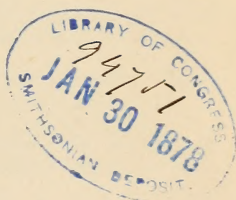


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centres of silication, and that the ribbons when fully developed are enclosed in a kind of muscular and membranous sheath. This sheath can be stripped off and allow of an easy separation of the three bands.

In *B. undatum* the odontophore is said to be longer than the whole length of the body of the animal. This I should think is a mistake; at all events that of *B. Greenlandicum*, when stretched out, is somewhat less than half the length of the body.

CRUSTACEA, TUNICATA, POLYZOA, ECHINODERMATA, ACTINOZOA, FORAMINIFERA, POLYCYSTINA, and SPONGIDA. By the Rev. A. M. NORMAN, M.A.

Four hundred and seven Invertebrata brought home by H.M.S. 'Valorous,' and belonging to the above classes have been examined. Considering the very short time allowed for dredging, the state of the weather, and other circumstances, the results of the Expedition are surprising and reflect great credit on all concerned. Moreover, if a proof were needed, it is here found how little is yet known of the fauna of the deep waters within the Arctic Circle, or even of the inhabitants of the shallower parts of these northern seas. It is necessary to bear in mind that the investigations of the 'Valorous' were chiefly confined to those portions of the coast which had been previously most carefully worked by the Scandinavian naturalists. Each time that the dredge was let down in the deeper parts of Davis Strait, it brought up animals of high interest altogether new to science; and it is not a little remarkable that among these were representatives of genera which had until lately been regarded as exclusively confined to tropical or subtropical seas. The results of this Expedition show how desirable it is that really systematic dredging should be carried out in Davis Strait, and still more that the wholly unexamined fauna of Baffin's Bay and Smith's Sound should be investigated. It is to be hoped that the Arctic Expedition may be enabled to carry out successful researches with respect to the fauna of these high latitudes. The determination of the character of the animals living in the abyss of the Arctic seas is a matter of no small importance whether regarded from a zoological or from a geological standpoint.

Of the 407 species, 339 were procured in Davis Strait, and 128 in the North Atlantic, many animals, especially among the Foraminifera, having been brought home from both areas.

I have made a careful examination of all that has been written on the animals belonging to those classes on which it is my duty to report which had been brought by previous British Arctic expeditions from Davis Strait, and I find that the total aggregate of these Invertebrata of earlier expeditions is at the most 166 species as against 339 brought home by the 'Valorous,'—a convincing proof of the results which can be obtained by the use of modern appliances when in skilful hands.

Of the 113 Greenland Crustacea, 43 are known as North-American,

82 as European, 49 as British; but one only, the Amphipod *Anonyx gulosus*, Kröyer, has as yet been found living in the Mediterranean.

Of the 66 Polyzoa, 33 are American, 59 European, 35 British, 1 Mediterranean. This Polyzoon is *Lepralia hyalina*, the range of which seems to be cosmopolitan.

Of the 30 Echinodermata, 27 are American, 21 European, and 9 British, but not any Mediterranean.

Of the 103 Foraminifera, 46 are known as American, 54 as European, 52 as British, and many Mediterranean.

Taking these four classes together, therefore, we find that of 312 Greenland species, 149 (or 47 per cent.) are North-American, 216 (or 69 per cent.) are European (including Spitzbergen under that term), and 145 (or 46 per cent.) are British. We might thus be led to infer that the Greenland Marine Invertebrata approached much more nearly in character to the European than to the American fauna. Closer examination, however, of the facts seems to prove that such a conclusion would be erroneous; for while the Marine Invertebrata of Europe have been very carefully worked out, very much remains to be done among all the less conspicuous animals of the North-American coasts*. Thus, as regards the great class of the Crustacea, comparatively little is known of any orders except those which contain the large stalk-eyed forms.

If, then, disregarding all other classes and orders, we confine our percentages to the Echinodermata and Stalk-eyed Crustacea, which we know to have been well worked up on the North-American coast, we find the results altogether changed; for of the 30 Greenland Echinodermata 27 (or 90 per cent.) are American, 21 (or 70 per cent.) are European, and 9 (or 30 per cent.) are British; and of the 15 Stalk-eyed Crustacea, 13 (or 86 per cent.) are American, 11 (or 73 per cent.) are European, and 6 (or 40 per cent.) are British; and we cannot but conclude that when the American marine fauna shall have been as fully known as that of European seas, the fauna of Davis Strait will be found to possess an American rather than a European character, though the contrary might at first sight be inferred from our present unequal knowledge of the several faunæ.

The following Tables will show at a glance:—(1st) the number of animals belonging to the several classes, (2nd) to the orders of the *Crustacea*, *Polyzoa*, and *Echinodermata*, which have been dredged by the 'Valorous,' whether in Davis Strait or the North Atlantic, and the proportionate geographical range of the forms in the American, European, and British seas; 3rd, our knowledge of the fauna of Davis Strait previous to the 'Valorous' Expedition, and the increased knowledge which is the fruit of that expedition.

* The more the fauna of the western side of the North Atlantic is studied the nearer it is found to approximate to that of the western side. This has become very evident from the recent valuable operations carried on, under the conduct of Messrs. Verrill and Smith, by the American Government, and, under Mr. Whiteaves in the Gulf of St. Lawrence, by the Canadian Government.

TABLE I.—Summary of the Crustacea, Tunicata, Polyzoa, Echinodermata, Actinozoa, Foraminifera, Polycystina, and Spongida, showing geographical distribution and other particulars.

	GREENLAND.					Brought by 'Valorous' from North Atlantic.	Total species brought home by 'Valorous.'
	Greenland and Davis Strait, 'Valorous.'	Known as N.-American.	Known as European.	Known as British.	Total number of species brought home by other British Arctic Expeditions.		
	1.	2.	3.	4.	5.	6.	7.
CRUSTACEA	113	43	82	49	72	29	133
TUNICATA	7	...	...	...	6	...	7
POLYZOA	66	33	59	35	12	2	67
ECHINODERMATA	30	27	21	9	22	5	35
ACTINOZOA	7	2	2	2	...	...	7
FORAMINIFERA	103	46	69	65	54	83	142
POLYCYSTINA	8	...	...	...	...	...	8
SPONGIDA	5	1	1	1	...	3	8
Total	339	152	234	161	166*	122	407

TABLE II.—The Crustacea, Polyzoa, and Echinodermata divided into their several orders (the columns corresponding to those in Table I.).

	1.	2.	3.	4.	5.	6.	7.
CRUSTACEA.							
Brachyura	3	3	2	2	1	1	4
Anomura	1	1	1	1	1	...	1
Macrura	11	9	8	2	7	1	12
Stomapoda .....	...	...	...	...	1	...	...
Cumacea	6	...	2	1	2	1	7
Isopoda	7	1	2	1	3	4	9
Amphipoda	39	12	32	9	18	6	42
Phyllopoda	3	1	2	2	1	...	3
Ostracoda	34	12	27	26	25	15	45
Copepoda	2	0	1	1	6	many	2
Cirripedia	4	3	4	3	2	1	5
Pycnogonoidea	3	1	1	1	5	...	3
	113	43	82	49	72	29	133

* This summary includes the animals collected in Parry's first and third voyages, Ross's second voyage, Penny's, Belcher's, and M'Clintock's voyages; and the Polyzoa recorded by Busk, the Ostracoda by Mr. G. Brady, and the Foraminifera by Parker and Jones.

TABLE II. (continued).

	1.	2.	3.	4.	5.	6.	7.
POLYZOA.							
Cyclostomata.....	10	8	10	8	2	...	10
Ctenostomata	1	1	1	1	...	...	1
Chilostomata.....	55	24	48	26	10	2	56
	66	33	59	35	12	2	67
ECHINODERMATA.							
Holothuroidea	8	7	4	1	3	1	9
Echinoidea	3	2	2	2	1	1	4
Asteroidea.....	8	8	7	3	5	2	10
Ophiuroidea	10	9	8	3	12(?)	1	11
Crinoidea	1	1	?	...	1	...	1
	30	27	21	9	22	5	35

TABLE III.—Showing the total Fauna of Davis Strait as known from *all* sources previously to the 'Valorous' Expedition, and the additions made to it by that Expedition.

	W. Greenland Fauna as known in 1875.	Results of 'Valorous' Expedition in 1875.	Addition to Fauna in 1875.	W. Greenland Fauna as now known.
CRUSTACEA	214	113	35	249
TUNICATA.....	14	7	...	14
POLYZOA	78	66	16	94
ECHINODERMATA	34	30	2	36
ACTINOZOA	8	7	2	10
FORAMINIFERA.....	54	103	63	117
POLYCYSTINA	0	8	8	8
SPONGIDA.....	28	5	...	28
	430	339	126	556

It will be seen from the above that an important addition has been made to the Greenland fauna. The numbers must be regarded as approximate only, since there is still some material to be worked through.

In the following notes, the more remarkable animals in the several dredgings are briefly noticed.

Tow-net.

In the tow-net in Lat. 52° 33' N., Long. 26° 44' W., in the North Atlantic, the very rare *Pasiphæa tarda*, Kröyer, was taken. The same mode of collecting also produced *Nautilograpsus pelagicus*, Roux, *Idotea robusta*, Kröyer, *Themisto libellula* (Mandt), *Parathemisto compressa* (Goës), and *Tauria medusarum* (Kröyer), together with many Copepoda, a Campanularian, *Lepralia hyalina*, many Diatomacea, &c. In Davis Strait were similarly taken *Themisto libellula* (Mandt), *Themisto bispinosa*, Boeck, *Tauria medusarum* (Kröyer), and *Onesimus littoralis* (Kröyer), together with the beautifully spinose Copepod recently figured by Buchholz, in the Report of the German North-Pole Expedition, under the name "*Cleta minuticornis*, Müller"*. It is, however, most certainly not the species described by Müller or Baird; and I would therefore propose for this very distinct Arctic form the name *Cleta horrida*.

Holsteinborg Harbour, 7-35 fathoms.

Holsteinborg Harbour produced a rich harvest of Arctic forms. The Crustacea included the great spider crab of the Greenland seas, *Chionectes opilio* (Fabr.), the fine northern shrimps *Crangon boreas* (Phipps) and *Argis Lar* (Owen), the rare Amphipods *Onchomene minuta* (Kröyer), *Byblis Gaimardi* (Kröyer), *Ædiceros lynceus*, M. Sars, and *borealis*, A. Boeck, *Protogeneia incrmis* (Kröyer), *Antonoë macronyx*, Bruzelius, and *Photis Reinhardtii*, Kröyer, together with many species familiar to us off the British coasts. The Ostracode *Bradycinetus Brenda* (Baird) was in extraordinary abundance, along with *Cytheridea papillosa*, Bosquet, *Sclerochilus contortus* (Norman), *Xestoleberis depressa*, G. O. Sars, *Cytherura undata*, Sars, *Cythere tuberculata*, *emarginata*, *lutea*, and other species. Most of the specially Greenlandic Echinodermata occurred here. The Holothurians *Orcula Barthii*, Trosch. (? or new), *Cucumaria minuta*, Fabr., and *calcigera*, Agassiz, *Psolus Fabricii*, Düb. and Koren, *Chirodota leve*, Fabr., and *Myriotrochus Rinkii*, Steenstrup, the Ophiuridan *Ophioglypha nodosa*, Lütken, and the Asteridan *Asterias albula*, Stimpson, were associated with forms which are also European. Here, too, were such interesting Polyzoa as:—*Leieschara subgracile* (D'Orb.); *Celleporaria incrassata*, Lamk.; *Bugula Murrayana*, Bean, both the typical form and that named by Packard from the coast of Labrador (*B. fruticosa*) and by Lovén from Finmark (*B. quadridentata*). Our common *Lepralia ventricosa*, Hassall, seems to be also the most abundant Greenland Lepralian; it was found here and in all the other inshore dredgings. A new *Cellepora* in Holsteinborg Harbour and other Greenland localities had been previously sent to me by Mr. Whiteaves from the River St. Lawrence, where it was procured in the dredgings of the

* Die zweite deutsche Nordpolarfahrt in den Jahren 1869 und 1870, p. 393, pl. xv. fig. 3.

Canadian Government; it may fitly bear the name of that naturalist, *Cellepora Whiteavesi*. The Shetland *Membranipora sacculata*, Norman, furnished here another link between our fauna and that of the Greenland seas. The more remarkable Foraminifera in the locality were *Trochammina gordialis*, Parker and Jones, *Lituola Canariensis*, D'Orb., *Textularia biformis*, Parker and Jones, and *Bolivina punctata*, D'Orb.

Godhavn Harbour, Disco, 5-20 fathoms.

There are certain common British Invertebrata which are equally abundant on the Greenland coast. These animals are for the most part also circumpolar in their distribution; conspicuous amongst these are *Hyas aranea* (Linn.) and *coarctata*, Leach (of gigantic size), *Eupagurus pubescens* (Kröyer), *Solaster papposus* (Linn.), *Ophiopholis aculeata* (Müll.). With these in Godhavn Harbour were associated *Chioneceetes opilio* (Fabr.), *Argis Lar* (Owen), *Hippolyte Fabricii*, Kröyer, and *turgida*, Kröyer, *Ampelisca Eschrichtii*, Kr., and *Haploops tubicola*, Lilljeborg, these two Amphipods being in great abundance. Among many Ostracoda were the rare *Cythere borealis*, G. S. Brady, *canadensis*, G. S. Brady, and an undescribed species of the same genus; and *Cytherura granulata*, G. S. Brady, and *cristata*, G. S. Brady, the two latter species being only previously known as fossil in the Posttertiary deposits of Canada. The great sea-cucumber, *Cucumaria frondosa* (Gunn), was living in company with *C. calcigera*, Agas., *Chirodota leve* (Fabr.), *Asterias albula*, Stimpson, *Ophiacantha bidentata* (Retz.), and *Ophioglypha robusta* (Ayr). Of the Polyzoa may be named:—*Scrupocellaria scabra*, var. *elongata*, Smitt; *Bugula Murrayana*, var. *fruticosa*, Packard; *Lepralia cruenta*, *sinuata*, *ansata*, *acutirostris*; *Cellepora plicata*, Smitt; and *Hippothoa divaricata*, Lamx.,—the true form, and not my *H. expansa*, which is much more abundant in the Arctic seas, and has probably been frequently recorded under the former name. Among thirty-six Foraminifera identified from this locality are *Dentalina consobrina*, D'Orb. (or the form figured under this name by Parker and Jones), *Polymorphina Burdigalensis*, D'Orb., *Pullenia sphaeroides*, D'Orb., *Verneuilina polystropha*, Reuss, *Cassidulina obtusa*, D'Orb., *Pulvinulina Karsteni*, Reuss, and *Discorbina obtusa*, D'Orb.

A small quantity of material examined from the harbour consists of a ferruginous mud, which contained large quantities of the tubes of *Pectinaria* and of another more delicate Annelid. The Foraminifera among this mud were specially interesting, as exhibiting a marked parallelism with those recorded by Mr. G. M. Dawson from Gaspé Bay in the Gulf of St. Lawrence*. Of the twenty-eight Lievely-Bay species, twenty-two are also in Mr. Dawson's Gaspé-Bay list; and

* On Foraminifera from the Gulf of St. Lawrence, by G. M. Dawson ('Canadian Naturalist,' 1870).

these include two very marked forms not hitherto found in any other localities, namely *Rhabdopleura abyssorum*, Parker, and *Lituola cassis*, Parker, and also *Nonionina Labradorica*, Parker, and *Bulimina pyrula*, D'Orb. The Ostracoda include *Cythere tuberculata*, G. O. Sars, *C. Canadensis*, G. S. Brady, and *Paradoxostoma flexuosum*, G. S. Brady; the last of gigantic size as compared with the dimensions it attains in our own seas.

Station No. 1. Off Hare Island, Waigat Strait, at the entrance of Baffin Bay; 175 fathoms.

The chief features in the dredging were the magnificent *Astrophytons* of the two Arctic species *Agassizii*, Stimpson, and *eucnemis*, Müll. & Trosch., and the abundance of luxuriantly developed *Hornera lichenoides*, upon the branches of which were living many other very rare Polyzoa. *Hippomedon abyssi* (Goës), *Pontoporeia femorata*, Kröyer, and *Amphithopsis latipes* (M. Sars) among the Amphipoda, *Pallene intermedia*, Kröyer, *Nymphon grossipes*, Fabr., and *N. hirtipes*, Bell, among the Pycnogonoidea, were the most interesting Crustacea. *Otenodiscus crispatus*, Retz., was abundant; and the only example of *Antedon Eschrichtii*, Müll. & Trosch., taken in the expedition occurred here. The Polyzoa were many and good; for example, *Eschara elegantula*, D'Orb., *Leieschara subgracile* (D'Orb.), *Idmonea Atlantica*, Forbes, *Alecto diastoporides*, Norman, *Menipea arctica*, Busk, and *Discopora sincera*, Smitt.

Station No. 3. Lat. 69° 31' N., Long. 56° 1' W.; 100 fathoms.

Among the Crustacea here were the extraordinary Isopod *Munnopsis typica*, M. Sars (which that excellent naturalist elaborately described in the last work published before his lamented death*), *Glaucanome leucopis*, Kröyer, *Hippomedon abyssi* (Goës), and *Aceros phyllonyx* (M. Sars). Among the Polyzoa *Flustra membranaceo-truncata*, Smitt, and a new *Lepralia*, which in many respects comes near *L. trispinosa*, but which, in addition to the acute-mandibled avicularia, has very numerous ovoid avicularia with rounded mandible scattered over the cells, while the mouth wants the spout-like projection of the lower margin, and is somewhat different in outline: this form may be named *L. Jeffreysi*. Among the Echinodermata were *Myriotrochus Rinkii*, Steenstrup, *Asterias Groenlandica*, Stimpson, *Ophioglypha Sarsii*, Lütken, *Ophiocten sericeum* (Forbes), *Amphiura Sundevalli*, Müll. & Trosch., and *Astrophyton eucnemis*, Müll. & Trosch. The Arctic Actinian *Chondactinia nodosa* (Fabr.) was also procured here, together with an undescribed *Ammothoa*, which Dr. Lütken has kindly given me the means of comparing and identifying with his *Ammothoa arctica*, Lütken, MS.

* Bidrag til kundskab om Christiania-Fjordens Fauna, 1868, pls. vi. & vii, pp. 70-95.

Station No. 4. Lat. 67° 50' N., Long. 55° 27' W.; 20 fathoms.

Rare Crustacea were met with here which had not been found in the preceding localities:—*Hippolyte spinus*, Leach, *aculeata*, Kröyer, and *Phippsii*, Kröyer; *Socarnes VahlII* (Rhdt.); *Anonyx lagena* (Rhdt.), and *gulosus*, Kröyer; *Onesimus plautus* (Kröyer); *Vertumnus serratus* (O. Fabr.); *Amphithoë carinata*, Kröyer; *Ædiceros saginatus*, Kröyer; *Podocerus anguipes*, Kröyer; *Caprella septentrionalis*, Kröyer; *Cythere Finmarchica*, G. O. Sars, and *angulata*, G. O. Sars; *Cytheropteron latissimum* (Norman), and *pyramidale*, G. S. Brady; and *Cytherura clathrata*, G. O. Sars; and the only example procured of the circumpolar *Solaster endeca* (Lin.) and of *Pteraster militaris* (Müller) were from this locality.

Station No. 5. Lat. 66° 59' N., Long. 55° 27' W.; 57 fathoms.

A wonderfully rich dredging. Bottom sand and shells, with an immense profusion of *Rhynchonella psittacea*, Ch. (living and dead, the latter covered with Polyzoa), *Balanus porcatus*, Da Costa, *Cynthia rustica*, L., and *Alcyonidium gelatinosum*, L. Among these animals Crustacea were living in extraordinary numbers, which included almost the whole of the Arctic Palæmonidæ and Crangonidæ, namely, *Crangon boreas* (Phipps), *Hippolyte Gaimardi*, M.-Edw., *gibba*, Kröyer, *borealis*, Owen, and *aculeata*, Kröyer; the Cumacea, *Diastylis Edwardsii* (Kröyer), *D. Rathkii* (Kröyer), and *Campylaspis rubicunda* (Lilljeborg); the Amphipoda, *Vertumnus inflatus* (Kröyer), *Stegocephalus ampulla* (Phipps), *Eusirus cuspidatus*, Kröyer, *Melita dentata*, Kröyer, *Gammaropsis erythrophthalmus*, Lilljeborg; and the Entomostraca, *Nebalia bipes* (Fabr.), *Cythere dubia*, G. S. Brady, *Cytheropteron punctatum*, G. S. Brady, *Cytherideis foveolata*, G. S. Brady (only previously known in the Gulf of St. Lawrence), and *Polycope orbicularis*, G. O. Sars. On *Hippolyte spinus*, Sow., there was the parasitic Isopod *Bopyrus abdominalis*, Kröyer; and on the abdomen of *Hippolyte borealis*, Kr., the parasitic Cirriped *Sylon Hippolytes*, Kr. Altogether there were no less than fifty species of Crustacea in this dredging. It was also very rich in Polyzoa, among which were:—*Escharoides rosacea* (Busk), and *Sarsii*, Smitt; *Leieschara subgracile* (D'Orb.), and *crustaceum*, Smitt; *Eschara elegantula*, D'Orb.; *Lepralia crystallina*, Norman, *labiata*, Busk, *bellis*, Busk, *hippopus*, Smitt, *spathulifera*, Smitt, and many others; *Hippothoa expansa*, Norman; and luxuriant growths of *Celleporaria incrassata*, D'Orb. The Echinodermata included *Asterias polaris*, Müll. & Trosch., *Ophiacantha bidentata* (Retz.), and *Ophioglypha robusta*, Ayr. Of thirty-five Foraminifera, ten belonged to the genus *Lagena*, rarest among which was the Greenlandic *L. striato-punctata*, Parker and Jones; there were also *Lituola globigeriniformis*, Parker and Jones, *Cyclamina cancellata*, H. B. Brady, MS., and *Bulimina elegantissima*, D'Orb.

Station No. 6. Lat. 64° 5' N., Long. 56° 47' W.; 410 fathoms.

Only a very small quantity came up in the dredge; but every scrap was a treasure, and showed that we as yet knew nothing whatever of the rich fauna which lies hid in the depths of the sea in the Arctic regions. Two actinozoans of the highest interest occurred here. Of these the first is a remarkably fine Gorgonian belonging to the genus *Mopsea*. It differs entirely from the recently described *Mopsea borealis*, M. Sars*, the only previously known northern form, and approaches much more nearly to the character of species from tropical seas. It grows in the form of a thick little bush, 6 inches high (probably, at least, 9 inches when perfect). The main stem continuously divides with verticils of three or four branches each, and the branches thus formed similarly subdivide. The polyps, instead of being short as is the case in *Mopsea borealis*, are very long, longer even than in *Mopsea Mediterranea*, Risso†. The form may be named *Mopsea arbuscula*. In floating the sharp sand of this dredging to separate the Foraminifera and Ostracoda, a tip of a branch of *Antipathes arctica*, Lütken, was procured. Although this fragment was not more than a quarter of an inch long, there can be no doubt of its belonging to the species described by Dr. Lütken‡; and we thus obtain a habitat for this Arctic form of what is otherwise known only as a marked tropical genus, if we except an as yet undescribed species found in the 'Porcupine' Expedition of 1869. The type and only known specimen of *Antipathes arctica*, described by Dr. Lütken, was found in the stomach of a shark (*Scymnus microcephalus*), in Rodebay, about two miles north of Jakobshavn in Greenland, by M. K. Fleischer. The Spatangoid *Schizaster fragilis* (Düb. and Kor.) was also dredged here, and is an addition to the Greenland fauna, to which it is remarkable that no Spatangoid and only one Echinoid, *Toxopneustes Dröbachiensis* (Müll.), was previously known to belong. The few Foraminifera did not include any species worth special notice; but among the Ostracoda were *Cytheridea Sorbyana*, Jones, and *Cythere abyssicola*, G. O. Sars.

Station No. 7.

Nothing received from this station.

Station No. 8. Lat. 62° 6' N., Long. 55° 56' W.; 1350 fathoms.

The very small quantity of sand from the sounding of this station contained, among many more common Foraminifera, a Nodosarian which incorporates sand and extraneous matter in its shell-substance, and appears

* On some remarkable Forms of Animal Life from the Great Deeps of the Norwegian Coasts (Christiania, 1872), pp. 50-57, pl. v. figs. 1-23.

† Hist. Nat. des principales productions de l'Europe Méridionale, vol. v. p. 332, pl. viii. figs. 43, 44.

‡ Oversigt over det Kongl. Danske Vidensk. Selsk. Forhandl. 1871 (translated Ann. & Mag. Nat. Hist. 1872, ser. 4, vol. x. p. 77).

to be the same as the Tertiary fossil figured by Schlicht from Pietzpuhl* (pl. vi. figs. 29-32), and which has been named by Reuss *Nodosaria Schlichtii*; this sand-incorporating form seems common in the depths of the North Atlantic, as I have observed it not only in many of the 'Valorous' dredgings, but also in several of those of the 'Porcupine,' 1869. *Orbitolites tenuissimus*, Carpenter †, *Pullenia quinqueloba*, Reuss, and *Lituola nautiloidea*, Lamk., also occurred here; the *Orbitolites* seems to have a wide distribution in the deep sea, as I have just received specimens from the Marquis da Monterosato which he dredged in 100-200 fathoms off the Sicilian coast.

Station No. 9. Lat. 59° 10' N., Long. 50° 25' W.; 1750 fathoms.

This was the last deep-water dredging in Davis Strait. A remarkable new genus of Echinoidea occurred here. In general outline it is almost cylindrical, the length being to the breadth as 5 to 2; and the height, which is greatest in the centre, exceeds the breadth. Viewed laterally the cylindrical form is interrupted anteriorly by two fifths of the length of the animal being sloped away anteriorly above. This sloped-away portion of the Spatangoid is surrounded by a well-marked fasciole, containing within it the ambulacral system, which is thus excentric and confined to the anterior portion of the animal; the four lateral ambulacra are remarkably short, consisting of only four or five pairs of pores each: the anterior odd ambulacrum is much larger, and consists of nine pairs of pores, which are of much larger size than those of the lateral ambulacra; it is situated in a broad but very shallow depression. The tentacles of the upper portion of the odd ambulacrum are very large and remarkable, of umbrella-like form, supported on flexible columns, which are densely studded and strengthened with fusiform nodulous spicula. The spines are of two forms, battledoor-shaped and of the more usual form. Pedicellariæ of two if not of three kinds. Mouth inferior, at one third the length of the animal from the anterior extremity, not situated in a groove (as is the case in *Pourtalesia*). Anal aperture dorsal, at about one fourth the length of the animal from the posterior extremity, nearly flush with the surface, neither in a deep depression (as in *Pourtalesia*) nor in an anal groove.

In its elongated form this genus shows an approach to *Pourtalesia*, but in mouth, anal aperture, and the condition of the ambulacral system it is altogether different. The nearest approach I know to the general outline of this genus is found in the Chalk fossil *Archiacia sandalina*, Ag.; but in *Archiacia* the anal aperture is inferior. Indeed the conditions of this organ are altogether exceptional; for in those known genera

* 'Die Foraminiferen des Septarienthones von Pietzpuhl,' 1870, pl. vi. figs. 29-32. Reuss, Sitzb. d. k. Akad. d. Wissensch. 1. Abth. Nov.-Heft, 1870, 'Die Foraminiferen des Septarienthones von Pietzpuhl' (separate copy, p. 18).

† Thomson's 'Depths of the Sea,' woodcut, p. 91.

in which it assumes a dorsal position (e. g. *Cassidulus*, *Echinobrissus*, *Clypeopagus*, and other genera) it is always sunk in an anal groove. This new and most interesting form will be named *Aërope rostrata* by Sir Wyville Thomson*. In this dredging were also procured a specimen of *Leucon longirostris*, G. O. Sars† (which was described by him from a fragment procured in the 'Josephine' Expedition), *Leucon serratus*, Norman, a new *Diastylis* (*D. armata*), and five undescribed Isopoda. This dredging was also by far the most important as regards the Foraminifera. The *Globigerinæ* here presented an entirely different aspect from that of those usually met with—so much so that they might have been taken to belong to a different species; the segments have a comparatively compactly compressed appearance, very different from the rounded, swollen outline so characteristic usually of the chambers of *Globigerina bulloides*. The ooze, moreover, has a reddish tinge, and contains a large number of remarkable arenaceous Foraminifera, and more Polycystina than are usually met with in North-Atlantic dredgings. From the peculiar appearance of the *Globigerinæ* and the character altogether of this dredging, it would seem that we have here the commencement of that transition state of the sea-bed between the '*Globigerina*-ooze' and the 'Red Clay‡' which has been termed by Sir Wyville Thomson "Grey ooze," and has been found by the 'Challenger' Expedition to constitute the bottom at depths of about 2500 fathoms in the South Atlantic. I am thus led to infer that the peculiar form of the *Globigerinæ* is dependent partially or wholly upon incipient decomposition. The arenaceous Foraminifera are an extraordinary assemblage. They embrace no less than eighteen distinct and well-marked forms, most of the more conspicuous species found in the 'Porcupine' Expedition, viz. *Rhabdammina*, *Pilulina*, what Carpenter has called 'nodosarine,' 'moniliform,' 'nodosarine No. 2,' 'globigerine,' 'orbuline,' and 'orthocerine' *Lituolæ* §, and other forms. With these there are others which have not been before observed, one of which must not be passed without notice. The genus *Astrorhiza* was constituted by Sandahl|| for the reception of a large flat disk-like Rhizopod, having a test which consists of extraneous matter

* When this description was read I had suggested a name for the present species; but having since learnt from Sir Wyville Thomson that it has also been procured in the 'Challenger' Expedition, I gladly adopt the above name, under which I found that he was about to describe it.

† Beskrivelse af de paa Fregatten Josephines Expedition funde Cumaceer, 1871, p. 42, pl. xv. fig. 75.

‡ Proc. Roy. Soc. 1874, vol. xxiii. p. 39 *et seq.*

§ See Carpenter, 'The Microscope,' 5th edit. 1875, pp. 531-535, and woodcuts.

|| Öfversigt af Kong. Vet. Akad. Förhand. 1857, p. 301, pl. iii. fig. 526. The same species has since been described by Bessels, *Jenaische Zeits. für Naturwiss.*, heraus. von der med.-natur. Gesellschaft zu Jena, 1857, p. 265, pl. xiv., under the name *Haeckelina gigantea*; and by Schultze, 'Jahresbericht der Commission zur wissenschaft. Untersuchung der deutschen Meere in Kiel für 1872-73,' pl. ii. fig. 10, under the name *Astrodiscus arenaceus*.

(pieces of shell, sand, and other materials) roughly cemented together, apparently without any selective power being exercised in the choice of the materials. From the edge of the disk proceed numerous spoke-like radii, giving the whole animal a stellate appearance; pseudopodia are extruded from the end of these radii; and Bessels has shown that in its most perfect state a number of these disks are attached to each other by their radii, so as to form a flat network animal, of which each disk will represent a chamber. This remarkable animal, which I have frequently taken off the British coast, was called by Sandahl *Astrorhiza limicola*. In the 'Porcupine' Expedition of 1869 a Rhizopod was dredged between Shetland and Färöe which had a much less regular outline, being sometimes stellate and sometimes cervicorn, and the test was composed entirely of fine sand-grains cemented together; to this Dr. Carpenter has given the MS. name *Astrorhiza arenaria**. At station No. 8 a beautiful form was found which must also be referred to this genus; the chambers are more or less ovoid, not flattened as in the previously known forms, but equally rounded on the sides and above and below; the spoke-like pseudopodian processes, instead of being all in one plane, as in *A. limicola*, radiate in all directions. Several specimens occurred in which two chambers were united together, a fresh chamber being developed at the end of one of the radiating processes; and it is probable that in its most perfect state the animal would consist not only of a series of chambers extended on all sides, as in *A. limicola*, but of other chambers superimposed on these, so that the whole animal would be of a most complex type. The arenaceous investiture consists of fine sand-grains and sponge-spicules firmly (not loosely as in *A. arenaria*) cemented together, and is of a ruddy hue, but not ferruginous. *Astrorhiza catenata*, n. sp., may be the name to distinguish this animal. Together with several more new arenaceous forms are two calcareous Foraminifera, which though known as fossils are now for the first time met with in a living state; the one is *Cristellaria obvelata*, Reuss†, the other is one of the most beautiful species I have ever seen, and is clearly the same as the fossil described by Karrer in his 'Zur Foraminiferenfauna in Österreich,' under the name *Orbulina Neojuriniensis*, Karrer‡. I may add that one of the arenaceous forms is very near to, if not identical with, *Globigerina arenaria*, Karrer, described in the same paper.

Station No. 12. Lat. 56° 11' N., Long. 37° 41' W.; 1450 fathoms.

A bottom of *Globigerina*-ooze and pebbles. The Crustacea here met

* Since the above was written Dr. Carpenter has published a description of this species, and well illustrated its various forms, though he has not given it a specific name (Quart. Journ. Micr. Science, April 1876, p. 221, pl. xix.). It is to be hoped that Dr. Carpenter will before long give us his anxiously looked-for Report on the Foraminifera of the 'Porcupine' Expedition.

† I am indebted to Mr. H. B. Brady for the identification of this form, and for much kind assistance with respect to the Foraminifera.

‡ Sitzb. d. k. Akad. d. Wissensch. 1. Abth. April-Heft, Jahrg. 1867, pl. iii. fig. 10.

with include *Cyclaspis longicaudata*, G. O. Sars (which was described by him from the Lofoden Islands, where it was found in 150 fathoms), three new Isopoda belonging to the family *Tanaidæ*, and fourteen Ostracoda, for the most part new and very fine species, but including also *Bairdia fusca*, G. S. Brady (only known before from Australia), *Bairdia subdeltoidea*, Von Münster, and *Bairdia Crosskeiana*, G. S. Brady (described from the Levant), *Cythere scabra*, Von Münster, and *Cythere echinata*, G. O. Sars (known before from the Lofoden Islands). The Foraminifera include a fine form of the very rare *Cornuspira margaritifera*, Williamson, *Lagena pulchella*, H. B. Brady, *Nonionina pompiloides*, F. & M., *Pulvinulina pauperata*, P. & J., and *Bolivina plicata*, D'Orb. Here, too, was procured the most interesting sponge of the cruise, being a fragment of what appears to form when perfect a large cup or fan-shaped Hexactinellid, nearest allied perhaps to *Farrea occa*.

Station No. 13. Lat. 56° 1' N., Long. 34° 42' W.; 690 fathoms.

A bottom of rock and sand. Notwithstanding the difference in depth between this and the last station, out of thirteen Ostracoda found here eight are common to the two localities; and of the remaining five, four are perhaps new, and the last is the *Cythere abyssicola* of Sars. Among about fifty species of Foraminifera are two *Biloculinæ* (which do not seem referable to any of the numerous recent and fossil forms already described), a pedunculate *Planorbulina* (which was also taken in the 'Porcupine' Expedition off Färöe, but is still undescribed), together with *Cyclammina cancellata*, H. B. Brady, MS., *Rheopax scorpiurus*, Montfort, *Gaudryina pupoides*, D'Orb., and *Orbitolites tenuissimus*, Carpenter.

Station No. 14. Lat. 55° 58' N., Long. 31° 41' W.; 1230 fathoms.

Remarkable among about thirty Foraminifera are a beautiful large variety of *Uvigerina pygmaea*, D'Orb., in which the ribs are elevated into strong plicæ, and the delicate, perfectly transparent, and extremely fragile genus *Cheilostomella*, which is now for the first time recorded as occurring in a recent state. Specimens have, however, been in my collection some years, which I found among sand dredged in 1870 by Dr. Jeffreys's yacht 'The Osprey,' in 112 fathoms, off Valentia Island.

Station No. 15. Lat. 55° 58' N., Long. 28° 42' W.; 1485 fathoms.

Only a very small quantity of material examined from this locality; and it contains nothing worthy of special remark, except that a fragment of *Orbulina Neojurinensis*, Karrer, gives a second locality for that fine addition to recent Foraminifera.

Station No. 16. Lat. 55° 10' N., Long. 25° 58' W.; 1785 fathoms.

Among the *Globigerina*-ooze of this the deepest dredging of the 'Valorous' Expedition there was a mutilated specimen of an Echinoderm

belonging to the remarkable abyssal genus *Pourtalesia*. The specimen seems referable to *P. phyle*, Wyv. Thomson. Here, too, was a new Ophiuridan belonging to that section of the genus *Amphiura* which is devoid of tentacle-scales. Of this section it belongs to the subsection* which has the arm-spines simple (that is, not hatchet-formed as in *A. filiformis* and its allies); and it may be distinguished among other characters from *A. Atlantica*, Ljungman, the only other species falling into this subsection, by having only three instead of six arm-spines. The present form may be named *Amphiura abyssorum*, n. sp.

Two young Asteroidea which occurred here, although they unquestionably have not attained their mature form, have characters so distinct that we cannot refer them to any described starfish. Though differing in all details they are alike in general outline, which resembles that of our well-known *Porania pulvillus*. In one case each angle of the disk terminates in a large calcareous plate bearing a large central spine flanked on each side by smaller spines; in the other case each angle bears three spines which project upwards from the dorsal surface. In the organs of the mouth and those of the ambulacra these two Asteridans are far removed from each other. Like station No. 12, this dredging produced several undescribed Isopoda and Ostracoda; and among the Foraminifera are *Glandulina lævigata*, var. *gracilis*, Reuss, a Nodosarian which has been already referred to as apparently identical with the *Nodosaria Schlichtii*, Reuss, *Candeina nitida*, D'Orb., and *Discorbina Parisiensis*, D'Orb.

ANNELIDA.

By W. C. M'INTOSH, M.D., F.R.S.E.

The Annelida collected during this expedition were kindly placed in my hands by Dr. Gwyn Jeffreys on his return. They resembled in many respects those recently examined from the Gulf of St. Lawrence, though the series was in neither the same.

Besides the Annelids mentioned in the following list, one Nemertean is abundant. The colour is brownish purple on the dorsum, whitish beneath. The short body and large proboscis distinguish it from *Nemertes Neesii*; but it may be related to the *Amphiporus Grœnlandicus* of Örsted. The empty tubes of some of the Annelids are interesting; thus the *Globigerina*-tubes are bristled with sponge-spicules, and the latter are also used by the *Terebella* in forming the processes at the anterior apertures. A remarkable one occurred at a depth of 1785 fathoms, amongst the *Globigerina*-ooze (station No. 16, 'Valorous'). It consists of a slender tube (about the thickness of a stout thread) of fine greyish mud, and having at one end an enlargement. The latter is tufted with what at first sight (under a lens) appears to be minute and

* Vide Ljungman's paper on the Ophiuridans procured in the 'Josephine' Expedition, Öfversigt af K. Vet. Akad. Förhand. 1871, p. 643.