

Diptera.—1. Muscid, everywhere; 2. *Pulex*, parasitic in the nests of *Diomedea* and *Eudyptes*.

Poduridæ.—*Thysanura*, on a dead puffin.

Crustacea.—1. *Oniscus*, everywhere under stones; 2. *Gammarus*, everywhere under stones.

Oligochaetæ.—*Lumbricus*, everywhere under stones.

V. "Preliminary Report to Professor WYVILLE THOMSON, F.R.S., Director of the Civilian Scientific Staff, on Crustacea observed during the cruise of H.M.S. 'Challenger' in the Southern Sea." By the late Dr. RUDOLF VON WILLEMÖES-SUHM, Naturalist to the Expedition. (Published by permission of the Lords of the Admiralty.) Received February 14, 1876. Read March 16.

In the following paper it is intended to give a short account of the Crustacea found at the bottom as well as on the surface of the sea during the antarctic cruise of H.M.S. 'Challenger.' Our expedition, as is probably well-known to most readers, left the Cape on December 17, proceeded towards the Prince-Edward Islands, and landed on one of them. Between these islands and the Crozets, on which landing was impossible, we had several successful deep-sea dredgings. From the Crozets we sailed to Kerguelen, where we stayed nearly a month, and where a great deal of shallow-water dredging was done. Proceeding from this large island to the south, we penetrated beyond the antarctic circle, and had four successful deep-sea dredgings near the ice-barrier. On our way to Australia we were able to trawl five times.

The surface animals were generally collected by the towing-net at every station by lowering the net to a depth of 50–100 fathoms, where, as experience has shown us, nearly the same quantity of animals are found during the day which at night are to be got from the very surface. In fine nights, when the ship was gliding very slowly through the water, the net was of course always put out, and its contents were carefully preserved; but during our antarctic cruise such nights were rare, so that in most cases we had to lower the net in the daytime, during the manipulations of dredging and sounding.

In shallow water near the shores of the antarctic islands we found scarcely any of the higher Crustacea. Only on the north coast of Marion Island (Prince-Edward group, the northernmost of the islands which we visited) a small Caridid shrimp was got in considerable numbers. Besides there was a *Serolis*, different from the only species which we had met with (in 700 fathoms off the coast of Brazil). On the south coast of Prince-Edward Island there were no Decapods at all in a similar depth, only *Serolis* came up in the dredge. Near the same place, however, we

got a successful dredging from 310 fathoms, showing that the conditions, whatever they may be, which do not allow the higher Crustacea to live in shallow water near the antarctic islands (a fact which will be shown to be also the case near Kerguelen and Heard Islands), do not apply to greater depths; for now we found plenty of higher Crustacea, fine Caridid decapods, Galatheas, and large spiny brachyurous crabs, allied to *Pisa* and *Maia*, of the finest red colour. This was the only time we got near the islands a dredge in such an intermediate depth as 310 fathoms.

Halfway between Prince-Edward Islands and the Crozets we had two trawlings in greater depths, both successful and very important, as they showed clearly that also in these southern regions of the Indian Ocean several of the animals are to be found which inhabit the deep sea of the Atlantic. *Euplectella*, *Hyalonema*, *Umbellularia*, *Brisinga*, *Powrtalesia*, as well as *Macrurus* and *Halosaurus* were all well-known forms to us, and in most cases, I should think, the same species which we have found all over the Atlantic. The Crustacea were represented by several *Scalpell*a, which were attached to Bryozoa by the same bluish *Serolis* which we got the first time on the coast of Brazil in 700 fathoms. An *Arcturus* was rather common, and so was an Isopod, which is very characteristic for the antarctic deep sea, but which nearly always comes up completely spoiled, as it loses all its antennæ and legs, evidently breaking like glass. We succeeded only once in getting a specimen, 24 millims. long, in which the second antennæ and the legs were preserved; and this one shows that it has a very long flagellum of the second antenna and the third and fourth pereopods elongated and exceedingly thin. Its subsequent pereopods are foliaceous swimmerettes, and its abdomen consists only of one segment. All this, besides its blindness, shows that it is a member of the family Munopsidæ, established by Sars, who has described several genera. Besides this larger species we found a smaller one in the antarctic deep sea which probably belongs to the same genus, but is rarer and equally very liable to lose all its appendages. Another Munopsid, which, however, may belong to a different genus, was found formerly by us in deep water (2175 fathoms) in the Atlantic, between Bermudas and the Azores, in lat. 38° 3', long. 39° 13' W. It is very large, 40 millims. long, and perfectly transparent and soft, so that it collapses as soon as taken out of the water. Its first antenna is of moderate size, the second is broken. The first pereopod is a prehensile organ; the three subsequent ones are broken. The last three feet are terminated by exceedingly large foliaceous joints, and the abdomen consists of one single segment. The large posterior pereopods make this strange animal look still stranger; but it is in every respect a normal member of the family Munopsidæ. I shall describe all these species when I come home, and shall be able to compare them with Sars's drawings.

The deep-sea dredging between Prince-Edward Islands and the Crozets

brought us also an immense ostracod, gigantic if compared to those forms which are known to us as common inhabitants of the fresh and salt water. Its soft sculptured shell has a length of 25 millims. and a height of 16 millims. The small cover formed by two excisions of the shell before the head has by itself the considerable length of 3 millims. I think this is the largest of all Ostracods known, only equalled in size by a Silurian form found in the island of Gothland, and described as *Cytherina baltica*. According to Quenstedt there seems to have been some doubt whether this is really an Ostracod, as it is ten times larger than any living form hitherto known. This deep-sea form shows that there is no reason for that; but unfortunately it does not allow me to decide to what family it belongs, for nothing is left of the animal inside the shell but the head with the eyes, the two antennæ, and what I consider to be a palpus mandibularis. The shell is rather soft and flexible, divided by five lines, originating from a central point in its anterior part, into as many fields, the largest of which on the posterior and inferior side is sculptured. The eyes are very large, pedunculated, and consequently movable. So far the description of the animal does not prevent its being put into the family Cypridinidæ; but the antennæ seem to me very different from those known in that group; for here the funiculus antennæ primæ has got four joints, the last of which has on the upperside an accessory prolongation, which resembles somewhat the scale on the lower antenna of higher Decapoda, but seems not to be in articulation with the funiculus. The flagellum seems to consist of twelve joints with a tuft of hair at the top. But about this number I am not quite sure, as I could not count them in a satisfactory way without spoiling the precious unicum. The lower antenna has, as far as I could make out, only a single flagellum (whereas the Cypridinidæ have got two), consisting probably of nine joints. The palpus mandibulæ, finally, resembles in its shape very much the one which is found among the Decapods, consisting of two joints, the last of which is covered with hairs on its inner side.

Probably this new and gigantic Ostracod belongs to one of the established families, a fact which, I hope, will be elucidated by further discoveries on our future cruise in the southern hemisphere.

This is not the only example, however, of gigantic forms in the deep sea, for the same trawlings brought up two specimens (from 1375 and 1600 fathoms) of a Gammarid Amphipod the larger of which has a length of 60 millims. and a height of 35 millims. Though we now know that certain Hyperids (*Cystisoma Neptunus*, both sexes of which we found in the Atlantic, and described in the Phil. Trans. 1873; see also Trans. Linn. Soc. 1875, 2nd ed. Zool. i. p. 24) attain the considerable length of more than 4 inches, these transparent and elongated animals do not make such an impression as the Gammarids, which are besides in no way peculiar, being perfectly normal, and approaching

perhaps most the genus *Typhimedia*. I shall therefore give later a more accurate description of them, and *here only direct attention to the fact that in the deep sea, as well as in the sedimentary strata, animals are found which, compared with their relations living now-a-days and in shallow water, are of a very considerable size*; and I may perhaps best in this place add that in this dredging of 1375 fathoms a Nymphoid (Pycnogonid) was got measuring nearly *two feet across the legs*.

The Schizopods appear to gain most by the deep-sea investigations; for strange forms have been discovered by us as in the Atlantic, and strange forms continue to come up as we go on with the researches in the other oceans. The *Chalaraspis unguifer*, which constitutes a new family (as has been shown in my paper on the Atlantic Crustacea) allied to the Lophogastridæ, and characterized by the presence of all the pereopods, the looseness of its dorsal shield, the absence of accessory eyes, &c., is one of the characteristic members also of the antarctic deep-sea fauna. It was got in these dredgings, as well as in those on our way from the Antarctic to Australia, when another new genus of this family came up, of which I shall speak afterwards. In these trawlings near the Crozets we got another Schizopod, a new species of my genus *Petalophthalmus*, first found in the tropical deep sea of the Atlantic. It is a form differing from the Mysidæ by the looseness of its dorsal shield, by large plate-like duplicatures of the chitinous substance in the place where we are accustomed to find the eyes, and by the presence of breeding-lamellæ at the base of all the pereopods. I must refer for the details to my previous paper, where I have discussed its zoological position and its nearest relations, and may here only repeat that the male of the Atlantic species *P. armiger*, v. W. S., differed very much from the female and showed characters hitherto never found in a Schizopod. Its first antenna, palpi mandibulares, maxillipeds, and first gnathopods are transformed into very powerful prehensile organs. In this species, which is much larger than the Atlantic one (length of the female 62, of the male 55 millims.), nothing of the kind exists. The male is only a little smaller than the female, has of course no breeding-lamellæ, and is only distinguished by the presence of two small recurved tubes, situated behind the last pair of pereopods, and having evidently the function of copulative organs. Besides the pleopods are larger than in the female, and have, as is the case in many Mysids, got two rami. I shall call this species *Petalophthalmus inermis*, as the chief difference from *P. armiger* consists in the resemblance of the male to the female and in its size. The parts of the mouth as well as the other appendages are very much alike in both species. Drawings of most of them have been made, and will be published on a later occasion. As we got many specimens of this larger species, I examined the curious petaliform organ which morphologically represents the eye, and found that it consists of nothing but a double chitinous layer, which contains a small quantity of muscular tissue.

The same petaliform organs, but on much shorter stalks and of different size, are met with in another animal which came up in these dredgings, and which belongs to the proper Mysids, as its carapax is not loose, as in *Petalophthalmus*, but adheres to the segments of the pereion, as in ordinary shallow-water Mysids. It has a length of 35 millims., and, being a male, is distinguished by two, small, tube-like copulative organs at the base of the last pair of pereopods. A form of the same genus was afterwards found in shallower water near Kerguelen, the females of which had got young ones in their pouches, showing that they undergo the same metamorphosis as *Mysis* does. They are in consequence closely allied to this genus, and have nothing to do with *Petalophthalmus*, though the eyes have undergone the same retrogressive metamorphosis as in this genus.

In these dredgings we caught several of the higher Decapods, Galatheas, several specimens of *Pagurus*, and Caridid as well as Peneid shrimps. One of the Caridids was important to us, as it was the same species which we had formerly got in quantities in deep water off the coast of Brazil between Pernambuco and Bahia. It has a very solid and spiny carapax and large eyes. From a morphological point of view all these crabs and shrimps have, however, scarcely any interest.

When cruising near the Crozets we dredged in a depth of 210 fathoms, where only a *Serolis* was got, and again in 550 fathoms, where no Crustacea came up at all.

In Kerguelen Island, where we stayed nearly a month, much shallow-water dredging took place in the different harbours, most of which was done by Prof. Wyville Thomson himself, while I was on shore collecting the land animals of the place. There is no *Gammarus* with terrestrial habits nor any Oniscas to be found in these barren islands, animals which still exist on the Tristan d'Acunha Islands. In the pools on shore, however, a small brachyurous crab was found, which was never got by the dredge not even in the shallowest water. Also in the pools it is by no means common, so that I only got three specimens. One of these, a female, had empty eggshells attached to its pleopoda; and I think that a small *Zoëa*, the only larva of higher Crustacea which I was able to get on the surface, belongs to this species; for *all the dredgings down to a hundred fathoms near Kerguelen Land never yielded any of the Decapod Crustacea except the small Mysis which has been already mentioned.*

The shallow-water fauna near Kerguelen may be divided into two zones—the one going from a few fathoms down to forty, and characterized by small silicisponges, a *Spatangus*, *Cribrella*, and especially by *Serolis*; and the second from 40–120 fathoms, inhabited by large silicisponges (*Rossella antarctica*, Carter), a large red Euryal, *Comatula*, another *Serolis*, by *Cuma*, *Tanais*, and *Anceus*. These two zones of course are not strictly separate, as many of their inhabitants go from one into the other; but I do not think, for example, that *Spatangus* will be found to be any-

where plentiful beyond 50 fathoms; nor do I think that *Rossella* will be found at all in a depth of 25 fathoms.

The Crustacea inhabiting the shallower water are several species of *Serolis*, *Sphaeroma*, *Arcturus*, some Gammarids, several species of *Caprella*, one of which has a very slender and long manus, and some Pycnogonids. There is scarcely any thing interesting to be found in that zone. In the second zone of deeper water (though not deep-sea fauna, which we scarcely ever have found in less than 500 fathoms) we had a richer harvest; *Tanais* and *Praniza*, very curious amphipods, Mysids and *Nebalia* are the inhabitants, about which I shall now say a few words.

A *Tanais* having a length of about 17 millims. is very common, and though not deviating by any means from the typical species of the genus, it has a peculiarity connected with its propagation; for the females, instead of having breeding-lamellæ, as the other species of the genus have, carry their eggs, like Copepods, in small cutaneous sacs attached to the genital opening at the base of the fifth pair of pereopods. These sacs extend as the development goes on, and attain a diameter of 3-4 millims. Professor Wyville Thomson having discovered among the echinoderms of Kerguelen Land many forms which do not undergo any metamorphosis, but develop in pouches of their parents, this peculiarity in *Tanais* deserves to be noted, not exactly as comparable to those facts, but as an anomaly in the group to which the animal belongs.

Less common than this *Tanais* was an animal which very closely resembles the European *Anceus maxillaris* (*Praniza*, Leach), of which I got several males and ovigerous females.

A larger species of *Serolis*, which is the predominant and most characteristic form of all the Crustacea in the shallow water of the Antarctic islands, was also to be found in this second zone. With it an Amphipod occurred, a Gammarid, distinguished by a bright red frontal prolongation of the head and having no eyes. These I first thought might be discovered in some form or other in the red proboscis; but my expectations were not justified by the results of the dissection. The organ is divided by a line along its top into a right and a left portion. The chitinous layer has got no facettes, and the whole organ is filled by a finely granulated red pigment. What its function may be I cannot say, having never met with any thing like it.

The *Nebalia* was very rare. Though I sifted the mud for a long time, and was most anxious to find more specimens of it, I only succeeded in getting two females, which differ from *N. Geoffroyi* only in having the borders of the abdominal segment somewhat more sharply denticulated. Until, however, the male is known I do not think it right to declare it to be the same species.

Besides a small *Cuma*, which was very common, we found in the deeper zone outside Christmas Harbour the only decapod which was brought

up by the dredge during the whole time of our stay in Kerguelen, where dredging has been effected at least in seven different places. This was a small Mysid with petaliform plates instead of eyes, allied to the larger species which was brought up from the deep sea. It has a length of 12 millims., and was not rare, as numerous males and females with young ones in their pouch were found in the mud. The females have got (as all Mysids have) two pairs of large breeding-lamellæ, which form a pouch for the reception of the young.

Possibly this Mysid genus is already described by Sars, who has established several genera, the descriptions of which are unfortunately not on board.

These are the Crustacea of the shallow water near Kerguelen—all belonging to the lower divisions, whose breeding-lamellæ form a pouch for the reception of the young. The only Decapod among them is (which is very remarkable) an animal in which the pouch is not wanting; so that it seems that in the shallow water near the Antarctic Islands higher Crustacea have not been able to find those conditions which are necessary for their development. The Echinoderms which have found the same difficulties have partly overcome them, by being represented here, especially by forms which have no metamorphosis, and in which the young ones find protection with the mother. The Crustacea (with only one exception, the Brachyurous crab in the pools) which develop with free-living larval stages have not been able to resist influences which seem to be especially hostile to the larval stages of these groups. In the deep sea, however, as well as on the surface of the ocean, we find higher and lower Crustacea distributed in the same way as they are in other regions of our globe.

Between Kerguelen and Heard Island we dredged in 150 fathoms, but got only a *Scalpellum*, an *Arcturus*, and a spiny Amphipod, which is the corresponding form to the *Gammarus loricatus* of the north. Near Heard Island, in 75 fathoms, we found the same animal and a *Sphæroma*, but no other crustacean at all.

Near the ice-barrier in the South we had three deep-sea hauls in 1260, 1675, and 1975 fathoms, but got only very few Crustacea, a spiny Isopod, the Munopsid which has been mentioned before, and a large *Serolis* (in 1975 fathoms), which has been figured by Mr. Wild, and which we propose to call *T. Bromleyana*, in honour of Mr. Bromley, Lieutenant in H.M.S. 'Challenger,' who has been many a time in charge of the deep-sea dredgings. The males of this species have a length of 54, the females of 46 millims.; and both sexes are distinguished by a fine blue colour, with a red spot extending over the midst of the body and the eyes. The lateral segments of the pereion are terminated in long spines, which are directed backwards, and attain in the male the length of 59 millims. and 43 millims. in the female.

On our way from the ice-barrier to Melbourne four successful hauls were

got in depths of 1950, 1800, 2150, and 2600 fathoms. In the second of these hauls we found a rhizocephalous cirriped in the open breeding-pouch of a very large *Hymenaster*, which is about to be described by Professor Wyville Thomson. Such crustaceans have, however, as far as I can see, never been described from an echinoderm; and I am not quite sure whether the specimen in question had not been detached from one of the shrimps which came up at the same time and tumbled into the open pouch of the *Hymenaster*. Another Cirriped, a *Scalpellum*, was caught in the last dredging (2600 fathoms), showing once more that Cirripeds are among those Arthropods which may be met with in very great depths. Of Isopods there were specimens of the described Munopsid, and fragments of another hitherto unknown member of this tribe.

The Schizopods yielded again several very interesting forms. *Petalophthalmus inermis* came up from 1950 fathoms, and from the same place we got the posterior part of a cast *Gnathophausia* skin. This genus, three species of which have been described by me from the depths of the Atlantic, is allied to *Lophogaster*, but distinguished by its carapace being not attached to the five posterior segments of the pereion, and by accessory eyes on the second maxilla. It is difficult to tell from this fragment whether it belongs to one of the described species: in size it seems to me to have been intermediate between *G. gigas* and *G. zoëa*. The Euphausiidae are also represented by a very interesting new form, a large species of *Thysanopoda* (from 1800 fathoms), a genus which has hitherto not been found in deep water. It has a length of 50 millims., and is, like the deep-sea *Euphausia* which I have described in my preceding paper, perfectly untransparent. I am not able to say how many pairs of accessory eyes there are in this species, but I think that they exist, and that black spots between the first pleopods may turn out to be such organs of sense.

Of *Chalaraspis* there was a specimen of the species which I have mentioned already (*C. unguifer*), and another very remarkable form which I shall call *C. alata*. In this one the large carapace is very thin and soft, perfectly loose, and covers three of the abdominal segments. The last legs are not elongated like in *C. unguifer*, but somewhat shorter; the first of them somewhat enlarged and recurved in its first joints.

Among the higher Decapods there were two species of *Galathea* and some Peneid and Caridid shrimps, which are not particularly interesting.