaginulinæ*, *Flabellinæ*, and *Frondiculariæ*.

The *Cristellariæ* represented by figs. 17–19 occur, common and large, in the Arctic Circle, Nordland, on a muddy bottom at 160 fathoms.

These recent northern specimens are, as regards size, equal to such as we find in those rich Cristellarian deposits, the Chalk and Chalk-marl. Like the rest of this group, however, the largest of this form are found in the Subapennine Tertiaries, the Vienna Basin, and in the Tertiary beds of Jamaica and San Domingo. Exactly similar specimens of *Cristellariæ* abound in the rich shelly bottom, at 50 fathoms, in the Port of Orotava, in the Canaries (*Robulina Canariensis*, D'Orb. For. Canar. p. 127, pl. 3. figs. 3, 4); and forms nearly as large are not at all uncommon in the Mediterranean, especially in mud at from 50 to 100 fathoms. In the Adriatic, however, this, with other *Cristellariæ*, is found of similar size in shallow water.

Of small size, these are found on our own coasts and throughout all seas. They are fossil in very many Secondary and Tertiary deposits, but of rather small size in the older strata; nevertheless in these latter beds they are exceedingly abundant and characteristic, not being mixed so much with species of other families of Foraminifera that have come in at a later epoch.

Genus Lagena.

For full descriptions, general and special, of this genus we refer to Professor Williamson's Memoir on *Lagenæ*, Annals Nat. Hist. 2 ser. vol. i. 1848; and his 'Mono-

graph of British Recent Foraminifera,' 1857; to Dr. CARPENTER'S 'Introduction to the Study of Foraminifera,' 1862; and to Professor REUSS'S 'Monographie der Lagenideen,' Sitzungsber. Akad. Wiss. Wien, vol. xlvi. 1 Abth. 1863 (read June 1862); and for the strict determination of the species noticed by WALKER, JACOB, and MONTAGU, and for some special remarks on *Lagenæ*, we refer to our own Papers in the Annals Nat. Hist. 1857, &c.

On account of their extreme variability (within certain limits) as to shape and ornament, without any definite break in the range of the modifications being recognizable, it is impossible to fix on any distinctive character, or set of characters, sufficiently limited in development to be of real importance in dividing the *Lagenæ* into even two *species*. For convenience, however, we must take the best marked shapes and ornaments as indicating subordinate or varietal types, around which the diverging modifications may be grouped in an artificial classification.

This has been nearly completely accomplished, in his "Monographie" above referred to, by Professor REUSS; who, however, regards these subordinate divisions as "species." The addition of some striking varieties chiefly found in the warm seas, including the two-mouthed elongate forms, and the correction of some errors in the synonymy, arising mainly from mistakes as to WALKER'S and MONTAGU'S *Lagenæ*, would still further improve Professor REUSS'S classified and illustrated conspectus of the chief members of this group of elegant little single-chambered Foraminifera; and, without doubt, his so-called "genus" *Fissurina* is open to criticism, as we shall see further on.

Lagena, including both those that have external apertural tubes (Ectosolenian) and those with internal neck-tubes (Entosolenian), have their chief features of shape and ornament shown by globose, ovate, and fusiform shells, either smooth, partly or wholly ribbed, reticulate, or granulate and spinose; also by more or less compressed shells, of round or oval outline, with and without linear and reticulate sculpture; further, the base of the shell, opposite to the aperture, becomes apiculate, produced, and perforate, in any of the above-mentioned kinds of shell, resulting in a more or less fusiform and perforate, or distomatous, condition.

Taking the *smooth* forms, varying from egg-shaped to flask- and amphora-shaped, with or without long necks, we have the "lævigatæ" of REUSS, among which *L. globosa*, Walker and Jacob, *L. lævis*, Montagu, and *L. clavata*, D'Orbigny, represent the three best-marked stages. REUSS includes also the apiculate smooth forms in this group; but we prefer to bring them into relation with the perforate forms, to which we believe they strongly tend.

Those with furrows, riblets, and ribs are the "striatæ aut costatæ" of REUSS. They are led by *L. semistriata*, Williamson, from out of the smooth forms up to *L. sulcata*, Walker and Jacob, and even more coarsely ribbed shells, with modifications of form exactly corresponding to those of the smooth varieties; but no particular stage of shape and of ornament can be said to be permanently associated.

In the "reticulatæ" (Reuss) the longitudinal riblets become united by cross-bars, of

varying strength; either regularly, so as to form rectangular meshes (*L. squamosa*, var. *catenulata*, Williamson, and *L. Melo*, D'Orbigny; or less regularly, and forming—1st, either tetragonal or hexagonal network, with the meshes one above the other from the base to the top of the shell, and divided by nearly straight longitudinal ridges or walls; 2ndly, hexagonal network, with the meshes alternately placed (honeycomb-pattern), the walls being zigzag, and equally developed along and across (*L. squamosa*, var. *hexagona*, Williamson). Lastly, hexagonal and quadrangular meshes are combined on one shell, as in *L. squamosa*, Montagu, sp., which herein well serves as the subtype.

The "asperæ" of Reuss are such as are ornamented with granules and spines. These exogenous shell-growths are, without doubt, equivalent to linear and reticulate ridges, variously modified; just as hispid *Nodosarinæ* show gradual modifications of riblets and spines. As with the "costatæ" and the "reticulatæ," no particular shape of shell specially affects this style of ornament. Reuss's "compressæ" comprise the more or less flattened *Lagenæ*, and must include those which he separates under the name *Fissurina* on the supposition that they are distinguishable by their slit-like aperture. All *Lagenæ* that are more or less compressed have the aperture correspondingly narrowed and outdrawn, just as all *Nodosariæ* becoming flattened and "Linguline" have a more and more chink-like aperture. The transitions are extremely gradual both into "Fissurina" and "Lingulina" respectively, and are associated indiscriminately with all the other modifications of outline and ornament that belong to the species. The compressed *Lagenæ* usually take on one or more keel-like riblets at or near the margin, representing the local accumulation of the linear exogenous shell-growth so common in *Lagena*. A similar feature occurs in the *Nodosarinæ*, where a similar ornamentation obtains.

Lastly, we propose to complete this artificial classification of the *Lagenæ*, by dividing off those that, passing from a pointed or apiculate shape at the base, ultimately present a perforate or distomatous, continuously tubular shell, more or less fusiform. Reuss's *L. apiculata* represents the smooth *apiculate* forms; D'Orbigny's *L. caudata* the ribbed ones; our *L. polita* the smooth, and our *L. distoma* the costulate, *perforate* forms. (See Scheme of the *Lagenæ*, p. 348.)

Of *Lagena* it may be said, that, though apparently one of the simplest of Foraminifera, it is not one of the oldest, as far as our knowledge serves us at present. Nor can it be regarded as an arrested *Nodosaria*; rather, it may be looked on as a higher specialization of the simple repetitive Nodosarian form. It has its isomorphisms with *Nodosaria*, both in ornamentation and in its flattening.

All the large *Lagenæ* are found at about 50 fathoms (25–70) in shelly sands; the more delicate forms occur both in shallow water (which may even be brackish), in the dark muds of harbours and bays, and, on the other hand, at great depths, being not uncommon in the deposits almost wholly composed either of Foraminifera alone, or of these with Pteropods.

Scheme of the LAGENÆ.

- Single-mouthed
  - round in section
    - smooth
      - egg-shaped .... *globosa*, Montagu; Williamson, Monogr. p. 8, pl. 1. figs. 15, 16.
      - flask-shaped .... *lævis*, Montagu; Williamson (*L. vulgaris*), Monogr. p. 3, pl. 1. fig. 5.
      - amphora-shaped . *clavata*, D'Orb. For. Foss. Vien. p. 21, pl. 1. figs. 2, 3.
    - ribbed
      - partly ..... *semistriata*, Williamson, Monogr. p. 6, pl. 1. figs. 7, 9.
      - delicately ..... *striata*, D'Orb. For. Amér. Mér. p. 21, pl. 5. fig. 12.
      - strongly ..... SULCATA, Walker and Jacob; Williamson (*L. vulgaris*, var. *striata*), Monogr. p. 6, pl. 1. fig. 10. [The typical *Lagena*.]
      - coarsely ..... *acuticosta*, Reuss, Sitz. Ak. Wiss. Wien, vol. xliv. p. 303, pl. 1. fig. 4.
    - reticulate
      - square meshes .. *Melo*, D'Orb. For. Amér. Mér. p. 20, pl. 5. fig. 9.
      - 6-sided meshes.. *hexagona*, Williamson, Monogr. p. 13, pl. 1. fig. 32.
      - both 4- and 6-sided meshes — *squamosa*, Montagu; Williamson, Monogr. p. 29, pl. 1. fig. 29.
    - rough-ened
      - spines ..... *hispida*, Reuss, Sitz. Ak. Wiss. Wien, vol. xlv. p. 335, pl. 6. figs. 77–79.
      - granules ..... *aspera*, Reuss, Sitz. Ak. Wiss. Wien, vol. xliv. p. 305, pl. 1. fig. 5.
  - compressed
    - smooth ..... *marginata*, Montagu; Williamson, Monogr. p. 10, pl. 1. figs. 19–21.
    - striate ..... *radiato-marginata*, Parker and Jones (var. nov.), Plate XVIII. fig. 3.
    - reticulate ..... *squamoso-marginata*, Parker and Jones (var. nov.), Plate XVIII. fig. 2,
    - 3-keeled ..... *trigono-marginata*, Parker and Jones (var. nov.), Plate XVIII. fig. 1.
- Passing from appendiculate or caudate to distomatous
  - smooth
    - short ..... *apiculata*, Reuss, Haid. ges. nat. Abhandl. vol. iv. p. 22, pl. 1. fig. 1; and Sitz. Ak. Wiss. Wien, vol. xlvi. p. 318, pl. 1. figs. 4–8, 10, 11.
    - long ..... *distoma-polita*, Parker and Jones (var. nov.), Ann. Nat. Hist. 2 ser. vol. xix. p. 279, pl. 11. fig. 23, Plate XVIII. fig. 8.
  - ribbed
    - short..... *caudata*, D'Orb. For. Amér. Méd. p. 19, pl. 5. fig. 6.
    - long ..... *distoma*, Parker and Jones (var. nov.), Ann. Nat. Hist. *ib.* fig. 24.
  - granulate
    - short..... *distoma-aculeata*, Parker and Jones (var. nov.), Plate XVIII. fig. 5.
    - long ..... *distoma-margaritifera*, Parker and Jones (var. nov.), Plate XVIII. fig. 6.

The family *Lagenida* (comprising *Lagena*, *Nodosarina*, *Orthocerina*, *Polymorphina*, and *Uvigerina*) may be said to have its central home (bathymetrically speaking) at about from 50 to 100 fathoms. Of these, *Polymorphina* is almost exceptional, however; for it is, of this group, the most inclined to seek and flourish in shallow water, always avoiding abyssal depths. *Uvigerina* and *Lagena* are more capable even than *Nodosarina* of living in deeper water than 100 fathoms, and of existing even at very great depths (2000 fathoms). *Uvigerina* has its feeblest representatives in shallow water; but *Lagena* attains as fair a size in shallow water as it does at 100 fathoms; and at 1000 fathoms it is often in good condition. *Nodosarinæ* are, as to their habitat, intermediate between *Polymorphinæ* and the others. They are of large size at 100 fathoms; and are found occasionally, but small and rare, at 1000 fathoms; and in shallow water they are more abundant than in the abyssal depths, and attain a larger size.

Lagena sulcata, Walker and Jacob, Var. (*Entosolenia*) *globosa*, Montagu. Plate XIII. figs. 37 *a*, 37 *b* (Arctic); Plate XVI. figs. 10 *a*, 10 *b* (North Atlantic).

This is the simplest of the *Lagenæ*, subspherical and Entosolenian, that is, having an intus-suscepted mouth-tube. It is entirely devoid of ornament, and generally thin-

walled. It may be said to be a feeble form connecting *L. lævis* with swollen varieties of *L. marginata*.

L. globosa comes from 30 to 40 fathoms, and from 60 to 70 fathoms at the Hunde Islands (Dr. SUTHERLAND); and in both dredgings it is rather common and of middling size. Also from Baffin's Bay, lat. 75° 10′ N., long. 60° 12′ W. (PARRY); here it seems to be rare, but is of large size,—a curious fact, in contrast with the occurrence of equally large individuals of this variety at very great depths (1080 fathoms) in the tropical Atlantic (lat. 2° 20′ N., long. 28° 44′ W.).

This also is a world-wide and very common *Lagena*, as we may see by Table VII. Professor REUSS has it fossil from the Chalk of Maestricht and of Lemberg, from the Septarian Clay of Pietzpuhl, the Salt-clay of Wieliczka, and the Crag of Antwerp (Monogr. Lagen. p. 318). It is of good size and rather common in the English Crag also.

L. globosa was figured and described by WALKER and BOYS, but not named by WALKER and JACOB in KANMACHER'S edition of ADAM'S 'Essays on the Microscope,' where the specific names given by WALKER and JACOB are recorded. It was named by MONTAGU, 'Test. Brit.' p. 523.

Plate XVI. figs. 10 *a*, 10 *b* (North Atlantic).

Equivalent to fig. 37 of Plate XIII., but having more neck, and like figs. 30 & 31 (*L. sulcata*) in outline and in thickness of neck.

Rare and large at 415 fathoms, lat. 52° 8′, long. 12° 31′, North Atlantic.

Lagena sulcata, Walker and Jacob, Var. *lævis**, Montagu. Plate XIII. fig. 22 (Arctic); Plate XVI. fig. 9 *a* (North Atlantic).

Fig. 22 is the common, smooth, flask-shaped *Lagena* of authors. In this specimen pseudopodial passages are crowded about the lower third of the shell, the upper two-thirds being destitute of such foramina. We have observed that in *Lagenæ* such perforations occur only when the shell is of a certain thickness, considerable tracts of the shell-wall being often extremely thin and imperforate. In the very small-ribbed varieties (such as figs. 25–27) perforations are arranged in a row on each side of the costa, where its base is thick (*L. striatopunctata*). In the closely allied Entosolenian *L. marginata* also (as in fig. 44), perforations occur principally along the thickened margins, occasionally as a broad band; though sometimes (as in fig. 42) they are also scattered sparsely over the whole shell.

This is from the mixed sands from Norway above alluded to. It is world-wide, often found at considerable depths, but shallow water appears to be its favourite habitat. In the fossil state this smooth variety is very abundant in the Post-pliocene clays of Lincoln-

* Taking this as the type of *Lagena*, WILLIAMSON thought that "lævis" was not an appropriate name for a shell that is often ornamented, and substituted the term "vulgaris"; this unnecessary change has been unfortunately adopted by REUSS (Sitzungsb. Ak. Wien, vol. xlvi. p. 321).

shire and Cambridgeshire, and in the Grignon sands (Eocene); it occurs also in the Vienna Tertiaries, and (according to REUSS, Monogr. Lagen. p. 322) in the Crag of Antwerp, the Septarium-clay of Pietzpuhl, and the Tertiary beds of Taranto (COSTA). It is rare in the English Crag.

Plate XVI. fig. 9 *a* (North Atlantic).

This figure represents a specimen of *L. lævis* from the North Atlantic, where this variety is very rare and of middling size at 329 fathoms, lat. 49° 26′, long. 49° 48′, and rare and large at 223 fathoms, lat. 52° 11′, long. 13° 45′.

Lagena sulcata, Walker and Jacob, Var. *semistriata*, Williamson. Plate XIII. fig. 23 (Arctic).

This beautiful little *Lagena* connects the smooth with the striated varieties. Like the others, it varies much in shape and in the strength of its riblets; the specimen figured by Professor WILLIAMSON (pl. 1. fig. 9) is much more decanter-shaped than ours, and has a very long neck, with a neatly turned rim or lip; our specimen is deficient as to this latter character. We quite agree with Professor REUSS in grouping WILLIAMSON'S *L. vulgaris*, var. *perlucida* (Monogr. p. 5, pl. 1. figs. 7, 8), with this variety. MONTAGU'S *L. perlucida* is a six-ribbed *L. sulcata*. We found this specimen (fig. 23) in the shelly sand from the Hunde Islands, Davis Straits, 50 to 70 fathoms. Dr. WALLICH figures *L. semistriata* in 'The North-Atlantic Sea-bed,' pl. 5. fig. 17.

It is very common to meet with *Lagenæ*, both recent and fossil, taking on striæ and riblets to greater or less extent, as in this instance. REUSS figures finely striated specimens from the Crag of Antwerp in his paper on the *Lagenidæ*, Sitzungsb. Wien Akad. vol. xlvi. pl. 2. figs. 18–21.

Lagena sulcata, Walker and Jacob, Var. *striatopunctata*, nov. Plate XIII. figs. 25–27 (Arctic).

We have long known this variety from the Indian Ocean on Clam shell, and at 2200 fathoms, the Red Sea (372 fathoms), South Atlantic (2700 fathoms), and from the Eocene deposits of Grignon, but it has not been hitherto figured nor described.

It is a relatively small *Lagena*, and is one of the most delicate. It varies in shape, from forms more delicately elongate than the tear-shaped specimen represented by fig. 25, to those having the usual flask-shape, with longer neck than in fig. 27. The ribs are comparatively strong; they range in number from four to twelve, and in one recent specimen we have seen them spiral. The thickened base of the ribs is neatly perforated on each side by pseudopodian foramina, which also occasionally pass through the rib itself, from within outwards.

L. striatopunctata occurs rather common at the Hunde Islands, 30 to 40 fathoms, in shelly sandy mud, and here attains a size greater than those in the Indian Ocean, or those from the inside of a Grignon shell (p. 419, note); the specimens from the Red Sea, however, are as large as those from Davis Straits.

Lagena sulcata, Walker and Jacob. Plate XIII. figs. 24, 28–32 (Arctic); Plate XVI. figs. 6, 7, 7 *a* (North Atlantic).

This is the typical form of *Lagena*; its variations lead, in one direction, into the feebler forms (*L. semistriata*, *lævis*, *globosa*); on the other hand, we have varieties with reticulated, hispid, and granular ornament; and there are also compressed forms, and elongate varieties, departing more or less widely from the middle type presented by the ovate and characteristically costate *Lagenæ*.

Figs. 30 & 31 represent the best characterized forms (though not absolutely the largest) that we know of in the group of *Lagenæ*. This is shown in their boldness of growth, the strength of their ribs (twelve to fourteen in number), and particularly in the radiated structure of the aperture. This last seems to be a rare condition; we have as yet seen it only in these specimens*, but it is one among many features showing the intimate relationship between *Lagena*, *Nodosarina*, and *Polymorphina*.

L. sulcata of Walker and Jacob, in Kanmacher's edition of Adam's 'Essays,' well-figured previously by Walker and Boys, is a good-conditioned, strongly ribbed, and flask-shaped shell; our figs. 28–31 present less neck; but Williamson's figure of *L. vulgaris*, var. *striata* (Monogr. p. 6, pl. 1. fig. 10), and Reuss's figure of his *L. filicosta* (Monogr. pl. 4. figs. 50, 51), show as much or more neck and a better lip than Walker's figure does; but they are rather less globose, passing off into *L. Amphora*, Reuss, and *L. gracilis*, Williamson. See Reuss's Monogr. Lagen. pl. 4, where by extreme care the ovate, flask-like, and fusiform shapes of the well-ribbed *L. sulcata* are divided into seven "species," according to their gradations of shape and modifications of ornament. It is, however, next to impossible, and of very little use, to institute minor distinctions with these *Lagenæ*.

As explained in the Annals Nat. Hist. 1859, 3 ser. vol. iv. p. 336, Montagu termed this form "striata," overlooking the prior name, which alone is necessary.

Figs. 28 & 29 are from the Hunde Islands, 30–70 fathoms; and from the Arctic Ocean (found in the mixed sands).

Figs. 30 & 31 represent specimens from the Hunde Islands also, three gatherings by Dr. P. C. Sutherland, in shelly sandy muds, from 30–70 fathoms; within this limit *L. sulcata* is most common; and is largest at the greater depth. Perhaps the figured specimens nearest to these are *L. Isabella* and *L. raricosta*, D'Orb., from the Falkland Islands (Foram. Amér. Mérid. p. 20, pl. 5. figs. 7, 8, 10, 11). The almost exact counterpart of these fine large specimens we have found in the Upper Chalk of Maestricht, in the Crag of Suffolk, and in recent shelly sands from the Isle of Man. Reuss figures (under other names) long- and short-necked specimens, strongly ribbed, of *L. sulcata* from the Black Crag of Antwerp, and the Septarian Clay of Pietzpuhl and Hermsdorf.

Among the localities given by Williamson for the common *L. sulcata* (Monogr. p. 6)

* Professor Reuss figures this feature in some of the illustrations of his paper on the *Lagenidæ*, Sitzungsb. Ak. Wiss. Wien, Math.-Nat. Cl. vol. xlvi. 1862, Erste Abth. p. 308, &c. pl. 1–7.

we find the Hunde and Beechey Islands; Petersburg, U.S. (fossil; Miocene); and English Crag.

This *Lagena* does not usually occur of so large a size as some of those from Hunde Islands. The most common condition is represented by figs. 28 & 29. These are smaller forms wanting the radiate structure of the aperture, but not separable from the type. Fig. 32 is a similar, but still smaller, form, and rather distorted. These feebler varieties of *L. sulcata* are common in all seas wherever *Lagenæ* are found.

Plate XIII. fig. 24 is a rather small flask-shaped *Lagena* with costulæ, having a spiral twist, which are intermediate in strength between the delicate riblets of fig. 23 and the strong ribs of the type-form, *L. sulcata*. The spiral arrangement of the costulæ is very variable in different individuals collected from various places: the obliquity and curvature of these ornaments being greater or less; and, as usual, the riblets vary in length, even in the same individual, being sometimes short, and sometimes lengthened so as to creep upwards, twining round the neck as far as the mouth. The intervals or flutings (sulci) may have a width equal to, or be far greater than, the ridges or riblets. When very small the riblets have been mistaken for minute sulci or "striæ." With regard to the rib-ornament of *Lagena*, we may observe that the costation of the flatter varieties is sometimes reduced to a mere keel (as in the Cristellarian forms of *Nodosarina*); either as a single keel; or a larger marginal, and a secondary, pair; thus making six costæ crowded at the edge (as in *Lagenæ* common in the Tertiary beds of Grignon). A somewhat similar condensing of the ordinary riblets into a few (six and even three) large ribs takes place in the cylindrical *Nodosariæ*. In one form of *Lagena* from the Grignon beds, we have three, meridional, three-edged, equal ribs (*L. trigono-marginata*, Parker and Jones, Plate XVIII. fig. 1); and in another four, strong, equal, spiral ribs (marked by pseudopodia, as in *L. striatopunctata*), this is our *L. tetragona*, Plate XVIII. fig. 14.

Fig. 24 is one of the feeble forms of *L. sulcata* (type), world-wide, and acclimatized to nearly all latitudes and depths; it is common at Hunde Islands (Dr. SUTHERLAND), at 60-70 fathoms in shelly sandy mud.

Plate XVI. figs. 6, 7, 7 *a* [including Var. *caudata*, D'Orb.] (North Atlantic).

Various modifications of the typical *Lagena*, from the North Atlantic, are shown by figs. 6, 7 *a*, 7 *b*. Fig. 6 is like fig. 29 of Plate XIII., but it is rather more globose, has rather shorter ribs, and is apiculate (non-essential differences, though the last feature makes it Var. *caudata*, D'Orb.). Fig. 7 *a* is smaller and less globular than figs. 30 & 31 of Plate XIII.

These are rare and of middling size at 2330 fathoms, lat. 50° 25′, long. 44° 19′, North Atlantic; rare and small at 223 fathoms, lat. 52° 11′, long. 13° 45′; and rather common but small at 43 fathoms, lat. 51° 57′, long. 10° 30′.

Fig. 7 *b* (Var. *caudata*, D'Orb.) has an elongate olive-like shape, and thinner costæ than the others. It was rare and of middle size at 1450 fathoms, lat. 50° 6′, long. 45° 45′; and rare and small at 2350 fathoms, lat. 51° 29′, long. 38° 1′, North Atlantic.

Lagena sulcata, Walker and Jacob, Var. (*Entosolenia*) *Melo*, D'Orb. Plate XIII. figs. 33–36 (Arctic).

This is *L. sulcata* with a modified ornamentation. It has small transverse ridges between the ribs, connecting them, and forming subquadrate reticulations, which vary in different specimens.

Professor Reuss would retain Williamson's term *catenulata* for those specimens that have the cross-bars weaker than the ridges; probably a convenient, though hardly necessary, arrangement; the modifications of the relative thicknesses of the longitudinal and transverse ridges are endless, varying from a network of thin lines, equal or unequal in strength, to that with broad, flat, equal ridges, and shallow squarish pits between.

Further, our figs. 33–36, Plate XIII., show sufficiently clearly that no characteristic can be found in the disposition of the secondary or transverse riblets, whether end to end, or alternately between contiguous ribs; for in the same specimen they vary as regards this arrangement.

Fig. 34 has but few of the cross-bars, and these are oblique. In this it not only connects *L. sulcata* with *L. Melo* by the presence of secondary riblets, but the obliquity of these connecting bars shows a tendency towards the formation of the variety *L. squamosa*, next to be described, in which the ornament has a honeycomb- rather than a ladder-pattern. Dr. Wallich figures another pretty passage-form, 'North-Atlantic Sea-bed,' pl. 5. fig. 23.

Figs. 33 & 35 differ in the relative size of the areolæ; a condition dependent upon the number of the primary ribs, and very variable. From the Hunde Islands, 30–70 fathoms; and from the Arctic Ocean (mixed sands).

Fig. 36 is an extremely rare monstrosity, being a *Lagena* with a superadded chamber. It is from the Hunde Islands, from between 30 and 40 fathoms, shelly muddy sand (Dr. P. C. Sutherland). This specimen is unique in our collection. Soldani has figured a specimen extremely like this one, in his 'Testaceograph.' vol. i. part 2, pl. 95. fig. A; named *Nodosaria cancellata* by D'Orbigny (Ann. Sc. Nat. vol. vii. p. 254, No. 29).

As a rule, monstrosities of the *Lagena* are formed by the budding, as it were, of a new chamber obliquely on the side of the original chamber (Plate XVIII. figs. 10–12); these are very rare. If, however, a smooth or ribbed *Lagena* were to take on an additional chamber in the axis of the primary chamber, it would be scarcely distinguishable from a *Nodosaria*. We possess such a form (from the shallow water at Eastbourne), Plate XVIII. fig. 9, which we believe to be a monster of *Lagena lævis*. In the Tertiary Sands of Bordeaux also, rich with *Lagenæ* and small *Nodosariæ*, very puzzling forms occur, which may either be two-celled individuals of *Nodosaria scalaris*, Batsch*, or possibly monstrous varieties of *Lagena sulcata*. In the specimen before us (Plate XIII. fig. 36) we have a mode of ornamentation never found in any Nodosarian Foraminifer;

* Well figured by Wallich in 'The North-Atlantic Sea-bed,' pl. 5. fig. 18, and in Journ. Sci. No. 1, Jan. 1864, fig. 6, in the plate illustrating his paper on the bed of the Atlantic Ocean. Figured also, for comparison, in our Plate XVIII. fig. 13.

and therefore, whilst we have some doubt as to the two-celled forms that have either no surface-ornament, or a sculpturing common to *Nodosaria* and *Lagena*, here we have satisfactory means of diagnosis.

Everywhere in the Foraminiferal group, we have most curious instances of *Isomorphism*, not merely between nearly related species, but between even the diverse forms of separate families (as between those of the Vitreous and Porcellanous Series). In the case under notice isomorphism may be said to occur between three closely cognate specific groups: thus, the specimen of *Lagena* before us has imitated a *Nodosaria*; whilst those already spoken of as taking on a second chamber obliquely have the habit of a young *Polymorphina* (see fig. 46).

Lagena Melo is not uncommon in company with other *Lagenæ*, though not so common as the smooth, sulcate, honeycombed, and marginate varieties. For its occurrence (recent and fossil) in the Mediterranean Area, see Quart. Journ. Geol. Soc. vol. xvi. Table, p. 302.

Lagena sulcata, Walker and Jacob, Var. (*Entosolenia*) *squamosa*, Montagu, sp. Plate XIII. figs. 40, 41 (Arctic); Plate XVI. figs. 11 *a*, 11 *b* (North Atlantic).

This represents a state of ornamentation peculiar to the *Lagenæ* amongst the "hyaline," and to certain varieties of *Miliola Seminulum* among the "porcellanous" Foraminifera. In *L. Melo* the cross-bars are often weaker than the longitudinal ribs, and pass straight across from rib to rib, like the secondary veins in a monocotyledonous leaf, such as *Alisma*, *Myrsiphyllum*, &c. In *L. squamosa*, however, not only have the secondary riblets become equal to the primary, but, by the zigzag inflection of the latter, a nearly regular hexagonally areolated ornament is produced, reminding one strongly of the polygonal meshes produced by the more perfect reticulation of the woody tubes in a dicotyledonous leaf. Early observers, using but imperfect microscopes, compared this retose ornament with a scaly skin of a fish (see WILLIAMSON, Monograph, p. 12).

In fig. 34 we have noticed a variety of *L. sulcata* in which a few secondary bands had united with the main ribs, commencing, as it were, the honeycomb-pattern.

Fig. 40, the largest of our specimens, is from the Hunde Islands* (Dr. P. C. SUTHERLAND), 50 to 70 fathoms; and the smaller one from the Arctic Ocean (MACANDREW and BARRETT).

L. squamosa is of world-wide occurrence; but, like *L. Melo*, is not so abundant as the long flask-shaped and the marginated forms. REUSS has it from the Black Crag of Antwerp, and we have it fossil from Castel Arquato. By far the bulkiest specimens of *L. squamosa* that we have seen are from a Tertiary sand, which, rich in many varieties of *Lagenæ*, in *Ovulites*, *Polymorphina*, and *Vertebralina*, was taken from the inside of a *Cerithium giganteum* from Grignon (page 419, note).

In this reticulate *Lagena* the neck is usually intussuscepted (Entosolenian); in the large fossil form (*L. tubifero-squamosa*, Parker and Jones, Plate XVIII. fig. 7), however,

* Professor WILLIAMSON has also noted its occurrence here (Monogr. p. 12).

the neck is protruded in some cases to a considerable extent, and has about three secondary tubular apertures arising from it laterally, and almost at right angles to the main tube. This is an isomorphism with *Polymorphina tubulosa*, and with certain feeble bifurcating forms of *Nodosaria* from Cretaceous beds.

Plate XVI. figs. 11 *a*, 11 *b* (North Atlantic).

The specimen here figured is a little less globular than figs. 40, 41 of Plate XIII., and has its reticulation rather more regular. Rare and middle-sized at 1450 fathoms, lat. 50° 6′, long. 45° 45′, North Atlantic. In Dr. WALLICH's 'North-Atlantic Sea-bed," pl. 5. fig. 21 seems to be *L. squamosa.*

Fig. 11 *a*, Plate XVI. has the six-sided meshes one above the other, touching by the parallel sides of the hexagon, and in so much corresponding with WILLIAMSON's *L. scalariformis* (Monogr. p. 13. pl. 1. fig. 30), and REUSS's *L. geometrica* (Monogr. Lag. p. 334, pl. 5. fig. 74); but this straight meridional arrangement of the meshes is lost in the less regular reticulation of such specimens as figs. 40 & 41 in Plate XIII., where square, six-sided, and irregular meshes occur, in straight, oblique, and irregular lines. Professor REUSS's unnecessary disuse of MONTAGU's term *squamosa* for this varietal group leads to increased confusion in any attempt to subdivide these reticulate *Lagenæ*, which have no natural divisions among themselves.

Lagena sulcata, Walker and Jacob, Var. (*Entosolenia*) *marginata*, Montagu. Plate XIII. figs. 42–44 (Arctic); Plate XVI. figs. 12 *a*, 12 *b* (North Atlantic).

These are flattened forms variable in shape; generally Entosolenian, but sometimes Ectosolenian with a long delicate neck. This compressed shape is usually associated with a trenchant margin, sometimes slightly apiculated (as in fig. 42), and sometimes dentate or rowelled (as in WILLIAMSON's Monograph, pl. 1, figs. 21 *a*, 25, 26), reminding one of the keel of certain *Cristellariæ*. Occasionally in large well-developed specimens of *L. marginata* (recent and fossil) the margin is composed of a large predominant rib, strengthened by a pair of smaller costæ; showing that, as in other Foraminifera, especially the Nodosarine group, the exogenous costæ gather themselves to the margins, the rest of the surface becoming less and less ornamented. The pseudopodial pores also usually affect the neighbourhood of the thickened margin in these flattened forms, just as they follow the ridges of *L. striatopunctata* (figs. 25–27). Occasionally the pseudopodia have perforated the whole surface, either sparsely, as in fig. 42 *a*, or freely, as we have seen in specimens from the Indian Sea.

In some rare specimens from the Coral-reefs of Australia, and fossil at Bordeaux, we see the pseudopodia begin to enter the shell-wall near the centre, and then burrow radially to escape near the margin; the shell-surface being perfectly smooth and as polished as glass. This is our subvariety *Lagena radiato-marginata*, Plate XVIII. fig. 3. In the Crag of Suffolk there is another subvariety of *L. marginata*, in which the radiating canals are visible only at the margin.

The intussuscepted neck-tube in *L. marginata* is generally more or less oblique, some-

what trumpet-shaped, and of varying length (as may be seen in figs. 42 & 43). Fig. 44 has the tube partly protruded, and partly internal. The apparent difference in the setting on of the mouth, which we formerly thought we could detect, between *Entosolenia* and *Lagena* proper (Annals Nat. Hist. 2 ser. vol. xix. p. 279), does not really exist, for we find that in any of the subspecific groups forms may occur having either a gently tapering neck (Ectosolenian), or a tube abruptly set in (Ento-ecto-solenian), or a mouth-tube entirely intussuscepted (Entosolenian). *L. marginata* is sometimes distomatous, being open at the base, and then coming under another (artificial) subdivision.

Between such globose forms as figs. 38 & 39, and the flattened ones (figs. 42–44), there is an almost infinite number of gentle gradations shown in specimens from all parts of the world.

The specimens figs. 42–44 occur at the Hunde Islands (Dr. SUTHERLAND), in three dredgings at from 30 to 70 fathoms, and at Drontheim, North Cape (MACANDREW and BARRETT), from 30 to 200 fathoms. Rather common. Professor WILLIAMSON has already recorded the occurrence of *L. marginata* at 100 fathoms at the Hunde Islands (Monogr. pp. 10 & 11). Like other *Lagenæ*, it is world-wide; and is abundant in the Tertiaries: it is rather common, for instance, in the Crag of Suffolk. For some of its Mediterranean habitats (recent and fossil) see Quart. Journ. Geol. Soc. vol. xvi. p. 302, Table. Under the name of *Oolina compressa*, D'ORBIGNY described it as occurring with other *Lagenæ* at the Falkland Isles. It is figured by J. D. MACDONALD, Assist.-Surgeon H. M. S. Herald, in the Annals Nat. Hist. 2 ser. vol. xx. pl. 5. figs. 7–10, but not described. He found it, together with a dimorphous *Uvigerina* (with loosely set, straggling chambers), *Spiroloculina planulata*, *Quinqueloculina Seminulum*, and *Triloculina oblonga* in 440 fathoms water between Ngau and Viti-Laru, in the Feejee group of islands.

L. marginata is sometimes hexagonally areolated, like *L. squamosa*, but more feebly (*L. squamoso-marginata*, Parker and Jones, Plate XVIII. fig. 2); as we have seen in specimens from the Tertiary beds of San Domingo, and from the white mud of the Australian Coral-reefs.

Plate XVI. figs. 12 *a*, 12 *b* (North Atlantic).

Here we have a slight modification in the development of the keel, as compared with the equivalent specimens represented by figs. 42, 43, Plate XIII. In the North Atlantic *L. marginata* is rare and small at 740 fathoms; rare and middle-sized at 1450 fathoms; rather common and large at 2350 fathoms; rare and large at 415 fathoms; rather common and small at 90 fathoms; and common and small at 78 and 43 fathoms. Dr. WALLICH figures three forms of *L. marginata*, 'North-Atlantic Sea-bed,' pl. 5. figs. 19, 20, 22.

Lagena sulcata, Walker and Jacob, Var. *distoma*, nov. Plate XIII. fig. 20 (Arctic).

Fig. 20 represents a long, costulated, fusiform *Lagena*, open at both ends, with one extremity rather more tapering than the other. This variety of *Lagena* has not been previously named. It was figured and described by us in the 'Annals Nat. Hist.' ser. 2. xix. p. 279, pl. 11. f. 24. See also Trans. Linn. Soc. xxiv. p. 467, pl. 48, f. 6, BRADY.

It can only be received as a varietal form of the typical *Lagena sulcata*, Walker and Jacob; but, like other noticeable varieties of Foraminifera, it requires a distinctive binomial appellation. It is from Norway (MacAndrew and Barrett); found in mixed sands and muds dredged at various places between Drontheim and North Cape, and at depths varying from 30 to 200 fathoms; of rare occurrence. It is very rare in deep water off Shetland, and not uncommon off the Northumberland coast (H. B. Brady).

The exact counterpart in form, but somewhat of less size, occurs in the clay beneath the fen near Peterborough, but not in any abundance. A somewhat similar, large, two-mouthed *Lagena* is found in the Sponge-sand from Melbourne, Australia, and is rather common: it is even larger than our Arctic specimens; is never quite straight; and, instead of being covered with delicate costulæ, is richly ornamented with pearl-like grains, profusely spread over the surface, hence we call it *Lagena distoma-margaritifera*, Plate XVIII. fig. 6.

A smooth distomatous *Lagena*, of twice the size of the last mentioned, is not uncommon in the rich fossil Rhizopodal fauna so well worked out of the Crag of Sutton, Suffolk, by Mr. S. V. Wood, F.G.S. This *Lagena* of the Crag of Suffolk is the largest of the elongate *Lagenæ* that we know.

Dr. Carpenter supposes that the elongate distomatous *Lagenæ* may be double *Lagenæ* joined by their bases (Introd. p. 157); and Professor A. E. Reuss suggests that they are separated chambers of *Nodosariæ* or *Dentalinæ* (Sitzung. Ak. Wien, vol. xlvi. p. 315); but in these opinions we can by no means agree. Our *L. distoma* is grouped by Reuss (*loc. cit.* p. 331) with *L. gracilis*, Williamson; but our description and figure show the distinctive features.

Lagena sulcata, Walker and Jacob, Var. *distoma-polita*, nov. Plate XIII. fig. 21 (Arctic).

Another elongate, fusiform, distomatous variety of *Lagena* (fig. 21), but smooth instead of costulate, occurs in the same Norway dredgings, and in the Red Sea (Pullen's soundings), on the beach near Melbourne, at Swan River, on the Australian Coral-reefs, and on the Durham Coast (Brady), and of a large size (relatively) in the Crag of Suffolk.

As fig. 20 represents a distomatous, striated, subcylindrical variety of *L. sulcata*, so fig. 21 is a smaller and smooth distomatous, but amphora-shaped, variety; the former may be said to be, in one sense, a subvariety of *L. striata*, and the latter a subvariety of *L. lævis*. In the Norway dredgings it is smaller and rarer than *L. distoma* (fig. 20). Its two extremities are not nearly so equal as those of fig. 20, and the shell is not so cylindrical; but in the hotter seas it is long and slender (Plate XVIII. fig. 8). We term it *L. distoma-polita*. In some respects it has less departed, than *L. distoma* has, from the ordinary smooth flask-like forms, especially those which are somewhat pointed at the bulbous end, as *Lagena apiculata*, Reuss (Sitzungs. Akad. Wien, vol. xlvi. p. 1, figs. 4–8, 10, 11). In fact the subdivision of these varieties is artificial, and made only for the sake of convenience.

Lagena sulcata, Walker and Jacob, Var. (*Entosolenia*) *apiculata*, Reuss, et *caudata*, D'Orbigny. Plate XIII. figs. 38, 39 (Arctic); Plate XVI. figs. 6, 7, 8, 9 (North Atlantic).

The distomatous condition of *Lagena* also obtains in the globular forms (included in the *Oolinæ* of D'ORBIGNY), which frequently have the neck-tube lengthened inwards and free (the characteristic of *Entosolenia*, Ehrenberg), see figs. 38 & 39. Among these the base of the shell is frequently drawn out or apiculate (as in fig. 39, and in the figures of *L. apiculata*, Reuss, above mentioned), and sometimes perforate, as it is in fig. 38. This also holds good in the compressed varieties (*L. marginata*). Also among the flask-like *Lagenæ* we have apiculate forms, as in *Oolina* (*Amphorina*) *caudata*, D'Orb., whether striated, as that is, or smooth; such also are *L. apiculata*, Reuss, *L. globosa*, var. *lineata*, Williamson (Monogr. pl. 1. fig. 17), *L. strumosa*, Reuss, *L. mucronata*, Reuss, &c. Any of these may be perforate. See also Plate XVI. figs. 6, 7, 8, 9.

Excepting, then, that the globular and lenticular *Lagenæ* are frequently Entosolenian, none of these characters, whether of elongation, apiculation, and perforation, or of being smooth, striated, sulcated, honeycombed, or reticulate (as we shall see with the ornamented forms), are confined to one or another set of *Lagenæ*. No specific distinctions can be based on any of these features; but, for convenience sake (as among other species of Foraminifera), several subspecies and varieties take binomial appellations. To avoid, however, too great an accumulation of such names we must adopt the published names whenever it is possible; and in this case D'ORBIGNY'S *Oolina caudata* will serve as a point around which the apiculate and distomatous *Lagenæ*, of the flask-shaped and more or less globular varieties, may be conveniently grouped. The large subcylindrical and fusiform specimens, like a little rolling-pin in shape, well represented by fig. 20, will stand as a distinct variety.

Fig. 38 (Plate XIII.) differs from *L. globosa* (fig. 37) in being more elongate or olive-shaped, and in having a subsidiary tubular aperture at its base. Fig. 39 has also the fundus drawn out or apiculate, but not pervious. A large number of these apiculated forms, varying much in outline and in ornament, sometimes distomatous (as fig. 38), are not at all uncommon, and may be grouped under the name "*caudata*" given by D'ORBIGNY to one of his *Oolinæ*. Sometimes they are Entosolenian (as is seen in fig. 39 *a*), and often they are Ectosolenian, as in D'ORBIGNY'S *O. caudata*, Foram. de l'Amér. Mérid. pl. 5. fig. 6, a striated form. Compare also the smooth, amphora-shaped, distomatous *Lagena*, fig. 21, above described.

From 30 to 40 fathoms at the Hunde Islands (Dr. P. C. SUTHERLAND); not common, small. World-wide. Fossil in the Tertiary formations.

Plate XVI. figs. 6, 7, 8, 9 (North Atlantic).

Allied closely to fig. 21 of Plate XIII., but more swollen; fig. 8 being more lanceolate in outline, and fig. 9 more flask-like, than fig. 21; whilst figs. 6 & 7 are striated also.

These are rare and small at abyssal depths in the North Atlantic.

A very interesting group of ten *Lagenæ* from the Falkland Isles was figured and

described (as *Oolinæ*) by D'ORBIGNY in his work on the Foraminifera of South America (Voyage dans l'Amér. Mérid. partie 5me, 1839, p. 20). These represent most of the modifications shown among the Arctic and North Atlantic forms. Thus

Oolina inornata, *op. cit.*	pl. 5.	fig. 13	= Lagena globosa, *Montagu.*
lævigata,	,,	fig. 3	= L. lævis, *Montagu.*
striatocollis,	,,	fig. 14	= L. semistriata, *Williamson.*
striata,	,,	fig. 12	
Vilardeboana,	,,	figs. 4, 5	= L. sulcata, *Walker and Jacob.*
Isabella,	,,	figs. 7, 8	
raricosta,	,,	figs. 10, 11	
Melo,	,,	fig. 9	
compressa,	,,	figs. 1, 2	= L. marginata, *Montagu.*
caudata,	,,	fig. 6	

Genus POLYMORPHINA.

Polymorphina lactea, Walker and Jacob, sp. Plate XIII. figs. 45, 46 (Arctic).

Of the hyaline Foraminifera, *Polymorphina* alone forms itself persistently of a double row of alternating opposite chambers; except very rarely, when its latest chambers are uniserial (*Dimorphina*). *Uvigerina* (a closely related form) has normally three chambers in one turn of the spire, forming a triple series of alternating chambers. *Textularia* has normally a double series of chambers alternating with each other, much as in *Polymorphina*, but more regular in arrangement, and having a far more gradual increase of size. *Textularia*, however, often begins with a triserial (Verneuiline) arrangement, such as is normal in *Uvigerina*; and, like the latter, it often finishes its shell with a single row of chambers (*Bigenerina*).

In *Polymorphina*, although the arrangement of the chambers is essentially biserial, yet they are very apt to grow so loosely that a cross section through the shell will often expose three or more chambers.

This shell is normally drop-shaped, tear-shaped, and pyriform; it may, however, become flattened out into the proportions of the thick leaf of a succulent plant, or be elongated into an irregular oblong, somewhat like a wheat-ear or grass-spike. These longer forms (such as fig. 48) are isomorphic with *Textularia* proper. Of its Dimorphine condition there are Nodosarian, Textularian, and Uvigerine isomorphs.

The aperture of *Polymorphina* agrees with that of the *Nodosarinæ*, and of the well-grown *Lagenæ* (such as figs. 30 & 31), being radiated or plicated, the sarcode passing through a circular series of slits. The actual centre of the aperture is sometimes filled up with a bead of calcareous matter (fig. 52 *b*), and this occurs in *Nodosarinæ* also.

We have seen above that the varieties of *Lagenæ* are almost equally divided among those which have a gently graduating external neck, those having an entirely internal neck-tube, and those in which the tube is partly extruded and partly internal. In *Polymorphina* also this may be said to hold good to some extent; for in small and in young specimens (fig. 46) we see the Entosolenian tube, just as in the globular and flat *Lagenæ*

(figs. 39, 42, 43). Indeed in specimens having five chambers we have distinguished a tube in each chamber. In large individuals the apertural plicæ grow quite as far into the chamber as they project outwards. Thus the Entosolenian character of aperture is generally present; and though the mouth does not pout so much as in many of the *Nodosariæ* and *Lagenæ*, yet the last chamber not unfrequently sends out a dendritic growth of exserted apertural tubes—a character noticed by us in a large *Lagena* also common in the Tertiary beds of Grignon (see p. 354). Nor is this feature unrepresented among the *Nodosariæ*, as shown by the dichotomous *Dentalina aculeata*, D'Orb., of the Chalk and Gault.

The shell of *Polymorphina* has usually a glassy smoothness; it rarely shows any tendency to striation; when this occurs, it is longitudinal, but feeble, and then arises from, apparently, the fusion of granules arranged in rows; whereas in the three most cognate species (*Nodosarina*, *Lagena*, and *Uvigerina*) striation and strong costation of the chamber-walls are extremely common. It has, however, at times another mode of ornament, such as is not unfrequently met with in the Nodosarine and Uvigerine groups, and especially in the *Globigerinæ* of the deep seas in low latitudes, and in *Calcarina*,—namely, prickles or long needles of shell-substance bristling over the surface. Another surface-ornament is common in large well-grown *Polymorphinæ*, especially those of the Crag of Suffolk (Mr. S. V. Wood's Collection), which have a rich granulation of clear, polished, calcareous beads and lobules scattered over the whole surface, but most strongly on the older chamber-walls. A like granular ornament is common in the very large distomatous *Lagenæ* from the Australian shores (as already mentioned). The best example of the development of this particular ornament is seen in the great explanate *Cristellariæ* of the Tertiary beds of Malaga, Sienna, and Turin.

In the form before us (figs. 45 & 46) we have a subglobular condition of *P. lactea*, Walker and Jacob. Fig. 46 is the young, showing, by transparency, the long Entosolenian neck, as well as the radiated aperture. It has but two chambers, the second of which is relatively small; in after-growth the chambers increase in size rapidly but irregularly, and overlap each other in proportion to the gibbosity of the shell. We possess complanate or leaf-shaped forms, such as are figured by D'Orbigny in his For. Foss. Vienne, pl. 13. figs. 25–30, in which there is scarcely the least overlapping of the chambers.

The two chambers of fig. 46 are the "primordial" and "circumambient" chambers of other polythalamous Foraminifera. We have seen a similar double-celled condition of shell belonging to young forms within the chambers of the mother-shell, in *Truncatulina lobatula* (from south coast of England), *Peneroplis pertusus* (from India), and in large *Orbitolites complanatus* (from Fiji). In the last (some specimens of which were full an inch in diameter) we found the mother-chambers, towards the periphery of the shell, crowded with young ones*.

* These specimens, both old and young, may be seen in the Hunterian Museum, Royal College of Surgeons (See Catal. Mus. Plants and Invertebr. 1860, p. 96, No. A 54); and have been described by Dr. Carpenter, Introd. Foram., Ray Soc. p. 38.

To us it appears that the Polythalamous Foraminifera are often, if not generally, viviparous, and that the young shell, when hatched, consists of two chambers. We think that the subsequent chambers of these Polythalamians are not always formed slowly, one by one, but sometimes, at least, laid down, and marked off by the growth of two or more septa, at the same time; calcification beginning at points nearest to the earlier chambers, the thickness of the chamber-wall being in direct ratio with its age. This mode of growth of more than one chamber at a time seems to be proved by the curious manner in which the sarcode passes, by many bundles, from the older chambers into the newest in those individuals of *Polymorphina lactea* which throw out tubular stag-horn processes from their last chamber (*P. tubulosa*, D'Orb.); for, as may be seen in fig. 52, the newest chamber, namely, that which bears the cervicorn appendage, communicates, not merely with the ante-penultimate chamber, but, by a double row of lateral apertures, with all the chambers occurring on its own side, namely those which it overlaps. The communication of the last, outer, wild-growing chamber with the penultimate is not only by means of this double row of apertures, but (as is seen in fig. 52 *b*) by the ordinary radiated mouth. Another view, however, may be taken of the growth of such an individual as fig. 52: thus, we may suppose that absorption has taken place, opening foraminal communications between the last and the former chambers. Either hypothesis would explain the fact,—that, as we find on breaking open very large specimens of the normal *P. lactea*, the stolon-passages between the older chambers are very free and patulous; whereas the terminal mouth of the last chamber presents the radiate condition; the only passage here for the sarcode being the thin slits around the strong growth of hyaline shelly matter in the mouth.

Fig. 45 represents the group of individuals to which D'Orbigny applied the subgeneric term *Globulina*; but neither this term nor that of *Guttulina* (another so-called subgenus) can be separated from the ordinary, more or less oval, more or less pyriform, or more or less elongate varieties of *Polymorphina lactea*.

Figs. 45 & 46 are from the Hunde Islands (Dr. Sutherland), in three dredgings from 25–70 fathoms. Rather common and of small size. Also from the Norway coast (MacAndrew and Barrett) in the mixed sands.

Polymorphina lactea, Walker and Jacob, Var. *compressa*, D'Orbig. Plate XIII. figs. 47–51 (Arctic).

These are more or less flattened forms, ranging themselves around *P. compressa*, D'Orb. (For. Foss. Vien. pl. 12. figs. 32–34), though not exactly identical with that variety of *P. lactea*. In the relative length of the chambers, their setting on, and in the degree of exposure of the plaiting by the alternation of the double series of chambers, these *Polymorphinæ* are so very variable, that we have taken the flattened condition as a characteristic, and out of the very many names they have received, we have chosen "*P. compressa*" as a secondary centre around which to collect a certain series of more or less elongate and compressed forms, more elongate than *P. lactea* proper, and less

compressed than *P. complanata*, D'Orb. (For. Foss. Vien. pl. 13. figs. 25–30); the latter being the centre of the group of leaf-like forms.

Fig. 47, though not so flat as D'ORBIGNY'S figure of *P. compressa*, comes nearest to it, of these before us. Fig. 48, somewhat Textularian in its make, connects *P. compressa* with D'ORBIGNY'S *P. Thouini* (Modèle, 23): the latter, however, is still more elongate and less compressed. In the Crag of Suffolk this elongation advances to such an extent that the shell at first sight looks like a *Dentalina*: it has become the isomorph of the elongate Virguline *Bulimina* of the English Gault and the German Pläner-Mergel. Figs. 49 & 51 connect *P. compressa* with D'ORBIGNY'S *P. Problema* (Modèle, 61). Fig. 50, composed of about three chambers, is a young or an arrested individual of the compressed type.

At the Hunde Islands, 30–40 fathoms, these forms of *P. compressa* occur rare and small. From the Norwegian coast we have them, rather common and small, in the mixed sands.

These are amongst the commonest forms of *Polymorphina* from the Lower Secondary period up to the Recent.

Polymorphina lactea, Walker and Jacob, Var. *tubulosa*, D'Orbigny. Plate XIII. fig. 52 *a–d* (Arctic).

This condition of *P. lactea* we have already spoken of. We may add that the tubular appendages are found on *Polymorphinæ* of various shapes, but generally on the more or less spheroidal, or at least ovoidal, forms; and it is only for the sake of convenience that it can be regarded as a subcentral group and distinguished by a binomial appellation. D'ORBIGNY'S figured and named specimen (For. Foss. Vien. pl. 13. figs. 15, 16) has priority among several.

Fig. 52 *a–c* is from Bred Sound, Finmark (MACANDREW and BARRETT), 30 fathoms. The fragment fig. 54 *d* is from some other part of the Norwegian coast.

Tubulose individuals of *P. lactea* occur common in the Cretaceous deposits; are very common in some of the Grignon and other Tertiary beds; and are very large in the Crag of Suffolk (Mr. S. V. WOOD'S Collection). In the Australian coast-sand (Melbourne) living individuals of large size are abundant; and fine specimens live in the Bay of Biscay (50–60 fathoms) and in the English Channel. One large and interesting specimen that we have obtained in the shelly sand off Plymouth is adherent to a fragment of a bivalve shell; its tubular arms spreading radially on the shell, like the wild-growing cells of a *Planorbulina* or of a *Carpenteria*. Professor WILLIAMSON figures a fine tubulose British *Polymorphina* (*P. lactea*, var. *fistulosa*, Monogr. fig. 150), and also a small plano-convex, crenately winged form (*P. lactea*, var. *concava*, fig. 151), which he regards (with much probability) as having been parasitic. We have met with similar forms in sands of shallow waters.

Genus Uvigerina.

Uvigerina pygmæa, D'Orbigny. Plate XIII. figs. 53–57 (Arctic); Plate XVII. figs. 65 *a*, 65 *b* (North Atlantic).

Uvigerina makes up its shell normally of three series of inflated chambers, alternating somewhat irregularly on an elongated spire. Its aperture is a very distinct and round passage, generally tubular (Ectosolenian) and lipped. The lip is sometimes faintly toothed, showing a relationship to the radiated mouth of the *Polymorphina*, *Lagena*, and *Nodosarina*. To the last genus it is mostly related by its style of ornament, which, as a rule, consists of strong well-marked costæ, parallel to the axis of the shell. In all large well-developed individuals, whether of typical or dimorphous growth, these costæ are distinct and strong, just as obtains in the large *Lagenæ* and *Nodosarinæ* (Plate XVIII. figs. 16, 17). In weaker individuals the ribbing is less prominent and often becomes obsolete in the newer chambers (Plate XIII. figs. 56 & 57). Certain dimorphous forms are quite smooth (Plate XVIII. fig. 18). As in *Nodosariæ*, some *Uvigerinæ* take on the aculeate or hispid ornamentation; the ribs of each chamber either sending back one or more spines, or breaking up into prickles; or the whole surface of the shell may become spinose and bristly. The hispid forms of *Uvigerina* are generally found at great depths (common at 1000 fathoms in the Tropical Atlantic, Indian Ocean, &c.), and are frequently angular in section, belonging to the variety *U. angulosa*, Williamson. In deep water also the large *Uvigerinæ* are frequently elegantly racemose, with a prickly surface; the chambers are globular and distinct, and the tubular mouth much elongated: this botryoidal form is, as far as shape is concerned, the most deserving of the generic term "*Uvigerina*" given originally to the really typical costate *U. pygmæa*, such as we have before us. Large *Uvigerinæ* of the typical form are especially abundant and well-grown in the southern and eastern parts of the Mediterranean, at from 100–300 fathoms: the home of *Uvigerina* seems to be in warm seas at this depth, but it is found also in shallower water (Coralline-zone), but is then of the small size. Feeble forms creep upwards, as it were, into shallow water, and downwards to great depths; still the abyssal forms predominate over the littoral, the latter retaining the greatest resemblance to the typical *U. pygmæa*; whilst the deep-water forms, whether angular or inflated, are prickly, the angular forms in shallow water are ribbed.

In the elongated form, of feeble growth and faint striation (fig. 57), we may see a tendency to a biserial and even a uniserial growth; the chambers ceasing to retain a definite triserial alternation; and, becoming loose in their setting on, they present such a condition as leads ultimately to a uniserial row of chambers in the newer part of the shell. Such a dimorphous condition is clearly seen in certain figures, given by Soldani, of Italian *Uvigerinæ*, named *U. nodosa* by D'Orbigny (Ann. Sc. Nat. vol. vii. p. 269); and we also possess similar forms both from the recent and the fossil deposit of the Mediterranean area, Plate XVIII. fig. 15. These dimorphous specimens present a growth of either one, two, or three chambers in a straight line in the younger part of the shell

(still retaining the same kind of aperture), and with or without the intervention of a biserial arrangement of chambers. This dimorphism of the Uvigerine type is seen best, however, in specimens from shell-beds in the tropical and subtropical parts of the Indian and Atlantic Ocean; but in these the triserial mode of growth is obsolete, and even the biserial is but feebly developed; the result being a shell which, at first sight, might easily be mistaken for a *Nodosaria Raphanus*. Close examination, however, shows the short, wide, strongly labiate aperture of *Uvigerina*, markedly developed, and a plaiting of the early chambers*. D'Orbigny has figured, under the name of *Sagrina pulchella*, Foram. Cuba, pl. 1, figs. 23, 24, a specimen which was either the young, or an arrested individual of such a biformed *Uvigerina*. *Bigenerina* amongst the *Textulariæ* is the isomorph of the above described dimorphous *Uvigerina* (*Sagrina*).

Not only is our Nodosariform *Uvigerina* connected with the typical *U. pygmæa* (figs. 53–56) through *Sagrina pulchella*, D'Orb., but an intermediate condition between it and the feebler dimorphs of the Mediterranean area occurs in the mud brought up by the sounding-lead from the Abrohlos Bank (*U. dimorpha*).

Altogether, this latter group of forms shows how great the affinity is between the always hyaline *Uvigerina* and the porous sandy *Textularia*.

The specimens figured in Plate XIII. figs. 53–57 are very common forms. The finest individuals (figs. 53, 54) are from the mixed sands of the Norwegian coast. The feebler specimens (figs. 55–57) are common in shell-sands from 30–70 fathoms at the Hunde Islands, Davis Straits.

In the North Atlantic *Uvigerina pygmæa* (Plate XVII. fig. 65) is large and common throughout the eastern marginal plateau; wanting at great depths; rare and middle-sized north of the Bank; and rather common and of middle size in Trinity Bay.

Uvigerina pygmæa is world-wide in its distribution, and goes back at least to the Middle Tertiary period.

Uvigerina pygmæa, D'Orb., Var. *angulosa*, Williamson. Plate XIII. fig. 58 (Arctic); Plate XVII. figs. 66 *a*, 66 *b* (North Atlantic).

Of this we have spoken above, page 363. This compressed condition turns up wherever *Uvigerinæ* are at all common; the ribbed or striated forms belonging to moderate depths.

In the mixed sands from Norway specimens were rather common.

In the North Atlantic *U. angulosa* is rare and small; it occurs on the eastern marginal plateau to the north of the Bank, and in Trinity Bay; but was not found in the Abyssal area.

Genus Orbulina.

Orbulina universa, D'Orbigny. Plate XVI. figs. 13, 14 (North Atlantic).

This is a monothalamous hyaline Foraminifer, globular and porous, of world-wide dis-

* A ribbed form from the East Indian Seas is our *Uvigerina* (*Sagrina*) *Raphanus*, Plate XVIII. figs. 16, 17; and a smooth one from the Abrohlos Bank is our *U.* (*S.*) *dimorpha*, Plate XVIII. fig. 18.

tribution, found in shallow water in the Adriatic and other warm seas, but usually frequent on sandy and muddy bottoms at not less than 30 fathoms and down to at least 2350 fathoms. It is richest in numbers where there is nothing but the calcareous matter of Foraminifera. In the shallow water of our coasts *Orbulina* is poorly developed.

We have not recognized it fossil in strata older than the Middle Tertiary period.

In the North Atlantic the deep-sea soundings indicate that at 78, 90, 223, 329, 1660, 1950, and 2050 fathoms *O. universa* is rare and of middling size; at 2350 fathoms it is middle-sized and rather common; at 1776 and 2050 it is middle-sized and common; at 415 fathoms it is large and common; and at 1750 and 2176 fathoms it is large but rare.

Genus Globigerina.

Globigerina bulloides, D'Orbigny. Plate XIV. figs. 1 & 2 (Arctic); Plate XVI. fig. 15, and Var. *inflata*, figs. 16, 17 (North Atlantic). [See also Professor Huxley's Appendix to Commander Dayman's Admiralty Report, p. 65, pl. 4.]

Globigerina bulloides is the type of a distinct species, which is related to the monothalamous *Orbulina* on one hand, and to the polythalamous *Rotalinæ* on the other. Its shell is composed of a series of hyaline and perforated chambers, of a spheroidal form, arranged in a spiral manner, and each opening by a large aperture around the umbilicus, in such a manner that the apertures of all the chambers are apparent on that aspect of the shell, and form a large "umbilical vestibule." This opening of the chambers into one common vestibule is also characteristic of *Carpenteria balaniformis*. The extraordinarily wild manner of growth of the latter is, to a certain degree, represented in many of the larger specimens of *Globigerina*, which, losing the vesicular or botryoidal form, become flat, outspread, and loosely lobulated or palmate. Although in these respects, and also in the close resemblance of the young shells, these two species show a near alliance, yet *Globigerina* seems, on the whole, from its general neat habit of growth, and from its peculiar varietal groups, to be most nearly related to the *Rotalinæ* (*Planorbulina* and *Discorbina*). In fact, *Globigerina* and its varieties form an interesting group, which may be regarded as central to the Planorbuline and Discorbine species and their varieties, as well as certain species (*Pullenia* and *Sphæroidina*) which were not until lately recognized as related to the *Rotalinæ*.

The chief varieties of *Globigerina* are peculiarly isomorphic of these other forms. The large, extremely thick-walled, compact *Globigerinæ*, of the deepest waters, may stand as the isomorphs of the equally abyssal solid specimens of *Sphæroidina*; nor are the two forms dissimilar at first sight. The smooth-walled compact *Globigerinæ*, such as have been named *Gl. inflata*, D'Orb. (Foram. Canaries, pl. 2. figs. 7–9), come near in structure to the highly polished, flush-celled, somewhat gigantic specimens of *Pullenia obliquiloculata*, Parker and Jones* (the type of which is the so-called *Nonionina sphæroides*, D'Orb.) from great depths. We have already mentioned the wild-growing *Globigerina*

* Carpenter's 'Introd. Foram.,' p. 183. See also Plate XIX. fig. 4.

(*Gl. helicina*, D'Orb. Ann. Sc. Nat. vol. vii. p. 277, after SOLDANI) as representing in its own group a type of structure which has its completeness in *Carpenteria*. Like certain varieties of *Planorbulina farcta*, hereafter to be described (Plate XIV. figs. 7–11), and of *Discorbina Turbo*, *Globigerina* has nearly symmetrical (nautiloid) varieties (*Gl. hirsuta*, D'Orb. For. Canar. pl. 2. figs. 4–6, and *Gl. pelagica*, D'Orb., sp., For. Am. Mér. pl. 3. figs. 13, 14): by the possession of these forms *Globigerina* touches isomorphically several other specific types, amongst which is *Pullenia*, its near relation, above referred to, typically symmetrical. Such an assumption of symmetry in these simple, vesicular, discoidal Foraminifers is interesting, as suggestive of a tendency to attain the more regular nautiloid form, normal amongst the higher forms, such as *Nummulina*, *Cycloclypeus*, *Heterostegina*, *Polystomella*, and others, which, on their part, when feebly developed, are apt to be asymmetrical. Indeed in this respect we have a connecting link between the higher and the lower group in *Amphistegina*, a congener of the true *Nummulinæ*, but simpler in structure and essentially asymmetrical.

The foregoing observations on the relationships of *Globigerina* will assist us in elucidating the alliances of many of the species and varieties about to be described, lying between the simple monothalamous *Orbulina* and those highest in the scale (*Polystomella* and *Nummulina*), which give the fullest expression of the type of structure possessed by this Rhizopodous order.

The affinities and isomorphisms of *Globigerina*, however, are not exhausted by the consideration of the groups above referred to; for the small and feebly developed individuals of the typical *Globigerina bulloides*, which are so extremely abundant in the deep seas, mixed with large specimens, are imitated by the small, vesicular, weakly grown *Textulariæ*, *Uvigerinæ*, *Buliminæ*, and *Cassidulinæ*; and we might even include the dwarf vesicular *Lituolæ* of deep waters (see Plate XV. figs. 46, 47, and Plate XVII. figs. 96–98).

Figs. 1 & 2 are relatively small specimens of *Globigerina bulloides*, such as are found in shallow seas all the world over, and also (as above mentioned) in abyssal depths, where they are in company with large individuals; the latter live in deep water only.

There is but little exogenous growth on the primary perforated chamber-wall of such *Globigerinæ* as those before us; but in deeper water, as a rule, a large proportion of the individuals have a thick deposit of exogenous shell-matter, which generally rises into reticulate ridges, surrounding the pseudopodian passages, and giving the surface a roughly honeycombed appearance. Sometimes these ridges are developed into asperities, prickles, needles, and even large tubules. The latter are sparsely scattered; are formed of the divergent growth of the whole areola around the pseudopodian passage; and occur on the symmetrical, nautiloid forms, such as occur at 1600–1700 fathoms between Malta and Crete. The acicular appendages arise at the junctions, or on the edges of the areolæ, and are found on some symmetrical varieties. Such are very abundant in the Red Sea at from 300–700 fathoms; and here the needles are often so long on the peripheral parts of the older chambers that they subdivide the large arched aperture of the last chamber into narrow oblong openings.

The chamber-walls attain their greatest thickness in those close-set and rough-shelled varieties which occur in great abundance at from 1600 to 2400 fathoms in the North Atlantic, between Ireland and Newfoundland (Plate XVI. fig. 15; and Professor HUXLEY'S plate in the Admiralty Report on the Telegraph-soundings in the North Atlantic), and at lat. 5° 37′ S., long. 61° 33′ E. in the Indian Ocean (2200 fathoms). These are the nearest isomorphs of *Sphæroidina dehiscens*, Parker and Jones, Plate XIX. fig. 5, which is found with them in the tropical parts of the Atlantic and in the Indian Ocean, and not in the North Atlantic. Those smooth forms (*Gl. inflata*, D'Orb., from the Canaries) having moderately thick chamber-walls, and which are nearest to *Pullenia* in style of growth, abound in the North Atlantic (Plate XVI. figs. 16, 17), and are very plentiful in the Southern Mediterranean, at about 700 fathoms, and in the Indian Ocean, lat. 36° 58′ S., long. 51° 49′ E. (900 to 1120 fathoms). *Gl. bulloides* is small and very abundant at 2700 fathoms in the South Atlantic; the greatest depth for its habitat that we know of.

The complanate form of *Globigerina*, with more or less limbate septal lines, is figured by D'ORBIGNY, as living on the coast of Cuba, with the name of *Rosalina Linnæi* (Foram. Cuba, pl. 5. figs. 10–12). It is common in the Chalk, and is known as *Rosalina marginata*, Reuss (Charakt. Kreid. Ostalpen, Denksch. Akad. Wien, vii. pl. 26. fig. 1), and *Rosalina canaliculata*, Reuss (Ibid. fig. 4).

Plate XIV. figs. 1 & 2 represent specimens obtained at three places among the Hunde Islands by Dr. P. C. SUTHERLAND (28–30, 30–40, and 60–70 fathoms), rather common and small; and others found (rare and very small) in the most northern soundings we have examined, namely, Baffin's Bay, lat. 76° 30′ N., long. 77° 52′ W. (PARRY) at 150 fathoms; and others from the coast of Norway, few and small in the mixed sands (MACANDREW and BARRETT).

In the North Atlantic *Globigerina bulloides*, including its variety *Gl. inflata*, D'Orb. (Plate XVI. figs. 16, 17), is spread broad-cast; but is abundant and of good size only at the greater depths ("Virginian Province," and the "Celtic" and "Boreal" abyssal areas, at upwards of 2000 fathoms in some places), and at 223, 338, and 415 fathoms on the eastern marginal plateau: elsewhere on this plateau it is small and varying in numbers. On the western plateau (north of the Bank of Newfoundland) it is small, though sometimes common; whilst in Trinity Bay it is very small and very rare.

The oldest known *Globigerinæ* are those in the Gault.

Globigerina bulloides, Var. *inflata*, D'Orbigny. Plate XVI. figs. 16, 17 (North Atlantic).

In this *Globigerina* (For. Canar. p. 134, pl. 2. figs. 7–9), peculiar for its large gaping aperture, the newer chambers are relatively larger than usual, and cover the former ones to a great extent (see figs. 16, 17). It is variable in its details, and does not differ specifically from *Gl. bulloides*. It has already been referred to above (page 365).

This variety abounds and is large on the North Atlantic, and on deep muddy bottoms in the Mediterranean (DAYMAN'S soundings). Professor BAILEY noticed it in soundings from off the Coast of New Jersey (see Appendix). D'ORBIGNY had it from the Canaries; it is plentiful in the Indian Ocean (see above).

From some mounted specimens lent to us by Mr. F. GALTON, F.R.S., we may add the following notes as to the *Globigerinæ* of the North Atlantic. See also Appendix I.

At 1650 fathoms the deep-sea ooze consists chiefly of *Globigerinæ*, many of them of large growth (as if well-nourished), thick-shelled and rough, the sarcode remaining (brown) in most of the larger shells; and at the same time there are very many small and delicate individuals (just as is the case with other Foraminifera,—minute dwarfs accompanying full-grown specimens of one and the same type). With *Globigerina* at this depth occur a rather small *Rotalia Beccarii*, a very small *Bulimina* (?), and siliceous Sponge-spicules. At 1600 fathoms *Globigerinæ* as above, with a small *Spirillina*. At 1500 fathoms *Globigerinæ* appear as at 1650 fathoms. The thickness of the chamber-wall is relatively great. A sponge-gemmule was also found here.

Dr. G. C. WALLICH has well illustrated *Globigerina* and *Orbulina* in plate 6 (undescribed) of the First Part of 'The North-Atlantic Sea-bed,' 1862.

Globigerinæ are (as is well known) among the most characteristic of *deep-sea* Foraminifera (*Abyssina*); and these form a group that love to live at from 1000 to 2500 fathoms. They are *Pullenia*, *Sphæroidina*, *Globigerina*, and its monothalamous congener *Orbulina*

The first three are always rare and small in shallow water; and *Orbulina* usually has similar conditions.

Cassidulina is also an abyssal form; but lives well up to 30 fathoms, though in flatter and more delicate forms than it has lower down.

Genus PULLENIA.

Pullenia sphæroides, D'Orbigny, sp. Plate XIV. figs. 43 *a*, 43 *b* (Arctic); Plate XVII. fig. 53 (North Atlantic).

For an account of *Pullenia*, one of the deep-sea forms, probably allied to *Globerigina*, though resembling *Nonionina*, see CARPENTER'S Introd. Foram. p. 184; it is the *Nonionina sphæroides*, D'Orb. Modèles, No. 43, Ann. Sc. Nat. vol. vii. p. 293, No. 1; and *N. bulloides* of the same author, For. Foss. Vienn. p. 107, pl. 5. figs. 9, 10, and Ann. Sc. Nat. vol. vii. p. 293, No. 2.

Our figure 43 is of normal shape, but small size, as are all those which we find in the Arctic and North Atlantic seas. Another form of *Pullenia* has the chambers set on obliquely (*P. obliquiloculata*, Parker and Jones, Plate XIX. fig. 4). In the mixed sands from Norway *Pullenia sphæroides* is rather common and small: it is rare and small, often very small, at 1776, 2035, 2176, and 2330 fathoms in the North Atlantic; also at 1203 fathoms north of Newfoundland Bank, and at 200 fathoms on the plateau off Ireland.

Fig. 53 is the *Nonionina quinqueloba*, Reuss, Zeitsch. Deutsch. Geol. Ges. vol. iii. pl. 5. fig. 31, an enfeebled, somewhat flattened form, of looser growth than usual. It occurs also in the Eocene Clays of Hants and the Isle of Wight (H. B. BRADY), in the 'Septarian Clay' (Eocene) near Berlin (REUSS), and recent in the Red Sea.

Pullenia sphæroides lives in the Mediterranean, the Red Sea, and South Atlantic at from 30–320 fathoms.

Genus SPHÆROIDINA.

Sphæroidina bulloides, D'Orbigny, sp. Plate XVI. fig. 52 (North Atlantic).

This peculiar species (of which *Sph. dehiscens* is another variety) is related to *Globigerina*; and, together with *Pullenia*, *Orbulina*, and *Globigerina*, essentially of deep-water habits, is small and rare in the North Atlantic, but large in the Tropics.

Sphæroidina has a small spire, somewhat irregularly wound, the vesicular chambers (of which only three or four are visible) hiding the spiral arrangement. REUSS has figured many specimens (*Sph. Austriaca*) in pl. 51, Denkschr. K. Akad. Wissen. Wien, vol. i. 1850.

Sphæroidina dehiscens, Parker and Jones, is largish, thick-shelled; the chambers not closely applied, and their edges roughly everted and jagged (Plate XIX. fig. 5).

Sph. bulloides is rare and small at 223 fathoms on the marginal plateau off Ireland; very rare and very small at 2330 fathoms in mid-ocean.

In the Mediterranean it occurs at 320 fathoms, in the Red Sea at 372, in the Tropical Atlantic at 1080, in the Southern Atlantic at 260 and 940, and in the Indian Ocean at 2200 fathoms.

Genus TEXTULARIA.

Textularia agglutinans, D'Orbigny. Plate XV. fig. 21 (Arctic).

Textularia agglutinans, D'Orbig. (Foram. Cuba, p. 144, pl. 1. fig. 17, 18, 32–34), in its ordinary and moderately developed condition, gives a fuller idea of the species than any other variety.

We have it in the mixed sands from Norway rather common and of middle size; and at the Hunde Islands it is small, rare at 30–40 fathoms, rather common at 25–30 fathoms.

Textularia agglutinans is world-wide; and has its representatives in many Tertiary and Secondary strata.

Textularia agglutinans, Var. *abbreviata*, D'Orbigny. Plate XVII. figs. 76 *a*, 76 *b* (North Atlantic).

T. abbreviata, D'Orb. (For. Foss. Vien. p. 249, pl. 15. figs. 7–12), is a short form, intermediate to *T. gibbosa*, D'Orb. Modèles, No. 28, and *T. agglutinans*, D'Orb., and smaller than either; but, like them, it is sandy.

We have it from the marginal plateau of the Atlantic off Ireland, where it is common and middle-sized at 43 and 78 fathoms; rather common and middle-sized at 90 fathoms; rare and small at 223 fathoms; rather common and small at 415 fathoms.

T. abbreviata has much the same range as its type *T. agglutinans*.

Textularia agglutinans, D'Orbigny, Var. *Sagittula*, Defrance. Plate XVII. figs. 77 *a*, 77 *b* (North Atlantic).

T. Sagittula, Defrance (see 'Annals Nat. Hist.' 3rd ser. vol. xi. p. 91, &c.), is the common, often small, sandy, triangular variety of *T. agglutinans*, D'Orb.

Our figures indicate a normal specimen of this form from the marginal plateau off Ireland, where it is common and of middle size at 78 fathoms.

T. Sagittula is world-wide, and common in many Tertiary deposits.

Textularia agglutinans, Var. *pygmæa*, D'Orbigny. Plate XV. fig. 22 (Arctic); Plate XVII. figs. 78 *a*, 78 *b* (North Atlantic).

This is the common, small, hyaline or clear-shelled, perforate *Textularia*; its sandy analogue is *T. Sagittula*. Normal specimens are figured here.

We have it in the mixed sands from Norway, common and middle-sized.

In the North Atlantic it is rather common and small at 78 and 90 fathoms on the marginal plateau; and it is rare and small at 200 and 415 fathoms, rare and middling at 223 and 338 fathoms on the same ground: in the abyssal depth (Boreal) it is rare and small at 2033 fathoms; and nearer to the Bank it is very rare and very small at 1450 fathoms.

T. pygmæa, D'Orb. Modèles, No. 7 (the same as *T. aciculata*, D'Orb., Ann. Sc. Nat. vol. vii. p. 263, pl. 11. figs. 1–4), has a distribution similar to that of the other chief varieties.

Textularia agglutinans, Var. *carinata*, D'Orb. Plate XVII. figs. 79 *a*, 79 *b* (N. Atlantic).

The shell of *T. carinata*, D'Orb. (For. Foss. Vienn. p. 247, pl. 15. figs. 32–34), is flatter than that of either *T. pygmæa* or *T. Sagittula*; the edges becoming very thin and more or less produced into a sharp keel; and the chambers extend backwards irregularly. The specimen figured is a small and feeble individual of this variety. Still more flattened is our new variety *T. Folium*, from the Australian coast, Plate XIX. fig. 19.

T. carinata in the London Clay frequently has a spiral arrangement of its earliest chambers, such as is seen also in many other varieties of *Textularia*. In fig. 79 *a* a faint tendency to a coil is seen at the apex of the specimen.

On the marginal plateau off Ireland *T. carinata* occurs rather common and small at 78 and 90 fathoms. It is found in the Adriatic and other seas, extremely large between Socotra and Kurachee; also fossil in the Tertiary deposits.

Textularia agglutinans, D'Orb., Var. *biformis*, nov. Plate XV. figs. 23, 24 (Arctic).

These very small *Textulariæ* have a sandy shell, often of a rusty colour, with scarce any shell-substance proper. They have a spiral commencement (a not uncommon feature in *Textularia*), and the later chambers are subquadrate, arranged alternately. This may be regarded as an arrested form of *T. annectens*, Parker and Jones (Annals Nat. Hist. 3rd ser. vol. xi. p. 92, fig. 1); for, if better developed and carried on with uniserial chambers, it would be equivalent to that variety. It is common in the Gault and Chalk with *T. annectens*.

Textularia biformis is common and small at the Hunde Islands in 60 to 70 fathoms.

Textularia agglutinans, Var. (*Bigenerina*) *Nodosaria*, D'Orb. Plate XV. fig. 25 (Arctic); Plate XVII. figs. 80 *a*, 80 *b* (North Atlantic).

Bigenerinæ are *Textulariæ* that commence with alternate biserial chambers and complete themselves with a uniserial set, the aperture becoming terminal, central, round, and sometimes pouting.

Bigenerina Nodosaria, D'Orb. (Ann. Sc. Nat. vol. vii. p. 261, pl. 11. figs. 9–12; and Modèle, No. 57), is usually sandy, and commences with flat interlacing of chambers, as in *T. agglutinans*, D'Orb.; whilst *B. digitata*, D'Orb. (Modèle, No. 58), begins with a conical set of chambers, as in *T. gibbosa*, D'Orb.

At the Hunde Islands (Dr. SUTHERLAND) *B. Nodosaria* is extremely small, but common, at 60 to 70 fathoms.

On the marginal plateau off Ireland it is common at 78 and 90 fathoms, coarsely arenaceous and of fair size.

B. Nodosaria lives in the Mediterranean and other seas, being widely distributed; it keeps a good size, and prefers muddy bottoms, flourishing down to 200 or 300 fathoms.

Textularia agglutinans, Var. (*Bigenerina*) *digitata*, D'Orbigny. Plate XVII. fig. 81 (North Atlantic).

B. digitata, D'Orb. (Modèle, No. 58), may be said to be a smooth, rusty subvariety of *B. Nodosaria*, with a conical instead of flattened apex.

On the marginal plateau of the North Atlantic *B. digitata* is rare and small at 78 fathoms; the figured specimen is obscure, and may be regarded as feebly developed.

B. digitata occurs in company with *B. Nodosaria* in the Mediterranean and elsewhere.

Textularia agglutinans, D'Orb., Var. (*Verneuilina*) *polystropha*, Reuss, sp. Plate XV. fig. 26 (Arctic).

When *Textulariæ* have a triple row of alternating chambers, as is not unusual with them, they are termed *Verneuilinæ*; having commenced triserially, they may afterwards take on a biserial or uniserial arrangement of chambers, and are known as *Gaudryinæ*, *Clavulinæ*, &c. Some that have a triple series of chambers are so much twisted on the axis as to have a Buliminoid aspect; a slight approach to this condition is shown in *Verneuilina polystropha* (*Bulimina polystropha*, Reuss, Böhm. Kreid. vol. ii. p. 109, pl. 24. fig. 53; *Polymorphina silicea*, Schultze; *Bulimina arenacea*, Williamson). In *Verneuilinæ* the aperture ceases to be transverse, becoming drawn upwards, as it were, across the septal plane more and more in the later chambers, until it ceases to be even a notch, and becomes terminal and round, as it is in *Bigenerinæ*.

V. polystropha may be said to be a small, vesicular, arrested Verneuiline *Textularia*; sandy, twisted on its axis, and very red in colour. It is of wide distribution, living in all latitudes; and is found fossil in the Tertiary and Cretaceous beds.

It is often of much larger size than our figured specimen, which is from the Hunde Islands (Dr. SUTHERLAND); where *V. polystropha* is common and small at 25–40 fathoms, and very common and small at 60–70 fathoms.

Genus BULIMINA.

Bulimina Presli, Reuss, Var. *Pyrula*, D'Orbigny. Plate XV. figs. 8, 9 (Arctic).

In describing the *Buliminæ* that form part of the Rhizopodal Fauna of the Arctic and North Atlantic Oceans, we have not occasion to treat so largely of the special characters of the genus, nor the relationships of the subspecific groups, as is necessary in the case of the *Nodosarinæ*, *Lagenæ*, *Polymorphinæ*, *Uvigerinæ*, *Globigerinæ*, *Rotalinæ*, and *Polystomellæ*; chiefly because these relationships and characters are not difficult to be understood, with the help of the figures before us, and because they have been clearly stated in CARPENTER'S 'Introd. Foram.,' p. 195, &c.

As the best medium-form of the very variable *Buliminæ* we take REUSS'S *B. Presli* (Verst. Böhm. Kreid. pl. 13. fig. 72; Haiding. Abhandl. iv. pl. 10. fig. 10; and CARPENTER'S 'Introd.' pl. 12. fig. 18). *B. Pyrula*, D'Orb. (For. Foss. Vien. pl. 11. figs. 9, 10), of which we have some Norwegian specimens before us, is one of the varieties (for we cannot see evidence of the existence of more than one species of *Bulimina*) that have the greatest tendency to overlap their chambers, and so hide the primary segments by the later ones closing over them. It is usually prickled at the apex.

We have it common and large in the mixed sands from the coast of Norway (MACANDREW and BARRETT). It lives in the Mediterranean, and is large between Socotra and Kurachee. It is found fossil in the Vienna Tertiaries (where it is large) and the London Clay. A *Bulimina* of very similar shape occurs also in the Upper Triassic Clay of Chellaston, Quart. Journ. Geol. Soc. xvi. p. 457, pl. 20. fig. 45.

Bulimina Presli, Reuss, Var. *marginata*, D'Orbigny. Plate XV. fig. 10 (Arctic); Plate XVII. fig. 70 (North Atlantic).

The neat, little, acute-ovate *Buliminæ* that next come under notice are characterized by the exogenous growth of shell-matter, in the form of prickles, on the primordial chamber (as in *B. Pyrula* also) and at the posterior edges of the other chambers to a greater or less degree.

The edges of the chambers may be pinched up, crenulated, serrated, toothed, or spined; the spines may be few or numerous along the sharpened border or on the surface of the chambers, and they may be present on all of them or limited to the earlier ones; intermediate conditions in every respect being observable. No real division can be made amongst these modifications; but for convenience-sake those edged with prickles are grouped under *B. marginata*, D'Orb. Ann. Sc. Nat. vol. vii. p. 269, No. 4, pl. 12. figs. 10–12; whilst *B. aculeata*, D'Orb. (after SOLDANI), Ann. Sc. Nat. vol. vii. p. 269, No. 7, takes those with fewer spines. WILLIAMSON'S *B. pupoides*, var. *spinulosa*, Monogr. p. 62, pl. 5. fig. 128, has many fine long spines along the margins. The crenate and prickly margins are found associated with more contracted forms of *Buliminæ** than those

* Such as *B. pulchella*, D'Orb. (For. Amér. Mér. p. 50, pl. 1. figs. 6, 7), a very small subcylindrical form, with pinched and fringed chambers; living in the Pacific, from the equator to 34° S. lat.; and *B. Patagonica*, D'Orb. (Ibid. p. 50, pl. 1. figs. 8, 9), a very rare form (contracted and fringed at first, irregularly globuliform afterwards), found at the Bay of San Blas, Patagonia.

above-mentioned; but the exogenous growths belong to thick-shelled specimens, and probably indicate favourable habitats; on the thin-shelled and the attenuate forms there is little or no fringing or other ornament.

Fig. 10. Plate XV. has the chambers somewhat extended by their produced spiny edge or prickly fringe, and has a long apical spine; such forms, with others (as fig. 11) with less of the marginal spines, occurred common and of middle size in the mixed sands from Norway (MacAndrew and Barrett).

Plate XVII. figs. 70 *a*, 70 *b*, 70 *c* (North Atlantic).

Figs. 70 *a* & 70 *b*, Plate XVII., differ somewhat one from the other and from fig. 10, Plate XV., in the marginal and caudal spines; but no two specimens, even among many, are exactly alike.

They are common and large at 43 fathoms; common and middling at 78 and 90 fathoms; and common and small at 223 and 415 fathoms, on the plateau off Ireland in the North Atlantic.

B. marginata lives in all seas, at no great depths.

Bulimina Presli, Reuss, Var. *aculeata*, D'Orbigny. Plate XV. fig. 11 (Arctic); Plate XVII. figs. 68 & 69 (North Atlantic).

In these specimens the chambers have a well-marked globosity, and favourable conditions of growth have given them a rapid rate of increase, as in the foregoing subvariety; the exogenous prickles, however, are less largely developed, being confined for the most part to the earliest chambers.

Fig. 11, Plate XV. is an intermediate form, from Norway (mixed sands), with fewer marginal spines than some of its congeners; and though more spinous than figs. 68 & 69, yet, as these are essentially *marginatæ* also, and as there is a difference of degree and not of kind, not only among these, but between these and others presently to be described, it is placed under *B. aculeata* as its fittest place in the grouping. Its chambers have sharp posterior edges, drawn out into comparatively few spines, short and strong; and it has a strong double caudal spine.

B. aculeata, D'Orb., is sufficiently well figured by Soldani, Testac. vol. i. part 2, pl. 127. fig. 1, pl. 130. fig. *v v*, and pl. 131. fig. *x x* (the last has been unnecessarily separated by D'Orbigny as *B. trilobata*).

Plate XVII. figs. 68 & 69 (North Atlantic).

In figs. 68 & 69, Plate XVI. the chambers are globose, and the earliest alone are armed with spiny excrescences. A less developed form appears in our next variety (fig. 67).

Figs. 68 & 69 are from the eastern marginal plateau at 223 fathoms, where *B. aculeata* is common and of middle size.

B. aculeata is found everywhere with *B. marginata* and *B. ovata*.

Bulimina ovata, D'Orbigny. Plate XVII. figs, 67 *a*, 67 *b* (North Atlantic).

Among the *Buliminæ* that fall short of the fair growth of the type (*B. Presli*, Reuss) are *B. ovata*, D'Orb., *B. pupoides*, D'Orb., and others which have a more or less subcylindrical form owing to the somewhat slow rate of increase in the successive chambers. Professor WILLIAMSON took *B. pupoides* as the type when describing the British *Buliminæ*, 'Monograph,' p. 61, &c.

B. ovata, D'Orb., For. Foss. Vien. p. 185, pl. 11. figs. 13 & 14, is just such a varietal form as occurs in the North Atlantic; on the Irish plateau, rare and small at 78 fathoms; rare and very small in the abyssal area at 1776 and 1950 fathoms; rare and middle-sized at 740 fathoms, north of the Bank; very rare and very small at 150 fathoms in Trinity Bay.

It is a British form (*B. pupoides*, var. *fusiformis*, Williamson, Monogr. p. 63, pl. 5. figs. 129, 130), together with the almost identical *B. pupoides*, D'Orb.; both of which are found fossil (and large) in the Vienna Tertiaries. It is large also in fossil beds at Jamaica (BARRETT). In Captain PULLEN'S Soundings from between Socotra and Kurachee it is very large (sometimes thin-shelled). *B. ovata* accompanies the other *Buliminæ*. They prefer muddy bottoms; flourishing in depths as great as 100 or 150 fathoms; and in the fossil state they are found in clays, corresponding to mud-beds.

Fig. 67 *a* shows a slight amount of exogenous growth on the early chambers, sufficient to indicate the close relationship of habit between this and its better grown allies (figs. 68 & 69).

Bulimina Presli, Reuss, Var. *Buchiana*, D'Orb. Plate XVII. fig. 71 (North Atlantic).

In this elegant little form we find the largest relative proportion of shell-matter among *Buliminæ*, which, on the other hand, are often very thin-shelled, but often thicker in deep seas. The chambers are here laid closely one on another, fitting well, nearly hiding their septa, and bearing vertical superficial ridges, sparse and strong, in which the marginal spines, seen in other varieties, are lost; just as spinose *Lagenæ*, *Nodosariæ*, &c. pass into ribbed varieties by modifications of the ornament. *B. Buchiana* is the most Uvigerine, both in shell-structure and shape, of all the *Buliminæ*.

B. Buchiana, D'Orb., For. Foss. Vien. pl. 11. figs. 15–18, is widely distributed; though never common. It is found in the Mediterranean; but, in comparison with *B. ovata* and *B. marginata*, it is rare: it is fossil near Vienna.

On the marginal plateau off Ireland it is rare and small at 78 fathoms.

Bulimina Presli, Reuss, Var. *elegantissima*, D'Orbigny. Plate XV. figs. 12–17 (Arctic).

Some *Buliminæ* have their segments or chambers lengthened sideways and set on very obliquely to the axis of the spine, the greater part of the shell being made up of the last whorl of from seven to ten chambers. More especially in short and gibbose individuals some of these many chambers are smaller than others in the whorl, and appear

to interdigitate or to be intercalated. *Bulimina elegantissima*, D'Orb., For. Amér. Mérid. p. 51, pl. 7. figs. 13, 14, and *Robertina arctica*, D'Orb., For. Foss. Vien. p. 203, pl. 21. figs. 37, 38, both belong to this group of *Buliminæ* (see CARPENTER'S Introd. Foram. p. 195, &c.), and the differences of modification are so slight that we include the latter in the former.

Our Arctic specimens of *B. elegantissima* are relatively large in size and thin-walled. In the Indian seas *B. elegantissima* occurs smaller, and with thicker walls; but from the Australian seas we have it more elongate and stronger than the Arctic form. The elongate form is found also on the British coasts (see WILLIAMSON'S 'Monograph,' p. 64, pl. 5. figs. 134, 135). *B. elegantissima* occurred to D'ORBIGNY in the sea-sands from the Pacific coast of South America; and he had *Robertina arctica* from the North Cape.

B. elegantissima is rare and of middling size at 25–30 fathoms, and common and large at from 30–70 fathoms, at the Hunde Islands (Dr. P. C. SUTHERLAND'S dredgings).

It is fossil at Grignon; also in the Eocene sandy clays of Hants and Isle of Wight (H. B. BRADY), and in the Pliocene clay under the fens near Peterborough. In the recent state it is world-wide,—the British coasts, the Mediterranean, Red Sea, Tropical Atlantic, Australia, and Fiji.

Bulimina Presli, Reuss, Var. (*Virgulina*) *Schreibersii*, Czjzek. Plate XV. fig. 18 (Arctic); Plate XVII. figs. 72, 73 (North Atlantic).

Virgulinæ are such *Buliminæ* as are very much outdrawn, with thin shells, and having long loop-like apertures, with inverted lips, as in *Bulimina* proper. The chambers are arranged less compactly than in the other *Buliminæ*, in consequence of the elongation of the shell, and are scarcely more than biserial, or even only irregularly so. *V. Schreibersii*, Czjzek, Haid. Abhandl. vol. ii. pl. 12. figs. 18–21, is of irregular growth, intermediate between the long and loose-growing varieties of *B. ovata*, D'Orb., and the Textulariform *Virgulina squamosa*, D'Orb., next described. It is an isomorph of *Polymorphina*, as *V. squamosa* is isomorphic with *Textularia*.

We have it rare and large from the Hunde Islands, where Dr. SUTHERLAND dredged it in 30–40 fathoms; and in the North Atlantic it is rare and middle-sized at 1950 fathoms; rare and large at 2330 fathoms (Boreal portion of the Abyss); and rare and small at 954 and 725 fathoms north of Newfoundland Bank.

V. Schreibersii and its subvarieties are not rare in existing seas, both of warm and cold climates; and it occurs fossil in the Tertiary beds of Sienna, Vienna, and Turin.

Some allied forms occur in the Chalk and in the Clays of the Oolite, which are isomorphs of the Dentaline or Virguline *Polymorphinæ* of the Sutton Crag.

Bulimina Presli, Reuss, Var. (*Virgulina*) *squamosa*, D'Orbigny. Plate XV. fig. 19 *a*, 19 *b*, 20 (Arctic).

Although the arrangement of the chambers has become almost regularly biserial, and alternate, as in *Textularia*, yet this variety retains the true Bulimine aperture; and

gradual modifications in form lead us from *Virgulina squamosa*, D'Orb. (Modèle, No. 64), before us, through *V. Schreibersii* (fig. 18), to the more regular *Buliminæ*.

This variety has the same world-wide distribution as *V. Schreibersii*; but is never common: at the Hunde Islands it is rare and small at 30–40 and 60–70 fathoms; and it was rare and large in the mixed sands from Norway.

As an enfeeblement of *Bulimina*, it points in one direction to *V. Schreibersii*, and in another to the *Bolivinæ*. Fig. 20 is a specimen that can scarcely be separated from *Bolivina punctata*.

Bulimina Presli, Reuss, Var. (*Bolivina*) *costata*, D'Orbigny. Plate XVII. fig. 75 (North Atlantic).

"A more decided modification of the Bulimine type is presented by those forms which have been ranked by D'Orbigny in his genus *Bolivina*; the arrangement of the segments being here regularly biserial and alternating, as in *Textularia*; but the aperture never loses the elongation and the inversion of its lips, characteristic of the Bulimine type, and its direction is usually somewhat oblique. In the *B. costata* of D'Orbigny (For. Amér. Mérid. p. 62, pl. 8. figs. 8, 9) there is a set of right parallel costæ, running continuously from one segment to another along the entire length of the shell, giving to it a very peculiar aspect" (Carpenter, 'Introd.' p. 196).

The inversion of the lip of the aperture, characteristic of *Bulimina*, and homologous with the intussusception of the neck-tube in *Lagena*, is well seen in some young transparent *Bolivinæ*.

B. costata is rare and large at 223 fathoms on the marginal plateau off the coast of Ireland. D'Orbigny found it common at 20 mètres at Cobija, South America; an allied and small variety, *B. plicata* (*op. cit.* pl. 8. figs. 4–7), he found in deeper water at Valparaiso.

B. costata lives on muds and is found fossil in clays, like other *Buliminæ*; flourishing down to about 100 fathoms; it is never common, but is found on the west coast of Scotland, and from the south coast of England (Eastbourne) to the tropics.

Bulimina Presli, Reuss, Var. (*Bolivina*) *punctata*, D'Orbigny. Plate XVII. fig. 74 (North Atlantic).

The figured specimen is a short and vesicular subvariety of *B. punctata*, D'Orbigny. (For. Amér. Mérid. p. 63, pl. 8. figs. 10–12), which is the centre of a group of many forms. The one before us is perfectly Textulariform, and can be diagnosed as a *Bulimina* only by the shape and subobliquity of its aperture.

We find it rare and small at 43 and 415 fathoms, and rather common and small at 223 fathoms, on the marginal plateau off Ireland.

D'Orbigny got it rather common at from 40 to 50 mètres at Valparaiso.

B. punctata is world-wide, reaching as low as 100 fathoms. In the Mediterranean area it is both recent and fossil. It is present in the Oxford and Kimmeridge Clays.

Genus CASSIDULINA.

Cassidulina lævigata, D'Orbigny. Plate XV. figs. 1–4 (Arctic); Plate XVII. figs. 64 *a*, 64 *b*, 64 *c* (North Atlantic).

Cassidulina, related to *Bulimina* and *Textularia*, is described in CARPENTER'S Introd. Foram. p. 197. It is of world-wide distribution, on muddy bottoms in both shallow and deep waters. In the Indian Ocean (between Socotra and Kurachee) *Cassidulina* takes on the uncoiled condition (*Cassidulina Pupa*, D'Orb., *Ehrenbergina serrata*, Reuss); and in the tropical deep seas it passes into thick-walled, flush-shelled, and uncoiled forms, isomorphic of *Bolivinæ*. It occurs in Tertiary deposits. Deep-sea forms are usually thick-walled.

C. lævigata, D'Orb. (Modèles, No. 41, Ann. Sc. Nat. vii. p. 282, pl. 15. figs. 4, 5 *bis*) is common and small in the mixed sands from Norway (MACANDREW and BARRETT); common and middle-sized at the Hunde Islands, from 30 to 70 fathoms*; common and middle-sized in 150 fathoms, 76° 30′ lat., 77° 52′ long., Baffin's Bay, and rare and middling at 75° 10′ lat., 60° 12′ long.

In the North Atlantic it is rare and small at 1750 fathoms in the central area; north of the Bank it is rare and of middle size at 102, 112, and 145 fathoms, and rather common at 740 fathoms; in Trinity Bay it is rare and small at 150 fathoms, middle-sized and not very common at 124, 133, and 192 fathoms.

On the Newfoundland Bank *Cassidulinæ* are few and probably dead, just as *Nonionina Scapha* occurs. *Cassidulina* is also a Middle Tertiary form.

Cassidulina lævigata, D'Orb., Var. *crassa*, D'Orb. Plate XV. figs. 5, 6, 7 (Arctic); Plate XVII. fig. 64 *d* (North Atlantic).

This thicker form accompanies the typical *C. lævigata* in its wide-spread occurrences. D'ORBIGNY first described and figured *C. crassa* from off Cape Horn (160 mètres), and, in company with *C. Pupa*, from the Falkland Isles ("at a considerable depth"). Professor WILLIAMSON'S *C. obtusa* (Monogr. p. 69, pl. 6. figs. 143, 144), from the British coasts, and from the Hunde Islands, is the same as *C. crassa*, excepting a slight difference in the variable aperture.

C. crassa, D'Orb. (For. Amér. Mér. p. 56, pl. 7. figs. 18–20) is small at 28–30 and 50–70 fathoms, and of middle size at 30–40 fathoms at the Hunde Islands, and common throughout; it is common and small at 150 fathoms in Baffin's Bay, 76° 30′ lat., 77° 52′ long.

On the eastern plateau of the North Atlantic it is very rare and very small at 223 fathoms.

C. crassa has its finest development (as far as we know) at 1100 fathoms in the Tropical Atlantic; like *C. lævigata* it is often among the deep-sea forms; it is found also in the Mediterranean and in Bombay Harbour.

* Professor WILLIAMSON (Monogr. p. 68) notices the umbonate and transparent condition of the *Cassidulinæ* from the Hunde and Beechey Islands.

Genus PLANORBULINA.

Planorbulina farcta, Fichtel and Moll, sp. (Varieties). Plate XIV. figs.3–11 (Arctic); Plate XVI. figs. 18–25 (North Atlantic).

This is a very common variety of a species belonging to the Rotaline group of Foraminifera. In endeavouring to elucidate the relationships of the *Rotalinæ*, we have been impressed with the distinctiveness of nine specific groups, six of which have more or less of the well-known Rotalian shape, and are extremely rich in varietal forms (see Dr. CARPENTER'S 'Introd. Study Foram.' Ray Soc. 1862, pp. 198, &c.). A great proportion of these varieties have been described by authors under the generic term "Rotalia"; others have been grouped under the leading names of *Rosalina*, *Planorbulina*, *Gyroidina*, *Anomalina*, *Truncatulina*, and several others, supposed to be of subgeneric, or even of generic, value. An artificial classification and extreme confusion have been the consequence. After a long examination of the subject in its bibliographic aspect, and having carefully studied large numbers of the actual organisms, recent and fossil, we find that they range themselves around six specific centres, which may also be regarded as types of so many genera; and with these are allied three other specific forms, not so Rotalian in aspect (*Tinoporus*, *Patellina*, and *Polytrema*).

The protean variability of all the six Rotalian types being great, and isomorphism, or similarity of form among the varieties and subvarieties of these several specific groups, being of very frequent occurrence, we still use binomial terms, in a subgeneric sense, for members of this great group; and often, in ordinary descriptions, we retain, for the sake of convenience, binomial appellations (without direct reference to their exact zoological value) for striking specimens even of varieties and subvarieties. Thus *Truncatulina lobatula* is a distinct binomial term for the common variety of *Planorbulina farcta* first to be noticed (page 381).

The old name *Rotalia* is retained for one of these six genera; and we arrange the whole as a subfamily with the appellation of ROTALINÆ*.

Discorbina Turbo, *D'Orb.*, sp.
Planorbulina farcta, *Fichtel and Moll*, sp.
Pulvinulina repanda, *Fichtel and Moll*, sp.
Rotalia Beccarii, *Linn.*, sp.
Cymbalopora Poyei, *D'Orb.*, sp.
Calcarina Spengleri, *Gmelin*, sp.
Tinoporus lævis, *Parker and Jones*, sp.
Patellina concava, *Lam.*, sp.
Polytrema miniaceum, *Esper*, sp.

Each of the six Rotaliform genera is represented by one typical species, which carries with it a large number (from 50 to 200 or 300) of divergent forms, most of them having

* See CARPENTER'S 'Introd. Foram.' Ray Soc. 1862, pp. 198, &c.

special names, which we must in many instances retain for convenience, though we refer them to one or the other of the six species above mentioned.

In nature these Foraminifera are never absolutely strict in their adherence to any one of the chief varietal forms; but the latter are serviceable as subspecific centres, around which may be arranged a large number of modifications, more and more gentle and mutually confluent; so that when we speak of *Truncatulina lobatula* or of *Discorbina vesicularis* (and the same may be said of the varietal groups of any true Foraminiferal species), we do not mean to say that the specimen which we have before us necessarily answers exactly to any figure or description in the literature of the subject, but that it is nearer to some one of the accepted illustrations than to any other. To attempt greater exactness would be useless; indeed the classification of these little creatures is very similar to what that of vegetables would be if we had only the separate leaves for our guides.

From 100 fathoms to shallow water (seaweed-belt, 10 fathoms and less) is the best home for the Rotaliform *Rotalinæ*. Certain varieties of *Pulvinulina repanda* attain a good size at 2400 fathoms. The varieties of *Planorbulina farcta*, also, are not uncommon at very great depths. *Discorbina Turbo*, *Rotalia Beccarii*, *Calcarina Spengleri*, and *Cymbalopora Poyei* avoid great depths (with few exceptions), the best developed specimens keeping themselves above the Coralline-zone or 25 fathoms.

Planorbulina has a coarsely porous shell (more so than any of its congeners), often of a relatively large size, consisting of from 15 to 200 or more chambers, with single septa, and very slight rudiments of the canal-system: it is usually complanate (*Pl. Mediterranensis*) and parasitic on sea-weeds and shells; but many of its varieties are plano-convex (*Truncatulina*), and some become almost subnautiloid (*Anomalina*). The shell is mostly smooth; rarely limbate (*Planulina*); and frequently granulate (*Pl. vulgaris* and *Pl. larvata*): the aperture varies from an open to a contracted slit, and is often produced and lipped.

Scheme of the chief members of the Rotaline genus PLANORBULINA.

Fully developed forms; becoming concentric, with alternating chambers built over the apertures of the penultimate ring.	*vulgaris*, D'Orb. For. Foss. Canar. pl. 2. fig. 30; Carpenter, Introd. For. pl. 13. figs. 13–15.
	Mediterranensis, D'Orb. Modèles, No. 79.
	retinaculata, Parker and Jones (sp. nov.); Carp. Int. For. p. 209. Plate XIX. fig. 2.
	larvata, P. and J. (sp. n.), Ann. Nat. Hist. 3 ser. vol. v. p. 68. Plate XIX. fig. 3.
Intermediate forms.	FARCTA, Fichtel and Moll, sp. (the type of *Planorbulina*), Test. Micr. pl. 9. figs. *g–i*.
	lobatula (*Truncatulina*), Walker and Jacob, sp., D'Orbigny's Modèles, No. 37.
	refulgens, Montfort, sp., D'Orbigny's Modèles, No. 77.
Quasi-rotalian and subnautiloid forms.	*Haidingerii*, D'Orb, sp., For. Foss. Vien. pl. 8. figs. 7–9.
	Ungeriana, D'Orb., sp., For. Foss. Vien. pl. 8. figs. 16–18.
	ammonoides, Reuss, sp., Böhm. Kreid. pl. 8. fig. 53.
	reticulata, Czjzek, sp., Haiding. Abhandl. ii. pl. 13. figs. 7–9.
	coronata (*Anomalina*), Parker and Jones, Ann. Nat. Hist. 2 ser. vol. xix. p. 294, pl. 10. figs. 15, 16.
	Ariminensis (*Planulina*), D'Orb., sp., Modèles, No. 49.

Figs. 3 to 11 include two striking varieties of *Planorbulina farcta*,—a type perhaps the richest of all the Rotalines in modification; and which not only developes the largest chambers, but produces the largest shells (some with a diameter of a quarter of an inch, *P. vulgaris*, D'Orb.). The disk and the chambers are so large in some specimens from tropical seas, that individuals have been mistaken for Polyzoa, and this mistake has been strengthened by the pouting of the marginal apertures.

Both of the varieties here under consideration, though attaining considerable size, are arrested and few-chambered varieties. They have attained the simple Rotaline form without as yet taking on the more characteristic features of the more outspread *Planorbulinæ*, although their somewhat free mode of growth, the coarseness of their shell-walls, and their relatively large aperture afford the connecting links to the observer; more especially when we find the same shells having the aperture firstly lipped, then protrusive, and gradually (among numbers of individuals) acquiring a neck and distinct rim. The typical development of this *Planorbulina*, with a subtubular chief aperture and supernumerary necked and lipped apertures on the periphery of the shell, is rarely found in the northern seas; by far the most common variety is the well-known form, figs. 3–6, long ago described as *Truncatulina lobatula*. This, as a rule, grows on a shell or other substance having a smooth surface, and during the growth of the shell the little parasitical Foraminifer occasionally becomes more or less imbedded in its substance. This plano-convex variety represents in the temperate climes the many-chambered plano-convex *Planorbulina Mediterranensis*. The latter swarms on sea-weeds and shells in the shallow water of the Mediterranean; and it is in company with it (especially when growing on the larger bivalves, such as *Pinna flabellum*) that *Pl. lobatula* is seen to take on a wild-growing condition, with subsidiary marginal necks, becoming *Pl. farcta* and *Pl. variabilis*, without developing nearly so many chambers as are seen in its associate, although exceeding the latter in size. In tropical and sub-tropical seas *Pl. farcta* grows on to be the great *Pl. vulgaris*, D'Orb., the arrested Truncatuline forms being comparatively rare.

In the seas of hot climates a large amount of exogenous granular matter is formed on the surface of the shell (as in *Pl. larvata* *, Parker and Jones); far different to the smooth, polished shells in the Mediterranean and northern seas. There is one parasitical form (*Pl. retinaculata* †, Parker and Jones) which, besides being scabrous with granulation, developes so large a number of peripheral, subsidiary, tubular apertures, connecting together, and still keeping apart, the sarcode-chambers, and forming a kind of irregular network over the surface of the shells on which it grows, like certain Polyzoa, that the features of this *Planorbulina* are extremely different from that of its type; and it can scarcely be connected with the simple varieties of the species without a knowledge of the real relationships of the great and widely extended Rotaline group. The same structure really exists in the great *Pl. vulgaris*, D'Orb. For. Canar. pl. 2. fig. 30, and Carpenter, Introd. For. pl. 13. figs. 13–15; but here the connexion of the chambers

* Plate XIX. fig. 3. Ann. Nat. Hist. 3 ser. vol. v. p. 68.

† Plate XIX. fig. 2. Carpenter's Introd. Foram. p. 209.

is masked in some degree by the obesity of the chambers themselves; the retinaculate variety developing smaller and more depressed lobes of sarcode. On *Chama gigas* there is often a wild-growing parasitic *Tinoporus* isomorphous with *Pl. retinaculata*, but still larger.

The oldest known *Planorbulinæ* are found in the Lias.

Planorbulina farcta, Fichtel and Moll, sp., Var. (*Truncatulina*) *lobatula*, Walker and Jacob, sp. Plate XIV. figs. 3–6 (Arctic); Plate XVI. figs. 18–20 (North Atlantic).

Planorbulina lobatula has been described above to some extent; we may add that it is an exceedingly unstable form, even whilst keeping its simple character; for frequently it has only half the thickness seen in fig. 5 *b*, which is an average specimen for such as live at from 30 to 160 fathoms in the Northern Seas; but at about 60 to 70 fathoms it frequently assumes a modified condition, taking a high conical shape (*Pl. refulgens*, Montfort, sp.), its smoothness and polish being much greater than in these flatter forms; and the apex of the shell is on the umbilical aspect (as in *Pl. lobatula*); the whole coil of chambers being seen on the base of the shell. *Pl. lobatula* also passes insensibly into an extremely thin scale-like variety, nearly symmetrical, with limbate septal lines and square edges, which has been described as *Planulina Ariminensis*, D'Orb. (Modèles, No. 49). Other forms gradually lose the plano-convex, or Truncatuline, character; the edges become rounded, the primary and succeeding chambers become elevated above the margin of the shell, which thus grows biconvex or lenticular; for instance, *Planorbulina Haidingerii*, D'Orb., sp. (For. Foss. Vien. pl. 8. figs. 7–9), and *Pl. Ungeriana*, D'Orb., sp. (Ibid. figs. 16–18), common forms at from 60 to 300 fathoms. We here omit any notice of the intermediate varieties, which have been extensively named as species.

Like *Pulvinulina repanda*, as seen in its variety *P. Micheliniana* (Plate XIV. fig. 16), the Truncatuline forms of *Pl. farcta* have the spiral arrangement of the chambers marked on the flat face of the shell; on the other hand, the plano-convex varieties of *Discorbina Turbo* have the umbilical surface flat; the apex of the cone being formed of the primordial chamber: an approach to this condition is seen in Plate XIV. figs. 18, 19, *Discorbina obtusa*, D'Orb., sp. (For. Foss. Vien. pl. 11. figs. 4–6), a variety of *D. Turbo*, D'Orb., sp. (Modèles, No. 73).

Plate XIV. figs. 3–6 represent specimens of *Pl. lobatula* from the Hunde Islands, in five dredgings by Dr. P. C. Sutherland (25 to 70 fathoms), where they are very common and generally of good size; from Baffin's Bay, at three places; lat. 75° 10′ N., long. 60° 12′ W., and lat. 76° 30′ N., long. 77° 52′ W., of middling size and common, and at lat. 75° N., long. 59° 40′ W. (220 fathoms), where they are small and rather common; and from seven out of the eight dredgings by MacAndrew and Barrett on the Norwegian coast we have them large and common. We have already indicated that this variety is world-wide; fossil, it occurs in the Chalk-marl, Chalk, and many later deposits.

Fig. 6 shows a condition of the parasitic forms of *Planorbulina farcta* very common,

both in this arrested Truncatuline variety and in the outspread *Planorbulinæ*. Two young individuals, establishing themselves close to each other, grow on until their shells become blended and confused; this is still better seen in the many-chambered *Planorbulinæ*, two or more of which, growing into each other, form lichen-like patches on shells.

Plate XVI. figs. 18–20 (North Atlantic).

Truncatulina lobatula belongs essentially to shallow waters, and it becomes smaller when in deeper water than usual (as is the case with the specimens before us), and is then more compact and neat, takes on a limbation (exogenous edging to the chamber-walls, fig. 19), and soon approaches the conical and shapely *Tr. refulgens*, Montfort, sp.

On the eastern marginal plateau of the North Atlantic *Truncatulina lobatula* is common and of middle size at from 43 to 78 fathoms, rare and small at 338 fathoms. It is absent from the abyssal depths. To the north of Newfoundland Bank ("Arctic" tract) it is rare and small at 145 fathoms, and rare and middle-sized at 740 fathoms.

Planorbulina farcta, Fichtel and Moll, sp., Var. *Haidingerii*, D'Orbigny, sp. Plate XVI. figs. 22 *a*, 22 *b* (North Atlantic).

This is a variety of *Planorbulina farcta* near to *Pl. lobatula*, but biconvex and having more chambers and a more solid and symmetrical make. It is usually larger and more ventricose than these Atlantic specimens.

This and *Pl. Ungeriana* are two closely allied, compact, and flush-chambered varieties of *Pl. farcta*, more Rotaliform than *Pl. lobatula*, and inhabiting moderately deep seas. In the North Atlantic *Pl. Haidingerii* is rare and of middle size at 1776 fathoms in the Abyssal area. It is more abundant in the "Virginian Province" on the coast of New Jersey (see page 333 and Appendix II.). The two are fossil together in Tertiary beds.

Pl. Haidingerii is world-wide, like the type, and bears the same relation to it that *Rotalia Soldanii* does to *R. Beccarii*,—a rather large and moderately deep-sea variety.

Planorbulina farcta, Fichtel and Moll, sp., Var. *Ungeriana*, D'Orbigny, sp. Plate XVI. figs. 23–25 (North Atlantic).

This variety has relatively narrower chambers and more limbation than its congener *Pl. farcta*, var. *Haidingerii*, D'Orb., sp., above-mentioned.

It is widely distributed in the Atlantic. On the marginal plateau off the Irish coast it is rare and small in the shallow, common and largest in the deeper parts. In the Abyssal tract ("Celtic") it is common but small; and throughout the "Boreal" portion of that tract (1400–2300 fathoms) it is rare and small. It is figured in Dr. Wallich's 'North-Atlantic Sea-bed,' pl. 6. figs. 20, 21.

Pl. Ungeriana is world-wide, like the last; but, as a weaker and smaller shell, it takes the place of the type in deepest waters, where also *Rotalia orbicularis* represents *R. Beccarii*. *Pl. Culter*, nov., Plate XIX. fig. 1, is a rare, keeled subvariety, living at great depths.

Planorbulina farcta, Fichtel and Moll, sp., Var. *Mediterranensis*, D'Orbigny. Plate XVI. fig. 21 (North Atlantic).

This explanate *Planorbulina* is of small size in the North Atlantic, as usual in North Temperate seas; it is rare off the Irish coast at 43 fathoms.

It is spiral at first, then excentric, and ultimately concentric; always orderly in its growth, with bipolar chambers; not having exogenous matter, nor a free growth of marginal apertures. It flourishes in the warmer temperate seas; is starved in the British area; abounds in the Mediterranean and Australian seas; but in the latter is less plentiful than *Pl. vulgaris*, with which it is associated. It forms a tiny scale on flat-fronded sea-weeds, and has a livid pinkish colour, both from its contained sarcode and from the shell-substance being actually coloured.

Planorbulina farcta, Fichtel and Moll, sp., Var. (*Anomalina*) *coronata*, Parker and Jones. Plate XIV. figs. 7–11 (Arctic).

This has been termed *Anomalina coronata*, Ann. Nat. Hist. 2 ser. vol. xix. p. 294; but it belongs to *Planorbulina*, and the term *Anomalina* is not really wanted, however convenient it may be as a term for the subsymmetrical or somewhat biconvex arrested *Planorbulinæ*, as *Truncatulina* indicates the plano-convex few-chambered forms. To make the so-called genus *Anomalina*, D'Orbigny took several of the minor forms of *Planorbulina farcta*, namely those which are somewhat symmetrical and subnautiloid, with one variety of *Discorbina Turbo* (*A. elegans*, Modèle, 42).

On taking into consideration the evident passage of form from the plano-convex (Truncatuline) to the biconcave (Anomaline) condition of the shell, shown by figs. 8, 10, 9, 7, & 11, the observer may at once see the force of the above remarks.

This variety, *Pl. coronata*, has the same kind of shell-substance, thick, subtransparent, and coarsely perforated, as *Pl. lobatula*; it has a greater tendency to develope clear, non-perforate, exogenous shell-matter on both faces of the shell, sometimes hiding the septal lines; the pseudopodia chiefly passing from the periphery of the chambers and through the lacunæ in the superadded coating, both on the umbilical (fig. 10) and the flatter spiral surface (fig. 8). The presence of these lacunæ is highly interesting, as being the first rough outline of the great vascular or interseptal canal-system which attains such perfection in the highly developed *Rotalinæ*, *Polystomellæ*, and *Nummulinæ*.

Pl. coronata is not so common as *Pl. lobatula*; it abounds, however, in MacAndrew and Barrett's Norway dredgings (at five places); and it is abundant at certain places in the Mediterranean, especially at about 100 fathoms. At such depths it is that *Pl. coronata* takes the place of *Pl. lobatula*, by living independently and developing its surfaces more or less freely, whilst but few of the parasitical variety are left on the rare shells of deep water. *Pl. coronata* has been found abundantly in the North British seas by Mr. H. B. Brady.

Pl. vulgaris also has a subnautiloid form in its young state; and throughout its growth the chambers are more or less convex both on the attached and the free face.

Planorbulina vulgaris grows on rough shells (such as *Tridacna* and *Hippopus*); and its under surface touches but at points, not lying flat (as in *Pl. Mediterranensis* on sea-weed-fronds, and *Pl. lobatula* on smooth shells and algæ).

In the fossil state we have *Pl. coronata* from the Grignon sands (Eocene), of large size, rivalling in size the *Discorbina trochidiformis* of that deposit.

Under the names of *Rotalia*, *Rosalina*, *Anomalina*, and *Truncatulina*, have been described a great number of subnautiloid forms which are evidently some of them enfeeblements of *Pl. coronata* (the nearest being *Truncatulina vermiculata*, D'Orb. Foram. Amér. Mérid. pl. 6. figs. 1–3), whilst others are either young or arrested modifications of *Pl. vulgaris*. In deep water *Planorbulina* scarcely ever takes its true Planorbuline character; this many-chambered condition seeming to require sea-weeds or shell-surfaces for support. Mixed with these, and at still greater depths, we get numbers of small subsymmetrical nautiloid forms of this species, such as have passed under the names of *Rotalia Clementiana*, D'Orb., and *Rotalia ammonoides*, Reuss; as well as many other forms ranging between the latter and *Planulina Ariminensis*. *Planorbulina ammonoides* of the Lias, Gault, and Chalk takes on the symmetrical (subnautiloid) character so distinctly as to be mistaken for small *Nonioninæ*. These small, more or less symmetrical *Planorbulinæ*, so common in some deposits of the Secondary period, are abundant enough in the existing seas at from 100 to 1000 fathoms, or even more. We may suppose that the sea-weeds and bivalves of the shallow water of the Secondary period were abundantly encrusted with *Planorbulinæ* as littoral representatives of the deep-sea forms now fossil in the clays of that period.

Genus Discorbina.

Discorbina Turbo, D'Orbigny (Varieties). Plate XIV. figs. 18–23 (Arctic); Plate XVI. figs. 26–28 (North Atlantic).

Discorbina presents a simple Rotaline form of shell, having from 7 to 30 more or less vesicular chambers, with double septa when the chambers are discrete, and with rudiments of the canal-system. The shell is coarsely porous (coarser than that of *Cymbalopora*, and less so than *Planorbulina*); somewhat conical in shape; the upper side the thickest; the margin rather sharp; but some varieties are complanate with square edges. The aperture is a large arched slit, usually occluded by an umbilical process or flap, which is sometimes developed into a subsidiary umbilical chamber; and the flaps or chamberlets of the successive chambers give a star-like or Asterigerine aspect in the umbilicus. Exogenous shell-growth sometimes thickens the septal lines of the spire; but it frequently ornaments, and even masks, the umbilical lobes.

The many varieties of this porous and flap-bearing Rotaline species are so intimately connected one with the other, that the following classification is little more than suggestive and provisional.

Scheme of the arrangement of the chief subspecific forms of DISCORBINA.

1. Conical.
- *trochidiformis*, Lam., sp., Ann. Mus. viii. pl. 62. fig. 8. Fossil from Grignon. Coarsely perforate, valvular or flapped, valvules marked by a mass of granules. It is an isomorph of *Polystomella craticulata*.
- TURBO, D'Orb., sp., Modèles, No. 73. Fossil from Grignon. Coarsely perforate. Valvules distinct. This is the typical species.
- *rosacea*, D'Orb., sp., Modèles, No. 39. Fossil from Bordeaux (=*Asterigerina Planorbis*, D'Orb.). It is delicately perforate; valvules distinct.
- *Pileolus*, D'Orb., sp., For. Amér. Mér. pl. 1. figs. 15–17. From India, Australia, &c., and fossil from Grignon. Small; conical or hemispherical: chambers vertical: granulate ornament in radiating lines. Connecting *D. rosacea* with *D. Parisiensis*. It has its extreme flatness in (*Ros.*) *semistriata*, D'Orb., For. Cuba, pl. 3. figs. 15–17.

2. Vesicular: valves feeble in the feeble vesicular forms, especially in *globularis* and its poor relations.
- *vesicularis*, Lamk. Ann. Mus. viii. pl. 62. fig. 7 (=(*Rot.*) *Gervillii*, D'Orb. Modèles, No. 72). From Australia, and fossil at Grignon. Carpenter, Introd. For. pl. 13. figs. 2, 3.
- *rimosa*, Parker and Jones (Carpenter, Introd. For. p. 205). Fossil at Grignon: recent from India to Australia, including Fiji. Plate XIX. fig. 6.
- *dimidiata*, Parker and Jones (Carpenter, Introd. For. p. 201. fig. 32, B.). Plano-convex. Plate XIX. fig. 9.
- *elegans*, D'Orb. Modèles, No. 42. Fossil from Bordeaux (=(*Rot.*) *complanata*, For. Foss. Vien. pl. 10. figs. 10–15). Passing insensibly into *D. vesicularis*.
- *globularis*, D'Orb. Modèles, No. 69 =(*Rot.*) *semiporata*, Egger, sp. Miocene, Germany.
- *obtusa*, D'Orb. For. Foss. Vien. pl. 11. figs. 4–6.
- *globigerinoides*, Parker and Jones. Extreme of *D. vesicularis*, running into *D. elegans*. It is an isomorph of *Cymbalopora bulloides*, D'Orb. (*Rosalina*, Cuba, pl. 3. figs. 2–5). Plate XIX. fig. 7.
- *Binkhorsti*, Reuss, Sitz. Akad. Wien. xliv. pl. 2. fig. 3. This is an isomorph of *Pulvinulina caracolla*, Roem., sp. Limbate.

3. Outspread (more or less complanate): valves feeble in the small outspread forms.
- *Parisiensis*, D'Orb., sp., Modèles, No. 38. Fossil at Grignon. Ornamented with granular lines.
- *Cora*, D'Orb., sp., For. Amér. Mér. pl. 6. figs. 19–21. Complanate, and round-edged; probably representing a somewhat starved condition.
- *Berthelotiana*, D'Orb., sp., For. Canaries, pl. 1. figs. 28–30.
- *biconcava*, Parker and Jones (Carpenter, Introd. Foram. p. 201. fig. 32, G). Complanate, with raised square edges. Plate XIX. fig. 10.

The oldest known are *Discorbina Turbo* and *D. Binkhorsti*, both in the Maestricht Chalk.

Discorbina Turbo, Var. *rosacea*, D'Orbigny, sp. Plate XVI. figs. 28 *a*, 28 *b* (North Atlantic).

Discorbina rosacea, D'Orb., sp. (Modèles, No. 39), has an exquisitely sculptured, and more delicately porous shell than usual (the margin only may be porous); its astral flaps form sometimes a secondary system of chambers. These characters are developed largely in *D. Turbo*, D'Orb., sp., the type of the whole group, from which this flat variety has no essential distinction. *D. rosacea* is rather common and of the middle size on the Irish plateau at 43 fathoms.

D'ORBIGNY'S *Asterigerina Planorbis* (For. Foss. Vien. pl. 11. figs. 1–3) supplies a very good representation of this elegant form: see also WILLIAMSON'S Monogr. pl. 4. figs. 109–111 (*Rotalina Mamilla*), and his pl. 4. fig. 112, and pl. 5. fig. 113 (*R. ochracea*). The most exquisite specimens of this variety are from San Domingo (fossil), where it abounds in the Miocene beds. It is always small; but is larger and coarse on the Australian shores, passing insensibly into *D. Turbo*. It is common in the Grignon Tertiary deposits, rare in our Crag, and world-wide in the present seas.

Discorbina Turbo, D'Orbigny, sp., Var. *vesicularis*, Lam., sp., Subvar. *globularis*, D'Orbigny, sp. Plate XIV. figs. 20–23 (Arctic).

This small vesicular form of *D. Turbo*, D'Orb., sp., is *D. globularis*, D'Orb., sp. (Modèle, No. 69), from the Atlantic; and the same as EGGER'S *Rosalina semipunctata*, Neues Jahrb. 1857, pl. 4. figs. 1–3. It is smaller than *D. vesicularis*, Lamarck, sp. (=*D. Gervillii*, D'Orb., sp., Modèles, No. 72), and has fewer chambers.

It is a world-wide form in shallow water and down to 70 fathoms, at which depth, west of the Bay of Biscay, it abounds; it is, however, flatter here than when nearer the shore. In deeper water it becomes *D. Berthelotiana* and *D. rosacea*, D'Orb., spp.

At the Hunde Islands (SUTHERLAND'S Soundings) it is large and rather common at from 30–40 fathoms; and middle-sized and common at from 50–70.

Discorbina Turbo, D'Orbigny, sp., Var. *vesicularis*, Lamarck, sp., Subvar. *obtusa*, D'Orbigny, sp. Plate XIV. figs. 18, 19 (Arctic).

Discorbina presents a simple Rotaline form of shell, usually having more or less vesicular chambers, with porous walls, and with the septal apertures in many cases guarded by flaps or plates, which sometimes form small secondary umbilical chambers.

The specimen here figured is near to *D. globularis*, D'Orb., sp. (Modèle, No. 69), but may either be regarded as a swollen condition of the beautiful *D. Parisiensis*, D'Orb., sp. (Modèle, No. 38), or, rather, as *D. vesicularis* with the style of ornament characteristic of *D. Parisiensis*. The nearest approach to it among published figures is made by *D. obtusa*, D'Orb., sp., For. Foss. Vien. pl. 11. figs. 4–6. The coarseness of its pores, its few and subvesicular chambers, its large central chamber, and its peculiar ornamentation, are the chief characters of the variety before us. In the Arctic specimens the ornament appears as obscure, irregularly radiating, minutely granular lines on the lower face [not well shown in the figure]; in *D. Parisiensis* the under surface has an exquisite sculpturing of minutely granulate lines or ridges; D'ORBIGNY'S *D. obtusa* has a granular ornament in radiating lines [not well shown in the figure]. *D. globigerinoides*, Plate XIX. fig. 7, a new variety of *D. Turbo*, also has this kind of ornament, being thickly covered on the septal plane with sinuous exogenous rugæ, having large pores opening out of them, thus presenting a rudiment of the canal-system.

At the Hunde Islands, *D. obtusa* is large and rare at 28 to 30 fathoms; large and rather common at 30 to 40; and large and common at 60 to 70 fathoms.

Discorbina Turbo, D'Orbigny, sp., Var. *Parisiensis*, D'Orbigny, sp., Subvar. *Berthelotiana*, D'Orbigny, sp. Plate XVI. figs. 26, 27 (North Atlantic).

Discorbina Berthelotiana, D'Orb., sp. (For. Canar. pl. 1. figs. 28–30), may be regarded either as a compressed and more or less limbate form of *D. globularis*, D'Orb., sp., or, rather, as intermediate to *D. globularis*, D'Orb., sp., and *D. Parisiensis*, D'Orb., sp. (Modèles, No. 38), but without the ornamentation below. It is generally small; usually showing an umbilical flap or angle; but in fig. 27 a granule represents it. This variety makes a near approach to the strongly limbate *Discorbina Binkhorsti*, Reuss, sp. (Sitz. Akad. Wien. 1861, vol. xliv. pl. 2. fig. 3), of the Maestricht Chalk; and, though it resembles some of the margined *Globigerinæ* of the Chalk, it has no relationship with them.

Our fig. 26 is much more limbate than the specimen figured by D'ORBIGNY; but they are essentially the same.

D. Berthelotiana occurs on the marginal plateau off Ireland, small and rather common at 78 fathoms, and small and rare at 43 fathoms.

Genus ROTALIA.

Rotalia Beccarii, Linn., sp. (Varieties). Plate XVI. figs. 29–34 (North Atlantic).

Rotalia has a finely porous shell (coarser than that of *Pulvinulina* and finer than *Calcarina*); biconvex (lowest side thickest), with round margin; made up of from thirteen to forty chambers, with double septa; canal-system present. Septal lines and umbilicus often beaded with exogenous granules, sometimes to a great extent. Aperture a slit (occasionally subdivided), sometimes notched at the umbilical margin of the septal plane, as in *Pulvinulina*, *Discorbina*, and arrested *Planorbulinæ*. Shell rarely prickly; occasionally Asterigerine; generally small, compared with most other Rotalines; or, rather, it does not attain to quite as great a size.

Scheme of the chief subspecies of ROTALIA.

ROTALIA Schrœteriana, *Parker and Jones*. See Carpenter, Introd. For. pl. 13. figs. 7–9.
—— ornata, *D'Orb.*, sp., For. Amér. Mér. pl. 1. figs. 18–20.
—— craticulata, *Parker and Jones*. Plate XIX. fig. 12. (Fiji.)
—— annectens, *Parker and Jones*. Plate XIX. fig. 11. (Hong Kong.)
—— pulchella, *D'Orb.*, sp., For. Cuba, pl. 5. figs. 16–18. See Carpenter, Introd. For. p. 213.
—— dentata, *Parker and Jones*. Plate XIX. fig. 13. (Bombay Harbour.)
—— BECCARII, *Linn.*, sp., D'Orbigny's Modèles, No. 74. This is the Type species.
—— ammoniformis, *D'Orb.* Ann. Sci. Nat. vol. vii. p. 276. No. 53. (After SOLDANI.)
—— lobata, *D'Orb.*, sp., For. Cuba, pl. 5. figs. 19–21. See Carpenter, Introd. For. p. 213.
—— carinata, *D'Orb.*, sp., For. Cuba, pl. 5. fig. 25, pl. 6. figs. 1, 2.
—— Soldanii, *D'Orb.* Modèles, No. 36.
—— umbilicata, *D'Orb.* Ann. Nat. Sci. vol. vii. p. 278. No. 4, and Mém. Soc. Géol. Fr. vol. iv. pl. 3. figs. 4–6.
—— orbicularis, *D'Orb.* Modèles, No. 13.

Rotalia affords us a good example of the parallelism that may be traced between the members of one and another Foraminiferal species (just as occurs in other natural groups). Thus, contrasted with *Polystomella*, we have an interesting series of representative forms.

Parallelism of ROTALIA BECCARII *and* POLYSTOMELLA CRISPA.

Varieties of ROTALIA BECCARII.	*Varieties of* POLYSTOMELLA CRISPA.
Rotalia Schrœteriana, *Parker and Jones.*	Polystomella craticulata, *Fichtel and Moll.*
—— Beccarii, *Linn.* (large typical form).	—— crispa, *Linn.*
—— ammoniformis, *D'Orb.* (flat var. Rimini).	—— macella, *Fichtel and Moll.*
—— Beccarii, *Linn.* (small smooth var.).	—— striato-punctata, *Fichtel and Moll.*
—— dentata, *Parker and Jones.*	—— strigilata (var. β), *Fichtel and Moll.*
—— Soldanii, *D'Orb.*	—— (Nonionina) asterizans, *Fichtel and Moll.*
—— orbicularis, *D'Orb.*	—— (Nonionina) pompilioides, *Fichtel and Moll.*
—— (Calcarina) pulchella, *D'Orb.*	—— unguiculata, *Gmel.*
—— (Asterigerina) lobata, *D'Orb.*	—— (Nonionina) stelligera, *D'Orb.*

The nearness of the two specific groups is also seen in our new *Rotalia craticulata* (Plate XIX. fig. 12) being separable from *Polystomella crispa* chiefly by its want of symmetry; and, further, *R. Schrœteriana* passes into *R. craticulata* by a greater differentiation of the canal-system, which approaches its most perfect condition in the higher *Polystomellæ*.

Rotalia Beccarii, Linn., sp. Plate XVI. figs. 29, 30 (North Atlantic).

Figs. 29 & 30 present a strongly granular condition on the lower surface, and may be said to be passing into the smaller varieties that belong to deep water; indeed, they are intermediate between the common *R. Beccarii* of shallow water and the variety known as *R. Soldanii*, D'Orb. (Modèles, No. 36), that inhabits deep water. With flattened and adpressed chambers on the upper side, and without granules on the lower, figs. 29 & 30 would be *R. Soldanii*; such modifications are common. *R. Beccarii* passes into *R. Soldanii* in deep seas everywhere; but in hot seas it also passes into the large, conical, craticulate form (*R. Schrœteriana*, Parker and Jones) with pseudopodial passages, as in *Polystomella*.

Both in its estuarine and its abyssal varieties *R. Beccarii* is feeble, being delicate in shell and small in size. Its smallest and most abyssal variety is *R. orbicularis*, D'Orb. (fig. 34), which is not abundant. In about 100 fathoms *R. Soldanii*, with a diameter three times as great as that of *R. orbicularis*, is abundant enough, and is of stronger make. The shell becomes larger, more vesicular and more granular in the best habitat of *R. Beccarii* (20 to 40 fathoms in warm seas); and in shallow waters it is smaller (of the size of *R. Soldanii*), less strong in its structure, even more vesicular, and extremely abundant (even in some brackish waters).

Rotalia Beccarii from the Lido (Venice) and Rimini, both on the Adriatic, is very smooth and complanate (although large and well-developed), compared with specimens

in the same latitude on the *western* shores of Italy and in fossil deposits (formed in shallow water) near Sienna; whilst the same species in the south-eastern parts of the Mediterranean has much thicker and more granular varieties than those in the *west* of Italy, and becomes very like the great *Rotalia Schrœteriana*, Parker and Jones (Ann. Nat. Hist. 3 ser. vol. v. p. 68, and Carpenter's 'Introd. Foram.' p. 213, pl. 13. figs. 7–9).

As we approach our own shores from the Mediterranean area, *Rotalia Beccarii* becomes gradually smaller but is still numerous: to the north it deteriorates more and more.

Rotalia Beccarii is rare and small at 78 fathoms on the Irish marginal plateau.

Rotalia Beccarii, Linn., sp., Var. *Soldanii*, D'Orbigny, sp. Plate XVI. figs. 31–33 (North Atlantic).

This may be described as *Rotalia Beccarii* becoming flush-chambered, conical (flat above), with a strong shell: in this form it inhabits deep water, about 100 fathoms (from 50 to 300 fathoms). D'Orbigny illustrated *R. Soldanii* by his Model, No. 36.

It is the *isomorph* of *Pulvinulina Micheliniana* and of *Planorbulina* (*Truncatulina*) *refulgens*, which are the deep-sea forms of their respective species.

R. Soldanii is rare and small at 43 fathoms, rather rare and middle-sized at 223 fathoms, and common and middle-sized at 415 fathoms, on the western plateau. It is rare and small at 1776, 2035, 2050, and 2350 fathoms in the abyssal area.

It is very common in the Mediterranean (at 100 fathoms), and fossil in the Subapennine clays. Generally it is not so flat at the top as our figured specimens are; but the upper faces of the cells are convex and separated by sulci (see D'Orbigny's Model).

Rotalia Beccarii, Linn., sp., Var. *orbicularis*, D'Orbigny, sp. Plate XVI. fig. 34 (North Atlantic).

This extremely delicate and minute abyssal variety of *R. Beccarii* is but little removed from *R. Soldanii*; but it is smaller, and has its upper face still flatter and smoother than in *R. Soldanii*. It is in shape half an oblate spheroid, having the upper side flat, the lower forming a low rounded cone. It may be said to be the starved abyssal variety of its species. It occurs, but sparsely, in deep-sea soundings in all latitudes—tropical to north-temperate; and it has been brought up from even 1000 fathoms and more, retaining its exquisite salmon-coloured sarcode.

D'Orbigny got his specimen, illustrated by Model No. 13, from the Adriatic.

The best localities for it are the Red Sea, where it has degenerated from *R. ornata* and *R. Schrœteriana*, and in the Mediterranean area, where it is ancestrally related to *R. Beccarii*. It becomes extremely small, one of the smallest even among starved Foraminifera; and, as such, is very rare at Shetland and in the Irish Sea (Brady).

In the abyssal area of the Atlantic it occurs very rare and very small at 1950 fathoms.

Genus PULVINULINA.

Pulvinulina repanda, Fichtel and Moll, sp. (Varieties). Plate XIV. figs. 12–17 (Arctic); Plate XVI. figs. 35–51 (North Atlantic).

Pulvinulina repanda is the type of a group of *Rotalinæ*, as above mentioned (page 378), of which we have here five varieties. Each of these belongs to a separate subspecific group; and, though they are few among many, yet they are of considerable importance in their several sub-groups, and may well serve as a basis for a general account of *Pulvinulina repanda* specifically considered.

P. repanda, when well developed, has its shell-structure dense and minutely perforated, compared with that of other *Rotalinæ*; more so than *Rotalia Beccarii* and *Calcarina Spengleri*, and much more so than *Discorbina Turbo* and *Planorbulina farcta*. In the delicacy of its tubuli (almost as fine as those of dentine) it rivals *Nummulina* and *Heterostegina*; whilst the loose coarse structure of some of the larger specimens of *Discorbina* and *Planorbulina* remind us of that of the Echinoderm and Madrepore.

Pulvinulina is most apt to take on an extra growth of shell-matter on the septal lines and the margins of the shell (limbation), and among its very numerous varieties there are many that are strongly limbate, and are more or less compact in growth; whilst other varieties are delicate, and become thin, outspread, Spirilline, and vermiculate. The shell has from seven to nearly thirty cells, with single septa and but little trace of the canal-system: it is rarely prickly; the umbilicus is often ornamented by granules, or by a boss, or a star of shelly matter; the aperture is a large fissure, often arched, and notched; and the septal face often bears numerous coarse subsidiary perforations. The shell is usually biconvex; the upper side the thickest; the margin more or less angular and subcarinate; some varieties are complanate, with square edges, as in RŒMER'S figures of *P. caracolla* and its allies from the Hils Clay and the Gault; similar forms to these occur also in the Kimmeridge Clay of Kimmeridge.

We may divide the *Pulvinulinæ* into five groups, as follows:—

First Group, or that including *P. repanda* proper.—In its typical form *P. repanda* is a spiral coil of chambers, forming a low conical shell, showing the spire, with a more or less open umbilicus; some of the older chambers usually having limbate septa. The shell has generally an irregularly oblong form; the chambers rarely forming a symmetrical disk, never flush at the edges, but set on loosely, and usually increasing in size in a somewhat rapid ratio; they present often a curved or sickle-shaped outline both above and below, or are curved and narrow above, broad and irregularly triangular below. The umbilical portions of the chambers are generally very attenuate, fitting neatly as they converge to the centre. Occasionally these lobes are separated by narrow chinks; sometimes they are deficient, leaving a large umbilical gap. The septal face is either gently convex, or flat; in the latter case it is perforated with proportionally large holes. The aperture is a large arched slit, occasionally notched at its upper margin. Granulate ornament is not uncommon on the upper surface of the shell; below, exogenous matter

may either fill the umbilical cavity, or affect the borders of the umbilical lobes, even to their union by a bridge-like growth. Limbation is seldom absent from the border of the shell; frequent on the older part of the spire; and not uncommon with the later chambers. Figs. 101–103 in Professor WILLIAMSON'S 'Monograph of British Recent Foraminifera' represent a common condition of this typical form.

The members of Group No. 1 inhabit depths of about 10 to 100 fathoms. The varieties affecting the shallow water are less neat in their make than those of greater depths.

Second Group, characterized by *P. Auricula* and *P. oblonga*.—In this group the shells are far more oblong in shape, from the very rapid increase of size of the chambers; and, as a rule, they are much more delicate and frail than the foregoing, although some small deep-sea varieties of this subtype are unusually dense. The septa and borders are rarely limbate. The septal face of the last chamber is usually drawn out and inflated, but narrow, and, by an umbilical process, overlaps the alar terminations of the older chambers. This feature has caused D'ORBIGNY to class several varieties of this subtype as species of his genus *Valvulina*. In some cases a portion of the septal face near the umbilicus is flattened and pertused; and this feature is usually associated with some degree of limbation of the upper septal lines. The whole of the septal face is flattened and coarsely perforate in certain forms lying between *P. Auricula* and *P. repanda*. The aperture is similar to that in Group No. 1; but occasionally there is a large subsidiary notch. The umbilical lobes terminate in a similar manner to what obtains in the typical group; and the umbilicus, as in the former, may either be closed, by the meeting of the lobes, or remain slightly open, or be largely excavate. The varieties in which the last-named feature occurs are small deep-sea forms, having dense shell-tissue, a flattened hispid upper surface, with flush chambers; the under surface being gently convex and highly polished.

As a rule, in each of the subgroups of *P. repanda*, here described, the thick-set varieties are those that inhabit deep water.

The members of the Group No. 2 have their best home at 50 to 70 fathoms; but they range from shallow water (algal zone) to 500 fathoms or more.

The Third Group, including *P. Menardii*.—This is an assemblage of closely related varieties, differing however considerably in feature. Some are very flat and scale-like, some conical, some biconvex. The flat forms have usually a somewhat oblong outline; but the members of this group are mostly circular, with indented septal lines; the chambers are sometimes triangular on both surfaces; though sometimes narrow and curved, or oblong, or even square above and more or less triangular below. *P. Menardii* and its nearest allies are margined and limbate on the upper surface, and often granular, scabrous, or hispid. These features are less striking in other varieties which pass gradually into feebly marked, smooth, thick, small, untypical forms. The septal face is still large in this group, gently convex or flat; sometimes sinking in at a spot near the aperture, which is often boldly notched. The chambers of these shells are fewer than in the "repanda-" or "type-group"; but in the better developed specimens they have the

same rapid increase of size, with the same neat convergence of the umbilical lobes; the lines between them, however, being usually straighter. The conditions of the umbilicus resemble those of the typical group; but the contracted form of the shell, in certain varieties, raises up the umbilical portions of the chambers into the apex of a cone, the base of which is the neat and almost flat spiral surface.

The members of this group, all of which are mutual companions, are obtained from abyssal depths, 100 to 2700 fathoms.

Fourth Group, characterized by *P. Schreibersii*.—These shells have more numerous chambers than we find in the foregoing groups, nor do they enlarge with age so rapidly. The lower surface shows but few chambers (5–11), in contrast with those seen above (15–30); whilst in groups Nos. 1–3, all except the four or five earliest chambers are seen on the umbilical as well as on the spiral surface, on account of the spire being subdiscoidal, whilst in *P. Schreibersii* and its allies the spire is helical or subturreted. There is also a greater tendency to limbation (exogenous shell-growth on the septal lines and the margin), especially about the umbilicus, where a knob, a group of granules, or a star-like ornament is not unusual; hence this may be termed the "stellar" group. These, moderately deep-sea forms for the most part, have often the thickest shells of any among the subtypes, especially *P. Schreibersii* itself, as found in the muds of the Gulf of Suez at about 40 fathoms. This group has a very extensive bathymetrical range.

Fifth Group, with *P. elegans* as the leading form.—This is closely allied to the last group in its general features, and may be said to represent a further development of its peculiarities. We have here a series of neat, compact, more or less biconvex, and for the most part limbate *Pulvinulinæ*. The limbation is less constant on the upper (spiral) than on the lower surface, on which latter a symmetrical wheel-like ornament is often found, imitating such as occurs on some nautiloid *Cristellariæ*. On the upper surface the limbation is sometimes strongly developed, both on the septal lines and the margin, and in some cases (*P. D'Orbignii*, Rœmer, and *P. ornata*, Roemer) masks the spire altogether. On the other hand the limbation may be but slight; and in *P. Cordieriana*, excepting as regards the umbilical boss, it is nearly obsolete. Some subvarieties of *P. elegans* itself appear with little exogenous or limbate ornament.

In this group the shell is polished to the utmost; and in the same gatherings from very deep water *P. Menardii* will be in its roughest condition and *P. elegans* will be highly enamelled and glistening. It is always neat and nautiloid. The group ranges from 70 to 1000 fathoms.

Scheme of the chief Members of the Genus PULVINULINA.

1st Group. The type or repanda group. 10–100 fathoms.

- *vermiculata*, D'Orb. (after Soldani). Carpenter, Introd. pl. 13. figs. 4–6.
- *sinuata*, Fichtel and Moll, sp., Test. Micros. pl. 10. figs. *a–c*.
- REPANDA, Fichtel and Moll, sp., Test. Micr. pl. 3. figs. *a–d*. (The type of *Pulvinulina*.)
- *pulchella*, D'Orb., sp., Modèles, No. 71.
- *punctulata*, D'Orb., sp., Modèles, No. 12.
- *Caribœa*, D'Orb., sp., For. Cuba, pl. 5. figs. 1–3.
- *Boueana*, D'Orb., sp., For. Foss. Vien. pl. 7. figs. 25–27.
- *concentrica*, Parker and Jones; Soldani, Test. i. pl. 37. fig. B.

2nd Group. Auricula or oblonga group. 10–500 fathoms (70 fathoms best).

- *Auricula*, Fichtel and Moll, sp., pl. 20. figs. *a–f*.
- *Sagra*, D'Orb., sp., For. Cuba, pl. 5. figs 13–15.
- *oblonga*, Williamson, sp., Monogr. pl. 4. figs. 98–100.
- *Brongniartii*, D'Orb., sp., For. Foss. Vien. pl. 8. figs. 22–24.
- *Hauerii*, D'Orb., sp., For. Foss. Vien. pl. 7. figs. 22–24.
- *contraria*, Reuss, sp., Zeitsch. Deutsch. Geol. Ges. iii. pl. 5. fig. 37, *a, b, c*.
- *deformis*, D'Orb., sp., For. Cuba, pl. 4. figs. 9–11.
- *inœqualis*, D'Orb., sp. (*Valvulina*), For. Amér. Mér. pl. 7. figs. 10–12.
- *oblonga*, D'Orb., sp. (*Valvulina*), For. Canar. pl. 1. figs. 40–42.
- *excavata*, D'Orb., sp. (*Valvulina*), For. Canar. pl. 1. figs. 43–45.
- *scaphoidea*, Reuss, sp., Neue For. Oester. Tert. pl. 47. fig. 3, *a, b, b'*.
- *Auris*, D'Orb., sp. (*Valvulina*), For. Canar. pl. 2. figs. 15–17.

3rd Group. Menardii group, Abyssal group. 100–2700 fathoms.

- *Menardii*, D'Orb., sp., Modèles, No. 10.
- *cultrata*, D'Orb., sp., For. Foss. Cuba, pl. 5. figs. 7–9.
- *umbonata*, Reuss, sp., Zeitschr. d. g. G. iii. pl. 5. fig. 35, *a–c*.
- *crassa*, D'Orb., sp., For. Craie bl. Fr. pl. 3. figs. 7, 8.
- *dubia*, D'Orb., sp., For. Cuba, pl. 2. figs. 29, 30, pl. 3. fig. 1.
- *Canariensis*, D'Orb., sp., For. Canar. pl. 1. figs. 34–36.
- *pauperata*, Parker and Jones, nov. sp. Plate XVI. figs. 50, 51.
- *Micheliniana*, D'Orb., sp., For. Craie bl. Fr. pl. 3. figs. 1–3.
- *nitida*, Reuss, sp., Böhm. Kreid. pl. 12. fig. 20, *a, b*.
- *truncatulinoides*, D'Orb., sp., For. Canar. pl. 2. figs. 25–27.

4th Group. Schreibersii group, Stellar group. 30–2700 fathoms.

- *Schreibersii*, D'Orb., sp., For. Foss. Vien. pl. 8. figs. 4–6.
- *Antillarum*, D'Orb., sp., For. Cuba, pl. 5. figs. 4–6.
- *concava*, Reuss, sp., For. Ostalp. Kreid. pl. 26. fig. 3, *a–c*.
- *Badensis*, Czk., sp., Fos. For. Wien, pl. 13. fig. 1–3.
- *Peruviana*, D'Orb., sp., For. Am. Mér. pl. 2. figs. 3–5.
- *Karsteni*, Reuss, sp., Zeit. d. g. G. vii. pl. 9. fig. 6, *a–c*.
- *squamiformis*, Reuss, sp., For. Kreid. Ostalp. pl. 26. fig. 2, *a–c*.
- *Alvarezii*, D'Orb., sp., For. Am. Mér. pl. 1. fig. 21, pl. 2. figs. 1, 2.
- *spinimargo*, Reuss, sp., Neue For. Oester. Tert. pl. 47. fig. 1, *a, b*.
- *Patagonica*, D'Orb., sp., For. Amér. Mér. pl. 2. figs. 6–8.

5th Group. Elegans group, strongly limbate. 70–1000 fathoms.

- *elegans*, D'Orb., sp., Ann. Sc. Nat. p. 276, No. 54.
- *caracolla*, Nils., sp., Rœmer's Nord-Deuts. Kreid. pl. 15. fig. 22.
- *Partschiana*, D'Orb., sp., For. Foss. Vienn. pl. 8. figs. 1–3.
- *Berthelotiana*, D'Orb., sp., For. Canar. pl. 1. figs. 31–33.
- *Cordieriana*, D'Orb., sp., For. Craie bl. Paris, pl. 3. figs. 9–11.
- *ornata*, Nils., sp., Rœmer's Nordd. Kr. pl. 15. fig. 25.
- *D'Orbignii*, Nils., sp., Rœmer's Nordd. Kr. pl. 15. fig. 24.
- *stelligera*, Reuss, sp., For. Kreid. Ostalp. pl. 25. fig. 15, *a–c*.
- *Partschiana*, D'Orb. sp., var., Borneman, Fauna Septar.-Thones Hermsd. pl. 16. fig. 6, *a–c*.

Pulvinulina repanda, Fichtel and Moll, sp., Var. *punctulata*, D'Orbigny, sp. Plate XIV. figs. 12, 13 (Arctic).

Though flatter, this is essentially the same as *Pulvinulina punctulata*, D'Orb., sp., Modèle, No. 12. When smaller, more limbate, and less compact in growth, it passes into more ordinary varieties, such as *P. repanda*, Fichtel and Moll, sp. (*Rotalina concamerata*, Williamson, Monogr. pl. 4. figs. 101–103).

In our former description of the Norwegian Foraminifera, we mistook this large variety for a large growth of *Discorbina vesicularis*, Lam., sp. It is represented, in Messrs. MacAndrew and Barrett's dredgings, by one specimen from sand at West Fiord (Nordland) from 60 fathoms depth, and eight specimens that occurred on sponge from 100 fathoms at Vigten Island, Inner Passage (Drontheim).

It lives also in the Adriatic (D'Orbigny) and at Orotava (Canaries); and is abundant and large off Sicily, and in the Levant, and in many other parts of the world at moderate depths. The huge specimens from the Crag, larger than our Norwegian specimens, lean more to the looser and few-celled type figured by Williamson.

Pulvinulina repanda, Fichtel and Moll., Var. *Menardii*, D'Orbigny, sp. Plate XVI. figs. 35–37 (North Atlantic).

Pulvinulina Menardii, D'Orb., Modèles, No. 10, is a deep-sea form of *P. repanda*; it is in best condition at from 100–500 fathoms, but lives well at even three miles depth; in shallow water (algal belt) it becomes either conus-shaped, or much depressed with a large keel (*P. pauperata*, Parker and Jones, Plate XVI. figs. 50, 51); whilst *P. repanda* (the type) becomes vermiculate, abounding in the Mediterranean as *Pulvinulina vermiculata*, D'Orb., sp. (*Planorbulina vermiculata*, D'Orb., Ann. Sc. vii. p. 280, No. 3; after Soldani). At from about 30–100 fathoms in the Mediterranean the typical *P. repanda* abounds; and in the same sea the obtusely conical *P. Micheliniana* represents the species abundantly at from 500–1500 fathoms on muddy tracts, whilst the flatter form (*P. Menardii*) common in the depths of the great oceans seems to be wanting there. *P. Micheliniana* is also potent in the Arctic seas and North Atlantic; and is fossil in great numbers in the Chalk.

P. Menardii is generally limbate and granulo-aciculate; the specimens before us are more or less limbate and have roughish shells. They are not numerous, nor have they attained the fulness of size and beauty that belong to the species in lower latitudes; the further north, the poorer they are; for those in the Mid-Atlantic (Dayman) are generally somewhat larger than those in the North Atlantic (Wallich's Collection); and this is the case with other species and varieties. In the Atlantic the proportion of *Pulvinulinæ* to the Foraminiferal fauna is perhaps not $\frac{1}{10}$th of what will be found in the deep water of tropical and subtropical seas.

In the North Atlantic *Pulvinulina Menardii* is widely distributed. On the marginal plateau off Ireland it is rare and small in the shallow, less rare and larger in the deeper part. It is of middle size and common in the "Celtic" portion, and rather rare

throughout the "Boreal" portion of the abyssal tract (1400–2300 fathoms); and neither large nor common at 329 fathoms north of Newfoundland Bank. Mr. BRADY has some fine specimens from the Irish Sea.

Pulvinulina repanda, Fichtel and Moll, sp., Var. *Menardii*, D'Orbigny, sp., Subvar. *Canariensis*, D'Orbigny, sp. Plate XVI. fig. 47–49 (North Atlantic).

Pulvinulina Canariensis, D'Orb., For. Canar. pl. 1. figs. 34–36, is a dwarf form of *P. Menardii*, common but distinct among the larger specimens in deep water, and widely distributed from the north to the Tropics. It is more attenuate than well-grown specimens of the subtype (*P. Menardii*), and usually is very imperfectly limbate. D'ORBIGNY'S figure has a limbate upper surface, and the mouth more patent on the lower plane than in our specimen: but these modifications are of continual occurrence. *P. Canariensis* may be said to be a starved form among well-fed ones (as happens with *Globigerinæ* and many other Foraminifera); yet it is well to keep it apart with a name, as, should it occur without *P. Menardii*, it would bespeak an unfavourable habitat.

In the North Atlantic *Pulvinulina Canariensis* is wide-spread. On the eastern marginal plateau it is common and small at 78 fathoms, rare and small at 338 fathoms, and rare and middle-sized at 415 fathoms. In the "Celtic" abyssal tract it is rather common; throughout the "Boreal" portion also (1400–2300 fathoms) it is rather common, but smaller. North of the Bank, at 161 fathoms, and in Trinity Bay, it is rare and small.

Pulvinulina repanda, Fichtel and Moll, sp., Var. *Menardii*, D'Orb. sp., Subvar. *pauperata*, nov. Plate XVI. figs. 50, 51 *a*, 51 *b* (North Atlantic).

Pulvinulina pauperata is rare, usually small, and nearly symmetrical; found at great depths (2000 fathoms) in both high and low latitudes, and is often much larger in the latter than in the former. It presents a feeble, and, as it were, accidental condition, in which the thin film of sarcode surrounding the few feebly marked chambers has been calcified beyond their verge. Though it is very small here, we have seen this variety (from subtropical seas) as large as the largest *P. Menardii*. In tropical seas (Tropical Atlantic and Indian Ocean) it is large but rare.

This variety occurs in company with *P. Menardii* and *P. Canariensis*, which are found taking on a margined condition, with feebly developed chambers, thus connecting the depauperated variety under notice with themselves. Comparing this deep-sea attenuated form with those of shallow water, we see that the latter become vermiculate, losing the power of forming separate chambers.

P. pauperata is rare in the North Atlantic (the figured specimens are all we met with); in the "Boreal" tract, towards Newfoundland Bank it is middle-sized at 1450 fathoms; and in the Abyssal "Celtic" tract it is small.

Pulvinulina repanda, Fichtel and Moll, sp., Var. *Menardii*, D'Orbigny, sp., Subvar. *Micheliniana*, D'Orbigny, sp. Plate XIV. fig. 16 (Arctic); Plate XVI. figs. 41–43 (North Atlantic).

This small compact conical *Pulvinulina* occurs in deep water. Its deepest known habitat is at 2700 fathoms (South Atlantic). It is very common in the North Atlantic. In the Mediterranean it flourishes at 400–500 fathoms on muddy bottoms, being larger there than our figured specimens; it then takes the place of *P. Menardii*. In shallow water it degenerates into bizarre varieties.

P. Micheliniana abounds fossil in the Chalk and Gault, and was first described by D'ORBIGNY in his Memoir on the Foraminifera of the White Chalk of Paris, Mém. Soc. Géol. de France, vol. iv. pl. 3. figs. 1–3, together with another closely allied variety of *P. Menardii* (*P. crassa*, D'Orb., sp., *loc. cit.* figs. 7–8); as well as a third variety (*P. Cordieriana*, D'Orb., *loc. cit.* figs. 9–11), a member of the *P. elegans* group of *P. repanda*.

At the Hunde Islands this usually deep-sea form, *P. Micheliniana*, is represented by rare and small individuals at 25–30 fathoms.

Plate XVI. figs. 41–43 (North Atlantic).

From the Arctic Ocean we had but very few specimens of *P. Micheliniana*, owing to the paucity of deep-sea soundings. In the North Atlantic it is very common; and generally very rough or scabrous in its shell-tissue; in fact it may be said to be here *P. truncatulinoides*, D'Orb., sp. (For. Canar. pl. 2. figs. 25–27), and the two forms are scarcely worth separating by distinct names.

On the Irish marginal plateau it is rare and small in the shallow, rather common and large in the deep parts. In the "Celtic" abyssal depths it is common and rather large; but in the "Boreal" tract (at upwards of 2000 fathoms) it is smaller and rarer; and nearer to the Bank it is rare and small at 1450 fathoms.

Pulvinulina repanda, Fichtel and Moll, sp., Var. *Karsteni*, Reuss, sp. Plate XIV. figs. 14, 15, & 17 (Arctic); Plate XV. figs. 38–40 (North Atlantic).

This is a neat, many-chambered, moderately conical variety of *P. repanda*, with some degree of limbation bordering the chambers, especially beneath, where a wheel-like system of exogenous shell-matter characterizes the shell.

This occurs in each of the soundings at the Hunde Islands (SUTHERLAND), and is common and of middling size in most of them. It is found also at 150 fathoms in Baffin's Bay, lat. 76° 30′, long. 77° 52′ (PARRY). It is small at Shetland (BRADY).

Plate XVI. figs. 38–40 (North Atlantic).

Pulvinulina Karsteni, Reuss, sp. (Zeitsch. deutsch. geol. Ges. 1855, vol. vii. pl. 9. fig. 6), is usually smaller and more conical than *P. Menardii*, also rounder, quite smooth, and free from the limbation on its upper face, which is present in *P. Menardii*; on its lower

face, however, the margin and sometimes the septal furrows are limbate (a feature usually wanting in *P. Menardii*); an umbilical knob is sometimes present also; and with this as a nave, and the septa for spokes, the shell has a wheel-like aspect.

A closely allied and still more conical form (*R. Schreibersii*, D'Orb., For. Foss. Vien., pl. 8. figs. 4–6), having a stellate umbilicus and neatly radiating septa, is the leading member of the group of varieties of *P. repanda*, among which *P. Karsteni* is arranged; it is found recent in the muds of the Gulf of Suez and the Red Sea (at 40 fathoms and thereabouts), and is fossil in the Tertiary beds of Tuscany and the Vienna Basin.

Though differing from it a little in details, the North Atlantic specimens here figured are still more like Reuss's figure than is the Arctic specimen, Plate XIV. fig. 15, which in some respects is nearer to D'Orbigny's figure of *Pulvinulina Antillarum* (Foram. Cuba, pl. 5. figs. 4–6), an allied form. Reuss's figure is intermediate to the Arctic and North Atlantic specimens.

In Trinity Bay *P. Karsteni* is rare but large at 133 fathoms, lat. 48° 18′, long. 52° 56′. It occurs at 2700 fathoms in the South Atlantic.

Pulvinulina repanda, Fichtel and Moll, sp., Var. *elegans*, D'Orbigny, sp. Plate XVI. figs. 44–46 (North Atlantic).

Our specimens show an unusually non-limbate condition of *Pulvinulina elegans*, which is a subtype of the *P. repanda* group, and was chosen as a species by D'Orbigny from amongst Soldani's figures (Sagg. Oritt. pl. 2. fig. 2, R; Ann. Sc. Nat. vii. p. 276, No. 54). *P. elegans* has a neat, smooth, and highly polished shell, varying always in limbation and conicity. The excess of characters in this subtype is found in *P. caracolla*, Rœmer, sp., *P. ornata*, Rœm., sp., and *P. D'Orbignii*, Rœm., sp. (Norddeutsch. Kreid. pl. 15. figs. 22, 24, 25), of the Cretaceous deposits. In our specimens we have nearly an equality with *P. Partschiana*, D'Orb., sp. (For. Fos. Vien. pl. 8. figs. 1–3), excepting as to limbation: and, further, we may regard our specimens as feeble forms of *P. elegans* with a tendency towards *P. umbonata*, Reuss (Zeitsch. d. g. Ges. vol. iii. pl. 5. fig. 35).

P. elegans abounds at from 100 to 200, and even to 300 fathoms. Forms intermediate to *P. elegans* and *P. Karsteni* are common in clays of the Secondary Formations (Oxford and Kimmeridge Clays, and Upper Trias of Chellaston).

In the North Atlantic *P. elegans* is common, but small, at 78 fathoms on the eastern plateau; rare and small at 1660 fathoms in the abyssal area ("Boreal"); but rather common and larger at 1450 fathoms. It is sa ll at 15 fathoms in the Irish Sea (Brady).

Genus Spirillina.

Spirillina vivipara, Ehrenberg. Plate XV. fig. 28 (Arctic).

For an account of *Spirillina*, see Ann. Nat. Hist. 2 ser. vol. xix. p. 284, and Carpenter's Introduct. Foram. p. 180. There is often a difficulty in distinguishing this form from its isomorph, the vermiculate *Pulvinulina*; the numerous and non-segmented whorls decide the doubt in this instance.

Sp. vivipara is rare anywhere, and always small. We have it in the mixed sands from Norway (MacAndrew and Barrett), and from 60 to 70 fathoms, Hunde Islands (Dr. Sutherland); in deep water it is represented by the better developed *Sp. margaritifera*, Williamson.

Genus Patellina.

Patellina corrugata, Williamson. Plate XV. fig. 29 *a*, 29 *b*, 29 *c* (Arctic).

This species has been well figured and described by Professor Williamson (Monogr. p. 46, pl. 3. figs. 86–89); see also Carpenter's Introd. Foram. p. 230.

We have *P. corrugata* from the Hunde Islands (Dr. Sutherland's dredgings), at from 30 to 70 fathoms; where it is common and small throughout. Professor Williamson had it from the same source, and found it in several sands on the British coasts. It is present in most sea-beds that are rich with Foraminifera, from the littoral zone down to 500 fathoms; but is rarely in great abundance.

Genus Nummulina.

Nummulina perforata, Montfort, sp., Var. *planulata*, Lamarck. Plate XIV. figs. 45 *a*, 45 *b* (Arctic).

From the Red Sea Fichtel and Moll got two little *Nummulinæ* very similar to the specimens before us; Professor Williamson also has similar specimens from the British coast; and in Mr. Jukes's Australian dredgings *Nummulinæ* of like character abound, but larger, and passing into *Operculinæ*. These are degenerate forms of *Nummulina planulata*, once so abundant in the Eocene (or Nummulitic) Tertiary period, and existing still later in, at least, the Vienna area (Middle Tertiaries). *N. planulata* itself is a simple form of the better-developed *N. perforata*, Montfort, which in its extreme growth became *N. nummularia*, Brug. (*N. complanata*, Lam.).

This small form of *N. planulata* (subvar. *radiata*, Fichtel & Moll.) is rather common at the Hunde Islands in 25 to 30 fathoms. See also Ann. Nat. Hist. ser. 3. vol. v. pp. 105–107.

Besides the above-mentioned localities, the Abrolhos Bank in the South Atlantic and Bombay Harbour are places where *N. planulata* has been found.

Nummulina perforata, Montf., sp., Var. (*Operculina*) *ammonoides*, Gronovius, sp. Plate XIV. figs. 44 *a*, 44 *b* (Arctic); Plate XVII. figs. 62, 63 (North Atlantic).

This is the diminutive and northern representative of the much larger *Operculina complanata*, Defrance, sp., which is a varietal form of *Nummulina*. The last (*Nummulina*) is but poorly represented now-a-days (as far as our knowledge goes); but *Operculina* is sometimes almost, if not quite, as large in the Australian, New Zealand, and Philippine seas as ever it was in the Cretaceous, Eocene, and Miocene times. See Ann. Nat. Hist. 3 ser. vol. viii. p. 220, &c. Dr. Carpenter has specially studied the structure of *Operculina*, Phil. Trans. 1859; and Introd. Foram. p. 247, &c. pl. 11.

Operculina ammonoides is very common in the mixed sands from Norway (MacAndrew and Barrett). On the Irish plateau of the North Atlantic it is common at 43, 78, 90, 223, and 415 fathoms; and rare at 200 fathoms. It abounds in the North British seas; in Professor Williamson's Monogr. it appears under the name of *Nonionina elegans*. It is found also in the Mediterranean and Red seas, and at Australia and Fiji.

Genus Polystomella.

Polystomella crispa, Linn., sp. Plate XIV. fig. 24 (Arctic); Plate XVII. fig. 61 *a*, 61 *b* (North Atlantic).

Polystomella comprises many closely allied forms, which, on account of their apparent dissimilarity, have been usually grouped under *Nonionina* and *Polystomella*. Their differences, however, are not sufficient to destroy the value of their correspondences in structure. The shells are symmetrically discoidal, either lenticular or subglobular, more or less Nautiloid, having from about fifteen to thirty, or many more, neatly fitting, more or less sickle-shaped chambers, with the aperture at the base of the septa; and this may be either a simple low arch-like opening, or it may be crossed by bars so as to be a grating, or a row of pores: this multiplicity of stolon-passages is the condition which gave the name to this genus in particular, and to the "Foraminifera" altogether*. The gradations from the simply notched septum of some *Nonioninæ*, to the barred apertures of others (*N. Faba*, Fichtel and Moll, sp.), and thence to the curved row of pores in *Polystomella* proper, are very well marked in numerous modified varieties. Another feature of the genus is the masking of the septal furrows of the shell, by "retral processes," or lobes on the posterior edges of the chambers, connected by bridges of exogenous shell-matter to the fronts of the preceding chambers, and thus forming pits or "fossettes" along the septal lines. The mouths of the canal-system open into the "fossettes;" but the latter are not a part of that system. The processes and the bridges or bands vary much in thickness, in proportion to the higher standing of the more strongly grown varieties of this species; and this increase of shell-matter on the surface of the shell, until it has a sculptured or basket-work appearance, accompanied more or less with keel, spines, and umbones, is also traceable through very gentle gradations.

The "bridges" occur freely, in *P. Arctica* and other forms, when the retral lobes are nearly obsolete, and thus they form crenulations on the edges of the chambers.

As the soft parts of the animal afford us no distinctive specific characters, all these modifications of shell-structure fall into a series of varietal differences among the individuals of one species, subject to different conditions of existence and consequent modes of growth.

In its symmetry of shell *Polystomella* resembles *Nummulina*, but it has a canal-system different from that of the latter; and, though the aperture in *Nummulina* is in the same position (at the base of the septum) as in Nonionine *Polystomellæ*, yet the very

* As being distinct in so much from the *single-tubed* Cephalopods, with which they were classed.

slight attempt to modify it by subsidiary pores in *Nummulina* is sufficient to indicate an inability to depart from a special plan. The feebler *Polystomellæ* (*Nonioninæ*) are, with their neat shell and simple aperture, isomorphic with some *Nummulinæ*, especially if we compare some of the more strongly limbate of the former with the small "Operculine" or "Assiline" varieties of the latter (*Nonionina limba* compared with *Operculina ammonoides*); but the shell-tissue is more dense and tubuliferous in the latter (as in *Nummulina* proper), and the perfect marginal rim and the canal-system are wanting in the former.

Again, both in some of its higher (*Polystomella macella*) and lower forms (*Nonionina turgida*) *Polystomella* loses its horizontal symmetry, which *Nummulina* (except in some Operculine individuals) never does; the asymmetrical ally of *Nummulina* (*Amphistegina*) being sufficiently differentiated as to canal-system and other points to be regarded as specifically distinct.

The close linking of *Nonioninæ* with *Polystomella*, especially by means of the graduated subdivision of aperture, and modification of lateral fossettes, retral processes, and septal bridges, is too strong to be in any way antagonized by the merely isomorphic resemblances of the former with *Nummulina*; and "Nonionina" is rightly suppressed as a generic term, being merged in "Polystomella," which well represents the peculiar features of the fairly developed, but not exaggerated, natural type. See Ann. Nat. Hist. 3rd ser. vol. v. p. 103, &c.; CARPENTER'S 'Introduct.' p. 286, &c.

Scheme of the POLYSTOMELLÆ.

A. Canal-system, retral processes of the chambers, and the septal bridges and apertural bars, all highly developed.

Polystomella craticulata, Fichtel and Moll, sp.

B. Canal-system feebly developed; but the retral processes, septal bridges, and apertural bars perfect.

P. CRISPA, Linn., sp.
P. unguiculata, Gmel., sp.
P. strigillata, Fichtel and Moll, sp.
P. macella, Fichtel and Moll, sp., &c.

C. Canal-system, the septal bridges, and apertural bars well-developed, but the retral processes abortive.

P. Arctica, Parker and Jones.

D. Canal-system and retral processes feebly developed, but the bridges over the septal lines and the bars across the aperture perfect.

P. striatopunctata, Fichtel and Moll, sp., and *P. Faba*, Fichtel and Moll, sp.

E. Canal-system, retral processes, septal bridges, and apertural bars all abortive more or less.

Nonionina limba, D'Orb.
N. asterizans, Fichtel and Moll, sp.
N. depressula, Walker and Jacob, sp.
N. stelligera, D'Orb.
N. Scapha, Fichtel and Moll, sp.

F. Canal-system, retral processes, septal bridges, and apertural bars all obsolete: there may, however, be granular shell-growth on the umbilici.

N. granosa, D'Orb. *N. umbilicatula*, Montagu, sp. *N. turgida*, Williamson, sp.

Both the feeble (Nonionine) and the well-grown varieties of *Polystomella* are distributed very widely, but avoid great depths. The thick-shelled *P. craticulata* is found in tropical seas; the medium-conditioned *P. crispa* is extensively spread about in temperate seas; *P. Arctica* and *P. striatopunctata* are the best of the species found in cold seas. The *Nonioninæ* accompany their better-grown congeners; *N. asterizans* and *N. depressula* affecting temperate climates; *N. Scapha* and *N. umbilicatula* being found more often in the warmer seas.

Polystomella crispa stands midway between those *Nonioninæ* that begin to take on a barred aperture and perforated septal furrows, and those that have cribriform septa and a surface masked with septal bridges and other exogenous shell-matter; it is therefore a good type, showing the generic and specific characters without exaggeration. It has been well illustrated and described by WILLIAMSON, CARPENTER, and SCHULTZE; and its many modifications, in the recent and fossil state, have received as many names. In some Tertiary beds *P. crispa* is plentiful; and it abounds at the present day in temperate and warm seas.

We find *P. crispa* in the dredgings from the Hunde Islands (at 25 to 30 fathoms) rare and small; and very rare and small in the North Atlantic at 725 fathoms, north of the Newfoundland Bank.

Polystomella crispa, Linn., sp., Var. *Arctica*, nov. Plate XIV. figs. 25–30 (Arctic).

One of the varietal stages presented by the simpler *Polystomellæ* is characterized by double pores for the canals in lines along the septal furrows of the shell, an advance upon the simple single pores of *P. striatopunctata*, and an approach to the higher *Polystomellæ*. These double-pored furrows belong to a rounded, bun-like, Nonionine shell, with barred aperture, sparsely perforated septa, and a tendency to irregularity of growth; the neat, definite, lenticular, sharp-edged, discoidal shell of *Polystomella* proper being but poorly represented as yet. The essential characters, however, of pores in the furrows and septal apertures are not to be mistaken, although the retral processes of the chambers and the intervening fossettes are very rudimentary. The spiral lamina is finely perforate.

This form differing from the smaller *P. striatopunctata*, Fichtel and Moll, sp., in having double pores for its lateral canals, shows thus much a differentiation of the shell-structure in relation to the forking tubes, which are single in *P. striatopunctata* (figs. 31–34). With this exception, and with some additional apertures, *P. Arctica* keeps to the *simple* type; but it attains a semigigantic size, having a similar relation to *P. striatopunctata* that *P. craticulata* has to *P. crispa*.

One individual (fig. 27) shows a tendency to produce rough exogenous accumulations of shell-substance, as is the habit of *P. craticulata*.

P. Arctica is peculiar to the most northern seas, and occurs plentifully at the Hunde Islands at from 30 to 40 and 60 to 70 fathoms (SUTHERLAND) in company with *P. striatopunctata*. Mr. H. B. BRADY has found it in Mr. JEFFREYS'S dredgings made at Shetland, in some abundance, and of a brown colour.

Polystomella crispa, Linn., sp., Var. *striatopunctata*, Fichtel and Moll, sp. Plate XIV. figs. 31–34 (Arctic); Plate XVII. fig. 60 *a*, 60 *b* (North Atlantic).

This is a smooth, round-edged, Nonionine shell, variable in its thickness and in the number of bridges over the septal furrows. The aperture is more or less divided by bars, and may have supplemental pores.

Individuals presenting two stages in this variety are described and figured by WILLIAMSON under the name of *Polystomella umbilicatula* and *P. umbilicatula*, var. *incerta*, Monograph, p. 42, &c., pl. 3. figs. 81, 82, 82 *a*. Some of our figures (Plate XIV. figs. 32–34) show but little of the septal markings; but in fig. 31, and Plate XVII. fig. 60, these are much more apparent, for the furrows are more distinctly bridged over by the posterior crenulation and retral processes of the chambers, and conspicuous fossettes are formed. SCHULTZE has also illustrated this form (EHRENBERG's *Geoponus Stella-borealis*, well figured by him in the Berlin Acad. Trans. 1841) and some near allies in his 'Org. Polyth.' pl. 6. figs. 1–9 (*Polystomella gibba*, *P. Stella-borealis*, and *P. venusta*).

P. striatopunctata is widely distributed in both warm and cold seas, but not in deep water. It occurs in Tertiary and Post-tertiary deposits, sometimes abundantly, and is a characteristic fossil of the Post-pliocene clays of Canada (DAWSON) and of the coast of Scotland (Quart. Journ. Geol. Soc. vol. xiv. p. 521, note).

We have *P. striatopunctata*, rather rare and small in the mixed Norwegian sands (MACANDREW and BARRETT'S dredgings); in all Dr. SUTHERLAND'S dredgings from the Hunde Islands (25–70 fathoms), where it is usually common and large. Also from Baffin's Bay (PARRY), lat. 75° 10′, long. 60° 12′, rare and very small; lat. 76° 30′, long. 77° 52′, 150 fathoms, common and middle-sized; lat. 75°, long. 59° 40′, 220 fathoms, very rare and very small. In the North Atlantic it is found on the eastern marginal plateau at 43 fathoms common and small; at 78 fathoms very rare and very small; at 223 fathoms rare and small; and north of the Newfoundland Bank it occurs rare and small at 145 fathoms, very rare and very small at 161, rather common and middle-sized at 740; rather rare and small at 725; rare and small at 954 fathoms.

Polystomella crispa, Linn., sp., Var. (*Nonionina*) *Faba*, Fichtel and Moll, sp. Plate XIV. fig. 36 (Arctic).

Nonionina Faba is a small, delicate, ovate-oblong shell, with the later chambers much larger than those first formed. The septal furrows are bridged by little processes from the advancing chambers, and the septal aperture is barred or subdivided. In these latter features *N. Faba* shows an advance of structure beyond *N. Scapha* towards *Polystomella* proper, in which the septa are cribriform and the surface of the shell fenestrated.

It occurs both fossil and recent in the Mediterranean area. We have it from the Hunde Islands, where it is rather rare and of middle size at from 25 to 30 fathoms; rather common and large at 30 to 40; and common and large at 60 to 70 fathoms (SUTHERLAND'S dredgings).

N. Faba among these delicate oblong *Nonioninæ*, and *P. striatopunctata* among the

less feeble Nautiloid forms make advances towards the true Polystomellan characteristics; thus showing that they certainly are within one and the same specific limits; moreover, the next variety, *N. Scapha*, is seldom quite free from bridges across the divisions of its chambers on each spiral lamina, as may be seen in figs. 37 and 38, Plate XIV.

Polystomella crispa, Linn., sp., Var. (*Nonionina*) *asterizans*, Fichtel and Moll, sp. Plate XIV. fig. 35 (Arctic); Plate XVII. figs. 54 *a*, 54 *b* (North Atlantic).

This is a small, many-chambered, Nautiloid *Nonionina*, somewhat variable in its features, but having a slight umbilical growth of exogenous shell-matter often radiating along the septal furrows for some distance. This star-like limbation is much exaggerated in *N. Limba*, D'Orb. (Modèles, No. 11), and curiously modified with flaps in *N. stelligera*, D'Orb. (For. Canar. pl. 3. figs. 1, 2). *N. asterizans* varies as to its granulations and stellate umbo, readily passing into *N. granosa* and into *N. stelligera*. Fig. 35 is of a stronger make than the latter, and is such as frequents deeper water than that does. It is from the Hunde Islands (SUTHERLAND'S dredgings) at from 25 to 30 fathoms, where it is common but small. *N. asterizans* is common in the British seas in shallow water.

Plate XVII. fig. 54 differs from the Arctic specimen as to the umbo, but is not separable. It is from 740 fathoms north of Newfoundland Bank.

The tribe of small *Nonioninæ* converging round *Nonionina asterizans*, although conveniently considered as a subspecific group, yet in reality are essentially of the same specific type as that to which *Polystomella crispa* belongs. They may be said to present arrested or feebly developed conditions of the form in which, under other circumstances, a luxuriant growth of exogenous shell-matter symmetrically bridges over the septal lines, and otherwise thickens and ornaments the shell. *Nonionina Limba*, D'Orb., belongs to this group, and is very apt to take on the characters of the type in connexion with its own, and thus to pass insensibly into it. It is a Tertiary form, at Grignon, Bordeaux, &c.

Polystomella crispa, Linn., sp., Var. (*Nonionina*) *depressula*, Walker and Jacob, sp. Plate XIV. figs. 39 *a*, 39 *b* (Arctic).

This is a delicate feeble form of *Nonionina asterizans*, Fichtel and Moll, sp., with the stellation of the umbilici imperfect.

It is common in the shallow sea-zone and in the brackish water of river-mouths and salt-marshes of the British area; and is the commonest shell in the clay of our Eastern Counties fen-district, excepting at the margin of that sub-recent deposit, for there *Trochammina inflata* attains its highest development and abounds most. This form is very apt to turn up, all the world over, in such shallow water as is rendered somewhat unfit for rhizopodal life by the presence of large quantities of earthy or vegetable matter,—for instance, in bays, harbours, estuaries, &c.

We have it from the Hunde Islands (SUTHERLAND'S dredgings) common and small at from 25 to 30 and 50 to 70 fathoms; common and middle-sized at from 60 to 70 fathoms.

Polystomella crispa, Linn., sp., Var. (*Nonionina*) *stelligera*, D'Orb., sp. Plate XIV. figs. 40, 41 (Arctic).

This delicate and variable *Nonionina* was first described by D'ORBIGNY as occurring at the Canaries (For. Canar., p. 123*, pl. 3. figs. 1, 2). It differs from *N. asterizans* in being altogether more delicate and feeble, and in the exogenous matter having the form of a radiating series of thin flaps, which cover over the inner half of the septal sulci on each face of the shell.

It inhabits shallow waters of the Atlantic and the Australian coast. We find it in the dredgings from the Hunde Islands, throughout, from 25 to 70 fathoms, and in the mixed sands from Norway.

Polystomella crispa, Linn., sp., Var. (*Nonionina*) *Scapha*, Fichtel and Moll., sp. Plate XIV. figs. 37-38 (Arctic); Plate XVII. figs. 55, 56 (North Atlantic).

In this, almost the lowest form of *Nonionina* (the small and more or less oblique *N. turgida* being still feebler), the successive chambers enlarge at a greater ratio than they do in *N. asterizans* and its allies; hence the shell is ovato-oblong instead of discoidal; it has the shape of the *Argonauta*, instead of that of the *Nautilus*. It is *N. communis*, D'Orb. The shell varies from the complanate condition (fig. 37) to the gibbose (fig. 38), and to the subglobose (figs. 55, 56); occasionally faint traces of the septal fossettes characteristic of *Polystomella* can be recognized (fig. 38 *a*); but the aperture is still a simple arch-like slit (fig. 38 *b*); whilst in the next stage (*N. Faba*, fig. 36) the fossettes and the barred aperture occur together.

N. Scapha occurs in warm seas rarely at great depths; it is found in the British seas; and the Arctic dredgings show that it also lives at high latitudes. It occurs in Baffin's Bay at lat. 75° 10′, long. 60° 12′, rare and of middling size; lat. 76° 30′, long. 77° 52′, at 150 fathoms, very common and of middling size. At the Hunde Islands it is abundant at from 25 to 70 fathoms, sometimes of large size, usually middling.

It abounds in many Tertiary deposits, Grignon, Bordeaux, Subappennines, San Domingo, English Crag, &c.

Plate XVII. figs. 55, 56 (North Atlantic).

Nonionina Scapha is rare and small at 225 fathoms on the Irish plateau of the North Atlantic; absent apparently in the central area; rare and of middle-size at 145 fathoms north of the Bank; very rare and middling at 161, 329, and 725 fathoms, and very rare and very small at 954 fathoms along the same tract; in Trinity Bay it is rare and middle-size at 124, 133, and 150 fathoms.

The very gibbose specimen, figs. 55, 56, is the same as *N. Labradorica*, Dawson (Canad. Geol. Nat. vol. v. 1860, p. 192, fig. 4), found by him both recent in the Gulf of St. Lawrence and fossil in the Post-pliocene clays of Labrador and Maine.

* In the text the name given is "stelligera," in the Plate it is "stellifera"; of course the former should be received.

The specimens from Newfoundland Bank are rare and have a deadish look, as if drifted from their more favourable northern habitats.

Polystomella crispa, Linn., sp., Var. (*Nonionina*) *umbilicatula*, Montagu, sp. Plate XIV. figs. 42 *a*, 42 *b* (Arctic); Plate XVII. figs. 58, 59 (North Atlantic).

This is a small, neat, many-chambered, Nautiloid *Nonionina*, with hollow umbilici. See Ann. Nat. Hist. 3rd ser. vol. iv. pp. 346 & 347, and vol. v. p. 101, &c., for a comparison of this and other *Nonioninæ*. It is common at greater depths than most other *Nonioninæ*, except *N. Scapha*, affect; it is found in warm seas, and occurs in many Tertiary deposits.

We have it in the mixed sands from the Norway coast (MacAndrew and Barrett). In the North Atlantic *N. umbilicatula* is common and of middle-size on the marginal plateau off Ireland, at 78, 90, 223, and 415 fathoms: in the abyssal depths it is rare and small at 1776, rather common and middle-sized at 1950, rather common and small at 2050 and 2176 fathoms; and at 2350 fathoms in the "Boreal" part of the abyss it is rare and small: north of Newfoundland Bank, at 329 fathoms, and in Trinity Bay at 150 fathoms, it is very rare and small; cold water having as bad an influence on it as abyssal depth.

This form, being flush-celled, is more thoroughly changed in character from the type than the feeble varieties found in shallow water, such as *P. stelligera* and *P. depressula*. In these the vesicularity of the chambers allows of the formation of some rudiments of the retral processes, the overlying bridges, and the intervening fossettes; but in this deeper-sea variety the septal walls of contiguous chambers become perfectly adapted, and their edges grow close together at the surface of the shell. This is well shown in the recent and fossil specimens of this kind from the Mediterranean area; further north, however, it scarcely holds its own, and intermediate forms are always turning up, which connect this with the vesicular varieties.

Polystomella crispa, Linn., sp., Var. (*Nonionina*) *turgida*, Williamson, sp. Plate XVII. figs. 57 *a*, 57 *b*, 57 *c* (North Alantic).

A delicate ovate *Nonionina*; the chambers increasing so rapidly in size that the discoidal form is lost, and we have the shape of the *Argonauta* instead of the *Nautilus*. The latter chambers, too, in adult specimens are apt to be swollen at the umbilical margin, concealing the spiral parts of the shell, and hanging over a little more on one side than the other.

Our figured specimen is much thicker and more symmetrical than Professor Williamson's *Rotalina turgida* (Monogr. p. 50, pl. 4. figs. 95–97), but they both belong to the same variety.

N. turgida is found in shallow and brackish water in the British area; and occurs especially in the sub-recent clay of Peterborough Fen, rather common, but extremely small, starved, and one-sided.

We have it from the Irish plateau of the North Atlantic at 43 and 223 fathoms, rare and small.

Genus VALVULINA.

Valvulina triangularis, D'Orbigny, Var. *conica*, nov. Plate XV. fig. 27 (Arctic).

This is a very simple condition of *Valvulina*. The triserial arrangement of chambers forms a smooth conical figure, without any trace of the three flat faces so usual in this species. A similar condition, but depressed, is shown in *V. fusca*, Williamson, sp.

Valvulina conica, Parker and Jones, was described and figured in the Annals Nat. Hist. 2 ser. xix. p. 295, pl. 11. figs. 15, 16, but not named separately from the better developed type, which has a triangular apex. It is also figured by Dr. CARPENTER, *op. cit.* pl. 11. fig. 16. It occurs with the typical form, both in the fossil and the recent state (extremely large in sea-sands from Melbourne); it is rare and small in the mixed sands from Norway (MACANDREW and BARRETT). It lives also in the Mediterranean and on the Abrolhos Bank, South Atlantic.

The type, *V. triangularis*, D'Orb. (Modèles, No. 23; CARPENTER'S 'Introd. Foram.' p. 146, pl. 11. fig. 15), though occurring of large size (with *V. conica*, also very large) in Australia, is usually rare; but it has been marvellously common and large in Tertiary times, as shown by specimens from Grignon and Hautville (France).

Lituola nautiloidea, Lamarck, Var. *Canariensis*, D'Orbigny, sp. Plate XV. figs. 45 *a*, 45 *b* (Arctic); Plate XVII. figs. 92–95 (North Atlantic).

Of the disco-spiral *Lituolæ* most are attached and therefore more or less plano-convex; when growing free, however, they attain the more symmetrical, somewhat biconvex, and nautiloid shape of *L. Canariensis*, without attaining the outgrowing rectilinear series of chambers shown in LAMARCK'S *L. nautiloidea*, and still more in *L. irregularis*, Rœmer, sp.

Lituola Canariensis, D'Orb., sp. (Foram. Canaries, p. 128, pl. 2. figs. 33, 34), has, like other *Lituolæ*, a rusty coloured shell-substance among the sand-grains that largely make up its shell. We have a few large specimens from Finmark (East of Rolfs Oe), 30 fathoms (MACANDREW and BARRETT); and some small specimens from the mixed sands from Norway. At the Hunde Islands (Dr. SUTHERLAND) it is large and common throughout; and in the sands from Baffin's Bay (PARRY) it is most common and sometimes large.

In the North Atlantic it is rare; on the Irish plateau it is small at 43 fathoms and middle-sized at 223 fathoms; and it is middle-sized at 1203 fathoms north of the Bank, and at 133 fathoms in Trinity Bay. The British coasts, Abrolhos Bank, Hobson's Bay (Australia), and Fiji are other localities for *L. Canariensis*.

Fig. 94 is probably not worth separating from *L. Canariensis*; its chambers are either imperfect or obsolete.

Lituola nautiloidea, Lamarck, Var. *globigeriniformis*, nov. Plate XV. figs. 46, 47 (Arctic); Plate XVII. figs. 96–98 (North Atlantic).

In this low form of *Lituola* the chambers are subglobular and agglomerated, presenting an isomorph of *Globigerina*; the somewhat scanty and rusty-red shell-substance cementing the sand-grains is characteristic, as in *Lituola nautiloidea* proper.

Lituola globigeriniformis is small and common at the Hunde Islands (Dr. SUTHERLAND) from 30 to 70 fathoms. It is small also in Baffin's Bay; being common at 75° 10′ lat., 60° 12′ long., and rare at 75° 25′ lat., 60° long. (314 fathoms), and 75° lat., 59° 40′ long. (220 fathoms).

In the North Atlantic it is rare and middle-sized at 1660 fathoms in the "Boreal" portion of the abyss; and very rare and small north of the Bank at 145 and 954 fathoms. It is figured by Dr. WALLICH in 'The North-Atlantic Sea-bed,' pl. 6. fig. 22.

L. globigeriniformis, Parker and Jones, is common, but small, in the Mediterranean; in our paper in the Quart. Journ. Geol. Soc. vol. xvi. Table, p. 302, it is referred to as "*L. pelagica*, D'Orb., sp.," as we then mistook the yellowish acerose *Globigerina* named "*Nonionina pelagica*" by D'ORBIGNY for our *Lituola*. It is present in the Red Sea, the Indian Ocean, and the South Atlantic.

Lituola nautiloidea, Lamarck, Var. *Scorpiurus*, Montfort, sp. Plate XV. figs. 48 *a*, 48 *b* (Arctic).

Lituola Scorpiurus, Montfort, sp., is a simple, linear, slightly curved, and, as it were, abortive variety of *L. nautiloidea*, Lamarck (see Ann. Nat. Hist. 3 ser. vol. v. p. 297; and CARPENTER'S 'Introd. Foram.' p. 143). It is of very common occurrence in shelly deposits, recent and fossil.

It is common and large at the Hunde Islands, 25 to 40 fathoms; common and middle-sized in Baffin's Bay, 75° 10′ lat., 60° 12′ long.; and rather common and very large at 150 fathoms, 76° 30′ lat., 77° 52′ long.

The late Mr. L. BARRETT obtained large specimens of *L. Scorpiurus* in deep water off Jamaica, of very large size, labyrinthic, and passing into *L. Soldanii*, Parker and Jones. *L. Scorpiurus* lives also in the Adriatic, the North and South Atlantic, and in the Australian seas.

Genus TROCHAMMINA.

Trochammina squamata, Parker and Jones. Plate XV. figs. 30, 31 *a*, 31 *b*, 31 *c* (Arctic).

This is the subvesicular Rotaliform *Trochammina* (Quart. Journ. Geol. Soc. vol. xvi. p. 305), having lunate, flattened chambers, several in a whorl, and regularly increasing with the progress of growth; it much resembles those flatter varieties of *Discorbina Turbo* which are intermediate between *D. globularis* and *D. rosacea*, but it has an arenaceous shell; it is also like some little scale-like varieties of *Valvulina triangularis*; but the latter have only three chambers in a whorl, and are more coarsely sandy.

Trochammina squamata, the type of the species, is usually rare; it is small and rare at 360 fathoms off Crete (Captain SPRATT'S soundings).

At the Hunde Islands (Dr. SUTHERLAND'S dredgings) *Troch. squamata* is rare at 30 to 40 fathoms, common at 60 to 70 fathoms, but small throughout.

Trochammina squamata, Var. *gordialis*, Parker and Jones. Plate XV. fig. 32 (Arctic).

Trochammina gordialis, Parker and Jones (CARPENTER'S 'Introd. Foram.' p. 141, pl. 11. fig. 4), presents sometimes an irregularly coiled tube, having but little segmentation; sometimes it presents long, inwound, tubular chambers.

It is common and small at 60 to 70 fathoms at the Hunde Islands, together with the type. It occurs in the Red Sea, and is found involutely coiled (commencing with a few irregularly segmented chambers, and continued as a long tube, turned and twisted on itself) in the Indian seas; the so-called *Serpula pusilla* of the Permian limestones is a very similar little Foraminifer.

Troch. incerta, D'Orb., sp., is discoidal, tubular, and without segments. The next stage beyond that seen in fig. 32 is that form of *Troch. squamata* shown by fig. 31.

Genus CORNUSPIRA.

Cornuspira foliacea, Philippi, sp. Plate XV. fig. 33 (Arctic).

The characters and relationships of this flat, spiral, non-segmented Milioline Foraminifer are treated of in CARPENTER'S 'Introd. Foram.' p. 68. It inhabits the shallow sea-zones of every climate, and is found fossil (Tertiary).

We find it common in Dr. SUTHERLAND'S dredgings from the Hunde Islands, where it is small at 60 to 70 fathoms, and of middle size at 25 to 30 fathoms. It is figured by Dr. WALLICH in 'The North-Atlantic Sea-bed,' pl. 5. fig. 12.

C. foliacea is extremely large (fossil) in the Crag of Sutton, Suffolk; in the recent state it is very large off Crete, and is found also living on the British coasts, in the Red Sea, the South Atlantic, and on the western and southern shores of Australia.

Genus MILIOLA.*

Miliola (Spiroloculina) planulata, Lamarck. Plate XVII. fig. 82 (North Atlantic).

The type of the symmetrical and flattened group of *Miliolæ*, *Spiroloculina planulata*, Lamarck, is often abundant in sea-sands and in Tertiary deposits.

In the North Atlantic it is rare; of middle size at 43 fathoms off Ireland; middle-sized at 2050 fathoms, and small at 2330 fathoms in the abyssal area. Dr. WALLICH figures it in 'The North-Atlantic Sea-bed,' pl. 5. fig. 13.

* For remarks on this genus (type, *M. Seminulum*), see CARPENTER'S Introd. Foram. pp. 74, &c.

Miliola (*Spiroloculina*) *limbata*, D'Orbigny. Plate XVII. figs. 83 *a*, 83 *b* (North Atlantic).

Here the edges of the chambers are limbate, or thickened with shell-growth, a non-essential feature. It is figured by SOLDANI and named by D'ORBIGNY, Ann. Sci. Nat. vol. vii. p. 299, No. 12.

We have *Spiroloculina limbata* rare and small from the Irish marginal plateau of the North Atlantic, at 78 fathoms. It is not rare in the existing seas, and occurs in the Tertiary deposits.

Miliola (*Biloculina*) *ringens*, Lamarck. Plate XV. figs. 42–44 (Arctic).

Taking the Biloculine *Miliolæ* by themselves, this well-known common *Biloculina ringens*, Lamarck, is the type of a very variable group. Not only the degree of globosity of the chambers, but the amount of overlap at the sides or at the ends, constitute infinite variations, presented in all seas.

Large *Biloculinæ*, but subject to great differences in the points above alluded to, were found abundantly in nearly all the dredgings from Norway. Fig. 44 represents a highly globose and *striated* specimen from Norway. Dr. WALLICH figures *B. ringens* in 'The North-Atlantic Sea-bed,' pl. 5. figs. 1, 3, 4, 6.

Miliola (*Biloculina*) *depressa*, D'Orbigny. Plate XVII. figs. 89 *a*, 89 *b* (North Atlantic).

This depressed form of *Biloculina ringens* is not uncommon in both the recent and fossil (Tertiary) states. D'ORBIGNY illustrated it by his Modèle, No. 91.

It occurs in several soundings from the North Atlantic, though rare in each. It is small on the Irish plateau at 43 and 78 fathoms; small at 2176 fathoms, and middle-sized at 1450, 1660, and 2350 fathoms in the abyss. It is figured in Dr. WALLICH'S 'North-Atlantic Sea-bed,' pl. 5. figs. 2, 5, 8.

Miliola (*Biloculina*) *elongata*, D'Orbigny. Plate XVII. figs. 88, 90, 91 (North Atlantic).

Biloculina ringens contracted gives *B. elongata*, figured by SOLDANI and named by D'ORBIGNY, Ann. Sci. Nat. vol. vii. p. 298, No. 4, and not rare wherever other *Biloculinæ* exist.

We have *B. elongata* from the North Atlantic, small and rare in the deep, at 1950, 2050, and 2330 fathoms.

Miliola (*Triloculina*) *tricarinata*, D'Orbigny. Plate XV. fig. 40 (Arctic).

Triloculina tricarinata, D'Orb. (Modèles, No. 94) differs from *Tr. trigonula*, Lamarck, in having produced or keeled edges. Our figured specimen has rather flatter sides than are usual.

Tr. tricarinata, D'Orb., has a very wide distribution and, like *T. trigonula*, Lam., abounds in some Tertiary beds. The sea-sand near Melbourne, Australia, yields large specimens of *Tr. tricarinata*, together with striped *Tr. trigonula*. At the Hunde Islands *Tr. tricarinata* is small, common at 25 to 30 fathoms, rare at 60 to 70 fathoms.

Miliola (*Triloculina*) *cryptella*, D'Orbigny. Plate XV. fig. 39 (Arctic).

This is an extremely inflated and short Triloculine *Miliola*, its chambers overlapping so much more than in the symmetrical trigonal forms, that in some instances the antepenultimate chamber is but little exposed. It is not common.

Triloculina cryptella, D'Orb., For. Amér. Mér. p. 70, pl. 9. figs. 4, 5, approaches closely, in appearance, to *Biloculina sphæra*, D'Orb., *op. cit.* p. 66, pl. 8. figs. 13–16, with which it was found at the Falkland Islands. *B. sphæra* has its chambers so much overlapping that it scarcely shows the *penultimate* chamber (as characteristic of *Biloculina*), *Tr. cryptella* having so much overlap in its chambers that it scarcely shows the *antepenultimate* (as characteristic in *Triloculina*).

Tr. cryptella is a curious isomorph of *Sphæroidina* (p. 369), and might easily be mistaken for it, for both are white in colour; the texture, however, is hyaline in *Sphæroidina* (related to *Globigerina*), and opake in *Triloculina*, as in all *Miliolæ*.

We have *Triloculina cryptella* from Baffin's Bay, 75° 25′ lat., 60° long., where it is rather common and middle-sized at 314 fathoms.

Miliola (*Quinqueloculina*) *Seminulum*, Linnè, sp. Plate XV. figs. 35 *a*, 35 *b* (Arctic); Plate XVII. fig. 87 (North Atlantic).

Figs. 35 *a*, *b* represent a neat form of the typical and widely distributed *Miliola* (*M. Seminulum*, Linn., sp.), such as is common in deepish water, and well figured by D'Orbigny as *Quinqueloculina triangularis* (For. Foss. Vienn. p. 258, pl. 18. figs. 7–9). It is from Norway.

Fig. 87, from the North Atlantic, is a sandy specimen, but is not so coarsely built up as the variety known as *Q. agglutinans*, D'Orb. (Plate XV. fig. 37).

Q. Seminulum is common and large on the Norway coast; common and rather small at the Hunde Islands; rare and small at 220 fathoms in Baffin's Bay.

In the North Atlantic soundings it is small; common at 43 and 78 fathoms, and rare at 90 fathoms on the Irish plateau; rare at 2035, 2050, and 2350 fathoms in mid-ocean; and rare and of middle size at 954 fathoms north of the Bank.

In his 'North-Atlantic Sea-bed' Dr. Wallich figures *Q. Seminulum*, pl. 5. figs. 9, 10, 15; and *Q. secans*, fig. 7.

Q. triangularis takes the place of the typical *Q. Seminulum* in many parts of the Mediterranean and Red Seas, and of the Indian, South Atlantic, and Pacific Oceans.

Miliola (*Quinqueloculina*) *agglutinans*, D'Orbigny. Plate XV. figs. 37 *a*, 37 *b* (Arctic).

Quinqueloculina agglutinans, D'Orb. (For. Cuba, p. 195, pl. 12. figs. 11–13), is a well-developed, often rusty-red, arenaceous *Miliola Seminulum*, of wide distribution, and varying much with the character of the sea-bed. The shell-substance cementing the grains of sand may be reddish in *Quinqueloculina*, though on white sand in Australia its shell becomes white, and on black sand at Orotava, Canaries, it is black.

We have *Q. agglutinans*, of middle size, from the Hunde Islands (Dr. Sutherland),

rare at 30 to 40 fathoms, common at 60 to 70 fathoms. Is rare and middle-sized in Baffin's Bay, 75° 10′ lat., 60° 12′ long. (Parry).

Miliola (*Quinqueloculina*) *Ferussacii*, D'Orbigny. Plate XV. figs. 36 *a*, 36 *b*, 36 *c* (Arctic).

Quinqueloculina Ferussacii, D'Orb. (Modèles, No. 32), is a coarsely ribbed or plicated form of *Q. Seminulum* (the type of the *Miliolæ*); it is very variable, and is known by a host of names.

It is found in some abundance in the European and other seas, and also in the Tertiary deposits.

At the Hunde Islands it is common and middle-sized at from 30 to 70 fathoms.

Miliola (*Quinqueloculina*) *oblonga*, Montagu, sp. Plate XV. figs. 34, 41 (Arctic); Plate XVII. figs. 85 *a*, 85 *b*, 86 *a*, 86 *b* (North Atlantic).

When *Miliola Seminulum*, Linn., sp., is contracted in its growth, it produces very variable forms, in which the normal lateral exposure of the chambers does not take place; and somewhat elongate, oblong, Quinqueloculine and Triloculine forms are the result, such as *Q. oblonga*, Montagu, sp., which is often Triloculine in aspect, and has been registered as *Triloculina oblonga* by D'Orbigny and others (see Annals Nat. Hist. 2 ser. vol. xix. p. 300); but it often has indications of its being really a poorly developed Quinqueloculine *Miliola*. *Quinque-* and *Tri-loculinæ* are excessively variable shells, both as to shape and ornament, and are amongst the most common Foraminifers in all latitudes and depths. We have two genuine *Triloculinæ* in the Arctic dredgings (Hunde Islands); but the so-called *Triloculina oblonga* is an ill-grown *Quinqueloculina*. It usually abounds in company with the typical *Miliola Seminulum*; the largest specimens we know of are fossil in the Lower Crag of Sutton, Suffolk. It is one of the most abundant of the Quinqueloculine varieties.

This feeble *Quinqueloculina Seminulum*, with a Triloculine aspect, is common and large in most of the Norway dredgings (MacAndrew and Barrett); common and small at the Hunde Islands (Sutherland) at 25 to 30 fathoms.

We have it very rare and very small from 2330 fathoms in the North Atlantic. Figs. 14 & 16, in pl. 5 of Dr. Wallich's 'North-Atlantic Sea-bed,' also illustrate this variety.

Miliola (*Quinqueloculina*) *subrotunda*, Montagu, sp. Plate XV. figs. 38 *a*, 38 *b* (Arctic).

A small, roundish, biconvex variety of *Miliola Seminulum*, Linn., often accompanying other *Miliolæ*. It may be said to be a dwarf of the variety *Q. secans*, D'Orb., and is very widely distributed.

At the Hunde Islands (Dr. Sutherland's dredgings) it is common at 60 to 70 fathoms.

Miliola (*Quinqueloculina*) *tenuis*, Czjzek. Plate XVII. fig. 84 (North Atlantic).

A nearly complanate, but often curved, thin, more or less unsymmetrical Quinquelo-

culine *Miliola*, named *Quinqueloculina tenuis* by CZJZEK in his description of some fossil Foraminifera from the Vienna Basin, in HAIDINGER'S Abhandl. Wiss. vol. ii. p. 149, pl. 13. figs. 31–34.

This tiny shell, which presents an extreme enfeeblement of *Q. Seminulum*, Spiroloculine in aspect and twisted on itself, occurs at great depths in the Mediterranean and other seas. We find it fossil in the Lias clay of Stockton, Warwickshire.

In the North Atlantic *Q. tenuis* is small; rather common at 415 fathoms on the marginal plateau off Ireland; rare at 2050 fathoms in the abyss.

DESCRIPTION OF THE PLATES.

PLATE XII.

Map of the Deep-sea Soundings, in the North Atlantic, from Ireland to Newfoundland, by Lieut.-Commander J. DAYMAN, R.N., assisted by Mr. J. SCOTT, Master R.N., H.M.S. Cyclops, 1857. With a Section of the Bed of the Atlantic Ocean from Valentia to Trinity Bay. The soundings are given in fathoms. Vertical scale 2000 fathoms to 1 inch. Scales as 15 to 1. See APPENDIX VII.

This Map is copied from Commander DAYMAN'S Report on the Soundings (1858); indications of the Natural-History Provinces, and of the thirty-nine Soundings described in this memoir, being added.

NOTE.—In the 'Nautical Magazine,' vol. xxxi. No. 11, November 1862, was published "The Report on the Deep-sea Soundings to the Westward of Ireland, made in H.M.S. Porcupine, in June, July, and August 1862," by R. HOSKYN, Esq., R.N., with a Chart, showing the slope of the Eastern Plateau to be, in that line of soundings, at a less angle off Southern Ireland than Commander DAYMAN found it where he sounded.

PLATES XIII.–XIX. illustrating the Foraminifera from the Arctic and North Atlantic Oceans, and other Foraminifera from other parts of the Atlantic, the Pacific, and elsewhere.

PLATE XIII. (ARCTIC FORAMINIFERA.)

[Figs. 1–19 are magnified 12 diameters; figs. 20–58, 24 diameters.]

Fig. 1. Glandulina lævigata, *D'Orbigny.*

Fig. 2, *a*, *b*.
Fig. 3.
Fig. 4, *a*, *b*.
Fig. 5, *a*, *b*.
Fig. 6.
Fig. 7.

Nodosaria Radicula, *Linn.* Various individuals passing from *Glandulina lævigata*, through *Nodosaria humilis*, to *N. Radicula.*

Fig. 8.
Fig. 9. } Dentalina pauperata, *D'Orbigny*. Fragments.

Fig. 10. Dentalina communis, *D'Orbigny*.

Fig. 11. Dentalina guttifera, *D'Orbigny*. A fragment.

Fig. 12, *a*, *b*.
Fig. 13, *a*, *b*. } Vaginulina linearis, *Montagu*. Fragments.

Fig. 14, *a*, *b*. Marginulina Lituus, *D'Orbigny*.

Fig. 15.
Fig. 16, *a*, *b*. } Cristellaria Crepidula, *Fichtel and Moll*.

Fig. 17, *a*, *b*.
Fig. 18, *a*, *b*. } Cristellaria cultrata, *Montfort*.

Fig. 19, *a*, *b*. Cristellaria rotulata, *Lamarck*.

Fig. 20. Lagena distoma, *Parker and Jones*.

Fig. 21. Lagena distoma-polita, *Parker and Jones*.

Fig. 22. Lagena lævis, *Montagu*.

Fig. 23. Lagena semistriata, *Williamson*.

Fig. 24. Lagena sulcata, *Walker and Jacob*. With spiral narrow riblets.

Fig. 25.
Fig. 26.
Fig. 27. } Lagena striatopunctata, *Parker and Jones*.

Fig. 28, *a*, *b*.
Fig. 29, *a*, *b*.
Fig. 30, *a*, *b*.
Fig. 31, *a*, *b*. } Lagena sulcata, *Walker and Jacob*.

Fig. 32. Lagena sulcata, *Walker and Jacob*. Dwarf.

Fig. 33.
Fig. 34.
Fig. 35. } Lagena Melo, *D'Orbigny*.

Fig. 36. Lagena Melo, *D'Orbigny*. Double (monster).

Fig. 37, *a*, *b*. Lagena globosa, *Montagu*.

Fig. 38, *a*, *b*.
Fig. 39, *a*, *b*. } Lagena caudata, *D'Orbigny*. Smooth and entosolenian.

Fig. 40.
Fig. 41. } Lagena squamosa, *Montagu*.

Fig. 42, *a*, *b*.
Fig. 43, *a*, *b*.
Fig. 44. } Lagena marginata, *Montagu*.

Fig. 45, *a*, *b*.
Fig. 46, *a*, *b*. } Polymorphina lactea, *Walker and Jacob*.

Fig. 47, *a*, *b*.
Fig. 48, *a*, *b*.
Fig. 49.
Fig. 50.
Fig. 51.
} Polymorphina compressa, *D'Orbigny*.

Fig. 52, *a*, *b*, *c*, *d*. Polymorphina tubulosa, *D'Orbigny*.

Fig. 53, *a*, *b*.
Fig. 54, *a*, *b*.
Fig. 55.
Fig. 56.
Fig. 57.
} Uvigerina pygmæa, *D'Orbigny*.

Fig. 58, *a*, *b*. Uvigerina angulosa, *Williamson*.

PLATE XIV. (ARCTIC FORAMINIFERA.)

[Figs. 1, 2, 14–45 are magnified 12 diameters; figs. 3–13, 24 diameters.]

Fig. 1.
Fig. 2.
} Globigerina bulloides, *D'Orbigny*.

Fig. 3.
Fig. 4.
Fig. 5, *a*, *b*.
Fig. 6, *a*, *b*.
} Truncatulina lobatula, *Walker and Jacob*.

Fig. 7.
Fig. 8.
Fig. 9.
Fig. 10.
Fig. 11, *a*, *b*.
} Anomalina coronata, *Parker and Jones*.

Fig. 12.
Fig. 13, *a*, *b*.
} Pulvinulina punctulata, *D'Orbigny*.

Fig. 14.
Fig. 15, *a*, *b*.
} Pulvinulina Karsteni, *Reuss*.

Fig. 16, *a*, *b*. Pulvinulina Micheliniana, *D'Orbigny*.

Fig. 17. Pulvinulina Karsteni, *Reuss*.

Fig. 18.
Fig. 19, *a*, *b*.
} Discorbina obtusa, *D'Orbigny*.

Fig. 20.
Fig. 21.
Fig. 22.
Fig. 23.
} Discorbina globularis, *D'Orbigny*.

Fig. 24. Polystomella crispa, *Linn*.

Fig. 25.
Fig. 26.
Fig. 27.
Fig. 28.
Fig. 29.
Fig. 30. } Polystomella arctica, *Parker and Jones.*

Fig. 31.
Fig. 32.
Fig. 33.
Fig. 34. } Polystomella striatopunctata, *Fichtel and Moll.*

Fig. 35. Nonionina asterizans, *Fichtel and Moll.*
Fig. 36. Nonionina Faba, *Fichtel and Moll.*
Fig. 37.
Fig. 38. } Nonionina Scapha, *Fichtel and Moll.*
Fig. 39. Nonionina depressula, *Walker and Jacob.*
Fig. 40, *a*, *b*.
Fig. 41, *a*, *b*. } Nonionina stelligera, *D'Orbigny.*
Fig. 42, *a*, *b*. Nonionina umbilicatula, *Montagu.*
Fig. 43, *a*, *b*. Pullenia sphæroides, *D'Orbigny.*
Fig. 44, *a*, *b*. Operculina ammonoides, *Gronovius.*
Fig. 45, *a*, *b*. Nummulina planulata, *Lamarck.*

PLATE XV. (ARCTIC FORAMINIFERA.)

[Figs. 1–33, 36–41, 45–48 are magnified 24 diameters; figs. 34, 35, 42, 43, 44, 12 diameters.]

Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4. } Cassidulina lævigata, *D'Orbigny.*

Fig. 5.
Fig. 6.
Fig. 7. } Cassidulina crassa, *D'Orbigny.*

Fig. 8.
Fig. 9, *a*, *b*. } Bulimina Pyrula, *D'Orbigny.*
Fig. 10, *a*, *b*. Bulimina marginata, *D'Orbigny.*
Fig. 11. Bulimina aculeata, *D'Orbigny.*

Fig. 12.
Fig. 13.
Fig. 14.
Fig. 15.
Fig. 16.
Fig. 17. } Bulimina elegantissima, *D'Orbigny.*

Fig. 18. Virgulina Schreibersii, *Czjzek.*
Fig. 19, *a*, *b.*
Fig. 20, *a*, *b.* } Virgulina squamosa, *D'Orbigny.*
Fig. 21, *a*, *b.* Textularia agglutinans, *D'Orbigny.*
Fig. 22, *a*, *b.* Textularia Sagittula, *Defrance.*
Fig. 23, *a*, *b.*
Fig. 24. } Textularia biformis, *Parker and Jones.*
Fig. 25. Bigenerina Nodosaria, *D'Orbigny.*
Fig. 26, *a*, *b.* Verneuilina polystropha, *Reuss.*
Fig. 27, *a*, *b.* Valvulina conica, *Parker and Jones.*
Fig. 28. Spirillina vivipara, *Ehrenberg.*
Fig. 29, *a*, *b*, *c.* Patellina corrugata, *Williamson.*
Fig. 30.
Fig. 31, *a*, *b*, *c.* } Trochammina squamata, *Parker and Jones.*
Fig. 32. Trochammina gordialis, *Parker and Jones.*
Fig. 33, *a*, *b.* Cornuspira foliacea, *Philippi.*
Fig. 34. Quinqueloculina oblonga, *Montagu.*
Fig. 35, *a*, *b.* Quinqueloculina Seminulum, *Linnè* (Var. *triangularis*, D'Orbigny).
Fig. 36, *a*, *b.* Quinqueloculina Ferussacii, *D'Orbigny.*
Fig. 37, *a*, *b.* Quinqueloculina agglutinans, *D'Orbigny.*
Fig. 38, *a*, *b.* Quinqueloculina subrotunda, *Montagu.*
Fig. 39, *a*, *b.* Triloculina cryptella, *D'Orbigny.*
Fig. 40, *a*, *b.* Triloculina tricarinata, *D'Orbigny.*
Fig. 41, *a*, *b.* Quinqueloculina oblonga, *Montagu.*
Fig. 42, *a*, *b.*
Fig. 43, *a*, *b.*
Fig. 44. } Biloculina ringens, *Lamarck.*
Fig. 45, *a*, *b.* Lituola Canariensis, *D'Orbigny.*
Fig. 46.
Fig. 47. } Lituola globigeriniformis, *Parker and Jones.*
Fig. 48, *a*, *b.* Lituola Scorpiurus, *Montfort.*

PLATE XVI. (NORTH ATLANTIC FORAMINIFERA).

[The figures are magnified 30 diameters.]

Fig. 1. Nodosaria Raphanus, *Linnè.* Dwarf.
Fig. 2, *a*, *b*, *c.* Nodosaria scalaris, *Batsch.*
Fig. 3. Dentalina consobrina, *D'Orbigny.* Fragment.
Fig. 4. Cristellaria Crepidula, *Fichtel and Moll.* Broken.
Fig. 5. Cristellaria cultrata, *Montfort.*

Fig. 6. Lagena sulcata, *Walker and Jacob*. Caudate variety.
Fig. 7. Lagena caudata, *D'Orbigny*. Striate.
Fig. 7, *a*. Lagena sulcata, *Walker and Jacob*.
Fig. 8.
Fig. 9. } Lagena caudata, *D'Orbigny*. Smooth.
Fig. 9, *a*. Lagena lævis, *Montagu*.
Fig. 10, *a*, *b*. Lagena globosa, *Montagu*.
Fig. 11, *a*, *b*. Lagena squamosa, *Montagu*.
Fig. 12, *a*, *b*. Lagena marginata, *Montagu*.
Fig. 13.
Fig. 14. } Orbulina universa, *D'Orbigny*.
Fig. 15. Globigerina bulloides, *D'Orbigny*.
Fig. 16.
Fig. 17. } Globigerina inflata, *D'Orbigny*.
Fig. 18, edge view.
Fig. 19, upper view. } Truncatulina lobatula, *Walker and Jacob*.
Fig. 20, lower view.
Fig. 21. Planorbulina Mediterranensis, *D'Orbigny*.
Fig. 22, *a*, *b*. Planorbulina Haidingerii, *D'Orbigny*.
Fig. 23, upper side.
Fig. 24, lower side. } Planorbulina Ungeriana, *D'Orbigny*.
Fig. 25, edge.
Fig. 26, upper side.
Fig. 27, lower side. } Discorbina Berthelotiana, *D'Orbigny*.
Fig. 28, *a*, upper side.
Fig. 28, *b*, edge. } Discorbina rosacea, *D'Orbigny*.
Fig. 29, upper side.
Fig. 30, lower side. } Rotalia Beccarii, *Linnè*.
Fig. 31, upper side.
Fig. 32, lower side. } Rotalia Soldanii, *D'Orbigny*.
Fig. 33, edge.
Fig. 34, upper view. Rotalia orbicularis, *D'Orbigny*.
Fig. 35, upper view.
Fig. 36, lower view. } Pulvinulina Menardii, *D'Orbigny*.
Fig. 37, edge.
Fig. 38, edge.
Fig. 39, upper side. } Pulvinulina Karsteni, *Reuss*.
Fig. 40, lower side.
Fig. 41, lower side.
Fig. 42, edge. } Pulvinulina Micheliniana, *D'Orbigny*.
Fig. 43, upper side.

Fig. 44, upper side.
Fig. 45, edge.
Fig. 46, lower side. } Pulvinulina elegans, *D'Orbigny.*

Fig. 47, lower side
Fig. 48, edge
Fig. 49, upper side } Pulvinulina Canariensis, *D'Orbigny.*

Fig. 50.
Fig. 51, *a*, *b* } Pulvinulina pauperata, *Parker and Jones.*

Fig. 52. Sphæroidina bulloides, *D'Orbigny.*

PLATE XVII. (NORTH ATLANTIC FORAMINIFERA.)

[The figures are magnified 30 diameters.]

Fig. 53. Pullenia sphæroides, *D'Orbigny.*
Fig. 54, *a*, *b*. Nonionina asterizans, *Fichtel and Moll.*
Fig. 55.
Fig. 56. } Nonionina Scapha, *Fichtel and Moll.*
Fig. 57, *a*, *b*, *c*. Nonionina turgida, *Williamson.*
Fig. 58.
Fig. 59. } Nonionina umbilicatula, *Montagu.*
Fig. 60, *a*, *b*. Nonionina striatopunctata, *Fichtel and Moll.*
Fig. 61, *a*, *b*. Polystomella crispa, *Linnè.*
Fig. 62.
Fig. 63. } Operculina ammonoides, *Gronovius.*
Fig. 64, *a*, *b*, *c*. Cassidulina lævigata, *D'Orbigny.*
Fig. 64, *d*. Cassidulina crassa, *D'Orbigny.*
Fig. 65, *a*, *b*. Uvigerina pygmæa, *D'Orbigny.*
Fig. 66, *a*, *b*. Uvigerina angulosa, *Williamson.*
Fig. 67, *a*, *b*. Bulimina ovata, *D'Orbigny.*
Fig. 68.
Fig. 69. } Bulimina aculeata, *D'Orbigny.*
Fig. 70, *a*, *b*, *c*. Bulimina marginata, *D'Orbigny.*
Fig. 71. Bulimina Buchiana, *D'Orbigny.*
Fig. 72.
Fig. 73. } Virgulina Schreibersii, *Czjzek.*
Fig. 74. Bolivina punctata, *D'Orbigny.*
Fig. 75. Bolivina costata, *D'Orbigny.*
Fig. 76, *a*, *b*. Textularia abbreviata, *D'Orbigny.*
Fig. 77, *a*, *b*. Textularia Sagittula, *Defrance.*
Fig. 78, *a*, *b*. Textularia pygmæa, *D'Orbigny.*
Fig. 79, *a*, *b*. Textularia carinata, *D'Orbigny.*

Fig. 80, *a*, *b*. Bigenerina Nodosaria, *D'Orbigny*.
Fig. 81. Bigenerina digitata, *D'Orbigny*.
Fig. 82. Spiroloculina planulata, *Lamarck*.
Fig. 83, *a*, *b*. Spiroloculina limbata, *D'Orbigny*.
Fig. 84. Quinqueloculina tenuis, *Czjzek*.
Fig. 85, *a*, *b*.
Fig. 86, *a*, *b*. } Quinqueloculina oblonga, *Montagu*.
Fig. 87. Quinqueloculina Seminulum, *Linnè*.
Fig. 88. Biloculina elongata, *D'Orbigny*.
Fig. 89, *a*, *b*. Biloculina depressa, *D'Orbigny*.
Fig. 90.
Fig. 91. } Biloculina elongata, *D'Orbigny*.
Fig. 92.
Fig. 93.
Fig. 94.
Fig. 95. } Lituola Canariensis, *D'Orbigny*.
Fig. 96.
Fig. 97.
Fig. 98. } Lituola globigeriniformis, *Parker and Jones*.

PLATE XVIII. (MISCELLANEOUS FORAMINIFERA.)

[Figures 15–18 are magnified 30 diameters; all the rest are magnified 60 diameters (excepting fig. 6 *b*, 200 diameters.)].

Fig. 1, *a*, *b*. Lagena trigono-marginata, *Parker and Jones*. A rare form, from the inside of an Eocene Tertiary shell from Grignon*. It is an isomorph of the trigonal *Nodosarinæ*. See page 348.

Fig. 2, *a*, *b*. Lagena squamoso-marginata, *Parker and Jones*. Living on the Coral-reefs of Australia (JUKES); fossil in the Middle Tertiary beds of San Domingo. See page 356.

Fig. 3, *a*, *b*. Lagena radiato-marginata, *Parker and Jones*. Rare. Recent, Australian Coral-reefs (JUKES); fossil, Middle Tertiary, Bordeaux. See page 355.

* This *Lagena*, as well as the other Grignon specimens on this plate, together with *Discorbina globigerinoides* on Plate XIX., and many other Foraminifera, were obtained from the inside of a *Cerithium giganteum*; and, as a group, they differ from those got by us from any other sample of the Calcaire grossier, in their extreme freshness and their minute size. The Australian seas supply a Foraminiferal fauna very analogous to that of Grignon (fossil); and that of the northern part of the Red Sea (300–600 fathoms) corresponds in many respects to that shown by the contents of the fossil shell referred to. The *Cerithium* itself would not, of course, indicate any such depth as that above mentioned; but the analogy of the fossil and recent faunæ under notice is certainly striking. Still, the smallness of some of the forms amongst those from the Red Sea, and the absence of *Polyzoa* and of small Gasteropods and Lamellibranchs in these soundings (replaced by abundance of small Pteropods), sufficiently separate the two.

Fig. 4, *a*, *b*. Lagena crenata, *Parker and Jones*. Rare. Recent, shore-sand at Swan River, Australia; fossil, Middle Tertiary of Bordeaux and Malaga. The figure well shows the characters of this pretty Lagena. Decanter-shaped; neck long and coiled; body gradually widening and smooth to the base, which for half its radius is widely and deeply crenate with broad radiating furrows; the centre of the base being smooth and gently convex.

Fig. 5. Lagena distoma-aculeata, *Parker and Jones*. Rare. Fossil at Grignon. Isomorphous of prickly *Nodosarinæ*. See page 348.

Fig. 6, *a*, *b*. Lagena distoma-margaritifera, *Parker and Jones*. Recent, from the surf-washed sponges at Melbourne, Australia. See page 357.

Fig. 7, *a*, *b*. Lagena tubifero-squamosa, *Parker and Jones*. Fossil at Grignon. This very large globular *Lagena*, with a distinct and ramifying neck, has shallow honeycombings and a very thick shell, the outer layers of which decaying leave a very smooth, thin *Lagena*, ordinary-looking except for its neck. See page 354.

Fig. 8. Lagena distoma-polita, *Parker and Jones*. A large, smooth, two-mouthed, fusiform *Lagena*, from the Red Sea and Australia. See page 357.

Fig. 9, *a*, *b*. Lagena lævis, *Montagu*. A double individual (monster). Fig. 9 *b* is a section. Rare. Recent, from the English Channel at Eastbourne. See page 353.

Figs. 10, 11. Lagena lævis, *Montagu*. Monstrous *Lagenæ*, double by lateral growth. Fossil, Grignon. See page 353.

Fig. 12, *a*, *b*. Lagena lævis, *Montagu*. Monstrous bilobed specimen. Fossil: Grignon. See page 353.

Fig. 13. Nodosaria scalaris, *Batsch*. For comparison with figs. 9 *a*, 9 *b*. See pages 340 and 353.

Fig. 14, *a*, *b*. Lagena tretagona, *Parker and Jones*. A rare, delicate, feeble form of *L. striatopunctata* with four ridges and surfaces. Fossil: Grignon. See page 350.

Fig. 15. Uvigerina (Sagrina) nodosa, *D'Orbigny*. See page 363.

Figs. 16, *a*, *b*, & 17. Uvigerina (Sagrina) Raphanus, *Parker and Jones*. Recent: West Indies, Panama, India (on Clam-shell), Bombay Harbour (anchor-mud), Hong Kong (anchor-mud), Australian Coral-reefs (17 fathoms). See page 364.

Fig. 18. Uvigerina (Sagrina) dimorpha, *Parker and Jones*. Recent: Red Sea (near the Isle of Shadwan, at 372 fathoms), Abrohlos Bank (260 fathoms), Australian Coral-reefs (17 fathoms). See page 364.

Fig. 19. Textularia Folium, *Parker and Jones*. A very thin *Textularia*, with linear chambers, usually very unequal in their length, and forming a flat, pectinated, irregularly triangular or subrhomboidal shell, seldom so symmetrical in shape as the figured specimen. Shore-sand near Melbourne. See page 370.

PLATE XIX. (MISCELLANEOUS FORAMINIFERA.)

[Figures 2 & 3 are magnified 15 diameters; figs. 1, 4–13, 25 diameters (excepting fig. 5 *c*, 25 diameters.)].

Fig. 1. Planorbulina Culter, *Parker and Jones.* Very rare. Tropical Atlantic (1080 fathoms). A neat, discoidal, biconvex, trochiform *Planorbulina*, showing on its upper face about twenty-five (often more) neatly set chambers in a compact spire, bordered with a thin keel, as wide as a whorl of the chambers. It is an extreme varietal condition of the subsymmetrical form, imitating *Pulvinulina*, and ought to have been noticed at page 379, as a starved *Pl. Ungeriana.*

Fig. 2. Planorbulina retinaculata, *Parker and Jones.* Parasitic on Shells, East and West Indies. See page 380.

Fig. 3, *a*, *b*. Planorbulina larvata, *Parker and Jones.* Indian Sea. See page 380.

Fig. 4, *a*, *b*. Pullenia obliquiloculata, *Parker and Jones.* Abrohlos Bank (260 fathoms), Tropical Atlantic (1080 fathoms), Indian Ocean (2200 fathoms). See page 368.

Fig. 5, *a*, *b*, *c*. Sphæroidina dehiscens, *Parker and Jones.* Fig. 5 *c*, fragment of shell-wall more highly magnified. Tropical Atlantic (1080 fathoms) and Indian Ocean (2200 fathoms). See page 369.

Fig. 6, *a*, *b*, *c*. Discorbina rimosa, *Parker and Jones.* Recent: India (on Clam-shell). Fossil: Tertiary, at Grignon, Hautville, Freville, La-Fosse-de-Launy, &c. (Sir C. Lyell's Collection). This is smaller than *D. vesicularis*, and close to it and *D. elegans* in alliance; somewhat oval in shape; shell-substance thick, pores large; septal plane notched for aperture; chambers very much larger in the newer than in the older part of the shell, and discrete; and on the upper side several of the newer chambers are separated by chinks. On the under side there are secondary chambers over the umbilicus, perfect, large, and astral, with chinks at their periphery. See page 385.

Fig. 7, *a*, *b*, *c*. Discorbina globigerinoides, *Parker and Jones.* Common in the Calcaire grossier of Grignon. This *Discorbina* equals in size fine Tropical *Globigerinæ*, and reminds one of their form. It is also isomorphous with *Cymbalopora bulloides*, D'Orb., sp. In appearance it is the very opposite of its real ally *D. Parisiensis*; but it has much the same kind of septal face, the inner two-thirds of which are thickly covered with sinuous wrinkles and granules of exogenous shell-matter, having large pores opening out of them, and thus presenting a rudiment of the canal-system. A similar thickened surface, but formed of radiating granules, on the under side of the shell, is seen in *D. obtusa*, D'Orb., and *D. Parisiensis*, D'Orb. The astral processes in *D. globigerinoides* are abortive. See page 385.

Fig. 8, *a*, *b*, *c*. Discorbina polystomelloides, *Parker and Jones.* From the Australian Coral-reefs (Jukes's dredgings). This may be said to be a granulose form of

D. rimosa; but it is larger, more symmetrical, and extremely rough; and the chinks between the chambers are partly bridged over, so as to form a rough canal-system, as in some of the *Polystomellæ*.

Fig. 9, *a*, *b*, *c*. Discorbina dimidiata, *Parker and Jones*. Large and profusely abundant among the surf-washed Sponges on the Melbourne coast. This is merely *D. vesicularis* modified by being sharp-edged, and flat, and even scooped on the under face (opposite to that which is flat in *Truncatulina*). The astral flaps or valves are strongly marked over the umbilicus. See page 385.

Fig. 10, *a*, *b*, *c*. Discorbina biconcava, *Parker and Jones*. Shore-sand, Melbourne. A very small isomorph of *Planulina Ariminensis*. It is a hyaline, thick, limbate, square-edged, biconcave *Discorbina*, most concave on the umbilical face (as usual with the genus). Its astral flaps are feeble. See page 385.

Fig. 11, *a*, *b*, *c*. Rotalia annectens, *Parker and Jones*. Hong Kong (anchor-mud) and Fiji (coral-reef). A well developed Conus-shaped *Rotalia*, which has, on its under or umbilical surface, partially formed secondary chambers, owing to angular processes of the septa nipping the umbilical lobes. It is thus a passage-form between *R. Schrœteriana*, P. & J., and *R.* (*Asterigerina*) *lobata*, D'Orb. See page 387.

Fig. 12, *a*, *b*, *c*. Rotalia craticulata, *Parker and Jones*. Fiji. This Polystomelloid *Rotalia* is noticed by Dr. CARPENTER, Introd. Study Foram. p. 213. See page 387.

Fig. 13, *a*, *b*, *c*. Rotalia dentata, *Parker and Jones*. Bombay Harbour (anchor-mud). A well-grown, biconvex *Rotalia*, with numerous subquadrate chambers, thickened and raised septal edges, rowelled margin, and massive umbilicus. See page 387.

APPENDIX I.—*Additional North Atlantic Foraminifera.*

The Rev. J. S. TUTE, of Markington, has shown us a set of carefully executed drawings of minute Foraminifera from 67 fathoms, Atlantic Soundings, belonging to the Rev. W. FOWLER, of Cleckheaton. These comprise

Globigerina bulloides.
Spirillina vivipara.
Planorbulina lobatula.
—— Ungeriana.
Textularia pygmæa.
Miliola (young).

Also

Pteropoda (*Cuvieria*? and *Limacina*?).

Among the above, *Spirillina vivipara* is additional to our list of Foraminifera from the Atlantic Soundings. See also page 368.

With reference to *very minute* Foraminifera, such as are here referred to, it may be

TABLE VII.—Table of T

[For the completion of the Fauna of eacl

vl. Very large. *l.* Large. *rl.* Rather large. *m.* Middle-size

Typical Species.	Genera, Species, and Varieties.	1 Sub-recent. Peterborough Fen, 1 mile from its western boundary (sandy clay).	2 Sub-recent. Peterborough Fen, 2 miles from its western boundary (sandy clay).	3 Sub-recent (clay). Boston, Lincolnshire.	4 Sub-recent (clay). Wisbech, Cambridgeshire (Valley of the Nene).	5 Mouth of Thames, Southend (shallow-water sands).	6 Pegwell Bay, near Margate, Kent (muddy shore-sand).
	Glandulina lævigata, D'O.	..	..	..	..	..	..
	Nodosaria Radicula, Linn.	..	..	..	..	..	..
	—— Raphanus, Linn.	..	*vs* VR	..	..	..	..
	—— scalaris, Batsch	..	..	..	..	..	..
	Dentalina communis, D.O.	..	*vs* VR	..	..	..	..
	—— consobrina, D'O.	..	..	..	..	..	..
Nodosarina Raphanus, Linn.	—— pauperata, D'O.	..	..	..	..	..	..
	—— guttifera, D'O.	..	..	..	..	..	..
	Vaginulina linearis, Montag.	..	..	..	..	..	..
	Marginulina Lituus, D'O.	..	..	..	..	..	..
	Cristellaria Crepidula, F. & M.	..	..	..	..	..	..
	—— cultrata, Montf.	..	..	..	..	..	..
	—— rotulata, Lam.	..	..	..	..	..	*s* R
	Lagena distoma, P. & J.	..	*s* RC	..	..	..	..
	—— polita, P. & J.	..	..	*m* RC	*m* C	..	..
	—— lævis, Montag.	..	*s* RC	*m* C	*m* C	..	*m* C
	—— semistriata, Will.	..	*s* VC	*m* C	..	..	..
	—— striatopunctata, P. & J.	..	..	..	..	..	..
Lagena sulcata, W. & J.	—— sulcata, W. & J.	..	*m* C	*m* C	*m* C	..	*m* C
	—— Melo, D'O.	..	..	*m* C	..	..	..
	—— globosa, Montag.	..	*s* RC	*m* C	*m* C	..	..
	—— caudata, D'O.	..	..	..	*m* C	*m* RC	*m* C
	—— squamosa, Montag.	..	*s* RC	*m* C	*m* C	..	*m* C
	—— marginata, Montag.	..	*s* C	*m* C	*m* C	..	*m* C
	Polymorphina lactea, W. & J.	..	*vs* C	*vs* RC	..	..	*m* R
Polymorphina lactea, W. & J.	—— compressa, D'O.	..	..	..	..	..	..
	—— tubulosa, D'O.	..	..	..	..	..	..
	Uvigerina pygmæa, D'O.	..	..	..	..	..	..
Uvigerina pygmæa, D'O.	—— angulosa, Will.	..	..	..	..	..	..
Orbulina universa, D'O.	Orbulina universa, D'O	..	..	..	..	..	..
	Globigerina bulloides, D'O.	..	*vs* C	..	..	..	..
Globigerina bulloides, D'O.	—— inflata, D'O	..	..	..	..	..	..
Sphæroidina bulloides, D'O.	Sphæroidina bulloides, D'O	..	..	..	..	..	..
	Planorbulina Haidingerii, D'O.	..	..	..	..	..	..
	—— Ungeriana, D'O.	..	..	..	..	..	..
Planorbulina farcta, F. & M.	—— Mediterranensis, D'O.	..	..	*vs* RR	*vs* C	..	..
	Truncatulina lobatula, W. & J.	..	..	..	*vs* C	..	..
	Anomalina coronata, P. & J.	..	..	..	..	..	..
	Pulvinulina Menardii, D'O.	..	..	..	..	..	..

, of each of these localities, excepting Nos. 5, 11, 12, 13, & 25, which are here complete, see A

iddle-sized. *s.* Small. *vs.* Very small. VC. Very common. C. Common. RC.

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	2
Pegwell Bay, near Margate, Kent (muddy shore-sand).	Isle of Arran, N.B. (muddy sands from shallow water).	Douglas, Isle of Man (shallow-water sands).	Eastbourne, Sussex (mud from shallow water.)	Colne (tidal) River, Essex (oyster-beds).	Greenland (Arctic). See Table IV.	Norway (Arctic). See Table IV.	North Atlantic, Ireland to Newfoundland, thirty-nine casts, from 43 to 2350 fms. See Table V.	Mediterranean. Galita Island, S. 32° W., 32 miles. Lat. 38° 00′ N., Long. 9° 13′ E., 320 fms**.	Red Sea. Gulf of Suez (muddy, shelly sand). 30 fms. Lat. 28° 38′ N., Long. 33° 9′ E.	Red Sea, close to Island Shadwan off S.E. point, entrance of Jubal Strait, 372 fms. (light yellow clay).	Red Sea, 557 fms. Lat. 17° 49′ N., Long. 40° 2′ E. (various-coloured mud).	Red Sea, 678 fms. Lat. 23° 30′ N., Long. 36° 58′ E. (pale clay).	Black Anchor-mud, Bombay Harbour (full of vegetable *débris*).	Dark Anchor-mud, Hong Kong, clay, sand, and vegetable matter, 8 or 9 fms.	Tropical Atlantic, 1080 fms. Lat. 2° 20′ N.,
..	..	..	..	..	..	*l* C	..	..	*m* RC	*l* RR	..	..	..	..	.
..	..	..	..	..	*rl* R	*l* C	..	..	..	*m* RR	..	..	..	..	.
..	..	..	..	..	..	..	*s* R	*m* RC	..	..	..	..	..	..	.
..	..	..	..	..	..	..	*s* RR	*l* VC	*s* RC	*s* RC	..	..	..	*s* RC	.
..	*rl* RR	..	..	..	*l* R	*vs* VR	*s* R	*m* C	..	*s* RC	*s* R	..	*s* VR	..	*vs*
..	..	..	..	..	..	..	*s* R								
..	..	..	..	..	*m* R										
..	*m* R	..	..	..	..	*l* R	..	*s* R	..	..	..	..	..	..	.
..	..	..	..	..	..	*s* RC									
..	*m* RR	..	..	..	..	*vl* C	..	..	..	..	*m* R	..	..	..	.
..	*m* RR	..	..	..	*s* C	..	*s* R	..	..	..	..	..	..	..	.
..	..	..	..	..	..	*l* C	..	*rl* C	..	..	..	..	..	..	.
s R	*m* RC	..	..	..	..	*l* C	*m* R	*rl* C	*s* RC	..	..	..	..	..	*vs*
..	..	..	..	..	..	*l* RC									
..	..	..	..	..	..	*s* RC	*s* R	..	..	*s* RR	..	..	..	..	.
m C	..	..	*m* RC	..	..	*s* R	*m* R	..	*m* R	*s* RC	..	..	*s* VC	..	.
..	..	..	*m* C	..	*m* RC	..	..	..	..	..	..	..	*s* VC	*l* RC	.
..	..	..	..	..	*l* RC	..	..	..	..	*s* C	*s* R	..	..	..	.
m C	*l* VC	*l* VC	*m* C	..	*l* C	*m* RC	*s* RC	*l* RC	..	*s* RR	..	..	*s* RR*	*m* RC†	.
..	..	..	*s* RC	..	*m* C	*m* RC	..	..	..	..	..	..	..	*m* RC	.
..	..	..	*s* C	..	*m* C	..	*l* R	..	..	..	..	..	*s* VC	..	*vl*
m C	..	..	*s* RC	..	*s* R	..	*s* R	..	..	*s* R	..	..	..	..	*s*
m C	*m* RC	..	..	..	*s* RC	*s* RC	*m* R	..	..	..	..	..	..	..	
m C	*m* C	..	*m* C	..	*m* C	*s* RC	*rl* C	*vl* VC	*m* R	*s* C	..	*s* R	*s* VC	*m* C	*vl*
m R	*rl* C	*s* C	*s* RC	..	*s* C	*s* RC	..	..	..	*s* RC	..	..	..	*m* C	
..	..	..	*s* RC	..	*s* R	*s* RC									
..	*rl* RC	..	..	..	..	*m* R	..	..	..	..	..	..	..	..	
..	..	..	..	..	*s* C	*m* C	*l* C	*vl* VC	..	..	..	..	..	..	
..	..	..	..	..	..	*m* C	*m* C	*m* RC	..	..	..	..	..	..	
..	..	..	..	..	..	..	*m* RR	*vl* VC	*l* R	*m* C	*l* VC	*l* VC	..	..	*l*
..	..	..	..	..	*s* RC	*s* R	*l* VC	*l* VC	*m* C	*l* VC	*l* VC	*l* VC	*vs* R	..	*l*
..	..	..	..	..	..	..	*l* C	*l* C	..	..	..	..	..	..	
..	..	..	..	..	..	..	*s* R	*rl* C	..	*m* RC	..	..	..	..	*n*
..	..	..	..	..	..	..	*m* R	..	*l* C	*m* C	*s* RC	..	..	..	
..	..	..	..	..	..	..	*m* RC	*m* C	..	..	..	..	..	..	
..	*vs* C	*rs* C	..	..	..	..	*s* R	..	..	..	..	..	..	*s* R	
..	*m* C	*m* VC	*s* RC	..	*l* C	*l* C	*m* RC	*m* RR	*m* RC	*s* RC	*s* R	..	*m* RC	*s* RC	*m*
..	..	..	..	..	..	*l* C									
..	..	..	..	..	..	..	*m* C	*rl* R‡	..	*m* RR	*m* C	*s* R	..	..	*l*

ppendix VI.]

Rather common. RR. Rather rare. R. rare. VR. Very rare.

21	22	23	24	25	26	27	28	29	30	31	32
Long. 28° 44′ W. (almost entirely organic).	South Atlantic, Abrolhos Bank, 47 fms. Lat. 23° 02′ S., Long. 41° 02′ W. (sand).	South Atlantic, Abrolhos Bank, 260 fms. Lat. 22° 54′ S., Long. 40° 37′, W. (dark mud).	South Atlantic, Abrolhos Bank, 940 fms. Lat. 19° 32′ S., Long. 37° 51½′ W. (whitish mud).	South Atlantic, 2700 fms. Lat. 26° 45′ S. Long. 32° 52′ W. (pale mud, half aluminous).	Indian Ocean, 2200 fms. Lat. 5° 37′ S., Long. 61° 33′ E. (fine white calcareous mud, with Polycystineæ).	Indian Ocean, two casts near each other, 900 and 1120 fms. Lat. 36° 58′ S., Long. 51° 49′ E. (pale mud).	Australia, coral-reef, Jukes's dredgings, August 6th, 1844, 17 fms. (white shelly mud).	Swan River, Australia, 7 or 8 fms. (white shelly mud).	Melbourne, Australia, Coast-sand (coarse quartz sand full of shells, zoophytes, sponges, and algæ).	Black Anchor-mud, Hobson's Bay, Australia (full of vegetable matter).	Fiji, coral-reef, and adherent to a hydroid polype (Dynamena).
..	..	..	..	..	..	..	*m* RC				
..	..	*s* RR									
..	..	*m* RR									
..	*s* C										
R	..	*l* RR	..	..	..	..	..	*s* R	..	*s* R	
..	*s* R	..	..	..	..	*s* R	..	..	*s* VR		
..	..	*s* RC									
..	..	*s* RC									
..	*l* C	*s* C	*m* RR								
R	*m* C	*l* C	..	..	..	*m* C	..	..	*vs* VR	*vs* VR	
..	..	..	..	..	..	..	*l* C	*m* RC	*s* RC		
..	..	..	..	..	..	..	*m* C	..	*l* C	*l* C	
..	..	..	..	..	..	..	..	*m* RC	*m* RC		
..	..	..	..	*vs* RR	*s* R						
..	..	*m* C	..	..	..	..	*s* RC	*l* RC†	*m* C		
..	..	*m* RC	*s* RR	..	..	..	..	..	*s* RC		
R	..	*s* RC	..	..	..	..	*m* C	*m* RC	*l* RC	*s* RR	
R		*m* RR									
..	..	..	..	..	..	..	..	..	*l* C		
RC	..	*m* C	*m* RR	..	..	*s* R	*l* C	*m* C	*m* C	*s* RR	
..	..	..	..	..	..	..	*s* RC	..	*m* C	*m* C	
..	..	..	..	..	..	..	..	..	*l* C		
..	..	*m* RC									
..	..	*m* C	..	..	..	*l* VC	..	*m* RC	*s* R		
VC	..	*l* VC	*l* C	..	*l* VC	*m* C					
VC	*m* C	*l* VC	*l* VC	*rs* VC	*l* VC	*m* VC	*s* RR				
..	..	..	..	..	..	*m* VC					
i R	..	*s* C	*l* C								
..	..	*m* RC	..	..	..	*l* RR	*m* VC				
..	*s* C										
..	*m* RC	*m* C	..	..	..	..	..	*m* C	*m* VC	..	*m* C
RR	..	..	..	..	..	..	*m* RC	..	..	*s* RC	*m* RC
VC	*m* C	*l* VC	*l* C	*s* C	*l* VC	*m* VC+					

Planorbulina farcta, F. & M.	—— Mediterranensis, D'O.	..	..	*vs* RR	*vs* C	..	..
	Truncatulina lobatula, W. & J.	..	..	..	*vs* C	..	..
	Anomalina coronata, P. & J.	..	..	..	..	..	..
Pulvinulina repanda, F. & M.	Pulvinulina Menardii, D'O.	..	..	..	..	..	..
	—— Canariensis, D'O.	..	..	..	..	..	..
	—— pauperata, P. & J.	..	..	..	..	..	..
	—— punctulata, D'O.	..	..	..	..	..	..
	—— Karsteni, Rss.	..	*vs* RR	*vs* RC	*vs* C	..	..
	—— elegans, D'O.	..	..	..	..	..	..
	—— Micheliniana, D'O.	..	..	..	..	..	..
Discorbina Turbo, D'O.	Discorbina obtusa, D'O	..	..	..	..	..	..
	—— globularis, D'O.	..	*vs* VR	..	*vs* RC	..	..
	—— rosacea, D'O.	..	..	..	*vs* RC	..	..
	—— Berthelotiana, D'O.	..	..	..	..	..	..
Rotalia Beccarii, Linn.	Rotalia Beccarii, Linn.	*rs* RC	*s* VC	*vs* C	*vs* VC	*vs* VC	*rs* VC
	—— Soldanii, D'O.	..	..	..	..	..	..
	—— orbicularis, D'O.	..	..	..	..	..	..
Polystomella crispa, Linn.	Polystomella crispa, Linn.	..	..	..	..	..	*rs* RR
	—— arctica, P. & J.	..	..	..	..	..	..
	—— striatopuncta, F. & M.	..	*s* C	*s* VC	*s* RC	*m* VC	*m* VC
	Nonionina asterizans, F. & M.	*m* RC	*m* C	*m* VC	*m* C	*m* VC	*m* VC
	—— Faba, F & M.	..	..	..	..	..	..
	—— Scapha, F. & M.	..	..	..	..	..	..
	—— depressula, W. & J.	*m* RC	*m* VC	*m* VC	*m* VC	*m* VC	*m* VC
	—— stelligera, D'O.	..	..	..	..	..	..
	—— umbilicatula, Montag.	..	..	..	*s* C	*m* RR	..
	—— turgida, Will.	..	*vs* R	..	..	..	..
Pullenia sphæroides D'O.	Pullenia sphæroides, D'O.	..	..	..	..	..	..
Nummulina perforata, Montf.	Nummulina planulata, Lam.	..	..	..	..	..	..
	Operculina ammonoides, Gronov.	..	..	..	..	..	..
Cassidulina lævigata, D'O.	Cassidulina lævigata, D'O.	..	..	..	..	..	..
	—— crassa, D'O.	..	..	..	..	..	..
Bulimina Presli, Rss.	Bulimina Pyrula, D'O.	..	..	..	..	..	..
	—— marginata, D'O.	..	..	..	..	..	..
	—— aculeata, D'O.	..	..	..	..	..	..
	—— ovata, D'O.	..	..	..	..	..	..
	—— Buchiana, D'O.	..	..	..	..	..	..
	—— elegantissima, D'O.	..	*vs* C	..	..	..	*s* R
	Virgulina Schreibersii, Czjzek	..	*vs* C	..	..	..	..
	—— squamosa, D'O.	..	*vs* R	..	..	..	..
	Bolivina punctata, D'O.	..	*s* RC	..	..	..	..
	—— costata, D'O.	..	..	..	..	..	..
Textularia agglutinans, D'O.	Textularia agglutinans, D'O.	..	..	..	..	..	..
	—— abbreviata, D'O.	..	..	..	..	..	..
	—— pygmæa, D'O.	..	..	..	..	..	..
	—— Sagittula, Defr.	..	..	..	..	..	..
	—— carinata, D'O.	..	..	..	..	..	..
	—— biformis, P. & J.	..	..	..	..	..	..
	Bigenerina Nodosaria, D'O.	..	..	..	..	..	..
	—— digitata, D'O.	..	..	..	..	..	..
	Verneuilina polystropha, Rss.	..	..	..	..	..	..
Valvulina triangularis, D'O.	Valvulina conica, P. & J.	..	..	..	..	..	..
Spirillina vivipara, Ehrg.	Spirillina vivipara, Ehrg.	..	*vs* VR	..	..	..	..
Patellina concava, Lam.	Patellina corrugata, Will.	..	*s* RC	..	..	..	..
Trochammina squamata, P. & J.	Trochammina squamata, P. & J.	..	..	..	..	..	..
	—— gordialis, P. & J.	..	..	..	..	..	..
Cornuspira foliacea, Phil.	Cornuspira foliacea, Phil.	..	*s* RC	*s* C	*s* RC	..	..
Miliola Seminulum, Linn.	Spiroloculina planulata, Lam.	..	..	..	..	..	..
	—— limbata, D'O.	..	..	..	..	..	..
	Quinqueloculina Seminulum, Linn.	..	..	..	..	..	*m* C
	—— triangularis§, D'O.	..	..	..	..	..	..
	—— Ferussacii, D'O.	..	..	..	..	..	*m* C
	—— agglutinans, D'O.	..	..	..	..	..	..
	—— subrotunda, Montag.	..	..	*vs* C	*vs* C	*s* RR	*s* C
	—— tenuis, Czjzek	..	..	..	..	..	..
	Triloculina cryptella, D'O.	..	..	..	..	..	..
	—— tricarinata, D'O.	..	..	..	..	..	..
	—— oblonga, Montag.	*s* R	*vs* RC	*vs* C	*vs* C	*s* RR	*m* C
	Biloculina ringens, Lam.	..	..	..	..	..	..
	—— depressa, D'O.	..	..	..	..	..	..
	—— elongata, D'O.	..	..	..	..	..	..
Lituola nautiloidea, Lam.	Lituola Canariensis, D'O.	*s* RR	*rs* VC	..	..	..	*s* R C
	—— globigeriniformis, P. & J.	..	..	..	..	..	..
	—— Scorpiurus, Montf.	..	..	..	..	..	..

..	*vs* C	*rs* C	..	..	..	..	*s* R	..	..	..	..	..	..	*s* R	..	*m* I
..	*m* C	*m* VC	*s* RC	..	*l* C	*l* C	*m* RC	*m* RR	*m* RC	*s* RC	*s* R	..	*m* RC	*s* RC	*m* RR	..
..	..	..	..	..	..	*l* C										
..	..	..	..	..	..	..	*m* C	*rl* R‡	..	*m* RR	*m* C	*s* R	..	..	*l* VC	*m*
..	..	..	..	..	..	..	*m* RC	*m* RR	..	..	*s* RC	..	..	..	*m* VC	..
..	..	..	..	..	..	..	*vs* VR	..	..	..	..	..	..	..	*s* R	..
..	..	..	..	..	..	*vl* C										
..	..	..	*vs* C	..	*m* C	..	*l* R	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	*s* R	*l* VC	..	..	..	..	..	..	*m* C	..
..	..	..	..	..	*s* R	..	*m* C	*l* VC	..	..	..	..	..	..	*l* VC	..
..	..	..	..	..	*l* C											
..	*m* VC	..	..	..	*m* C	*m* C	..	..	*s* RC	*vs* RC	..	..	..	*s* C	..	*l* F
..	*m* VC	..	*vs* C	..	..	..	*m* RR	..	..	..	..	..	..	..	..	*m*
..	..	..	..	..	..	..	*s* RR	*l* C	*m* C	*s* RC	..	..	*s* RC	*m* RC	..	*l*
rs VC	*m* C	*m* C	*s* C	*m* C	..	..	*s* R	..	..	*vs* C	..	..	..	*vs* VC	..	..
..	..	..	..	..	..	..	*rs* RR	*l* VC								
..	..	..	..	..	..	..	*vs* VR	*m* C	..	*vs* VC	*s* R	*s* R				
rs RR	*m* C	*m* C	..	*m* C	*s* R	..	*s* VR	..	*m* RC	..	..	..	..	..	..	..
..	..	..	..	..	*l* C											
m VC	*rl* RC	*rl* VC	*m* VC	*m* C	*l* C	*s* R	*m* RC	..	*m* RC	..	..	..	*vs* C	*s* C	..	..
m VC	..	..	*m* VC	*m* C	*s* C											
..	..	..	..	..	*l* C											
..	..	..	..	..	*l* C	..	*m* RC	..	*m* C	*vs* RC	..	*s* R	*s* VC	*m* C	..	..
m VC	..	..	*m* VC	*m* C	*s* C	..	..	..	..	..	..	..	*vs* C	..	..	..
..	..	..	..	..	*s* C	*s* C	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	*m* R	*m* VC	*m* C	*m* C	..	*s* C	*s* RC	*s* C	..	..	..	..
..	..	..	..	..	..	..	*s* R									
..	..	..	..	..	..	*vs* VC	*s* R	*rl* C	*l* R	..	..	..	..	..	..	*s*
..	..	..	..	..	*s* RC	..	..	..	..	..	..	..	*s* R	..	..	*s*
..	..	..	..	..	..	*s* VC	*s* RC	*s* VC	*m* C	..	..	..	..	..	..	..
..	..	..	..	..	*m* VC	*s* C	*m* RC	..	..	*vs* RC	..	..	..	..	..	..
..	..	..	..	..	*s* C	..	*vs* VR	*s* RR	..	..	..	..	*s* RR			
..	..	..	..	..	..	*l* C										
..	..	..	..	..	..	*m* C	*m* C	*l* RC	..	*s* C	*s* R	..	*s* C	..	..	..
..	..	..	..	..	..	*m* C	*m* RC	*m* RC	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	*rs* RR									
..	..	..	..	..	..	..	*s* R	*vl* RC	..	..	..	..	..	..	*m* C	..
s R	..	..	..	..	*l* C	..	..	*m* RC	..	*vs* RC	..	..	..	..	*l* R	..
..	..	..	..	..	*l* R	..	*m* R	*l* C	*m* RR	*s* RC	..	..	*s* C	*s* RC	..	..
..	..	..	..	..	*s* R	*l* R	..	..	..	*s* R	..	*s* R	*s* VC	..	*l* R	..
..	..	..	*s* RC	..	..	..	*s* RR	*m* C	*m* C	*m* C	*m* C	*s* R	*rs* VC	*vl* C	..	..
..	..	..	*m* RC	..	..	..	*l* R	..	..	..	..	..	*rs* VC			
..	..	..	..	..	*s* RC	*m* RC	..	*m* RC	*m* C	..	..	..	..	*m* C	..	*m*
..	..	..	..	..	..	..	*m* C									
..	..	..	..	..	..	*m* C	*s* RC	*m* RC	..	..	..	..	..	..	..	..
..	*m* C	..	..	..	..	..	*m* RC	..	..	..	..	..	..	..	..	*m*
..	..	..	..	..	..	..	*s* RC	*m* RC								
..	..	..	..	..	*s* C											
..	..	..	..	..	*s* C	..	*m* C	*l* VC	..	..	..	..	..	*m* RC	..	..
..	..	..	..	..	..	..	*s* R	*l* R								
..	..	..	..	*l* C	*s* C											
..	..	..	..	..	..	*s* R	..	*rl* R	..	..	..	..	..	..	..	*m*
..	..	..	..	..	*s* R	*s* R	..	..	..	*s* RC	*s* R	*s* RR	..	..	..	..
..	..	..	..	..	*s* C	..	..	*vs* R	..	*s* RC	..	*s* RR	..	..	..	..
..	..	..	..	..	*s* C											
..	..	..	..	..	*s* C	..	..	..	..	..	*s* R	*s* R				
..	..	*m* RC	*m* RC	*vs* C	*m* C	..	..	..	..	*s* RC	..	..	..	..	..	..
..	..	..	..	..	..	..	*m* R	..	*m* C	..	..	..	*rs* C	*m* C	..	..
..	*vl* C	*rs* C	..	..	..	..	*s* R	*m* C	*m* C	*s* RR	*s* R	..	..	..	..	..
m C	*rl* C	*l* VC	..	*m* VC	*m* C	*l* C	*s* RC	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	*s* R	*rl* C	*m* C	*vs* RC	*s* R	..	*rs* C	*m* C	*s* C	*s*
m C	..	..	..	..	*m* C											
..	..	..	..	..	*m* C	..	*rs* RR§	*l* VC	*l* C	*m* RC	..	*s* R	..	..	..	*l*
s C	..	*m* VC	*vs* C	*m* C	*s* C	..	..	..	*s* C	*s* C	..	*s* R	..	*s* RC	..	..
..	..	..	..	..	..	..	*s* R	*s* C	..	*s* RR	..	*m* C	..	*s* C	..	..
..	..	..	..	..	*m* C	..	..	..	..	..	..	..	..	..	*l* R	
..	..	..	..	..	*s* C	..	..	*s* RC	*m* C	*m* RC	..	*s* R	..	*s* C	..	..
m C	*rl* C	*m* VC	*vs* RC	*m* C	*s* C	..	*s* R	*s* RC	*s* C	*s* RC	..	*s* C	*s* C	*s* C	*vs* R	..
..	*m* C	..	..	..	..	*l* C	..	*l* RC	..	..	..	..	..	..	..	*s*
..	*m* VC	*rs* C	..	..	..	..	*m* RR	*l* C	..	..	*s* R	..	..	..	..	..
..	..	..	..	..	..	..	*s* R	*m* C	..	..	..	..	..	..	*s* R	..
s R C	..	..	..	*m* RC	*l* C	*m* RR	*m* R	..	..	..	..	..	..	..	..	..
..	..	..	..	..	*s* C	..	*s* R	..	..	..	*s* R	*s* R	..	..	..	..
..	..	..	..	..	*l* C	..	..	..	..	..	..	..	..	..	..	*l*

..	*m* RC	*m* C	..	..	..	..	..	*m* C	*m* VC	..	*m* C
RR	..	..	..	..	..	..	*m* RC	..	..	*s* RC	*m* RC
VC	*m* C	*l* VC	*l* C	*s* C	*l* VC	*m* VC‡					
VC	..	*m* C	*m* C	..	*m* C	*m* VC					
R	..	..	..	..	..	*s* R					
..	..	..	..	*s* VC							
n C	..	..	*m* RR	..	..	*s* RR					
VC	..	*m* C	..	*s* C	..	*m* VC					
..	*l* RC	..	..	..	..	..	*s* C	*m* RC	*m* C	..	*l* C
..	*m* C	..	..	..	..	..	*s* RC	..	*l* C	*s* R	*l* C
..	*l* C	*s* R	..	..	..	..	*l* C				
..	..	..	..	..	..	..	*s* RC	*vs* R	*m* C	*m* VC	*s* RC
..	..	..	..	..	..	..	*m* C	*m* C	*m* VC	*s* C	*m* C
..	..	..	..	..	..	..	*s* RC	*vs* VC	*s* RC	*s* C	*s* C
..	..	*s* C	..	..	..	..	*s* RC				
..	..	..	..	..	..	..	..	*s* RC	..	*l* C	
..	..	..	..	..	..	..	..	..	..	..	*s* C
..	..	*s* C	*s* C	..	..	*s* R					
..	*s* R	*s* C									
..	*s* R	..	..	..	..	..	*m* VC				
..	..	..	..	..	..	..	*m* VC	..	..	..	*m* C
..	..	..	*s* C	..	..	*s* R					
..	..	*m* C	..	..	..	..	..	..	..	*m* RC	
..	..	..	..	..	..	..	..	..	..	*m* RC	
n C	..	*m* C									
l R	..	..	..	..	..	..	..	..	*m* RC	*s* RC	
..	..	..	..	..	..	..	*s* RR	..	..	*l* C	
l R	..	..	..	..	..	..	..	..	..	*s* RR	
..	..	..	*s* C	..	..	..	*l* VC	*m* RC	*m* RC	*m* C	
..	*m* C	..	..	..	..	*s* RC	*l* VC	*s* C	*l* C	*vs* R	*vl* C
..	..	..	..	..	..	*m* RR					
..	*m* C										
..	..	*l* RC									
..	*m* C	..	..	..	..	..	..	..	*vl* RC		
..	..	..	..	..	..	..	..	*s* RC	*m* C		
..	..	..	..	..	..	..	..	..	*vs* RC		
..	..	*m* RR	*s* RR	..	..	..	..	*s* RC	*s* R		
..	..	..	..	..	..	..	*m* C				
..	..	..	..	..	..	..	*m* RC				
..	..	..	..	..	..	..	..	*s* C	*l* VC		
C	*s* C	*s* RR	*s* RR	..	..	*s* C	*m* C	*s* C	*m* C	*s* RC	*m* C
..	*l* C	*s* RR	..	..	..	..	*l* C	*s* C	*l* RC		
..	..	..	..	..	..	..	..	*s* C	*m*C	..	*s* C
..	..	*m* C	*s* R	..	..	..	*s* RR				
R											
..	..	..	..	..	..	..	*m* C	*rl* C	*l* VC		
s R	..	..	*s* R	*s* RR	..	..	*s* R	*s* C	*m* VC	*m* RC	*s* C
..	*s* R	*m* RC	..	..	..	..	*m* C	..	*m* R		
..	..	..	..	..	*l* RR	..	..	..	*m* RC		
R	..	*s* RR	..	..	..	*s* R	..	..	*m* RC		
..	..	*s* RC	..	..	..	..	..	..	..	*s* RC	*m* RC
..	..	*m* RC	*m* R	..	*m* R						
..	*l* C	*m* RC	*m* RR	..	..	..	*l* C				

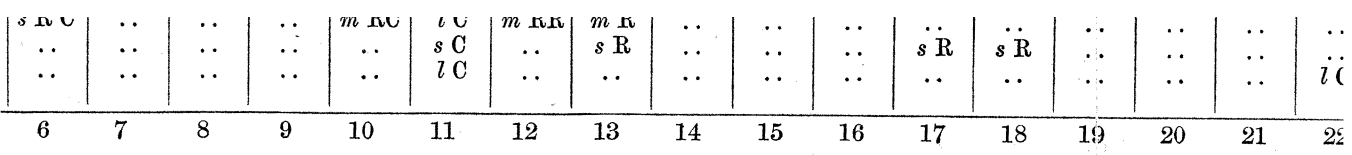
Lituola nautiloidea, Lam.	Lituola canariensis, D'O.	s RR	rs VC	..	..	..	s R C
	—— globigeriniformis, P. & J.	..	..	..	..	..	..
	—— Scorpiurus, Montf.	..	..	..	..	..	..
		1	2	3	4	5	6

* Var. *striata* very common here.

‡ In these localities *P. Menardii* is represented by a hirsute subvariety.

** Lists of Mediterranean Foraminifera

Some also of the North-Atlant



aminifera from several other soundings are published in the Quart. Journ. Geol. Soc. vol. xvi. p. 302 (1860).
th-Atlantic specimens are rather prickly.

21	22	23	24	25	26	27	28	29	30	31	32
..	..	*s* RC	..	..	..	..	..	..	..	*s* RC	*m* RC
..	..	*m* RC	*m* R	..	*m* R						
..	*l* C	*m* RC	*m* RR	..	..	..	*l* C				

† In both these places represented by var. *striata*.

§ In the text these are included with *Q. Seminulum*.

observed that wherever Foraminifera are abundant small individuals are plentiful, but they very rarely represent other types than those to which the larger specimens are referable.

Appendix II.—*Professor* J. W. Bailey's *Researches on the "Virginian" Foraminifera of the North Atlantic.*

"Microscopical Examination of Soundings made by the U. S. Coast-survey off the Atlantic Coast of the U. S. By Professor J. W. Bailey," Smithsonian Contributions to Knowledge, vol. ii. 1861, Article III. *

The examination was made and reported in 1848. The soundings were taken off the coast of New Jersey and Delaware, from lat. 50° to lat. 38° N., varying in depth from 10 to 105 fathoms. In the deeper soundings Professor Bailey found "a truly wonderful development of minute organic forms, consisting chiefly of Polythalamia" (Foraminifera). He also remarked that these deep soundings were from a sea-bed under the influence, more or less, of the Gulf-stream; and that probably this might cause an immense development of organic life—giving rise to a "milky way of Polythalamia." Professor Bailey also noticed that Foraminifera abundant in deep water would necessarily there make extensive calcareous deposits, contrasting with the quartzose and felspathic sands and muds of the coast.

We will, in the first place, give abridged notices of those soundings which were found to contain *Foraminifera*; and afterwards we will offer some remarks on Prof. Bailey's specific determinations, adapting them to the nomenclature used in this monograph, and so make them available for comparison with our "Celtic" forms.

E. No. 37. About South-east of Montauk Point; lat. 40° 59′ 55″, long. 71° 48′ 55″: 19 fathoms. Coarse gravel, mingled with ash-coloured mud. With a few small *Foraminifera*, chiefly *Rotalina*; a small bivalve Crustacean, *Diatomaceæ*, and Sponge-spicules.

E. No. 9. Lat. 40° 21′ 54″, long. 70° 55′ 35″: 51 fathoms. Greenish-grey mud or fine sand, with a few bits of shells, and a considerable number of *Foraminifera*, among which were *Marginulina Bachei*, Bailey (fig. 5, not abundant), *Robulina D'Orbignii*, Bailey (figs. 9 & 10), and *Bulimina auriculata*, Bailey (figs. 25–27).

F. No. 27. About South-east of Fire Island Inlet; lat 40° 14′ 13″, long. 72° 21′ 30″: 20 fathoms [material not described]. One specimen of *Quinqueloculina occidentalis*, Bailey (figs. 46–48); with a spine of *Echinus* and small plates of an Echinoderm.

F. No. 24. Lat. 39° 52′ 40″, long. 72° 14′: 49 fathoms. Greenish grey, rather coarse sand, mixed with some mud. *Foraminifera* rather abundant, comprising *Marginulina Bachei*, Bailey (fig. 5, rather common), *Orbulina universa*, D'Orb. (fig. 1, rare), a small *Bulimina*, a few small specimens of *Globigerina*; also a few Sponge-spicules, a small Cypridiform Crustacean shell, and a spine of *Echinus*.

* As this memoir is referred to by Professor Bailey in the Am. Journ. Sc. Arts, March 1854, it was in print long before 1861.

F. No. 25. Lat. 39° 41′ 10″, long. 71° 43′: 105 fathoms. Fine greyish-green sand, very rich in *Foraminifera*, especially in *Globigerina* (figs. 20–22, *Gl. inflata*, D'Orb.), with *Marginulina Bachei*, Bailey (fig. 5, rare), and *Textularia Atlantica*, Bailey (figs. 11–13, common); also Sponge-spicules and *Diatomaceæ*.

G. No. 27. About East from Little Egg Harbour; lat. 38° 41′, long. 76° 6′: 20 fathoms. Fine-grained sand with black specks. A few fragments of bivalve and univalve Shells, small spines and numerous plates of an Echinoderm, and some *Foraminifera*: *Triloculina Brongniartiana*, D'Orb. (figs. 44, 45), *Robulina D'Orbignii*, Bailey (figs. 9, 10, rather common), and several specimens of a minute species of *Rotalina* (?); also *Diatomaceæ*.

G. No. 31. Lat. 39° 20′ 38″, long. 72° 44′ 35″: 50 fathoms. Fine-grained greyish sand with much mud. A considerable number of *Foraminifera*, including *Marginulina Bachei*, Bailey (rather common), *Robulina D'Orbignii*, Bailey (figs. 9, 10), and *Globigerina rubra*, D'Orb. (common; but not so common as in F. No. 25); also *Diatomaceæ* and some Sponge-spicules.

G. No. 8. Lat. 39° 31′, long. 72° 11′ 20″: 89 fathoms. Sand, coarser than the last, not so muddy, and about the same colour. Abounding in *Textularia Atlantica*, Bailey (figs. 38–43), and in *Globigerinæ* (figs. 20–24, *Gl. inflata* and *Gl. bulloides*), and also containing *Marginulina Bachei*, Bailey, *Robulina D'Orbignii*, Bailey, and *Orbulina universa*, D'Orb., together with a few *Diatomaceæ* and Sponge-spicules.

H. No. 2. South-east from Cape Henlopen; lat. 38° 46′ 40″, long. 75° 00′ 30″: 10 fathoms. Fine sand, slightly muddy. One specimen of *Triloculina* and a few minute nautiloid *Foraminifera*; together with a great variety of *Diatomaceæ*, some Sponge-spicules, and a few small spines of an Echinoderm.

H. No. 17. Lat. 38° 29′ 56″, long. 74° 38′ 4″: 20 fathoms. Clean quartzose sand, coarser than the last, white and yellow, with black specks. Many *Diatomaceæ*, but no evidences of *Foraminifera* except their soft parts, retaining the form of the chambers.

H. No. 67. Lat. 38° 9′ 25″, long. 74° 4′ 5″: 50 fathoms. Clean greyish sand, containing a few minute *Globigerinæ* and *Rotalinæ*; also *Diatomaceæ*.

H. No. 1. Lat. 38° 4′ 40′, long. 73° 56′ 47″: 90 fathoms. A rather coarse grey sand, with some mud, containing a few *Diatomaceæ* and a vast number of *Foraminifera*, "particularly *Globigerina*, many thousands of which must exist in every inch of the sea-bottom at this locality." The following were also common here:—*Orbulina universa*, D'Orb. (fig. 1), *Marginulina Bachei*, Bailey (figs. 2–6), *Robulina D'Orbignii*, Bailey (figs. 9, 10), *Rotalina Ehrenbergii*, Bailey (figs. 11–13).

Professor Bailey described and figured nearly, if not quite, all the different forms of Foraminifera that he met with in his examination of these soundings,—also some of the Diatoms and Sponge-spicules, as well as some minute spherical calcareous bodies, occurring either singly or united in strings and bunches (transparent when mounted in balsam), which he thought might possibly be ova of Foraminifera, but which we believe to be little inorganic crystalline globules of calcite, common in many sea-beds. The calcareous granules he found abundantly at 90 fathoms, and at 105, 89, and 20 fathoms.

The allusions to the Foraminifera in the Soundings "E. No. 37," "H. No. 2," and "H. No. 67," are not precise enough for the determination of the species found therein; and even with the notes appended to the account of the Species, we cannot make a very exact table of the distribution.

In Professor BAILEY'S plate illustrating his memoir, we have

1. *Orbulina universa*, D'Orb., fig. 1.

2. *Nodosaria*, a fragment, fig. 8. With almost cylindrical chambers, as in some subvarieties of *N. Pyrula*, D'Orb. Several fragments in the deeper soundings are said to have occurred.

3. *Dentalina mutabilis*, Bailey, fig. 7. This fragment might well belong to such a subvariety of *Dentalina communis* as *D. pauperata*, D'Orb. Several fragments were found in "H. No. 1."

4. *Marginulina Bachei*, Bailey, figs. 2–6. Figs. 2–4 are the same as *M. similis*, D'Orb., and *M. pedum*, D'Orb., all of these being dimorphous or Marginuline modifications of *Nodosaria Radicula*, Linn., sp.; and figs. 5, 6 represent a larger individual of the same form, such as has been named *Marginulina regularis* by D'ORBIGNY in his 'Foram. Foss. Bassin Vienne,' where the others are figured.

5. *Robulina D'Orbignii*, Bailey, figs. 9, 10. This is the common *Cristellaria cultrata*, Montfort, sp. The figured specimen has its last few chambers keelless, and trying, as it were, to leave the discoidal plan of growth, each having its septal aperture almost free. This is said to accompany the foregoing, which was in considerable numbers in all except the shallow soundings.

6. *Rotalina Ehrenbergii*, Bailey, figs. 11–13. This is *Planorbulina Haidingerii*, D'Orb., sp. (a variety of *Pl. farcta*, Fichtel and Moll, sp.), and occurred in "F. No. 25½" and in several of the deeper soundings. Professor BAILEY thought it to be near *Rotalia Soldanii*, D'Orb.; and in truth *Pl. Haidingerii* does resemble that form,—but as an isomorph, not as a relative: so also it is an isomorph of *Pulvinulina truncatulinoides*, D'Orb.

7. *Rotalina cultrata?*, D'Orb., figs. 14–16. This is the common *Pulvinulina Menardii*, D'Orb., a variety of *P. repanda*, Fichtel and Moll, sp. Referred to as common in the deeper soundings.

8. *Rotalina semipunctata*, Bailey, figs. 17–19. The same as *Planorbulina Ungeriana*, D'Orb., sp. (*Pl. farcta*, var.).

9. *Globigerina rubra*, D'Orb., figs. 20–24. Professor BAILEY rightly considered figs. 20–22 to represent a separate form; it is *Gl. inflata*, D'Orb., a variety of *Gl. bulloides*, D'Orb., to which all must be referred specifically, D'ORBIGNY'S *Gl. rubra* being so named on account of the ruddiness of its shell, which is not dependent on the sarcode for its pink colour. *Gl. inflata* is specially noticed as occurring at 105 fathoms. Vast numbers of *Globigerinæ* occurred in the deeper soundings, especially the deepest; whilst they were but few and small at 49 fathoms. "The abundance in which the species of *Globigerina* occur in the deep soundings G. No. 31 and H. No. 1 gives to these green muds a most striking resemblance to the green Tertiary marls perforated by the artesian wells

at Charleston, S. C. This similarity appears to indicate that the Charleston beds were a deep-sea deposit, perhaps made under the influence of an ancient Gulf-stream" (p. 11).

10. *Bulimina auriculata*, Bailey, figs. 25–27. This is *B. Pyrula*, D'Orb. Several found at 51 fathoms.

11. *Bulimina turgida*, Bailey, figs. 28–31. A slight modification of *B. Pyrula*, D'Orb., the newer chambers being proportionally large and overlapping. It occurred with the foregoing, and at 49 fathoms.

12. *Bulimina serrata*, Bailey, figs. 32–34. The very small *Bulimina* (*Virgulina*) *Schreibersii*, Czjzek.

13. *Bulimina compressa*, Bailey, figs. 35–37. The same as *B.* (*Virgulina*) *squamosa*, D'Orb.

14. *Textularia Atlantica*, Bailey, figs. 38–43. This is the *Textularia* (*Verneuilina*) *triquetra*, Münster (*Verneuilina tricarinata*, D'Orb.). Found by Professor BAILEY only in the deeper soundings; especially abundant at 89 fathoms ("G. No. 38"). (Judging from our own specimens, we think that in these figured specimens the aperture of the shell is drawn too smoothly.)

15. *Triloculina Brongniartii*, D'Orb., figs. 44, 45.

16. *Quinqueloculina occidentalis*, Bailey, figs. 46–48. This fair typical form of *Miliola* (*Quinqueloculina*) *Seminulum*, Linn., sp., is said by Professor BAILEY to occur "not uncommonly in the sands along the western shores of the Atlantic,"—as indeed it does along many coasts.

In presenting the annexed bathymetrical Table (No. VIII.) of Professor BAILEY'S Foraminifera, we must express a hope that some day a fuller Synopsis of this marginal Fauna of the "Virginian Province" will be produced by the Transatlantic naturalists from more ample materials than Professor BAILEY had to work on; for we cannot think that this Fauna is fully represented by the present list.

TABLE VIII.—Table of the Foraminifera of the "Virginian Province."
(After Professor BAILEY; with Nomenclature corrected.)

GENERA, SPECIES, AND VARIETIES.	1	2	3	4	5	6	7	8	9	10	11
	H. 2*.	E. 37†.	F. 27.	G. 27‡.	F. 24.	G. 31.	H. 67§.	E. 9.	G. 8.	H. 1.	F. 25.
Lat.	38° 46′ 40″	40° 59′ 50″	40° 14′ 13″	38° 41′ 0″	39° 52′ 40″	39° 20′ 38″	38° 9′ 25″	40° 21′ 54″	39° 31′ 0″	38° 4′ 40″	39° 41′ 10″
Long.	75° 0′ 30″	71° 48′ 55″	72° 21′ 30″	76° 6′ 0″	72° 14′ 0″	72° 44′ 35″	74° 4′ 5″	70° 55′ 35″	72° 11′ 20″	73° 56′ 47″	71° 43′ 0″
Fathoms ..	10.	19.	20.	20.	49.	50.	50.	51.	89.	90.	105.
Orbulina universa, D'O.	..	..	..	..	*	..	..	..	*	*	
Nodosaria Pyrula, D'O.	..	..	..	..	?	?	..	?	?	?	?
Dentalina communis (pauperata), D'O.	..	..	..	..	..	..	..	..	..	*	
Marginulina regularis, D'O.	..	..	..	..	*	*	..	*	*	*	*
Cristellaria cultrata, Montf.	..	..	..	*	?	*	..	*	*	*	?
Planorbulina Haidingerii, D'O.	..	..	..	..	*	?	?	?	?	*	
—— Ungeriana, D'O.	..	..	..	..	..	..	..	..	*		
Pulvinulina Menardii, D'O.	..	..	..	..	?	?	..	?	?	?	?
Globigerina bulloides, D'O.	..	..	..	..	*	*	*	..	*	*	*
Bulimina Pyrula, D'O.	..	..	..	..	*	..	..	*			
—— (Virgulina) Schreibersii, Czjzek	..	..	..	..	..	*	..	*			
—— (——) squamosa, D'O.	..	..	..	..	*	*	..	..	..	..	*
Textularia (Verneuilina) triquetra, Münst.	..	..	..	..	..	?	..	..	*	*	*
Triloculina Brongniartii, D'O.	*	..	..	*							
Quinqueloculina Seminulum, Linn.	..	..	*								
Diatomaceæ	*	*	..	*	..	*	*	..	*	*	*
Sponge-spicules	*	*	..	..	*	*	..	..	*	..	*
Echinodermata	*	..	*	*	*						
Mollusca (fragments of shells)	..	..	..	*	..	..	*				
Bivalved Entomostraca	..	*	..	..	*						

* Containing "a few minute nautiloid Foraminifera" besides the *Triloculinæ*.

† A few small Foraminifera, chiefly "Rotalina," were found in this sounding.

‡ Also containing "a minute species of Rotalina."

§ Containing a few minute *Globigerinæ* and *Rotalinæ*.

APPENDIX III.—*Further Researches by Professor* J. W. BAILEY.

"Examination of Deep Soundings from the Atlantic Ocean." By Professor J. W. BAILEY, of West Point, New York," American Journal of Science and Arts, 2 ser. vol. xvii. p. 176, &c. 1854.

In this memoir Professor BAILEY describes the results of his examination of five deep-sea soundings, from the Atlantic, given him by Lieut. MAURY, and of one sounding, of less depth, made by Lieut. BERRYMAN.

I. Lieutenant MAURY'S Soundings.

	Fathoms.			
1.	1800	Lat. 42° 04′ / Long. 29° 00′	N. of the Azores.	"Lusitanian Province."
2.	1360	Lat. 44° 41′ / Long. 24° 35′	N.E. of the Azores.	
3.	1580	Lat. 49° 56′ 30″ / Long. 13° 13′ 45″	S.W. of Ireland.	"Celtic Province."
4.	1800	Lat. 47° 38′ / Long. 09° 08′	Off the mouth of English Channel.	
5.	2000	Lat. 54° 17′ / Long. 22° 33′	W. of Ireland.	

These soundings contained no gravel, sand, or other recognizable inorganic mineral matter, but consisted of *Foraminifera* and calcareous mud derived from their disintegrated shells. *Globigerinæ* greatly predominated; and *Orbulinæ* were in immense numbers in some, especially in the sounding from 1800 fathoms. They all contained *Diatomaceæ*, Sponge-spicules, and *Polycystinæ*. Professor BAILEY remarked that *Agathistegia* (*Miliola*, &c.) were absent, as well as *Marginulina*, *Textularia*, and other forms that he had met with in shallower soundings.

II. Lieutenant BERRYMAN'S Sounding.

Fathoms.		
175.	Lat. 42° 53′ 30″ N. / Long. 50° 05′ 45″ W.	S.S.E. of Newfoundland. On northern border of the "Virginian Province" (the western extension of the "Celtic Province").

The sea-bed off Newfoundland is here destitute of Foraminifera as far as this sounding shows; the quartzose sand, with a few grains of hornblende, being barren of shells or other organic remains.

Professor BAILEY'S results in these examinations are therefore very similar to those obtained by ourselves from similar parts of the Atlantic bed.

APPENDIX IV.—*Researches on the North Atlantic Foraminifera, by* F. L. POURTALES, *Esq.*

"Examination (by F. L. POURTALES, Esq., Assistant in the United States Coast-survey) of Specimens of Bottom obtained in the Exploration of the Gulf-stream, by Lieutenants Commanding, T. A. M. CRAVEN and J. N. MAFFITT, United States Navy," Report of the Superintendent of the United States Coast-survey for 1853; Appendix, No. 30, pages 82*, 83*, 1854.

From fourteen soundings off the eastern coast of Florida, and three off Georgia (all belonging to the "Caribbæan Province"), Count F. POURTALES obtained results similar in a great degree to those of Professor BAILEY'S examination of the soundings off New Jersey and Delaware (see above, page 423); and having soundings from much greater depths (150 to 1050 fathoms), he met with a greater predominance of *Globigerinæ*, forming, with other Foraminifera, the white mud of the sea-bed; in one instance *Globigerinæ* and the minute green stony casts of these shells entirely formed the bed† (at 150 fathoms, lat. 31° 2′, long. 79° 35′). At 1050 fathoms (lat. 28° 24′, long. 79° 13′) he found *Globigerina* and *Orbulina*, and the so-called *Rotalina cultrata*, *R. Ehrenbergii*, and *R. Bayleyi*, with fragments of Molluscan Shells, of Corals, and of *Anatifer*, as well as some *Pteropoda*; and only about 1 or 2 per cent. of fine sand in the Foraminiferal mud.

As these soundings are beyond the limits of the "Provinces" that we have to do with in the foregoing memoir, we omit the details of the other specimens of the "Caribbæan" sea-bed; but we remark that the author of this notice refers to former Reports (and Proc. Amer. Assoc. Charleston) in which he had intimated that "with the increase in depth—in the greater depths—the number of individuals [of *Foraminifera*, especially *Globigerina*] appeared to increase," having then seen a sounding from 267 fathoms where the sand contained 50 *per cent.* of *Foraminifera*; whilst now he found at upwards of 1000 fathoms *Foraminifera* with little or no sand. The extension of life to greater depths than 300 fathoms (E. FORBES, Ægean, Brit. Assoc. Rep. 1843) is also noticed by the author; but his suggestion, that *Globigerina* would be found to decrease gradually "for a considerable depth before it should cease to appear," does not appear to be as yet substantiated, since *Globigerina* holds its own at the greatest depth (2700 fathoms, South Atlantic) hitherto experimented upon. He remarks that the *Foraminifera* appear to be fresh in the deep-sea soundings, and probably live at the great depths from which they are brought up.

Note.—MAURY has already observed that the bed of the Atlantic at more than two miles depth has no sand nor gravel, but consists chiefly of *Foraminifera* and a small number of *Diatomaceæ* (siliceous).—"Sailing Directions," &c., 6th edit. 1864.

† To this Professor BAILEY refers in his interesting paper "On the Origin of Greensand and its formation in the Oceans of the present Epoch," Quart. Journ. Microscop. Science, vol. v. pp. 83–87; 1857.

Appendix V.—*The Foraminifera of the "Celtic and Virginian" Provinces of the North Atlantic, as a Fauna.*

The accompanying Table (No. IX.), already alluded to at p. 332, gives us a synoptical view of the Foraminifera of the "Celtic Province," including its western or "Virginian" portion. Excepting that further research will enrich the "Virginian" columns (Coralline and Coral zones of the American side of the Province), the Table comprises a complete Foraminiferal Fauna; and we believe that, by careful condensation of the multitudinous varietal forms under specific heads, we have fairly indicated the range and relative abundance of the members of a natural-history-group under such local conditions as naturalists have determined, chiefly by the aid of Mollusca and other marine animals, to belong to a more or less uniform zoological area.

Professor Williamson's 'Monograph of the British Recent Foraminifera' has (with corrections of nomenclature) supplied the first column, for the Littoral, Laminarian, Coralline, and Coral zones; Mr. H. B. Brady's researches in the Shetland and other British Foraminifera give us the second column; the next four columns refer to the different parts of the North Atlantic from whence we have many of the Foraminifera described in this memoir; and the last two columns comprise what we know of the "Virginian" Foraminifera, to which the Appendices Nos. II., III., & IV. have reference.

TABLE IX.—Table of the Foraminifera of the "Celtic Province," including the North-American or "Virginian" portion of that Province.

Note.—Mr. H. B. BRADY has kindly aided us in making the first two Columns as complete as possible.

GENERA, SPECIES, AND VARIETIES.	1 Littoral, Laminarian, Coralline, and Coral(?)-zones of British Isles (chiefly after Williamson).	2 Coral-zone [50–100 fms.] of British Isles; represented by the Shetland Fauna (Mr. H. B. Brady, F.L.S.) of 60–80 fms.	3 North Atlantic [Coral-zone] (43–90 fms.); off the Irish coast.	4 North Atlantic; Deep Water of the Eastern Plateau (200–400 fms.).	5 North Atlantic; Abyssal Depths (1750–2176 fms.).	6 North Atlantic; Abyssal Depths (1450–2350 fms.), "Boreal Province."	7 [Coralline zone] (10–20 fms.). "Virginian Province" (after Bailey).	8 [Coral-zone] (49–105 fms.).
Fathoms ...	0–80.		43–90.	200–400.	1750–2176.	1450–2350.	10–20.	49–105.
					1450–2350.			
Lagena sulcata ..... type	*	*	*	*	..	*		
—— lævis	*	*	.	*				
—— semistriata	*	*						
—— striata	*	*						
—— distoma ..... subtype	*	*						
—— (Entosolenia) globosa	*	*	..	*				
—— (——) caudata	*	*	..	..	*	*		
—— (——) marginata	*	*	**	*	..	**		
—— (——) squamosa	*	*	..	..	..	*		
—— (——) Melo	*	*						
Nodosarina (Glandulina) lævigata	..	*						
—— (Nodosaria) scalaris	*	*	*	*				
—— (——) Pyrula	*	*	..	..	..	..	..	*
—— (——) Raphanus ..... subtype	*	*	*					
—— (Lingulina) carinata	*	*						
—— (Dentalina) communis (and subvarieties)	*	*	..	..	*	..	..	*
—— (——) Acicula	*	*						
—— (Vaginulina) linearis	*	*						
—— (Cristellaria) cultrata and rotulata	*	*	*	..	..	..	*	*
—— (——) Crepidula	*	*	*					
—— (——) Italica	*							
—— (Marginulina) Lituus	*							
—— (——) regularis	..	..	..	..	..	..	..	*
Polymorphina lactea ..... type	*	*						
—— compressa	*	*						
—— tubulosa	*	*						
—— concava	*	*						
—— myristiformis	*	*						
Uvigerina pygmæa ..... type	*	*	**	**				
—— angulosa	*	*	*	*				
—— irregularis	*							
Orbulina universa ..... type	*	*	*	**	**	**	?	*
Globigerina bulloides ..... type	*	*	**	***	***	***	?	***
Sphæroidina bulloides	..	..	..	*	...	*		
Pullenia sphæroides	..	..	..	*	*	*		
Textularia Sagittula	*	*	*					
—— Trochus	*	*						
—— variabilis	*	*						
—— abbreviata	..	..	**	*				
—— pygmæa	*	*	**	*	..	*		

TABLE IX. (continued).

GENERA, SPECIES, AND VARIETIES.	1 Littoral, Laminarian, Coralline, and Coral(?)-zones of British Isles (chiefly after Williamson).	2 Coral-zone [50–100 fms.] of British Isles; represented by the Shetland Fauna (Mr. H. B. Brady, F.L.S.) of 60–80 fms.	3 North Atlantic [Coral-zone] (43–90 fms.); off the Irish coast.	4 North Atlantic; Deep Water of the Eastern Plateau (200–400 fms.).	5 North Atlantic; Abyssal Depths (1750–2176 fms.).	6 North Atlantic; Abyssal Depths (1450–2350 fms.), "Boreal Province."	7 [Coralline zone] (10–20 fms.).	8 [Coral-zone] (49–105 fms.). "Virginian Province" (after Bailey).
Fathoms ...	0–80.		43–90.	200–400.	1750–2176.	1450–2350.	10–20.	49–105.
					1450–2350.			
Textularia carinata	..	..	**					
—— difformis	*	*						
—— complexa	*							
—— (Verneuilina) polystropha	*	*						
—— (——) triquetra	..	..	..	..	..	..	..	**
—— (Bigenerina) digitata	..	*	*					
—— (——) Nodosaria	..	*	**					
Bulimina pupoides	*	*						
—— Pyrula	..	..	..	..	..	..	..	*
—— Buchiana	..	..	*					
—— marginata	*	*	**	*				
—— aculeata	*	*	..	*				
—— ovata	*	*	*	..	*			
—— convoluta	*	*						
—— (Robertina) elegantissima	*	*						
—— (Virgulina) Schreibersii	*	*	..	..	*	*	..	*
—— (——) squamosa	..	..	..	..	..	..	..	*
—— (Bolivina) punctata	..	*	*	*				
—— (——) costata	*	..	..	*				
Cassidulina lævigata ..... type	*	*	**	*	*			
—— crassa	*	*	..	*				
Spirillina vivipara ..... type	*	*						
—— margaritifera	*							
Discorbina rosacea	*	*	*					
—— ochracea	*	*						
—— globularis	*	*						
—— Berthelotiana	..	*	*					
Planorbulina Mediterranensis	*	*	*					
—— Haidingerii	..	*	..	..	*	..	..	*
—— Ungeriana	..	*	*	*	*	*	..	*
—— (Truncatulina) lobatula	*	*	**	*	*			
—— (——) refulgens	*	*						
—— (Anomalina) coronata	..	*						
Pulvinulina repanda ..... type	*	*						
—— Auricula	*	*						
—— Karsteni	..	*						
—— concentrica	..	*						
—— elegans	*	..	*	..	..	*		
—— Menardii ..... subtype	*	..	*	*	**	**	..	*
—— Canariensis	..	..	*	*	**	**		
—— pauperata	..	..	..	..	*	*		
—— Micheliniana	..	..	*	**	**	*		
Rotalia Beccarii ..... type	*	*	*					
—— nitida	*	*						

TABLE IX. (continued).

GENERA, SPECIES, AND VARIETIES.	1 Littoral, Laminarian, Coralline, and Coral(?)-zones of British Isles (chiefly after Williamson).	2 Coral-zone [50–100 fms.] of British Isles; represented by the Shetland Fauna (Mr. H. B. Brady, F.L.S.) of 60–80 fms.	3 North Atlantic [Coral-zone] (43–90 fms.); off the Irish coast.	4 North Atlantic; Deep Water of the Eastern Plateau (200–400 fms.).	5 North Atlantic; Abyssal Depths (1750–2176 fms.).	6 North Atlantic; Abyssal Depths (1450–2350 fms.), "Boreal Province."	7 [Coralline zone] (10–20 fms.). "Virginian Province" (after Bailey).	8 [Coral-zone] (49–105 fms.).
Fathoms ...	0–80.		43–90.	200–400.	1750–2176.	1450–2350.	10–20.	49–105.
					1450–2350.			
Rotalia Soldanii	..	..	*	*	*	*		
—— orbicularis	*	*	..	..	*			
Tinoporus lævis	*	*						
Patellina corrugata	*	*						
Nummulina radiata	*							
—— (Operculina) ammonoides	*	*	**	**				
Polystomella crispa ... type	*	*						
—— striatopunctata	*	*	*	*				
—— Arctica	..	*						
—— (Nonionina) umbilicatula	*	*	**	**	*	*		
—— (——) depressula	*	*						
—— (——) turgida	*	*	*	*				
—— (——) Scapha	*	..	..	*				
—— (——) stelligera	..	*						
—— (——) asterizans ... subtype	*	*						
Valvulina Austriaca	*	*						
Lituola nautiloidea ... type	*							
—— Canariensis	*	*	*	*				
—— Scorpiurus	*?	*						
Trochammina inflata	*	*						
—— incerta	*	*						
Cornuspira foliacea ... type	*	*						
Miliola (Quinqueloculina) Seminulum .. type	**	**	**	*	*	*	*	
—— (——) agglutinans	*	..	..	**	*	*		
—— (——) secans	*	*						
—— (——) bicornis	*	*						
—— (——) Ferussacii	*	*						
—— (——) pulchella	..	*						
—— (——) subrotunda	*							
—— (——) tenuis	..	..	..	*	..	*		
—— (Triloculina) oblonga	*	*	*	..	..	*		
—— (——) Brongniartii	*	..	..	..	..	..	*	
—— (——) trigonula ... subtype	*	*						
—— (——) tricarinata	..	*						
—— (Biloculina) ringens ... subtype	*	*						
—— (——) compressa	*	*						
—— (——) depressa	*	..		..	*	*		
—— (——) elongata	*	*	..	..	*	*		
—— (——) Sphæra	*	*						
—— (——) contraria	..	*						
—— (Spiroloculina) planulata ... subtype	*	*	*	..	*	*		
—— (——) limbata	*	*	*					
—— (——) excavata	*							
—— (——) canaliculata	*	*	*					

Appendix VI.—*General Distribution of Foraminifera.*

For the comparison of the Arctic and North-Atlantic Foraminifera with those of other seas, we selected twenty-nine sets of specimens from different parts of the Atlantic, Mediterranean, Red Sea, Indian Ocean, and Pacific, and showed in Table VII. the relative distribution of such of them as we have obtained from the Arctic and North-Atlantic sea-beds. Most of the localities, however, yielded other forms, the enumeration of which will complete what we know of the Foraminiferal fauna of each of the places quoted in Table VII.; and, as the proportional size and occurrence can also be indicated, so many complete lists will furnish material help in the study of representative groups of Foraminifera, as to their distribution and habits.

Table X.—Showing the Foraminifera belonging to the several Dredgings and Soundings indicated in Table VII., but omitted there as not being known in the Arctic and North-Atlantic Sea-beds. (The materials of this Table and of Table VII., taken together, supply perfect lists of the Foraminiferal Fauna for the several localities. Columns Nos. 5, 11, 12, 13, & 25 of Table VII. are complete in themselves.)

vl. Very large. *l.* Large. *rl.* Rather large. *m.* Middle-sized. *s.* Small. *vs.* Very small.
VC. Very common. C. Common. RC. Rather common. RR. Rather rare.
R. Rare. VR. Very rare.

Additional Genera, Species, and Varieties.		Additional Genera, Species, and Varieties.	
For Column No. 1.		For Column No. 6.	
Trochammina inflata, Montag.	*vl* VC	Polystomella strigillata, β, F. & M.	*rs* RR
		Bulimina pupoides, D'O.	*m* R
For Column No. 2.		Textularia variabilis, Will.	*s* R
		Trochammina inflata, Montag.	*m* VC
Uvigerina aculeata, D'O.	*vs* R	Triloculina Brongniartii, D'O.	*m* C
Textularia variabilis, Will.	*vs* VC		
Verneuilina pygmæa, Egger	*vs* C	For Column No. 7.	
Trochammina inflata, Montag.	*vl* VC		
Lituola agglutinans, D'O.	*s* R	Polystomella strigillata, β, F. & M.	*m* C
		Tinoporus lævis, P. & J.	*s* R
For Column No. 3.		Spiroloculina excavata, D'O.	*m* C
		Quinqueloculina secans, D'O.	*rl* C
Nodosaria aculeata, D'O.	*vs* VR	—— pulchella, D'O.	*rl* C
Textularia variabilis, Will.	*s* C	Triloculina trigonula, Lam.	*m* C
		—— Brongniartii, D'O.	*rl* C
For Column No. 4.		For Column No. 8.	
Nonionina granosa, D'O.	*vs* C		
Bulimina pupoides, D'O.	*rs* C	Quinqueloculina secans, D'O.	*l* VC
Textularia variabilis, Will.	*s* C		

TABLE X. (continued).

Additional Genera, Species, and Varieties.	
For Column No. 9.	
Polystomella strigillata, β, F. & M.	*vs* C
Bulimina pupoides, D'O.	*vs* RC
Textularia variabilis, Will.	*s* RC
Quinqueloculina secans, D'O.	*l* RR
For Column No. 10.	
Polystomella strigillata, β, F. & M.	*m* C
Bulimina pupoides, D'O.	*m* RR
Trochammina inflata, Montag.	*m* C
Quinqueloculina secans, D'O.	*m* RC
—— pulchella, D'O.	*m* C
Triloculina Brongniartii, D'O.	*m* C
For Column No. 14.	
Lingulina carinata, D'O.	*l* C
Dentalina brevis, D'O.	*m* C
—— elegans, D'O.	*l* C
—— Acicula, Lam.	*m* C
Vaginulina Badenensis, D'O.	*m* C
Rimulina glabra, D'O.	*rl* RC
Marginulina tuberosa, D'O.	*m* C
—— Falx, P. & J.	*m* C
—— elongata, D'O.	*m* C
Cristellaria Calcar, Linn.	*rl* C
—— Italica, Defr.	*m* RC
—— Vortex, F. & M.	*m* RC
Uvigerina aculeata, D'O.	*m* C
Globigerina hirsuta, D'O.	*m* R
—— helicina, D'O.	*m* RC
Planulina Ariminensis, D'O.	*m* VC
Planorbulina reticulata, Czjzek	*m* C
Pulvinulina repanda, F. & M.	*l* C
Cassidulina oblonga, Rss.	*m* RR
Bolivina Triticum, nov.	*m* RR
Textularia carinata, D'O.	*m* RC
—— conica, D'O.	*m* RC
Bigenerina rugosa, D'O.	*vl* C
Verneuilina triquetra, Münst.	*m* RC
Clavulina communis, D'O.	*l* VC
Webbina* clavata, P. & J.	*l* VC
Trochammina incerta, D'O.	*m* RC
—— charoides, P. & J.	*m* RC
Spiroloculina abortiva, nov.	*s* R
—— canaliculata, D'O.	*m* C
Biloculina Sphæra, D'O.	*m* C
Lituola Cenomana, D'O.	*vs* R

Additional Genera, Species, and Varieties.	
For Column No. 15.	
Rotalia ornata, D'O.	*m* C
Calcarina rarispina, Desh.	*s* C
—— Defrancii, D'O.	*s* C
Cymbalopora Poeyi, D'O.	*m* C
Pulvinulina Schreibersii, D'O.	*m* C
—— Auricula, F. & M.	*m* C
Cassidulina serrata, Rss.	*m* R
Polystomella discoidalis, D'O.	*m* C
Amphistegina vulgaris, D'O.	*m* C
Bolivina plicata, D'O.	*m* C
Verneuilina spinulosa, Rss.	*m* RC
Textularia Partschii, Czjzek	*m* C
—— pectinata, Rss.	*m* RC
—— Trochus, D'O.	*m* RC
—— Candeiana, D'O.	*m* RC
Spiroloculina alata, nov.	*l* C
Quinqueloculina Sagra, D'O.	*l* R
—— pulchella, D'O.	*m* C
Biloculina Sphæra, D'O.	*s* R
For Column No. 16.	
Dentalina elegantissima, D'O.	*s* R
Uvigerina aculeata, D'O.	*s* C
Sagrina dimorpha, P. & J.	*s* R
Globigerina helicina, D'O.	*m* C
Rotalia ornata, D'O.	*s* R
Cymbalopora Poyei, D'O.	*m* C
Planorbulina ammonoides, Rss.	*s* RC
Pulvinulina pulchella, D'O.	*m* C
—— Auricula, F. & M.	*m* C
—— excavata, D'O.	*rs* RC
—— Schreibersii, D'O.	*m* RR
Amphistegina vulgaris, D'O.	*vs* RC
Cassidulina oblonga, Rss.	*vs* RC
Bolivina dilatata, Rss.	*m* C
—— plicata, D'O.	*m* C
—— Triticum, nov.	*s* R
Textularia Candeiana, D'O.	*m* C
—— prælonga, Rss.	*s* RC
—— pectinata, Rss.	*m* RC
Vertebralina inæqualis, Gm.	*vs* C
—— alata, nov.	*vs* C
Spiroloculina alata, nov.	*s* RR
Orbitolites complanatus, Lam.	*vs* RR

* We retain D'ORBIGNY's term *Webbina* for the subtype of *Trochammina* which he named *Webbina irregularis*, with its varieties *W. clavata*, &c.

TABLE X. (continued.)

Additional Genera, Species, and Varieties.	
For Column No. 17.	
Uvigerina aculeata, D'O.	*s* C
Globigerina hirsuta, D'O.	*l* VC
—— helicina, D'O.	*l* VC
Planorbulina ammonoides, Rss.	*m* RC
Pulvinulina excavata, D'O.	*s* R
Bolivina hyalina, nov.	*s* C
—— dilatata, Rss.	*s* RR
Textularia variabilis, Will.	*m* RC
—— Candeiana, D'O.	*m* RR
—— prælonga, Rss.	*m* RC
Spiroloculina alata, nov.	*m* R
For Column No. 18.	
Uvigerina aculeata, D'O.	*s* C
Globigerina hirsuta, D'O.	*l* VC
—— helicina, D'O.	*l* VC
Planorbulina ammonoides, Rss.	*s* R
Bolivina dilatata, Rss.	*s* RR
Textularia Candeiana, D'O.	*m* R
Trochammina charoides, P. & J.	*s* R
Spiroloculina alata, nov.	*m* C
Peneroplis pertusus, Forsk.	*s* R
For Column No. 19.	
Uvigerina aculeata, D'O.	*s* RC
Sagrina Raphanus, P. & J.	*m* RC
Rotalia dentata, P. & J.	*m* VC
—— ornata, D'O.	*m* VC
Planorbulina ammonoides, Rss.	*s* RR
Pulvinulina Auricula, F. & M.	*s* C
—— pulchella, D'O.	*m* C
Polystomella Sagra, D'O.	*m* RC
Bulimina pupoides, D'O.	*s* VC
Bolivina hyalina, nov.	*s* VC
Verneuilina spinulosa, Rss.	*s* R
Textularia variabilis, Will.	*s* RR
Quinqueloculina dilatata, D'O.	*s* R
Peneroplis pertusus, Forsk.	*s* C
For Column No. 20.	
Sagrina Raphanus, P. & J.	*m* RR
Rotalia Schrœteriana, P. & J.	*l* RR
—— annectens, P. & J.	*l* C
Planulina Ariminensis, D'O.	*s* RC
Planorbulina ammonoides, Rss.	*s* RC
Cymbalopora Poeyi, D'O.	*m* RC
Pulvinulina Auricula, F. & M.	*s* RC

Additional Genera, Species, and Varieties.	
Polystomella Sagra, D'O.	*m* VC
—— discoidalis, D'O.	*m* VC
Bolivina Triticum, nov.	*m* RC
Verneuilina spinulosa, Rss.	*m* C
Textularia Candeiana, D'O.	*m* C
Spiroloculina canaliculata, D'O.	*m* RC
Quinqueloculina Sagra, D'O.	*s* RC
—— pulchella, D'O.	*s* RC
Triloculina trigonula, Lam.	*m* RC
For Column No. 21.	
Marginulina tuberosa, D'O.	*s* R
Uvigerina aculeata, D'O.	*l* C
Globigerina helicina, D'O.	*l* VC
Anomalina variolaria, D'O.	*rl* R
Planorbulina Culter, P. & J.	*m* RC
—— Clementiana, D'O.	*rl* R
Pulvinulina crassa, D'O.	*l* VC
—— cuneiformis, nov.	*l* VC
Sphæroidina dehiscens, P. & J.	*vl* VC
Pullenia obliquiloculata, P. & J.	*vl* VC
Cassidulina oblonga, Rss.	*vl* C
—— serrata, Rss.	*l* C
Verneuilina spinulosa, Rss.	*rl* R
Textularia variabilis, Will.	*s* C
For Column No. 22.	
Planulina Ariminensis, D'O.	*m* C
Pulvinulina pulchella, D'O.	*m* C
—— Schreibersii, D'O.	*rl* C
Verneuilina spinulosa, Rss.	*m* RC
Lituola Soldanii, P. & J.	*l* C
For Column No. 23.	
Nodosaria hirsuta, D'O.	*m* C
Uvigerina aculeata, D'O.	*m* C
Sagrina dimorpha, P. & J.	*m* C
Planulina Ariminensis, D'O.	*m* C
Planorbulina ammonoides, Rss.	*m* RC
—— reticulata, Czjzek	*l* C
Pulvinulina crassa, D'O.	*m* C
Pullenia obliquiloculata, P. & J.	*m* RC
—— quinqueloba, Rss.	*s* RC
Bolivina plicata, D'O.	*m* RC
—— dilatata, Rss.	*l* C
—— Triticum, nov.	*s* C
Verneuilina spinulosa, Rss.	*s* R
Gaudryina Badenensis, Rss.	*m* C
Textularia prælonga, Rss.	*m* RC
Trochammina inflata, Montag.	*s* RR

TABLE X. (continued.)

Additional Genera, Species, and Varieties.	
Trochammina charoides, P. & J.	*l* RC
Webbina clavata, P. & J.	*s* R
Quinqueloculina pulchella, D'O.	*s* RR
Biloculina Sphæra, D'O.	*s* RR
For Column No. 24.	
Planulina Ariminensis, D'O.	*s* R
Planorbulina ammonoides, Rss.	*l* RC
Cymbalopora Poeyi, D'O.	*s* C
Pulvinulina crassa, D'O.	*m* RR
Amphistegina vulgaris, D'O.	*s* C
Textularia variabilis, Will.	*s* C
Spiroloculina alata, nov.	*m* C
Quinqueloculina pulchella, D'O.	*s* R
Biloculina contraria, D'O.	*m* R
Vertebralina Cassis, D'O.	*s* R
—— inæqualis, Gm.	*s* C
—— conico-articulata, Batsch.	*s* RR
For Column No. 26.	
Globigerina hirsuta, D'O.	*l* C
—— helicina, D'O.	*l* C
Pulvinulina cuneiformis, nov.	*l* RC
Sphæroidina dehiscens, P. & J.	*vl* VC
Pullenia obliquiloculata, P. & J.	*vl* VC
For Column No. 27.	
Dentalina Acicula, Lam.	*l* R
Vaginulina Badenensis, D'O.	*s* R
Uvigerina aculeata, D'O.	*m* RR
Globigerina hirsuta, D'O.	*m* C
Planorbulina farcta, F. & M.	*m* C
Pulvinulina crassa, D'O.	*m* VC
Cassidulina oblonga, Rss.	*m* C
Bolivina dilatata, Rss.	*m* C
Verneuilina pygmæa, Egger	*m* R
Gaudryina Badenensis, Rss.	*s* R
Textularia variabilis, Will.	*m* RC
For Column No. 28.	
Lagena squamoso-marginata, P. & J.	*m* C
Rotalia ornata, D'O.	*l* C
Planorbulina vulgaris, D'O.	*m* RC
Pulvinulina pulchella, D'O.	*m* RC
—— Auricula, F. & M.	*m* C
Cymbalopora Poeyi, D'O.	*s* RC
—— squamosa, D'O.	*l* R

Additional Genera, Species, and Varieties.	
Calcarina Spengleri, Gm.	*m* RR
Polystomella craticulata, F. & M.	*vl* VC
Amphistegina vulgaris, D'O.	*m* VC
Bulimina convoluta, Will.	*s* R
Bolivina Triticum, nov.	*s* R
—— dilatata, Rss.	*m* R
Verneuilina spinulosa, Rss.	*s* R
Textularia Partschii, Czjzek.	*l* VC
—— Trochus, D'O.	*l* VC
—— Candeiana, D'O.	*l* VC
—— prælonga, Rss.	*vl* C
Valvulina Parisiensis, D'O.	*s* RR
—— angularis, D'O.	*m* C
Tinoporus vesicularis, P. & J.	*m* R
Spiroloculina rugoso-depressa, nov.	*l* C
—— striata, D'O.	*m* RC
Quinqueloculina Sagra, D'O.	*l* VC
—— pulchella, D'O.	*m* VC
—— Inca, D'O.	*l* C
—— rugoso-saxorum, nov.	*l* C
Triloculina trigonula, Lam.	*s* R
Hauerina plicata*, P. & J.	*m* C
—— complanata, nov.	*m* C
Vertebralina Cassis, D'O.	*m* C
—— conico-articulata, Batsch.	*m* C
Alveolina sabulosa, Montf.	*m* C
Alveolina Quoyii, D'O.	*m* C
Orbitolites complanatus, Lam.	*m* VC
Peneroplis pertusus, Forsk.	*l* VC
Dendritina Arbuscula, D'O.	*l* VC
Spirolina Lituus, Gm.	*s* RR
Dactylopora Eruca, P. & J.	*m* R
For Column No. 29.	
Discorbina vesicularis, Lam.	*m* RC
—— Turbo, D'O.	*rl* C
Polystomella craticulata, F. & M.	*m* C
Bolivina plicata, D'O.	*m* RR
Textularia Candeiana, D'O.	*m* C
Valvulina Polystoma†, P. & J.	*m* C
—— Parisiensis, D'O.	*m* C
—— angulosa, D'O.	*m* C
Spiroloculina striata, D'O.	*l* C
Quinqueloculina tricarinata, D'O.	*vl* RC
—— Sagra, D'O.	*l* RC
Triloculina trigonula, Lam.	*s* C
Vertebralina Cassis, D'O.	*rl* C
—— striata, D'O.	*l* VC
—— inæqualis, Gm.	*m* R
Orbitolites complanatus, Lam.	*m* VC
Peneroplis pertusus, Forsk.	*m* VC
Spirolina Lituus, Gm.	*m* RC
Nubecularia lucifuga, Defr.	*m* RC

* CARPENTER's Introd. Foram. pl. 6. fig. 35.

† Ibid. pl. 11. figs. 21 & 24.

TABLE X. (continued.)

Additional Genera, Species, and Varieties.		Additional Genera, Species, and Varieties.	
For Column No. 30.		For Column No. 31.	
Lagena distoma-margaritifera, P. & J.	*l* C	Polymorphina Thouini, D'O.	*m* C
Dentalina brevis, D'O.	*rs* VR	Uvigerina aculeata, D'O.	*vs* R
Vaginulina Badenensis, D'O.	*s* R	Polystomella discoidalis, D'O.	*m* C
Polymorphina Thouini, D'O.	*m* C	Bulimina pupoides, D'O.	*m* C
—— elegantissima, nov.	*m* RC	Bolivina plicata, D'O.	*m* C
Planorbulina vulgaris, D'O.	*vl* VC	—— hyalina, nov.	*m* R
—— ammonoides, Rss.	*s* RR	Textularia variabilis, Will.	*s* RC
Discorbina vesicularis, Lam.	*vl* VC		
—— dimidiata, P. & J.	*vl* VC	For Column No. 32.	
—— biconcava, P. & J.	*s* C		
—— Turbo, D'O.	*vl* VC		
—— Cora, D'O.	*m* R	Calcarina Spengleri, Gm.	*m* C
Polystomella macella, F. & M.	*l* C	—— Defrancii, D'O.	*s* RR
—— strigillata β, F. & M.	*s* RC	Rotalia annectens, P. & J.	*m* C
Textularia variabilis, Will.	*l* RC	—— craticulata, P. & J.	*m* C
—— Folium, P. & J.	*s* RC	Planorbulina farcta, F. & M.	*m* RC
Valvulina Parisiensis, D'O.	*l* C	Cymbalopora Poeyi, D'O.	*m* C
—— angularis, D'O.	*l* C	Discorbina Turbo, D'O.	*m* C
—— mixta*, P. & J.	*l* VC	—— Pileolus, D'O.	*m* RC
—— Polystoma, P. & J.	*l* C	Polystomella craticulata, F. & M.	*m* C
—— triangularis, D'O.	*m* VC	—— macella, F. & M.	*m* C
Patellina annularis, P. & J.	*m* C	Heterostegina depressa, D'O.	*m* C
—— simplex, P. & J.	*s* R	Amphistegina vulgaris, D'O.	*m* C
Spiroculina striata, D'O.	*l* VC	Textularia conica, D'O.	*m* RC
Quinqueloculina tricarinata, D'O.	*vl* RC	Tinoporus lævis, P. & J.	*l* C
—— pulchella, D'O.	*l* C	—— sphærulo-lineatus†, P. & J.	*l* C
—— secans, D'O.	*m* C	Polytrema miniaceum, Esper.	*l* RC
—— dilatata, D'O.	*l* VC	Spiroloculina striata, D'O.	*m* RC
Triloculina striato-trigonula, nov.	*l* VC	Quinqueloculina tricarinata, D'O.	*l* C
Vertebralina striata, D'O.	*l* C	Triloculina reticulata‡, D'O.	*l* RC
Peneroplis pertusus, Forsk.	*l* RC	Peneroplis pertusus, Forsk.	*m* VC
Spirolina Lituus, Gm.	*m* RC	Orbitolites complanatus, Lam.	*vl* VC
		Alveolina Quoyii, D'O.	*vl* VC

In these Tables (VII. & X.) we have materials for a conspectus of nearly all the Foraminiferal Genera (of which few, if any, can be said to have more than one true species), as represented by one form or another, type or subtype, species or variety, in widely distant parts of the world, under very different conditions of climate, depth, and sea-bottom.

It is probable that, in some of the instances tabulated, the smallness of the quantity of sand, clay, or ooze manipulated has limited the catalogue of forms, and therefore that further observation is necessary; nevertheless, the freedom with which some genera range over the globe, whilst others are limited to narrow areas, or rather to special conditions, is readily apparent. Table XI. exemplifies this.

* CARPENTER's Introd. Foram. pl. 11. figs. 19, 20, 25, 26.

† Ibid. pl. 15. fig. 1. ‡ Ibid. pl. 6. fig. 13.

Table XI.—Showing the distribution of the Genera of Foraminifera in Thir

Genera of Foraminifera (represented by species or varieties).	1 Sub-recent. Peterborough Fen, 1 mile from its western boundary (sandy clay).	2 Sub-recent. Peterborough Fen, 2 miles from its western boundary (sandy clay).	3 Sub-recent (clay). Boston, Lincolnshire.	4 Sub-recent (clay). Wisbech, Cambridgeshire (Valley of the Nene).	5 Mouth of Thames, Southend (shallow-water sands).	6 Pegwell Bay, near Margate, Kent (muddy shore-sand).	7 Isle of Arran, N.B. (muddy sands from shallow water).	8 Douglas, Isle of Man (shallow-water sands).	9 Eastbourne, Sussex (mud from shallow water).	10 Colne (tidal) River, Essex (oyster-beds).	11 Greenland (Arctic). See Table IV.	12 Norway (Arctic). See Table IV.	13 North Atlantic, Ireland to Newfoundland, thirty-nine casts, from 43 to 2350 fms. See Table V.	1 Mediterranean. Galita Island, S. 32° W., 32 miles.
Lagena	..	*	*	*	*	*	*	*	*	..	*	*	*	
Nodosarina	..	*	*	..	..	*	*	..	..	..	*	*	*	
Polymorphina	..	*	*	..	..	*	*	*	*	..	*	*	*	
Uvigerina	..	*	..	..	..	..	..	..	..	..	*	*	*	
Orbulina	..	..	..	..	..	..	..	..	..	..	*	*	*	
Spirillina	..	*	..	..	..	..	..	..	..	..	*	*	*	
Globigerina	..	*	..	..	..	..	..	..	..	..	*	*	*	
Pullenia	..	..	..	..	..	..	..	..	..	..	*	*	*	
Sphæroidina	..	..	..	..	..	..	..	..	..	..	*	*	*	
Textularia	..	*	*	*	..	*	*	..	*	*	*	*	*	
Bulimina	..	*	..	*	..	*	..	..	*	*	*	*	*	
Cassidulina	..	..	..	..	..	..	..	..	..	..	*	*	*	
Discorbina	..	*	..	*	..	..	*	..	*	..	*	*	*	
Planorbulina	..	*	*	*	..	..	*	..	*	..	*	*	*	
Pulvinulina	..	*	*	*	..	..	*	*	*	..	*	*	*	
Rotalia	*	*	*	*	*	*	*	*	*	*	*	*	*	
Cymbalopora	..	..	..	..	..	..	..	..	..	..	..	..	..	
Calcarina	..	..	..	..	..	..	..	..	..	..	..	..	..	
Tinoporus	..	..	..	..	..	..	*	..	..	..	..	..	..	
Patellina	..	*	..	..	..	..	..	..	..	..	*	..	..	
Polytrema	..	..	..	..	..	..	..	..	..	..	..	..	..	
Amphistegina	..	..	..	..	..	..	..	..	..	..	..	..	..	
Nummulina	..	..	..	..	..	..	..	..	..	..	*	*	*	
Polystomella	*	*	*	*	*	*	*	*	*	*	*	*	*	
Heterostegina	..	..	..	..	..	..	..	..	..	..	..	..	..	
Valvulina	..	..	..	..	..	..	..	..	..	..	..	*	..	
Lituola	*	*	..	..	..	*	..	..	..	*	*	*	*	
Trochammina	*	*	..	..	..	*	..	*	*	*	*	..	..	
Cornuspira	..	*	*	*	..	..	..	*	*	*	*	..	..	
Nubecularia	..	..	..	..	..	..	..	..	..	..	..	..	..	
Vertebralina	..	..	..	..	..	..	..	..	..	..	..	..	..	
Miliola	*	*	*	*	*	*	*	*	*	*	*	*	*	
Peneroplis	..	..	..	..	..	..	..	..	..	..	..	..	..	
Alveolina	..	..	..	..	..	..	..	..	..	..	..	..	..	
Orbitolites	..	..	..	..	..	..	..	..	..	..	..	..	..	
Dactylopora	..	..	..	..	..	..	..	..	..	..	..	..	..	
	1	2	3	4	5	6	7	8	9	10	11	12	13	1

IN THIRTY-TWO GATHERINGS FROM THE ATLANTIC, MEDITERRANEAN, RED SEA, INDIAN OCEAN, AND PACIFIC.

13	North Atlantic, Ireland to Newfoundland, thirty-nine casts, from 43 to 2350 fms. See Table V.	13
14	Mediterranean. Galita Island, S. 32° W., 32 miles. Lat. 38° 00′ N., Long. 9° 13′ E., 320 fms.	14
15	Red Sea. Gulf of Suez (muddy, shelly sand). 30 fms. Lat. 28° 38′ N., Long. 33° 9′ E.	15
16	Red Sea, close to Island Shadwan, off S.E. point, entrance of Jubal Strait, 372 fms. (light-yellow clay).	16
17	Red Sea, 557 fms. Lat. 17° 49′ N., Long. 40° 2′ E. (various-coloured mud).	17
18	Red Sea, 678 fms. Lat. 23° 30′ N., Long. 36° 58′ E. (pale clay).	18
19	Black Anchor-mud, Bombay Harbour.	19
20	Dark Anchor-mud, Hong Kong, 8 or 9 fms.	20
21	Tropical Atlantic, 1080 fms. Lat. 2° 20′ N., Long. 28° 44′ W. (almost entirely organic).	21
22	South Atlantic, Abrolhos Bank, 47 fms. Lat. 23° 02′ S., Long. 41° 02′ W. (sand).	22
23	South Atlantic, Abrolhos Bank, 260 fms. Lat. 22° 54′ S., Long. 40° 37′, W. (dark mud).	23
24	South Atlantic, Abrolhos Bank, 940 fms. Lat. 19° 32′ S., Long. 37° 51½′ W. (whitish mud).	24
25	South Atlantic, 2700 fms. Lat. 26° 45′ S. Long. 32° 52′ W. (pale mud).	25
26	Indian Ocean, 2200 fms. Lat. 5° 37′ S., Long. 61° 33′ E. (fine white calcareous mud, with Polycystineæ).	26
27	Indian Ocean, two casts near each other, 900 and 1120 fms. Lat. 36° 58′, Long. 51° 49′ E. (pale mud.)	27
28	Australia, Coral-reef, 17 fms. (white shelly mud).	28
29	Swan River, Australia, 7 or 8 fms. (white shelly mud).	29

PACIFIC.

29	30	31	32
Swan River, Australia, 7 or 8 fms. (white shelly mud).	Melbourne, Australia, Coast-sand (coarse quartz sand, full of shells, zoophytes, sponges, and algæ).	Black Anchor-mud, Hobson's Bay, Australia.	Fiji, coral-reef, and adherent to a hydroid polype.
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*	. .	. .	*
29	30	31	32

APPENDIX VII.—*The North-Atlantic Soundings.*

Owing to our having taken the positions of the soundings from the MS. labels, we find in some instances discrepancies as to the depths and positions given in the published Report, arising probably from corrections of the observations in some cases, and from errors of copying and printing in others. Some, also, of our specimens are not noted in the Report, as, for instance, Nos. 15, 25, 31, 34, 35, & 36; and Nos. 4 & 33 can be only doubtfully recognized. No. 21 (80) has 1405 instead of 1450 fathoms; No. 26 (22) has 2250 instead of 1660 fathoms; and No. 28 (86) has 2050 instead of 1950 fathoms; and there are minor discrepancies of depth and position, as the annexed Table indicates. These we point out now, to save any waste of labour to those who wish to verify our work.

In consequence of the differences in some of the manuscript and printed positions, the vertical lines drawn over the reduced copy of Commander DAYMAN'S Chart (Plate XII.) are often merely approximative; and the Section of the Sea-bed is not quite correct at Soundings No. 21 (80) & 26 (22).

TABLE XII.—The Thirty-nine Soundings described in the foregoing Memoir; with their positions and depths, as indicated by the MS. Labels and by the printed Report.

Nos. in Table V.	From the Labels.			From the Admiralty Report.					Remarks.
	Nos.*	Fms.	Lat. N. & Long. W.	Nos.*	Fms.	Lat. N. & Long. W.	Materials †.	Page.	
1	53	195	Lt. 48° 0′ 30″ Ln. 53 27 35	..	195	Lt. 48° 0′ 30″ Ln. 53 27 45	Mud.	56	
2	49	129	Lt. 48 0 10 Ln. 53 26 36	..	129	Lt. 48 8 10 Ln. 53 22 36	Stones, mud.	56	
3	47	190	Lt. 48 9 0 Ln. 53 15 0	..	190	Lt. 48 9 5 Ln. 53 15 0	Mud.	56	
4	39	124	Lt. 48 15 30 Ln. 53 13 0	?	125	Lt. 48 15 15 Ln. 53 9 0	Blue mud.	56	Possibly the same Soundings.
5	45	150	Lt. 48 9 45 Ln. 53 10 50	..	150	Lt. 48 9 54 Ln. 53 10 50	Blue mud.	56	
6	41	129	Lt. 48 11 0 Ln. 53 7 50	..	129	Lt. 48 12 0 Ln. 53 7 55	Mud.	56	
7	61	167	Lt. 48 14 22 Ln. 53 1 0	..	167	Lt. 48 14 22 Ln. 53 1 0	Dark mud.	56	
8	59	133	Lt. 48 18 0 Ln. 52 56 0	..	133	Lt. 48 17 55 Ln. 52 45 50	Dark mud.	56	
9	55	112	Lt. 48 21 0 Ln. 52 44 0	..	112	Lt. 48 21 0 Ln. 52 42 40	Mud, stones.	56	
10	65	102	Lt. 48 28 30 Ln. 52 19 30	..	102	Lt. 48 28 30 Ln. 52 19 30	Stone, clay.	56	
11	69	146	Lt. 48 40 0 Ln. 51 45 0	..	146	Lt. 48 40 0 Ln. 51 45 0	Mud, stone.	56	
12	63	145	Lt. 47 57 20 Ln. 51 31 30	..	145	Lt. 47 57 20 Ln. 53 31 30	Mud.	56	
13	73	161	Lt. 49 0 0 Ln. 50 48 30	..	161	Lt. 49 0 0 Ln. 50 48 30	Mud.	56	

* These numbers refer to the compartments of the box containing the specimens. † See also Table VI.

TABLE XII. (continued).

Nos. in Table V.	From the Labels.			From the Admiralty Report.					Remarks.
	Nos.*	Fms.	Lat. N. & Long. W.	Nos.*	Fms.	Lat. N. & Long. W.	Materials †.	Page.	
14	33	405	Lt. 49° 2′ 0″ Ln. 50 14 30	..	405	Lt. 49° 5′ 0″ Ln. 53 3 0	Mud.	55 & 59	
15	77	221	Lt. 49 23 30 Ln. 49 55 0						
16	78	329	Lt. 49 26 0 Ln. 49 48 0	..	330	Lt. 49 25 0 Ln. 49 48 0	Sand, mud.	55 & 59	331 fathoms, at p. 59.
17	32	740	Lt. 49 16 30 Ln. 49 17 0	32	742	Lt. 49 12 0 Ln. 49 35 0	Mud.	54 & 59	
18	79	725	Lt. 49 18 0 Ln. 49 12 0	79	725	Lt. 49 18 0 Ln. 49 12 0	Mud, with a Worm.	53 & 59	
19	31	954	Lt. 49 23 0 Ln. 48 48 0	..	954	Lt. 49 24 0 Ln. 48 48 0	Ooze ‡.	59	Our specimen of this Sound was a sandy mud. See TABLE VI.
20	30	1203	Lt. 49 33 0 Ln. 48 5 0	30	1203	Lt. 49 32 0 Ln. 48 4 0	Blue mud, with "remains of Bones, &c."	51 & 59	Lat. 49° 32′ 30″, at p. 59.
21	80	1450	Lt. 50 6 0 Ln. 45 45 0	80	1405	Lt. 50 6 0 Ln. 45 45 0	Ooze, "full of Foraminifera, when seen in the Microscope."	47 & 59	Lat. 50° 6′ 30″, at p. 59.
22	26	2330	Lt. 50 25 0 Ln. 44 19 0	26	2330	Lt. 50 25 0 Ln. 44 19 0	Ooze.	44 & 59	
23	25	2250	Lt. 50 46 0 Ln. 42 20 0	25	2050	Lt. 50 49 0 Ln. 42 26 0	Ooze, with Foraminifera.	42 & 59	
24	19	2035	Lt. 52 11 0 Ln. 31 29 0	19	2030	Lt. 52 11 0 Ln. 31 27 0	Ooze.	29 & 58	2030 fms. is the *corrected* depth. Long. 31° 27′ 30″, at p. 58.
25	81	2350	Lt. 51 29 0 Ln. 38 1 0	..	....	.....	.....	....	Compare No. 26 (22).
26	22	1660	Lt. 51 30 0 Ln. 38 0 0	22	2250	Lt. 51 29 0 Ln. 38 0 0	Ooze.	37 & 58	Compare No. 25, 2350 fathoms.
27	85	2176	Lt. 52 16 30 Ln. 29 28 30	85	2176	Lt. 52 16 30 Ln. 29 28 0	Ooze.	27 & 58	Long. 29° 28′ 30″, at p. 58.
28	86	1950	Lt. 52 25 0 Ln. 28 10 0	86	2050	Lt. 52 26 0 Ln. 28 10 0	Ooze.	26 & 58	
29	15	1776	Lt. 52 33 30 Ln. 21 16 0	15	1800?	Lt. 52 46 0 Ln. 21 20 0	Ooze, with Foraminifera and Diatomaceæ.	21 & 58	
30	90	2050	Lt. 52 16 0 Ln. 16 46 0	90	2050	Lt. 52 16 30 Ln. 16 46 0	Ooze.	16 & 58	
31	13	2050	Lt. 52 16 0 Ln. 16 42 0	..	....	.....	.....	....	Compare No. 30 (90), 2050 fms.
32	12	1750	Lt. 52 21 30 Ln. 15 6 0	12	1750	Lt. 52 21 30 Ln. 15 6 0	Ooze.	14 & 58	Lat. 52° 21′ 40″, at p. 58.
33	93	200	Lt. 52 16 0 Ln. 14 30 0	?	240	Lt. 52 17 0 Ln. 14 30 0	Fine sand.	13 & 58	Possibly the same Soundings.
34	95	223	Lt. 52 11 0 Ln. 13 45 0						
35	98	415	Lt. 52 8 30 Ln. 12 31 0	....		.....	.....	....	Not noticed, but intermediate to others mentioned at pp. 13 & 58.
36	7	338	Lt. 52 0 30 Ln. 12 7 30						
37	99	90	Lt. 52 1 0 Ln. 11 14 40	..	90	Lt. 52 1 0 Ln. 11 15 0	Sand.	13 & 58	Long. 11° 14′ 40″, at p. 58.
38	100	78	Lt. 51 59 0 Ln. 11 0 0	..	78	Lt. 51 59 0 Ln. 11 0 0	Fine sand.	13 & 58	
39	102	43	Lt. 51 57 0 Ln. 10 30 30	..	43	Lt. 51 57 0 Ln. 10 30 0	Fine sand.	13 & 58	

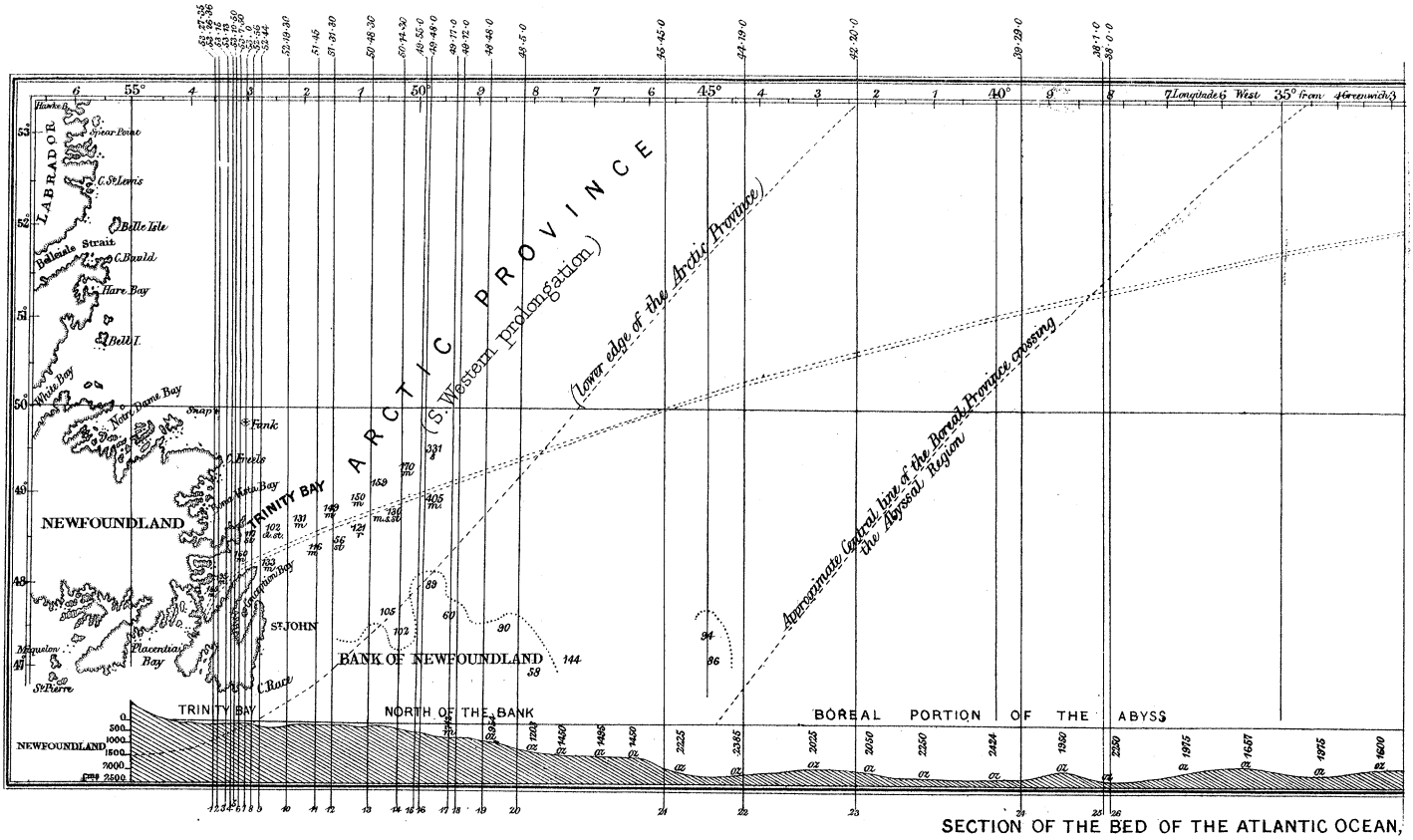
* These numbers refer to the compartments of the box containing the specimens. † See also Table VI.

‡ Described as "a light-coloured fine mud;" "a soft mealy substance;" "sticky."

In one of the above-mentioned Soundings from the Abyssal ooze-floor of the North-Atlantic (Nos. 19–32), Commander DAYMAN observed "remains of bones" (No. 20); and other rare extraneous objects were noticed by him in some of the deep soundings not included in the foregoing Table. As the presence of Molluscan Shells and of stones at such depths, and so far from land, are of great interest, we append an abstract of such occurrences.

Nos.*	Fms.	Lat. N. & Lon. W.	Materials.	Report, page.	Remarks.
103	1950	Lat. 52° 37′ Long. 17 39	One small stone.	17 & 58	
88	2100	Lat. 52 30 Long. 19 10	Ooze, full of Foraminifera and Diatomaceæ.	19 & 58	
87	2400	Lat. 52 29 Long. 26 14	Ooze.	25 & 58	The deepest sounding showing bottom: but a deeper (2424 fms.) was exactly measured Lat. 51°9′ N., Long. 40° 3′ W.
18	1675	Lat. 52 14 Long. 30 45	Broken Shells.	9, 28, 58	1765 fathoms, at p. 9.
	1600	Lat. 51 52 Long. 33 21	Two small stones.	9, 31, 32, 58	Marked "oz." on the Chart by mistake.
27	2225	Lat. 50 14 Long. 45 23	Ooze and stones.	46 & 59	
28	1450	Lat. 50 9 Long. 46 15	Ooze and stones.	49 & 59	
29	1495	Lat. 49 47 Long. 46 52	All stones, at p. 50.	50 & 59	Lat. 49° 47′ 30″ Long. 41 51 0 } and Ooze, at p. 59.

* In the box of specimens.



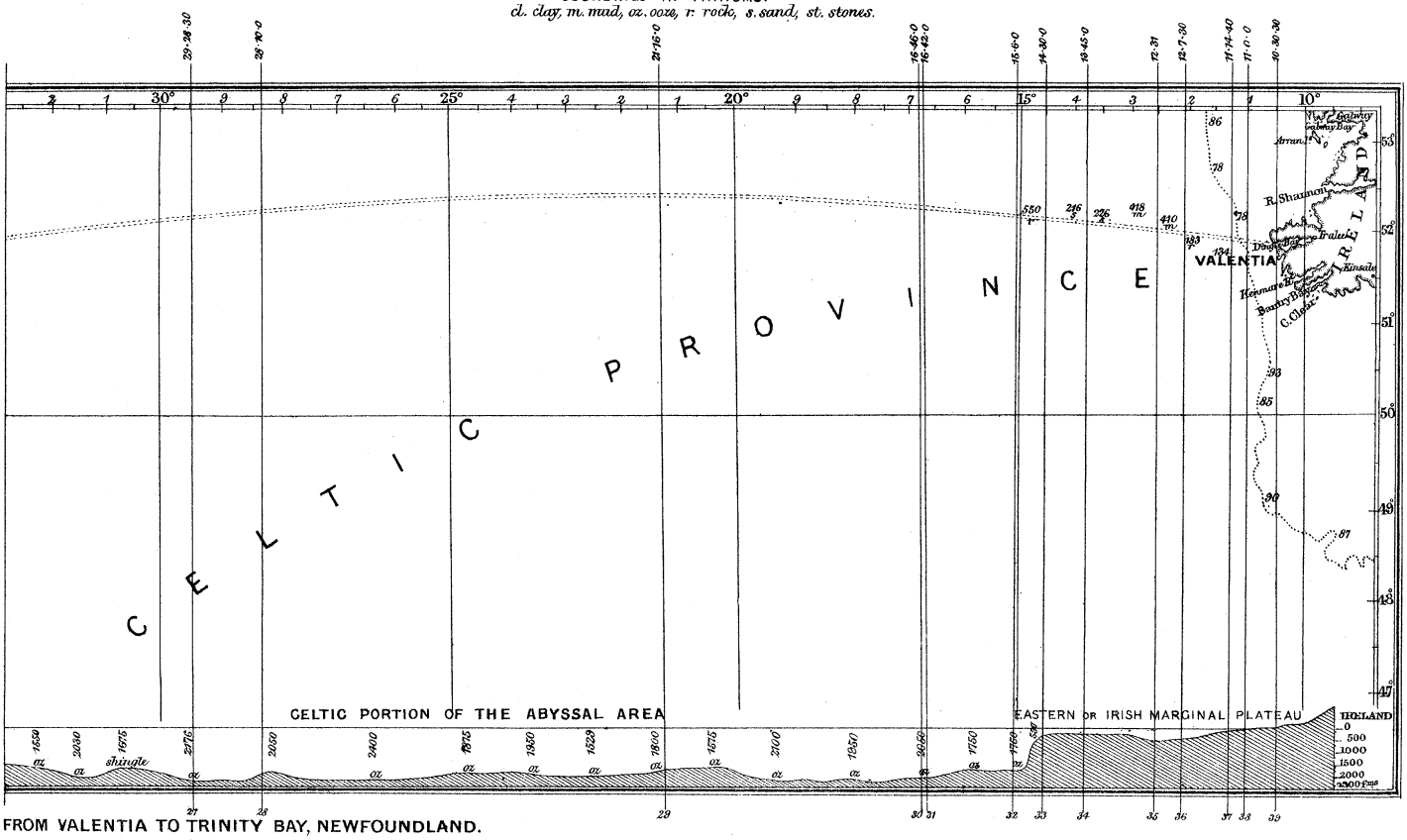
SECTION OF THE BED OF THE ATLANTIC OCEAN,

DEEP-SEA-SOUNDINGS, IN THE NORTH ATLANTIC, FROM IRELAND TO NEWFOUNDLAND,

By Lieut. J. Dayman, R.N. *assisted by Mr. J. Scott, Mast. R.N.* H.M.S. Cyclops, 1857.

SOUNDINGS IN FATHOMS.

cl. clay, m. mud, oz. ooze, r. rock, s. sand, st. stones.

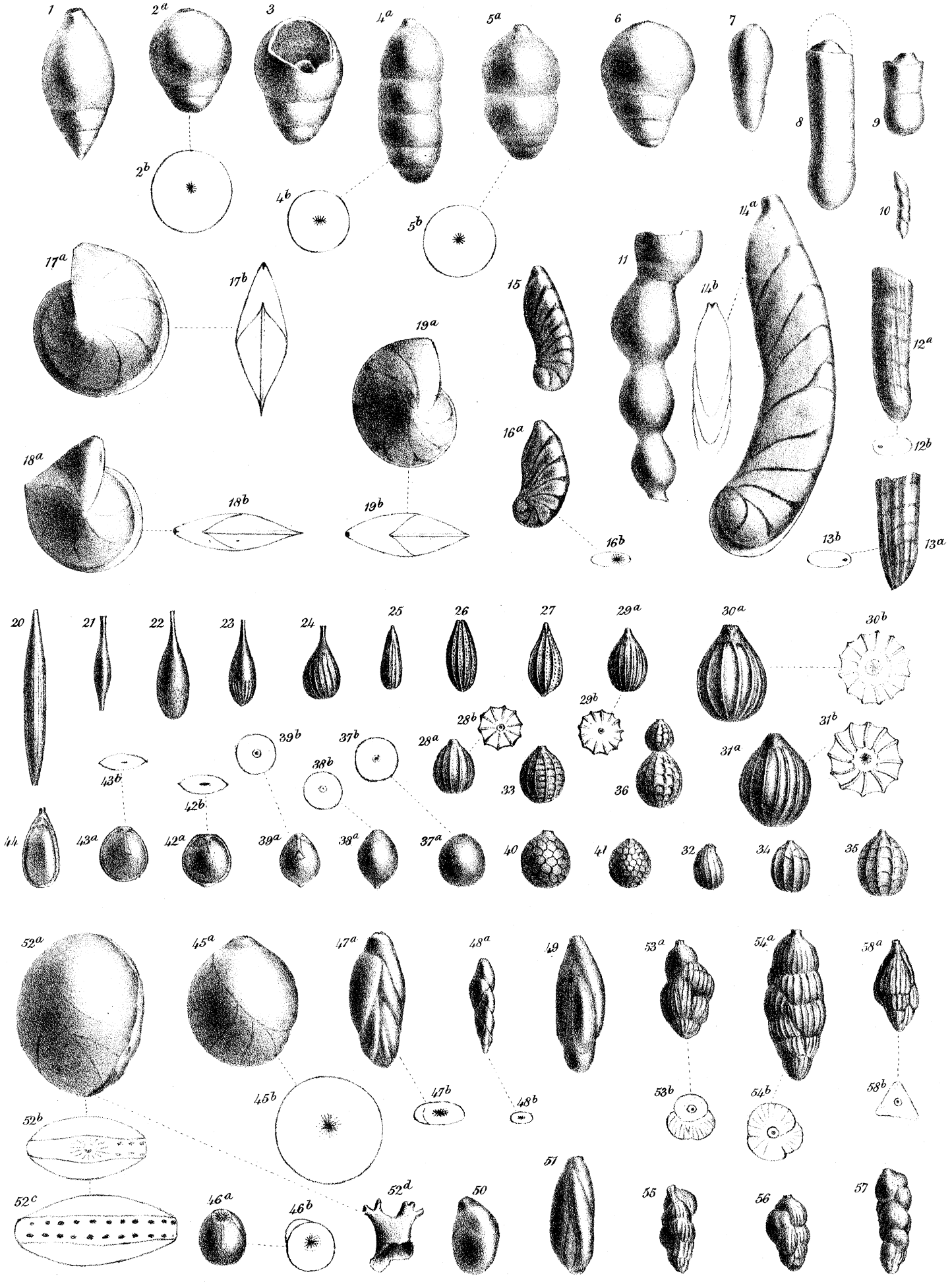


FROM VALENTIA TO TRINITY BAY, NEWFOUNDLAND.

N.B. The vertical lines numbered 1–39, & bearing measures of Longitude, cross the Spots where the 39 Soundings were taken.

Vertical Scale. 2,000 fms 1 Inch. Scales as 15 to 1.

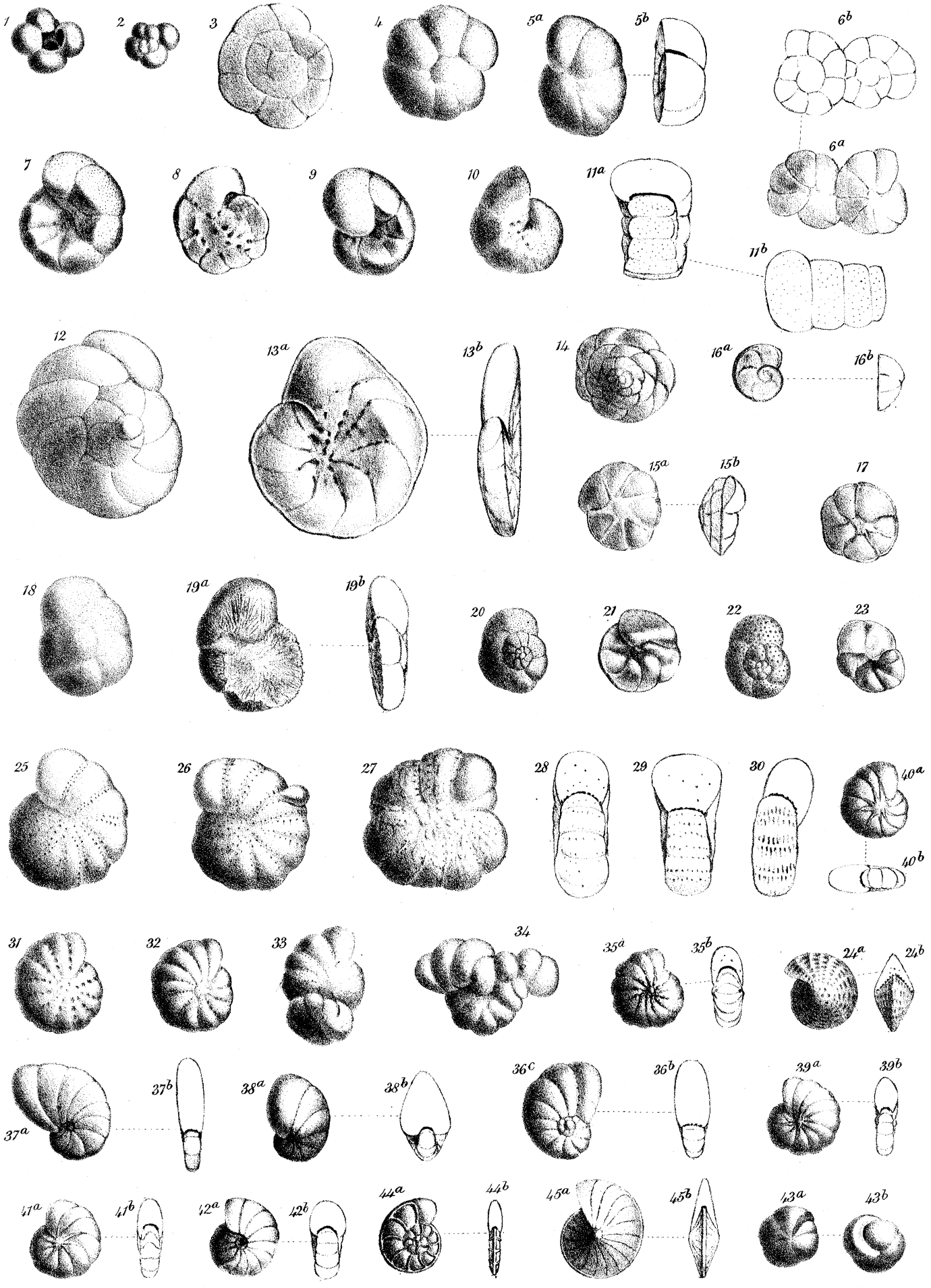
J. Basire lith.



G. West. del.

W. West imp.

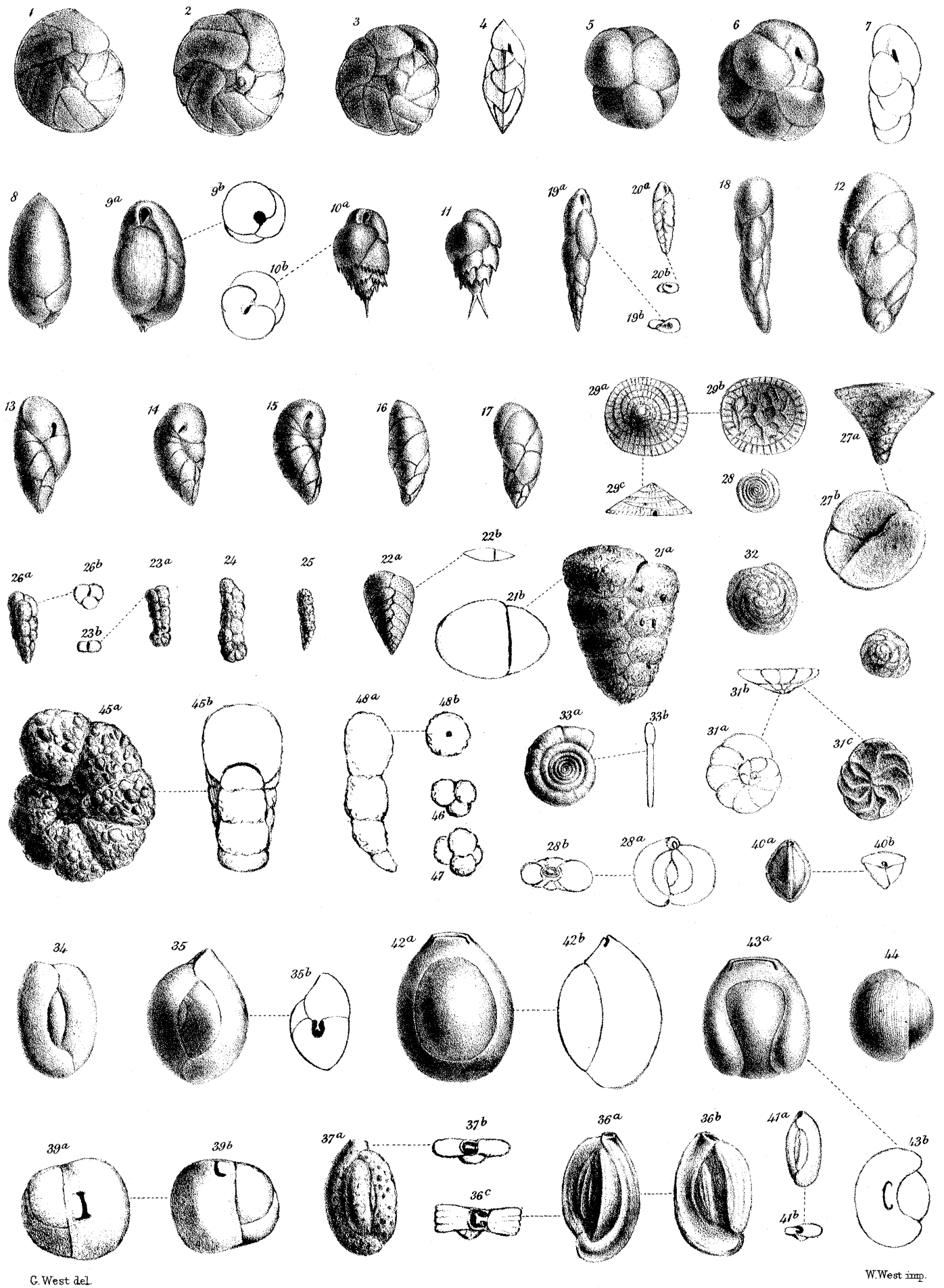
ARCTIC FORAMINIFERA.



G. West del.

W. West imp.

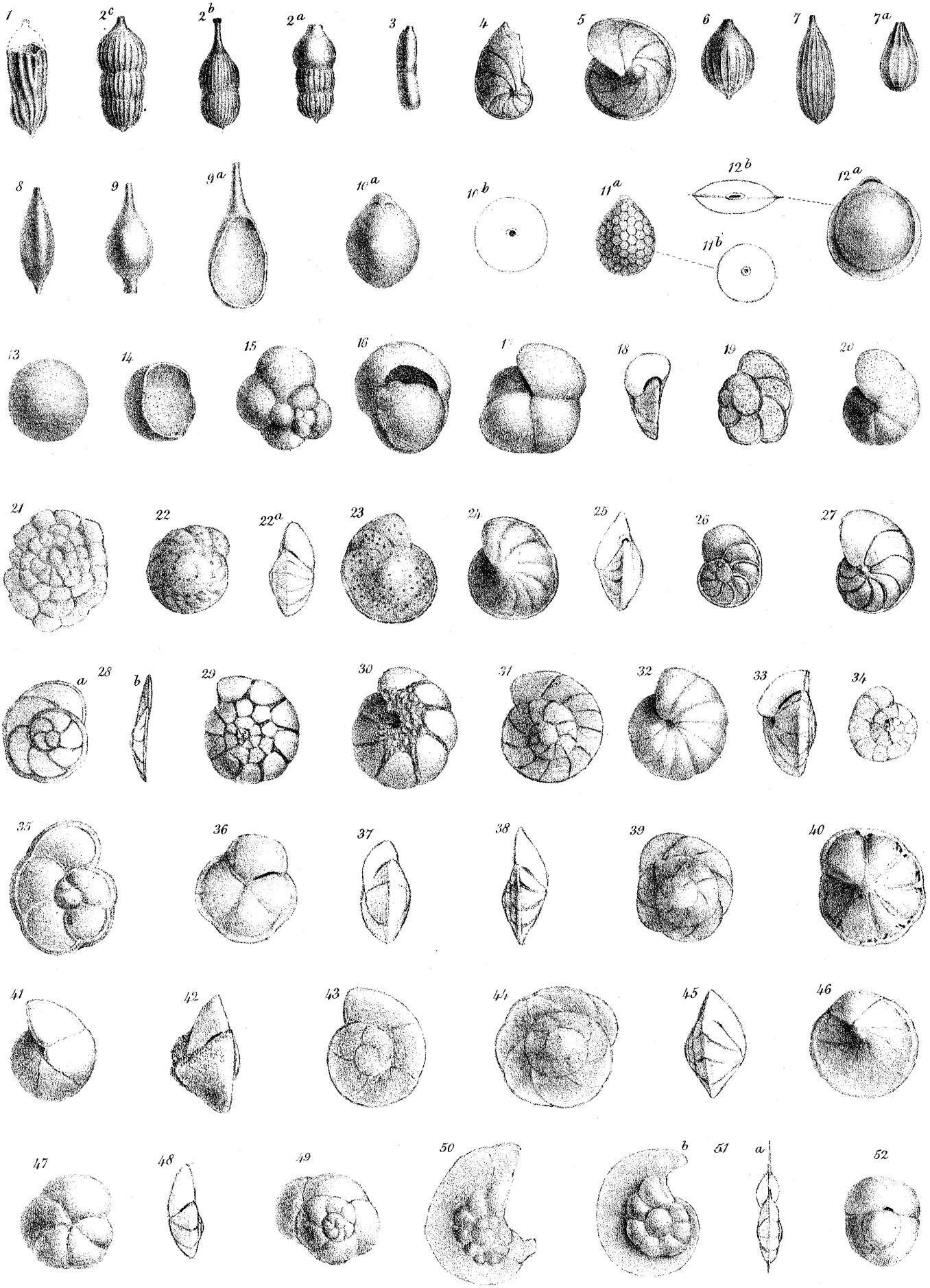
ARCTIC FORAMINIFERA.



C. West del.

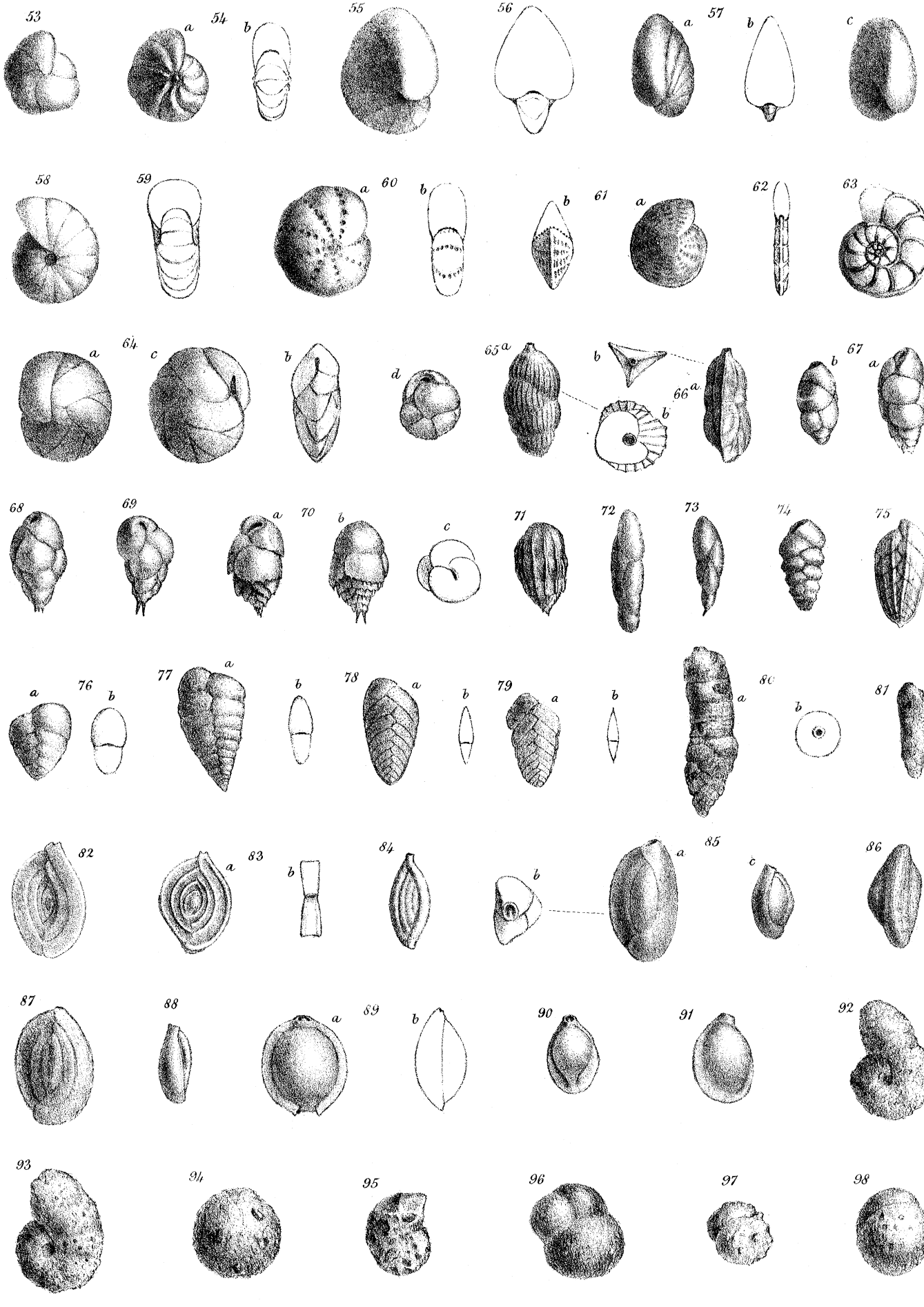
W. West imp.

ARCTIC FORAMINIFERA.



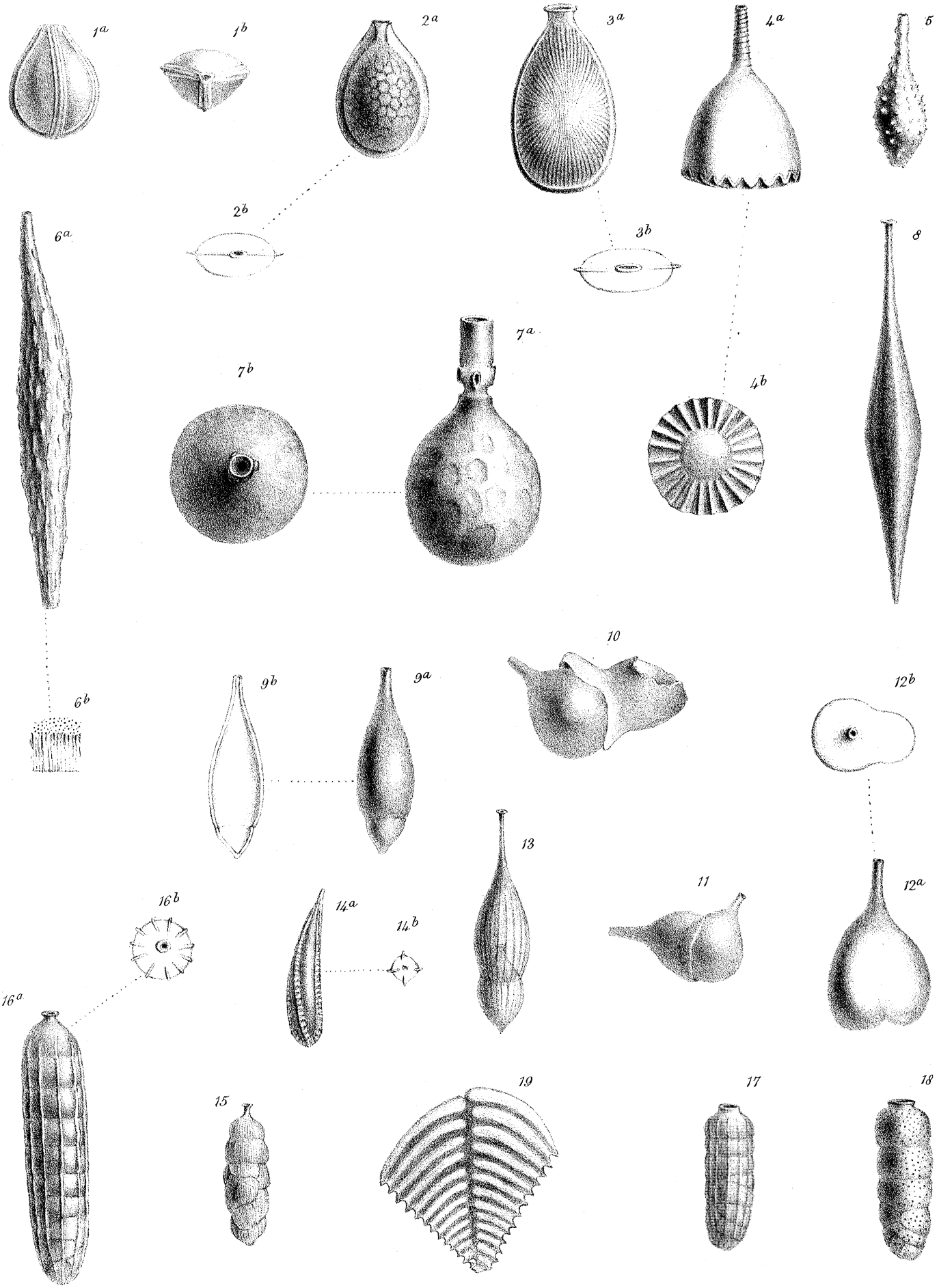
G. West del.

NORTH-ATLANTIC FORAMINIFERA.



C. West del.

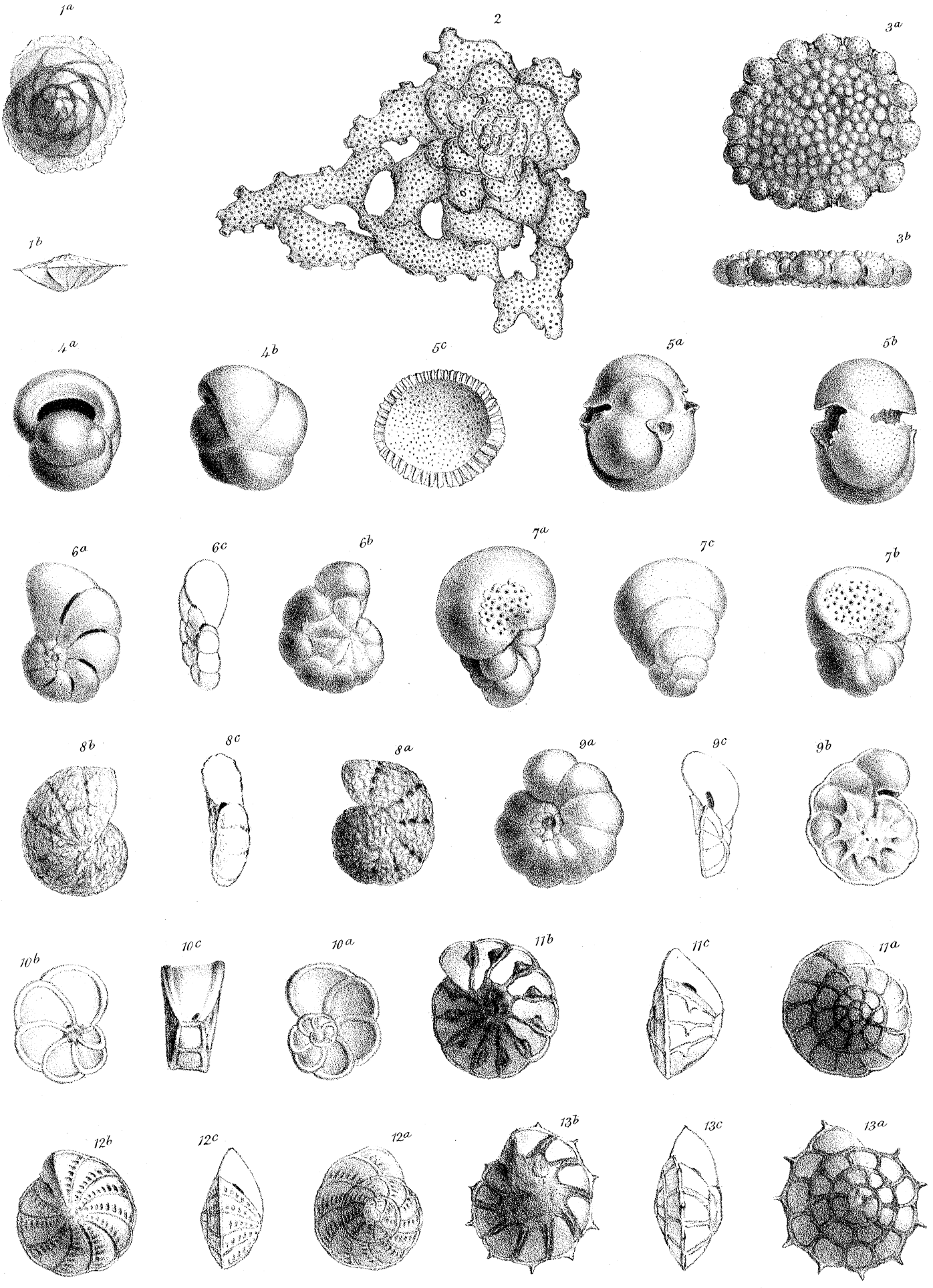
NORTH-ATLANTIC FORAMINIFERA.



C. West del.

W. West imp

FORAMINIFERA



G. West del.

W. West imp.

FORAMINIFERA.

TABLE IV.—Distribution of Foraminifera in the Arctic Ocean, off the Coasts of Greenland and Norway.

rl. Rather large. *l.* Large. *vl.* Very large. *m.* Middle-sized. *s.* Small. *vs.* Very small. VC. Very common. C. Common. RC. Rather common. RR. Rather rare. R. Rare. VR. Very rare.

Genera, Species, and Varieties.	1 Hunde Islands, Davis Straits, 25 to 30 fms.	2 Hunde Islands, Davis Straits, 28 to 30 fms.	3 Hunde Islands, Davis Straits, 30 to 40 fms.	4 Hunde Islands, Davis Straits, 50 to 70 fms.	5 Hunde Islands, Davis Straits, 60 to 70 fms.	6 Baffin's Bay, No. 1. Lat. 75° 10′ N., Long. 60° 12′ W.	7 Baffin's Bay, No. 2, 150 fms. Lat. 76° 30′ N., Long. 77° 52′ W.	8 Baffin's Bay, No. 3, 250 fms. Lat. 74° 45′ N., Long. 59° 17′ W.	9 Baffin's Bay, No. 4, 314 fms. Lat. 75° 25′ N., Long. 60° W.	10 Baffin's Bay, No. 5. Lat. 76° 20′ N., Long. 76° 27′ W.	11 Baffin's Bay, No. 6, 220 fms. Lat. 75° N., Long. 59° 40′ W.	12 Baffin's Bay, No. 7. Sand from an Iceberg. Lat. 76° 10′ N., Long. 76° W.	13 Norway, No. 1, 30 fms. East of Rolfs Oe, or Bred Sound, Finmark.	14 Norway, No. 2, 40 fms. Omnoes Oe, Nordland.	15 Norway, No. 3, 60 fms. West Fjord, Nordland.	16 Norway, No. 4, 70 to 100 fms. Bodoe, Nordland.	17 Norway, No. 5, 100 fms. Vigten Island (Inner Passage), Drontheim.	18 Norway, No. 6, 150 fms. Finmark.	19 Norway, No. 7, 160 fms. Arctic Circle, Nordland.	20 Norway, No. 8, 30 to 200 fms. Var. loc. between Drontheim and N. Cape.
Glandulina lævigata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*l* C	
Nodosaria Radicula, Linn.	..	..	*rl* R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*l* C	
Dentalina pauperata, D'O.	..	..	..	..	*m* R	*m* R														
—— communis, D'O.	..	..	..	..	*l* R	*l* R	..	..	..	..	..	..	..	..	..	..	..	..	..	*vs* VR
—— guttifera, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*l* R	..	..	..	*l* R	
Vaginulina linearis, Montag. ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* RC
Marginulina Lituus, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*vl* C	
Cristellaria Crepidula, F. & M. ..	..	..	*s* C	..	*s* C															
—— cultrata, Montf.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*l* C	
—— rotulata, Lam.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*l* C	
Lagena distoma, P. & J.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*l* RC
—— polita, P. & J.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* RC
—— lævis, Montag.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* R
—— semistriata, Will.	..	..	..	*m* RC																
—— striatopunctata, P. & J. ..	..	..	*l* RC																	
—— sulcata, W. & J.	..	..	*l* C	*m* C	*vl* VC	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* RC
—— Melo, D'O.	..	..	*m* C	*m* C	*m* C	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* RC
—— globosa, Montag.	..	..	*m* C	..	*m* C	*l* R														
—— caudata, D'O.	..	..	*s* R																	
—— squamosa, Montag.	..	..	..	*s* RC	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* RC
—— marginata, Montag.	..	..	*m* C	*m* C	*m* C	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* RC
Polymorphina lactea, W. & J. ..	*s* C	..	..	*s* RC	*s* C	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* RC
—— compressa, D'O.	..	..	*s* R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* RC
—— tubulosa, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* R	..	..	..	..	..	*m* R
Uvigerina pygmæa, D'O.	..	..	*s* C	*s* RC	*s* C	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* C
—— angulosa, Will.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* C
Globigerina bulloides, D'O.	..	*s* RR	*vs* C	..	*s* RC	..	*vs* R	..	..	..	..	..	..	..	..	..	..	..	..	*s* RR
Truncatulina lobatula, W. & J. ..	*s* C	*l* VC	*l* C	*l* C	*l* C	*m* C	*m* C	..	..	..	*s* RC	..	*l* C	*l* C	*l* C	*l* C	..	*l* C	*l* C	*m* C
Anomalina coronata, P. & J.	..	..	..	..	..	..	..	..	..	..	..	..	*l* C	*l* C	..	*l* C	..	..	*l* C	*m* C
Pulvinulina punctulata, D'O. ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*vl* R	..	*vl* C			
—— Karsteni, Reuss	*s* R	*s* RC	*m* VC	*s* C	*m* C	..	*s* RC													
—— Micheliniana, D'O.	*s* R																			
Discorbina obtusa, D'O.	..	*l* R	*l* RC	..	*l* C															
—— globularis, D'O.	..	..	*s* RC	*s* C	*m* C	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* C
Polystomella crispa, Linn.	*s* R																			
—— striatopunctata, F. & M. ..	*m* C	*m* C	*m* VC	*m* C	*m* VC	*vs* R	*m* C	..	..	..	*vs* VR	..	..	..	..	..	..	..	..	*s* RR
—— Arctica, P. & J.	*m* C	*l* C	*l* C	*l* C	*l* C															
Nonionina asterizans, F. & M. ..	*s* C																			
—— Faba, F. & M.	*m* RR	..	*l* RC	..	*l* C															
—— Scapha, F. & M.	*m* C	..	*l* C	*m* RC	*l* C	*m* R	*m* VC													
—— depressula, W. & J.	*s* C	*s* C	..	*s* C	*m* C															
—— stelligera, D'O.	*s* C	*s* C	*s* C	*s* C	*s* C	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* C
—— umbilicatula, Montag.	..	..	..	..	..	..	..	..	..	..	*m* R	..	..	..	..	..	..	..	..	*m* VC
Pullenia sphæroides, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*vs* RC
Nummulina planulata, Lam.	*s* RC																			
Operculina ammonoides, Gronov.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* VC
Cassidulina lævigata, D'O.	*m* VC	*m* VC	*m* VC	*m* C	*m* VC	*m* R	*m* C	..	..	..	..	..	..	..	..	..	..	..	..	*s* C
—— crassa, D'O.	..	*s* C	*m* C	*s* C	*s* C	..	*s* C													
Bulimina Pyrula, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.	..	*l* C
—— aculeata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* C
—— elegantissima, D'O.	*m* R	..	*l* C	..	*l* C															
Virgulina Schreibersii, Czjzek ..	..	..	*l* R																	
—— squamosa, D'O.	..	..	*s* R	..	*s* R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*l* R
Textularia agglutinans, D'O.	*s* RC	..	*s* R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* RC
—— pygmæa, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*m* C
—— biformis, P. & J.	..	..	..	..	*s* C															
Bigenerina Nodosaria, D'O.	..	..	..	..	*s* C															
Verneuilina polystropha, Reuss	*s* C	..	*s* C	..	*s* VC															
Valvulina conica, P. & J.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* R
Spirillina vivipara, Ehrenb.	..	..	..	..	*s* R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*s* R
Patellina corrugata, Will.	..	..	*s* C	*s* RC	*s* C															
Trochammina squamata, P. & J.	..	..	*s* R	..	*s* C															
—— gordialis, P. & J.	..	..	..	..	*s* C															
Cornuspira foliacea, Phil.	*m* C	..	..	..	*s* C															
Quinqueloculina Seminulum, Linn.	*s* C	*m* C	*s* C	*s* C	*m* C	*vs* R	..	..	..	..	*s* R	..	*l* C	*l* C	*l* C	*l* C	..	*l* C	*l* C	*m* C
—— Ferussacii, D'O.	..	..	*m* C	..	*m* C															
—— agglutinans, D'O.	..	..	*m* R	..	*m* C	*m* R														
—— subrotunda, Montag.	..	..	..	..	*s* C															
Triloculina cryptella, D'O.	..	..	..	..	..	..	..	..	*m* C											
—— tricarinata, D'O.	*s* C	..	..	..	*s* R															
—— oblonga, Montag.	*s* C																			
Biloculina ringens, Lam.	..	..	..	..	..	..	..	..	..	..	..	..	*l* C	..	..	*l* C	..	..	*l* C	
Lituola Canariensis, D'O.	*l* VC	*l* R	*l* C	*s* C	*l* VC	*m* C	*vl* C	..	*m* C	..	*s* R	..	*l* R	..	..	..	..	..	..	*s* RC
—— globigeriniformis, P. & J. .	..	..	*s* C	*s* RC	*s* RC	*s* C	..	..	*s* R	..	*s* R									
—— Scorpiurus, Montf.	*l* C	..	*l* C	..	..	*m* C	*vl* RC													

TABLE V.—Table showing the presence of Foraminifera in 39 specimens of sea-bottom from the North Atlantic (Dayman's Soundings); also their abundance or rarity, and their relative size. [See Appendix VIII.]

vl. Very large. *l.* Large. *m.* Middle-sized. *rs.* Rather small. *s.* Small. *vs.* Very small. VC. Very common. C. Common. RC. Rather common. RR. Rather rare. R. Rare. VR. Very rare.

Typical Species.	Genera, Species, and Varieties.	Arctic Province (Trinity Bay).									Arctic (North of Newfoundland Bank).											Boreal (Abyssal).						Celtic (Abyssal).						Celtic (Marginal).						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
		Lat. 48° 0′ 30″ N. Long. 53° 27′ 35″ W.	Lat. 48° 0′ 10″ N. Long. 53° 26′ 36″ W.	Lat. 48° 9′ N. Long. 53° 15′ W.	Lat. 48° 15′ 30″ N. Long. 53° 13′ W.	Lat. 48° 9′ 45″ N. Long. 53° 10′ 50″ W.	Lat. 48° 11′ N. Long. 53° 7′ 50″ W.	Lat. 48° 14′ 22″ N. Long. 53° 1′ W.	Lat. 48° 18′ N. Long. 52° 56′ W.	Lat. 48° 21′ N. Long. 52° 44′ W.	Lat. 48° 28′ 30″ N. Long. 52° 19′ 30″ W.	Lat. 48° 40′ N. Long. 51° 45′ W.	Lat. 47° 57′ 20″ N. Long. 51° 31′ 30″ W.	Lat. 49° N. Long. 50° 48′ 30″ W.	Lat. 49° 2′ N. Long. 50° 14′ 30″ W.	Lat. 49° 23′ 30″ N. Long. 49° 55′ W.	Lat. 49° 26′ N. Long. 49° 48′ W.	Lat. 49° 16′ 30″ N. Long. 49° 17′ W.	Lat. 49° 18′ N. Long. 49° 12′ W.	Lat. 49° 23′ N. Long. 48° 48′ W.	Lat. 49° 33′ N. Long. 48° 5′ W.	Lat. 50° 6′ N. Long. 45° 45′ W.	Lat. 50° 25′ N. Long. 44° 19′ W.	Lat. 50° 46′ N. Long. 42° 20′ W.	Lat. 52° 11′ N. Long. 31° 29′ W.	Lat. 51° 29′ N. Long. 38° 1′ W.	Lat. 51° 30′ N. Long. 38° W.	Lat. 52° 16′ 30″ N. Long. 29° 28′ 30″ W.	Lat. 52° 25′ N. Long. 28° 10′ W.	Lat. 52° 35′ 30″ N. Long. 21° 16′ W.	Lat. 52° 16′ N. Long. 16° 46′ W.	Lat. 52° 16′ N. Long. 16° 42′ W.	Lat. 52° 21′ 30″ N. Long. 15° 6′ W.	Lat. 52° 16′ N. Long. 14° 30′ W.	Lat. 52° 11′ N. Long. 13° 45′ W.	Lat. 52° 8′ 30″ N. Long. 12° 31′ W.	Lat. 52° 0′ 30″ N. Long. 12° 7′ 30″ W.	Lat. 52° 1′ N. Long. 11° 14′ 40″ W.	Lat. 51° 59′ N. Long. 11° W.	Lat. 51° 57′ N. Long. 10° 30′ 30″ W.
		No. 53, 195 fms.	No. 49, 129 fms.	No. 47, 190 fms.	No. 39, 124 fms.	No. 45, 150 fms.	No. 41, 129 fms.	No. 61, 167 fms.	No. 59, 133 fms.	No. 55, 112 fms.	No. 65, 102 fms.	No. 69, 146 fms.	No. 63, 145 fms.	No. 73, 161 fms.	No. 33, 405 fms.	No. 77, 221 fms.	No. 78, 329 fms. [330 fms.]	No. 32, 740 fms. [742 fms.]	No. 79, 725 fms.	No. 31, 954 fms.	No. 30, 1203 fms.	No. 80, 1450 fms. [1465 fms.]	No. 26, 2330 fms.	No. 25, 2250 fms. [2050 fms.]	No. 19, 2035 fms. [2030 fms.]	No. 81, 2350 fms. [Deepest.]	No. 22, 1660 fms. [2250 fms.]	No. 85, 2176 fms.	No. 86, 1950 fms. [2050 fms.]	No. 15, 1776 fms.	No. 90, 2050 fms.	No. 13, 2050 fms.	No. 12, 1750 fms.	No. 93, 200 fms.	No. 95, 223 fms.	No. 98, 415 fms.	No. 7, 338 fms.	No. 99, 90 fms.	No. 100, 78 fms.	No. 102, 43 fms.
1. Nodosarina Raphanus, Linn.	Nodosaria Raphanus, Linn.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	
	—— scalaris, Batsch.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rs R	s RR	s R	..	s R	s R	
	Dentalina communis, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	vs R	..	..	..	..	..	..	..	..	..	
	Cristellaria Crepidula, F. & M.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R
	—— cultrata, Montf.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m R	..	
2. Lagena sulcata, W. & J.	Lagena sulcata, W. & J.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m R	..	..	s R	..	..	..	..	..	..	..	..	s R	..	..	..	..	s RC
	—— lævis, Montag.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m VR	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	l R	..	..	..	..	
	—— caudata, D'O. striated	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
	—— caudata, D'O. smooth	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	..	s R	..	..	..	..	..	..	..	..	..	..	..	
	—— globosa, Montag.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	l R	..	..	..	
	—— squamosa, Montag.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
	—— marginata, Montag.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	..	..	..	..	m R	..	..	..	l RC	..	..	..	..	..	..	..	..	l R	..	..	s RC	s C	s C
3. Orbulina universa, D'O.	Orbulina universa, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m R	..	..	..	..	..	..	..	..	..	m RC	m R	l R	m R	m C	m C	m R	l R	..	m R	l C	..	m R	m R	
4. Globigerina bulloides, D'O.	Globigerina bulloides, D'O.	..	..	..	..	vs VR	..	..	vs VR	..	..	..	..	..	..	..	vs VR	rs C	s RR	s C	s C	m VC	m VC	m VC	m VC	m VC	m VC	s RR	m C	m C	m VC	m VC	m VC	s RR	m C	l C	s R	s C	s RC
5. Planorbulina farcta, F. & M.	Truncatulina lobatula, W. & J.	..	..	..	..	..	..	..	..	..	..	..	s R	..	..	..	..	m R	..	..	..	..	..	..	..	..	..	..	s R	..	..	..	..	..	..	..	s R	..	m RC	m C
	Planorbulina Mediterranensis, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R
	—— Haidingerii, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m R	..	..	..	..	..	..	..	..	..	
	—— Ungeriana, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	s R	s R	..	s C	m RR	s C	s R	s R	s RC	..	..	m RC	l C	m C	..	m R	s RR	s RC
6. Discorbina Turbo, D'O.	Discorbina Bertheloti ana, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s RC	s R
	—— rosacea, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m RC
7. Rotalia Beccarii, Linn.	Rotalia Beccarii, Linn.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	
	—— Soldanii, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m R	s R	..	..	..	vs R	..	s R	..	..	m RR	m C	..	..	..	s R
	—— orbicularis, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	vs VR	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
8. Pulvinulina repanda, F. & M.	Pulvinulina Menardii, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m VR	..	..	..	..	..	m RC	m RC	m R	..	m RC	m RR	m C	m RC	m C	m C	m R	..	..	m RC	m RC	m R	..	s R	
	—— Karsteni. Rss.	..	..	..	..	..	..	..	l R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
	—— Micheliana, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	m RC	..	m R	m RC	m RR	m R	l RC	m C	m C	m C	..	m RC	m RC	m C	..	..	s R	
	—— elegans, D'O.	..	..	..	..	..	..	..	m RR	..	..	..	..	..	..	..	..	..	..	..	..	..	m RC	..	..	..	s R	..	..	..	..	..	..	..	..	..	..	..	..	s C	
	—— Canariensis, D'O.	..	..	..	s VR	..	..	..	s R	..	..	..	..	s VR	..	..	s RC	vs C	s R	m RC	s RC	s RR	m C	m RC	s R	..	..	..	..	..	..	..	s R	..	..	m R	s R	..	s C	
	—— pauperata, P. & J.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m R	..	..	..	..	..	s R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
9. Sphæroidina bulloides, D'O.	Sphæroidina bulloides, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	vs VR	..	..	..	..	..	..	..	..	..	..	..	s R	..	..	..	..	
10. Pullenia sphæroides, D'O.	Pullenia sphæroides, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	vs VR	..	..	vs VR	..	s R	..	..	vs RR	..	vs R	..	..	..	s R	..	..	..	..	
11. Polystomella crispa, Linn.	Nonionina asterizans, F. & M.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
	—— Scapha, F. & M.	..	..	..	m RC	m R	..	..	m RR	..	..	..	m R	m VR	..	..	m VR	..	m VR	vs VR	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	..	..	..	..	
	—— turgida, Will.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	..	..	..	..	s R
	—— umbilicatula, Montag.	..	..	..	..	vs VR	..	..	..	..	..	..	..	..	..	..	vs VR	..	..	..	..	..	..	..	..	..	s R	..	s RC	m RC	s R	s RC	..	..	..	m C	m C	..	m C	m C	
	Polystomella striatopunctata, F. & M.	..	..	..	..	..	..	..	..	..	..	..	s R	vs VR	..	..	..	m RC	s RR	s R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	..	..	..	vs VR	s C
	—— crispa, Linn.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s VR	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
12. Nummulina perforata, Montf.	Operculina ammonoides, Gm.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	s C	s C	..	s C	s VC	s C
13. Cassidulina lævigata, D'O.	Cassidulina lævigata, D'O.	..	m RC	..	m RC	s R	..	..	m RR	m RR	m VR	..	m RR	..	..	..	..	m RC	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	s C	s RC	s C	..	m C	m C	m C
	—— crassa, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	vl VR	..	..	..	..	
14. Uvigerina pygmæa, D'O.	Uvigerina pygmæa, D'O.	..	..	..	..	vs R	..	..	..	m RR	..	..	..	s VR	..	..	..	..	..	..	..	..	..	..	..	..	..	..	l C	l VC	l VC	l C	l VC	l VC	l VC	l VC	l C	l VC	l VC	l VC
	—— angulosa, Will.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m C	..	..	m RC	s R	
	Bulimina ovata, D'O.	..	..	..	..	vs VR	..	..	..	..	..	..	..	..	..	..	..	m R	..	..	..	..	..	..	..	..	..	..	..	vs R	vs RR	..	..	..	..	..	..	..	s R		
	—— aculeata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m C	..	..	..	..	
	—— marginata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s C	s C	..	m C	m C	l C
15. Bulimina Presli, Rss.	—— Buchiana, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R		
	Virgulina Schreibersii, Czjzek	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s VR	s R	..	..	l R	..	..	..	..	..	m R	..	..	..	..	..	..	..	..	..	..	
	Bolivina punctata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s RC	s R	..	..	..	s R	
	—— costata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	l R	..	..	..	..	..	
16. Textularia agglutinans, D'O.	Textularia abbreviata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	s RC	..	m RC	m C	m C
	—— Sagittula, Defr.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m C		
	—— pygmæa, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	vs VR	..	..	s R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
	—— carinata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	m R	s R	m R	s RC	s RC	..	..	..	..	..	
	Bigenerina Nodosaria, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s C	s RC		
	—— digitata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m C	m C		
17. Miliola Seminulum, Linnè.	Spiroloculina planulata, Lam.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	..	..	..	..	..	..	..	m R	..	..	..	..	..	..	s R		
	—— limbata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m R
	Quinqueloculina tenuis, Czjzek	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	..	..	..	..	..	..	s R		
	—— Seminulum, Linn.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m R	..	..	..	..	..	s R	s R	..	..	s R	..	..	..	..	s RC	..	..	..		
	—— triangularis, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	vs VR	..	..	..	vs VR	s R	..	vs R	..	..	..	..	..	..	..	s R	s C	s C
	—— agglutinans, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s VR	..	..	..	..	..	..	vs R	..	..	..	..	..	..	..	..	..	..	
	Triloculina oblonga, Montag.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	vs VR	..	..	..	..	..	..	..	..	..	..	..	m C	..	..	..		
	Biloculina depressa, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m R	..	..	..	m R	m R	s R	..	..	..	..	..	..	..	..	..	..	s R	s R
	—— elongata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s R	..	..	..	..	..	vs VR	..	..	s R	..	..	..	..	..	..	..	
18. Lituola nautiloidea, Lam.	Lituola Canariensis, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m R	..	..	..	..	..	..	..	..	..	..	s R	..	..	..	..	..	..	..	
	—— globigeriniformis, P. & J.	..	..	..	..	..	..	..	m R	..	..	..	..	vs VR	..	..	..	..	..	..	s VR	..	..	..	..	..	..	m R	..	..	..	..	..	..	m R	..	..	..	..	s R	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39

TABLE VI.—Table showing the presence and proportion of Organic and Inorganic substances in 100 parts of dry sea-bottom from the North-Atlantic. See also Table XII.

	Arctic Province (Trinity Bay).									Arctic (North of Newfoundland Bank).											Boreal (Abyssal).						Celtic (Abyssal).						Celtic (Marginal).						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
	No. 53, 195 fms.	No. 49, 129 fms.	No. 47, 190 fms.	No. 39, 124 fms.	No. 45, 150 fms.	No. 41, 129 fms.	No. 61, 167 fms.	No. 59, 133 fms.	No. 55, 112 fms.	No. 65, 102 fms.	No. 69, 146 fms.	No. 63, 145 fms.	No. 73, 161 fms.	No. 33, 405 fms.	No. 77, 221 fms.	No. 78, 329 fms.	No. 32, 740 fms.	No. 79, 725 fms.	No. 31, 954 fms.	No. 30, 1203 fms.	No. 80, 1450 fms.	No. 26, 2330 fms.	No. 25, 2250 fms.	No. 19, 2035 fms.	No. 81, 2350 fms.	No. 22, 1660 fms.	No. 85, 2176 fms.	No. 86, 1950 fms.	No. 15, 1776 fms.	No. 90, 2050 fms.	No. 13, 2050 fms.	No. 12, 1750 fms.	No. 93, 200 fms.	No. 95, 223 fms.	No. 98, 415 fms.	No. 7, 338 fms.	No. 99, 90 fms.	No. 100, 78 fms.	No. 102, 43 fms.
Molluscs—small, with fragments	..	..	..	..	..	..	..	..	..	..	..	..	sand-tube.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	frag^ts.	shells and fragments.
Annelids—sand-tubes and Serpulæ	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	fragments of shells.	..	..	..	..
Polyzoa—fragments	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	a valve.	a valve.	a valve.	..	..	..	..	..	..	..	frag^ts.	..	frag^ts.
Entomostraca—valves	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	a trace.	a trace.	..	..	..	..	..	a few.	..	..	..	..	a few.
Echinoderms—spines and plates	..	..	..	..	..	..	a trace.	..	..	..	..	..	2 spicules.	..	..	..	..	..	..	..	a trace.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	a spine.	frag^ts.	5·	15·
Sponges—spicules	..	..	..	..	..	..	..	..	a trace.	..	..	..	..	..	a trace.	..	8·	..	0·7	1·5	97·	52·	95·	97·	95·5	95·	73·5	97·5	83·	53·	49·	97·5	..	..	..	..	..	..	a few.
Foraminifera a. Globigerina bulloides	..	..	..	a trace.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	0·3	0·5	1·	1·	a few.	a few.	0·5	a few.	0·5	0·5	1·	1·5	a few.	a few.	4·	7·5						
Foraminifera b. Other species	..	a few.	..	..	a few.	..	..	a few.	a few.	1 spec.	..	a trace.	a trace.	a few.	..	a trace.	a few.	a few.	..	..	..	..	..	..	..	..	a few.	a few.	..	..	..	..	5·	32·	8·	10·	5·	10·	20·
Polycystineæ*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	a few.	..	..	..	..	..	..	..	..	some.	some.	..	..	..	..	..	..	..	..	..	some.		
Diatomaceæ †	..	..	some	..	some.	some.	some.	some.	some.	..	some.	some.	some.	..	..	..	..	some.	some.	some.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Whitish mud	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	49·	a trace.	45·	a trace.	2·	1·5	a trace.	25·	1·5	15·	45·	50·	a trace.	..	..	..	a trace.	..	..	..	..
Grey mud	99·	50·5	99·	2·	49·5	60·	1·	..	..	33·	25·	33·	33·	2·5	1·	25·	88·	98·	75·	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sand, mostly quartz a. Fine	1·	30·5	1·	96·	49·5	..	49·	..	..	10·	35·	33·	30·	97·5	49·	72·	3·	1·5	12·	49·	1·5	2·	2·	a trace.	1·5	2·	1·	0·5	a trace.	a trace.	a trace.	a trace.	5·	50·	40·	66·	92·5	70·	25·
Sand, mostly quartz b. Coarse	..	18·	..	..	..	20·	50·	..	49·	23·	40·	33·	36·	..	50·	2·	..	..	12·	..	1·	..	2·	..	1·	2·	..	..	..	..	..	..	89·	..	..	..	..	10·	25·	
Small gravel stones	..	..	..	..	..	20·	..	..	50·	33·																														

* In some portions of this Atlantic ooze that Mr. Roper received from Professor Huxley, he met with many varieties of *Polycystineæ*; and in his Appendix to Commander Dayman's Report on the North-Atlantic Sea-bed, Professor Huxley states (p. 64) that, in the grey calcareous mud (ooze) of from 1700 to 2400 fathoms, he noticed among the siliceous organisms a number of *Polycystineæ*, e. g., *Flustrella*, *Eucyrtidium*, *Stylosphæra*, *Haliomma*, &c.; also the spicular bodies known as *Spongolitharia*, and the doubtful organisms *Codium* and *Rhizosalenia*.

† See Mr. Roper's letter, p. 334.

TABLE VII.—Table of the North Atlantic and Arctic Foraminifera, with their distribution in other Seas.

[For the completion of the Fauna of each of these localities, excepting Nos. 5, 11, 12, 13, & 25, which are here complete, see Appendix VI.]

vl. Very large. *l.* Large. *rl.* Rather large. *m.* Middle-sized. *s.* Small. *vs.* Very small. VC. Very common. C. Common. RC. Rather common. RR. Rather rare. R. rare. VR. Very rare.

Typical Species.	Genera, Species, and Varieties.	1 Sub-recent. Peterborough Fen, 1 mile from its western boundary (sandy clay).	2 Sub-recent. Peterborough Fen, 2 miles from its western boundary (sandy clay).	3 Sub-recent (clay). Boston, Lincolnshire.	4 Sub-recent (clay). Wisbech, Cambridgeshire (Valley of the Nene).	5 Mouth of Thames, Southend (shallow-water sands).	6 Pegwell Bay, near Margate, Kent (muddy shore-sand).	7 Isle of Arran, N.B. (muddy sands from shallow water).	8 Douglas, Isle of Man (shallow-water sands).	9 Eastbourne, Sussex (mud from shallow water.)	10 Colne (tidal) River, Essex (oyster-beds).	11 Greenland (Arctic). See Table IV.	12 Norway (Arctic). See Table IV.	13 North Atlantic, Ireland to Newfoundland, thirty-nine casts, from 43 to 2350 fms. See Table V.	14 Mediterranean. Galita Island, S. 32° W., 32 miles. Lat. 38° 00′ N., Long. 9° 13′ E., 320 fms**.	15 Red Sea. Gulf of Suez (muddy, shelly sand). 30 fms. Lat. 28° 38′ N., Long. 33° 9′ E.	16 Red Sea, close to Island Shadwan off S.E. point, entrance of Jubal Strait, 372 fms. (light yellow clay).	17 Red Sea, 557 fms. Lat. 17° 49′ N., Long. 40° 2′ E. (various-coloured mud).	18 Red Sea, 678 fms. Lat. 23° 30′ N., Long. 36° 58′ E. (pale clay).	19 Black Anchor-mud, Bombay Harbour (full of vegetable *débris*).	20 Dark Anchor-mud, Hong Kong, clay, sand, and vegetable matter, 8 or 9 fms.	21 Tropical Atlantic, 1080 fms. Lat. 2° 20′ N., Long. 28° 44′ W. (almost entirely organic).	22 South Atlantic, Abrolhos Bank, 47 fms. Lat. 28° 02′ S., Long. 41° 02′ W. (sand).	23 South Atlantic, Abrolhos Bank, 200 fms. Lat. 22° 54′ S., Long. 40° 37′, W. (dark mud).	24 South Atlantic, Abrolhos Bank, 940 fms. Lat. 19° 32′ S., Long. 37° 51½′ W. (whitish mud).	25 South Atlantic, 2700 fms. Lat. 26° 45′ S. Long. 33° 52′ W. (pale mud, half aluminous).	26 Indian Ocean, 2200 fms. Lat. 5° 37′ S., Long. 61° 33′ E. (fine white calcareous mud, with Polycystinea).	27 Indian Ocean, two casts near each other, 900 and 1120 fms. Lat. 36° 58′ S., Long. 51° 49′ E. (pale mud).	28 Australia, coral-reef, Jukes's dredgings, August 6th, 1844, 17 fms. (white shelly mud).	29 Swan River, Australia, 7 or 8 fms. (white shelly mud).	30 Melbourne, Australia, Coast-sand (coarse quartz sand full of shells, zoophytes, sponges, and algæ).	31 Black Anchor-mud, Hobson's Bay, Australia (full of vegetable matter).	32 Fiji, coral-reef, and adherent to a hydroid polype (Dynamena).
Nodosarina Raphanus, Linn.	Glandulina lævigata, D'O.	..	..	..	..	..	..	..	..	..	..	..	*l* C	..	..	m RC	*l* RR	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Nodosaria Radicula, Linn.	..	..	..	..	..	..	..	..	..	..	*rl* R	*l* C	..	..	m RR	..	..	..	..	..	..	..	..	..	s RR	..	..	..	..	..	..	..	..	..
	—— Raphanus, Linn.	..	*vs* VR	..	..	..	..	..	..	..	..	..	..	s R	m RC	..	..	..	..	..	..	..	..	..	m RR	..	..	..	..	..	..	..	..	..	..
	—— scalaris, Batsch	..	..	..	..	..	..	..	..	..	..	..	..	s RR	*l* VC	s RC	s RC	..	..	..	..	s RC	..	s C	..	..	..	..	..	..	..	..	..	..	..
	Dentalina communis, D.O.	..	*vs* VR	..	..	..	..	*rl* RR	..	..	..	*l* R	*vs* VR	s R	m C	..	s RC	s R	..	..	s VR	..	*vs* R	..	*l* RR	..	..	..	..	..	..	s R	..	s R	..
	—— consobrina, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	s R																					
	—— pauperata, D'O.	..	..	..	..	..	..	..	..	..	..	m R																							
	—— guttifera, D'O.	..	..	..	..	..	..	m R	..	..	..	..	*l* R	..	s R	..	..	..	..	..	..	..	..	s R	..	..	..	..	..	s R	..	s VR			
	Vaginulina linearis, Montag.	..	..	..	..	..	..	..	..	..	..	..	s RC																						
	Marginulina Lituus, D'O.	..	..	..	..	..	..	m RR	..	..	..	..	*vl* C	..	..	..	..	m R	..	..	..	..	..	..	s RC										
	Cristellaria Crepidula, F. & M.	..	..	..	..	..	..	m RR	..	..	..	s C	..	s R	..	..	..	..	..	..	..	..	..	..	s RC										
	—— cultrata, Montf.	..	..	..	..	..	..	..	..	..	..	..	*l* C	..	*rl* C	..	..	..	..	..	..	..	..	*l* C	s C	m RR									
	—— rotulata, Lam.	..	..	..	..	..	s R	m RC	..	..	..	..	*l* C	m R	*rl* C	s RC	..	..	..	..	..	..	*vs* R	m C	*l* C	..	..	..	m C	..	..	*vs* VR	*vs* VR		
	Lagena distoma, P. & J.	..	s RC	..	..	..	..	..	..	..	..	..	*l* RC																						
	—— polita, P. & J.	..	..	m RC	m C	..	..	..	..	..	..	..	s RC	s R	..	..	s RR	..	..	..	..	..	..	..	..	..	..	..	*l* C	m RC	s RC				
	—— lævis, Montag.	..	s RC	m C	m C	..	m C	..	..	m RC	..	..	s R	m R	..	m R	s RC	..	..	s VC	..	..	..	..	..	..	..	m C	..	l C	l C			
	—— semistriata, Will.	..	s VC	m C	..	..	..	..	..	m C	..	m RC	..	..	..	..	..	..	..	s VC	*l* RC	..	..	..	..	..	..	..	m RC	m RC				
	—— striatopunctata, P. & J.	..	..	..	..	..	..	..	..	..	..	*l* RC	..	..	..	..	..	..	s C	s R	..	..	..	..	..	..	vs RR	s R						
Lagena sulcata, W. & J.	—— sulcata, W. & J.	..	m C	m C	m C	..	m C	*l* VC	*l* VC	m C	..	*l* C	m RC	s RC	*l* RC	..	s RR	..	..	s RR*	m RC†	..	..	m C	..	..	..	s RC	*l* RC†	m C				
	—— Melo, D'O.	..	..	m C	..	..	..	..	..	s RC	..	m C	m RC	..	..	..	..	..	..	..	m RC	..	..	m RC	s RR	..	..	..	s RC					
	—— globosa, Montag.	..	s RC	m C	m C	..	..	..	..	s C	..	m C	..	*l* R	..	..	..	..	..	s VC	..	*vl* R	..	s RC	..	..	..	..	m C	m RC	*l* RC	s RR			
	—— caudata, D'O.	..	..	..	m C	m RC	m C	..	..	s RC	..	s R	..	s R	..	..	s R	..	..	..	..	s R	..	m RR											
	—— squamosa, Montag.	..	s RC	m C	m C	..	m C	m RC	..	..	..	s RC	s RC	m R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*l* C					
	—— marginata, Montag.	..	s C	m C	m C	..	m C	m C	..	m C	..	m C	s RC	*rl* C	*vl* VC	m R	s C	..	s R	s VC	m C	*vl* RC	..	m C	m RR	..	..	s R	*l* C	m C	m C	s RR		
Polymorphina lactea, W. & J.	Polymorphina lactea, W. & J.	..	*vs* C	*vs* RC	..	..	m R	*rl* C	s C	s RC	..	s C	s RC	..	..	..	s RC	..	..	..	m C	..	..	..	..	..	..	s RC	..	m C	m C			
	—— compressa, D'O.	..	..	..	..	..	..	..	..	s RC	..	s R	s RC																					
	—— tubulosa, D'O.	..	..	..	..	..	..	*rl* RC	..	..	..	..	m R	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*l* C					
Uvigerina pygmæa, D'O.	Uvigerina pygmæa, D'O.	..	..	..	..	..	..	..	..	..	..	s C	m C	*l* C	*vl* VC	..	..	..	..	..	..	..	..	..	m RC									
	—— angulosa, Will.	..	..	..	..	..	..	..	..	..	..	..	m C	m C	m RC	..	..	..	..	..	..	..	..	m C	..	..	..	l VC	..	m RC	s R			
Orbulina universa, D'O.	Orbulina universa, D'O	..	..	..	..	..	..	..	..	..	..	..	..	m RR	*vl* VC	*l* R	m C	*l* VC	*l* VC	..	..	..	l VC	..	l VC	*l* C	..	l VC	m C					
Globigerina bulloides, D'O.	Globigerina bulloides, D'O.	..	*vs* C	..	..	..	..	..	..	..	..	s RC	s R	*l* VC	*l* VC	m C	*l* VC	*l* VC	*l* VC	*vs* R	..	*l* VC	m C	*l* VC	*l* VC	*rs* VC	*l* VC	m VC	s RR					
	—— inflata, D'O	..	..	..	..	..	..	..	..	..	..	..	..	*l* C	*l* C	..	..	..	..	..	..	..	..	..	..	..	..	..	m VC					
Sphæroidina bulloides, D'O.	Sphæroidina bulloides, D'O	..	..	..	..	..	..	..	..	..	..	..	..	s R	*rl* C	..	m RC	..	..	..	..	m R	..	s C	*l* C									
Planorbulina farcta, F. & M.	Planorbulina Haidingerii, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	m R	..	*l* C	m C	s RC	..	..	..	..	..	m RC	..	..	..	*l* RR	m VC					
	—— Ungeriana, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	m RC	m C	..	..	..	..	..	..	..	s C											
	—— Mediterranensis, D'O.	..	..	*vs* RR	*vs* C	..	..	*vs* C	*rs* C	..	..	..	..	s R	..	..	..	..	..	..	s R	..	m RC	m C	..	..	..	..	m C	m VC	..	m C		
	Truncatulina lobatula, W. & J.	..	..	..	*vs* C	..	..	m C	m VC	s RC	..	*l* C	*l* C	m RC	m RR	m RC	s RC	s R	..	m RC	s RC	m RR	..	..	..	..	..	..	m RC	..	..	s RC	m RC	
	Anomalina coronata, P. & J.	..	..	..	..	..	..	..	..	..	..	..	*l* C																					
Pulvinulina repanda, F. & M.	Pulvinulina Menardii, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	m C	*rl* R‡	..	m RR	m C	s R	..	..	*l* VC	m C	*l* VC	*l* C	s C	*l* VC	m VC‡						
	—— Canariensis, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	m RC	m RR	..	..	s RC	..	..	..	m VC	..	m C	m C	..	m C	m VC						
	—— pauperata, P. & J.	..	..	..	..	..	..	..	..	..	..	..	..	*vs* VR	..	..	..	..	..	..	..	s R	..	..	..	..	..	s R						
	—— punctulata, D'O.	..	..	..	..	..	..	..	..	..	..	..	*vl* C																					
	—— Karsteni, Rss.	..	*vs* RR	*vs* RC	*vs* C	..	..	..	..	*vs* C	..	m C	..	*l* R	..	..	..	..	..	..	..	..	..	..	..	s VC								
	—— elegans, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	s R	*l* VC	..	..	..	..	..	..	m C	..	..	..	m RR	..	..	s RR					
	—— Micheliniana, D'O.	..	..	..	..	..	..	..	..	..	..	s R	..	m C	*l* VC	..	..	..	..	..	..	*l* VC	..	m C	..	s C	..	m VC						
Discorbina Turbo, D'O.	Discorbina obtusa, D'O	..	..	..	..	..	..	..	..	..	..	*l* C																						
	—— globularis, D'O.	..	*vs* VR	..	*vs* RC	..	..	m VC	..	..	..	m C	m C	..	..	s RC	*vs* RC	..	..	..	s C	..	*l* RC	..	..	..	..	..	s C	m RC	m C	..	*l* C	
	—— rosacea, D'O.	..	..	..	*vs* RC	..	..	m VC	..	*vs* C	..	..	..	m RR	..	..	..	..	..	..	..	..	m C	..	..	..	..	s RC	..	l C	s R	l C		
	—— Berthelotiana, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	s RR	*l* C	m C	s RC	..	..	s RC	m RC	..	*l* C	s R	..	..	..	..	*l* C					
Rotalia Beccarii, Linn.	Rotalia Beccarii, Linn.	*rs* RC	s VC	*vs* C	*vs* VC	*vs* VC	*rs* VC	m C	m C	s C	m C	..	..	s R	..	..	..	..	..	*vs* C	..	..	..	..	..	..	..	s RC	*vs* R	m C	m VC	s RC		
	—— Soldanii, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	*rs* RR	*l* VC	..	..	..	..	..	*vs* VC	..	..	..	..	..	..	..	..	..	..	..	..		
	—— orbicularis, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	*vs* VR	m C	..	*vs* VC	s R	s R																
Polystomella crispa, Linn.	Polystomella crispa, Linn.	..	..	..	..	..	*rs* RR	m C	m C	..	m C	s R	..	s VR	..	m RC	..	..	..	..	..	..	..	..	..	..	..	..	m C	m C	m VC	s C	m C	
	—— arctica, P. & J.	..	..	..	..	..	..	..	..	..	..	*l* C																						
	—— striatopuncta, F. & M.	..	s C	*s* VC	*s* RC	*m* VC	*m* VC	*rl* RC	*rl* VC	*m* VC	*m* C	*l* C	s R	m RC	..	m RC	..	..	..	*vs* C	s C	..	..	..	..	..	..	..	s RC	*vs* VC	s RC	s C	s C	
	Nonionina asterizans, F. & M.	m RC	m C	m VC	m C	m VC	m VC	..	..	m VC	m C	s C																						
	—— Faba, F & M.	..	..	..	..	..	..	..	..	..	..	*l* C																						
	—— Scapha, F. & M.	..	..	..	..	..	..	..	..	..	..	*l* C	..	m RC	..	m C	*vs* RC	..	s R	s VC	m C	..	..	s C	..	..	..	..	s RC					
	—— depressula, W. & J.	m RC	m VC	m VC	m C	m VC	m VC	..	..	m VC	m C	s C	..	..	..	..	..	..	..	*vs* C	..	..	..	..	..	..	..	..	s RC	..	l C			
	—— stelligera, D'O.	..	..	..	..	..	..	..	..	..	..	s C	s C	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	s C			
	—— umbilicatula, Montag.	..	..	..	s C	m RR	..	..	..	..	..	m R	m VC	m C	m C	..	s C	s RC	s C	..	..	..	..	..	s C	s C	..	..	s R					
	—— turgida, Will.	..	*vs* R	..	..	..	..	..	..	..	..	..	..	s R																				
Pullenia sphæroides D'O.	Pullenia sphæroides, D'O.	..	..	..	..	..	..	..	..	..	..	..	*vs* VC	s R	*rl* C	*l* R	..	..	..	..	..	s R	s C												
Nummulina perforata, Montf.	Nummulina planulata, Lam.	..	..	..	..	..	..	..	..	..	..	s RC	..	..	..	..	..	..	..	s R	..	..	s R	..	..	..	..	m VC						
	Operculina ammonoides, Gronov.	..	..	..	..	..	..	..	..	..	..	..	s VC	s RC	s VC	m C	..	..	..	..	..	..	..	..	..	..	..	..						
Cassidulina lævigata, D'O.	Cassidulina lævigata, D'O.	..	..	..	..	..	..	..	..	..	..	m VC	s C	m RC	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m VC	..	..	..	m C	
	—— crassa, D'O.	..	..	..	..	..	..	..	..	..	..	s C	..	*vs* VR	s RR	..	..	..	..	s RR															
	Bulimina Pyrula, D'O.	..	..	..	..	..	..	..	..	..	..	..	*l* C																					
	—— marginata, D'O.	..	..	..	..	..	..	..	..	..	..	..	m C	m C	*l* RC	..	s C	s R	..	s C	..	..	..	..	m C	..	..	..	..	..	..	m RC		
	—— aculeata, D'O.	..	..	..	..	..	..	..	..	..	..	..	m C	m RC	m RC	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	m RC		
	—— ovata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	*rs* RR																				
Bulimina Presli, Rss.	—— Buchiana, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	s R	*vl* RC	..	..	..	..	..	..	m C	..	m C	..									
	—— elegantissima, D'O.	..	*vs* C	..	..	..	s R	..	..	..	..	*l* C	..	..	m RC	..	*vs* RC	..	..	..	..	*l* R	..	..	..	..	..	..	..	..	..	..	..	..
	Virgulina Schreibersii, Czjzek	..	*vs* C	..	..	..	..	..	..	..	..	*l* R	..	m R	*l* C	m RR	s RC	..	..	s C	s RC	..	..	..	..	..	..	..	s RR	..	..	m RC	s RC	
	—— squamosa, D'O.	..	*vs* R	..	..	..	..	..	..	..	..	s R	*l* R	..	..	..	s R	..	s R	s VC	..	*l* R	..	..	..	..	..	..	..	..	..	..	*l* C	
	Bolivina punctata, D'O.	..	s RC	..	..	..	..	..	s RC	..	..	..	..	s RR	m C	m C	m C	m C	s R	*rs* VC	*vl* C	..	..	..	s C	..	..	..	..	..	..	s RR		
	—— costata, D'O.	..	..	..	..	..	..	..	m RC	..	..	..	..	*l* R	..	..	..	..	..	*rs* VC															
Textularia agglutinans, D'O.	Textularia agglutinans, D'O.	..	..	..	..	..	..	..	..	..	..	s RC	m RC	..	m RC	m C	..	..	..	..	m C	..	m C	..	..	..	..	s RC	*l* VC	s C	*l* C	*vs* R	*vl* C	
	—— abbreviata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	m C																				
	—— pygmæa, D'O.	..	..	..	..	..	..	..	..	..	..	..	m C	s RC	m RC	..	..	..	..	..	..	..	..	..	..	..	..	m RR						
	—— Sagittula, Defr.	..	..	..	..	..	..	m C	..	..	..	..	..	m RC	..	..	..	..	..	..	..	..	m C	..	..	..	..							
	—— carinata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	s RC	m RC																			
	—— biformis, P. & J.	..	..	..	..	..	..	..	..	..	..	s C																						
	Bigenerina Nodosaria, D'O.	..	..	..	..	..	..	..	..	..	..	s C	..	m C	*l* VC	..	..	..	..	..	m RC	..	..	*l* RC										
	—— digitata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	s R	*l* R																			
	Verneuilina polystropha, Rss.	..	..	..	..	..	..	..	..	..	*l* C	s C																						
Valvulina triangularis, D'O.	Valvulina conica, P. & J.	..	..	..	..	..	..	..	..	..	..	..	s R	..	*rl* R	..	..	..	..	..	..	..	m C	..	..	..	..	..	*vl* RC					
Spirillina vivipara, Ehrg.	Spirillina vivipara, Ehrg.	..	*vs* VR	..	..	..	..	..	..	..	..	s R	s R	..	..	..	s RC	s R	s RR	..	..	..	..	..	..	..	..	..	s RC	m C				
Patellina concava, Lam.	Patellina corrugata, Will.	..	s RC	..	..	..	..	..	..	..	..	s C	..	..	*vs* R	..	s RC	..	s RR	..	..	..	..	..	..	..	..	..	..	..	*vs* RC			
Trochammina squamata, P. & J.	Trochammina squamata, P. & J.	..	..	..	..	..	..	..	..	..	..	s C																						
	—— gordialis, P. & J.	..	..	..	..	..	..	..	..	..	..	s C																						
Cornuspira foliacea, Phil.	Cornuspira foliacea, Phil.	..	s RC	*s* C	*s* RC	..	..	..	m RC	m RC	*vs* C	m C	..	..	..	..	s RC	..	s R	..	..	..	..	m RR	s RR	..	..	..	s RC	s R				
Miliola Seminulum, Linn.	Spiroloculina planulata, Lam.	..	..	..	..	..	..	..	..	..	..	..	..	m R	..	m C	..	..	..	*rs* C	m C	..	..	..	..	m C								
	—— limbata, D'O.	..	..	..	..	..	..	*vl* C	*rs* C	..	..	..	..	s R	m C	m C	s RR	s R	..	..	..	..	..	..	..	m RC								
	Quinqueloculina Seminulum, Linn.	..	..	..	..	..	m C	*rl* C	*l* VC	..	m VC	m C	*l* C	s RC	..	..	..	..	..	..	..	..	..	..	..	..	..	s C	*l* VC					
	—— triangularis§, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	s R	*rl* C	m C	*vs* RC	s R	..	*rs* C	m C	s C	s C	s RR	s RR	..	..	s C	m C	s C	m C	s RC	m C	
	—— Ferussacii, D'O.	..	..	..	..	..	m C	..	..	..	..	m C																						
	—— agglutinans, D'O.	..	..	..	..	..	..	..	..	..	..	m C	..	*rs* RR§	*l* VC	*l* C	m RC	..	s R	..	..	..	*l* C	s RR	..	..	..	*l* C	s C	*l* RC				
	—— subrotunda, Montag.	..	..	*vs* C	*vs* C	s RR	s C	..	m VC	*vs* C	m C	s C	..	..	..	s C	s C	..	s R	..	s RC	..	..	..	..	..	..	..	s C	mC	..	s C		
	—— tenuis, Czjzek	..	..	..	..	..	..	..	..	..	..	..	..	s R	s C	..	s RR	..	m C	..	s C	..	..	m C	s R	..	..	..	s RR					
	Triloculina cryptella, D'O.	..	..	..	..	..	..	..	..	..	..	m C	..	..	..	..	..	..	..	..	..	*l* R												
	—— tricarinata, D'O.	..	..	..	..	..	..	..	..	..	..	s C	..	..	s RC	m C	m RC	..	s R	..	s C	..	..	..	..	..	..	m C	*rl* C	*l* VC				
	—— oblonga, Montag.	s R	*vs* RC	*vs* C	*vs* C	s RR	m C	*rl* C	m VC	*vs* RC	m C	s C	..	s R	s RC	s C	s RC	..	s C	s C	s C	*vs* R	..	..	s R	s RR	..	s R	s C	m VC	m RC	s C	
	Biloculina ringens, Lam.	..	..	..	..	..	..	m C	..	..	..	..	*l* C	..	*l* RC	..	..	..	..	..	..	..	s R	m RC	..	..	..	..	m C	..	m R				
	—— depressa, D'O.	..	..	..	..	..	..	m VC	*rs* C	..	..	..	..	m RR	*l* C	..	..	s R	..	..	..	..	..	..	..	..	*l* RR	..	..	..	m RC			
	—— elongata, D'O.	..	..	..	..	..	..	..	..	..	..	..	..	s R	m C	..	..	..	..	..	..	s R	..	s RR	..	..	..	s R	..	..	m RC			
Lituola nautiloidea, Lam.	Lituola Canariensis, D'O.	s RR	*rs* VC	..	..	..	s R C	..	..	..	m RC	*l* C	m RR	m R	..	..	..	..	..	..	..	..	..	s RC	..	..	..	..	s RC	m RC				
	—— globigeriniformis, P. & J.	..	..	..	..	..	..	..	..	..	..	s C	..	s R	..	..	..	..	s R	s R	..	..	..	m RC	m R	..	m R							
	—— Scorpiurus, Montf.	..	..	..	..	..	..	..	..	..	..	*l* C	..	..	..	..	..	..	..	..	..	..	*l* C	m RC	m RR	..	..	..	l C					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	

* Var. *striata* very common here.

‡ In these localities *P. Menardii* is represented by a hirsute subvariety.

** Lists of Mediterranean Foraminifera from several other soundings are published in the Quart. Journ. Geol. Soc. vol. xvi. p. 302 (1860). Some also of the North-Atlantic specimens are rather prickly.

† In both these places represented by var. *striata*.

§ In the text these are included with *Q. Seminulum*.

TABLE XI.—SHOWING THE DISTRIBUTION OF THE GENERA OF FORAMINIFERA IN THIRTY-TWO GATHERINGS FROM THE ATLANTIC, MEDITERRANEAN, RED SEA, INDIAN OCEAN, AND PACIFIC.

GENERA OF FORAMINIFERA (represented by species or varieties).	1 Sub-recent. Peterborough Fen, 1 mile from its western boundary (sandy clay).	2 Sub-recent. Peterborough Fen, 2 miles from its western boundary (sandy clay).	3 Sub-recent (clay). Boston, Lincolnshire.	4 Sub-recent (clay). Wisbech, Cambridgeshire (Valley of the Nene).	5 Mouth of Thames, Southend (shallow-water sands).	6 Pegwell Bay, near Margate, Kent (muddy shore-sand).	7 Isle of Arran, N.B. (muddy sands from shallow water).	8 Douglas, Isle of Man (shallow-water sands).	9 Eastbourne, Sussex (mud from shallow water).	10 Colne (tidal) River, Essex (oyster-beds).	11 Greenland (Arctic). See Table IV.	12 Norway (Arctic). See Table IV.	13 North Atlantic, Ireland to Newfoundland, thirty-nine casts, from 43 to 2350 fms. See Table V.	14 Mediterranean. Galita Island, S. 32° W., 32 miles. Lat. 38° 00′ N., Long. 9° 13′ E., 320 fms.	15 Red Sea. Gulf of Suez (muddy, shelly sand). 30 fms. Lat. 28° 38′ N., Long. 33° 9′ E.	16 Red Sea, close to Island Shadwan, off S.E. point, entrance of Jubal Strait, 372 fms. (light-yellow clay).	17 Red Sea, 557 fms. Lat. 17° 49′ N., Long. 40° 2′ E. (various-coloured mud).	18 Red Sea, 678 fms. Lat. 25° 30′ N., Long. 36° 58′ E. (pale clay).	19 Black Anchor-mud, Bombay Harbour.	20 Dark Anchor-mud, Hong Kong, 8 or 9 fms.	21 Tropical Atlantic, 1080 fms. Lat. 2° 20′ N., Long. 28° 44′ W. (almost entirely organic).	22 South Atlantic, Abrolhos Bank, 47 fms. Lat. 25° 02′ S., Long. 41° 02′ W. (sand).	23 South Atlantic, Abrolhos Bank, 260 fms. Lat. 22° 54′ S., Long. 40° 37′, W. (dark mud).	24 South Atlantic, Abrolhos Bank, 940 fms. Lat. 19° 32′ S., Long. 37° 51½′ W. (whitish mud).	25 South Atlantic, 2760 fms. Lat. 26° 45′ S. Long. 32° 52′ W. (pale mud).	26 Indian Ocean, 2200 fms. Lat. 5° 37′ S., Long. 61° 39′ E. (fine white calcareous mud, with Polycystinæ).	27 Indian Ocean, two casts near each other, 900 and 1120 fms. Lat. 36° 58′, Long. 51° 49′ E. (pale mud.)	28 Australia, Coral-reef, 17 fms. (white shelly mud).	29 Swan River, Australia, 7 or 8 fms. (white shelly mud).	30 Melbourne, Australia, Coast-sand (coarse quartz sand, full of shells, zoophytes, sponges, and algæ).	31 Black Anchor-mud, Hobson's Bay, Australia.	32 Fiji, coral-reef, and adherent to a hydroid polype.
Lagena	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nodosarina	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Polymorphina	..	●	●	..	..	●	●	●	●	..	●	●	..	..	..	..	..	..	..	..	●	..	..	..	..	..	..	..	●	..	●	●	..
Uvigerina	..	●	..	..	..	..	..	..	..	..	●	●	●	●	..	●	●	●	●	●	●	..	..	●	..	..	..	●	..	●	●	●	..
Orbulina	..	..	..	..	..	..	..	..	..	..	..	..	●	●	●	●	●	●	..	●	..	..	..	●	●	..	●	●	..	..	..	..	..
Spirillina	..	●	..	..	..	..	..	..	..	..	●	●	●	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	●	..	..	..
Globigerina	..	●	..	..	..	..	..	..	..	..	●	●	●	●	●	●	●	●	●	●	..	●	●	●	●	●	●	●	●	..	..	..	..
Pullenia	..	..	..	..	..	..	..	..	..	..	..	●	●	●	..	..	..	..	..	..	..	●	●	●	..	..	●	..	..	..	..	..	..
Sphæroidina	..	..	..	..	..	..	..	..	..	..	..	..	●	●	..	●	..	..	..	..	..	●	..	●	..	..	●	..	..	..	..	..	..
Textularia	..	●	●	●	..	●	●	..	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	..	..	●	●	●	●	●	●
Bulimina	..	●	..	●	..	●	..	..	●	●	●	●	●	●	●	●	●	●	●	●	●	●	..	●	●	..	..	..	●	●	●	●	..
Cassidulina	..	..	..	..	..	..	..	..	..	..	●	●	●	●	●	●	●	●	●	●	●	●	..	●	●	..	..	..	..	..	..	..	..
Discorbina	..	●	..	●	..	..	●	..	●	..	●	●	●	●	●	●	●	●	●	●	●	●	..	●	●	..	..	..	●	●	●	●	●
Planorbulina	..	..	●	●	..	..	●	●	●	..	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	..	..	..	●	●	●	●	●
Pulvinulina	..	●	●	●	..	..	..	..	●	..	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Rotalia	●	●	●	●	●	●	●	●	●	●	..	..	●	●	●	●	●	●	●	●	●	..	..	..	..	..	..	..	..	●	●	●	●
Cymbalopora	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	●	●	..	..	..	..	..	..	●	..	..	..	..	●	..	..	●
Calcarina	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	●	..	..	..	..	..	..	..	..	..	..	..	..	●	..	..	●
Tinoporus	..	..	..	..	..	..	●	..	..	..	..	..	..	●	..	●	..	●	..	..	..	..	..	..	..	..	..	..	..	●	..	..	●
Patellina	..	●	..	..	..	..	..	..	..	..	●	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	●
Polytrema	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Amphistegina	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	●
Nummulina	..	..	..	..	..	..	..	..	..	..	..	..	..	..	●	●	..	..	..	..	..	..	..	●	..	..	..	..	..	●	..	..	●
Polystomella	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	..	..	●	●	..	..	..	●	●	●	●	●
Heterostegina	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	●
Valvulina	..	..	..	..	..	..	..	..	..	..	..	●	..	●	..	..	..	..	..	..	..	..	..	..	..	..	..	..	●	●	●	..	..
Lituola	●	●	..	..	..	●	..	..	..	●	●	●	●	●	..	..	●	●	..	..	..	..	..	●	●	..	●	..	●	..	..	●	●
Trochammina	●	●	..	..	..	●	..	..	..	●	●	..	..	●	..	..	●	●	..	..	..	..	..	..	●	..	..	..	..	..	..	..	..
Cornuspira	..	●	●	●	..	..	..	●	●	●	●	..	..	..	..	..	●	..	..	..	..	..	..	..	..	..	..	..	●	●	●	..	..
Nubecularia	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Vertebralina	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	●	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Miliola	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Peneroplis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alveolina	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Orbitolites	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dactylopora	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	●	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32