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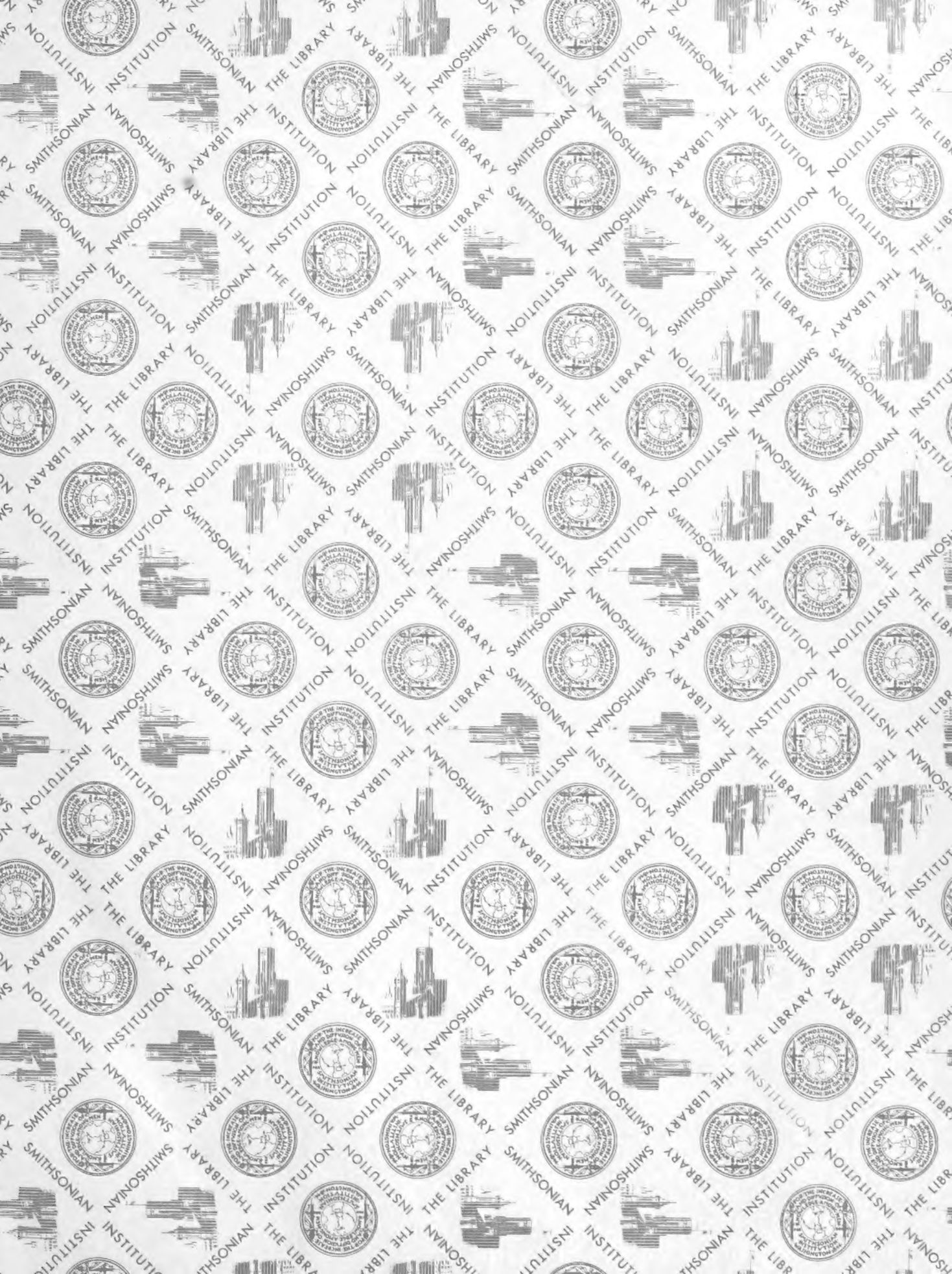
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X.—*On the Deep and Shallow-water Marine Fauna of the Kerguelen Region of the Great Southern Ocean.* By JOHN MURRAY, D.Sc., LL.D., Ph.D., of the Challenger Expedition. (With a Map.)

CONTENTS.

INTRODUCTION.

During her famous circumnavigation of the world, H.M.S. Challenger left the Cape of Good Hope on the 17th December 1873, and, proceeding in a south-easterly direction, visited in succession Prince Edward and Marion Islands, the Crozet Islands, Kerguelen Island, and Heard Island. From Heard Island the Expedition sailed southward, and on the 16th February 1874 passed ten miles beyond the Antarctic Circle in longitude 78° 22′ E., the ship being at this time surrounded by a large number of huge tabular icebergs, some of them four miles in length, and all with perpendicular sides rising about 200 feet above the sea-level. From this most southerly point the Challenger took a north-easterly course towards Melbourne in Australia, where she arrived on the 17th March 1874.

Throughout this cruise to the Antarctic Regions the Expedition made a very large number of observations on the meteorological, physical, chemical, and biological conditions of the Great Southern Ocean. In this communication it is proposed to deal chiefly with the biological results, and more especially with the biological results obtained in the deep water and shallow water trawlings and dredgings of this region of the

Southern Ocean to the south of the Indian Ocean, which may for shortness be called the Kerguelen Region. The animals captured in the eight deep trawlings between 1260 fathoms (2304 m.) and 2600 fathoms (4755 m.) are peculiarly interesting, because they represent the most southerly positions at which organisms have been procured from the deep sea; and further, because this group of deep trawlings and dredgings has turned out to be more productive than any similar group of Stations during the whole voyage with regard to the number of genera and species obtained from deep water.

Complete lists of the genera and species of Metazoa captured at these deep-water Stations, as well as of the genera and species obtained in the other trawlings and dredgings in deep water over 1000 fathoms south of the southern tropic, are given in this paper, and an examination of what is known of their distribution in other regions of the deep sea brings out some interesting results. Lists of the Metazoa captured in the dredgings and trawlings in intermediate depths between 1000 fathoms (1829 m.) and 150 fathoms (274 m.), and in shallow water in depths less than 150 fathoms around the oceanic islands of the Kerguelen Region, are likewise presented in the paper, and the distribution of the species is analysed with some detail. Our knowledge of the marine fauna of the Kerguelen Region is almost entirely derived from the trawlings and dredgings of the Challenger Expedition; the few additions to our knowledge from other sources are collected in a supplementary list.

In addition to these lists of the Metazoa, lists of the Foraminifera in the deposits, and of the Radiolaria and Diatoms in the deposits and at the surface of the sea, together with notes on the general results obtained by means of the surface nets while the Challenger was engaged in the investigation of the region, are brought together in the concluding portion of the paper. In the map accompanying this paper the temperature of the ocean at a level of 1000 fathoms, and on the bottom in greater depths, is shown, as well as the position of the eight dredging and trawling Stations in the deep-water area of the Kerguelen Region, and the other twenty-nine Stations south of the southern tropic.

Sir Wyville Thomson and the other naturalists of the Challenger were very much struck by the general resemblance of the animals captured in the trawlings and dredgings at moderate depths, in the temperate and colder regions of the Southern Hemisphere, to those they had been accustomed to procure under similar conditions off the coasts of Great Britain and Norway. In the reports of the specialists who have examined the collections from Kerguelen and the other islands of the Southern Ocean, very frequent reference is made to the identical or closely allied species which occur in the colder waters of the Northern and Southern Hemispheres, but have not as yet been recorded from the intervening tropical regions, either in shallow or in deep water. If there be, as indeed seems to be proved by the following investigations, very few widely distributed, or rather universally distributed, species in the deep sea, and if there be a large number of identical and closely allied species in the colder waters of the two hemispheres, wholly separated from each other by

the tropics; if, in short, the marine faunas towards either pole are genetically more closely related to each other than to any intervening fauna, then we are face to face with one of the most remarkable facts in the distribution of organisms on the surface of the globe. A study and comparison of Arctic and Antarctic marine faunas and floras seem indeed to lead directly to very important suggestions as to the past history of the earth and the gradual evolution to the physical and biological conditions which now prevail over its surface.

But apart altogether from the interesting questions here mooted, it is important at the present time, when there is a prospect of a renewal of Antarctic exploration, to summarise our knowledge of the marine fauna of the far south, and to point out the interesting scientific results that would likely flow from a thorough exploration of these regions with modern appliances. However, before proceeding to deal with the biological observations of the Challenger Expedition during the cruise to the Antarctic Regions, it is desirable to recapitulate briefly the present state of our knowledge concerning the geographical, bathymetrical, and physical conditions of the Great Southern Ocean.

The Great Southern Ocean.

Position and Extent.—The name Great Southern Ocean is usually given by geographers to that great belt of water surrounding the world in the Southern Hemisphere between the parallels of 40° S. and the Antarctic Circle (66° 30′ S.). The most important land mass interrupting this continuous band of water is the southern end of South America, which extends as far south as 56° S. The South Island of New Zealand, Tasmania, Kerguelen, and numerous smaller oceanic islands, are also situated within the limits of this great circumpolar ocean.

The boundaries are wholly imaginary and artificial, and are not marked off by any natural features on the surface of the planet; still for convenience of description artificial boundaries are most useful. The Great Southern Ocean is then broadly divided into three regions, merging on their northern limits into the South Atlantic, the South Pacific, and the Indian Ocean. On its southern limit the Great Southern Ocean merges into the ice-bound Antarctic Ocean, situated to the south of the Antarctic Circle.

The area of the Southern Ocean is estimated at about 26,158,850 square miles (67,749,800 square kilometres), or about 18 per cent. of the total water-covered surface of the earth.

Depth.—On either side of the parallel of 40° S. we have a large number of trustworthy soundings extending right around the world, and an examination of these shows that at its northern limit the Southern Ocean has an average depth of about 2300 fathoms (4206 metres) or 2½ English miles. Southward of this line of soundings our knowledge of the depth of the Southern Ocean is very scanty. During her Antarctic trip the Challenger obtained 11 soundings in depths exceeding 1000 fathoms (1829 metres), the depths ranging from 1260 to 2600 fathoms (2304 to 4755 metres). Five of these

soundings were situated towards the Antarctic Circle. Three other soundings greater than 1000 fathoms are recorded to the south of the 60th parallel of south latitude. Ross obtained many soundings in depths ranging from 190 to over 600 fathoms (347 to 1097 metres) to the east of Victoria Land and off the Ice Barrier within the Antarctic Circle. Again, in long. 15° W., within the Antarctic Circle, Ross paid out 4000 fathoms (7315 metres) of line without reaching bottom, so that there is probably a great depth in this position. WILKES obtained depths of 800 and 500 fathoms (1463 and 914 metres) off Adelie Land.

With the exception of several deep soundings where no bottom was found, this is all we know about the depths in the Southern and Antarctic Oceans. The indications, on the whole, point to a gradual shoaling of the sea-bed from the 40th parallel southwards towards the shores of the Antarctic Continent, situated at some points close to the Antarctic Circle, for instance at Wilkes Land. In some places, however, the sea-bed rises into somewhat shallow plateaus, as around Kerguelen and other oceanic islands, and in other places sinks to great depths, as in the Ross Deep and Barker Basin.[1]

Marine Deposits on the Sea-floor.—Nearly all the information we have as to the deposits on the sea-bed near to or within the Antarctic Circle is derived from the observations of the Challenger Expedition, together with a few additions from the Ross and WILKES Expeditions. At her most southerly soundings and dredgings the Challenger procured a Blue Mud made up chiefly of detrital matter from the Antarctic Continent. Imbedded in these muds were large and small fragments of granites, quartziferous diorites, schistoid diorites, amphibolites, mica schists, grained quartzites, sandstones, compact limestones, and partially decomposed earthy shales. These rock fragments were evidently transported from the Antarctic Continent by the icebergs, and their lithological character leaves no doubt that true continental land, and not a group of volcanic islands, is situated within the Antarctic Circle. These rocks were most abundant in the Challenger's dredgings on the Blue Mud at the most southerly stations, but they were met with in diminished numbers in all the dredgings within the area of the ocean affected at times by floating ice from the Antarctic Seas.[2] Although we have very few observations as to its geographical extension, still, judging from what occurs off other continental shores, we may feel sure that the Blue Mud extends all round the Antarctic Continent to a distance of about 200 miles (322 kilometres) seawards.

To the north of the Blue Mud the sea-floor is occupied by a white or cream-coloured deposit chiefly made up of the silicious frustules of Diatoms, with a large admixture of Radiolarians and Sponge spicules. In some places this Diatom Ooze extends north nearly to the 40th parallel. But about the 50th parallel it appears to be usually replaced by a

[1] See Charts in a Summary of the Scientific Results obtained at the sounding, dredging, and trawling Stations of H.M.S. Challenger, 1895.

[2] This view as to the origin of these continental rocks is supported by the facts that D'URVILLE found a rocky islet off Adelie Land, to be composed of gneiss and granite, that WILKES found, on an iceberg in the same locality, boulders of red sandstone, and that Mr BORCHGREVINK, who landed at Cape Adair from the whaler "Antarctic" in 1895, brought away fragments of mica-schists and microcline-granite, with quartz, felspar, tourmaline, and garnets.

deposit for the most part composed of the dead shells of pelagic Foraminifera—the well-known Globigerina Ooze. This calcareous deposit appears to form a continuous band right around the world to the north of the Diatom Ooze.

In great depths, however, as for instance to the west of Tasmania in 2600 fathoms (4755 m.), a Red Clay occupies the sea-bed. The peroxides of iron and manganese make up a large part of this Red Clay, and in it are embedded manganese nodules, zeolitic crystals, magnetic spherules with metallic nuclei of extra-terrestrial origin, thousands of sharks' teeth, ear-bones and other bones of whales or other Cetaceans. The Red Clay deposit with all these special characteristics is especially well developed on the northern limits of the Great Southern Ocean in the Pacific. In the composition of all these deposits the physical conditions of the surface waters are reflected. The Blue Muds with abundant boulders indicate a sea very frequently covered with floating icebergs. The Diatom Ooze indicates cold surface water of a low specific gravity, and with clayey matter in suspension. The Globigerina Ooze indicates the warmer water of the temperate regions with numerous pelagic organisms having calcareous shells and skeletons, such as Coccospheres, Foraminifera and shelled Molluscs.

Meteorology.—There is a wide range of temperature of both the air and sea-water within the limits of the Great Southern Ocean. In the neighbourhood of the Antarctic Circle the temperature of the air and sea-surface is, even in summer, at or below the freezing-point of fresh water. Direct observations have, in these latitudes, only been made during the summer, so that we have no certain knowledge of the air temperature during the winter months, nor of the annual range of temperature. In all probability the range of the water temperature at the Antarctic Circle throughout the year is not greater than three or four degrees Fah. (about two degrees Cent.), and the sea in these latitudes must always be burdened with floating ice. Indeed, with the exception of an area to the south of Australia and New Zealand, the whole area of the Southern Ocean may be occasionally affected with floating ice from the Antarctic Continent; the extreme limit within which drift ice has been observed extends to the north of the 40th parallel of south latitude in the Atlantic, and nearly to this parallel at some points of the Pacific and Indian Oceans.

At the northern limits of the Southern Ocean on the 40th parallel south there is a wide annual range of temperature, both of the air and of the sea-surface. At some points the range is over 50° F. (about 28° C.) in the case of the air, and over 31° F. (about 17° C.) in the case of the water, for instance, off the Agulhas Bank. These great variations in the temperature of the sea-surface are brought about chiefly by a mixture of oceanic currents from a tropical source on the one hand and from a south polar source on the other. One result of this mixture of currents from different sources is the destruction of large numbers of pelagic organisms in the surface waters of the Southern Ocean, and these, falling to the bottom, provide abundant food for the rich deep-sea fauna, which, we shall see, lives on the sea-bed in this region of the ocean.

One of the most remarkable features of the meteorology of the globe is the low

atmospheric pressure at all seasons in the southern hemisphere between the latitudes of 40° and 60° S. Over certain parts of these latitudes—for example to the south-east of the Falkland Islands and to the south-east of New Zealand—the observations hitherto made point to a mean pressure of 29·000 inches (736·6 mm.) and under. To the north of this broad belt of low atmospheric pressure there is, about lat. 30° S., an area of very high atmospheric pressure, and we have many reasons for believing that an area of high pressure rests on the Antarctic Continent in the far south.[1]

The inevitable result of this arrangement of isobars is that strong westerly winds with large rain-fall and snow-fall prevail over nearly the whole area of the Southern Ocean. These "Anti-Trades" blow with great persistency nearly due west, and having an uninterrupted sea space over which to blow they frequently rise to the force of a violent gale, and blow as such for several days in succession. Thus out of sixty-eight days during which Sir JAMES C. ROSS lay at Kerguelen, a gale from the north-west is reported on forty-five days. Among sailors the latitudes of these winds are known as the "roaring forties."

Waves and Currents.—The depth of the Southern Ocean and the great extent of open sea over which they blow, enable the strong westerly winds to produce the longest and highest waves anywhere encountered. Thus the "Novara" in 1857 records waves 36·1 feet (11 m.) in height about lat. 40° S., long. 31° E. Lieut. PARIS in 1867 measured six successive waves 37·7 feet (11·5 m.) in height between the Cape of Good Hope and the island of St. Paul's, and the Challenger in 1874 met the highest waves of the voyage, viz., 23 feet (7 m.), between the Crozet Islands and Kerguelen.

A much more profound and far-reaching influence of the westerly winds of the Southern Ocean is the creation of enormous westerly drift currents. These currents are fed by warm and saline water from the tropics, and by cold and less saline water from the south polar area; water must likewise sometimes be drawn towards the surface from the deep layers, and a thorough mixing of the waters appears to take place in these latitudes. So persistent is the action of the westerly winds in the Southern Ocean throughout the year, that their influence appears to be felt right down to the bottom, the density produced by varying degrees of salinity and temperature greatly facilitating this downward movement.

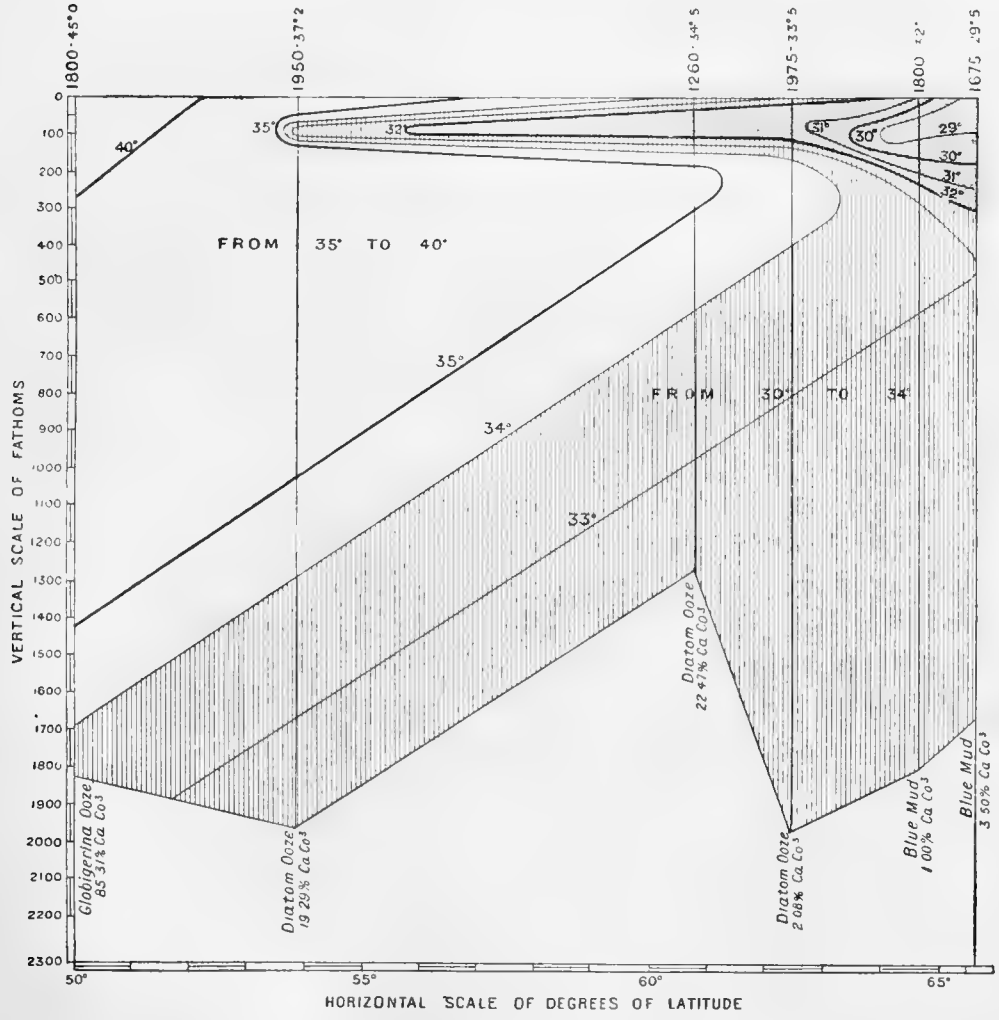
Temperature of the deeper layers of water.—The object of the Challenger's excursion into the Antarctic Regions in 1874 was not to reach a high latitude, but chiefly to make observations on the depth, temperature, and salinity of the ocean in the vicinity of the Antarctic ice. The observations were of the greatest value, although not satisfactory in all respects; they give some hints as to the kind of circulation that takes place, and very clearly demonstrate the urgent necessity for further observations in these regions. In this region of the Antarctic and Southern Oceans there appears to be a cold layer of water sandwiched between a warmer one on the surface and a warmer and thicker one

[1] See MURRAY, "The Renewal of Antarctic Exploration," *Geogr. Journ.*, vol. iii. p. 17, 1894, with map of isobars and winds.

at the bottom. The temperature of the lower warm stratum could not be accurately determined, for the thermometers, being maximum and minimum ones, were unable to record, having passed through a warm layer of 37°·2 F. (2°·89 C.) and a cold layer of 32°·5 F. (0°·28 C.).[1] The general result may be thus stated:—A cold intermediate stratum of water was traced from the Antarctic Circle as far north as 54° S., where its temperature was 32°·5 F. (0°·28 C.) at 80 fathoms (146 m.). Towards the south the

MERIDIONAL TEMPERATURE SECTION

Between the Parallels of 50° and 65° South Lat



temperature of this cold stratum decreased till at the Antarctic Circle it was 29° F. (−1°·67 C.) from immediately below the surface to a depth of 200 fathoms (366 m.).

[1] Thus we find that at Station 156, 1975 fathoms, the surface temperature was 33°·5, the temperature at 100 fathoms was 31°·9, and at 150 fathoms 34°, and below the depth of 150 fathoms the thermometer came up, showing on the maximum side 34°, and on the minimum side 31°·9; hence it is impossible to say what the precise temperature of the sea was below 150 fathoms: all that can be asserted is that it ranged between 34° and 31°·9.

A wedge of cold water thus stretches northwards from the Antarctic Circle for more than twelve degrees of latitude, being overlaid and underlaid by strata of a higher temperature (see diagram). In the Antarctic Ocean the temperature of the water is probably 28° or 29° F. (−2°·22 or −1°·67 C.) from the surface to the bottom, for the temperature of the lower stratum decreases as colder latitudes are reached. One remarkable fact brought out by these observations is that in latitude 50° S. the bottom water has a temperature of 33°·5 F. (0°·83 C.), which is very little different from the temperature found all over the bottom in the Indian and other Oceans. The tendency in a polar ocean, isolated from general oceanic circulation, is to produce a uniform temperature of about 28° or 29° F., and this is the temperature actually observed in the Norwegian Sea, north of the Wyville-Thomson Ridge, on which the depth is 250 fathoms (457 m.). There is no evidence at the present time of a similar condition of things in the Antarctic or Great Southern Ocean.

Salinity and Density of the Sea.—Mr Buchanan's observations on the density of sea-water, and his experiments on the formation of sea-water ice, throw much light on the causes of the remarkable distribution of temperature noted above. All the observations made on water from the bottom or intermediate depths in the Southern Ocean, with the density of the surface-water at each Station, are brought together in the following table.[1]

Salinity of Water expressed as Density at $S^{\frac{60°\text{ F.}}{39°{\cdot}2\text{ F.}}}$ $\left(S^{\frac{15°{\cdot}56\text{ C.}}{4°\text{ C.}}}\right)$

Depth from which Water was taken.	Station 143. Lat. 36° 48′ S. Long. 19° 24′ E.	Station 144. Lat. 45° 57′ S. Long. 34° 39′ E.	Station 147. Lat. 46° 16′ S. Long. 48° 27′ E.	Station 152. Lat. 60° 52′ S. Long. 80° 20′ E.	Station 153. Lat. 65° 42′ S. Long. 79° 49′ E.	Station 154. Lat. 64° 37′ S. Long. 85° 49′ E.	Station 156. Lat. 62° 26′ S. Long. 95° 44′ E.	Station 157. Lat. 53° 55′ S. Long. 108° 35′ E.	Station 158. Lat. 50° 1′ S. Long. 123° 4′ E.	Station 159. Lat. 47° 25′ S. Long. 130° 32′ E.	Station 160. Lat. 42° 42′ S. Long. 134° 10′ E.
Surface, . . .	1·02657	1·02516	1·02515	1·02512	1·02413	1·02458	1·02508	1·02509	1·02522	1·02566	1·02570
50 fathoms, . .	629	...	...	...	...	534	...	507	522	...	576
100 ,, . .	616	524	512	...	...	(140 faths.) 1·02547	561	537	544	...	565
200 ,, . .	593	533	535	...	...		565	...	548	...	573
300 ,, . .	572	532	534	...	...	558	565	... (315 faths.) 1·02546	...	...	560
400 ,, . .	579	537	536	...	...	562	555	...	...	...	557
Bottom, . . .	607	525	550	1·02561	1·02567	529	515	561	554	1·02564	570
Depth of bottom (fathoms), . .	1900	1570	1600	1260	1675	1800	1975	1950	1800	2150	2600

It will be observed that the salinities in the first column in lat. 36°48′ S. are higher than in any other column; the water from surface to bottom bears evidence of having been warmed and concentrated in tropical or sub-tropical regions, the position being where the warm water of the Indian Ocean is carried southwards of the Cape of Good Hope. The salinities of all the other columns are from stations within the zone of

[1] See Challenger Report, Summary of Results, First Part, *passim*.

southern icebergs, and it will be observed that the salinity of the surface water decreases as a colder latitude is approached, and that, generally speaking, there is a rise of salinity with increase of depth. It is therefore probable that the bottom water in the deeper regions of the Southern Ocean is a mixture of water cooled to a low temperature in these regions with water of a higher temperature drawn in, or driven in, from a warmer latitude.

The effect produced on a sea when its surface is frozen over is an important consideration in discussing these relations of temperature and density. Sea-water ice is composed of a mixture of ice, salt crystals, and mechanically inclosed brine, so that ocean water is divided by freezing into two saliniferous parts—one liquid, one solid—which are of different chemical compositions, a striking feature of the freezing process being that the mixture of ice and salt crystals is richer in sulphates than the brine, while the brine is richer in chlorides. In the act of freezing, then, the sea-water separates into ice which contains less salt and into brine which contains more salt than the parent sea-water, and it may be assumed that both the ice and brine have the same temperature (29° F.). The brine being denser than the surrounding water, sinks into it, and by mixing with it renders it more salt and slightly different in composition from the original water, and, at the same time, lowers its temperature.

Circulation of Ocean Water.—In the portion of the Southern Ocean traversed by the Challenger, the soundings show that there is only a very slight and gradual shoaling from the Indian Ocean towards the Antarctic Circle. Hence there is no impediment to the free circulation of the water between cold and warm latitudes. The effect of the winter cold in the far south is in one respect the same as that of heat in tropical regions —it removes water from the sea and thus produces concentration. In the tropics the water is removed as vapour; in the polar regions it is removed as ice, leaving a salter water, at the freezing temperature of the sea-water, which sinks and cools the deeper water by convection. In summer, when the ice breaks up, some of it melts and forms a layer of less saltness but low temperature at the surface. This layer, along with the melting pack-ice and icebergs floating in it, is generally driven in part far to the northward of the place where it was formed. Its place must be supplied from below by water coming from more northerly latitudes, unless the supply of land ice from the Antarctic Continent were sufficient to supply the deficiency.

In the Atlantic, Indian, and Pacific Oceans the return currents of dense warm tropical water which run southward along the eastern shores of South America, Africa, and Australia, penetrate southwards into the region of the Great Southern Ocean, and the effect of these currents can evidently be traced in the distribution of the southern ice at its northern limits. The water of these currents has such a high salinity that it can bear much dilution and still sink through the water of cold latitudes at the same temperature. It is very probable, therefore, that the cold water of the bottom of the ocean within the tropics mostly comes from the Southern Hemisphere, and leaves the surface between the parallels of 42° and 56° of south latitude. From this zone the water is drawn northward

over the ocean's floor to make good the deficiencies caused in the tropics by surface currents and evaporation, and there can be little doubt that it also flows southward to supply the place of the ice and cold surface water drifted northward. The comparatively warm water which reaches the Antarctic Circle at depths greater than 200 fathoms probably comes also from this zone between 42° and 56° S. lat., its temperature being, of course, lowered by being drawn into polar areas.

If there were in the Antarctic Ocean basins like that of the Norwegian Sea, cut off by submarine ridges from general ocean circulation, the water in these basins would have the same low temperature of 29° F. from surface to bottom. The brisk superficial circulation which is kept up in the Arctic Ocean by the extension of the Gulf Stream waters along the coast of Norway, and the return of the cold polar currents removing ice by the eastern coast of Greenland and Baffin's Bay, results in that ocean being comparatively open to a very high latitude, and produces at the same time a great depth of relatively warm and saline water along the northern coasts of Norway. A similar circulation appears to be entirely wanting in the Antarctic Seas; hence their ice-bound character.

The mean of the eighteen surface salinities observed by the Challenger to the south of lat. 60° S. is 1·02475 ($S_{39\cdot2}^{60^\circ}$), and of the six furthest south of these the mean is 1·0245. This is the same as Mohn's line of lowest salinity between Greenland and Spitzbergen. Nothing was observed, however, so low as 1·0240 found by Admiral Makaroff in the southern part of the Sea of Okhotsk.

We have already pointed out that, owing to the mixture of cold and warm waters in the upper layers of the Southern Ocean, large numbers of pelagic marine organisms are killed, and their bodies, falling to the bottom, afford abundant food for the deep-sea animals of this region, and thus have a determining influence on the richness of the Benthos fauna. The abundance of food, however, is not the only condition favourable to animal existence, for the physical condition of the water renders it peculiarly fit for the support of animal life. Owing to the low temperature of the surface, the dissociation tension of the atmospheric gases in solution is very low. In order, therefore, to come into equilibrium with the atmospheric pressure, the water takes up a correspondingly large quantity of atmospheric gases, particularly oxygen. This cold, and therefore heavy, water sinks down, carrying with it to the lower strata its store of oxygen. This unusually copious supply of oxygen cannot but have an important influence on the life at great depths in these regions.

Colour of the Water.—The colour of the sea varies considerably throughout the Southern Ocean, sometimes being a deep blue, but in the neighbourhood of the ice it is often green or brown-coloured, due to the presence of Diatoms or other marine Algæ. The lower forms of Crustacea are occasionally so numerous as to give the water a reddish tinge.

LIST I.

Metazoa procured by the Challenger in the Deep-water Area of the Kerguelen Region, in depths exceeding 1260 Fathoms.

This list contains all the species and varieties of marine Metazoa described and recorded in the Challenger Report from eight deep-water Stations in the Great Southern Ocean, south of the Indian Ocean, traversed by the Challenger during the cruise from the Cape of Good Hope to the Antarctic Circle and Australia, viz., Stations Nos. 146, 147, 152, 153, 156, 157, 158, and 160, lying between latitude 42° 42′ to 65° 42′ S. and longitude 45° 31′ to 134° 10′ E., the depths varying from 1260 fathoms at Station 152 to 2600 fathoms at Station 160. For the sake of brevity this region has been called the deep-water area of the Kerguelen Region. At the most southerly Station (No. 153) the dredge was used, the trawl being sent down at the other seven Stations. The species not known to occur outside the region represented by these eight Stations, nor therefore in depths less than 1000 fathoms, are indicated in this list by an asterisk *.

Monaxonida:

Axinella erecta [1] (Carter).
**Cladorhiza* [2] *moruliformis*,[3] Ridley and Dendy.
* ,, (?) *tridentata*,[4] Ridley and Dendy.
**Esperella mammiformis*,[5] Ridley and Dendy.
**Esperiopsis* [6] *profunda*,[7] Ridley and Dendy.

[1] *Axinella erecta* is a very variable species.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, p. 182.)

[2] Although the different species of *Cladorhiza* vary very much in external form, yet the different modifications of the main skeleton, upon which the external form of the sponge depends, are easily derivable from one common primary type, and afford interesting instances of adaptation.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, p. 86.)

[3] *Cladorhiza moruliformis* is a form of the very greatest interest, and affords a good example of radial symmetry in a Monaxonid Sponge. It was a question with us whether or not this species should form the type of a new genus, but we finally decided not, as no essential changes are necessary to derive it from the more typical species. . . . It is, of course, by no means impossible that perfect specimens of *Cladorhiza moruliformis* may have a branching stem with a head at the end of each branch.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, pp. 91, 92.)

[4] In the arrangement of its skeleton *Cladorhiza tridentata* stands quite alone in the genus, and as this is generally such a good guide, it seems very doubtful whether it ought to be admitted as a *Cladorhiza*, but for the sake of convenience we shall retain it here for the present, placing it at the end as a doubtful species.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, p. 96.)

[5] *Esperella mammiformis* is a very beautiful little species, and affords another good example of a deep-sea sponge with a definite external form.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, p. 63.)

[6] Several of the species of the genus *Esperiopsis* are remarkable for their well-defined external forms, which serve as excellent guides by which to separate them from one another and from others of the genus. . . . The distribution of the genus *Esperiopsis* is very wide, both vertically and horizontally, but it appears to prefer deep water in temperate or boreal seas.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, p. 77.)

[7] *Esperiopsis profunda* is interesting on account of the great depth (1600 fathoms) from which it was obtained, and with this must again be associated the presence of a definite external form.—(Ridley and Dendy, *Zool. Chall Exp.*, part 59, p. 84.)

**Meliiderma stipitata*,[1] Ridley and Dendy.
Stylocordyla[2] *stipitata* (Carter).

TETRACTINELLIDA :

**Thenea*[3] *delicata*, Sollas.

HEXACTINELLIDA[4] :

Aulocalyx irregularis,[5] Schulze.
**Balanella pipetta*, Schulze.
**Bathydorus spinosus*, Schulze.
**Caulophacus latus*,[6] Schulze.
Farrea sp. (?).
**Holascus fibulatus*, Schulze.
* ,, *polejævii*, Schulze.
**Hyalonema conus*, Schulze.
* ,, (*Stylocalyx*) *clavigerum*, Schulze.
**Malacosaccus vastus*, Schulze.
**Pleorhabdus oviformis*, Schulze.

[1] The genus *Meliiderma* stands in much the same relation to *Chondrocladia* as does *Axoniderma* to *Cladorhiza*, having, like *Axoniderma*, developed a special spicule for external defensive purposes. The form of the extra spicule is, however, totally different in the two cases ; and in *Meliiderma* it appears to be confined to the stalk, while in *Axoniderma* it is most abundant in the body of the sponge. In both these cases it is very difficult to say whether the extra spicule ought to be classed amongst megasclera or microsclera ; for the sake of convenience both will here be regarded as microsclera, though standing on quite a different footing from other microsclera. The form of the extra microsclera in *Meliiderma stipitata* is as yet unparalleled. From their resemblance to spears or darts we have derived the generic name. . . . Only one perfect specimen of this sponge and one damaged one are in the collection ; in both of these the stalk is encrusted by a thin, yellow, velvet-like layer of the densely packed, spear-like spicules. At first we thought that these spicules belonged to some foreign encrusting sponge, and hence no mention of them was made in our Preliminary Report, but subsequent examination has convinced us that they are proper to the species ; the fact of their occurring in both specimens being strong evidence in favour of this view. An interesting point about the sponge is the position in which the embryos develop. In the specimen which we cut open a number of round yellow bodies were found, each enclosed in a membranous capsule around which the chelate spicules were lying in very great numbers. These embryos were placed in a zone of tissue occupying about the centre of the spherical head, and lying immediately above the expanded termination of the stalk, between the bands of spiculo-fibre which radiate from it ; this being obviously the position of greatest security.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, pp. 102, 103.)

[2] The genus *Stylocordyla* still stands aloof from all other Suberitidæ in its remarkable spiculation, though, as regards external form, the old distinction embodied in the term *Stylocordyla* no longer holds good, for similar stipitate forms are found to occur in the genus *Suberites*. . . . The external form of this sponge is very variable. SCHULZE, as well as CARTER, has already noticed that the head in young forms is more or less round ; we have to notice below a variety in which the head is globular even in the adult.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, pp. 222, 223.)

[3] The genus *Thenea* is the characteristically deep-water genus of the Tetractinellida, the shallowest water from which it has yet been recorded being 78 fathoms, the deepest 1913 fathoms.—(SOLLAS, *Zool. Chall. Exp.*, part 63, p. 404.)

[4] It is a striking fact that [among the Hexactinellida] the Asconematidæ, which occur somewhat abundantly in the south temperate zone, and likewise in the north, are represented in the tropics only by a single species.—(SCHULZE, *Zool. Chall. Exp.*, part 53, p. 449.)

[5] *Aulocalyx irregularis* appears to be widely distributed, since it was found both in the north and south temperate zones.—(SCHULZE, *Zool. Chall. Exp.*, part 53, p. 450.)

[6] *Caulophacus latus* was found in the south temperate zone, the other species, *Caulophacus elegans*, far removed in the northern region.—(SCHULZE, *Zool. Chall. Exp.*, part 53, p. 450.)

ALCYONARIA :

**Callozostron mirabilis*,[1] Wright.

PENNATULIDA[2] :

**Umbellula carpenteri*,[3] Kölliker.
* ,, *magniflora*, Kölliker.

ANTIPATHARIA :

**Bathypathes tenuis*, Brook.

ACTINIARIA[4] :

**Bunodes minuta*, Hertwig.
Cereus spinosus, Hertwig.

[1] The axis in the imperfect specimen dredged of this deep-sea form [*Callozostron mirabilis*] is about 280 mm. in length, it is extremely flexible, and nearly 20 mm. in widest diameter. The colony strongly reminds one at first sight of some gigantic Annelid. . . . It seems probable that this species lived prostrate in the mud, and possibly there may have been some power of expansion and contraction in the colony. It was dredged in the most southern station reached by the Challenger.—(WRIGHT and STUDER, *Zool. Chall. Exp.*, part 64, pp. 48, 49.)

[2] It follows from all these facts that the simpler forms of the Pennatulida, especially those with sessile polyps, inhabit great depths. The presence of their less complex representatives in deep water has also been shown in other invertebrate groups. These simpler forms are probably also the oldest, and may be regarded as the last remnants of an extinct primary creation. The Protoptilidæ and the Umbellulidæ are the principal representatives of these old forms, and of these two families especially the Challenger Expedition has discovered a large number of species with a wide distribution. This addition to our knowledge makes it possible to gain a better insight than formerly into the development of the whole group.—(KÖLLIKER, *Zool. Chall. Exp.*, part 3, p. 39.)

[3] The five specimens of *Umbellula carpenteri* showed a very interesting gradation from a bilateral to an apparently irregular arrangement of the polyps. One specimen had one terminal and two lateral polyps ; another specimen had four polyps, all lateral ; a third specimen had one terminal polyp, two lateral on the right and one only on the left side ; in a fourth there were eight polyps, of different sizes, so disposed that they formed a rosette surrounding a small dorsal area of the rachis of a stellate form, but amongst these polyps the terminal one was easily recognisable, as the axis ended in its base, and the other seven could be interpreted as lateral polyps arising from a shortened rachis ; the fifth specimen finally showed eight polyps, arranged in the form of a rosette, and surrounding like a cup a ninth middle polyp, but this was not the terminal one in which the axis ended, one of the eight had this signification.—(KÖLLIKER, *Zool. Chall. Exp.*, part 3, pp. 23–4.)

[4] The varying character of the deep-sea fauna leads us to the question, has life in the great depths a visible influence on the organisation of the Actiniæ ? This influence can be distinctly recognised in many forms, and is shown by the nature of the tentacles which have undergone retrograde formation, and are transformed first into tubes, and afterwards into simple openings in the oral disk. In *Paractis tubulifera* (1875 fathoms) the tentacles have the same constitution as in the majority of Actiniæ, except in one point, that the terminal opening, which is usually small or entirely wanting, gapes widely. In *Polysiphonia tuberosa* (565 fathoms) the tentacles have become short, slightly movable, wide-mouthed tubes ; in *Sicyonis crassa* (1600 fathoms) they are small wart-like rings, and in *Polystomidium patens* (1825 fathoms) and *Polyopis striata* (2160 fathoms) the walls have almost entirely disappeared, so that the terminal opening forms a fissure in the oral disk, the last remains of the tentacle being represented by a circular margin surrounding the fissure, and so we come finally to the genus *Liponema* (1875 fathoms), in which the points at which the tentacles were actually placed are merely indicated by openings in the oral disk. Of the twenty-one forms from 500 to 3000 fathoms here described, no less than six species have therefore undergone modifications of the tentacles in the same sense, whilst it has never been observed in a single one of the forms of the coast fauna, which greatly exceed the deep-sea fauna in number. . . . There is another point in the mode of life of the deep-sea Actiniæ which seems to me to favour the transformation of the tentacles into tubes and openings. The nutriment of the deep-sea animals probably consists chiefly of material which is already disintegrated, and of a soft nature when obtained. The animals often ingest sand, impregnated with nutriment, from which they extract what is digestible ; at least I have repeatedly found the interior of the deep-sea Actiniæ full of mud. In such a mode of nutrition the long prehensile tentacles would not be of the same use as they are in the littoral Actiniæ, which lie in wait for booty, whilst on the other hand it would

Corallimorphus obtectus, Hertwig.
„ *rigidus*, Moseley.
Liponema multiporum,[1] Hertwig.
Porponia elongata,[2] Hertwig.
Sicyonis crassa,[3] Hertwig.
Tealidium cingulatum,[4] Hertwig.
Another Actinian undetermined.

CORALS :

Bathyactis symmetrica [5] (Pourtalès).

be a decided advantage to the animals to be furnished with numerous inhalent tubes and openings through which they can absorb semi-liquid nourishment. This then is the advantage of the stomidia and tubular tentacles. The retrograde formation of the tentacles is by no means the only point to be taken into consideration in the varying character of the deep-sea Actiniæ, the position of the septa being equally important. The arrangement of the septa typical of the Hexactiniæ is only present in thirteen genera, among which I reckon *Ophiodiscus* and *Polystomidium*, in which we meet with the differentiation of muscular and genital septa which is otherwise unknown, and the genera *Stephanactis* and *Amphianthus*, in which we find some approach to the Antipatharia. The other four genera differ from one another as well as from the Hexactiniæ in the arrangement of the septa. They swell the number of the varying forms represented in shallow water by the Zoantheæ, Cerianthea, and Edwardsiæ, and therefore seem to indicate that the diversity in the structure of the Anthozoa was formerly much greater than it is at present, and that the remains of this diversity have been more extensively preserved in the depths of the sea than in the shallow waters. In this way we can recognise peculiarities in deep-sea Actiniæ which are common to the whole deep-sea fauna.—(HERTWIG, *Zool. Chall. Exp.*, part 15, pp. 132–134.)

[1] The tentacles in *Liponema multiporum* have undergone retrograde formation to a greater extent than in any other Actinia, as there are not the smallest remains of their walls, while in *Polyopis* these can still be recognised as thickened ridges surrounding the openings.—(HERTWIG, *Zool. Chall. Exp.*, part 15, p. 129.)

[2] Whilst the majority of Actiniæ, especially those from great depths, form a short column, and are frequently flattened into a disk, the body form of *Porponia elongata*, from 2600 fathoms, approximates that of the elongated Cerianthidæ. In both specimens examined the body, though contracted, was twice as long as high. It is broadest in the region of the oral disk, below which it becomes a little narrower, and then becomes broader again at the pedal disk, by which it is firmly attached to the bottom.—(HERTWIG, *Zool. Chall. Exp.*, part 15, p. 125.)

[3] *Sicyonis crassa* is one of the most interesting Actiniæ dredged from great depths, both on account of the constitution of the tentacles and of the arrangement of the septa.—(HERTWIG, *Zool. Chall. Exp.*, part 15, p. 98.)

[4] The single specimen of *Tealidium cingulatum*, which was taken attached to a stone from a depth of 1800 fathoms, belongs to the smallest forms among the Challenger material. It is so strongly contracted that the wall closes over the entrance to the oral disk till only a small opening is left.—(HERTWIG, *Zool. Chall. Exp.*, part 15, p. 51.)

[5] *Bathyactis symmetrica* was dredged by the Challenger in all parts of the world. It varies very much in size and appearance, the smallest specimens obtained measuring 3 mm. and the largest 40 mm. in diameter ; the increase in size being evidently not a matter of age and growth as of different development under different conditions. . . . The inspection of a long series of specimens leaves no doubt as to the identity of the large specimens with the small ones. The very large specimens are excessively thin and fragile, and only a small percentage of them were obtained in an unbroken condition. . . . The larger specimens vary in very much the same manner as the smaller ; some have the margins of their septa fused for long distances at their points of junction ; others show little fusion of the septal margins. In some specimens the fusion of the septal margins is very irregular, in one a spongy outgrowth is developed from the coverings of one of the deltas. In some of the largest specimens there is scarcely any trace of a columella ; in others there is a large oval one, composed of a membranous expansion, through which the spines project. . . . After tabulating all the occasions on which this coral was dredged, I cannot succeed in establishing any relation between the size of the specimens dredged, and the conditions of depth, bottom, or temperature. No large specimen was dredged in less than from 200 to 360 fathoms, but from one of these depths a broken specimen, which must have measured more than 30 mm. in diameter, was obtained. Small, apparently adult, specimens of the stouter variety, measuring only 9 mm. in diameter, were dredged from such depths as 2440 fathoms on several occasions. The greater number of very large specimens were obtained from deep water, many being brought up at one haul of the dredge, as at Station 147, in the South Indian Ocean, where twenty or thirty specimens were obtained from 1600 fathoms, curiously enough, all of them large, no young ones being found amongst them. *Bathyactis symmetrica* was found to have a wider range

Leptopenus[1] *discus*, Moseley.

HYDROIDA :

**Cryptolaria abyssicola*,[2] Allman.
**Halisiphonia megalotheca*,[3] Allman.
Stephanoscyphus simplex, Allman, MS.

MEDUSÆ :

Atolla wyvillei, Haeckel.
**Pectis antarctica*, Haeckel.
**Periphema regina*, Haeckel.
**Thamnostylus dinema*, Haeckel.

SIPHONOPHORÆ :

**Disconalia pectyllis*, Haeckel.

CRINOIDEA :

Antedon[4] *abyssicola*,[5] Carpenter.

than any other deep-sea coral, being, in fact, apparently universally distributed in deep water. It has also a wider range in depth than any other animal, occurring in 30 fathoms off Bermuda, and in the East Pacific Ocean at a depth of 3 miles. It was dredged abundantly at Station 244, 2900 fathoms, the specimens being large and in full vigour, full of ripe ova. Some specimens appear as if they had been broken and had reunited, or possibly they were when obtained in the act of splitting up into fragments, or have a tendency to do so.—(MOSELEY, *Zool. Chall. Exp.*, part 7, pp. 186–188.)

[1] I have founded this genus [*Leptopenus*] to contain two very remarkable corals, dredged in deep water, which are so fragile that it is astonishing that they arrived at the surface in such good preservation as that in which they were obtained. The two species differ markedly from one another, but have so many fundamental agreements that they must evidently be placed in the same genus. They are evidently closely related to the Stephanophyllias, but their corallum is so perforate as to be reduced to a mere lace-work. No corals immediately like them appear to have been procured before, or since, either in the recent or fossil condition. Specimens belonging to the genus were dredged on four occasions, all from deep water (over 1500 fathoms), and all in the Southern Hemisphere.—(MOSELEY, *Zool. Chall. Exp.*, part 7, p. 205.)

[2] The vast depth from which *Cryptolaria abyssicola* has been dredged (2600 fathoms) gives it a special interest, which is greatly enhanced by the fact that it affords one of the very few instances as yet known in which the gonosome of *Cryptolaria* has been detected. The scattered instead of distichous disposition of the hydrothecæ is a peculiar and exceptional character.—(ALLMAN, *Zool. Chall. Exp.*, part 70, p. 40.)

[3] The genus *Halisiphonia* is represented in the Challenger collection by a single species, which presents many points of special interest. . . . The very long tubular hydrothecæ gradually passing into their long peduncles confer on this remarkable species [*Halisiphonia megalotheca*] an aspect as striking as it is distinctive. . . . The enormous depth of 2600 fathoms from which both *Halisiphonia megalotheca* and *Cryptolaria abyssicola* were obtained has much significance, in connection with the fact that in both species the gonangia are present, *Halisiphonia megalotheca* affording the only known instance, and *Cryptolaria abyssicola* one of the very few, in which any part of the gonosome has been observed in these genera.—(ALLMAN, *Zool. Chall. Exp.*, part 70, p. 31.)

[4] In discussing the distribution of *Antedon* and *Actinometra*, the two principal genera of Comatulæ, it must be remembered that each of them, but especially *Antedon*, contains a very large number of species, and they should be considered for this purpose to represent subfamilies rather than genera. Thus, for example, the name *Antedon* is now given to all endocyclic Comatulæ with the basals metamorphosed into a rosette, and five rays bearing ten or more arms, just in the same way as the name *Echinus* was originally used for a variety of regular Urchins, which have now received different generic names. The difference between the tiny ten-armed *Antedon abyssicola* inhabiting depths of 3 miles and upwards, and the littoral *Antedon elegans*, *Antedon multiradiata*, or *Antedon regalis*, is no doubt very considerable at first sight; but there are so many intermediate links between the simple and the complex forms, that no hard and fast generic lines can be drawn.—(P. H. CARPENTER, *Zool. Chall. Exp.*, part 60, p. 31.)

[5] This little species [*Antedon abyssicola*] is one of very considerable interest, apart altogether from the peculiarities

**Antedon abyssorum*, Carpenter.
* ,, *bispinosa*,[1] Carpenter.
* ,, *remota*, Carpenter.
Bathycrinus[2] *aldrichianus*, Wyville Thomson.
Hyocrinus bethellianus, Wyville Thomson.
**Promachocrinus abyssorum*, Carpenter.
**Thaumatocrinus renovatus*, Carpenter.

ASTEROIDEA :

**Brisinga discincta*, Sladen.
* ,, *membranacea*, Sladen.
**Chitonaster cataphractus*, Sladen.
**Freyella*[3] *fragilissima*, Sladen.
**Hymenaster*[4] *cælatus*, Sladen.
* ,, *coccinatus*, Sladen

of its calyx, for it is the only Comatula yet found at a greater depth than 2000 fathoms. *Bathycrinus*, and perhaps also *Hyocrinus*, extend down to 2400 fathoms; *Promachocrinus* and *Thaumatocrinus* occur at 1800 fathoms, but with the exception of *Antedon abyssicola*, no other Comatulæ have been found below 1600 fathoms, at which depth (Station 147) *Antedon abyssorum*, *Antedon bispinosa*, and *Antedon remota* were obtained. *Antedon abyssicola* has been dredged, however, at two Stations, one (Station 160) shortly before the Challenger reached Melbourne, where the depth was 2600 fathoms, and the other in the deepest part of the North Pacific at 2900 fathoms (Station 244). *Antedon abyssicola* thus resembles *Antedon alternata* in occurring at widely separated localities in the abyssal region, and it has some points of resemblance with the younger individuals of this type.—(CARPENTER, *Zool. Chall. Exp.*, part 60, pp. 191–2.)

[1] *Antedon bispinosa* has such very definite characters that it is not likely to be confounded with any other. The spiny calyx and the double row of long hook-like spines along the arms distinguish it very clearly. . . . It is rather a robust species for such a considerable depth (1600 fathoms). But the sacculi are poorly developed, as is so often the case in the abyssal Comatulæ.—(CARPENTER, *Zool. Chall. Exp.*, part 60, p. 116.)

[2] *Bathycrinus* ranges through a greater number of degrees of latitude than any other stalked Crinoid, even *Rhizocrinus;* and it is only surpassed in this respect by the ubiquitous *Antedon*. *Bathycrinus carpenteri* was found by the Norwegian North Sea Expedition as far north as 65° 55′ N. lat.; while *Bathycrinus aldrichianus* was twice met with by the Challenger in the Southern Ocean beyond the parallel of 46° S. lat. In the intervening Atlantic Ocean have been found *Bathycrinus gracilis* (Bay of Biscay) and *Bathycrinus campbellianus* (just north of the equator); while other examples of the genus were dredged by the "Talisman" in the Atlantic at a depth of from 2000 to 2380 metres (1200 fathoms). It is distinctly an abyssal type, ranging from 1050 to 2435 fathoms. The only Crinoids which have been found at greater depths than the latter are two species of *Antedon*.—(CARPENTER, *Zool. Chall. Exp.*, part 32, p. 237.)

[3] As now classified the species [of the genus *Freyella*] present a remarkable similarity of general facies, and the comparatively small amount of morphological plasticity exhibited by the genus is extraordinary, considering the wide geographical area over which it is distributed. The bathymetrical range is also remarkable, extending from the commencement of the continental zone to the greatest depth at which starfishes have been found.—(SLADEN, *Zool. Chall. Exp.*, part 51, p. 615.)

[4] The dredgings of the Challenger Expedition have now shown that *Hymenaster* possesses a world-wide distribution in deep waters, and that the genus exhibits a remarkable amount of morphological plasticity, no less than twenty-four species being now known. The bathymetrical range of the genus is also remarkable, as, with the exception of the type form (*Hymenaster pellucidus*), which ranges from 70 to 1539 fathoms, all the species are confined to the abyssal zone. One, *Hymenaster infernalis*, extends to 2900 fathoms, the greatest depth at which starfishes have hitherto been found; and four other species occur in depths greater than 2000 fathoms. . . . The general facies of the type appears to be one of great antiquity. This, however, is not the place to discuss, as I should desire, the archaic relationships of existing Asterids; and I would therefore now only briefly direct attention to the remarkable resemblance and, in many respects, apparent similarity of general character, which exist between *Hymenaster* and the recently described *Loriolaster* of STÜRTZ from the Lower Devonian slates of Bundenbach.—(SLADEN, *Zool. Chall. Exp.*, part 51, p. 492.)

**Hymenaster crucifer*, Sladen.
* ,, *formosus*, Sladen.
* ,, *graniferus*, Sladen.
* ,, *latebrosus*, Sladen.
,, *nobilis*, Wyville Thomson.
* ,, *præcoquis*, Sladen.
* ,, *sacculatus*, Sladen.
**Hyphalaster planus*, Sladen.
**Lonchotaster forcipifer*, Sladen.
**Pararchaster antarcticus*, Sladen.
,, *pedicifer*, Sladen.
Pontaster forcipatus, Sladen, var. *echinata*, Sladen.
Porania antarctica,[1] Smith.

Ophiuroidea :

**Amphiura patula*, Lyman.
Ophiacantha cosmica, Lyman.
Ophiernus vallincola, Lyman.
Ophiocten amitinum, Lyman.
,, *hastatum*, Lyman.
* ,, *pallidum*, Lyman.
**Ophiocymbium cavernosum*, Lyman.
**Ophioglypha fraterna*, Lyman.
,, *lacazei*, Lyman.
* ,, *lienosa*, Lyman.
* ,, *loveni*, Lyman.
* ,, *minuta*, Lyman.
Ophiolebes scorteus, Lyman.
**Ophiomitra sarsii*, Lyman.
**Ophioplinthus grisea*, Lyman.
* ,, *medusa*, Lyman.

Echinoidea :

Cystechinus vesica, Agassiz.
,, *wyvillii*, Agassiz.
**Echinocrepis cuneata*, Agassiz.
Echinus magellanicus, Philippi.
**Genicopatagus affinis*, Agassiz.
Goniocidaris canaliculata, Agassiz.

[1] This species [*Porania antarctica*] may be distinguished from the rather closely related northern *P. pulvillus*, Müller, by differences in the ambulacral spines, and in the number and character of the marginal spines.—(E. A. Smith, *Phil. Trans.*, vol. 168, p. 276.)

Pourtalesia[1] *carinata*, Agassiz.
,, *ceratopyga*, Agassiz.
* ,, *hispida*, Agassiz.
,, *phiale*, Wyville Thomson.
Schizaster[2] *moseleyi*, Agassiz.
**Spatagocystis challengeri*, Agassiz.
Urechinus naresianus, Agassiz.

HOLOTHURIOIDEA :

**Achlyonice lactea*, Théel.
Benthodytes sanguinolenta, Théel, var. *marginata*, Théel.
,, *sordida*, Théel.
Cucumaria abyssorum, Théel.
,, ,, var. *hyalina*, Théel.
**Elpidia ambigua*, Théel.
,, *glacialis*, Théel.
* ,, *incerta*, Théel.
* ,, *purpurea*, Théel.
* ,, *willemoesi*, Théel.
Holothuria thomsoni,[3] Théel, var. *hyalina*, Théel.
Kolga nana, Théel.
Lætmogone wyville-thomsoni, Théel.
Oneirophanta mutabilis, Théel.
**Peniagone affinis*, Théel.
* ,, *atrox*, Théel.
* ,, *challengeri*, Théel.

[1] In the genus *Pourtalesia* proper, as I have retained it here, there are two groups of species readily distinguished from the character of the test; these I was at first inclined to separate into distinct sub-genera on comparing such extreme forms as *Pourtalesia miranda*, *laguncula*, and *phiale* with such forms as *Pourtalesia ceratopyga* and *rosea*. The former group is distinguished by the extreme tenuity, almost transparency, of the test and its more or less bottle-shaped outline, while the latter group contains species with a flattened test, a triangular outline from above, and a comparatively thickened test.—(AGASSIZ, *Zool. Chall. Exp.*, part 9, pp. 132–3.)

[2] The limits which have been assigned to the genera closely allied to *Schizaster* are very unsatisfactory, and the generic characters by which different species are assigned to these genera or sub-genera pass so gradually one into the other, not merely among the recent species, but especially when we come to include the fossil species, that the task of properly limiting them appears hopeless, although these characters are convenient as sub-divisions according to which we may associate groups of species.—(AGASSIZ, *Zool. Chall. Exp.*, part 9, p. 200.)

[3] The three species above mentioned, viz., *Holothuria lactea*, *Holothuria thomsoni*, and *Holothuria murrayi*, form a group by themselves among the numerous representatives of the genus *Holothuria*, and it is very probable that they may be properly placed in a new genus, or, at least, in a sub-genus. Indeed, *Holothuria thomsoni* differs so strikingly from all forms hitherto known that I should not hesitate to refer it to a new genus if I had not had the opportunity of examining the two other forms, which evidently form a transition to the true *Holothuriæ*. *Holothuria thomsoni* is distinguished by twelve tentacles, and its variety by fifteen, numbers of tentacles hitherto unknown in any species of *Holothuria*. That which seems to be common to the three species above mentioned and their varieties is, firstly, the conformation of the calcareous deposits, and secondly, the peculiarity that the pedicels of the two lateral ventral ambulacra either form a simple distinct row, or that, if they are more numerous and crowded, some of them are larger and more or less distinctly arranged in a row along each side of the body.—(THÉEL, *Zool. Chall. Exp.*, part 38, p. 187.)

**Peniagone horrifer*, Théel.
* ,, *naresi*, Théel.
Pseudostichopus villosus, Théel.
,, ,, var. *violaceus*, Théel.
Psychropotes longicauda, Théel.
* ,, ,, var. *fusco-purpurea*, Théel.
* ,, ,, var. *monstrosa*, Théel.
* ,, *loveni*, Théel.
**Scotoanassa diaphana*, Théel.
Scotoplanes globosa, Théel.
* ,, *insignis*, Théel.
* ,, *mollis*, Théel.
* ,, *murrayi*, Théel.
* ,, *robusta*, Théel.

ENTOZOA :

**Ascaris macruroidei*, Linstow.
**Prothelmins profundissima*, Linstow.

NEMERTEA :

Pelagonemertes rollestoni, Moseley.

GEPHYREA :

**Phascolion lutense*, Selenka.

ANNELIDA :

**Amphicteis wyvillei*, M'Intosh.
**Ephesia antarctica*, M'Intosh.
**Eunoa abyssorum*, M'Intosh.
**Grubianella antarctica*, M'Intosh.
Hyalinœcia benthaliana, M'Intosh.
Lætmonice producta, Grube, var. *benthaliana*, M'Intosh.
,, ,, var. *willemoesi*, M'Intosh.
,, ,, var. *wyvillei*, M'Intosh.
**Lagisca crosetensis*, M'Intosh.
**Leœna antarctica*, M'Intosh.
**Maldanella antarctica*, M'Intosh.
Nothria abranchiata (= *abyssicola*), M'Intosh.
* ,, *armandi*, M'Intosh.
**Petta assimilis*, M'Intosh.
**Pista abyssicola*, M'Intosh.
**Polynoë ascidioides*, M'Intosh.

**Polynoë (Admetella) longipedata*, M'Intosh.
**Praxilla abyssorum*, M'Intosh.
**Trophonia wyvillei*, M'Intosh.

MYZOSTOMIDA :

**Myzostoma compressum*, Graff.
* ,, *coronatum*, Graff.
**Stelechopus hyocrini*, Graff.

OSTRACODA :

Bairdia[1] *bosquetiana*, Brady.
Cythere[2] *acanthoderma*, Brady.
,, *dasyderma*, Brady.
,, *dictyon*, Brady.
* ,, *viminea*, Brady.
**Cytheropteron abyssorum*, Brady.
,, *mucronalatum*, Brady.
Krithe producta,[3] Brady.
Macrocypris similis, Brady.

CIRRIPEDIA :

**Scalpellum*[4] *antarcticum*, Hoek.
* ,, *brevicarinatum*, Hoek.
* ,, *flavum*, Hoek.
* ,, *improvisum*, Hoek, MS.
* ,, *planum*, Hoek.
* ,, *tenue*, Hoek.

[1] *Bairdia* is a widely dispersed genus, attaining, apparently, its greatest development in the tropical and southern seas, in dredgings from which regions the number of specimens of *Bairdiæ* not unfrequently exceeds that of all other Ostracoda together ; the individuals, however, though numerous, are usually found to belong in each gathering to one, or at most two, predominant species.—(G. S. BRADY, *Zool. Chall. Exp.*, part 4, p. 48.)

[2] The genus *Cythere* includes probably nearly as many species, recent and fossil, as all the remaining genera [of Ostracoda] put together, the number assigned to it in this monograph being 83 out of a total of 221. But though in its present form excessively unwieldy, it seems impossible, without a more perfect knowledge than we yet possess of the variations of anatomical structure in the several species, either to form useful sub-genera, or to separate from the main group any true generic types.—(BRADY, *Zool. Chall. Exp.*, part 4, p. 62.)

[3] This species [*Krithe producta*] is either a cosmopolitan one, and very variable as to shape, or the figures given under its name, which are fairly representative of many different examples, must belong to other undescribed species. I prefer, however, to consider them as forms of *Krithe producta*, the variations observable in a large series of specimens being almost countless, and, as I think, in many cases fairly referable to differences of age, sex, or race.—(BRADY, *Zool. Chall. Exp.*, part 4, p. 114.)

[4] *Scalpellum* seems to be the only genus of Cirripedia which is often met with in the great depths of the ocean. This strikingly coincides with the common occurrence of this genus in the fossil deposits, especially in secondary strata (Cretaceous period). . . . The great number of species in this genus suggested the idea of dividing it into smaller genera. After careful examination this idea, however, has been given up, as all the species in essential characters correspond as closely, even more closely, with one another than in any other genus of Cirripedia. Nor has it been an easy matter to arrange the species in a natural way.—(HOEK, *Zool. Chall. Exp.*, part 25, p. 60.)

AMPHIPODA :

**Andania gigantea*, Stebbing.
**Lanceola*[1] *australis*, Stebbing.
Phronima[2] *novæ-zealandiæ*, Powell.
**Pleustes abyssorum*, Stebbing.
**Valettia coheres*, Stebbing.

ISOPODA :

**Acanthocope spinicauda*, Beddard.
**Arcturus brunneus*, Beddard.
,, *furcatus*, Studer.
* ,, *glacialis*, Beddard.
* ,, *spinosus*, Beddard.
Eurycope fragilis, Beddard.
* ,, *sarsii*, Beddard.
* ,, *spinosa*, Beddard.
,, sp. (?).
**Iolanthe acanthonotus*, Beddard.
**Ischnosoma bacillus*, Beddard.
**Munnopsis australis*, Beddard.
Serolis antarctica, Beddard.
,, *bromleyana*, Suhm.

PHYLLOCARIDA :

Nebaliopsis typica, Sars.

SCHIZOPODA :

**Amblyops crozetii*, Suhm (MS.), Sars.
Bentheuphausia amblyops, Sars.
Boreomysis scyphops, Sars.

[1] From west to east the genus *Lanceola* may be considered as ranging round the world, while from north to south a range is shown of more than ninety degrees, to which may be added about thirty degrees northward, since *Lanceola clausii* was taken in Davis Strait, lat. 72° N. It is remarkable that each of the Challenger specimens was labelled, not, like most of the Hyperina with the word "surface," but with the number of fathoms of the particular station, indicating that the specimen was supposed to have come from the great depth mentioned. It may be conjectured that the smallness of the eyes and the soft membranaceous character of the integument are connected with residence in the abysses of the ocean, and the latter character perhaps also with a capacity for passing without injury from the bottom to the surface. The pleopods are well developed, so that the animal may be itself a good swimmer, but, to account for the wide distribution of the genus, it may be supposed that the creature often avails itself of extraneous assistance, the retractile claws of the last three pairs of pereopods being well adapted for giving it a firm hold upon animals of much greater size and speed.—(STEBBING, *Zool. Chall. Exp.*, part 67, p. 1317.)

[2] The range of the genus *Phronima* as illustrated by the Challenger specimens is between lat. 36° 23′ N. and 50° 1′ S., and over a space of 223 degrees between long. 13° 5′ W. and 123° 4′ E. Specimens from the Shetland Isles carry the range in latitude up to 60° N. in the Atlantic ; Dr STREETS extends it to 40° N. in the Pacific ; and since Dr GILES has added the Bay of Bengal to so many other localities from which the genus is known, its range from east to west may fairly be considered as extending all round the world.—(STEBBING, *Zool. Chall. Exp.*, part 67, p. 1361.)

**Chalaraspis alata*, Suhm.
Eucopia australis,[1] Dana.
Gnathophausia[2] *gigas*,[3] Suhm.
Pseudomma[4] *sarsii*, Suhm.

MACRURA :

**Glyphocrangon*[5] *podager*, Bate.
**Hymenodora*[6] *duplex*, Bate.
,, *mollicutis*, Bate.
**Nematocarcinus*[7] *lanceopes*, Bate.
,, *proximatus*, Bate.
**Petalidium foliaceum*, Bate.

[1] This Schizopod [*Eucopia australis*] would appear, on the whole, to be a true deep-sea form, ranging, as it does, from a depth of 1000 to 1975 fathoms. It is worthy of remark, however, that the specimen described by DANA was taken from the stomach of a penguin ; and, as it cannot be reasonably assumed that any air-breathing animal can descend to the enormous depths stated above, the said form may also be considered as occasionally occurring at a less considerable depth. It would seem, too, that this view is in part corroborated by the statement of the late Dr v. WILLEMOES-SUHM, who says that in the Atlantic this species is met with at depths ranging from 350 to 2500 fathoms. The late Dr v. WILLEMOES-SUHM observes concerning this form that "it is the commonest Schizopod of the deep-sea fauna, and seems to enjoy a very wide bathymetrical and geographical distribution." Indeed its geographical range is quite astounding, for it is met with not only throughout the great depths of the Atlantic, but also in the Antarctic Ocean, the Australian seas, and even in the Pacific, as far north as Japan.—(SARS, *Zool. Chall. Exp.*, part 37, p. 62.)

[2] All the species belonging to the genus *Gnathophausia* seem to be well-marked deep-sea forms. The least depth from which specimens have been obtained is 250 fathoms, and the greatest 2200 fathoms. *Gnathophausia* has never been taken at the surface of the sea ; it may therefore certainly be assumed that these Crustacea, notwithstanding their strongly developed natatory organs, never leave the deeper strata of the sea, and that in all probability they have their habitat on the sea-bottom itself. . . . The genus seems to exhibit a very extensive geographical distribution, being most probably represented throughout the greater part of the ocean, excepting perhaps the Arctic and Antarctic regions. Thus, species of this genus have been recorded both from the North and South Atlantic, from the Pacific, and from the seas of the Indian Archipelago. The genus may even be reckoned among the European fauna, one of its species having been found by the French expedition in the Bay of Biscay.—(SARS, *Zool. Chall. Exp.*, part 37, p. 29.)

[3] Exclusive of the specimen of *Gnathophausia gigas* taken in the North Atlantic, west of the Azores, I also found among the material placed in my hands for examination the recently moulted skin of the outer part of the tail of another specimen, apparently belonging to the same species, brought up in the Southern Ocean, between Kerguelen and Australia. Hence the species seems to exhibit a rather extensive geographical distribution, its occurrence in both hemispheres having been ascertained.—(SARS, *Zool. Chall. Exp.*, part 37, p. 35.)

[4] Of this genus [*Pseudomma*] three northern species have been recorded ; two additional species were met with on the Challenger Expedition, both in the southern hemisphere.—(SARS, *Zool. Chall. Exp.*, part 37, pp. 188–9.)

[5] The various forms of this genus [*Glyphocrangon*] can scarcely be considered as being more than varieties of one great type ; the specific differences being little else than a greater or less exaggeration of features common to them all. —(SPENCE BATE, *Zool. Chall. Exp.*, part 52, p. 507.)

[6] The species of this genus [*Hymenodora*], like most of the family, are from deep water ; only two specimens of one species being taken at a less depth than 2 miles. They are mostly found in mid ocean, on a bottom of mud or ooze : in the Atlantic beneath the equator and as far south as Tristan, and in the Indian Ocean as far south as Kerguelen. BUCHHOLZ'S specimen was taken at the surface near the pack ice in lat. 78° N. . . . In the most typical forms the eyes have almost entirely lost their pigment ; in some species it is reduced to a brown colour, and in a few it is black, as if the degree of pigmentation was dependent upon variation in depth and degree of light.—(SPENCE BATE, *Zool. Chall. Exp.*, part 52, p. 841.)

[7] I am inclined to believe that the animals [of the genus *Nematocarcinus*] live at an average depth of between 300 and 500 fathoms in mid-water.—(SPENCE BATE, *Zool. Chall. Exp.*, part 52, p. 801.)

ANOMURA :

Munidopsis[1] *antonii* (M.-Edwards, MS.).
,, *subsquamosa*, Henderson, var. *aculeata*, Henderson.
Pagurodes inarmatus, Henderson.

PYCNOGONIDA :

**Ascorhynchus glaber*, Hoek.
Colossendeis gigas, Hoek.
* ,, *gigas-leptorhynchus*, Hoek.
* ,, *gracilis*,[2] Hoek.
,, *leptorhynchus*, Hoek.
**Nymphon hamatum*, Hoek.
* ,, *meridionale*, Hoek.
**Phoxichilidium pilosum*, Hoek.

LAMELLIBRANCHIATA :

Amussium meridionale, Smith.
Kellia (?) sp.
Leda sp. (?).
Lima (*Limatula*) sp. (?).
,, (?) sp.
**Lyonsiella papyracea*, Smith.
**Neæra* [= *Cuspidaria*] *meridionalis*, Smith.
**Pecten pudicus*, Smith.
Silenia sarsii, Smith.

SCAPHOPODA AND GASTEROPODA :

**Dentalium leptoskeles*, Watson.
**Fusus* (*Neptunea*) *calathiscus*, Watson.
* ,, (,,) *setosus*, Watson.
**Guivillea alabastrina*, Watson.
Lamellaria sp. (?).
Pleurobranchus sp. (?).
**Pleurotoma* (*Pleurotomella*) *papyracea*, Watson.

[1] The members of this genus [*Munidopsis*] have been taken in almost all seas the deep water of which has been explored by the dredge, and they are found at depths varying from about 100 to upwards of 2000 fathoms. The species differ widely among themselves in the form of those parts which in other Crustacea afford generic characters; and yet it is impossible to effect a natural sub-division, or one which is not founded on a single character to the exclusion of others. It is probable that the loss of sight is compensated by a greater development of the tactile sense, and in some species this is evidenced by the great length of the antennal flagella, which in all probability enable the animal to grope its way about on the bottom.—(HENDERSON, *Zool. Chall. Exp.*, part 69, p. 148.)

[2] Whether I am right or not in considering the specimens collected at Stations 146 and 147 (*Colossendeis gracilis*), Station 298 (*Colossendeis media*), and Station 325 (*Colossendeis brevipes*), as three different species can only be ascertained by examining a larger number of specimens than are at my disposal. I can only point out here the great affinity of these different specimens.—(HOEK, *Zool. Chall. Exp.*, part 10, p. 73.)

Peurotoma (Surcula) lepta, Watson.
„ („) *staminea*, Watson.
Trochus (Margarita) brychius, Watson.
„ („) *infundibulum*, Watson.

CEPHALOPODA :

Bathyteuthis abyssicola,[1] Hoyle.
Cirroteuthis magna, Hoyle.
Eledone rotunda, Hoyle.

POLYZOA :

Bicellaria infundibulata, Busk.
Bugula[2] *bicornis*, Busk.
„ *reticulata*, Busk.
Cellepora[3] *solida*, Busk.
Farciminaria[4] *magna*, Busk.
Foveolaria orbicularis, Busk.
Idmonea marionensis, Busk.
Onchopora sinclairii, Busk.
Salicornaria magnifica, Busk.

BRACHIOPODA :

Terebratula wyvillii,[5] Davidson.

[1] Notwithstanding the great distance between the localities where this species [*Bathyteuthis abyssicola*] and VERRILL'S *Bentheoteuthis megalops* [North Atlantic] were captured, it seems quite possible that they may ultimately prove to be the same species (HOYLE, *Zool. Chall. Exp.*, part 44, p. 169).

[2] In order to include several of the species in the present collection, and to avoid the creation of one or more new genera, I have thought it better in this catalogue so to modify the definition of *Bugula* as to admit of these, for the most part, new forms being placed in it. . . . The group, however, as thus made up, includes several apparently distinct types, which will probably at some time be thought of at least sub-generic value. . . . It may also be observed that the first and second of these groups consist almost exclusively of very deep-water forms, the shallowest being 150 fathoms, whilst the depths from which the other species, included in those groups, were brought up was on the average not less than 2000 fathoms. They would appear therefore to constitute a distinctively abyssal type. . . . The group affords a striking instance of the comparatively large size and free growth, and at the same time of the extremely delicate structure, characteristic it may almost be said of the Polyzoa that live in the tranquil depths of the ocean.—(BUSK, *Zool. Chall. Exp.*, part 30, pp. 37, 38.)

[3] The species of this multiform and perplexing genus [*Cellepora*] may be conveniently arranged in two principal more or less artificial sections or groups, characterised primarily by the form of the operculum and secondarily by the general zoarial habit. . . . On the whole the genus would appear to belong to comparatively shallow water.—(BUSK, *Zool. Chall. Exp.*, part 30, pp. 191–2.)

[4] The genus *Farciminaria* may be regarded emphatically as abyssal; the mean depth at which the species here enumerated occurred being not less than 1500 to 1600 fathoms, or from 450 to 2750 fathoms.—(BUSK, *Zool. Chall. Exp.*, part 30, p. 49.)

[5] *Terebratula wyvillii* is one of the most interesting species of deep-sea Brachiopoda dredged during the Challenger Expedition. It appears to abound over a wide geographical range, and at depths varying from 1035 to 2900 fathoms. The shell is of such extreme thinness that it is almost transparent; indeed, the valves when separated are really so, and the muscular impressions may be seen through its transparency. It is also exceedingly brittle. It bears much resemblance to several species occurring in the Jurassic and Cretaceous formations and especially so to *Terebratula boneti*, Zeuschner, from the Kimmeridge of Switzerland, and from which some of the Challenger specimens are scarcely distinguishable, either by size or shape.—(DAVIDSON, *Zool. Chall. Exp.*, part 1, pp. 27, 28.)

TUNICATA :

**Abyssascidia vasculosa*, Herdman.
* ,, *wyvillii*, Herdman.
**Bathyoncus mirabilis*, Herdman.
Corynascidia suhmi, Herdman.
**Culeolus*[1] *perlucidus*, Herdman.
,, *recumbens*, Herdman.
**Fungulus cinereus*, Herdman.
**Pharyngodictyon mirabile*, Herdman.
**Styela bythia*, Herdman.
* ,, *sericata*, Herdman.
* ,, *squamosa*, Herdman.

FISHES :

Antimora rostrata, Günther.
**Bathydraco antarcticus*,[2] Günther.
**Bathylagus*[3] *antarcticus*, Günther.
Cyema atrum,[4] Günther.
Gonostoma microdon, Günther.
Halosaurus[5] *macrochir*, Günther.
Macrurus[6] *armatus*,[7] Hector.

[1] The genus *Culeolus* has a very considerable horizontal range, two of the species being found in the northern hemisphere, while the remaining four are from the southern. Those in the northern seas are from the temperate zone, while of the southern forms, one is from near the equator, one from between 20° to 30° S. lat., and the remaining two species are from much further south. . . . *Culeolus* is a peculiarly deep-water genus, but has a considerable range, viz., from 630 to 2425 fathoms. Five of the species are from upwards of 1000 fathoms, four from over 1500 fathoms, and two from upwards of 2000 fathoms. Thus they all belong to the abyssal fauna.—(HERDMAN, *Zool. Chall. Exp.*, part 17, pp. 265, 270.)

[2] *Bathydraco antarcticus* is clearly allied to *Chænichthys*; its habitat at a great depth is evidenced by the diminished proportion of earthy matter in the bones of the skull, by its large eyes, wide muciferous channels, and coloration.—(GÜNTHER, *Zool. Chall. Exp.*, part 57, p. 48.)

[3] In *Bathylagus* the thinness of the bones, the fragility of the fin-rays, the delicacy of the skin and scales, and the enormously large eyes, seem to be sufficient evidence that these fishes are actually inhabitants of very great depths. These fishes must therefore be entirely dependent for vision on the phosphorescent light which is produced by other abyssal creatures. Not being fish of prey themselves, or only to a slight degree, they would be attracted by the light issuing from the Pediculates and Stomiatids of the deep, and thus fall an easy prey to these fishes.—(GÜNTHER, *Zool. Chall. Exp.*, part 57, p. 219.)

[4] *Cyema atrum* is extremely interesting, inasmuch as it is still nearer to the Leptocephalid condition than *Nemichthys infans*. In fact, I had to consider the possibility of its being a less advanced stage of development of that species; however, the minute size of the eye disposes of the idea of genetic affinity.—(GÜNTHER, *Zool. Chall. Exp.*, part 57, p. 266.)

[5] Of the genus *Halosaurus* which hitherto was known from a single example only, four species were discovered by the Challenger, showing that it is widely and abundantly represented in the deep sea.—(GÜNTHER, *Zool. Chall. Exp.*, part 57, p. 232.)

[6] Before the Challenger Expedition the known species of *Macrurus* were few in number . . . The dredge of the Challenger secured more than 140 examples referable to thirty species, and proved that this type of fishes is not only one of the most widely spread in the depths of all oceans, but also extremely abundant with regard to species and individuals.—(GÜNTHER, *Zool. Chall. Exp.*, part 57, p. 122.)

[7] *Macrurus armatus* has a wide range in the southern hemisphere, and is subject to some variation, the variation

Macrurus filicauda,[1] Günther.
Melamphaës[2] *crassiceps*, Günther.
* „ *microps*, Günther.
**Melanonus gracilis*, Günther.
**Scopelus*[3] *antarcticus*, Günther.
Stomias boa (Risso).
Synaphobranchus bathybius, Günther.

The 272 species enumerated in the above list include one or two species of Medusæ, Siphonophoræ, Amphipoda, and Fishes undoubtedly belonging to the surface and intermediate water fauna; these might have been eliminated, but it has been considered best to allow them to remain as they occur in the Challenger lists. With these exceptions, however, all the above species live on or near the bottom beyond 1000 fathoms.

The great majority of the species were each taken only at one of the eight Stations, but a few occurred at more than one of these Stations.

LIST I *a*.

It may be of interest to give here a list of such species, indicating in brackets the number of Stations at which each species was found. It will be noticed that out of the 57 species occurring at more than one Station, not a single one occurred at all the Stations, nor even at seven out of the eight Stations, while only 1 species occurred at six Stations, 1 at five Stations, 2 species each at four Stations, 13 species each at three Stations, and the remaining 40 species each at two Stations. This does not seem to

occurring in individuals from the same locality, and affecting the form of the head, length of dorsal spine, &c. The most striking deviation from the typical form is a kind of albino, not quite white, but of a much lighter colour than the ordinary specimens. In these albinos the scales are much thinner, the ridges sometimes scarcely visible, and if developed, they are merely keels without spines.—(Günther, *Zool. Chall. Exp.*, part 57, p. 150.)

[1] This species [*Macrurus filicauda*] is clearly one of those in this family which extend to the greatest depths. The decrease in the size of the eye, the very soft bones, the concomitant want of firmness in the structure of the scales, and the tail, which tapers into a very fine filament, indicate its abyssal abode. The scales are nearly all gone in all the specimens obtained. This species appears to be abundant in individuals, and has, like a true deep-sea fish, a wide distribution.—(Günther, *Zool. Chall. Exp.*, part 57, p. 142.)

[2] The formation of the head, the black colour of the body, together with the circumstances attending the capture of the three specimens first known, clearly indicate that the fishes of this genus [*Melamphaës*] are inhabitants of the depths of the ocean. Lowe's two specimens were picked up at the surface, near Madeira, evidently in an exhausted condition; whilst the specimen described by Lütken was found in the stomach of a dolphin. The discoveries by the Challenger, and by the U.S.S. "Albatross," have proved the surmise of the bathybial nature of these fishes to be correct.—(Günther, *Zool. Chall. Exp.*, part 57, p. 26.)

[3] The numerous species which I refer to this genus [*Scopelus*] are, as far as we know of their habits, nocturnal pelagic surface fishes, which are frequently caught at night in the surface net, but disappear during the daytime, when they evidently descend to a depth to which only a moderate amount of light penetrates. A few undoubtedly belong to the bathybial fauna, but with regard to the other species, I consider it equally probable that they accidentally entered the dredge during its ascent. Only a few specimens were captured in this manner, much fewer than of *Argyropelecus*, a fact which is no doubt due to their greater activity, by which they are enabled to make their escape on perceiving the approach of the net.—(Günther, *Zool. Chall. Exp.*, part 57, pp. 195-6.)

indicate that many of the deep-sea species have a wide distribution. The probability is that further trawlings and dredgings will yield a very large number of new species and genera.

Holascus fibulatus (3).
Umbellula carpenteri (2).
„ *magniflora* (2).
Bathyactis symmetrica (2).
Leptopenus discus (2).
Bathycrinus aldrichianus [1] (2).
Promachocrinus abyssorum (2).
Brisinga membranacea (2).
Freyella fragilissima (2).
Hymenaster præcoquis (2).
Lonchotaster forcipifer (2).
Ophiacantha cosmica (6).
Ophiernus vallincola (2).
Ophiocten amitinum (3).
„ *pallidum* (2).
Ophioglypha loveni (5).
„ *minuta* (2).
Cystechinus wyvillii (3).
Goniocidaris canaliculata (3).
Pourtalesia carinata (2).
„ *hispida* (2).
Spatagocystis challengeri (2).
Urechinus naresianus (3).
Benthodytes sanguinolenta (2).
„ *sordida* (3).
Cucumaria abyssorum (2).
Elpidia purpurea (2).
Lætmogone wyville-thomsoni (2).
Oneirophanta mutabilis (3).
Pseudostichopus villosus (4).
Psychropotes longicauda (2).
Phascolion lutense (2).
Grubianella antarctica (3).
Lætmonice producta (3).
Maldanella antarctica (3).
Scalpellum brevicarinatum (2).
Andania gigantea (2).
Eurycope fragilis (3).
„ *sarsii* (2).
Serolis antarctica (2).
Boreomysis scyphops (3).
Eucopia australis (2).
Hymenodora mollicutis (2).
Petalidium foliaceum (2).
Colossendeis gigas (2).
„ *gracilis* (2).
„ *leptorhynchus* (2).
Nymphon hamatum (2).
Phoxichilidium pilosum (2).
Amussium meridionale (2).
Dentalium leptoskeles (2).
Fusus (*Neptunea*) *setosus* (2).
Bicellaria infundibulata (2).
Gonostoma microdon (2).
Macrurus armatus (4).
„ *filicauda* (3).
Scopelus antarcticus (2).

The preceding list of species from the deep-water area of the Kerguelen Region (List I.) shows that in the region of the Southern Indian Ocean represented by the eight Stations referred to, the Challenger procured in depths exceeding 1260 fathoms representatives of 272 species and varieties of Metazoa, belonging to 186 genera. The large proportion of genera relatively to the number of species is striking, being as 1 to 1·46.

An examination of the list shows that 9 of the species have received no specific names, owing to the specimens being in an unsatisfactory condition or to other causes, and they cannot therefore be taken into account in any discussion of distribution. There are besides 6 varieties enumerated, as well as the species to which they belong, but in what follows the distribution of each species is considered as a whole, including varieties. Of 2 species (*Stephanoscyphus simplex* and *Bairdia bosquetiana*) we have no trustworthy information as to distribution, so that we must deduct from the total number of species

[1] Wyville Thomson says this species was taken at, at least, six or seven Stations in the Atlantic and Southern Sea, but it is recorded in the Challenger Report only from two of these Stations.

(272), 9 unnamed species, 6 varieties, and 2 species of which we have no information, leaving 255 distinct fully-described species, the distribution of which may be discussed in detail.

These 255 species naturally fall into two divisions, viz., those that are known only from the region represented by these eight Stations, and those that are known from other regions of the ocean.

a. *Species limited to the area under consideration.*

In the first place, we find that there are 164 species (or 60 per cent. of the total number of species and varieties found at these eight Stations) which, as far as we know up to the present time, are limited to the region represented by these eight Stations. These 164 species are distinguished by an asterisk in the list, and very little can be said about them beyond the fact that they are known only from this area and from depths over 1260 fathoms.

LIST I *b*.

We may here, however, enumerate those species found at more than one of these Stations, indicating in brackets the number of Stations at which each species was found. It will be observed that here again the species limited to this area do not show a wide distribution within the area itself, for out of the 28 species occurring at more than one Station, 24 species were each taken at two Stations, 3 species were each taken at three Stations, and 1 species was taken at five Stations.

Holascus fibulatus (3).
Umbellula carpenteri (2).
„ *magniflora* (2).
Promachocrinus abyssorum (2).
Brisinga membranacea (2).
Freyella fragilissima (2).
Hymenaster præcoquis (2).
Lonchotaster forcipifer (2).
Ophiocten pallidum (2).
Ophioglypha loveni (5).
„ *minuta* (2).
Pourtalesia hispida (2).
Spatagocystis challengeri (2).
Elpidia purpurea (2).
Phascolion lutense (2).
Grubianella antarctica (3).
Maldanella antarctica (3).
Scalpellum brevicarinatum (2).
Andania gigantea (2).
Eurycope sarsii (2).
Petalidium foliaceum (2).
Colossendeis gracilis (2).
Nymphon hamatum (2).
Phoxichilidium pilosum (2).
Dentalium leptoskeles (2).
Fusus (Neptunea) setosus (2).
Bicellaria infundibulata (2).
Scopelus antarcticus (2).

b. *Species extending outside the area under consideration.*

We come now to consider those species which have a wider distribution and extend into other regions of the ocean outside the area represented by these eight Stations. The number of such species is 91 (or 33 per cent. of the total number of species and varieties

found at these eight Stations), and for the purpose of considering their geographical distribution they may most conveniently be divided into groups according as they have been recorded from the tropical and extra-tropical regions of the ocean. Thus we find that of these 91 species,

38 species (or 42 per cent.) are known, up to the present time, to occur in regions south of the southern tropic outside the area under consideration (List I*c.*);

24 species (or 26 per cent.) are known to occur in regions both south and north of the tropics, but not in the intervening tropical zone (List I*d.*);

12 species (or 13 per cent.) are known to occur in regions both south of and between the tropics, but not north of the tropical zone (List I*e.*); and

17 species (or 19 per cent.) are known to occur in regions both south of, between, and north of the tropics, and some of them may for the present be regarded as almost cosmopolitan or very widely distributed in the deep sea (List I*f.*).

We may now proceed to consider in detail the distribution of these 91 species, according to the groups given above, indicating briefly the geographical and bathymetrical distribution of each species outside the region represented by these eight Stations.

LIST I*c.*

In the first place, we give a list of the 38 species which are known to occur outside the region under consideration in somewhat similar latitudes, *i.e.* in regions south of the tropic of Capricorn, but not in other regions of the deep sea. From the distributional notes accompanying each species it will be observed that 26 of the species are eminently deep-sea species, being unknown from depths less than 1000 fathoms; the other 12 species, though found in depths greater than 1000 fathoms in the region represented by these eight Stations, occur outside this region in depths less than 1000 fathoms, and 8 of these species are recorded from shallow water under 150 fathoms.

Leptopenus discus—Western South Atlantic, 1900 fathoms.
Pararchaster pedicifer—South Atlantic, 1900 fathoms (doubtfully referred to the young of this species).
Porania antarctica—Near Marion Island, 50 to 150 fathoms; Kerguelen and South Georgia.
Ophiocten amitinum—Near Marion and Kerguelen Islands, 85 to 150 fathoms.
Ophioglypha lacazei—Eastern South Pacific, 2160 fathoms.
Ophiolebes scorteus—Near Marion Island, 310 fathoms.
Cystechinus vesica—Eastern South Pacific, 2160 and 2225 fathoms.
„ *wyvillii*—Eastern South Pacific, 1375 to 2160 fathoms.
Echinus magellanicus—Near Marion Island, Falklands, and Magellan Strait, 9 to 310 fathoms: Chili, Cape, Australia, New Zealand.
Pourtalesia carinata—Eastern South Pacific, 2225 fathoms.
„ *ceratopyga*—Eastern South Pacific, 2160 and 2225 fathoms.
Schizaster moseleyi—Near Kerguelen and Magellan Strait, 40 to 400 fathoms.

Urechinus naresianus—Eastern South Pacific, 1450 fathoms.
Benthodytes sanguinolenta—Eastern South Pacific, 2225 fathoms.
„ *sordida*—Eastern South Pacific, 2225 fathoms.
Cucumaria abyssorum—Eastern South Pacific, 1375 to 2225 fathoms.
Psychropotes longicauda—Eastern South Pacific, 2225 fathoms.
Scotoplanes globosa—Eastern South Pacific, 2160 fathoms.
Hyalinœcia benthaliana—South Pacific near New Zealand, 1100 fathoms.
Nothria abranchiata—Mid South Atlantic, 1425 fathoms.
Arcturus furcatus—Near Kerguelen and Heard Islands, 7 to 127 fathoms.
Serolis bromleyana—South Pacific near Sydney and New Zealand, 400 to 1100 fathoms.
Nebaliopsis typica—Mid South Pacific, 2550 fathoms.
Pseudomma sarsii—Near Kerguelen, 120 fathoms.
Pagurodes inarmatus—South Pacific near New Zealand, 1100 fathoms.
Colossendeis gigas—Eastern South Pacific, 1375 fathoms.
„ *leptorhynchus*—Eastern South Pacific, 1375 fathoms, and Magellan Strait, 400 fathoms.
Amussium meridionale—Eastern South Pacific,1450 fathoms.
Silenia sarsii—Western South Atlantic, 2650 fathoms.
Pleurotoma (*Surcula*) *staminea*—Near Kerguelen, 105 fathoms.
Cirroteuthis magna—Eastern South Pacific, 2225 fathoms.
Eledone rotunda—Eastern South Pacific, 2225 fathoms.
Farciminaria magna—Western South Atlantic, 1900 and 2650 fathoms.
Onchopora sinclairii—Near Kerguelen and Heard Islands, 28 to 150 fathoms; Australia.
Corynascidia suhmi—Eastern South Pacific, 2160 fathoms.
Antimora rostrata—Western South Atlantic, 600 fathoms.
Cyema atrum—Eastern South Pacific, 1500 fathoms.
Macrurus filicauda—Eastern South Pacific and Western South Atlantic, 1900 to 2650 fathoms.

LIST I*d*.

In the second place we give a list of the 24 species which are known to occur in regions both south and north of the tropics, but which have not hitherto been recorded from the intervening tropical zone. From the distributional notes accompanying each species it will be observed that 15 of the species are true deep-sea forms, being unknown from depths less than 1000 fathoms; other 7 species, though found in depths over 1000 fathoms in the region represented by these eight Stations, occur outside this region in depths less than 1000 fathoms, and 4 of these species are recorded from shallow water under 150 fathoms; the depths for 2 of the species outside the area under consideration are unrecorded.

Axinella erecta—Near Crozet, Marion, and Tristan Islands, 90 to 550 fathoms; North Atlantic.
Aulocalyx irregularis—Near Marion Island, 310 fathoms, and North Atlantic, 1075 fathoms.
Cereus spinosus—Western North Pacific near Japan, 1875 fathoms.
Liponema multiporum—Magellan Strait, 125 to 160 fathoms, and Western North Pacific, 1875 fathoms.
Antedon abyssicola—Western North Pacific, 2900 fathoms.
Pontaster forcipatus—Western North Atlantic, 1240 to 1700 fathoms.
Ophiernus vallincola—Mid North Atlantic near Azores, 1000 fathoms.
Ophiocten hastatum—South Pacific near New Zealand and Mid North Atlantic, 1100 and 1000 fathoms.
Pourtalesia phiale—North Atlantic ("Porcupine" and "Valorous"), 1215 fathoms.
Elpidia glacialis—North Atlantic (Norw. N. Atl. Exp.) and Kara Sea, 50 to 150 fathoms (Swed. Arct. Exp.).

Holothuria thomsoni—Western North Pacific, 1875 and 2900 fathoms.
Kolga nana—Western North Atlantic, 1250 fathoms.
Lætmogone wyville-thomsoni—Eastern South Pacific, 1375 fathoms, and off Japan, 345 fathoms.
Pelagonemertes rollestoni—Near Japan, 420 to 775 fathoms.
Eurycope fragilis—Western North Pacific, 1875 fathoms.
Boreomysis scyphops—North Atlantic and Arctic, depth (?).
Gnathophausia gigas—Mid North Atlantic, 2200 fathoms.
Munidopsis antonii—Eastern South Pacific, 1375 fathoms; North-West Africa, 2187 fathoms.
„ *subsquamosa*—Eastern South Pacific and Western North Pacific, 1450 and 1875 fathoms.
Trochus (*Margarita*) *infundibulum*—Western North Atlantic (Bermuda), 1075 fathoms.
Idmonea marionensis—Near Marion and Heard Is., and off R. Plate, 50 to 600 fathoms; Mediterranean and Australia.
Halosaurus macrochir—Eastern North Atlantic (Portugal), 1090 fathoms.
Stomias boa—Mediterranean and South Pacific, depth (?).
Synaphobranchus bathybius—Western North Pacific, 1875 and 2050 fathoms.

LIST I*e*.

In the third place we give a list of the 12 species which are known to occur in regions both south of and within the tropics, but which have not hitherto been recorded from regions north of the tropic of Cancer. From the distributional notes accompanying each species it will be observed that 5 of the species are true deep-sea forms, being unknown from depths less than 1000 fathoms; the other 7 species, though found in depths over 1000 fathoms in the region represented by these eight Stations, occur outside this region in depths less than 1000 fathoms, and 1 of these species is recorded from shallow water under 150 fathoms.

Corallimorphus rigidus—Eastern South Pacific and Western tropical Pacific, 2160 and 1425 fathoms.
Atolla wyvillei—Western South Atlantic, 2040 fathoms; Indian Ocean, 240 to 405 fathoms.
Hyocrinus bethellianus—Mid tropical Atlantic and Western tropical Pacific, 1850 and 2325 fathoms.
Hymenaster nobilis—Indian Ocean, 1748 fathoms.
Ophiacantha cosmica—Mid South Atlantic and Eastern South Pacific, 1000 to 2225 fathoms; Western tropical Atlantic, 350 fathoms; Western tropical Pacific, 800 and 1070 fathoms.
Goniocidaris canaliculata—Near Heard, Kerguelen, and Falkland Islands; Natal, Zanzibar, Australia, shore to 1975 fathoms.
Macrocypris similis—Magellan Strait, 165 fathoms; tropical Atlantic near Brazil and Ascension, 675 and 420 fathoms.
Serolis antarctica—Western tropical Atlantic near Brazilian coast, 400 fathoms.
Bentheuphausia amblyops—Mid South Atlantic and mid tropical Atlantic, 1000 and 1500 fathoms.
Salicornaria magnifica—Western South Atlantic and mid tropical Atlantic, 1900 fathoms, and Western tropical Atlantic, 350 fathoms.
Culeolus recumbens—Indian Ocean, 1997 fathoms.
Melamphaës crassiceps—Mid tropical Atlantic and Western tropical Pacific, 1500 and 1100 fathoms, and Western tropical Atlantic, 675 fathoms.

LIST I*f*.

In the fourth place we give a list of the 17 widely-distributed species which are known to occur both in tropical and each of the extra-tropical regions. From

the distributional notes accompanying each species, it will be observed that 5 of the species are true deep-sea forms, being unknown from depths less than 1000 fathoms; the other 12 species, though found in depths over 1000 fathoms in the region represented by these eight Stations, occur outside this region in depths less than 1000 fathoms, and 6 of these species are recorded from shallow water under 150 fathoms.

Four of the species (viz., *Bathyactis symmetrica*, *Cythere dasyderma*, *Cythere dictyon*, and *Gonostoma microdon*) appear to be almost cosmopolitan, occurring in all regions of the ocean, and in all depths from relatively shallow to very deep water.

Stylocordyla stipitata—Off Kerguelen, Marion Island, Bahia and Nova Scotia, 7 to 140 fathoms; also Eastern North Atlantic and Grenada.

Bathyactis symmetrica—North, tropical and South Atlantic, North, tropical and South Pacific, 32 to 2900 fms.

Oneirophanta mutabilis—Eastern South Pacific, Western South Atlantic, mid tropical Pacific, and Western North Pacific, 2160 to 2900 fathoms.

Pseudostichopus villosus—Eastern South Pacific, Western South Atlantic, Western tropical Pacific, Western North Pacific, and Western North Atlantic, 1450 to 2900 fathoms.

Laetmonice producta—Off Marion, Kerguelen, and Heard Is., New Zealand, and Nova Scotia, 20 to 700 fathoms; mid South Atlantic, mid North Atlantic, Western tropical Pacific, and Western North Pacific, 1400 to 2900 fathoms.

Cythere acanthoderma—Western tropical Pacific, 580 fathoms; Eastern South Pacific, Western North Pacific, and mid North Atlantic, 1000 to 2750 fathoms.

„ *dasyderma*—Magellan Strait, South, tropical and North Atlantic, South, tropical and North Pacific, 150 to 2740 fathoms.

„ *dictyon*—Off Heard Island, Magellan Strait, South, tropical and North Atlantic, South, tropical and North Pacific, 37 to 2750 fathoms.

Cytheropteron mucronalatum—Eastern South Pacific, Western tropical Pacific, Western North Pacific, and mid North Atlantic, 1375 to 2050 fathoms.

Krithe producta—Off Marion Island, Magellan Strait, South, tropical and North Atlantic, South and tropical Pacific, 50 to 1825 fathoms.

Eucopia australis—Eastern and mid tropical Atlantic, Western and mid North Atlantic, and Western North Pacific, 1000 to 1975 fathoms; original specimen from stomach of penguin in Antarctic regions.

Hymenodora mollicutis—Western and mid South Atlantic, mid tropical Atlantic, and Eastern North Atlantic, 1675 to 2500 fathoms.

Nematocarcinus proximatus—Eastern South Pacific and Western North Pacific, 1375 to 1875 fathoms, and Arafura Sea, 28 fathoms.

Bugula reticulata—Magellan Strait, 175 fathoms; Western South Atlantic, 600 fathoms; and Eastern South Pacific, mid tropical Atlantic, and mid North Atlantic, 1850 to 2500 fathoms.

Terebratula wyvillii—Eastern South Pacific, Western South Atlantic, Western tropical Pacific, and Western North Pacific, 1035 to 2900 fathoms.

Gonostoma microdon—South, tropical and North Atlantic, South, tropical and North Pacific, 500 to 2900 fms.

Macrurus armatus—Mid tropical Pacific and Western North Pacific, 2425 and 2050 fathoms; South Pacific near New Zealand, 400 fathoms.

We may now summarise the distribution of these 91 species which extend into other regions of the ocean outside the area represented by these eight Stations, as follows:—

Bathymetrical Distribution.—It appears that of these 91 species, 51 species are known to occur only in depths greater than 1000 fathoms, while 38 species are recorded

from above and below the 1000 fathoms line (of which 19 species extend into shallow water less than 150 fathoms—see list below), the depths from which the remaining 2 species were obtained outside the region under consideration being unrecorded.

LIST I*g*.

We give here the names of the 19 species which extend from deep water over 1000 fathoms into shallow water under 150 fathoms, one of which is recorded from the shore :—

Axinella erecta.
Stylocordyla stipitata.
Liponema multiporum.
Bathyactis symmetrica.
Porania antarctica.
Ophiocten amitinum.
Echinus magellanicus.
Goniocidaris canaliculata (shore).
Schizaster moseleyi.
Elpidia glacialis.
Lætmonice producta.
Cythere dictyon.
Krithe producta.
Arcturus furcatus.
Pseudomma sarsii.
Nematocarcinus proximatus.
Pleurotoma (*Surcula*) *staminea.*
Idmonea marionensis.
Onchopora sinclairii.

Geographical Distribution.—Of the 91 species we find that :—

43	species	are	represented	in the South Pacific area,
27	,,	,,	,,	North Atlantic ,,
25	,,	,,	,,	South Atlantic ,,
22	,,	,,	,,	North Pacific ,,
18	,,	,,	,,	Kerguelen Region,
17	,,	,,	,,	Tropical Pacific area,
16	,,	,,	,,	Tropical Atlantic ,,
9	,,	,,	,,	Magellan Strait,
4	,,	,,	,,	Tropical Indian Ocean,
2	,,	,,	,,	Arctic area.

These terms are used collectively, and include the various regions within the area indicated; for instance, the South Pacific area includes New Zealand and the south-east of Australia, although the great majority of the species occur in the eastern portion of that area off the coast of South America.

LIST I*h*.

In the foregoing notes the distribution of each species has been considered as a whole, including all varieties. Were the distribution of each variety to be looked upon as distinct, certain modifications would be made, as will be seen from the following list of species with varieties represented in the area under consideration (which is here designated Kerguelen Region), the geographical distribution of each variety being briefly indicated :—

Stylocordyla stipitata—North and tropical Atlantic and Southern Ocean (Kerguelen region).
,, var. *globosa*—Marion and Kerguelen Islands.
Pontaster forcipatus—North Atlantic.
,, var. *echinata*—Southern Ocean (Kerguelen region).
Benthodytes sanguinolenta—South Pacific.
,, var. *marginata*—Southern Ocean (Kerguelen region).
Cucumaria abyssorum—Southern Ocean (Kerguelen region).
,, var. *grandis*—South Pacific.
,, var. *hyalina*—South Pacific and Southern Ocean (Kerguelen region).
Holothuria thomsoni—North Pacific.
,, var. *hyalina*—Southern Ocean (Kerguelen region).
Pseudostichopus villosus—North and South Atlantic, North, tropical and South Pacific, and Southern Ocean (Kerguelen region).
,, var. *violaceus*—Southern Ocean (Kerguelen region).
Psychropotes longicauda—South Pacific and Southern Ocean (Kerguelen region).
,, var. *fusco-purpurea*—Southern Ocean (Kerguelen region).
,, var. *monstrosa*—Southern Ocean (Kerguelen region).
Lætmonice producta—Kerguelen and Heard Islands.
,, var. *assimilis*—Nova Scotia.
,, var. *benthaliana*—North Pacific and Southern Ocean (Kerguelen region).
,, var. *willemoesi*—North and South Atlantic, tropical and South Pacific, and Southern Ocean (Kerguelen region).
,, var. *wyvillei*—Marion Island and Southern Ocean (Kerguelen region).
Munidopsis subsquamosa—North Pacific.
,, var. *aculeata*—South Pacific and Southern Ocean (Kerguelen region).
Bugula reticulata—South Atlantic, South Pacific, Magellan Strait, and Southern Ocean (Kerguelen region).
,, var. *unicornis*—North and tropical Atlantic.
Farciminaria magna—South Atlantic and Southern Ocean (Kerguelen region).
,, var. *armata*—South Atlantic.

LIST I*i*.

Turning now our attention for a moment to the genera represented at these eight Stations in the Southern Indian Ocean, we find that out of the total number of genera (186) 30 genera (or 16 per cent.) are known up to the present time only from the region under consideration. We give here a list of these 30 genera, from which it will be observed that the great majority include only a single species, there being in fact only 2 genera (*Ophioplinthus* and *Abyssascidia*) each containing 2 species, and that the great majority occur at a single Station; 3 of the genera, were, however, represented each at two Stations, while 1 genus (*Grubianella*) was found at three Stations.

Meliiderma (contains 1 species taken at a single Station).
Balanella (contains 1 species taken at a single Station).
Pleorhabdus (contains 1 species taken at a single Station).
Callozostron (contains 1 species taken at a single Station).
Tealidium (contains 1 species taken at a single Station).
Halisiphonia (contains 1 species taken at a single Station).
Pectis (contains 1 species taken at a single Station).
Periphema (contains 1 species taken at a single Station).
Thamnostylus (contains 1 species taken at a single Station).

Thaumatocrinus (contains 1 species taken at a single Station).
Chitonaster (contains 1 species taken at a single Station).
Ophiocymbium (contains 1 species taken at a single Station).
Ophioplinthus (contains 2 species taken at the same Station).
Echinocrepis (contains 1 species taken at a single Station).
Genicopatagus (contains 1 species taken at a single Station).
Spatagocystis (contains 1 species taken at two Stations).
Scotoanassa (contains 1 species taken at a single Station).
Prothelmins (contains 1 species taken at a single Station).
Grubianella (contains 1 species taken at three Stations).
Stelechopus (contains 1 species taken at a single Station).
Valettia (contains 1 species taken at a single Station).
Iolanthe (contains 1 species taken at a single Station).
Chalaraspis (contains 1 species taken at a single Station).
Petalidium (contains 1 species taken at two Stations).
Guivillea (contains 1 species taken at a single Station).
Abyssascidia (contains 2 species taken at two Stations).
Fungulus (contains 1 species taken at a single Station).
Pharyngodictyon (contains 1 species taken at a single Station).
Bathydraco (contains 1 species taken at a single Station).
Melanonus (contains 1 species taken at a single Station).

LIST IX.

We may also draw attention to the following 10 genera which, though not limited to the region represented by these eight Stations, are known to occur only in regions south of the southern tropic. With two exceptions (*Foveolaria* and *Onchopora*) they are all deep-sea genera unknown from depths less than 1000 fathoms. The number of species contained in each genus, and the geographical and bathymetrical distribution of each genus, are briefly indicated :—

Leptopenus (containing 2 species), South Pacific, South Atlantic, 1600 to 2160 fathoms.
Scotoplanes („ 7 „), South Atlantic, South Pacific, Cape, 1260 to 2650 fathoms.
Maldanella („ 3 „), South Pacific, 1100 to 2225 fathoms.
Acanthocope („ 2 „), South Pacific, 1450 to 1800 fathoms.
Nebaliopsis („ 1 „), South Pacific, 1375 to 2550 fathoms.
Silenia („ 1 „), South Atlantic, 1950 to 2650 fathoms.
Foveolaria („ 4 „), South Pacific, South Atlantic, Simon's Bay, shallow water to 1600 fathoms.
Onchopora („ 1 „), Southern Islands, South Pacific, 28 to 1950 fathoms.
Corynascidia („ 1 „), South Pacific, 1375 to 2160 fathoms.
Bathylagus („ 2 „), South Atlantic, 1950 to 2040 fathoms.

LIST II.

METAZOA PROCURED BY THE CHALLENGER IN THE OTHER DEEP-WATER AREAS OF THE SOUTHERN HEMISPHERE SOUTH OF THE TROPIC OF CAPRICORN, IN DEPTHS EXCEEDING 1000 FATHOMS, EXCLUDING THOSE FROM THE DEEP-WATER AREA OF THE KERGUELEN REGION.

For the purposes of comparison we have divided the deep-water areas of the Southern Hemisphere into two categories, viz.: (1) the deep-water area of the Kerguelen Region, and (2) the remainder of the deep-water areas of the Southern Hemisphere. We have already treated fully of the marine Metazoa from the deep-water area of the Kerguelen Region (see List I.), and will now proceed to consider the marine Metazoa from the remaining deep-water areas of the Southern Hemisphere; to avoid repetition we have omitted forty-eight species which occur in both these divisions,[1] particulars of which will be found in Lists Ic., I*d.*, Ie., I*f.*

This list (List II.) contains all the species and varieties of marine Metazoa described and recorded in the Challenger Report from twenty-nine deep-water Stations in the Southern Hemisphere, lying between latitude 24° 38′ to 48° 37′ S., the depths varying from 1000 to 2650 fathoms, with the exception of the forty-eight species above referred to, so that by adding together Lists I. and II. we have a complete list of all the species of marine Metazoa known up to the present time from deep water in the Southern Hemisphere in depths exceeding 1000 fathoms. These twenty-nine Stations are on the whole further north than the eight Stations treated of in List I., and were not nearly so productive. Fifteen of the Stations (viz., Nos. 133, 134, 135, 137, 143, 317, 318, 323, 325, 331, 332, 333, 334, 335, and 337) are situated in the Southern Atlantic Ocean, and the remaining fourteen Stations (viz., Nos. 165, 168, 285, 286, 289, 291, 293, 295, 296, 297, 298, 299, 300, and 302) are situated in the Southern Pacific Ocean. The trawl was used at twenty-two of these Stations, the dredge being sent down at the other seven Stations. The species not known to occur to the north of the southern tropic are indicated in this list by an asterisk *.

DEEP-SEA KERATOSA:

**Holopsamma argillaceum*, Haeckel.
**Psammina plakina*, Haeckel.

[1] Viz., *Corallimorphus rigidus*, *Bathyactis symmetrica*, *Leptopenus discus*, *Atolla wyvillei*, *Pararchaster pedicifer*, *Ophiacantha cosmica*, *Ophiocten hastatum*, *Ophioglypha lacazei*, *Cystechinus vesica* and *wyvillii*, *Pourtalesia carinata* and *ceratopyga*, *Urechinus naresianus*, *Benthodytes sordida*, *Lætmogone wyville-thomsoni*, *Oncirophanta mutabilis*, *Pseudostichopus villosus*, *Psychropotes longicauda*, *Scotoplanes globosa*, *Hyalinœcia benthaliana*, *Lætmonice producta*, *Nothria abranchiata* (=*abyssicola*), *Cythere acanthoderma* and *dasyderma* and *dictyon*, *Cytheropteron mucronalatum*, *Krithe producta*, *Serolis bromleyana*, *Nebaliopsis typica*, *Bentheuphausia amblyops*, *Hymenodora mollicutis*, *Nematocarcinus proximatus*, *Munidopsis antonii* and *subsquamosa*, *Pagurodes inarmatus*, *Colossendeis gigas* and *leptorhynchus*, *Amussium meridionale*, *Silenia sarsii*, *Cirroteuthis magna*, *Eledone rotunda*, *Bugula reticulata*, *Salicornaria magnifica*, *Terebratula wyvillii*, *Corynascidia suhmi*, *Cyema atrum*, *Gonostoma microdon*, and *Macrurus filicauda*.

MONAXONIDA :

**Axoniderma mirabile*, Ridley and Dendy.
**Cladorhiza inversa*,[1] Ridley and Dendy.
Esperella biserialis,[2] Ridley and Dendy.
Phakellia[3] *ventilabrum*[4] (Johnston), var. *connexiva*, Ridley and Dendy.
**Tedania*[5] *actiniiformis*,[6] Ridley and Dendy.
**Trichostemma*[7] *irregularis*, Ridley and Dendy.

TETRACTINELLIDA :

**Thenea wrightii*, Sollas.
,, sp. (?).

HEXACTINELLIDA :

**Bathydorus baculifer*, Schulze.
**Caulocalyx tener*, Schulze.
**Holascus stellatus*, Schulze.

[1] The most remarkable feature about *Cladorhiza inversa* concerns its external form; compared with other "*Crinorhiza*" forms it appears to be upside down; nor can we be certain that the surface which we have called "lower" in the description is not really the upper, and *vice versa*.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 94.)

[2] *Esperella biserialis* forms a most interesting and important link between the two genera *Esperella* and *Cladorhiza*, especially as regards external form. It is also particularly interesting in that it exhibits a distinctly bilateral symmetry.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 76.)

[3] We have thought it desirable in the case of the genus *Phakellia* to make use of external form as a generic character, otherwise we know of no character which would serve to separate the genus *Phakellia* from the genus *Axinella*.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 170.)

[4] *Phakellia ventilabrum* is typically an inhabitant of deep water, being common in depths over 100 fathoms, seldom occurring in shallower water, and going down to 1035 fathoms, as shown by the Challenger dredgings.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 171.)

[5] The range of external form exhibited by the genus *Tedania* is shown by the Challenger dredgings to be a very remarkable one indeed; hitherto known only by more or less massive or digitate specimens, we have had to add to the genus two new species, *T. infundibuliformis* and *T. actiniiformis*, characterised by very specialised, though quite different, external forms; the former being funnel-shaped, and the latter "actiniiform" (like an Actinia) with ocular projections on the top and a definite zone of pores. The species of this genus are very difficult to separate satisfactorily from one another; future researches may, very probably, by the discovery of intermediate forms, render possible the union of some which are at present described as distinct.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, pp. 50–51.)

[6] *Tedania actiniiformis* is a very important and well-characterised species; it is distinguished from all previously known by its external form and the arrangement of the pores in a definite zone. Its stylote spicule is the largest in the genus. It affords a really splendid instance of the manner in which sponges, which are shapeless masses when occurring in shallow water, assume in abyssal depths (in this case 2160 fathoms) a definite, symmetrical external form; this is its chief interest, for the species of the genus hitherto known, from comparatively shallow water, are, *par excellence*, amorphous sponges.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 56.)

[7] The original type of the genus *Trichostemma* is *Trichostemma hemisphæricum*, which occurs not rarely at Lofoten in a depth of 120 to 300 fathoms on soft clay bottom. The Challenger adds two new species, both from a very great depth and a bottom of ooze or mud. It is essentially a deep-sea genus, and affords another example of the manner in which deep-sea sponges commonly assume a definite, symmetrical external form. In this case, however, the object of the flattened form and the long radiating spicules is obvious, namely, as pointed out by SARS, to support the animal in the soft mud on which it lies; in our new species, *Trichostemma sarsii*, this arrangement is brought to a much greater degree of perfection than in the original type of the genus. The genus has a very wide geographical range, being found in deep water off the north of Scotland, coast of Norway, Arctic Sea, Gulf of St Lawrence, off the Azores, N.E. coast of Australia, and W. coast of South America.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 217.)

**Hyalonema poculum*, Schulze.
,, *tenue*, Schulze.
,, (*Stylocalyx*) *tenerum*, Schulze.
,, sp. (?).
**Hyalostylus dives*, Schulze.
**Trachycaulus gurlittii*, Schulze.
Dictyonine undetermined.

PENNATULIDA :
**Anthoptilum simplex*, Kölliker.

ANTIPATHARIA :
**Schizopathes crassa*,[1] Brook.

ACTINIARIA :
**Aulorchis paradoxa*,[2] Hertwig.
**Corallimorphus profundus*, Moseley.
Edwardsia sp. (?).
**Epizoanthus thalamophilus*, Hertwig.
**Ophiodiscus annulatus*, Hertwig.
* ,, *sulcatus*, Hertwig.
Palythoa (?) sp.
**Paractis excavata*,[3] Hertwig.
Phellia (?) sp.
**Polyopis striata*,[4] Hertwig.
**Polystomidium patens*,[5] Hertwig.
Actinian undetermined.

[1] The single specimen on which the species *Schizopathes crassa* is based is the finest example of the Schizopathinæ contained in the Challenger collection. The stem is 57 cm. long, gracefully but gently flexuose, with a peculiar flattened sickle-like base replacing the rounded horny disc by which the Antipathinæ are attached to stones and other objects. In this case the species is probably fixed by the base being embedded in the mud constituting the bottom deposit in the area in which it occurs. The specimen is 53 cm. high, and measures 53 cm. also across the lower branches. The stem is simple, much flattened below, but gradually becoming cylindrical and slightly tapering above the lower branches.—(BROOK, *Zool. Chall. Exp.*, part 80, p. 147.)

[2] *Aulorchis paradoxa* is a form of great interest as enlarging by a new genus and species the group of forms devoid of tentacles. Unluckily, I have had but the one solitary specimen for study, and even this was badly preserved, and had apparently suffered much from the dredge. . . . From my description it may be recognised that *Aulorchis* is one of the most interesting Actiniæ, and that it would be very desirable that a richer material of it should be acquired by fresh deep-sea investigations.—(HERTWIG, *Zool. Chall. Exp.*, part 71, pp. 21, 24.)

[3] *Paractis excavata* is one of the most characteristic forms of the Challenger material, both as to the shape of the body, and as to its finer structure.—(HERTWIG, *Zool. Chall. Exp.*, part 15, p. 41.)

[4] The small Actinia without tentacles, which I call *Polyopis striata*, was probably sac-shaped during life; its rounded posterior end probably stuck in the mud, whilst its broad anterior end formed by the oral disk projected freely.—(HERTWIG, *Zool. Chall. Exp.*, part 15, p. 101.)

[5] In *Polystomidium patens* the tentacles have undergone retrograde formation to an extent which has hitherto been observed only in the genus *Polyopis*; the only traces of them are the terminal openings, which lead directly into the radial chambers and are surrounded by swollen margins, the remains of the tentacle wall. In their habit of body, in the endodermal position of the circular muscle, and in the presence of the marginal spherules, these animals are allied to the Antheadæ.—(HERTWIG, *Zool. Chall. Exp.*, part 15, p. 67.)

CORALS :

Deltocyathus italicus,[1] M.-Edwards and Haime.
**Leptopenus hypocœlus*, Moseley.
Solenosmilia variabilis,[2] Duncan.

DEEP-SEA MEDUSÆ :

**Leonura terminalis*, Haeckel.
**Nauphanta challengeri*, Haeckel.
**Periphylla mirabilis*, Haeckel.
**Tesserantha connectens*, Haeckel.

SIPHONOPHORÆ :

**Anthemodes articulata*, Haeckel.
**Bathyphysa gigantea*, Haeckel.

CRINOIDEA :

**Rhizocrinus*[3] *lofotensis*,[4] Sars.

ASTEROIDEA :

Dytaster exilis,[5] Sladen.
,, ,, var. *gracilis*, Sladen.
* ,, *nobilis*, Sladen.
Freyella benthophila, Sladen.
**Hymenaster anomalus*, Sladen.

I have little to add to the very full accounts of the many varieties of *Deltocyathus italicus* contained in the memoirs cited. . . . It is very remarkable that none of the specimens obtained by us were attached, and that only one shows any trace of ever having been attached. This one specimen [from Station 285, South Pacific, 2375 fathoms], however, is large, and though somewhat imperfect, has a most distinct pedicle and scar of attachment, and evidently remained fixed up to a period of full maturity.—(MOSELEY, *Zool. Chall. Exp.*, part 7, pp. 145, 146.)

[2] *Solenosmilia variabilis* is a very widely-spread and characteristic deep-sea form, and varies exceedingly. Many specimens dredged by us were dead, old, and much broken, but always recognisable by the peculiar mode of branching and the texture of the cœnenchym.—(MOSELEY, *Zool. Chall. Exp.*, part 7, p. 181.)

[3] Of the stalked Crinoids *Rhizocrinus* has the farthest northern range (68° N.), but it has not been met with more than once (Station 122), or possibly twice (Station 323), south of the equator, and is limited to the Atlantic and Caribbean Ocean.—(CARPENTER, *Zool. Chall. Exp.*, part 32, p. 136.)

[4] The form of the calyx in this species [*Rhizocrinus lofotensis*] varies very considerably ; for it is nearly hemispherical in some specimens and much elongated in others. These last have the best developed arms ; and to some extent, therefore, the forms with a low and wide cup must be regarded as premature. But differences of development will not entirely account for the variation, as the calyx of a young specimen found by SARS is distinctly higher (longer) than broad.— (CARPENTER, *Zool. Chall. Exp.*, part 32, p. 261.)

[5] Of *Dytaster exilis* and its two varieties, *carinata* and *gracilis*, SLADEN writes :—The variety *carinata* resembles the type more nearly than the variety *gracilis* does. The wide separation of the geographical positions of the type and its two varieties is of the greatest interest, and bears evidence to the enormous range of the *Dytaster exilis* form, and of the comparatively small amount of variation exhibited by this type in what may well be spoken of as extreme limits of position. The type comes from the Pacific, off the western coast of South America, the nearly allied variety *carinata* from the North Atlantic, off the eastern coast of the United States of America, whilst the more divergent variety—if, indeed, it be not a distinct species—was dredged in the South Atlantic, westward of Tristan da Cunha.—(*Zool. Chall. Exp.*, part 51, p. 70.)

**Hymenaster carnosus*, Sladen.
* ,, *echinulatus*, Sladen.
* ,, *geometricus*, Sladen.
* ,, *pergamentaceus*, Sladen.
* ,, *porosissimus*, Sladen.
* ,, *vicarius*, Sladen.
**Hyphalaster diadematus*, Sladen.
Marsipaster hirsutus, Sladen.
* ,, *spinosissimus*, Sladen.
**Pontaster pristinus*, Sladen.
**Porcellanaster crassus*, Sladen.
* ,, *eremicus*, Sladen.
* ,, *gracilis*, Sladen.
**Pythonaster murrayi*,[1] Sladen.

OPHIUROIDEA :

**Amphilepis patens*, Lyman.
**Amphiura dalea*, Lyman.
**Ophiacantha sentosa*, Lyman.
**Ophiactis poa*, Lyman.
**Ophiocten umbraticum*, Lyman.
Ophioglypha bullata, Wyville Thomson.
,, *irrorata*, Lyman.
* ,, *jejuna*, Lyman,
* ,, *meridionalis*,[2] Lyman.
,, *ornata*, Lyman.
,, sp. (?).
Ophiomastus tegulitius, Lyman.
**Ophiomusium archaster*, Wyville Thomson (MS.), Lyman.
,, *armigerum*, Lyman.
,, *lymani*,[3] Wyville Thomson.
**Ophiomyces*[4] *grandis*, Lyman.

[1] This remarkable and abnormal type of Asterid [*Pythonaster murrayi*] is altogether unlike any other form. Its general morphological structure appears to me to justify its inclusion in the family Pterasteridæ. Its aberrant peculiarities, however, necessitate in my opinion its separation in a distinct sub-family.—(SLADEN, *Zool. Chall. Exp.*, part 51, p. 531.)

[2] *Ophioglypha meridionalis* is the southern cousin of *Ophioglypha robusta*, from which it differs in shorter arm spines, more swollen disk scales, smaller mouth papillæ, and fewer tentacle scales.—(LYMAN, *Zool. Chall. Exp.*, part 14, p. 41.)

[3] The specimens [of *Ophiomusium lymani*] from the widely separated stations showed certain minor differences. For example, those from Station 235 [Japan] had more arm spines and rather more numerous lower disk plates, and the tentacle scales were entire, instead of divided. I have deemed it best to keep the varieties together for the present. —(LYMAN, *Zool. Chall. Exp.*, part 14, p. 90.)

[4] This singular genus [*Ophiomyces*] stands quite by itself, unless we compare its curious mouth papillæ with the spatula-like tentacle scales of *Ophiopsila*. All the specimens I have seen had a tendency to raise the arms above the

Ophiophyllum sp. (?).
Ophiothamnus sp. (?).
**Ophiotholia supplicans*, Lyman.
**Ophiozona stellata*, Lyman.

ECHINOIDEA :

Aceste bellidifera,[1] Wyville Thomson.
Aspidodiadema[2] *microtuberculatum*, Agassiz.
Brissopsis luzonica (Gray).
Cystechinus clypeatus,[3] Agassiz.
Echinus elegans (Düben and Koren).
**Phormosoma asterias*, Agassiz.
* ,, *hoplacantha*,[4] Wyville Thomson.
Pourtalesia laguncula, Agassiz.
Salenia hastigera, Agassiz.

disk, vertically; which shows that the muscular tension must have some peculiar proportion. . . . The peculiar twisting upward of the arms and disk of *Ophiomyces* is explained by the absence of radial shields, a want not yet observed in any other genus. It seems, then, that one function of radial shields is to keep the disk in shape, somewhat like the action of the sticks of an umbrella.—(LYMAN, *Zool. Chall. Exp.*, part 14, pp. 240, 242.)

[1] At first glance *Aceste bellidifera* appears one of the most remarkable of Sea-urchins. . . . The enormous development of the sucker of the odd anterior ambulacrum is an eminently embryonic feature; it exists in the youngest stages of all the Spatangoids of which we know the development. . . . The general outline of the test as seen both in profile and from above is strikingly similar to that of the Schizasteridæ. In fact, this genus is of the greatest interest, showing as it does striking affinities on the one side to the Schizasteridæ and other Spatangina, such as *Brissopsis*, and on the other to the Pourtalesiæ, not only in the structure of its ambulacral system, but also from the position and shape of the actinostome, and the more or less cylindrical test modified in its outline from its Schizasterid affinities.—(AGASSIZ, *Zool. Chall. Exp.*, part 9, pp. 195–6.)

[2] *Aspidodiadema* is a most interesting genus, intermediate between the Cidaridæ proper and the Diadematidæ. It has like the latter a thin test, with long hollow primary spines nearly straight, and strongly verticillate, especially in the young. . . . The most remarkable feature of this genus is the structure of the ambulacral system.—(AGASSIZ, *Zool. Chall. Exp.*, part 9, pp. 64–5.)

[3] The test of this species [*Cystechinus clypeatus*] is quite stout, judging from the thickness of the fragments preserved. In the specimens from the greatest depths at which this species has been found, the test is much thinner than in the fragments which are found near the 1000 fathom line. As a general rule among the Pourtalesiæ, the test of the different species having an extended bathymetrical range varies very materially in thickness, according to the depth at which the specimens were dredged, specimens of the same species from shallower regions having pretty generally a comparatively stouter test.—(AGASSIZ, *Zool. Chall. Exp.*, part 9, pp. 149–150.)

[4] *Phormosoma hoplacantha* is the largest Sea-urchin with which I am acquainted. It measures no less than 312 mm. in diameter, and when fully expanded, must have been a striking object. This species is remarkable for the large size of the primary tubercles, arranged both on the actinal and abactinal surface of the interambulacral areas in horizontal rows; on the abactinal surface they are distant, separated by large secondaries and miliaries, irregularly arranged on the coronal plates. . . . In alcohol the colour of the specimens of this species is dark violet, almost black both for the test and spines, and this formed a marked contrast to the white tips of the spines on the actinal surface. The existence of primary spines tipped with hoofs as in the Arbaciadæ is an interesting structural feature, connecting groups which thus far seemed somewhat isolated in their relationship to other Echinids. THOMSON speaks of the wear of the base of the cones as if they had been in use for "vigorous locomotion" over the ground, as we know to be the case in one of the species of *Arbacia* of the eastern North American coast. In the Echinothuridæ the conical tip does not extend along the sides of the extremity of the spine, forming, as in the Arbaciadæ, a kind of cap; it is merely attached by a nearly horizontal base to the more flattened end of the spine. In consequence of this mode of attachment the tip is frequently lost.—(AGASSIZ, *Zool. Chall. Exp.*, part 9, pp. 101-2.)

HOLOTHURIOIDEA :

**Benthodytes abyssicola*, Théel.
* „ *mamillifera*, Théel.
„ *papillifera*, Théel.
* „ *sanguinolenta*, Théel.
**Cucumaria abyssorum*, Théel, var. *grandis*, Théel.
**Elpidia verrucosa*, Théel.
**Enypniastes eximia*, Théel.
Euphronides depressa, Théel.
Holothuria murrayi, Théel.
**Pælopatides confundens*, Théel.
**Parelpidia cylindrica*, Théel.
* „ *elongata*, Théel.
**Peniagone vitrea*, Théel.
Psychropotes semperiana, Théel.
**Scotoplanes albida*, Théel.
* „ *papillosa*, Théel.
**Stichopus* (?) *torvus*, Théel.
Trochostoma sp. (?).
Two Holothurians undetermined.

NEMERTEA :

**Cerebratulus angusticeps*, Hubrecht.

GEPHYREA :

**Phascolosoma catherinæ*,[1] Müller.

ANNELIDA :

**Amphicteis sarsi*, M'Intosh.
Buskiella abyssorum, M'Intosh.
**Eumenia reticulata*, M'Intosh.
**Eunoa opalina*,[2] M'Intosh.
Eupista darwini, M'Intosh.
* „ *grubei*, M'Intosh.
**Euthelepus chilensis*, M'Intosh.

[1] Since FRITZ MÜLLER'S specimen [of *Phascolosoma catharinæ*] was labelled "Desterro," one may infer that it was not obtained in trawling, but was found on the shore during ebb tide. The specimen of the Challenger Expedition, on the other hand, was obtained from a very considerable depth. This difference of distribution is not, however, by any means unique, for other true Sipunculids exhibit a similar occurrence on the shore and at considerable depths.—(SELENKA, *Zool. Chall. Exp.*, part 36, p. 13.)

[2] An eyeless variety [of *Eunoa opalina*, Magellan Strait, Station 311, 245 fathoms] was trawled at Station 299, 2160 fathoms [S.E. Pacific]. It is of good size. The head is devoid of any trace of eyes, so that it forms another example of the influence of habitat on these important organs.—(M'INTOSH, *Zool. Chall. Exp.*, part 34, pp. 71-2.)

**Leæna langerhansi*, M'Intosh.
* „ *neo-zealaniæ*, M'Intosh.
**Lumbriconereis abyssorum*, M'Intosh.
**Maldanella neo-zealaniæ*, M'Intosh.
* „ *valparaisiensis*, M'Intosh.
**Melinna armandi*, M'Intosh.
Myriochele heeri, Malmgren.
**Nothria ehlersi*, M'Intosh.
* „ *pycnobranchiata*, M'Intosh.
**Placostegus mörchii*, M'Intosh.
„ *ornatus*, Sowerby.
**Samythopsis grubei*, M'Intosh.
Vermilia (?) sp.

Ostracoda :

**Argillæcia eburnea*, Brady.
**Bairdia hirsuta*, Brady.
„ *victrix*, Brady.
**Bythocypris elongata*, Brady.
**Crossophorus imperator*, Brady.
**Cythere dorsoserrata*, Brady,
„ *irpex*, Brady.
* „ *normani*, Brady.
„ *scutigera*, Brady.
„ (?) *serratula*, Brady.
* „ *squalidentata*, Brady.
* „ *stolonifera*, Brady.
* „ *sulcatoperforata*, Brady.
**Cytheropteron fenestratum*, Brady.
Krithe tumida, Brady.
Pseudocythere[1] *caudata*, Sars.
Xestoleberis[2] *curta*, Brady.
„ *expansa*, Brady.

Cirripedia :

**Scalpellum carinatum*, Hoek.

[1] The genus *Pseudocythere* is widely distributed, occurring in the European seas as well as in distant regions of the southern hemisphere. As a fossil it has been recognised only in the Post-Tertiary deposits of the British Islands.—(G. S. Brady, *Zool. Chall. Exp.*, part 4, p. 144.)

[2] The genus *Xestoleberis* is widely distributed, containing apparently a very large number of species, and occurring abundantly in the seas of all parts of the world. So far, however, as we know of it palæontologically, it would seem to be a genus of comparatively recent development.—(Brady, *Zool. Chall. Exp.*, part 4, p. 124.)

**Scalpellum darwinii*,[1] Hoek.
* „ *eximium*,[2] Hoek.
* „ *minutum*, Hoek.
„ *velutinum*,[3] Hoek.
**Verruca gibbosa*,[4] Hoek.
* „ *incerta*, Hoek.
* „ *quadrangularis*, Hoek.

AMPHIPODA :

**Andania abyssorum*,[5] Stebbing.
**Camacho bathyplous*, Stebbing.
**Cyphocaris micronyx*, Stebbing.
**Elasmopus subcarinata* (Haswell).
**Gammaropsis thomsoni*, Stebbing.
Lanceola, two species undetermined.
**Leucothoë tridens*, Stebbing.
**Œdiceroides cinderella*, Stebbing.
**Orchomene abyssorum*,[6] Stebbing.
**Podocerus hoeki*,[7] Stebbing (= *P. tuberculatus*, Hoek).
Stenopleura atlantica, Stebbing.

[1] *Scalpellum darwinii* is the largest species of *Scalpellum* known. Only a single specimen of it was dredged during the cruise of the Challenger attached to a manganese nodule.—(HOEK, *Zool. Chall. Exp.*, part 35, pp. 110–111.)

[2] Of this splendid species [*Scalpellum eximium*] only a single specimen was dredged, attached to a piece of pumice-stone.—(HOEK, *Zool. Chall. Exp.*, part 35, p. 100.)

[3] This beautiful species [*Scalpellum velutinum*] is represented by a single specimen. Provisionally there must be referred to the same species three smaller specimens, which were dredged near the southern point of Portugal ; yet I am not quite sure that they belong really to the same species. . . . The two Stations from which this species was obtained are both in the Atlantic ; the one (near Cape St Vincent) has about the same northern latitude as the other (north of Tristan da Cunha) has southern latitude.—(HOEK, *Zool. Chall. Exp.*, part 35, pp. 96, 99.)

[4] *Verruca gibbosa* is the largest and the most beautiful of the deep-sea species.—(HOEK, *Zool. Chall. Exp.*, part 35, p. 134.)

[5] The specific name [of *Andania abyssorum*] refers to the great depth from which this little creature was obtained, but is principally designed to call attention to its close relationship with the northern species *Andania abyssi*.—(STEBBING, *Zool. Chall. Exp.*, part 67, p. 742.)

[6] The specific name [of *Orchomene abyssorum*] has been given in allusion to the great depth from which the species is reported to have come. The single specimen was mounted during the voyage. Had this species been taken within any reasonable distance of *Orchomene musculosus*, the resemblance is so great that one might have been tempted to disregard the points of difference as due to some other cause than difference of species. It might be an accident that has caused one to be reported from the surface, and the other from so great a depth as 1900 fathoms, but that the Stations at which the two species were obtained are separated by nearly half the circumference of the globe is a circumstance not open to any such explanation.—(STEBBING, *Zool. Chall. Exp.*, part 67, pp. 678–9.)

[7] The specific name [of *Podocerus hoeki*] is given in compliment to Dr P. P. C. HOEK, who in 1882 gave a brief description and some figures of a new species, *Podocerus tuberculatus*, among the Crustacea of the "Willem Barents" Expedition. This species was obtained in lat. 71° 23′ N., long. 49° 38′ E., and judging only from the preliminary description and the figures of the two gnathopods, third uropods, and telson, presents an extraordinary resemblance to the Challenger species. . . . Considering the enormous distance between the places of capture, I have not thought it right to identify the two forms. Had they belonged to a single species of so wide a distribution, it is highly improbable that it would have escaped discovery for so long, and then suddenly have been discovered almost simultaneously at two enormously distant points.—(STEBBING, *Zool. Chall. Exp.*, part 67, pp. 1140–1.)

The single specimen [of *Podocerus tuberculatus*] described by Dr HOEK was taken in 1879 in lat. 71° 23′ N.,

ISOPODA :

**Acanthocope acutispina*, Beddard.
**Acanthomunna proteus*,[1] Beddard.
**Eurycope novæ-zelandiæ*, Beddard.
**Ischnosoma bacilloides*, Beddard.
**Munnopsis gracilis*, Beddard.
Neotanais americanus, Beddard.
**Serolis neæra*, Beddard.
,, sp. (?).

MACRURA :

Acanthephyra brachytelsonis, Bate.
,, *longidens*, Bate.
,, *sica*,[2] Bate.
Aristeus[3] *armatus*, Bate.
Benthesicymus altus, Bate.
,, *brasiliensis*, Bate.
* ,, *iridescens*, Bate.
* ,, *mollis*, Bate.
Gennadas intermedius, Bate.
,, *parvus*, Bate.
Glyphocrangon rimapes, Bate.

long. 49° 38′ E., from a depth of 67 fathoms. Other specimens were obtained on Sept. 6, 1881, in lat. 77° 7′ N., long. 49° 37′ E., from a depth of 170 fathoms. An examination of these has shown that the fingers of the gnathopods precisely agree in dentation with those of the specimen described in the Challenger Report under the name of *Podocerus hoeki*. That specimen was taken in the neighbourhood of New Zealand, July 8, 1874, in lat. 40° 28′ S., long. 177° 43′ E., and was supposed to come from a depth of 1100 fathoms. But though its habitat is separated by so vast a distance from the Arctic localities, there does not seem to be a single feature which can be relied on for distinguishing it from the species to which Dr HOEK had earlier given a name.—(STEBBING, "The Amphipoda collected during the voyages of the Willem Barents in the Arctic Seas in the years 1880-1884," *Bijdragen tot de Dierkunde*, Afl. 17, 1894, p. 45.)

[1] Two specimens of a deep-sea Isopod, belonging apparently to the same species [*Acanthomunna proteus*], are referred to this genus; they were dredged in 700 and 1100 fathoms respectively off New Zealand. The genus is remarkable for its dense spiny covering, a condition met with in other deep-sea and cold-water Isopoda. The specimens only differ from each other in colour; the larger specimen (from 1100 fathoms) is of a pale buff colour, the smaller of a rich brown.—(BEDDARD, *Zool. Chall. Exp.*, part 48, pp. 47–8.)

[2] *Acanthephyra sica* appears to be both abundant and widely distributed; it was taken by the Challenger at eleven Stations, more or less distant from one another,—in the Atlantic and Pacific Oceans, as far north as Japan, and as far south as New Zealand. Its bathymetrical range is also great, since it has been taken at a distance of from less than half a mile to about three miles from the surface of the ocean. It appears to be very prolific also, since some of the females that were captured carry a large number of small eggs.—(SPENCE BATE, *Zool. Chall. Exp.*, part 52, p. 743).

[3] This genus [*Aristeus*] consists mostly of deep-water species, which swim freely in the sea, and during the cruise of the Challenger were never captured in less than 255 fathoms of water. . . . *Aristeus armatus* was captured at seven different localities at depths ranging from 1400 to 2350 fathoms. . . . Running down the eastern coast of South America, in the month of September 1873, the Challenger must have passed through a great multitude of young animals of this genus, varying in size from 4 to 14 mm., all of which bore evidence of belonging to allied species. The specimens corresponded closely excepting in such features as may be dependent upon age.—(SPENCE BATE, *Zool. Chall. Exp.*, part 52, p. 311.)

Haliporus curvirostris, Bate.
**Hemipenæus speciosus*, Bate.
" *spinidorsalis*, Bate.
**Hepomadus inermis*, Bate.
**Notostomus murrayi*, Bate.
Pentacheles lævis, Bate.
Pontophilus gracilis, Bate.
* " *profundus*, Bate.
**Sergestes profundus*,[1] Bate.
Willemœsia leptodactyla (Willemoes-Suhm).

ANOMURA :

**Elasmonotus marginatus*, Henderson.
**Galacantha bellis*, Henderson.
Parapagurus abyssorum,[2] M.-Edwards.
**Tylaspis anomala*,[3] Henderson.

PYCNOGONIDA :

**Colossendeis brevipes*,[4] Hoek.
* " *media*, Hoek.
**Nymphon compactum*,[5] Hoek.
* " *longicollum*, Hoek.
* " *longicoxa*,[5] Hoek.
* " *procerum*, Hoek.

[1] The species of this genus [*Sergestes*] mostly live within 100 fathoms of the surface, but there is every reason to believe that this one [*Sergestes profundus*] resides near the bottom.—(SPENCE BATE, *Zool. Chall. Exp.*, part 52, p. 429.)

[2] A certain amount of variation is noticeable in specimens [of *Parapagurus abyssorum*] from different localities, more especially as regards the amount of pubescence and granulation on the chelipedes and ambulatory limbs. In a specimen from Station 133 [South Atlantic], the ophthalmic scales are bidentate, and the external prolongation of the second antennal peduncular joint is dentate. In spite of these apparent incongruities, an examination of the numerous specimens taken by the Challenger has convinced me that they all belong to a single species. . . . *Parapagurus abyssorum* is of special interest on account of its very extended distribution and deep-water habitat. It was taken by the Challenger in all the great ocean beds explored (with the exception of the Southern Ocean between the Cape and Australia), and nowhere in less than 1000 fathoms of water. [This species is recorded from Magellan Strait, 45 fathoms, but HENDERSON maintains that this is an error ; he says that a shallow-water habitat for the species is quite out of the question.] It appears to be invariably associated with an Anemone which exerts a solvent action on the Gastropod shell originally selected as a dwelling-place by the Hermit ; in many cases the shell has entirely disappeared, and in others it is greatly reduced, while the Anemone forms a soft and saccular covering on the exterior.—(HENDERSON, *Zool. Chall. Exp.*, part 69, p. 88.)

[3] The single specimen [of *Tylaspis anomala*] came from the greatest depth at which any Anomurous Crustacean was taken by the Challenger. The form of the abdomen points to the species having occupied some other dwelling-place than the Gastropod shell usually selected by the soft-tailed Pagurids.—(HENDERSON, *Zool. Chall. Exp.*, part 69, p. 81.)

[4] This true deep-sea species [*Colossendeis brevipes*] was dredged from the greatest depth at which a Pycnogonid has been found, viz., 2650 fathoms.—(HOEK, *Zool. Chall. Exp.*, part 10, p. 72.)

[5] I believe this species [*Nymphon longicoxa*] with its rudimentary eyes to form the transition from the shallow-water species to the true deep-sea species. . . . *Nymphon longicoxa* and *Nymphon compactum* were obtained [at the same Station] from a depth of 1100 fathoms. *N. longicoxa* shows rudimentary eyes, those of *N. compactum* are quite

LAMELLIBRANCHIATA :

Arca (*Barbatia*) *corpulenta*, Smith.
**Cryptodon moseleyi*, Smith.
Glomus nitens, Jeffreys
Lima (*Limatula*) sp. (?)
**Lyonsiella grandis*, Smith.
**Malletia pallida*, Smith.
**Venus* (*Chamelæa*) *mesodesma*, Quoy and Gaimard.

SCAPHOPODA AND GASTEROPODA :

**Basilissa simplex*, Watson.
**Clathurella cala*, Watson.
**Dentalium amphialum*, Watson.
\" *keras*, Watson.
Ianthina rotundata, Leach.
**Nassa dissimilis*, Watson.
**Pleurotoma* (*Spirotropis*) *aganactica*, Watson.
* " (*Thesbia*) *membranacea*, Watson.
* " (") *xanthias*, Watson.
**Stilifer brychius*, Watson.
Trochus sp. (?)

CEPHALOPODA :

**Histiopsis atlantica*, Hoyle.

POLYZOA :

Bicellaria naviculoris, Busk.
**Bugula margaritifera*,[1] Busk.
**Cellularia crateriformis*, Busk.
**Farciminaria cribraria*, Busk.
* " *magna*, Busk, var. *armata*, Busk.
Flustra biseriata, Busk.
Kinetoskias cyathus (Wyville Thomson).
" *pocillum*, Busk.
**Menipea pateriformis*, Busk.

obsolete. *N. longicoxa* is one of the most slender, *N. compactum* one of the stoutest species dredged by the Challenger. In the one the auxiliary claws are wanting, whereas small ones are present in *N. longicoxa*, and in every other respect they are as widely different as two species of the same genus of Pycnogonids can be.—(HOEK, *Zool. Chall. Exp.*, part 10, pp. 39, 42).

[1] [*Bugula margaritifera* is] a very interesting form as coming from such an extreme depth. Its structure, as in most of the abyssal forms, is very delicate and transparent, and it is rooted by an infinite number of radical fibres, each attached to a dead Globigerina shell or similar small particle.—(BUSK, *Zool. Chall. Exp.*, part 30, p. 42.)

BRACHIOPODA :

Discina atlantica, King.
**Magasella flexuosa* (King).
* *Waldheimia wyvillii*, Davidson.

TUNICATA :

Octacnemus bythius, Moseley.
Pyrosoma spinosum, Herdman.

FISHES :

**Bathylagus atlanticus*, Günther.
**Bathypterois longicauda*, Günther.
* „ *longipes*, Günther.
**Bathysaurus ferox*,[1] Günther.
**Chlorophthalmus gracilis*, Günther.
Ipnops murrayi,[2] Günther.
**Macrurus affinis*, Günther.
* „ *fernandezianus*, Günther.
* „ *murrayi*, Günther.

As in the case of List I., here again the great majority of the 253 species enumerated were each taken at only one of the twenty-nine Stations.

LIST II *a*.

Only 25 species occurred at more than one of these Stations, and of these 18 species were each represented at two Stations, and the remaining 7 species each at three Stations, as shown in the following list, where the number of Stations at which each species was found is indicated in brackets after the name of the species :—

[1] *Bathysaurus agassizii*, Goode and Bean, obtained at a depth of 647 fathoms in the Atlantic, lat. 33° 35′ N. long. 76° 0′ W., is probably not specifically distinct from the Pacific specimen [*Bathysaurus ferox* from Station 168, near New Zealand, 1100 fathoms]. It seems to be a fish with a somewhat deeper body, but, then, it was ascertained to be a "female, full of nearly mature eggs."—(GÜNTHER, *Zool. Chall. Exp.*, part 57, p. 183.)

[2] Ever since the discovery of this fish [*Ipnops murrayi*] much uncertainty has prevailed with regard to the nature and function of the extraordinary apparatus on the upper side of the head ; but from Professor MOSELEY's examination it seems to be almost beyond doubt, that it is a special form of phosphorescent organ. The power of producing light, and thereby attracting other creatures, must be of great use to a fish, which, deprived of organs of sight and touch, would be unable to procure its food. The question of the homology of the luminous organ and its covering lamellæ is still obscure ; and no other specimen can be sacrificed to investigate the osteology of the skull. If, as Professor MOSELEY's investigations seem to prove, the luminous organ is not a modification of the eye, as Mr MURRAY and myself supposed at first, and if the organ of vision with the optic nerve has disappeared, the luminous organ is probably the homologue of that which is found in some Scopelids between the eye and nostril, and the covering plates would be the homologues of the præorbital membrane bones. With the abortion of the eyes the luminous organs with their præorbitals would have moved from their usual lateral position to the top of the head.—(GÜNTHER, *Zool. Chall. Exp.*, part 57, pp. 190–1.)

Corallimorphus profundus (2).
Dytaster exilis (2).
Ophiomusium armigerum (2).
„ *lymani* (2).
Aspidodiadema microtuberculatum (3).
Cystechinus clypeatus (2).
Benthodytes mamillifera (2).
Cucumaria abyssorum (3).
Holothuria murrayi (2).
Pœlopatides confundens (3).
Nothria ehlersi (2).
„ *pycnobranchiata* (2).
Bairdia hirsuta (2).
Cyphocaris micronyx (2).
Acanthephyra sica (2).
Aristeus armatus (2).
Benthesicymus brasiliensis (3).
Glyphocrangon rimapes (2).
Pontophilus gracilis (2).
Sergestes profundus (2).
Willemœsia leptodactyla (3).
Parapagurus abyssorum (3).
Bugula margaritifera (2).
Cellularia crateriformis (2).
Chlorophthalmus gracilis (3).

The preceding list (List II.) of species from the deep-water areas of the Southern Hemisphere south of the southern tropic and outside of the Kerguelen Region, shows that in the regions of the Southern Hemisphere represented by the twenty-nine Stations referred to, the Challenger procured in depths exceeding 1000 fathoms representatives of 253 species and varieties of Metazoa, belonging to 182 genera. To these numbers must be added 48 species and 24 genera mentioned in footnote on page 36, not included in this list, having been already enumerated in the list (List I.) of species from the deep-water area of the Kerguelen Region. The proportion of genera to species in these twenty-nine Stations is exactly the same as in the eight Stations in the Kerguelen Region, viz., as 1 to 1·46. These twenty-nine Stations are situated on an average about seventeen degrees to the north of the mean latitude of the eight deep-water Stations in the Kerguelen Region, and it will be observed that, while 301 species were obtained at the twenty-nine Stations in the Southern Hemisphere outside the Kerguelen Region (or 10·4 species per haul), 272 species were taken at the eight Stations in the Kerguelen Region (or 34 species per haul).

An examination of the list shows that 19 of the species have received no specific names, and there is besides one variety as well as the species to which it belongs. As in the case of List I., and for reasons there stated, these must be deducted from the total number, leaving 233 distinct fully-described species the distribution of which may be discussed in detail.

These 233 species may be divided into (1) those that are known to occur only in the regions represented by these twenty-nine Stations; and (2) those that are known to occur in other regions situated northwards of the southern tropic.

a. *Species limited to the Southern Hemisphere south of the Tropic of Capricorn.*

In the first place we find that there are 165 species (or 65 per cent. of the total number[1] of species and varieties found at these twenty-nine Stations) which, as far as we know up to the present time, are limited in their distribution to regions south of the

[1] Not including the 48 species also occurring in the deep-water area of the Kerguelen Region (see footnote, p. 36).

southern tropic. These 165 species are indicated in the list by an asterisk, and little can be said about them beyond the fact that they are known only from the Southern Hemisphere, and (with the exception of 16 species referred to later on—see List II*g*.) from depths over 1000 fathoms.

LIST II *b*.

We enumerate here those species found at more than one of these Stations indicating in brackets the number of Stations at which each species was taken. It will be observed that the species limited to this area show a very restricted distribution within the area itself, for only 9 species were each taken at two Stations, and 3 species each at three Stations.

Corallimorphus profundus (2).
Benthodytes mamillifera (2).
Cucumaria abyssorum (3).
Pœlopatides confundens (3).
Nothria ehlersi (2).
„ *pycnobranchiata* (2).
Bairdia hirsuta (2).
Cyphocaris micronyx (2).
Sergestes profundus (2).
Bugula margaritifera (2).
Cellularia crateriformis (2).
Chlorophthalmus gracilis (3).

b. *Species extending outside the area under consideration.*

We come now to consider those species which have a wider distribution and extend into the tropical and northern extra-tropical regions. The number of such species is 68 (or 27 per cent. of the total number[1] of species found at these twenty-nine Stations), and for the purposes of this discussion they may be divided into groups in accordance with their distribution. Thus we find that of these 68 species,

25 species (or 37 per cent.) are known to occur in regions within the tropics, but not north of the tropical zone (List II*c*.);

19 species (or 28 per cent.) are known to occur to the north of the tropics, but not within the intervening tropical zone (List II*d*.); and

24 species (or 35 per cent.) are known to occur both within and to the north of the tropics, some of which may for the present be regarded as almost cosmopolitan (List II*e*.).

We may now proceed to consider in detail the distribution of these 68 species according to the groups given above, indicating briefly the geographical and bathymetrical distribution of each species northward of the tropic of Capricorn.

LIST II *c*.

In the first place we give a list of the 25 species which extend within the tropics, but are unknown up to the present time to the north of the tropic of Cancer. From the

[1] Not including the 48 species occurring also in the deep-water area of the Kerguelen Region (see footnote, p. 36).

distributional notes accompanying each species it will be observed that 15 of the species are true deep-sea forms, being unknown from depths less than 1000 fathoms; the other 10 species, though found in depths greater than 1000 fathoms in the regions represented by these twenty-nine Stations, occur outside those regions in depths less than 1000 fathoms, and only one of these species (*Cythere scutigera*) appears to be an inhabitant of shallow water under 150 fathoms. It will also be noticed that 15 of the species occur in the tropical Pacific, 7 species in the tropical Atlantic, while 1 species is common to both the tropical Pacific and tropical Atlantic, the remaining 2 species being recorded from the Indian Ocean.

Esperella biserialis—Tropical Pacific, 2385 fathoms.
Solenosmilia variabilis—Tropical Atlantic, 420 fathoms; also near Marion Island, 310 fathoms.
Freyella benthophila—Tropical Indian Ocean, 1520 to 1997 fathoms.
Marsipaster hirsutus—Tropical Indian Ocean, 1997 fathoms.
Ophioglypha ornata—Tropical Pacific, 2000 fathoms.
Ophiomastus tegulitius—Tropical Pacific, 1070 fms.; also near Australia and New Zealand, 410 and 275 fms.
Aspidodiadema microtuberculatum—Tropical Atlantic, 350 and 1600 fathoms.
Cystechinus clypeatus—Tropical Pacific, 1050 fathoms.
Benthodytes papillifera—Tropical Pacific, 1400 and 2425 fathoms.
Psychropotes semperiana—Tropical Atlantic, 2500 fathoms.
Buskiella abyssorum—Tropical Atlantic, 1850 and 2500 fathoms.
Cythere scutigera—Tropical Pacific, 15 to 37 fathoms; also near New Zealand, 150 fathoms.
Stenopleura atlantica—Tropical Atlantic, 1850 fathoms.
Acanthephyra longidens—Tropical Pacific, 2150 fathoms.
Benthesicymus brasiliensis—Tropical Pacific, 315, 1400, and 2440 fathoms.
Haliporus curvirostris—Tropical Pacific, 2385 fathoms.
Hemipenæus spinidorsalis—Tropical Pacific, 2050 fathoms.
Pentacheles lævis—Tropical Pacific, 500 fathoms.
Pontophilus gracilis—Tropical Pacific, 1400 and 2150 fathoms.
Arca (*Barbatia*) *corpulenta*—Tropical Pacific, 200, 1400, 2000, and 2425 fathoms.
Bicellaria navicularis—Tropical Atlantic, 32 to 400 fathoms.
Flustra biseriata—Tropical Pacific, 825 fathoms.
Kinetoskias pocillum—Tropical Atlantic, 32 to 400 fathoms.
Octacnemus bythius—Tropical Pacific, 1070 fathoms.
Ipnops murrayi—Tropical Atlantic and tropical Pacific, 1600 and 2150 fathoms.

LIST II*d*.

In the second place we give a list of the 19 species which have been recorded from regions north of the northern tropic as well as south of the southern tropic, but which, up to the present time, are not known to occur within the intervening tropical zone. From the distributional notes accompanying each species it will be observed that 12 of the species are true deep-sea forms, being unknown from depths less than 1000 fathoms [in the case of *Pyrosoma spinosum*, though the trawl descended to a depth of 2200 fathoms, it is pretty certain the specimen entered the net near the surface]; the other 6 species, though found in depths greater than 1000 fathoms in the regions represented by these twenty-nine Stations, occur outside those regions in depths

less than 1000 fathoms, and only one of these species (*Pseudocythere caudata*) appears to be an inhabitant of shallow water under 150 fathoms. It will also be noticed that 16 of the species are represented in the North Atlantic and 4 species in the North Pacific, while only one of these 19 species (*Dentalium keras*) is common to both the North Atlantic and North Pacific.

Dytaster exilis—North Atlantic, 1700 fathoms.
Ophioglypha bullata—North Atlantic, 1240, 2075, 2650, and 2850 fathoms.
„ *irrorata*—North Atlantic, 470 to 1125 fathoms.
Phormosoma hoplacantha—North Pacific, 565 fathoms; also near S.E. Australia, 410 fathoms.
Euphronides depressa—North Atlantic, 1090 fathoms.
Eupista darwini—North Atlantic, 2750 fathoms.
Placostegus ornatus—North Pacific, 2900 and 3125 fathoms.
Cythere irpex—North Atlantic, 1000 fathoms.
Krithe tumida—North Atlantic, 2700 fathoms.
Pseudocythere caudata—North Atlantic, shallow; also near Marion and Kerguelen Islands, 20 to 150 fms.
Xestoleberis expansa—North Atlantic, 2700 fathoms.
Scalpellum velutinum—North Atlantic, 900 fathoms.
Neotanais americanus—North Atlantic, 1240 fathoms.
Glyphocrangon rimapes—North Pacific, 1875 fathoms.
Glomus nitens—North Atlantic, 500 to 1750 fathoms.
Dentalium keras—North Pacific, 2050 fathoms; Gulf of Mexico, 1568 fathoms.
Ianthina rotundata—North Atlantic, surface and 1000 fathoms.
Kinetoskias cyathus—North Atlantic, 1525 fathoms.
Pyrosoma spinosum—North Atlantic, 2200 fathoms (surface ?).

LIST II *c*.

In the third place we give a list of the 24 widely-distributed species which are known to occur both in the tropical and northern extra-tropical regions as well as south of the tropics. From the distributional notes accompanying each species, it will be observed that only 4 of the species are true deep-sea forms, being known only from depths greater than 1000 fathoms; the other 20 species, though found in depths over 1000 fathoms in the regions represented by these twenty-nine Stations, occur outside those regions in depths less than 1000 fathoms, and 8 of these species appear to be inhabitants of shallow water under 150 fathoms. Three of the species (viz., *Gennadas parvus*, *Parapagurus abyssorum*, and *Discina atlantica*) appear to be almost cosmopolitan.

Phakellia ventilabrum—Tropical Atlantic, 400 fathoms; North Atlantic and Arctic, over 100 fathoms.
Deltocyathus italicus—Tropical and North Atlantic and tropical Pacific, 200 to 1075 fathoms.
Rhizocrinus lofotensis—Tropical and North Atlantic, 80 to 955 fathoms.
Ophiomusium armigerum—Tropical and North Atlantic, 1650 and 1850 fathoms.
„ *lymani*—North Atlantic, tropical and North Pacific, 565 to 1250 fathoms; also near New Zealand, 700 fathoms.
Aceste bellidifera—North Atlantic and tropical Pacific, 620 and 2600 fathoms.
Brissopsis luzonica—Tropical and North Pacific, shore to 800 fathoms.
Echinus elegans—North Atlantic and tropical Pacific, 80 to 1350 fathoms.

Pourtalesia laguncula—Tropical and North Pacific, 345 to 2900 fathoms; also near New Zealand, 700 fathoms.

Salenia hastigera—Tropical and North Atlantic and tropical Pacific, 100 to 1850 fathoms; also near Kermadecs, 600 and 630 fathoms.

Holothuria murrayi—North Atlantic and tropical Pacific, 150 and 1090 fathoms.

Myriochele heeri—Tropical and North Atlantic, 1340 and 2975 fathoms.

Bairdia victrix—Tropical and North Atlantic, shallow water to 675 fathoms; also near Kerguelen and South-East Australia, 38 to 410 fathoms.

Cythere serratula—Tropical and North Atlantic, 390 and 1125 fathoms.

Xestoleberis curta—Tropical and North Atlantic, and tropical Pacific, 6 to 435 fathoms; also near Kerguelen and Port Jackson, 2 to 28 fathoms.

Acanthephyra brachytelsonis—Tropical and North Pacific, 200 to 775 fathoms; also near Kermadecs, 520 to 630 fathoms.

" *sica*—North Atlantic, tropical and North Pacific, 200 to 2675 fathoms; also near Kermadecs and New Zealand, 520 and 700 fathoms.

Aristeus armatus—Tropical and North Pacific, 1400 to 2350 fathoms; tropical Indian Ocean, 1748 fathoms.

Benthesicymus altus—Tropical and North Pacific, 345 to 1400 fathoms; also near Kermadecs, 520 and 600 fathoms.

Gennadas intermedius—Tropical and North Atlantic, surface and 1850 fathoms.

" *parvus*—Tropical and North Atlantic, tropical and North Pacific, surface (?) to 2500 fathoms; tropical Indian Ocean, 738 to 1644 fathoms.

Willemœsia leptodactyla—North Atlantic, 1900 fathoms; Mediterranean, 3000 m. (= 1600 fathoms).

Parapagurus abyssorum—Tropical and North Atlantic, tropical and North Pacific, 1050 to 2175 fathoms; also Magellan Strait, 45 fathoms (?).

Discina atlantica—Tropical and North Atlantic, tropical and North Pacific, and Arctic, 200 to 2425 fathoms.

We may now summarise the distribution of these 68 species which extend into the tropical and northern extra-tropical regions, as follows:—

Bathymetrical Distribution.—It appears that of these 68 species, 31 species are known to occur only in depths greater than 1000 fathoms, while 37 species are recorded from both above and below the 1000 fathoms line (of which 12 species extend into shallow water under 150 fathoms; to these 12 species we must add 8 of the species confined to the Southern Hemisphere which have been recorded from shallow water under 150 fathoms).

LIST II*f*.

We give here the names of the 20 species which extend from deep water over 1000 fathoms into shallow water under 150 fathoms, of which 3 species (viz., *Brissopsis lyzonica*, *Phascolosoma catharinæ*, and *Venus* (*Chamelæa*) *mesodesma*) have been recorded from the shore:—

(?) *Phakellia ventilabrum.*
Rhizocrinus lofotensis.
Brissopsis lyzonica.
Echinus elegans.
(?) *Salenia hastigera.*
Cerebratulus angusticeps.
Phascolosoma catharinæ.
Argillæcia eburnea.
Bairdia victrix.
Cythere scutigera.
" *stolonifera.*
(?) *Cytheropteron fenestratum.*
Pseudocythere caudata.
Xestoleberis curta.
Elasmopus subcarinata.
(?) *Parapagurus abyssorum.*
Venus (*Chamelæa*) *mesodesma.*
(?) *Bicellaria navicularis.*
(?) *Kinetoskias pocillum.*
Magasella flexuosa.

Six of the above species are preceded by a mark of interrogation:—*Phakellia ventilabrum*, *Salenia hastigera*, and *Cytheropteron fenestratum* have been recorded only from depths over 100 fathoms, and might, therefore, not merit the title of shallow-water species; *Parapagurus abyssorum* is said to have been dredged from a depth of 45 fathoms in Magellan Strait, but the author of the Challenger Report on the Anomura regards this as an error, as he thinks a shallow-water habitat for the species is quite out of the question; the two species of Polyzoa (*Bicellaria naviculoris* and *Kinetoskias pocillum*) are recorded from the coast of Brazil, "32 to 400 fathoms," so that it is doubtful whether they actually came from less than 150 fathoms.

Geographical Distribution.—Of the 68 species we find that:—

35	species	are	represented	in the North Atlantic area,
32	,,	,,	,,	Tropical Pacific area,
21	,,	,,	,,	Tropical Atlantic area,
14	,,	,,	,,	North Pacific area,
4	,,	,,	,,	Tropical Indian Ocean,
2	,,	,,	,,	Arctic Ocean.

LIST II*g*.

In List II. those species apparently limited to the Southern Hemisphere south of the tropic of Capricorn are distinguished by an asterisk. A few of these species were, however, obtained in depths less than 1000 fathoms in the Southern Hemisphere, as well as in depths over 1000 fathoms among the twenty-nine Stations under consideration. We give here a list of 16 such species, with an indication of the localities in which each species occurred in depths less than 1000 fathoms.

Ophiactis poa—Near Tristan da Cunha, 500 fathoms.
Ophioglypha jejuna—Near Tristan and Sydney, 500 and 410 fathoms.
,, *meridionalis*—Near River Plate, 600 fathoms.
Ophiozona stellata—Near New Zealand, 700 fathoms.
Cerebratulus angusticeps—Near New Zealand, 10 fathoms.
Phascolosoma catharinæ—Brazil, shore.
Eunoa opalina—Magellan Strait, 245 fathoms [specimen from deep water is an eyeless variety].
Argillæcia eburnea—Kerguelen, 20 to 120 fathoms.
Cythere normani—Near Heard Island, 150 fathoms.
,, *stolonifera*—Cape, 15 to 20 fathoms.
Cytheropteron fenestratum—Kerguelen, 120 fathoms.
Elasmopus subcarinata—Bass Strait, Port Jackson, New Zealand, 30 to 50 fathoms.
Acanthomunna proteus—Near New Zealand, 700 fathoms.
Serolis neœra—Near River Plate, 600 fathoms.
Venus (*Chamelœa*) *mesodesma*—New Zealand, shore [the localities Valparaiso and Philippines, assigned to this species, require verification].
Magasella flexuosa—Falklands and Patagonia, 5 to 12 fathoms.

As already stated, of the twenty-nine Stations where the Challenger dredged in depths of over 1000 fathoms to the south of the tropic of Capricorn (excluding the eight deep-water Stations in the Kerguelen Region), fifteen Stations are situated in the South Atlantic, between lat. 24° 38′ and 48° 37′ S., and fourteen Stations in the South Pacific, between lat. 32° 36′ and 42° 43′ S.

Of the 253 species and varieties of marine Metazoa obtained at these Stations,[1]

101 species (or 40 per cent.) were taken only in the South Atlantic,
140 „ („ 55 „) „ „ „ South Pacific, and
12 „ („ 5 „) „ „ both in the S. Atlantic and S. Pacific.

For convenience of reference it is desirable to indicate the species taken in each of these oceanic regions.

LIST II *h*.

In the first place we give a list of the 101 species taken only in the South Atlantic deep-water Stations :—

Psammina plakina.
Cladorhiza inversa.
Phakellia ventilabrum.
Caulocalyx tener.
Holascus stellatus.
Hyalonema tenue.
„ sp. (?).
Anthoptilum simplex.
Schizopathes crassa.
Solenosmilia variabilis.
Nauphanta challengeri.
Anthemodes articulata.
Bathyphysa gigantea.
Rhizocrinus lofotensis
Dytaster exilis, var. *gracilis.*
„ *nobilis.*
Hymenaster anomalus.
„ *pergamentaceus.*
Pontaster pristinus.
Porcellanaster eremicus.
Pythonaster murrayi.
Amphiura dalea.
Ophiactis poa.
Ophiocten umbraticum.
Ophioglypha bullata.
„ *irrorata.*
„ *jejuna.*
„ *meridionalis.*
Ophiomusium archaster.
Ophiomyces grandis.
Ophiophyllum sp. (?).
Aceste bellidifera.
Cystechinus clypeatus.
Echinus elegans.
Salenia hastigera.
Psychropotes semperiana.
Scotoplanes albida.
„ *papillosa.*
Phascolosoma catharinæ
Amphicteis sarsi.
Buskiella abyssorum
Eupista grubei.
Myriochele heeri.
Argillæcia eburnea.
Bairdia victrix.
Bythocypris elongata.
Cythere dorsoserrata.
„ *irpex.*
„ (?) *serratula*
„ *squalidentata*
Cytheropteron fenestratum.
Krithe tumida.
Pseudocythere caudata.
Xestoleberis expansa.
Scalpellum carinatum.
„ *eximium.*
„ *velutinum.*
Verruca gibbosa.

[1] Not including the 48 species occurring also in the deep-water area of the Kerguelen Region (see footnote, p. 36).

Verruca incerta.
„ *quadrangularis.*
Lanceola sp. (?).
Œdiceroides cinderella.
Orchomene abyssorum.
Stenopleura atlantica.
Neotanais americanus.
Serolis neœra.
Acanthephyra brachytelsonis.
Aristeus armatus.
Benthesicymus altus.
„ *iridescens.*
„ *mollis.*
Gennadas intermedius.
Hemipenæus speciosus.
„ *spinidorsalis.*
Notostomus murrayi.
Colossendeis brevipes.
Cryptodon moseleyi.
Glomus nitens.
Lima (*Limatula*) sp. (?).
Lyonsiella grandis.
Malletia pallida.
Venus (*Chamelœa*) *mesodesma.*
Basilissa simplex.
Clathurella cala.
Dentalium amphialum.
Ianthina rotundata.
Pleurotoma (*Spirotropis*) *aganactica.*
Stilifer brychius.
Trochus sp. (?).
Histiopsis atlantica.
Bicellaria navicularis.
Bugula margaritifera.
Cellularia crateriformis.
Farciminaria cribraria.
„ *magna.*
Kinetoskias cyathus.
Pyrosoma spinosum.
Bathylagus atlanticus.
Bathypterois longipes.
Ipnops murrayi.
Macrurus affinis.

LIST II*i*.

In the second place we give a list of the 140 species taken only in the South Pacific deep-water Stations :—

Holopsamma argillaceum.
Axoniderma mirabile.
Esperella biserialis.
Tedania actiniiformis.
Trichostemma irregularis.
Thenea wrightii.
„ sp. (?).
Bathydorus baculifer.
Hyalonema poculum.
„ (*Stylocalyx*) *tenerum.*
Hyalostylus dives.
Trachycaulus gurlittii.
Dictyonine undetermined.
Aulorchis paradoxa.
Corallimorphus profundus.
Edwardsia sp. (?).
Epizoanthus thalamophilus.
Ophiodiscus annulatus.
„ *sulcatus.*
Palythoa (?) sp.
Paractis excavata.
Phellia (?) sp.
Polyopis striata.
Polystomidium patens.
Actinian undetermined.
Deltocyathus italicus.
Leptopenus hypocœlus.
Leonura terminalis.
Periphylla mirabilis.
Tesserantha connectens.
Dytaster exilis.
Freyella benthophila.
Hymenaster carnosus.
„ *echinulatus.*
„ *geometricus.*
„ *porosissimus.*
„ *vicarius.*
Hyphalaster diadematus.
Marsipaster hirsutus.
„ *spinosissimus.*
Porcellanaster crassus.
„ *gracilis.*
Amphilepis patens.
Ophiacantha sentosa.
Ophioglypha ornata.
„ sp. (?).

Ophiomastus tegulitius.
Ophiothamnus sp. (?).
Ophiotholia supplicans.
Ophiozona stellata.
Brissopsis luzonica.
Phormosoma asterias.
„ *hoplacantha.*
Pourtalesia laguncula.
Benthodytes abyssicola.
„ *mamillifera.*
„ *papillifera.*
„ *sanguinolenta.*
Cucumaria abyssorum, var. *grandis.*
Elpidia verrucosa.
Enypniastes eximia.
Euphronides depressa.
Holothuria murrayi.
Pœlopatides confundens.
Parelpidia cylindrica.
„ *elongata.*
Peniagone vitrea.
Stichopus (?) *torvus.*
Trochostoma sp. (?).
Two Holothurians undetermined.
Cerebratulus angusticeps.
Eumenia reticulata.
Eunoa opalina.
Eupista darwini.
Euthelepus chilensis.
Leœna langerhansi.
„ *neo-zealaniæ.*
Lumbriconereis abyssorum.
Maldanella neo-zealaniæ.
„ *valparaisiensis.*
Melinna armandi.
Nothria ehlersi.
„ *pycnobranchiata.*
Placostegus mörchii.
„ *ornatus.*
Samythopsis grubei.
Vermilia (?) sp.
Bairdia hirsuta.
Crossophorus imperator.
Cythere normani.
„ *scutigera.*
„ *stolonifera.*
„ *sulcatoperforata.*
Xestoleberis curta.
Scalpellum darwinii.
„ *minutum.*
Andania abyssorum.
Camacho bathyplous.
Elasmopus subcarinata.
Gammaropsis thomsoni.
Lanceola sp. (?).
Leucothoë tridens.
Podocerus hoeki [=*tuberculatus*].
Acanthocope acutispina.
Acanthomunna proteus.
Eurycope novæ-zelandiæ.
Ischnosoma bacilloides.
Munnopsis gracilis.
Serolis sp. (?).
Acanthephyra longidens.
Gennadas parvus.
Haliporus curvirostris.
Hepomadus inermis.
Pentacheles lævis.
Pontophilus profundus.
Elasmonotus marginatus.
Galacantha bellis.
Tylaspis anomala.
Colossendeis media.
Nymphon compactum.
„ *longicollum.*
„ *longicoxa.*
„ *procerum.*
Arca (*Barbatia*) *corpulenta.*
Dentalium keras.
Nassa dissimilis.
Pleurotoma (*Thesbia*) *membranacea.*
„ („) *xanthias.*
Flustra biseriata.
Kinetoskias pocillum.
Menipea pateriformis.
Discina atlantica.
Magasella flexuosa.
Waldheimia wyvillii.
Octacnemus bythius.
Bathypterois longicauda.
Bathysaurus ferox.
Macrurus fernandezianus.
„ *murrayi.*

LIST II *k*.

In the third place we give a list of the 12 species taken both in the South Atlantic and South Pacific deep-water Stations :—

Ophiomusium armigerum.	*Glyphocrangon rimapes.*
,, *lymani.*	*Pontophilus gracilis.*
Aspidodiadema microtuberculatum.	*Sergestes profundus.*
Cyphocaris micronyx.	*Willemœsia leptodactyla.*
Acanthephyra sica.	*Parapagurus abyssorum.*
Benthesicymus brasiliensis.	*Chlorophthalmus gracilis.*

To these 12 species must be added *Dytaster exilis*, the type form of which was taken in the South Pacific and the variety *gracilis* in the South Atlantic.

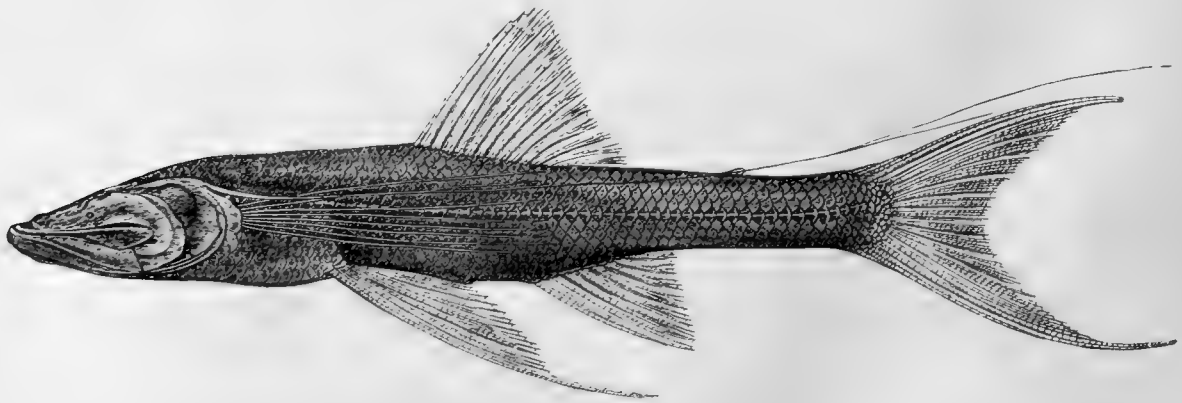
Turning now our attention to the genera represented at these twenty-nine Stations in the Southern Hemisphere, we find that out of the total number (182) 19 genera (or 10 per cent.) are known up to the present time only from these Stations.

LIST III.

We give here a list of these 19 genera, the great majority of which include only a single species taken each at a single Station, but two of the genera (*Ophiodiscus* and *Parelpidia*) each contain 2 species, each species being represented at a distinct Station.

Axoniderma.	*Polystomidium.*	*Parelpidia.*
Caulocalyx.	*Nauphanta.*	*Samythopsis.*
Hyalostylus.	*Tesserantha.*	*Crossophorus.*
Trachycaulus.	*Pythonaster.*	*Camacho.*
Aulorchis.	*Ophiotholia.*	*Tylaspis.*
Ophiodiscus.	*Enypniastes.*	*Histiopsis.*
Polyopis.		

To these 19 genera may be added the genus *Acanthomunna* with a single species, which was taken at two neighbouring Stations near New Zealand, one of them being, however, under 1000 fathoms (viz., Stations 168 and 169, 1100 and 700 fathoms).



Bathypterois longipes, Günther. South Atlantic.

Total Number of Species of Marine Metazoa procured by the Challenger in the Southern Hemisphere South of the Tropics, in Depths exceeding 1000 Fathoms.

If now we combine the information in the two preceding lists (Lists I. and II.) of species taken by the Challenger in the two groups of deep-water Stations to the south of the southern tropic, we shall have a fair general idea of the deep-sea Metazoan fauna of the Southern Hemisphere in depths over 1000 fathoms so far as at present known.

There are in all thirty-seven Stations, at twenty-nine of which the trawl was used, and the dredge was sent down at the remaining eight Stations.

15 of the Stations are situated in the South Atlantic or its extension into the Southern Ocean,
14 „ „ South Pacific or its extension into the Southern Ocean, and
8 „ „ Southern Indian Ocean (Kerguelen Region).

The total number of species obtained is 523, belonging to about 312 genera, the proportion of genera to species being as 1 to 1·67.

272 species (or 52 per cent. of the total number) occur in the Kerguelen Region,
194 „ („ 37 „ „ „) occur in the South Pacific, and
138 „ („ 26 „ „ „) occur in the South Atlantic.

These figures show that in the eight deep-water Stations of the Kerguelen Region, a much larger number of species was procured than at nearly double the number of Stations, situated, however, nearer the tropics, in the South Atlantic or in the South Pacific.

Of the 523 species obtained we find that

164 species (or 31 per cent. of the total number) are known only from the Kerguelen Region,
89 „ („ 17 „ „ „) are known only from the South Pacific, and
54 „ („ 10 „ „ „) are known only from the South Atlantic.

There are, in addition, 29 species (or 6 per cent. of the total number) which, though not confined to any one of these three divisions, are known only from these deep-water Stations of the Southern Hemisphere south of the tropic of Capricorn ; of these 29 species,

20 species are common to the Southern Indian and South Pacific areas,
5 „ „ „ „ South Atlantic areas,
3 „ „ South Atlantic and South Pacific areas,
1 „ „ to all three divisions (South Indian, South Atlantic, and South Pacific).

Of the 523 species present in these deep-water Stations of the Southern Hemisphere there are thus altogether 336 species (or 64 per cent.) which, so far as our knowledge at present extends, are unknown outside the area represented by these deep-water Stations.

Besides these 336 species known only from deep water in the Southern Hemisphere south of the southern tropic, there are 28 species (or 5 per cent. of the total number present) not known to occur to the northwards of the southern tropic, but occurring in shallower water less than 1000 fathoms in southern regions.

There are 121 species (or 23 per cent. of the total number) which extend to regions north of the tropic of Capricorn, and their distribution outside this area may be shown thus :—

43 species (8 per cent.) occur to the *north* of the tropics (but not within the tropics),
41 „ (8 „) „ both *within* and *north* of the tropics,
37 „ (7 „) „ *within* the tropics (but not north of the tropics).

These 121 species are represented in the various oceanic regions as follows :—

62 species (or 12 per cent.) occur in the North Atlantic,
49 „ („ 9 „) „ Tropical Pacific,
37 „ („ 7 „) „ Tropical Atlantic,
36 „ („ 7 „) „ North Pacific,
7 „ („ 1 „) „ Indian Ocean,
4 „ („ 1 „) „ Arctic Ocean.

As regards the bathymetrical distribution of the species taken at these deep-water Stations of the Southern Hemisphere, 336 species, as already stated, are known only from these Stations, and are consequently known only from depths over 1000 fathoms. Of the species with a wider distribution, 54 species are known only from deep water over 1000 fathoms, making a total number of 390 exclusively deep-sea species (or 74 per cent. of the total number present). The remaining 93 species occur both in deep water over 1000 fathoms and in lesser depths, of which 39 species have been recorded from shallow water under 150 fathoms, 4 of which are known from the shore. The depth at which 2 species occur outside the area under consideration is not recorded.

Of the 312 genera represented at these deep-water Stations, 57 genera (or 18 per cent.) are known only from these Stations, and there are, besides, 3 genera which are known, apart from these Stations, only from shallower water south of the southern tropic.

LIST III.

Metazoa procured by the Challenger in Intermediate Depths between 150 and 1000 Fathoms, in the Kerguelen Region.

Returning now to the region in the Southern Indian Ocean traversed by the Challenger during the cruise from the Cape of Good Hope to Australia, which is the special subject of this paper, we proceed to complete our review of the marine fauna of this Kerguelen Region by giving a list of the species taken by the Challenger in depths less than 1000 fathoms. We give in the first place a list of the species taken in moderate depths (between 1000 and 150 fathoms), reserving for a future list (List IV.) the essentially shallow-water species taken in depths less than 150 fathoms in the same region. There were only three dredgings taken in intermediate depths between 150 and 1000 fathoms, viz., at Station 145a, near Marion Island, in 310 fathoms, and at Stations 148 and 148a, near the Crozet Islands, in 210 and 550 fathoms; the trawl was not used at any of these Stations. The species known only from these dredgings are indicated by an asterisk *.

Monaxonida:

Axinella erecta (Carter).
**Esperiopsis symmetrica*,[1] Ridley and Dendy.
Gellius carduus,[2] Ridley and Dendy.
Iophon chelifer,[3] Ridley and Dendy.
* ,, *laminalis*,[4] Ridley and Dendy.

[1] *Esperiopsis symmetrica* is a very remarkable sponge, the most noticeable feature in which is the radiately symmetrical arrangement of the skeleton.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, p. 78.)

[2] *Gellius carduus* is readily distinguished by its very characteristic external form, the surface resembling that of a large thistle-leaf, whence the specific name. The shape of the skeleton spicules is also very characteristic. . . . The variety *magellanica* is a very interesting geographical variety from the Strait of Magellan. The main features in which it differs from the type specimens concern the oxeote spicules which, in the variety in question, are much more pointed and a good deal shorter than in the type.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, pp. 39, 40.)

[3] Three specimens of this interesting species [*Iophon chelifer*] are present; two are fairly large, but broken into fragments, the other is small, and occurs encrusting a branched Polyzoon. The latter is in all probability a young form, and differs in several minor respects from the larger specimens. . . . The species differs very decidedly from all described forms in the large size and also in the degree of elaboration of the bipocillate spicules. The other spicules are also larger in almost every case than the corresponding forms in other species of *Iophon; Iophon* (*Alebion*) *piceum*, Vosmaer, from Barents Sea, approaches it the most nearly in this respect.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, pp. 119–120.)

[4] Only one specimen, broken into fragments, of this interesting species [*Iophon laminalis*] was obtained. In the fine state of development of its bipocillate microsclera it approaches *Iophon chelifer*, a specimen of which was obtained at the same Station; while in external form it probably comes near *Iophon piceum*, Vosmaer, from Barents Sea. The species to which it is perhaps most nearly related is, however, *Iophon cylindricus* (from off Cape Howe), which, like it, has the stylote spicule smooth.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, p. 121.)

Myxilla nobilis,[1] Ridley and Dendy.
**Phakellia papyracea*,[2] Ridley and Dendy.
**Suberites mollis*,[3] Ridley and Dendy.

[TETRACTINELLIDA :

Tetilla antarctica (Carter). Taken by Ross' Antarctic Expedition in the neighbourhood of Victoria Land (lat. 74° 30′ and 77° 30′ S.), 206 and 300 fathoms.]

HEXACTINELLIDA :

**Acanthascus grossularia*, Schulze.
**Aulascus johnstoni*, Schulze.
Aulocalyx irregularis, Schulze.
Chonelasma lamella, Schulze.
,, sp. (?).

ALCYONARIA :

**Acanthogorgia ramosissima*, Wright and Studer.
**Lophogorgia lutkeni*, Wright and Studer.
Pleurocorallium secundum, Dana.
**Primnoides sertularoides*, Wright and Studer.
Primnoisis antarctica (Studer).
**Stenella spinosa*, Wright and Studer.
Thouarella antarctica (Valenciennes).
,, *variabilis*,[4] Wright and Studer.
,, ,, var. *brevispinosa*, Wright and Studer.

[1] The species which we have called *Myxilla nobilis*, and its varieties, have given us a great deal of trouble in determining their true relations ; they appear to be sufficiently connected *inter se* to warrant us in considering them all as varieties of one species, and that species perhaps finds its nearest already known ally in BOWERBANK'S *Hymeniacidon* (*Myxilla*) *paupertas* [British] ; the two species seem, however, to be distinct.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 143.)

[2] *Phakellia papyracea* is a very delicate species, which perhaps comes near to BOWERBANK'S *Isodictya infundibuliformis* [British], more especially if it should ultimately prove to be cup-shaped when perfect, but it is distinguished at once and absolutely from that species by the absence of the oxeote spicules, so that further comparisons are needless. In the absence of the oxeote spicules, however, it agrees with VON MARENZELLER'S *Cribrochalina ambigua* [from Jan Mayen], but differs widely in the size of the spicules, while there do not seem to be two distinct sizes as in our sponge. —(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 172.)

[3] The most remarkable features of this sponge [*Suberites mollis*] are its great softness and looseness of texture, as compared with the more typical species of *Suberites*, and the reduction of the "dermal crust" of spicules, which no longer forms a distinct cortical layer.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 205.)

[4] *Thouarella variabilis*, of which there are numerous examples, varies to an extraordinary degree in the size of the calyces, the development of the spines, and the development of the colony, without it being possible thereby to sharply separate the individual forms specifically. Nevertheless one can generally distinguish the following three varieties from each other : *a*. the type (Station 145, 310 fathoms), *b*. var. *brevispinosa* (Station 145, 310 fathoms), *c*. var. *gracilis* (Station 150, 150 fathoms).—(WRIGHT and STUDER, *Zool. Chall. Exp.*, part 64, p. 68.)

ANTIPATHARIA :

Cladopathes plumosa, Brook.
**Schizopathes conferta*, Brook.

CORALS :

Flabellum apertum, Moseley.
Solenosmilia variabilis, Duncan.

ASTEROIDEA :

Cribrella præstans, Sladen.
,, *simplex*, Sladen.
**Leptoptychaster antarcticus*,[1] Sladen.

OPHIUROIDEA :

Amphiura studeri, Lyman.
Astrotoma agassizii, Lyman.
Ophiacantha rosea, Lyman.
**Ophioglypha elevata*, Lyman.
Ophiolebes scorteus, Lyman.

ECHINOIDEA :

Echinus magellanicus, Phil.

HOLOTHURIOIDEA :

Cucumaria serrata, Théel, var. *marionensis*, Théel.
Psolus ephippifer, Wyville Thomson.
**Stichopus challengeri*, Théel.

ANNELIDA :

Lagisca magellanica, M'Intosh, var. *grubei*, M'Intosh.
Polyeunoa lævis, M'Intosh.

AMPHIPODA :

**Atylopsis emarginatus*, Stebbing.

ISOPODA :

Arcturides cornutus, Studer.
Serolis latifrons, White.

[1] This form [*Leptoptychaster antarcticus*] is unquestionably the southern representative of *Leptoptychaster arcticus* (Sars) of the North Atlantic, to which it is structurally nearly related. . . . It is interesting to note that *Leptoptychaster antarcticus* is more nearly related to the distant Arctic form than to the comparatively neighbouring species *Leptoptychaster kerguelenensis*; perhaps a more extended series of specimens than we possess at present might lead to *Leptoptychaster antarcticus* being ranked as a variety only of the northern form. At present I do not feel justified in taking that step.—(SLADEN, *Zool. Chall. Exp.*, part 51, p. 192)

MACRURA :

**Chorismus tuberculatus*, Bate.

ANOMURA :

**Lithodes murrayi*,[1] Henderson.
Munida spinosa, Henderson.
**Paralomis aculeatus*, Henderson.
**Uroptychus insignis*, Henderson.

LAMELLIBRANCHIATA :

**Neæra fragilissima*,[2] Smith.

GASTEROPODA :

**Jeffreysia edwardiensis*, Watson.
Puncturella noachina[3] (Linné), var. *princeps*, Mighels.

POLYPLACOPHORA :

**Lepidopleurus dorsuosus*, Haddon.

POLYZOA :

Caberea darwinii, Busk.
Cellepora mamillata, var. *atlantica*, Busk.
,, *vagans*, Busk.
Escharoides occlusa, Busk.
Farciminaria hexagona, Busk.
Mucronella ventricosa, var. *multispinata*, Busk.
Myriozoum marionense, Busk.
Nellia oculata, Busk.
**Retepora cavernosa*, Busk.
** ,, *gigantea*, Busk.
**Reteporella myriozoides*, Busk.
Schizoporella elegans (d'Orbigny).
**Smittia graciosa*, Busk.

BRACHIOPODA :

**Terebratula moseleyi*, Davidson.

[1] *Lithodes murrayi* is apparently most closely allied to *Lithodes maia* [from the North Atlantic], but the latter species is of large size, and the spines on the carapace are more numerous and more uniformly equal in size.—(HENDERSON, *Zool. Chall. Exp.*, part 69, p. 44.)

[2] *Neæra fragilissima* is a large and very fragile species, in many respects similar to *Neæra curta*, Jeffreys [from the North Atlantic].—(SMITH, *Zool. Chall. Exp.*, part 35, p. 54.)

[3] After careful study I have found it impossible to separate the southern form from the species of LINNÉ [*Puncturella noachina*—a northern species].—(WATSON, *Zool. Chall. Exp.*, part 42, p. 43.)

FISHES :

**Lepidopsetta maculata*, Günther.
**Macrurus carinatus*, Günther.

As in the case of the preceding lists, the majority of the 68 species were taken only at one Station, in fact only four species (viz., *Axinella erecta*, *Iophon chelifer*, *Phakellia papyracea*, and *Cribrella simplex*) were found to be common to both the Marion Island and Crozet Islands localities.

The preceding list shows that in the vicinity of Marion and the Crozet Islands, in depths between 210 and 550 fathoms, the Challenger procured 68[1] species and varieties of Metazoa, belonging to 61 genera. The large proportion of genera relatively to the number of species is here very striking, for, except in five cases, each individual species is the representative of a distinct genus.

One of the species has received no specific name, and there is besides one variety enumerated as well as the species to which it belongs, so that there remain 66 distinct fully-described species the distribution of which may be discussed in detail.

These 66 species may be divided into those that are known only from the dredgings under consideration, and those that extend into other regions of the ocean.

a. *Species limited to the area under consideration.*

In the first place, we find that there are 30 species (or 44 per cent. of the total number) which, as far as we know, are confined to the region represented by these Stations. These 30 species are distinguished by an asterisk in the list, and we can say nothing about them beyond the fact that they are known only from this region and from depths between 210 and 550 fathoms; only one of the species (*Phakellia papyracea*) occurred both in the vicinity of Marion Island and of the Crozet Islands.

b. *Species extending outside the area under consideration.*

We come now to consider those species with a wider distribution which extend into other regions of the ocean outside the area represented by these three Stations. The number of such species is 36 (or 53 per cent. of the total number of species and varieties found at these three Stations), and they may be divided into groups according to their distribution in the tropical and extra-tropical regions of the ocean. Thus we find that of these 36 species,

21 species (or 58 per cent.) are known from other regions south of the southern tropic (see List III*a*.);

7 species (or 19 per cent.) are known from between the tropics, but not from regions north of the northern tropic (see List III*b*.);

[1] The species taken by Ross' Antarctic Expedition (*Tetilla antarctica*) is not included in these and succeeding remarks.

6 species (or 17 per cent.) are known from regions north of the tropic of Cancer, but not from the intervening tropical zone (see List III*c*.); and

2 species (or 6 per cent.) are known both from regions within and north of the tropics (see List III*d*.).

We may now consider in detail the distribution of these 36 species, according to the groups given above, indicating briefly the geographical and bathymetrical distribution of each species outside the region represented by these three Stations; five of the species (viz., *Axinella erecta*, *Aulocalyx irregularis*, *Solenosmilia variabilis*, *Ophiolebes scorteus*, and *Echinus magellanicus*) occur in the previous lists (Lists I. and II.) and the distributional notes need not be repeated here.

LIST III *a*.

In the first place we give a list of the 21 species which are known to occur outside the region under consideration only in somewhat similar latitudes, *i.e.*, in regions south of the tropic of Capricorn. From the distributional notes it will be observed that 2 of the species are known from deep water over 1000 fathoms (the distribution of which has already been discussed in detail); other 5 species are unknown in depths less than 150 fathoms; the remaining 14 species extend into shallow water under 150 fathoms.

Gellius carduus—Marion Island, 50 to 150 fathoms; Magellan Strait, 245 fathoms (var.).
Iophon chelifer—Near the Cape, 150 fathoms.
Myxilla nobilis—Magellan Strait, 140 and 245 fathoms (vars.); near River Plate, 600 fathoms.
Primnoisis antarctica—Kerguelen, shallow water.
Thouarella antarctica—Falkland Islands, shallow water.
„ *variabilis*—Near Heard Island, 150 fathoms (var).
Cribrella simplex—Kerguelen, 10 to 50 fathoms (var.); Tristan da Cunha, 90 to 150 fathoms.
Amphiura studeri—Marion Island, 50 to 150 fathoms; Kerguelen, 20 to 60 fathoms; Heard Island, 75 fathoms.
Astrotoma agassizii—Near Heard Island, 150 fathoms; Magellan Strait, 40 to 175 fathoms; between Magellan Strait and Falkland Islands, 55 fathoms.
Ophiolebes scorteus (for distribution, see List I.).
Echinus magellanicus (for distribution, see List I.).
Cucumaria serrata—Marion Island, 50 to 75 fathoms; Heard Island, 75 and 150 fathoms.
Psolus ephippifer—Marion Island, depth (?); Kerguelen, 20 to 60 fathoms; Heard Island, 75 and 150 fathoms.
Lagisca magellanica—Kerguelen, 127 fathoms; Magellan Strait, 175 and 400 fathoms.
Polyeunoa lævis—Magellan Strait, 400 fathoms.
Arcturides cornutus—Kerguelen, shallow water.
Serolis latifrons—Kerguelen, 5 to 40 fathoms; Auckland Islands, shallow water.
Munida spinosa—Near River Plate, 600 fathoms.
Mucronella ventricosa—Marion Island, 80 to 150 fathoms.
Myriozoum marionense—Marion Island, 50 to 150 fathoms; Heard Island, 75 fathoms.
Schizoporella elegans—Near the Cape, 150 fathoms.

LIST III *b*.

In the second place we give a list of the 7 species which extend into the tropics, but are not known to occur to the north of the northern tropic. From the distributional notes it will be observed that 2 of the species are known from deep water over 1000 fathoms (the distribution of one of which has already been noted); other 4 species extend into shallow water under 150 fathoms. Two of the species are unknown in depths less than 150 fathoms.

Solenosmilia variabilis (for distribution, see List II.).
Cribrella præstans—Indian Ocean, 240 to 480 fathoms.
Cabeza darwinii—Marion Island, 50 to 150 fathoms; Kerguelen, 45 to 127 fathoms; near Cape, 150 fathoms; Tristan, 110 and 150 fathoms; Magellan Strait, New Zealand, and Cumberland Island, depth (?).
Cellepora mamillata—Bahia, 10 to 20 fathoms; Patagonia and Australia, depth (?).
„ *vagans*—Sandwich Islands, 20 to 40 fathoms.
Escharoides occlusa—Cape York, 8 fathoms; Philippines, 10 fathoms.
Farciminaria hexagona—Near Amboina, 825 and 1425 fathoms.

LIST III *c*.

In the third place we give a list of the 6 species which are known to occur north of the northern tropic, but which have not hitherto been recorded from the intervening tropical zone. From the distributional notes it will be observed that 4 of the species are known from deep water over 1000 fathoms (the distribution of two of which has already been discussed); 2 of the species extend into shallow water under 150 fathoms, being at the same time represented in deep water over 1000 fathoms, viz., *Axinella erecta* and *Puncturella noachina*, the remaining 3 species being unknown in depths less than 150 fathoms.

Axinella erecta (for distribution, see List I.).
Aulocalyx irregularis (for distribution, see List I.).
Chonelasma lamella—Near Kermadec Islands, 630 fathoms; North Atlantic near Bermuda, 1075 fathoms.
Flabellum apertum—North Atlantic, off coast of Portugal, 900 fathoms.
Ophiacantha rosea—Magellan Strait, 175 fathoms; near Japan, 420 to 775 fathoms.
Puncturella noachina—Marion Island, 69 and 140 fathoms; Kerguelen, 60 fathoms; Magellan Strait, 9 to 15 fathoms; Arctic, North Atlantic and North Pacific, 5 to 1095 fathoms.

LIST III *d*.

In the fourth place the following 2 species occur both in the tropical and northern extra-tropical regions; they are unknown in depths over 1000 fathoms, and extend into shallow water under 150 fathoms.

Pleurocorallium secundum—Near Ki and Banda Islands, 140 and 200 fathoms; Sandwich Islands and Japan, depth (?).

Nellia oculata—Heard Island, 75 fathoms; Torres Strait, 28 and 49 fathoms; Philippines, 18 fathoms; Bahia, 10 to 40 fathoms; India and Gulf of Florida, depth (?).

We may now summarise the distribution of the 36 species which extend into other regions of the ocean outside the area represented by these three Stations, as follows :—

Bathymetrical Distribution.—It appears that of these 36 species, 13 species are known to occur only in depths over 150 fathoms (of which 5 species extend into deep water over 1000 fathoms); the remaining 23 species extend into shallow water under 150 fathoms (of which 3 species extend into deep water over 1000 fathoms).

LIST III *e*.

We give here the names of the 23 species which extend into shallow water under 150 fathoms, indicating the 3 species which are also known from deep water over 1000 fathoms by the word "deep" in brackets after the name :—

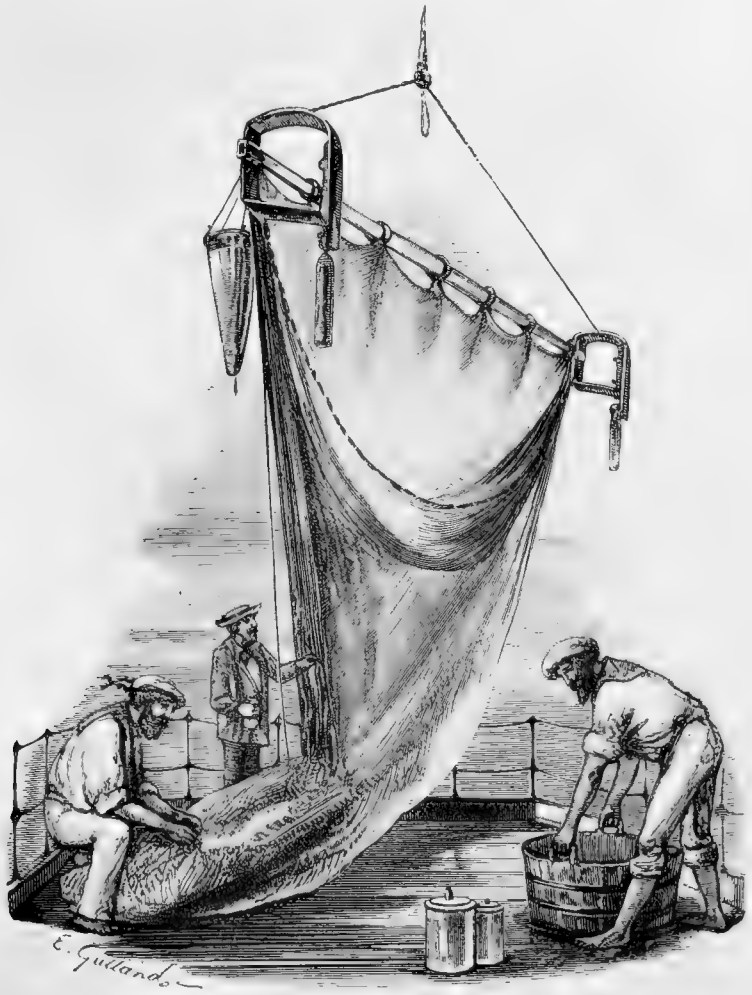
Axinella erecta (deep).
Gellius carduus.
Myxilla nobilis.
Pleurocorallium secundum.
Primnoisis antarctica.
Thouarella antarctica.
Cribrella simplex.
Ampliura studeri.
Astrotoma agassizii.
Echinus magellanicus (deep).
Cucumaria serrata.
Psolus ephippifer.
Lagisca magellanica.
Arcturides cornutus.
Serolis latifrons.
Punctarella noachina (deep).
Caberea darwinii.
Cellepora mamillata.
„ *vagans.*
Escharoides occlusa.
Mucronella ventricosa.
Myriozoum marionense.
Nellia oculata.

Geographical Distribution.—Of the 36 species we find that :—

10 species are represented in the Magellan Strait.
9 „ „ near Kerguelen under 150 fathoms.
8 „ „ near Marion Island under 150 fathoms.
7 „ „ near Heard Island.
6 „ „ in the tropical Pacific.
6 „ „ in the North Atlantic.
4 „ „ in the Southern Ocean in deep water.
4 „ „ near Tristan da Cunha.
4 „ „ in the North Pacific.
3 „ „ near the Cape of Good Hope.
3 „ „ near the Falkland Islands.
3 „ „ in the tropical Atlantic.

2 species are represented near the Rio de la Plata.
2 ,, ,, in the Indian Ocean.
1 ,, ,, near the Auckland Islands.
1 ,, ,, near Australia.
1 ,, ,, near New Zealand.
1 ,, ,, near the Kermadec Islands.
1 ,, ,, in the Arctic Ocean.

Turning now our attention to the 61 genera represented at the Stations under consideration, we find that 4 genera are known only from these Stations, viz. :—*Aulascus*, *Primnoides*, *Cladopathes*, and *Chorismus*; there is also the genus *Polyeunoa*, known, apart from these Stations, only from the Magellan Strait. These 5 genera are each represented by a single species. The genus *Reteporella* (containing 2 species) is known from one of these Stations (148) and from near Heard Island, 75 fathoms.



Examining Contents of Trawl.

LIST IV.

Metazoa procured by the Challenger in Shallow Water, in Depths less than 150 Fathoms, in the Kerguelen Region.

Let us now consider the shallow-water fauna of the Kerguelen Region of the Great Southern Ocean, taking the depth of 150 fathoms as the limit of the area. The following is a list of the species and varieties of marine Metazoa obtained by the Challenger in the vicinity of the islands of the Kerguelen Region, viz., off Marion and Prince Edward Islands, in 50 to 140 fathoms (six dredgings); off Kerguelen, from the shore to 150 fathoms (many dredgings and trawlings); between Kerguelen and Heard Island, in 150 fathoms (one dredging); and off Heard Island, in 75 fathoms (one dredging). The species known only from these dredgings and trawlings are indicated by an asterisk *.

Monaxonida :

**Amphilectus apollinis*,[1] Ridley and Dendy.
* „ *pilosus*,[2] Ridley and Dendy.
**Axinella balfourensis*,[3] Ridley and Dendy.
* „ *mariana*,[4] Ridley and Dendy.
Desmacidon (?) *ramosa*, Ridley and Dendy.
* „ (*Homœodictya*) *kerguelenensis*,[5] Ridley and Dendy.
Gellius carduus, Ridley and Dendy.
* „ *flagellifer*,[6] Ridley and Dendy.

[1] Vosmaer (Sponges of the "Willem Barents" Expedition, 1881–2) has founded a genus *Artemisina* of which the most characteristic spicule is a toxite with spined ends like that which occurs in *Amphilectus apollinis*. Possibly the two species *Artemisina suberitoides*, Vosmaer, and *Amphilectus apollinis*, nobis, come near to one another and may even belong to the same genus, but they differ very widely in the texture of the sponge, and our present species possesses an additional form of megasclera not present in *Artemisina*.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, p. 124.)

[2] This species [*Amphilectus pilosus*] is very well marked, and may be readily recognised both by its external appearance and its spiculation. All the spicules, except the minute isochela, which is unusually small, are of exceptionally large size. The toxa are probably the largest known examples of their kind. Some of them were found still enveloped by the mother-cell. The most interesting feature of the species is, however, the manner in which the toxa appear to develop into oxea.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, p. 127.)

[3] *Axinella balfourensis* seems to be a very aberrant species of the genus, as indicated both by its external form and by the extreme sparseness of the skeleton.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, p. 180.)

[4] *Axinella mariana* is a pretty little species, distinguished by its external form and by the peculiar shape of the smaller stylote spicule, which seems to be homologous with the "vermicular" spicule of *Axinella erecta*, &c.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, p. 180.)

[5] We were at first inclined to regard this sponge [*Desmacidon* (*Homœodictya*) *kerguelenensis*] as a variety of the British species, *Desmacidon* (*Homœodictya*) *palmata*, which it very nearly approaches both in external form and in spiculation. There can be no doubt that the two are closely related, but on the whole it appears better to separate the Kerguelen form as distinct.—(Ridley and Dendy, *Zool. Chall. Exp.*, part 59, p. 110.)

[6] Vosmaer mentions under "*Gellius vagabundus* (O.S)," in the Sponges of the "Willem Barents" Expedition, a variety of that species possessing oxea and sigmata, similar in form to those of our species. His specimen, though containing a few styli, is obviously a true *Gellius* (*Gellius vagabundus* being *Desmacella* for us), and it is not improbably referable to *Gellius flagellifer*. It was obtained by the "Willem Barents" Expedition of 1880, and hence probably in

Gellius glacialis, var. *nivea*, Ridley and Dendy.
Halichondria panicea, Johnston.
„ sp. (?).
**Iophon abnormalis*, Ridley and Dendy.
Latrunculia apicalis,[1] Ridley and Dendy.
* „ *bocagei*,[1] Ridley and Dendy.
**Myxilla fusca*, Ridley and Dendy.
„ *mariana*, Ridley and Dendy.
**Pachychalina* (?) *pedunculata*,[2] Ridley and Dendy.
**Petrosia hispida*, Ridley and Dendy.
„ *similis*,[3] Ridley and Dendy.
Stylocordyla stipitata (Carter), var. *globosa*, Ridley and Dendy.
Suberites antarcticus, Carter.
„ *caminatus*,[4] Ridley and Dendy.
* „ *microstomus*, Ridley and Dendy.

TETRACTINELLIDA :

**Cinachyra barbata*,[5] Sollas.

the Arctic Sea, though the exact locality is unknown. Having regard to the want of definite characters in this species other than the form of the sigmata, we cannot further insist on the strong resemblance which this form bears to our species, as its locality is so far removed from that of *Gellius flagellifer*.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 43.)

[1] As regards external form it will be seen that *Latrunculia bocagei* is almost indistinguishable from the Kerguelen specimen of *Latrunculia apicalis*, and correspondingly different from *Latrunculia brevis* [Station 320, off the Rio de la Plata, 600 fathoms] ; but in this case we are not inclined to set much value on external form as a specific character, for we have already seen that the specimens of *Latrunculia apicalis* from Kerguelen and from Station 320 respectively, differ in external appearance ; indeed, to judge from the Challenger series of specimens of the genus, it would seem that external appearance depends on the locality, and that all the species from the same locality tend to have a similar external form.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 239.)

[2] *Pachychalina* (?) *pedunculata* resembles in several respects VOSMAER's *Pachychalina caulifera* (from the Arctic Sea), but it is cylindrical instead of flattened, and the shape of the spicules is different, being slender instead of broadly fusiform. The fibres in *Pachychalina caulifera* appear to contain a good deal more spongin than in the present species ; indeed, it is only doubtfully that we include the latter in the genus at all ; it forms another connecting link between the Renierinæ and Chalininæ, and shows how little value can be placed upon the amount of spongin present for purposes of classification.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 25.)

[3] No doubt the Kerguelen specimen [of *Petrosia similis*] forms a connecting link, but we think it advisable to distinguish between two closely allied species, *Petrosia subtriangularis* and *Petrosia similis*, the former characteristic of West Indian seas, and the latter of the seas south of the Cape. Two well-marked varieties of the latter are described below [one from near the Falklands, the other from the Philippines].—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, p. 11.)

[4] The single specimen [of *Suberites caminatus*] in the collection is attached by a broad base to an empty Brachiopod shell, and terminates in a singular oscular projection at the apex. . . . This is a very pretty and interesting little sponge ; it may be recognised by its external form, and more especially by the projecting, well-marked osculum. . . . We have from Station 320 an interesting series of specimens which should perhaps be considered as belonging to a slight variety of the above species ; they do not, however, appear to be distinct enough from the type to justify us in giving a varietal name. They occur, for the most part, encrusting dead branches of a *Sporadopora*, on which they form colonies, the different cushion-like individuals being united together by their bases. . . . The sponge is further remarkable as forming colonies by continuous gemmation, in a manner very rare in silicious sponges.—(RIDLEY and DENDY, *Zool. Chall. Exp.*, part 59, pp. 198–9.)

[5] Over sixty specimens of this remarkable sponge [*Cinachyra barbata*] were dredged off the shores of Kerguelen. They vary considerably in shape ; the smallest is a prolate ellipsoid, the next a little larger is egg-shaped, both are

**Pœcillastra schulzii*, Sollas.
**Tetilla coronida*, Sollas.
* „ *grandis*, Sollas.
* „ „ var. *alba*, Sollas.

HEXACTINELLIDA :

Rossella antarctica, Carter.

CALCAREA :

**Amphoriscus elongatus*, Poléjaeff.
**Leucetta vera*, Poléjaeff.
Leuconia fruticosa (Haeckel).
* „ *levis*, Poléjaeff.
* „ *ovata*, Poléjaeff.

ALCYONARIA :

**Alcyonium antarcticum*, Wright and Studer.
Lophogorgia flammea (Ellis and Solander).
**Primnoisis ambigua*, Wright and Studer.
* „ *sparsa*, Wright and Studer.
Thouarella variabilis, var. *gracilis*, Wright and Studer.

ACTINIARIA :

Halcampa clavus (Quoy and Gaimard).
* „ *kerguelensis*, Hertwig.
Leiotealia nymphæa (Drayton).
**Scytophorus striatus*, Hertwig.

HYDROIDA :

**Campanularia tulipifera*, Allman.
Eudendrium rameum (Pallas).
* „ *vestitum*, Allman.
**Grammaria insignis*, Allman.
* „ *stentor*, Allman.
**Halecium arboreum*, Allman.
„ *flexile*, Allman.
**Hypanthea aggregata*, Allman.
Obelia geniculata (Linné).
**Plumularia abietina*, Allmán.

provided with the characteristic oscules of the species, but without anchoring filaments ; these are present, however, in specimens but very slightly larger, and by the time the sponge has attained a length of 20 mm., they are already matted together into a compact basal lump.—(SOLLAS, *Zool. Chall. Exp.*, part 63, pp. 24–5.)

**Plumularia flabellum*, Allman.
* ,, *insignis*, Allman.
**Schizotricha multifurcata*, Allman.
* ,, *unifurcata*, Allman.
**Sertularia articulata*, Allman.
* ,, *echinocarpa*, Allman.
* ,, *exserta*, Allman.
* ,, *secunda*, Allman.
**Staurotheca dichotoma*, Allman.

CRINOIDEA :

**Antedon antarctica*, Carpenter.
* ,, *australis*, Carpenter.
* ,, *exigua*,[1] Carpenter.
* ,, *hirsuta*, Carpenter.
**Promachocrinus kerguelensis*, Carpenter.

ASTEROIDEA :

**Asterias meridionalis*, Perrier.
* ,, *perrieri*, Smith.
* ,, (*Smilasterias*) *scalprifera*, Sladen.
* ,, (,,) *triremis*, Sladen.
Bathybiaster loripes, var. *obesa*, Sladen.
Cribrella simplex, Sladen.
,, ,, var. *granulosa*, Sladen.
Crossaster penicillatus, Sladen.
**Echinaster spinulifer*, Smith.
**Gnathaster elongatus*, Sladen.
* ,, *meridionalis* (Smith).
Labidiaster annulatus, Sladen.
**Leptoptychaster kerguelenensis*, Smith.
**Pedicellaster hypernotius*, Sladen.
* ,, *scaber*, Smith.
**Perknaster densus*, Sladen.
* ,, *fuscus*, Sladen.
Porania antarctica, Smith.
* ,, *glaber*, Sladen.
,, *spiculata*, Sladen.

[1] *Antedon exigua*, which represents *Antedon tenella* [of northern seas] in the Southern Sea, differs from it in the shortness of the later cirrus-joints and in the characters of the lower pinnules.—(CARPENTER, *Zool. Chall. Exp.*, part 60, p. 179.)

**Pteraster*[1] *affinis*, Smith.
* ,, *rugatus*, Sladen.
* ,, *semireticulatus*, Sladen.
**Retaster peregrinator*, Sladen.
**Solaster subarcuatus*,[2] Sladen.

OPHIUROIDEA :

**Amphiura angularis*, Lyman.
,, *antarctica* (Ljungman).
,, *studeri*, Lyman.
* ,, *tomentosa*, Lyman.
Astrotoma agassizii, Lyman.
Gorgonocephalus pourtalesii, Lyman.
**Ophiacantha imago*,[3] Lyman.
,, *vivipara*, Ljungman.
**Ophioconis antarctica*, Lyman.
Ophiocten amitinum, Lyman.
,, *sericeum*, Ljungman.
**Ophioglypha ambigua*, Lyman.
* ,, *brevispina*,[4] Smith.
* ,, *deshayesi*, Lyman.
* ,, *hexactis*,[5] Smith.
* ,, *intorta*, Lyman.

ECHINOIDEA :

Echinus magellanicus, Phil.
,, *margaritaceus*, Lamarck.
Goniocidaris canaliculata, Agassiz.
Hemiaster cavernosus[6] (Phil.).
Schizaster moseleyi, Agassiz.

[1] With the exception of two Atlantic species, *Pteraster caribbæus* [from the West Indian area] and *Pteraster sordidus* [from the "Talisman" or "Travailleur" dredgings], all the members of this genus are confined to the colder temperate and frigid zones. Notwithstanding its wide range of distribution the genus appears to show only a comparatively small amount of morphological plasticity.—(SLADEN, *Zool. Chall. Exp.*, part 51, p. 470.)

[2] *Solaster subarcuatus* is nearly allied to *Solaster endeca* [from the Arctic and North Atlantic], of which it is perhaps the southern representative.—(SLADEN, *Zool. Chall. Exp.*, part 51, p. 457.)

[3] *Ophiacantha mago* represents in the Antarctic zone the Arctic *Ophiacantha anomala*, from which it differs in having a minute slender tentacle scale and only five arms.—(LYMAN, *Zool. Chall. Exp.*, part 14, p. 187.)

[4] Several species inhabiting the seas of the North bear a superficial resemblance to this form [*Ophioglypha brevispina*] :—such are *O. albida*, Forbes, *O. robusta*, Ayres, and *O. nodosa*, Lütken. And besides these *O. Lymani*, Ljungman, from Patagonia, is very like it.—(E. A. SMITH, *Phil. Trans.*, vol. 168, p. 281.)

[5] In colour and general appearance it [*Ophioglypha hexactis*] approaches *O. sarsii*, Lütken, of the Greenland coast, which seems to be its nearest ally ; but these species are so different from one another in detail, that it is needless to specify their distinctions.—(E. A. SMITH, *Phil. Trans.*, vol. 168, p. 280.)

[6] The Challenger series [of *Hemiaster cavernosus*] is so extensive, and shows such a range of variation both in form and in the structure of the petals according to age and sex, that I am quite convinced it is impossible to define the

HOLOTHURIOIDEA[1] :

Chirodota contorta,[2] Ludwig.
**Cucumaria kerguelensis*, Théel.

Kerguelen specimens as a different species [*Hemiaster cordatus*]. Dr STUDER and Mr SMITH enumerate it as a distinct species in their lists of Kerguelen Echinoderms. . . . From the evidence furnished by the large material collected by the Challenger, there seems but little doubt that species which have thus far been distinguished as *Hemiaster australis*, *philippii*, and *cavernosus* are all different stages of growth of one and the same species, but owing to the great difference in structure between the ambulacral petals of the males and females, and the extraordinary changes this species passes through from its youngest stage until it has reached its adult sexual form, it was very natural that these several stages of growth should on scanty material have been regarded as so many distinct species. The coloration of specimens from different localities appears also quite distinct, and in some cases the test and spines are of a light brownish-yellow, in striking contrast to the dark coloured specimens found at other localities.—(AGASSIZ, *Zool. Chall. Exp.*, part 9, pp. 183–4.)•

[1] The examination of the vast harvest brought home by the Challenger Expedition from different regions of the world, from the shore as well as from the abysses of the ocean, shows clearly that those Holothurids which live in the deep sea have two different derivations. The great majority are Elasipoda, which cannot be derived from the present shallow-water fauna, but must have originated from a past type that certainly bore another stamp. On the other hand, so far as can be judged from the results of the expeditions hitherto made, the remaining Holothurids met with in the great depths are comparatively few, both in species and individuals, and unmistakably show the closest relation to the present shallow-water fauna ; so that while the Elasipoda have retired toward the abysses an infinitely long time ago, the latter have emigrated only at a comparatively much later period. . . . With regard to the bathymetrica distribution of Apoda and Pedata, our present knowledge does not enable us to speak of any results of very general value. However, the Challenger Expedition has been successful even in these respects, several important discoveries having been made, proving that the present shallow-water fauna has far more outposts in the great depths of the ocean than at first supposed. Before the Challenger Expedition set out, only a very few forms belonging to the Apoda and Pedata were known from depths exceeding 100 fathoms, and scarcely one below 200 fathoms. This list [of the species met with in the deep sea at depths from 500 fathoms and under] induces me to believe the following remarks to be true, or, at least, to have some probability :

1. Descendants of the recent shallow-water Holothurioidea have escaped to the greatest depths at which any living Holothurid has been obtained, viz., 2900 fathoms, but they are by no means so prevalent as the Elasipoda, nor do they form such a characteristic feature in the abyssal fauna.

2. Most of the forms met with in the deep sea below 500 fathoms are distinct from the shallow-water species though they belong to the same genera.

3. Several species have a vast bathymetrical distribution, some individuals of them still living near the shore, others having descended without any obvious change in their organisation into the considerable depth of 500 to 700 fathoms or exceptionally even deeper.

4. A wider distribution seawards of a species seems to take place preferably in the northern and southern oceans, where the different belts proceeding from the vicinity of land outwards would seem to have in general a greater uniformity in temperature and other physical conditions than in the tropical and subtropical regions, where it is stated that the belts below 100 or 200 fathoms have lost the influence of the climate, etc., and present conditions of life far different from those above them. Such forms are *Myrotrochus rinkii* from shore to 500 fathoms ; *Echinocucumis typica* from about 40 to 530 fathoms ; *Thyone raphanus* from 20 to 672 fathoms ; *Holothuria intestinalis* from 10 to 650 fathoms ; *Holothuria tremula* from 20 to 672 fathoms ; *Trochostoma violacea* from 20 to 700 fathoms ; *Thyonidium pellucidum* from about 30 to 1081 fathoms, etc. The two deep-sea species of *Synapta* are scarcely distinguishable from some of the shallow-water species.

5. *Pœlopatides*, *Pseudostichopus*, *Acanthotrochus* and probably even *Ankyroderma* are the only true deep-sea genera of Apoda and Pedata, no representatives of them having hitherto been obtained near the shore or, at least, from any trifling depth. Species of these genera very seldom seem to thrive at a less depth than 500 fathoms.

6. Among the Apoda the Synaptidæ are, with a very few exceptions, shore forms, living near the surface of the sea, while the Molpadidæ are probably in a state of emigration seawards, a great number of them having already reached the abysses and settled there.

7. The Dendrochirotæ and Aspidochirotæ are still true shore or shallow-water forms, though there are even here many exceptions, proving that their representatives are thriving even at great depths.—(THÉEL, *Zool. Chall. Exp.*, part 39, pp. 1, 2, 6, 7.)

[2] It is remarkable that the forms [of *Chirodota purpurea*] dredged at the Falkland Islands are devoid of any sigmoid deposits, while those found by the Challenger Expedition in the Strait of Magellan and at Kerguelen

**Cucumaria lævigata* (Verrill).
,, *serrata*, Théel.
,, ,, var. *intermedia*, Théel.
,, ,, var. *marionensis*, Théel.
Pseudostichopus mollis, Théel.
Psolus ephippifer, Wyville Thomson.
* ,, *incertus*, Théel.
**Thyone recurvata*, Théel.
**Trochostoma violaceum*, Studer.

ENTOZOA :

Ascaris simplex, Rudolphi.
,, *spiculigera*, Rudolphi.

NEMERTEA :

**Amphiporus marioni*, Hubrecht.
* ,, *moseleyi*, Hubrecht.
**Cerebratulus corrugatus* (M'Intosh).
* ,, *longifissus*, Hubrecht.
,, sp. (?).
Drepanophorus serraticollis, Hubrecht.

GEPHYREA :

**Phascolosoma pudicum*, Selenka.

ANNELIDA :

**Ampharete kerguelensis*, M'Intosh.
**Amphitrite kerguelensis*, M'Intosh.
**Artacama challengeriæ*, M'Intosh.
**Autolytus maclearanus*, M'Intosh.
**Brada mammillata*, Grube.

Island have, as a rule, such deposits. Therefore it seems to me far more credible that *Holothuria purpurea* of LESSON, which was also obtained at Falkland Islands (Soledad), is identical with the above described forms rather than with STUDER'S *Sigmodota purpurea* [re-named by THÉEL *Chirodota studerii*], which is found living in the Strait of Magellan and at Kerguelen Island. . . . The specimens [of *Chirodota contorta*] brought home from Station 314 [Falklands] differ from the others in having the aggregations of wheels much more crowded, while the aggregations of wheels, especially in the individuals obtained at Marion Island, are very scattered, so that they almost appear at first sight to be devoid of them. The specimens examined by me differ from LUDWIG'S type in their violet colour. It seems very peculiar that all the individuals dredged by the Challenger Expedition in several localities at the Kerguelen Islands, as well as in or in the neighbourhood of the Strait of Magellan, belong to LUDWIG'S *Chirodota contorta*. Not a single specimen of STUDER'S *Sigmodota purpurea* was obtained, therefore I cannot help thinking that the very scattered aggregations of wheels have escaped the attention of STUDER, because of the sigmoid bodies being so conspicuous by their number as well as by their size.—(THÉEL, *Zool. Chall. Exp.*, part 39, pp. 15–16.)

**Ereutho kerguelensis*, M'Intosh.
Eulagisca corrientis, M'Intosh.
**Eunice edwardsi*, M'Intosh.
,, *magellanica*, M'Intosh.
,, *ærstedi*, Stimpson.
**Eupolynoë mollis*, M'Intosh.
**Eusyllis kerguelensis*, M'Intosh.
**Evarne kerguelensis*, M'Intosh.
**Exogone heterosetosa*, M'Intosh.
**Glycera kerguelensis*, M'Intosh.
Hermadion kerguelensis, M'Intosh.
Lætmonice producta, Grube.
,, ,, var. *wyvillei*, M'Intosh.
**Lagisca antarctica*, M'Intosh.
,, *magellanica*, M'Intosh.
**Lumbriconereis kerguelensis*,[1] Grube.
Neottis antarctica, M'Intosh.
**Nephthys trissophyllus*, Grube.
**Nereis kerguelensis*, Baird.
,, (*Platynereis*) *eatoni*,[2] M'Intosh.
Notomastus (?) sp.
Phyllocomus crocea, Grube.
**Polycirrus kerguelensis*, M'Intosh.
**Praxilla assimilis*, M'Intosh.
* ,, *kerguelensis*, M'Intosh.
**Salvatoria kerguelensis*, M'Intosh
Scolecolepis cirrata, Sars.
**Scoloplos kerguelensis*, M'Intosh.
Serpula narconensis, Baird.
**Sphærosyllis kerguelensis*, M'Intosh.
Spirorbis sp. (?).
**Syllis gigantea*, M'Intosh.
Terebella (*Lanice*) *flabellum*, Baird.
Terebellides strœmi, Sars, var. *kerguelensis*, M'Intosh.
**Travisia kerguelensis*, M'Intosh.
**Trophonia kerguelarum*, Grube.

[1] *Lumbriconereis kerguelensis* evidently takes the place of the European *Lumbriconereis nardonis*, to which it is closely allied in the structure of the dental apparatus.—(M'Intosh, *Zool. Chall. Exp.*, part 34, p. 247.)

[2] This form [*Nereis* (*Platynereis*) *eatoni*], which was first procured by Rev. Mr Eaton, of the Transit of Venus Expedition, seems to take the place of *Nereis dumerilii*, Aud. and Ed., of the European seas, and indeed it is allied in a very close manner to the latter species.—(M'Intosh, *Zool. Chall. Exp.*, part 34, p. 224.)

OSTRACODA :

Aglaia (?) obtusata, Brady.
Argillæcia eburnea, Brady.
**Bairdia simplex*, Brady.
,, *victrix*, Brady.
,, *villosa*, Brady.
Bythocypris reniformis, Brady.
**Bythocythere pumilio*, Brady.
**Cypridina danæ*, Brady.
Cythere audei, Brady.
,, *dictyon*, Brady.
* ,, *foveolata*,[1] Brady.
Cythere kerguelenensis,[2] Brady.
,, *normani*, Brady.
* ,, *parallelogramma*, Brady.
,, *polytrema*,[3] Brady.
* ,, *securifer*, Brady.
* ,, *subrufa*, Brady.
,, *suhmi*, Brady.
,, *wyville-thomsoni*, Brady.
**Cytherideis lævata*, Brady.
Cytheropteron (?) angustatum, Brady.
* ,, *assimile*,[4] Brady.
,, *fenestratum*, Brady.
* ,, *scaphoides*,[5] Brady.
**Cytherura costellata*, Brady.
* ,, *lilljeborgi*,[6] Brady.

[1] The general form of this species [*Cythere foveolata*] is very familiar ; many might be named which approach it rather closely, but no described species seems to be absolutely identical with it. The nearest, perhaps, are *Cythere borealis*, Brady—an Arctic form,—and *Cythere ædichilus*, Brady, a fossil of the Antwerp Crag.—(BRADY, *Zool. Chall. Exp.*, part 4, p. 76.)

[2] Seen on the dorsal surface, this species [*Cythere kerguelenensis*] bears a close resemblance to the common British *Cythere albomaculata*, Baird, but the shell is much more coarsely sculptured, while the spinous margins and very broadly reniform lateral outline are constant distinctive characters.—(BRADY, *Zool. Chall. Exp.*, part 4, p. 79.)

[3] A few detached valves brought by the Challenger from off Prince Edward Island in the Southern Ocean are in no respect distinguishable from the fossil specimens described by me in a Monograph of the Fossil Ostracoda of the Antwerp Crag, under the name *Cythere polytrema*. It is extremely interesting to note the occurrence, alive in this distant region, of so well marked a European fossil.—(BRADY, *Zool. Chall. Exp.*, part 4, p. 87.)

[4] Though bearing considerable resemblance to the northern species *Cytheropteron latissimum* (Norman), this [*Cytheropteron assimile*] is easily distinguished by the character of the surface-sculpture, which shows no tendency to run into transverse grooves ; the lateral alæ, too, are considerably more prominent.—(BRADY, *Zool. Chall. Exp.*, part 4, p. 139.)

[5] *Cytheropteron scaphoides* is not unlike in general character to *Cytheropteron subcircinatum*, Sars, but is very much less tumid.—(BRADY, *Zool. Chall. Exp.*, part 4, p. 136.)

[6] The nearest known ally [of *Cytherura lilljeborgi*] is probably *Cytherura clathrata*, Sars, with which it closely agrees in style of surface-sculpture though quite different in proportions and general contour.—(BRADY, *Zool. Chall. Exp.*, part 4, p. 133.)

**Cytherura obliqua*, Brady.
Krithe bartonensis (Jones).
„ *producta*, Brady.
Macrocypris decora, Brady.
„ *maculata*, Brady.
„ *tumida*, Brady.
Paradoxostoma abbreviatum, Sars.
Polycope orbicularis, Sars.
Pseudocythere caudata, Sars.
Sclerochilus contortus (Norman).
Xestoleberis curta, Brady.
„ *depressa*, Sars.
* „ *setigera*, Brady.
**Xiphichilus complanatus*, Brady.

CIRRIPEDIA :

**Balanus corolliformis*,[1] Hoek.
**Scalpellum recurvirostrum*, Hoek.

AMPHIPODA[2] :

**Acanthechinus tricarinatus*, Stebbing.
**Acontiostoma kergueleni*, Stebbing.
* „ *marionis*, Stebbing.
* „ *pepinii*, Stebbing,
**Ambasia integricauda*, Stebbing.
**Amphilochus marionis*,[3] Stebbing.
**Amphithoë kergueleni*, Stebbing.

[1] *Balanus hirsutus* [taken by H.M.S. "Triton" in the Faroe Channel, 516 fathoms] and *Balanus corolliformis* [from Station 150, 150 fathoms] are two nearly related species, corresponding in all essential respects. I must consider them, however, as different species, because their shape is quite different, and in the second place, because the tergum shows very striking differences also. . . . *Balanus corolliformis* is a very remarkable species, and I confess to have been long in doubt whether it was a *Balanus* or not. The investigation of specimens of a nearly related form [*Balanus hirsutus*], which showed the same characteristic differences from the other species of the genus, convinced me that I was right in considering them as representatives of a new section of the genus *Balanus*.—(HOEK, *Zool. Chall Exp.*, part 25, pp. 155, 6, 8.)

[2] To judge by the results obtained at Kerguelen Island in the Southern Ocean it is much rather in Antarctic than in Arctic waters that the explorer who devotes himself to the search after Amphipoda may hope to find new and surprising forms. There are, it is true, some remarkable instances in which the same species occurs both far north and far south, but these are after all not very numerous.—(T. R. R. STEBBING, "The Amphipoda collected during the voyages of the Willem Barents in the Arctic Seas in the years 1880–1884," *Bijdragen tot de Dierkunde*, Afl. 17, p. 1, 1894.)

[3] A specimen of *Amphilochus* from the Clyde, kindly sent me by Mr DAVID ROBERTSON, agrees in most respects with BOECK'S description of his *Amphilochus tenuimanus*, and has also a great resemblance to the present species [*Amphilochus marionis*]; the maxillipeds in the Scotch form and in that from the Southern Ocean are remarkably alike. . . . altogether the sum of the differences, added to the great distance between the localities at which the specimens occur, makes it unsafe to place the northern and southern examples in one and the same species.—(STEBBING, *Zool. Chall. Exp.*, part 67, p. 746.)

**Anonyx cicadodes*, Stebbing.
**Aora kergueleni*, Stebbing.
* „ *trichobostrychus*, Stebbing.
Atyloides australis (Miers).
**Autonoe kergueleni*, Stebbing.
**Cardenio paurodactylus*, Stebbing.
**Cerapus sismithi*, Stebbing.
**Cheirimedon crenatipalmatus*, Stebbing.
**Dodecas elongata*, Stebbing.
**Eusiroides pompeii*, Stebbing.
Eusirus longipes,[1] Boeck.
Euthemisto thomsoni,[2] Stebbing.
**Gammaropsis exsertipes*, Stebbing.
**Halimedon schneideri*, Stebbing.
**Haplocheira plumosa*, Stebbing.
**Harpinia obtusifrons*, Stebbing.
**Harpinioides drepanocheir*, Stebbing.
**Hippomedon kergueleni* (Miers).
* „ *trigonicus*, Stebbing.
**Iphimedia pacifica*, Stebbing.
* „ *pulchridentata*, Stebbing.
**Kerguelenia compacta*, Stebbing.
**Lepidepecreum foraminiferum*, Stebbing.
**Liljeborgia consanguinea*,[3] Stebbing.
**Metopa nasutigenes*,[4] Stebbing.
**Neohela serrata*, Stebbing.
**Œdiceroides rostrata*, Stebbing.
**Orchomene cavimanus*,[5] Stebbing.
**Pardalisca marionis*,[6] Stebbing.
**Photis macrocarpus*, Stebbing.
**Phoxocephalus kergueleni*, Stebbing.

[1] I cannot find any points of difference that would justify the separation of this southern species from the northern *Eusirus longipes*, Boeck.—(STEBBING, *Zool. Chall. Exp.*, part 67, p. 969.)

[2] *Euthemisto thomsoni* appears to stand extremely near to the northern *Euthemisto bispinosa* (Boeck).—(STEBBING, *Zool. Chall. Exp.*, part 67, p. 1416.)

[3] The specific name [of *Liljeborgia consanguinea*] refers to the obviously very close relationship between this southern species and the northern *Liljeborgia pallida*, Spence Bate.—(STEBBING, *Zool. Chall. Exp.*, part 67, p. 984.)

[4] *Metopa nasutigenes* is very like *Metopa nasuta*, Boeck [a northern species], which also has the large beak or nose formed by the first joint of the upper antennæ. Hence the specific name is a hybrid, to express "of the lineage of *nasuta*."—(STEBBING, *Zool. Chall. Exp.*, part 67, p. 756.)

[5] In the course of the description the differences have been noticed between this [*Orchomene cavimanus*] and the very similar species, *Orchomene musculosus*, taken at an enormously distant Station to the south of Japan.—(STEBBING, *Zool. Chall. Exp.*, part 67, p. 681.)

[6] This species from the south [*Pardalisca marionis*] is remarkably like the northern species *Pardalisca cuspidata*.—(STEBBING, *Zool. Chall. Exp.*, part 67, p. 999.)

**Platophium danæ*, Stebbing.
Podocerus falcatus[1] (Montagu).
**Protellopsis kergueleni*, Stebbing.
**Rhachotropis kergueleni*, Stebbing.
**Socarnoides kergueleni*, Stebbing.
**Sophrosyne murrayi*, Stebbing.
**Tritæta kergueleni*, Stebbing.
**Tryphosa antennipotens*, Stebbing.
* ,, *barbatipes*, Stebbing,
**Urothoë lachneëssa*, Stebbing.

Isopoda :

**Anceus gigas*, Beddard.
* ,, *tuberculosus*, Beddard.
**Apseudes antarctica*, Beddard.
* ,, *spectabilis*, Studer.
Arcturus furcatus, Studer.
* ,, *stebbingi*, Beddard.
* ,, *studeri*, Beddard.
**Astacilla marionensis*, Beddard.
**Astrurus crucicauda*, Beddard.
Cymodocea darwini, Cunningham.
**Ilyarachna quadrispinosa*, Beddard.
Jæra pubescens, Dana.
**Jæropsis marionis*, Beddard.
**Leptognathia australis*,[2] Beddard.
**Munna*[3] *maculata*, Beddard.
* ,, *pallida*, Beddard.
Neasellus kerguelenensis, Beddard.
**Paranthura neglecta*, Beddard.
**Paratanais dimorphus*, Beddard.
**Pleurogonium albidum*,[4] Beddard.
* ,, *serratum*,[4] Beddard.

[1] Speaking of *Podocerus falcatus*, Stebbing says: There is the possibility, as I have elsewhere suggested, that these creatures may have travelled out from our own waters along with the vessel to the southern latitudes at which they were captured.—(*Zool. Chall. Exp.*, part 67, p. 1135.)

[2] This species [*Leptognathia australis*] is probably new, but agrees very closely with *Leptognathia longiremis*, Sars, from the Norwegian North Atlantic Expedition.—(Beddard, *Zool. Chall. Exp.*, part 48, p. 127.)

[3] Only five species of this genus [*Munna*] are at present known, all of which are inhabitants of the shallow water off the coasts of Great Britain, Norway, North America, &c.; in the present Report I have two new species to add, both of which are from shallow water off Kerguelen.—(Beddard, *Zool. Chall. Exp.*, part 48, p. 24.)

[4] *Pleurogonium albidum* and *Pleurogonium serratum* [from Kerguelen] evidently come very near to Sars' *Pleurogonium rubicundum* [from Norway].—(Beddard, *Zool. Chall. Exp.*, part 48, p. 28.)

Serolis cornuta, Studer.
„ *latifrons*, White.
„ *septemcarinata*, Miers.
**Tanais hirsutus*, Beddard.
* „ *willemœsii*, Studer.
Typhlotanais kerguelenensis, Beddard.
About twelve species of Isopoda undetermined.

CUMACEA :

**Campylaspis nodulosa*,[1] Sars.
**Diastylis horrida*,[2] Sars.
**Leucon assimilis*,[3] Sars.
**Paralamprops serrato-costata*, Sars.
**Vaunthompsonia meridionalis*, Sars.

SCHIZOPODA :

Euphausia murrayi, Sars.
Pseudomma sarsii, Suhm.

MACRURA :

Campylonotus capensis, Bate.
Nauticaris marionis, Bate.

ANOMURA :

Parapagurus dimorphus (Studer).

BRACHYURA :

Halicarcinus planatus (Fabricius).

PYCNOGONIDA :

Colossendeis megalonyx,[4] Hoek.
* „ *robusta*, Hoek.
**Nymphon brachyrhynchus*,[5] Hoek.

[1] The Norwegian form *Campylaspis verrucosa* would seem to be nearly related to the present species [*Campylaspis nodulosa*], at least as regards the sculpture of the carapace.—(SARS, *Zool. Chall. Exp.*, part 55, p. 68.)

[2] In general appearance *Diastylis horrida* would seem to be most nearly related to the northern form *Diastylis lucifera* (Kröyer).—(SARS, *Zool. Chall. Exp.*, part 55, p. 55.)

[3] *Leucon assimilis* is very nearly allied to the northern species *Leucon nasicus*, Kröyer, from which it may, however, be distinguished by the somewhat different form of the pseudorostral projection.—(SARS, *Zool. Chall. Exp.*, part 55, p. 34.)

[4] *Colossendeis megalonyx* resembles *Colossendeis proboscidea* (Sabine) [from the Arctic] in the form of the proboscis. That species, however, is a great deal stouter, and has a much larger body with comparatively short legs.—(HOEK, *Zool. Chall. Exp.*, part 10, p. 69.)

[5] In some respects *Nymphon brachyrhynchus* shows a resemblance to *Nymphon stromii* of KRÖYER [from the Arctic and North Atlantic].—(HOEK, *Zool. Chall. Exp.*, part 10, p. 48.)

**Nymphon brevicaudatum*,[1] Miers.
* ,, *fuscum*, Hoek.

LAMELLIBRANCHIATA :

Anatina elliptica, King and Broderip.
Astarte magellanica, Smith.
**Cardita astartoides*,[2] Martens.
**Crenella marionensis*, Smith.
**Cryptodon marionensis*,[3] Smith.
**Dacrydium meridionalis*, Smith.
**Davila* (?) *umbonata*, Smith.
**Kellia cardiformis*, Smith.
* ,, *nuculina*, Martens.
,, *suborbicularis*[4] (Montagu).
Lima (*Limatula*) *pygmæa*, Philippi.
**Limopsis marionensis*, Smith.
* ,, *straminea*, Smith.
**Malletia gigantea*, Smith.
**Modiolarca kerguelensis*, Smith.
,, *trapezina* (Lamarck).
**Mytilus kerguelensis*, Smith.
,, *magellanicus*, Chemnitz.
* ,, *meridionalis*, Smith.
**Neæra* [= *Cuspidaria*] *kerguelenensis*, Smith.
**Pecten aviculoides*, Smith.
* ,, *clathratus*, Martens.
* ,, *distinctus*, Smith.
Saxicava arctica,[5] Linné.

[1] This species [*Nymphon brevicaudatum*] is allied to the boreal *N. brevitarse*, Kröyer; but it is distinguished by its more robust form, its long and slender oculigerous tubercle, its longer tarsal joints, &c.—(E. J. MIERS, *Phil. Trans.*, vol. 168, p. 213.)

[2] *Cardita astartoides*, as pointed out by MARTENS, bears a great resemblance to the North American *Cardita borealis*, and may be regarded as the southern representative of that form. It certainly is more like that species than *Cardita velutina* from South Patagonia, which we should not expect, considering how similar the fauna of that region and of Kerguelen Island appear to be.—(SMITH, *Zool. Chall. Exp.*, part 35, pp. 212, 213.)

[3] *Cryptodon marionensis* is the southern form of *Cryptodon gouldii*, Philippi, and *Cryptodon flexuosus*, Montagu, both of which species it closely resembles.—(SMITH, *Zool. Chall. Exp.*, part 35, p. 194.)

[4] Two specimens from Kerguelen I cannot distinguish from this well-known European species [*Kellia suborbicularis*], which has not, I believe, been previously met with farther south than the Canaries.—(SMITH, *Zool. Chall. Exp.*, part 35, p. 201.)

[5] This polymorphous species [*Saxicava arctica*], judging from the shells alone, is apparently distributed all ove the globe. Of the animals inhabiting them we know nothing except those of northern varieties. The shells vary immensely in form, thickness, and ornamentation. Those found off the South African coast are especially remarkable for the great development of the spines on the posterior side, and have been raised to specific rank by Mr SOWERBY under the name of *Saxicava spinifera*. Many localities have already been cited for this species, and among them may

**Thracia meridionalis*,[1] Smith.
**Yoldia isonota*, Martens.
* ,, *subæquilateralis*, Smith.

SCAPHOPODA AND GASTEROPODA :

**Actæon* (*Acteonina*) *edentulus*, Watson.
**Alaba* (*Diala*) *limnæiformis*, Watson.
,, (,,) sp. (?).
**Buccinum albozonatum*, Watson.
**Cancellaria* (*Admete*) *carinata*, Watson.
* ,, (,,) *specularis*, Watson.
,, (,,) sp. (?).
Cerithium sp. (?).
Cyclostrema sp. (?).
**Dentalium ægeum*, Watson.
,, *entalis*, Linné, var. *orthrum*, Watson.
**Eatoniella caliginosa* (Smith).
* ,, *subrufescens* (Smith).
Emarginula sp. (?).
**Eulima amblia*, Watson.
**Fusus* (*Euthria*) *chloroticus*, Martens.
,, (,,) *fuscatus* (Bruguière).
* ,, (*Neptunea*) *edwardiensis*, Watson.
* ,, (,,) *regulus*, Watson.
* ,, (*Sipho*) *futile*, Watson.
Homalogyra atomus[2] (Philippi).
Hydrobia caliginosa (Gould).
Lamellaria sp. (?).
**Litorina setosa*, Smith.
**Natica fartilis*,[3] Watson.
* ,, *grisea*, Martens.

be mentioned Greenland, Norway, Great Britain, Sitka, Japan, California, Peru, Patagonia, Canaries, Madeira, Mogador, Mediterranean, Madagascar, Cape of Good Hope, Australia, New Zealand, &c. ; and it is also found fossil in several Upper Tertiary formations.—(SMITH, *Zool. Chall. Exp.*, part 35, p. 78.)

[1] *Thracia meridionalis* is the southern representative of the Greenlandic species *Thracia truncata*, and indeed differs so slightly from it that it is with considerable hesitation I venture to describe it as distinct, being mainly influenced to do so by the difference of locality.—(SMITH, *Zool. Chall. Exp.*, part 35, p. 69.)

[2] The step from Madeira to lat. 46° S. is so enormous, that I was glad to have my identification of the specimen [of *Homalogyra atomus*] confirmed by one who knows the species so well as Dr GWYN JEFFREYS does. It is extremely abundant in Madeira, and careful search will probably supply very many additional localities for its dwelling.—(WATSON, *Zool. Chall. Exp.*, part 42, p. 121.)

[3] *Natica fartilis* so closely approaches *Natica affinis* [a northern species] that I have hesitated very much to separate them, and have been glad to be strengthened in so doing by the opinion of Professor VON MARTENS and Mr E. A. SMITH.—(WATSON, *Zool. Chall. Exp.*, part 42, p. 447.)

**Natica xantha*, Watson.
* „ (*Amauropsis*) *perscalpta*, Martens.
* „ („) *suturalis*,[1] Watson.
„ (*Lunatia*) *grönlandica*,[2] Beck.
* „ („) *prasina*, Watson.
**Neobuccinum eatoni*, Smith.
* „ *vestitum* (Martens).
Odostomia rissoïdes,[3] Hanley.
Patella fuegiensis, Reeve.
* „ *kerguelensis*, Smith.
**Pleurotoma* (*Spirotropis*) *studeriana*, Martens.
„ (*Surcula*) *staminea*, Watson.
* „ („) *trilix*, Watson.
* „ (*Thesbia*) *corpulenta*, Watson.
* „ („) *platamodes*, Watson.
* „ („) *translucida*, Watson.
* „ (*Typhlomangelia*) *fluctuosa*, Watson.
* „ („) „ var. *cariosa*, Watson.
„ sp. (?).
**Provocator pulcher*, Watson.
Puncturella noachina (Linné), var. *princeps*, Mighels.
**Rissoa* (*Ceratia*) *transenna*, Watson.
* „ (*Setia*) *australis*, Watson.
* „ („) *edwardiensis*, Watson.
* „ („) *marionensis*, Watson.
* „ („) *principis*, Watson.
* „ („) *sinapi*, Watson.
Scissurella crispata, Fleming.
* „ *obliqua*, Watson.
**Skenea subcanaliculata*, Smith.
**Struthiolaria mirabilis*, Smith.
Triton (*Lagena*) *magellanicus* (Chemnitz).

[1] *Natica* (*Amauropsis*) *suturalis* has so strongly the aspect of *Natica islandica* that I can easily believe connecting links will yet establish their identity. The age of *Natica islandica* and its distribution, as well as its present habitat in Subarctic and Arctic seas, make its presence in Antarctic regions more probable. But for the present it is impossible to unite them.—(Watson, *Zool. Chall. Exp.*, part 42, p. 456.)

[2] On comparing this [*Natica* (*Lunatia*) *grönlandica* from Heard Island] with Sars' specimens from Norway I am not quite satisfied, and yet I cannot part them. . . . It was unsatisfactory to put a Kerguelen shell to an Arctic species without fuller conviction, and I was glad, therefore, to have my determination of the species confirmed by Mr E. A. Smith.—(Watson, *Zool. Chall. Exp.*, part 42, p. 448.)

[3] I give this species [*Odostomia rissoïdes* from Marion Island] on the authority of Dr Gwyn Jeffreys. I had remarked the shell's great resemblance in form to *Odostomia rissoïdes*, but the distinct and strong spiral structure which characterises it, coupled with the locality, prevented my referring it to that species.—(Watson, *Zool. Chall. Exp.*, part 42, p. 481.)

Triton (*Lagena*) sp. (?).
**Trochus* (*Margarita*) *charopus*, Watson.
* ,, (,,) ,, var. *cæruleus*, Watson.
,, (*Photinula*) *expansus* (Sowerby).
**Trophon albolabratus*, Smith.
* ,, *declinans*,[1] Watson.
,, *geversianus* (Pallas).
**Trophon scolopax*, Watson.
* ,, *septus*, Watson.
,, sp. (?)
**Turritella austrina*,[2] Watson.
* ,, *incolor*, Smith.
**Volutomitra fragillima*, Watson.

POLYPLACOPHORA :

**Hemiarthrum setulosum*, Carpenter, MS.
**Leptochiton kerguelensis*, Haddon.

NUDIBRANCHIATA :

**Archidoris*[3] *australis*, Bergh.
* ,, *kerguelenensis*, Bergh.

MARSENIADÆ :

**Marseniopsis murrayi*, Bergh.
* ,, *pacifica*, Bergh.

CEPHALOPODA :

**Octopus levis*, Hoyle.

POLYZOA :

**Amphiblestrum cristatum*, Busk.
Bicellaria pectogemma, Goldstein.
**Bugula longissima*, Busk.
* ,, *sinuosa*, Busk.
Caberea darwinii, Busk.
Carbasea ovoidea, Busk.

[1] I have described this [*Trophon declinans*] as a new species with very great reluctance. My own opinion is that it is a large thin variety of *T. truncatus*, Ström ; and that opinion is shared by Mr E. A. SMITH. Dr GWYN JEFFREYS, however, and Professor G. O. SARS decidedly hold it as distinct ; and their extensive acquaintance with the large northern variety of *T. truncatus* makes their judgment of great weight.—(WATSON, *Zool. Chall. Exp.*, part 42, pp. 168–9.)

[2] *Turritella austrina* is very like our British *T. terebra*, Linné, but is stumpier in form, smaller, with a much more impressed suture, and fewer spiral threads.—(WATSON, *Zool. Chall. Exp.*, part 42, p. 471.)

[3] BERGH enumerates two species of *Archidoris* from the North Atlantic, one species from the North Pacific, and two new species from Kerguelen.—(*Zool. Chall. Exp.*, part 26, p. 85.)

**Catenaria attenuata*, Busk.
Cellepora albirostris (Smitt).
,, *bicornis*, Busk.
,, *eatonensis*, Busk.
,, *pustulata*, Busk.
**Cellularia elongata*, Busk.
* ,, *quadrata*, Busk.
Chorizopora hyalina, var. *bougainvillei*, d'Orbigny.
Cribrilina monoceros (Busk).
,, *philomela*, Busk.
,, ,, var. *adnata*, Busk.
Crisia eburnea (Linné), var. *laxa*, Busk.
,, *holdsworthii*, Busk.
Diachoris inermis, Busk.
,, *magellanica*, Busk, var. *distans*, Busk.
**Electra cylindracea*, Busk.
Escharoides verruculata (Smitt).
**Flustra crassa*, Busk.
Flustramorpha marginata (Krauss).
Hippothoa flagellum, Manzoni.
Hornera violacea, Sars.
Idmonea atlantica, Forbes.
,, *australis*, MacGillivray.
,, *marionensis*, Busk.
,, *milneana*, d'Orbigny.
Membranipora crassimarginata (Hincks), var. *erecta*, Busk.
,, *galeata*, Busk.
,, ,, var. *furcata*, Busk.
Menipea benemunita, Busk.
,, *flagellifera*, Busk.
,, *marionensis*, Busk.
**Mucronella rostrigera*, Busk.
,, *tricuspis*, Hincks.
,, *ventricosa*, var. *multispinata*, Busk.
Myriozoum marionense, Busk.
Nellia oculata, Busk.
Onchopora sinclairii, Busk.
Pustulopora deflexa (Smitt).
,, *proboscidea*, M.-Edwards.
,, *proboscidioides* (Smitt).
**Reteporella flabellata*, Busk.

Salicornaria clavata, Busk.
,, *malvinensis*, Busk.
,, *variabilis*, Busk.
Schizoporella marsupifera, Busk.
,, *triangula*, Hincks.
Smittia jacobensis, Busk.
* ,, *marionensis*, Busk.
**Supercytis tubigera*, Busk.
**Vincularia gothica*, d'Orbigny.
* ,, ,, var. *granulata*, Busk.

BRACHIOPODA :

Platydia anomioides (Scacchi).
Rhynchonella nigricans (Sowerby), var. *pixydata*, Watson.
Terebratella dorsata (Gmelin).
Terebratula uva, Broderip.
Terebratulina caput-serpentis, Linné, var. *septentrionalis*, Couthouy.
**Waldheimia kerguelenensis*, Davidson.

TUNICATA :

**Amaroucium complanatum*, Herdman.
* ,, *globosum*, Herdman.
* ,, *nigrum*, Herdman.
* ,, *variabile*,[1] Herdman.
* ,, ,, var. *tenerum*, Herdman.
Aplidium fumigatum, Herdman.
* ,, *fuscum*, Herdman.
* ,, *leucophæum*, Herdman.
**Ascidia challengeri*,[2] Herdman.
* ,, *despecta*, Herdman.
* ,, *placenta*, Herdman.
* ,, *translucida*, Herdman.
* ,, *vasculosa*, Herdman.
**Ascopera gigantea*, Herdman.
* ,, *pedunculata*, Herdman.

[1] I unite under this species [*Amaroucium variabile*] a large number of specimens, collected in the neighbourhood of Kerguelen Island, which present great variations in form, size, colour, and some other particulars. They are, however, all closely related to one another, and although it might be possible to break them up into two or three species, I believe that the differences between the extreme forms are sufficiently bridged over by intermediate conditions to warrant one in regarding them as composing a single species only. They form an extremely interesting series on account of the way in which they illustrate individual variation.—(HERDMAN, *Zool. Chall. Exp.*, part 37, p. 216.)

[2] *Ascidia challengeri* is a large and somewhat variable species, which appears to be common at Kerguelen Island. In the first part of the Preliminary Report it was considered as being identical with *Ascidia mentula*, O. F. Müller, a species to which it is closely allied.—(HERDMAN, *Zool. Chall. Exp.*, part 16, p. 203.)

**Chorizocormus reticulatus*, Herdman.
**Colella concreta*, Herdman.
,, *pedunculata* (Quoy and Gaimard).
* ,, *quoyi*, Herdman.
**Eugyra kerguelenensis*, Herdman.
**Leptoclinum rubicundum*, Herdman.
* ,, *subflavum*, Herdman.
**Molgula pedunculata*, Herdman.
**Morchellioides affinis*, Herdman.
**Morchellium giardi*, Herdman.
**Polycarpa minuta*, Herdman.
**Polyclinum minutum*, Herdman.
* ,, *pyriformis*, Herdman.
**Psammaplidium retiforme*, Herdman.
**Sidnyum pallidum*, Herdman.
**Styela convexa*, Herdman.
* ,, *grandis*, Herdman.
* ,, *lactea*, Herdman.
**Tylobranchion speciosum*, Herdman.
*———(?) *pyriformis*, Herdman (genus doubtful).

FISHES[1]:

Chœnichthys rhinoceratus, Rich.
Harpagifer bispinis, Forst.
**Murænolepis marmoratus*, Günther.
**Notothenia acuta*, Günther.
,, *cyaneobrancha*, Rich.
* ,, *marionensis*, Günther.
* ,, *mizops*, Günther.
* ,, *squamifrons*, Günther.
**Raja eatoni*, Günther.
* ,, *murrayi*, Günther.
**Zanclorhynchus spinifer*,[2] Günther.

[1] The study of the Antarctic surface fish-fauna, and its comparison with that of the Arctic regions, is one of the most instructive portions of zoogeography. The abundance of fish-life appears to decrease in the same proportion towards both Poles. The forms peculiar to the Antarctic are analogous to those of the north; thus the Cottoids of the north are represented by the *Notothenidæ*, *Chœnichthys*, &c., of the south, the Salmonoids by the Haplochitonidæ; yet there is no such relation between the representative forms as might be considered to be genetic. The resemblance is rather an external one, indicated by the general form of the body, structure and development of the fins, presence of an adipose fin, &c. Besides those fishes which are peculiar to the Antarctic some other forms well developed in the north, but nearly or entirely disappearing between the tropics, reappear, as *Sebastes*, *Agonus*, *Spinax*, *Myxine*, differing but little from their northern congeners.—(GÜNTHER, *Zool. Chall. Exp.*, part 6, p. 14.)

[2] It may be of interest to insert here some general remarks of Dr VON WILLEMOES-SUHM on the results of the shallow-water dredgings and trawlings taken at Kerguelen by the Challenger in the month of January 1874, extracted from the Challenger Report, Summary of Results, pp. 478–480, as he refers to a few animals not included in our

As in the case of the preceding lists, the great majority of the 533 species enumerated in the above list were each taken only at one of the four Stations or localities, but a certain number occurred at more than one of these localities.

LIST IV*a*.

We give here a list of such species, indicating in brackets the number of Stations or localities at which each species was found. It will be noticed that out of the 102

list, the specimens of which probably did not reach the hands of the specialists who described the Challenger collections :—"The prevailing animals in the shallow-water dredging on January 17 were Echinodermata, next to which Sponges and Polyzoa were represented by a considerable number of genera and species. There were also a large simple Ascidian and a small composite one ; simple Ascidians were apparently far from numerous here, nor, indeed, were hey abundant at any place where we have dredged in shallow water,—an interesting fact, if confirmed as we go on. Annelids were represented especially by numerous Aphroditaceans, belonging probably to the genera *Aphrodita* and *Hermione*, and a few Terebellids ; there were also two Nemerteans, one a particularly large one with immense mouth. The almost total absence of higher Crustacea in the shallow-water fauna of these Antarctic islands is very astonishing. Near Marion Island a caridid shrimp was taken in great numbers, while here at Kerguelen not a single Decapod was found. An Amphipod, the *Gammarus* which in water takes the place of flies on land, was very common. For Isopods this seemed to be a favourite territory, *Serolis* being probably the most numerous in specimens and species, though small Sphæromidæ were not uncommon, and several specimens of a spiny *Arcturus* were taken ; most of these Isopods had eggs or young in their breeding pouches. A species of *Tanais* obtained to-day was very interesting on account of its method of reproduction ; it had no breeding lamellæ, as in all Isopods hitherto known, but instead two sacs at the base of the fifth pair of legs, which contained the young ones, reminding one very much of the well-known sacs at the base of the last pair of feet in Copepods. They were in every way similar, but here rounded and not elongated, about 2½ inches in diameter, and containing each about twenty embryos, which evidently remain there, as they do in the breeding pouches of other species, until they have attained their full development. Among the Molluscs there was a large white Nudibranch and a few Gasteropoda and Lamellibranchiata, all indicating great uniformity in the Molluscan fauna of the place. On January 20, the dredge brought up some specimens of *Siphonostomum*, a genus very common in the north and in the Mediterranean, which has a great resemblance to the northern species. These worms have, besides two long tentacles, a quantity of branchial filaments and papillæ surrounding the mouth ; at the first segment there are also very strong and long setæ standing erect in front, and having a peculiar structure ; in the skin are many glands that exude a slimy secretion, by which they are generally surrounded. On January 21, the dredge brought up large specimens of *Serolis*, and in the trawl were great quantities of a *Caprella*, the male of which is very much elongated, and has enormously long anterior claws ; the female had eggs in its pouch. On January 29, the dredge brought up many Echinoderms, a singular round simple Ascidian, and among the worms *Clymenia* and *Terebella*, along with *Dentalium* and other Molluscs. The trawl procured in the afternoon a prodigious quantity of animals, including specimens of a large *Rossella*, a smaller siliceous Sponge, and a stalked one ; small Planarians and Nemerteans ; many Annelids, among which were large quantities of *Aphrodita* and *Siphonostomum*, and also a small *Sipunculus ;* quantities of Polyzoa, also simple and composite Ascidians ; among Crustacea, an Ostracode belonging to the Cypridinidæ, some of the big members of which seem to inhabit deeper water, many Pycnogonids, among which were a small *Nymphon*, a large red *Nymphon*, and *Pycnogonum* (several of these spiders were overgrown by an *Alcyonium*, which much enlarged their appearance), two female specimens of *Nebalia*, differing only slightly from the Mediterranean *Nebalia geoffroyi*, several male and female specimens of a Petalophthalmid, an inch long, apparently belonging to my genus *Crozetia* [=*Amblyops*, Sars], established on a much larger species from deep water (these specimens with their larvæ show that the animals undergo the *Mysis*-development, and that the genus is more nearly allied to the ordinary *Mysis* than to the deep-sea Petalophthalmids) ; among the Isopods were quantities of *Serolis*, old and young in all stages of development, a few specimens of the *Tanais* taken on the 17th, and males and ovigerous females of *Praniza* (*Anceus*), showing hardly any differences from the species studied by Dohrn at Plymouth and described by Spence Bate in his British Sessile-Eyed Crustacea ; Amphipods were represented by several small species, and a large one distinguished by a bright-red process at the front of the carapace, containing, under a simple chitinous layer, pigment arranged in hexagons (I could discover no trace of bodies entitling them to be called eyes, of which they are very probably the rudiments) ; of Cumacea a little *Cuma* was very abundant, in the males of which the second antennæ seem to remain in the same state of development as in the female. Except the Schizopod already mentioned, not a single member of the higher stalk-eyed Crustacea was taken, and probably no others exist here in shallow water. Three specimens of a *Raia*, not mentioned in Günther's Catalogue of Fishes, were also obtained."

species, only 4 species were procured at all the four localities, while 23 species occurred each at three of the Stations, and the remaining 75 species each at two of the Stations (looking upon the many dredgings taken in the vicinity of Kerguelen and of Marion Islands as constituting each one Station).

Amphilectus pilosus (2).
Stylocordyla stipitata (2).
Tetilla grandis (2).
Rossella antarctica (3).
Leuconia fruticosa (2).
Promachocrinus kerguelensis (2).
Asterias meridionalis (3).
„ (*Smilasterias*) *scalprifera* (2).
Bathybiaster loripes (2).
Cribrella simplex (2).
Gnathaster elongatus (4).
„ *meridionalis* (4).
Labidiaster annulatus (3).
Leptoptychaster kerguelenensis (2).
Perknaster fuscus (2).
Porania spiculata (2).
Amphiura studeri (3).
Gorgonocephalus pourtalesii (3).
Ophiacantha imago (3).
„ *vivipara* (3).
Ophioconis antarctica (2).
Ophiocten amitinum (2).
Ophioglypha deshayesi (3).
„ *hexactis* (2).
Echinus margaritaceus (3).
Goniocidaris canaliculata (3).
Hemiaster cavernosus (2).
Chirodota contorta (2).
Cucumaria lævigata (2).
„ *serrata* (3).
Psolus ephippifer (4).
„ *incertus* (3).
Amphiporus marioni (2).
Cerebratulus corrugatus (2).
Lætmonice producta (3).
Lagisca antarctica (2).
Neottis antarctica (4).
Nephthys trissophyllus (2).
Nereis (*Platynereis*) *eatoni* (2).
Serpula narconensis (3).
Bairdia villosa (2).
Cythere foveolata (2).
„ *kerguelenensis* (2).
„ *subrufa* (2).
„ *wyville-thomsoni* (3).
Cytheropteron assimile (2).
Macrocypris maculata (2).
Pseudocythere caudata (2).
Sclerochilus contortus (2).
Xestoleberis depressa (2).
„ *setigera* (3).
Eusirus longipes (2).
Iphimedia pacifica (2).
Liljeborgia consanguinea (2).
Œdiceroides rostrata (2).
Phoxocephalus kergueleni (2).
Arcturus furcatus (2).
Astacilla marionensis (2).
Serolis septemcarinata (2).
Halicarcinus planatus (2).
Cardita astartoides (2)
Davila (?) *umbonata* (2).
Kellia nuculina (2).
Lima (*Limatula*) *pygmæa* (2).
Modiolarca trapezina (2).
Mytilus meridionalis (2).
Saxicava arctica (2).
Thracia meridionalis (2).
Cancellaria (*Admete*) *specularis* (2).
Natica fartilis (3).
Neobuccinum eatoni (2).
„ *vestitum* (2).
Patella kerguelensis (2).
Pleurotoma (*Thesbia*) *translucida* (2).
„ (*Typhlomangelia*) *ductuosa* (2).
Provocator pulcher (2).
Rissoa (*Setia*) *principis* (2).
Struthiolaria mirabilis (2).
Trochus (*Margarita*) *charopus* (2).
„ (*Photinula*) *expansus* (2).
Trophon declinans (2).
Turritella austrina (2).
Bicellaria pectogemma (3).
Bugula longissima (2).
Caberea darwinii (2)
Carbasea ovoidea (2).
Cellepora bicornis (3).
Cellularia quadrata (2).
Cribrilina philomela (2).
Idmonea marionensis (2).
„ *milneana* (2).
Membranipora galeata (3).
Menipea flagellifera (2).
Myriozoum marionense (2).

Onchopora sinclairii (3).
Pustulopora proboscidea (2).
Salicornaria clavata (3).
„ *malvinensis* (2).
Smittia marionensis (2).
Vincularia gothica (2).
Waldheimia kerguelenensis (3).
Colella pedunculata (2).

The preceding list of species from the shallow waters of the Kerguelen Region (List IV.) shows that in the vicinity of these islands of the Southern Indian Ocean, in depths not exceeding 150 fathoms, the Challenger procured representatives of 533 species and varieties of Metazoa belonging to about 325 genera. The proportion of the number of genera relatively to the number of species is here as 1 to 1·64.

An examination of the list shows that 25 of the species have received no specific names, and there are besides 11 varieties enumerated as well as the species to which they belong; in addition the list includes 2 species of internal parasites (Entozoa), the distribution of which cannot be discussed along with the other marine organisms. Making these deductions there remain 495 distinct fully-described species the distribution of which may be discussed in detail.

These 495 species may be divided into those that are known only from these dredgings in the neighbourhood of the islands in the Southern Indian Ocean, and those that extend into other regions of the ocean.

a. *Species limited to the shallow-water area of the Kerguelen Region.*

In the first place, we find that there are 326 species (or 61 per cent. of the total number of species and varieties found in these dredgings) which, so far as we know up to the present time, are confined to the area represented by these dredgings.[1] These 326 species are distinguished by an asterisk in the list, and very little can be said about them beyond the fact that they are known only from the area represented by these dredgings and from depths not exceeding 150 fathoms.

LIST IV *b*.

We here enumerate the 52 species found at more than one of these Stations or localities, indicating in brackets the number of Stations at which each species was found. It will be observed that only 2 species occurred at all the four localities, while 7 species were each found at three of the Stations, and the remaining 43 species each at two Stations.

[1] Nine of these species have subsequently been recorded from South Georgia, viz., *Asterias meridionalis*, *Ophioglypha hexactis*, *Lagisca antarctica* [=*Harmothoë vesiculosa*], *Nereis kerguelensis*, *Nymphon brevicaudatum*, *Litorina* [=*Pellilitorina*] *setosa*, *Hemiarthrum setulosum*, *Chorizocormus reticulatus*, and *Colella concreta*; there are besides other eight species with a wider distribution (as will be noticed in the succeeding notes) recorded from South Georgia, viz., *Porania antarctica*, *Hemiaster cavernosus*, *Serolis septemcarinata*, *Modiolarca trapezina*, *Hydrobia* [=*Lævilitorina*] *caliginosa*, *Trochus* (*Photinula*) *expansus*, *Colella pedunculata*, and *Harpagifer bispinis*, making altogether seventeen species in our list found since at South Georgia (see PFEFFER, "Die Niedere Thierwelt des antarktischen Ufergebietes," *Ergebnisse der deutschen Polar-Expeditionen*).

Amphilectus pilosus (2).
Tetilla grandis (2).
Promachocrinus kerguelensis (2).
Asterias meridionalis (3).
,, (*Smilasterias*) *scalprifera* (2).
Gnathaster elongatus (4).
,, *meridionalis* (4).
Leptoptychaster kerguelenensis (2).
Perknaster fuscus (2).
Ophiacantha imago (3).
Ophioconis antarctica (2).
Ophioglypha deshayesi (3).
,, *hexactis* (2).
Cucumaria lævigata (2).
Psolus incertus (3).
Amphiporus marioni (2).
Cerebratulus corrugatus (2).
Lagisca antarctica (2).
Nephthys trissophyllus (2).
Cythere foveolata (2).
,, *subrufa* (2).
Cytheropteron assimile (2).
Xestoleberis setigera (3).
Iphimedia pacifica (2).
Liljeborgia consanguinea (2).
Œdiceroides rostrata (2).
Phoxocephalus kergueleni (2).
Astacilla marionensis (2).
Cardita astartoides (2).
Davila (?) *umbonata* (2).
Kellia nuculina (2).
Mytilus meridionalis (2).
Thracia meridionalis (2).
Cancellaria (*Admete*) *specularis* (2).
Natica fartilis (3).
Neobuccinum eatoni (2).
Neobuccinum vestitum (2).
Patella kerguelensis (2).
Pleurotoma (*Thesbia*) *translucida* (2).
,, (*Typhlomangelia*) *fluctuosa* (2).
Provocator pulcher (2).
Rissoa (*Setia*) *principis* (2).
Struthiolaria mirabilis (2).
Trochus (*Margarita*) *charopus* (2).
,, (*Photinula*) *expansus* (2).
Trophon declinans (2).
Turritella austrina (2).
Bugula longissima (2).
Cellularia quadrata (2).
Smittia marionensis (2).
Vincularia gothica (2).
Waldheimia kerguelenensis (3).

b. *Species extending outside the shallow-water area of the Kerguelen Region.*

We come now to consider those species which have a wider distribution, and extend into other regions of the ocean outside the area represented by these dredgings. The number of such species is 169 (or 32 per cent. of the total number of species and varieties found in these dredgings), and they may be divided into groups according to their distribution in the tropical and extra-tropical regions of the ocean. Thus we find that of these 169 species,

100 species (or 60 per cent.) are known to occur in other regions south of the southern tropic (see List IV*c*.);

33 species (or 19 per cent.) are known to occur in regions both south and north of the tropics, but not in the intervening tropical zone (see List IV*d*.);

20 species (or 12 per cent.) are known to occur in regions both south of and within the tropics, but not to the north of the northern tropic (see List IV*e*.); and

16 species (or 9 per cent.) are known to occur in regions both south of, within, and north of the tropics, and some of them may be regarded as cosmopolitan, or almost cosmopolitan (see List IV*f*.).

We may now proceed to discuss in some detail the distribution of these 169 species, according to the groups given above, indicating briefly the geographical and bathymetrical distribution of each species outside the area represented by these dredgings.

LIST IV*c*.

In the first place we give a list of the 100 species which are known to occur outside the Kerguelen shallow-water area in regions south of the southern tropic. From the distributional notes accompanying each species it will be observed that 41 of the species descend into depths greater than 150 fathoms, of which 11 species reach deep water over 1000 fathoms.

Desmacidon (?) *ramosa*—Near the Cape, 150 fathoms.
Gellius carduus—Near the Crozets, 210 to 550 fathoms; Magellan Strait, 245 fathoms (var.).
„ *glacialis*—Near the Cape, 150 fathoms.
Latrunculia apicalis—Near River Plate, 600 fathoms.
Myxilla mariana—Off South-West Patagonia, depth (?).
Suberites antarcticus—Antarctic (lat. 74½° S.), 206 fathoms.
„ *caminatus*—Near River Plate, 600 fathoms.
Rossella antarctica—Antarctic (lat. 74°–77° S., long. 175° W.), 206–300 fathoms; near River Plate, 600 fms.
Leuconia fruticosa—[Recorded from ?].
Lophogorgia flammea—Cape of Good Hope, depth (?); [the Challenger specimen was without label, but is supposed to have come either from Simon's Bay or Prince Edward Island].
Thouarella variabilis—Near Crozets, 310 fathoms.
Halcampa clavus—[Recorded from ?].
Leiotealia nymphæa—Near Valparaiso, depth (?).
Halecium flexile—Magellan Strait, 9 fathoms.
Bathybiaster loripes—Magellan Strait, 245 fathoms.
Cribrella simplex—Near Crozets, 310 fathoms; near Tristan da Cunha, 90 to 150 fathoms.
Crossaster penicillatus—Near Tristan da Cunha, 110 fathoms.
Porania antarctica—Southern Ocean, 1600 fathoms; South Georgia, depth (?).
Amphiura antarctica—Magellan Strait, depth (?).
„ *studeri*—Near Marion Island, 310 fathoms.
Astrotoma agassizii—Near Crozets, 210 fathoms; Magellan Strait, 40 to 175 fathoms; between Magellan Strait and Falklands, 55 fathoms.
Gorgonocephalus pourtalesii—Magellan Strait, 140 and 175 fathoms; between Magellan Strait and Falkland Islands, 55 fathoms; East Patagonia, depth (?).
Ophiacantha vivipara—Falkland Islands, 70 fathoms; between Falklands and Magellan Strait, 55 fathoms; near River Plate, 600 fathoms.
Ophiocten amitinum—Southern Ocean, 1260, 1375, and 1950 fathoms.
Echinus magellanicus—Southern Ocean, 1600 fathoms; Magellan Strait, 9 to 175 fathoms; Falkland Islands, 12 fathoms; Patagonia, Chili, Cape, Australia, New Zealand.
„ *margaritaceus*—Magellan Strait, 175 and 245 fathoms; New Zealand (shore).
Hemiaster cavernosus—Magellan Strait, 400 fathoms; Patagonia, Chili, River Plate (shore); South Georgia.
Schizaster moseleyi—Southern Ocean, 1375 fathoms; Magellan Strait, 40 to 400 fathoms.
Chirodota contorta—Falkland Islands, 70 fathoms; between Magellan Strait and Falklands, 55 fathoms.
Cucumaria serrata—Near Crozets, 550 fathoms.
Pseudostichopus mollis—Magellan Strait, 140 and 245 fathoms.
Psolus ephippifer—Near Marion Island, 310 fathoms.
Eulagisca corrientis—Near River Plate, 600 fathoms.
Eunice magellanica—Magellan Strait, 175 and 245 fathoms.
Hermadion kerguelensis—Falkland Islands, 5 to 10 fathoms.
Lagisca magellanica—Near Marion Island, 310 fathoms (var.); Magellan Strait, 175 and 400 fathoms.
Neottis antarctica—Between Magellan Strait and Falkland Islands, 55 fathoms.
Phyllocomus crocea—Antarctic, between Crozets and Kerguelen, depth (?).

Serpula narconensis—Magellan Strait, 175 fathoms; Narçon Island, depth (?).
Terebella (*Lanice*) *flabellum*—South-East Australia, 150 fathoms; Narçon Island, depth (?).
Argillœcia eburnea—Near Rio de la Plata, 1900 fathoms.
Bairdia villosa—Tristan da Cunha, 100 to 150 fathoms; Bass Strait, 38 fathoms.
Cythere kerguelenensis—Bass Strait, 38 fathoms; Port Jackson, 2 to 10 fathoms.
„ *normani*—South-East Pacific, 1825 fathoms. [Recorded from ?].
„ *polytrema*—Known outside this area only as a fossil from Antwerp Crag.
Cytheropteron fenestratum—South Atlantic, near Tristan da Cunha, 1425 fathoms.
Macrocypris tumida—Wellington Harbour, New Zealand, tow-net at trawl.
Atyloides australis—Port Jackson, depth (?).
Euthemisto thomsoni—Antarctic, on several occasions at the surface.
Arcturus furcatus—Southern Ocean, 1675 fathoms.
Cymodocea darwini—Patagonia, depth (?).
Jæra pubescens—Patagonia, depth (?).
Neasellus kerguelenensis—Near River Plate, 600 fathoms.
Serolis cornuta—Crozets, depth (?).
„ *latifrons*—Near Crozets, 210 fathoms; Auckland Islands, depth (?).
„ *septemcarinata*—Crozets, depth (?); South Georgia.
Euphausia murrayi—Southern Ocean, surface.
Pseudomma sarsii—Southern Ocean, 1675 fathoms.
Nauticaris marionis—Falkland Islands, 12 fathoms.
Parapagurus dimorphus—Tristan da Cunha, 110 fathoms; Cape, 150 fathoms; Magellan Strait, 245 fathoms.
Halicarcinus planatus—Falkland Islands, 4 fathoms; New Zealand, depth (?).
Colossendeis megalonyx—Falkland Islands, 70 fathoms; between Falklands and Magellan Strait, 55 fathoms.
Anatina elliptica—New South Shetlands, depth (?)
Astarte magellanica—Magellan Strait, depth (?).
Lima (*Limatula*) *pygmœa*—South Patagonia, depth (?).
Modiolarca trapezina—Magellan Strait, 245 fathoms; Falkland Islands, 12 fathoms; South Georgia.
Hydrobia caliginosa—Tierra del Fuego, depth (?); South Georgia.
Patella fuegiensis—Tierra del Fuego and Falklands, depth (?).
Pleurotoma (*Surcula*) *staminea*—Southern Ocean, 1375 fathoms.
Triton (*Lagena*) *magellanicus*—Magellan Strait, 40 fathoms; Cape Horn, depth (?).
Trochus (*Photinula*) *expansus*—Falkland Islands, 5 to 12 fathoms (and from crop of duck); Magellan Strait, depth (?); South Georgia.
Trophon geversianus—Falkland Islands, 12 fathoms; Magellan Strait, depth (?).
Bicellaria pectogemma—[Recorded from ?].
Carbasea ovoidea—Magellan Strait, 9 and 175 fathoms; Falkland Islands, 12 fathoms; Patagonia, depth (?).
Cellepora albirostris—[Recorded from ?]
„ *bicornis*—Falkland Islands, 70 fathoms; between Falklands and Magellan Strait, 55 fathoms.
„ *eatonensis*—Magellan Strait, 175 fathoms; Falklands, 5 to 12 fathoms.
„ *pustulata*—New Zealand, 150 fathoms.
Chorizopora hyalina—Tristan da Cunha, 75 to 90 fathoms; Falkland Islands, 12 fathoms.
Cribrilina philomela—Curtis Island, depth (?).
Diachoris inermis—New Zealand and Magellan Strait, depth (?).
Flustramorpha marginata—Near Cape, 150 fathoms; South Africa, depth (?).
Idmonea australis—Port Jackson, 30 to 35 fathoms; Australia, depth (?).
Menipea benemunita—Magellan Strait, 175 fathoms; between Magellan Strait and Falklands, 55 and 70 fathoms; Falkland Islands, 5 to 12 fathoms.
„ *flagellifera*—Between Magellan Strait and Falklands, 55 and 70 fathoms.
„ *marionensis*—Near the Cape, 150 fathoms.
Mucronella tricuspis—Simon's Bay; Bass Strait, 38 fathoms; Falklands, 5 to 12 fathoms; South America, depth (?).

Mucronella ventricosa—Near Crozets, 210 fathoms.
Myriozoum marionense—Near Crozets, 210 to 550 fathoms.
Onchopora sinclairii—Southern Ocean, 1950 fathoms; Marion Island, Australia, and New Zealand, depth (?).
Salicornaria clavata—Bass Strait, 28 fathoms; Port Jackson, 35 fathoms; Magellan Strait, 45 fathoms.
„ *variabilis*—Magellan Strait, 45 fathoms; near Falklands, 70 fathoms.
Schizoporella marsupifera—New Zealand, 150 fathoms.
„ *triangula*—Bass Strait, 28 fathoms.
Rhynchonella nigricans—New Zealand and Chatham Islands, depth (?); fossil (?), Tasmania.
Terebratella dorsata—Chili to Magellan Strait, depth (?).
Colella pedunculata—Between Magellan Strait and Falklands, 55 and 70 fathoms; Falkland Islands, 12 fathoms; Magellan Strait, South Georgia and Australia, depth (?).
Chœnichthys rhinoceratus—[Recorded from ?].
Harpagifer bispinis—Cape Horn and Falkland Islands, depth (?); South Georgia.
Notothenia cyaneobrancha—[Recorded from ?].

LIST IV *d*.

In the second place we give a list of the 33 species which are known to occur in regions both south and north of the tropics, but which have not hitherto been recorded from the intervening tropical zone. From the distributional notes accompanying each species, it will be observed that 13 of the species descend into depths greater than 150 fathoms, of which 9 species reach deep water over 1000 fathoms.

Eudendrium rameum—British Seas, depth (?).
Obelia geniculata—Falkland Islands, 5 to 12 fathoms; Arctic, North Atlantic and North Pacific, depth (?).
Ophiocten sericeum—Off coast of Massachusetts, depth (?).
Drepanophorus serraticollis—Bass Strait, 38 fathoms; Mediterranean, depth (?).
Eunice ærstedi—Off east coast of United States, 1240 fathoms; off Nova Scotia, 85 fathoms.
Terebellides strœmi—Near Nova Scotia, 1340 fathoms; Europe and America, depth (?).
Cythere suhmi—North-West Pacific, 2300 fathoms.
Paradoxostoma abbreviatum—European Seas, depth (?).
Pseudocythere caudata—Near Rio de la Plata, 1900 fathoms; European Seas, depth (?).
Sclerochilus contortus—Wellington Harbour, New Zealand (tow-net at trawl); Arctic and European Seas, depth (?); fossil.
Xestoleberis depressa—Arctic, European and American Seas, depth (?); fossil.
Eusirus longipes—Northern Seas, depth (?).
Podocerus falcatus—Near Cape, from screw; South Atlantic, near River Plate, tow-net; British Seas.
Typhlotanais kerguelenensis—Mid North Pacific, 2050 fathoms.
Kellia suborbicularis—European Seas southward to Canaries, depth (?).
Homalogyra atomus—European seas to Madeira, depth (?); fossil.
Natica (*Lunatia*) *grönlandica*—Arctic, European, and American Seas, 2 to 1290 fathoms; fossil.
Odostomia rissoïdes—European Seas, 0 to 777 fathoms; fossil.
Puncturella noachina—Near Marion Island, 310 fathoms; Magellan Strait, 9 to 15 fathoms; Arctic, North Atlantic and North Pacific, 5 to 1095 fathoms; fossil.
Cribrilina monoceros—Port Jackson, 35 fathoms; Magellan Strait, 175 fathoms; between Magellan Strait and Falkland Islands, 55 fathoms; Falkland Islands, 12 fathoms; near River Plate, 600 fathoms; mid North Pacific, 3125 fathoms.
Crisia eburnea—Arctic and European Seas to Madeira, depth (?).
Diachoris magellanica—Port Jackson, 2 to 10 fathoms; Falklands, 5 to 12 fathoms; Magellan Strait, Australia, New Zealand, Adriatic, depth (?).

Escharoides verruculata—Gulf of Mexico, West of Tortugas, depth (?).
Hornera violacea—Arctic, Northern and British Seas, depth (?).
Idmonea atlantica—Tristan da Cunha, 100 to 150 fathoms; Simon's Bay, 18 fathoms; off Nova Scotia, 85 fathoms; Arctic, North Atlantic, Mediterranean, Florida, depth (?); fossil.
„ *marionensis*—Southern Ocean, 1600 fathoms; near River Plate, 600 fathoms; Australia and Naples Bay, Mediterranean, depth (?); fossil.
„ *milneana*—North Atlantic, off Azores, 450 fathoms; Australia, Falklands, Tierra del Fuego, Patagonia, Chonos Archipelago, 10 to 30 fathoms (?).
Membranipora crassimarginata—Tristan, 110 to 150 fathoms; Bass Strait, 38 fathoms; Madeira, depth (?); Gulf of Florida, 13 to 60 fathoms.
„ *galeata*—Simon's Bay; near Rio de la Plata, 600 fathoms; North Atlantic, off Azores, 450 fathoms. [Recorded from ?].
Pustulopora deflexa—British Seas, Mediterranean, Gulf of Florida, depth (?).
„ *proboscidea*—Australia, North Atlantic, Mediterranean, Gulf of Florida, depth (?).
„ *proboscidioides*—Gulf of Florida, depth (?).
Platydia anomioides—Mediterranean and North Atlantic, 40 to 600 fathoms; Florida Reefs, depth (?); fossil.

LIST IV *e*.

In the third place we give a list of the 20 species which are known to occur in regions both south of and within the tropics, but which have not hitherto been recorded from regions north of the tropic of Cancer. From the distributional notes accompanying each species it will be observed that 10 of the species descend into depths greater than 150 fathoms, of which only 1 species reaches deep water over 1000 fathoms.

Petrosia similis—Near the Cape, 150 fathoms; between Magellan Strait and Falklands, 70 fathoms (var.); Philippines, 18 fathoms (var.).
Labidiaster annulatus—Near Arrou Islands, 800 fathoms.
Porania spiculata—Near Arrou Islands, 800 fathoms.
Goniocidaris canaliculata—Southern Ocean, 1600 to 1975 fathoms; between Magellan Strait and Falkland Islands, 55 fathoms; Falklands, 5 to 12 fathoms; Natal, Zanzibar and Australia, depth (?).
Nereis (*Platynereis*) *eatoni*—Falkland Islands, 5 to 10 fathoms; Fernando Noronha, 25 fathoms.
Bythocypris reniformis—Bass Strait, 38 fathoms; off Brazil, 350 and 675 fathoms; West Indies, 390 fathoms.
Cythere audei—Ascension, 7 fathoms; Mauritius and Colon-Aspinwall, depth (?).
„ *wyville-thomsoni*—Torres Strait, 155 fathoms.
Cytheropteron (?) *angustatum*—Torres Strait, 155 fathoms.
Macrocypris decora—West Indies, 390 fathoms; off Brazil, 350 fathoms; Admiralty Islands, 16 to 25 fathoms; Australia and Batavia, depth (?).
„ *maculata*—Simon's Bay, 15 to 20 fathoms; Bass Strait, 38 fathoms; Amboina, 15 to 20 fathoms.
Campylonotus capensis—Off Brazil, 350 fathoms.
Mytilus magellanicus—Falkland Islands, 12 fathoms; Fiji, New Zealand, depth (?).
Fusus (*Euthria*) *fuscatus*—Falkland Islands, 4 to 12 fathoms; Peru, depth (?),
Caberea darwinii—Tristan da Cunha, 110 to 150 fathoms; near Cape, 150 fathoms; near Crozets, 210 to 550 fathoms; Magellan Strait, New Zealand and Cumberland Island, depth (?).
Crisia holdsworthii—Ceylon, depth (?).
Salicornaria malvinensis—Magellan Strait, 45 fathoms; Falkland Islands, 5 to 10 fathoms; New Hebrides 70 fathoms; South Patagonia, depth (?); fossil.
Smittia jacobensis—Cape Verde Islands, 100 to 120 fathoms.
Terebratula uva—S.E. Australia, 150 fathoms; off River Plate, 600 fathoms; Falklands and Guatemala, depth (?).
Aplidium fumigatum—Philippines, reefs.

LIST IV *f*.

In the fourth place we give a list of the 16 widely-distributed species which are known to occur both in tropical and extra-tropical regions. From the distributional notes accompanying each species it will be observed that 13 of the species descend into depths greater that 150 fathoms, of which 7 species reach deep water over 1000 fathoms.

Halichondria panicea—Japan, shore ; Torres Strait, Ceylon, British Seas, and Atlantic, depth (?).

Stylocordyla stipitata—Southern Ocean, 1600 fathoms ; Bahia, 7 to 20 fathoms ; Nova Scotia, 85 fathoms ; British Seas, and Grenada, depth (?).

Laetmonice producta—Mid South Atlantic, 1900 fathoms ; Southern Ocean, 1375 to 1950 fathoms ; near New Zealand, 700 fathoms ; near Torres Strait, 1400 fathoms ; Nova Scotia, 85 fathoms ; Mid North Atlantic, 1675 fathoms ; Mid North Pacific, 2300 and 2900 fathoms.

Scolecolepis cirrata—West Indies, 450 fathoms ; both sides of North Atlantic, 29 to 584 fathoms.

Bairdia victrix—Bass Strait, 38 fathoms ; near Sydney, 410 fathoms ; Mid South Atlantic, 1425 fathoms ; off Brazil, 350 and 675 fathoms ; off Azores, 450 and 900 fathoms ; Colon-Aspinwall and Cuba, depth (?).

Cythere dictyon—Cosmopolitan, 37 to 2750 fathoms.

Krithe bartonensis—Near Arrou Islands, 580 fathoms ; European seas, depth (?) ; fossil.

„ *producta*—Widely distributed : South, tropical and North Atlantic, Magellan Strait, South and tropical Pacific, and Southern Ocean, 50 to 1825 fathoms.

Polycope orbicularis—Near Cape, 150 fathoms ; Torres Strait, 155 fathoms ; Vigo Bay, 11 fathoms ; Arctic and North Atlantic, depth (?) ; fossil.

Xestoleberis curta—Port Jackson, 2 to 10 fathoms ; South-East Pacific, 1375 fathoms ; Torres Strait, 6 fathoms ; Sandwich Islands, 40 fathoms ; off Bermuda, 435 fathoms ; West Indies, depth (?).

Saxicava arctica—Tristan da Cunha, 100 to 150 fathoms ; Cape, 98 and 150 fathoms ; Port Jackson, 2 to 10 fathoms ; Magellan Strait, 245 fathoms ; between Magellan Strait and Falklands, 55 fathoms ; off Azores, 450 fathoms ; a cosmopolitan species ; fossil.

Dentalium entalis—Ascension, 420 fathoms ; North Atlantic, off Portugal, Canaries, Azores, and Nova Scotia, 85 to 620 fathoms ; Arctic, North Atlantic, Gulf of Mexico, and Mediterranean, down to 1750 fathoms ; fossil.

Scissurella crispata—West Indies, 390 fathoms ; Arctic, North Atlantic, and Mediterranean, 4 to 790 fathoms ; fossil.

Hippothoa flagellum—Cosmopolitan, depth (?) ; fossil.

Nellia oculata—Near Crozets, 210 to 550 fathoms ; Torres Strait, 28 and 49 fathoms ; Philippines, 18 fathoms ; Bahia, 10 to 40 fathoms ; Indian Ocean, Gulf of Florida, depth (?).

Terebratulina caput-serpentis—Near Cape, 150 fathoms ; Nova Scotia, 51 and 85 fathoms ; West Indies, Arctic, North Atlantic, North Pacific, and Australia, depth (?).

We may now summarise the distribution of these 169 species, which extend into other regions of the ocean outside the Kerguelen shallow-water area, as follows :—

Bathymetrical Distribution.—It appears that of these 169 species, 92 species are apparently not found deeper than the 150 fathoms line, the remaining 77 species are found on both sides of the 150 fathoms line, of which 28 species cross the 1000 fathoms line into deep water.

LIST IV *g*.

Eight of the species are recorded from the shore, and there are also 9 species recorded from the shore which are known only from the area under consideration; it may be of interest to give here a list of these 17 shore species, indicating the 9 species confined to this area by an asterisk *.

Halichondria panicea.
Echinus margaritaceus.
Hemiaster cavernosus.
Jæra pubescens.
Halicarcinus planatus.
Mytilus magellanicus.
**Eatoniella caliginosa.*
Hydrobia caliginosa.
**Neobuccinum eatoni.*
Patella fuegiensis.
* „ *kerguelensis.*
**Rissoa* (*Setia*) *australis.*
* „ („) *principis.*
* „ („) *sinapi.*
**Scissurella obliqua.*
**Skenea subcanaliculata.*
**Hemiarthrum setulosum.*

These are all shallow-water species unknown deeper than 150 fathoms, except *Echinus margaritaceus* and *Hemiaster cavernosus*, which descend to 245 and 400 fathoms respectively.

Geographical Distribution.—Of the 169 species we find that :—

62 species are represented in the Magellan Strait area (including Falklands and Fuegia).
45 „ „ „ North Atlantic.
44 „ „ „ South Pacific (including Bass Strait).
40 „ „ „ South Atlantic.
29 „ „ among the islands of the Southern Ocean (including South Georgia).
22 „ „ in the Tropical Pacific.
18 „ „ „ Tropical Atlantic.
14 „ „ „ deep-water area of the Kerguelen Region.
13 „ „ „ Arctic Ocean.
11 „ „ „ North Pacific.
5 „ „ „ Indian Ocean.
5 „ „ „ Antarctic regions (surface and moderate depths).

In addition there are 6 species the habitats of which outside this area are unknown, and 1 species (*Cythere polytrema*) known only as a fossil outside this area.

LIST IV *h*.

The following eighteen species have been recorded as occurring in the fossil condition, and are therefore of interest :—

Cythere polytrema.
Krithe bartonensis.
Polycope orbicularis.
Sclerochilus contortus.
Xestoleberis depressa.
Saxicava arctica.
Dentalium entalis.
Homalogyra atomus.
Natica (*Lunatia*) *grönlandica.*
Odostomia rissoïdes.
Puncturella noachina.
Scissurella crispata.
Hippothoa flagellum.
Idmonea atlantica.
„ *marionensis.*
Salicornaria malvinensis.
Platydia anomioides.
Rhynchonella nigricans.

LIST IV *i*.

Turning now our attention to the 325 genera represented at these shallow-water Stations, we find that the following 25 genera (or 8 per cent.) are known up to the present time only from these Stations. It will be observed that the great majority (20) of the genera each include only a single species taken at a single Station; 1 genus, however, with a single species was taken at two distinct Stations; 3 genera each contain 2 species taken at two Stations, and 1 genus contains 2 species, both taken at the same Station, as indicated in brackets after the name :—

Cinachyra	(1	species	taken	at	1	Station).	*Socarnoides*	(1	species	taken	at 1 Station).
Scytophorus	(1	„	1	„	)		*Sophrosyne*	(1	„	1	„)
Schizotricha	(2	„	2	„	)		*Astrurus*	(1	„	1	„)
Staurotheca	(1	„	1	„	)		*Paralamprops*	(1	„	1	„)
Perknaster	(2	„	2	„	)		*Provocator*	(1	„	2	„)
Salvatoria	(1	„	1	„	)		*Marseniopsis*	(2	„	2	„)
Acanthechinus	(1	„	1	„	)		*Ascopera*	(2	„	1	„)
Cardenio	(1	„	1	„	)		*Chorizocormus*	(1	„	1	„)
Cheirimedon	(1	„	1	„	)		*Morchellioides*	(1	„	1	„)
Dodecas	(1	„	1	„	)		*Tylobranchion*	(1	„	1	„)
Harpinioides	(1	„	1	„	)		*Murænolepis*	(1	„	1	„)
Kerguelenia	(1	„	1	„	)		*Zanclorhynchus*	(1	„	1	„)
Protellopsis	(1	„	1	„	)						

In addition the two genera *Eulagisca* and *Neasellus*, each with a single species, are known apart from these dredgings only from near the Rio de la Plata, in 600 fathoms.

Gnathophausia gigas, Willemoes-Suhm. Taken by the Challenger in the North Atlantic and in the Kerguelen Region.

LIST V.

METAZOA RECORDED FROM THE KERGUELEN REGION, FROM SOURCES OTHER THAN THE CHALLENGER EXPEDITION.

In order to complete our survey of the marine fauna of the Kerguelen Region we give here a list of species recorded from other sources[1] (British and American Transit of Venus Expeditions, "Gazelle" Expedition, &c.), excluding a number of unnamed species, the distribution of which cannot be discussed, as well as land and fresh-water species. Species already recorded in the preceding Challenger list (List IV.) are not repeated in this list, and where the nomenclature does not agree that adopted in the Challenger Report is indicated in square brackets.

MONAXONIDA[2]:

Halichondria [=*Suberites*] *carnosa*, Johnston. Recorded from Britain, Azores, Fernando Noronha, Port Jackson, and Vancouver's Island (?).

,, [=*Myxilla*] *plumosa*, Johnston. Recorded from Britain.

,, *sanguinea*, Johnston. Recorded from Britain.

Isodictya rosea, Bowerbank. Recorded from Britain.

[1] See "An account of the Petrological, Botanical, and Zoological Collections made in Kerguelen's Land and Rodriguez during the Transit of Venus Expeditions, carried out by order of Her Majesty's Government in the years 1874-75," *Philosophical Transactions*, vol. 168 (extra volume), 1879; J. H. KIDDER, "Contributions to the Natural History of Kerguelen Island, made in connection with the United States Transit-of-Venus Expedition, 1874-75," *Bull. U.S. Nat. Mus.*, No. 3, 1876; STUDER, "Über Echinodermen aus dem antarktischen Meere, gesammelt auf der Reise S.M.S. Gazelle um die Erde," *Monatsber. d. k. Akad. d. Wiss. Berlin*, 1876, pp. 452–463; STUDER, *Ibid.*, 1878, pp. 542-546, 633, 661; STUDER, "Die Fauna von Kerguelensland," *Archiv für Naturgeschichte*, Jahrg. xlv. Bd. i. pp. 104–141, 1879; STUDER, "Uebersicht über die Ophiuriden, welche, während der Reise S.M.S. Gazelle um die Erde 1874–1876 gesammelt wurden," *Abhandl. d. k. Akad. d. Wiss. Berlin*, 1882, pp. 1–37; STUDER, "Isopoden, gesammelt während der Reise S.M.S. Gazelle um die Erde 1874–76," *Ibid.*, 1883, pp. 1–28; GRUBE, "Annelidenausbeute von S.M.S. Gazelle," *Monatsber. d. k. Akad. d. Wiss. Berlin*, 1877, pp. 509–554; CROSSE, "Faune malacologique des îles Kerguelen," *Journ. de Conchyliologie*, sér. 3, tom. xvii. p. 1, 1877.

[2] Of the Sponges collected at Kerguelen by the British Transit of Venus Expedition, H. J. CARTER writes:—The collection of Sponges from Kerguelen Island is very limited in extent. So far as it goes, it may be said to present a European, and more especially a British facies. Half of the species at the fewest, may be picked up at any time on the beach of South Devon:—viz., *Isodictya rosea*, *Halichondria plumosa*, *H. carnosa*, and *H. sanguinea*. To these we might add a fifth species, *H. panicea*, for the Kerguelen variety differs from the normal British form only in the possession of spicules twice the size of the latter. Of the three species remaining *Thalysias* is common to the Mediterranean and the seas between the Americas; the *Ute* occurs on the N.W. coast of Spain and in the Mediterranean; and one only, the *Tethya*, is decidedly antarctic. This last was the only specimen obtained from a considerable depth; all of the others were either collected with the grapple within the Laminarian zone, or were the produce of shore-collecting between tide-marks or amidst the refuse of the beach. Probably more extended research would have brought to light divers of the many peculiar forms which abound in the Cape seas and in those of the southern part of Australia. In the course of my examination I have met with very few *Foraminifera*, no *Globigerina*, and no *coccoliths*.—(*Phil. Trans.*, vol. 168, p. 286.)

CARTER refers some Sponges collected at Kerguelen by the British Transit of Venus Expedition to the species *Thalysias subtriangularis*, Duchassaing and Michelotti, and *Tethya antarctica*, Carter. RIDLEY and DENDY refer the first to their *Petrosia similis*, regarding it as distinct from the West Indian *Petrosia subtriangularis*, while SOLLAS refers the second to his *Tetilla grandis*, regarding it as distinct from *Tetilla antarctica* obtained by ROSS' Antarctic Expedition in 206 and 300 fathoms in the neighbourhood of Victoria Land.

CALCAREA :

Ute [= *Sycon*] *capillosa*, Schmidt. Recorded from Vigo Bay and Mediterranean.

ALCYONARIA :

Clavularia rosea, Studer.
Isis [= *Primnoisis*] *antarctica*, Studer (see List III.).

ACTINIARIA :

Actinopsis rosea, Studer.
Bolocera kerguelensis, Studer.
Bunodes kerguelensis, Studer.
Edwardsia kerguelensis, Studer.
Halcampa purpurea, Studer.

HYDROIDA [1] :

Campanularia (?) *cylindrica*,[2] Allman. Recorded from Baffin's Bay.
Coryne conferta, Allman.
Halecium mutilum,[3] Allman.
Hydractinia antarctica, Studer.
Sertularella [= *Sertularia*] *lagena*, Allman.
,, [,,] *unilateralis*, Allman.
Sertularia polyzonias, Linné. A widely distributed species.
Tubularia (?) *kerguelensis*, Studer.

ASTEROIDEA [4] :

[1] PFEFFER records the widely distributed species, *Sertularia operculata*, Linné, from the Kerguelen region.—(*Ergebnisse der deutschen Polar-Expeditionen.*)

[2] The species which has been referred to *Campanularia* cannot be specifically distinguished from a hydroid obtained last autumn by H.M.S. "Valorous" in Baffin's Bay. It belongs to a common group of campanularian forms; but yet the fact of identical forms occurring in such widely separated localities, though under conditions probably very similar, is one of great interest and significance, more especially as the distribution can hardly be explained, as in certain other cases, by the transporting agency of ships' bottoms. . . . A form which cannot be distinguished specifically from this [*Campanularia* (?) *cylindrica*], has more recently been dredged by H.M.S. "Valorous" from 60 fathoms in Baffin's Bay.—(ALLMAN, *Phil. Trans.*, vol. 168, pp. 282, 284.)

[3] This species [*Halecium mutilum*], like *H. macrocephalum*, Allman, from the western part of the Gulf Stream, and *H. sessile*, Norman, from the Hebrides, is remarkable for the utter absence of the tubular prolongation of the lateral orifice of the internode which gives support to the hydranth in most of the species of *Halecium*.—(ALLMAN, *Phil. Trans.*, vol. 168, p. 283.)

[4] Of the Echinodermata collected at Kerguelen by the British Transit of Venus Expedition, E. A. SMITH writes:—Opportunity was taken some pages back of exhibiting the relations of the Molluscan fauna of Kerguelen Island to that of the Falklands and Patagonia; and it was pointed out that representatives of boreal types entered into its composition. Materials for similar comparisons between the Echinodermata indigenous to the same regions scarcely exist, but such as there are, make it apparent that what obtains in the Mollusca holds good also in the Echinodermata with respect to geographical distribution. . . . A similarity to certain boreal terms is exhibited by some of the species. Thus *Porania antarctica* strangely resembles *P. pulvillus* of the northern seas of Europe; the *Pedicellaster* represents another septentrional genus; *Pteraster affinis* imitates closely *Pt. militaris* of boreal waters. The genera *Ophioglypha* and *Ophiocantha* are almost cosmopolitan in distribution; yet the Kerguelen Island representative of the

Asterias rupicola,[1] Verrill.
„ *studeri*, Bell.
Luidiaster hirsutus, Studer.

OPHIUROIDEA :

Ophiogona lævigata, Studer.
Ophiolepis (*Ophioglypha*) *carinata*, Studer.
Ophiomyxa vivipara, Studer. Recorded from Cape, Falklands, and Magellan Strait.
Pectinura (*Ophioglypha*) *verrucosa*, Studer.

HOLOTHURIOIDEA :

Cuvieria [= *Psolus*] *porifera*,[2] Studer.
Sigmodota purpurea, Studer [= *Chirodota studerii*, Théel]. Recorded from Magellan Strait.
Trachythyone [= *Thyone*] *muricata*, Studer.

GEPHYREA :

Thalassema verrucosa, Studer.

ANNELIDA[3] :

Arenicola piscatorum, Cuvier, var.
Artacama proboscidea,[4] Malmgren. Recorded from North Atlantic.
Lumbricus kerguelarum, Grube.
Neottis spectabilis, Verrill.
Nereis antarctica, Verrill.
Ophryotrocha claparedii, Studer.
Polynoë (*Harmothoë*) *fullo*, Grube. Recorded from Magellan Strait.
Sabella costulata, Grube.

COPEPODA :

Harpacticus fulvus,[5] Fischer. Recorded from Europe.

former, *O. hexactis*, in colour and in *tout ensemble* approaches *O. Sarsii* of the Greenland coast.—(*Phil. Trans.*, vol. 168, pp. 270–1.)

[1] F. Leipolt doubtfully regards this as a synonym of *Asterias rupispina*, Stimpson, from Tierra del Fuego, Magellan Strait, and off Buenos Ayres (*Zeitschr. f. wiss. Zool.*, Bd. lix. p. 563, 1895).

[2] THÉEL considers the form named by STUDER *Cuvieria porifera* to be possibly identical with *Psolus ambulator*, Bell, from Australia.

[3] GRUBE and M'INTOSH referred specimens collected at Kerguelen to the Magellan Strait species *Hermadion longicirratus*, Kinberg, and *Hermadion magalhaens*, Kinberg, but an examination of Challenger specimens from Kerguelen convinced M'INTOSH that the Kerguelen species is distinct, and he named it *Hermadion kerguelensis*.

M'INTOSH considers the *Serpula patagonica* of GRUBE to be a synonym of *Serpula narconensis*, Baird.

STUDER records a species of *Nereis* without authority (*Nereis aprogenia*) from Kerguelen, 100 fathoms.

[4] GRUBE records the northern *Artacama proboscidea*, Malmgren, from Kerguelen; his specimens possibly belong to *Artacama challengeriæ*, M'Intosh, which seems to be very frequent in Kerguelen waters.

[5] The occurrence of this species [*Harpacticus fulvus*] in Kerguelen Island is particularly interesting from the fact

AMPHIPODA[1]:

Anonyx kergueleni[2] (Miers).
Lysianassa kidderi, Smith.
Podocerus ornatus, Miers.

ISOPODA[3]:

Æga semicarinata, Miers.
Cassidina emarginata, Guérin-Ménéville. Recorded from Patagonia, Magellan Strait, Falklands, and South Georgia.
,, *maculata*, Studer.
Dynamene eatoni, Miers.
Sphæroma gigas, Leach. Recorded from Patagonia, Australia, and New Zealand.

PYCNOGONIDA:

Nymphon gracilipes,[4] Miers.
Tanystylum styligerum, Miers.

LAMELLIBRANCHIATA[5]:

Anatina impressa, Watson *in litt.*

that it is found all over the European shores in precisely similar situations, that is to say in brackish pools, at or above high-water mark, which are liable to become warm through exposure to the sun's rays. These are in no respect distinguishable from European specimens—(G. S. BRADY, *Phil. Trans.*, vol. 168, p. 215.)

[1] PFEFFER records *Rhachotropis aculeatus* (Lepechin) from the Kerguelen region (*Ergebnisse der deutschen Polar-Expeditionen*); this is probably the species named by STEBBING *Rhachotropis kergueleni*.

[2] In the form of the antero-lateral angles of the cephalon, and of the postero-lateral angles of the third segment of the pleon, this species [*Anonyx kergueleni*] to some extent resembles (1) *Hippomedon holbölli*, Kröyer, as described by BOECK, as well as (2) *H. abyssi*, Goës, and (3) *Anonyx pumilus*, Lilljeborg—all from the Northern Sea. . . . The eyes, also, which are well marked in the species just referred to, are not visible in any of the specimens of *A. kergueleni*.—(E. J. MIERS, *Phil. Trans.*, vol. 168, p. 208.)

[3] STUDER'S *Serolis ovalis* is a synonym of *Serolis septemcarinata*, Miers, as STUDER himself supposed when he published his description.

[4] This species [*Nymphon antarcticum=N. gracilipes*] is allied to *N. grossipes*, O. Fab., as described by KRÖYER, from the northern seas, but differs somewhat in the length of the neck, and in the proportions of the joints of the legs and appendages.—(E. J. MIERS, *Phil. Trans.*, vol. 168, p. 212.)

[5] E. A. SMITH introduces his description of the Mollusca collected by the British Transit of Venus Expedition at Kerguelen thus:—The Malacological fauna resembles generally that of the Falkland Islands and South Patagonia. More than half of the genera and seven or eight of the species found at Kerguelen Island are known to occur at those localities, and further research will probably discover a still greater number of genera and species to be common to these two, longitudinally, so widely separated localities. With respect to their latitudes the difference is unimportant, since they both range between 49° and 54° S. lat. As the Cape of Good Hope, Tasmania, and South West Australia are the nearest points of mainland, it might be expected that some resemblance to the fauna of those countries might be observable. However, it is not so, as far as our present knowledge extends. Many of the shells from Kerguelen Island have the generally unattractive appearance, as regards coloration, which so frequently obtains in species found in cold climates. Indeed, some of them seem to be southern representatives of boreal types. The *Neobuccinum*, *Trophon*, *Saxicava*, *Kellia*, *Yoldia*, *Radula*, and *Doris*, are remarkable instances of similarity to northern forms.—(*Phil. Trans.*, vol. 168, p. 167.)

In the actual state of our knowledge, the malacological fauna of Kerguelen is composed of 26 species. This fauna is eminently austral. It is intimately related to that of New Zealand, by the presence of some common species (*Purpura striata*, *Venus stutchburyi*, *Mytilus canaliculus*), and by that of the genus *Struthiolaria*, which is also known

Arca (*Lissarca*) *rubro-fusca*, Smith. Recorded from Magellan Strait and South Georgia.

Kellia consanguinea,[1] Smith.

Kidderia [=*Modiolarca*] *minuta*, Dall. Recorded from Patagonia.

Lasea rubra (Montagu). Distribution world wide.

Lepton parasiticum, Dall (parasitic on *Hemiaster cavernosus*).

Modiolarca exilis, H. & A. Adams. Recorded from Falklands.

Mytilus canaliculus, Hanley. Recorded from Chili and New Zealand.

,, *edulis*,[2] Linné. A cosmopolitan species.

Saxicava bisulcata, Smith.

Venus (*Chione*) *stutchburyi*, Gray. Recorded from New Zealand and Sandwich Islands (?).

GASTEROPODA :

Admete (—— ?) *limnæformis*, Smith.

Eatoniella kerguelenensis (Smith). Recorded from South Georgia.

Hydrobia pumilio, Smith.

Lamellaria kerguelensis, Studer.

Marsenia kerguelenensis, Studer.

Natica sculpta, Martens.

Patella aenea, Martyn.

,, *delesserti*, Philippi. Recorded from Magellan Strait.

,, (*Nacella*) *mytilina*, Gmelin. Recorded from Magellan Strait.

,, (or *Patinella*) *magellanica*, Gmelin. Recorded from Magellan Strait.

from Australia. On the other hand, it participates in character with those of the Strait of Magellan (*Siphonaria tristensis*, *Patella magellanica* and *delesserti*, *Kilderia minuta*), of the south of Chili (*Mytilus canaliculus*) and of the islands in the neighbourhood of the Cape of Good Hope (*Siphonaria tristensis*). Finally, it presents particular characters which imprint it, in spite of its relative poverty, with a certain seal of originality. In fact, of the 25 marine species composing it, we encounter 15 which have been found to be new to science. This is a proportion of about 60 per cent., a proportion veritably enormous, which may be perhaps explained by the isolation of the Kerguelen Islands and by their almost complete state of *terra incognita* in a malacological sense. The unique terrestrial species which lives at Kerguelen, *Helix hookeri*, is assuredly one of the *Helices* nearest to the Antarctic circle, the existence of which is known up to the present time.—(CROSSE, *Journ. de Conchyliologie*, sér. 3, tom. xvii. pp. 14–15, 1877.)

PFEFFER records *Modiolarca pusilla*, Gould, and *Mytilus ungulatus*, Reeve, from the Kerguelen region.—(*Ergebnisse der deutschen Polar-Expeditionen.*)

[1] At a first glance this species [*Kellia consanguinea*] might easily be mistaken for the European *Lasæa rubra*, to which it has a very great resemblance.—(E. A. SMITH, *Phil. Trans.*, vol., 168, p. 185.)

[2] Of *Mytilus edulis* SMITH writes :—No definite distinction can be traced in the shells (unfortunately only eleven in number) collected at Kerguelen, from specimens from the Dutch coast bought in the London market. The form of the shell (always more or less variable), colour of the exterior and interior, the hinge with the few irregular teeth, muscular scars, and the punctures in the interior towards the ventral margins, are precisely alike in both local forms. . . . . I have closely examined the soft parts of four Kerguelen specimens, and . . . I find them to be exactly the same as in European specimens.—(*Phil. Trans.*, vol. 168, p. 189.)

This common species [*Mytilus edulis*] has become widely distributed, and differs considerably in form, colour, and size. HUTTON quotes it as occurring in New Zealand, and I have already identified it as coming from Kerguelen. —(SMITH, *Zool. Chall. Exp.*, part 35, p. 272.)

Purpura striata, Martyn. Recorded from New Zealand.
Rissoa kergueleni, Smith.
Scalaria symphylla, Martens.
Scissurella supraplicata, Smith.
Siphonaria redimiculum, Reeve
„ *tristensis*, Sowerby } [=*Siphonaria* (*Liriola*) *tristensis*, Leach]. Recorded from Tristan da Cunha, Chili, Peru, Patagonia, and Falklands.

NUDIBRANCHIATA :

Doris tuberculata,[1] Cuvier [=? *Archidoris kerguelenensis*, Bergh].

POLYZOA[2] :

Caberea boryi,[3] Audouin [=? *Caberea darwinii*, Busk].
Cellularia cirrata, Ellis and Solander [=*Menipea cirrata*, Lamouroux]. Recorded from the Cape.
Crisia edwardsiana (d'Orbigny). Recorded from Patagonia, Tierra del Fuego, Australia, and New Zealand.
„ *kerguelensis*, Busk.
Diachoris costata, Busk. Recorded from Falklands and Australia.
Discoporella [=*Lichenopora*] *canaliculata*, Busk.
„ [„] *fimbriata*, Busk. Recorded from Tristan da Cunha, Tierra del Fuego, Chiloe, Chonos Archipelago, and Tasmania.

[1] A Nudibranch brought from Kerguelen Island by the Antarctic Expedition has been identified as a variety of this common European species [*Doris tuberculata*], by Mr P. S. ABRAHAM, who has recently been studying the species of this genus in the national collection. He says that it possesses no characters of specific distinction from *D. tuberculata*, and differs from it only in a few slight and unimportant particulars attributable to mere variation. . . . The undetermined *Doris* found by Dr KIDDER in tide pools at low-water in Royal Sound will very likely prove to be the same species.—(SMITH, *Phil. Trans.*, vol. 168, p. 183.)

STUDER doubtfully records *Doris tuberculata* from Kerguelen, but BERGH considers the form referred to as probably identical with his *Archidoris kerguelenensis* and distinct from the northern form.

[2] Of Mr EATON'S collection of Polyzoa from Kerguelen BUSK writes :—The collection affords nine or ten forms previously undescribed ; the remainder belong to a fauna which ranges from the southern extremity of S. America (which may be regarded as its "centre") to New Zealand in a westerly direction, one or two species extending even farther, to Australia and the Cape of Good Hope. It is observable that no Arctic form has been brought from Kerguelen Island, although some have been met with further south, two instances of the occurrence of the Arctic *Hornera lichenoides* obtained during the voyage of H.M.SS. "Erebus" and "Terror" having been communicated to me by Sir J. HOOKER. Mr EATON suspects their absence may be attributed to the shallowness of the areas searched by him, the greatest depth being not more than 10 fathoms.—(*Phil. Trans.*, vol. 168, p. 193.)

PFEFFER records *Lichenopora gignonensis*, Busk, and *Pedicellina australis*, Ridley, from the Kerguelen region (*Ergebnisse der deutschen Polar-Expeditionen*) ; in the same place he also gives *Pedicellina australis*, Jullien, from the Magellan Strait region.

[3] The form called by BUSK in the Transit of Venus Report *Caberea boryi*, Audouin, he subsequently considered to be distinct from the true *Caberea boryi*, and he names it *Caberea darwinii* in the Challenger Report, where he says :—"So far as I know at present, the true *Caberea boryi* of AUDOUIN is confined to the Mediterranean and Atlantic regions, as far north as our own coast, and as far south, in all probability, as the Cape (Algoa Bay)."—(*Zool. Chall. Exp.* part 30, p. 29.)

Discoporella [*Lichenopora*] *infundibuliformis*, Busk.
Lepralia eatoni, Busk.
,, *galeata*, Busk. Recorded from Falklands and Tierra del Fuego.
,, *margaritifera* (Quoy and Gaimard). Recorded from Falklands and Tierra del Fuego.
? *Membranipora spinosa*[1] (Quoy and Gaimard).
Menipea fuegensis, Busk [= *M. aculeata* (d'Orbigny)]. Recorded from Magellan Strait, Patagonia, and Falklands.
,, *patagonica*, Busk. Recorded from Patagonia and Falklands.
Pustulopora delicatula, Busk. Recorded from Australia and Madeira (?).
Tubulipora organizans, d'Orbigny. Recorded from Falklands.
,, *stellata*, Busk.

Brachiopoda :
Waldheimia dilatata (Lamarck) [= *W. venosa* (Solander)]. Recorded from Patagonia and Falklands.

Fishes :
Notothenia antarctica, Peters.
,, *coriiceps*, Rich. Recorded from South Georgia and Auckland Islands.
,, *purpuriceps*, Rich.
,, *tesselata*, Rich (?). Recorded from Falkland Islands.

The following species might perhaps be included among the Kerguelen fauna, but their habitats are only vaguely specified :—

Corals :
Errina fissurata, Gray. Antarctic Ocean.

Siphonophora :
Armenista antarctica (Eschscholtz). Antarctic Ocean ; also Indian Ocean and Cape of Good Hope.

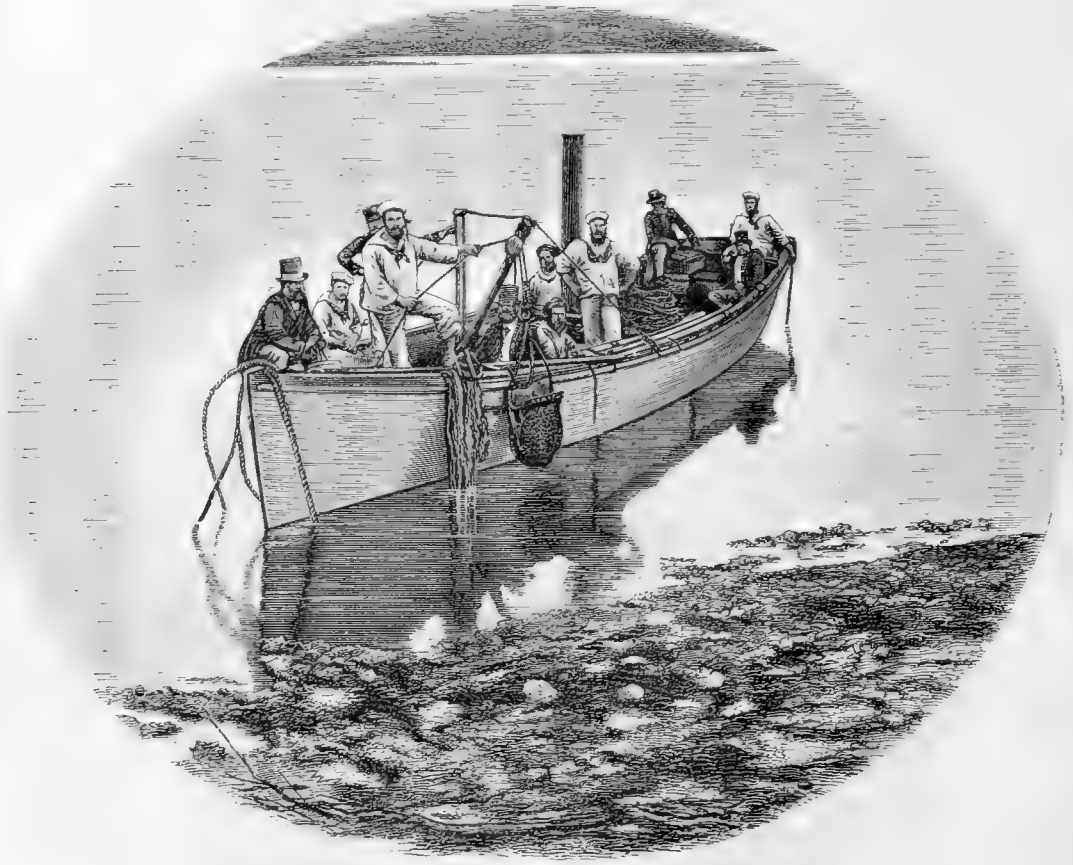
Holothurioidea :
Ocnus [= *Cucumaria*] *vicarius*, Bell. Antarctic Sea.

Cirripedia :
Coronula balænaris (Gmelin). Attached to whales in the Southern Ocean.

Fishes :
Notothenia phocæ, Rich. "Eismeer" (according to Pfeffer).

[1] Busk records *Membranipora spinosa* (Quoy and Gaimard) from Kerguelen in the Transit of Venus Report, and in the Challenger Report he gives *Membranipora spinosa*, d'Orbigny, from Australia and South Patagonia, but he makes no mention of Kerguelen.

The foregoing enumeration (List V.) of species recorded from Kerguelen, from sources other than the Challenger Expedition, includes about 112 species belonging to about 87 genera. Some of these species require verification, but looking upon them for the present as authentic, and adding them to the Challenger List (List IV.), we should have a total of 645 species of Metazoa, belonging to 371 genera, recorded from the shallow waters of the Kerguelen Region in depths not exceeding 150 fathoms. The proportion of genera to species would thus be as 1 to 1·74, while the proportion of genera to species in List IV. is as 1 to 1·64, due to the fact that, while all the species in List V. are distinct from those in List IV., about half the genera in List V. are already included in List IV.



Dredging in Shallow Water from the Steam Pinnace of H.M.S. Challenger.

LIST VI.

IDENTICAL AND CLOSELY-ALLIED SPECIES FOUND IN THE EXTRA-TROPICAL REGIONS OF THE NORTHERN AND SOUTHERN HEMISPHERES, AND UNKNOWN HITHERTO WITHIN THE TROPICS.

Frequent reference has been made in the foregoing pages to the identity and close resemblance of species recorded from the extra-tropical regions of the Northern and Southern Hemispheres, which, however, up to the present time, are unknown from the intervening tropical zone. For the information of those interested in the subject, the names of the identical and closely-allied species[1] which show this peculiar distribution are brought together in the following lists.

In the first place we give a list of 90 identical species from the Northern and Southern Hemispheres unrecorded from within the tropics:—

MONAXONIDA :

Axinella erecta.
Halichondria sanguinea.
Isodictya rosea.
Myxilla plumosa.
Suberites carnosus.

HEXACTINELLIDA :

Aulocalyx irregularis.
Chonelasma lamella.

CALCAREA :

Sycon capillosum.

ACTINIARIA :

Cereus spinosus.
Liponema multiporum.

CORALS :

Flabellum apertum.

[1] For further species known only from north and south of the tropics, and unrecorded from the intervening tropics, which do not come within the scope of this paper, see Challenger Report, Summary of Results, pp. 1446-1449.

HYDROIDA :

Campanularia cylindrica.
Eudendrium rameum.
Obelia geniculata.

CRINOIDEA :

Antedon abyssicola.

ASTEROIDEA :

Dytaster exilis.
Pontaster forcipatus.

OPHIUROIDEA :

Ophiacantha rosea.
Ophiernus vallincola.
Ophiocten hastatum.
„ *sericeum.*
Ophioglypha bullata.
„ *irrorata.*

ECHINOIDEA :

Phormosoma hoplacantha.
Pourtalesia phiale.

HOLOTHURIOIDEA :

Elpidia glacialis.
Euphronides depressa.
Holothuria thomsoni.
Kolga nana.
Lætmogone wyville-thomsoni.

NEMERTEA :

Drepanophorus serraticollis.
Pelagonemertes rollestoni.

ANNELIDA :

Artacama proboscidea.
Eunice ærstedi.
Eupista darwini.
Placostegus ornatus.
Terebellides strœmi.

OSTRACODA :

Cythere irpex.
„ *suhmi.*
Krithe tumida.
Paradoxostoma abbreviatum.
Pseudocythere caudata.
Sclerochilus contortus.
Xestoleberis depressa.
„ *expansa.*

COPEPODA :

Harpacticus fulvus.

CIRRIPEDIA :

Scalpellum velutinum.

AMPHIPODA :

Eusirus longipes.
Podocerus falcatus.
„ *tuberculatus.*

ISOPODA :

Eurycope fragilis.
Neotanais americanus.
Typhlotanais kerguelenensis.

SCHIZOPODA :

Boreomysis scyphops.
Gnathophausia gigas.

MACRURA :

Glyphocrangon rimapes.

ANOMURA :

Munidopsis antonii.
„ *subsquamosa.*

LAMELLIBRANCHIATA :

Glomus nitens.
Kellia suborbicularis.
Mytilus edulis.

Scaphopoda and Gasteropoda :

Dentalium keras.
Homalogyra atomus.
Ianthina rotundata.
Natica (Lunatia) grönlandica.
Odostomia rissoïdes.
Puncturella noachina.
Trochus (Margarita) infundibulum.

Nudibranchiata :

? *Doris tuberculata.*

Polyzoa :

Cribrilina monoceros.
Crisia eburnea.
Diachoris magellanica.
Escharoides verruculata.
Hornera lichenoides.
,, *violacea.*
Idmonea atlantica.
,, *marionensis.*
,, *milneana.*
Kinetoskias cyathus.
Membranipora crassimarginata
,, *galeata.*
Pustulopora deflexa.
,, *delicatula.*
,, *proboscidea.*
,, *proboscidioides.*

Brachiopoda :

Platydia anomioides.

Tunicata :

Pyrosoma spinosum.

Fishes :

Halosaurus macrochir.
Stomias boa.
Synaphobranchus bathybius.

LIST VI *a*.

In addition to the identical species noted in the preceding list as having been recorded from both the Northern and Southern Hemispheres and unknown in the intervening tropical zone, we give now, in the second place, a list of representative or apparently closely-allied species occurring in northern and southern waters respectively, and so far as is known not recorded from the tropics.

Southern Species.	Northern Representatives.
Monaxonida :	
Amphilectus apollinis.	*Artemisina suberitoides.*
Desmacidon (H.) kerguelenensis.	*Desmacidon (H.) palmata.*
Gellius flagellifer.	*Gellius vagabundus* of Vosmaer.
Iophon chelifer.	*Iophon piceum.*
Myxilla nobilis.	*Myxilla paupertas.*
Pachychalina pedunculata.	*Pachychalina caulifera.*
Phakellia papyracea.	*Cribrochalina ambigua.* / *Isodictya infundibuliformis.*
Hexactinellida :	
Caulophacus latus.	*Caulophacus elegans.*
Crinoidea :	
Antedon exigua.	*Antedon tenella.*
Asteroidea :	
Leptoptychaster antarcticus.	*Leptoptychaster arcticus.*
Porania antarctica.	*Porania pulvillus.*
Pteraster affinis.	*Pteraster militaris.*
Solaster subarcuatus.	*Solaster endeca.*
Ophiuroidea :	
Ophiacantha imago.	*Ophiacantha anomala.*
Ophioglypha hexactis.	*Ophioglypha sarsii.*
„ *meridionalis.*	„ *robusta.*
Annelida :	
Lumbriconereis kerguelensis.	*Lumbriconereis nardonis.*
Nereis (P.) eatoni.	*Nereis dumerilii.*

Southern Species.	Northern Representatives.
Ostracoda :	
Cythere forcolata.	*Cythere borealis.*
„ *kerguelenensis.*	„ *albomaculata.*
Cytheropteron assimile.	*Cytheropteron latissimum.*
„ *scaphoides.*	„ *subcircinatum.*
Cytherura lilljeborgi.	*Cytherura clathrata.*
Cirripedia :	
Balanus corolliformis.	*Balanus hirsutus.*
Amphipoda :	
Amphilochus marionis.	*Amphilochus tenuimanus.*
Andania abyssorum.	*Andania abyssi.*
Euthemisto thomsoni.	*Euthemisto bispinosa.*
Liljeborgia consanguinea.	*Liljeborgia pallida.*
Metopa nasutigenes.	*Metopa nasuta.*
Orchomene abyssorum. }	*Orchomene musculosus.*
„ *cavimanus.* }	
Pardalisca marionis.	*Pardalisca cuspidata.*
Isopoda :	
Leptognathia australis.	*Leptognathia longiremis.*
Pleurogonium albidum. }	*Pleurogonium rubicundum*
„ *serratum.* }	
Cumacea :	
Campylaspis nodulosa.	*Campylaspis verrucosa.*
Diastylis horrida.	*Diastylis lucifera.*
Leucon assimilis.	*Leucon nasicus.*
Anomura :	
Lithodes murrayi.	*Lithodes maia.*
Pycnogonida :	
Colossendeis megalonyx.	*Colossendeis proboscidea.*
Nymphon brachyrhynchus.	*Nymphon strœmii.*
„ *brevicaudatum.*	„ *brevitarse.*
„ *gracilipes.*	„ *grossipes.*

Southern Species.	Northern Representatives.
Lamellibranchiata :	
Cardita astartoides.	*Cardita borealis.*
Cryptodon marionensis.	*Cryptodon flexuosus.*
	„ *gouldii.*
Neæra fragilissima.	*Neæra curta.*
Thracia meridionalis.	*Thracia truncata.*
Gasteropoda :	
Natica fartilis.	*Natica affinis.*
„ (*A.*) *suturalis.*	„ *islandica.*
Trophon declinans.	*Trophon truncatus.*
Turritella austrina.	*Turritella terebra.*
Cephalopoda :	
Bathyteuthis abyssicola.	*Bentheoteuthis megalops.*
Tunicata :	
Ascidia challengeri.	*Ascidia mentula.*
Fishes :	
Bathysaurus ferox.	*Bathysaurus agassizii*
Haplochitonidæ.	Salmonoids.
Chænichthys. }	Cottoids.
Notothenia. }	

Cythere dictyon, Brady. A cosmopolitan species, taken in the Kerguelen Region both in deep and in shallow water.

LIST VII.

Foraminifera observed in the Deposits from the Kerguelen Region at various Depths.

The following species of Foraminifera were observed in the deposits obtained in the Southern Indian Ocean during the cruise of the Challenger between the Cape of Good Hope and Australia to the south of lat. 40° S., viz. :—Station 144, 1570 fathoms; Station 146, 1375 fathoms; Station 149 (Kerguelen), 20 to 120 fathoms; Station 150, 150 fathoms; Station 151 (Heard Island), 75 fathoms; Station 153, 1675 fathoms; Station 157, 1950 fathoms; Station 158, 1800 fathoms; and Station 160, 2600 fathoms. The pelagic species are indicated by an asterisk *.

Nubecularia inflata, Brady.
Biloculina bulloides, d'Orbigny.
„ *depressa*, d'Orbigny.
„ „ var. *murrhyna*, Schwager.
„ „ var. *serrata*, Brady.
„ *elongata*, d'Orbigny.
„ *irregularis*, d'Orbigny.
„ *ringens* (Lamarck).
„ *sphæra*, d'Orbigny.
„ *tubulosa*, Costa.
Spiroloculina planulata (Lamarck).
„ *tenuis* (Czjzek).
Miliolina auberiana (d'Orbigny).
„ *bucculenta*, Brady.
„ *circularis* (Bornemann).
„ *fichteliana* (d'Orbigny).
„ *oblonga* (Montagu).
„ *seminulum* (Linné).
„ *subrotunda* (Montagu).
„ *venusta* (Karrer).
Articulina funalis, Brady.
„ „ var. *inornata*, Brady.
Ophthalmidium inconstans, Brady.
Planispirina celata (Costa).
Cornuspira foliacea (Philippi).
„ *involvens*, Reuss.
Orbitolites tenuissima, Carpenter.
Keramosphæra murrayi, Brady.
Astrorhiza angulosa, Brady.
„ *arenaria*, Norman.
„ *crassatina*, Brady.
„ *granulosa*, Brady.
„ sp. (?).
Pelosina cylindrica, Brady.
Pelosina rotundata, Brady.
Storthosphæra sp. (?).
Technitella legumen, Norman.
Bathysiphon filiformis, Sars.
Psammosphæra fusca, Schulze.
Saccammina sphærica, Sars.
Jaculella obtusa, Brady.
Hyperammina elongata, Brady.
„ *ramosa*, Brady.
„ *vagans*, Brady.
Marsipella cylindrica, Brady.
Rhabdammina abyssorum, Sars.
„ *discreta*, Brady.
Aschemonella catenata (Norman).
„ *ramuliformis*, Brady.
Rhizammina algæformis, Brady.
Reophax adunca, Brady.
„ *ampullacea*, Brady.
„ *cylindrica*, Brady.
„ *dentaliniformis*, Brady.
„ *difflugiformis*, Brady.
„ *distans*, Brady.
„ *fusiformis* (Williamson).
„ *guttifera*, Brady.
„ *nodulosa*, Brady.
„ *pilulifera*, Brady.
„ *scorpiurus*, Montfort.
„ *spiculifera*, Brady.
Haplophragmium agglutinans (d'Orbigny).
„ *canariense* (d'Orbigny).
„ *foliaceum*, Brady.
„ *globigeriniforme* (Parker and Jones).
„ *glomeratum*, Brady.

Haplophragmium latidorsatum (Bornemann).
„ *nanum*, Brady.
„ *rotulatum*, Brady.
„ *scitulum*, Brady.
„ *turbinatum*, Brady.
Placopsilina bulla, Brady.
„ *cenomana* (d'Orbigny).
„ *vesicularis*, Brady.
Thurammina albicans, Brady.
„ *compressa*, Brady.
„ *papillata*, Brady.
Hormosina carpenteri, Brady.
„ *ovicula*, Brady.
Ammodiscus charoides (Jones and Parker).
„ *gordialis* (Jones and Parker).
„ *schoneanus*, Siddall.
„ *tenuis*, Brady.
Trochammina galeata, Brady.
„ *lituiformis*, Brady.
„ *pauciloculata*, Brady.
„ *trullissata*, Brady.
Webbina clavata, Jones and Parker.
„ *hemisphærica*, Jones, Parker, and Brady.
Cyclammina cancellata, Brady.
„ *orbicularis*, Brady.
„ *pusilla*, Brady.
Textularia concava (Karrer).
Verneuilina pygmæa (Egger).
Gaudryina pupoides, d'Orbigny.
Clavulina communis, d'Orbigny.
Bulimina aculeata, d'Orbigny.
„ *marginata*, d'Orbigny.
„ *rostrata*, Brady.
„ *subteres*, Brady.
Virgulina schreibersiana, Czjzek.
„ *squamosa*, d'Orbigny
„ *subdepressa*, Brady.
Bolivina punctata, d'Orbigny.
„ *reticulata*, Hantken.
Pleurostomella brevis, Schwager.
„ (?) sp.
Cassidulina bradyi, Norman.
„ *crassa*, d'Orbigny.
„ *lævigata*, d'Orbigny.
„ *subglobosa*, Brady.
Ehrenbergina serrata, Reuss.
Lagena acuta (Reuss).
„ *acuticosta*, Reuss.
„ *alveolata*, Brady.
„ „ var. *substriata*, Brady.
„ *apiculata*, Reuss.
„ *auriculata*, Brady.
„ *botelliformis*, Brady.
Lagena clavata (d'Orbigny).
„ *distoma*, Parker and Jones.
„ *exsculpta*, Brady.
„ *feildeniana*, Brady.
„ *fimbriata*, Brady.
„ *formosa*, Schwager.
„ „ var. *favosa*, Brady.
„ *globosa* (Montagu).
„ *gracilis*, Williamson.
„ *gracillima* (Seguenza).
„ *hertwigiana*, Brady.
„ *hexagona* (Williamson).
„ *interrupta*, Williamson.
„ *lævigata* (Reuss).
„ *lævis* (Montagu).
„ *lineata* (Williamson).
„ *longispina*, Brady.
„ *marginata* (Walker and Boys).
„ „ var. *semimarginata*, Reuss.
„ *orbignyana* (Seguenza).
„ *quadralata*, Brady.
„ *quadricostulata*, Reuss.
„ *semistriata*, Williamson.
„ *squamosa* (Montagu).
„ *staphyllearia* (Schwager).
„ *stelligera*, Brady.
„ *striata* (d'Orbigny).
„ *sulcata* (Walker and Jacob).
„ *truncata*, Brady.
Nodosaria calomorpha, Reuss.
„ *communis*, d'Orbigny.
„ *mucronata*, Neugeboren.
„ *obliqua* (Linné).
„ *roemeri* (Neugeboren).
„ (*Glandulina*) *lævigata*, d'Orbigny.
„ („) *rotundata*, Reuss.
„ sp. (?).
Marginulina costata (Batsch).
Vaginulina legumen (Linné).
„ *linearis* (Montagu).
Cristellaria convergens, Bornemann.
„ *crepidula* (Fichtel and Moll).
„ *cultrata* (Montfort).
„ sp. (?).
Polymorphina angusta, Egger.
„ *lanceolata*, Reuss.
„ *sororia*, Reuss.
„ „ var. *cuspidata*, Brady.
„ *thouini*, d'Orbigny.
Uvigerina aculeata, d'Orbigny.
„ *angulosa*, Williamson.
„ *asperula*, Czjzek.
„ *brunnensis*, Karrer.

Uvigerina pygmæa, d'Orbigny.
„ *tenuistriata*, Reuss.
„ sp. (?).
Sagrina raphanus, Parker and Jones.
**Globigerina bulloides*, d'Orbigny.
* „ „ var. *triloba*, Reuss.
* „ *dubia*, Egger.
* „ *dutertrei*, d'Orbigny.
* „ *inflata*, d'Orbigny.
**Orbulina universa*, d'Orbigny.
**Pullenia obliquiloculata*, Parker and Jones.
„ *quinqueloba*, Reuss.
„ *sphæroides* (d'Orbigny).
Sphæroidina bulloides, d'Orbigny.
Spirillina decorata, Brady.
„ *limbata*, Brady.
„ *obconica*, Brady.
„ *tuberculata*, Brady.
„ *vivipara*, Ehrenberg.
Patellina corrugata, Williamson.
Discorbina araucana (d'Orbigny).
„ *parisiensis* (d'Orbigny).
„ *rosacea* (d'Orbigny).
„ *vilardeboana* (d'Orbigny).
Truncatulina akneriana (d'Orbigny).
„ *haidingerii* (d'Orbigny).
„ *lobatula*, Walker and Jacob.
„ *pygmæa*, Hantken.
„ *tenera*, Brady.
„ *ungeriana* (d'Orbigny).
„ *wuellerstorfi* (Schwager).
Anomalina grosserugosa (Gümbel).
**Pulvinulina crassa* (d'Orbigny).
„ *elegans* (d'Orbigny).
„ *exigua*, Brady.
* „ *micheliniana* (d'Orbigny).
* „ *patagonica* (d'Orbigny).
„ *pauperata*, Parker and Jones.
„ *umbonata*, Reuss.
Rotalia orbicularis, d'Orbigny.
„ *soldanii*, d'Orbigny.
Nonionina depressula (Walker and Jacob).
„ *pompilioides* (Fichtel and Moll).
„ *umbilicatula* (Montagu).
Polystomella crispa (Linné).
„ *macella* (Fichtel and Moll).
„ *striatopunctata* (Fichtel and Moll).

In the foregoing list, 220 species and varieties of Foraminifera are enumerated, belonging to 63 genera; the number of pelagic species amounts to 10, or less than 5 per cent. of the total number. It may be pointed out that the total number of species observed in the deposits from all these different depths in the Kerguelen Region does not equal the number of species in the deposit collected off Raine Island, Torres Strait. Generally speaking, in the shallow waters of the tropics the genera and species of Foraminifera, especially those which secrete carbonate of lime, are more abundant than in the colder regions north and south.

118	species	(or 54	per cent.)	were taken	each	at a single	Station,
38	„	(„ 17	„)	„	„	two	Stations,
26	„	(„ 12	„)	„	„	three	„
19	„	(„ 9	„)	„	„	four	„
10	„	(„ 4	„)	„	„	five	„
3	„	(„ 1	„)	„	„	six	„
4	„	(„ 2	„)	„	„	seven	„
2	„	(„ 1	„)	„	„	eight	„
220	„	100	„				

LIST VII *a*.

The following is a list of those species taken at more than one Station, the number of Stations being indicated in brackets after the name :—

Biloculina depressa (7).
„ „ var. *murrhyna* (3).
„ *elongata* (2).
„ *irregularis* (2).
„ *ringens* (3).
„ *sphæra* (5).
Spiroloculina tenuis (2).
Miliolina auberiana (2).
Miliolina circularis (2).
„ *oblonga* (3).
„ *seminulum* (5).
„ *venusta* (3).
Articulina funalis (2).
Ophthalmidium inconstans (2).
Astrorhiza angulosa (2).
Pelosina cylindrica (2).
Psammosphæra fusca (4).
Saccammina sphærica (3).
Hyperammina ramosa (3).
„ *vagans* (3).
Marsipella cylindrica (2).
Rhabdammina abyssorum (3).
Rhizammina algæformis (5).
Reophax adunca (3).
„ *dentaliniformis* (3).
„ *difflugiformis* (4).
„ *distans* (3).
„ *guttifera* (2).
„ *nodulosa* (2).
„ *pilulifera* (3).
„ *scorpiurus* (7).
Haplophragmium agglutinans (2).
„ *canariensis* (2).
„ *globigeriniforme* (4)
„ *latidorsatum* (4).
„ *turbinatum* (4).
Thurammina papillata (3).
Hormosina ovicula (2).
Ammodiscus charoides (4).
Trochammina pauciloculata (2).
„ *trullissata* (4).
Webbina clavata (5).
Verneuilina pygmæa (4).
Gaudryina pupoides (4).
Clavulina communis (5).
Bulimina aculeata (2).
Virgulina schreibersiana (2).
Bolivina punctata (2).
Cassidulina crassa (6).
„ *lævigata* (2).
„ *subglobosa* (6).
Lagena acuta (3).
„ *acuticosta* (2).
„ *alveolata* (2).
„ *globosa* (3).
„ *gracilis* (2).
„ *gracillima* (3).
„ *interrupta* (2).
„ *lævigata* (8).
„ *lævis* (7).
„ *lineata* (2).
„ *longispina* (2).
„ *marginata* (4).
„ *orbignyana* (2).
„ *squamosa* (3).
„ *staphyllearia* (3).
„ *stelligera* (3).
„ *striata* (4).
„ *sulcata* (5).
Nodosaria communis (3).
Vaginulina legumen (2).
Polymorphina angusta (2).
„ *lanceolata* (2).
„ *sororia* (2).
Uvigerina angulosa (3).
„ *asperula* (5).
„ *pygmæa* (4).
Globigerina bulloides (8).
„ *dutertrei* (3).
„ *inflata* (5).
Orbulina universa (4).
Pullenia quinqueloba (7).
„ *sphæroides* (4).
Sphæroidina bulloides (5).
Patellina corrugata (2).
Discorbina araucana (2).
„ *parisiensis* (2).
Truncatulina haidingerii (2).
„ *lobatula* (6).
„ *pygmæa* (4).
„ *tenera* (2).
„ *ungeriana* (3).
„ *wuellerstorfi* (3).
Anomalina grosserugosa (2).
Pulvinulina crassa (4).
„ *exigua* (3).
„ *micheliniana* (5).
„ *patagonica* (4).
Rotalia soldanii (4).
Nonionina pompilioides (4).
„ *umbilicatula* (3).
Polystomella striatopunctata (2).

In List VII. are included 6 unnamed species, which must be excluded in any discussion of distribution; there are, besides, 8 varieties enumerated as well as the species to which they belong, leaving altogether 206 distinct species, the distribution of which may be examined in detail.

4 species (or 2 per cent. of the total number) are known to occur only to the *south* of the southern tropic;

7 species (or 3 per cent. of the total number) extend *within* (but not north of) the tropics;

16 species (or 7 per cent. of the total number) are found to the *north* of (but not within) the tropics; and

179 species (or 82 per cent. of the total number) are known *both* from tropical and extra-tropical regions.

LIST VII *b*.

The following is a list of the 4 species recorded only from the south of the tropics, 2 of which are known only from the area under consideration, the remaining 2 extending into the South Atlantic and South Pacific, as indicated :—

Keramosphæra murrayi—Known only from this area.
Reophax ampullacea—Known only from this area.
Cyclammina orbicularis—Known outside this area from South Pacific and South Atlantic, 1100 and 1900 fathoms.
Lagena quadralata—Known outside this area from South Atlantic, 2200 fathoms.

LIST VII *c*.

The following is a list of the 7 species known from within (but not recorded to the north of) the tropics, the distribution of each species outside the area under consideration being briefly indicated :—

Nubecularia inflata—Islands of tropical Pacific (Tonga, Tahiti, Admiralty, Sandwich), 17 to 420 fathoms.
Miliolina circularis—Bass Strait and Admiralty Islands, 15 to 150 fathoms.
Bolivina reticulata—Tropical and South Atlantic and tropical Pacific, 130 to 1425 fathoms.
Pleurostomella brevis—Tropical Pacific (Ki Islands), 129 fathoms.
Lagena botelliformis—Tropical and South Atlantic and South Pacific, shallow water to 2350 fathoms.
Uvigerina aculeata—South Atlantic, South and tropical Pacific, 240 to 1975 fathoms.
Spirillina obconica—Tropical Pacific (Admiralty Islands), 17 fathoms.

LIST VII *d*.

The following is a list of the 16 species known from the north of the northern tropic but not recorded from between the tropics, the distribution of each species outside the area under consideration being briefly indicated :—

Orbitolites tenuissima—North Atlantic and Mediterranean, 64 to 1700 fathoms.
Astrorhiza angulosa—South Pacific and North Atlantic, 410 to 1000 fathoms.
„ *arenaria*—North and South Atlantic and South Pacific, 150 to 650 fathoms.
„ *crassatina*—Faroe Channel, 640 fathoms.
„ *granulosa*—North Atlantic, 1000 and 1700 fathoms.
Reophax cylindrica—North Atlantic and North Pacific, 1750 and 1875 fathoms.
Placopsilina bulla—North and South Atlantic and South Pacific, 410 to 2160 fathoms.
vesicularis—North and South Atlantic and South Pacific, 410 to 1900 fathoms.

Thurammina albicans—North and South Pacific and South Atlantic, 1825 to 2050 fathoms.
„ *compressa*—North Atlantic, 630 fathoms.
Ammodiscus schoneanus—North Atlantic and North Pacific, shallow water to 3950 fathoms.
Webbina hemisphærica—North and South Atlantic and South Pacific, 25 to 1900 fathoms.
Lagena lineata—North and South Atlantic, North and South Pacific, shore to 1875 fathoms.
Polymorphina thouini—Bass Strait and Mediterranean, 38 and 90 fathoms.
Uvigerina brunnensis—North and South Pacific, South Atlantic, Magellan Strait, 245 to 2050 fathoms.
Discorbina parisiensis—North Atlantic, shallow water.

LIST VII *e*.

The following is a list of the 179 species known both from tropical and extra-tropical regions, the distribution of each species outside the area under consideration being briefly indicated:—

Biloculina bulloides—North and South Atlantic, South and tropical Pacific, shallow water to 2750 fathoms.
„ *depressa*—Cosmopolitan, shore to 3000 fathoms.
„ *elongata*—Cosmopolitan, shore to 2025 fathoms.
„ *irregularis*—North, tropical and South Atlantic, tropical Pacific, 350 to 1415 fathoms.
„ *ringens*—Cosmopolitan, shore to 3000 fathoms.
„ *sphæra*—Cosmopolitan, shallow water to 2300 fathoms.
„ *tubulosa*—North and tropical Atlantic, South and tropical Pacific, 210 to 1240 fathoms.
Spiroloculina planulata—Cosmopolitan (except Arctic), shore to 2600 fathoms.
„ *tenuis*—Cosmopolitan, shallow water to 2750 fathoms.
Miliolina auberiana—Mediterranean, North and tropical Atlantic, Magellan Strait, tropical Pacific, shallow water to 2435 fathoms.
„ *bucculenta*—Arctic, North and tropical Atlantic, 390 to 1785 fathoms.
„ *fichteliana*—North and tropical Atlantic, Indian Ocean, North Pacific, shore and shallow water.
„ *oblonga*—Cosmopolitan, shore to 3000 fathoms.
„ *seminulum*—Cosmopolitan, shore to 3000 fathoms.
„ *subrotunda*—Arctic, North, tropical and South Atlantic, tropical Pacific, shore to 150 fathoms.
„ *venusta*—North, tropical and South Atlantic, North, tropical and South Pacific, 150 to 2740 fathoms.
Articulina funalis—North Atlantic and tropical Pacific, 37 to 950 fathoms.
Ophthalmidium inconstans—North, tropical and South Atlantic, North, tropical and South Pacific, 100 to 2300 fathoms.
Planispirina celata—Cosmopolitan, 28 to 1630 fathoms.
Cornuspira foliacea—Cosmopolitan, shallow water to 1500 fathoms.
„ *involvens*—Cosmopolitan, 7 to 1900 fathoms.
Pelosina cylindrica—North, tropical and South Atlantic, North, tropical and South Pacific, 620 to 2900 fathoms.
„ *rotundata*—North and tropical Atlantic, North, tropical and South Pacific, 350 to 2050 fathoms.
Technitella legumen—North, tropical and South Atlantic, North, tropical and South Pacific, 60 to 2350 fathoms.
Bathysiphon filiformis—North, tropical and South Atlantic, North, tropical and South Pacific, 410 to 1900 fathoms.
Psammosphæra fusca—North, tropical and South Atlantic, North, tropical and South Pacific, 45 to 2800 fathoms.
Saccammina sphærica—Arctic, North and tropical Atlantic, North and South Pacific, 89 to 2050 fathoms.
Jaculella obtusa—North and tropical Atlantic, North Pacific, 350 to 1875 fathoms.
Hyperammina elongata—Cosmopolitan, 80 to 3124 fathoms.
„ *ramosa*—Cosmopolitan, 60 to 3000 fathoms.
„ *vagans*—Cosmopolitan, 15 to 2900 fathoms.
Marsipella cylindrica—North and South Atlantic, North, tropical and South Pacific, 210 to 1900 fathoms.
Rhabdammina abyssorum—Cosmopolitan, 108 to 2435 fathoms.
„ *discreta*—Cosmopolitan, 20 to 2475 fathoms.
Aschemonella catenata—North, tropical and South Atlantic, North, tropical and South Pacific, 390 to 2900 fathoms.
„ *ramuliformis*—North, tropical and South Atlantic, tropical and North Pacific, 1125 to 3125 fathoms.
Rhizammina algæformis—North, tropical and South Atlantic, North, tropical and South Pacific, 150 to 2900 fathoms.
Reophax adunca—North, tropical and South Atlantic, North, tropical and South Pacific, 540 to 2950 fathoms.
„ *dentaliniformis*—Cosmopolitan, 20 to over 3000 fathoms.
„ *difflugiformis*—Cosmopolitan, 55 to 3950 fathoms.

Reophax distans—North, tropical and South Atlantic, North, tropical and South Pacific, 355 to 2775 fathoms.
„ *fusiformis*—Arctic, North and South Atlantic, tropical Pacific, 40 to 1900 fathoms.
„ *guttifera*—North and South Atlantic, North, tropical and South Pacific, 540 to 2350 fathoms.
„ *nodulosa*—Cosmopolitan, shallow water to 3150 fathoms.
„ *pilulifera*—North, tropical and South Atlantic, North, tropical and South Pacific, 800 to 2900 fathoms.
„ *scorpiurus*—Cosmopolitan, 3 to 3950 fathoms.
„ *spiculifera*—Tropical Atlantic, North, tropical and South Pacific, 255 to 2350 fathoms.
Haplophragmium agglutinans—Cosmopolitan, 2 to 3125 fathoms.
„ *canariense*—Cosmopolitan, shallow water to 3950 fathoms.
„ *foliaceum*—North and South Atlantic, North, tropical and South Pacific, 345 to 2600 fathoms.
„ *globigeriniforme*—Cosmopolitan, 15 to 3950 fathoms.
„ *glomeratum*—North, tropical and South Atlantic, North, tropical and South Pacific, 14 to 2740 fathoms.
„ *latidorsatum*—Cosmopolitan, 113 to 3950 fathoms.
Haplophragmium nanum—Arctic, North, tropical and South Atlantic, Magellan Strait, North and South Pacific, 55 to 3125 fathoms.
„ *rotulatum*—North, tropical and South Atlantic, North and South Pacific, 1000 to 3150 fathoms.
„ *scitulum*—North, tropical and South Atlantic, Magellan Strait, North and South Pacific, 400 to 2900 fathoms.
„ *turbinatum*—North, tropical and South Atlantic, North and tropical Pacific, 150 to 2450 fathoms.
Placopsilina cenomana—North, tropical and South Atlantic, Mediterranean, Gulf of Suez, tropical Pacific, 3 to 1900 fathoms.
Thurammina papillata—Cosmopolitan, 45 to 2740 fathoms.
Hormosina carpenteri—North and tropical Atlantic, tropical and South Pacific, 54 to 1940 fathoms.
„ *ovicula*—North and South Atlantic, tropical and North Pacific, 1070 to 3950 fathoms.
Ammodiscus charoides—North, tropical and South Atlantic, Mediterranean, Red Sea, North, tropical and South Pacific, shallow water to 2575 fathoms.
„ *gordialis*—Cosmopolitan, 55 to 3125 fathoms.
„ *tenuis*—North and tropical Atlantic, Magellan Strait, North, tropical and South Pacific, 210 to 2350 fathoms.
Trochammina galeata—North, tropical and South Atlantic, North, tropical and South Pacific, 390 to 2750 fathoms.
„ *lituiformis*—North and tropical Atlantic, tropical and South Pacific, 390 to 2350 fathoms.
„ *pauciloculata*—North, tropical and South Atlantic, North, tropical and South Pacific, 173 to 3950 fathoms.
„ *trullissata*—North, tropical and South Atlantic, North, tropical and South Pacific, 390 to 3950 fathoms.
Webbina clavata—North, tropical and South Atlantic, Mediterranean, North, tropical and South Pacific, 90 to 2000 fathoms.
Cyclammina cancellata—North, tropical and South Atlantic, Magellan Strait, Mediterranean, North, tropical and South Pacific, 75 to 2900 fathoms.
„ *pusilla*—North, tropical and South Atlantic, North Pacific, 390 to 2050 fathoms.
Textularia concava—North, tropical and South Atlantic, Magellan Strait, tropical and South Pacific, 17 to 2750 fathoms.
Verneuilina pygmæa—North, tropical and South Atlantic, North, tropical and South Pacific, 129 to 3125 fathoms.
Gaudryina pupoides—North, tropical and South Atlantic, North, tropical and South Pacific, 129 to 2425 fathoms.
Clavulina communis—North, tropical and South Atlantic, Magellan Strait, North, tropical and South Pacific, 147 to 2300 fathoms.
Bulimina aculeata—North, tropical and South Atlantic, North, tropical and South Pacific, shallow water to 2740 fathoms.
„ *marginata*—North, tropical and South Atlantic, Magellan Strait, North, tropical and South Pacific, shallow to 1630 fathoms.
„ *rostrata*—North, tropical and South Atlantic, tropical Pacific, 580 to 1570 fathoms.
„ *subteres*—Arctic, North, tropical and South Atlantic, North, tropical and South Pacific, 28 to 1875 fathoms.
Virgulina schreibersiana—Cosmopolitan, 10 to 3000 fathoms.
„ *squamosa*—Cosmopolitan, 30 to 3000 fathoms.
„ *subdepressa*—North, tropical and South Atlantic, North and South Pacific, 1375 to 2350 fathoms.
Bolivina punctata—Cosmopolitan, 2 to 2750 fathoms.
Cassidulina bradyi—North and tropical Atlantic, Magellan Strait, North, tropical and South Pacific, 90 to 2050 fathoms.
„ *crassa*—Cosmopolitan, 40 to 2760 fathoms.
„ *lævigata*—Cosmopolitan, 60 to 1600 fathoms.
„ *subglobosa*—North, tropical and South Atlantic, North, tropical and South Pacific, 12 to 2950 fathoms.
Ehrenbergina serrata—North, tropical and South Atlantic, North, tropical and South Pacific, 150 to 2350 fathoms.
Lagena acuta—Cosmopolitan, 2 to 3125 fathoms.
„ *acuticosta*—Cosmopolitan, shore to 2750 fathoms.
„ *alveolata*—North and South Atlantic, North, tropical and South Pacific, 150 to 2740 fathoms.

Lagena apiculata—Cosmopolitan, shore to 2750 fathoms.
„ *auriculata*—North, tropical and South Atlantic, North, tropical and South Pacific, 620 to 2750 fathoms.
„ *clavata*—Cosmopolitan, shore to 2435 fathoms.
„ *distoma*—North, tropical and South Atlantic, Magellan Strait, North, tropical and South Pacific, shallow to 1900 fathoms.
„ *exsculpta*—North and South Atlantic, North, tropical and South Pacific, 800 to 2600 fathoms.
„ *feildeniana*—Arctic, North and South Atlantic, North, tropical and South Pacific, 45 to 2300 fathoms.
„ *fimbriata*—North Atlantic, North, tropical and South Pacific, 580 to 2300 fathoms.
„ *formosa*—North, tropical and South Atlantic, North, tropical and South Pacific, 50 to 2750 fathoms.
„ *globosa*—Cosmopolitan, shore to over 3000 fathoms.
„ *gracilis*—Cosmopolitan, shallow water to 2775 fathoms.
„ *gracillima*—Cosmopolitan, shallow water to 2300 fathoms.
„ *hertwigiana*—North Atlantic, tropical Pacific, 150 to 200 fathoms.
„ *hexagona*—Cosmopolitan, shallow water to 2300 fathoms.
„ *interrupta*—Cosmopolitan, shore to 2750 fathoms.
„ *lævigata*—Cosmopolitan, 2 to 3125 fathoms.
„ *lævis*—Cosmopolitan, shore to 2435 fathoms.
„ *longispina*—Cosmopolitan, 1070 to 2740 fathoms.
„ *marginata*—Cosmopolitan, shore to 3125 fathoms.
„ *orbignyana*—Cosmopolitan, shallow water to over 3000 fathoms.
„ *quadricostulata*—Tropical and South Atlantic, North, tropical and South Pacific, 410 to 2325 fathoms.
„ *semistriata*—Cosmopolitan, shore to 2750 fathoms.
„ *squamosa*—Cosmopolitan, shallow water to 2300 fathoms.
„ *staphyllearia*—North, tropical and South Atlantic, North, tropical and South Pacific, shallow to 2750 fathoms.
„ *stelligera*—North, tropical and South Atlantic, North, tropical and South Pacific, 20 to 2740 fathoms.
„ *striata*—Cosmopolitan, shallow water to 2600 fathoms.
„ *sulcata*—Cosmopolitan, shore to 2750 fathoms.
„ *truncata*—North, tropical and South Atlantic, tropical and South Pacific, 1825 to 2740 fathoms.
Nodosaria calomorpha—North, tropical and South Atlantic, tropical Pacific, 6 to 2200 fathoms.
„ *communis*—Cosmopolitan, shore to 3000 fathoms.
„ *mucronata*—North, tropical and South Atlantic, Mediterranean, North, tropical and South Pacific, shallow to 2600 fathoms.
„ *obliqua*—Cosmopolitan, shallow water to 2000 fathoms.
„ *roemeri*—Cosmopolitan, shore to 3000 fathoms.
„ (*Glandulina*) *lævigata*—Cosmopolitan, 7 to 1360 fathoms.
„ („) *rotundata*—Cosmopolitan, 7 to 1360 fathoms.
Marginulina costata—North, tropical and South Atlantic, Mediterranean, South Pacific, shallow to 2350 fathoms.
Vaginulina legumen—Cosmopolitan, shallow water to over 2000 fathoms.
„ *linearis*—North, tropical and South Atlantic, shallow water to 435 fathoms.
Cristellaria convergens—North, tropical and South Atlantic, North, tropical and South Pacific, 16 to 2740 fathoms.
„ *crepidula*—Arctic, North and tropical Atlantic, North, tropical and South Pacific, 6 to 2350 fathoms.
„ *cultrata*—Cosmopolitan, shallow water to 2435 fathoms.
Polymorphina angusta—North, tropical and South Atlantic, North, tropical and South Pacific, shallow to 2400 fathoms.
„ *lanceolata*—North, tropical and South Atlantic, North, tropical and South Pacific, shallow to 2350 fathoms.
„ *sororia*—Cosmopolitan, shallow water to 2350 fathoms.
Uvigerina angulosa—Cosmopolitan, 8 to 1630 fathoms.
„ *asperula*—North, tropical and South Atlantic, North, tropical and South Pacific, 37 to 2600 fathoms.
„ *pygmæa*—Cosmopolitan, 2 to 2600 fathoms.
„ *tenuistriata*—North and South Atlantic, Magellan Strait, North, tropical and South Pacific, 40 to 2600 fathoms.
Sagrina raphanus—North and tropical Atlantic, Indian Ocean, North, tropical and South Pacific, shore to 260 fathoms.
Globigerina bulloides—Cosmopolitan, surface and bottom at all depths.
„ *dubia*—North, tropical and South Atlantic, North, tropical and South Pacific, surface and bottom.
„ *dutertrei*—North and tropical Atlantic, South Pacific, surface and bottom.
„ *inflata*—Cosmopolitan, surface and bottom.
Orbulina universa—Cosmopolitan, surface and bottom.
Pullenia obliquiloculata—North, tropical and South Atlantic, North, tropical and South Pacific, surface and bottom.
„ *quinqueloba*—Cosmopolitan, 20 to 2750 fathoms.
„ *sphæroides*—Cosmopolitan, shallow water to 2750 fathoms.
Sphæroidina bulloides—Cosmopolitan (except Arctic), 37 to 2600 fathoms.

Spirillina decorata—North, tropical and South Atlantic, tropical Pacific, 6 to 1900 fathoms.
„ *limbata*—North, tropical and South Atlantic, Mediterranean, North, tropical and South Pacific, 6 to 1425 fathoms.
„ *tuberculata*—North Atlantic, Magellan Strait, Indian Ocean, tropical Pacific, shallow to 400 fathoms.
„ *vivipara*—Cosmopolitan, shallow water to 620 fathoms.
Patellina corrugata—Arctic, North and South Atlantic, Mediterranean, Indian Ocean, tropical and South Pacific, 2 to 620 fathoms.
Discorbina araucana—Cosmopolitan (except Arctic), shallow water to 1375 fathoms.
„ *rosacea*—Cosmopolitan (except Arctic), shallow water to 1000 fathoms.
„ *vilardeboana*—Cosmopolitan (except Arctic), shallow water.
Truncatulina akneriana—Cosmopolitan, shore to 3000 fathoms.
„ *haidingerii*—Cosmopolitan (except Arctic), 9 to 1776 fathoms.
„ *lobatula*—Cosmopolitan, shore to 3000 fathoms.
„ *pygmæa*—North, tropical and South Atlantic, North, tropical and South Pacific, 1450 to 3125 fathoms.
„ *tenera*—North, tropical and South Atlantic, Magellan Strait, North, tropical and South Pacific, 166 to 2050 fathoms.
„ *ungeriana*—North, tropical and South Atlantic, Mediterranean, North, tropical and South Pacific, 37 to 2600 fathoms.
„ *wuellerstorfi*—North, tropical and South Atlantic, North, tropical and South Pacific, 210 to 2435 fathoms.
Anomalina grosserugosa—North, tropical and South Atlantic, North, tropical and South Pacific, 345 to 2160 fathoms.
Pulvinulina crassa—North, tropical and South Atlantic, North, tropical and South Pacific, surface and bottom.
„ *elegans*—North, tropical and South Atlantic, North, tropical and South Pacific, shore to 2000 fathoms.
„ *exigua*—North, tropical and South Atlantic, North, tropical and South Pacific, 64 to 2740 fathoms.
„ *micheliniana*—Cosmopolitan, 15 to 2950 fathoms; taken at the surface in tropical and South Atlantic, North, tropical and South Pacific.
„ *patagonica*—North, tropical and South Atlantic, North, tropical and South Pacific, 90 to 2900 fathoms; taken at the surface in South Atlantic and Magellan Strait.
„ *pauperata*—North, tropical and South Atlantic, tropical and South Pacific, 129 to 2350 fathoms.
„ *umbonata*—North, tropical and South Atlantic, North, tropical and South Pacific, 37 to 3125 fathoms.
Rotalia orbicularis—Cosmopolitan (except Arctic), 100 to 2400 fathoms.
„ *soldanii*—Cosmopolitan (except Arctic), 100 to over 2000 fathoms.
Nonionina depressula—Cosmopolitan, shallow water to 2740 fathoms.
„ *pompilioides*—North, tropical and South Atlantic, Mediterranean, North, tropical and South Pacific, 1000 to 2750 fathoms.
„ *umbilicatula*—Cosmopolitan, 30 to 3125 fathoms.
Polystomella crispa—Cosmopolitan, shore to 355 fathoms.
„ *macella*—North, tropical and South Atlantic, Indian Ocean, tropical and South Pacific, shallow water.
„ *striatopunctata*—Cosmopolitan, shallow water to over 2000 fathoms.

It will be noticed that there is an important difference in the geographical and bathymetrical distribution of this group of Protozoa from what obtains in the case of the Metazoa considered in the previous lists. 179 species or 82 per cent. of the total number recorded from the Kerguelen Region have also been found within the tropics and in the extra-tropical regions of the Northern Hemisphere, and the majority of these species have a wide range in depth. The peculiar habits of the group as well as its antiquity possibly explain this distribution.

LIST VII*f*.

Looking upon the distribution of varieties as distinct from that of the species to which they belong, the following shows the distribution outside this area of the 8 varieties represented in the area under consideration :—

Biloculina depressa, var. *murrhyna*—North, tropical and South Atlantic, North, tropical and South Pacific, 1100 to 2425 fathoms.
„ „ var. *serrata*—North and tropical Atlantic, North, tropical and South Pacific, 580 to 2350 fathoms.

Articulina funalis, var. *inornata*—Known only from this area.
Lagena alveolata, var. *substriata*—South Atlantic, tropical and South Pacific, 150 to 2350 fathoms.
„ *formosa*, var. *favosa*—Tropical Pacific, 1850 fathoms.
„ *marginata*, var. *semimarginata*—North, tropical and South Atlantic, tropical and South Pacific, 50 to 2600 fathoms.
Polymorphina sororia, var. *cuspidata*—North Atlantic, 808 to 1443 fathoms.
Globigerina bulloides, var. *triloba*—Cosmopolitan, surface and bottom.

The distribution of these species of Foraminifera may be summarised thus :—

Geographical Distribution.—It will be observed that no fewer than 71 species (or 32 per cent. of the total number) are cosmopolitan, and that other 8 species (or 4 per cent.) are almost cosmopolitan, having a world-wide distribution, except that they have not yet been recorded from the Arctic regions. The remaining species are distributed among the various regions of the oceans as follows :—

111	species	(or 50 per cent.)	are represented in	the North Atlantic.
94	„	(„ 43 „)	„	Tropical Pacific.
94	„	(„ 43 „)	„	South Pacific.
93	„	(„ 42 „)	„	South Atlantic.
87	„	(„ 40 „)	„	Tropical Atlantic.
81	„	(„ 37 „)	„	North Pacific.
14	„	(„ 6 „)	„	Magellan Strait.
13	„	(„ 6 „)	„	Mediterranean.
8	„	(„ 4 „)	„	Arctic.
7	„	(„ 3 „)	„	Indian Ocean (including Red Sea).

Bathymetrical Distribution.—It appears that a total of 178 species (or 81 per cent. of the total number) occur both in deep water over 1000 fathoms and in lesser depths, while 14 species (or 6 per cent.) are known only from deep water over 1000 fathoms, and 14 species (or 6 per cent.) are known only from depths less than 1000 fathoms; 147 species (or 67 per cent.) occur in shallow water under 150 fathoms.

LIST VII *g*.

The following are the 14 species known only from deep water over 1000 fathoms :—

Keramosphæra murrayi.
Astrorhiza granulosa.
Aschemonella ramuliformis.
Reophax cylindrica.
Haplophragmium rotulatum.
Thurammina albicans.
Hormosina ovicula.
Cyclammina orbicularis.
Virgulina subdepressa.
Lagena longispina.
Lagena quadralata.
„ *truncata.*
Truncatulina pygmæa.
Nonionina pompilioides.

LIST VII *h*.

The following are the 14 species known only from depths under 1000 fathoms, of which 6 species are known only from shallow water under 150 fathoms as indicated :—

Nubecularia inflata.
Miliolina subrotunda (shallow).
Articulina funalis.
Reophax ampullacea (shallow).
Sagrina raphanus.
Spirillina obconica (shallow).
„ *tuberculata.*
„ *vivipara.*
Patellina corrugata.
Discorbina parisiensis (shallow).
Discorbina rosacea.
„ *vilardeboana* (shallow).
Polystomella crispa.
„ *macella* (shallow).

LIST VIII.

Radiolaria observed in the Deposit and at the Surface at the Challenger Station 157 in the Southern Indian Ocean.

The following is a list of the species of Radiolaria (numbering 81 species, belonging to 63 genera) observed in the deposit from the Challenger deep-water Station 157, lat. 53° 55′ S., 1950 fathoms, in the Southern Indian Ocean.

The sediment which remains after removing the Diatoms and Foraminifera and larger mineral particles is almost entirely composed of Radiolarians, mainly belonging to a few species of Sphæroidea which make up about nine-tenths of the whole mass. By far the commonest of these Spumellaria is *Cromyosphæra antarctica*, which is probably genetically related with the very similar form, *Cromyomma perspicuum*, occurring on the surface at the same Station. Of the other Spumellaria the Discoidea are the most abundant, particularly the spongy forms (Spongodiscida, *e.g.*, *Spongodiscus*, *Spongotrochus*, *Stylotrochus*). Particularly noteworthy is a new genus, *Spongopyle*, not described in the Challenger Report; it is a Spongodiscid with a marginal osculum like that of the Porodiscid *Ommatodiscus*, which also occurs at this Station. In contrast to the large number of Sphæroidea and Discoidea, the Prunoidea and Larcoidea are present only as isolated specimens.

Very few species of Nassellaria are present, but among them the Botryodea, which are generally rare, are rather abundant, especially *Botryocella borealis* and *Botryopyle cribrosa*. The most common Cyrtoidea are a few cosmopolitan forms, for example, *Cornutella clathrata*, *Cornutella cannulata*, and *Lithomitra lineata*.

The Acantharia are only represented in this deposit by a single rare species, *Pantopelta icosaspis*.

The Phæodaria are represented by a few remarkable forms, such as *Sagenoscena penicillata*, *Aulosphæra bisternaria*, *Cannosphæra antarctica*, and *Conchasma hippurites*; all these, however, are rare.

I. Spumellaria.

a. Sphæroidea.

Cenosphæra solida, Haeckel.
„ *papillata*, Haeckel.
„ *antiqua*, Haeckel.
„ *antarctica*, Haeckel.
Carposphæra nobilis, Ehrenberg.
Thecosphæra diplococcus, Haeckel.
Cromyosphæra antarctica, Haeckel.
Styptosphæra spongiacea, Haeckel.
Spongoplegma antarcticum, Haeckel.
Spongodictyon antarcticum, Haeckel.
Amphisphæra neptunus, Haeckel.
Stauracontium antarcticum, Haeckel.
Hexacontium hexaconicum, Haeckel.
„ *antarcticum*, Haeckel.
Acanthosphæra antarctica, Haeckel.
Cladococcus antarcticus, Haeckel.
„ *dendrites*, Haeckel.
Haliomma antarcticum, Haeckel.
Actinomma pachycapsa, Haeckel.

Pityomma piniferum, Haeckel.
Cromyomma perspicuum, Haeckel.
Rhizosphæra trigonacantha, Haeckel.
„ *antarctica*, Haeckel.

b. Prunoidea.

Cromyocarpus quadrifarius, Haeckel.
Cromyatractus tetraphractus, Haeckel.
Spongurus cylindricus, Haeckel.
Spongocora cincta, Haeckel.

c. Discoidea.

Porodiscus flustrella, Haeckel.
„ *heterocyclus*, Haeckel.
„ „ *spiralis* (Ehrenberg).
Ommatodiscus stöhrii, Haeckel.
„ *lævigatus*, Stöhr.
Stylodictya multispina, Haeckel.
Rhopalastrum irregulare, Haeckel.
Euchitonia muelleri, Haeckel.
Spongodiscus resurgens, Ehrenberg.
„ *spiralis*, Haeckel.
Spongopyle osculosa, Haeckel.
„ *setosa*, Haeckel.
Stylotrochus antarcticus, Haeckel.
„ *challengeri*, Haeckel.
Spongotrochus murrayi, Haeckel.
„ *wyvillei*, Haeckel.
„ *moseleyi*, Haeckel.
„ *willemoesii*, Haeckel.
„ *scutella*, Haeckel.

d. Larcoidea.

Stypolarcus spongiosus, Haeckel.
Larcospira oliva, Haeckel.

II. Acantharia.

Pantopelta icosaspis, Haeckel.

III. Nassellaria.

a. Plectoidea.

Hexaplagia antarctica, Haeckel.

b. Spyroidea.

Tripospyris eucolpos, Haeckel.
Dictyospyris tetrastoma, Ehrenberg.
„ *enneastoma*, Haeckel.

c. Botryodea.

Androspyris aptenodytes, Haeckel.
Botryocella borealis, Ehrenberg.
Botryopyle cribrosa (Ehrenberg).
Botryocyrtis quinaria, Ehrenberg.
Botryocampe inflata, Ehrenberg.

d. Cyrtoidea.

Cyrtocalpis oculum, Haeckel.
Cornutella clathrata, Ehrenberg.
„ *annulata*, Ehrenberg.
Cornutanna orthoconus, Haeckel.
Halicapsa hystrix, Haeckel.
Dictyocephalus antarcticus, Haeckel.
Dicolocapsa megacephala, Haeckel.
Dictyophimus antarcticus, Haeckel.
Theocorys plutonis, Haeckel.
Lithostrobus bicornis, Haeckel.
„ *cornutella*, Butschli.
Theocalyptra cornuta (Ehrenberg).
Lithomitra lineata (Ehrenberg).
Eucyrtidium chrysalidium, Haeckel.

IV. Phæodaria.

Aulactinium actinosphærium, Haeckel.
Sagenoscena penicillata, Haeckel.
Aulosphæra bisternaria, Haeckel.
Aulastrum dichoceros, Haeckel.
Aulodictyum hydrodictyum, Haeckel.
Cannosphæra antarctica, Haeckel.
Challengeria naresii, Murray.
„ *trifida*, Haeckel.
Conchasma hippurites, Haeckel.

Of the 81 species enumerated, 57 species (or 70 per cent.) are not recorded in the Challenger Report from any other locality, while 21 species (or 26 per cent.) are represented in the tropical Pacific (11 species both at the surface and bottom, 7 species at the bottom only, and 3 species at the surface only), 3 species are represented in the South Atlantic (2 at the surface and 1 at the bottom), 2 species are recorded from the bottom in the tropical Atlantic (West Indies), and 1 species each from the bottom in the North Pacific and South Pacific respectively.

Two species (*Cenosphæra papillata* and *Thecosphæra diplococcus*) occur outside this

area both in the South Atlantic and tropical Pacific, while another species (*Cenosphæra antiqua*) occurs both in the tropical and South Atlantic and tropical Pacific. The remainder of the species occurring outside this area are each represented in a single region of the ocean, as indicated above.

LIST VIII *a*.

The following species of Radiolaria were observed in the surface gatherings taken by the Challenger in the Southern Indian Ocean (Station 157, lat. 53° 55′ S.). Of the 24 species enumerated, one-half (*i.e.*, the 12 species of Spumellaria and Nassellaria) were observed also in the bottom-deposit at the same Station, of which 5 species (*Styptosphæra spongiacea*, *Cromyomma perspicuum*, *Rhizosphæra trigonacantha*, *Porodiscus flustrella*, and *Cyrtocalpis ovulum*) occur also in the tropical Pacific. Of the 12 species of Acantharia and Phæodaria (the skeletons of which apparently pass into solution before, or immediately after, reaching the bottom), 4 species are recorded from other regions, but, curiously enough, only from the Atlantic (while, as stated above, the 5 species of Spumellaria and Nassellaria occurring outside this area are recorded only from the tropical Pacific), viz., *Acanthostaurus purpurascens* recorded from the surface in the North and tropical Atlantic, *Challengeron balfouri* recorded from the surface in the North Atlantic, and *Dictyocha stapedia* and *Distephanus speculum* recorded from the bottom in the tropical Atlantic (West Indies, 450 fathoms).

In striking contrast to the wealth of forms in the deposit at this Station is the uniformity of the Radiolarian surface fauna. This, doubtless, arises from the fact that the tow-nets were only dragged through a relatively small distance of the surface waters, whereas the deposit at the bottom represents the accumulation of forms which have fallen from the surface during an immense period of time. The absence of some species of Acantharia and Phæodaria in the deposit, when compared with their relative abundance in the surface-net gatherings, is to be accounted for by the structure and composition of the skeletons, which are more readily dissolved after the death of the animals. Certain species of Acantharia and Phæodaria are the most abundant on the surface, and these are very rich in individuals. Of the Acantharia the most abundant are *Acanthonia claparedei*, *Acanthostaurus purpurascens*, and *Amphilonche lanceolata*, and of the Phæodaria the species of *Challengeron*.

I. Spumellaria.

a. Sphæroidea.

Styptosphæra spongiacea, Haeckel.
Acanthosphæra antarctica, Haeckel.
Cromyomma perspicuum, Haeckel.
Rhizosphæra trigonacantha, Haeckel.
„ *antarctica*, Haeckel.

b. Discoidea.

Porodiscus flustrella, Haeckel.
Stylodictya multispina, Haeckel.
Euchitonia muelleri, Haeckel.
Stylotrochus challengeri, Haeckel.

II. Acantharia.

Acanthonia claparedei, Haeckel.
Acanthostaurus purpurascens, Haeckel.

Amphilonche lanceolata, Haeckel.
Porocapsa coronodon, Haeckel.

III. Nassellaria.

Dictyospyris tetrastoma, Ehrenberg.
Cyrtocalpis ovulum, Haeckel.
Cornutella clathrata, Ehrenberg.

IV. Phæodaria.

Dictyocha stapedia, Haeckel.
Distephanus speculum, Haeckel.
Aulodendron antarcticum, Haeckel.
Auloscena penicillus, Haeckel.
Challengeron pearceyi, Haeckel.
„ *swirei*, Murray.
„ *balfouri*, Murray.
„ *richardsii*, Haeckel.

It may be pointed out that the species collected from the surface and bottom at this Station are much fewer than at many tropical Stations; for instance, at a Station in the Central Pacific, just under the equator, 379 species of Radiolaria were observed in the surface gatherings, and 550 species in the deposit at the bottom.

Callozostron mirabilis, Wright. Discovered by the Challenger in the deep-water area of the Kerguelen Region.

LIST IX.

Diatomaceæ observed in the Deposits and at the Surface in the Kerguelen Region.

Although it was proposed to limit the scope of this paper to the *fauna* of the Kerguelen Region, it has been deemed desirable to include a list of the Diatoms observed in the deposits and captured at the surface. The following is a list of the Diatoms observed in the deposits from the Kerguelen Region of the Southern Ocean, viz., at Station 145 (Marion Island), 85 to 140 fathoms; Station 149 (Kerguelen), 20 to 120 fathoms; Station 151 (Heard Island), 75 fathoms; and Station 157, 1950 fathoms:—

Amphora angusta, Gregory.
„ *cuneata*, Cleve.
„ *plicata*, Gregory.
„ *proteus*, Gregory.
Navicula apis, Donkin.
„ *arenaria*, Donkin.
„ *aspera*, Ehrenberg, var. *oblonga*, Cleve.
„ „ „ var. *rhombica*, Cleve.
„ *brasiliensis*, Grunow.
„ *consors*, A. Schmidt.
„ *constricta*, Grunow.
„ *distans*, Ralfs.
„ *firma*, Kutzing, var. *tumescens*.
„ *gemmata*, Greville, var. *minuta*.
„ *jejuna*, A. Schmidt.
„ *multicostata*, Grunow.
„ *nitescens*, Gregory.
„ *oscitans*, A. Schmidt, var. *subundulata*, Cleve and Grunow.
„ *rhomboides*, Ehrenberg.
„ *smithii*, Brebisson.
„ *serians*, Brebisson.
„ *splendida*, Gregory.
„ *subtilis* (Gregory).
„ *viridis*, Ehrenberg.
Rhoikoneis bolleana, Grunow.
Pleurosigma delicatulum, Smith.
„ *directum*, Cleve.
„ *kerguelense*, Grunow.
„ *rigidum*, Smith.
Rhoikosigma arcticum, Cleve.
Amphiprora duplex, Donkin.
„ *kriophila*.
„ *lepidoptera*, Gregory.

Cocconeis arctica, Grunow.
„ *costata*, Gregory.
„ „ var. *kerguelensis*, Petit.
„ *cyclophora*, Grunow.
„ *decipiens*, Cleve.
„ *dirupta*, Gregory, var. *fulgur*, Brun.
„ „ var. *minutissima*, Grunow.
„ „ var. *sigma*, Pant.
„ *scutellum*, Ehrenberg.
„ „ var. *ampliata*, Grunow.
„ „ var. *distans*, Grunow.
„ „ var. *fulgur*, Cleve.
„ „ var. *minutissima*, Grunow.
„ sp. (?).
Orthoneis wrightii (O'Meara).
Achnanthes brevipes, Agardh.
„ „ var. *subsessilis*.
„ *parvula*, Kutzing.
Gephyria gigantea, Greville.
„ *incurvata*, Arn.
Thalassiothrix longissima, Grunow, var. *antarctica*, Cleve and Grunow.
„ *nitzschioides*, Grunow.
„ „ var. *lanceolata*, Grunow.
„ *nordenskioldii*, Cleve.
Nitzschia apiculata, Smith.
„ *constricta*, Gregory, var. *antarctica*, Rattray.
„ „ var. *similis*, Grunow.
„ *distans*, Gregory.
„ *insignis*, Gregory.
„ *marina*, Grunow.
Synedra filiformis, Grunow.
„ *lanceolata*, Castracane.
„ sp. (?).

Trachysphenia australis, Petit.
„ „ var. *antarctica* (Schwarz).
Clavicula delicata, Temp. and Brun.
Licmophora australis, Grunow.
„ *californica*, Grunow.
„ *jurgensii*, Grunow.
Fragilaria capensis, Grunow.
„ *dubia*, Grunow.
„ *linearis*, Castracane.
„ *pliocena*, Brun.
„ (?) an *Terebraria* (?) sp.
Grammatophora angulosa, Ehrenberg, var. *hamulifera*.
„ „ var. *islandica*.
„ *marina*, Kutzing.
„ *maxima*, Grunow, var. *genuina*.
„ *oceanica*, Ehrenberg.
„ *stricta*, Ehrenberg.
„ *subundulata*, Grunow.
Biddulphia roperiana, Greville.
„ *weissflogii*, Grunow.
Isthmia enervis, Ehrenberg.
Hemiaulus antarcticus, Ehrenberg.
Triceratium antediluvianum, Heurck.
„ *arcticum*, Brightwell, var. *kerguelensis*, Grunow.
Hemidiscus cuneiformis, Wallich.
„ sp. (?).
Auliscus cœlatus, Bailey.
Coscinodiscus africanus, Janisch.
„ „ var. *wallichiana*, Grunow.
„ *antarcticus*, Grunow.
„ *apollinis*, Ehrenberg, var. *compacta*, Rattray.
„ *asteromphalus*, Ehrenberg.
„ *atlanticus*, Castracane.
„ *centralis*, Ehrenberg.
„ *concinnus*, Smith.
„ „ var. *kerguelensis*, Castracane.
„ *convexus*, A. Schmidt.
„ *curvatulus*, Grunow.
„ „ var. *elegans*, Rattray.
„ „ var. *genuina*, Grunow.
„ „ var. *maculata*, Rattray.
„ „ var. *recta*, Rattray.
„ „ var. *subocellata*, Grunow.
„ *decrescens*, Grunow, var. *polaris*, Grunow.
„ „ var. *repleta*, Grunow.
„ *denarius*, A. Schmidt.
„ *denticulatus*, Castracane.
„ *elegans*, Greville.
„ *elegantulus*, Greville.
„ *excentricus*, Ehrenberg.
„ „ var. *sublineatus*, Grunow.
Coscinodiscus fasciculatus, A. Schmidt.
„ *grandis*, Rattray.
„ „ var. *sparsa*, Rattray.
„ *griseus*, Greville, var. *gallopayensis*, Grunow.
„ *impolitus*, Rattray.
„ *kutzingii*, A. Schmidt, var. *glacialis*, Grunow.
„ *lentiginosus*, Janisch.
„ „ var. *maculata*, Grunow.
„ *lineatus*, Ehrenberg.
„ *lunæ*, Ehrenberg.
„ *margaritaceus*, Castracane.
„ *marginatus*, Ehrenberg.
„ *minor*, Ehrenberg.
„ *mölleri*, A. Schmidt, var. *antarctica*, Rattray.
„ *nodulifer*, A. Schmidt.
„ *normanni*, Gregory.
„ *oculus-iridis*, Ehrenberg.
„ *perforatus*, Ehrenberg, var. *cellulosa*, Grunow.
„ *radiatus*, Ehrenberg.
„ *radiosus*, Grunow.
„ „ var. *kerguelensis*, Grunow.
„ *robustus*, Greville.
„ „ var. *minor*, Rattray.
„ *rothii*, Grunow.
„ *rotula*, Grunow.
„ *stellaris*, Roper.
„ *subtilis*, Ehrenberg.
„ „ var. *glacialis*, Grunow.
„ *symbolophorus*, Grunow.
„ *tuberculatus*, Greville, var. *antarctica*, Rattray.
„ „ var. *excentrica*, Rattray
„ *tumidus*, Janisch.
„ „ var. *fasciculata*, Rattray.
Hyalodiscus radiatus, Petit.
„ „ var. *arctica*, Grunow.
„ *subtilis*, Ehrenberg.
Podosira hormoides, Kutzing.
„ *maxima*, Kutzing.
„ *montaguei*, Kutzing.
Cyclotilla castracanei, Brun.
Melosira arenaria, Moore.
„ *borreri*, Greville.
„ *sol*, Kutzing.
„ sp. (?).
Actinocyclus oliverianus, O'Meara.
Actinoptychus campanulifer, A. Schmidt.
„ sp. (?).
Asteromphalus antarcticus, Castracane.

Asteromphalus brookei, Bailey.
„ *darwinii*, Ehrenberg.
„ *hookerii* (Ehrenberg), Ralfs.
„ „ forma *buchii* (Ehrenberg).
„ „ forma *cuvierii* (Ehrenberg).
„ „ forma *denarius* (Janisch).
„ „ forma *humboldtii* (Ehrenberg).
Rhabdonema adriaticum, Kutzing.
„ *minutum*, Kutzing.
Paralia sulcata, Cleve.
Stephanopyxis turris, Ralfs, var. *inermis*, Grunow.
Rhizosolenia furcata, Rattray.
„ *hastata*, Grunow.
„ *setigera*, Brightwell.
„ *styliformis*, Brightwell.
Stauroneis phenicenteron, Ehrenberg.
Epithemia sp. (?).
Tabellaria fenestrata, Kutzing.
Chætoceros dicladia, Castracane, and its sporangial form *Dicladia capreolus*, Ehrenberg.
Diatoma rhombicum, O'Meara, var. *oceanica*, Rattray.
Corethron criophilum, Castracane.
Brunia mirabilis, Tempère.

LIST IX *a*

The following 25 species were found in the deposits from both deep and shallow-water, viz. :—

Thalassiothrix longissima.
„ *nitzschioides.*
Nitzschia constricta.
Trachysphenia australis.
Biddulphia weissflogii.
Hemiaulus antarcticus.
Triceratium arcticum.
Hemidiscus cuneiformis.
Coscinodiscus africanus.
„ *atlanticus.*
„ *centralis.*
„ *concinnus.*
„ *convexus.*
Coscinodiscus curvatulus.
„ *denarius.*
„ *excentricus.*
„ *kutzingii.*
„ *lentiginosus.*
„ *lineatus.*
„ *radiatus.*
„ *tumidus.*
Hyalodiscus radiatus.
Actinocyclus oliverianus.
Asteromphalus hookerii.
„ *brookei.*

LIST IX *b*.

The following is a list of the Diatoms observed in the surface gatherings procured by the Challenger in the Southern Indian Ocean (Station 157, lat. 53° 55′ S.) :—

Navicula aspera, Ehrenberg.
„ *subtilis* (Gregory).
Pleurosigma antarcticum, Grunow.
Amphiprora antarctica, Grunow.
Synedra lanceolata, Castracane.
Nitzschia scalaris, W. Smith.
Thalassiothrix longissima, Grunow, var. *antarctica*, Cleve and Grunow.
Trachysphenia australis, Petit, var. *antarctica* (Schwarz).
Fragilaria (?) an *Terebraria* (?) sp.
Rhizosolenia indica, Peragallo.
„ *inermis*, Castracane.
„ *setigera*, Brightwell.
„ *styliformis*, Brightwell.
Dactyliosolen antarcticus, Castracane.
Melosira sp. (?).
Chætoceros antarcticum, Grunow.
„ *atlanticum*, Cleve.
„ „ var. *attenuata*, Cleve and Grunow.
„ *boreale*, var. *brightwellii*, Cleve.
„ *decipiens*, Cleve.
„ *dispar*, Castracane.
„ *remotum*, Cleve and Grunow.
„ „ var. *biaurita*, Rattray.
„ „ var. *robusta*, Rattray.
„ *sigmoidea*, Rattray.
„ *tetrachæta*, Ehrenberg.
Corethron criophilum, Castracane.
„ „ var. *tumescens*, Rattray.
„ *hispidum*, Castracane.
„ *murrayanum*, Castracane.
„ *pennatum* (Grunow).

Corethron splendens, Rattray.
Hemiaulus antarcticus, Ehrenberg.
Actinocyclus oliverianus, O'Meara.
„ „ forma *minor*.
Asteromphalus brookei, Bailey.
„ *hookerii*, Ehrenberg.
Bacteriastrum varians, Lauder.
Coscinodiscus africanus, Janisch, var. *wallichiana*, Grunow.
„ *anguste-lineatus*, A. Schmidt.
„ *convexus*, A. Schmidt.
Coscinodiscus denarius, A. Schmidt.
„ *excentricus*, Ehrenberg.
„ *kutzingii*, A. Schmidt, var. *glacialis*, Grunow.
„ *lentiginosus*, Janisch.
„ *lineatus*, Ehrenberg.
„ *lunæ*, Ehrenberg.
„ *margaritaceus*, Castracane.
„ *oculus-iridis*, Ehrenberg.
„ *subtilis*, Ehrenberg.
„ *tumidus*, Janisch.

LIST IX *c*.

The following 26 species occur both in the surface gatherings and in the deposits at the bottom within this region :—

Navicula aspera.
„ *subtilis*.
Synedra lanceolata.
Thalassiothrix longissima.
Trachysphenia australis.
Fragilaria (?) an *Terebraria* (?) sp.
Rhizosolenia setigera.
„ *styliformis*.
Melosira sp. (?).
Corethron criophilum.
Hemiaulus antarcticus.
Actinocyclus oliverianus.
Asteromphalus brookei.
Asteromphalus hookerii.
Coscinodiscus africanus.
„ *convexus*.
„ *denarius*.
„ *excentricus*.
„ *kutzingii*.
„ *lentiginosus*.
„ *lineatus*.
„ *lunæ*.
„ *margaritaceus*.
„ *oculus-iridis*.
„ *subtilis*.
„ *tumidus*.

The following general remarks on the Diatoms observed in the surface gatherings and in the deposit from the Challenger deep-water Station 157, extracted from the Challenger Report, Summary of Results, pp. 513–514, may be of interest :—

Considerable differences are recognisable between the general appearance of Diatom preparations made from surface gatherings as contrasted with those procured from the ooze forming the bottom in this locality. By far the most abundant form at the surface was the peculiar, very elongated, flexuous *Thalassiothrix longissima*, var. *antarctica*, Cleve and Grunow [=*Synedra thalassiothrix*, Cleve *in parte*], a species which has already been recorded as forming large floating masses in the Arctic Ocean.[1] In the Antarctic its frustules were found arranged in little bundles—from ten to twelve together—fastened together loosely at one end, but separate at the other, the whole being loosely twisted into a spindle. In preparations isolated frustules of it occur but rarely, often two are found closely apposed, but not uncommonly three, four, or even more are so placed. It is, perhaps, with *Chætoceros remotum*, Cleve and Grunow [=*C. janischianum*, Castracane], the most characteristic species found on the surface.

The Chætocerotidæ and Rhizosoleniæ are abundantly represented in the surface waters, but they are only represented by the terminal calyptræ of the latter in the bottom ooze. Most of the delicately curved, though often large, forms, of *Corethron*, and the singular cylindrical *Dactyliosolen*, have only been found in surface gatherings, whilst the remarkable *Trachysphenia australis*, Petit, var. *antarctica* (Schwarz) [=*Fragilaria antarctica*, Castracane], which abounds in the ooze, is much less common in the surface gatherings. Frustules of *Coscinodisci* and *Actinocycli* are also much less numerous at the surface than upon the bottom, but no species which is present in the superficial waters is absent from the ooze.

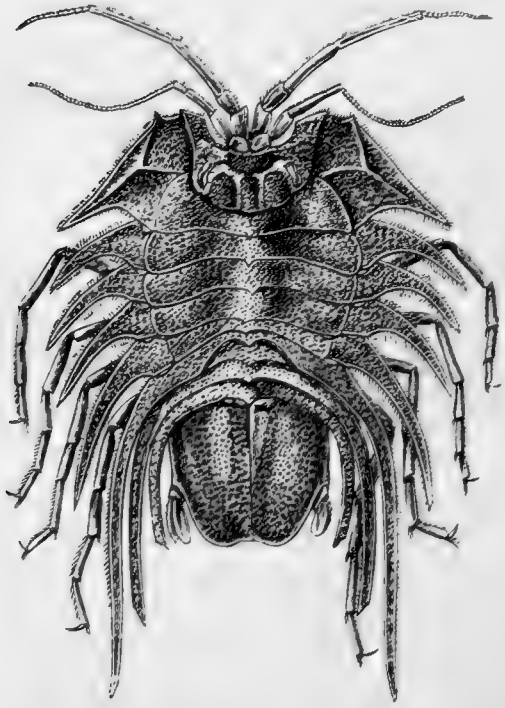
The contents of the alimentary canals of several of the Echinoderms and Annelids were examined with the view of ascertaining whether or not a predilection was exhibited by the animals for any particular species of Diatoms ; it was found, however, that they made use of the ooze as a whole, in all probability taking in the immediate surface layer containing specimens recently fallen from the surface, which, doubtless, still contained some organic matter. The tubes of the Annelids, and the test of the Foraminifera *Reophax nodulosa*, contained many of the large *Coscinodisci* which would appear to have been to a greater extent selected than the others in the deposit.

[1] *Bihang til K. Svensk. Vetensk. Akad. Handl.*, Bd. i., No. 13, Stockholm 1873.

The form, which Count Castracane has indicated as "*Fragilaria?* an *Terebraria?* sp.,"[1] may be regarded as the southern representative of *Fragilaria oceanica*, Cleve, from the Arctic Ocean, with which it shows in the general arrangement and character of the frustules a considerable amount of agreement. Among the Diatoms observed at this Station, the following have been also recorded in the Arctic zone, a few of the species being almost cosmopolitan :—

Navicula aspera, Ehrenberg.
Triceratium arcticum, Brightwell.
Rhizosolenia setigera, Brightwell.
,, *styliformis*, Brightwell.
Chætoceros decipiens, Cleve.
,, *atlanticum*, Cleve.
Coscinodiscus decrescens, var. *polaris*, Grunow.
,, ,, var. *repleta*, Grunow.
Coscinodiscus subtilis, Ehrenberg, var. *glacialis*, Grunow.
,, *oculus-iridis*, Ehrenberg.
,, *centralis*, Ehrenberg.
,, *normanni*, Gregory.
,, *kutzingii*, A. Schmidt.
,, *excentricus*, Ehrenberg.
,, *lineatus*, Ehrenberg.

[1] Bot. Chall. Exp., part iv. p. 47, pl. xxv. fig. 1.



Serolis bromleyana, Willemoes-Suhm. A southern deep-sea form.

LIST X.

Surface Organisms observed during the Cruise of the Challenger in the Kerguelen Region.

The following 47 species of Metazoa are recorded in the Challenger Reports from the surface in the Southern Indian Ocean, south of lat. 40° S. :—

Annelida :

Alciopa antarctica, M'Intosh.
Tomopteris carpenteri, Quatrefages.

Ostracoda :

Halocypris atlantica, Lubbock.
„ *brevirostris*, Dana.

Copepoda :

Ætidius armatus, Brady.
Calanus propinquus, Brady.
Candace truncata, Dana.
Drepanopus pectinatus, Brady.
Eucalanus attenuatus, Dana.
Euchæta prestandreæ, Philippi.
Heterochæta spinifrons, Claus.
Leuckartia flavicornis, Claus.
Machairopus idyoides, Brady.
Pleuromma abdominale (Lubbock).
Pseudothalestris imbricata, Brady.
Rhincalanus gigas, Brady.
Saphirinella stylifera (Lubbock).
Scolecithrix minor, Brady.
Zaus spinatus, Goodsir.

Amphipoda :

Atyloides australis (Miers).
Euthemisto gaudichaudii (Guérin).
„ *thomsoni*, Stebbing.
Halimedon schneideri, Stebbing.
Hyperiella dilatata, Stebbing.

Primno antarctica, Stebbing.
„ *menevillei*, Stebbing.
Vibilia antarctica, Stebbing.
Zaramilla kergueleni, Stebbing.

SCHIZOPODA :

Euphausia antarctica, Sars.
„ *murrayi*, Sars.
„ *superba*, Dana.
Thysanoëssa macrura, Sars.

MACRURA :

Caricyphus angulatus, Spence Bate.

LAMELLIBRANCHIATA :

Modiolarca trapezina (Lamarck).

PTEROPODA :

Clio australis (d'Orbigny).
„ *sulcata* (Pfeffer).
Limacina antarctica, Woodward.
„ *australis* (Eydoux and Souleyet).
Spongiobranchæa australis (d'Orbigny).

CEPHALOPODA :

Taonius suhmi (Lankester).

TUNICATA :

Appendicularia sp. (?).
Salpa africana-maxima, Forskål.
„ *cylindrica*, Cuvier.
„ *runcinata-fusiformis*, Chamisso-Cuvier.
Pyrosoma giganteum, Lesueur [trawl, surface ?].

FISHES :

Prymnothonus sp. (?), young.
Sternoptyx diaphana (Herm.) [trawl, surface ?].

The following notes from the manuscript journals of the naturalists bearing on the surface organisms observed during this part of the cruise may be of interest:—

Lat. 45° 57′ S., surface and down to 100 fathoms:—Many Foraminifera of small size with long flexible spines, compound Radiolaria, Ctenophoræ, great numbers of *Sagitta* of

large size, some over two inches in length, *Tomopteris*, Cytherid, Copepods, many small specimens of *Euphausia*, Pteropods (*Limacina*?), and *Cranchia*, a few specimens of which were taken in every haul.

On the night of December 27, 1873, off Prince Edward Island, the tow-net procured many *Salpæ*, larvæ of *Euphausia*, Copepods, several specimens of *Lepas* on a piece of pumice, many specimens of *Hyperia* and *Gammarus*, probably commensalistic and feeding on the *Salpæ*.

In lat. 46° 46′ S., the tow-net was sent down to 80 fathoms, and brought up *Globigerina*, very much smaller than in the Atlantic, compound Radiolaria, many *Sagittæ*, small Copepods, a large species of *Hyperia*, Pteropods, and *Cranchia*.

In lat. 46° 45′ S. the water was quite red-coloured, due to innumerable red Copepods, which were captured in so thick a mass that it was impossible to see the other animals; *Sagitta*, *Hyperia*, and other organisms were, however, present. The red colour of the water, mentioned in the Indian Ocean Directory as occurring among the islands in these latitudes, is probably due to these small Copepods.

Off the Crozet Islands, January 3, 1874, a tow-net was sent down on the dredge rope, and another was towed behind the ship at a depth of about 80 fathoms, and yielded many Diatoms and small *Globigerinæ*, *Sagitta*, *Halocypris*, Copepods, *Hyperia*, Pteropods and Pteropod larvæ, and *Salpæ*.

Off Kerguelen, January 9 to 29, 1874, there were observed Medusæ (*Oceania*), small Planarians, small Tomopterid, *Peltidium*, Calanids and other Copepods, *Gammarus* and another Amphipod, small Isopod, Zoëæ (probably of the Brachyurous crab inhabiting the pools) very small and having just left the eggs. On the floating masses of *Macrocystis* were found Hydroids, Holothurians, small bivalve shells, *Patella*, and Polyzoa. Occasionally the tow-net was completely filled with various species of Diatoms, at other times with Amphipods (*Hyperia*) and numerous Copepods; Pteropods (*Limacina*) were also at times very abundant.

In lat. 52° 4′ S., the tow-nets procured Ctenophoræ, *Sagitta*, young Aphroditaceans, Copepods, *Hyperia*, and *Euphausia*. At times the surface-net was full of living Diatoms, in masses forming a yellowish slime, among which could be distinguished small *Globigerinæ* and Radiolarians. When dragged at a depth of 100 fathoms, the tow-nets produced similar results.

In lat. 60° 52′ S., the tow-nets procured Diatomaceæ, small *Globigerinæ*, Radiolaria (including very fine specimens of *Aulosphæra elegantissima*, Haeckel), Ctenophoræ, Medusæ, *Diphyes*, larvæ of *Chirodota* (?), *Alciopa*, *Tomopteris*, *Sagitta*, Copepods (Calanids), *Hyperia*, *Primno*, Pteropods, and *Appendicularia*.

In lat. 65° 42′ S. were observed *Globigerina*, Radiolaria, *Diphyes*, *Sagitta*, *Alciopa*, Annelid larvæ, *Cypridina*, *Primno*, *Clio*, shell-less Pteropod, and the remains of a large Cephalopod.

During the afternoon of February 17th, 1874, in lat. 65° 5′ S., the sea was of a greenish colour, and the water was found to be filled with many little spherical transparent

masses, which were identical with those Mr MURRAY had observed in the Arctic Ocean. These minute Algæ can be seen in the water with the naked eye, when the vessel is held towards the light; they have the surface covered with little dots of a greenish or yellowish tinge, which, when examined under high powers, were seen to be arranged in groups of four.[1] A few hours later the sea was blue, and these Algæ could not be observed in the water.

In lat. 64° 37′ S., the following surface organisms were collected by Mr MURRAY in a boat, *Euphausia superba* being especially abundant (the supplementary eyes of which were in the evening observed to be phosphorescent) :—Diatoms, *Globigerina*, Radiolaria, *Diphyes*, larvæ of *Chirodota* (?) with twelve divided wheels, *Sagitta*, *Cypridina*, and *Euphausia superba*.

In lat. 62° 26′ S. there were observed a few larvæ of *Chirodota* (?), small specimens of *Alciopa* and *Tomopteris*, a very large specimen of *Sagitta* from the trawl, a few Cypridinidæ, Calanids abundant, *Hyperia*, *Primno*. WILLEMOES-SUHM writes :—"The *Euphausiæ*, very common on the surface near the ice, were scarcer in clear water, where the Copepod genera *Calanus* and *Eucalanus* were the most abundant animals."

In lat. 53° 55′ S., among the masses of Diatoms only comparatively few animals were observed, viz., Cypridinidæ, Copepods, *Hyperia*, *Primno*, and a few small shells of *Limacina*.

In lat. 50° 1′ S. were observed a very few Diatoms, *Globigerina*, *Orbulina*, Medusæ, a fine Nemertean [*Pelagonemertes*], which, though taken in the trawl, is evidently a pelagic animal, but probably lives in moderately deep water, *Sagitta*, *Cypridina*, great quantities of the Antarctic Copepods, large *Hyperia*, *Primno*, *Phronima*, and small shells of *Limacina*. WILLEMOES-SUHM writes :—"Some of the surface animals taken to-day indicate that we have entered the warm Indian current, *e.g.*, a *Phronima*, and a large transparent Nemertean, with Dendrocœlous characters, which was two inches in length and showed well the intestine, nervous system, and ovary."

In lat. 47° 25′ S., the tow-nets procured compound Radiolaria, Foraminifera, *Diphyes*, Physophorid, *Apolemia* (?), *Sagitta*, *Cypridina*, Nauplii of a Cirriped (*Archizoëa gigas*, Dohrn), *Hyperia*, *Phronima* with house and young, *Primno*, *Euphausia*, *Sergestes*, Zoëæ, *Atlanta*, and *Appendicularia*.

WILLEMOES-SUHM writes :—"The warm-water animals are in greater number on the surface; there were five specimens of *Pyrosoma*, nearly every one of which had eggs but no embryos. There was a Nauplius, with a carapace like the cap of a Madeira peasant, with many spines, 3 mm. in length; it belongs to *Euphausia*, of which METSCHNIKOFF has figured a similar larva (*Zeitschr. f. wiss. Zool.*, Bd. xxi. p. 396, pl. xxxiv., 1871), but not with such a striking form. There were many adult *Euphausiæ* on the surface. *Phronima* was taken with its house; CLAUS has shown that the house is a young *Pyrosoma* in which *Phronima* establishes itself in order to feed on the Tunicata. He has found all

[1] This Alga has since been described by G. POUCHET as *Tetraspora poucheti*, Hariot (*Comptes rendus des séances de la Societé de Biologie*, 1892).

stages, from the *Pyrosoma* just recently attacked by the Amphipod to those soft remains in which it has been taken by us. Preparations made by us show that the tissues of these houses have the same histological structure as Pyrosomata when treated in the same manner. *Sergestes,* which we have not taken since leaving the Cape, is present at the surface. A little Amphipod, always taken on the surface during our Antarctic cruise, I find now to be *Primno macropa*, which was discovered by GUÉRIN-MÉNÉVLILE near Chili, and which appears to be circumpolar. There were two beautifully transparent Cephalopoda apparently belonging to the genus *Loligopsis.*"

MOSELEY writes :—" The surface fauna is changing ; on the night of the 9th March the sea was full of *Pyrosomæ,* and the wake of the ship was lighted up with them. Moreover this morning several pieces of *Durvillea* were met with, and one piece covered with barnacles caught on the log ; hitherto the sea has been remarkably free from floating weed. This *Durvillea* probably comes from St Paul's and Amsterdam Islands, since these islands lie in the direct course of the South Indian connecting current which, sweeping almost directly eastwards, joins the South Australian current. On the night of the 10th March *Pyrosoma* was again abundant. On the evening of the 11th March there were no *Pyrosomæ* at the surface, but a slight scintillating phosphorescence from the Copepods, and I saw a piece of *Durvillea* float past. *Phronima*, while in its house with its young, moves the whole about by protruding its tail from the end and working it."

Mermaids and Tow-nets.

Recapitulation.

We may now recapitulate the main points of this paper as given in the preceding pages.

The Challenger trawlings and dredgings at eight deep-water Stations in the Kerguelen Region, in depths greater than 1260 fathoms, resulted in the capture of—

272 species of Metazoa, belonging to 186 genera; there are
255 distinct fully-described species, of which
164 species are known only from these dredgings, and
91 species extend into other regions of the ocean, viz.:
38 species are known only from other regions south of the southern tropic,
24 species are known from regions both south and north of (but not within) the tropics,
17 species are known from regions both south of, within, and north of the tropics, and
12 species are known from regions both south of and within (but not north of) the tropics.

164 species confined to this region, added to
51 species which extend into other regions, make a total of
215 exclusively deep-sea species unknown in depths less than 1000 fathoms.
38 species occur both above and below the 1000 fathoms line, of which
19 species extend into shallow water under 150 fathoms (1 from the shore).

Of the 186 genera represented,
30 genera are known only from these dredgings, and other
10 genera are known only from other regions south of the southern tropic, 2 of which extend into shallower water under 1000 fathoms.

The Challenger trawlings and dredgings at the remaining twenty-nine deep-water Stations in the Southern Hemisphere, south of the tropic of Capricorn, in depths greater than 1000 fathoms, resulted in the capture of (avoiding the repetition of those species occurring also in the Kerguelen Region)—

253 species of Metazoa, belonging to 182 genera; there are
233 distinct fully-described species, of which
165 species are known only from regions south of the tropics, and
68 species extend into other regions of the ocean, viz.:
25 species are known from regions within (but not north of) the tropics,
24 species are known from regions both within and north of the tropics, and
19 species are known from regions north of (but not within) the tropics.

149 species confined to regions south of the tropics, added to
31 species which extend into other regions, make a total of
180 exclusively deep-sea species unknown in depths less than 1000 fathoms;
53 species occur both above and below the 1000 fathoms line, of which
20 species extend into shallow water under 150 fathoms (3 from the shore).

Of the 182 genera represented,
19 genera are known only from these dredgings, while another genus known only from regions south of the tropics extends into shallower water under 1000 fathoms.

Combining the results of the Challenger trawlings and dredgings at these thirty-seven deep-water Stations in the Southern Hemisphere, south of the southern tropic, in depths greater than 1000 fathoms, there were captured—

523 species of Metazoa, belonging to 312 genera.
336 species are known only from these deep-water dredgings, and
149 species extend into other regions of the ocean, viz.:
43 species are known from regions north of (but not within) the tropics,
41 species are known from regions both within and north of the tropics,
37 species are known from regions within (but not north of) the tropics, and
28 species are known from shallower water south of the tropics.

There are
390 exclusively deep-sea species unknown in depths less than 1000 fathoms;
93 species occur both above and below the 1000 fathoms line, of which
39 species extend into shallow water under 150 fathoms (4 from the shore).

Of the 312 genera represented,
57 genera are known only from these dredgings, and other
3 genera are known only from regions south of the tropics, but extend into shallower water under 1000 fathoms.

At three dredgings in moderate depths (210 to 550 fathoms) in the Kerguelen Region, the Challenger procured—

68 species of Metazoa, belonging to 61 genera; there are
66 distinct fully-described species, of which
30 species are known only from these dredgings, and
36 species extend into other regions of the ocean, viz.:

21 species are known only from other regions south of the tropics,
7 species are known from regions both south of and within (but not north of) the tropics,
6 species are known from regions both south and north of (but not within) the tropics, and
2 species are known from regions both south of, within, and north of the tropics.

30 species confined to this region, added to
13 species which extend into other regions, make a total of
43 species known only from depths over 150 fathoms (of which 5 species reach deep-water over 1000 fathoms); the other
23 species extend into shallow water under 150 fathoms (of which 3 species are known at the same time from deep-water over 1000 fathoms).

Of the 61 genera represented,

4 genera are known only from these dredgings, and other
2 genera are known only from other regions south of the tropics.

In the shallow waters of the Kerguelen Region, in depths less than 150 fathoms, the Challenger procured—

533 species of Metazoa, belonging to 325 genera; there are
495 distinct fully-described species, of which
326 species are known only from this region, and
169 species extend into other regions of the ocean, viz.:
101 species are known only from other regions south of the tropics,
32 species are known from regions both south and north of (but not within) the tropics,
20 species are known from regions both south of and within (but not north of) the tropics, and
16 species are known from regions both south of, within, and north of the tropics.

326 species confined to this region, added to
92 species which extend into other regions, make a total of
418 species known only from shallow water under 150 fathoms; the other
77 species occur both above and below the 150 fathoms line, of which
28 species extend into deep water over 1000 fathoms;
18 species have been recorded as occurring in the fossil condition.

Of the 325 genera represented,

25 genera are known only from this region, and other
2 genera are known only from other regions south of the tropics.

Over 100 additional species from sources other than the Challenger expedition are enumerated from the Kerguelen Region, but some of them require verification.

There are 90 identical species of Metazoa referred to in the paper as occurring in the extra-tropical regions of the northern and southern hemispheres unrecorded from the intervening tropical zone, and over 50 cases of closely-allied species occurring in the extra-tropical regions of the northern and southern hemispheres separated by the intervening tropics.

In the deposits collected by the Challenger at six deep-water stations and three shallow-water localities in the Kerguelen Region,

220 species of Foraminifera were observed ; there are
206 distinct fully-described species, of which
179 species are known from regions both south of, within, and north of the tropics,
16 species are known from regions both south and north of (but not within) the tropics,
7 species are known from regions both south of and within (but not north of) the tropics, and
4 species are known only from regions south of the tropics.

The wide geographical distribution of these Protozoa is thus in marked contrast to that of the Metazoa previously considered, and the majority have also a great range in depth, for

178 species occur both above and below the 1000 fathoms line, while
14 species occur only in deep water over 1000 fathoms, and
14 species occur only in depths less than 1000 fathoms, of which 6 species occur only in shallow water under 150 fathoms.

In the deposit collected by the Challenger at Station 157, 1950 fathoms, in the deep-water area of the Kerguelen Region,

81 species of Radiolaria were observed, of which
57 species are recorded only from this place, the other
24 species extending into other regions of the ocean, viz. :
22 species are known from other regions both south of and within the tropics,
1 species occurs in other regions only south of the tropics, and
1 species occurs in other regions only north of the tropics.

In the surface gatherings from the same Station in the deep-water area of the Kerguelen Region,

24 species of Radiolaria were observed (of which 12 species occur also in the deposit at the same place),

15 species are recorded only from this place, and

9 species extend into other regions of the ocean, viz. :

6 species are known from regions within (but not north of) the tropics,

2 species are known from regions both within and north of the tropics, and

1 species occurs in other regions only north of the tropics.

In the deposits collected by the Challenger at three shallow-water localities and one deep-water Station in the Kerguelen Region,

187 species of Diatoms were observed (of which 25 species occur both in the deep-water and shallow-water deposits).

In the surface gatherings from Station 157 in the deep-water area of the Kerguelen Region,

51 species of Diatoms were observed (of which 26 species occur also in the deposits of the same region);

15 species of Diatoms from these Antarctic localities are known also from Arctic regions.

In the surface gatherings from the Kerguelen Region of the Southern Indian Ocean, south of latitude 40° S.,

47 species of Metazoa are recorded, along with particulars and notes on other pelagic organisms observed in this portion of the cruise of the Challenger.

Concluding Remarks.

The principal object in view in this paper has been to exhibit the present state of knowledge concerning the deep-water and shallow-water marine faunas of the Kerguelen Region of the Great Southern Ocean, and to compare these faunas with the deep-water and shallow-water faunas in other regions of the ocean. In consequence of the researches of the Challenger Expedition in 1873 and 1874, our knowledge of the faunal conditions of the Kerguelen Region is more complete than that of any other area of the Great Southern and Antarctic Oceans. In view of the possible more thorough exploration of the south polar regions in the near future, it has seemed desirable to summarise our knowledge of the marine organisms of the Kerguelen area, for the use of those who may be engaged in Antarctic exploration, and to point out directions in which future investigations might likely yield some interesting and important results.

In the concluding volume of the Challenger Report, I have pointed out that an analysis of the results obtained by the Challenger's trawlings and dredgings in different parts of the world indicated certain general conclusions with reference to the distribution of organisms over the floor of the ocean. It appears to be established by these investigations that life is everywhere present on the sea-bed in all depths and at all distances from the shore. The number of species in great depths far removed from land is very small when compared with the number of species present in lesser depths near to the shores of continents; the number of species gradually increases towards the shallow water of the continents, the greatest number being found in the whole area less than 50 fathoms surrounding the dry land. The proportion of species to genera is, on the whole, larger in shallow than in deep water, the Challenger results giving a gradually decreasing ratio from shallow water down to the greatest depths, as follows :—

Over 2500	fathoms,	ratio of species	to genera =	1·17 to 1
2000–2500	,,	,,	,,	1·36 ,,
1500–2000	,,	,,	,,	1·45 ,,
1000–1500	,,	,,	,,	1·50 ,,
500–1000	,,	,,	,,	1·67 ,,
100– 500	,,	,,	,,	2·37 ,,
Under 100	,,	,,	,,	2·93 ,,

The Challenger researches did not indicate the existence of large numbers of individuals belonging to any one species in deep water beyond 1000 fathoms. In lesser depths, however, the number of individuals belonging to a single species was sometimes very large; and just below the 100 fathoms line, where on open coasts fine detrital matters finally commence to settle on the bottom, enormous numbers of individuals belonging to one species are present in, or on the surface of, the mud. A comparison of the species captured in deep water in two widely separated areas under apparently similar conditions did not show many species in common, and on the whole there was little evidence

to show that deep-sea species had a world-wide distribution, as usually supposed. While some deep-sea species present archaic characters, and others recall the fossils of the chalk period, still deep-sea species do not represent such an old fauna as many shore and fresh-water forms living at the present day, such as *Ceratodus*, *Protopterus*, *Amphioxus*, *Trigonia*, *Lingula*, and *Heliopora*. There appears to be little evidence from the Challenger's researches to show that the deep sea has been peopled since the earliest geological times; it is more probable that migration took place from the mud-line into the deep sea at a not very remote geological period. The recent oceanographical researches show that both in deep and shallow water there are large numbers of identical and closely-allied species in the extra-tropical regions of the Northern and Southern Hemispheres which, so far as at present known, are not represented within the intervening tropics, even though in deep water the climatic conditions as regards temperature are the same. It will now be interesting to inquire how far these general conclusions are supported by the foregoing analysis of the results obtained within the Kerguelen Region of the Great Southern Ocean.

The Challenger in the Kerguelen Region made seven hauls with the trawl and one with the dredge in depths exceeding 1260 fathoms. This was probably the most productive series of hauls obtained in deep water in any one region of the ocean during the whole cruise of the Challenger. In 1375 fathoms, exclusive of Protozoa, over 200 specimens of fishes and invertebrates were obtained belonging to 78 species; in 1600 fathoms about the same number of specimens were obtained belonging to 89 species; in 1950 fathoms over 150 specimens were procured belonging to 79 species; the total number of species in the three hauls being 199. The number of species procured in these three hauls with a small twelve or sixteen feet beam trawl is certainly very remarkable when we remember that the depth is about two English miles.[1]

The total number of species of Metazoa obtained at the eight deep-water stations of the Kerguelen Region in depths exceeding 1260 fathoms amounted in all to 272 species. The total number procured in the other twenty-nine stations in the Southern Hemisphere south of the tropic of Capricorn in depths over 1000 fathoms was 301 species, the average per haul in this last case being only 10·4 species, while in the first case the average is 34·0 species per haul. The twenty-nine stations are on the whole situated about seventeen

[1] Since the above was written a list of the species procured in three hauls with a trawl in shallow water (6 to 21 fathoms), off the west coast of England, has been published with the view of showing the large number of species that may be captured in single hauls from the shallower zones of depth (Third Report of British Association Committee on the *Marine Zoology, Botany, and Geology of the Irish Sea*, Ipswich, 1895). The total number of species procured in these three shallow-water hauls was 189, therefore less by 10 species than were procured in the three deep-sea hauls above noted. The most marked difference in the character of the species in these series of deep-water and shallow-water hauls is the predominence of Echinodermata in the deep sea and of the Mollusca in shallow water: —54 species of Echinodermata occurring in the deep hauls, while only 18 species are present in the shallow ones; and 40 species of Mollusca occurring in the shallow hauls, while only 26 species are present in the deep ones. This comparison has been introduced with the view of calling attention to the large number of species in these deep hauls, and not with the purpose of showing that in the deep sea species are more abundant than in shallow and shore regions of the ocean. Though, as already stated, it is recognised that the total number of species present in the whole area of depths less than 50 fathoms all over the world is greater than in deeper water, still we have good reason for believing that in high northern and high southern latitudes the reverse holds good for depths less than 25 fathoms, and that there may be a larger total number of species in deep water than quite close to the land.

degrees further to the north than the eight stations making up the Kerguelen group of stations, and this may have a bearing on the different results in the two groups of stations. The more productive hauls in the deep water of the Kerguelen Region may perhaps be purely accidental, but a more likely explanation is to be found in the physical conditions of the region towards the Antarctic, as suggested in the first paragraphs of this paper.

Of the 272 species of Metazoa captured in the deep-water stations of the Kerguelen Region, it is to be observed that not one species is common to all the eight stations nor even to any seven of the stations; one species occurred at six stations, one at five stations, 2 species each at four stations, 13 species each at three stations, and 40 species each at two stations. In the two deep-sea stations nearest to each other—separated by a distance of 122 miles—there were only 22 species in common out of a total of 145 species of Metazoa. This does not seem to indicate any very wide distribution of deep-sea species within the Kerguelen Region, not indeed much wider than in the case of the shallow-water species as stated on pages 432–433. Again, of the 272 deep-sea species, 164 species are at present unknown outside of the Kerguelen Region, and only 48 out of the 272 species occur in the twenty-nine deep-sea trawlings and dredgings in the other regions of the Southern Hemisphere south of the tropics. The total number of species of Metazoa taken by the Challenger in depths over 1000 fathoms south of the tropic of Capricorn was 523. Of these, 336 species, or 64 per cent. of the total number present, were taken neither in any of the Challenger's trawlings within the tropics nor to the north of the tropics. We thus see that deep-sea species are not apparently much more widely distributed than shallow-water ones, for, as has been stated on page 434, 61 per cent. of the Kerguelen shallow-water species have not as yet been procured outside that area. It may therefore be expected that further dredgings in the deep sea towards the Antarctic will yield a large number of new species of marine organisms.

The Challenger's trawlings and dredgings around Marion, Kerguelen, and Heard Islands, in depths less than 150 fathoms, yielded in all 533 species. There were about forty hauls with the trawl and dredge, but this large number of hauls yielded only about double the number of genera and species procured in the eight deep-sea hauls in depths greater than 1260 fathoms. In the trawlings between 50 and 150 fathoms the hauls were very much more productive than in depths less than 50 fathoms. In 120 and 105 fathoms off Kerguelen the note books say never before were so many animals procured in the trawl, and in 75 fathoms off Heard Island it is said that the bottom was teeming with animal life. These two stations were situated just about the mud-line off the eastern—that is to say the leeward—coasts of Kerguelen and Heard Islands. Off the western or windward shores the mud-line must be situated at a much greater depth, for a gravelly bottom was found at a depth of 150 fathoms between these islands.

The total number of species collected by the Challenger at Kerguelen in depths less than 50 fathoms appears to be only 130 species; in some cases the hauls were from less to deeper than 50 fathoms, so that the separation at this line is not very distinct, and it is therefore not possible to state the number with great certainty. If now we add to these

130 species, 112 species recorded from other sources from shallow water at Kerguelen, we have a total of 242 species of Metazoa. The remarkable result arrived at is that the eight deep-water hauls in depths of about two English miles have yielded 30 more species than are known from Kerguelen down to the depth of 50 fathoms. The result would have been still more striking had the species recorded from the shore down to 25 fathoms been taken for comparison.

This result agrees with observations in other regions of the Great Southern Ocean where there is a low mean annual temperature. The Challenger's dredgings and trawlings at the Falkland Islands in depths less than 12 fathoms yielded only 85 species, while two hauls in depths of 55 and 70 fathoms between the Falklands and the Strait of Magellan yielded 99 species. The German South Georgia Expedition appear to have collected about 170 species of Metazoa in the shallow waters of that island. Altogether, the marine fauna around the land in high southern latitudes appears to be very poor in species down to a depth of 25 fathoms when compared with the number of species present at the mud-line about 100 fathoms, or even at depths of about two miles.

It is of interest to point out that in the deep-water hauls over 1000 fathoms in the Southern Hemisphere, both in the Kerguelen Region and in the other areas south of the tropic, the ratio of the species to the genera is as 1·46 to 1. The ratio of the species to the genera in the Challenger collections from shallow water under 50 fathoms at Kerguelen is about the same, being as 1·47 to 1. When we take all the species and genera recorded from the Kerguelen Region both by the Challenger and other expeditions and extend the depth to 150 fathoms, the ratio of species to genera is only 1·74 to 1. We have shown that the ratio of species to genera in the whole shallow-water zone in all parts of the world is nearly as 3 to 1. This relation of genera to species may be in part elucidated by a comparison of the shallow-water fauna of the Kerguelen Region with the shallow-water fauna of a region within the tropics.

In the vicinity of Cape York, Australia, the Challenger collected in ten or twelve trawlings and dredgings 554 species of Metazoa in depths less than 12 fathoms. This greatly exceeds the number taken in many more dredgings at Kerguelen in depths less than 25 fathoms, and also exceeds by over 20 species the total number collected at Kerguelen, Marion Island, and Heard Island in depths less than 150 fathoms. The result of numerous other comparisons of a similar kind is to show that everywhere within the tropics the number of Benthos species in shallow water much exceeds the number of Benthos species in the shallow water at Kerguelen or areas similarly situated with respect to temperature.

When we compare the orders of marine animals taken at Cape York in depths less than 12 fathoms with the kinds of shallow-water animals taken in the Kerguelen area down to 150 fathoms, we find that all those animals which secrete large quantities of carbonate of lime greatly predominate in the tropical area, as Corals, Macrura, Brachyura, Anomura, Lamellibranchiata, and Gasteropoda. On the other hand, those kinds of animals with little carbonate of lime predominate at Kerguelen, as Hydroida, Holothurioidea, Annelida, Amphipoda, Isopoda, and Tunicata. If we compare the shallow-water Cape

York fauna with the fauna of the deep water of the Kerguelen Region, we find that the same groups on the whole predominate in the deep sea as predominate in the shallow water of the Kerguelen Region. If we compare the shallow-water fauna of the Kerguelen area with the fauna procured in the tropics between 100 and 500 fathoms, we find that the groups present in this deeper area of the tropics resemble much more the shallow-water Kerguelen fauna than is the case with the shallow-water fauna of the tropics. A very large percentage of the Foraminifera found at the mud-line off Kerguelen in 100 fathoms are found within the tropics and indeed all over the world in the mud at similar or greater depths.

The quantity of carbonate of lime secreted by marine organisms is determined by the temperature of the water in which the animals live, and therefore chiefly by chemical rather than by physiological conditions. When neutral ammonium carbonate is added to sea-water at a temperature of 80° or 85° F., the lime salts present—other than carbonate—are rapidly decomposed and thrown out of solution, giving down at once a precipitate of carbonate of lime with the properties of aragonite. When a similar experiment is carried out at a temperature of 40° or 45° F., the precipitate of carbonate of lime separates out very slowly, and in doing so takes the form of calcite. The secretion of lime salts, such as carbonate and phosphate, is effected by the soluble salts of lime in the sea-water forming insoluble compounds with the effete products (principally ammonium carbonate) set free by the metabolism of the organism. The warm waters of the tropics contain ammoniacal salts in much greater abundance than the cold waters of the polar regions. To this fact may be attributed the coral reefs, large shells, and other massive carbonate of lime structures within the tropics, and the very feeble development of carbonate of lime shells and skeletons in the cold waters of the Antarctic, Arctic, and deep sea. A parallel condition of matters with reference to the secretion of carbonate of lime occurs among pelagic organisms. In the tropics numerous species of Pteropods and other Molluscs with carbonate of lime shells are present in the surface waters of the ocean. These species gradually disappear as the cold waters of the polar regions are approached, and in the Arctic and Antarctic are replaced by naked species and one species of minute thin-shelled *Limacina*. The pelagic Foraminifera are represented in tropical waters by about twenty species—some of them, like *Pulvinulina* and *Sphæroidina*, having very thick shells. In the waters of the northern and southern temperate zones a lesser number of species is present and the shells are not so massive. In the cold waters of the Arctic and Antarctic only two small dwarfed species are present. A similar distribution holds with respect to the unicellular Algæ; the calcareous Coccospheres and Rhabdospheres, while abundant in the warm waters of the tropics, are absent from the surface waters of the polar regions.

It is well known that in Palæozoic and even later geological times massive coral reefs flourished within the Arctic circle, and even in Tertiary times massive shells were formed in both the Arctic and Antarctic areas which could not have been secreted were the waters of the polar regions as cold as they are at the present day. It has sometimes

been argued that in ancient times marine animals might have secreted massive lime structures in cold water, but from the considerations stated above this may be regarded as impossible.

The absence of all the pelagic larvæ of Benthos animals from the tow-net gatherings in the cold Antarctic and Arctic waters is another striking fact, as these are universally present within the tropics. The Benthos animals of the cold waters of the polar regions appear to have in nearly all cases a direct development, and the same appears to be the case with deep-sea animals. When coral reefs flourished within the Arctic circle, we must suppose that there was associated with them a large number of animals with pelagic larvæ, as we find in the coral-reef regions of the present day.

Instances of identical species occurring at Kerguelen and on the coasts of Europe are frequently referred to in the notes to the foregoing lists, and in some cases it has been supposed that these animals may have been carried on ships' bottoms from the one hemisphere to the other, but no such explanation can now be entertained, so numerous are the cases of identical species occurring in the far north and in the far south, and not present in the intermediate torrid zone. From very early times the general similarity between the whales, seals, and birds in the Arctic and Antarctic areas has been the subject of remark, and this was attributed to similarity in the physical conditions in the two polar areas.

The first dredgings and trawlings conducted by the Challenger in comparatively shallow water in the extra-tropical regions of the Southern Hemisphere were those about the Tristan da Cunha group of islands. Concerning these Wyville Thomson wrote at the time : "These shallow-water dredgings around Tristan da Cunha gave a great amount of material, the fauna being very much of the same character as that of somewhat shallower water in the north. The species seem in many cases to be identical, but this will require critical examination to determine." This impression was deepened by further trawlings towards the Antarctic, and has been confirmed by the specialists who have reported on the several groups of marine organisms. In the Summary volumes of the Challenger Report I have given lists of the identical species found in the temperate and cold regions of the two hemispheres, but not recorded from the intervening tropical zone. In the present paper further lists are given of identical and closely-allied species which occur in the Kerguelen Region and other areas of the southern hemisphere, and in the northern hemisphere north of the tropic of Cancer, but not within the tropics. Indeed, the marine fauna of high southern latitudes is more closely related to the marine fauna of high northern latitudes than to any fauna in the intervening regions. This is all the more remarkable when we remember that there is hardly a single species of marine Benthos Metazoa common to the east and west coasts of Africa within the tropics, if we except some brackish water and deep-sea species.

In an interesting paper on Arctic and Antarctic marine floras, George Murray and E. S. Barton write : "Nothing is more striking in the distribution of seaweeds than the change from our northern *Fucaceæ* to the *Sargassa* and other allied genera

of the tropical belt, and then to other *Fucaceæ* again in the south temperate and Antarctic seas."[1] In the paper they give a list of fifty-four species common to the Northern and Southern Oceans but not occurring within the tropics. It has sometimes been supposed that the shallow-water marine animals may pass by way of the deep sea from high northern to high southern latitudes, but this explanation would in no way apply to sea-weeds which can live only in the shallow-waters of the sea. Mr GEORGE MURRAY informs me that the abundance of calcareous incrustation on marine Algæ follows the same distribution as in the case of the lime-secreting animals, these incrustations being much more abundant within the tropics; he says:—"No *Siphoneæ* with encrustation of calcium carbonate occur in the Arctic or Antarctic Seas, or for the matter of that in the colder temperate seas. The *Corallineæ*, which are massively encrusted and occur in great abundance of individuals in the tropics, exhibit a progressive diminution in both mass and number towards the colder areas of the sea. While several genera found in the tropics and temperate seas are absent from the polar seas, the *Corallineæ* are yet represented by four genera in the Arctic Sea. The ten species of *Lithothamnion* recorded from the Arctic Sea would indicate at first sight a high degree of representation of the most massively encrusted genus. But these ten species are notoriously of insecure foundation, and really only form one species in the opinion of some phycologists. In addition to the four Arctic genera of *Corallineæ* two others are recorded (six in all) from the Antarctic region as delimited in the paper quoted. But this again is accounted for by the line of delimitation being too far north and including an area properly south temperate in character. Most other encrusted *Florideæ* are confined to tropical or warm seas. Taking marine Algæ with calcium carbonate encrustation as a whole, it is undoubtedly the case that they diminish both in numbers of species and individuals, and in massiveness of encrustation towards the polar seas."

Whoever may have read the foot-notes appended to the foregoing lists in this paper must have been struck with the numerous instances in which an author was in doubt as to whether a certain specimen should be described as a new species or referred to a known species. The great geographical distance separating the spots where specimens were collected is sometimes considered a sufficient reason for laying great stress on some slight variation, and creating a new species; this is especially the case with specimens from high northern and high southern latitudes. Again, an author has often had a difficulty in deciding whether to include a species in a known genus or to create a new genus for its reception. The descriptions of the several authors very much impress one with the great want of equivalence in the features of an organism which serve as specific and generic characters in the different groups of invertebrates. But for these considerations the resemblances between the marine faunas of high northern and southern latitudes would be much more evident than appears from the statistics in the foregoing pages with reference to the species which have hitherto been recorded from the two polar areas.

[1] *Phycological Memoirs of the British Museum*, part iii. p. 88, London, 1895.

It may therefore be assumed that the identical species now found living towards both poles, or their immediate ancestors, had a world-wide distribution, which involves a nearly uniform temperature throughout the whole body of ocean waters. From what has been stated with reference to coral reefs, and from what we know of the distribution of plants in the coal period, this appears to have been the actual state of matters during the earlier stages of the earth's history; down to the middle of Mesozoic times the ocean had, probably, an approximately uniform temperature of about 70° F. from pole to pole, being probably not much warmer at the equator than elsewhere. The evidence afforded by the distribution of fossils in the geological strata, proceeding backwards in time from the most recent to those of Palæozoic age, indicates that the tropical zone of temperature slowly widens towards the north and south till in the earlier ages it eventually embraced the whole world.

From the general character of the deep-sea fauna, as well as from its distribution over the floor of the ocean at the present day, it cannot be said that there is any evidence in support of the view that from the Silurian period to the present day there had been, as now, a continuous deep ocean with a bottom temperature oscillating about the freezing point, and that there had always been an abyssal fauna.[1] It is more probable that in early times the ocean had a nearly uniform temperature throughout its whole mass, and that, like the Black Sea at the present day, it was uninhabited much below the mud-line, except perhaps by some species of Bacteria.

We may suppose that if cooling set in at the poles towards the middle or close of Mesozoic times colder water then descended to the greater depths of the ocean, carrying with it a larger supply of oxygen, so that it then became possible for animals to live in the greater depths, and migrations slowly took place into the deep sea. A cooling at the poles such as here indicated would bring about the destruction of many shallow-water organisms, especially of those provided with pelagic larvæ and of those which secreted large quantities of carbonate of lime for their shells and skeletons. Owing to the weeding out of these groups of animals a fauna less rich in genera and species would be left behind; the survivors would be chiefly those with a direct development inhabiting the deeper mud-line. In this way we may account for the relatively few species in the shallow or shore waters of the polar regions when compared with the number present in depths less than 20 fathoms within the tropics, and for the absence of pelagic larvæ of Benthos animals in the cold waters towards the poles. The large number of individuals belonging to many of the polar species compared with what obtains within the tropics, as well as the identity or great resemblance of the species in the two polar areas, may be explained by similar considerations, for in water of a low temperature the metabolism in cold-blooded animals would be much less rapid than in water of a high temperature, and all those changes which result in the evolution of new species would proceed at a much slower rate at the poles than in the tropical belt.

As the process of cooling proceeded and the Antarctic continent became covered

[1] Wyville Thomson, *Zool. Chall. Exp.*, vol. i., Introd. p. 47.

with ice and snow, the glaciers descending from the land would destroy the shore and shallow-water fauna, especially those with pelagic larvæ, while those with a direct development would be able to take refuge in the deeper water; migration from the Antarctic continent towards the equator would thus set in all over the sea-bed in the Great Southern Ocean, and the other physical conditions of the area, such as the mixture of currents of different temperatures and the consequent destruction of pelagic organisms, would combine to furnish this deep-sea fauna with abundance of food and oxygen.[1] In this way we may account for the apparently greater abundance of life in the very deep sea of the Great Southern Ocean and the North Atlantic and the North Pacific than elsewhere.

Some geologists have cited the appearances presented by certain ancient conglomerates as evidence for the existence of glacial periods during Palæozoic times,[2] but this hypothesis seems to be in direct opposition to the testimony furnished by the coral reefs preserved in Palæozoic strata within the Arctic circle—indeed, coral reefs apparently flourished in all Palæozoic seas. The vegetation of the Carboniferous formations likewise indicates a universal tropical climate all over the world both on the land and in the ocean. Palæontological evidence points to the gradual diminution of temperature in the higher latitudes of the globe during the later geological periods. When considering the climates of the past it is not so much an excess of light and heat in ancient times as a nearly uniform distribution of tropical conditions over the whole globe, and a progressive withdrawal of the then universal torrid zone within its existing limits, that require explanation.

In seeking for a solution of the problems connected with the geographical distribution of fossils in the geological strata, as well as of those connected with the distribution of existing species over the face of the earth, it has been almost universally assumed that the astronomical relations of our globe have remained stable. This may well be accepted as true for the period covered by human history, but the variation in these relations assumes a very great importance when dealing with the immense duration of geological history. It seems certain that the Palæozoic trilobite looked out on a very different sun from what we now behold in the heavens. In picturing the successive stages in the evolution of the surface features and biological conditions of our globe it is necessary to take into consideration the contemporary evolution of the other members of the solar system, and especially that of the central luminary—the sun.[3]

The nebular theory of the formation of the solar system is now almost universally accepted. It starts from a plenum filled with absolutely cold matter, the potential energy of which is at a maximum, and with a rotatory motion at least equal to that of the whole

[1] See *ante*, p. 352.

[2] See A. Geikie, *Text-book of Geology*, ed. 3, p. 802, London, 1893 ; A. de Lapparent, *Traité de Géologie*, ed. 3, p. 884, Paris, 1893 ; A. C. Ramsay, *Quart. Journ. Geol. Soc.*, 1855, p. 185 ; M. Neumayr, *Erdgeschichte*, Bd. 2, p. 193, Leipzig and Wien, 1890.

[3] See Eug. Dubois, *The Climates of the Geological Past and their relation to the Evolution of the Sun*, London, 1895.

solar system at present. This cold matter falling together under the influence of mutual gravitation developed such an enormous quantity of heat that even its most refractory constituents were at once dissipated into gas. Lord KELVIN says :—"The vapour or gas thus generated will fly outwards, and after several hundreds or thousands of years of outward and inward oscillatory motion, may settle into an oblate rotating nebula extending its equatorial radius far beyond the orbit of Neptune, and with moment of momentum equal to or exceeding the moment of momentum of the solar system. This is just the beginning postulated by LAPLACE for his nebular theory of the evolution of the solar system, which, founded on the natural history of the stellar universe as observed by the elder HERSCHEL and completed in details by the profound dynamical judgment and imaginative genius of LAPLACE, seems converted by thermodynamics into a necessary truth, if we make no other uncertain assumption than that the materials at present constituting the dead matter of the solar system have existed under the laws of dead matter for a hundred million years. Thus there may in reality be nothing more of mystery or of difficulty in the automatic progress of the solar system from cold matter diffused through space, to its present manifest order and beauty, lighted and warmed by its brilliant sun, than there is in the winding-up of a clock and letting it go till it stops."[1]

The mass of rotating hot gas would at once begin to lose heat by radiation into space ; but this loss of heat would cause contraction, which would generate an amount of energy more than sufficient to account for the loss by radiation. In due time the various planets would (either successively, in order of their distances as held by LAPLACE,[2] or either simultaneously or irregularly as held by KIRKWOOD and NEWCOMB[3]) become separated from the gaseous mass as more or less nebulous annuli. These annuli would ultimately condense into planets, which, on account of their small size, would cool down comparatively rapidly. C. WOLF says :—"La période géologique de la Terre, masse de peu d'importance et par suite rapidement refroidie, a donc pu commencer bien avant la formation du Soleil *actuel*, et lorsque la nébuleuse n'avait peut-être pas encore donné naissance à Vénus ni à Mercure. Les géologues pourront trouver, dans le diamètre considérable de la masse solaire à ces époques, l'explication de l'égalité de climat dont paraît avoir joui la terre jusqu'au commencement de l'époque actuelle."[4]

A sun, the diameter of which was equal to that of the orbit of Venus, that is about 137,400,000 miles, would subtend an arc of over 95° in the heavens, and at the nodes, instead of barely illuminating the poles, the rays would pass over both poles and strike the earth as far as the forty-third parallel. The shortest day would be at the equator, and even there it would be of about 18 hours duration. Under such a sun the poles

[1] Lord KELVIN, *Popular Lectures and Addresses*, ed. 2, vol. i. pp. 421–2, London, 1891.

[2] LAPLACE, *Exposition du Système du Monde*, ed. 6, 1836.

[3] KIRKWOOD, "On Certain Harmonies of the Solar System," *Amer. Journ. Science*, ser. 2. vol. xxxviii. p. 5 ; S. NEWCOMB, *Popular Astronomy*, p. 513.

[4] *Les Hypothèses Cosmogoniques*, p. 32, Paris, 1886 ; see also BLANDET, *Bull. Soc. géol. de France*, sér. 2, t. xxv. p. 777, 1868.

would never be in darkness even at the winter solstice, so that poleward of the parallels of 66° there would be no night whatever at any time of the year.

When the sun was reduced to such a size that its rays just grazed the pole at the winter solstice, the thermal history of the earth would have reached an important stage, for this would mark the close of perpetual sunshine at the poles, provided we do not consider the refraction of the earth's atmosphere. When a ray from the sun's limb is tangential to the pole at the winter solstice, that is when the pole is turned away 23° 28′ from the sun, it follows that the angular distance of the limb from the centre of the sun would also be 23° 28′, and the sun would subtend an angle of 46° 56′ in the heavens, its diameter being therefore 72,818,000 miles. This is nearly equal to the diameter of the orbit of Mercury. The precipitation of water, the formation of the first stratified rocks, and the advent of life on the surface of the earth, may possibly have taken place before or have coincided with this stage of the sun's development, and because of the great size of the sun there would be a universal tropical climate on the earth.

At the present time a very little over 50 per cent. of the earth's surface is under illumination; but with a sun in the heavens having an angular diameter of 46° 56′, 69·9 per cent. of the earth's surface would be illuminated. If we assume that the total amount of radiant energy from such a large sun was the same as from the present sun, the amount of light and heat radiated from a unit surface of such a nebulous sun would be much less than from a unit surface of the present sun. Assuming that the insolation due to any element of area of the sun's disc is proportional to the cosine of its zenith distance, then it may be readily shown that, if the total radiation from the large sun be the same as from the existing one, the insolation at any place due to the whole sun is independent of the sun's apparent magnitude, provided the whole of the sun's disc is visible. When, however, only part of the sun's disc is visible, as at sunrise and sunset, the size of the sun has a marked effect on the distribution of heat, the ultimate result being that, at sunrise and sunset, the earth receives an additional amount of energy entirely on account of the sun's greater magnitude.

At the equator the duration of sunrise and sunset, that is the length of time during which only part of the sun is above the horizon, is short compared with other latitudes; the additional heat received at the equator during one whole day, therefore, on account of the increased magnitude of the sun, would be comparatively small, being indeed an absolute minimum at the equinox when the sun's apparent path in the heavens cuts the horizon at right angles. The nearer to the poles we go, the longer does the sun take to emerge completely above the horizon, and the longer is the period during which the sun is only partly seen; the greater therefore would be the quantity of additional energy received on account of the sun's great size. There might thus have been a large luminary, the rate of insolation of which at any place on the earth's surface was equal to that of the sun at present; but from that sun, on account of its great size, the earth as a whole would receive more energy, distributed in the most advantageous manner possible, viz., a very slight increase at the tropical regions, and

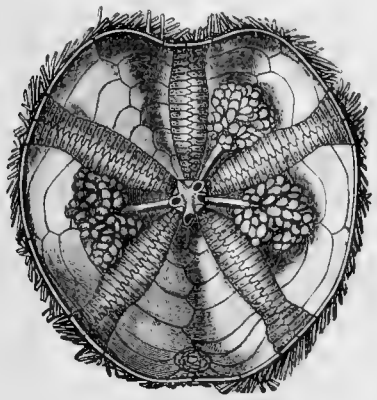
a much greater absolute increase at the poles, the intervening latitudes receiving an amount intermediate between these limits. Such a distribution of energy would tend to that uniformity of climate apparently demanded by palæontological evidence.

A few illustrative figures calculated under the above assumptions may be of interest; in this approximation the effects of solar and terrestrial atmospheres have been neglected. The earth as a whole would receive from the large sun about 7·2 per cent. more energy than at present. At the equinox the equator would receive 2·6 per cent. more energy than it does at present; the polar circle 16·7 per cent. more. At the solstice the equator would receive 3 per cent. more energy than at present; lat. 45° at the summer solstice would receive 4·1 per cent. more. When we consider the insolation at the pole we find that during the whole year the pole would receive between 17 and 18 per cent. more energy from the large sun than from the present small one. As much of this fresh accession of energy would be spread over the period from the autumnal to the vernal equinox, when, at present, the pole receives no heat from the sun, the ultimate effect would be the raising of the temperature during the polar winter.

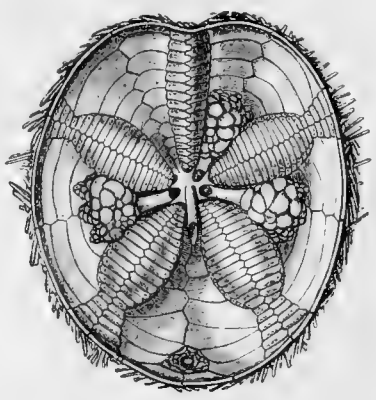
It may be interesting here to state that when the centre of this large nebulous sun rested over either of the tropics, part of the limb would be vertical 23° 28′ polewards from the tropics, that is at the 47th parallel; an equatorial belt 94° wide, having an area of 143,830,200 square miles, or 73·14 per cent. of the earth's surface, would be under the vertical rays of some portion of the sun's surface at least twice in the year. The corresponding region of the earth (having vertical rays) at present has an area of only 40 per cent. of the earth's surface, or about 79,258,000 square miles.

At the summer solstice this large sun would shine over one pole to a distance of 47° on the other side of the pole, that is to say, any place within the 43rd parallel would at the solstice enjoy a 24 hours day. But at the summer solstice a belt 4° in width between the 43rd and the 47th parallels would have the sun in the zenith at noon and at the same time enjoy a 24 hours day. At the summer solstice the total area of the region having a 24 hours day, that is the region polewards from the 43rd parallel, would be 31,269,500 square miles, or 15·9 per cent. of the whole earth's surface, the two polar caps together amounting to 31·8 per cent. At this time the other pole, turned away from the sun, would be undergoing a regular alternation of day and night, the longest night being one of 12 hours, and even that would be only at the pole at the instant of the solstice. The region of a possible 24 hours day at present has an area of about 16,674,200 square miles, or 8·38 per cent. of the earth's surface, only 26 per cent. of what it must have been with a sun of the size above indicated. The complete annihilation of the 24 hours polar night, and the almost perpetual insolation near the pole (only interrupted for a few hours at the winter solstice), would go far to counteract the diminution of energy due to the obliquity of the sun's rays. We must also take into account the fact that the nearer to the pole we go, the higher is the elevation of the sun at midnight, although lower at noon. On the whole, then, we would expect in the tropics warm days and cold nights, and in circumpolar regions cooler days and mild nights, the

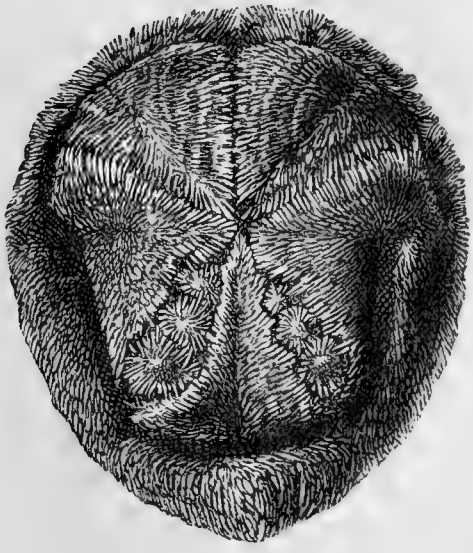
diurnal temperature in the two regions tending to balance and approximate closely to the annual mean for the whole earth. In the foregoing we have not taken into consideration the effect of the refraction of the earth's atmosphere on the sun's rays, but it is evident that a very much smaller sun than one subtending an arc of 46° 56′ would produce an equable temperature all over the earth when aided by atmospheric refraction.



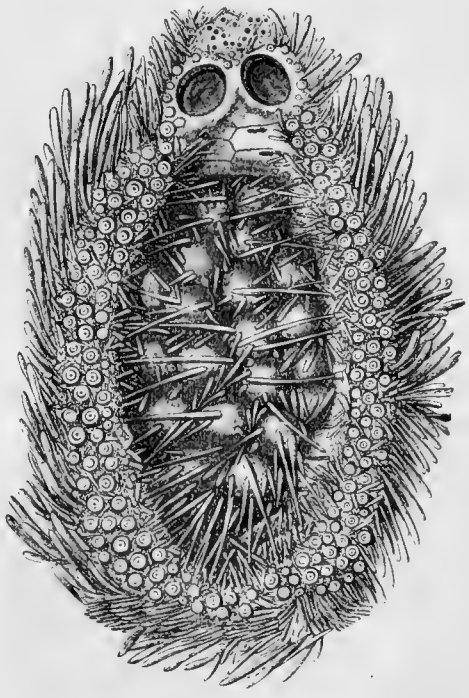
Hemiaster cavernosus (Philippi). Apical portion of test of male seen from within, slightly enlarged.



Hemiaster cavernosus (Philippi). Apical portion of test of female seen from within, slightly enlarged.



Hemiaster cavernosus (Philippi). Accessible Bay, Kerguelen, $\frac{2}{1}$.

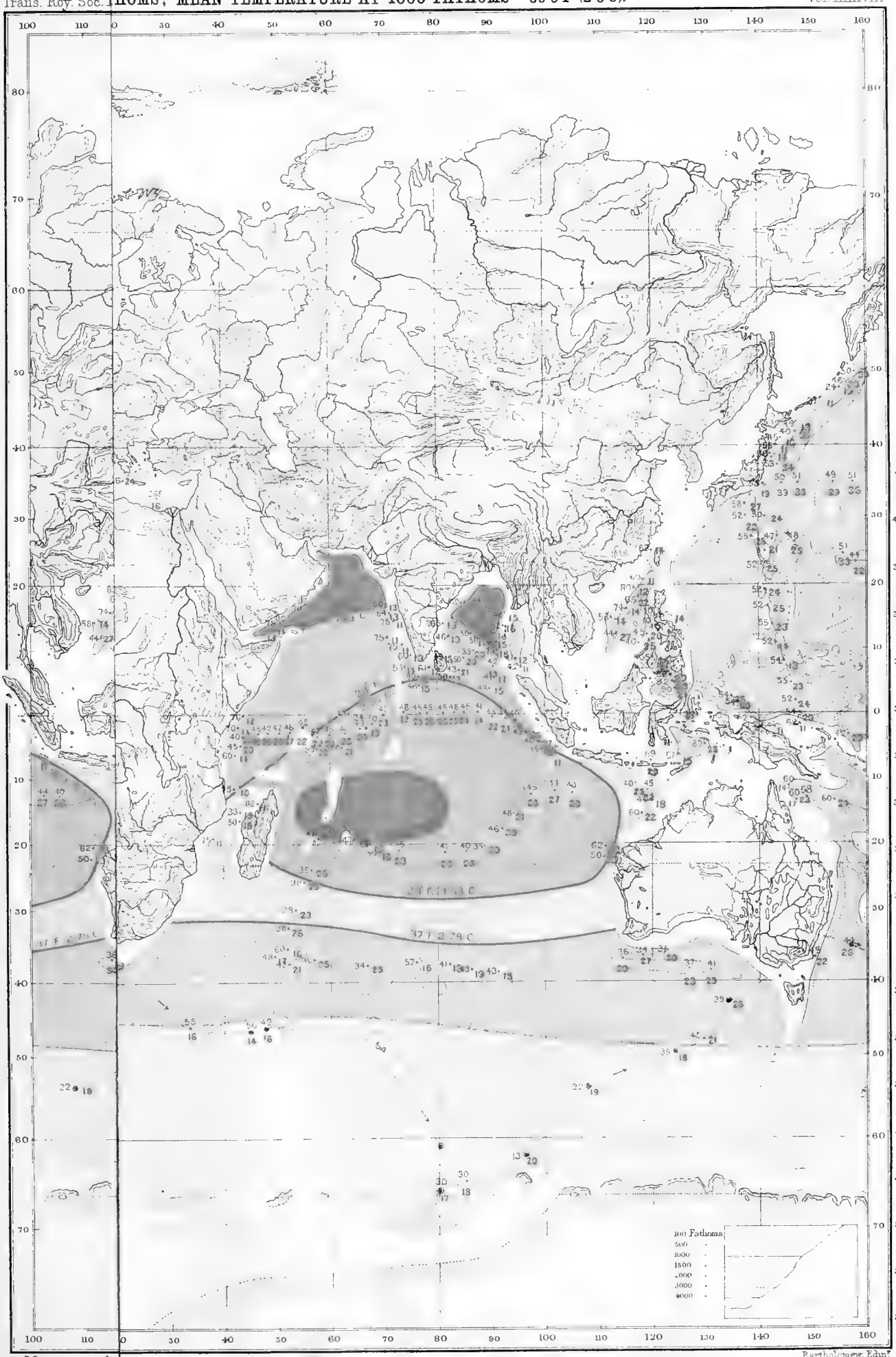


Hemiaster cavernosus (Philippi). Arrangement of eggs in one of the Marsupial recesses, $\frac{5}{1}$.

Explanation of the Map showing the Temperature of the Ocean at 1000 Fathoms and at the Bottom in greater depths.

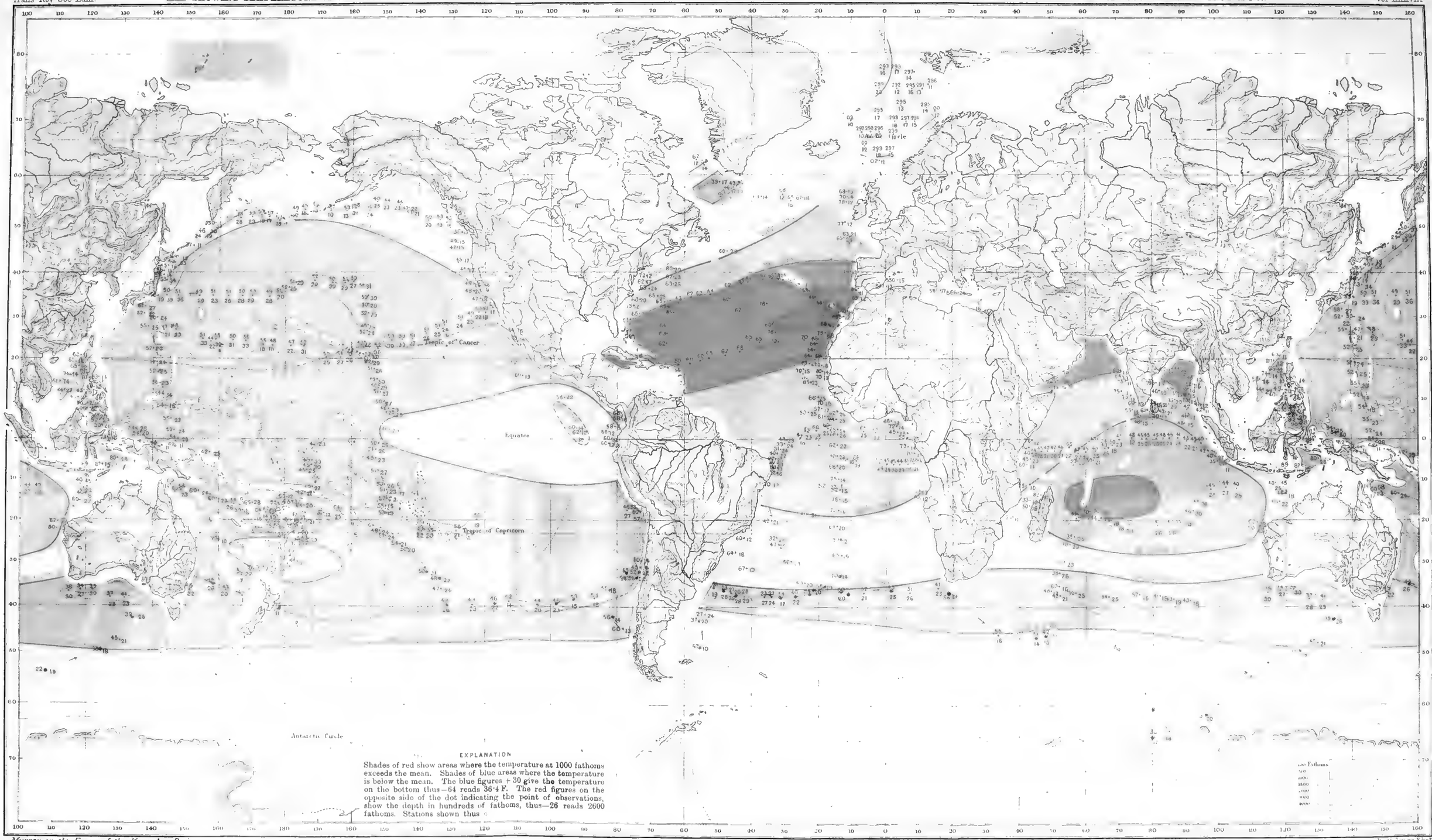
The accompanying Map has been constructed from materials in Dr Buchan's Challenger Report on Oceanic Circulation, and shows the temperature of the ocean at 1000 fathoms as well as the temperature at the bottom of the ocean in depths greater than 1000 fathoms. The different shades of red and blue within the different isotherms show the temperature in different areas at the uniform level of 1000 fathoms. For the depths below 1000 fathoms the actual observations are given. The *red* figures, on the one side of the *dot* marking the position, give the depth in hundreds of fathoms; thus 28 in *red* figures stands for 2800 fathoms; 11 for 1100 fathoms, etc. The *blue* figures on the other side of the *dot*, plus 30, give the temperature at the depth indicated by the *red* figures; thus 35 in *blue* figures must be read 33°·5 F. and 64 must be read 36°·4 F., etc. Where the temperature is below 30° F. or above 40° F., the temperature has been entered in full to the first decimal place, and in all such cases there are three figures instead of two; for instance, in the Arctic Ocean 292 signifies 29°·2 F., in the Mediterranean 565 signifies 56°·5 F., and in the Sulu Sea 505 signifies 50°·5 F.

At a depth of 1000 fathoms the lowest temperature recorded is 29° F. (−1°·7 C.) in the Arctic Ocean, and the highest in the open ocean is about 41° F. (5° C.) between the Canaries and Madeira, the total range at this depth being about 12° F. (6°·7 C.). It will be noticed that at the depth of 1000 fathoms the North Atlantic is much the warmest ocean, and that the whole of the Atlantic and Indian Oceans is above the average at this depth (36°·5 F.), while the greater part of the Pacific is below this average. The same general features persist to the bottom in each ocean with some slight deviations due to local conditions. The thirty-seven deep-water Challenger stations south of the southern tropic, specially referred to in this paper, are indicated by a circle in black.



Bartholomew, Edin.

MAP SHOWING TEMPERATURE OF THE OCEAN AT 1000 FATHOMS, AND THE TEMPERATURE ON THE FLOOR OF THE OCEAN AT DEPTHS EXCEEDING 1000 FATHOMS; MEAN TEMPERATURE AT 1000 FATHOMS = 36·5 F (2·5 C).



EXPLANATION

Shades of red show areas where the temperature at 1000 fathoms exceeds the mean. Shades of blue areas where the temperature is below the mean. The blue figures +30 give the temperature on the bottom thus—64 reads 36·4 F. The red figures on the opposite side of the dot indicating the point of observations, show the depth in hundreds of fathoms, thus—26 reads 2600 fathoms. Stations shown thus ·

Track of H.M.S. Challenger shown thus

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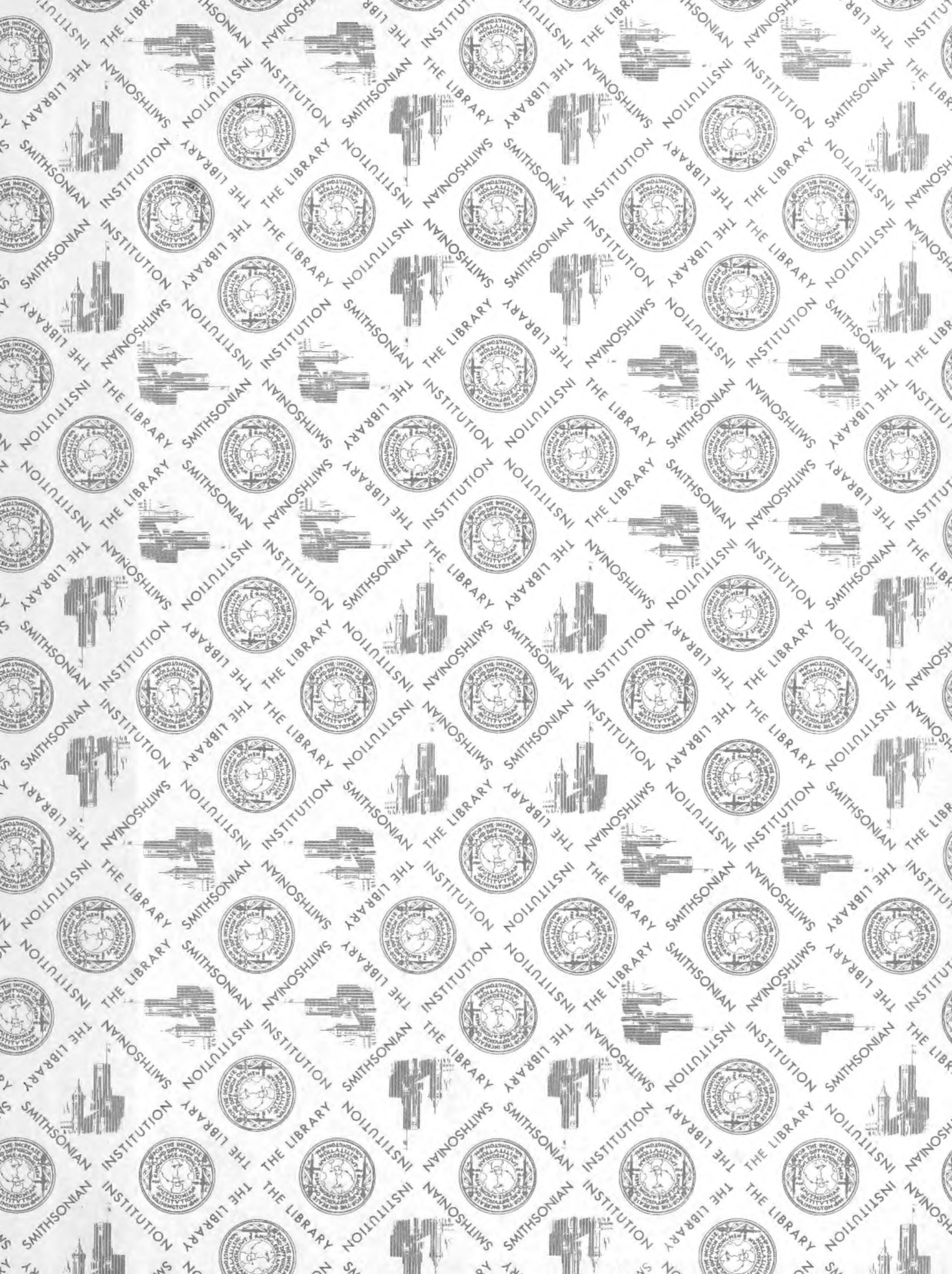
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