

S. S. BERRY
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Sept. 29, 1916.

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REPORT ON THE COLLECTIONS
OF
NATURAL HISTORY

MADE IN THE ANTARCTIC REGIONS DURING
THE VOYAGE OF THE

“SOUTHERN CROSS.”

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P R E F A C E .

THE expedition of the '*Southern Cross*' was fitted out by Sir George Newnes, Bart., in 1898. Everything that experience could suggest for an Antarctic Expedition was amply provided for by him, and it is certain that he spared no expense to render it successful.

The scientific staff on board the '*Southern Cross*' appears to have been well chosen. Mr. Nicolai Hanson, the Zoologist, was an indefatigable collector and taxidermist, and Mr. Hugh Evans was an excellent Assistant-zoologist. They were supported by Lieut. Colbeck, Mr. Louis Bernacchi, Dr. Klovstad as the surgeon, and Mr. Anton Fougner; Mr. C. E. Borchgrevink was in command of the expedition.

The '*Southern Cross*' sailed from the Thames on the 22nd of August, 1898, touched at Madeira and St. Vincent, and reached Hobart Town on the 28th of November. After a fortnight spent in Tasmania, the ship sailed for Victoria Land on the 17th of December, and met with the first of the ice-pack on the 30th of the same month. The initial attempt to reach Victoria Land was not successful, and the result was that the '*Southern Cross*' was hemmed in in the ice-pack for forty days, and was at last headed northwards and returned for a second attempt to penetrate to Cape Adare, the future winter residence of the landing-party. The open sea was once more attained on the 10th of February, and on the 14th the '*Southern Cross*' successfully passed through the ice-pack in six hours.

During the time that the ship was shut up in the ice-pack, Mr. Hanson made large collections of the Seals and Birds, and the natural history notes recorded by him in his private diary are published in the present volume, by permission of his widow. Before starting on the voyage, Mr. Hanson spent some weeks at the

Biological Station near Christiania, in Southern Norway, receiving instructions from Professor Hjorth as to the proper methods of the capture and preservation of marine Invertebrata, *Algæ*, &c. His death in October, 1899, was a great loss to the expedition, as it was to Science generally, for, either from want of knowledge or want of care on the part of the survivors, his collections suffered considerably, especially in the case of the Invertebrata, as will be seen from the reports of the various specialists who have described them. The Seals, of which there was a large series, were sent home in brine, but the tubs in which they were packed were not labelled in any way, and only a few specimens had leaden tickets attached to them. These had unfortunately become so corroded from immersion in the brine as to be, in nearly every case, undecipherable, and no list of the collection of Seals was forthcoming. The memoir on the White Seal, which Mr. Hanson prepared, and which would undoubtedly have added much to our knowledge of this animal, was, I am informed, lost by some mischance on the voyage home. It is, therefore, to be regretted that the work will have to be done again by the naturalists on board the '*Discovery*' and other expeditions which may visit "Antarctica" in the future.

Sir George Newnes has presented to the National Museum the first set of all the specimens collected, and by his directions I have distributed the duplicates to various Museums and Public Institutions in Great Britain and abroad, so that many of these have been enriched by his generosity. There were very few duplicate bird-skins, but the collection of eggs, mostly preserved by Mr. Hugh Evans, was a fine one. A good many duplicate fishes remained, and these have been given to Museums where they were likely to be useful for study. Of the Invertebrata there were not many to distribute. The second set has been sent to Professor Collett for the Christiania Museum, in acknowledgment of the assistance rendered by him in promoting the objects of the expedition, and in consideration of the nationality of the commander.

The task of preparing for publication the various memoirs on the different classes of Vertebrata was assigned by me to Dr. Bowdler Sharpe, and the Invertebrata have been edited by Professor Jeffrey Bell.

Preface.

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I have to acknowledge the kindness of Sir George Newnes in lending several blocks for the purpose of illustrating the present memoir; they appeared in Mr. Borchgrevink's 'First on the Antarctic Continent.' Messrs. Hurst & Blackett have also been good enough to allow the reproduction of many of the illustrations from Mr. Bernacchi's work 'To the South Polar Regions.'

E. RAY LANKESTER,

Director.

BRITISH MUSEUM (NAT. HIST.),

April 20th, 1902.

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THE NATURAL HISTORY COLLECTIONS

OF THE

“SOUTHERN CROSS.”

not

I. MAMMALIA.¹

BY G. E. H. BARRETT-HAMILTON,

Capt. 5th Royal Irish Rifles.

(PLATE I.)

INTRODUCTION.—When it is considered how frequently sealing and whaling vessels have visited the Antarctic seas, and how heavy has been the toll levied upon the marine Mammalia of those regions, it is astounding to find how little is really known of these animals. Leaving out of the question the Elephant-Seal (*Macrorhinus*), whose valuable commercial properties early made it the object of a pursuit so keen that it seems to have been well-nigh wiped out of existence, we find four species of true Seals represented in collections from the Antarctic. These are the Crab-eating or White Seal (*Lobodon*

¹ This report on the Antarctic Seals was written by Capt. Barrett-Hamilton before his departure with his regiment for South Africa: it has been incorporated in the ‘Antarctic Manual for 1901’ (pp. 209–224). Since that publication appeared, I have received corrected proofs from the author from South Africa, and he has made a good many emendations and corrections; so that his account of the Seals, as here published, will be found to differ slightly from the report in the ‘Antarctic Manual.’ I have received valuable assistance from my colleague, Mr. R. I. Pocock, who undertook to look over the proofs in Capt. Barrett-Hamilton’s absence. Mr. Pocock has been at great pains to supply some of the details which the author’s departure for the front had prevented him from completing.

I have also added references to certain books which have appeared since Capt. Barrett-Hamilton left England. He was only acquainted with Mr. Borchgrevink’s paper in the *Geographical Journal*, and I have, therefore, added references, as far as possible, to the latter’s book, ‘First on the Antarctic Continent’ (Newnes, 1901), and to Mr. Bernacchi’s ‘To the South Polar Regions’ (Hurst and Blackett, 1901), in order to bring the synonymy up to date. I have also inserted a few blocks kindly lent by the publishers of the above-mentioned volumes.—R. B. S.

carcinophagus), Weddell's Seal, or the False Leopard-Seal (*Leptonychotes weddelli*), the True Leopard-Seal (*Oymorhina leptonyx*), and Ross's Seal (*Ommatophoca rossi*). All these are at home on the pack-ice of the extreme South Polar regions, probably at all portions of this area, a region where neither the Elephant-Seal nor any species of Eared Seal are known to exist. Three of them are not confined to the pack-ice, but have been found elsewhere; the single exception being Ross's Seal. No other mammal has ever been brought from the Antarctic, and it is highly unlikely, in spite of certain statements to the contrary, that any remarkably new form of mammalian life, at least among the Pinnipeds, remains to be discovered.

Of the above-mentioned four species the earliest to attract the attention of Zoologists, and perhaps the best known to science at the present day, is the Leopard-Seal, a species which was first recognised as distinct by De Blainville in 1820. In 1822 appeared the first notice of Weddell's Seal in the shape of a short description by Professor Jameson in 'Weddell's Voyage to the South Pole,' to be followed by its correct description in binominal terms by Lesson in 1826. Next in order comes the Crab-eating Seal, discovered by the French expedition of 1837-1840. This species formed the subject of two plates in Jacquinot's and Pucheran's 'Atlas,' published some time between 1842 and 1844. Lastly, Ross's Seal was discovered by Sir James Clark Ross during his voyage of 1839-1843, and was described by Dr. J. E. Gray in his account of the 'Zoology of the Voyage of H.M.S. "Erebus" and "Terror,"' published in 1844. Sir James Ross's expedition obtained specimens of each of the four species, and accordingly Gray's work became, and still remains, the standard description of them all. It contains in fact the first written description of the Crab-eating Seal and of Ross's Seal, and the first intelligible description of Weddell's Seal.

From 1844 until the nineties, practically no specimens, except those brought home by sealers, reached our museums; and even the 'Challenger's' share of the spoil, although fortunately described by Sir William Turner in 1888, was meagre enough.

It is not surprising then, that while we actually knew nothing of the appearance and habits of any of the four species, two of them (Weddell's and Ross's Seals) might, until a year or two ago, have claimed, and claimed justly, to be considered amongst the rarest and most obscurely known of all Mammals. Of the latter species, in fact, only the two original specimens were known to exist. A third skin, the skull once attached to which has disappeared, is preserved, as Prof.

D'Arcy W. Thompson has been good enough to inform me, in the Town museum at Dundee.

Very welcome, then, were the specimens brought back by the '*Belgica*' in 1899. Although not numerous, they were excellently preserved and carefully labelled, and in all cases the sex of each specimen had been ascertained. I count it a distinct privilege to have been permitted to describe and study the first scientifically-prepared specimens of Antarctic Seals which have reached Europe. In the '*Belgica*' collection all four species of Seal were represented, and the four skulls of Weddell's Seal, and the two of Ross's Seal, which formed a part of it, must be regarded as special prizes.

The present collection, like that of the '*Belgica*,' contains specimens (both skins and skulls) of each species, the greatest rarities being the skins and skulls of Ross's Seal. Weddell's Seal is poorly represented; of the Leopard-Seal there is one skin and skull, and there are several skins and skulls of *Lobodon*. It is unfortunate that, owing to the death of Mr. Nicolai Hanson, the Zoologist to the expedition, his notes on the Seals have been lost to science. This, and the fact that the metal labels which had been attached to the specimens have been in nearly all cases corroded through immersion in brine, detract greatly from the importance of what would otherwise have been a most valuable collection.

Habits, Life-history, &c.—It may be said with truth that until the last decade of the nineteenth century we knew practically nothing of the habits of the Antarctic Seals. During that period, with reviving interest in the exploration of the South Polar regions, several efforts were made to supplement our information on these subjects, so that at the present time our knowledge, although far from adequate, is no longer a complete blank. I have thought that, in the present incomplete state of our knowledge, it is better to give in detail the observations of the various naturalists rather than to attempt a summary which, at the best, would need almost immediate revision.

The Antarctic summer of 1892-93 found the Scottish whalers '*Diana*,' '*Balaena*' and '*Active*' in the neighbourhood of Joinville Island and Louis Philippe Land. Mr. W. S. Bruce, who accompanied the '*Balaena*' as naturalist, has given us a few notes on the Seals which he observed. These—although I suspect that his identification may have been in some cases mistaken—are graphically written, and give us a fair picture, in a general way, of the mammalian life of the Antarctic.

Mr. Bruce found all four species on the pack-ice, where, "loving the sun, they lie on the pack all day, digesting their meal of the previous night, which had consisted of fish or small crustaceans, or both. . . . All the Seals were obtained from the pack-ice, in bluest and clearest water. . . . The present generation had never seen man, and at his approach they did not attempt to flee, but surveyed him open-mouthed and fearful, during which process they were laid low with club or bullet. Sometimes they were so lazy with sleep that I have seen a man dig them in the ribs with the muzzle of his gun, and, wondering what was disturbing their slumbers, they raised their head, only too quickly to fall pierced with a bullet. . . ."

". . . In December all the Seals were in bad condition, thinly blubbered, and grievously scarred, and it is noteworthy that the females appeared to be as freely scarred as the males. During January their condition improved, and by February they were heavily blubbered and full of scars. The males were apparently as numerous as the females, but I made no definite statistics. . . . By February the embryo is well developed, gestation probably beginning in December. . . . Almost every female, towards the end of January and February, is with young. In no individual did I find more than one embryo. . . ."

The Seals showed great power of jumping out of the water. On one occasion some were found "on a tilted berg, and so high was the ledge above the level of the water," that Mr. Bruce relates that the sealers only "clambered up with difficulty and secured their prey." He has seen the Seals "rising 8 or 10 feet above the sea, and covering distances of fully 20 feet in length."

The extraordinary scars and wounds observed on the Seals, as described by Mr. Bruce, have been already noticed by previous naturalists and attributed to various causes. One of the most fanciful theories ascribes them to the attacks of a large and unknown terrestrial carnivorous mammal corresponding to the Polar Bear of Arctic regions. No traces of any such mammal have been found by later expeditions.

Mr. W. G. Burn-Murdoch, who visited the Antarctic in 1892-93 on board the '*Balaena*,' writes:—The "Seals evidently consider the centre of the snow-pieces their refuge from danger; probably the *Orca* or *Grampus* treats them here as it does the Seals in the north. We found some of the Seals very much scarred with long parallel wounds almost encircling their bodies. I think that these were marks left by the *Grampus*; the smaller cuts about their necks and

shoulders were signs of domestic worries.”¹ These scars are also described by Mr. H. J. Bull, who gained his experiences of the Seals in 1894–95 during a sealing and whaling trip to Victoria Land.² Mr. Bull states that nearly one-half of the seals captured exhibited these peculiar scars or wounds. The wounds, which were in some cases “quite fresh—in fact bleeding—were not found about the necks and heads of the animals, but about their body, more particularly the lower parts.” Their peculiarity consisted in their great length—“up to twelve inches,” and their frequently parallel arrangement at a distance of “about one inch apart.” Their nature and appearance as described above, together with the fact that “the wounded Seals were met with throughout the pack, consequently in many cases hundreds of miles away from the nearest land,” are, thinks Mr. Bull, a death-blow to the theories which ascribe them either to the work of a “huge land mammal” or to the fighting of the males in the breeding season. Far more likely is it that they are caused by the attacks either of some Shark, or more probably still by the Killer Whale, a cosmopolitan Cetacean with a well-known reputation for a partiality for Seal-flesh. Mr. Bull’s opinion is strengthened by the fact that “the scars were rarely, if ever, found on the Sea-Leopards,” “as if the size of this animal rather awed the mysterious enemy of his smaller cousins.”

Mr. Bull’s theory, which has certainly much to recommend it, is commented on by Dr. C. Hart Merriam,³ who says:—“The long scars on Hair-Seals in the North Atlantic are believed to be caused by Sharks’ bites, and the same may be true in the Antarctic Ocean.” My own experience of the Northern Fur-Seal (*Callotaria ursina*), and its apparent apathy in the water, when in close proximity to its enemy, the Killer, makes it seem highly probable that if the Seals of the Antarctic be only half as foolish as the Fur-Seals—a supposition which seems to be well-nigh proved by the ease with which they allow themselves to be killed by man—then many would easily fall victims to the Killers or Sharks, who might scar many more than they eat, either in a mere spirit of wantonness, or, if well fed, through sheer half-heartedness in securing their prey. It is significant that Mr. Bull’s experience of the pack was gained in December and January, exactly at the time when Mr. Bruce found the Seals heavily scarred, but improving in condition. It seems

¹ ‘From Dundee to the Antarctic: an Artist’s Notes and Sketches during the Dundee Antarctic Expedition, p. 237, 1892–93.’ London, 1894.

² ‘The Cruise of the “Antarctic” to the South Polar Regions.’ London, 1896. See pp. 139, 187–194.

³ *Century Magazine* for January, 1896.

probable that on the pack, in January and February, they are safe from their enemies, whoever they be. It may be that food is then so abundant that there is no need to leave the pack for the purpose of obtaining it, and so the Seals escape exposure to the attacks of their enemies. It may be that those enemies are migratory, as the Killer is said to be, and have already betaken themselves to other regions. At all events the subject is well worthy of further attention.

Besides his account of the scars observed on the Seals, Mr. Bull's most interesting statement is (for a naturalist) that, while all four species were observed in the pack, they were evidently in no great numbers. The whole catch, in fact, reached only 180 skins.

Capt. C. A. Larsen, of the Norwegian whaler '*Jason*,' has given us a few notes¹ as the result of his visits to the regions east of Graham Land in 1892-93 and 1893-94. At some places Seals (the species not specified) were found in enormous numbers, especially in localities "where there were plenty of small fishes and shrimps." One hundred and twenty-five *Fiskerel* killed on December 1st, 1893, are described as being "very big and fat." On December 11th near Christensen Island, "the Seals lay in places so closely packed that we had to make circles in order to advance. It was a delightful sight to see those masses of animals, most of which proved to be youngsters of the *Fiskerel*, which already had changed hair; they were beautifully fed, and looked like so many balls. Here and there an old animal was amidst the youngsters. The Seals were not a bit afraid of us; on the contrary, they stretched their flippers towards us as we pelted them. . . . There must have been here abundant food for the Seals, as the ice was everywhere strewn with fishes and fish-bones. When I opened their stomachs, I saw them filled with a fish which has a white flesh, and which we call at home *Kvitting* (Whiting), and also with sharp bones."

Like other explorers, Capt. Larsen sometimes found dead Seals. "In one of the valleys," near Cape Seymour, Louis Philippe Land, "many dead Seals were seen, one of which was almost petrified, while others seemed to have come only recently; and there were corpses in which the fat still contained some streaks of blood."

Dr. Racovitza, the naturalist of the '*Belgica*,' has also published some highly interesting observations on the Seals which he encountered in the pack-ice in the neighbourhood of Palmer Land in the same region. These will be recorded under the heading of

¹ See the *Geographical Journal*, vol. iii., January-June 1894, pp. 239-336; also vol. iv. pp. 333-344.

each species. Of special novelty is the description of the appearance and of the strange and unexpected vocal powers of *Ommatophoca*. As regards food, it would seem that small Crustaceans and other Invertebrates are so abundant, that the life of all, with the single exception, probably, of the Leopard-Seal, consists, except in the breeding season, of a monotonous alternation of heavy gorging and long sleeps during the digestion of a meal which needs no trouble to procure.

Dr. Racovitz has something to say about the temperature of the Seals, which, as in the case of the Penguins, he found to be remarkably low. In the case of the Seals it did not exceed 37°. So efficacious is the protection against the cold afforded by the thick layer of blubber which underlies the skin in these animals, that the carcase of a Seal, exposed to a temperature of 20°, was still warm inside, twenty-four hours after death.

It is obvious that we are still in sore need of careful and detailed studies of the life-history of each species, of their habits during the breeding season; and, above all, of the circumstances which admit the existence side by side of four species each distinct enough to form a separate genus, and whose very dentition differs in a highly remarkable degree. Such marked diversity of teeth and skull cannot be meaningless; yet (except in the case of *Ogmorhinus*) no observer has as yet laid special stress upon any corresponding divergences of habits or life-history.

Owing to the unfortunate death of Mr. Hanson and the loss of his zoological notes, the 'Southern Cross' Expedition has made no striking addition to our knowledge of the habits and life-history of the Antarctic *Phocidae*. No MS. of any sort dealing with this subject has been placed in my hands, but Mr. Borchgrevink occasionally mentions Seals in a paper read before the Geographical Society.¹ These notes, wherever they deal with a particular species, are alluded to under the heading of that species. The more important entries tell us that Seals were scarce in the pack, increasing in numbers, however, as the ship proceeded southwards, when the number of Seals basking together increased considerably, and in the vicinity of Coulman Island, Cape Constance, and in Lady Newnes Bay, there were as many as three hundred Weddell's Seals together. In the vicinity of Cape Adare they were to be found nearly all the winter, either on the ice near their blow-holes, or in the water at these holes, which they managed to keep open in Robertson Bay

¹ 'The 'Southern Cross' Expedition to the Antarctic, 1899-1900.' *Geographical Journal*, October, 1900, pp. 381-414.

throughout the winter. As to the moult of the Seals Mr. Borchgrevink simply remarks (p. 382): "The moulting starts on the back, in a straight line from nose to tail."

As to the *migratory movements*, if any, on the part of the Seals, we have practically no evidence. Mr. Hanson is silent on the subject, and Mr. Borchgrevink's remarks certainly do not help us as to the existence of any extensive migration.

Classification, Relationship, &c. — In dealing with the Antarctic *Phocidae*, it is hardly possible to escape from the difficult questions of classification and relationship. I am, however, fortunate in this respect to be able to follow in the footsteps of zoologists like the late Sir William Flower, Dr. St. George Mivart, and Sir William Turner.¹ They have entered into the matter rather fully, and I feel little reason to depart from their conclusions, although I was in duty bound to verify them for my own satisfaction.

The number of the incisor teeth has usually been taken as the most convenient feature upon which to base a classification of the *Phocidae*. It seems, however, at first sight a somewhat artificial proceeding to attach so much importance to a single character, especially as such great divergences occur amongst the teeth in this family. I therefore set to work to ascertain if any other more natural character should be forthcoming. My inquiry was without success, and I am bound to say that there is no character which agrees so well with the known facts of distribution as does that of the number of the incisor teeth. Adopting this, we have three clearly defined groups, of which one, the *Phocinae*, includes nearly all the northern forms, another, the *Stenorhynchinae*, nearly all the southern, with the addition of the tropical and sub-tropical *Monachus*, while the third, the *Cystophorinae*, includes the geographically separated, but certainly allied, *Cystophora* and *Macrorhinus*. No other character would give such clearly defined groups. To take the shape of the teeth, for instance. Here all kinds of intermediate forms exist, from the feeble organs of *Ommatophoca* to the extraordinary and highly specialised instruments of *Lobodon* or of *Ogmorhinus*. Further, on this basis, the little *Phoca hispida* of Arctic waters would find its nearest relative in the giant Antarctic *Ogmorhinus*, since the teeth of the one are miniatures of those of the other. Moreover, if there be any meaning in the prevalent

¹ Cf., for instance, Sir William Flower (P.Z.S. 1881, pp. 145-162); Dr. Mivart (P.Z.S. 1835, pp. 484 to 501), and Mr. H. N. Turner (P.Z.S. 1848, pp. 63 to 88).

views of relationship and descent, it becomes, I think, impossible to refuse recognition to a character such as that presented by the number of the teeth, until it can be shown to be useless or misleading. Thus, although I am aware that, by doing so, I am forming a kind of hotch-potch, in bringing together in the case of the *Stenorhynchinae* some, in other respects, highly distinct animals, I find myself unable to depart from the arrangement of sub-families already laid down by previous writers.

PHOCINAE.	STENORHYNCHINAE.	CYSTOPHORINAE.
<i>Phoca</i> (including all northern sub-genera, such as <i>Erignatus</i> and <i>Histri-cophoca</i>), <i>Halichærus</i> .	<i>Monachus</i> , <i>Leptonychotes</i> , <i>Ogmorhinus</i> , <i>Lobodon</i> , <i>Ommatophoca</i> .	<i>Cystophora</i> , <i>Macrorhinus</i> .

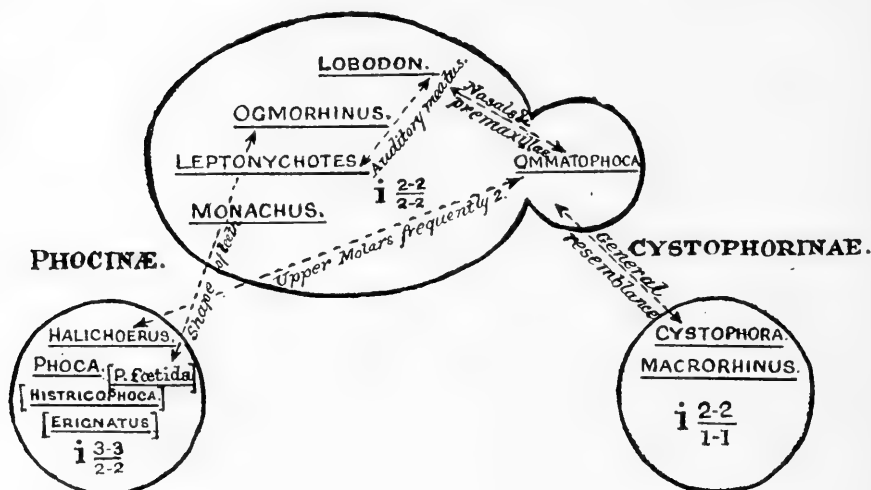
Of these Sub-families, one, viz., of the *Cystophorinae*, is quite satisfactory. Further, I have no doubt about the propriety of including, in a distinct group, all the species represented by *Phoca* in its broad sense. *Halichærus* I regard as the most distinct form of northern Seal. Yet, except in its teeth, it shows no characters not easily attributable to its isolated existence, and, if we are to make sub-families for every Seal whose teeth show remarkable features, we shall find ourselves instituting almost as many Sub-families as there are species at present. In the strength and shape of its teeth *Halichærus* approaches most nearly to *Monachus*, but, in the bulbous character of their roots, it resembles to a certain extent *Cystophora* and *Macrorhinus*.

The greatest difficulties beset us when we come to consider the *Stenorhynchinae*, a sub-family in which every genus possesses teeth which are at first sight unparalleled elsewhere. I think, however, that these dental characters must be regarded as instances of high specialisation to suit the particular needs of each species. They can afford no aid in the search for relationship. We are, therefore, I think, justified in neglecting them for the present purpose, and we may turn to more generalised characters, such as the appearance and structure of the skull. Apart from the question of dentition, there is a very close general resemblance between *Monachus* and *Leptonychotes*. At the other end of the group and nearer the *Cystophorinae* lies *Ommatophoca*, but even this, the most aberrant member of the sub-family, is connected by the form of its nasals with the remainder through *Lobodon*, in which the peculiar formation of the pre-maxillae and the inclination of the external nares is paralleled, although to a lesser degree. *Lobodon*, again, is related to *Ogmo-*

rhinus and *Leptonychotes*, and thus to *Monachus*, in the inclination of the external nares and in the fact that the auditory meatus opens externally and not posteriorly.

My view of the various relationships will be best shown by means of the following diagram:—

STENORHYNCHINÆ.



By this arrangement the *Phocinae* are shown as the least, the *Cystophorinae* as the most, specialised sub-family. Between them lie the *Stenorrhynchinae*, with *Monachus* and *Leptonychotes*, both resembling the *Phocinae*, at the top, and *Ommatophoca*, with its strong *Cystophorine* leanings, at the base of the tree. Connecting these are *Ogmorhinus* and *Lobodon*, in some respects showing resemblances both to *Leptonychotes* and to *Ommatophoca*; in other respects, as in their dentition, they are the most highly specialised members of the whole family.

It will be seen that I am not inclined to impute importance to characters such as the large orbits of *Ommatophoca*, or to the presence or absence of claws on the hind-flippers. Stress has been laid on both these characters, and *Leptonychotes* and *Lobodon* have been distinguished on the ground of the total absence of claws on the hind-flippers in the former. The orbits of *Ommatophoca* are, however, not larger than those of *Cystophora* and of other Seals, while a careful examination of the undried skins has revealed the presence of a

variable number of, it is true, rudimentary claws on the hind-flippers of each species.

It seems improbable that we shall ever approach more nearly to an understanding of the true inter-relationships of the *Phocidae* until we discover some of the ancestral forms from which they have sprung.¹ Possibly the various genera left the ancestral tree at various epochs, and, if we are to follow Sir William Flower, we have in *Macrorhinus* the most highly specialised form of the whole group.

As to the *Stenorhynchinae*, they must be regarded as the descendants of an ancestor which became isolated from the precursors of the remaining two sub-families at a sufficiently early period to allow of the formation of the various distinct genera which now exist. The exact relationships of these amongst themselves cannot, I think, be more clearly indicated than has been attempted above. *Ommatophoca* is certainly the most distinct, and may be regarded as annectant between the *Stenorhynchinae* and *Cystophorinae*. If any convenient result would accrue therefrom, it might be taken to constitute a separate sub-family, the *Ommatophocinae*, but I do not see how the multiplication of sub-families can help us much.

A certain amount of light on the origin of some of the genera may, perhaps, be derived from the young. Thus the young of *Halichærus*, a genus which has not at the present day an Arctic habitation, are white (or nearly so), thereby permitting the suspicion that its ancestors were of Arctic origin, or, at least, dwellers in regions where the cold was more intense than those which they at present frequent. On the other hand, the only Seal of the Antarctic, which is nearly white, is *Lobodon*, and its mottled young suggest a comparatively recent inroad of the species into the cold regions of the South Polar area.

It is interesting to find the teeth of *Phoca hispida* paralleled in the south by those of *Ogmorhinus*, while the teeth of *Leptonychotes* recall those of *P. vitulina*, and *Monachus*, in this respect to a certain extent, resembles *Halichærus*.

Dentition.—The teeth of the *Phocidae* are remarkable for the extreme variation which they display in the genera. In most cases dental characters present the most distinct features between animals which are externally very similar. In the skins, as seen in museums, *Leptonychotes* and *Lobodon* are, but for their colour, difficult to separate, yet nothing could be more distinct than the forms of their

¹ *Stenorhynchus vetus* of Leidy is so close to (if not identical with) *Lobodon carcinophagus* that it affords us no help whatsoever.

respective teeth. It is evident that, whereas the needs of existence do not tend towards any very great variation in bodily shape, the food of the *Phocidae*, or the method of securing it, may be so varied as to have induced the evolution of many quite distinct types of dentition, the production of which postulates great plasticity of the teeth. The result is that the *Phocidae* have already, by their teeth, shown themselves to be on the road to division into groups corresponding with some of those of the terrestrial mammalia. Thus, while *Ogmorhinus*, with its sinuous body and saw-like teeth, represents the most specialised form of Pinniped Carnivore on a large scale, *Ommatophoca*, *Erignatus*, and *Cystophora* feed on more feeble prey, while the smaller Carnivora are represented by *Phoca hispida* and *P. vitulina*—resemblances which seem to suggest all sorts of possibilities in dual evolution, possibilities of the rise of what now appear to be homogeneous Orders of mammalia independently and in different regions, just as Dr. Kükenthal believes may have been the case with the Whalebone and Toothed Whales.

As regards the modifications of the teeth, it is, at first sight, difficult to discover any connection between the grinders of *Lobodon* with their five complicated cusps, and the comparatively simple teeth of *Phoca vitulina*. We have, however, numerous intermediate stages whence we may gain some insight into the relationship of these two, and of other forms. Thus, in *Leptonychotes* and *Phoca vitulina* the teeth are simple, the central cusp is all prominent, and there is but small trace of accessory or smaller cusps. *Leptonychotes* is relatively the weaker of the two in dentition; but from very strong teeth, of the type of those of *P. vitulina*, may have been derived the (relatively) strongest teeth of the whole group, those of *Monachus*. Diminish the cusps and reduce the size of the teeth, and there results the remarkably weak-toothed *Ommatophoca*! *Phoca groenlandica* may be taken as an example of development in another direction, for here there are distinct accessory cusps, although they are not nearly so strongly developed as in *Phoca hispida* or in *Ogmorhinus*, the triple-cusped teeth of which are examples, the former on a small, the latter on a large scale, of precisely the same type of instrument. Finally, there is the complicated arrangement of *Lobodon*, in which the central cusp is immensely developed at the expense of the remainder, and possesses a frequently bulbous and recurved apex. The anterior cusp of *Ogmorhinus* is here represented by a small corresponding protuberance, the posterior cusp appears as three distinct, rather antero-posteriorly flattened, projections running across the width of the tooth.

Quite as distinct in their own way are the teeth of the *Cystophorinae*. In these there is a simple conical crown, very feeble for the size of the animal and wanting all trace of cusps on its cutting edge. The root is swollen and bulbous. Somewhat similar, but much stronger, are again the teeth of *Halichoerus*, and these in their massiveness remind us of those of *Monachus*.

In the whole economy of the Antarctic *Phocidae*, nothing can be more remarkable than the divergences in the shape and size of the cheek-teeth. Side by side, on the South Polar pack-ice occur four genera, *Lobodon*, *Ogmorhinus*, *Ommatophoca*, and *Leptonychotes*. Living the same life, with the same sources of food around them, and, moreover, with the same number of teeth, no two genera agree in any single respect in the form and pattern of the individual grinders. In *Ogmorhinus* there is found the most formidable, in *Ommatophoca* the most feeble, dentition of the family. Again, while *Lobodon* seems to find necessary for its existence a set of teeth surmounted by perhaps the most complicated arrangement of cusps found in any living mammal, *Leptonychotes* survives on the same ice-floe with the help of a simple fairly strong dentition. Lastly, while there is, so far as is known, little individual variation in the three remaining genera, in *Ommatophoca* there occurs one of the most remarkable instances of individual variation in mammalian teeth known to science. Not only are the size and the number of the roots of each tooth variable, but the actual number of teeth in any particular specimen can never be foretold with certainty.

Nothing can be more certain than that such a state of things as I have here described cannot be meaningless. Developments like these must in each case be connected with habits and food, which must surely differ in a manner corresponding to such remarkable differences of structure. This supposition is, I think, supported by the fact that, as already stated, there are to be found amongst the Antarctic *Phocidae* resemblances of dentition to those of northern seas. Thus it is reasonable to suspect that the resemblances between the teeth of *Ogmorhinus* and of *Phoca hispida* are not altogether without reference to similar uses.

With a view to approach the root of this matter I have examined with some care all the available accounts of the habits of the Antarctic *Phocidae*. Meagre as these are, they are sufficient to afford me some assistance, especially those of Dr. Racovitza. Thus the fact that *Ogmorhinus* is alone described as occasionally killing and eating Penguins, and that one of these Seals accepted as food the bodies of two of these birds thrown overboard from the

'*Belgica*,' is certainly in keeping with the formidable cutting teeth and massively developed cranial crests of this animal. The Leopard-Seal may then be regarded as the true carnivore of the group, subsisting on fish (and, when they can be obtained, birds), a prey which needs both catching and holding. For such a rôle, requiring both speed, strength and activity, besides its teeth, its elongated head and body must be eminently suited. The three remaining genera are more puzzling. In their case no difference of food or habits had, until recently, been recorded. In spite of this I felt sure that the differences of dentition must be correlated with differences of habit, in however inconspicuous a degree. In *Lobodon* and *Leptonychotes* poorly developed cranial crests seem to indicate that no great violence of jaw action is needed, a character in the second case supported by the feeble dentition. In *Lobodon* the teeth, although actually not of feeble size, are not of a shape which would lend itself to much use in gnawing and grinding, and the small extent to which they are actually worn down bears this out. It is then not easy to imagine what can be the use of teeth so unique in zoology. Possibly their formation may be explained by some words of Dr. Racovitza. His account of the feeding of *Lobodon* is as follows:—"Les *Euphausia* forment sa nourriture habituelle: il nage la bouche ouverte dans les bancs de ces crustacés, à la façon des Baleines, et en consomme de grandes quantités." On reading these words I was at once struck by the idea that the teeth of *Lobodon* might possibly serve the animal as a sieve, whereby to rid its mouth of the water taken in with the *Euphausia*, somewhat after the manner of baleen in the *Balaenidae*. For this purpose the teeth seem to be exactly suited. They do not fit closely, but alternate with those of the opposite jaw so that the cusps form a perfect sieve. I believe, therefore, that the use of these extraordinary teeth is as I have suggested, and I would direct the attention of zoologists who visit the Antarctic in the future to what appears to be a point of great interest in the life-history of this animal, and is, I believe, a hitherto unparalleled function for the teeth of a mammal. Even if my supposition prove incorrect, attention should be directed to the study of *Lobodon*, with a view to throw light on the use of its teeth. At all events, if extensively used for mastication, they would speedily show the effects of wear and tear in a far more conspicuous manner than they actually do.

On the Antarctic pack-ice the food of *Leptonychotes*, like that of *Lobodon*, is said to consist of *Euphausia*. Its teeth are utterly different. I suggest that the form of the simple but not very

strong teeth of this species is due to the fact that it is not confined to the pack-ice, and that in other regions its food-supply is derived from creatures which need some holding, but yet are not so strong or active as those which serve to nourish *Ogmorhinus*. The external shape of *Leptonychotes* is that of an animal fitted for rapid motion in the water, so that it is natural to suppose that fish may form no small portion of its diet.

Lastly we have *Ommatophoca*, with its very feeble and variable dentition, obsolete sagittal crest, yet comparatively strong lambdoid crest. It seems probable that the exact number of its teeth is not of importance to this animal. Even their size is sufficiently variable to admit of the thought that the whole dentition is little used, and it seems to me highly probable that *Ommatophoca* is in the process of reducing its teeth. Its food is soft, consisting, according to Dr. Racovitza, of large cephalopods. Such crushing of these as might be necessary would be performed as well by the flat jaws as by cusped teeth like those of the *Phocidae*. Consequently the teeth are in a state of disintegration. This supposition agrees very well with what I have already suggested in the case of *Lobodon*. In the last-named genus the teeth are highly developed, not for grinding purposes, but for use as a sieve. In *Ommatophoca*, not being available as a sieve, they are useless. They thus fall outside the influence of natural selection, except in so far as their reduction may be of use to the species. Variation and enfeeblement result, processes which, if for the advantage of the animal, will no doubt be carried to their fullest extent. My supposition is supported by the external appearance of the animal as graphically described, I think for the first time, by Dr. Racovitza. It is, he writes: "le plus phoque des phoques, car chez lui toute forme de quadrupède a disparu. Son corps n'est plus qu'un sac fusiforme pourvu de membres très réduits," from which I gather that Ross's Seal does not possess the natural appearance which belongs to an agile carnivore such as *Ogmorhinus*. But the most remarkable confirmation of my supposition is supplied by one of the skulls obtained by Mr. Nicolai Hanson. In this skull (No. 1), which, although adult, reaches the shortest total length of any skull of the genus known to me, there is no trace of any cheek-teeth either in the upper or lower jaws. Not only have the teeth disappeared, but with them have vanished, to a great extent, the alveoli. There seems, then, to be some solid ground for my hypothesis both in regard to *Lobodon* and to *Ommatophoca*. If I am right, there is here a striking instance of the acquirement of perfectly distinct habits, and consequently of form and appearance,

by two animals which must have been formerly closely allied, and which are subject to the influence of precisely similar surroundings.

P.S.—In the account of each Seal my procedure has been to commence, as usual, with the synonymy. Under this heading I give not a complete list of the works wherein any given species has been mentioned—a method involving, so far as I can see, immense labour without any corresponding advantages—but a list of the principal references to the species.

After the synonymy follows an indication of the location and origin of the type specimens when known, succeeded by paragraphs dealing with the history, distribution, habits, and external appearance.

Next comes a short description of the skull. The principal dimensions of the crania brought home by the '*Southern Cross*' are compared with those of the specimens procured by the staff of the '*Belgica*' and with those in the British Museum.

There are general remarks on any character which seems deserving of special notice, a short list of the distinguishing characteristics for the guidance of the zoologists accompanying the new British expedition, and a summary of what is known of the habits and distribution.

Any attempt at a detailed description of either skulls or skins has been purposely avoided. In the case of the skins of the '*Southern Cross*' collection I have had no opportunity of inspecting them (with the exception of one or two examples) in a condition in which it would have been possible to describe them. Moreover, I believe that descriptions and dimensions of Seals, to be of value, should be taken from the animals when in the flesh.

As regards the skulls, there is not one of which I know the sex, and only a few of which I know the skin appertaining to them. It would, in my opinion, be of little value to enter into details regarding specimens, the labels of which have perished from want of care on the part of those entrusted with their preservation. Moreover, owing to the death of Mr. Hanson, and the absence of his notes, the whole work will have to be performed again from the collections procured by the various expeditions which started in 1901.

LEPTONYCHOTES.

Leptonyx, J. E. Gray, Ann. & Mag. Nat. Hist. vol. i. p. 582, 1837, nec **Leptonyx**, Wm. Swainson, Zoological Illustrations, ser. 2, vol. iii. pl. 117, 1832-33 = **Hylactes** (see Catalogue of Birds, vol. xv. p. 349, 1890), nec **Leptonyx**, Wm. Swainson in Lardner's Cyclopædia, vol. xxviii.; Animals in Menageries, p. 314, 1838 = **Coryphospiza** (see Catalogue of Birds, vol. xiii. p. 765, 1890)Type *L. weddelli*

Leptonychotes, Gill, Arrangement of the Families of Mammals, p. 70, 1872.

Poecilophoca, R. Lydekker, in Flower and Lydekker's Study of Mammals p. 605, 1891.

1. LEPTONYCHOTES WEDDELLI.—WEDDELL'S SEAL, OR THE FALSE SEA-LEOPARD.

Leopardine Seal, Jameson in Weddell's Voyage towards the South Pole, vol. i. pp. 22, 24, & 134, with a plate (not correct).

Sea Leopard, or Leopard Seal. Weddell, *op. cit.* pp. 22 & 134.

Otaria weddellii, R. P. Lesson, in Ferussac's Bull. Sci. Nat. vol. vii. pp. 437-438, 1826.

Leptonyx weddelli, J. E. Gray, Ann. & Mag. Nat. Hist. vol. i. p. 582, 1873; Voy. H.M.S. 'Erebus' and 'Terror,' Zool. p. 7, pls. 5 & 6, 1844; Cat. Bones of Mammalia, p. 142, 1862; Cat. Seals and Whales, pp. 11 to 13, 1866; Hand.-List of Seals, Morses, Sea-Lions, and Sea-Bears, p. 14, 1874; T. Gill, Prodrome of a Monograph of the Pinnipeds, Comm. Essex Institute, p. 6, July 1866.

Stenorhynchus weddellii, R. P. Lesson, Manuel de Mammalogie, p. 200, 1827; Sir Richard Owen in Ann. & Mag. Nat. Hist. vol. xii. pp. 331-332, 1843.

Leptonychotes weddelli (or **weddelli**), T. Gill, Arrangement of the Families of Mammals, p. 70, November 1872; J. A. Allen, History of North American Pinnipedes, p. 467 (see also pp. 214, 418, 419, 421, 446, 450, 451, 452, 453, 463), 1880; Sir William Turner, Report on the Seals collected during the Voyage of H.M.S. 'Challenger' in the years 1873-76, pp. 20 to 28 & 65, 1888; E. G. Racovitza, La Vie des Animaux et des Plantes dans l'Antarctique, pp. 30, 52, 1900; Cook, First Antarctic Night, p. 264 (1901, photograph); Barrett-Hamilton, Antarctic Manual, p. 218 (1901); Bernacchi, To the South Polar Regions, pp. 73, 165, 235, 240, 245 (photo.), 274 (1901); Albert, Pinip. Chile, p. 10 (1901, Juan Fernandez).

Weddellii (*Lobodon carcinophaga*), Borchgrevinck, First on the Antarctic Continent, p. 81 (1901, photo.).

A **Weddellii** Seal, id. t. c. p. 109 (photo.).

Weddellii, id. t. c. pp. 236, 237 (photo.), 260, 286.

Sea Leopard (**Stenorhynchus leptonyx**, Gray), H. N. Moseley, Notes by a Naturalist. An account of observations made during the Voyage of H.M.S. 'Challenger' found the World in the years 1872-76, &c. London, 1879.

Type.—The original specimen of the "Leopardine Seal" of Jameson and *Otaria weddellii* of Lesson was presented to the old Museum of Edinburgh University in that city in 1821-22, and is now in the Museum of Science and Art. Dr. R. H. Traquair, Keeper of the Natural History collections, to whom I am indebted

for this information, has kindly sent me a sketch of the teeth of this specimen, which places its identity beyond question.

Synonymy.—This calls for but little notice. The generic terms *Leptonyx* and *Stenorhynchus* being preoccupied, must be succeeded by *Leptonychotes*, which is nearly twenty years older than *Pocillophoca*.

History and Distribution.—The first examples of this Seal seem to have been brought home by Captain James Weddell from the South Orkneys, where several of them were killed on the 15th of January, 1823 (pp. 22 and 24). As already stated, a specimen was deposited in the old Museum of the Edinburgh University, and was recognised by Professor Jameson as representing a new species “to be referred to the division *Stenorhinque* of F. Cuvier,” but



FEMALE AND YOUNG OF WEDDELL'S SEAL.

(By permission of Sir George Newnes, Bart.)

with the teeth not quite in agreement “with those of his *Phoque Septonyx* (*sic*), nor with those of Sir E. Home, figured in pl. xxix. of the *Philosophical Transactions* for 1822.” Again, in writing of the South Shetlands, Weddell states (p. 124), that “some *Sea-Leopards* have also been seen.” At page 24 of the same work is printed a brief description of the new Seal by Professor Jameson, who, however, did not apply to it a Latin name, but contented himself with styling it the “leopardine seal.” The description is in many respects vague. The teeth are neither figured nor described, and the sketch, “drawn from nature” by Weddell himself, is extremely fanciful. It is not then surprising that Lesson, who saw an opportunity of describing the new species under the name of *Otaria weddellii*, should have been completely deceived as to its true nature. Lesson’s description

is, in fact, highly incorrect, and would in many respects apply rather to the True Leopard-Seal (*Ogmorhinus leptonyx*) than to the present species. Mystified by this and by the use of the name Sea-Leopard, Dr. J. E. Gray, although at first recognising the distinctness of the new species, was afterwards for a time induced to believe that the name *Otaria weddellii* had actually been applied to a specimen of *Ogmorhinus leptonyx*. He subsequently convinced himself by an examination of the teeth of the type specimen that this opinion was not correct. I am fortunately able to support Gray in his second opinion.

For the first intelligible description of Weddell's Seal, science is indebted to Gray. This was based upon two specimens (skins, with skulls) sent home by Captain Fitzroy, R.N., from the river Santa Cruz, in about latitude 50° South, on the east coast of Patagonia. Mr. Albert has recently recorded a specimen from Juan Fernandez. Later a skin and two skulls were brought home by the Antarctic Expedition of 1839–1843, which (although not precisely labelled) were doubtless obtained on the Antarctic pack-ice. The skull of another specimen, shot at Betsy Cove, Kerguelen, on the 9th of January, 1874, by the members of the 'Challenger'¹ Expedition, formed the subject of an elaborate account by Sir W. Turner, and is now in the Anatomical Museum of the University of Edinburgh. The bones of this Seal were found abundantly by the members of the expedition, together with those of the Elephant-Seal, on the sandy beach of Heard Island. The species for long remained so poorly represented in collections, that an imperfect skull, brought home by a sealing ship, and presented by Mr. R. M. Martin in 1897, of which the exact origin is unknown, only brought the number of the specimens in the Natural History Museum to four.

The specimens brought home by the 'Belgica' and 'Southern Cross' were therefore very welcome additions to our list. The species was found by the former expedition, both on the pack-ice as well as in the Straits of Gerlache in the Palmer Archipelago; by the latter in many places in Victoria Land.

Although so little known, Weddell's Seal is probably of wide distribution, and, except where its numbers have been reduced by the sealers, of frequent occurrence. It is not quite certain whether the herd of four hundred alluded to by Moseley as occupying a station at Swain's Island, a small outlier of Kerguelen, belonged to this species or to the True Leopard-Seal, especially as he mentions having

¹ See narrative of the Voyage of the 'Challenger,' pp. 355 and 373.

seen "one much larger in Royal Sound."¹ At all events, the specimen which the '*Challenger*' brought home has proved to be a *Leptonychotes*.

In his voyage on the '*Balaena*,' Mr. Bruce saw only about four of this species altogether, and these singly; Dr. Donald, however, met with greater numbers. Two were quite young, and one of these he attempted unsuccessfully to bring on board alive.

Contrary to this experience, we learn from Mr. Borchgrevink (p. 236) that Weddell's Seal was, next to *Lobodon*, the "best represented" Seal met with during the passage of the '*Southern Cross*' through the pack-ice.² Its numbers increased considerably as the ship proceeded southwards, and in the vicinity of Coulman Island and Cape Constance in Lady Newnes Bay as many as three hundred were seen together. It was found breeding in Robertson Bay, and occurred throughout the winter.

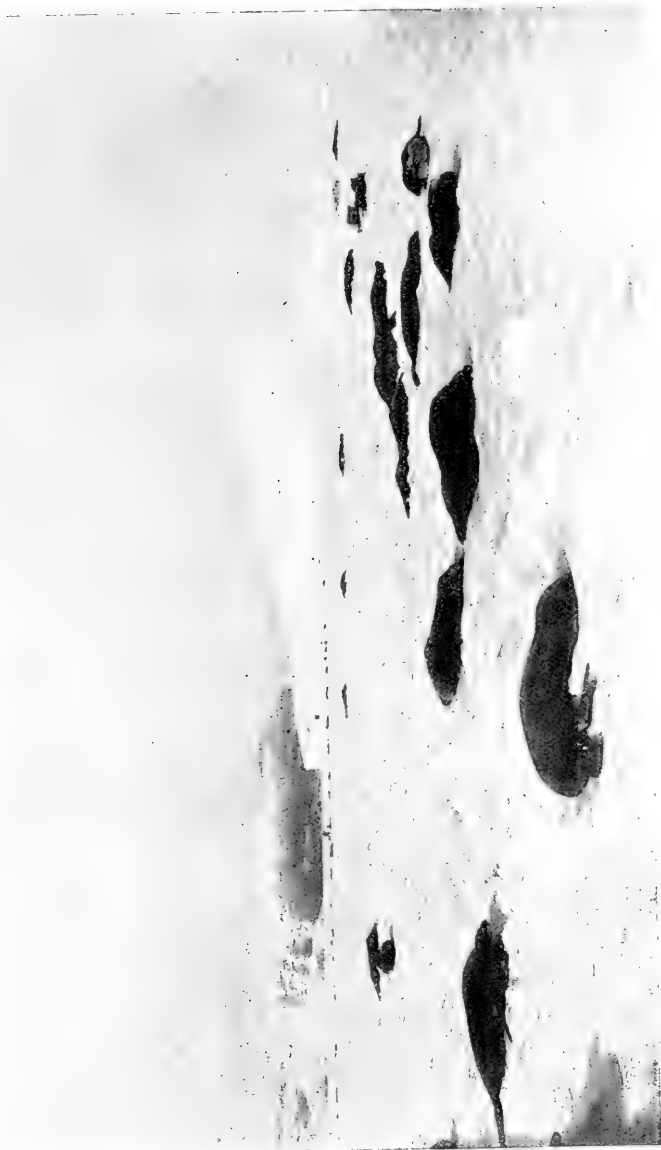
Habits.—Practically nothing is known of the habits of Weddell's Seal. Like the Crab-eating Seal, it feeds, when on the pack-ice, according to Dr. Racovitza, on *Euphausia*, and the young, which resemble little plump and hairy Bears, are born in September. Unlike *Lobodon*, it does not show its teeth on being approached, but executes a manœuvre which is described by Racovitza in the following words: "Il ouvre une large gueule rose et d'ordinaire se renverse sur le dos en relevant en même temps sa tête et l'arrière train, se courbant ainsi en arc. C'est une simple manœuvre pour effrayer l'ennemi assez naïf pour se laisser prendre." It seems to well deserve the epithets "silly" and "lazy." Moseley's Kerguelen Island specimen "showed no fight at all, and never snarled or showed its teeth." It was killed with a stone and a hunting knife.

External appearance.—This species seems to be recognisable rather by its negative than its positive characters. Although spotted, it is not so distinctly or abundantly so as the True Leopard-Seal, so that it is, in this respect, intermediate between that species and Ross's Seal. Moseley described³ the specimen which he killed at Kerguelen Island as "very like the common British Seal in appearance. It is spotted yellowish-white and dark grey on

¹ H. N. Moseley's '*Notes by a Naturalist: an account of Observations made during the Voyage of H.M.S. "Challenger" round the world in the years 1872-1876*,' &c. London, "New" edition, p. 174, 1892.

² Cf. *infra*, p. 94.

³ It is a pity that Moseley made the very pardonable error of alluding to his specimen as "a Sea-Leopard (*Stenorhynchus leptonyx*, Gray)" since such errors are readily copied and not easily eradicated. Moseley's description is, for instance, quoted under the heading of the True Leopard-Seal on p. 143 of vol. ii. of the '*Royal Natural History*.'



ROOKERY OF WEDDELL'S SEAL.

(By permission of Messrs. Hurst & Blackett.)

the back, the under surface being of a general yellowish colour." Dr. Racovitza characterises it as being "à pelage gris-fer moucheté de taches rondes de couleur jaune." Of the specimens brought home by the '*Belgica*,' the younger (No. 891), is slaty grey above, with the under side both of the body and of the flippers dirty white. The colour of the back and belly is separated by a fairly distinct line of demarcation, which runs from the base of the hind- to that of the fore-flippers, and thence to the nose, the upper lip being white like the under surface. A number of dirty-white spots running obliquely from front to rear on the flanks are arranged almost in rows, and give the impression of being discontinuous streaks.

The under side of an older specimen (No. 893) is far yellower. It is, however, so soiled that the mixture of various tints of dirty yellow which it presents to the view are well-nigh indescribable. A mixture of dirty yellow and slate-grey colouring is so arranged on the chest as to produce a pattern which may be described as mottled. The under side of the jaw is without spots.

In build this Seal is, judging from the photographs of Dr. Cook and Dr. Racovitza, more slender than *Lobodon*. The last-named naturalist states that it is larger than *Lobodon*, and in that case the head should be proportionately smaller. It is relatively longer and more slender, and lacks the blunt nose of *Lobodon*.

Distinguishing characteristics of skull.—Both the skull and skeleton of Weddell's Seal have been described in detail by Sir William Turner in his report on the Seals collected by the '*Challenger*' expedition (pp. 20–28). The skull has neither great size nor remarkable teeth to mark it off at a glance from those of the other Seals of the Antarctic seas. Yet *Lobodon*, which is of very similar size, is the only form with which it could possibly be confused. Even here, however, there are several obvious points of difference, and *Leptonychotes* (apart from its simple teeth) may be at once distinguished by the proportionately greater breadth of its brain-case and the high and narrow anterior portion of the skull, as well as by the shorter palate. The under jaws of the two animals are also characteristic, that of *Lobodon* being far deeper, stronger, and more massive, than that of *Leptonychotes*.

Sex.—We know next to nothing as regards any difference that may obtain between the sexes. The only skull labelled as that of a female which I have examined, is No. 895 of the '*Belgica*' collection. In this the canines are smaller than are those of the males of the same collection, and, if this distinction be borne out by a series of specimens, all the skulls in the British Museum will prove to be, as I have

provisionally labelled them, those of males. It should be noted, however, that the dimensions of one specimen (No. 44, 4, 6, 1), are somewhat intermediate in character.

Age.—Three of the skulls brought home by the ‘*Belgica*,’ Nos. 893, 900 and 895 are those of particularly fine animals. But, although they obviously belonged to adults, the development of the sagittal crest is imperceptible.

The cheek-teeth do not seem to be subject in any marked degree to the processes of wearing down. The effect of use appears more conspicuously in the case of the canines and incisors, perhaps as a consequence of fighting.

Teeth.—The simple teeth and their uses have already been discussed (see pp. 14–15). There seems to be a tendency, variously exhibited in the different individuals, but most marked in No. 893 of the ‘*Belgica*’ collection, to show a distinct space between the two last cheek-teeth of the upper jaw in a manner somewhat reminiscent of the corresponding teeth of *Otaria (Eumetopias) stelleri*.

As already stated, the skeleton has been described in detail by Sir William Turner (see Table I, p. 24).

OGMORHINUS.

Sténorhinque, F. Cuvier, “De quelques Espèces de Phoques et des groupes génériques entre lesquels elles se partagent,” *Mém. du Muséum*, t. xi. Stenorhynque (plate), p. 190, pl. 13, fig. 2, A, 1824.

Stenorhinchus (*sic*), F. Cuvier, *Dict. Sci. Nat.* xxxix. p. 549, 1826 (preoccupied by **Stenorhynchus**, Lamarck, *Hist. Nat. des Animaux Sans Vertèbres*, &c., tome xv. p. 236, July, 1818).

Stenorhynchus (*nec* Lamarck), R. P. Lesson, *Manuel de Mammalogie*, p. 199, 1827.

Stenorhineus, Hamilton Smith in Jardine’s *Naturalist’s Library*, p. 258 (1845–1846).

Ogmorhinus, W. Peters, *Monatsb. K. Akad.*, Berlin, p. 393, footnote (1875). Barrett-Hamilton, *Antarctic Manual*, p. 219 (1901)Type *O. leptonyx*

1. OGMORHINUS LEPTONYX. THE LEOPARD-SEAL OR TRUE SEA-LEOPARD.

“Phoque a petits ongles, **Phoca leptonyx**,” de Blainville, *Journ. de Physique*, &c., t. xci. pp. 288–289, and 297–298, Oct. 1820; Desmarest, *Mammalogie*, pt. i. pp. 247–248 (see also footnote to p. 243), 1820; Cuvier, *Ossements Fossiles*, pp. 207 and 208, pl. xviii. fig. 2 (skull (*fig. mala*) 1823); J. E. Gray in Griffith’s *Animal Kingdom*, v. p. 128, 1827; ¹de Blainville, *Ostéographie*, ii. pl. v. and ix. (figures of skull and teeth of specimen in Paris Museum) 1840.

¹ For the date of this work see Mr. C. Davies Sherborn’s paper in the ‘*Annals and Magazine of Natural History*,’ ser. 7, vol. ii., July 1898.

TABLE I.—LEPTONYCHOTES WEDDELLI.

A.—From the Collection of the Belgian Antarctic Expedition, obtained in or near the Palmer Archipelago and Graham Land.

	Baso-palatal length.	Greatest breadth at zygoma.	Greatest breadth of cranium.	Length of nasals.	Length of upper cheek-tooth series.	Length of lower cheek-tooth series.	Length of exposed portion of upper canines.	Greatest diameter of 3rd lower tooth, taken at the base of the tooth.	Antero-posterior diameter of check-tooth.	Height of exposed portion of lower cheek-tooth.	
No. 893.—♂ adult	118	178	130	68	65	56	26.5	17.5	10	5	Teeth worn. Sagittal crest barely perceptible.
No. 900.—♂ adult	257	178	130	72	61.5	54	25.5	18.5	10.5	9	Teeth worn. Sagittal crest barely perceptible.
No. 891.—♂ juv.	Damgd.	Damgd.	Damgd.	40	46	45	21	12.5	14	5.5	Molars crowded. No sagittal crest.
No. 895.—♀ adult	242	150	122	..	54	52	23.5	14.5	10.5	8	Teeth a little worn. Sagittal crest almost imperceptible.

B.—From the Collection of the British Museum of Natural History, obtained in various localities.

No. 44.3.21.1, 323b, apparently an old ♂. River Santa Cruz, E. Patagonia, Capt. Fitzroy, R.N.	Damgd.	113	Damgd.	67	64	60	26	18.5	11	9.5	Teeth worn. Sagittal crest barely perceptible.
No. 46.2.15.22, 323d, apparently an adult ♂. Antarctic Seas, Sir James Ross' Antarctic Expedition of '39-43. Presented by the Admiralty. Figured in J. E. Gray's Hand-List to the Seals, &c., in the British Museum, pl. x.	260	110	168	122	64	62	55.5	28	17.0	11	Teeth worn. Sagittal crest barely perceptible.
No. 97.3.4.2, apparently a ♂. Presented by R. M. Martin, Esq.	260	110	Damgd.	..	59	53.5	26.5	17.5	11.5	9	Teeth slightly worn. Sagittal crest barely perceptible.
No. 44.4.6.1, 323c, probably a ♂. River Santa Cruz, E. Patagonia, Capt. Fitzroy, R.N. The stuffed skin of this specimen is also in the collection.	243	Damgd.	160	123	..	55	25.5	15.5	11	11.5	

¹ The skulls of this species brought home by the 'Southern Cross' were so fragmentary that it was found impossible to measure them.
² This item is hardly comparable with those given in the corresponding place for older animals, since this specimen was so young that the crowns of the teeth had not risen to nearly their complete height above the jaw; hence this measurement was necessarily made for a broader part of the tooth than was the case in the other specimens.

Seal from New Georgia, Home, Phil. Trans., pp. 239-240, pl. 29 (skull figured), 1822.

"Phoque nommé **Leptonyx**," F. Cuvier, Dents des Mammifères, pp. 118 and 119, pl. 38A, 1825.

Stenorhynchus leptonyx, F. Cuvier, Dict. Sci. Nat., xxxix. p. 549, 1826.

Stenorhynchus leptonyx, Lesson, Manuel de Mammalogie, p. 199, 1827; S. Nilsson, Syst. Einth. der Phoken (translation by W. Peters), Arch. für Naturg., pp. 307, 1841; Owen in Ann. and Mag. Nat. Hist. vol. xii. pp. 331, 332, 1843; Catalogue of the Osteological Series, Mus. College of Surgeons, vol. ii. pp. 642-643, 1833; J. E. Gray, Zool. Voy. 'Erebus' and 'Terror,' p. 6, pls. 3 and 4, 1844; Cat. Bones of Mammalia, p. 141, 1862; Cat. Seals and Whales, Brit. Mus., pp. 16, 17, 1866; Hand-List of Seals, etc., Brit. Mus., p. 11, 1874; Gervais, Hist. Nat. Mam., ii. 302; Jacq. and Pucher., Voy. Pole Sud, Zoologie iii. Mammifères et Oiseaux, p. 27, 1853; good figures of animal and skull, pl. 9¹ of Atlas, 1844; Gill, Prodrôme Monogr. Pinnipedes, Communications Essex Institute, vol. v. July 1866, p. 6; Moseley, Naturalist on the 'Challenger,' p. 200 (1879); Flower and Garson, Cat. Osteology of Vertebrated Animals Mus. College of Surgeons, Pt. ii. pp. 211-213, 1884; Bruce, Proc. Phys. Soc. Edin., vol. xii., 1892-1894, p. 380, 1894; Report Sixty-third Meeting of the British Assoc., Nottingham, September, 1893, p. 807 (1894); Borchgrevink, First on the Antarctic Continent, pp. 170, 230 (photo.) (1901); Bernacchi, To the South Polar Regions, p. 235 (1901).

Stenorhynchus leptonyx, the Small-nailed Seal, Hamilton Smith in Jardine's Naturalist's Library, vol. xv. p. 258, 1845-1846.

Ogmorhinus leptonyx, Peters, Monatsb. K. Akad., Berlin, 1875, p. 393; Allen, Hist. N. Amer. Pinnipeds, p. 466 (see also pp. 440, 441, 445, 446, 450 and 457), 1880; Turner, Report on the Seals collected during the Voyage of H.M.S. 'Challenger,' p. 64, 1888; Trouessart, Catalogue Mammallium I., p. 380, 1897; Cook, First Antarctic Night, pp. 257, 280 (1891, photos.); Barrett-Hamilton, Antarctic Manual, p. 209 (1901).

Phoca homei, R. P. Lesson, Dict. Class, N. H. xiii. p. 417 (Jan. 1828).

Ogmorhynchus leptonyx, Racovitza, La vie des Animaux et des Plantes dans l'Antarctique, p. 33, 1900.

Sea Leopard, Borchgrevink, First on the Antarctic Continent, p. 237 (1901); Bernacchi, To the South Polar Regions, p. 235 (1901).

Types.—The two skulls examined by De Blainville are stated to be, one in the museum of the Royal College of Surgeons of England, London, and the other in the Paris Museum. The former is probably that now numbered 1091 (vide *infra*). As to the latter I have written to the authorities of the Paris Museum, but have received no reply to my communication.

Synonymy.—The original generic name of this Seal has appeared under several different forms, viz., *Stenorhynchus* (Cuvier), *Stenorhynchus* (Lesson), *Stenorhynchus* (Hamilton Smith) and *Stenorynchus* (Moseley). Each of these antedates Peters' *Ogmorhinus*—a matter of importance to those naturalists who regard a name when once published as not subject to alteration. For them *Stenorhynchus* of

¹ For date of this plate see p. 35 (under *Lobodon*).

Cuvier is not preoccupied by *Stenorhynchus* of Lamarck, and the correct name of this animal will, no doubt, some day stand as *Stenorhynchus leptonyx*, F. Cuvier!¹

History.—The two earliest descriptions of the Leopard Seal—the one by de Blainville, the other by Desmarest—appeared in the year 1820. The latter was a meagre extract from the MS. notes of the former naturalist, whose own description, published under the name of “P. a petits ongles. *Phoca leptonyx*,” was based on two



LEOPARD SEAL BASKING IN THE SUN.

(By permission of Sir George Newnes, Bart.)

specimens, the one a skull in the museum of the Royal College of Surgeons, the other a skin and skull from the Falklands, then in the collection of Monsieur Hauville at Havre. According to Gray, the former skull was that figured by Sir E. Home in the ‘Philosophical Transactions,’ 1822, which specimen the latter writer states to have been presented to the Royal College of Surgeons “by Mr. Chevalier: this proves to have been brought by Mr. Kearns, in a whaler, from New Georgia, near the ice towards the South Pole.” G. Cuvier² states that M. Hauville’s specimen found its way to the Paris

¹ *Ogmorhinus* is antedated by *Hydrurga*, Gistel, Nat. Thierw., p. xi., 1848, so that the correct name of the Leopard-Seal should probably be *Hydrurga leptonyx*.—R. I. P.

² Oss. Foss., V., pt. I., p. 207, 1825.

Museum. It formed the subject of the inaccurate figure in the 'Ossemens Fossiles' which was afterwards copied in Hamilton's work on Seals.

On referring to the Catalogue of the specimens in the museum of the Royal College of Surgeons, I found that, whereas a mutilated skull, No. 1096 (of the history of which no details are given) is stated to have been "presented by Thomas Chevalier, Esq., 1814," another skull, No. 1091, "from the Island of New Georgia" and "presented by William Kearn, Esq.," is described as "the original of Mr. Clift's figure, published in Home's paper . . . and in his 'Lectures on Comparative Anatomy,' vol. iv., pl. 20." There seemed therefore to be room for some doubt as to the exact identity of the type or typical specimens, a doubt to which Allen's statement (p. 441) that de Blainville's descriptions of the species were "both based on specimens in the museum of the Royal College of Surgeons of London" may probably be attributed.

It is gratifying to find that the matter can now be cleared up. Professor Stewart, to whom I wrote for information on the subject, tells me that "the skull 1091 is without doubt that figured in the Phil. Trans. for 1822." In the copy of these 'Transactions' kept at the museum of the Royal College of Surgeons there are two marginal notes, written in pencil, signed W. C., and, according to Professor Stewart, in Clift's handwriting. These are to the effect that Mr. Chevalier did not know whence came the specimen No. 1096: it was the other skull, No. 1091, which was brought by Mr. Kearn. It is evident that the information given with the figure in the 'Transactions' is inaccurate, being a mixture of the history of the two specimens.

These two skulls for long remained the sole representatives of their species in museums, but most of the later explorers in the Antarctic seem to have met with the Leopard-Seal, and several skulls have reached this country. It is, at the present time, probably the best known species inhabiting Antarctic waters.

Distribution.—There can be no doubt that the True Leopard-Seal is widely distributed in the South Polar regions. It has, moreover, been found in more northern regions than either of the remaining three species. Besides the localities (New Georgia and the Falkland Islands) whence came the type specimens, there is an example in the British Museum from Lord Howe Island, another in the Anatomical Museum of the University of Edinburgh, presented by Sir James Hector, from Wellington Harbour, New Zealand (*cf.* Turner, p. 20); while the museum of the Royal College of Surgeons contains



HEAD OF OGMORHINUS LEPTONYX.
(By permission of Messrs. Hurst & Blackett.)

specimens from New Zealand (1858), the Falkland Islands (1867 and 1880), and Tasmania (1871). One was brought home from the shore south-east of Cape Horn by the French Antarctic Expedition of 1837–1840, and Gray alludes to others from the North Shore, Newcastle, New South Wales, and from Port Nicholson, New Zealand. It occurs, no doubt, on the coast of Patagonia. On the other hand, although it probably frequents numerous islands, it is not quite safe to accept Moseley's note of a herd, estimated at four hundred in number, which occupied a small outlier of Kerguelen as being of this species. Moseley's information was derived from sealers, and although he states that he had seen examples of Seals larger than the Weddell's Sea Leopard which he brought home under this name, he evidently did not at the time distinguish the two species. Moseley also states that a beach at Herald Island, which lies about three hundred miles south of Kerguelen, "was strewed with bones of the Sea-Elephant and Sea-Leopard, those of the former being most abundant."

On the pack ice this species has been found in some numbers, notably by Mr. Bruce, near Graham Land, and by the '*Southern Cross*.' According to Mr. Borchgrevink, it was one of the two "best represented" Seals in the pack ice near Victoria Land, and it breeds at Robertson Bay (pp. 236, 237). Further it is probably this species which, on the same authority, remained at Robertson Bay and Cape Adare nearly all the winter. It was also found by the '*Belgica*' on the pack ice, but in what numbers is not stated by Dr. Racovitza.

Habits.—The first notice of the habits of the Leopard-Seal was that sent to Gray by Dr. Frederick Knox, and accompanied the skeleton and part of the viscera of a specimen stated to have been shot and captured in Evans Bay, Port Nicholson, New Zealand, in November, 1843. The stomach is recorded to have "contained numerous fish-bones, a few feathers (gulls'), and some considerable portions of a pale green, broad-leaved, marine fucus: thousands of a small, hard, round, white worm (parasitical) pervaded all parts of the intestines." Some details are added as to the appearance of the animal and the dimensions of its viscera. Dr. Knox called it the "Sea-Bear," an error to which Gray thinks is due the inclusion of the true *Otaria (Callotaria) ursina* in the New Zealand Fauna.

Other observers have referred to a predilection on the part of the Leopard-Seal for birds' flesh. On this subject Dr. Racovitza remarks that all he can say is that he once saw two of these Seals quarrelling over the carcase of an Emperor Penguin which had been

thrown overboard from the 'Belgica.' Mr. Bruce too states that "the Penguin is also occasionally the victim of the Seal, and I have found stones in their stomachs. These stones are probably part of the geological collection which the penguins are accustomed to carry about with them. Nematode worms were almost invariably present in the stomachs."

There can be little doubt that the formidable dental armature of this species finds its use, as I have already suggested, in the capture of prey of a stouter character than that which suits the more moderate appetite of *Lobodon* and *Ommatophoca*.

Mr. Bruce states that while "all the Seals were obtained from the pack-ice, in bluest and clearest water," the Leopard-Seal frequented "the outermost streams, and was most frequently found singly, but sometimes in pairs or threes, on one piece of ice." That it occasionally occurs on the pack-ice in very great numbers is evident from the statement of Mr. Bruce that "on the last day of sealing we were among a great host of the larger Sea-Leopards, and as we were returning to the ship they were moaning loudly."

External appearance.—The Leopard-Seal justly deserves its name, since it bears more spots upon its body than any other species of Seal. In the single specimen brought home by the 'Southern Cross' the spots extend all over the body, and Dr. Racovitza says that the colour of the coat is "gris foncé, moucheté de taches jaunes."

The animal is, moreover, readily distinguishable by the great size of its elongated body. The longest measured by Mr. Bruce attained to a length of over 13 feet (= 3900 millimetres) and the species gained the name of "serpent" from the sailors.

The single specimen brought home by the 'Southern Cross' was immature. The dimensions of the flat skin were as follows:—

	ft. in.	milli- metres.
Total length measured from tip of nose to end of tail	6 0 or	1800
Length of fore-flippers.	1 5 "	425
Greatest breadth of fore-flippers	0 5 "	125
Length of hind-flippers measured along outer edge .	1 4 "	400
Length of hind-flippers measured along centre to base of lobes	0 9·5 "	247

The flippers were in each case completely clothed with hair. The fore-flippers were proportionately narrower and longer than those of either of the other Antarctic species. There are five claws on the hind-flippers. I could find only one rudimentary claw. It is probable that in regard to the number and size of the

claws, the hind-flippers may show some variation, as this species is not, like *Leptonychotes* and *Ommatophoca*, one of those to which attention has been directed as lacking hind claws on its hind-flippers.

As regards the sexes Mr. Bruce makes the interesting and unexpected statement that "Dr. Donald also noted that the females of the larger species were larger than the males"—a statement to which I would draw the attention of future explorers as well worthy of confirmation.

SKULL.

The tabular record given below corresponds to that given in the case of *Leptonychotes*.

Distinguishing characteristics.—The skull of the Leopard-Seal needs no description. It is well known, and has been described by Owen in the Catalogue of the Osteological Museum of the Royal College of Surgeons of London (see Nos. 3938 to 3941). It is at once distinguishable by two characters from the skull of any other living Seal. These characters are—(1) the great length and size of the skull, and (2) the powerful teeth which are recognisable at all ages by their large proportions, and the peculiar arrangement of the cusps. Of these there are three, placed one after the other in a line running parallel to the long axis of the jaw. The apices of the two smaller and outer cusps usually incline towards the larger central cusp, which itself bears a recurved apex. In addition, it should be noticed that in no Seal of the Antarctic are the lambdoid and sagittal crests so prominently developed as in this species.

Sex.—The young male brought home by the Belgian Expedition is the only one of which the sex has been definitely ascertained. This is regrettable, since very considerable differences of size and proportions occur amongst the skulls of this species. I had supposed that these must represent sexual characters, and I further believed that the larger specimens with stronger canines, enormous development of the lambdoid, and, in some cases, of the sagittal crests, would prove to be males. Quite upsetting this supposition is the observation of Dr. Donald, as reported by Mr. Bruce, that in this species the females are larger than the males—a statement which, if not based upon some error, is of considerable interest, since it is, so far as I am aware, not applicable to any other species of the *Pinnipedia*. At all events, until the point be finally settled by further

TABLE II.—OGMORHINUS LEPTONYX.

A.—From the Collection of the 'Southern Cross' Expedition, obtained at or near Victoria Land.

	Basal length.	Baso-palatal length.	Greatest breadth at zygoma.	Greatest breadth of cranium.	Length of nasals in middle line.	Length of upper cheek-tooth series.	Length of lower cheek-tooth series.	Length of exposed portion of upper canines.	Greatest diameter of upper canines.	Anterior length of lower cheek-tooth.	Height of exposed portion of 3rd lower cheek-tooth.
♂. No. 17, 22, 12, 99	345	145	182	135	87, -	94.5	93.5	30.5	16.5	17.5	19

Sagittal crest slight. Sutures: sphenoidal almost closed, basilar closed.

B.—From the Collection of the Belgian Antarctic Expedition, obtained at or near the Palmer Archipelago and Graham Land.

No. 899, ♂, juv.	283	156	125	130	87	80	81	55	18	17	18
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Teeth clean and unworn; cheek-teeth crowded.

C.—From the Collection of the British Museum of Natural History, obtained in various localities.

No. 46.4.15.23 (325 ^l), adult. Antarctic Seas. Presented by the Admiralty. Sir James Ross' Antarctic Expedition of 1839-1843.	392	182	210	132	107	115	114	36	19	19.5	16.5
											Teeth clean and but slightly worn. Height of sagittal crest 11 mm.
No. 85.10.20.1 (325 ^m), old. Falkland Islands. Mr. E. A. Holmstead.	390	173	222	132	101	100	91.5	32	19	16	14
											Teeth worn. Height of sagittal crest (at base) 12 mm.
No. 325 ⁱ , old. Lord Howe Island. Voyage of the <i>Herald</i> , Sept. 1853, J. McGillivray.	382	168	220	132	118	101.5	100.5	27	17.5	15.5	17.5
								Damag. Approx.			Teeth much worn and damaged. Height of sagittal crest 7 mm.

No. 93.9.14.1, not quite adult. Near New Georgia, Capt. D. Gray.	382	163	188	134	..	101	..	35	20	..	..	No lower jaw. Teeth clean and unworn. First upper cheek-teeth close to canines. Height of sagittal crest about 2.5 mm. at base.
No. 46.4.15.24 (325b), adult. Antarctic Seas. Presented by the Admiralty. Sir James Ross' Antarctic Expedition of 1839-1843. The skin of this specimen is in the Museum.	379	162	207	135	..	98	94.5	36.5	19	15.5	16.5	Teeth worn. Height of sagittal crest 5-6 mm.
No. 43.1.8.4 (325a), adult . . .	368	163	207	133	..	98	98	37	21	19	18.5	Teeth clean and unworn. Height of sagittal crest 5 mm.
No. 325b, adult. Antarctic Seas. Presented by the Admiralty. Sir James Ross' Antarctic Expedition of 1839-1843.	360	168	223	Damaged.	103	98.5	98	33	19.5	17.5	17.5	Teeth slightly worn. Sagittal crest damaged.
No. 325c, adult (?). The skeleton of this specimen is in the Museum.	369	Da. g. d.	186.5	133	..	98	98	34.5	19.5	18	19	Skull damaged, teeth worn. Height of sagittal crest 5-6 mm.
No. 80.7.28.5 (325f), adult. Falkland Islands. Dr. Copinger. Voy. of H.M.S. 'Alert.'	340	157	172.5	129	..	Damaged.						Sagittal crest barely perceptible.
No. 325g, immature. Antarctic Seas. Presented by the Admiralty. Sir James Ross' Antarctic Expedition of 1839-1843.	325	143	175	132	..	85	84	30	16	14	14	Teeth clean and unworn. First cheek-teeth very close to canines. Sagittal crest slight.
No. 47.9.4.2 (325f), immature.	315	131	176	135	..	88	87	35.5	19	19	18.5	Teeth fresh and crowded. Sagittal crest undeveloped.

investigations, it is unsafe to attempt to guess the sex of any skull of this Seal.

Whether, however, the larger skulls be those of males or of females, there are, as in the case of *Lobodon*, so many specimens of intermediate proportions that the determination of the sex they represent must always be a matter of difficulty. It can only be supposed that, as in the case of the male of *Otaria ursina* and *O. jubata*, the size and development of the larger sex of the Leopard Seal are exceedingly variable characters.

Age.—As might have been expected, the cheek-teeth of this species show, in a far more marked degree than those of the other three Antarctic Seals, the effects of use and wear. But although there is a very great difference between the clean and unworn teeth of some specimens, and the worn teeth of others, it is strange that those of the largest specimens which I have examined are clean and unworn. In young individuals the cheek-teeth are much crowded.

In some specimens the sagittal crest is prominently developed: the largest which I have measured reached a height of twelve millimetres. In all the lambdoid crest is large.

Individual variation.—Conspicuous individual variations in the skulls of this species seem to be rare. It may be worth placing on record that the posterior margin of the palate of No. 325*d* of the British Museum Collection is formed as a crescent and not as a Y as in all the other specimens. This variation is said to be paralleled in the case of a single specimen (No. 1095), which forms part of the collection in the Royal College of Surgeons of London.

Teeth.—The massive teeth and prominent crests at once stamp the Leopard-Seal as distinct from the other three Antarctic species, and demonstrate, as I have already argued, that the dentition is adapted to a different kind of food.

Skeleton.—The skeleton has been fully described by Sir William Turner, who used it for comparison in his detailed description of that of *Leptonychotes* (see Table II, pp. 32, 33).

LOBODON.

Leptorhynchus, J. E. Gray, (by misquotation of Owen's **Stenorhynchus**).

Lobodon, Gray, Zool. Voy. 'Erebus' and 'Terror,' vol. i. Mammalia, pp. 5 & 6, pls. 1 & 2, 1844; Barrett Hamilton, Antarctic Manual, p. 220 (1901). Type *L. carcinophagus*.

3. **LOBODON CARCINOPHAGUS**.¹ ANTARCTIC WHITE OR
CRAB-EATING SEAL.

Phoca carcinophaga, Jacq. & Pucher. Zoological Atlas Voy. Pole Sud²; no description; plates 10 (animal) and 10A (skull) good, 1842-1853 (prior to 1844).

Lobodon carcinophaga, J. E. Gray, Zool. Voy. 'Erebus' and 'Terror,' p. 5, 1844; Jacq. & Pucher. Voy. Pole Sud, Zoologie iii. Mammifères et Oiseaux, pp. 27 to 31, 1853; J. E. Gray, Cat. Bones of Mammalia Brit. Mus. p. 141, 1862; Cat. of Seals and Whales Brit. Mus. p. 10, 1866; Hand-List. of Seals Brit. Mus. p. 13, 1874; Gill, Prodrome of a Monograph of the Pinnipedes, Comm. Essex Institute, v. p. 6, July 1866; Allen, Hist. N. Amer. Pinnipedes, p. 466 (see also pp. 413, 414, 416, 419, 420 & 463), 1880; W. S. Bruce, Report Sixty-third Meeting Brit. Ass. Nottingham, September 1893, p. 807, 1894; E. G. Racovitza, La Vie des Animaux et des Plantes dans l'Antarctique, p. 29, 1900; Cook, First Antarctic Night, pp. 257, 280 (photo.); Bernacchi, To the South Polar Regions, pp. 37, 44, 274 (1901).

Stenorhynchus serridens, Owen, Ann. & Mag. Nat. Hist. xii. p. 332, 1843; Cat. of Osteological series Mus. College of Surgeons, pp. 641 & 642, 1853.

Leptorhynchus serridens, J. E. Gray (misquoting Owen), Zool. Voy. 'Erebus' and 'Terror,' p. 5, 1844.

Stenorhynchus carcinophagus, Flower & Garson, Cat. Osteology Vertebr. Anim. Mus. College of Surgeons, part. iii. p. 213, 1884.

Ogmorhinus carcinophagus, Turner, Rep. Seals Voy. 'Challenger,' p. 64, 1888.

Stenorhynchus carcinophaga, Bruce, Proc. R. Phys. Soc. Edinburgh, vol. xii. 1892-94, p. 350, 1894.

Lobodon carcinophagus, C. Berg, Com. Mus. Buenos Aires, i. p. 15, 1898.

Stenorhynchus vetus, Leidy, Proc. Acad. Nat. Sci. Philad. vi. p. 377, 1853.

White Seal, Borchgrevinck, First on the Antarctic Continent, p. 81, 1901 (photo.).

Weddellii, Borchgr., *t. c.*, p. 103 (figures of skull, upper and lower aspect, wrongly identified as that of the Leopard Seal).

¹ **Halichoerus antarctica**, Peale, described in Cassin's edition of 'The United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U.S.N. Mammalogy and Ornithology,' 1858, is sometimes referred to **Lobodon carcinophagus**, but Gill, who examined the type in the Smithsonian Institution at Washington, found it to be a skull of a species of **Phoca**, inhabiting the coast of Oregon and California, and renamed it **P. pealei**. See Prodrome of a Monograph of the Pinnipedes, Comm. Essex Institute, vol. v. pp. 4 & 6, footnotes, July 1866.

² The exact date of publication of these plates is unknown. It was at all events prior to 1844, for they are alluded to by Gray in 'The Zoology of the Voyage of H.M.S. "Erebus" and "Terror."'

Types.—No actual specimen was indicated by the describers of this species. One of the specimens brought home by the French Antarctic Expedition is in the University Museum of Zoology at Cambridge. It is a skull numbered 897, and was presented to the museum by Professor J. W. Clark. Dr. S. F. Harmer has been good enough to inform me that this specimen, together with a skull of *Ogmorhinus leptonyx* (De Blainville), was purchased in Paris in 1853 of M. Dumortier, by whom they had been obtained, and “who had accompanied MM. Quoy and Gaimard on board the ‘*Astrolabe*.’”

Synonymy and history.—The tooth figured by Leidy under the name of *Stenorhynchus vetus* bears such a remarkably close resemblance to those of *Lobodon carcinophagus* that I provisionally regard the two species as identical. Without an actual examination of the tooth it is impossible to come to any final decision in regard to it. It is possible that there may have been some mistake as to its origin, which is stated to be the Cretaceous Greensand of New Jersey.

Owen’s description of *Stenorhynchus serridens* was taken from a skeleton presented by Dr. McCormick, the Surgeon of H.M.S. ‘*Terror*,’ to the museum of the Royal College of Surgeons of England. It had been obtained during Sir James Ross’ expedition in a high latitude in the Australian seas.

The Crab-eating or Antarctic White Seal was first made known to science by the two good plates, the one of the animal, the other of the skull, which were published in the “Zoological Atlas” of the French Voyage to the South Pole. The exact year of publication of these plates is doubtful, since the series bears only the vague date of 1842 to 1853. All we know for certain is that the written description of the animal did not make its appearance until after Gray had described the skins and skulls brought home by Sir James Ross. Gray, however, could not but recognise his specimens as belonging to the same species as that already figured; he therefore, while instituting the new genus *Lobodon*, felt bound to accept the specific name *carcinophaga*, a compliment which the French naturalists returned by adopting the generic term proposed by the Englishman. The first specimens were captured on the South Polar ice, between the islands of the Sandwich and Powel group, at a distance of 150 leagues from either. The specific name had its origin in the food of the animals, which is stated to have consisted principally of shrimps (“crevettes”), as a result of eating which their excrement was coloured red.

As already stated, this species was met with by Sir James Ross,

but no exact locality is attached to the specimens which he brought home, apart from that mentioned in the statement appended to the type of Owen's *Stenorhynchus serridens*.

The species, although often reported and no doubt frequently killed by sealers, has been hitherto very poorly represented in museums. No scientific account of its habits has yet been written.

Distribution.—Most of the later expeditions, whether to the neighbourhood of Victoria or Graham Land, have met with *Lobodon*. It is, therefore, probable that it is also found on the pack-ice of the intermediate localities all round the circle. That it may sometimes stray to quite a distance from the Antarctic pack-ice is shown by the record by Mr. C. Berg of the capture of a specimen, now in the La Plata Museum, near San Sidro, north of Buenos Aires, in latitude 34° 28' South.

Habits.—Until quite recent years, our only information regarding the habits of this Seal was that conveyed by its specific name, namely that it feeds on crustaceans of some sort.

Mr. Bruce seems to have missed a great opportunity of distinguishing the various Antarctic Seals by their habits, but his notes can only be read as applying to all four, with the single exception of his remark that the "creamy white seals," as he calls this species, were, with what he supposed to be Ross's Seal, in greatest abundance; there lay four, five, or even ten on a single piece of pack-ice; the greatest number he saw on one piece of ice at a time was forty-seven.

Most interesting is the graphic, although short, account of Dr. Racovitza, who states (thus corroborating Mr. Bruce), that the Belgian Expedition found *Lobodon* the most frequent species on the pack-ice. It was also present with *Leptonychotes* in the Straits of Gerlache, in the Palmer Archipelago. On being approached it showed a great anxiety to make its visitors acquainted with its dental armature, displaying its teeth, and, in the words of Dr. Racovitza, "en soufflant violemment par les narines." The young, which when born are already of a considerable size, make their appearance on the pack-ice in September. Their first coat is thicker than that of their parents. The mother suckles her offspring for some days, and afterwards leaves it to look out for itself.

Dr. Racovitza's most interesting account of the feeding of this seal has already been quoted,¹ as well as my suggestion as to the supposed use of the extraordinarily cusped teeth.

Based upon specimens from a quite different region, Mr. Nicolai

¹ See page 14.

Hanson's notes on this species should have been of considerable value, especially as he was instructed, at the "special request" of Mr. Borchgrevink, to make "as good a study of this interesting species as time, specimens, and opportunity allowed." This Mr. Hanson seems to have done, according to the verbal testimony of his colleagues of the scientific staff of the '*Southern Cross*'; but the sole information relating to the animal brought home by the Expedition is the statement by Mr. Borchgrevink that it was found in greater numbers than in 1894, and that it was not so well represented as Weddell's Seal. Mr. Borchgrevink had expected to find the White Seal breeding in Robertson Bay, but this was not the case, although both the Leopard-Seal and Weddell's Seal bred in that locality.¹ According to Mr. Bull,² this Seal is particularly afflicted with the scars which have been alluded to above.

External appearance.—Externally the Crab-eating Seal would appear to be the most conspicuous Antarctic species, as the names applied to it by the various explorers indicate. Thus Mr. Bruce calls it "the Creamy White Seal," Mr. Borchgrevink styles it "the characteristic white seal of the Antarctic," and Mr. Bull writes of it as "the whitish-yellow or light grey Seal which goes under the name of the White Antarctic Seal, though it is never found of such whiteness that it cannot readily be distinguished on the ice-floes" (*op. cit.* p. 139). Yet, beyond the fact that it is, at all ages, of far lighter coloration than any of the other three species, we are as yet in some doubt as to its exact hues and their arrangement—a doubt which can only be dispelled when a detailed description of the animal, taken from specimens still in the flesh by a competent naturalist, shall be forthcoming. Meanwhile, it may be well to compare the various descriptions which have reached us. The original was as follows:—"Pelage brun olive, parsemé çà et là, en dessus, aussi bien qu'en dessous, de grandes plaques de couleur jaunâtre," a description borne out by the plate (No. 10), in which, however, the animal is represented as having the nose white. Mr. Bruce, on the other hand, writes of "a darker dorsal stripe," contrasted with the "creamy white" general body colour. The skins of all ages, collected by the '*Belgica*,' are nearly white, with only indistinct traces of mottling. In life they were, once more to quote Dr. Racovitza, "d'un blanc pelucheux à reflet verdâtre." Lastly, the skins brought home by the '*Southern Cross*' show, as far as I could ascertain from an examination of them while in salt, a considerable indication of

¹ *Geographical Journal*, October 1900, p. 403.

² *Op. cit.* p. 139.

indistinct spots or mottling, a character which is quite borne out by the specimens in the British Museum. Immature skins exhibit a considerable amount of mottling, and I strongly suspect that the Crab-Eating Seal is one of those species, the young of which shows traces of spots, which are gradually lost as the animal grows older.¹

Dr. Cook's photographs seem to show us in *Lobodon* an animal somewhat intermediate in its proportions between *Leptonychotes* and *Ommatophoca*. Both head and body are thicker and blunter than in the former, but not so thick and blunt as in the latter form. The long flat anterior portion of the skull has a distinct effect on the physiognomy. The total length of the flat skins (in salt) reaches from 6 to 7 feet (2000 millimetres) when measured from the tip of the nose to the end of the tail. The thick and hairy tail itself reaches a length of from 3½ to 4 inches (100 millimetres). All the flippers are clothed with hair throughout their extent. The fore-flippers reach a length of about 14 inches (350 millimetres) and have a greatest breadth of 5½ inches (137 millimetres). They are provided with 5 nails. The bilobed hind-flippers are provided with 3 rudimentary nails. They are somewhat constricted at the base, where their width is only about 7 inches (175 millimetres), but gradually expand posteriorly until at about their centre their width is about 11 inches (265 millimetres), and at their termination about 13 inches (325 millimetres), measured from the extreme tip of one lobe to that of the other. Along their outer edge, from the base to the tip of either lobe, their length is about 16 inches (400 millimetres), measured along the centre, from their base to the bifurcation of the lobes they reach about 10 inches (250 millimetres). The lobes therefore extend posteriorly for a distance of about 6 inches (150 millimetres) beyond the remainder of the flipper. The details above may be taken as the average of the skins brought home by the '*Southern Cross*.' An immature specimen, evidently moulting, since its back is smooth, whereas its flanks and flippers are still woolly, supplies the following dimensions: total length of skin (from tip of nose to tip of tail) 3 feet 6 inches (1050 millimetres), length and greatest width of fore-flipper 9 inches × 5 inches (225 millimetres × 125 millimetres), greatest length and width at centre of hind flippers 10 inches × 6 inches (250 millimetres × 150 millimetres).

¹ See Dr. Wilson's notes, *infra*, pp. 74, 75.—R. B. S.

SKULLS.

In the tabular records will be found the principal dimensions of the skulls brought home by the '*Southern Cross*,' to which are added for purposes of comparison similar details of those collected by the '*Belgica*,' as well as of the specimens contained in the collection of the British Museum. The only specimens, of which we know the sex from examinations made in the flesh, are those collected by the Belgian expedition. These are therefore arranged according to their sex, the males first, and each sex in order of size from largest to smallest. The British Museum specimens are arranged simply in order of size, as are also those brought home by the '*Southern Cross*.' The numbers attached to the latter are simply those which were placed upon them in order to prevent confusion when first received. They have no other significance, but a knowledge of these facts will probably be of interest to the authorities of the various museums into whose hands they may find their way.¹

Distinguishing characteristics.—The skull of this species is well known, so that a detailed description is uncalled for. Although not possessing the enormous dimensions of that of *Ogmorhinus*, it may be at once distinguished at all ages from that of any other species by the peculiar cheek-teeth. These are both large and remarkable for the complicated arrangement of their cusps. As in *Ogmorhinus*, there is a principal central cusp, but this is supported, not by two others, one anterior, the other posterior, but by one quite small cusp in front, and by from one to three behind. The central cusp is far larger than the remainder, and its apex is usually bulbous; all have a tendency to point backwards. In addition to these dental characters, the skull of this species differs from that of *Leptonychotes*, which it approximately equals in size, in its longer palate, and longer, broader, anterior portion, as well as in the shape of the lower jaw. This is in *Lobodon* far deeper, stronger, and more massively built than in *Leptonychotes*.

Sex.—An attempt has been made in the "Table" of dimensions to determine the sex of each specimen, both in the case of the '*Southern Cross*' and the British Museum collections, from the data supplied by those collected by the members of the Belgian expedi-

¹ Doubtless all the specimens collected by Mr. Hanson were fully described in his notes, and could have been identified, if these notes had been properly cared for after his death.

tion. This cannot, however, be regarded as having been very successful. It seems certain that those specimens which possess the largest canine teeth are males, while those with the smallest are females. But between the two extremes there are so many individuals in which these characters are intermediate that my determinations can only be regarded as quite hypothetical. As far as the evidence presented by the skull goes, there is no very marked sexual difference. The differences of size would, however, I suspect, arrange themselves more definitely about a mean, were it possible to collate the specimens exactly by their sexes.

Age.—Here again, except in the case of the specimens brought home by the ‘*Belgica*,’ the remarks in the first column of my “Table” must be regarded as purely hypothetical, although certainly resting upon a securer foundation than in the case of sex. Both the basilar and sphenoidal sutures close completely before the animal becomes very old, in contradiction to what occurs in the case of *Ommatophoca* and *Ogmorhinus*, in which the sphenoidal suture seems to remain open throughout life. As in *Ommatophoca*, the development of the sagittal crest is very slightly marked, and the lambdoid crest is even weaker than in that species. Similarly the nearest approach to the formation of the former crest is to be found along the parieto-frontal junction, near the middle line.

The extraordinary cheek-teeth, although apparently so liable to suffer from wear and tear, yet seem to preserve their form in a very remarkable manner. They wear away, in fact, at a far less rapid rate than do the massive canines and incisors. Such damage as makes its appearance is for the most part confined to the anterior teeth and to the anterior portions of these. In contradistinction to the cheek-teeth, the canines and incisors may be broken and cut as if by use in fighting.

The skeleton has been described in detail by Sir Richard Owen in the catalogue of the Osteological Museum of the Royal College of Surgeons of London (p. 642), and also in the ‘Annals and Magazine of Natural History’ for 1843 (p. 331).

(See Table III, pp. 42–45.)

TABLE III.—LOBODON CARCINOPHAGUS.

A.—From the Collection of the 'Southern Cross' Expedition, obtained at or near Victoria Land.

No.	Sex	Basal length.	Baso-palatal length.	Greatest breadth at zygoma.	Greatest breadth of cranium.	Length of nasals (measured along the middle line).	Length of upper cheek-teeth series.	Length of lower cheek-teeth series.	Length of exposed portion of upper canines.	Greatest diameter of upper canines.	Antero-posterior length of 3rd lower cheek-tooth.	Height of exposed portion of 3rd lower cheek-tooth.	Remarks.
No. 1.	♂	280	143	154	129	83	89	22.5	14.5	15	16	Incisors and canines out. No sagittal crest. Basilar and sphenoidal sutures closed.	
No. 5.	♀ (?)	272	141	..	119	71	81.5	20	13	14	15	Teeth unworn. Sagittal crest slight. Sutures: sphenoidal not closed; basilar closed.	
No. 2.	♂ (?)	265	139	146.5	121	73	77	21.5	15	15	15.5	Teeth fresh. Sagittal crest slight. Basilar and sphenoidal sutures closed.	
No. 6.	♀ (?)	265	138	..	119	71.5	79	20	13	14	14	Teeth fresh. No sagittal crest. Sphenoidal suture not closed.	
No. 11	..	265	132.5	..	126	76.5	81	76.5	20	12	13	Teeth slightly worn. Molars crowded. No sagittal crest.	
No. 9.	♂ (?)	263	132	..	121.5	67	78	22	15	14	15	Teeth fresh. No sagittal crest. Sphenoidal suture unclosed.	
No. 8	..	262	135	..	119	66	79	20.5	11	13	15	Teeth fresh. No sagittal crest. Sphenoidal suture not quite closed.	
No. 4.	♀ (?)	260	141	..	123	..	77.5	17	11.5	13	13	Teeth slightly worn. No sagittal crest. Sphenoidal sutures closed.	
No. 13.	♀ (?)	260	140	..	120	74	76	16	11	12.5	13	Teeth fresh. No sagittal crest.	

No. 3.—♀ (?). Nearly adult (?).	258	130	..	125	51.5	80	77.5	19	12.5	14	12	Teeth fresh. No sagittal crest. Sutures: sphenoidal not closed; basilar closed.
No. 7.—♀ (?). Nearly adult (?).	258	135	..	124	70	80	77	14.5	11	12	13	Teeth fresh. No sagittal crest. Sphenoidal sutures not closed.
No. 12.—(Belongs to skin labelled No. 2, and dated 11.1.99.)	250	123	..	120	67	73	70	18	12	14	13	Teeth fresh. No sagittal crest.
No. 10.—♂ (?). Not adult.	245	137	..	123	73	75	73	22	14	14	12	Teeth fresh. No sagittal crest. Sphenoidal suture unclosed.
No. 14.—(Belongs to skin labelled No. 4.) Damaged. Not measured.												
No. 15.—Skull damaged, therefore not measured. (Belongs to skin labelled No. 3.)												

B.—From the Collection of the Belgian Antarctic Expedition, obtained at or near the Palmer Archipelago and Graham Land.

No. 894.—♂. Adult. (The skin was also received.)	272	149	162	134	70	85	81	20.5	14.5	14.5	15	Cheek-teeth worn anteriorly; incisors broken and worn. Sagittal crest slight.
No. 696. Immature ♂	258	Damaged.	147	120	88	82	82	17	15	14.5	10.5	Cheek-teeth clean and fresh, the crowns not yet fully above the jaw. Skull not nearly so swollen and massive as No. 894. No sagittal crest.
No. 697.—♀. Apparently adult.	270	..	157	123	73	81	79	20	14.5	12	12	Anterior cheek-teeth and incisors worn. Sagittal crest slight.
No. 901.—♀. Apparently adult.	270	148	151	122	63	76	76	18	11.5	12	15	Anterior cheek-teeth slightly worn; incisors worn and broken. Sagittal crest slight.
No. 892. Immature ♀. (The skin also was received.)	201	..	120	115	66	67	68	16	9	13.5	13.5	

TABLE III.—LOBODON CARCINOPHAGUS—continued.

	Basal palatal length.	Basal length.	Greatest breadth at zygoma.	Greatest breadth of cranium.	Length of nasals (measured along the middle line).	Length of upper cheek-tooth series.	Length of lower cheek-tooth series.	Length of exposed portion of upper tooth canines.	Greatest diameter of upper cheek-canines.	Antero-posterior length of 3rd lower cheek-tooth.	Height of exposed portion of 3rd lower cheek-tooth.	
No. 896. Immature ♀ . . .	180.5	..	111	113	113	Teeth just appearing above jaw.						
No. 699.—♀ fetus, (The skin was also received.)	168	..	106	108	108	Teeth still in alveoli.						
C.—From the collection of the British Museum of Natural History, obtained in various localities.												
No. 326c. Adult. Probably ♀. Antarctic Seas. Sir James Ross' Antarctic Expedition of 1839-43. Lieut. Smith, R.N. Fig. α(?) at p. 13 of Gray, "Hand-List," 1874.	285	146	150.5	118	58	80.5	76	20	13	13.5	13	Anterior check-tooth and incisor worn. Sagittal crest just perceptible.
No. 326b (43.11.16.8). Old ♂. Sir James Ross' Antarctic Expedition. (The skin is also in the collection.)	277	149	165	131	56	85	82.5	21	17	14	15.5	Teeth worn. No sagittal crest.
No. 326d. Apparently adult ♂. Antarctic Seas. Sir James Ross' Antarctic Expedition of 1839-43. Lieut. Smith, R.N.	270	143	155	123	61	83.5	81	19.5	13	13.5	14.5	Teeth beginning to wear. Sagittal crest small.
No. 46.4.15.3. Probably a nearly adult ♂. Sir James Ross' Antarctic Expedition of 1839-43. Presented by the Admiralty. (The skin is also in the collection, and is No. 46.4.15.1.)	270	..	150	122	..	81	82	20	14	13.5	13	Teeth clean and hardly worn. Sagittal crest small. Skull much damaged.
No. 97.3.4.1. Apparently an adult ♀. R. M. Martin, Esq.	268	135	152	123	76	77	75	17	15	14	15	Teeth beginning to wear. No sagittal crest. Skull damaged.

No. 326c (44.11.16.4). Apparently an adult ♀.	260	139	143	123	..	77	75.5	20	13	15	12	Teeth fresh and unworn. No sagittal crest.
No. 326i (46.4.15.15). Apparently an immature ♀. Antarctic Seas. Sir James Ross' Antarctic Expedition of 1839-43. Presented by the Admiralty. (The skin is also in the collection, and is No. 46.4.15.3.)	217	..	131	118	..	67.5	65	16	11.5	13	11.5	Cheek-teeth crowded in jaws. No sagittal crest. A quite young skull; much damaged, and broken right across.
No. 326a (43.11.16.20). Apparently an immature ♀. Antarctic Seas. Sir James Ross' Antarctic Expedition of 1839-43. Presented by the Admiralty. Figured in the Zoology of the voyage of H.M.S. 'Erebus', and 'Terror'. (The stuffed skin is also in the collection.)	217	114	118	114	60	67.5	66	18	12	15	10	Teeth not fully grown above the jaw. No sagittal crest.
No. 326b (46.4.15.20). Apparently an immature ♂. Sir James Ross' Antarctic Expedition of 1839-43. Presented by the Admiralty. (The skin is also in the collection, and is No. 46.4.15.20.)	210	112	119	117	66	65	66	22	13.5	13.5	10	Cheek-teeth much crowded. No sagittal crest.
No. 43.11.16.4. Sex uncertain, but nearly adult.	..	..	..	117	..	77	77	19	13	12.5	14	A much damaged skull.
No. 326f. Probably an immature ♂.	..	111	..	115	..	65	66	17.5	14	14	13	Cheek-teeth crowded in jaw. A quite young skull; much damaged.
No. 326g (46.4.15.19). Apparently an immature ♀. Antarctic Seas. Sir James Ross' Antarctic Expedition of 1839-43. Presented by the Admiralty. (The skin is also in the collection, and is No. 46.4.15.7.)	197	100	113	117	52	64	65	13.5	9	13.5	10	Anterior cheek-teeth of both upper and lower jaws still crowded. A quite young skull.

OMMATOPHOCA.

Ommatophoca, J. E. Gray, Zool. Voy. '*Erebus*' and '*Terror*,' p. 7, 1844; Barrett-Hamilton, Antarctic Manual, p. 221 (1901). Type *Ommatophoca rossi*.

Ommatophora (misprint for **Ommatophoca**), Turner, P. Zool. Soc., 1848, p. 88.

OMMATOPHOCA ROSSI.—ROSS'S SEAL.

Ommatophoca rossii, J. E. Gray, Zool. Voy. '*Erebus*' and '*Terror*,' pp. 7-8, pls. vii. & viii. 1844; Cat. of Bones of Mammalia, Brit. Mus. p. 142, 1862; Cat. Seals, Brit. Mus. pp. 13 to 15, 1866; List of the Seals, &c. Brit. Mus. p. 15, 1874; T. Gill, Prodrôme of a Monograph of the Pinnipeds, Comm. Essex Institute, p. 6, July 1866; Allen, Hist. N. Amer. Pinnipeds, p. 467 (see also pp. 413, 414, 416, 419, 420, 449, 451, 453, 458, 459 & 463), 1880; Turner, Rep. Seals, Voy. '*Challenger*' in the years 1873-76, pp. 65-66, 1888; Bateson, P. Z. S. 1892, pp. 106-7 to 114-15, 1894, pp. 237-238; W. Kükenthal, Denkschr. Medic. Natur. Gesellsch. Jena, iii. p. 443, 1893, & Jenaischen Zeitschrift, xxviii. Bd. N. F. xxi. p. 115, 1893; E. G. Racovitza, La Vie des animaux et des plantes dans l'Antarctique, p. 30, 1900; Bernacchi, To the South Polar Regions, pp. 44, 45, 1901 (photo).

"New (Species of) Seal discovered January 21, 1899" (with figure), Sir George Newnes, *Strand Magazine*, September 1899, pp. 283 & 284; Berchgrevink, *Geogr. Journ.* October 1900, p. 403.

"Rossii," Berchgrevink, First on the Antarctic Continent, pp. 74, 103, 1901 (figs. of skull, upper and lower aspect).

Type.—No. 43.11.25.4 (324A) of the British Museum collection.

The *synonymy* of this species presents no difficulties.

History.—For the first description of this Seal, as also of *Lobodon* and *Leptonychotes*, we are indebted to Dr. J. E. Gray. Until the return of the '*Belyica*' from her imprisonment in the Antarctic pack-ice our knowledge of Ross's Seal was of the most slender description. The first known specimens were those brought home by Sir James Ross from an unknown locality in the South Polar regions. These, a skin and two skulls, for many years remained the unique representatives of their race in Europe, if not in the world. I am indebted to Professor D'Arcy W. Thompson for the information that a skin and skull of this rare species were presented to the Town Museum of Dundee, but that the skull seems to have been lost, and its whereabouts cannot be traced. No specimens, therefore, of those brought home by the '*Belyica*' and '*Southern Cross*' could exceed in value those of Ross's Seal.

The first naturalist to lay claim to the rediscovery of Ross's Seal was Mr. W. S. Bruce, who states that the "Mottled Grey Seal," as he calls it, was with the Crab-Eating Seal "in greatest abundance" on the pack-ice. "They were usually associated with the Creamy-White Seals (*Lobodon*) on the pack, and I found many to be with young."

It is, however, questionable whether Mr. Bruce's identification was correct (*vide infra*, p. 49).

Following Mr. Bruce, came the Belgian Antarctic Expedition, which, however, found this Seal but rarely. According to Dr. Racovitza, it was encountered on only thirteen occasions during the sojourn of the '*Belgica*' in the ice. To this expedition we owe the first photographs ever taken of this rare Mammal, and our interest in it is but heightened by Dr. Racovitza's vivid description of its peculiar appearance and strange voice.

So little known, in fact, was Ross's Seal that the members of the '*Southern Cross*' Expedition did not at first recognise it. The result was the announcement in the *Strand Magazine* of the discovery of a new species of Seal on January 27th, 1899. Illustrations taken from photographs were also published, from a glance at which Dr. Racovitza was able to surmise that the supposed new Seal was in reality the present species.¹

Like the '*Belgica*,' the '*Southern Cross*' found this species "very poorly represented." Only four specimens were secured, all in the pack; of these one only was a female. These, no doubt, represent the four skins and skulls which have been examined by me, and two of which are now in the collection of the British Museum.

Distribution.—Although probably poorer in numbers than the other three species, Ross's Seal is thus shown to have a fairly wide distribution, having been found (excluding Ross's own specimens, the locality for which is uncertain), so far as we know, in all cases on the pack-ice in the neighbourhood of Joinville Island and Louis Philippe Land (Bruce), west of Alexander Land ('*Belgica*'), and in the neighbourhood of Victoria Land ('*Southern Cross*').

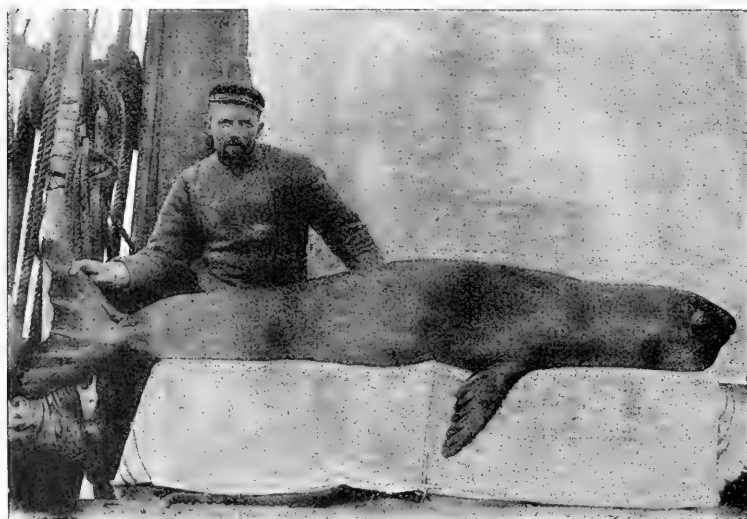
Habits.—Of the habits of Ross's Seal practically nothing was known until the publication of Dr. Racovitza's interesting notes. As has been already stated, that naturalist found it, like Weddell's Seal, the White Seal and the Leopard-Seal, an inhabitant of the pack-ice, where it feeds exclusively on large Cephalopods.

The most novel observation, however, is that which has regard to its voice, which is said to be very curious. The sounds which it emits are very varied. "Son larynx fortement gonflé constitue une caisse de résonance, et le voile du palais très développé, distendu par de l'air, constitue à l'animal une sorte de cornemuse. On entend d'abord, chez la bête irritée, une sorte de roucoulement de tourterelle enrouée, auquel succède le gloussement d'une poule affolée de terreur,

¹ Mr. Hanson, as I learn from the other officers of the scientific staff on the '*Southern Cross*,' always maintained that the supposed new Seal was nothing but Ross's Seal. See also Bernacchi (*t.c.* pp. 44, 45).—R. B. S.

et la finale c'est un reniflement sans harmonie produit par l'air violemment expulsé par les narines."

External appearance.—As in the case of the other species, the exact details of the coloration of *Ommatophoca* are still very imperfectly known. Gray's plate tells us very little. In his written description of the type-specimen he stated that the colour was "greenish-yellow, with close oblique yellow stripes on the side, pale beneath." The present coloration of the skin I should describe as being as nearly as possible olive above, shading gradually into tawny-olive beneath, with regions of lighter yellowish shades on the breast and neck.



MR. NICOLAI HANSON, WITH ROSS'S SEAL.

(By permission of Messrs. Hurst & Blackett.)

There is no very distinct line of demarcation between the colours of the upper and under surfaces; neither are there many spots. The "stripes" described by Gray are, however, present at about the place where a line of demarcation might be expected to occur. On the flanks they occur as streaks of the colour of the under surface, having a breadth of about a quarter of an inch, which running obliquely forwards invade the colour of the upper surface. Occasionally in places where the streaks are interrupted a spot or two is formed. Otherwise the creature is spotless.

Mr. Bruce in his very brief allusion to the coloration of this species makes no mention of these streaks, but merely compares it with the Crab-eating Seal, adding that its coat is "somewhat sleeker,

of a beautiful pale mottled grey colour, darker on the back and lighter on the belly, and varying in intensity in different individuals." The streaks are so well represented in the reproductions of Dr. Cook's photographs published both in his own book and in Dr. Racovitza's paper, that I cannot help regarding them as highly characteristic of the species. Mr. Bruce compares *Ommatophoca* with *Lobodon*, to which, he states, "in form and size" it is "very like." This remark about an animal which has been described by Dr. Racovitza in such vivid language as so highly distinct from all the other species makes me suspect that Mr. Bruce may have been mistaken in his identification of Ross's Seal.

Unfortunately no skins of *Ommatophoca* were entrusted to me for examination by Dr. Racovitza. The skins secured by Mr. Hanson were in salt, and not in a condition suitable for description.

From the account of Dr. Racovitza, *Ommatophoca* would appear to be of very remarkable form. It is, he says, "le plus phoque des phoques, car chez lui toute forme de quadrupède a disparu. Son corps n'est plus qu'un sac fusiforme pourvu de membres tres réduits"—a description completely borne out by Dr. Cook's photographs, as well as by Mr. Borchgrevink's note (op. & loc. cit.), that the body of the first specimen of his supposed new species "was not unlike that of the ordinary Seal, but the neck was of more than ordinary thickness, and under the chin it extended to a great round muscular purse. The head was short and broad, the eyes large and protruding, and the mouth short. The eyes were somewhat slanting. It had six front teeth in the upper jaw, two in the under jaw, but no back teeth."¹ The four skins brought home by the '*Belgica*' are those of an animal distinctly smaller than the other three species. Their total length, measured from the tip of the nose to that of the tail, reaches only from 4 feet 4 inches to 4 feet 10 inches (1400 millimetres). The thick and hairy tail presents no characteristic features, having a length of about 4 inches (100 millimetres). The flippers, as in the other species, are completely covered with hair. They are decidedly smaller than those of *Lobodon* or *Leptonychotes*. The fore-flippers carry five, the hind two to five, in the latter case rudimentary, claws. The greatest length is, for the fore-flippers 9 to 12 inches (300 millimetres), for the hind 10 to 12 inches (300 millimetres). It is due to those who have worked only at the type skin to say that, like them, in examining it, I have completely failed to find any traces of claws on the hind-flippers.

¹ See Mr. Hanson's account of the capture of this specimen, as recorded in his private 'Diary' (*infra*, pp. 89).—R. B. S.

SKULLS.

In the specimens brought home by the 'Southern Cross' the numbers are those used by Mr. Hanson. Of these four, one (No. 1) is the smallest adult, another (No. 2) the largest known, the latter exceeding slightly in size No. 897 of the 'Belgica' collection, which considerably exceeds the largest of Ross's own specimens (No. 43, 11, 25, 4).

Distinguishing characteristics.—The skull of Ross's Seal cannot possibly be confounded with that of any other living Pinniped. As regards general appearance, its nearest resemblances lie with *Cystophora cristata*, Erxleben, of Arctic waters. In size it about equals that of *Leptonychotes*, and is slightly smaller than that of *Lobodon*. Here the resemblance ceases: the feeble dentition, broad interzygomatic and short naso-palatal regions, together with the vertical inclination of the nares, at once mark its distinctness.

The cranial characters of *Ommatophoca* are exceedingly puzzling. Were it not for the differences of dental formulae (*Ommatophoca* possessing one more incisor on each side of the lower jaw than *Cystophora*), we should have very strong grounds for including it in the *Cystophorinae*. Indeed, its resemblances to *Cystophora* are very remarkable. As pointed out by Sir W. Turner, the two skulls approach each other in the vertical inclination of the anterior nares, in their relation to the infraorbital foramina, in the great width of the orbits and interzygomatic regions, and in the length of the ascending portions of the premaxillae. These are so short as to leave a definite part of the anterior nares bounded by the superior maxillae. He might have added the feebleness of the post-canine dentition. They differ, however (besides the dental formula), in the greater length of the nasals of *Ommatophoca*, in which also the superior maxillae articulate with their outer border as far as the tip, and do not leave the anterior part of their border free. Further, the palate plates of the palatal bones are shorter in *Ommatophoca*—a character evidently connected with the resonant vocal powers of the animal—the upper incisors are immensely more feeble, and the shape of the crowns of the cheek-teeth is quite distinct.

Most of these characters are peculiar to *Ommatophoca* and are not found in any other genus, but, in addition to its dental formula, which allies it to the *Stenorhynchinae*, it finds a connection with that family through *Lobodon*, in which genus I find to a lesser degree a similar conformation of the pre-maxillae.

An account of the teeth will be given below. They do not help

us to discover the relationships of this strange form, but are as distinct from any other genus of *Stenorhynchinae* as each of them is in this respect from the rest.

Altogether, I can only regard *Ommatophoca* as a most interesting generalised form, an annectant genus, showing affinity both to the *Stenorhynchinae* and the *Cystophorinae*, to both of which it stands in a quasi-ancestral relationship. I think it more convenient that it should remain included in the *Stenorhynchinae* than that it should form the type of a new family or sub-family.

To come to individual differences (apart from the teeth) I find little variation in the eight skulls before me. The most variable character in the cranium appears to be the amount of the superior maxillae which enters into the boundary of the superior nares. The length of this section of the boundary varies in the different specimens from 5 to 17 millimetres.

As in *Lobodon* and *Leptonychotes* there is practically no development of the sagittal crest. The lambdoid crest is, however, well developed.

Sex.—The sex of Ross's specimens is unknown. One skull of those collected by the 'Belgica' was that of an adult female, the other that of a young male. Since one of the known females is the largest skull of the four and there are no apparent differences in the size of the teeth, I see no way of telling the sex of the two unknown skulls. Neither can the one unknown female amongst the skulls brought home by the 'Southern Cross' be certainly indicated—unless, indeed, it be No. 1, which, although distinctly adult, is the smallest skull of the eight known. All things considered, it is evident that there can be no striking differences between the sexes of this Seal, and it is as likely as not that differences of size represent age and not sex.

Age.—There is little to be said on this point. In many of the skulls, even the larger examples, the teeth are fresh or but slightly worn. Yet, in the smallest skull of all (No. 1 of the 'Southern Cross' collection) not only have the cheek-teeth completely disappeared from both jaws, but in some cases hardly a trace of the alveoli is discernible.

Dentition.—Undoubtedly a great deal of the interest aroused by *Ommatophoca* centres in its dentition. The first striking point in this connection is the remarkable feebleness of the teeth. Thus, with a skull attaining to more than double the size of that of *Phoca groenlandica* or *P. vitulina*, the teeth are about equal in size to those of the former, and actually inferior to those of the latter

species. The only southern Seal which at all nearly approaches *Ommatophoca* in the size of the teeth is *Leptonychotes*; but here again the canines of the latter species are many times larger than those of the former, while the cheek-teeth are also larger and of a different shape. In *Ommatophoca* the cheek-teeth are provided with three cusps, the central one being the largest. In *Leptonychotes* the rudiments of posterior or anterior cusps, even when present, are obscured by the prominence of the central cusp. In spite of their feebleness, the teeth of young specimens of *Ommatophoca* may, as is usual with other Pinnipeds, be so crowded in the jaw as to overlap one another. With the lengthening of the bone in which their roots are embedded, the space between them increases, and the position of their long axis becomes parallel to that of the jaw itself.

The second point in connection with the teeth of Ross's Seal is the remarkable instance of *variation* with which they present us. This had attracted attention even when the species was represented in collections only by the two skulls brought home by Ross, and formed the subject of discussion by Mr. Bateson¹ and Dr. Küken-thal.² The difficulties and interest of the subject have been doubly increased by the specimens brought home by the 'Belgica' and the 'Southern Cross.' Before dealing with these it will be well to describe the peculiarities of the teeth of Ross's specimens.

In one of these skulls (No. 43.11.25.4) the single-rooted first post-canine is followed on each side of either jaw by three double-rooted pre-molars and one true molar, that is to say, if, taking the analogy from other Seals, we regard the dental formula as p.m. $\frac{4 \times 4}{4 \times 4}$ m. $\frac{1 \times 1}{1 \times 1}$.

This dentition has been supposed by Mr. Bateson to represent the normal arrangement in the animal. In No. 324b, on the contrary, the upper jaw is provided with six cheek-teeth on the left side, the first two of which are smaller, and it is reasonable to suppose that they represent the first cheek-tooth of No. 43.11.25.4, since the corresponding tooth on the right side, although single, is provided with two distinct crowns, and looks, when *in situ*, exactly like two teeth united in a single cavity. Presumably then, although the first cheek-tooth of the left side is represented by two distinct teeth, these have apparently originated from some kind of splitting process, since on the right side this process has been imperfectly carried out, leaving an organ which is exactly half-way between

¹ P. Z. S. 1892, pp. 106-108; also 'Materials for Study of Variation,' pp. 237-238, 1894.

² Jena. Zeitschr. (2), xxviii. pp. 76-118, pl. III., IV. 1893.

one and two teeth, being in fact a single root with two crowns. The remaining teeth differ markedly from the corresponding teeth of No. 43.11.25.4 in that only one of them is distinctly double-rooted. The bifurcation of the root is represented in the remainder merely by a slight basal notch, most prominent in the last tooth on the left side, and by a central groove which, passing up each side of the root and being deeper externally, evidently represents the double-rooting of the cheek-teeth of No. 43.11.25.4. The groove is so prominent in the last tooth on the right side that this tooth is double-rooted, although not so prominently so as is the corresponding tooth of No. 43.11.25.4.

The teeth of the lower jaw in 324*b* represent in various degrees the steps between single- and double-rooted teeth. Each of the first pre-molars is double-crowned, but single-rooted, like the first tooth on the right side of the upper jaw. The second and third teeth on each side possess a broad, compressed, single root, divided by a rather deep, central, longitudinal groove on each side. The fourth and fifth are distinctly double-rooted, but not so prominently as are the corresponding teeth of No. 43.11.25.4.

Of the two '*Belgica*' skulls, No. 897 agrees, in the number of its cheek-teeth and the character of their roots, with No. 43, 11, 25, 4. The teeth, however, especially the lower incisors, are rather small. No. 700, on the other hand, presents us with an entirely new combination. In this head there are six teeth on either side of the upper jaw, but here, if we are to apply the same hypothesis as before, the splitting process has apparently taken place not at the anterior, but at the posterior, end of the series. Thus the two last teeth on either side are much smaller than the remainder, and may be taken to represent the fifth tooth of a normal head. The first of the pair is in each case double-rooted; the second is single-rooted on the left and imperfectly provided with two roots on the right. The remaining teeth of the upper jaw are similar to those of No. 43, 11, 25, 4, except only that the double root of number two is very feebly developed and the small basal notch runs up the tooth as a groove as in No. 324*b*. In the teeth of the lower jaw we have every gradation, from the tapering single-rooted number one, through the flattened and grooved number two, and the slightly double-rooted number three, to numbers four and five, both double-rooted, and with, in the latter case, widely separated fangs.

The four specimens brought home by the '*Southern Cross*' are invaluable as presenting us with further modifications of the same type of variation. All are adult, but not one of them agrees with

the normal formula for other Seals. In skull No. 4 the formula for the cheek-teeth is p.m. and m. $\frac{6 \times 6}{5 \times 5}$. In the case of the upper jaw the lesser size of the last two teeth suggests that, as in skull No. 700 ('*Belgica*'), they are the representatives of the typical fifth grinder. On the right side and on the left side each is provided with double roots. The remaining teeth resemble those of No. 43.11.25.4, being all, with one exception, more or less provided with double roots. The single exception is the first, which, as in every other known instance, is single rooted.

In No. 3 the formula is again p.m. and m. $\frac{6 \times 6}{5 \times 5}$, where, if we still apply Mr. Bateson's hypothesis, it appears to be the last tooth which has undergone reduplication. The supposed "daughter" teeth¹ are, however, remarkable in two ways. In the first place they are not small teeth as is the case in the two instances already described (Nos. 700 and 4). On the contrary, one of them (the anterior one), is, like all the teeth of this particular specimen, uncommonly robust, and probably larger than any single fifth tooth of any known skull of this species. The posterior one is smaller than its comrade; but still not small when measured by the standard of the "daughter" teeth of other specimens. Secondly, these teeth are unique, amongst four similar instances, in being both single-rooted. Opposite to these teeth in the lower jaw we have a tooth which is again unique of its kind, being the only absolutely single rooted m. $\frac{1}{1}$ in the whole series. It looks as if the development of the teeth of one jaw had had some influence on those of the other. All the cheek-teeth of the left upper side are single-rooted, the roots of the third, fourth, and fifth being broad and grooved. Those of the right upper side, with the exception of the first, second, and last, are double-rooted. In the lower jaw all are double-rooted except the first and last. Of these p.m. $\frac{1}{1}$ and $\frac{2}{2}$ are crowded and slightly overlap each other. The whole head is remarkable for the great size of the teeth. These are as remarkable for their unusually large, as are those of No. 897, for their unusually small size.

No. 2 presents us with a fourth instance where the formula is again p.m. and m. $\frac{6 \times 6}{5 \times 5}$. In this case each supposed "daughter" tooth is fully provided with double roots, those of the last forming

¹ I borrow this term from Mr. Bateson.

a particularly wide angle. They are slightly smaller than the remainder of the series. All the teeth of this specimen, except the first premolars, both upper and lower, possess well-developed double roots. P.m. $\frac{4}{4}$ is a remarkable tooth. Its crown is, for *Ommatophoca*, particularly well formed and carries three cusps. The central cusp is far more prominent than either of the others, and is partially split into two by a groove. This seems to me to afford an exact parallel to the "cloven" cusp of a specimen of *Phoca groenlandica*, as described and figured by Mr. Bateson at p. 239 of his work. But in this instance the "cloven" tooth is not opposite to a reduplicated tooth on the corresponding side of the same jaw, as in the case of *Ommatophoca*. Dr. Forsyth Major has been good enough to draw my attention to a similar occurrence in *Didelphys marsupialis*. In a specimen of this species (No. 93.12.24.1) in the British Museum, i. $\frac{3}{-}$ on the left side is an exceptionally well-developed tooth, and is cloven in an exactly similar manner.

In No. 1 we come to a completely new phase of the question. This specimen, which, although fully adult and the smallest known example of the species, is, as regards its post-canine dentition, absolutely toothless. Not only have all the cheek-teeth disappeared, but even the alveoli have partially or wholly vanished with them.

We have then in *Ommatophoca* a highly remarkable instance of variation in the teeth—an instance which, I believe, is unique amongst the mammalia. It may be, perhaps, well to summarise the main points:—

(I.) Disregarding the toothless skull (No. 1) we have seven specimens. Of these only two (Nos. 43. 11. 25. 4 and 897) have the normal Phocid formula of p.m. and m. $\frac{5 \times 5}{5 \times 5}$. For four of the remainder the formula is p.m. and m. $\frac{6 \times 6}{5 \times 5}$, and for one (No. 324b) p.m. and m. $\frac{6 \times 5}{5 \times 5}$.

(II.) In all cases where six cheek-teeth occur in the upper jaw, two adjoining individuals of the series are smaller than the remainder, and are sometimes also so closely associated, that it may reasonably be supposed (as in the case of the original specimens) that they represent a corresponding single tooth of an individual possessing only five upper cheek-teeth. In one case only (No. 3)

are the "daughter" teeth almost equal in size to the remaining individuals of the series.

(III.) In four of these five cases, on the above reasoning, the extra tooth is apparently the product of $m. \frac{1}{1}$. In one only (No. 324*b*) is it apparently the product of $p.m. \frac{1}{1}$.

(IV.) In addition to the above, there occur several instances of what, following the above suppositions, can only be regarded as abortive or incomplete division or reduplication of teeth. Such abortive reduplication may be of two kinds.

(V.) Either it occurs (*a*) as if by some kind of sympathy in a tooth closely related to an individual supposed to have undergone reduplication, either on the opposite side of the same jaw or in the opposite jaw. Thus in No. 324*b* (a highly interesting specimen, since it presents the only instance of reduplication in $p.m. \frac{1}{1}$,—the only instance of complete reduplication on one side accompanied by only abortive reduplication on the other—also the only instance of, in addition to the above, abortive variation in $m. \frac{1}{1}$ —in which the formula

is $p.m.$ and $m. \frac{6 \times 5}{5 \times 5}$), all the first premolars being halfway along the road to division. Each, although singly rooted, is provided with two, in most cases quite distinct and perfect, crowns, and is grooved along the most probable line of division into two teeth.

(VI.) or (*b*) it may occur independently, as has happened in the case of $m. \frac{1}{1}$ —of the same head (No. 324*b*), or in $p.m. \frac{1}{4}$, of No. 2.

(VII.) In addition to the supposed reduplication or splitting a very wide range of variation is observable in regard to the rooting of the teeth. Almost any of these, except the first premolars, may appear either with two perfect roots or with a single root only.

(VIII.) But between these forms there are many gradations represented by flattened single roots—flattened single roots grooved along the plane where a division into two roots would occur—flattened single roots in which incipient division is indicated by a terminal notch and all stages of development of this terminal notch, until it becomes a cleft deeply dividing the pillars of a fully developed double root. These gradations are most easily seen in the teeth of a single head, such as the lower molars of No. 324*b* or of No. 700:

they occur, however, with much completeness in certain teeth taken throughout the series, such as premolar $\frac{2}{2}$ of either jaw, and I have not the slightest doubt that in a series of sufficient size they would be exhibited in every cheek-tooth.

(IX.) It seems fair to regard this variability of the rooting as closely connected with the actual reduplication of the teeth, so that a tooth with double roots would, perhaps, in this species, be regarded as no less on the way to reduplication than a tooth with double crowns. At all events this possibility is strongly suggested by the numerous intermediate steps which occur between a tooth with a single columnar root and a fully double-rooted tooth.

(X.) This variability in respect to the roots is not confined to the original teeth, but may occur also in the supposed "daughter" teeth. A pair of these may occur in any of the following combinations:— (a) both single-rooted; (β) both double-rooted; (γ)¹ one double-rooted and the other single-rooted; or (δ) one fully, and the other only partially double-rooted. Further, a single-rooted pair of "daughter" teeth on one side of the jaw may be represented by a double-rooted pair on the other side, as in No. 4.

(XI.) The variability in respect to the roots is greater in some teeth than in others. Thus (although one or both of the "daughter" teeth of m. $\frac{1}{1}$ may be single-rooted), in no head except No. 3 does this tooth itself, if unreduplicated, possess less than two roots. Where reduplication is supposed to have occurred, one or both of the "daughter" teeth may be single-rooted. It is remarkable that the only instance of a single-rooted m. $\frac{1}{1}$ is due, apparently, to a case of "sympathy." This occurs in No. 3, a head in which both "daughter" teeth of m. $\frac{1}{1}$ are single-rooted. Similarly, p.m. $\frac{4}{4}$, although very variable in the nature and development of the two roots, only once appears (in No. 324b), with a single flattened and grooved root, while p.m. $\frac{4}{4}$ is never single-rooted. P.m. $\frac{3}{3}$ and $\frac{3}{3}$ appear each once single-rooted (both again in No. 324b). P.m. $\frac{2}{2}$ and $\frac{2}{2}$ each appear twice, with single roots, and to these exceptions No. 324b

¹ Cases γ and δ occur opposite to each other in the same jaw.

again contributes largely. On the contrary, there is no instance of a double-rooted p.m. $\frac{1}{1}$, and of p.m. $\frac{1}{1}$ it may be said that in all cases where this tooth was found *in situ* it also was single-rooted. In a single case (No. 4), where all the teeth had been removed from the skull, and could not be certainly identified, I suspect it to have been double-rooted.

(XII.) Besides variation in number and shape there is also variation in size. The teeth of No. 897 are abnormally small; those of No. 3 abnormally massive, and crowded together in the jaw.

(XIII.) Further, the size of the incisors is conspicuously variable, as exhibited by the large incisors of No. 324*b* and the small ones of No. 897.

Having thus described the variations to which the teeth of the known specimens of *Ommatophoca* are subject, it is time to turn to what has been written on the subject by Mr. Bateson and Dr. Kükenthal. In fairness to these writers it should be at once stated that Mr. Bateson's remarks were based upon an examination of only two skulls—those brought home by Ross,—while, so far as I know, Dr. Kükenthal never had an opportunity of seeing the actual specimens, but based his conclusions on mere descriptions and upon Mr. Bateson's arguments. It will not then appear surprising, if I find myself, after the advantages of examining no less than eight skulls, unable to agree with all that has been written on the subject.

To deal first with Mr. Bateson. That naturalist has found in the variations of skull No. 324*b* the material for a highly ingenious paper, wherein he has used them in conjunction with other like variations as a ram wherewith to batter the prevailing views on the homologies of mammalian teeth.

As the result of an examination of great numbers of skulls of the Primates, Carnivora and Marsupialia, he finds that in many examples of various genera and species "reduplication of teeth may occur in such a way that a tooth which is usually single may be represented by two teeth, and that the two teeth thus formed may either (1) both take place in the ordinary series, or (2) may stand externally and internally respectively."

The prevailing hypothesis, as Mr. Bateson points out, necessarily "involves a definite conception of the mode in which variation works," and, further, that "in variation the individuality of each member of the series is respected."

But, as in the case also with other multiple parts, such as digits and phalanges, the difficulty in applying this principle and in

following the individual history of each tooth is notorious. Especially is this the case because "though variation may sometimes respect the individual homologies, yet this is by no means a universal rule; and, as a matter of fact, in all cases of Multiple Parts, as to the variation of which any considerable body of evidence has been collected, there are numerous instances of new forms arising in which what may be called the stereotyped or traditional individuality of the members has been superseded."

Judged by the ordinary rules of morphological criticism, this [original] specimen [of *Ommatophoca rossi*] shows one or both of two things:—

(1) The first premolar of *Ommatophoca* may in itself represent two premolars of an ancestor;

Or (2) in the descendants of *Ommatophoca* the single first premolar may be represented by two distinct and separated premolars.

One or both of these propositions may be true. If the division of the other three first premolars were as complete as that of the left p.m. $\frac{1}{2}$, there would be no indication of their origin. But if it is possible for a premolar to represent or to be represented by two premolars, without any visible indication of its double nature, may not the same be true of the premolars of other forms? may it not be true of teeth generally? And if it is true, how are the homologies of teeth to be determined?

Mr. Bateson's arguments carry with them all the virtues and vices of brilliant destructive criticism. He has seized a tempting opportunity to attempt the downfall of, or at least to heap discredit upon, the theory of homology, a theory which, like all other human theories, is but a working hypothesis, and as such no more unsatisfactory or satisfactory than others of its kind. Without the theory of homology, much of the best biological work of the past century would be barren and meaningless. Regarded by its light, a good deal of it seems to tend towards the same goal. To brand our system as "imperfect" is to tell us what we already knew. To discredit that system is to retard rather than to advance knowledge—unless the objector can produce another system better and more workable in its stead.

This Mr. Bateson, like many other destructive critics, conspicuously fails to do. In fact he does not even attempt a task which he probably regards as impossible. The weakness of his position is best demonstrated by his concluding paragraph, wherein

he confesses that "the present system of homology must probably be retained as a basis of notation, imperfect though it is, and although it is founded on a misconception of essential facts."

It is unnecessary, in the present connection, to deal further with Mr. Bateson's arguments. He has certainly indicated the difficulties of reading homologies; he has not necessarily proved the impossibility.

As a critic of Mr. Bateson, Dr. Kükenthal acknowledges the probable existence of numerous instances of (to use Mr. Bateson's term) reduplication in teeth, and believes that such reduplication or splitting may in certain cases occur in any cheek-tooth. But, since all intermediate stages of the phenomenon may be found, there is nothing to prevent the reading of the homologies. Thus in the case of skull No. 324*b*, he finds no difficulty in believing that at the anterior end of the series two teeth on the left are homologous with one on the right, and, that being so, there is nothing to prevent us from regarding each of the remainder, starting from the last two, as homologous—a supposition which is, indeed, not denied by Mr. Bateson.

Continuing, Dr. Kükenthal thinks that, since in some cases each of a pair of these reduplicated teeth may attain to the same size as the remainder of the series, there may in this way arise a permanent increase in number and the formation of a new species possessing six cheek-teeth.

The more often the new six-toothed form alone occurs, the less frequent will be intermediates, and the more difficult, although not impossible, will it be to follow the phylogeny. Even were the original five-toothed forms entirely ousted, and the new six-toothed forms predominant, there would still occasionally occur five-toothed individuals to indicate the origin of the former. Difficulties in reading homologies might increase; impossibility would not exist.

Turning to another form of variation in Mammalian teeth, the appearance of extra teeth, as in *Halichoerus*,¹ in which the upper jaw may possess six instead of five cheek-teeth, Dr. Kükenthal remarks that in this case the new teeth are always at the same place at the posterior end of the jaw. They are not the result of reduplication, but represent an entirely new factor. Here again homology is still possible and even easy, the five teeth of a typical skull corresponding to the first five of a six-toothed skull, and the sixth tooth of the latter being something new.

¹ See A. Nehring, Ueber Gebiss und Skellett von *Halichoerus grypus*. Zool. Anzeiger, p. 610, 1873.

Kükenthal's opinion seems to be that the increase of teeth amongst the *Pinnipedia*, whether by reduplication or by the addition of new teeth, is due to a tendency to lengthen the jaw amongst a group of animals whose development is still going on, and to whom in the execution of their main object in life, namely the capture of fish, such a lengthening would be useful.

He finds a parallel between the reduplication of the teeth of *Ommatophoca* and the development of teeth in young Whalebone Whales, in which his studies have shown that, while the rudimentary cheek-teeth of the youngest embryos are many-cusped, those of older embryos are single-cusped, and occasionally reduplicated.

With the earlier portion of Dr. Kükenthal's remarks few, no doubt, will be found to disagree. The suggestion that a new tooth may arise either as an offshoot of one already in existence or as a new and independent organ is indeed not without probability. When, however, he comes to deal with increase of the teeth amongst the *Pinnipedia*, he gives vent to suggestions which, however probable they may have appeared at the time when they were written, certainly do not apply to *Ommatophoca* as we now know it in the light of Dr. Racovitza's description. According to that naturalist, the animal never catches fish; its jaw is extremely short and feeble, and there is no evidence whatsoever to justify us in supposing that a lengthening of the jaw would be either useful or probable in the future. Whatever applications Dr. Kükenthal's remarks may bear to other Pinnipeds they can have no meaning whatsoever as applied to *Ommatophoca*.

To consider the specimens once more, the most striking characteristic of the series is, to my mind, not any possible increase or reduction of the teeth, but the exceeding variation which they exhibit. The most noticeable feature of this variation is certainly its quantity: its quality (for a knowledge of which we are so largely indebted to Mr. Bateson) may be found exhibited in numerous other instances amongst the Mammalia. As compared with this variation, questions of increase or decrease of teeth are evidently, in this case, even if proved, subsidiary. The one thing obvious is that we have in *Ommatophoca* an animal in which the dentition is, whether in number of teeth, in their size or form, vastly more variable than it is in any other known Heterodont Mammal.

Recent investigation has shown that teeth, like every other character, are subject to variation. They are not the entirely stable organs they were at one time believed to be. Yet no instance of instability so remarkable as that of *Ommatophoca* has, I believe, been

described—an instance in which, of eight known examples, only two resemble each other.

The first problem then which confronts us is the explanation of such variability. It can be no more meaningless than is, as a rule, the remarkably definite form and condition of Mammalian dentition. The question is—can we possibly find the meaning?

To my mind there is one point which stands out most clearly in regard to a case like the present. The animal whose teeth are subject to such variation *can have no use* for a stable dentition. Just as the highly specialised complications of the crowns of the cheek-teeth of *Lobodon* must have arisen through some very special need of the animal—some very specialised manner of feeding for which the particular form of tooth must be an advantage—so it seems clear that *Ommatophoca* must be an animal, the capture and ingestion of whose food is not affected by changes in its dentition. I go further even than this, since I believe that, as already explained, the animal is in the course of losing its teeth. The dentition shows a condition of extreme weakness. The teeth are small and feeble, and it is to this very feebleness that I feel inclined to attribute the variability as regards the roots. It seems to me, in fact, as if the strength to form a completely double-rooted tooth is frequently absent. I would suggest then that except for p.m. $\frac{1}{1}$ and $\frac{1}{1}$ the double-rooted tooth must be the normal, the single-rooted a variation. My supposition gains strength from the fact that in all the eight skulls there is no instance of a double-rooted first premolar—a variation which should assuredly, one would think, occur, were variations towards strength and not towards weakness the rule. Taking the remaining cheek-teeth of the left side, of sixty teeth 49 or over 80 per cent. are more or less double-toothed, while of the remainder many are small, imperfectly formed, or mere “daughter” teeth of one of the supposed cases of reduplications. It seems impossible to doubt then that, following the analogy of other Seals, the posterior cheek-teeth of *Ommatophoca* are normally double-rooted.

Lastly comes the question of the supposed reduplication of teeth, a point upon which I have, in the earlier part of this article, followed the nomenclature and suggestions of previous writers. Viewed in the light of my previous suggestions, the possibility of reduplication or the reverse loses much of its importance, since it is probable that, where variation is so rife, it may take the form either of increase or of decrease in the number of the teeth. In the former case the new

teeth, as is actually the case, would not be so strong as those of the original series. Yet it is necessary to consider the matter, especially in view of what has already been written concerning it.

And first it is advisable to consider what is the normal cheek-dentition of *Ommatophoca*. As long as only two skulls were known, I think there could be no doubt that it was necessary to regard it as (following the analogy of other Seals) p.m. $\frac{4 \times 4}{4 \times 4}$ m. $\frac{1 \times 1}{1 \times 1}$. This view was certainly not shaken by the arrival of the two specimens brought home by the 'Belgica,' since this dental formula was then represented on both sides of two skulls and on one side of a third, as against only one skull with a complete dentition of pm. and m. $\frac{6 \times 6}{4 \times 4}$. Now, however, that the 'Southern Cross' specimens are added to the series, we may divide the skulls before us into the following classes:—

- | | | |
|---|---|---|
| (I.) Those with p.m. $\frac{4 \times 4}{4 \times 4}$, m. $\frac{1 \times 1}{1 \times 1}$ (nos. 43.11.25.4 and 700). | } | 2 |
| (II.) One with practically the same dentition, but with an extra tooth, apparently as a 'daughter' of p.m. $\frac{1}{1}$ on the left side and the remaining premolars apparently in a state of semi-reduplication (no. 324b.) | } | 1 |
| (III.) Those with p.m. and m. $\frac{6 \times 6}{5 \times 5}$ —in each case at first sight by reduplication of m. $\frac{1}{1}$ —(nos. 700, 4, 3 and 2). | } | 4 |

—a result in the face of which it clearly behoves us to reconsider our opinions as to what must be properly regarded as the normal dentition of *Ommatophoca*.

In view of the probable capture in the near future of further examples of this most interesting Seal, it is not safe to venture on positive assertions as to the intricacies of its dentition. It is impossible, however, to avoid the suspicion that the four skulls of Class III. are those of individuals in which a normal complement of two upper molars is in process of reduction, that those of Class I. are skulls of individuals in which such a reduction has taken place, and that No. 324b is an altogether abnormal and unusual variation—an example, in fact, of quite a different class of variation.

Coupled with the feebleness of dentition, which I have already pointed out, nothing could be more natural than reduction of the teeth. This is, as is so well shown in the short-jawed races of the human species, first manifested by a lessening in size of the last

molar, as so well paralleled in *Ommatophoca* in the case of the last two molars. For in no one of the instances of supposed reduplication of $m. \frac{1}{1}$ are either of the "daughter" teeth so well formed or rooted as the remainder of the series.

This process of reduction is admirably in keeping with the anatomy of an animal whose teeth are feeble, jaws short, and whose prey requires neither holding nor much mastication.

Further, the fact that, except in the case of No. 324*b*, the supposed cases of reduplication were in each case in connection with $m. \frac{1}{1}$ and never in the lower jaw, does not point to a meaningless reduplication of any tooth of the series.

Lastly, it seems hardly advisable or possible to take as normal any condition other than that of the majority, in this case $p.m. \frac{4 \times 4}{4 \times 4}$, $m. \frac{2 \times 2}{1 \times 1}$. Nor could we indeed attempt to do so were it not for the existence of No. 324*b*. This skull is undoubtedly the most curious of the whole series. I look on it as one of those quite abnormal specimens which must in all cases be eliminated from questions of the present kind. It seems to be a skull in which both reduction and reduplication of the teeth have occurred—the former in regard to $m. \frac{2}{1}$, the latter in regard to $p.m. \frac{1}{1}$.

I believe, then, that until the accumulation of more specimens proves the contrary, we must regard *Ommatophoca* as having originally possessed two upper molars, one of which it is now in process of losing—a supposition which, if borne out, may have far-reaching results, and may even turn the scale in favour of the formation of a new family for the sole reception of *Ommatophoca*.

A distinct parallel to such a state of things occurs in *Halichoerus*, as has been shown by Professor Nehring. No other species of Earless Seal possesses a similar dental formula, but *Ommatophoca* is just that cranially generalised species in which we should expect such a type of dentition to occur—a dentition which, perhaps, suggests an interesting bridge between the *Phocidae* and *Stenorrhynchinae*.

In my previous remarks I have not attempted to discuss the causes of reduplication in teeth, nor alluded to those hypotheses which view with favour the rise of the Cetacean dentition by means of a wholesale process of this kind. As to the former matter, the exact causes of such reduplication hardly lend themselves to

discussion—unless such discussion be based upon minute histological, physiological, or embryonical research. Why two teeth may occasionally grow where it appears to us that there should be one, is as yet—and perhaps always will remain—a mystery. That the phenomenon does occur we may regard as proved; no other hypothesis will account for the instances collected by Mr. Bateson, nor, as I think, for the vagaries exhibited by skull No. 324*b*. Further, it seems certain that in the cited instances of the occurrence of “cloven” teeth, this condition is due to what I may call a process of incomplete or abortive reduplication—a process of reduplication which has commenced, but never reached completion. But here again the cause is at present beyond conjecture.

As to the second point, the possible origin of the Cetacean dentition by some wholesale process of reduplication, this may or may not have happened. There is, I believe, no real evidence one way or the other. I cannot help thinking, however, that those who rack their brains for complicated theories in explanation of Cetacean dentition, have overlooked the simplest explanation of all. For, if it be admitted, as I think has already been suggested by Mr. Bateson—a not very difficult or unreasonable concession—that the power of forming teeth is distributed along the whole length of the jaw, what is more easy than the formation of many teeth in a long jaw, of fewer teeth in a shorter jaw? The exact size of such teeth, like the size of an *Amoeba*, would be governed primarily by mechanical reasons of unknown scope, secondarily by Natural Selection. Their shape would fall easily under the influence of the latter force. (See Table IV, p. 66.)

EXPLANATION OF PLATE I.

TO ILLUSTRATE THE VARIATION IN THE CHEEK-TEETH OF THE KNOWN
SKULLS OF *Ommatophoca rossi*.

1 (upper) and 1' (lower), teeth of skull numbered 324A (43.11.25.4), collected by Sir James Ross's Antarctic Expedition.

2 and 2' ditto of skull numbered 324B, with same history as No. 324A.

3 and 3' ditto of skull numbered 700, obtained by the '*Belgica*.'

4 and 4' ditto of skull numbered 897, with same history as No. 700.

5 and 5' ditto of skull numbered 4, obtained by the '*Southern Cross*.'

6 and 6' ditto of skull numbered 3, obtained by the '*Southern Cross*.'

7 and 7' ditto of skull numbered 2, obtained by the '*Southern Cross*.'

TABLE IV.—OMMATOPOHOCA ROSSI.

A.—From the Collection of the "Southern Cross" Expedition, obtained in the ice-pack near Victoria Land.

	Basal length.	Baso-palatal length.	Greatest breadth at zygoma.	Greatest breadth of cranium.	Length of nasals in middle line, and at greatest length.	Length of upper cheek-teeth series.	Length of lower cheek-teeth series.	Length of exposed portion of upper canines.	Greatest diameter of upper canines.	Antero-posterior length of 3rd lower cheek-tooth.	Height of exposed portion of 3rd lower cheek-tooth.	
No. 2.—Adult. The largest known skull. ♂ (?).	244	Dangl.	94	Dangl.	55	53	11.5	9.5	66-69	9.5	8	Teeth unworn.
No. 4.—Adult. ♂ (?).	236	176	82.5	113	50	53	13.5	10	49	..	..	No cheek-teeth.
No. 3.—Adult. ♂ (?).	230	185	85	121	50	46.5	16.5	10	57.5	8.5	9	
No. 1.—Old. ♀ (?).	213	..	84	120	..	..	15	8.5	65	Old.	Old.	

B.—From the Collection of the Belgian Antarctic Expedition, obtained at or near the Palmer Archipelago and Graham Land.

No. 897.—♀ adult; the largest skull known.	242	88	176	117	..	46.5	52, R. 50, L.	11	7.5	7.5	5.75	Teeth slightly worn. No sagittal crest.
No. 700.—A ♂ not adult.	220	78	157	103	..	49	46.5	8	6.5	8	5	Teeth fresh and unworn. No sagittal crest.

C.—From the Collection of the British Museum of Natural History, obtained in various localities.

No. 324a (43.11.25.4). Apparently an adult ♀. Sir James Ross' Antarctic Expedition 1839-43. The original of Gray's Figure and Description in 'The Zoology of the Voyage of "Erebus" and "Terror,"' and the type of the species. (The skeleton and skin of this specimen also exist in the Museum.)	230	90	177	117	..	L47.5, R43	L45.5, R44.5	16(11) ^[2]	8.5	8.5	8.5	Teeth slightly worn. No sagittal crest. Skull damaged.
No. 324b.—An apparently immature ♀. The history is the same as that of No. 324a.	222	92	167.5	109	..	L47.5, R45.5	L44.5, R44.5	13.5	8	8	7.5	Teeth unworn. No sagittal crest. Skull fragmentary.

R = right side; L = left side.

[1] Owing to the constant rising of the teeth from the jaw the length of the cheek-teeth series, as measured at the base, may actually decrease with advancing age, since the exposed upper portion of the root of a cheek-tooth is less bulky than its crown.

[2] Similarly the amount of the canines exposed is somewhat variable. The figure in parenthesis expresses the length of the portion originally exposed in this specimen.

II.

NOTES ON ANTARCTIC SEALS.

COLLECTED DURING THE EXPEDITION OF
THE 'SOUTHERN CROSS.'

BY EDWARD A. WILSON, M.B., F.Z.S.¹

(PLATES II.-VI.)

Owing to the death of Mr. Nicolai Hanson (the zoologist best qualified to have written an account of the Antarctic Seals), the task of describing his specimens has devolved upon one, who though at present unacquainted with these animals in a state of nature, has nevertheless a great interest in the work, from the fact that he shortly hopes to cover the same ground in search of the still (unfortunately) hidden treasures of knowledge concerning the Seals of the Antarctic

¹ Dr. Wilson has sailed as the naturalist on board the 'Discovery.' Before he left for the Antarctic, he made a special study of the animals known to inhabit the southern seas, and, shortly before his departure, he forwarded to Professor Ray Lankester the notes now published on the *Pinnipedia*, accompanied by coloured drawings of the Seals taken from the newly-mounted specimens presented by Sir George Newnes to the British Museum. These notes are supplementary to the memoir prepared by Captain Barrett-Hamilton, which is an excellent *resumé* of our knowledge of the Seals of the Antarctic. The enforced departure of the latter naturalist for South Africa took place before Sir George Newnes' specimens of the Antarctic Seals had been mounted in the Museum, and he was only able to determine the species of Seals brought home by the 'Southern Cross' from the skins roughly preserved in brine. A few leaden labels were attached to some of the specimens, but these had perished in nearly every case, and the two or three which remained on the skins no one was able to decipher. Dr. Wilson managed to identify the characters stamped by Mr. Hanson on the labels which were attached to one or two of the skins, and he was thus able to connect a few of the skulls with the actual specimens to which they belonged. He examined the types of Antarctic Seals in our Museum, and compared with them the specimens brought home by the 'Southern Cross.' The pictures which form the subject of the plates in the present volume have been lithographed by Mr. H. Grönvold from Dr. Wilson's paintings, and Mr. Bernacchi's photographs of the Seals in life were of great assistance in determining the natural form of the animals. To Dr. Wilson's notes have been added the accounts given by Mr. Bernacchi in his work 'To the South Polar Regions' (pp. 318-320), which give us a good idea of the habits and distribution of the species of Seals met with by the 'Southern Cross'; and many interesting records will be found in the private Diary of the late Mr. Nicolai Hanson, printed below (pp. 79-105).—E. R. L.

regions. A lamentable succession of accidents has succeeded in robbing the collection of the 'Southern Cross' of a very considerable part of its value. Through the death of Mr. Hanson most of the details as to the preservation of the animals and the labelling of the skins have been lost. Thus the possibility of properly attaching the skulls to their own several skins, and of correctly determining the sexes of the latter, has also vanished. That he was extremely careful in recording these details may be gathered by a perusal of his private diary and from the verbal testimony of his surviving colleagues of the scientific staff of the expedition.

In only a few cases has it been possible to connect certain skins with the zoological notes incidentally included in his private journal, but we are deeply indebted to his near relations for the care and trouble with which they have sought out and given for our use these very valuable extracts.

I am also personally deeply grateful to Mr. Bernacchi, the Meteorologist on the 'Southern Cross,' for his information respecting the life-history of the Seals, and for the use of his very excellent photographs, which demonstrate how different is the appearance of the living Seals from any illustrations which have hitherto appeared.

Seals of five species are represented in the collection. Of these, four only were taken in the Antarctic regions, all of which were already known to science as examples of the Earless *Phocidæ*. The fifth was an immature Eared-Seal, one of the *Otariidæ*, which was apparently captured by Captain Jensen on Campbell Island, and cannot properly be included among the Seals of the Antarctic collection.

The four Antarctic Seals have been named thus: The Crab-eating Seal (*Lobodon carcinophagus*); Weddell's Seal (*Leptonychotes weddelli*); the Leopard-Seal (*Ogmorhinus leptonyx*); Ross' Seal (*Ommatophoca rossi*).

The question of right in these four Seals to generic distinction must be left to others to determine. The name *Leptonychotes* for Weddell's Seal has been preferred in this paper to connect it superficially, more than really, with *Ogmorhinus leptonyx*. There is probably no more real connection between these two Seals than between any other two of the series, and even the superficial resemblance between them is far more obvious in the tanned skin than in the living animal. Mr. Bernacchi states that there is no possibility of confusing a living *Ogmorhinus* with a living *Leptonychotes*, the former having a speed and energy, strength and ferocity, which makes it as different from Weddell's Seal, as the skull and dentition of the one are different from those of the other.

1. LEPTONYCHOTES WEDDELLI. Weddell's Seal.

(PLATE II.)

Weddell's Seal is found in great numbers on the coast of South Victoria Land, and is the species most commonly met with in Ross's Sea. At almost the farthest southern point reached by the *Southern Cross* Expedition these Seals were numerous, and even in a piece of water south of the edge of the Great Barrier, which apparently communicated under ice with the sea, a number of them were found (*cf.* Borchgrevink, 'First on the Antarctic Continent,' p. 286).¹

Not a single Weddell's Seal was met with in the pack-ice by the '*Southern Cross*,' and the numbers which were found on landing at Cape Adare are mentioned by Mr. Hanson as belonging to a species not before met with by him (*cf. infra*, p. 93).

Weddell's Seal is therefore a shore Seal, and it remained throughout the winter with the party which was landed at Cape Adare.

Mr. Bruce confirms this view of the distribution of the two Sea-Leopards when he says that they were the most rare species in the pack-ice about Louis Phillipe Land: and since, in speaking of Ross's Seal there can be little doubt that Mr. Bruce is describing the new coat of the Crab-eater (*Lobodon*), the former species may, without doubt, be added to the two Leopard-Seals, and all three classed as rare in the pack-ice. The only common Seal in the pack is the White Crab-eater (*Lobodon*), and the only common Seal on the coast-line of the Antarctic regions is *Leptonychotes weddelli*.

Weddell's Seal was the only species found breeding in any considerable numbers by the '*Southern Cross*' Expedition. Some dead young Seals were found buried in *guano* at Camp Ridley on Cape Adare, but apparently no Weddell's Seals breed there now, though in Robertson Bay, close by, a large number of them were breeding, and many young were born. Three fetal Seals of this species were brought home in spirits by the '*Southern Cross*' with the membranes and placenta more or less intact.

Two quite small specimens were taken from the mothers on March 25th and March 29th. Both were females and measured but 28 centimetres in length. The third specimen was taken from the mother on May 5th and measured 45 centimetres in length. This was a male, and it showed the typical marking of *Leptonychotes*, though no hairs were visible to the naked eye, save on the face and

¹ Although many examples of this Seal were killed by the members of the expedition, and several preserved, only a single specimen has reached the British Museum.—R. B. S.

muzzle. The former was covered with fine and silky hairs, the latter carried numerous fine black bristles.

Mr. Bernacchi (p. 318) writes as follows: "Weddell's Seal (*Leptonychotes weddelli*) is found in great numbers along the coasts of the Antarctic lands, but rarely in the pack-ice. As many as two hundred of these Seals were seen together by the 'Southern Cross' Expedition, even at the farthest point south reached by the ship. In the depths of winter it is still to be found near open pools of water around large icebergs, which are kept open by the movements of the bergs. In appearance it is the most *rounded* of all the Antarctic Seals, with a bullet-like head, and large and prominent dark-brown eyes, which appear bloodshot and protruding, though always full of expression and pathos. It is slow, quiet, and very inoffensive. The staple food of this Seal is crustaceous matter and small fish. In colour the back and sides are dark grey, shading off into a tawny orange colour underneath. It was found breeding in considerable numbers in Robertson Bay during the spring of 1899, the first young appearing early in September.

In the latter month Mr. Bernacchi says that a common red crustacean and a small fish like an anchovy, form the principal food of the species, and on February 17th Mr. Hanson notes that the stomach of a *Leptonychotes* was quite full of a small fish like a whiting (*infra*, p. 93).

Perhaps the most characteristic point in the colour of the skin of this Seal is the absence of vivid black amongst its many splashes and spots of grey. The back and sides are dark grey, darker, as usual, mid-dorsally, and shading off into a tawny-orange colour underneath, which is streaked in a very liberal fashion from head to tail with grey of a varying depth, but not with black. Again, on the upper parts, where the ground colour is dark grey, shading off down the sides into tawny orange, there are also longitudinal streaks and splashes of pale tawny colour, often very pale, but none of black as are found in the *Ogmorhinus*. There is considerable difference apparently in the ruddiness of the under parts of the two Leopard-Seals—the True and the False. In *Ogmorhinus* the colour is more fulvous; whereas in Weddell's Seal the tawny colour exhibits almost a greenish tinge by the free admixture of grey markings of varied intensity.

Mr. Borchgrevink (*t.c.* p. 236) mentions Weddell's Seal as the "best represented" species in the pack,¹ which, however, was not the case; but he does not seem to be well acquainted with the Seals

¹ Mr. Bernacchi (p. 73) says that not one Weddell's Seal was met with in the pack.

obtained by his expedition, as he also figures the skull of a *Lobodon* (*t.c.* p. 103), and calls it "*Weddellii*."

In his account of the '*Southern Cross*' expedition, he mentions the present species as being met with on his winter sledge journey (p. 159), near Coulman Island and near Cape Constance, where about three hundred were seen together (p. 237), as well as in Lady Newnes Bay, on the 4th of February (p. 260), and again in a bay in the ice-barrier (p. 286). He writes: "Towards the south some Seals were basking on the ice. I sent a boat to the end of the bay after them, and found that they were *Weddellii*. A party of ski-runners which I despatched to the west came upon a large number of Seals in a lake, or large deep basin, formed in the plateau of the barrier. Although the plateau at that place fell with a gentle slope, it evidently reached the level of the sea, as the Seals shot up through blow-holes in the ice at the water's edge."

Mr. Bernacchi mentions the species as occurring on one of the Possession Islands (p. 235). He further describes the finding of Weddell's Seal on the ice-barrier: "Round this Cape [Constance] we found low land, or, I should say, the edge of the great ice-cap at this spot was low. Steaming along the edge of the ice-barrier, we discovered a kind of inlet or 'arm' running into the glacier for a distance of about three miles, with perfectly smooth ice between, and fastened to the walls of the glacier. This spot was well sheltered from winds, and the great inland ice-cap was easily accessible. A rookery of Seals, some hundreds in number, could be seen lying on the ice at the bottom end of the arm, and two Emperors and one Adelia Penguin were observed. These Seals proved to be *Leptonychotes weddellii*. They were lying alongside a crack in the ice, most of them asleep; they were totally unconcerned at our presence, and evinced not the slightest interest in us." He also gives (p. 274) an account of the Seal rookery in the ice-barrier.

2. OGMORHINUS LEPTONYX. Leopard-Seal.

(PLATE III)

The Leopard-Seal was nowhere, and at no time, common. Two young ones were captured in the pack-ice on January 3rd. A male was killed at Cape Adare on December 22nd, and another was seen and successfully photographed by Mr. Bernacchi, also at Cape Adare.

They are therefore obviously rare at all times, though widely distributed.

A female of the Leopard-Seal was found on September 11th in Robertson Bay, containing a young male ready for birth. As September is also the month when Weddell's Seal gives birth to its young, there can be no doubt that the Leopard-Seal had come to the coast for the same purpose. The food of this Seal, the most active, powerful, and ferocious of all the southern Seals, and the most truly carnivorous in its dentition, consists mainly of fish, though it is stated by Dr. Racovitza that Penguins were accepted as food when thrown overboard by him from the '*Belgica*.'

Sir James Ross found in the stomach of one of these animals no less than 28 lbs. of fish, including *Sphyrænia* of 28 inches length, and *Notothenia* of $6\frac{1}{2}$ inches. The stomachs of the two young Leopard-Seals killed in the pack-ice contained the remains of Octopus.

Mr. Bernacchi (p. 319) gives the following note: "The Leopard-Seal (*Ogmorhinus leptonyx*) is readily distinguished by the great size of its elongated body, by its large, flat square head, with small fierce slit-like eyes set sloping inwards, and by a greater number of spots upon its body than any of the other species. It is not a common Seal, for only three or four specimens were secured by the '*Southern Cross*' Expedition. It is the largest and fiercest of all the Seals, not hesitating to attack a man on being molested. It is a most voracious animal, and feeds upon fish and Penguins. I have seen one near Possession Island give chase to a Penguin in the water; the latter appeared to have little chance against such a determined and rapidly-moving foe. In colour the back is of a dark hue, but the most characteristic point seems to be the presence of black as well as tawny spots on the grey of the upper part of the sides. The young of this Seal is born during the month of September."

These Seals are easily recognised by their activity and strength, and are the largest of all the species of the Antarctic regions. Sir James Ross gives 850 lbs. as the weight of one of these Seals, measuring 12 feet from nose to the tip of the tail, and 6 feet round the body.

The largest skin of the *Ogmorhinus* brought home by the '*Southern Cross*' measured nearly 11 feet from nose to tail.

When lying on the ice, as is well seen in Mr. Bernacchi's excellent photographs of this Seal, the sides bulge and the whole animal is flattened out, much as a Lizard spreads itself to catch the full rays of a hot sun.

The "True Sea-leopard," as this species is sometimes called, is

distinguished from the "False Sea-leopard" or Weddell's Seal, mainly, so far as the skin is concerned, by the length of the fore limbs, and the presence of vivid black spots in addition to the tawny spots encroaching upon the dark grisly-grey of the back and sides. The line of division between this grey colour, which deepens to grisly-black on the mid-dorsal line, and the tawny orange of the belly and lower part of the sides, is very distinct, though broken by a number of irregular mottlings of black and dark grey. These dark irregular markings are most plentiful on the orange colour of the shoulders and flanks, where they are almost confluent; on the sides they are less frequent, and, though plentiful on the sides of the face and jaw and under the chin, there is a large space of almost unspotted orange skin under the throat and neck, and another immediately behind the spotted shoulder. The hind-flippers are richly marked with black and orange spots and splashes, very much more so than on the fore-flippers; and whereas the ends of the digits of the hind limbs are black, those of the fore limbs are of a rich orange colour. Nails are discoverable on all the flippers, and the same may be said of the nails in every one of the four species of southern Seals. They are perhaps least conspicuous in *Ommatophoca rossii*. In the fore limbs of the Leopard-Seal they are very long and well formed. But in colouring, the most characteristic point seems to be the presence of black, as well as pale tawny, spots on the grey of the upper part of the sides.

Mr. Borchgrevink (p. 65) first mentions the species in the pack-ice early in January, when two young ones were obtained, and he also speaks of a "large sea-leopard" in whose stomach was found remains of an octopus. He also says that it bred in Robertson Bay (p. 237), and that young were frequently found on the sledge journeys. It is a pity that more specimens were not brought home. Mr. Borchgrevink also writes (p. 170) on Sept. 11th: "I killed a female Seal near the edge of Dugdale glacier. It was a Leopard (*Stenorhynchus leptonyx*). When I had skinned it, I cut it open, and, to my surprise, found a nearly full-grown male young one alive in her. As I had freed him, he seemed quite happy as he rolled about on the ice in his soft smooth coat. I put him on my sledge, and drove him to the stone hut, where we kept him alive on condensed milk, until we were later on able to send him by sledge to Camp Ridley, where Dr. Klövstad fed him from a bottle!" The arrival of this living Seal at the Camp is not mentioned in Mr. Hanson's Diary.

LOBODON CARCINOPHAGUS. White Seal.

(PLATES IV.-V.)

The White Seal, or Crab-eater, is the common Seal of the pack ice, at any rate during the months of Antarctic summer. It is, however, not confined to this belt of ice, but is also to be found sparingly as far south as the great Ice Barrier, in company with Weddell's Seal, which is the most common Seal of Ross's Sea and of South Victoria Land. Of the breeding habits of the Crab-eater practically nothing is known.

Its food is said by Dr. Racovitza to consist of *Euphausia*, and in this connection may be quoted the interesting suggestions of Capt. Barrett-Hamilton, "that the teeth of *Lobodon* may possibly serve the animal as a sieve whereby to rid its mouth of the water taken in with the *Euphausia*, somewhat after the manner of baleen in the *Balenida*. For this purpose the teeth seem to be exactly suited. They do not fit closely, but alternate with those of the opposite jaw, so that the cusps form a perfect sieve." The teeth show no evidence of mastication.

It is worthy of notice that in the pack-ice the stomachs of all the White Seals were quite empty. This was in the summer months, when the moult was in progress, and probably points to the fact that, while the new hair is still thin, the Seals, like the Penguins, object strongly to entering the water, even for food.

The moult starts in the first week of January, and is often far advanced by the 16th of that month. It always begins with a line down the middle of the back and on the flippers, both hind and fore, spreading from these points till only a few patches of old hair remain upon the sides. (*Cf.* also Borchgrevink, 'First on the Antarctic Continent,' p. 382.)

In life, the shape of the Crab-eater is less rounded than that of Weddell's Seal, but when lying on the ice flattens out less than Ross's Seal and the Leopard Seal.

The colouring of this Seal shows great variation. It is known as the "White" Seal from the creamy whiteness of its old winter coat. This is changed during the summer for a very beautiful silky greyish-brown coat, with more or less richly-marked mottling on the shoulders, flanks, and sides of the head, and on the dark-brown flippers. I have given illustrations (Plate V.) of the old winter coat (Fig. 1), the coat in change (Fig. 2), and the new summer

coat (Fig. 3). So much does the coat of this Seal vary in colour and marking with age, sex, and season, that much confusion has arisen in the description of its skin. There is now in the Museum a fairly complete series of skins, preserved by Mr. Hanson, showing how this Seal changes from a creamy-white, faintly mottled with a pale rusty colour on the flanks, shoulders, and sides of the head, to the very beautiful and characteristically silky coat of warm brownish grey, darker mid-dorsally, silvery white ventrally, mottled as before, but now with a very rich warm brown, instead of the hardly perceptible rusty colour.

That these are merely seasonal changes is evident from the fact that in the creamy-white skins can nearly always be found a mid-dorsal line of the new and darker hair appearing; whereas in the more handsomely mottled dark skins, a few belated patches of the old white fur can still be found attached to the sides of the animal. The largest, and presumably the oldest, of the Seals, probably males, still in their creamy white coat, show no trace of mottling anywhere; but on the flippers, both hind- and fore-, where the moult first takes effect, there appears, without exception, the rich and beautiful dark brown mottling of the new coat, with its characteristic silky gloss. The flippers share in the change. From being covered with a rusty or creamy-white hair to the end of each digit, they moult to a very rich brown colour, in some cases very dark, marbled with silky pale-grey spots.

Mr. Bernacchi observes:—"One of the first Seals to be met with on entering the pack-ice is the Crab-eating or White Seal (*Lobodon carcinophagus*), which is a Seal common during the summer months in the pack-ice, and even seen far south towards the Great Ice Barrier, but rarely met with near the shores of the Antarctic lands. In appearance this Seal varies somewhat; or, more correctly speaking, its colour varies according to the seasons of the year, and also according to the age and sex of the animal. The long old winter coat is creamy-white, hiding almost completely the mottlings on the shoulders and flanks and sides of the head. During the early part of January the Seal commences to moult, discards its old coat, and by the end of the month emerges with a beautiful silky-grey brown skin, with richly-marked mottlings. The body of this Seal is not rounded like the Weddell seal, but is rather slim and slightly flattened out when lying on the ice. It is somewhat solitary, pugnacious when disturbed, and feeds principally on *Euphausia*."

"The only young of this Seal procured by the 'Southern Cross' Expedition was the specimen killed near its mother in Robertson

Bay on the 29th of November, 1899. It was the only one we saw during the fourteen months we spent within the Antarctic Circle. It was by no means so far developed as the young of Weddell's Seal, which were quite common. The following are the dimensions of the calf of this White Seal:—

Length, 4 feet 11 inches;
Girth round flippers, 2 feet 5 inches;
Girth round hips, 1 foot 9 inches."

Mr. Borchgrevink, in his narrative of the '*Southern Cross*' Expedition (p. 65), mentions the occurrence of the White Seal in the pack early in January, 1899. By the 5th of that month ten specimens had been preserved, and on that day Mr. Hanson's diary records the capture of another kind of Seal, like the White Seals in appearance, but having a different cranium (*vide, infra*, p. 86). Mr. Borchgrevink also seems to have been aware of the circumstance (p. 65), but no further attempt at identification apparently took place. In the south-east part of Robertson Bay he also found two of this species (p. 234). On page 102 of Mr. Borchgrevink's book, the skull of the Crab-eating Seal is figured, but under the name of '*Weddellii*.'

The mummies of most of the Seals found buried in the guano on Cape Adare were those of the White Seal. Mr. Borchgrevink (p. 237) suggests that they were all undoubtedly of this species, and adds that some of them were quite young. It will be seen (*infra*, p. 95), that Mr. Nicolai Hanson includes some *Leptonychotes weddelli* in his list, and does not mention any young ones, beyond the two embryos which he found inside the females.

Mr. Bernacchi in his book (p. 37) gives an account of an encounter between one of these Seals and Mr. Hanson, showing that the animals can be very fierce on occasion. [See also Hanson's account of the adventure (*infra*, p. 84).] He also (p. 274) describes a meeting with a solitary White Seal, far to the south, on the Ice Barrier in company with a number of Weddell's Seals.

OMMATOPHOCA ROSSI. Ross's Seal.

(PLATE VI.)

Ross's Seal is nowhere common. From Mr. Hanson's private diary we learn, however, that no less than four specimens of this Seal were captured in the pack-ice: it was not seen elsewhere.

Of its breeding habits nothing is known. Three beautiful skins of this Seal now rest in the British Museum, and two skulls, one having no molar teeth whatever, the other having six molars on each side in the upper jaw, and five on each side in the lower. The latter skull was that of a female, belonging to one of the steel-grey skins, whereas the former was the skull of a male which belonged to the brownish-grey individual.

The food of this species consists of *Octopus* and vegetable stuff or sea-weeds, as was proved in three cases by Mr. Hanson from an examination of the contents of the stomach (*vide infra*, pp. 89, 90, 92).

The vocal powers of this Seal have been well described by Dr. Racovitza, and, apart from this remarkable characteristic, the thickness of its neck and the enormous protrusion of the chin and throat are peculiarities of the species.

The colour of this species is either of a pure steel-grey or of a greyish-brown colour, deepening considerably in tone towards the middle line of the back, and becoming almost white on the under surface. Starting from the upper lip, which is nearly white, a broad band of pale grey extends backwards on the neck to be lost in the grey of the shoulder. Just below this, starting from the lower lip and the chin, which are nearly black, a broad dark grey band passes backwards and fades into the lighter colour on the chest and shoulders. These two bands are in perfect harmony both in colour, tone, and direction, with a somewhat limited number of indistinct pale and narrow markings which streak and line the sides of the animal from the shoulder almost to the tail. These parallel stripes, some inches in length in the region of the shoulder, are somewhat broken into splashes and spots towards the sides and flanks of the animal. Nails are present on both hind and fore-limbs, but are small on the latter and still smaller on the former. The dark colour of the back is continued on to the dorsal digit of the hind limb, the other digits and the ventral aspect of the limb being pale.

Mr. Bernacchi gives the following note:—"The least known of all the Antarctic Seals is the Ross's Seal (*Ommatophoca rossi*). Only a few specimens of it have ever been procured, four of them by the '*Southern Cross*' Expedition. Of its breeding habits nothing is known. It, however, has a very wide distribution, having been found on the pack-ice in the neighbourhood of Victoria Land ('*Southern Cross*'), Alexander Land ('*Belgica*'), and by Dr. Bruce near Joinville Island and Louis Philippe Land.¹ In

¹ As before mentioned, however, the Seals identified by Mr. Bruce as *Ommatophoca* were probably White Seals in summer coat.

colour the back is greyish-brown, and under the belly silver-grey, with lighter spots in the division. A specimen I saw soon after it had been shot appeared to me to be distinctly slaty-colour; this specimen measured nearly eleven feet in length. The eyes were very large, and underneath the chin was a most extraordinary protuberance or sack, which is evidently inflated when the animal is angered. The greatest interest centres in the skull, which is quite different to that of any other known Seal. The dentition is exceedingly feeble; of two of the skulls procured by the '*Southern Cross*,' one had no molar teeth whatever, and the other six molars on each side in the upper jaw, and five on each side in the lower.

"The food of this Seal is much the same as that of Weddell's and the White Seals. The remains of Octopus were found in the stomach examined by Mr. Hanson."

An interesting account of the capture of the first Ross's Seal will be found in Mr. Nicolai Hanson's private diary (*infra*, p. 89). See also Mr. Borchgrevink's book (p. 74).

III.

EXTRACTS FROM THE PRIVATE DIARY

OF THE LATE

NICOLAI HANSON.¹

[Published by permission of Mrs. Nicolai Hanson, and translated from the Norwegian by his father, Mr. Anton Hanson, of Christiansund.]

September 15th, 1898.—In the forenoon I observed a shoal of fish, apparently Bonitoes, and a few Flying-fish. A number of Petrels (*Puffinus*) followed the fish, among them a Frigate-bird. In the afternoon some small whales, like Bottle-noses, approached the ship. I fired two shots with explosive shells at two of them, but killed none, though one was hit pretty hard.

October 5th.—[Nicolai had been dangerously ill from September 15th until to-day.—A. H.] Have seen my first Albatros. It is strange how very few birds there are here; for the last few days I have only seen some little Petrels. Yesterday I saw five birds, like Terns, which were fishing a short distance away from us.

¹ This excellent young naturalist and collector was appointed to the post of Zoologist on the 'Southern Cross,' on the recommendation of Professor Robert Collett, of Christiania University. A better appointment could not have been made. As to the esteem in which Hanson was held, nothing need be added to the tribute paid to his memory by Mr. Bernacchi in his book 'To the South Polar Regions' (pp. 184-190), and this appreciation of the dead naturalist has been personally confirmed to me by his colleagues of the scientific staff, Dr. Klovstad, Lieut. Colbeck, Mr. Hugh Evans, and Mr. Anton Fougner.

His notebooks were handed to the Commander of the Expedition by the dying naturalist (Bernacchi, *t.c.* p. 185) on the 14th of October, 1899. Mr. Borehgreivink has published some observations from one of these books in his "Appendix" (pp. 320-324), and he has handed to me one other book, which contains a mere list of the *Procellariidae* collected during the voyage out, and the details are also to be found on the labels attached to the specimens themselves.

Knowing, however, from personal experience, and from the verbal testimony of his colleagues, that Mr. Hanson was in the habit of making careful notes on every natural history fact that came under his observation, I wrote to Mrs. Nicolai Hanson, to ask whether she had in her possession any private letters from her late husband, which contained natural history notes. In return she kindly placed her husband's private diary at my disposal, and the notes which Nicolai Hanson wrote for his wife's information are here reproduced, having been translated by his father, Mr. Anton Hanson, of Christiansund. I think that, in the absence of the official note-books, Zoologists throughout the world will rejoice that, by means of these private records, written without any idea of their subsequent publication, and merely for the amusement and instruction of his young wife, some details of the strenuous work done by Mr. Hanson during the expedition of the 'Southern Cross' have been rescued from oblivion.—R. B. S.



CAPTIVE EMPEROR PENGUIN ON BOARD THE 'SOUTHERN CROSS.'

(By permission of Messrs. Hurst & Blackett.)

October 6th.—To-day we have had a visit from the first Cape Pigeon. It was a pretty little bird, with grey back, grey neck and white belly; very tame, often coming close under our stern [see October 8].

October 7th.—Have seen some Petrels and an Albatros to-day.

October 8th.—More birds have been noticed than on any previous day. Two Albatroses and a great number of the Petrel I observed the day before yesterday, which I then took to be the Cape Pigeon, but I was wrong. To-day I have seen the first Cape Pigeons, very pretty birds, a little larger than a Tern, with black head, white belly, grey back and wings with white spots. They have more rounded wings than the other Petrels I have seen, but do not fly with less speed on that account.

October 9th.—Shot two Cape Pigeons to-day, but did not get them, though I tried to fire when they were over the ship. A large number of birds noticed, of five different kinds.

October 10th.—Have seen the same kinds of birds to-day as yesterday, and probably also a kind of Albatros I have not observed before. It was very dark on the back.

October 12th.—There have been a great number of birds round the ship to-day. We have tried to snare some of them, but caught none. Borchgrevink went out in a boat to shoot, and killed three Albatroses of two different kinds (not of the large species) and also two Petrels of the size of a Pigeon. The dogs would not eat the flesh of the Albatroses.

October 13th. Lat. $33^{\circ} 37' S.$, Long. $9^{\circ} 54' W.$ —A number of birds round the ship to-day. I snared two Albatroses (*Diomedea melanophrys*). The doctor killed them with chloroform, which was quickly and neatly done. Saw a shoal of Dolphins and some Whales. [*Cymodroma melano-gastra* has put in an appearance. N. H. in Borchgr. App., p. 321.]

October 14th.—Have prepared the skins of the two Albatroses killed yesterday.

October 15th.—Caught and prepared two Cape Pigeons to-day.

October 16th. Lat. $38^{\circ} 29' S.$, Long. $5^{\circ} 51' W.$ —Rose early and began catching Cape Pigeons with a line and hook. Caught six during the day. Have seen two new species of birds to-day, one a white-headed Petrel, and a *Lestris*.

October 17th.—Saw a new kind of Petrel to-day (*Prion*).

October 18th. Lat. $40^{\circ} 27' S.$, Long. $0^{\circ} 21' E.$ —A number of birds about the ship. I caught (with hook and line) one Mollymawk and seven Cape Pigeons.¹

October 19th. Lat. $39^{\circ} 55' S.$, Long. $3^{\circ} 16' E.$ —A number of birds about the ship. I have caught seven Cape Pigeons and two *Puffinus* (*Kuhli*?).² This is ashy-grey on the back, but for the rest exactly like *Puffinus major*.

October 20th. Lat. $40^{\circ} 27' S.$, Long. $5^{\circ} 22' E.$ —Caught a *Puffinus*. Have seen a large number of this species to-day.

[October 21st. Lat. $41^{\circ} 14' S.$, Long. $8^{\circ} 44' E.$ —Two Petrels, *Prion desolatus* and *P. vittatus*, have been seen for the first time to-day. N. H. in Borchgr. App., p. 322.]

[October 22nd. Lat. $41^{\circ} 20' S.$, Long. $13^{\circ} 1' E.$ —We saw some

¹ "Most of the birds caught up to date have recently started moulting."—N. H. in Borchgrevink's book, App. p. 321.

² These proved to be *Puffinus cinereus*.—R. B. S.

specimens of *Diomedea fuliginosa*, the first of this kind we have seen on the voyage, *t. c.*, p. 323.]

October 23rd. Lat. $42^{\circ} 1' S.$, Long. $20^{\circ} 32' E.$ —Caught a Cape Pigeon. ["It had not started moulting." N. H. App. to Borchgrevink, p. 322.]

October 24th. Lat. $42^{\circ} 23' S.$, Long. $20^{\circ} 32' E.$ —This morning, as soon as I came on deck, I caught a large Albatros and two other *Diomedæ* with black-and-yellow bills.¹ In the afternoon we shot some birds. The Englishmen shot from a boat sixteen birds. I shot sixteen birds from the ship and eleven from the boat. Saw two nearly white birds to-day about the size of a Kittiwake (*Larus tridactylus*).

October 27th.—Have to-day prepared the last of the birds we killed on the 24th. I have now forty-one skins and eight skeletons.² I hope we may soon get a calm again, so that I can get some more work. Numbers of birds follow the ship every day.

October 29th. Lat. $44^{\circ} 26' S.$, Long. $37^{\circ} E.$ —This morning I caught a large Albatros. It is a little darker than the first, and perhaps a year younger. The number of Albatroses about the ship increases every day. Last night I observed at one time eight large ones.

October 30th.—Saw a white bird as large as a Mollymawk. Short; high bill; a few dark spots under the belly and wings; wings narrow; tail straight across. On the 24th I observed two similar birds, but smaller (of the size of a *Puffinus*).

November 1st.—Passed the Crozet Islands, ten miles off, but out of sight. Saw some Penguins.

November 2nd.—Caught this evening three Cape Pigeons, two Albatroses with black-and-yellow bills, and one Sooty Albatros. Saw a Giant Petrel this afternoon (I am, however, not quite sure of it). This was the last time I observed Cape Pigeons in flocks before we came to Tasmania. Saw a small Whale while I was busy catching birds; it was like a "Bottle-nose."

November 6th. Lat. $44^{\circ} 20' S.$, Long. $68^{\circ} 28' E.$ —Numbers of birds about the ship. Have caught four black-billed³ and two Yellow-billed Mollymawks.⁵

November 7th.—Caught six Mollymawks (two Yellow-billed) and four Cape-hens.⁴

November 8th.—Caught a yellow-billed Mollymawk.⁵ This afternoon Bernacchi, Evans and I went out in a boat shooting. Bernacchi shot two birds, I shot one Yellow-billed Mollymawk and four Cape-hens. Colbeck shot a Sooty Albatros from the ship.

November 9th.—Caught two grey-headed Mollymawks with entirely black bills, probably young birds.³

November 10th.—This evening Colbeck caught two Sooty Albatroses and one black-billed Mollymawk.³ I caught three of the latter species.

November 13th to 18th.—During these days I have caught four Mollymawks (three with black bills) and a *Puffinus*, but I have skinned none of them, as at present we have no more room for storing the skins. The Cape Pigeons have now left us entirely, and the birds which are usually seen about the ship are: The large Albatros, the Sooty Albatros, Molly-

¹ *Thalassogeron culminatus*. Vido *infra*, p. 82.—R. B. S.

² No skeletons of birds were received by the British Museum.—R. B. S.

³ *Thalassogeron culminatus*, juv.—R. B. S. ⁴ *Majaqueus aequinoctialis*.—R. B. S.

⁵ *Diomedea melanophrys*.—R. B. S.

mawks (with black and with yellow bills), also Cape-hens, Giant Petrels, *Prion*, *Puffinus*, Whale-birds, and two small Storm Petrels. This evening (the 18th) I saw a flock of Mollymawks resting on the sea.

November 25th.—More of the large Albatros are seen now. A white-headed Petrel has been tolerably numerous this week, also a black bird, whose flight is like that of the Swift, but more than double the size of this bird. Cape-hens, Cape Pigeons, and Shear-waters have now nearly all left us. Caught a large Albatros.

November 26th.—I have forgotten to put down that on the 17th inst. I caught four Mollymawks (two with yellow¹ and two with black bills²) and a *Puffinus*. Two of the Mollymawks were again set at liberty with a zinc label tied to their necks with the ship's name and date inscribed thereon.

November 27th.—In sight of Tasmania. With the proximity of land came also some birds I have not seen before. The short-tailed Albatros, Mutton-birds, Gannets, *Sula australis*; also two Gulls, one like *Larus marinus*, and the other one very much like *Larus tridactylus*, but with red legs and bill. The next morning (at anchor in Adventure Bay) I observed a number of Cormorants and some Gulls.

December 17th.—Left Hobart at 2.30 P.M. Anchored in Adventure Bay.

December 18th.—Have been on the shore to-day collecting on the beach and have made a good collection of Molluscs and Marine Plants. Shot also some birds. Visited Penguin Island and saw there a large number of Parrots. Saw a white-headed Sea-Eagle catch a big fish. Observed several black Oyster-Catchers.

December 20th. (At sea).—Have seen some Mutton-birds, Petrels and Albatroses to-day.

December 21st.—Few birds seen, and only the same species as yesterday, also a yellow-billed Mollymawk.

December 23rd.—Saw some Albatroses, Petrels and *Prion*; no Mutton-birds.

December 24th.—Same kind of birds to-day as yesterday; also some white-headed Petrels, Sooty Albatroses and yellow-billed Mollymawks, which are quite common now. Caught two Sooty Albatroses and a Mollymawk, which were set at liberty again after we had attached tin labels to them.

December 25th.—Same birds as before. No large Albatroses, but a *Lestrus* was seen to-day.³

December 26th.—No black Petrels seen. Same kind of birds as yesterday, and a couple of Mollymawks with black bills,² and some Penguins.

December 27th.—A number of Penguins were seen this forenoon. They played like porpoises before the bows of the ship.

December 28th.—Besides the usual species of birds we have seen lately, I observed a large Albatros and a Giant Petrel, which have followed us to-day. A small Storm Petrel with white belly, some Mutton-birds, and a couple of Sooty Albatroses have also been about the ship.

December 29th.—Saw some Mutton-birds this morning. This afternoon we are followed only by the Yellow-billed Mollymawk¹ and *Prion vittatus*. We are now past the 60th degree of S. Latitude.

December 30th. (In the ice).—With the ice have also come three new species of birds, two light and one dark coloured, of the size of *Daption*

¹ *Diomedea melanophrys*.—R. B. S.

² *Thalassogeron culminatus*, juv.—R. B. S.

³ Doubtless *Megalestris antarcticus*.—R. B. S.

capensis. Our old acquaintance, the *Daption*, has also appeared again. Besides these four kinds of birds, I have also to-day observed six different species: *Diomedea fuliginosa*, *D. melanophrys*, *Cymodroma grallaria*, *Fregatta melanogaster*, *Oceanites oceanicus*, *Āstrelata lessoni* and *Prion vittatus*.¹ The last-named species is the only one which has followed us in among the ice; the others left us before we sighted it. Have seen some Whales to-day. One immense fellow we saw after we got in among the ice. Some ice-floes were of a yellow colour, which I at first thought to be caused by mineral dust, but afterwards I found it to be *Algæ*.

December 31st.—I was called at 3 A.M. by Borchgrevink, who came down to fetch a gun and cartridges, as a White Seal was lying on an ice-floe close to the ship. I hurried up on deck, but he had disappeared before I came up. We saw, however, a Brown Seal in the water, but the gun missed fire, and at the same moment he dived, and we saw him no more. Borchgrevink, who had been on deck all night, went below, but requested me to look out for Seals so that we could get some food for the dogs. I stayed, therefore, on the bridge till 5 A.M. without seeing any Seal, when I went below, after having ordered the second mate to call me in case he saw any animals. I had barely covered myself up in my bunk, when one of the Finns came down calling out, "Hanson, there is a Seal on the ice!" I jumped out of my bed and got my trousers and slippers on, and ran on deck. In my hurry I took only an old needle-rifle with copper cartridges and a seal-pick with me. With two men in the boat I set off from the ship and pulled towards the Seal under cover of a hummock on the ice-floe on which it was lying. I came close up to it, and saw that it was a large male of the White Seal. He was lying on a tolerably large floe, and when I landed on this, I could approach him under shelter of a piece of ice. My rifle came quickly to my shoulder, but it missed fire with the five cartridges I had brought with me, and as the Seal now began to move, I threw away the rifle and rushed on him with my seal-pick. The Seal tried to escape, but I gave him a blow with the pick. It glanced off his skull, and he immediately turned on me and rose up from the ice as if to get on the top of me; and as I had sunk in the snow above my knees, I could not get away from him. I therefore again dealt him a blow with the pick. This blow fell on his neck, but did not manage to stun him. I had now, however, so strong a hold on him that I could keep him away from me, and as I soon extricated myself from the snow, I jumped on to his back; and now began a fight worse than the first, for he turned himself round and rolled over me, but luckily without getting hold of me with his teeth, for I had still the pick firmly fixed in his neck. We rolled over again, and at last I staggered to my feet and gave him another blow on the skull, and as one of the sailors in the boat now came to my assistance and dealt him some blows on the nose with a boat-hook, he was soon killed. I have not felt well all day after this fight, for it is not the most healthy occupation to have a big Seal dancing about on one's chest. After I had again been in my bunk for half an hour, I was called up by the cry, "Seal on a floe!" This time I took my shot-gun and cartridges with explosive bullets. This new Seal was even bigger than the first, and measured 10 feet 7 inches in length. It was a female Leopard-Seal. By the way she behaved, it was evident

¹ This list appears in Mr. Borchgrevink's book (p. 54).

she had never before met her master, for when I landed on the floe, she merely lifted her head and stared at me. Evidently she took me for a Penguin or some other inferior being, for she soon settled down to rest again. A ball from my gun finished her. We pulled the whole carcass into the boat, which was quite loaded up with such a big Seal. Later in the day Borchgrevink shot from the ship a White Seal which was lying on a floe we passed. This last one was much smaller than the two I had killed. In the evening the ship was stopped by the closure of the ice. I therefore took one of the small canvas boats and pulled about in the lanes to shoot birds. I bagged twenty-eight birds in thirty-three shots. They were mostly Cape Pigeons and Ice Petrels, and two species I have not seen before, one like the Fulmar (*Fulmarus glacialis*) we have at home,¹ and a new one, with brown back and head and a brown band over the neck, and a white band length-ways over the wings, as well as a white belly.² Besides these birds I also saw to-day *Oceanites oceanicus*.

New Year's Day, 1899.—This afternoon I was out on the ice and shot seventeen birds: fifteen Ice Petrels, one Cape Pigeon and one *O. oceanicus*. I saw two Whales. One of the firemen who was with me found a small herring-like fish on an ice-floe. Some of the crew took a long trip on "Shi" over the ice, and brought back to me a number of shrimps, one inch and a half long, which they had found on the ice. I noticed some *Medusæ*; some were oblong, but one was round, of a blue colour, with four round brown eyes, like the stinging *Medusa*, and with long brown tendrils.

January 2nd.—At 5 A.M. to-day I was called by the second mate to come and shoot a Penguin. When I came on deck the bird stood on a floe about 100 yards from the ship, but when I stepped down on the ice he jumped into the water and dived. I thought that he was frightened, and I should see him no more, but a few moments after he came up on a floe about 100 feet away from the ship. It was a funny sight to see him sitting there fanning himself with his flippers while he regarded the ship and its inhabitants. The noise made by the dogs appeared to interest him most, for now and again he uttered a grunting sound, as if in response to their barking. His confidence cost him his life, for I killed him with a shot from the ship. Later in the day I went up on the bridge to look for Seal on the ice, as we now were lying fast in the pack. I soon espied a large White Seal lying asleep on a floe about 500 yards distant. With my double-barrelled gun, and two men to assist me, I set out for this Seal. When I came within easy range I shouted out to him to "wake up," as I did not like to kill him asleep. An hour later Borchgrevink shot a young Leopard-Seal on a floe upon which it had crawled to look at the dogs. Of birds I shot only an Ice Petrel and an *O. oceanicus*.

January 3rd.—My bag to-day was one White Seal, two Cape Pigeons and five Ice Petrels.

January 4th.—I was called up before breakfast, as the Captain reported, from the mast-head, a Seal on a floe ahead of the ship. I took one of the old needle-rifles and stood waiting on the fore-castle-head till the ship had come within range. When we were still about 200 yards distant from him, he began to show signs of uneasiness and wanted to get to the water. I therefore dared not wait any longer, but sent a ball

¹ *Priocella glacialisoides*.—R. B. S.

² *Thalassæca antarctica*.—R. B. S.

through his ribs. This stopped him, and to make quite sure of him I sent two bullets through his head. The ship was steered towards him, and we got him on board. It was a fine young Leopard-Seal. Like the one Borchgrevink killed, his stomach was full of small shrimps. When the Captain came down from the mast-head, he told me that he had seen a Seal at some distance from the ship. As the vessel was now lying fast in the ice again, the Captain, Fougner and I set out on "Shi" for that Seal. Fougner was armed with a seal-pick, and I with an old needle-gun. After looking about for some time, we found the Seal near a large hummock, where I killed him with two bullets. It was a large male of the White Seal. His stomach was quite empty. I have also to-day shot four Cape Pigeons and sixteen Ice Petrels.

January 5th.—I was called at 7.30 A.M. to kill a Seal. It was a large specimen of the common White Seal. While I was on the ice later in the day, I saw a large white bird with a few black spots flying out of range. It was presumably one of the same kind that I saw at sea on the 30th of October last year. Borchgrevink called it *Procellaria gigantea*. To-day I bagged eight Ice-Petrels.

January 6th.—When we stopped to-day, four Seals were seen on the ice. Borchgrevink, Colbeck, Bernacchi and I went in one of the small canvas boats to shoot two which were lying some distance off on the star-board side among some small hummocks. In order not to spoil the cranium, which I wanted for the collection, I fired a shot into the ribs of one of the Seals, but he appeared to be as lively as ever, so I had to give him a ball in the neck, which settled him. The skin of this Seal was like that of all the others I had shot as regards colour; but when I skeletonised the cranium, I found that the latter was quite different from those we had caught before, and it may be that I have obtained a very rare species. I cannot find a name for it in any of my books. Later in the day I shot a Giant Petrel.

January 8th.—Fougner and I went out on "Shi" to shoot an Emperor Penguin, but he went into the water before I came within range. Saw some Mutton-birds while I was away. At 3 P.M. the Captain came down from the mast-head and told me that he had seen two Seals on the ice about a couple of English miles astern of the ship. I went with him up to the maintop to get the bearings of the place where the Seals lay. The second mate had also seen them from the mast-head, and he wanted to go with me. We were in all seven men, who set out armed with seal-picks. I was the only one who carried a gun. The ice was very bad, and we had not gone far before the second mate fell through a hole and got soaked, for he had no "Shi." We, who had "Shi," fared better, although in some places we slid along only on a thick layer of snow-slush, so we had to move quickly in order not to sink through. We had not gone far before I thought that we were going in a wrong direction according to my bearings, but thinking that the second mate had a better idea of the locality than myself, I said nothing. When, however, we were stopped by an open lane of water, and as my three English companions were now fagged out and wanted to return to the ship, I set out on my own account to find the Seals. I had not gone far before I saw them lying by a large hummock. When I came within range I found that there were three large White Seals, instead of two. Three shots fired in as many seconds laid them low.

Three of the men who had accompanied me came and assisted me to skin them and drag the skins on board. We had a tough job to get the heavy skins on the ship, as the ice was full of water-lanes and hummocks, so that we had more than double the distance to traverse before we reached the ship. On the way back to the vessel I shot three small Petrels and an Ice Petrel. The Seals were of the common white species, and their stomachs were quite empty. They were a male and two female Seals, large, full-grown animals.

January 10th.—Killed two young female Seals to-day. Stomachs quite empty. One was of a new species, which I have not seen before. Saw a Mutton-bird. The Brown-backed Petrel, which was so common in the outer edge of the ice, I have not seen since the 6th of this month.

January 11th.—To-day I shot two Silver Petrels, one Cape Pigeon, one Ice Petrel, and one *O. oceanicus*.

January 12th.—While we were lying fast to-day in the ice, I went out shooting and bagged one Emperor Penguin, eleven Silver Petrels, six Ice Petrels, four Cape Pigeons, and three *O. oceanicus*.

January 13th.—One of the crew shot two Penguins on a floe: otherwise only the usual birds were seen. No Seals about. Took two good casts with the large Plankton-net this evening. Saw a fish about six inches long.

January 14th.—I had just turned into my bunk this morning when Borchgrevink came to fetch a rifle and cartridges to shoot a Seal. I went on deck with him, as I wanted the skin for the collection. When the ship had approached the Seal to within fifty yards, Borchgrevink fired five shots at him, but only two hit him, one in the hind-quarters, the other in the neck. Two of the crew went away to bring him on board, but, as he still moved, they dared not lay hold of him, so I went to their assistance and killed him. While we skinned the Seal on the floe, the ice slackened, and we had to be fetched back by a boat. I went to bed again and slept till noon, when Lieut. Colbeck came and called me, and told me that he had killed a Seal of the same kind as the one I got on the 10th inst. It was a fine specimen, and I preserved the skin and the cranium for the collection.

January 16th.—To-day at noon I killed a Seal of the same kind as the one Colbeck killed two days ago. The whole pack of dogs were with me and they ate the flesh of the Seal as fast as I skinned the animal. It was like working in the midst of a pack of wolves. The skin and cranium went into the collection. It was a fine specimen of a female Seal.

January 18th.—As to-day we moved into tolerably clear water I saw some birds, more in fact than I have seen for many days past, and among them was one of the Brown-backed Petrel, which was so common on the outer edge of the pack. Just as we were sitting down to supper, it was reported: "A large Penguin on the starboard bow!" I ran up, armed with a gun and a seal-pick; but we were still some distance from the bird, which could be seen on a large ice-floe on which there was a hummock. Under the lee of this hummock, sheltered from the wind, the big bird sat crouching. As we approached it, the colour of its plumage became more and more strange in appearance, and I even thought that we had met with a bird of an unknown species. Suddenly we discovered

another bird of the same kind, but of a darker colour, in our wake ; but this bird disappeared suddenly, and all our attention was turned to the one on the floe. This sat quite still, undisturbed by the noise made by the ship as it worked its way through the ice nearer to it. All at once the Penguin, which we had seen in our wake, shot up out of the water and on to the floe on which the first Penguin was sitting. When the two birds met, they greeted each other and opened a conversation, gesticulating in a most funny manner. It was curious to observe the power of location these birds possessed even under water, as shown by the fact that this last comer could at once find the floe where its mate was sitting. The distance it had to swim under water was about 200 yards, and, as far as we saw, it was not above water once during its journey. When we were about 200 yards distant the birds showed signs of fear, and I fired two shots at each of them from the fore-castle-head; but both set off as if nothing was the matter with them. One of them—the one first seen—broke down, however, before it reached the water and fell dead on the ice. Then, with a couple of men, I jumped on to the ice to reclaim the dead bird, while the other bird dived and disappeared among the pieces of ice. While the men brought the bird on board, I inspected the place where it had been sitting. All over the floe, feathers were thickly scattered, and round the ice-hummock, behind which the bird had been sitting, a path had been trodden, as the bird had apparently shifted its position in order to be sheltered from the wind, for, as I found afterwards, it was moulting, and for that reason was probably very sensitive to cold. These birds do not change their plumage like other species, but more in the way in which snakes cast their skins, the new skin being ready before the old one is cast off. In the same way with these birds. The quill of the old feather is connected with the top of the new feather by a skin capsule ; the new feather begins to grow under the quill of the old feather and pushes it before it until the new feather is fully developed, when the old one loosens and drops off, together with the capsule which connected the two feathers. The old feather is so loose that it drops off when stroked by the hand. During the moulting the Penguins apparently do not like to go into the water. How long this bird had stayed on the floe I could not judge, owing to the short time which I had to make my observations.

As soon as this specimen was brought on board, I observed the other bird sitting crouching with its head down between the shoulders, on a piece of ice further ahead of us. The ship was steered in its direction, and, as we approached it, I could see the blood trickling down from a wound in its side. I again gave it two shots, and so added another Emperor Penguin to my collection. This bird had finished its moulting, and was very pretty in its new plumage. The first bird was a female, the second a male.

January 19th.—The animal life has been proportionally plentiful around us to-day, as we have killed seven White Seals (of these five fell to my rifle and two to Borchgrevink's). We have also seen a couple of Whales and some Penguins, and more of the birds we are accustomed to see every day. The Seals were all moulting and their stomachs were quite empty. Twice we found three together. The seventh jumped up on the ice as the ship was passing through a long lane. To judge from

the teeth, the six Seals first killed were very old, as the teeth were very dark and worn. Have preserved the two Emperor Penguins I shot yesterday, and, on opening their stomachs, my conjecture as to the moulting bird not having been in the water for some time was proved to be true; for in it were found only some beaks of *Octopus*, stones, and a green substance, which in appearance was most like the brown vegetable substance found underneath the ice-floes. The stomach of the other bird was, on the contrary, quite full of different fishes, fragments of shrimps, and small stones. These last, I suppose, are meant to assist digestion, although the stomach does not appear constructed for this kind of assistance.

January 20th.—Another fact which goes to prove that we are far from open water is, that the number of birds decreases from day to day. To-day the bird-life about us has been very poor. I have, however, obtained a new bird, a Skua-Gull. The body is somewhat bigger than that of our Skua (*Lestris parasiticus*) at home, but the tail is shorter, and the wings are not so pointed. It has no claw on the hind toe; on the wings there is a white spot at the base of the spurious wing-feathers; the two middle tail-feathers are about $\frac{3}{4}$ inch longer than the others. Besides this I shot an *O. oceanicus*.

I also killed three Seals to-day—the prettiest I have seen yet. One was a female of the common White Seal, but the other two were of a dark grey colour, with lighter spots and black flippers. These two were male and female. Both the females had tumours in their inner sexual organs, which in the doctor's opinion had made them sterile. The milt of the male was also diseased (tubercles?). This, with the ovaries of the females, I preserved in spirits.

January 21st.—While the ship was going through the ice to-day I saw numbers of Penguins of the small species (*Pygoscelis adeliae*). In the largest flock I counted nine on one floe, but ordinarily they sat two and two together. Saw one white-throated and one black-throated Penguin sitting together. This is the first perfectly white-throated Penguin I have seen as yet. The first I shot was nearly pure white under the throat. About 1 P.M., I observed a large Penguin far away on a large floe, and the ship was at once turned towards it and stopped. As we were slowly passing along the edge of the floe, we saw a Seal scamper away and hide between some large hummocks; but I wanted to secure the Penguin, which I considered of more value to me than the Seal. After some racing, I added my third Emperor Penguin for the collection. One of my companions brought the bird on board, while I went after the Seal. I soon reached him behind the hummocks and came within range of him; but, just as I peeped out, he caught sight of me and made off again at a great speed, which is faster than a man can run, when there is a little snow on the ice. But his speed availed him little, for a ball through the neck settled him at once. If the Seal had been surprised on seeing me, I was no less surprised when I came near to him, for a stranger animal I had never seen. The head was short and thick, with large eyes and a terribly big lower jaw; no molar teeth, and only two front teeth in the lower jaw and six in the upper jaw. These teeth were sharp as awls, and shaped like ordinary carnivorous cutting teeth. The tail was short and narrow; he had nails on all toes, before and behind, and his hind-flippers

were very large, in proportion to his fore-flippers. The colour was greyish-brown on the back, under the belly silver-grey, with lighter spots on the division. The fur was much softer than the common Seal-fur, more like Otter-skin. The dimensions were: Total length, 6 feet $10\frac{1}{2}$ inches. Girth behind the ears, 2' 10"; behind the fore-flippers, 4' 11"; over the hips, 2' $9\frac{1}{2}$ ". Distance from the foremost corner of the eye to the point of the nose, 0' 4"; from the hinder corner of the eye to the point of the nose, $5\frac{1}{2}$ "; between the eyes: forward, $6\frac{1}{2}$ "; behind, $10\frac{1}{2}$ ". The Seal was photographed by Mr. Bernacchi, and Mr. Borchgrevink took a sketch of it. The contents of the stomach consisted of sea-weed. In the intestines he had an immense number of worms.

January 22nd.—In spite of the severe weather to-day, two of the crew killed a White Seal close to the ship. Afterwards we killed four small Penguins. The collection increases day by day, and will soon be too large for the space we can at present spare for it.

January 23rd.—To-day I have obtained one Seal, one Emperor Penguin, three small Penguins, and one *Prion vittatus*, the first I have seen this year.

January 24th.—When we came out into a water-lane to-day we observed an Emperor Penguin and two Seals on a floe, and these we at once decided on capturing. As we steered for the Seals, two Whales came before our bows, and as I was on the fore-castle head, I quickly got the harpoons into both guns, but the Whales became frightened by the ship and disappeared under the ice. The Seals, one white and one grey, I managed to secure. Fougner and Borchgrevink caught the Penguin. As we went through the ice we observed several Seals, one of the same kind as the one I shot on the 21st, but he was lying too far out on the ice for us to stop the ship. Several White Seals were seen on the ice, and in the water, but we could not stop for them. Soon after supper it was reported from the mast-head that a Seal was on the ice, and as we came nearer I saw that it was one of the rare kind, and this became No. 2 of this species in my collection. It was a female. Colour: steel grey on the back, lighter underneath, with light irregular stripes along the sides. This one has more teeth than the first, as it has six molars on each side in the upper jaw, and five in the lower jaw, and six front teeth in each jaw. The four middle teeth in the lower jaw were only slightly developed. The most strange peculiarity connected with these teeth was that they were all loose, so they could be moved with a finger. The contents of the stomach consisted of remains of Octopus and vegetable stuff. Have seen more Whales and Seals to-day than at any other time since we entered the ice. The birds have also been very numerous, but were only of the ordinary species.

January 25th.—Still fast in the ice. Numerous Whales, Seals and birds have been round us to-day, but we have not got many of them, for the ice is so full of holes underneath the snow that it is nearly impossible to travel about on it. I managed, however, to get away twice after Seals. The first time I went after three, which were lying about two or three miles away from us. Fougner and Colbeck went with me, and we brought with us one of the small canvas-boats to assist us over the water-lanes, but when we came to the place where we had seen the Seals, they were gone into the water, so we had all our trouble for nothing. I had

barely returned on board when I again saw a Seal some distance astern of us. I took one of the Finns with me, and in a quarter of an hour we had it in the boat; it was one of the common white ones. This forenoon we caught three large Penguins on the floe near which we were lying. They swam round the ship and we had a good opportunity to study their way of moving in the water.

January 26th.—Killed three of the common Seals, and also two *Megalestris*. Saw some Giant Petrels. These birds must have a very keen sense of sight or smell, for no sooner is a Seal skinned on the ice than they put in an appearance.

January 27th.—Last night, soon after I had turned in, I was called up by the cry: "Seal on the ice!" and I scrambled up on deck as fast as I could. There were two Seals lying not very far off. Some of the crew were already on the ice, but when I made a jump on to it, I missed my footing and fell into the sea. I soon hauled myself up, however, on the edge of the ice and ran off after the others, who were now some distance off. As soon as I had shot the two Seals, a third crawled up on the ice, and I immediately killed this one also. It was rather a chilly pastime to travel about on the ice wet through, clad only in shirt and trousers and sea-boots, and without either a cap or stockings. We have seen no Whales to-day, and birds have been very scarce.

January 28th.—About 4 P.M. a Seal was seen lying far in on an immense floe, about two miles away from the ship. Some of the crew went with me to fetch it, and we had a splendid run on "Shi" over ice which probably was several years old, as it was covered with large hummocks. The Seal was a male of the rare, thick-necked species. He was shedding his hair, and, to all appearance, he had been lying several days in the same place where we found him, as there was a lot of hair and excrement scattered round about on the ice, and, on opening the stomach, it was found to be quite empty. Like the first I killed, the stomach and part of the intestines was crowded with an immense number of worms. There was hardly an inch thick of blubber on the skin. While three men hauled the skin on board I took two men with me up to some adjacent open water. The distance the Seal lay from the nearest open water was not less than 1500 yards, and we walked along the lane towards the ship to look for more Seals, but found none. Some Whales and White Seals have been seen in the open lane. Few birds. Took the temperature of the sea and found it to be $+ \frac{1}{2}^{\circ}$ Celsius at a depth of 1000 yards.

January 29th.—Some Whales and Seals about to-day. I saw twenty or thirty small Penguins. The Black Petrels and Cape Pigeons have disappeared.

January 30th.—This evening I shot four Silver Petrels and two Ice Petrels. Some Whales and Seals have been seen, but none killed. At 3 A.M. when I came on deck to read off the thermometers, the watchman told me he had seen five Seals close to the ship. One of them came up with a fish about fifteen inches long. It was of a greyish colour and shaped like a Torsk (*Brosmius vulgaris*). All the birds I have seen to-day are flying from S.W. to N.E. Are they migrating to softer climes?

January 31st.—Killed three Seals of the common species to-day, and an Ice Petrel. Since I came on board, I have often heard it said by old sealers that they have seen Seals jump on the ice after being skinned;

I have not put much faith in this report, but to-day I actually saw it myself. The second mate and I had this morning gone after a Seal. I fired an explosive bullet into its head, so that the entire skull was smashed, and, in consequence, there could be no question of life or consciousness remaining in it. Yet, while the mate was skinning it, it kept moving all the time; and, at last, when it was more than half skinned, and even the two fore-flippers with their large arteries were cut off from the body, it jumped so high that it was perfectly clear off the ice.

February 2nd.—No Penguins seen to-day and very few of any other birds. The Doctor killed his first Seal to-day, and I killed two, all of the common kind.

February 3rd.—Still lying hard-and-fast in the ice. Fine weather. The whole forenoon I was away to the north, far away from the ship, looking for Seals. I killed three. One was a male of the thick-necked species,



ADELIA PENGUINS ON THE ICE.

(By permission of Sir George Newnes, Bart.)

which, like the last I killed, lay far out in the middle of a large floe. He had got his new fur, and was the finest I have got as yet. The stomach was quite full of food, consisting solely of Octopus. After supper, I was out in an opening in the ice and dragged with my Plankton-net, but got nothing, neither animals nor plants.

February 6th.—Caught the first young Penguin of the smaller species. It was nearly full grown. Saw a number of Penguins to-day. This afternoon we caught one of the Emperors. My bag to-day was two common Seals, and two Silver Petrels. One of the Seals swam near the ship. His stomach was full of shrimps. It was a young male.

February 7th.—Before we left the place where we had been moored last night, the second mate and two of the crew killed a Seal and two small Penguins. These last were moulting, and were found in holes in a large hummock, where they had apparently sought refuge for some time. The men also found other holes, full of feathers and droppings, where Penguins

had been. While we were under way to-day I shot a Seal and an Ice Petrel and caught an Emperor Penguin. Saw some more Seals to-day, besides the one I shot. Close by the ship I shot two more Seals, and it was with difficulty I avoided a cold bath when I was on the ice after them, for the ice was so rotten that it gave way under me at every step. Saw many Whales and Mutton-birds.

February 8th.—Have seen a number of Seals to-day, once four on one floe, but have only killed two, as we could not stop long enough to shoot more. Saw three small Penguins in the holes of a large hummock. They were moulting, and with my field-glass I could see the feathers they had shed, lying round about them. Among the Seals I saw to-day there were four which had not commenced moulting as yet.

February 9th.—Have seen only a few birds and Seals to-day. One of the latter was a large Leopard-Seal, the first we have seen since the last we shot. Have twice seen Ice Petrels—three or four together—sitting resting on the ice. Colbeck saw a little fish to-day about four or five inches long.

February 10th.—While we were in this heavy ice I killed two large glossy-coated White Seals, the largest of their kind I have yet seen. Have seen three large Whales and one of the small Whales which were so common in the ice. Of Seals we have seen very few. None of the ordinary kinds of birds have been very numerous; only once in a while a single individual of the Brown-backed Petrel has been about. No Penguins. Saw some small fish and some Jelly-fish with red spots.

February 11th.—On a point of the ice we passed to-day I observed about a hundred Seals scattered over the floes. Some were large and very dark, and appeared to be Leopard-Seals. A number of large Whales have been about us. Of birds I have seen all my old acquaintances of the ice-pack, except the Penguins and Giant Petrels, and of new birds a species of Tern and a large white or greyish bird very like *Larus glaucus*.

February 12th.—(The ship was lying hove-to in a gale of wind). Of birds I have seen some Sooty Albatrosses, yellow-billed Mollymawks, *Prion*, Cape Pigeons, Silver Petrels, and the Brown-backed Petrel.

February 13th.—On an iceberg, which had capsized quite lately, a number of the Brown-backed Petrel were sitting. In addition to the same birds as I observed yesterday, I have to-day also noticed the black- and yellow-billed Mollymawk, and a grey Petrel of the same size as the Ice Petrel. No Whales.

February 14th.—69° 13' S. Lat. While we were in open water to-day we were followed by a great many Sooty Albatrosses and yellow-billed Mollymawks. A *Diomedea*, apparently *D. exulans*, followed us also for some time, and I believe that this is the first time that this bird has been seen so far south. The little Penguin has been very numerous on the ice and in the sea to-day. Just before we entered the ice again I observed three grey birds like Terns: their cry was very like that of *Sterna hirundo*. Some Whales and Seals also seen.

February 15th.—(Ship lying hove to, in a hurricane off Victoria Land.) We have seen large numbers of the Brown-backed Petrel, as many as a hundred birds in a flock. Ice Petrels and Cape Pigeons have also been among them. Some few *O. oceanicus* and small Penguins have also been about.

February 16th.—Have seen a number of the Brown-backed Petrel to-day, all flying towards the east. Have also seen an *Ossifraga gigantea* and a grey Petrel.

February 17th (the day we anchored at Cape Adare).—Borchgrevink and the whole staff landed. B. and I carried guns, as we intended to shoot some Seals as food for the dogs. I killed sixteen Seals of a kind we had not seen before.¹ The stomach of one Seal was opened, and I found it quite full of a kind of small fish like Whittings. Of birds we saw the little Penguin; *O. oceanicus*; *Megalestris maccormickii*, and *O. gigantea*. Of this last we observed four albinos. Borchgrevink shot four *Megalestris*. Before we landed we saw hundreds of a small fin Whale. The majority of the Penguins have left now; those we saw were still in the moulting stage.

March 2nd.—We have killed some Seals and Penguins to-day for food for the dogs. Found an embryo, about $4\frac{1}{3}$ inch long, in one of the Seals. Unfortunately this was not preserved.

March 3rd.—I had some sport to-day. Borchgrevink asked me to shoot some Skuas, as they do us a great deal of damage by eating and carrying away the Seal- and Penguin-meat we have stored for the dogs. I killed eighty-two in ninety-one shots, all on the wing. Colbeck killed a large Seal to-day in which was found an embryo about 5 inches long. The stomach was full of remnants of fish and a large number of intestinal worms.

March 4th.—The bay in which the 'Southern Cross' was lying is now filled with heavy ice, so that, if the ship had still been here, she would never have emerged again. The ice brought with it a number of Seals, so that there would have been a good opportunity to lay in a considerable stock of food for the dogs and as fuel, if we had had time to look after them. I only killed one Seal to-day; it was a fine specimen of *Lobodon carcinophagus*, with uncommonly big teeth and a number of old scars on the skin. In the stomach only sand and pebbles were found, and also some round intestinal worms. All the other Seals seen to-day have been *Leptonychotes weddelli*. Saw a *Pagodroma nivea* to-day.

March 5th (Sunday).—Have done a little work outside and inside, putting things to-rights. We have also had some rifle practice.

March 7th.—The number of birds is now rapidly decreasing since the ice came, so there are now only a few left. Penguins (*Pygoscelis adeliæ*), *Megalestris maccormickii*, *Ossifraga gigantea*, and *Oceanites oceanicus* are now only to be found singly. The Seals (*Leptonychotes*) are still as numerous as before.

March 9th.—Yesterday I observed an *O. oceanicus* performing evolutions high up in the air, at a height of about 200–300 metres, like a Swift. I have often observed these birds, both when I was on board the ship and also after we landed here, flying round the ship and the house in the evenings after dark, like Bats, which they very much resemble in their flight. Yesterday I observed a Penguin walking round the house as if saying "Good-bye" to us. To-day none are observed, neither on land nor on the sea.

March 12th.—Of the birds there are now only a few left. Once in a while a solitary individual is seen. Seals are proportionally more

¹ *Leptonychotes weddelli*.—R. B. S.

numerous now on the ice, which off and on fills the bay, than they were on the drift-ice in which we lay with the ship. They have all, with few exceptions, been *Leptonychotes*, as far as I am able to judge. The females we have killed these last few days have all had embryos, from 4 to 7 inches long. The contents of the stomach have, so far as there has been any, consisted of remnants of fish. Generally there are also a lot of worms, both round and flat, in the stomachs, and a great number adhering to the sides of the latter. Yesterday I killed two Seals and three *Megalestris* with a rifle. Saw a blue oblong-shaped Jelly Fish. I shot fourteen *Megalestris* to-night in fifteen shots.

March 17th.—During these last days I have captured twenty-six *Megalestris maccormicki* and two *Ossifraga*. The former can now be said to be the only species remaining. Of other birds we only see one now and again, and that not every day. If it had not been for the offal from the Seals and Penguins which we have killed, I do not think that even the Skuas would have stayed with us longer than when the Penguins left us, for, when first we arrived here, it appeared as if the Penguins formed the main part of their food; but now they will be able to exist for a long time on the offal from our slaughtering. The number of Seals appears now to decrease every day. To-day, while taking a walk with Bernacchi and Evans, we found a mummy of a White Seal (*Lobodon carcinophagus*). One of these days I will examine these mummies to see if they will satisfy my curiosity and give me a hint of what I may expect to find here when spring comes again. Perhaps this is the place where the Seal breeds?

March 18th.—Went out for a walk this forenoon. My walk was not without some result, as I found a solitary Penguin sitting in a hole. As I thought he might be of some interest for a nearer examination and study of his moulting, he had to accompany me back to the house in spite of his energetic protests, and I have him now lodged in an empty box. He has as yet not moulted one single feather, but all his old plumage sits so loosely that it can hardly be touched without dropping off. I intend to keep him captive to see how long the moulting lasts. This afternoon I commenced digging out some Seal mummies. I found in all twelve of them.

No.	1.	<i>Lobodon carcinophagus.</i>	Old male.
"	2.	" "	Sex indeterminable.
"	3.	" "	Female.
"	4.	Species indeterminable.	Male.
"	5.	<i>Lobodon carcinophagus.</i>	Old. Sex indeterminable.
"	6.	<i>Leptonychotes weddelli.</i>	Female with embryo.
"	7.	<i>Lobodon carcinophagus.</i>	" "
"	8.	" "	Sex indeterminable.
"	9.	Uncertain. Young.	Sex indeterminable.
"	10.	<i>Lobodon carcinophagus.</i>	Old.
"	11.	<i>Leptonychotes weddelli.</i>	Old. Male.
"	12.	<i>Lobodon carcinophagus.</i>	Old. Female.

What does this list tell us? Shall we here find a solution of the Zoological problem:—Where do the Antarctic Seals bring forth their young? It would be of great interest to get this problem solved, as the

life and resort of the Seals during the breeding season is entirely unknown.

March 21st (A hurricane has been blowing for the last two days).—The gale has carried away my Penguin, from which I was to have studied the moulting problem. The wind took the box with the bird in it, and I presume that he is now sailing merrily along to New Zealand.

March 22nd.—Found two young Skuas, hardly able to fly, at an altitude of 1,050 feet, but some of the dogs, which followed us, killed them, so they were of no use for the collection. Went out with the Finns and killed three Seals, one young female without embryo, and two males, also young animals. The contents of their stomachs were remnants of fish. Found Seal mummy, No. 13, to-day, a full-grown *Lobodon*, sex indeterminable.

March 23rd.—Borchgrevink and I shot some Skuas to-day. I killed



A WEDDELL'S SEAL.

(By permission of Sir George Newnes, Bart.)

nine. No Seals observed to-day, neither in the sea nor on the ice, which again fills the bay.

March 25th.—The Finns and I were out Seal-hunting to-day. We killed four, three of which were males, the fourth a female with an embryo 9 inches long. Seven Penguins visited us to-day and were killed. Their tail-feathers were three-fourths developed.

March 26th.—The Finns and I went again Seal-hunting. We killed one—an old male.

March 29th.—A couple of Seals (*Leptonychotes weddelli*) have been killed to-day. One was a female with an embryo nine inches long. During these last few days the bay has been filled with ice which has been in incessant motion. One of the Finns and myself had to run away three times from a Seal we were skinning, only about 100 yards from the land,

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owing to the violent swerving of the ice. At last we got through with our work, and not a bit too soon, for half a minute afterwards the floe on which we had been was swept out to sea. A few *Megalestris* are still to be seen, but apparently the cold now becomes too much for them, so I expect it will not be long before the last bird will have left us.

March 31st.—No Seal has been seen or killed. Saw an *Ossifraga gigantea* to-day. Borchgrevink saw a *Pagodroma nivea* to-night.

April 1st.—This morning I shot a Seal, a female of the *Leptonychotes weddelli*, which is very common here. At the same time I observed nine other Seals swimming and playing among the ice. These were all White Seals (*Lobodon carcinophagus*). There appears to be a great deal of animal life on the drift ice to-day, as I saw two large flights of *Megalestris* and also some of the common *Leptonychotes*, but too far out for me to reach them. The one I killed had no embryo, but its stomach was filled with remnants of fish. Among these I found a lower jaw, three inches broad, with a construction of the teeth very much like that of the Tørsk (*Brosmius vulgaris*).

April 5th.—Walked along the beach to-day with Fougner and Evans to see if the sea had washed anything ashore of any value for my collection during the last gale. Besides a number of Sand-skippers of several different kinds, we also found a grey Holothurian and a large brown Jelly-fish. Of birds we saw a *Pagodroma* and some *Megalestris maccormicki*.

April 6th.—To-day I have assorted the small animals I gathered yesterday. All in all, there seem to be eight different species, all sea-bottom forms.

April 7th.—When the gale had moderated, Borchgrevink and I walked along the beach to collect, and we had not gone far before we had gathered so much that Borchgrevink had to return to the house to fetch two knapsacks to carry our collection in. We found three different kinds of *Polypus*, one yellow, one grey, and one white. Of the two first-mentioned we found a large number. Besides these we obtained seven beautiful Star-fish and two or three other species of Invertebrata.

April 8th.—Walking along the beach this morning, all I found was one little fish. I saw, however, large numbers of this fish, apparently of the *Cottus scorpius* kind, but I had no gear with me to catch them. I also saw a large Jelly-fish, like the Stinging *Medusa* we have at home, but the stinging threads on this one were thicker. Of Seals I saw only one *Lobodon* in the sea, and two *Leptonychotes*, of which I killed one, a male, perhaps the biggest I yet have seen of this species. In its stomach I found a number of fish of three different species.

April 13th.—The day before yesterday we tried a cast with a sein-net on the outside of the point to see if we could catch some fish. The only results were wet clothes and frost-bitten fingers, but of fish we got none, as the current and the cold were both too strong. While we were busy with the sein, two dogs drifted out on an ice-floe, and Ole and I, who were in the boat, had to pull away to save them. It was certainly not with the most amiable feelings towards the animals that we pulled the deserters into the boat, as we had more than 100 yards of drift-ice in rapid motion to pass through in a canvas boat, without mittens—I had left mine on shore—and the temperature at -26° Fahr. My temper, too,

was not improved by the dogs, who twice jumped out of the boat, so that we had to catch them again. I got some relief to my anger by thrashing them soundly. I saw a number of *Pagodroma* and some *Megalestris*. This afternoon Fougner and I went out on the ice to fish, with "pilk," and I had the pleasure of catching the first six fishes taken here by our Norwegian method. The largest were from six to eight inches long. There were two different species, one grey and one brown, both bottom species, very much like the Wolf-fish (*Anarrichas*), but with large scales and not such strong teeth.

April 16th.—These last days the weather has been beautiful and invigorating. Wind calm, with the temperature down to 0° Fahr.; but we do not feel the cold when there is no wind. Every day I have been on the ice, fishing. I am generally accompanied by Fougner and the two Finns when I indulge in this sport. All in all, we have caught fifty fish of the same species as before. To-day Fougner caught fourteen, of which one was a foot long. While we were on the ice to-day, the dogs found a Seal which they had nearly half eaten before Ole killed it. It was a female without an embryo. The Finns killed to-day a large Seal (*Leptonychotes*). No birds seen to-day. Yesterday I saw some *Megalestris*.

April 18th.—The zoological results of this trip were two fishes and an embryo, 18 inches long, which they took out of an old *Leptonychotes*, which they killed for food for their dogs. They brought also the head of the Seal with them. On examination I found the teeth entirely worn out, so it must have been an uncommonly old animal. Yesterday and to-day I have been very busy preparing the fishes we have caught till now and photographing some of them. This forenoon Fougner was out fishing and brought back to me four small white fishes. Is this perhaps a new species?

April 20th.—It has been rather cold to-day. The temperature was this forenoon down to -10° Fahr., but to-night it has risen to -2° . To-day I took observations of the depth of the sea and the temperature and currents round the point. I was assisted by Fougner and Ole, and worked for some time on the north side of the Cape out towards the point, but the swerving of the ice drove us soon on shore again. It was only small floes of ice we had to walk on, and for the most part they were so small that they could barely carry us. It is not over pleasant to be dabbling in the water in a temperature such as we had to-day, and we were not sorry to be driven on shore. Saw some *Pagodroma* while we were out. No *Megalestris* and no Seals have been seen these last days. Evidently the Seals do not like the motion there has been in the ice.

April 21st.—Evans, Ole and I were out taking observations of the temperature of the sea to-day; at 300 and 400 yards from the land we found the highest temperature $+28.8^{\circ}$ Fahr., lowest $+27.5^{\circ}$ Fahr. On the south side all our observations were below $+28^{\circ}$ Fahr.

April 24th.—A gale is blowing. Of zoological interest I can note that I saw a great number of the Brown-backed Petrel (*Thalassæca antarctica*), and the Ice Petrel (*Pagodroma nivea*), which fished in the mashed up ice. We saw some Seals in the ice, white and grey, and on the beach I found washed up a brown thing, very much like a Hag (*Myxine*), about a foot long, without fins.

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April 25th.—The doctor, Colbeck, and I took a walk this forenoon round on the beach. We found three Heart Urchins¹ and a Sponge—both species quite new to me. Some Seals and birds have been observed to-day of the same species as yesterday.

April 26th.—Some birds have been seen to-day of the same species as those of the last days. To-night, at 9 P.M., I heard just above my head a bird cry four or five times. The note sounded like “Kaw-kaw.” It was too dark to see the bird; but it was the cry of the *Pagodroma*. I had heard it before on the 30th of last month.

April 28th.—I killed two Ice Petrels to-day while out for a walk.

April 29th.—Walked on the beach to-day. Found three animals like Sand Worms four to six inches long.² They were transparent, with brown stripes or bands, one millimeter in breadth, and a number of feet like the Millipedes. Some Ice Petrels seen to-day.

April 30th.—Killed two male *Leptonychotes* and three Ice Petrels.

May 3rd.—This afternoon an Emperor Penguin came to us and was immediately attacked and killed by our savage dogs and torn so badly that the skin was of no use for the collection, but I preserved the skeleton.³

May 5th.—The Finns killed two large female Seals on the ice to-day. Only one had an embryo, 55 centimeters long. This had fully developed light and dark spots on the skin, but no hair anywhere except on the nose. It was preserved. Several other Seals were seen, amongst them a *Lobodon*. Some birds of the species lately observed were again seen to-day. Fougner and I were on the ice fishing, and we caught eleven fishes.

May 6th.—Evans and I took a walk along the beach. We brought a gun with us in case a bird should happen to come near. As we walked along we observed two large Penguins far away—about 1,000 yards—on the ice. We went immediately out on the ice to take the shortest cut towards them. The birds appeared to be restless, so we thought it advisable to hurry on as fast as possible; this we soon found to be necessary, as some dogs which had followed the Finns, who were out on the ice fishing, had also got a scent of the Penguins, and were already far ahead of us before we saw these competitors. There was nothing else for us to do but to launch out as fast as possible, but we were nevertheless left behind in the race. The dogs reached the Penguins a good while before us and had already spoilt one of them before we arrived and killed the birds with two shots. Fougner came now to our assistance to bring the birds into camp, where they were admired, photographed, weighed, and at last preserved. I made one skin and one skeleton⁴ of these our unexpected winter visitors. They weighed respectively 64 and 71 lbs. English. The layer of fat on their backs was one inch thick. The contents of their stomachs were fish, but no stones. Soon after the Finns also came in and brought with them upwards of twenty fish, which we had for supper, and found to be excellent eating.

¹ *Hemiaster*.—F. J. B.

² Probably *Vanadis antarctica*.—F. J. B.

³ This skeleton was not in the collection delivered to the British Museum.—R. B. S.

⁴ This second skeleton was also not brought to the Museum.—R. B. S.

May 9th.—Ole and I were on the ice to-day fishing and caught fifty-seven fish. Twice Ole got two fish on the "pilk" at the same time, and once even three fish. On two occasions Seals came up in the ice-holes in which we were fishing, and at last they frightened the fish away from us. Saw a *Pagodroma nivea*.

May 10th.—To-day has been a very good day for my collection. Evans and I went out this morning, and we were very fortunate, as we shot twelve Ice Petrels, and we also collected a great number of *Invertebrata*. Among others we had five different species of Jelly-fish. We, moreover, found hundreds of those worms which I discovered on the 29th of last month. We also found some Fish-fry, nearly as transparent as water; also a grey swimming thing, and some more small animals of species and forms we have not seen before. It was certainly not a very pleasant work to be dabbling with naked hands in the water with the temperature down to -5° Fahr. But when our fingers tingle the most and are stiff and numbed from the cold, we have this to comfort us, that we are suffering for the cause of science, and that many zoologists are waiting for the results we shall bring back and will thank us accordingly.

May 15th.—These last few days we have only now and then seen a solitary Seal and two or three birds of those species we have been accustomed to see. To-day also some Seals and an Ice Petrel have been seen. In the forenoon I saw a troop of Seals, about a dozen, in the sea, presumably *Leptonychotes*. This evening, just as I was going to turn in, the three Englishmen came in and told me that they had seen and heard a "Whistling" Seal out by the point, but they had not killed it, neither had they ascertained to which species it belonged. I hurried into my clothes again and in company with Fougner, Kolbein, and Evans as a guide, I set off armed with a rifle and a lantern. Evans could not find the place where the Seal was lying, and we searched a long time in vain, but at last one of the dogs began to bark a short distance off, and by going up to the dog we at last found the Seal. The light from the lantern made him lie still and stare without making any sign of moving away. I poked him on the nose with the barrel of my rifle, and then he gave vent to the before-mentioned "whistling" sound and also a sharp smacking noise, which seemed to come from the bottom of his chest. The whistling was quite shrill and clear, like the note of a canary-bird. The Seal was a young female of *Leptonychotes weddelli*, the smallest we have seen as yet. She was only five feet long; the skin and cranium we took for the collection.

June 8th.—The Finns were far away on the ice to-day to look for some dogs. They found five Seals lying by a hole in the ice. As they had nothing with them wherewith to kill the animals, they stopped up the hole, so that we can find the Seals to-morrow. No birds of any kind seen.

June 9th.—We did not find the Seals by the hole the Finns had stopped up, but, on following up their track, we found that they had moved away to an iceberg about one kilometer away, where we discovered that they had gone into a narrow water-lane which ran round the iceberg. Near by we found on the ice a young *Leptonychotes*, half killed by our four-legged bandits. In the lane round the berg there were a number of Seals, and what interested me most was the fact that there were a large

number of the White Seal, *Lobodon carcinophagus*; some of them were immensely big animals. Here seemed a fine opportunity to get some good skins for the collection. There were about three *Lobodon* to every *Leptonychotes*. We walked about for a long time looking at the animals. It was like looking into an immense aquarium, as they were not in the least shy, and we might have touched them with our hands if we had wished. On the ice close by the side of the lane we found a fish, very much like a herring, five inches long. It was a new species for the collection, and presumably it had been frightened out of the water by the Seals. But it was of no use to us to be only looking at the Seals; we had to secure a couple of them before the twilight disappeared and darkness set in. We had only one seal-pick, and with only this it was difficult, not to say impossible, for one man to drag these large animals up on the ice. We had to shoot them first and drag them up with the pick afterwards. A Seal, which was splashing in the water close by the edge of the ice, was approached by us. I held my rifle in readiness and fired the ball into his neck, and he was dead immediately; Ole drove the pick into his neck, but although we thought we had a good hold of the animal, the pick slipped, and the Seal sank like a stone before we could get a new hold on him. The next one was also a large White Seal, but this sank so immediately after the shot that it was impossible to get hold with the pick. Seals lay blowing everywhere in the lane, but it took some time before any of them came to the spot where we had shot the two; but as this was by far the best place for hauling them up, we stayed there waiting for them to come near. After a quarter of an hour three came up close to me, and Ole stood ready with the pick, and soon the finest and biggest of the three lay dead with a ball between the eyes; but it took the strength of all five of us to haul him up on the ice. It was a male Seal, more than eight feet long, and very fat. I did not intend to shoot any more, but while I stood and skinned the one I had shot, a large Seal came and laid himself nicely up for a shot. In the next second he had a ball crashing through his head. When we got this Seal on the ice, I found it to be a female, and, to judge by her circumference, with young, so I did not regret having killed her, as I now could get the embryo from this Seal, and thereby the time of pairing approximately fixed. It was now quite dark, so we had to light our lanterns before we were half through with our work. We found large quantities of the above-mentioned herring-like fish in the stomachs of these two Seals, and these were so recently swallowed that I took some of them for the collection. The embryo was two feet long, and had just begun to get hair on its body. With the skin and flesh of one Seal and the embryo on a sledge, we started for camp. The other Seal we left behind to be fetched to-morrow or a following day. It was, however, easier said than done to pull the heavily-laden sledge along in the dark, as the ice was full of hummocks screwed up by the motion of the ice. By heavy pulling, and by one of us going before with a lantern to pick out the way, we had at last gone so far that we thought the worst of the job was over, when suddenly the sledge capsized on a little hummock, and broke one of the runners. Dark as it was, there was now nothing else for us to do than to let the sledge with the skin and the flesh lie where it fell and proceed to camp with the rest of the load. During the whole trip the temperature was down to -32° Fahr.

The skin we brought home measured eight feet five and a half inches in length and six feet round behind the fore flippers.

June 14th.—Nothing to do and nothing done. We intended to take a trip to the iceberg where on the 9th saw so many Seals, to look for some addition to my collection; but the sky has not been so clear in the middle of the day that we could go without lanterns, and under such circumstances the chances for collecting anything were very small. We therefore decided to put off the trip to a more favourable day. I hope it will not be for long, for the want of having something to do often becomes very depressing.

June 17th.—Colbeck saw a *Pagodroma nivea* this morning. It came close to him when he was reading off the thermometers.

June 24th.—Four of us went for a walk on the ice looking for Seal for food for the dogs. Fortune favoured us, and we killed three large animals. The only thing of zoological interest on this trip was that we observed an immense number of *Leptonychotes*. Those we killed were two males and one female. Strangely enough this last had no embryo, although it was a full-grown animal.

June 28th.—Went out for a walk and to look for Seals and specimens for the collection. Everywhere on the ice we found "blow-holes," but the Seals were all driven into the water by the number of dogs which, much against our wish, accompanied us and coursed all over the ice. I can note as a fact of zoological interest that we found several "Seal caves" in the ice, where the Seal crawls in when the ice and weather is such that they do not care to be exposed to it. By the iceberg where I before killed the White Seal there were also now a number of Seals, but they all kept under the ice, so I got none.

June 30th.—On the ice I found by the same hole I passed yesterday a large Seal, and to judge by its circumference, it appeared to be worth including in my collection; when I returned to camp I therefore sent Ole away to kill it. He brought me an embryo about two feet long, which was well developed, and appeared to be more than half grown. To judge by the embryos I have now collected, the pairing season should be February and the breeding season September. The placenta, which in the Seals lies like a belt round the embryo was, in the one I got to-day, seven inches broad. The Seal was a *Leptonychotes weddelli*.

July 8th.—To-day we killed two large Weddell's Seals, male and female, but there was no embryo in this last. They were uncommonly fat, with five to six inches of blubber where it was thickest.

July 15th.—Alongside of this iceberg there was a large seal-hole where we observed some Seals, both *Lobodon* and *Leptonychotes*. Some of them were very large animals. To judge from the different colouring of the hair, I believe I saw White Seals in three stages of fur. The colour varied from greyish-brown, with darker spots on the fore and hind parts. The apparently oldest of them was dazzling white, without spots. This last, which was the only one of its colour in this hole, was an uncommonly large animal.

July 17th.—The Finns killed a large female *Leptonychotes*, without embryo.

July 23rd.—From his trip Borchgrevink brought back with him a cranium of *Lobodon*, which they killed last night.

July 25th.—Ole killed an uncommonly handsome *Lobodon* yesterday. He was as white as an Ermine.

August 3rd.—The three Englishmen went out to look for Seal to-day. They found none, but they observed a quite fresh track of a Penguin, which Evans followed till it grew dark, when he had to leave it. He took it to be that of a small Penguin. The open sea can certainly not be far away when the Penguins are so near the land.

August 6th.—While walking on the ice, the Doctor found a dead Emperor Penguin, probably killed by the dogs.

August 10th.—By the iceberg they found two dead Emperor Penguins, killed by the dogs. Last night Evans and Colbeck killed a large male Weddell's Seal. He was very fat, with a layer of blubber six inches thick.

August 20th.—It is strange that no Seal has been seen, neither in the



HERALDS OF SPRING-TIME.

(By permission of Sir George Newnes, Bart.)

open sea nor on the ice. Perhaps they travel to other parts to breed. It would be a great disappointment to me if this were the case, and leave a great vacancy in my collection, not only of specimens, but also of notes.

August 21st.—Colbeck and Savio killed a large Weddell's Seal, female, without an embryo. There was no milk in the breasts, so it was probably sterile.

August 25th.—The Doctor and Colbeck returned to-day, without having found the other party. They had seen eight Seals, and of these three were females, to all appearance without embryo. This is strange. Where are the young? The Seals should have bred by now. They were all Weddell's Seal. It is a pity I cannot get out and look for the Seal's breeding-place, as it would be of great interest to know where it is.

August 27th.—Last night Bernacchi and Kolbein returned from Duke of

York Island. What interested me most was that they had found a number of Seals, but no young, neither did they find any females with embryos.

August 29th.—Ole killed yesterday two females of Weddell's Seal, but without embryos. One was a young animal, so this perhaps has had none, but the other was an old animal. I cannot understand where the young are.

September 3rd.—To-day brought me a solution of the question, as to where Weddell's Seal breeds, as they have found embryos, nearly ready for birth, in a couple of Seals of this species which they killed, and also a young one, which they had found on the ice. This appeared, however, not to be quite fully born, as it had not the covering-hair, peculiar to the young Seal. In one of the Seals they killed to-day, they found an embryo four feet long, with fully-developed covering-hair. Among the contents of the stomachs they found only little fish, but in several were fragments of a red Cray-fish, of which they brought me a tolerably well-preserved specimen. Every time they approached one of these animals, especially the females, they gave out an angry roar like that of a bull, which we never have heard before here. Only in April we heard this roar now and again, when the animals were in the sea. They saw not a single White Seal in their trip (to Duke of York Island), so where this Seal now dwells is still a mystery. Perhaps Evans will find it out when he starts on his next expedition. I am, unfortunately, still unable to move about. Kolbein saw a brown-backed Petrel (*T. antarctica*) outside the house last night.

September 5th.—Yesterday and to-day I have been busy, drawing and measuring the Cray-fish which Evans and Fougner brought me, and examining the embryos. The head of the young Seal which Borchgrevink found, they also brought me, and, by its long woolly hair, it must have been full-born, but probably killed by the dogs.

September 10th.—The Seals are beginning to return here again now and to-morrow Fougner is going out to kill some for food.

September 13th.—Yesterday they observed some *Pagodroma nivea* on Duke of York Island. They kept about 1000 feet up in the mountain, and when they flew they played about in pairs, incessantly giving vent to the before-mentioned sound, "kaw-kaw," but they were perfectly silent when sitting on the rocks. They have also found a new species of fish, and also the backbone of a very large fish and some beaks of *Octopus* in the stomachs of some Weddell's Seals they had killed. Four of these had full-grown embryos, which were fully capable of living after they came on the ice. Even if we should get no other proofs, I think this justifies me in putting the breeding-season for Weddell's Seal as September, and this would agree with what I before have said about February being the season of pairing. Besides the new fishes, they have also caught some of the broad-headed bottom fishes which are common here. The temperature in the surface of the sea where they fished was + 28·6 Fahr., and the new species of fish was caught only about one-half fathom (three feet) below the surface.

September 14th.—To-day something of great zoological interest happened. Fougner found a male White Seal far up in the land (about 500 metres) under the mountain. As he was very savage and wanted to attack Fougner when he approached him, he had to return to the hut and call Evans to come to his assistance with a rifle. They brought me

the skin and skull and part of the intestines for the collection. To judge by the colour it was an exceedingly old animal—white as chalk—and he had not a sound tooth in his jaws. In the skin there was a number of large scars, but all old. The peritoneum was full of innumerable small, black, hard tumours, as big as shot of all sizes. What has brought this old Seal on shore? To judge by his tracks he has stayed there several days. He was presumably ill, as he was very lean—with only about half an inch of fat. Perhaps this is a solution of the question, as to where all the dead Seals come from, which I have found scattered about on the point here, and in the guano. Perhaps this is a burial-place for old Seals, and they crawl on land here to die. If this is so, my first supposition that all the Seal-mummies are due to its being a breeding-place for the White Seal is thereby knocked on the head. But this does not decrease the interest of my last conjecture—if there is anything in it.

September 16th.—Yesterday, Fougner and Ole and Evans were away to fetch a boat; they found a dead White Seal which the dogs had killed. The skin was torn and spoilt, so they brought only the head. They had seen one Weddell's Seal, but did not kill it. To-day Evans went out on the ice to look for White Seals. He was away for five hours, but saw only one *Leptonychotes*, which he killed. It was a small male, only six feet long; the skin went into my collection. He also saw some *P. nivea*. He found a little Penguin lying dead far in on the ice, killed by the dogs.

September 24th.—Evans was away after Seals and killed two White Seals, but no sign of young, either born or unborn.

[*Note by Mr. Anton Hanson.*—With the 24th September ends my son's private Diary. Three weeks afterwards, on the 14th October, 1899, he died. May he rest in Peace!]

P.S.—Four species of Seals brought home by the '*Southern Cross*' have been identified, but it would almost seem as if more than this number were procured by Mr. Hanson. On the 31st of December and on several subsequent days he speaks of the "*White Seal*." On the last-named day he killed a "*Leopard Seal*," and again, on the 2nd and 4th of January, specimens were procured of the latter species. On the 6th, he procured a Seal like the others he had shot, but with a different cranium.

On the 10th of January he killed two young female seals, "one of a new species which I have not seen before." On the 14th one of the same kind was killed by Lieut. Colbeck, and another was obtained by himself on the 16th; so that, up to this date, he would seem to have obtained four species.

On the 21st he killed his first Ross's Seal, his second on the 24th, his third on the 28th, and a fourth on the 3rd of February. Thus all the four skins brought to the Museum are accounted for.

On February 9th and 11th Sea-Leopards were again procured.

On landing at Cape Adare, Hanson killed sixteen Seals of a kind not seen before [= *L. weddelli*].

This apparently makes a total of *six* kinds of Seals recognised as different by the zoologist to the expedition.—R.B.S.

IV. AVES.

BY R. BOWDLER SHARPE, LL.D., F.L.S., ETC.

(Plates VII., VIII., IX., X.)

MR. HOWARD SAUNDERS has contributed to the 'Antarctic Manual,' published by the Royal Geographical Society, an admirable account of the birds which occur within the Antarctic regions. The list of specimens obtained by the '*Southern Cross*' was placed at his disposal, and I have had no hesitation in extracting from his memoir above-mentioned such notes as seem to me of importance for the present volume.

I have received from Mr. Borchgrevink only one note-book of the late Nicolai Hanson, which consists merely of a list of the specimens collected by the latter between October 13th, 1898, and January 19th, 1899. This list is of no actual importance, and adds nothing to our knowledge, since Mr. Hanson, like the careful naturalist that he was, has given exactly the same information on the labels attached to the specimens. Of the Emperor Penguins (*Aptenodytes forsteri*) there is no record in the note-book which I received from the commander of the '*Southern Cross*' expedition, and as there was only a number pinned on to the breast of each specimen, with no corresponding MS. notes handed over to me, the exact dates of the capture of these birds cannot be recorded. The list of the specimens delivered to the British Museum does not entirely correspond with that given in Nicolai Hanson's note-book, and shows that several are missing. No skeletons were received by the Museum, though Mr. Hanson's private 'Diary' (*vide supra*, p. 99) expressly records the preparation of at least two of those of the Emperor Penguin. Eight skeletons are also mentioned by him on the 27th of October (*infra*, p. 82), but these also did not reach me.

In the official account of his expedition, Mr. Borchgrevink ('First on the Antarctic Continent,' App. pp. 320-324), publishes in the *Appendix* some "Zoological Notes by Mr. Nicolai Hanson," which,

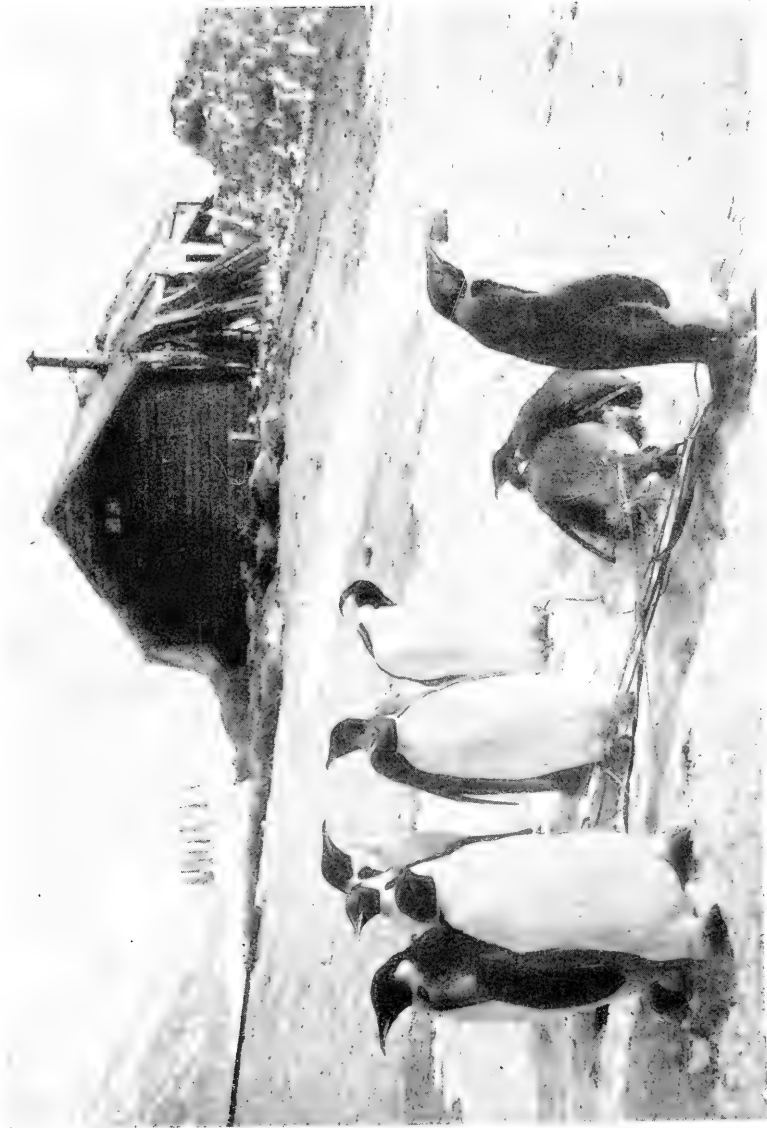
it will be seen, correspond to the records of the same dates in his private 'Diary,' as written to his wife (*vide supra*, pp. 80-83).

In Mr. Hanson's 'Diary' mention is made of the shooting of numbers of specimens of birds in the pack-ice, few of which appear to have reached the British Museum: this is especially the case with the Adelia Penguins, and but for the series obtained by Mr. Hugh Evans near Cape Adare, there would have been but a poor series of this interesting species. Mr. Evans informs me that his notes on the Penguins were handed over to Mr. Borchgrevink, but they appear to have been lost or left behind at Hobart Town, and have not been available for the present memoir. Such skins as have reached the Museum were beautifully prepared: in fact, better specimens of taxidermy than those preserved by Mr. Hanson and Mr. Evans have never come under my notice.

Under the heading of each species I have given a list of the specimens handed over to the British Museum by Mr. Borchgrevink. The first set has been presented to the nation by Sir George Newnes, who has given such duplicates as remained to public institutions at home and abroad.

I have done my best, in the unexpected absence of official note-books, to afford some idea of the distribution and natural history of the various species, by giving a reference to the works which contain records of Antarctic zoology, as has been done by Captain Barrett Hamilton with the Seals, and the jottings from the MS. in Mrs. Nicolai Hanson's possession are not the least interesting of the observations on the zoology of the South Polar regions.

Dr. H. O. Forbes gives a 'List of the Birds in the Derby Museum collected in the Antarctic Regions' (Bull. Liverp. Mus. ii. pp. 48-50), and records a Teal (*Nettion flavirostre*), a Plover (*Ægialitis falklandica*), and a Grebe (*Podiceps calipareus*). All three species are said to have been obtained at Victoria Land. Without affirming that this is impossible, it seems to me highly improbable.



EMPERORS IN CAPTIVITY.
(By permission of Messrs. Hurst & Blackett.)

ORDER SPHENISCIFORMES.

FAMILY SPHENISCIDÆ.

APTENODYTES, Forst.

1. APTENODYTES FORSTERI.

Aptenodytes forsteri, Gray, Ann. Mag. Nat. Hist., XIII., p. 315 (1844, S. lat., 64° 77' S.); Selater, *Ibis*, 1888, p. 325, figs. 2, 4; Donald, Pr. Roy. Soc., Edinb., XX., pp. 172, 174 (1894, 'Erebus' and 'Terror' Gulf, lat. 64° 20' S.); *id.*, Pr. Roy. Phys. Soc., Edinb., XII., p. 329 (1894); Sel., *Ibis*, 1894, p. 499; Ogilvie Grant, Cat. Birds Brit. Mus., XXVI., p. 626 (1898, lat. 64° S., Pack Ice); Sharpe, Hand-list B., I., p. 117 (1899); Forbes, Bull. Liverp. Mus., ii. p. 49 (1899); Racovitza, Vie des Animaux dans l'Antarctique, p. 22 (photo., 1900); Borchgrevink, First on Antarctic Cont., p. 224 (1901); Bernacchi, South Polar Regions, pp. 44, 47 (photo.), 192, 313 (1901); Howard Saunders, Antarctic Manual, p. 234 (1901).

King Penguin, Bull. Cruise 'Antarctic,' p. 156, cum fig. (1896).

Aptenodytes forsterii, Borchgrevink, Antarctic Continent, pp. 66, 71, 213 (photo), 292 (1901).

Emperor Penguin, Borchgrevink, *t. c.* p. 286 (1901); Bernacchi, South Polar Regions, pp. 129, 225, 240 (1901); Hanson, *antea*, pp. 87-90 (1902).

Aptenodytes patachonica (*nec* Forst.), Coues, Pr. Philad. Acad., 1872, p. 192; Sharpe, Voy. 'Erebus' and 'Terror,' Birds, App., p. 38, pl. 31 (1875).

Royal Penguin, Cook, First Antarctic Night, pp. 193, 210, 229, 234, pl., to pp. 332, 334, 382 (1900).

No. 3. Adult, apparently about to commence moulting.¹

No. 4. Adult.

No. 5. Adult.

No. 6. Adult.

No. 7. Adult

No. 8. In nearly completed moult.

All these splendid birds were in full plumage, and had a number pinned on the breast, but there were no further particulars attached to them: the original labels have been removed, and there are no details of the colours of the soft parts, or of the exact localities where the specimens were procured. One of them is evidently the moulting individual described by Mr. Nicolai Hanson in his 'Diary': this is a most interesting specimen, and, in connection with it, Mr. De Winton's papers on the moult of the King-Penguin (*Aptenodytes pennanti*) should be studied ('P. Z. S.,' 1898, p. 900; 1899, pp. 980-981.)

¹ Nos. 1 and 2 are missing from the collection, and none of the specimens had a label.

The distribution of the Emperor Penguin is given by Mr. Howard Saunders in the 'Antarctic Manual' (p. 227), as "ranging longitudinally to 151° E. in Victoria Quadrant, through Ross Quadrant, and to about 50° W. in Weddell Quadrant." No authenticated egg of this bird is known to exist; but Mr. Saunders mentions a large Penguin's egg in the possession of Mr. J. H. Walter, of Drayton House, Norwich, said to have been procured in the "Antarctic regions," prior to 1855, which is bigger than any King Penguin's egg, and may well be that of an Emperor Penguin.



EMPEROR PENGUINS.

(By permission of Sir George Newnes, Bart.)

Mr. Bull, in his 'Cruise of the "*Antarctic*,"' mentions meeting with the large Penguin in the pack-ice in about $68^{\circ} 21'$ S., $176^{\circ} 15'$ E., but he calls it by mistake the 'King' Penguin, instead of the 'Emperor.' The latter is first recorded by Mr. Borchgrevink as having been met with in the pack-ice on January 8th, and he chronicles the capture of a pair on the 18th of the same month. His account of these birds is practically the same as that in Mr. Hanson's private 'Diary' (*antea*, p. 87), and need not be repeated here.

On p. 224 of his book, Mr. Borchgrevink writes: "We saw comparatively few of the Emperor Penguins (*A. forsteri*), and were not able to find their nesting-places. We came across odd ones in the

pack at intervals, and not before the Antarctic autumn of 1900 did we see several together. At the end of November we saw more than twenty (?) at a time. They were then walking slowly into Robertson Bay. I secured ten of these, and kept them for some time alive at Camp Ridley. They came in shoals, swimming just like the small Penguins, with whom they, however, did not mix. Undoubtedly, they were on their way to their old nesting-places, and some of them had pretty large eggs inside them. Their stomachs generally contained crustacea, very small fish, and a quantity of pebbles." He also records (p. 286) the occurrence of an Emperor Penguin, who "walked philosophically up and down upon the ice towards the E.," as the '*Southern Cross*' entered the harbour in the ice barrier, the furthest south reached by the ship. He likewise seems to have taken some living specimens on board the ship, as we read that on March 4th, 1900, he "ordered the last live Penguin (*A. forsterii*) to be thrown overboard, as he looked miserable, would not eat, and his spirits sank with the rise of the temperature."

Mr. Bernacchi writes (p. 44):—"We saw the large Emperor [in the pack] rarely, and nearly always solitary. . . . On one occasion three of these Penguins suddenly leapt up on a floe quite close to the ship. . . . Two of these birds were procured one day that weighed between seventy and eighty pounds. They were found on an ice-floe, seeking shelter from the wind behind a hummock. One was moulting, and, from the stained appearance of the ice upon which he was resting, had been perched there some days. It took nearly twenty minutes to asphyxiate them with chloroform. On dissecting one, the contents of the stomach were examined, and found to hold red crustaceous matter, small fish, some two to three inches in length, some green matter like seaweed, and a few small rock-fragments. Three of these fragments presented granitoid characters, and the fourth was a greenish-grey lava-rock." [These are doubtless the pair of birds whose capture is described by Mr. Nicolai Hanson in his 'Diary' of Jan. 18th, 1899.]

About the end of May Mr. Bernacchi records the capture of a very fine specimen on the ice-pack near Cape Adare, "a big, sad, solitary bird, over four feet high." He remarks that the presence of these birds so far south (late in the year) proves that they do not migrate far north during the Antarctic winter. He also mentions the species as occurring near Cape Adare about the middle of November—"A large handsome Emperor Penguin suddenly shot out of the water on to the ice within a few yards of us, and gazed around in a quiet, dignified fashion, looking like a giant among the

smaller ones. Strange to say, the smaller Penguins were afraid of him, and gave him a very wide berth. We endeavoured to get between him and the water's edge, so as to capture him, but he was much too wise for us; he perceived our little manoeuvre, and quietly took a header back into the sea. Ten of these large Penguins were, however, captured some days afterwards, and were incarcerated in a square made of boxes, but somehow they overturned the cases, and effected their escape." In the inlet of the ice barrier, at about the southernmost point reached by the '*Southern Cross*,' Mr. Bernacchi found a couple of Emperor Penguins, inhabiting the same ground as a large rookery of Weddell's Seal. In the appendix to his book (p. 313), he says that "the species is rarely seen further north than Lat. 63° S., but some had been seen by the '*Southern Cross*' expedition as far south as 78° S. At Cape Adare specimens were procured both in summer and in winter. They were generally solitary, or in small groups of five or six. Its food consists principally of crustaceans. Great pains were taken to find a clue to the breeding-place of the Emperor Penguin, but unsuccessfully."

Dr. Racovitza, of the '*Belgica*,' gives an interesting account of the species on the pack-ice (*t.c.* p. 22), with an excellent photograph by Dr. Cook. The latter also has many notes in his book, '*Through the First Antarctic Night*,' on the "Royal" Penguin, as he terms the species, which was met with by the '*Belgica*' in the pack-ice early in March. He says:—"The Penguins we saw were stragglers which failed to go to more congenial regions before the new ice formed; they remained near icebergs, where they are sure to find new crevices in the next few days, and to be deprived of food and water for a few days does not seem to seriously disturb a Penguin. About the bergs we found some small holes through the new ice, out of which there came a puff of vapour with a hiss, at regular intervals. These were the breathing holes of the crab-eating Seals, who, like the stranded Penguins, awaited a change in the movement of the ice, when new crevices, with open spaces of water, will again appear." The Emperors also occurred during the winter, as Dr. Cook observes that on the 14th of July, though no life was visible, the tracks of both the Royal and the smaller Adelia Penguins were seen.

PYGOSCELIS, Wagler.

PYGOSCELIS ADELÆ.

(Plates VII., VIII., X., figs. 4-6.)

- Catarrhactes adeliæ**, Hombr. and Jacq., Ann. Sci. Nat. (2), p. 320 (1841, Adélie Land).
- Pygoscelis brevirostris**, Gray, List B. Brit. Mus., Part III., p. 154 (1844, Ice off Louis Philippe Land, lat. 64° 72' S., long. 171° 6').
- Aptenodytes longicaudata**, Peale, U.S. Expl. Exped., Birds, p. 261 (1848, lat. 64° 40' S., long. 103° 4' E.).
- Eudyptes adeliæ**, Sharpe, Voy. 'Erebus' and 'Terror,' App., pp. 38, pl. 28 (1875); Borchgrevink, First on Antarctic Cont., pp. 198-217 (photos.), p. 257 (photo., Possession Island), p. 286 (Ice barrier, Robertson Bay).
- Spheniscus adeliæ**, Schl., Mus. Pays Bas, Urinat., p. 4 (1867, Adélie Land, Victoria Land).
- Dasyrhamphus adeliæ**, Donald, Proc. Roy. Soc., Edinb., XX., p. 170 (1894, lat. 61° 14' S., long. 52° 27' W., Danger Islands).
- Pygoscelis adeliæ**, Coues, Proc. Ac. Philad., 1872, p. 196; Sci., *Ibis*, 1894, p. 499; Ogilvie Grant, Cat. B. Brit. Mus., XXVI., p. 632 (1898); Forbes, Bull. Liverp. Mus., II., pp. 49 (1899); Racovitza, Vie des Animaux, etc., pp. 23-27 (1900, with photos.); Bernacchi, South Polar Regions, pp. 44, 58, 190, 192, 314 (1901); Howard Saunders, Antarctic Manual, p. 235 (1901).
- Eudyptes adalicia**, Borchgrevink, First on Antarctic Continent, pp. 64, 102.

a. ♀ ad. Killed on the pack-ice, 64° 8' S.L., 16° 52' E.L., Jan. 5th, 1899.

"Iris dark brown; eyelids white; bill crimson and black; feet flesh-colour in front, dark blue-grey behind; webs flesh-colour on top, dark blue-grey underneath; claws reddish." (*H. B. Evans.*)

b. ♀ ad. (in moult). Caught on pack-ice, 64° 43' S.L., 161° 6' E.L., Jan. 7th, 1899.

"Iris dark brown; eyelids white; bill crimson and black; feet flesh-colour in front, dark blue-grey behind; webs flesh-colour on top, blue-green underneath; claws reddish." (*H. B. Evans.*)

c. ♂ ad. Caught on the pack-ice, 66° 16' S.L., 166° 56' E.L., Jan. 22nd, 1899.

"Iris dark brown; eyelids white; bill crimson and black; feet flesh-colour in front, dark blue-grey behind; webs flesh-colour on top, dark blue-grey underneath; claws reddish-black." (*H. B. Evans.*)

d. ♀ ad. In the pack-ice. Feb. 5th, 1899.

e. ♂ ad. (in moult).¹ In the pack-ice. Feb. 7th, 1899.

¹ This is one of the two specimens mentioned in Mr. Hanson's private 'Diary' (*vide supra*, p. 92). The other one did not reach the Museum.



ADELIA PENGUINS ON THE ICE IN SPRING.
(By permission of Sir George Newnes, Bart.)

- f. ♂ ad Cape Adare. Oct. 14th, 1899.
 g. ♂ ad. Cape Adare. Nov. 21st, 1899.
 h. ♂ pull. } Cape Adare. Dec. 12th, 1899.
 i. pull. } Cape Adare. Dec. 12th, 1899.
 k. l. m. ♂ p. ♀ pull. Cape Adare. Dec. 29th, 1899.
 n. o. ♂ ♀ pull. Cape Adare. Jan. 4th, 1900.
 p. ♂ imm. Cape Adare. Jan. 18th, 1900.
 q. ♀ pull. Cape Adare. Jan. 22nd, 1900.
 r. ♀ pull. Cape Adare. Jan. 24th, 1900.

The nestlings of this Penguin, obtained in December, are pretty little creatures, covered with silvery-grey down, with a black head and face; the throat also is shaded with sooty-black. Even in the nestling



ADELIA PENGUINS AND YOUNG.

(By permission of Sir George Newnes, Bart.)

stage there is considerable difference in the colour of the down, for one specimen is sooty-brown all over, excepting on the head, which is blackish, though not in very strong contrast to the back. As the bird increases in size the silvery-grey appearance gives place to sooty down, and a little black spot shows the position of the tail. A nearly full-grown young bird, killed on the 24th of January, is entirely clothed in sooty-grey down and has lost the black head, but the stiffened tail-feathers are fairly developed and have flat and glossy black shafts. The thighs are beginning to show white plumes.

In another, a female, procured on the 22nd of January, the thighs are entirely white, and the grey down is being shed, so that on the lower back the blue plumage is already visible. On the breast, however, the grey down is changing to an isabelline colour, which forms the downy top to the true feathers, these being developed from *oblique transverse rows*.

Two white-throated birds were obtained, one on the 22nd of January, 1899, and another on the 18th of January, 1900. They are in pale and bleached plumage, and have, as Mr. Ogilvie Grant has pointed out, no black patch at the end of the flipper. This



ADELIA PENGUIN FEEDING ITS YOUNG.

(By permission of Sir George Newnes, Bart.)

character, however, varies in extent in adult birds, and is not of any great importance. It thus appears that some of the young birds of the previous year come back in the next breeding season without having moulted into the adult livery.

The nestlings were obtained in the middle of December, and by the end of January were nearly of full size, though still clothed in down. The old birds, or at least some of them, must commence to moult early in January, and one bird killed on the 7th of February has almost completed its change. Another female, obtained on the 5th of February, is in excellent feather, with the exception of the tail, which is still undeveloped.



PENGUIN ROOKERY AT CAPE ADARE.

(By permission of Messrs. Harst & Blackett.)

A male killed on the 21st of November has a curious patch of white feathers on the nape.

The Adelia Penguin apparently does not extend its range far to the north of the Antarctic Circle, and the exact habitat is given by Mr. Howard Saunders as follows:—"This is the black-headed species found in immense 'rookeries' on Victoria Land and Adélie Land, as well as in the area round Louis Philippe and Graham Lands, and at the South Shetland Islands." Mr. Borchgrevink says that the species was seen soon after entering the pack-ice (p. 67). On landing at Cape Adare on the 17th of February, 1899, only a few Penguins were left (p. 86), and all had departed by the 14th of March (p. 105). Mr. Borchgrevink mentions the 14th of October (the day of Mr. Hanson's death) as the day on which the first Penguin returned (p. 190), and on the 19th many arrived: "some stood at their old nests, which they occasionally left to pick up pebbles, arranging them about their nests (p. 190). The first eggs were gathered on the 3rd of November (p. 198). Mr. Borchgrevink [p. 247] says that the young Penguins during the stay of his expedition at Cape Adare were not so far advanced as when he first landed there (with Mr. Bull¹) on the 23rd of January, 1894 [*sic*]. On Possession Islands on the 3rd of February very few Penguins were left (p. 257). Near Mount Melbourne, "a small Penguin colony was thriving, and, as the young ones were not so far advanced as those few which were still left at Cape Adare when we departed, they did not seem to have any immediate intentions of leaving their breeding-place. At all events they were evidently well protected by the cone of Mount Melbourne from the south" (p. 262). On Franklin Island "there were very many Penguins on the peninsula, many more than were left at Cape Adare when we said farewell to Camp Ridley" (p. 268). At the foot of Mount Terror, "a large Penguin colony seemed to flourish" (p. 276), a pair were seen in the harbour in the ice-barrier (lat. 80° S.), "who discussed our boldness with the utmost interest" (p. 286). On p. 291, Mr. Borchgrevink speaks of the "hoarse scream" of the Penguin. He devotes an interesting chapter to the habits of the bird (pp. 198-224).

Mr. Bernacchi's work also contains numerous references to *Pygoscelis adelia*, part of which I have quoted. It was "very common" in the ice-pack. "Once a party, headed by Lieutenant Colbeck, set out across the ice to hunt some small Penguins. At about the same time the Penguins set out for the party, in order

¹ See Bull's 'Cruise of the "*Antarctic*,"' p. 180, where the first landing on the Antarctic Continent is said to have taken place at 1 A.M. on the 24th of January, 1895.

to investigate the strange animals coming towards them; for their curiosity was astonishing. Along the floes they came waddling from side to side, and raising and lowering their flippers in a most ludicrous fashion. At last they came right up to the men, walked round, and surveyed them critically in a most comical manner" (p. 44). "On the morning of the 6th of February, we passed an ice-floe upon which there was quite a small colony of Penguins: some were moulting and had made themselves small cavities in the ice where they stood, until, apparently, the period of moulting was over" (p. 58). Of the landing at Cape Adare Mr. Bernacchi writes (p. 66): "We had not



THE "SECLUDED AND MELANCHOLY INHABITANTS."

(By permission of Messrs. Hurst & Blackett.)

walked far before we met the secluded and melancholy inhabitants of that South Polar land; these were the Penguins scattered about in groups of a hundred and more. They extended us but cold courtesy and gravely regarded us from a distance; but on our approaching closer they evinced more interest, and commenced talking loquaciously together in their own particular vernacular. They had evidently discovered that there was something unusual about our appearance, and some were commissioned to investigate matters. These, with perfect *sans-froid*, slowly marched right up to our feet and ogled up at us in most ludicrous fashion. Having finished this scrutiny, they returned to their fellows as sedately as they had come, and thence-



ADELIE PENGUINS ON THE PEBBLY BEACH AT CAPE ADAIRE.

(By permission of Messrs. Hurst & Blackett.)

forth took no more notice of us. What impressed us was the general appearance of sadness prevailing among them: they seemed to be under the shadow of some great trouble. It is no small matter that will arouse them from their stolidity. There were many young birds among them, and no doubt most of the older ones had already migrated northwards, it being late in the year for them. The effluvium from the guano was very powerful. The strong ammoniacal odour at first gave us a sensation of nausea, but we soon got used to it, and never afterwards suffered from any unpleasantness. There was, however, no large accumulation of guano of any commercial value, for in no place was it deeper than from three to four inches, and this only in very small patches of only a few feet in extent. The powerful winds prevent any extensive formation by sweeping all accumulations into the sea." On the beach at Cape Adare "bleached remains of thousands of Penguins were scattered all over the platform, mostly young birds that had succumbed to the severity of the climate" (p. 73). On the climb to the top of Cape Adare, on February 17th, Mr. Bernacchi saw a few Penguins, and even at the top (950 feet by aneroid) there were traces of them.

On the journey south after the return of the '*Southern Cross*' to Cape Adare, he records numbers of Penguins as being observed on the Possession Islands on the 3rd of February, 1900 (p. 234), and on the inlet in the ice-barrier one of these birds was seen on the 4th (p. 240). They were again met with in Wood's Bay at the foot of Mount Melbourne (p. 244). The pebbly beach on Franklin Island, "similar to the one in Wood's Bay and at Cape Adare, was occupied by thousands of Penguins. The young birds were not in so advanced a state of development as those at Cape Adare and the Possession Islands (p. 252). On p. 260 he writes: "Even stranger than the absence of snow on Mount Terror is the existence of an exceedingly large Penguin rookery at the foot of the mountain, and near Cape Crozier. This rookery was occupied by millions of Penguins, and was far and away larger than any we had previously seen. The brown discolouration caused by these birds can be seen some miles off."

The earliest date of the return of the Penguins to the neighbourhood of Cape Adare seems to have been the 16th of September, when Mr. Evans found one "lying dead far in on the ice, killed by the dogs" (*vide* Mr. Nicolai Hanson's 'Diary,' *antea*, p. 105). Specimen *f.* of my list was the one brought in to Mr. Hanson half-an-hour before he died (October 14th, 1899) (*cf.* Borchgrevink, 'Antarctic Continent,'

p. 198). In November Mr. Bernacchi writes (p. 222):—"Flocks of thousands of Penguins now toddled to and fro between the shore and the water, those arriving grimy and sordid in appearance, and those returning neat, clean, and glossy. Thousands were standing along the edge of the ice, ready to take their plunge into the brine, but hesitating like children. As soon as one plunged in, all followed in rapid succession. Others, again, were sporting about in the water, enjoying themselves immensely—racing along and leaping out like Dolphins; by the uninitiated they might have been easily mistaken for



ARRIVAL OF THE ADELIA PENGUINS IN THE SPRING.

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such. As soon as they tired of their frolics, they all leapt up again on to the ice, and then no amount of persuasion would induce them to enter again. In this respect, as indeed in all, they were most obstinate."

Mr. Bull in the '*Antarctic*' landed on the Possession Islands on the 19th of January, 1895 (see '*Cruise of the "Antarctic,"*' p. 172). He writes:—"Thousands of Penguins could be seen from the deck to occupy nearly the whole extent of one of the islands. We found the colony as it no doubt appeared in 1840 to Sir James Ross and his party, the foundation consisting of an extensive heap of guano mixed with pebbles and bones of Penguins, carried off by a natural or a violent death, chiefly the latter, as the numerous predatory Skua-Gulls look

upon the colony as a private and inexhaustible larder, from which they draw their supplies in the form of young Penguins, with the utmost insolence and contempt for parental feelings. The myriads of colonists are drilled to the same degree of perfection which excited our wonder in other Penguin's rookeries. In spite of their bewildering numbers, all their functions of life ashore are carried out with a perfect absence of confusion; the only scenes of disorder are caused by an occasional attack from Skua-Gulls, when the old ones are 'played' by some of the robbers, whilst others quietly haul away



ADELIA PENGUINS NESTING ON CAPE ADARE.

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and despatch the screaming youngsters with a few savage pecks from their powerful bills." Mr. Bull also mentions having seen another colony on a beach off Cape Hallett (p. 175).

Mr. Bull (p. 181) describes the landing of himself, with the captain and second mate of the '*Antarctic*,' and Mr. Borchgrevink, on the pebbly beach at Cape Adare in 1895. He writes (p. 181):—"The sensation of being the first men who had set foot on the real Antarctic mainland was both strange and pleasurable. . . . To commemorate our landing, a pole was erected, carrying a box on which was painted the Norwegian colours, the date, and the vessel's name. . . .

"Our surroundings and our hosts were as strange and unique as

our feelings. The latter—myriads of Penguins—fairly covered the flat promontory, many acres in extent, jutting out into the bay between Cape Adare and a more westerly headland; they further lined all accessible projections of the rocks to an altitude of 800 or 900 feet. The youngsters were now almost full-grown. In their thick, woolly, and grey down they exhibited a most remarkable and comical appearance. At a distance the confused din and screaming emanating from parents and children resembled the uproar of an excited human assembly, thousands in number.

“Our presence was not much appreciated, considering the millions of years which must have elapsed since the last visit by prehistoric man or monkey—before the glacial period. Our sea-boots were bravely attacked as we passed along their ranks. The space covered by the colony was practically free from snow; but the layer of guano was too thin, and mixed with too many pebbles, to be of commercial value in these days of cheap phosphates. Unless the guano has been carried out to sea from time to time by rains and melting snow, the thinness of the layers, compared with the massiveness of similar deposits in other climes, would indicate that South Victoria land has only during comparatively recent ages been made use of by the Penguins during their breeding season. From this (assumed) fact, interesting inferences may again be drawn regarding changes in the climate of Antarctica during recent times; but men of science must weigh the pros and cons of this theory, and the most permissible deductions to be made.

“The mortality in the colony must be frightful, judging by the number of skeletons and dead birds lying about in all directions. A raptorial (Skua) Gull was present here, as everywhere in the neighbourhood of Penguin nurseries, and was busily occupied with its mission in life—viz., prevention of over-population in the colony. The patience and endurance of the Penguins are beyond praise, when it is considered that thousands of them have to scale ridges hundreds of feet in height to reach their nests, although their mode of locomotion ashore is painfully awkward and slow. Like so many other Polar animals, the full-grown bird is able to subsist on its own fat for long periods; but the young birds require frequent and regular feeding, as in all other cases of animal life. The capacity of most Polar inhabitants for stowing away incredible quantities of food at one meal, and bringing it up again at will, explains no doubt how the young can be fed with fair regularity, although the parents may go for days without an opportunity of eating.”

From the 'Southern Cross' Expedition, I have received the series of specimens recorded above, but no notes of any kind, beyond the record of the soft parts on the labels. The entire series seems to have been preserved by Mr. Evans, and no notes by Mr. Hanson have reached me. That he must have devoted some study to the species is certain, as he was always most interested in the moulting and changes of plumage in bird—witness his beautiful series of Eider Ducks (*Somateria mollissima*) and Black Guillemots (*Cephus grylle*) procured off the Norwegian coasts, and now in the British Museum. He also kept a living Adelia Penguin in a box (see his 'Diary,' *supra*, p. 95), in order to study the moult. Mr. Borchgrevink also writes: "Half an hour before he died, the first Penguin came back. Enthusiastic as he had always been in his calling, he asked to see the bird, and, on its being brought to him, he was delighted to examine it." Dr. Klovstad told me that Hanson had been much interested in the changes of plumage undergone by the Penguin, and, on examining the tail-feathers of the above-mentioned specimen, he pronounced it to be an "old bird." Whether the development of the tail or the black throat were the points which Hanson was indicating, we cannot now determine, without his note-books. In his private 'Diary' there are not many observations concerning the Adelia Penguins, and it is possible that his account of the species was in one of the missing note-books.

Mr. Hugh Evans tells me that his own note-books were delivered up to the commander, when the ship arrived at Stewart Island on the return voyage. He gave special attention to the habits of the species, and hoped that I should find his account of some interest. No note-books have been submitted to me; but, in answer to some of my inquiries, Mr. Evans has been kind enough to write me a letter, with some remarks about the Penguins, which are deserving of quotation: "Your letter is rather a difficult one to answer, from the scanty data I have in my possession. Referring to the first question you ask me concerning the time the Adelia Penguin takes to get its full plumage, it only takes *one year* for the great majority of them; for we only came across a few isolated instances of birds having come to Cape Adare with the crowd, still with their throats not quite covered with black feathers, which seems to be the last stage of their change from young to adult plumage. The birds I took on January 15-22, 1900, were all that season's young. There was a great difference of time between the hatching of the first and last young birds; the first being hatched out on the 9th of December, and the last ones not until

January, the period of incubation lasting from thirty-one to thirty-four days. When we left Cape Adare, on the 2nd of February, although most of the young birds had completely lost their down, and had their full feathers, with the exception of the black ones on the throat, there were still very many young and tiny ones, only about a fortnight old. They seem to vary a good deal in the time they take to develop; for, even when we left Cape Adare, there were still some of the previous year's birds with white or partly white throats, and I took some on board with me, but was unable to skin them.



ADELIA PENGUINS ON THEIR NESTS.

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The young birds seem to grow very rapidly, and, when once they start casting their down, they have it all off in a few days' time."

From Mr. Borchgrevink's account of the species I extract the following notes:—

"Although the Penguin colony seemed to fill the very ground of the peninsula, new arrivals continued even after the Penguins which arrived first had been sitting on their eggs for a fortnight. The Penguin rookery at the Peninsula of Camp Ridley, at Cape Adare, was the same as when I visited it in 1894. The Penguins literally covered the ground; their nests lying on the top of the guano deposits and consisting of small pebbles. I remembered I often

wondered, after my first visit, how the Penguins managed to get the material for their nests, and I presumed that they brought it from the sea-shore. This, however, they seldom did. The pebble supply generally came down to the Peninsula from the top of the Cape, driven by the furious gales, and I could not but recollect the old proverb which runs: 'It's an ill wind that blows nobody good,' and the Penguins usually had a very busy time after one of those very strong gales, which we, however, did not appreciate. Those Penguins (*Eudyptes adeliae*) which we met on the outward voyage have nearly all of them black throats, and so have the myriads on the peninsula at Cape Adare in the early spring. However, I was enabled to solve



ADELIA PENGUINS PAIRED.

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the question whether the black-throated Penguin is of the same species as the white-throated one or not, later in the season, when the young ones were nearly full-grown. The full-grown young ones had more or less white throats, and no doubt at my first visit to Camp Ridley in 1894, when I found the Penguin colony consisted almost entirely of white-throated birds, they were evidently well advanced young ones. The absence of the black-throated Penguin at that time is easily explained by the fact that the old ones, uncharitable as it may seem, leave their young ones and go to sea towards the time their offspring should be able to look after themselves. Hence I believe that it had been a somewhat more favourable season for the Penguin colony at the time of my first visit to Cape Adare, as

the date of that visit was much earlier in the season than when the old Penguins left their young ones in 1900. I noticed that the young birds generally found their mothers whenever they wanted food, and soon began to pay visits to their neighbours and mix amongst them; but a mutual understanding seemed to have been arrived at by the old Penguins not to quarrel as much as at the time of love-making. They seemed to realise the necessity of falling into each other's peculiarities as much as possible. When the old Penguins left, the young ones, being able, like the rest of their kind, to live for a long while without food, remained on shore until starvation forced them to work for their own living, then they too went to sea and left their birthplaces until the next short summer."

Mr. Bernacchi (p. 192) also gives an excellent account of the habits of the Adelia Penguin, from which the following extracts have been made:—

"The arrival of the small Penguins at Cape Adare presented a most curious appearance. When walking on the rough ice they struttle along upright, but as soon as they reach ice upon which there is some snow, they drop down on their breasts and glide along toboggan fashion, making use of flippers as well as feet. They all travelled along the same path, which soon became bloodstained from their bleeding feet cut by the projecting pieces of ice. They came from the north and must have travelled at least twenty miles over very rough ice. Some landed upon the pebbly shore at Cape Adare and nearly all at the same spot, but others continued to journey southwards towards the bottom of Robertson Bay, where there was another rookery. It was like an immense army. For fourteen days they came in an absolute unbroken continuation. One day we witnessed the black meandering line of Penguins from the summit of Cape Adare, and could trace it for quite two miles out towards the northern horizon.

"They did not in the least hurry themselves, but trudged along steadily in their own phlegmatic way. Their pace was, perhaps, one mile an hour. When approached by anyone they stop and make no attempt to get out of the way, but they shorten their necks and lower their beaks until they assume the appearance of looking down their noses; then they slowly stretch their necks and raise their beaks until they point upwards towards the sky, making at the same time a droll raucous cry, all this with a most ludicrous aspect of indignation, as no doubt they were—profoundly indignant. Sometimes one or more of the most audacious would rush out from among their



PENGUINS ARRIVING.
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companions and attack you furiously; on presenting the sole of the foot, booted of course, they peck at it viciously and with such vigour as to leave marks upon the hard frozen leather. They do not give way an inch of ground, but stand up before you erect and determined.

“As to their general habits. On landing they made straight for a certain spot; some to the summit of the Cape, up the snow slope of which they climb with great facility, some to the base of the mountain, and others scattered over the shore. They congregate



ADELIA PENGUINS AND YOUNG.

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together in communities or social coteries of fifty and upwards. On reaching the spot they immediately start to build their nests, in which work the male as well as the female participates. The nests are crude affairs; the first operation consists of scratching a small depression in the old guano, then pebbles are carried to it in their bills and piled around, and as soon as it is completed, which takes a day or so, the female sits in it and the male commences his courtship. It was highly amusing to watch their love antics. Some are industrious and pile around many hundreds of small pebbles, others—the lazy ones—were quite proud and delighted with only half-a-

dozen. On approaching the former nests, the occupants generally modestly retreated before the intruder, but on approaching the latter—the lazy ones with absolutely nothing to boast about—they made an enormous fuss and rushed at you to bluff you away with their own prowess! It was laughable to watch how they pilfered stones from each other's nests; they are most shameless thieves. The thief slowly approaches the one he wishes to rob with a most creditable air of nonchalance and disinterestedness, and if, on getting close the other looks at him suspiciously, he will immediately gaze around most childlike and bland, and appear to be admiring the scenery. The assumption of innocence is perfect; but no sooner does the other look in a different direction, than he will dart down upon one of the pebbles of its nest and scamper away with it in his beak as fast as his little legs will bear his fat body. If the theft is discovered, the injured party will give chase; then all the kind and sympathetic neighbours rush in and rob to their heart's desire!

“Woe to the foolish Penguin that rambles about in a restless fashion among the community; before making his escape outside the circle he will have left behind a large quantity of his plumage, with which the others will feather their nests; he must either have a home, *i.e.*, a nest, or keep quiet on the outside of the circle if he wishes to be left alone; that is a *sine qua non* among them. The females generally fought whilst sitting in the nest by stretching out their necks and pecking at each other's tongues; but the males fought in the orthodox and picturesque human fashion, with their arms, that is to say, their flippers, and their teeth, that is to say, their beaks. The pugilists stand erect and deal each other resounding blows with their flippers, first one and then the other, with astonishing rapidity. When one is knocked down the beak of his opponent is brought into play with no slight effect. The females rise from their nests and try to intervene and separate them, repeatedly getting between the combatants and moving their heads rapidly from side to side in protestation. I have seen the females drive the least attractive fighter right out of the circle, but, quite unabashed, he would at once rush back to his antagonist, and the fray would commence again. These fights lasted as long as a quarter of an hour, in fact, they were not terminated until one was completely conquered. The vanquished bird generally presented a pitiful appearance, being covered with gore and devoid of much of his plumage, and it took him some days to recover his equilibrium. The din that those thousands of Penguins made was deafening, and was like the roar of a vast multitude of people.

“The Antarctic Skua-Gull (*Megalestris maccormicki*) arrived on the same day as the Penguins, singly at first; a few days after in great numbers. They are of a light brown colour and measure nearly five feet from tip to tip of the wings. Being of a most predatory nature, they played great havoc among the eggs and young of the Penguin. Indeed, they may be said to live entirely upon them during the breeding season, for, whenever there are Penguins, the Skua-Gulls are not far away. On November the 2nd the Penguins commenced to lay their eggs. Two is the number laid, and an interval of three days elapses between the laying of the first and second egg. They



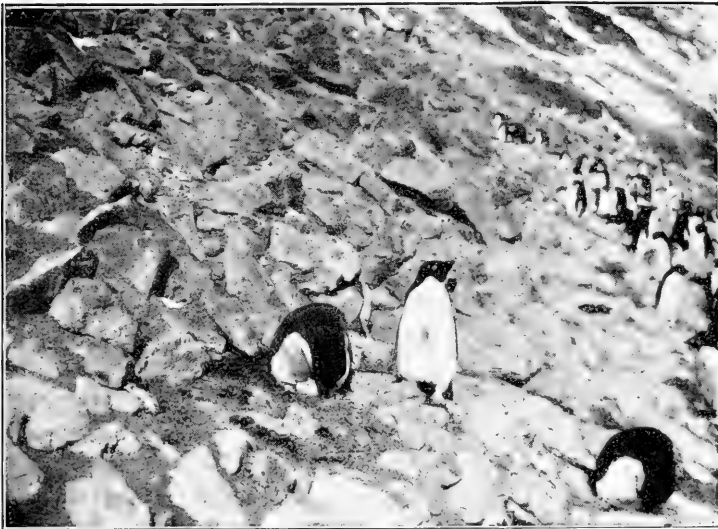
COLLECTING THE EGGS OF THE ADELIA PENGUIN IN THE SPRING.

(By permission of Sir George Newnes, Bart.)

are white, and average from two to more than three inches in length, and from one and a half to two inches in breadth; some are almost spherical in shape. The shell is thick, and the inside has a greenish tint; the yolk is comparatively small, the contents of the shell being mostly albumen. We collected some 4,000 of these eggs for dietary purposes and packed them in salt. They were a luxurious addition to our larder; being utterly devoid of any strong flavour, they were greatly relished. The poor Penguins, when robbed, looked extremely disconsolate; however, there was some consolation to be derived from the fact that we were not the only thieves, for the rapacious Skua-Gull would walk up to a Penguin in the most

barefaced manner and extract the egg from underneath it. The eggs took exactly thirty-one days to incubate, the temperature beneath the bird being between 70° and 80° Fahr. An actual observation with a thermometer placed alongside the eggs gave 72° Fahr.

“During the period of incubation absolutely no food of any kind was taken, but it was observed that large quantities of snow were frequently consumed. The first young appeared on December 9th. They were quaint little creatures, of a dark slaty colour, darkest towards the head, and with dark feet, and a dark rim around the eye, which, subsequently, changed into the spotless white circle of the



ADELIA PENGUINS TURNING THEIR EGGS.

(By permission of Sir George Newnes, Bart.)

parent bird; they grew very rapidly, the dark legs at birth becoming, in a few days, quite pink. What a spirit of homeliness, peace and industry existed among them. There were no fights now. Indeed, the *paterfamilias* was much too engrossed to think of fighting; family responsibilities rested heavily upon him. Poor fellow, he was really to be pitied; he had to work so hard to satisfy the insatiable appetites of the family. Thousands and thousands of ‘bread-winners’ went fishing each day in the lanes of open water; when filled with crustacea, they return and disgorge into the open mouth of the youngster. This method of feeding the young was interesting. The baby places its head into the open mouth of the parent and

devours the food forced up into the throat. By January 18th nearly all the young birds had discarded their downy coat, and been seduced to the water's edge and taught how to swim by their ever-attentive parents. Strange to say, all the young birds, unlike the older, had white throats; evidently, they do not acquire the dark throat until the first or second year."

The account given by Dr. Racovitza (*t.c.*) is also very entertaining. He writes (p. 24):—"As often happens with people of small size, this bird is nervous, lively in its movements and passionate. Its little personality, moreover, is full of an extravagant curiosity. As soon as it perceived us appearing on the pack-ice, it approached with the utmost celerity of which it was capable, and on arriving within two or three paces, it regarded us with a curious eye, agitating its wings, and uttering some interrogative interjections. Under ordinary conditions our relations were extremely friendly, but what a change took place when we laid hands on his back! Cries and violent protestations, and blows from his beak and wings fell like hail.

"When it is not disturbed or annoyed, this Penguin walks on its two feet, inclining its body alternatively to the right and to the left, but when it wishes to advance quickly, it lies on its stomach and pushes itself with its feet and wings. Seen from a distance, it resembles a small up-to-date motor-car going at full speed.

"At the approach of winter, these sensible beasts change their garments. The old dress, which has undergone the vicissitudes of the wear and tear of a year, can no longer serve as a protection against the snow-storms and colds of winter, so at the end of February they have begun to moult. It is a bad time for them to pass through! They cannot go into the water, because their old feathers have fallen off in patches, and the new ones are still too little developed. During the two weeks that the moult lasts the bird is an outcast, and lives on its provision of fat. Moreover, they suffer from the moulting-fever, as babies suffer in cutting their teeth. So to keep company together and for mutual consolation, they assemble in small companies of thirty or forty behind a hummock so as to shelter themselves from the winds, and there they wait, their heads sunk between their shoulders, morose and peevish, till the old plumes take themselves off, and the new ones attain their required length. All this time everything that comes into the neighbourhood of their retreat, be it Bird or be it Seal, is violently cursed and loaded with fierce invectives. I was obliged to admit that we were ourselves not spared in the least, notwithstanding the exalted position which we are supposed to hold in the animal scale."

Mr. Burn-Murdoch, in his book, 'From Edinburgh to the Antarctic,' has also some notes on the Adelia Penguins. He tells of how a school of Grampuses came down from the northward when they were in the ice off Mount Haddington:—"Whales and Penguins fled before them, the Penguins leaping like shoals of Mackerel, and the Finners blowing along in great fright. The Penguins got on to the first ice for safety, and toddled into the centre as fast as their little legs would carry them. To-day we found another black Seal full of fish and Penguins. It is a wonder these birds continue to exist with such powerful and numerous enemies" (pp. 267, 268). On the 1st of January to the north-east of the Danger Islets he met with a "regiment" of Penguins standing at attention at the top of a dome-shaped ice-island in the open sea (p. 272). All this colony were sacrificed for the larder. Mr. Burn-Murdoch says that the jumps the Penguins gave out of the water were astonishingly high; three feet seemed to be an easy jump, but he often saw them fail at higher attempts (pp. 272, 273). On the 31st of January, 1893, he writes:—"Still blowing hard; but we are in splendid shelter behind a long ridge that was piled up last night. It is some thirty feet high—the highest pack that we have seen. The currents and wind have collected it between them; they have piled block upon block, and the new snow has rounded off the points and angles with a smooth white sheet, so that it does not look as if it had only been formed last night. It is amusing to watch the row of Penguins standing on the slope. The wind is driving the falling snow past them, and then blotting them out of sight, but they do not seem to mind in the least, but preen their thin, wiry feathers, apparently in perfect content" (pp. 314, 315).

‡ Dr. Donald, who was on board the Dundee whaling-ship '*Active*,' in the Erebus and Terror Gulf, has written an account of the Penguins observed during the voyage (Proc. Roy. Soc., Edinb. xx., pp. 170–176). He writes:—"This bird was met with on making the ice, in the latitude of the S. Shetlands, and about thirty miles off the land (lat. $61^{\circ} 14'$ S., long. $52^{\circ} 27'$ W.); about a dozen or so were seen at a time sitting or lying in twos and threes on the floating cakes of 'pan-ice.' Passing further to the southward, and nearing the Danger Islands immediately to the east of Joinville Land, the birds increased greatly in number, and were seen in the water in small schools, or sitting on the ice by tens and twenties. We had ample opportunities of watching the peculiar gait and attitudes of the bird, which he shows in common with all his tribe, and which, indeed, have often been described before. Standing absolutely erect,

he supports himself on the tripod feet and tail; as he waddles along, with his feet, as it were, tied together, and trying to balance himself by vigorous movements of his flippers, his tail cuts a deep furrow in the snow, broken at intervals as he half loses his balance and sways forwards; hurrying on, he soon loses his balance altogether and topples forward on his breast, in which attitude he progresses at an even more rapid pace, the flippers being used alternately as paddles, and the feet pushing behind, the tail in this posture not touching the ground. In the water his modes of progression are also two: usually he is seen to swim under water in a prolonged dive, broken at intervals of about thirty yards, as he rises for breath, leaping clean out of the water to the height of perhaps a foot, and immediately disappearing with scarcely a ripple, after clearing a space of 2 to $2\frac{1}{2}$ feet. Swimming in this way, the feet remain motionless, and only the flippers act as powerful paddles; in this manner the bird shoots along with great rapidity. The other mode of swimming develops but a slow pace; floating on the surface like a Cormorant, he swims in the ordinary way by means of his webbed feet, his wings remaining idle. On leaving the water for the ice, he shoots straight up from below the surface, and lands in an erect position; in this way he can jump on to a piece of ice as much as $2\frac{1}{2}$ feet above the water-line.

“In Lieutenant Spry’s notes on the voyage of the ‘*Challenger*,’ he states, as the result of an experiment, that a Penguin perished on being held under the water for the space of one and a half minutes. To test this statement I repeated the experiment, and held a Penguin below the surface for the space of six minutes. At the end of two minutes, among other violent struggles, convulsive pumping movements of the chest occurred; these were repeated at the end of four and a half minutes, and again immediately before I released the bird. Though considerably exhausted, it recovered satisfactorily, and was set at liberty half an hour afterwards. To account for this discrepancy in the two results, I may say that I carefully excluded water from the lungs by compressing the trachea, whereas in Lieutenant Spry’s experiment the bird was simply lowered below the surface in a lobster creel.

“On one occasion (January 5th), in the north of the Erebus and Terror Gulf, we had an opportunity of seeing the birds swimming in large schools of from 200 to 300, the movements of the school being controlled by a single individual which followed in the rear, and which appeared to be of larger size, though we could not approach close enough to determinate its characters. When first seen, at a

distance of about 2000 yards, the school nearest the ship were leaping and diving noisily; on a croak from the leader this noisy sport instantly ceased, and the whole school swam quietly along for several minutes; in response to another and slightly altered croak, the leaping and diving recommenced; and on a third croak, the whole school disappeared in a prolonged dive.

“On the evening of the same day we saw on a piece of ice, some eight or ten miles to the south-east, about forty black-throated Penguins grouped round a pair of large Penguins of a different species, possibly identical with those that had directed the schools. One of these was preserved, and is an Emperor Penguin in young plumage. On the same piece of ice was a *Chionis* and a Seal. It was found over and over again, from inspection of the Seal's stomach, that the Penguins form the main portion of their diet, but at the same time the Penguins while on the ice show no fear of the Seals; and it is, therefore, probable that they are captured while in the water or during the night. The Seals mostly come upon the ice about nine o'clock in the morning, and leave it to feed about seven in the evening.

“Three Penguin rookeries were seen in Joinville Land. Two of these were not visited; the other, a very large one, belonged to this species, and was situated on the north shore of the new inlet named by Captain Robertson the Firth of Tay, in lat. $63^{\circ} 16' S.$, long. $55^{\circ} 53' W.$ I had not the good fortune to land upon this rookery. According to the boat's crew who did so, the birds were in countless multitudes; the nests were crowded together in blocks formed by pathways running nearly at right angles to one another, and the birds were uniformly of the same species. Two eggs from the rookery measured 2.5 by 2 inches, and 2.6 by 2.1 inches.

“The cry is seldom heard, and mostly at night or when the birds are disturbed; it is a short, rather harsh ‘quaugk.’ Among themselves, when undisturbed, they make a gentle crooning sound. Their food consists mainly of a rather large red shrimp, or rather Schizopod, of the genus *Euphausia*, and the stomachs frequently contained a number of pebbles.

“The black-throated Penguin was seen as far south as lat. $64^{\circ} 50'$, and I have no doubt extended much farther. Within thirty miles of the land they were fairly numerous, but at a greater distance from shore, even in the midst of abundant ice of the same character, they became scarce, and only very few were seen ninety miles from the land.”

The eggs of the Adelia Penguin are of a chalky nature, white

with a tinge of green. The ground-colour of the egg beneath the chalky surface seems to be a pale bluish-green. As incubation proceeds, the eggs become stained and smeared with green and with brown. The shape varies from almost perfectly round to a lengthened and biconical form. The dimensions, therefore, vary considerably, the extremes in a series of fourteen clutches being 2.2×2.35 and 3.2×2.35 inches.

MEGADYPTES, Milne-Edwards.

MEGADYPTES ANTIPODUM.

Catarrhactes antipodes, Hombr. and Jacq., Ann. Sci. Nat. (2), XVI, p. 320 (1841, Auckland Islands).

Eudyptes antipodes, Gray, Voy. 'Erebus' and 'Terror,' p. 17 (1845, Auckland and Campbell Islands, New Zealand).

Aptenodytes flavilarvata, Peale, U.S. Expl. Exped., p. 260 (1848, Auckland Islands).

Eudyptes antipodum, Buller, B. N. Zeal., p. 346 (1873, South Isl., N.Z.); Sharpe, Voy. 'Erebus' and 'Terror,' App., p. 35, pl. 27 (1875); Buller, B. N. Z., 2nd ed., II., p. 294, pl. 46, fig. 1 (1888); Sci., P. Z. S. (1891), p. 121 (New Zealand).

Megadyptes antipodum, Ogilvie Grant, Cat. B. Brit. Mus., XXVI, p. 644 (1898, New Zealand, Auckland and Campbell Islands).

Nos. 7, 8, ♂, Campbell Island, June 18th, 1899.

No. 9, ♀, ad., „ „ June 19th, 1899.

No. 10, ♂, jnr., „ „ June 20th, 1899.

These birds were obtained by Captain Jensen during the cruise of the ship during the winter, when the 'Southern Cross' was absent from Cape Adare.

The old female seems to resemble the male in every respect, excepting that the yellow on the head and nape is paler, and the sides of the face are browner with very little yellow. The light brown throat-mark is paler and not so strongly pronounced.

In the young bird the throat is entirely white, and there is a little yellow on the cheeks and on the eyebrow, but no complete circle round the nape.

ORDER PROCELLARIIFORMES

OCEANITIS, Keys. u. Blas.

OCEANITES OCEANICUS.

Procellaria oceanica, Kuhl., Beitr., p. 136 (1820), ex Banks's Icon., no. 12.

Oceanites oceanicus, Sharpe, Phil. Trans., CLXVIII. (extra vol.), p. 132 (1879, Louis Philippe Island, Royal Sound, Kerguelen Island); Racovitza, Vie des Animaux, p. 42 (1900); Borchgrevink, First on Antarctic Continent, p. 54 (1901, lat. 61° 56' S., long. 153° 53' E.), p. 64 (in the pack-ice, Jan. 3, 1899), p. 218 (Victoria Land, breeding, Nov.), p. 231 (eggs obtained, Robertson Bay, Dec. 10); Bernacchi, South Polar Regions, p. 204 (1901, South Victoria Land), p. 315 (Cape Adare); Howard Saunders, Antarctic Manual, p. 235 (1901); Hanson, *antea*, pp. 85-88.

No. 64, L. ♀ ad. Killed on the pack-ice, 63° 41' S.L., 160° 16' E.L., Jan. 2nd, 1899.

Iris dark brown; bill black; feet black; webs yellow [*vide supra*, p. 85].

No. 65, L. ♂ ad. Killed on the pack-ice, 63° 43' S.L., 161° 6' E.L., Jan. 8th, 1899.

Soft parts as above [*vide supra*, p. 86].

Nos. 78, 79, L. ♀ ad. Killed on the pack-ice, 65° 3' S.L., 161°

Soft parts as above [*vide supra*, p. 87].

No. 81, L. ♀. Killed on the pack-ice, 66° 4½' S.L., 166° 51' E.L., Jan. 19th, 1899 [*vide supra*, p. 88].

a. b. c. d. e. ♂ ad. Cape Adare. Dec. 13th, 1889. (*H. B. Evans.*)

f. ♀ ad.

As Mr. Howard Saunders points out, the breeding-place of Wilson's Petrel is undoubtedly in the southern area of the globe, and the occurrences of the species in higher latitudes take place after the nesting-season when the bird migrates in the direction of the equator, and occurs sometimes off the coasts of Great Britain and North America. I copy the following from Mr. Saunders' article in the 'Antarctic Manual':—"This bird is not much larger than our familiar 'Mother Carey's Chicken,' from which, as from any other of the small blackish Petrels, it can be distinguished by its unusually long legs, and the bright yellow colour of the webs between the toes. It was observed by Dr. McCormick hovering, like a Swallow or Martin, over the mast-heads of the 'Erebus' when in the pack; and, on the third attempt to go southwards, examples (now in the British Museum) were obtained off Louis Philippe Land in January, 1843.

These birds were evidently incubating at no great distance, as their breasts were bare of feathers. Surgeon Webster, of H.M.S. '*Chanticleer*,' refers to the abundance of this species at Deception Island, one of the South Shetlands; and I venture to surmise that this may be the small Petrel which the German expedition found breeding at the end of December, 1882, on South Georgia, and which is called *O. melanogaster* by Steinen. The '*Belgica*' obtained specimens in Gerlache Strait in January, 1898, as well as in the pack at about 70° S. and 87° W. in January, 1899. The '*Challenger*' Expedition secured several off the ice-barrier in February, 1874, and examples were obtained on the '*Southern Cross*' Expedition between 63° – 66° S. and 161° – 166° E. The first breeding-place definitely made known, however, in Kerguelen Island, where the bird was discovered by the Rev. A. E. Eaton, the naturalist to the '*Transit of Venus*' Expedition in 1874–5. He found the single egg belonging to each pair of birds, laid in January or February, in some crevice or hole among shattered rocks or large boulders; the egg, as usual with the Petrels, being of a dull white colour, with minute purplish-red spots tending to form a zone at the broader end; measurements, 1.3 by 0.9 in. Subsequently, Mr. R. Hall has contributed some interesting details on the breeding of this, as well as other species, on Kerguelen. Both sexes, he says, take turns at incubation, and about 8 P.M. the 'night shift' comes in from the sea to go on duty, when the relief is marked by loud croakings; and few birds are to be seen over the land in the day-time. After the breeding-season, Wilson's Petrel wanders widely, and, owing to the fact that it has been often observed on the coasts of Western Europe, including the British Islands, as well as on those of America up to Labrador, some ornithologists have assumed that it bred on the islands of the North Atlantic. Of this there is not the slightest proof; on the contrary, some of the birds obtained between the spring and autumn of our Northern Hemisphere are in moult."

In Mr. Hanson's '*Diary*' he records the present species as occurring on the 5th of October, 1898, when the '*Southern Cross*' was in Lat. 27° 27' S., Long. 23° 33' W. He mentions Black Petrels again on the voyage out, but some of these may have been *Fregetta melanogaster*. Wilson's Petrel was met with on reaching the ice-pack on December 30th, 1898 (Lat. 61° 56' S., Long. 153° 53' E.), and again on the 31st, as well as on various dates in January, 1899. After the 30th he does not seem to have noticed the species till the ship approached Victoria Land, on the 15th of February. By the 7th of March it was getting scarce, and was only seen singly. On the 9th

of March he makes the interesting note respecting Wilson's Petrel flying round the house like a Swift, as he had observed it doing round the ship on the voyage out (*vide supra*, p. 94).

As will be seen by the list of specimens, the species was observed by Mr. Evans near Cape Adare on the 13th of December, 1899, and half a dozen were preserved.

Mr. Borchgrevink likewise records the curious habit of Wilson's Petrel "flying round the vessel several times, sometimes straight into the rigging" (p. 54), as noticed by Mr. Hanson (*supra*, p. 94). He writes (p. 218): "The *Oceanites oceanicus* also hatched on Victoria Land. I found their nests in the cracks of the rocks, under stones and boulders. Although we secured eggs from them, we got no live young ones; but from the multitude of the dead young ones in their old nests, I should say that very many perish every year. Like the rest of the Petrels, they always spat out the yellow, evil-smelling oil from their beaks when in danger. I caught several of them on their nests, and found that they behaved very much like the *Pagodroma nivea*, the elegant White Petrel, the life of which interested me even more than that of the Penguins." It is to be regretted that no eggs of Wilson's Petrel were brought home by the 'Southern Cross,' nor have any of the "very valuable photos of these birds on their nests" (*cf.* p. 231) been reproduced in Mr. Borchgrevink's book, or been submitted to me.

Mr. Bernacchi (p. 315) says that the present species was found nearly as far south as the Great Ice Barrier, and it bred high up on the mountain sides of South Victoria Land. He adds: "The eggs were very large for the size of the bird, and, strange to say, as many as five were found in the same nest. Mr. Evans, who had found the eggs of these birds on Kerguelen Island, assured us that this Petrel never laid more than one egg, so how five eggs came to be in the same nest is not very obvious. I may add, however, that the eggs were not all fresh when found."

FREGETTA, Bp.

FREGETTA MELANOGASTER.

Thalassidroma melanogaster, Gould, Ann. and Mag. Nat. Hist., XIII., p. 367 (1844, South Pacific and Indian Oceans); id. B. Austr., VII., pl. 62 (1847, Cape Lagullas).

Fregetta melanogaster, Gigl., Faun. Vert. Oceano, p. 38 (1870); Salvin, P. Z. S., 1878, p. 736 (Betsy Cove, Kerguelen); Saunders, P. Z. S., 1880, p. 164 (lat. 36° 57' S., long. 40° 41' E.); Buller, B. N. Zeal., 2nd ed., II., p. 249

- (1888); Wigglesw., Abh. K. Zool. Mus., Dresd., 1892, No. 6, p. 79; Sharpe, Hand-list B., I., p. 122 (1899).
Oceanitis tropica (Gould); Sharpe, Phil. Trans. CLXVIII. (extra vol.), p. 130 (1879).
Cymodroma melanogaster, Salvin, Cat. B. Brit. Mus., XXV., p. 364 (1896); Hanson in Borchgr., First on Antarctic Cont., App., p. 321 (1901).
Cymodroma grallaria, Hanson, *supra*, p. 83; Borchgr., First on Antarctic Cont., p. 54.

No. 33 F, ♀ ad. 35, ♂ ad. [Cape Seas] 42° 23' S.L., 20° 32' E.L., Oct. 24th, 1898.

Iris dark brown; bill, feet, and webs black. (*N. Hanson.*)

The first specimens of this species were observed on the 13th of October, 1898, and five were obtained on the 24th of that month, the day when Mr. Hanson and the other officers of the '*Southern Cross*' shot a large number of Petrels (*vide supra*, p. 81). These five specimens are recorded in Mr. Hanson's private list given over to me by Mr. Borchgrevink, as two males and three females, but a single pair alone has reached me.

The species is again mentioned by Mr. Hanson as having been noticed on the 30th of December, when the '*Southern Cross*' reached the ice-pack, but he says that it left the ship before they sighted the ice. Mr. Borchgrevink (p. 54) gives a list of the birds observed on this date, which not only agrees with that in Mr. Hanson's '*Diary*,' but includes the present species, which is wrongly named *Cymodroma grallaria*, in both instances.

PRIOFINUS, Hombr. and Jacq.

PRIOFINUS CINEREUS.

- Procellaria cinerea**, Gm., Syst. Nat., I., p. 563 (1788); Milne Edwards and Grandid, Hist. Madag. Ois., p. 671 (1885).
Priofinus cinereus, Gigl., Faun. Vert. Oceano, p. 34 (1870); Baird, Brewer and Ridgway, Water Birds, N. Amer., II., p. 375 (1884); Salv., Cat. B. Brit. Mus., XXV., p. 390 (1896); Sharpe, Hand-list B., I., p. 124 (1899).
Adamastor cinereus, Salvin, P. Z. S., 1878, p. 737 (South Pacific); Saunders, P. Z. S., 1880, p. 164 (lat. 35° 20' S., long. 9° 43' E.); Buller, B. N. Zeal., 2nd ed., II., p. 241 (1888).
Puffinus, Hanson in, Borchgr., First on Antarctic Continent, p. 321 (1901).

Nos. 21, 22, ♀ ad. 39° 55' S.L., 3° 16' E.L. [Cape Seas]. Oct. 19th, 1898.

Iris dark brown; bill horn-colour, yellowish on upper mandible, from nostrils to tip; feet, including webs, grey. (*N. Hanson.*)

Nos. 23, 24, ♂. 25, ♀ ad. 42° 23' S.L., 20° 32' E.L., Oct. 24th, 1898. (*N. H.*)

All the five specimens recorded above have been examined by me. Two were caught on the 19th of October, 1898, and Mr. Hanson thought that he had procured *Puffinus kuhli* (*vide supra*, p. 81). He says that the *Puffinus* (*P. kuhli*?) captured on this date were "ashy-grey on the body, but for the rest exactly like *Puffinus major*."

Three more specimens were obtained on the 24th of October with the mass of Petrels of different kinds obtained on that day. On the 25th they were "about in hundreds" (see Hanson App. to Borchgrevink's book, p. 321) (*vide supra*, p. 81).

THALASSECA, Reichenb.

THALASSECA ANTARCTICA.

Procellaria antarctica, Gm., Syst. Nat., I., p. 565 (1788).

Thalassœca antarctica, Coues, Proc. Acad. Nat. Sci., Philad., 1866, pp. 31, 192; Salv., P. Z. S., 1878, p. 737 (Ice Barrier, Jan.); Buller, B. N. Zeal., 2nd ed., p. 229 (1888); ScL., 'Ibis,' 1894, p. 498 (Antarctic ice-barrier, Feb.); Salvin, Cat. B. Brit. Mus., XXV., p. 392 (1896); Sharpe, Hand-list B., I., p. 125 (1899); Racovitza, Vie des Animaux Antarct., p. 18 (1900); Saunders, Antarctic Manual, Birds, pp. 229, 236 (1901); Bernacchi, S. Polar Regions, pp. 62, 315 (1901).

Priocella antarctica, Sharpe, Voy. 'Erebus' and 'Terror,' App., p. 37, pl. 33 (1875).

Brown-backed Petrel, Borchgrevink, First Antarctic Cont., pp. 55, 64, 120, 220, 226 (1901); Hanson, *antea*, pp. 84, 86, 87, 93, 94, 95, 98, 104.

49 I. ♂ ad. Pack-ice, 62° 52' S.L., 159° 29' E.L., Dec. 31st, 1898.

Iris dark brown; bill brown; feet and webs light grey.

50 I. ♂ ad. Ditto ditto. (*H. B. Evans.*)

51 I. ♂ ad. Ditto ditto. (*N. Hanson.*)

a. ♂ ad. Cape Adare. April 27th, 1899.

The last specimen is much darker than the other three, especially on the throat, where the colour is dark brown, even on to the sides of the fore-neck.

Of the range of the Antarctic Petrel, Mr. Howard Saunders gives the following account:—"It was found by the 'Erebus' and 'Terror' Expedition as far as Lat. 77° 49' S. in Long. 181° 10' E. It seems to occur along the ice-border, but I cannot find any definite account of

its breeding-places. This species, which seems to be the "Aglet" or "Eaglet" of Weddell and early explorers, has the upper surface brown, and has twelve tail-feathers."

The first specimens met with by the '*Southern Cross*' were observed by Mr. Hanson on the 30th of December, 1898, when the ship entered the ice-pack; it is the "dark-coloured" bird mentioned by him (*supra*, p. 83). On Jan. 10th (*supra*, p. 86), he records that the "brown-backed bird," which was so common on the outer edge of the ice, had not been seen since the 6th of this month. The '*Southern Cross*' was then fast in the ice-pack; but on the 18th of January, when the ship "moved into tolerably clear water," he saw some birds, more, in fact, than he had seen for many days past, and among them was one of the Brown-backed Petrels. On Feb. 10 he writes: "None of the ordinary kinds of birds have been very numerous; only once in a while a single individual of the Brown-backed Petrel has been about. No Penguins" (p. 93). At this date the '*Southern Cross*,' after having been forty days in the pack (see Bernacchi, p. 61), was heading northward for the open sea again, in order to enter the pack further to the eastward. On the 12th and 13th of February, when the ship had regained the open sea, the Brown-backed Petrel was again observed in Lat. $65^{\circ} 33' S.$, Long. $165^{\circ} 48' E.$ Hanson says that a number of them were seen on an iceberg, which had lately capsized. On the 14th the ship re-entered the pack, which was then traversed in six hours (*cf.* Bernacchi, p. 61), and on the 15th, when there was a hurricane, and the ship was hove to off Victoria Land, Hanson records having seen "large numbers of the Brown-backed Petrel, as many as a hundred birds in a flock" (*supra*, p. 93). The species was again noticed on the 24th of April, off Cape Adare, when numbers were seen fishing in the mashed-up ice (*supra*, p. 98); one was shot on the 27th. The bird was once more seen on the 3rd of September, outside the house at Cape Adare (*supra*, p. 104). Mr. Bernacchi (p. 315) says that *T. antarctica* was found as far south as Lat. $78^{\circ} S.$ At Cape Adare they were seen early in November, flying in large flocks towards the south. Mr. Borchgrevink also states that he saw one of these birds on the 5th of May (p. 120). His notes on the species are as follows:—"The Brown-backed Petrel, with white borders on the wings, was also evidently nesting on Victoria Land, but we never found it on its nest. When we first approached Cape Adare, dense flocks of them sailed about in the gales. During the summer we saw few of them, but in the autumn they again sailed about in the air, at great heights, while during the gales

they swept low over the peninsula like a cloud. Although I never found them on Geikie Land, I believe that they have their nests in that vicinity." On the 25th November, 1899, he says that a heavy gale started from the S.E. . . . and that large flocks of Brown-backed Petrels pierced the air (p. 226).

Dr. Racovitz (p. 18) says that this species was a rare visitor to the '*Belgica*.'

PRIOCELLA, Hombr. and Jacq.

PRIOCELLA GLACIALOIDES.

Procellaria glacialis, Smith, Ill. Zool. S. Afr. Aves., pl. 51 (1840); Gould, B. Austr., VII., pl. 48 (1848); Buller, B. N. Zeal., p. 301 (1873); Moseley, Notes Nat. '*Challenger*,' p. 134 (1879, Tristan da Cunha).

Thalassœca glacialis, Coues, Proc. Nat. Sci., Philad., 1866, p. 393; Gigl., Faun. Vert. Oceano, p. 47 (1870); Salvin, P. Z. S., 1878 (ice-barrier, Feb.); Moseley, Notes Nat. Chall., p. 253 (1879, edge of pack ice); Buller, B. N. Zeal., 2nd ed., II., p. 228 (1888); Bernacchi, S. Polar Regions, p. 315 (1901); Saunders, Antarctic Manual, pp. 230, 236 (1901).

Thalassœca tenuirostris, Sharpe, Phil. Trans. CLXVIII. (extra vol.), p. 123 (1879, Kerguelen Isl.).

Priocella glacialis, Baird, Brewer, and Ridgw., Water Birds, N. Amer., II., p. 373 (1884); Salvin, Cat. B. Brit. Mus., XXV., p. 393 (1896); Sharpe, Hand-list B., I., p. 125 (1899).

Tagalassoica glacialis, Borchgrevink, First on Antarctic Cont., pp. 65, 66 (1901).

Silver Petrel, Hanson, *l. s. c.*, pp. 86, 87, 90, 92, 93.

Nos. 52, 54 K. ♀ ad. Shot on the pack-ice, 62° 52' S.L., 159° 25' E.L. 53 K. ♂ ad. Dec. 31st, 1898.

Iris brown; bill flesh-colour, tip and nostrils grey; feet pale grey, webs flesh-colour.

No. 62 K. ♂ ad. Shot on the pack-ice, 63° 40' S.L., 160° 36' E.L., Jan. 4th, 1899.

Nos. 73, 74, 75 K. ♂. 72, 76, 77 K. ♀ ad. Shot on the pack-ice, 65° 3' S.L., 161° 42' E.L., Jan. 12th, 1899.

a. ♂ ad. Shot on the pack-ice, Feb. 6th, 1899.

Of this Silver-grey Petrel, Mr. Howard Saunders writes as follows ('Antarctic Manual,' p. 230):—"The range of this species extends along the Pacific coast of America, occasionally as far north as Washington Territory, and also to the Cape Seas; while Kerguelen Island seems to be a breeding-place, although I am not aware of any authenticated eggs. It reaches the ice-barrier, and a specimen was

obtained by the 'Belgica' just before her escape from the pack-ice, on March 14th, 1899, in Lat. 70° 40' S., and Long. 102° W.; while the 'Challenger' brought back one example, taken on the edge of the pack, in about 66° S. Lat., on the 14th of February, 1874."

This species is doubtless one of the "three new species of birds" which met the 'Southern Cross,' when the ship entered the pack-ice on the 30th of December (*supra*, p. 83). On the 31st (*supra*, p. 84) Mr. Hanson shot several specimens of the Silver Petrel, which, as he truly observes, is very like the Fulmar (*Fulmarus glacialis*) of the northern seas. While laying fast in the ice, he shot a number of specimens on the 11th and 12th of January (*supra*, pp. 86, 87), and again on the 30th (p. 91). Two were shot by him on the 6th of February (p. 92); and he saw the species again on the 12th of that month, when the 'Southern Cross' returned to the open sea, before making a second endeavour to get through the pack-ice.

Mr. Borchgrevink (p. 65) speaks of this species as being, next to *Pagodroma*, the best represented in the pack-ice. "They were always seen swimming about in the open spaces in the ice, seeking food, which mainly consisted of crustacea. Only in a few instances a very small fish, like a Herring in shape, has been found in them."

M A J A Q U E U S, Reichenb.

M A J A Q U E U S Æ Q U I N O C T I A L I S.

Procellaria æquinoctialis, Linn., Syst. Nat., I., p. 213 (1766); Moseley, Notes Nat. Chall., p. 137 (1879, Tristan da Cunha); Milne-Edwards and Grand., Hist. Madag. Ois., p. 671 (1885).

Procellaria conspicillata, Gould, B. Austr., VII., pl. 46 (1848).

Majaqueus æquinoctialis, Coues, Proc. Nat. Sci., Philad., 1864, pp. 118, 142; Gigl., Faun. Vert. Oceano, p. 35 (1870); Salvin, in Rowley's Orn. Misc., I., p. 232 (1876); Sharpe, Phil. Trans., CLXVIII. (extra vol.), p. 119 (1879, Royal Sound, Kerguelen); Moseley, Notes Nat. Chall., p. 208 (1879, Kerguelen), p. 254 (edge of pack ice); Saunders, P. Z. S., 1880, p. 164 (lat. 29° 45'—34° 39' S., long. 8° 51' E.); Sharpe, P. Z. S., 1881, p. 12 (Valparaiso); Salvin, Cat. B. Brit. Mus., XXV., p. 395 (1896); Sharpe, Handlist B. I., p. 125 (1899).

Majaqueus conspicillatus, Coues, Proc. Acad. Nat. Sci., Philad., 1864, pp. 118, 142; Gould, Handb. B. Austr., II., p. 445 (1865); Gigl., Faun. Vert. Oceano, p. 36 (1870).

Cape Hen. Hanson, *l. s. c.*, pp. 81, 82.

26 C. ♂ ad. 42° 23' S.L., 20° 32' E.L., Oct. 24th, 1898.

Iris dark brown; bill yellow; feet and webs black. This specimen has a patch of white feathers in the middle of the abdomen.

- 37, 38 C. ♂ ♀ ad. 44° 23' S.L., 72° 5' E.L., Nov. 7th, 1898.
 40 C. ♀ ad. 44° 23' S.L., 72° 5' E.L. Soft parts as above.

This large Petrel was first obtained in the Cape Seas on the 24th of October, 1898; and, on the voyage to Hobart Town, as many as eight specimens were obtained on Nov. 7th and 8th in Lat. 44° 23' S., Long. 72° 5' E.; of these, three appear to have been preserved (*supra*, p. 82). Mr. Hanson also records the species as having been seen about the ship from Nov. 13th to the 18th; but by the 25th of that month he remarks that they had nearly all disappeared (p. 82).

ÆSTRELATA, Bp.

ÆSTRELATA MOLLIS.

- Procellaria mollis**, Gould, Ann. and Mag. N. H., XIII., p. 363 (1844); id., B. Austr., VII., pl. 50 (1848); Layard, *Ibis*, 1862, p. 98 (lat. 44° S., long. 138° E.), 1872, p. 337 (lat. 8° 40' N., long. 34° 31' W.); Newton, *Ibis*, 1863, p. 186 (Madeira), 1868, p. 340.
Æstrelata mollis, Coues, Proc. Acad. Nat. Sci., Philad., 1866, pp. 150, 170; Gould, Handb. B. Austr., II., p. 453 (1865); Gigl., Faun. Vert. Oceano, p. 42 (1870).
Æstrelata mollis, Salvin, *Ibis*, 1877, p. 480; id., P. Z. S., 1878, p. 738 (Nightingale Island); Sharpe, Phil. Trans., CLXVIII., p. 128 (1879); E. L. and L. C. Layard, *Ibis*, 1882, p. 539 (New Caledonia, Feb., breeding); Dagleish, *Ibis*, 1890, p. 386 (Porto Santo); Salvin, Cat. B. Brit. Mus., XXV., p. 406 (1896).
Æstrelata philippi, Saunders (*nec* Gray), P. Z. S., 1880, p. 164 (South Trinidad Island).

No. 36 G. ♀ ad. 42° 23' S.L., 20° 32' E.L., Oct. 24th, 1898.
 Iris dark brown; bill black; feet and web grey.

The single specimen obtained forms part of the great capture of Petrels of Oct. 24th, 1898, all of which Mr. Hanson had prepared by the 27th of the month (*supra*, pp. 81, 82). This was probably the species which followed the ship on Oct. 6th and 16th (*supra*, p. 81).

¹ After leaving Hobart Town, Mr. Hanson (*supra*, p. 83) records some "white-headed Petrels" as seen on the 24th of December, and it is doubtless this bird which he calls *Æstrelata lessoni*, on December 30th. The latter species, he says, left them on their approach to the ice-pack. Mr. Borchgrevink has a similar record (p. 54). No specimen of *Æ. lessoni* appears to have been secured.

CESTRELATA BREVIROSTRIS.

Procellaria brevirostris, Less., *Traité d'Orn.*, p. 611 (1828).

Cestrelata brevirostris, Salvin, in Rowley's *Orn. Misc.*, I, p. 235 (1876); id., *P. Z. S.*, 1878, p. 738; Sharpe, *Phil. Trans.*, CLXVIII. (extra vol.), p. 124 (1879, Royal Sound, Kerguelen); Salv., *Voy. 'Challenger,' II.*, Birds, p. 145 (1881); id., *Cat. B. Brit. Mus.*, XXV., p. 409 (1896); Sharpe, *Hand-list B.*, I., p. 126 (1899).

No. 27 D. ♀. 42° 23' S.L., 20° 32' E.L., Oct. 24th, 1898.

Iris dark brown; bill grey; feet and webs black.

Only one specimen was obtained, in the Cape seas on the 24th of October, the day when the officers of the '*Southern Cross*' captured so many Petrels of different kinds.

PAGODROMA, Bp.

PAGODROMA NIVEA.

(Plate X., figs. 1-3.)

Procellaria nivea, Gm., *Syst. Nat.*, I, p. 562 (1788); Cassin, *U.S. Expl. Exped.*, p. 415, pl. 42 (1858, lat. 64° S., long. 104° W.).

Pagodroma nivea, Cones, *Proc. Ac. Nat. Sci.*, Philad., 1866, pp. 160, 171; Sharpe, *Voy. 'Erebus' and 'Terror,' App.*, p. 37, pl. 34 (1875); Salvin, *P. Z. S.*, 1878, p. 737 (ice-barrier); Moseley, *Notes Nat. 'Challenger.'* p. 253 (1879, Antarctic ice-pack); Salvin, *Cat. B. Brit. Mus.*, XXV., p. 419 (1896); Forbes, *Bull. Liverp. Mus.*, II., pp. 48-50 (1899); Racovitza, *Vie des Animaux Antarct.*, p. 17 (1900); Saunders, *Antarctic Manual*, p. 229 (1901); Borchgrevink, *First on Antarct. Cont.*, pp. 64, 219, 223, 226, 230, 239; Bernacchi, *S. Polar Regions*, p. 226 (1901); Hanson, *antea*, pp. 84, 85, 86, 91, 92, 93, 94, 96, 98, 99, 100, 102, 104.

45 H. ♂ ad. Pack-ice, 62° 52' S.L., 159° 25' E.L., Dec. 31st, 1898. (*N. Hanson.*) Wing 11·8.

Iris dark brown; bill black; feet and webs grey.

47 H. ♂ ad. Pack-ice, 62° 52' S.L., 159° 25' E.L., Dec. 31st, 1898. Wing 11·6.

48 H. ♂ . Pack-ice, 62° 52' S.L., 159° 25' E.L., Dec. 31st, 1898. Wing 10·3.

57 H. ♂ ad. Pack-ice, 63° 27' S.L., 160° 6' E.L., Jan. 1st, 1899. Wing 11·8.

59 H. ♀ ad. Pack-ice, 63° 27' S.L., 160° 6' E.L., Jan. 1st, 1899. Wing 11·8.

63 H. ♂ ad. Pack-ice, 64° 8' S.L., 160° 52' E.L., Jan. 5, 1899. Wing 11·5.

68 H. ♀ ad. Pack-ice, 65° 3' S.L., 161° 42' E.L., Jan. 12th, 1899. (*N. Hanson.*) Wing 11·8.

a. ♀ ad. Cape Adare, April 27th, 1899. Wing 10·6.

b. ♀ ad. Cape Adare, April 28th, 1899. Wing 9·9.

c. ♂ ad. Cape Adare, April 29, 1899. Wing 10·6.

d. ♀ ad. Cape Adare, April 30th. (*H. B. Evans.*) Wing 9·8.

e. ♀ ad. Cape Adare, Dec. 13th, 1899. (*H. B. Evans.*) Wing 10·6.

f. g. ♂ ad. Dec. 13th, 1899. (*H. B. Evans.*) Wing 10·1.

The difference in size between specimens of the Ice Petrel is somewhat remarkable, and at first I thought that there must be two species of *Pagodroma*, as the size of the bill is so much less in certain individuals, and the length of the wing varies also. I have therefore given the dimensions of the latter in the series of specimens brought home by the '*Southern Cross*,' and it will be seen that this variation in the length of wing is not due to any difference of sex, as in the males it ranges from 10·1 to 11·8 inches, and in the females from 9·8 to 11·8 inches.

The eggs are white, and measure :—Axis 2·01 to 2·38 ; diameter 1·35 to 1·67.

Mr. Howard Saunders gives the following concise account of the range of this species :—“ This bird has been obtained as far north as the Falkland Islands, but it does not occur in any numbers until Lat. 60° S. is passed, whence it can be traced as far southward as man has penetrated. Every expedition has noticed it. Ross found it laying its bluish-white egg, measuring 2·2 by 1·6 inches, among the crevices of the cliffs at Cockburn Island ; Surgeon Webster, of H.M.S. '*Chanticleer*,' met with the bird from January to March on Deception Island, South Shetlands ; and the German expedition found it nesting at the end of December on South Georgia. From the Enderby Quadrant it has not yet been recorded.”

The Ice Petrel was first seen by Mr. Hanson (*supra*, p. 84) on the 31st of December, 1898, directly the ship got into the pack-ice, and four specimens were preserved on that day. On the 1st of January, 1899, no less than fifteen of these birds were killed, and some were preserved. On most days in this month he seems to have noticed the species (*supra*, pp. 85, 86). On the 30th and 31st, when the '*Southern Cross*' was still in the pack-ice, Mr. Hanson procured some more specimens (p. 91). On the way north towards the open sea, he records having seen a few Ice Petrels sitting resting on the ice on the 9th of February, but they do not appear to have been seen after leaving the pack (p. 93). They were again found off Victoria Land

on the 15th of February among the large flocks of *Thalassaca antarctica* (p. 93), but they were not often seen near Cape Adare when the party first landed. One is recorded on the 4th of March, and another on the 31st (pp. 94, 96). On the 13th of April, however, a number were seen by Mr. Hanson (p. 97), and several were obtained by himself and Mr. Evans near Cape Adare towards the end of the month (see list of specimens).

On the 24th of April, Mr. Hanson says that a gale was blowing and he saw a number of Ice Petrels fishing in the mashed-up ice (p. 98), and again on the 26th he writes:—"To-night, at 9 P.M., I heard, just above my head, a bird cry four or five times. The note sounded like 'kaw-kaw.' It was too dark to see the bird, but it was the cry of the *Pagodroma*. I had heard it before on the 30th of last month" (p. 98). Twelve specimens were procured on the 10th of May by Mr. Hanson and Mr. Evans (p. 99). The species was now apparently more scarce, as a single specimen is recorded as having been seen on May 15th (p. 100), and again on June 17th (p. 102). Mr. Hanson's last note is on the 13th of September, 1899:—"Yesterday they observed some *Pagodroma nivca* on Duke of York Island. They kept about 1,000 feet up in the mountain, and when they flew, they played about in pairs, incessantly giving vent to the before-mentioned sound 'kaw-kaw,' but they were perfectly silent when sitting on the rocks" (p. 104).

Mr. Borchgrevink writes (p. 64):—"Since we entered the ice, we were met by quite a different bird-life to that we had seen in the open sea. *Pagodroma nivca* and *Tagalassoica* [lege *Thalassaca*] *glacialoides* were best represented. They were always seen swimming about in the open spaces in the ice, seeking food which mainly consisted of crustacea. Only in a few instances a very small fish, like a herring in shape, has been found in them." He noticed the species from time to time soaring about the peninsula at Cape Adare (p. 124) during a very heavy gale. Again he writes (p. 200) on the 9th of November:—"I travelled to the eastward of Cape Adare amongst very heavy screw-ice. Many *Pagodroma nivca* were resting among the rocks; they kept up a continual noise during the night." He continues on p. 219:—"From the time we first entered the icy regions they had soared around the vessel. They were difficult to distinguish against the pure white snow. Spotless and white, this bird, with its large black eyes, black beak, and black, webbed feet, is perhaps the most striking bird of the Antarctic regions. It seemed almost transparent as it sailed swiftly along in the rays. The couple are greatly attached to one another, and the courage of the male bird

to help his mate when in danger is marked. It builds its nest in cavities of the rocks, or cracks in the mountain side, and lays but one egg." On the 15th of November (p. 222) he writes:—"How different it was to travel on those bright nights, instead of having to work in the darkness as we did in the winter-time."

"Many of the *Pagodroma nivea* were about" (p. 222), "and the air sounded with their original and remarkable half-whistling, half-shrieking voices. They did not seem to have immediate intentions of settling down to the quiet family life of the season; they were still seen to flirt about in pairs in the air, though some of them began



ICE PETREL IN ITS NESTING-PLACE.

(By permission of Sir George Newnes, Bart.)

to repair their old nesting-places in cavities of the rocks. Their nests were still in many instances filled with snow, and the bird was gradually thawing a hollow downwards towards the rock by sitting at the place from time to time. They were, however, very restless, and I expected that still a fortnight would go before they would begin to lay their eggs.

"On the 20th November I discovered a fine *Pagodroma* on its nest some 300 feet above my tent. I at once set to work, and managed to mine a hole through the roof of the cave in which it was resting, so that the light could come in for photographic purposes.

We were unable to get a photo of the nest as it was, on account of the depth and darkness of the cave. But Mr. Bernacchi managed to get some very fine photos, showing the characteristic stratifications of the rocks."

On the 10th of December, 1899, Mr. Borchgrevink started on his last sledge journey into Robertson Bay, "principally for the purpose of securing eggs of the different birds." He "secured *Pagodroma* eggs," and says that the hunt was "arduous, and at times involved difficult climbing" (p. 231).

Mr. Bernacchi gives the following note (p. 226):—"Towards the end of November a short sledge journey was undertaken to the end of Robertson Bay, for the purpose of collecting eggs of the Snow Petrels. Travelling on the surface of the bay ice, which had already commenced to break up, and was traversed by huge cracks and open lanes, was difficult work. The surface snow, too, was soft and slushy. A large number of eggs, however, were gathered." On p. 204 he writes:—"The Snow Petrel (*Pagodroma nivea*) nests high up on the mountain sides of South Victoria Land, in long tunnel-like holes under the large slabs of rock, some being as much as six feet in depth, others only a foot or two. The actual nest is as crude as that of the Skua-Gull. The female sits on the nest long before she lays her single egg; when the bird is approached in its nest it expectorates a reddish fluid towards the intruder. This fluid has a most obnoxious fishy odour, and no doubt is a very effective means of defence. They are able to eject it to a distance of eight feet, and, if it catches the garments, the smell clings to them for many days after. I believe this method of defence is common to most Petrels. Some dozens of small white eggs were gathered at a height of 800 feet above the sea."

During the voyage of the '*Belgica*,' Dr. Racovitza says (p. 17): "The most faithful of our winged companions was the White or Snow Petrel. It is one of the most graceful little birds possible to see. Its plumage is of a satiny white, purer even than the white of the snow itself. Its eyes are of jet, its bill and feet are black, and its flight is rapid and graceful. It seeks its food, which consists of small marine animals, when skimming over the cracks and channels in the ice. With a sudden plunge it seizes its prey, scarcely ruffling the water as it does so. Between whiles it makes long excursions over the ice, and nothing can be more pleasing than to see these little white woolly-looking objects disporting themselves over the white pack-ice.

"But it is better not to make too intimate an acquaintance

with these lily-white beings, for thus one is saved from some cruel disillusion. Its voice is shrill and disagreeable, and its ways are deplorably low caste. It possesses the faculty of being sea-sick at will; and when one attempts to seize it, it discharges full in one's face the oily contents of its chest. I can affirm, from personal experience, that one does not come off with the perfume of the rose. One must add, however, to do strict justice, that it merits extenuating circumstances; for this unpleasant habit of the bird serves as a protection for its feeble person, and that is a reason of a certain value."

GENUS **OSSIFRAGA**, Hombr. and Jacq.

OSSIFRAGA GIGANTEA.

Procellaria gigantea, Gm., Syst. Nat., I., p. 563 (1788); Gould, B. Aust., VII., p. 45 (1848).

Ossifraga gigantea, Gigl., Faun. Vert. Oceano, p. 48 (1870); Sharpe, Phil. Trans., CLXVIII. (extra vol.), p. 142 (1879, Kerguelen Isl.); Salvin, P. Z. S., 1878, p. 737; Moseley, Notes Nat. 'Challenger,' p. 134 (1879, Tristan da Cunha), pp. 180, 183 (Crozet Islands), p. 205 (Kerguelen Isl.), p. 254 (edge of pack-ice); Buller, B. N. Zeal., 2nd ed., II., p. 225 (1888); Salvin, Cat. B. Brit. Mus., XXV., p. 422 (1896); Racovitza, Vie des Animaux Antarct., p. 18 (1900); Borchgrevink, First on Antarctic Cont., p. 64 (1901); Saunders, Antarctic Manual, p. 231 (1901); Bernacchi, S. Polar Regions, pp. 73, 316 (1901); Hanson, *antea*, pp. 86, 93, 94, 96.

Giant Bird, Borchgrevink, *t. c.* p. 54 (1901).

Gigantic Petrel, Borchgrevink, *t. c.* p. 220 (1901).

Giant Petrel, Bruce in Burn Murdoch, Edinb. to Antarctic, p. 363 (1894, Danger Isl.); Cook., First Antarctic Night, p. 229 (1900); Hanson, *antea*, pp. 82, 83, 86, 90.

Nelly, Burn-Murdoch, Edinb. to Antarctic, p. 315 (1894).

No. 80 M. ♀ ad. Pack-ice, 65° 43' S.L. 164° 9½, E.L., Jan. 16th, 1899. (*Nicolai Hanson.*)

Iris brown; bill dirty yellow; feet sooty brown; webs black.

No. 2 ♂ alb. Campbell Island, May 28th, 1899. (*Captain*

Jensen.)

a. b. ♂ ♀ imm. Cape Adare, Jan. 2nd, 1900. (*Hugh Evans.*)

c. ♀ semi-alb. Cape Adare, Jan. 13th, 1900. (*Hugh Evans.*)

The Campbell Island bird is pure white, excepting for a few leaden grey feathers scattered over the back and breast.

I take the following note on the distribution of this great Petrel from Mr. Howard Saunders's essay in the Antarctic Manual' (pp. 230, 231):—

“The Giant Petrel (*Ossifraga gigantea*), which approaches the larger species of Albatros in size, was observed by Dr. McCormick soaring over Possession Island, Victoria Land, and the ‘*Belgica*’ found it a constant attendant in the ice-pack. The ‘Nelly,’ as sealers call it, is, in fact, the Vulture of the sea, visiting every spot where carcasses and refuse of Seals and Penguins, or any other means of subsistence, can be found. Its breeding and habits on Marion and Kerguelen Islands have been described by Moseley and others, and the bird probably nests on Heard Island; Webster found it on Deception Island, South Shetlands, from January to March; and, as regards South Georgia, where the eggs are laid in the beginning of November, the practical Weddell remarks that these are inferior in taste to those of other species. The beak of this voracious bird is very powerful, and assertions have often been made by sailors that it will attack a drowning man and accelerate his death. Dr. McCormick states that when, after leaving Kerguelen, the boatswain of the ‘*Erebus*’ fell overboard and could not be saved, the Giant Petrels swooped at him as he struggled to keep afloat, and it is doubtful if they did not actually strike him with their bills; while Mr. Arthur G. Guillemard states that a sailor, who was picked up, had his arms badly lacerated in defending his head from the attacks of an ‘Albatros,’ which may well have been this Giant Petrel.”

The first specimen recorded by Mr. Hanson was on October 30th, 1898 (*antea*, p. 82), when the ‘*Southern Cross*’ was nearing the Crozet Islands, and the species was again observed as the ship approached Tasmania, being noticed nearly every day. On December 28th, when nearing the ice-pack, the *Ossifraga* is again recorded (*antea*, p. 83), and it was seen on several occasions in the ice in January (*antea*, pp. 86, 90). On the 26th, Mr. Hanson writes: “Saw some Giant Petrels. These birds must have a very keen sense of sight or smell, for no sooner is a Seal skinned on the ice than they put in an appearance” (*antea*, p. 90). When the ‘*Southern Cross*’ was retracing its steps after its long imprisonment in the ice, he remarks (p. 93), under date of February 11th: “Of birds, I have seen all my old acquaintances of the ice-pack, except the Penguins and Giant Petrels.” The latter species, however, reappeared when the ship was hove to off Victoria Land, on the 16th and 17th of February (*antea*, p. 93). By the 7th of March it was getting scarcer near Cape Adare, and was only to be found singly (*antea*, p. 94), but he captured two specimens in the middle of March (*antea*, p. 94), and the last one recorded was seen on the 31st of that month (*antea*, p. 96).

Mr. Bernacchi (p. 316) says that during the summer the Giant

Petrel was frequently seen at Cape Adare, and down near the Great Ice Barrier.

Mr. Borchgrevink's account of the species is as follows (p. 220):—
 “The Gigantic Petrels also visited Camp Ridley. They were very scarce during the summer, but we saw several of them during the autumn. We did not find one of their nests, and their visits to the peninsula were always short and interrupted; and, to a great extent, I ascribe their visits to Robertson Bay and our peninsula to strong gales at sea, which drove them in towards shore for shelter. In fact, during the strongest gale we had in the autumn, they arrived at Camp Ridley the day before the gale commenced, and left immediately after it was over. So I, at least, came to look upon their arrival as the sign of an approaching gale. These large birds, which in their flight much resemble the Albatros, vary somewhat in colour—perhaps as much as the *Lestris*—from dark brown to light faded brown; and albinos are occasionally seen. I secured one of these latter, and Captain Jensen secured another. We had both of us great difficulty in obtaining a specimen; a noble, rare bird as he is, he seemed to soar about higher and more lonely than the rest, and remarkable was it that an albino—although of exactly the same species as the dark one—was seldom or never seen in its company. Whether this is because the others combine against him and hunt him because of his whiteness, or because he, in modest ignorance of his value, seeks his own sphere I do not know, but certain is it that he, willingly or compulsorily, soared about in higher regions than the rest.”

Mr. Burn-Murdoch, who was on the ‘*Balaena*,’ gives the following note on the species (p. 315):—

“A number of Nellies or Giant Petrels come circling over us as we slowly drift from our shelter to leeward. They gorge themselves with the ‘cran’ (scraps of Seals’ flesh cut off the blubber: this name is also given to the carcase of the Seal when its skin and blubber has been stripped off), that is constantly being thrown over our sides, then fly back to the snow and sit down beside their Penguin friends. Strange, ugly birds they are, the apparent coarseness of their build, and their grey-green clumsy beaks and rough brown feathers, give the impression that Nature has turned them out in a very wholesale fashion. Some of them are partly white, and a few, of the same kind of bird I believe, perhaps one in twenty, are pure white, all but one or two brown feathers. The different stages of colouring are rather like those of the Gannet. We call them ‘Scavengers.’ They appear to be on a friendly footing with the living Penguins, and when one

of the latter dies the Nellie swallows it, and the relations of the deceased do not seem to mind. Two Penguins that were shot the other day were gobbled up before there was time to row the boat round a piece of ice to pick them up."

Dr. Racovitza's account is as follows:—

"The Giant Petrel is a hideous and repulsive bird. The size is that of a Goose, and the extent of wing in the males, which are larger than the females, exceeds two metres. Some are entirely white, and others entirely brown, but the colour often consists of a mixture of chocolate brown, white and grey, which imparts a generally dirty aspect to the bird. Add to this a formidable hooked bill of a flesh colour, and large webbed feet, and you have an *ensemble* which would never gain a prize in any beauty show started by the feathered races. For the rest, its vile employment is on a par with its vile appearance. The Giant Petrel performs on the pack-ice the *rôle* of the Vultures. It is a knacker of repute, who knows how, in the course of his aerial manœuvres, to discover the corpses of Seals and birds out on the pack-ice. Constantly in motion, it traverses immense distances in search of its food. When the object is detected, it descends to its meal at once, gorging itself with blubber and meat, more or less decomposed, to such an extent that it is not able to fly. Do not believe that this is a good time to approach it! The Giant Petrel has the same faculty as the Snow Petrel for ridding itself of an enemy. With a vigour equalled by its size, it discharges the contents of its digestive canal, and, in a twinkling, you are covered with bits of blubber and partially-eaten meat, together with the oil from its stomach. If the projectile of the Snow Petrel is not otto of roses, the bomb fired by the Giant Petrel spreads around a smell calculated to astound even a zoologist, who during his experiences has to see, or rather suffer from, all sorts of queer effects."

DAPTION, Steph.

DAPTION CAPENSIS.

Procellaria capensis, Linn., Syst. Nat. I., p. 213 (1766); Milne-Edwards & Grandid., Hist. Madag. Ois., p. 671 (1885).

Daption capensis, Gould, B. Austr., VII., pl. 53 (1847); Gigl., Faun. Vert. Oceano, p. 46 (1870); Sharpe, Phil. Trans., CLXVIII. (extra vol.), p. 118 (1879, off Kerguelen Isl.); Moseley, Notes Nat. 'Challenger,' p. 134 (1879, Tristan da Cunha), p. 183 (Crozet Islands), p. 229 (Heard Island); Salvin,

Cat. B. Brit. Mus., XXV., p. 428 (1896); Borchgrevink, First on Antarctic Cont., pp. 54, 64, 66 (1901); Saunders, Antarctic Manual, p. 230 (1901).

Cape Pigeons, Burn-Murdoch, Edinb. to Antarctic, p. 281 (1894); Bernacchi, S. Polar Regions, pp. 15, 315 (1901); Hanson, *antea*, pp. 81, 82, 84, 85, 86, 87, 91, 93.

No. 2, A. ♂ ad. 37° 31' S.L., 8° 51' W.L., Oct. 15th, 1898.

Iris dark brown; bill black; feet black with a little grey on the inside, webs grey.

Nos. 3, 4, 5, 6, 7, A. ♀ ♂ ad. 38° 29' S.L., 5° 5' W.L., Oct. 16th, 1898.

Soft parts as above.

Nos. 8, 9, 10, 13, A. ♂ ad. 12 ♀ ad. 47° 27' S.L., 0° 21' E.L., Oct. 18, 1898.

Nos. 14, 16, 17, 18, 19, A. ♀ ad. 15 A. ♂ ad. 39° 55' S.L., 3° 16' E.L., Oct. 19th, 1898.

No. 20, A. ♀ ad. 44° 52' S.L., 57° 32' E.L., Nov. 2nd, 1898.

Nos. 41, 42, A. ♀ ♂ ad. 62° 52' S.L., 159° 25' E.L., Dec. 31st, 1898.

No. 56, A. ♀ ad. Shot on the pack-ice. 63° 27' S.L., 160° 6' E.L., Jan. 1st, 1899.

No. 60, A. ♂ ad. Shot on the pack-ice. 63° 41' S.L., 160° 16' E.L., Jan. 2nd, 1899.

No. 61, A. ♂ ad. Shot on the pack-ice. 63° 40' S.L., 160° 36' E.L., Jan. 4th, 1899.

No. 66, A. ♂ ad. Shot on the pack-ice. 65° 3' S.L., 161° 42' E.L., Jan. 11, 1899.

No. 69, A. ♂ ad., 70, 71, A. ♀ ad. Shot on the pack-ice. 65° 3' S.L., 161° 42' E.L., Jan. 12th, 1899.

A. ♀ ad. Shot on the pack-ice. Feb. 3rd, 1899.

In the 'Antarctic Manual,' Mr. Howard Saunders observes:—
 "The well-known Cape Petrel, or 'Cape Pigeon' (*Daption capensis*), is another of the medium-sized species which has hitherto succeeded in concealing its eggs from the gaze of naturalists, although the bird has been found in burrows with its young on Kerguelen, and there can be no doubt that it breeds on South Georgia, as well as other suitable localities in the Antarctic regions. It occurs throughout the Southern seas, and has even been obtained on one occasion off Ceylon. At long intervals individuals have been taken in the North Atlantic, from the United States to the British Islands; but among the numerous birds captured at sea many are known to have been

carried hundreds of miles before their eventual liberation, and this may account for occurrences so far beyond the usual limits."

The first Cape Pigeons are recorded in Mr. Hanson's diary as having been noticed by him on the 8th of October, when between St. Vincent and the Cape, and many were snared by him between the 8th and 29th of that month (*antea*, p. 81). The 2nd of November was the last time that he observed Cape Pigeons in flocks before reaching Tasmania (p. 82). By the 25th of November, when nearing Tasmania, they had nearly all left the ship (*antea*, p. 82): but he notes that when the latter entered the ice-pack on the 30th of December, "our old acquaintance, the Cape Pigeon, also appeared again" (p. 83). He procured specimens in the pack from the 1st to the 12th of January, 1899. On the 29th he notices that the birds disappeared, so that up to that time they must have been generally observed in the pack (p. 91). On the 12th of February, when the ship had escaped from the ice and regained the open sea, Cape Pigeons were again observed, and they were also seen during the hurricane off Victoria Land on the 15th of February (p. 93).

Mr. Borchgrevink mentions his having seen *Daption capensis* in the ice-pack, especially on the 12th of January, when they were "swimming about in the open water catching crustacea" (p. 68). He also speaks of the species as moulting at the end of December, "and flying with some difficulty" (p. 54).¹

Mr. Bernacchi writes:—"A general favourite among seamen is the Cape Pigeon, a pretty, busy little sea bird about the size of a dove, but plumper, with a black head and an elaborate pattern in black, grey, and white upon its wings. Around the stern of any passing ship large numbers of fluttering visitors hover continually, their shrill cries and unweary manœuvres contrasting pleasantly with the deep monotone made by the driving keel through the foaming sea. In common with most Southern sea-birds having hooked beaks, they are easily caught with hook and line, but will not live in captivity. Thoughtless passengers often amuse themselves by shooting these graceful wanderers, although what satisfaction may be found in reducing a beautiful living thing to a useless morsel of draggled carrion is not easy to see."

¹ Cf. Hanson's Diary for October 18th, 1898 (*antea*, p. 81).

PRION, Lacép.

PRION BANSKI.¹

Prion banksi, Gould, Ann. and Mag. N. H., XIII., p. 366 (1844); id., Handb. B. Austr., II., p. 474 (1865); Gigl., Faun. Vert. Oceano, p. 44 (1870); Salvin, P. Z. S., 1878, p. 739 (Marion Island and at sea near Crozets); Buller, B. N. Zeal., 2nd ed., II., p. 211 (1888); Salvin, Cat. B. Brit. Mus., XXV., p. 434 (1896).

Nos. 28, 29, E. ♂ ad. [Cape Seas], 42° 23' S.L., 20° 32' E.L., Oct. 24th, 1898.

Only one specimen of *Prion* was in the collection, and this is undoubtedly *P. banksi*.

Mutton Bird, Borchgrevink, First on Antarctic Cont., pp 52, 54 (1901); Hanson, *antea*, pp. 83, 86, 92.

P.S.—The "Mutton Bird" of Australia is *Puffinus tenuirostris* (Temm.), which is *Puffinus brevicaudus* of Gould's 'Handbook' (II., p. 549). No specimen was procured by the 'Southern Cross' expedition, so that I can only conjecture that this is the species intended by Mr. Borchgrevink and Mr. Hanson in their notes. It was noticed at sea on nearing Tasmania (*antea*, p. 83), and on several occasions on the voyage from Hobart to the pack-ice. Some were even noticed in the ice-pack itself from the 6th to the 10th of January (*antea*, p. 86), and many were seen in the open sea on the return of the ship, after its long imprisonment, on the 7th of February (p. 92). On the 13th of February, Mr. Hanson also speaks of a 'Grey Petrel,' which was again seen off Victoria Land on the 16th of the same month (p. 93).

¹ Whether it was this species which is recorded as *Prion vittatus* by Mr. Hanson and Mr. Borchgrevink, I have no means of judging, as specimens do not seem to have been obtained. The former (*antea*, p. 82) noticed a species of *Prion* round the ship from November 13th to 18th on the voyage to Tasmania, and when approaching the last-named island. On leaving Hobart it seems to have been again noticed, and Mr. Hanson states that, on nearing the ice-pack, "*Prion vittatus*" appeared, after the 'Southern Cross' had passed the 60th degree of south latitude (*antea*, p. 82). He says that it was the only species which followed them in among the ice, the others having left before they sighted it. On the 23rd of January, 1899, Mr. Hanson states (*antea*, p. 90) that he obtained a specimen of *Prion vittatus*, the first he had seen that year, when the ship was in the ice-pack, but the skin of this bird, which would have been so interesting for the identification of the species, was not in the collection brought to the Museum. A species of *Prion* was again noticed when the open water was reached after the 'Southern Cross' came out of the ice-pack, before entering it for the second time (*antea*, p. 93). Mr. Borchgrevink's first notice of "*Prion vittatus*" is on the 20th of December, 1898, and again on the 21st. After leaving Tasmania (p. 53) on the 29th, "*Prion vittatus*" appeared in far greater quantities than he had ever seen them before (p. 54). On the 30th he mentions the species again among other kinds of Petrels, as recorded also by Mr. Hanson (*antea*, p. 83). He further says that it followed the ship for some distance into the pack, but it left long before the latter came to the dense pack.

DIOMEDEA, Linn.

1. DIOMEDEA EXULANS.

Diomedea exulans, Linn., Syst. Nat., I., p. 214 (1766); Gould, B. Austr., VII., pl. 38 (1844); id. Handb., II., p. 427 (1865); Gigl. Faun. Vert. Oceano, p. 49 (1870); Sharpe, Phil. Trans., CLXVIII. (extra vol.), p. 145 (1879, Kerguelen); Moseley, Notes Nat. 'Challenger,' p. 134 (1879, Tristan da Cunha, breeding), p. 171 (Marion Island), p. 180 (Crozet Islands); Salvin, Cat. B. Brit. Mus. XXV., p. 441 (1896); Hanson in Borchgr. Antarctic Cont. App., p. 322 (1901).

No. 1 A. ♂. 42° 23' S.L., 20° 32' E.L., Oct. 24th, 1899.

Iris brown, the eyelids bluish grey; bill bluish livid, the tip white; feet light bluish red, with the webs of the same colour.

No. 2 A. ♀. 44° 26' S.L., 37° E.L., Oct. 29th, 1898.

Soft parts as above.

Neither bird is completely adult, though the male has the secondaries for the most part white, with brown frecklings; on the crown are the remains of a brown patch. In the younger female the crown is dull brown, and the entire wing is blackish, as pointed out by Mr. Salvin.

No. 1 is the specimen mentioned by Mr. Hanson (*antea*, p. 81) on the 24th of October, 1898. "This morning, as soon as I came on deck, I caught a large Albatros." And again on the 29th he says:—"Caught a large Albatros. It is a little darker than the first, and perhaps a year younger. The number of Albatroses about the ship increases every day. Last night I observed at one time eight large ones" (p. 82). Previous entries in his diary record the occurrence of the species on the voyage south to the Cape seas. Nearing Tasmania, towards the end of November, Albatroses were noticed, and one was caught on the 25th, but was apparently not preserved. These may have been *Diomedea regia*, and not *D. exulans*, as may also have been the Albatros recorded by Mr. Borchgrevink as "plentiful" on December 20th, the day after the '*Southern Cross*' left Hobart. He saw some more on the 23rd (p. 53).

Mr. Hanson observes (*antea*, p. 93) on the 14th of February:—"A *Diomedea*, apparently *D. exulans*, followed us also for some time, and I believe that this is the first time that this bird has been seen so far south (69° 13' S. Lat.)," but the species seen may have been *D. regia*. It was noticed when the '*Southern Cross*' had left the ice-pack and was in the open sea again.

2. DIOMEDEA REGIA.

Diomedea regia, Buller, Trans. N. Zeal. Inst., XXIII., p. 230 (1891); Salvin, Cat. B. Brit. Mus. XXV., p. 443 (1896).

No. 11, imm., Campbell Island, Oct. 4th, 1899. (*Capt. Jensen.*)

No. 12, juv., Campbell Island, Oct. 5th, 1899.

No. 13, juv., Campbell Island, Oct. 6th, 1899.

No. 14, juv., Campbell Island, Oct. 7th, 1899.

No. 19, ad., Campbell Island, Oct. 7th, 1899.

Three specimens carry a great deal of nestling down. One is full-grown, with white back and white breast, but still bears nestling down round the neck and on the breast. The only one which has no down on the plumage has the wings black, with white margins to the wing-coverts; the scapulars also are for the most part black, with white bases and fringes, but showing a tendency to become more entirely white.

The other whitish bird was procured on the 13th of January, 1900. It is more grey than white, and seems to be in an intermediate stage of some kind. The other birds are in the dark brown young plumage, with the throat rather lighter brown.

3. DIOMEDEA MELANOPHRYS.

Diomedea melanophrys, Boie in Temm., Pl. Col. V., pl. 456 (1828); Gould, B. Austr. VII., pl. 43 (1884); id., Handb. II., p. 438 (1865); Salvin, P. Z. S., 1878, p. 740 (Christmas Harbour, Kerguelen); Sharpe, Phil. Trans. CLXVIII. (extra vol.), p. 146 (1879); Moseley, Notes Nat. 'Challenger,' p. 254 (1879); Milne-Edwards and Grandid., Hist. Madag. Ois., p. 669 (1881); Baird, Brewer and Ridgw., Water B. N. Amer., II., p. 357 (1884); Buller, B. N. Zeal., 2nd ed., II., p. 198 (1888); Salvin, Cat. B. Brit. Mus., XXV., p. 447 (1896); Borchgrevink, First on Antarctic Cont., pp. 53, 54 (1901); Hanson, *antea*, pp. 81, 83; Hanson in Borchgr. Ant. Cont. App., pp. 321, 324 (1901).

Thalassarche melanophrys, Gigl. Faun. Vert. Oceano, p. 57 (1870).

Yellow-billed Mollymawk, Hanson, *antea*, pp. 82, 83.

No. 4 B, ♂ ad. 33° 37' S.L., 9° 54' E.L., Oct. 13th, 1898.

Iris greyish-brown; bill yellow, tip red; feet fleshy-red, the webs of the same colour.

No. 3 B, ♂ ad. 33° 37' S.L., 9° 54' E.L., Oct. 13th, 1898. Soft parts as above.

No. 13 B, ♀ ad. 44° 20' S.L., 68° 28' E.L., Nov. 6th, 1898. Soft parts as above.

No. 20 B, ♀ ad. 44° 23' S.L., 72° 5' E.L., Nov. 7th, 1898. Soft parts as above.

No. 22 B, ♂ ad. 44° 23' S.L., 72° 5' E.L., Nov. 7th, 1898. Soft parts as above.

Although Mr. Hanson has given the colour of the bill as the same in all the specimens, there is a good deal of black near the tip. In some the general colour of the back is rather browner, and the white head and neck are shaded with grey; all these points I believe to be characteristic of the immature bird.

The first specimens captured by Mr. Hanson were those of October 13th, 1898, which he prepared on the following day (*antea*, p. 81). The species is also recorded as the "Yellow-billed Mollymawk" on November 6th and 7th (p. 82); and he again mentions it by this name as noticed after leaving Hobart, on the 21st and 24th of December. It was one of the species which accompanied the ship to the ice-pack, but left before it entered the ice on the 30th of December (p. 83). On emerging from the pack in February, the Yellow-billed Mollymawk was again seen (p. 93). Mr. Borchgrevink observed the species on the same days recorded above by Mr. Hanson. He also records "*Diomedea chlororhyncha*" [*sic*], as having been noticed by him on the 26th of December, six days after leaving Hobart, but the species is not mentioned by Mr. Hanson.

The latter states (*antea*, p. 13) that the "Short-tailed" Albatros was also seen on nearing Tasmania, on the 27th of November. Mr. Borchgrevink also says that on leaving Tasmania "the Short-tailed Albatros followed the ship, until the 20th December, when no more were to be seen" (pp. 52, 53). Which species of Albatros is here intended I cannot determine, but it cannot have been the Short-tailed Albatros (*Diomedea brachyura*) of Gould's 'Handbook' (II., p. 433), which is the northern *D. albatrus* of Pallas [*cf.* Salvin, Cat. B. Brit. Mus. xxv., p. 444].

THALASSOGERON, Ridgw.

1. THALASSOGERON CULMINATUS.

Diomedea culminata, Gould, Ann. and Mag. Nat. Hist., XIII., p. 361 (1844, South Pacific and Atlantic Oceans); id., B. Austr., VII., pl. 41 (1848); id., Handb. B. Austr., II., p. 436 (1865); Sharpe, Phil. Trans., CLXVIII. (extra vol.), p. 147 (1879); Moseley, Notes Nat. 'Challenger,' p. 129 (1879, Tristan da Cunha), p. 183 (Crozet Islands); Hanson in Borchgr. Ant. Cont. App., pp. 322, 333 (1901).

Thalassarche culminata, Gigl., Faun. Vert. Oceano, p. 59 (1870).

Thalassogeron culminatus, Baird, Brewer and Ridgw., Water Birds N. Amer., II., p. 358 (1884); Salvin, Cat. B. Brit. Mus., XXV., p. 451 (1896); Sharpe, Hand-list B., I., p. 129 (1899).

Black-and-yellow-billed Mollymawk, Hanson, *antea*, pp. 81, 82, 93.

Black-billed Mollymawk, Hanson, *antea*, pp. 82, 83, 93.

No. 56, C, ♂ 42° 23' S.L., 20° 32' E.L., Oct. 24th, 1898.

Iris light brown; bill black, with yellow edge above and below, the tip red; feet and webs fleshy grey.

Nos. 9, 10, 14, 15, C, 12 B, ♂ ad. 44° 20' S.L., 68° 28' E.L., Nov. 6, 1898.

No. 17, C, ♀ ad. 44° 23' S.L., 72° 5' E.L., Nov. 7th, 1898.

Nos. 18, 19, C, ♂ ♀ imm. 45° 9' S.L., 77° 13' E.L., Nov. 9th, 1898.

Bill black, the tip yellow.

The younger birds are recognised by their black bill and browner plumage, the whole head and sides of face being leaden grey, and the throat paler grey. There is no trace of the yellow band along the culmen, but a slightly paler appearance at the base of the lower mandible; otherwise the bill is black. In the youngest example there are indications of lighter brown edges to the feathers of the mantle. The white head and throat are only gradually assumed and are evidently the signs of very old birds. In the majority of specimens these parts are of a beautiful dove-grey.

This species is of wide distribution in the Southern oceans. Mr. Hanson records the first capture of the Albatros, with "black-and-yellow bill," on the 24th of October, 1898 (*antea*, p. 81). Two more were caught on the 2nd of November (p. 82), but were apparently not preserved, and on the 6th of the same month four "black-billed" specimens were obtained. This Albatros followed the ship to Tasmania, and is recorded nearly every day in Mr. Hanson's Diary. After leaving Tasmania, it was seen on the 26th of December (*antea*, p. 83) and is again recorded as occurring in the open sea, after the ship emerged from the ice-pack in February (p. 93).

PHŒBETRIA, Reichenb.

PHŒBETRIA FULIGINOSA.

Diomedea fuliginosa, Gm. Syst. Nat. I., p. 568 (1788); Gould, B. Aust., VII., pl. 44 (1848); Salvin, P. Z. S., 1878, p. 740 (Ice Barrier); Sharpe, Phil. Trans. CLXVIII. (extra vol.), p. 148 (1879, Royal Sound, Kerguelen);

Moseley, Notes, Nat. 'Challenger,' pp. 180, 183 (1879, Crozet Islands), p. 254 (margin of the pack ice); Saunders, P. Z. S., 1880, p. 165 (lat. 37° 59' S., long. 29° 18' E.); Sci. Ibis, 1894, p. 498 (edge of pack ice); Hanson in Borchgr. Ant. Cont. App., p. 322 (1901).

Phœbetria fuliginosa, Gould, Handb. B. Austr., II., p. 441 (1865); Coues, Proc. Acad. Nat. Sci., 1866, pp. 186, 188; Gigl., Faun. Vert. Oceano, p. 60 (1870); Baird, Brewer and Ridgw., Water Birds, N. Amer., II., p. 359 (1884); Salvin, Cat. B. Brit. Mus., XXVI., p. 453 (1896); Saunders, Antarctic Manual, p. 230 (1901); Bernacchi, S. Polar Regions, p. 316 (1901).

Diomedea fuliginosa, Borchgrevink, First on Antarctic Cont., pp. 53, 54 (1901). Sooty Albatros, Hanson, *antea*, pp. 82, 83, 93; id. in Borchgr. Ant. Cont. App., p. 324.

No. 7, D, ♂. 42° 23' S.L., 20° 32' E.L., Oct. 24th, 1898.

Iris dark brown; bill black, with a white streak on either side of the lower mandible; feet and webs greyish brown.

No. 23, D, ♀ ad. Nov. 8th, 1898.

Iris dark brown; a blue edge along the under mandible.

No. 24, D, ♂ ad. 45° 9' S.L., 77° 30', Nov. 9th, 1898.

No. 25, D, ♀ ad. 45° 9' S.L., 77° 30', Nov. 10th, 1898.

The Sooty Albatros has also a wide range over the Southern oceans, and extends to the edge of the ice-pack, where a specimen was obtained by the 'Challenger' on the 10th of February, 1874. Mr. Hanson's diary records many observations of the species, and his first specimen was obtained in the Cape seas on the 24th of October, 1898. On the voyage to Tasmania it was seen on the 2nd of November, and thence nearly all the way thither (p. 82). On the 24th and 28th of December the Sooty Albatros was seen on the voyage from Hobart to the ice-pack, but it was last seen on the 30th when nearing the latter, which it did not enter. When the 'Southern Cross' left the ice-pack for its second attempt to penetrate to Cape Adare, this Albatros was observed directly the ship regained the open sea (p. 93).

Mr. Bernacchi (p. 316) states that the Sooty Albatros actually entered the ice-pack, and was occasionally seen during the month of January, 1899, but I think that the *Ossifraga* must have been mistaken for the present species, as it seems almost certain that Hanson would have recorded the fact.

ORDER LARIFORMES.

STERNA, Linn.

1. STERNA VITTATA.

Sterna vittata, Gm., Syst. Nat., I., p. 606 (1788); Pelzeln, Reise Novara, Vög., p. 152 (1865, St. Paul's Island); Saunders, P. Z. S., 1876, p. 647, 1877, p. 795 (Inaccessible Island, Tristan da Cunha); Sharpe, Phil. Trans., CLXVIII. (extra vol.), p. 113 (1879, Kerguelen Island); Saunders, Cat. B. Brit. Mus., XXV., p. 51 (1896); id., Antarctic Manual, p. 233 (1901).

No. 15, ♀ ad. Campbell Island, Oct. 15th, 1899. (*Capt. Jensen.*)

On this species Mr. Howard Saunders gives the following note:—

“There is ample evidence that Terns are found in large numbers in the South Polar Regions, and even within the Antarctic circle, for Bellingshausen, of the Russian ship ‘*Wostok*,’ has recorded Terns on the 18th February, 1820, 68° S., while McCormick saw one in 76° 52' S., and 178° W., said he had previously observed ‘flocks’ on the ice between 65° 66' S., and in about 158° W. On the third attempt of the ‘*Erebus*,’ McCormick noticed Terns breeding on Cockburn Island. Webster found birds of this family in the South Shetlands, and the Dundee whalers brought back specimens from that neighbourhood, which are referable to a well-known South American species, *Sterna hirundinacea*, akin to our own common Tern, though quite distinct. This distribution might be expected, and it may be reasonably assumed that all the Terns found to the southward of America are of this species. But the species found off Victoria Land has still to be identified, and all that can be said is that, inasmuch as the ‘*Southern Cross*’ expedition obtained at Campbell Island an adult of *Sterna vittata*, there is a probability that this species may go as far as Victoria Land.”

2. LARUS SCOPULINUS.

Larus scopulinus, Gray in Dieffenb. Trav. N. Zeal., II. App., p. 200 (1843: New Zealand); Buller, B. N. Zeal., 2nd ed., II. p. 55, pl. XXIX. (1888); Saunders, Cat. B. Brit. Mus., XXV., p. 238 (1896).

No. 1, imm. Campbell Island, May 2nd, 1899. (*Capt. Jensen.*)

Nos. 16, 17, ♂ ♀ ad. Campbell Island, Oct. 16th, 1899. (*Capt. Jensen.*)

Two species of true Gulls occur within the Antarctic area. One of these is the Southern Black-backed Gull (*Larus dominicanus*), which was found by Dr. McCormick breeding on Cockburn Island, and it was also met with by Capt. Fairweather of the 'Balacna' in Lat. 64° 18' S. (cf. Saunders, 'Antarctic Manual,' p. 232). The same observer obtained a specimen of *Larus scoresbii* in Lat. 64° 55' S., in the vicinity of the South Shetland Islands (cf. Saunders, *l.c.*). It was probably *Gabianus pacificus*, which Mr. Hanson noticed off the coast of Tasmania (cf. *antea*, p. 83) as very like *L. marinus*.

MEGALESTRIS, Bp.

1. MEGALESTRIS MACCORMICKI.

(Plate IX.)

- Lestrus**, apparently a new species, McCormick, Voy. Discov. Antarctic, I., p. 154; Possession Islands, off Victoria Land (71° 56' S.L., 171° 15', E.L.)
- Stercorarius antarcticus**, (*nec* Less.), Saunders, P. Z. S., 1876, p. 322; id. Journ. Linn. Soc. Zool., XV., p. 393 (1878).
- Stercorarius maccormicki**, Saunders, Bull., B. O. C., III., p. 12 (Dec. 1893, Possession Islands).
- Megalestris maccormicki**, Saunders, Cat. B. Brit. Mus., XXV., p. 321, pl. 1 (1896); Sharpe, Hand-l. B. I., p. 144 (1899); Saunders, Antarctic Manual, pp. 231, 237 (1901); Bernacchi, S. Polar Regions, pp. 74, 317 (1901); Hanson, *antea*, p. 94, 96, 97, 98.
- Megalestris antarctica** (*nec* Less.), Racovitza, Vie des animaux dans l'Antarctique, p. 39 (1900).
- Skua-Gulls, Borchgrevink, First on Antarctic Cont., pp. 105, 193, 216, 218, 223, 226, 242, 257, 262, 291 (1901); Bernacchi, *l.c.*, pp. 236, 244 (1901); Hanson, *antea*, pp. 89, 94, 95, 96.

No. 3, B, ♂ ad. Pack-ice, 66° 4' S.L., 166° 50' E.L., Jan. 20th, 1899.

Iris dark brown; bill slaty black; feet and webs black. (*N. Hanson.*)

No. 4, 5, B, ♂ ♀ ad. Pack-ice, 66° 34' S.L., 166° 5' E.L., Jan. 26th, 1899. (*N. Hanson.*)

Soft parts as above.

a. b. ♂ ♀ juv. Cape Adare, Feb. 19th, 1899. (*N. Hanson.*)

c. ad. Cape Adare, Oct. 29th, 1899. (*H. B. Evans.*)

d. ♀ ad. Cape Adare, Nov. 6th, 1899. (*H. B. Evans.*)

e. ♂ ad. Cape Adare, Nov. 20th, 1899. (*H. B. Evans.*)

d. ♂ ad. Cape Adare, Nov. 29th, 1899. (*H. B. Evans.*)

e. ♂ pull. Cape Adare, Dec. 29th, 1899. (*H. B. Evans.*)

About three days old.

- f.* ♀ pull. Cape Adare, Jan. 8th, 1900. (*H. B. Evans.*)
g. h. ♂ pull. Cape Adare, Jan. 9th, 1900. (*H. B. Evans.*)
i. k. ♂ ♀ ad. Cape Adare, Jan. 14th, 1900. (*H. B. Evans.*)
l. ♀ juv. Mount Melbourne, Feb. 6th, 1900. (*H. B. Evans.*)

Nestling (about two days old). Covered with greyish-white down, with a pinkish-brown tinge on the interscapular region and on the rudimentary wings.

As the nestling grows older, the brown tinge becomes more prevalent.

The full-grown young birds, killed in February, are much darker than the adults, and are sooty grey, with edgings of lighter sooty grey to the feathers of the upper surface. Two of these young birds have a lighter grey hind neck, and are paler grey below, while the third has no lighter area in the hind neck, and is everywhere darker and somewhat melanistic.

The sign of an old bird is undoubtedly the yellow on the hind neck and throat, and this becomes more and more bleached, like the rest of the plumage.

The eggs of this Skua are plentifully varied in colour. There are at least three distinct types of ground-colour—an olive brown, more or less dark, an olive-grey stone-colour, and a pale green. The latter are not so plentifully spotted as the rest of the series, having faint brown spots and lines, with nearly obsolete underlying spots and blotches of purplish grey. The series measures:—Axis, 2·58–3·09; diameter, 1·86–2·08.

The brown eggs have the underlying marks very distinct, but not so prominent or so dark as the overlying spots and blotches, which take a variety of shapes, and are sometimes confluent near the larger end of the egg, so as to form a large irregular patch. Of this species, Mr. Howard Saunders writes in the 'Antarctic Manual':—

"After the Penguins and some of the Petrels, the most prominent species within the Antarctic circle is a predacious and aggressive Gull, McCormick's Skua, named after its virtual discoverer. It was first obtained at Possession Island, Victoria Land, where a pair had taken up their residence in the midst of a colony of the Adélie Penguins, and subsequently examples were obtained or seen nearly as far south as 78°, while Long. 178° W. was the furthest record in the direction of America. The '*Belgica*' brought back four examples, from lat. 82° and 86° W., in the ice-pack. The '*Southern Cross*' obtained a fine series, from the downy plumage upwards; these young birds being of a dark slaty grey, and very different from those of the

other Great Skuas, of which four representatives are now recognised. The species known as the 'Bonxie,' of the Shetlands, frequenting the North Atlantic, is not known south of the coast of Morocco; but in the Southern Ocean, from the New Zealand area to Heard, Kerguelen, Marion and Crozet Islands, and westward to the Falklands, is found a larger and darker Skua (*Megalestris antarctica*), which seems to breed as far south as the South Shetlands and Cockburn Island, and I have examined a specimen obtained by the Dundee whalers. Some six or seven degrees of latitude separate this dark form from McCormick's Skua, which is a much paler bird, almost dirty straw-colour about



MACCORMICK'S SKUA.

(By permission of Sir George Newnes, Bart.)

the head and neck. The fourth species, *M. chilensis*, has the under parts of a warm chestnut colour. Further specimens of these Southern Skuas, with notes on their geographical distribution, are much wanted, but anything approaching the extermination of a colony is to be deprecated."

This large Skua was observed in large numbers on several occasions by the '*Southern Cross*,' and a great many were shot by Mr. Hanson at Cape Adare, but only two of the skins thus procured were in the collections brought to England, and the series consists principally of skins prepared by Mr. Evans after Mr. Hanson's death.

The first specimen was procured by the latter in the ice-pack on the 20th of January, 1899 (*antea*, p. 89). Two more were obtained on the 26th (p. 90). This Skua was one of the species noticed on landing at Cape Adare on the 17th of February (p. 93), and on the 3rd of March Mr. Hanson shot eighty-two specimens, as the birds were becoming destructive to the stores of Seal and Penguin-meat. As winter approached the Skuas became less plentiful, but fourteen were shot on the 12th of March (p. 94). On the 26th of the month, Mr. Hanson records the finding of two young birds "hardly able to fly," at an altitude of 1,050 feet (p. 95). The species was noticed in diminishing numbers throughout April up to the 20th, when Mr. Hanson's diary mentions that none had been recently seen (p. 98).

Mr. Bull (Cruise of the '*Antarctic*,' p. 182) speaks of the mortality among the Penguins as frightful in Victoria Land, judging by the number of skeletons and dead birds lying about in all directions. At Cape Adare he says, "the raptorial Skua-Gull was present, as everywhere in the neighbourhood of Penguin nurseries, and was busily occupied with its mission in life, viz., the prevention of over-population in the colony."

Mr. Borchgrevink says that the Skuas were in great numbers on the arrival of the Expedition at Cape Adare, but began to get scarce in the middle of March (p. 105). On the 31st of October they returned, and he shot five of them (p. 193). He writes:—"The worst enemy of the Penguin is the Skua-Gull, which constantly soared over their nests, watching for an opportunity when they might steal an egg or catch a young one. As I already observed in 1895, I now also often saw two of these birds attack a Penguin family; whilst one kept the old ones away, the other took the young one" (pp. 215, 216).¹ The Skua-Gulls arrived somewhat later than the Penguins, and their nesting also took place later. They had their nests in the heights, for instance, 1,000 feet up on Cape Adare, amongst the rocks, while a small Skua rookery was also to be found some fifty feet above the peninsula, on a small rocky gallery close to the perpendicular wall of the Cape. Their eggs were of a greyish brown, with dark brown stains. Generally two eggs were found in each nest. The young ones were exceedingly pretty in their fluffy coats of light grey down. The old Skuas were very bold at ordinary times, and attacked us frequently with wings and beak when we climbed the rocks, but when they had young ones their indomitable courage and audacity surpassed that of any other bird of prey I have seen" (p. 218). On November 20th he

¹ See also Mr. Bull's account, *antea*, p. 123.

writes :—" We daily saw fresh proofs of the audacity of the Skua-Gulls. On several occasions they attacked the dogs, and nearly all of us were, on more than one occasion, also attacked by them. They shot down from a great height in the air straight on our heads, hit us with their wings, only to rise again and renew the attack. We killed several of them with short sticks" (p. 223). On November 27th we learn that Mr. Evans (p. 226) "brought in his first Skua-Gull's egg. The colour was light green, brown or grey, with dark brown spots" (!). On the 27th of December, 1899, Mr. Borchgrevink



SKUA-GULL ON NEST.

(By permission of Messrs. Hurst & Blackett.)

says that he caught some very fine specimens of young Skua-Gulls when he went to the top of Cape Adare (p. 242). The species was also observed on Possession Island (p. 257), and again near Mount Melbourne on February 5th on a beach where "there were no Penguins, but a great many Skuas, with nearly full-grown young ones" (p. 262). The note of the bird, according to Mr. Borchgrevink, is a "cruel screech" (p. 291).

Mr. Bernacchi has also several notes on the species. On landing at Cape Adare a great number of Skua-Gulls "seemed to resent our

visit, for they repeatedly darted at our heads, and made a noisy outcry" (p. 74). On the 3rd of February, 1900, some young ones were procured on Possession Island (p. 236). He also writes:—"At nine o'clock in the evening of the 5th of February we landed in a boat on a pebbly beach at the foot of Mount Melbourne. The place upon which we landed was a pebbly bank, even larger in extent than that at Cape Adare, entirely free from snow and 'ponds,' and occupied by Penguins and Skua-Gulls" (p. 244).

Dr. Racovitza's notes on the species as observed by him during



YOUNG SKUA-GULLS IN NEST.

(By permission of Messrs. Hurst & Blackett.)

the voyage of the '*Belgica*' are as follows:—"Among the *Gavia* there was our old friend the Brown Skua-Gull, against whom I have a considerable grudge. One day when I was at the foot of the high cliff on De Cuverville Island, I saw, by the aid of my spy-glass, on a platform in the perpendicular wall, a little tuft which seemed to me not to be formed of moss, but of real grass. It was the first time I had made such an identification, so I felt that I must at all hazards try to reach this little platform and capture this unique specimen of a plant. I laid aside my gun and collecting-bag, and was soon scaling, with the aid of my alpenstock, the wall of the cliff. The

task was not easy; one had to hang on with the tips of the fingers to the rough rocks, or to hoist oneself by the force of one's wrists by sticking the alpenstock into crevices. I was already a great height up, when two of these Skuas began to interest themselves in my affairs. They had made their nest on the top of the cliff, and there were two little nestlings, covered in down, sitting quietly in the nest. The father and mother, evidently believing that I wanted to carry off their progeny, addressed themselves to the task of preventing my upward climb.

"With vigorous strokes of their wings, they threw themselves upon me, and attempted to strike me with their wings and bills. With my left hand gripping a point of rock, one foot resting on a tiny excrescence and the other hanging in the air, I fenced with my stock with all the force of my right arm, glancing all the time at the beautiful bed of pebbles upon which I had the chance of extending myself after a fall of thirty metres, and I vowed that henceforth I would never part with my gun. A few well-directed blows with my stock rid me for a few moments of my enraged aggressors, and I was thus enabled to reach the platform and at last secure the little plant I was in search of. My contest with the Brown Skuas must not prevent my rendering justice to a brave enemy, whom I recognise as the most courageous bird of the Antarctic, the true representative of the Eagle among the birds of the ocean."

MEGALESTRIS ANTARCTICUS.

Lestris antarctica, Less., *Traité d'Orn.*, p. 616 (1831, Falkland Isl.; New Zealand); Gray in *Dieffenb., Trav. N. Zeal.*, II., App., p. 200 (1843): *id.* *Voy. 'Erebus' and 'Terror,'* p. 18 (1846).

Stercorarius antarcticus, Gray, *List B. Brit. Mus. Anseres*, p. 167 (1844, Campbell Isl.); *Gigl. Faun. Vert. Oceano*, p. 61 (1870); Sharpe, *Phil. Trans. CLXVIII.* (extra vol.), p. 109, pl. 7, figs. 1, 2 (1879, Royal Sound and Christmas Harbour, Kerguelen); McCormick, *Voy. Discovery*, I., p. 142, cum tab. (1844, Campbell Isl.); Buller, *B. N. Zeal.*, 2nd ed., p. 63 (1888).

Megalestris antarctica, Saunders, *Cat. B. Brit. Mus.* XXV., p. 321, pl. I. (1826).

No. 18. Campbell Island, Oct. 20th, 1899. (*Capt. Jensen*).

This species is much darker than *M. maccormicki*, and has an extensive range over the islands of the Southern oceans, but does not extend to the Antarctic ice-pack.

ORDER PELECANIFORMES.

PHALACROCORAX, Briss.

PHALACROCORAX CAMPBELLI.

Urile campbelli, Filhol, Bull. Soc. Philom. (2), II., p. 132 (1878, Campbell Isl.).

Phalacrocorax campbelli, Filhol, Mém. Pass. Venus à l'île Campbell, III., pt. II., p. 55 (1885); Ogilvie Grant, Cat. B. Brit. Mus. XXVI., p. 387 (1898).

No. 3, ♀ ad. Campbell Island, May 29th, 1899. (*Capt. Jensen.*)

Nos. 5, 6, ♂ ad. Campbell Island, June 10th, 1899. (*Capt. Jensen.*)

N.B.—Mr. Howard Saunders speaks of Cormorants being found breeding on Deception Island, South Shetlands, and again on Cockburn Island ('Antarctic Man,' p. 234). Dr. Forbes identifies the last-named bird as *Phalacrocorax atriceps* of King [Bull. Liverp. Mus., II., p. 48].

V. PISCES.

BY G. A. BOULENGER, F.R.S.

(Plates XI.-XVIII.)

LEAVING out a few Fishes obtained on the way to the Antarctic region and about New Zealand and Tasmania, as well as a number of others, the decomposed condition of which precluded any attempt at identification, the collection on which this report is based consisted of about 200 specimens, referable to sixteen species, eight of which are new, two belonging to undescribed genera.

CHONDROPTERYGII.**SPINACIDAE.**1. *EUPROTOMICRUS LABORDII*, Q. et G.

A single female specimen from Campbell Island, south of New Zealand. First discovered by Quoy and Gaimard near Mauritius, this very rare little Selachian has since been reported from the Antarctic Ocean, west of Cape Horn (R. O. Cunningham, Proc. Zool. Soc., 1899, p. 732).

TELEOSTEI.**SCOPELIDAE.**2. *SCOPELUS ANTARCTICUS*, Gthr.

A single specimen was obtained on an ice-floe in Robertson Bay.

NOTOTHENIIDAE.

Not long ago,¹ whilst examining the skeletons of the "Trachinoid" Fishes with a view to a more natural arrangement of this

¹ Ann. and Mag. N. H. (7) viii., 1901, p. 261.

artificial group, I came to the conclusion that a valuable character existed in the position of the fenestra at the base of the pectoral fin, situated either in the scapula or between the latter and the coracoid. Although I had myself pointed out the variable position of this fenestra within the limits of a natural family, the *Mormyridae*,¹ I felt justified in assigning to it the importance of a family character in the higher group Acanthopterygians, the more so as various authors² had even regarded it as worthy of defining Sub-orders or Orders. In this, however, I was mistaken; and, after having reduced its importance to that of a family character, I must now abandon its use for anything higher than generic definition.

This result is brought about by the study of the 'Southern Cross' collection. The genus *Notothenia*, the type of the family *Nototheniidae*, is possessed of a pectoral arch similar to that of the *Trachinidae*, *Callionymidae*, and *Gadidae*, i.e. with the scapular fenestra between the scapular and coracoid bones, as I have ascertained on the type species of the genus, *N. coriiceps*, Richards., as well as on all the other species represented in the British Museum. But now, on examining the condition of things in some of the new fishes discovered in Robertson Bay, which, so far as external characters are concerned, do not differ materially from *Notothenia*, I find, to my great surprise, that the fenestra is situated in the scapula, as in the *Leptoscopidae*. It is perfectly clear, therefore, that the value of the character in question has been over-rated, and its claim to anything higher than generic importance is out of the question. Even this might be contested by some systematists, but the facility with which the point may be ascertained, without injury to the specimen, by lifting up the skin and muscles at the base of the pectoral fin, should encourage the use of a character which is after all of importance and may still help in defining family groups other than the very generalised *Nototheniidae*. These differ from the *Trachinidae*, *Percophiidae*, *Parapercididae*, *Leptoscopidae*, and *Uranoscopidae* in having a single nostril instead of the two possessed by most Teleosts. I have attempted, in the following synopsis, to enumerate and define the genera grouped under the *Nototheniidae*. The pectoral arch has not been examined in the genera marked with an asterisk; otherwise all except *Trematomus* conform to the type to which *Notothenia* belongs.

The air-bladder is constantly absent, and every form examined

¹ Poiss. du Bassin du Congo, p. 50 (1901).

² Cope, Trans. Amer. Philos. Soc. (2), xiv., 1871, p. 458. Gill, Proc. Acad. Philad., 1884, p. 170. Jordan and Evermann, Fish. N. Amer., iii., p. 2528 (1898).

by me, including *Bathyl Draco*, has pseudobranchiae. The ventral fins are never close together, as in the *Trachinidae* and *Uranoscopidae*.

I. Gill-membranes free or narrowly attached to the isthmus.

A. Dorsal formed of two portions, which may be united at the base.

1. Two lateral lines, the lower of which may be confined to the caudal region; palate toothless.

a. Body covered with ctenoid scales; teeth in several series; snout not spatulate.

a. Anterior dorsal formed of slender, flexible rays.

Scapular foramen in scapular bone..... *Trematomus*, g. n.

Scapular foramen between scapula and coracoid *Notothenia*, Rich.

B. Anterior dorsal formed of short, pungent spines

Macronotothen, Gill.*

b. Body covered with very small cycloid scales; teeth in a single series; snout not spatulate.....

Dissostichus, Smitt.*

c. Body naked; snout spatulate.

Lateral line with granulated plates *Chaenichthys*, Rich.

Lateral line without plates *Champscephalus*, Gill.

2. Three lateral lines; body naked; snout spatulate; palate toothless

Cryodraco, Dollo.*

3. A single lateral line.

a. Body scaly.

Teeth on vomer and palatines; head armed..... *Centropercis*, Ogilby.*

Teeth on vomer and palatines; opercle with a flat spine... *Pseudaphritis*, Casteln.

Teeth on vomer only; a praeorbital spine..... *Acanthaphritis*, Gthr.

Palate toothless..... *Eleginops*, Gill.

b. Body naked; habit cottoid; opercle strongly armed.....

Bovichthys, C. & V.

B. A single dorsal; snout long and flattened; palate toothless.

1. Two lateral lines.

a. Body naked; opercle armed.

Lateral lines without bony plates *Gymnodraco*, g. n.

Lateral lines with bony plates *Parachaenichthys*, g. n.*¹

b. Body covered with extremely small scales; no opercular spines.....

Gerlachia, Dollo.*

2. Lateral line single; body covered with extremely small scales.

No opercular spines..... *Bathyl Draco*, Gthr.

Opercular spines *Racovitzia*, Dollo.*²

II. Gill-membranes broadly united to the isthmus; habit cottoid; body naked; head armed; palate toothless

Harpagifer, Rich.

The genus *Pagetodus*, Rich., rests on an insufficient description and figure.

¹ Based on *Chaenichthys georgianus*, Fischer, from South Georgia Island.

² The distinctive characters of these genera have unfortunately been inverted in the synopsis given in Ann. and Mag. N. H. (7) viii. 1901, p. 266.

TREMATOMUS, gen. n.

Differing from *Notothenia* in the scapular fenestra being pierced in the scapula instead of between the latter and the coracoid.

Synopsis of the Species.

- I. Interorbital width 3 to $3\frac{1}{2}$ times in length of head; lower jaw projecting beyond upper; gill-rakers 18 to 20 on lower part of anterior arch.
 D. VI-VIII, 32-36; A. 32-33; Sq. 90-100 $\frac{7-8}{30-31}$; lateral lines strongly marked, tubular..... 1. *newnesi*, sp. n.
 D. V-VI, 34-37; A. 31-33; Sq. 97-110; lateral lines ill-defined..... 2. *borchgreviniki*, sp. n.
- II. Interorbital width $4\frac{1}{3}$ to $5\frac{1}{2}$ times in length of head; lower jaw not projecting beyond upper; gill-rakers 12 to 15 on lower part of anterior arch.
 D. V-VII (usually VI), 38-41; A. 34-35; Sq. 65-75 $\frac{5-6}{20-24}$; interorbital region scaly..... 3. *hansoni*, sp. n.
 D. IV-VI (usually V), 35-38; A. 32-35; Sq. 66-80 $\frac{5-6}{20-25}$; interorbital region naked or with a few scales..... 4. *bernacchii*, sp. n.

As regards the skeleton, which I have been able to examine in the four species, the characters are essentially the same, except that the ossification is stronger, and the skull more massive, in the species of Group I. than in those of Group II. The parapophyses begin on the second or third vertebrae and soon become very strong; they bear the rib and the epipleural, which are inserted close together. Number of vertebrae:—

<i>T. newnesi.</i>	20 + 34 = 54
<i>T. borchgreviniki.</i>	20 + 32 = 52
<i>T. hansoni.</i>	21 + 35 = 56
<i>T. bernacchii.</i>	17 + 35 = 52

3. **TREMATOMUS NEWNESI**, sp. n.

(PLATE XI.)

Depth of body 4 to $4\frac{2}{3}$ times in total length, length of head $3\frac{1}{2}$ to 4 times. Diameter of eye 3 (young) to 4 times in length of head, interorbital width 3 to $3\frac{1}{2}$ times; maxillary extending to below centre or posterior third of eye; lower jaw projecting beyond the upper; upper surface of head naked; cheek and opercle densely scaled. Gill-rakers long and slender, 18 to 20 on lower part of anterior arch. Dorsal VI-VIII,¹ 32-36; longest rays $\frac{2}{3}$ to $\frac{1}{2}$ length of head. Anal 32-35; longest rays $\frac{1}{3}$ length of head. Pectoral

¹ Out of 70 specimens, 48 have VII, 19 have VIII, and 3 have VI.

truncate behind, a little shorter than head, reaching beyond origin of anal. Ventral $\frac{2}{3}$ to $\frac{3}{4}$ length of head. Caudal rounded. Caudal peduncle as long as deep. Scales 87-100 $\frac{7-8}{28-30}$; lateral line $\frac{41-52}{3-17}$. Dark olive, uniform or with darker spots or marblings; anterior dorsal blackish, other fins greyish, often with small black spots.

Total length, 190 mm.

Forty-seven specimens found about Duke of York Island, at a depth of 3 to 5 fathoms, and 23 from Cape Adare, 4 to 8 fathoms.

Measurements and numbers of fin-rays and scales of some of the specimens¹:—

	1	2	3	4	5	6	7	8	9	10	11
Duke of York Island	190	VII	33	33	4 $\frac{1}{2}$	3 $\frac{2}{3}$	4	3 $\frac{1}{2}$	93	$\frac{7}{30}$	$\frac{43}{14}$
" " "	190	VIII	32	32	4 $\frac{1}{2}$	3 $\frac{2}{3}$	3 $\frac{3}{4}$	3 $\frac{1}{3}$	92	$\frac{8}{30}$	$\frac{46}{12}$
" " "	180	VII	36	35	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{3}$	100	$\frac{7}{20}$	$\frac{49}{16}$
" " "	180	VIII	34	32	4 $\frac{1}{3}$	3 $\frac{2}{3}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	98	$\frac{8}{20}$	$\frac{45}{6}$
" " "	180	VII	34	32	4 $\frac{1}{4}$	3 $\frac{1}{2}$	3 $\frac{3}{4}$	3 $\frac{1}{3}$	94	$\frac{7}{22}$	$\frac{42}{4}$
" " "	170	VII	34	32	4	3 $\frac{1}{2}$	3 $\frac{2}{3}$	3 $\frac{1}{3}$	88	$\frac{8}{30}$	$\frac{43}{8}$
" " "	170	VI	36	34	4 $\frac{1}{2}$	4	3 $\frac{2}{3}$	3 $\frac{1}{3}$	95	$\frac{8}{30}$	$\frac{52}{15}$
" " "	170	VII	35	32	4	3 $\frac{2}{3}$	4	3	90	$\frac{8}{28}$	$\frac{47}{16}$
" " "	170	VII	34	33	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{4}$	93	$\frac{7}{20}$	$\frac{46}{8}$
" " "	170	VII	34	32	4 $\frac{1}{2}$	3 $\frac{3}{4}$	3 $\frac{1}{2}$	3 $\frac{1}{3}$	92	$\frac{7}{30}$	$\frac{44}{3}$
" " "	170	VII	34	33	4 $\frac{1}{2}$	3 $\frac{2}{3}$	3 $\frac{1}{2}$	3 $\frac{1}{4}$	87	$\frac{7}{28}$	$\frac{43}{13}$
" " "	165	VII	36	34	4 $\frac{1}{2}$	3 $\frac{2}{3}$	3 $\frac{1}{2}$	3 $\frac{1}{4}$	95	$\frac{7}{20}$	$\frac{47}{17}$
" " "	165	VIII	35	32	4 $\frac{2}{5}$	3 $\frac{2}{5}$	4	3 $\frac{1}{2}$	95	$\frac{8}{32}$	$\frac{47}{2}$
" " "	155	VIII	34	34	4 $\frac{1}{3}$	3 $\frac{1}{3}$	3 $\frac{1}{2}$	3 $\frac{1}{3}$	90	$\frac{8}{31}$	$\frac{45}{14}$
" " "	150	VIII	35	34	4 $\frac{1}{2}$	3 $\frac{4}{5}$	3 $\frac{1}{2}$	3 $\frac{1}{4}$	90	$\frac{7}{30}$	$\frac{47}{5}$
" " "	140	VII	36	33	4 $\frac{2}{3}$	3 $\frac{2}{3}$	3 $\frac{1}{4}$	3 $\frac{1}{2}$	89	$\frac{7}{28}$	$\frac{46}{14}$
" " "	135	VII	35	35	4 $\frac{2}{3}$	3 $\frac{2}{3}$	3	3 $\frac{1}{2}$	100	$\frac{8}{28}$	$\frac{47}{5}$
Cape Adare	115	VII	35	33	4 $\frac{2}{3}$	3 $\frac{1}{2}$	3	3 $\frac{1}{2}$	98	$\frac{8}{28}$	$\frac{49}{9}$
" " "	90	VIII	35	33	4 $\frac{2}{3}$	3 $\frac{1}{2}$	3	3 $\frac{1}{2}$	95	$\frac{7}{30}$	$\frac{45}{9}$

¹ This and the following tables read thus:—1. Total length (in millimetres). 2. Rays in anterior dorsal. 3. Rays in second dorsal. 4. Rays in anal. 5. Depth of body in total length. 6. Length of head in total length. 7. Diameter of eye in length of head. 8. Interorbital width in length of head. 9. Scales in a longitudinal series (above upper lateral line). 10. Scales in a transverse series. 11. Tubular scales in the lateral lines.

5. TREMATOMUS HANSONI, sp. n.

(PLATE XIII.)

Depth of body $3\frac{1}{2}$ to $4\frac{1}{2}$ times in total length, length of head $3\frac{1}{2}$ to 4 times. Diameter of eye $3\frac{2}{3}$ to 4 times in length of head, interorbital width $4\frac{1}{3}$ to 5 times; maxillary extending to below anterior third or centre of eye; lower jaw not projecting beyond the upper; cheek, opercle, occiput, and interorbital region densely scaled; openings of sensory canals on head large. Gill-rakers short, 13 to 15 on lower part of anterior arch. Dorsal V-VII,¹ 38-41; longest rays about $\frac{1}{2}$ length of head. Anal 34-35; longest rays about $\frac{1}{3}$ length of head. Pectoral rounded, a little shorter than head, reaching beyond origin of anal. Ventral $\frac{2}{3}$ to $\frac{3}{4}$ length of head. Caudal rounded. Caudal peduncle as long as deep. Scales 65-75 $\frac{5-6}{20-24}$; upper lateral line 38-44, lower usually formed of a series of pits, or reduced to a few tubular scales. Brownish, lighter beneath, with large dark spots or marblings or more or less regular cross-bands; fins greyish, dorsals, pectorals, and caudal usually with more or less distinct darker bars.

Total length, 280 mm.

Seventeen specimens from Cape Adare, 4 to 8 fathoms, and 1 from Duke of York Island, 3 to 4 fathoms.

Measurements and numbers of fin-rays and scales of some of the specimens:—

	1	2	3	4	5	6	7	8	9	10	11
Cape Adare	280	VI	39	34	4	$3\frac{1}{2}$	4	5	70	$\frac{6}{2\frac{1}{2}}$	40
" "	270	VI	39	35	$3\frac{1}{2}$	$3\frac{2}{3}$	4	5	75	$\frac{6}{2\frac{1}{4}}$	43
" "	265	VI	41	35	$3\frac{2}{3}$	$3\frac{2}{3}$	4	5	67	$\frac{6}{2\frac{1}{4}}$	41
" "	250	VII	38	34	$3\frac{2}{3}$	$3\frac{2}{3}$	4	5	65	$\frac{6}{2\frac{1}{4}}$	42
" "	250	VI	40	35	$4\frac{1}{4}$	4	4	5	71	$\frac{6}{2\frac{1}{2}}$	39
" "	220	VI	40	35	$4\frac{1}{2}$	$3\frac{2}{3}$	4	$4\frac{1}{2}$	73	$\frac{6}{2\frac{1}{2}}$	45
" "	210	V	40	35	$4\frac{1}{4}$	$3\frac{2}{3}$	4	5	70	$\frac{6}{2\frac{1}{2}}$	39
" "	205	VI	40	35	4	$3\frac{2}{3}$	4	5	65	$\frac{6}{2\frac{1}{2}}$	40
" "	205	VI	40	35	4	$3\frac{2}{3}$	$3\frac{3}{4}$	5	65	$\frac{6}{2\frac{1}{2}}$	38
" "	195	VI	40	35	$4\frac{1}{3}$	$3\frac{2}{3}$	$3\frac{3}{4}$	5	70	$\frac{6}{2\frac{1}{2}}$	44
" "	190	VI	39	35	$4\frac{1}{4}$	$3\frac{2}{3}$	4	5	68	$\frac{6}{2\frac{1}{2}}$	40
" "	190	VI	39	35	$4\frac{1}{4}$	4	4	$4\frac{2}{3}$	68	$\frac{6}{2\frac{1}{2}}$	39
" "	165	VI	38	35	$4\frac{1}{3}$	$3\frac{1}{3}$	$3\frac{2}{3}$	5	65	$\frac{6}{2\frac{1}{2}}$	42
" "	160	VI	39	34	$4\frac{1}{3}$	$3\frac{2}{3}$	$4\frac{1}{2}$	5	66	$\frac{6}{2\frac{1}{2}}$	40
Duke of York Island . .	175	VI	39	34	$4\frac{1}{2}$	$3\frac{2}{3}$	$3\frac{3}{4}$	5	70	$\frac{6}{2\frac{1}{4}}$	42

¹ Usually VI; of the 18 specimens examined, only one has five rays, and one seven.

6. TREMATOMUS BERNACCHII, sp. n.

(PLATE XIV.)

Depth of body $3\frac{1}{3}$ to 4 times in total length, length of head $3\frac{1}{2}$ to 4 times. Diameter of eye $3\frac{1}{2}$ to 4 times in length of head, interorbital width 5 to $5\frac{1}{2}$ times; maxillary extending to below anterior third or centre of eye; lower jaw not projecting beyond the upper; cheek, opercle, and occiput densely scaled; interorbital region naked or with a few scales; openings of sensory canals on head large. Gill-rakers short, 13 to 15 on lower part of anterior arch. Dorsal IV-VI,¹ 35-38; longest rays about $\frac{1}{2}$ length of head. Anal 32-35; longest rays about $\frac{1}{3}$ length of head. Pectoral rounded, $\frac{2}{3}$ length of head, reaching origin of anal or a little beyond. Ventral $\frac{3}{4}$ to $\frac{5}{6}$ length of head. Caudal rounded. Caudal peduncle deeper than long. Scales 66-80 $\frac{5-6}{20-25}$; upper lateral line 31-40, lower usually formed of a series of pits or reduced to a few tubular scales. Brownish, lighter beneath, with large dark spots, usually forming two or three alternating series on the side; fins grey, upper half of anterior dorsal black or blackish.

Total length, 250 mm.

Thirty-nine specimens from Cape Adare, 5 to 8 fathoms, and 5 from Duke of York Island, 3 to 4 fathoms.

Measurements and numbers of fin-rays and scales in some of the specimens:—

	1	2	3	4	5	6	7	8	9	10	11
Cape Adare	250	V	36	33	$3\frac{3}{4}$	$3\frac{3}{4}$	4	$5\frac{1}{2}$	72	$\frac{6}{23}$	36
"	230	V	38	33	$3\frac{1}{3}$	$3\frac{1}{3}$	4	$5\frac{1}{2}$	68	$\frac{6}{22}$	36
"	230	V	35	35	$3\frac{2}{3}$	$3\frac{2}{3}$	4	5	75	$\frac{6}{25}$	40
"	220	V	37	34	$3\frac{1}{3}$	$3\frac{1}{3}$	4	$5\frac{1}{2}$	77	$\frac{6}{24}$	37
"	220	V	35	33	$3\frac{2}{3}$	$3\frac{2}{3}$	4	5	75	$\frac{6}{25}$	32
"	220	V	36	33	$3\frac{1}{3}$	$3\frac{1}{3}$	4	5	68	$\frac{6}{23}$	35
"	220	IV	37	35	$3\frac{2}{3}$	$3\frac{2}{3}$	4	$5\frac{1}{2}$	80	$\frac{6}{24}$	37
"	215	V	35	33	$3\frac{1}{3}$	$3\frac{1}{3}$	4	$5\frac{1}{2}$	72	$\frac{6}{23}$	35
"	200	V	38	33	4	$3\frac{1}{3}$	4	5	73	$\frac{5}{21}$	35
"	200	VI	36	33	4	$3\frac{1}{3}$	$3\frac{1}{3}$	5	74	$\frac{6}{20}$	36
"	185	V	35	35	4	$3\frac{2}{3}$	4	$5\frac{1}{2}$	77	$\frac{6}{24}$	31
"	180	IV	37	34	$3\frac{1}{3}$	$3\frac{1}{3}$	4	5	70	$\frac{6}{24}$	35
"	180	V	36	34	$3\frac{2}{3}$	$3\frac{2}{3}$	$3\frac{2}{3}$	$5\frac{1}{2}$	76	$\frac{6}{25}$	35
"	170	V	36	34	4	$3\frac{1}{3}$	$3\frac{1}{3}$	$5\frac{1}{2}$	67	$\frac{6}{21}$	35
"	165	V	38	32	4	$3\frac{2}{3}$	$3\frac{2}{3}$	$5\frac{1}{2}$	77	$\frac{6}{20}$	35
Duke of York Island	230	V	37	32	4	$3\frac{1}{3}$	$3\frac{1}{3}$	5	70	$\frac{6}{21}$	34
"	185	V	35	33	4	$3\frac{1}{3}$	$3\frac{1}{3}$	$5\frac{1}{2}$	68	$\frac{6}{20}$	31
"	180	V	38	32	$3\frac{1}{2}$	$3\frac{1}{3}$	$3\frac{1}{3}$	$5\frac{1}{2}$	75	$\frac{6}{23}$	35
"	170	V	38	35	4	$3\frac{3}{4}$	$3\frac{3}{4}$	$5\frac{1}{2}$	66	$\frac{6}{20}$	33
"	120	V	35	32	4	$3\frac{1}{2}$	$3\frac{1}{2}$	$5\frac{1}{2}$	79	$\frac{6}{22}$	35

¹ Usually V.

NOTOTHENIA, Richardson.

The identification of the fishes of this Peri-Antarctic genus is beset with great difficulties, in the absence of a general account of them, and this deficiency has resulted in the description of a good number of purely nominal species. An attempt to reduce the number of species described from the Fuegian district has recently been made by Professor Smitt,¹ but a careful examination of the large material in the British Museum has failed to convince me of the soundness of his conclusions. In no species do I find the number of rays in the anterior dorsal varying as much as from 4 to 7, as Professor Smitt believes, nor does the size of the eye prove to be an unreliable character, provided the comparison be made of similar-sized specimens; and the width of the interorbital region, compared to the length of the head, is still more important as not varying with age. Autopsy of a number of individuals among the material at hand has satisfied me that sexual dimorphism does not account for the differences in the proportions of the parts of the head which has been ascribed to it. In his endeavour to settle questions of species by means of elaborate tables of measurements, the Professor appears to have lost sight of many really important specific characters, and I consider his contribution as a misleading guide to the study of this difficult group. My conclusions are embodied in the following synopsis of the species, concerning which I wish to point out that I have myself counted, with the greatest care, the fin-rays and scales in nearly all the specimens at my command. Except for the definition of *N. canina* and *N. filholi*, which are only known to me from the descriptions, all the characters are taken from specimens in the British Museum.

The length of the head is measured to the extremity of the opercular bone. The scales in a longitudinal series are counted above the lateral line, from the origin of the latter to the end of the muscular part of the tail; those in the transverse series are counted from the middle of the anterior dorsal to the lateral line, and from the latter to the mid-ventral line, some distance in front of the vent. The lateral line, in these fishes, consists partly of tubules and partly of more or less distinct impressions or pits; only the tubular scales are counted. For the purpose of uniformity, the scales have been almost invariably counted on the left side of the specimens.

¹ Bih. Vet. Ak. Handl., xxiii, iv., 1897, No. 3.

Synopsis of the Species.

I. Anal with 28 to 35 rays.

A. Interorbital width $3\frac{2}{3}$ to 6 times in length of head.

1. Six or seven rays to anterior dorsal; interorbital region and occiput scaly.

- D. 33-34; A. 31-33; Sq. 75-86 $\frac{6-7}{20-23}$; ventral fin $\frac{3}{5}$ length of head..... 1. *tessellata*, Rich.¹
 D. 32-33; A. 30-31; Sq. 68-71 $\frac{5-6}{18-19}$; ventral fin $\frac{3}{5}$ length of head; very strong canine teeth 2. *canina*, Smitt.
 D. 28-30; A. 28-30; Sq. 50-52 $\frac{4}{14-16}$; ventral fin $\frac{3}{4}$ length of head..... 3. *sima*, Rich.²

2. Five or six rays to the anterior dorsal; interorbital region and occiput naked.

- D. 32-38; A. 28-31; Sq. 67-90 $\frac{7-10}{20-28}$; cheek entirely or partially naked 4. *coriiceps*, Rich.³
 D. 36; A. 33; Sq. 87 $\frac{8}{28}$; cheek densely scaled..... 5. *cyaneobranchia*, Rich.

B. Interorbital width 7 to 8 times in length of head.

1. Sq. 48-54 $\frac{3-5}{13-14}$; A. 28-31.

- D. VI-VII, 29; ventral $\frac{2}{3}$ length of head; interorbital region scaly..... 6. *marionensis*, Gthr.⁴
 D. VI, 33-35; ventral nearly as long as head; interorbital region naked 7. *elegans*, Gthr.

2. Sq. 66-77 $\frac{5-8}{23-24}$; A. 31-33.

- D. V-VI, 35-37; ventral $\frac{3}{4}$ to $\frac{4}{5}$ length of head; interorbital region scaly..... 8. *longipes*, Stdr.⁵
 D. IV, 37; ventral $\frac{2}{3}$ to $\frac{3}{4}$ length of head; interorbital region naked 9. *nicolai*, sp. n.

C. Interorbital width 10 to 11 times in length of head; interorbital region scaly.

- D. IV-V, 35-37; A. 33-35; Sq. 59-66 $\frac{5}{16-17}$; ventral as long as or a little shorter than head..... 10. *mizops*, Gthr.
 D. VI, 30; A. 32; Sq. 68 $\frac{7}{22}$; ventral $\frac{3}{4}$ length of head..... 11. *acuta*, Gthr.

II. Anal with 23 to 25 rays.

A. Interorbital width 3 to $3\frac{1}{2}$ times in length of head.

- D. VII-VIII, 26-27; Sq. 100-112 $\frac{12-13}{32-37}$; gill-rakers 15 or 16 on lower part of anterior arch; caudal emarginate..... 12. *colbecki*, sp. n.

¹ *N. veitchii*, Gthr., 1874.² *N. squamiceps*, Ptrs. 1876. *N. cornucola*, f. *squamifrons*, Smitt, 1897.³ *N. purpuriceps*, Rich., 1844. *N. cornucola*, Rich., 1844. *N. virgata*, Rich., 1845. *N. marginata*, Rich., 1845. *N. cornucola*, ff. *calva* et *intermedia*, Smitt, 1897. *N. modesta*, Stdr., 1898.⁴ *N. angustifrons*, Fischer, 1885.⁵ *N. squamifrons*, Gthr., 1880. *N. tessellata*, f. *megalops*, Smitt, 1897.

D. VI, 28-29; Sq. 65-68 $\frac{8-9}{23-25}$; gill-rakers 10 to 12; caudal rounded 13. *microlepidota*, Hutt.¹

B. Interorbital width $2\frac{2}{3}$ to $2\frac{1}{2}$ in length of head.

D. IV, 29-30; Sq. 58-62 $\frac{7-8}{21-24}$; gill-rakers 10 or 11; caudal truncate or slightly emarginate 14. *macrocephala*, Gthr.²

III. Anal with 18 to 20 rays.

D. VII, 24-25; Sq. 100-110; head scaly above 15. *filholi*, Sauv.

Notothenia phocae, Rich., and *N. magellanica*, Forst., have not been identified.

7. NOTOTHENIA NICOLAI, sp. n.

(PLATE XV.)

Depth of body nearly 4 times in total length, length of head $3\frac{1}{3}$ to $3\frac{1}{2}$ times. Diameter of eye 3 times in length of head, interorbital width 7 to 8 times; maxillary extending to below anterior fourth or anterior third of eye; lower jaw projecting beyond the upper; upper surface of head naked; cheek and opercle densely scaled. Gill-rakers rather short, 11 or 12 on lower part of anterior arch. Dorsal IV, 35-37; longest rays $\frac{1}{2}$ length of head. Anal 31-33; longest rays $\frac{1}{3}$ length of head, Pectoral rounded, a little shorter than head, reaching beyond origin of anal. Ventral $\frac{2}{3}$ to $\frac{3}{4}$ length of head. Caudal rounded. Caudal peduncle nearly as long as deep. Scales 69-77 $\frac{7-8}{23-24}$; lateral line $\frac{39-43}{8-18}$. Olive-brown, with more or less distinct cross-bars, and with or without small black spots; fins dark brown, anterior dorsal black.

Total length, 230 mm.

This new species, named in memory of Nicolai Hanson, is represented by four specimens from Cape Adare, at a depth of 5 to 8 fathoms, and one from Duke of York Island, 4 fathoms. Measurements and numbers of fin-rays and scales in these specimens are here given.

	1	2	3	4	5	6	7	8	9	10	11
Cape Adare	230	IV	37	33	4	$3\frac{3}{4}$	3	7	70	$\frac{7}{24}$	$\frac{39}{18}$
" "	190	IV	35	32	4	$3\frac{3}{4}$	3	$7\frac{1}{2}$	76	$\frac{7}{24}$	$\frac{40}{15}$
" "	160	IV	37	32	4	$3\frac{3}{4}$	3	7	69	$\frac{7}{23}$	$\frac{42}{15}$
" "	145	IV	37	32	4	$3\frac{3}{4}$	3	7	70	$\frac{7}{23}$	$\frac{43}{12}$
Duke of York Island . .	160	IV	37	31	4	$3\frac{3}{4}$	3	8	77	$\frac{8}{23}$	$\frac{41}{8}$

¹ *N. parva*, Hutt., 1879.

² *N. maoriensis*, Haast, 1873. *N. angustata*, Hutt., 1875. *N. hassleriana*, Sldr., 1875. *N. antarctica*, Ptrs., 1876. *N. arguta*, Hutt., 1879. *N. marmorata*, Fischer, 1885.

8. NOTOTHENIA CORIICEPS, Rich.

Robertson Bay, 5 to 7 fathoms.

9. NOTOTHENIA COLBECKI, sp. n.

(PLATE XVI.)

Depth of body 4 to 5 times in total length, length of head $3\frac{1}{3}$ to $3\frac{2}{5}$ times. Diameter of eye 4 (young) to 6 times in length of head, interorbital width 3 to $3\frac{1}{2}$ times; maxillary extending to below anterior third or centre of eye; lower jaw projecting beyond the upper; head smooth or papillose, granulate, only the upper part of the cheek and opercle being scaly. Gill-rakers rather short, 15 or 16 on lower part of anterior arch. Dorsal VII–VIII, 26–27; longest rays about $\frac{2}{3}$ length of head. Anal 23–24; longest rays about $\frac{1}{3}$ length of head. Pectoral rounded, $\frac{2}{3}$ length of head, not reaching beyond origin of anal. Ventral about $\frac{1}{2}$ length of head. Caudal emarginate. Caudal peduncle longer than deep. Dark olive above, yellowish beneath; fins dark brown, dorsal, anal and caudal tipped with yellowish.

Total length, 380 mm.

Twelve specimens from Campbell Island, south of New Zealand.

Measurements and number of rays and scales of some of the specimens:—

	1	2	3	4	5	6	7	8	9	10	11
Campbell Island . . .	380	VII	27	23	4	$3\frac{3}{5}$	6	3	106	$\frac{12}{37}$	$\frac{52}{32}$
" " . . .	230	VII	27	23	$4\frac{2}{3}$	$3\frac{1}{2}$	5	3	100	$\frac{12}{34}$	$\frac{70}{32}$
" " . . .	130	VIII	27	23	$4\frac{1}{2}$	$3\frac{1}{2}$	5	3	112	$\frac{13}{32}$	$\frac{65}{26}$
" " . . .	120	VII	26	24	$4\frac{1}{2}$	$3\frac{1}{3}$	$4\frac{2}{3}$	$3\frac{1}{2}$	105	$\frac{12}{32}$	$\frac{71}{31}$
" " . . .	85	VII	26	24	5	$3\frac{1}{5}$	4	$3\frac{1}{2}$	112	$\frac{12}{35}$	$\frac{94}{30}$

10. NOTOTHENIA MICROLEPIDOTA, Hutton.

Auckland and Campbell Islands. This species grows to a length of 400 mm.; and the very massive adults have quite a cottoid physiognomy.

11. NOTOTHENIA MACROCEPHALA, Gthr.

Campbell Island.

BOVICHTHYS, Cuv. et Val.

12. BOVICHTHYS VARIEGATUS, Rich.

Several specimens from Campbell Island.

GYMNODRACO, gen. n.

Body elongate, depressed in front, compressed behind, naked; two lateral lines. Snout flattened, much produced; mouth large, jaws with a single series of closely-set, curved compressed teeth, and with very large canines anteriorly, those of the mandible exposed in front of the snout; palate toothless. Gill-cover with two spines, the upper very strong and with a hooked branch. Gill-membrane narrowly attached to isthmus; branchiostegal rays 6. A single, long dorsal fin, formed of articulated rays; a similar anal fin.

Scapular fenestra between the scapula and the coracoid. Vertebrae 20 + 28; ribs and epipleurals very slender, inserted behind well-developed parapophyses on the praesacral vertebrae.

13. GYMNODRACO ACUTICEPS, sp. n.

(PLATE XVII.)

Depth of body 8 to 9 times in total length, length of head 3 to 3 $\frac{1}{4}$. Head strongly depressed, twice as long as broad; snout acutely pointed, as long as postocular part of head; nostril rather large, not tubular, nearer the eye than the end of the snout; interorbital region broad and slightly concave; diameter of eye 5 times in length of head, equal to interorbital width; maxillary extending to below anterior border of eye; lower jaw strongly projecting beyond the snout, which is overlapped by the very strong backwardly directed canine teeth with which the symphysis is furnished; the anterior canine teeth of the praemaxillaries directed forward, the posterior stronger and directed backward; opercle armed with a very strong, flat spine, with an upper hooked branch as in *Harpagifer*; subopercle with a small spine. Dorsal 28-30, originating a little in advance of

the vent, its length nearly twice its distance from the head; longest rays $\frac{1}{3}$ to $\frac{1}{4}$ length of head. Anal 24-26, originating below sixth or seventh ray of dorsal; rays nearly as long as dorsals. Pectoral rounded, subtruncate behind, $\frac{1}{2}$ to $\frac{3}{5}$ length of head, not reaching vent. Ventral a little shorter than pectoral. Caudal truncate. Caudal peduncle $1\frac{1}{4}$ to $1\frac{2}{3}$ as long as deep. Lateral lines appearing as tubes or pits in a series of small scales embedded in the skin; the upper extends from the gill-opening to about the vertical of the origin of the dorsal, the lower from below the extremity of the upper to the root of the caudal fin, running along the middle of the caudal region. Brownish olive, belly whitish; more or less distinct irregular dark brown spots on the head, back, and sides of the caudal region; fins greyish.

Total length, 300 mm.

Five specimens were obtained at Cape Adare, in 4 to 8 fathoms, in April and November, 1899.

This curious fish has been noticed by Bernacchi, 'To the South Polar Regions,' p. 209, and a photograph of it is given in Borchgrevink's book, p. 113, middle figure.

LEPTOSCOPIDAE.

PLEURAGRAMMA, gen. n.

Body rather elongate, compressed, covered with large, thin, cycloid scales; lateral line absent. Snout flattened, but not spatulate; mouth large, with bands of villiform teeth; a pair of canines at the premaxillary symphysis; lateral mandibular teeth in a single series, unequal in size; palate toothless. Opercle ending in a point; no spines on the head. Gill-membrane free; pseudobranchiae present; branchiostegal rays six. Two distinct dorsal fins, the first short and formed of slender simple rays, the second, as well as the anal, long. Skeleton feebly ossified; suborbital chain very slender; scapular fenestra in the scapula; vertebrae 19 + 34, praecaudals without parapophyses.

14. PLEURAGRAMMA ANTARCTICUM, sp. n.

(PLATE XVIII.)

Depth of body about 5 times in total length, length of head $3\frac{1}{2}$ times. Snout flattened above, with feeble bony ridges, nearly as long as the eye, the diameter of which is contained 3 or $3\frac{1}{4}$ times in length

of head ; interorbital region flat, with a feeble median ridge, its width $4\frac{1}{2}$ times in length of head ; maxillary extending to below anterior third or centre of eye ; lower jaw projecting beyond the lower, with a symphysial knob ; upper surface of head naked ; large thin scales on opercle. Gill-rakers long and slender, 23 to 25 on lower part of anterior arch. Dorsal VI, 37-40 ; the anterior rays of the first division longer than those of the second. Anal 30-34. Pectoral scarcely longer than ventral, about $\frac{3}{5}$ length of head. Caudal emarginate. Scales 45 or 46 in a longitudinal series, 12 in a transverse series. Silvery, brownish on the back, speckled with blackish.

Total length, 165 mm.

This description is based on several specimens, in very bad state of preservation and falling to pieces, obtained on the ice barrier at $78^{\circ}35'$ S. lat., the farthest point at which fishes have yet been obtained in the Antarctic region. Owing to the condition of the specimens, the figure here given of the entire fish must be regarded as, to some extent, a restoration, which I believe, however, to be correct.

BLENNIIDAE.

15. TRIPTERYGIUM VARIUM, Bl. Schn.

Auckland Island, 5 fathoms.

PLEURONECTIDAE.

16. RHOMBOSOLEA TAPIRINA, Gthr.

Campbell Island.

EXPLANATION OF PLATES.

PLATE XI.

Trematomus newnesi (p. 177), with upper view of head and side view of skull.

PLATE XII.

Trematomus borchgrevinki (p. 179), with upper view of head and side view of skull.

PLATE XIII.

Trematomus hansonii (p. 180), with upper view of head and side view of skull.

PLATE XIV.

Trematomus bernacchii (p. 181), with upper view of head and side view of skull.

PLATE XV.

Notothenia nicolai (p. 184), with upper view of head.

PLATE XVI.

Notothenia colbecki (p. 185), adult, reduced to $\frac{1}{3}$ with upper view of head, and young, natural size.

PLATE XVII.

Gymnodraco acuticeps (p. 186).

PLATE XVIII.

Pleuragramma antarcticum (p. 187).

VI. TUNICATA.

By W. A. HERDMAN, D.Sc., F.R.S.

(Plates XIX-XXIII.)

THIS collection does not contain many species, but some of the specimens are of very large size. Unfortunately some of them are in very bad condition, and none are really well preserved. Even when refinements of killing and fixing are impossible it should be easy for all collectors of Tunicata to make simple incisions through the test into the interior of the animal—whether it be a simple Ascidian or a colony—before dropping the specimen into alcohol, and that makes a very great difference in the condition of the internal organs after preservation. However, in some of the present cases, from the ragged appearance and the broken-down condition even at the surface of the animal, I am inclined to think that no precautions and care would have availed, as the specimens were probably dead and decomposing colonies when collected.

Although our knowledge of the Antarctic Tunicate fauna is very limited, still we know that the Southern seas generally have a rich Tunicate fauna. Quoy and Gaimard long ago remarked, “La Nouvelle-Hollande, dans sa partie sud, et la Nouvelle-Zélande, sont les lieux de prédilection des Ascidiées en général;” and the Australian fauna includes over 180 known species of Ascidians, a greater number than that known from the shores of North-West Europe, a corresponding coastal area in the northern hemisphere, and the one that has probably been most exhaustively worked up. The south coast of Australia is in about 40° south latitude. Whether species remain as abundant as we go still further south we do not yet know; but on the shores of Kerguelen Island (about 50° south latitude) and in the Straits of Magellan (about 55° south latitude), not only are species of Ascidians numerous, but they abound in individuals, and moreover are, as a general rule, of large size. Between latitudes 40° and 55° S. the ‘*Challenger*’ obtained twenty-eight species of simple Ascidians and thirty-nine species of compound. At far southern stations such large and remarkable forms as *Asciusia challengerii*,

A. placenta and *A. meridionalis*, *Corynascidia suhmi*, *Abyssascidia vasculosa*, *Eugyra kerguelensis*, *Ascopera gigantea* and *A. pedunculata*, *Molgula gigantea* and *M. pedunculata*, *Goodsiria coccinea* and *G. pedunculata*, *Culcolus recumbens* and *C. perlucidus*, *Fungulus cinereus*, *Bathyoncus mirabilis*, *Styela lactea*, *S. sericata*, *S. grandis*, *S. convexa*, and *Pharyngodictyon mirabile*, *Colella pedunculata* and *C. concreta*, *Amaroucium variabile*, *Chorizocormus reticulatus*, *Tylobranchion speciosum*, *Atopogaster gigantea* and *A. elongata*, were evidently a marked feature of the fauna. Since the 'Challenger' expedition the 'Belgica' and the 'Valdivia' have brought home collections from the far south. These are being worked out, but no results in regard to the Tunicata have so far¹ been published.

The present collection, made by the officers of the 'Southern Cross' along the beach and in the shallow water at Cape Adare, Victoria Land, consists of two species of simple Ascidians belonging to the family Cynthiidae, six species of compound Ascidians, five of which are Polyclinidae, and of a number of specimens of Salpidae, all of which seem to belong to the chain-form of *Salpa runcinata-fusiformis*. Four of the species seem new to science: a *Tylobranchion*, a *Polyclinum*, and two species of *Psemmaphidium*, but none of these can be said to be in any way remarkable. The *Tylobranchion* is interesting as adding a new species to a genus only known from the Southern Ocean.

ASCIDIACEA.

ASCIDIAE SIMPLICES.

FAMILY CYNTHIIDAE.

SUB-FAMILY BOLTENINAE.

Boltenia pachydermatina. (Plate XIX., figs. 1 and 2.)

(See 'Challenger' Rep., Pt. I., p. 89; also Cat. Tunicata Australian Mus., Pl. Cyn. I., fig. 1.)

About twenty specimens of this large species were obtained from "Adventure Bay, Tasmania, 12th Dec., 1898, along the beach." The individuals range from 8 cm. to 22 cm. in total length, and closely

¹ December, 1901.

resemble those figured in the Catalogue of the Tunicata in the Australian Museum.

The species shows considerable variation in external form and also in internal structure. But the present specimens, although varying in the proportions of stalk to head, and in the amount of corrugation of the surface, are all clearly members of the species and agree in essential characters, such as the peculiarly convoluted dorsal tubercle. There is some variation shown in the branchial sac, not only in different individuals, but also in different regions of the same sac. Some parts are like the specimen figured in the 'Challenger' Report (Pl. VII., fig. 7), with many (six to nine or so) stigmata in each mesh. Other parts are much more solid (see Pl. XIX., fig. 1) and contain only two or four circular stigmata in a mesh, and sometimes only one large opening (figs. 1 and 2 show two such irregular parts of the same branchial sac). The latter condition recalls the branchial sac of the allied abyssal genus *Culcolus*, and suggests the possibility that the condition in the latter may be a secondary one due to the fusion of stigmata, or possibly to the arrest of subdivision of stigmata, so that as the sac grows older stigmata may become much enlarged. In all cases the vessels of the branchial sac contain spicules as figured in the Australian Museum Catalogue (Pl. Cyn. I., fig. 2).

The test is also crowded with short knobbed spicules like those of Alcyonaria. In some places the test is mottled on the surface with circular black spots, which are seen in sections to be due to spherical masses of yellow-brown pigment granules. It is not improbable that these pigmented masses are the remains of parasitic algae.

SUB-FAMILY **STYELINAE.**

Styela lactea. (Plate XIX., figs. 3-8.)

(See 'Challenger' Rep., Pt. I., p. 156.)

Half-a-dozen specimens of this species were found "washed up on the beach" at Cape Adare on 6th April, 1899. The largest measures 8.5 cm. in antero-posterior extent by 5.5 cm. dorso-ventrally, and the smallest shows 3 cm. and 2 cm. for the same two dimensions. These specimens are considerably larger than the 'Challenger' specimens obtained at Kerguelen Island, the largest of which measured 4.5 cm. in length and 3.5 cm. in breadth.

The Cape Adare specimens show a marked posterior pad-like thickening, upon which the animal evidently rested (see Pl. XIX.,

fig. 3); but sections show that although the test is thickened in this region, the pad is really due more to a great increase in the bulk of the mantle than of the test. In one specimen examined (fig. 4) the thickest part of the test, at the posterior end, measured 5 mm., while the mantle underneath it reached the extraordinary thickness of 10 mm. Over the rest of the body both test and mantle are thin. The mantle though thin is muscular, and has distinct external circular and internal longitudinal layers of fibres. The branchial sac does not extend to the posterior end of the body, but leaves a considerable cavity which is occupied by the alimentary canal. The stomach and intestine thus come to lie posteriorly to the branchial sac (fig. 7). The endostyle shows large glandular thickenings, forming pad-like masses placed alternately at its sides (see fig. 6). There are very broad shelf-like horizontal membranes on each transverse vessel (fig. 5); otherwise the branchial sac is as shown in the 'Challenger' Report. There are two long gonads on each side of the body, and in addition to these there are many irregular tag-like "endocarps" (see fig. 8).

ASCIDIAE COMPOSITAE.

FAMILY POLYCLINIDAE.

Tylobranchion antarcticum. (Plate XX., figs. 1-6.)

External appearance.—This is a small colony with a rounded slightly lobed upper surface. Each lobe contains a small group of two or three ascidiozooids placed vertically in the transparent test. The colour is light grey, the test being lighter and the ascidiozooids a little darker and showing opaque in the transparent mass.

Test.—The lower part of the colony is a solid mass of test about 1 cm. in thickness, and covered with adhering and imbedded sand grains, the upper part is soft and transparent.

Mantle.—Thin with prominent muscle bands running longitudinally.

Branchial sac.—Large, with numerous stigmata. There are no internal longitudinal bars, but the transverse vessels bear large papillae which bifurcate at the free end (figs. 5 and 6).

Ascidiozooid.—From 5 to 7 mm. in length, exclusive of the long post-abdomen or ectodermal tube. The visceral part (abdomen) is

slightly longer than the branchial sac (thorax), while the post-abdomen may be twice as long as the rest of the body, bringing the whole up to about 20 mm. (figs. 2 and 3). At its posterior end the post-abdomen spreads out a little. It is then a plain ectodermal tube.

The Dorsal Tubercle has a plain circular opening. Figure 4 shows its relations to the nerve ganglia and the peripharyngeal bands.

Tentacles about 12, simple, all the same size.

The Stomach has longitudinal ridges (figs. 2 and 3). The intestine is large, and rather irregularly dilated.

This colony was obtained off Cape Adare on January 2nd, 1900, from a depth of 20–24 fathoms, where the temperature of the water was 29° Fahr. It is preserved in formol. In the bottle along with it is a large mass of the gelatinous spawn of some mollusc. The appearance of the animal suggests the genus *Diazona*, which, however, has internal longitudinal bars.

It seems best to put this new species in the genus *Tylobranchion*, established in the 'Challenger' Report for a species (*T. speciosum*) of which three colonies were obtained at Kerguelen Island from depths between 10 and 100 fathoms. *Tylobranchion speciosum*, while agreeing in general anatomy with the present species, differs from it in form of colony (see 'Challenger' Rep., Part II. Pl. XXII, fig. 1) and proportions of ascidiozoooid, and in details of most organs. It shows, however, the same bifid papillae on the transverse vessels of the branchial sac.

Atopogaster elongata. (Plate XXI., figs. 1–10.)

(See 'Challenger' Rep., Pt. II., p. 173, 1886.)

This is a species that was trawled up in quantity during the 'Challenger' expedition at Station 313 in the Strait of Magellan, from 55 fathoms. The 'Challenger' colonies presented a great variety in form, and the specimens now before us do so to an even greater degree. On plate III. we show a few prevalent shapes selected from the hundred or so in the collection.

The greater number of the specimens, over fifty, were obtained washed up on the beach at Cape Adare on April 6th, 1899. A handful of the smaller ones (figs. 6 and 7) look like nothing so much as a group of new potatoes. The larger colonies (figs. 1, 2, 4, and 8) are more irregular in form.

Other specimens were obtained:—

"April 24th," one specimen.

"Cape Adare, 25th January, washed up on beach," twenty specimens.

"Cape Adare, 7-10 fathoms, 23rd January, 30° Fahr.," five specimens.

"Cape Adare, 21st January, 1900, washed up on beach," twenty specimens.

"Cape Adare, 5th January, 1900, on the beach," eleven colonies.

A well-grown colony measures $9 \times 4 \times 3$ cm., another is $6 \times 2 \times 2$ cm. The longest is 10 cm., and some of the smallest are nearly globular, being about 2.5×2 cm. They are all of a dark grey colour, and are very hard and solid to the feel. The test is very compact, and in many cases no trace of ascidiozooids can be seen unless the colony is cut open. In sections they show as long yellow bodies in the grey test.

A few of the colonies were evidently attached by one end, others apparently near the middle, but many not at all—probably most lay free on the bottom.

In many cases the colony is the same in character all over its surface, but in others (see figs. 9 and 10) the lower parts may be much wrinkled and rougher, forming a stalk for the upper end or "head," which is of a lighter grey, and softer, and shows the anterior ends of the ascidiozooids distinctly. The branchial sac is large, and shows many large stigmata.

Polyclinum adareanum. (Plate XXII., figs. 1-9.)

External appearance.—Colony large, globular or pear-shaped, with a rounded upper end. The lower end is rather narrower and may be wrinkled and incrustated with sand.

Test.—Grey, tough; firmer on the surface where it forms a cuticle, softer inside, looser in texture on the top of the colony, and strengthened with sand in the lower part.

Ascidiozooids arranged in systems of eight or ten in a circle round a common cloaca.

Branchial sac, with about twenty rows of numerous small stigmata. There are very strong muscle bands in the transverse vessels.

Langucts.—A row of short curved tentacle-like processes, shorter than their distance apart and not flattened.

Locality.—"Cape Adare, 6th April, 1899, washed up on beach," half-a-dozen colonies; and "Cape Adare, 21st January, 1900, washed up on beach," one colony. This last colony measures $9.5 \times 6.5 \times 3.5$ cm., while the largest of the series is $14 \times 12 \times 10$ cm., and the smallest $6 \times 4 \times 3$ cm.; the rest are all about

12 × 9 × 5 cm. Some of the colonies (Pl. XXII., figs. 1 and 2) are rather like turnips in appearance, others longer and more cylindrical, like large sausages. The ascidiozooids are large, measuring over 1 cm. in length, and up to 1·5 mm. in breadth (dorso-ventrally). In some the wrinkling of the surface layer of test at the posterior end is very close (fig. 6), and in some the darkening of the surface with sand grains is more marked than in others. The minute black sand grains may even adhere to the test over the upper end, where they are placed around the apertures of the ascidiozooids in such a way as to mark out the systems with dots (fig. 4). The systems are about 1 cm. in diameter, and the common cloaca measures 1·5 mm. across. Figure 5 shows the test covering a system as seen from the underside when sliced off.

This species comes near *Polycrinum giganteum* and *P. globosum*, found at Port Jackson, Australia.

Psammaplidium nigrum. (Plate XXIII., figs. 1-3.)

External appearance.—The colony is large, flat, and soft, measuring 10 × 6 × 1 cm., nearly black in colour, and finely sandy all over. It is marked with conspicuous coarse granulations, which indicate the anterior ends of the ascidiozooids, and is also marked out into polygonal areas by slight creases (see Pl. XIII., fig. 1).

The Test is very soft and flimsy, easily torn, and giving no stiffness to the colony. It is of a dark grey colour even when free of sand. Most of the sand is in the surface layer, but there is a little throughout. The sand grains are dark, which adds to the black appearance of the colony.

The Branchial sac has at least a dozen rows of numerous small stigmata (fig. 3).

The Mantle is muscular. There is a rather large muscular branchial siphon, and a large atrial languet.

Locality.—“Cape Adare, 26 fathoms, 14th November, 1899.”

In addition to the colony described above there is a second, measuring 4 × 3 × 1 cm. (see fig. 2). Both colonies are remarkably soft and flabby. This and the black colour are characteristic features of the species.

Psammaplidium antarcticum. (Plate XXIII., figs. 4-6.)

External appearance.—Colony irregular in form, or rising into a convex mass in centre, quite firm with a thick layer of black sand over the surface. Size of one colony 8 × 6 × 4 cm.

The Test is hard. It has very much less sand inside than on the surface (fig. 5), but there is some throughout.

The Branchial sac has many rows of large stigmata (fig. 6).

Locality.—"Cape Adare, 26 fathoms, 14th November, 1899." This species is, I think, distinct from the last. It is very different in texture and habit, and the appearance of the colonies is quite distinct. They were found together.

There were three colonies of this species; the dimensions above are those of the largest; all are firm and solid to the touch.

FAMILY DISTOMIDAE.

Distaplia ignota. (Plate XX., figs. 7-9.)

——(?) *ignotus*, Herdman, 'Challenger' Rep., Pt. II., p. 251, 1886.

? *Julinia australis*, Calman, Quart. Journ. Mic. Sci., 1894, p. 1.

In the collection brought home by the 'Challenger' expedition from the Strait of Magellan, there were two large Polyclinid-like colonies which I had to report upon. The species was sufficiently distinct and striking to render me certain that it was undescribed, but the specimens were in such very bad condition anatomically that I felt it impossible to refer the new species with certainty to its proper genus. Consequently I described and figured it under the heading, "——(?) *ignotus*, n. sp." (see 'Challenger' Rep., Part II., p. 251). I had also examined a specimen in the British Museum collection (measuring about 3 feet in length), labelled from the Antarctic, which I found to belong to the same species, and which curiously enough was also, like the 'Challenger' specimens, in a very bad state of preservation; and I made the suggestion, in the 'Challenger' Report, that all these colonies had been dead and partially decomposed when they were found and put in spirit. My remarks on the species ended with the sentence, "It is to be hoped that some future explorers in the Southern Seas may be successful in obtaining specimens of this, probably the largest known species of compound Ascidian, in a living condition." The present collection contains no less than four large colonies or fragments of this same species, and it is most disappointing to find that they also are in a decomposed condition, so that very little more can be made out with certainty in regard to the minute anatomy. Still, I think I am now justified, from the specimens I have before me, in saying that this gigantic species must be referred to the family Distomidae, and probably to the genus *Distaplia*; consequently I now, until

further evidence is forthcoming, consider the name of the species to be *Distaplia ignota*, Hrdn.

In 1894 Mr. Calman¹ described, under the name of *Julinia australis*, a large colony from the Antarctic, which he considered to be "nearly related, if not identical," with my 'Challenger' species. Mr. Calman's specimen had been found by Dr. C. M. Donald floating on the surface of the sea in the north of Erebus and Terror Gulf, where it is said that "considerable quantities were seen." Although partly ragged and beginning to decay, Mr. Calman's specimen was in sufficiently good condition to enable him to make out all essential points in the anatomy, and he correctly refers the species to the family Distomidae. I cannot, however, agree to his statement that it "evidently forms the type of a new genus," as I think if there is anything evident it is that, from the general shape and structure of the ascidiozoid and from the atrial languet and the incubatory pouch, Calman's form fits into the genus *Distaplia*. Moreover, the specimen collected by Dr. Donald is very probably, as Calman suggested, the same species as the 'Challenger' and the British Museum specimens, all of which must now therefore be known by the name *Distaplia ignota*.

In the present collection there are :—

1. Three large fragments, measuring respectively 19 cm., 21 cm., and 26 cm. in length, and from 3 to 6 cm. in diameter, from "Cape Adare, beginning of January, 24 fathoms."

2. One smaller specimen from "Cape Adare, 16th December, 1899, on surface, 28·9° Fahr."

3. Many irregularly shaped and more or less spreading masses from "Cape Adare, 2nd January, 1900, 20–24 fathoms, 29° Fahr." The colonies in this bottle are in very bad condition, and were probably all dead and more or less decomposed when collected. There are a number of Amphipoda and Pycnogonida with the Ascidians in the bottle which seem to be in fair condition, so probably it is not the method of preservation that is at fault. The average size of colony is 7 × 4 × 1 cm. Some of the smaller lumps (fig. 7) are more rounded, and are no doubt the youngest colonies present, others (fig. 8) become irregularly lobed and spreading, and finally the largest grow out into long cylindrical masses (fig. 9). Some of these are attached by the greater part of one surface to small stones and fragments of sea-weeds, and so, no doubt, lay on the sea-bottom; but it is easy to understand how they might become detached in storms and be washed up on beaches,

¹ Quart. Journ. Mic. Sci., vol. 37, p. 1.

or even when decomposing be found floating on the surface. The specimens collected on 16th December, 1899, and by Dr. Donald in the Erebus and Terror Gulf, floating on the surface, were, doubtless, detached and probably decaying masses from colonies at the bottom.

The central parts of the colonies are occupied by very loose test, much vacuolated, and penetrated by canals in which run ectodermal processes or stolons from the ascidiozooids. These processes end in dilated bulbs, and have numerous buds in the test around them, recalling the condition in the stalk or basal part of some species of the closely allied genus *Coella*.

THALIACEA.

FAMILY SALPIDAE.

Salpa runcinata-fusifformis, Chamisso—Cuvier.

This was the only species of pelagic Tunicate in the collection, and all the specimens belong to the aggregated or chain form. They were found as follows:—

“Cape Adare, 5th April, 1899, ten specimens.” These are all small, the largest being 2 cm. in length.

“Cape Adare, 9th April, 1899,” thirty specimens, of sizes up to 4 cm. in length.

“Cape Adare, 30th April, 1899,” forty specimens, “found on the surface, and on beach; temperature of water 28·6° Fahr.”

“Cape Adare, 10th May, 1899, on surface and along beach, temperature of water 28° Fahr.” Fifty specimens from 2·5 to 3·5 cm. long.

Some of the specimens show lines of minute denticles projecting from the surface of the test. This is a species that seems to be abundant in the Antarctic. The ‘*Challenger*’ expedition obtained it both in tropical seas (north of the Admiralty Islands, under the equator) and also in several localities far south, such as “off Prince Edward Island,” “near Heard Island,” and at “Station 152, Antarctic Ocean, lat. 60° 52’ S., long. 80° 20’ E., surf. temp. 34° 5’ Fahr.; about 160 specimens of the aggregated form, many of them large.” But the present is probably its furthest south record. Apparently the southern forms are usually larger than those found in warmer seas.

If we take account of all localities from 40° south latitude southwards to the Antarctic Continent, we find that the following pelagic Tunicates have been obtained in the area:—

Pyrosoma giganteum.
Doliolum ehrenbergi.
Salpa costata-tillesii.
S. echinata.
S. cordiformis-zonaria.
S. cylindrica.
S. runcinata-fusififormis.
S. democratica-mucronata.
S. africana-maxima.
Appendicularia.

Only two of these species have been found in the corresponding latitudes round the North Pole.

EXPLANATION OF PLATES.

PLATE XIX.

Fig. 1.—Part of the branchial sac of *Boltenia pachydermatina* showing variations.

Fig. 2.—Another part of the same branchial sac.

Fig. 3.—*Styela lactea*, Hrdn., from side, nat. size.

Fig. 4.—Section of posterior end of same to show thickened pad of mantle and test.

Fig. 5.—Alimentary canal of *Styela lactea*.

Fig. 6.—Some of the endocarps $\times 2$.

Fig. 7.—Part of the endostyle.

PLATE XX.

Fig. 1.—*Tylobranchion antarcticum*, nat. size.

Figs. 2 and 3.—Ascidiozooids enlarged.

Fig. 4.—Dorsal tubercle.

Fig. 5.—Branchial sac.

Fig. 6.—A papilla.

Figs. 7, 8, and 9.—Colonies of *Distaplia ignota*, Hrdn.

PLATE XXI.

Figs. 1–10.—Shapes of colonies of *Atopogaster elongata*, Hrdn.

PLATE XXII.

Figs. 1 and 2.—Colonies of *Polyclinum adareanum*.

Fig. 3.—Systems of ascidiozooids.

Fig. 4.—Arrangement of pigment.

Fig. 5.—Common cloacal aperture from inside.

Fig. 6.—Lower end of a colony.

Figs. 7, 8, and 9.—Branchial sacs.

PLATE XXIII.

Figs. 1 and 2.—Colonies of *Psammaphidium nigrum*.

Fig. 3.—Branchial sac of same.

Fig. 4.—Colony of *Psammaphidium antarcticum*.

Fig. 5.—Section of edge of colony.

Fig. 6.—Part of branchial sac.

VII. MOLLUSCA.

By EDGAR A. SMITH, F.Z.S.

(Plates XXIV, XXV.)

OF the twenty-eight species quoted or described in the following account, all, with the exception of seven, are from Cape Adare, Victoria Land, or Franklin Island, a little further south. These seven are mostly from Auckland and Campbell Islands, south of New Zealand, practically in the same latitudes as Kerguelen Island, of which the molluscs in several instances are identical with those of Cape Adare. In view of the fact that these are the first collections described from this remote region, it is not surprising that such a large proportion of the species appear to be new. It is worthy of note, however, that, with the exception of the new genus *Newnesia*, and *Philine*, no generic types were obtained which are new to the Antarctic fauna. The genus *Philine* ranges from the Arctic region to New Zealand, and some of the species appear to be very widely distributed. For example, the common British *P. aperta* ranges from Norway to the Cape of Good Hope, and a scarcely distinguishable form, *P. angasi*, occurs in Australia and New Zealand. The occurrence therefore of this widely-dispersed genus in Antarctic waters is not surprising. This collection furnishes only negative evidence with regard to the similarity of Arctic and Antarctic mollusca. It is, however, none the less interesting, and may be regarded as not only the first, but a satisfactory instalment of the species which inhabit these inhospitable regions.

CEPHALOPODA.

POLYPUS CAMPBELLI.

(Pl. XXIV., figs. 7-11.)

Corpus breve, bursaeforme, supra saturate sordide olivaceum, infra dilute cinnamomeum; caput et superficies superior brachiorum colore simile tinctæ; corpus supra et infra granulosum, granulis supra superficiem inferiorem parvis et confertis; supra utrumque oculum cirrus parvus, compressus; brachia superne carinata, ad basim cute brevi conjuncta, longitudine subæquantia; acetabula magnitudinis mediocris; par septimum supra brachia lateralia, maximum, valde prominens.

The body of this Octopus is short and purse-like, dark, dirty olivaceous upon the dorsal surface and buff beneath; body finely granular above and below, the granules small and very close together on the ventral surface; above each eye is a small compressed cirrus. Arms (in spirit), keeled above, connected at the base by a short web, all of about the same thickness. The right dorsal is shorter than the left, probably bitten by a fish or crustacean; it has thirty-eight pairs of suckers, the left having sixty-seven pairs. The suckers are of moderate size excepting the seventh pair from the base on the two lateral pairs of arms: these are enormously developed and stand out 4 mm. from the surface and are about the same in diameter. It is curious that the upper of the left lateral pair has developed only a single large sucker instead of two. The presence of these large suckers indicate the male sex of the specimen, and this is substantiated by the hectocotylied lower arm of the right lateral pair. This has only thirty-six pairs of suckers, whereas the corresponding arm on the other side has seventy-five pairs.

Length from web between dorsal arms to the end of body 48 mm., width of body across back 24 mm., from back to front 19 mm.

Habitat.—Campbell Island.

GASTROPODA.

NEOBUCCINUM EATONI.

Buccinopsis eatoni, Smith, Ann. Mag. Nat. Hist., 1875, Vol. XVI., p. 68.

Neobuccinum eatoni, Smith, Phil. Trans. Roy. Soc., Vol. CLXVIII., p. 169, Pl. IX., figs. 1, 1A (1879); Tryon, Man. Conch., Vol. III., pp. 100, 197, Pl. LXXXVII., figs. 357, 358.

Habitat.—Cape Adare, 7–10 fathoms.

This Antarctic whelk has hitherto been only known from Kerguelen and Heard Island. The specimens in the present collection are mostly a little narrower than those from Kerguelen and generally rather darker in colour, in some instances being dark purplish brown. The colour of the interior of the aperture is also of a somewhat deeper brown tint. The following measurements will show the variation in the proportions of two selected examples.

Length.	Diam.	APERTURE.	
		Length.	Width.
50	31	24	14
55	28	24	13

CHLANIDOTA VESTITA.

Cominella vestita, Martens, Sitzungsab. Gesell. naturforsch. Fr. Berlin, 1878, p. 23.

Neobuccinum vestitum, Watson, 'Challenger' Gasteropoda, p. 216.

Buccinum (Chlanidota) vestitum, Martens, Conch. Mittheil., Vol. I., p. 43, Pl. IX., figs. 3A-C.

Chlanidota vestita, Tryon, Man. Conch., Vol. III., p. 201, Pl. LXXIX., fig. 391.

Habitat.—Cape Adare, 24–26 fathoms.

Previously known only from Kerguelen Island. The specimens from Cape Adare are almost identical with those from Kerguelen. Some of them, however, are less contracted at the base of the body-whorl, and others are of a reddish-brown colour, which is most observable within the aperture. They do not offer much variation in form, but some specimens are a little stumper than others. Very remarkable is the small size of the operculum, which occupies less than one-fourth the length of the aperture.

EUTHRIA AUCKLANDICA.

(Pl. XXIV., figs. 12, 13.)

Testa fusiformis, rufo-fusca, longitudinaliter costata et transversim lirata; spira turrata, conica, ad apicem mammillata; anfractus 6 regulariter crescentes, primus laevis, nitens, globosus, caeteri supra leviter excavati, dein convexi, costis rotundatis, superne in excavatione fere obsolete, circiter 11 instructi, lirisque transversis supra et inter costas continuis (in anfr. penult. 4, ultimo 9 quarum infima caeteris magis conspicua) ornati, ultimus infra medium contractus; apertura intus rufo-fusca, antice in canalem obliquum recurvum producta; labrum tenue; columella albida, ad medium leviter arcuata, callo tenui nitido induta.

Longit. $9\frac{1}{2}$ mm., diam. $4\frac{1}{2}$ mm. Apertura cum cauale 5 longa.

Habitat.—Auckland Islands, 10 fathoms.

It is possible that the above may not be the dimensions of a full-grown specimen of this species, for there is a look of immaturity about all the four examples obtained. Still I have not hesitated to describe this form as a new species, as it is so clearly characterized by the peculiar oblique lira around the anterior narrowed extremity of the last whorl. In addition to the longitudinal ribs and the transverse ridges, the surface exhibits very fine lines of growth and some traces of fine spiral striae.

LITTORINA (PELLILITORINA) PELLITA.

Pellilitorina pellita, Martens and Pfeffer, Jahrb. Hamburg. Wiss. Anstalt., III., 1886, p. 79, Pl. I., figs. 6A-6F.

Habitat.—Cape Adare, 7 fathoms.

A very interesting species originally described from New Georgia. The single example in the present collection contains the soft parts. The animal is deep black, with the sole of the foot pale and the operculigerous lobe white. The hairs of the periostracum are arranged in spiral series, in shallow grooves, three in the penultimate and seven in the last whorl.

LITTORINA (PELLILITORINA) SETOSA.

Littorina setosa, Smith, Phil. Trans. Roy. Soc., Vol. CLXVIII., p. 172, Pl. IX., fig. 6.

Pellilitorina setosa, Pfeffer, Jahrb. Hamburg. Wiss. Anstalt., III., 1886, p. 77, Pl. I., figs. 7A, B.

Littorina (Pellilitorina) setosa, Tryon, Man. Conch., Vol. IX., p. 255, Pl. XLVI., figs. 37, 38.

Habitat.—Cape Adare, 24 fathoms.

Kerguelen Island (Smith and 'Challenger' Expedition). Also New Georgia (Pfeffer and Martens). Only one young specimen obtained.

PALUDESTRINA ANTARCTICA.

(Pl. XXIV., fig. 16.)

Testa elongata, fusco-purpurea, imperforata, lineis incrementi tenuibus striata; spira producta, turrita, ad apicem obtusa; anfractus 4-5, perconvexi; apertura rotunde ovata, longit. totius $\frac{1}{2}$ haud aequans; labrum tenue, margine columellari pallido, anguste reflexo.

Longit. $3\frac{3}{4}$ mm., diam. $2\frac{1}{2}$ mm.

Habitat.—Cape Adare, 8 fathoms.

Quite distinct from *P. caliginosa* (Gould), from Terra del Fuego and Kerguelen Island, being smaller and quite different in form. The spire is more elongate, the whorls more convex, and the aperture rounder. The operculum is very thin, pale yellowish, striated with lines of growth, and consists of about two whorls.

EATONIELLA PALUDINOIDES.

(Pl. XXIV., fig. 18.)

Testa ovato-conica, perforata, fuscescens, lineis incrementi tenuibus striata; spira ad apicem obtusa; anfractus 4, valde convexi; apertura irregulariter ovato-rotundata, leviter obliqua; peristoma continuum, margine externo simplice, tenui, columellari obliquo, vix reflexo.

Longit. $1\frac{1}{2}$ mm., diam. 1 mm. Apertura $\frac{3}{4}$ longa, $\frac{1}{2}$ lata.

Habitat.—Cape Adare, 8 fathoms.

Allied to *E. subrufescens* (Smith), from Kerguelen Island, but of a more robust form, the body-whorl being broader, and the apex of the spire more obtuse. The opercula are very similar on both surfaces.

RISOO ADARENSIS.

(Pl. XXIV., fig. 17.)

Testa oblongo-ovata, supra angustata, alba, laevis, nitida, rimata, hic illic lineis incrementi striata; spira elongata, ad apicem rotundata, obtusa; anfractus $4\frac{1}{2}$, valde convexi, sutura leviter obliqua sejuncti; apertura obliqua, ovato-piriformis, longit. totius $\frac{1}{3}$ adaequans; peristoma continuum, margine externo leviter incrassato, columellari antice expanso, effuso. Operculum tenue, paucispirale, simplex.

Longit. $2\frac{3}{4}$ mm., diam. $1\frac{1}{2}$ mm.

Habitat.—Cape Adare, 24 fathoms.

A pure white shell, with a smooth surface, except that in the upper whorls there is a trace of faint longitudinal costation.

LAMELLARIA MOLLIS.

(Pl. XXIV., figs. 19–21.)

Animal globosum, subpellucidum, albidum; cutis dorsalis (*notaeum*) crassissima, laevis, antice supra caput subprofunde fissa; pes dilute coriaceus, elongatus, postice angustatus, antice truncatus, utrinque productus, margine anteriore duplice vel transversim sulcato; tentacula mediocriter brevia, acuminata, oculis parvis leviter prominentibus ad basim externam instructa; testa membranacea.

Longit. 65 mm., diam. 45 mm., alt. 40 mm.

Habitat.—Cape Adare, 6–29 fathoms.

In spirits this species has a globose, somewhat gelatinous appearance, and is remarkable on account of the shell being membranous only, without any shelly thickening, so that on removal from the spirally coiled viscera it at once collapses. The foot in

front has a double edge and is somewhat produced or auriculate on each side, and is completely concealed beneath the enormously developed notaeum. The measurements given above are only approximate, as, owing to contraction of the animals at the time of death, the form and natural dimensions become altered and diminished.

LAMELLARIA CONICA.

(Pl. XXIV., fig. 4.)

Testa ovata, superne acuminata, conica, tenuis, pellucida, periostraco tenui pallido induta, lineis incrementi curvatis conspicuis sculpta; anfractus quatuor, celeriter accrescentes, duo superiores (protoconcha) flavescentes, aliis crassiores, convexiusculi, ultimus maximus, ventricosus, infra suturam anguste marginatus; apertura magna, inverse late auriformis; peristoma tenue, margine columellari arcuato, leviter incrassato, callo tenui appreso labro juncto.

Longit. 18 mm., diam. 14 mm. Apertura 14 longa, 10 lata.

Habitat.—Cape Adare, 28 fathoms.

Only a single specimen of this interesting species was obtained. The animal is much contracted in spirit and of a buff colour, but when alive is said to be reddish-brown. The mantle investing the shell is very thin above, but thicker at the sides, and in the contracted state has a granose or finely warty appearance. The foot is short, somewhat quadrate in front and tapering behind. The tentacles are very short and blunt, the eyes at the outer bases being conspicuous and prominent. The apical whorls exhibit one or two spiral shallow sulci, but this feature may not be constant.

NATICA DELICATULA.

(Pl. XXIV., fig. 6.)

Testa globosa, tenuis, anguste perforata, pellucido-albida, periostraco dilute virescente tenui induta, lineis incrementi tenuibus obliquis striata; spira obtusa; anfractus tres celeriter crescentes, convexiusculi, ultimus globosus, infra suturam concave impressus, antice descendens; apertura semicircularis; labrum tenue; columella incrassata, reflexa, superne leviter dilatata, labro callo tenui juncta.

Diam. maj. $7\frac{1}{2}$ mm., min. 6 mm., alt. $7\frac{1}{3}$ mm. Apertura 6 mm. longa, $3\frac{1}{2}$ mm. lata.

Operculum tenue, testaceum, extus leviter concavum, album, infra flavescens.

Habitat.—Cape Adare, 26 fathoms.

The single specimen obtained has the spire much eroded. The suture dividing the whorls is rather deep, but hardly channelled.

CANTHARIDUS PRUNINUS.

Cantharidus pruninus, Gould; Pilsbry, Man. Conch., Vol. XI., p. 122, Pl. XLVI., figs. 60, 61; Pl. XXXIV., fig. 1, var. *perobtusa*.

var. **minor**. Testa minima. Longit. 8 mm., diam. maj. $6\frac{2}{3}$ mm., min. 6 mm.

Habitat.—Auckland Islands, 10 fathoms.

A few specimens were obtained, which, although apparently adult, are not a quarter the size of other examples from the Auckland Islands. In form, colour, and sculpture, however, they are quite similar. The species also occurs at Campbell Island.

CALLIOSTOMA AUCKLANDICUM.

(Pl. XXIV., fig. 5.)

Testa parva, conica, obtecte umbilicata, roseo-purpurea; anfractus sex, primus laevis, convexus, involutus, pallidus, vel flavescens, caeteri levissime convexi, liris spiralibus tenuibus roseo-purpureis cincti, infra suturam nodosi vel subplicati, striis incrementi obliquis confertis concinne sculpti, ultimus ad peripheriam angulatus, infra concentrice liratus, in medio excavatus et albus; apertura subquadrata, margaritacea, laevis; peristoma ad marginem acutum, roseo-limbatum, intus leviter incrassatum; columella alba, subobliqua, superne leviter reflexa, antice subdentata.

Diam. maj. 8 mm., min. 7 mm., alt. $7\frac{1}{2}$ mm.

Operculum tenue, corneum, multispirale.

Habitat.—Auckland Islands, 10 fathoms.

The general tone of this species is purplish-rose, but under the lens the narrow sulci between the spiral lirae are dirty whitish, and the small umbilical excavation is also white. The spiral threads increase in number upon the whorls with the growth of the shell, there being about eight upon the penultimate, the uppermost, or that just below the suture, being somewhat nodose or subplicate. The body-whorl has eight lirae above the angle and ten or eleven below.

PHOTINULA EXPANSA.

Photinula expansa (Sowerby); Pilsbry, Man. Conch., Vol. XI., p. 279, Pl. XXXIX., figs. 51, 52.

Habitat.—Cape Adare, 24 fathoms.

One very young specimen ($3\frac{1}{2}$ mm. in diameter), at which age there is a small umbilical perforation, but the reflection of the columella has already commenced. This species is also known from the Straits of Magellan, Falkland Islands, South Georgia, and Kerguelen Island.

PHILINE ANTARCTICA.

(Pl. XXIV., fig. 1.)

Testa magna, semiconvoluta, tenuis, alba, periostraco tenuissimo nitente induta, lineis incrementi conspicuis sculpta; spira involuta, depressa, excavata; anfractus 2-3, ultimus maximus, antice latior quam supra, callo lato tenui parietali amictus; apertura subpiriformis, longit. totam aequans; columella cariniformis, spiralis, usque ad apicem intus perspicua.

Longit. 29 mm., diam. maj. 21 mm.

Habitat.—Cape Adare, 20 fathoms.

A fine species, not unlike *Scaphander lignarius* in form. More convolute than usual and consequently with a more contracted aperture. The periostracum is peculiarly shining, having a somewhat metallic look. The cephalic disc is oblong, rounded in front, widening behind, where it is slightly notched in the middle. The foot is about the same length as the head-disc, but broader. The mantle investing the shell is thickened into a ridge around the spire and forms a blunt end to the animal. Only a single specimen was obtained.

PHILINE APERTISSIMA.

(Pl. XXIV., figs. 2, 3.)

Testa compressa, ovata, tenuis, alba, periostraco tenui pallido induta, lineis incrementi valde curvatis striata; spira nulla, involuta, excavata; apertura latissima, longitudinem totam aequans; columella cariniformis, spiralis, intus usque ad apicem perspicua, callo lato parietali tenui superne labro juncta.

Longit. 11½ mm., diam. maj. 9 mm.

Habitat.—Cape Adare, 24 fathoms.

Much smaller than *P. antarctica*, with a more patulate aperture and less convoluted. Four specimens were collected.

NEWNESIA ANTARCTICA.

(Pl. XXV., figs. 1-6.)

Animal testa omnino tectum; caput compressum, antice truncatum, in medio leviter incisum, postice forma tentaculi utrinque productum; oculi inter bases tentaculorum siti; pes medioeriter latus, antice quadratus, postice haud valde acuminatus, in medio glandula minuta instructum; parapodia nulla; pallium margine anteriore incrassato, postice in lobum magnum tenuem testam amplectentem productum; os maxillis corneis haud instructum; lamellae in stomacho nullae; radula 0.1.0.; dentes centrales 27, conici, triangulares, acuminati, ad apicem prorsum curvati, denticulis quinque parvis utrinque armati, ad basim leviter concavi.

Testa globosa, tenuis, subpellucida, albida, periostraco tenuissimo nitido induta; spira depressa; anfractus tres convexi, sutura profunda sejuncti, ultimus maximus, incrementi lineis tenuibus arcuatis sculptus, undique spiralter confertim punctato-striatus; apertura late inverse auriformis, maxima, longit. totius $\frac{9}{10}$ aequans; labrum tenuissimum, margine columellari leviter reflexo appresso.

Longit. 20 mm., diam. 18 mm. Apertura 18 longa, 14 lata.

Habitat.—Cape Adare, 20-24 fathoms.

This very interesting Tectibranch is well distinguished by its very peculiar type of radula. The absence of epipodia and gizzard plates also separates it from those genera which it somewhat resembles in shell characters. The general form of the shell is most like that of *Hydatina*. The globose outline, the visible convolute spire, the form of the aperture and the character of the columella are very similar. I have much pleasure in associating with this interesting new genus the name of the promoter of the expedition, Sir George Newnes, Bart.

DORIS KERGUELENENSIS.

Archidoris Kerguelensis, Bergh, Nudibranch., 'Challenger' Exped., p. 85, Pl. I., figs. 1-12.

Habitat.—Cape Adare, 20-28 fathoms.

Very like the well-known northern species *D. tuberculata*. Also found at Kerguelen Island. The largest specimen is considerably larger than that described by Bergh, being 67 mm. long, 29 mm. broad, and 21 mm. in height. The rhinophore-openings are 15 mm. apart.

LIMACINA ANTARCTICA.

Limacina antarctica, Woodward, Man. Moll., p. 207, Pl. XIV., fig. 41; Fischer's Man. Conch., Pl. XIV., fig. 41; Pelseneer, Pteropoda, 'Challenger' Exped., p. 22, Pl. I., figs. 3, 4.

Habitat.—Surface, 66°, 20', S. Lat., 164°, 37', E. Long.

The shell is so excessively thin that it appears to get more or less broken when captured. In the only fairly preserved example in the present collection the spire is even less raised than it is represented in any of the above-quoted figures.

CLIONE ANTARCTICA.

(Pl. XXV., figs. 7, 8.)

Corpus elongatum, postice acuminatum, extremitatem posticam versus utrinque leviter carinatum, sordide albidum, semitranslucidum, punctis opacis albis minutis undique notatum, punctisque fuscis supra dimidium anticum plus minus pictum; massa viscerum rufescens, longit. totius $\frac{2}{3}$ adaequans; caput mediocre, tentaculis tribus brevibus acutis subaequalibus utrinque instructum; pes parvus, lobis anterioribus tenuissimis antice junctis (in exemplis spiritu conservatis), angulum acutum conformantibus, lobo postico minimo, acuminato; alae subovatae, foliiformes, ad extremitatem acuminatae.
Longit. tota 22 mm., diam. corporis 8 mm., longit. corporis 18 mm.

Habitat.—Cape Adare.

Apparently smaller than the Arctic *C. limacina*, differing also in form, colour, etc. It is a shorter species with numerous close-set pigment spots. Some examples show an indication of a linear constriction near or a little above the middle. The anterior lobes of the foot are united in front and form a Λ shaped angle above.

SPONGIOBRANCHAEA AUSTRALIS.

Spongiobranchaea australis, d'Orbigny; *vide* Pelseneer, 'Challenger,' Pteropoda Gymnosomata, p. 19, Pl. I., figs. 6, 7.

Habitat.—Off Cape Adare, at surface.

Of a sooty blackish colour excepting the postmedian constriction, which is dirty whitish, varying much in form, according to the contraction which has taken place at death. Obtained by the 'Challenger' Expedition in lat. 36° 22' S. and by d'Orbigny in lat. 54° 30' S.

LAMELLIBRANCHIATA.**ANATINA ELLIPTICA.**

(Pl. XXV., figs. 9, 10.)

Anatina elliptica, King and Broderip, Zool. Journ., Vol. V., p. 335; Reeve, Conch. Icon., Vol. XIV., fig. 14; Griffith's Anim. Kingd., Vol. XII., Pl. XXII., fig. 3; Smith, 'Challenger,' Lamellibranch., p. 76.

— *prismatica*, Sowerby, Proc. Zool. Soc., 1834, p. 87.

Habitat.—Franklin Island, 10 fathoms.

Other localities are Kerguelen Island and South Shetland.

This species is the giant of the genus, one of the examples in the present collection measuring nearly four inches in length and more than two inches across. Externally this shell bears a strong resemblance to *Mya truncata* of northern and Arctic seas.

CARDITA ASTARTOIDES.

Cardita astartoides, Martens; *vide* Smith, Lamellib., 'Challenger' Exp., p. 212, Pl. XV., figs. 2-2c.

Habitat.—Cape Adare, 24 fathoms.

Also known from Kerguelen Island and in 150 fathoms between that island and Heard Island. Only one small specimen obtained by the present expedition.

VENUS (CHAMELAEA) MESODESMA.

Venus (Chamelaea) Mesodesma, Quoy and Gaimard; *vide* Smith, 'Challenger' Rep., Lamellibranchiata, p. 131.

Habitat.—Auckland Islands, 10 fathoms.

One small example of a yellowish grey tint, without any colour-markings. New Zealand and Tristan da Cunha are other localities for this well-known species.

YOLDIA EIGHTSI.

Nucula eightsii, Couthouy; *vide* Jay, Cat. Shells, 1839, ed. iii., p. 113, Pl. I., figs. 12, 13.

Leda (Yoldia) eightsi, Hanley, in Sowerby's Thes. Conch., Vol. III., p. 142, Pl. CCXXX., fig. 164.

Yoldia eightsi, Sowerby, Con. Icon., Vol. XVIII., Pl. V., fig. 26.

Habitat.—Franklin Island, 10 fathoms. New South Shetland (Jay).

Allied to *Y. subaequilateralis* (Smith), from Kerguelen Island, but distinguishable by its different form and larger cartilage-pit. The periostracum also is darker, and the valves a little more convex.

LISSARCA AUCKLANDICA.

(Pl. XXIV., figs. 14, 15.)

Testa minima, aequivalvis, valde inaequilateralis, convexa, purpureo-rufa, lineis incrementi tenuibus, postice sublamellatis, sculpta, striis tenuissimis paucis postmedianis radiantibus ornata; umbones leviter prominentes, approximati sed haud contigui; dentes utrinque circiter quinque; valvarum margines (praeter prope partem anteriorem marginis ventralis et ad medium lateris postici) intus fortiter denticulati.

Longit. $4\frac{1}{2}$ mm., diam. $2\frac{1}{3}$ mm., alt. $3\frac{1}{2}$ mm.

Habitat.—Auckland Islands, 10 fathoms.

Closely allied to *L. rubro-fusca* (Smith),¹ from Kerguelen Island, but of a different form, being less oblong, having the umbones less terminal and the hinge-teeth somewhat different. A faint depression is observable extending from the umbo down the posterior end.

PECTEN COLBECKI.

(Pl. XXV., fig. 11.)

Testa tenuis, magna, compressa, rotundata, purpureo-rufa, costis radiantibus circiter 18 subobsoletis, vel minime prominentibus instructa, concentricè confertim striata; margines dorsales aequales, late concavi; linea cardinis aequè leviter concava; auriculae subaequales, antica valvæ dextrae inferne haud profunde sinuata; pagina interna rufescens.

Longit. 70 mm., alt. 70, diam. 16.

Habitat.—Franklin Island, 10 fathoms.

A large very thin species of which only a single right valve was obtained. It is remarkable for its rich purplish red or plum colour and the feebleness of the radiating costation. The costae are somewhat more pronounced towards the umbo than upon the rest of the surface, and are about twelve in number. Other intervening and more feeble ribs are developed at a later period of growth. The concentric sculpture consists of very fine thread-like lamellae which are more remote in the early stages of growth than at a later period. The auricles are striated with fine lines of growth, and anterior, in the valve described, exhibits a faint raised ray down the middle.

There does not seem to be any species bearing sufficient resemblance as to suggest a comparison with the present form. The Arctic *P. greenlandicus* of Sowerby has even a thinner shell, but in size, colour, and sculpture is quite distinct.

¹ Phil. Trans. Roy. Soc., 1879, Vol. CLXVIII., p. 185, Pl. IX., fig. 17.

EXPLANATION OF PLATES.

PLATE XXIV.

- Fig. 1.—*Philine antarctica*.
 Figs. 2, 3.—*Philine apertissima*.
 Fig. 4.—*Lamellaria conica*.
 Fig. 5.—*Calliostoma aucklandica*.
 Fig. 6.—*Natica delicatula*.
 Fig. 7.—*Polypus campbelli*, dorsal view.
 Fig. 8.— " " ventral side.
 Fig. 9.— " " lateral view of part of arm.
 Fig. 10.— " " end of hectocotylyzed arm.
 Fig. 11.— " " oral end of a lateral arm.
 Figs. 12, 13.—*Euthria aucklandica*.
 Figs. 14, 15.—*Lissarca aucklandica*.
 Fig. 16.—*Paludestrina antarctica*.
 Fig. 17.—*Rissoa adarensis*.
 Fig. 18.—*Eatoniella paludinoides*.
 Fig. 19.—*Lamellaria mollis*, dorsal view, mantle cut open.
 Fig. 20.— " " side view.
 Fig. 21.— " " ventral side.

PLATE XXV.

- Fig. 1.—*Newnesia antarctica*, ventral side.
 Fig. 2.— " " dorsal view.
 Fig. 3.— " " lateral view.
 Figs. 4, 5.— " " shell.
 Fig. 6.— " " tooth of radula, front (*b*) and side view (*a*).
 Figs. 7, 8.—*Clione antarctica*.
 Figs. 9, 10.—*Anatina elliptica*.
 Fig. 11.—*Pecten colbecki*.

VIII. ECHINODERMA.

By F. JEFFREY BELL, M.A.

(Plates XXVI-XXVIII.)

THE collection of Echinoderma is poor in species though comparatively abundant in specimens. The condition in which they arrived can hardly be said to be satisfactory, and it is to be seriously considered by collectors whether they should continue to use formol for objects which contain a large quantity of carbonate of lime. It will be observed that the collecting stations were not numerous and that there are but slight differences in the depth or temperature of the water.

The interest of the collection centres in the instructive series of variations of *Cycethra simplex*, and in the two well-marked new genera of Ophiuroids.

A. ANACTINOGONIDIATA.

I. HOLOTHURIOIDEA.

1. CUCUMARIA CROCEA.

Holothuria crocea, Lesson, Cent. Zool. (1832), p. 153, Pl. LII.

Cucumaria crocea, Wyv. Thomson, Journ. Linn. Soc. XIII. (1878), p. 55; Lampert, Seewalzen (1885), p. 149.

Station.—Franklin Island, February 9th, 1900, 10-24 fathoms, 29·8° Fahr.

Distribution.—Apparently circumpolar, as it has already been reported from Kerguelen and the Falkland Islands.

2. THYONE, sp.

There is a five-banded species in the collection which will, I hope, be more fully represented in the collections of the 'Discovery.'

3. HOLOTHURIA, sp.

There is likewise a species of *Holothuria*, on which I propose to suspend my judgment.

B. ACTINOAGONIDIATA.

II. ASTEROIDEA.

4. ASTERIAS NEGLECTA.

Asterias neglecta, Bell, Proc. Zool. Soc., Lond., 1881, pp. 94 and 506.

The name I gave this species had reference to its past; it might well be regarded as prophesying its future. For twenty years the single specimen found by Dr. Cunningham in the Straits of Magellan has been unnoticed and without a companion; as a larger specimen comes from Franklin Island we are led to suppose that the distribution of this southern species is circumpolar.

5. ASTERIAS ANTARCTICA.

Asteracanthion antarcticum, Lütken, Vidensk. Meddel., 1856, p. 105.

Asterias antarctica, Perrier, Arch. Zool. Expe. IV. (1875), p. 315.

This species does not appear to have been studied by any other naturalists than the two named above. I had begun a correspondence with the late Dr. Lütken regarding our lately acquired specimens, but the state of his health and his lamented death prevented my having the advantage of his judgment. As Lütken's specimens came from the Straits of Magellan, and the '*Southern Cross*' examples from Cape Adare (28 fathoms), it may be supposed that the distribution of the species is circumpolar.

6. CYCETHRA SIMPLEX.

The following appears to be the synonymy of this species; to Professor Perrier belongs the credit of having been the first to

recognise its great variability, and his establishment of seven species after the appearance of Mr. Sladen's 'Challenger' report can only be regarded as a piece of Gallic gaiety.

	<i>Cyathra simplex</i> , Bell, P. Z. S. 1881, p. 96; Studer, Abh. Ak. Berl. (Anhang), (1884) [5], p. 41; Perrier, Miss. Cap. Horn. (1891), p. K. 122.
..	<i>dectilis</i> , Sladen, 'Challenger' Rep., Ast. (1889), p. 377.
..	<i>nitida</i> " " " " p. 379.
..	<i>pinguis</i> " " " " p. 380.
..	<i>elongata</i> , Perrier, Miss. Cap. Horn. (1891), p. K. 172.
..	<i>media</i> " " " " p. K. 174.
..	<i>asterina</i> " " " " p. K. 176.
..	<i>subdectilis</i> " " " " p. K. 181.
..	<i>calva</i> " " " " p. K. 183.
..	<i>regularis</i> " " " " p. K. 184.
..	<i>asteriscus</i> " " " " "

Professor Perrier's observations on the variability of this singular form, which it fell to my lot to describe, from a single specimen, twenty years ago, are fully borne out by the very interesting series before me.

Distribution.—Apparently circumpolar.

Stations.—Cape Adare: 5·7 fathoms: Nov. 22nd, 1899 (28·9° F.).

Cape Adare: 24 fathoms: Jan. 2nd, 1900 (29° F.).

Cape Adare: 26–28 fathoms: Jan. 9th, 1900 (29·2° F.).

Cape Adare: April 6th, 1899.

Franklin Island: 10 fathoms: Feb. 9th, 1900 (29·8° F.).

Franklin Island: 10–24 fathoms: Feb. 9th, 1900 (29·8° F.).

Robertson Bay: 2 fathoms: Sept. 27th to Oct. 2nd, 1899.

ODONTASTER MERIDIONALIS.

Astrogonium meridionale, E. A. Smith, Ann. and Mag. Nat. Hist. XVII. (1876), p. 109.

Odontaster meridionalis, Bell, P. Z. S., 1893, p. 261, *ibique citatu*; Leipoldt, Zeit. f. Wiss. Zool., lix. (1895), p. 620.

A young specimen of this variable species was found washed up on shore at Cape Adare after a gale. I cannot think that Prof. Verrill (Trans. Connect. Acad. x. (1899), p. 202) has sufficiently weighed the variability of this starfish and its allies.

Its distribution would appear to be circumpolar.

III. OPHIUROIDEA.

A large number of specimens of two species were collected, both of which are representatives of new generic types, allied to *Ophiura* (*Ophioglypha* of Mr. Lyman), but distinguished by several striking characters. These new genera are perhaps the most valuable additions to our zoological knowledge made by the 'Southern Cross' Expedition. There are also two specimens of an *Ophiactis*, which recalls at once *O. asperula*, Phil., known from the southern parts of South America, but which is distinguished by the want of delicate spines at the edge of the disc; the condition of preservation of the collection does not justify one in coming to any conclusion as to the exact position of this form. There are moreover three specimens of a creature which appears to be allied to, if not a member of, the genus *Ophiomusium*, but this is a group which requires revision before any addition is made to it; it will be sufficient to put on record that an *Ophiomusium*-like Ophiurid has penetrated into Antarctic waters.

7. OPHIOZONA INERMIS.

An Ophiozonia with two small tentacle-scales at base of arm and none further out. Three minute peg-like arm-spines. Radial shields inconspicuous and separated. Side arm-plates large and meeting below.

Diameter of disc, 10 : 9 : 12 mm.

Length of arm (ca.), 25 : 25 : 28.

This is a type not uncommon among Ophiurids, where there are many forms so distinct as to be called "species," but exhibiting no morphological characters of any apparent interest or significance.

Cape Adare, 26 fathoms, 28·5° Fahr.

OPHIOSTEIRA.

This new genus is remarkable for the possession of a large keel-like plate on the disc, at the base of each arm, which completely overshadows the radial shields. The arms are compressed laterally, so that they are almost triangular in cross-section; the upper arm-plates are separated from one another by a slight groove, and stand up high so as to give both a serrated and a keeled appearance to the

arm; the arm-spines are numerous, but so small as to merge imperceptibly into the tentacle scales. Under arm-plates small, separated from one another by the side plates, which unite in the middle line. Like *Ophioglypha* it has "the innermost pair of tentacle pores shaped like slits, surrounded by numerous tentacle scales, and opening diagonally into the mouth slits." Mouth-papillae as in *Ophioglypha* (*Ophiura*).

It is very likely that *Ophiosteira* is derived from *Ophiura*, but the keel-like plates on the disc, the serrated keel formed by the upper arm-plates, and the reduction in size of the arm-spines, are points by which this Antarctic form may be distinguished from any Ophiurid yet known to us.

8. OPHIOSTEIRA ANTARCTICA. (Pl. XXVI. and XXVII.).

With the exception of the large plates noted in the generic diagnosis nothing definite can be said as to the plates on the upper surface of the disc, for, as Plate XXVII. shows, the most extraordinary variations are to be seen.

The colour of the specimens in spirit is more constant; the greater part of the disc is dark grey, and the arms cream-yellow. The disc is high and arched; the arms taper gradually and carry about eight very short spines; the side arm-plates have a swollen appearance.

Diam. of disc.	Length of arms (ca.).
8 mm.	20 mm.
7.5 mm.	19 mm.
10 mm.	26 mm.

Stations.—Cape Adare: 26 fathoms: Nov. 4th, 5th and 10th, 1899 (28.8° F.).

Cape Adare: 20 fathoms: Jan. 6th, 1900 (20° F.).

Cape Adare: 24 fathoms: Jan. 6th, 1900 (20° F.).

OPHIONOTUS.

A genus allied to *Ophiura* (*Ophioglypha*), but distinguished by having a number of supernumerary arm-plates, no incision to the disc above, and no comb of spines at the base of the arms.

These characters in combination appear to be sufficient to justify the formation of a new genus, and an opportunity such as this may be taken for pointing out that an exhaustive revision of the genus *Ophiura* would be a real service for students of brittle-stars.

9. O. VICTORIAE. (Pl. XXVIII).

Disc large, rounded, smooth and shining above, with numerous small scales; the scales below slightly larger; the whole covered with a smooth skin. Arms broad at base and narrowing rapidly but not abruptly, quite delicate at tip; arm-spines moderately stout, pointed, generally three, with two tentacle-scales; beyond the middle of the arm one scale.

Diam. of D.sc.	Length of arm.	Breadth at base.
30 mm.	—	7 mm.
27 mm.	74 (ca.) mm.	6·5 mm.
24 mm.	70 (ca.) mm.	6 mm.

Stations.—Cape Adare: 24 fathoms: Nov. 4th, 1899 (28·8° F.).

Cape Adare: 26 fathoms: Nov. 14th, 1899 (28·8° F.).

Cape Adare: 20–24 fathoms: Jan. 2nd, 1900 (29° F.).

Cape Adare: 27 fathoms: Jan. 9th, 1900 (29·2° F.).

Franklin Island: 10 fathoms: Feb. 9th, 1900 (29·8° F.).

IV. ECHINOIDEA.

10. ECHINUS MARGARITACEUS.

Echinus margaritaceus, Lamk. Anim. s. Vert. (1816), p. 47; A. Ag. Rev. Ech. (1872), p. 124, *ibi pue citatu*; *id. op. cit.*, p. 493; *id.*, 'Challenger' Rep., Echin. (1881), p. 117.

It is with some diffidence that I assign to this species (of which it is known that specimens exhibit marked variability) two examples from Franklin Island (29·8° Fahr., 10–24 fathoms), as they appear to want the large pedicellariae that are so characteristic of the creature; the general condition of the collection, with other points for consideration, apparently justifies the course adopted.

Distribution.—Apparently circumpolar.

11. HEMIASTER CAVERNOSUS.

Tripylus cavernosus, Philippi, Arch. f. Nat., 1845, p. 345.

Faorina antarctica, Gray, Ann. and Mag. Nat. Hist. VII. (1851), p. 132; *id.*, Cat. Rec. Echin. B. M. i. (1855), p. 57.

Hemiaster cavernosus, A. Ag. Rev. Ech. I. (1872), p. 132; *id.*, 'Challenger' Rep. (1881), p. 177.

This species has been so fully discussed by Professor Alex. Agassiz in his 'Challenger' Report that it would be superfluous to

dilate on it here. It is of some interest to note that Gray's specimens were collected by Ross in the "South Polar Seas."

Distribution.—Circumpolar.

Stations.—Cape Adare : 20–24 fathoms : Jan. 2nd and 9th, 1900 (29° F.).

Cape Adare : 26 fathoms : Nov. 10th, 1899 (28° F.).

Franklin Island : 20–24 fathoms : Feb. 9th, 1900 (29·8° F.).

EXPLANATION OF PLATES.

PLATE XXVI.

Ophiosteira antarctica.

Fig. 1.—The animal, natural size, from above.

Fig. 2.—The disc, from above, magnified four times, showing the large keel-shaped plate between the radial shields.

Fig. 3.—The same, showing an abnormal increase and diminution of the plates in two rays, $\times 4$.

Fig. 4.—The disc from below, magnified four times, showing the *Ophiura*-like arrangements of the oval skeleton.

Fig. 5.—The disc from the side (interradial view), $\times 4$.

Fig. 6.—An arm, near its base, from above, $\times 8$.

Fig. 7.—An arm, from the side, showing the gap between the upper arm-plates, $\times 8$.

Fig. 8.—An arm, from below, showing the small under arm-plate, the large side arm-plates meeting in the middle line below, and the short arm-spines, $\times 8$.

Figs. 9, 10, 11.—Views of the arm at some distance from the base, from above, from the side and from below, all $\times 8$.

PLATE XXVII.

Five photographs of the disc of *Ophiosteira antarctica* to show the extraordinary variations of the plates of the disc.

PLATE XXVIII.

Ophionotus victoriae.

Fig. 1.—The creature from above, natural size.

Fig. 2.—The disc, from below, $\times 2$, showing the same *Ophiura*-like character of the mouth as *Ophiosteira*.

Fig. 3.—An arm, near the base, from above, $\times 4$, showing the way in which the side arm-plates encroach upon the upper arm-plates, and their mode of breaking up.

Fig. 4.—The same, from below, $\times 4$, showing the encroachment of the side arm-plates on the under arm-plates.

Figs. 5, 6.—An arm near its end, from above and from below, $\times 4$.

IX. INSECTA.

APTERA.

COLLEMBOLA.

BY GEORGE H. CARPENTER, B.Sc. LOND.,

(Plate XLVII.)

THE presence of at least one species of springtail on the Antarctic Continent is not the least interesting fact established through the voyage of the '*Southern Cross*.' Eight specimens of an *Isotoma* were collected on Geikie Land at the head of Robertson Bay (about 71° 40' S. Lat., 169° 50' E. Long.) in the month of November, 1899, by Dr. Klovstad, who found the insects among lichens when engaged in a botanical expedition.¹ Springtails are fairly numerous in the Arctic regions, as many as sixty-one species being recorded in the recent comprehensive summary of Schäffer.² Among these the genus *Isotoma* is predominant, sixteen of the sixty-one species belonging to it. It is of interest that the first discovered Antarctic springtail should prove to be an *Isotoma*, especially as the genus has been traced into the southern hemisphere only during the last few years.

The insects were mounted as microscopic preparations in balsam shortly after their capture. Unfortunately, the delicate integument of springtails renders them very liable to shrivel in such a medium, and all the specimens are more or less distorted. But from the number of slides available, it has been possible to make out all the principal structural features of the insect. *Isotoma* is readily

¹ C. E. Borchgrevink, 'First on the Antarctic Continent,' London (1901), pp. 231-2.

² C. Schäffer, 'Die Arktischen und Sub-Arktischen Collembola,' in Römer and Schaudinn's 'Fauna Arctica,' Jena (1900), pp. 237-258.

distinguished from other genera of its family by the forwardly directed head, the close equality in length between the third and fourth abdominal segments, and the entire absence of scales.

As might have been expected, the Geikie Land *Isotoma* does not seem to be referable to any described species, though, as will be seen, it closely approaches one from Tierra del Fuego.

FAMILY ENTOMOBRYIDAE.

ISOTOMA KLOVSTADI.

Plate XLVII., figs. 1-8.

Antennae 1.6 times as long as the head, the second segment slightly longer than the third, but markedly shorter than the fourth. Eight ocelli on each side; post-antennal organ elongate, about twice as long as an ocellus. Feet without tenent hairs; both upper and lower claws without teeth; third abdominal segment slightly longer than the fourth. Spring (apparently borne on the fifth abdominal segment) with very slender dentes, $2\frac{1}{2}$ times as long as the manubrium; mucro narrow and elongate, with straight ventral edge, prominent apical and sub-apical teeth, and two less prominent dorsal teeth close together.

Colour.—Dark blue-violet; legs and spring yellowish-brown.

Length.—2 mm.

This springtail seems to be related to the common European and American *Isotoma palustris* (Müller); in that species, however, the feelers are relatively longer and the mucro much shorter and thicker than in this.

No member of the genus *Isotoma* was known outside the Holarctic region until Lord Avebury in 1879 recorded an undeterminable species from Kerguelen.¹ Recently, however, several species have been described by Schäffer from the southern regions of America, and it is one of his Fuegian *Isotomae*—*I. silvatica*²—that of all hitherto known species seems the nearest to our insect from Geikie Land. The feet of *I. silvatica* seem to agree almost exactly with those of *I. Klovstadi*. So do the antennal segments in their relative lengths. Only in the Antarctic insect the antennae as a

¹ Sir J. Lubbock, 'Collembola in "The Collections of Kerguelen Island,"' Phil. Trans., CLXVIII. (1879), p. 249.

² C. Schäffer, 'Hamburger Magalhaensische Sammelreise: Apterygoten,' Hamburg (1897), p. 18, figs. 34-7.

whole are relatively longer than in *I. silvatica*, while in the latter species the third and fourth abdominal segments are equal to one another, and the mucro is comparatively short and stout. It could, however, be readily derived from the mucro of *I. Klovstadi*, as the general arrangement of the teeth is identical in the two species. The post-antennal organ in *I. silvatica* is more rotund than in our insect.

Several of the specimens were so mounted as to exhibit portions of the jaws. It seemed advisable, therefore, to figure the parts visible—the labium (Fig. 3) and the extremity of a maxilla and its palp (Fig. 2). The maxillary palp in this species is prolonged into a thin leaf-like process bearing four bristles, while the fifth bristle is borne on a very prominent papilla.

Our knowledge of the distribution of these insects is as yet too incomplete to elucidate any details of ancient geography. But the existence of a species of this order of wingless insects in Geikie Land—a species belonging to a genus widely spread in the northern hemisphere—cannot but support the theory of a former extension of the Antarctic Continent. And the further fact that the species is closely related to a Fuegian insect is consistent with the view that there may have been a southern route of migration between eastern and western lands.

EXPLANATION OF FIGURES.

PLATE XLVII.

- Fig. 1.—*Isotoma Klovstadi*. Dorsal view, $\times 18$.
 Fig. 2.—Left maxilla (ventral aspect), showing head and extremity of palp, $\times 350$.
 Fig. 3.—Labium (ventral aspect), $\times 350$.
 Fig. 4.—Ocelli and post-antennal organ of right side, $\times 200$.
 Fig. 5.—Fore-foot, $\times 350$.
 Fig. 6.—Hind-foot, $\times 350$.
 Figs. 7, 8.—Mucro drawn from two specimens to show variation, $\times 350$.

PTERYGOTA.

HEMIPTERA PARASITICA.

PEDICULIDÆ.

BY THE HON. N. C. ROTHSCHILD, B.A.

ECHINOPHIRIUS SETOSUS.

Pediculus setosus, Lucas, Magazin de Zool., IV., p. 121, f. 12.

Thirteen specimens of this species were secured by the 'Southern Cross' Expedition from the Antarctic Seal (*Oymorhinus leptonyx*) on October 6th, 1899 (*cf.* Borchgrevink, 'First on Antarctic Continent,' p. 184).

This species is known to be a parasite of the common seal (*Phoca vitulina*). I have, however, failed to find any distinguishing characters between the thirteen specimens from the South Polar Seas and examples from the better known host.

Piaget¹ characterizes the genus *Echinopthirius* as possessing four-jointed antennæ, pointing out, moreover, that by this character *Echinopthirius* may be readily distinguished from *Hæmatopinus*.

I am inclined to consider Piaget to be mistaken in this respect, as the first two joints of the antennæ are, under a low power, somewhat difficult to distinguish. Lucas, moreover, in his description of *Pediculus setosus*, mentioned the five-jointed antennæ.

¹ Les Pédiculines, Vol. I., p. 656.

X. ARACHNIDA.

ACARINA.

PAR LE DR. E. L. TROUESSART,

*Président de la Société Zoologique de France, Membre Correspondant de la
Zoological Society of London.*

PENTHALEUS BELLI.

EN ovale allongé avec les flancs sub-parallèles, le sillon thoracique formant en dessus et sur les flancs une saillie transversale bien marquée au niveau du premier tiers du corps. Abdomen arrondi en arrière. Couleur (sur la préparation dans le baume) d'un brun verdâtre, avec les pattes plus claires (très probablement rouges sur le vivant).

Rostre bien découvert, à palpes robustes, présentant la forme typique du genre : le 1^{er} article très court, le 2^e allongé, renflé à l'extrémité, le 3^e plus court que le 2^e, le 4^e un peu plus long, aminci à son extrémité et terminé par des poils tactiles assez courts et plumeux. Chélicères de la forme normale dans ce genre.

Tronc ovale. *Face dorsale* tronquée en avant par l'ouverture du camérostome, qui est assez resserrée, en forme de cou, et dépourvue de dilatation en forme de collerette évasée, l'épistome coupé carrément ou même un peu échancré en avant, ne recouvrant que la base du rostre ; cette face dorsale est nettement séparée par le sillon thoracique en région thoracique et région notogastrique, arrondie en arrière mais légèrement échancrée de chaque côté de la protubérance anale. (Je n'ai pu voir les yeux.) *Face ventrale* fortement échancrée en avant par l'ouverture du camérostome ; les épimères formant deux groupes, l'anérieur (épimères 1 et 2) en forme de plaque sternale, les hanches de la 1^{re} paire fortement dilatées et saillantes

de chaque côté du rostre, deux fois plus larges que le 1^{er} article des pattes; celles de la 2^e paire pas plus larges que le 1^{er} article. Épimères postérieurs (3 et 4) largement séparés sur la ligne médiane et placés vers le milieu de la longueur totale du corps. De chaque côté, en dehors des hanches, il existe une ligne longitudinale saillante, partant des côtés du camérostome, où elle est un peu dentelée, et se terminant à l'extrémité de l'abdomen par une petite bosse, de telle sorte que cette extrémité présente, de chaque côté de la protubérance anale, une échancrure plus marquée qu'à la face dorsale. En dedans des épimères on voit une seconde ligne longitudinale, partant de la plaque sternale pour aller rejoindre la face interne de la petite bosse latérale. Plaque génitale (♀) grande et large, sub-quadrangulaire, à angles fortement arrondis, l'ouverture en forme de fente longitudinale. Anus infère, à cadre petit, elliptique, situé en dessous de la protubérance qui termine l'abdomen. Une paire de poils plumeux à l'extrémité de l'abdomen.

Pattes grêles, de 5 articles (par soudure du 3^e au 2^e), sensiblement de la longueur du corps et décroissant de taille dans l'ordre suivant: 1, 4, 3, 2. La 1^e paire à premier article court, conique; le 2^e très long, étranglé à sa base, la soudure du 3^e bien visible vers les $\frac{4}{5}$ de la longueur totale; le 4^e moitié plus court; le 5^e un peu plus court que le précédent; le 6^e un peu plus long, terminé par une double griffe assez faible et un petit pulvillum en brosse. L'extrémité du tarse est brusquement atténuée et un peu échancrée en dessus, permettant aux griffes de se relever verticalement. La 2^e paire plus courte, à 2^e article presque moitié plus court que celui de la première paire, la soudure du 3^e placée vers les $\frac{2}{3}$ de l'article. Les deux paires postérieures semblables, mais la 4^e paire presque aussi longue que la première. Des poils plumeux assez courts au tarse; d'autres poils plus longs et très grêles assez rares sur les autres articles. Le tronc en est presque entièrement dépourvu, sauf à l'extrémité de l'abdomen.

Longueur totale 0·62 mm.; largeur 0·35 mm.

Tous les exemplaires examinés sont femelles et renferment 3-4 œufs gros et d'un jaune orangé avec une petite tache rouge.

Habitat.—Sur les Mousses du Cap Adare (Terre Victoria). L'espèce est dédiée à Mr. Francis Jeffrey Bell, Emeritus Professor in King's College, London.

Remarques, rapports et différences.—La soudure du 3^e article des pattes au 2^e est la règle dans ce groupe: je l'ai constatée sur les genres *Penthaleus*, *Halotydeus*, *Notophallus* et *Nörneria* (= *Scyphius*).

Penthaleus Belli, est une espèce parfaitement typique, que j'ai comparée ici à *P. ovatus*, Koch (Berlese, "Acari, Myriopod. Scorp, Ital.," fasc. 60, no. 2); elle en diffère par son tronc plus allongé, à flancs sub-parallèles. Elle diffère d'une autre espèce antarctique (qui sera décrite dans la Partie Zoologique de l'Expédition Antarctique Belge), par l'absence d'une large collerette, rabattue sur le rostre, qui caractérise cette dernière espèce (*Penthaleus villosus*, Trt.), par le dernier article des palpes plus allongé, et par l'absence d'une fine pubescence qui couvre tout le tronc sur l'espèce du détroit de Gerlache.

XI. CRUSTACEA.

By T. V. HODGSON.

(Plates XXIX-XL.)

FOR the opportunity of examining the collection of Crustacea brought home by the '*Southern Cross*' Expedition, I am indebted to Professor F. J. Bell, and I am much more indebted to him for his kind assistance and advice during the progress of the examination. The collection came to me in about sixty bottles, for the most part of two-ounce capacity. The state of preservation of the specimens is a matter which calls for some comment; as a rule, far too many specimens were crammed into one bottle, the result being that they arrived at the Museum in a more or less macerated condition; some were very bad.

A summary of the results may be expressed as follows:—

Decapoda	6 genera, 6 species, including 1 new species
Schizopoda	1 " 2 " " 2 " "
Isopoda	7 " 10 " " 10 " "
Pycnogonida	1 " 1 " " 1 " "
Cumacea	1 " 1 "
Copepoda	2 " 2 "

With regard to the Amphipoda, I sincerely regret that my duties have prevented me from seriously dealing with this group.

A preliminary examination has been made, and the species roughly sorted out; from this I should assume that there are upwards of thirty-five species in the collection, and that at least twenty-five will prove to be new. This group then, as might have been expected, is the most important of the Arthropod phylum.¹

The Cumacea was represented by a single mutilated specimen from Cape Adare, and I am unable to assign even its generic rank. Two genera of Copepoda were found in a bottle containing an assortment of specimens, but they were so macerated as to be useless for identification. They represented two genera of Calanids. It is

¹ I am glad to say that Mr. A. O. Walker has kindly undertaken to examine it.—F. J. B.

noteworthy that no Decapods were found within the Antarctic circle or anywhere near it, and further that no new genera were discovered; most of the species belong to well-known genera, and on the whole show a close relationship to northern forms.

I am also indebted to the Rev. T. Stebbing, F.R.S., for assistance with regard to the Isopoda, and more particularly to Mrs. L. E. Sexton for the drawings, which have been made with extreme care under very disadvantageous conditions.

CRUSTACEA THORACOSTRACA.

1. DECAPODA.

FAMILY PORTUNIDAE.

NECTOGARCINUS ANTARCTICUS.

Portunus antarcticus, Jacquinot and Lucas, Voyage au Pole Sud (Hombron and Jacquinot), vol. iii. (1853), Crustacea, p. 51.

Nectocarcinus antarcticus, A. Milne Edwards (21, p. 407.)

This species was one of the discoveries of Dumont d'Urville on his celebrated voyage to southern regions. It was also obtained by Ross (16). The large genus *Portunus* was broken up into numerous genera by Milne Edwards in 1861 (21), and that author ascribes as the distinctive features of the genus *Nectocarcinus* the presence of only four anterolateral teeth on the carapace, and the sub-lanceolate character of the dactylus of the last pair of thoracic appendages. In the paper cited above, Milne Edwards assigns three species to this genus, and figures two of them, but not this species. Milne Edwards does not refer to the dactylus of the last thoracic appendage of this species, which is broadly ovate and typically "portunid," and is so figured by Mr. Miers in the 'Zoology of the "*Erebus*" and "*Terror*,"' and shown by the specimen in the National collection.

The '*Southern Cross*' specimens are two in number, an adult male and a young one, and were taken at the Auckland Islands in ten fathoms.

Distribution.—Known only from New Zealand and Auckland Islands.

FAMILY PERICERIDAE.

PRIONORHYNCHUS EDWARDSI.

Prionorhynchus Edwardsii, Jacquinot and Lucas, Voyage au Pole Sud, Zoology, vol. iii. (1853), Crustacea, p. 8; Rathbun (25, p. 243).

A single specimen of this species was taken at the Auckland Islands on Dumont d'Urville's voyage to the South Pole, and upon this the genus was established. The genus is characterised by the depressed lamellate and emarginate rostrum. In describing the species, MM. Jacquinot and Lucas allude to a second specimen, a female, in the possession of the British Museum, and it would appear that their figure was drawn from this specimen. The figure in question is admittedly defective; the tubercles on the carapace are much too prominent, while the rounded elevations with which they are associated are not indicated, neither is the granular nature of the appendages shown.

Two specimens, ♂ and ♀, occur in the National collection, but nothing is stated as to the locality from which they were obtained. The '*Southern Cross*' specimens, three in number, were taken at the Campbell Islands in 1898, and are all much larger than the specimens alluded to above. The carapace and the greater part of the appendages are concealed by a dense incrustation of Polyzoa, and in addition to this, on the two smaller specimens, there is an interesting growth of a stout foliaceous green alga. These growths very largely conceal many details of structure, but there can be no doubt as to the identity of the species. The granular character of the limbs, which has been made a specific character, is practically absent, but enough remains on the female specimen to show that this feature is doubtless dependent on age. Another point to which it is desirable to call attention is the abdomen of the ♀. In the specimen in the National collection the abdomen is narrow, and scarcely covers more than half of the sternal area, whereas in the '*Southern Cross*' specimen the abdomen is much broader, and entirely occupies the sternal area. This latter specimen bears ova, the condition of which indicates they were not far from hatching.

1 ♂. Size of carapace, 160 × 135 mm.

2 ♂. Size of carapace, 133 × 114 mm. Two legs and a cheliped missing.

3 ♀. Size of carapace, 114 × 102 mm. Both chelipeds missing. Bearing ova.

Distribution.—This species is only known from the Campbell and Auckland Islands.

FAMILY MAIIDÆ.

PARAMITHRAX PERONI.

Paramithrax Peronii, Milne Edwards, Hist. Nat. des Crustacés, vol. i., p. 324; Jacquinot and Lucas (15, p. 10); Miers (17, p. 5); Haswell (9, p. 13).

Two small ovigerous females of this species were obtained in Adventure Bay, Tasmania. As with numerous members of the Maioid Crustacea, these specimens are covered with algæ, sponges, &c. A few dried specimens, showing considerable variation in size, occur in the National collection, and from the available information it appears clear that this crab is not uncommon in the shallow waters of the South Australian region.

Distribution.—"Indian Ocean" (20), "Australia" (17), "New Zealand" (15).

FAMILY PINNOTHERIDÆ.

HALICARCINUS PLANATUS.

Cancer planatus, Fabr., Ent. Syst. ii. (1793), p. 446.

Halicarcinus planatus, White, Ann. and Mag. Nat. Hist. xviii. (1846), p. 178.

Hymenosoma planatum, Haswell, Cat. Austral. Crust. (1882), p. 114, *ibique citata*.

This is a very abundant and widely distributed species in the Southern Hemisphere. It is subject to a considerable amount of variation, but this after all is confined to comparatively narrow limits. These variations and the immense area over which this species is distributed has led to the existence of a number of synonyms. The '*Southern Cross*' specimens are three in number, males, and quite small, being barely a quarter of an inch across the carapace, and were obtained at Auckland Islands in ten fathoms.

The habitat of this species seems to vary from between tidemarks, rock-pools to a depth of 150 fathoms, and a bottom of sand, mud or ooze.

The National collection contains a large number of specimens from various localities, showing a circumpolar distribution.

FAMILY GALATHEIDAE.

MUNIDA SUBRUGOSA.

Munida subrugosa, Miers, Zool. Voy. 'Erebus' and 'Terror,' Crustacea (1874), p. 3; Henderson (10, p. 124); Milne Edwards (22, p. F 36).

This is one of the widely distributed species of the Southern Hemisphere and is very closely allied to its congener *M. rugosa* of the northern region. A. Milne Edwards (22) points out that it is subject to a not inconsiderable amount of variation, and Professor Henderson, relying on the distribution of spines on the dorsum of the carapace, names a particular variety *australiensis*. Mr. Miers invariably maintained that *M. gregaria*, which is found in company with this species in the Falkland region, is only the young of *M. subrugosa*. General opinion does not, however, favour this view, though it is generally admitted that the only reliable points of distinction are to be found in the maxillipeds. The specimens brought home by the 'Southern Cross' expedition were numerous and were obtained at the Auckland and the Campbell Islands. None of them, however, show the distinctive features of Professor Henderson's *australiensis*, although it is true that the characteristic row of four spines is usually present. These should be sub-equal, but they are not, for the outer ones are extremely minute and not readily seen. Spines on or near the cervical groove may or may not be present and are usually minute. The absence of spines is more noticeable in the Auckland Island specimens, but as these are much smaller it is only to be expected.

Fifty-one specimens, ♂, ♀, and young, Auckland Islands.
Ten fathoms.

Thirteen specimens, ♂, Campbell Islands.

Distribution.—Circumpolar.

FAMILY HIPPOLYTIDAE.

In dealing with the Crustacea Macrura of the 'Challenger' Expedition Spence Bate (1) sub-divided this family into some ten genera, but these do not appear to be generally accepted. At any rate, a number of new species belonging to the family have been described since the appearance of that report, and in many cases (Milne Edwards, 22) without either reference to Spence Bate's classification, or the essential features upon which it is based. This

can only cause confusion, and having no desire to add to it I have accepted Spence Bate's classification in its abbreviated form as quoted by Mr. Stebbing in his "Crustacea" (30). This summary admirably answers all practical purposes and serves to discriminate fairly readily between a large and increasing number of species.

The genus *Merhippolyte* of Spence Bate had two species assigned to it by its author and, for the reason alluded to above, I have not been able to ascertain whether any further additions have been made.

MERHIPPOLYTE AUSTRALIS.

(Pl. XXIX.)

Carapace rather short, the posterior two-thirds straight, the anterior third produced into a prominent rostrum, the two together bearing seven or eight prominent teeth. The rostrum is deep and bears two or three teeth on the under margin. The carapace bears a stout spine at the outer margin of the orbit and another exists at the lower angle. Posteriorly the carapace is curved backwards. Pleon smooth, epimera large, those of the first three segments rounded and the second much the largest, the remainder are pointed posteriorly, the last being small and spinous. Telson moderately long, narrow, five spines at the extremity, two pairs of spines and a few setae on the dorsal surface.

First antenna. A stout three-jointed peduncle, of which the basal joint is longer than the other two and bears a very large spine, reaching to the extremity of the following joint. Of the two multiarticulate flagella, the inner one is long and somewhat tapering, the outer one is exceedingly stout for nearly two-thirds of its length and then suddenly becomes quite slender.

Second antenna. The basal joint bears a stout spine externally at the articulation of the exopoditic squame. The second joint of the two-jointed peduncle of the flagellum is long and the two basal joints of the flagellum are larger than the remainder. The flagellum is comparatively long. The squame is spinose at its exterior termination and bears a close fringe of long setae; the broadest part of the squame is rather less than one-third of its length. A row of red pigment spots (in spirit specimen) occurs along the margin of the muscles of the organ.

Eye large, pyriform, cornea hemispherical with ocellus contiguous.

Mandible is stout, with a broad cutting edge bearing five blunt

teeth. The molar process is a somewhat oval pad surrounded by a close fringe of stout papillae. The palp is well developed and consists of a three jointed appendage, the joints being nearly uniform in length but differing considerably in breadth from the basal one.

First maxilla. The coxa is somewhat crescentic in shape, the horn directed forwards and thickly covered with long spinose setae; the basis is large, irregularly oval, and its inner margin very thickly covered with stout setae; the endopodite is a curved, tapering joint, its truncate end being indented and the inner lobe bearing two long setae.

Second maxilla consists of a small rounded setose coxa, and a large bilobed basis, the distal lobe being much the largest, both are setose. The endopodite is a comparatively long, slender process armed at the extremity with two slender spines. The scaphognathite is large and its entire margin is setose, excepting the innermost posterior portion. It is truncate in front and fairly broad, curved and narrow behind.

First maxillipede is lamellar, the coxa is comparatively small and somewhat rounded, the basis is half as large again, the inner margin being slightly incurved and the distal margin rounded, both coxa and basis are very setose. The endopodite is a two-jointed setose appendage with a terminal claw. The exopodite is a thin lamellar appendage provided with long setae, and from its inner margin arises a multiarticulate flagellum which bears long plumose setae at its extremity.

Second maxillipede is a large lamellar appendage. The propodus is almost the largest joint, and somewhat pyriform in shape; it is reflexed on the remainder of the limb. The dactylus is a narrow band-like joint which runs along the apparent posterior half of the propodus. Both are richly setose. The exopodite is a large multiarticulate flagellum, setose, more particularly at its extremity; at the base is a fan-like appendage of numerous segments.

Third maxillipede. The first joint is small, the next is very long and stout, with small tufts of setae throughout its entire length, and these not confined to any part of the margin. The two following joints are not so long as the latter, and the longer terminal one appears to be broken; if so, the wound is an old one, and the tip is much discoloured. These two joints bear horizontal rows of setae throughout their length.

The thoracic appendages vary in size; the first two are chelate, the former being very stout and with small tufts of setae throughout its length; these are specially noticeable at the extremity of the

propodos and dactylus. The chela of the second appendage is similar but smaller, and the entire limb is much more delicate and, by a good deal, the longest of the series. The carpus is divided into fourteen more or less distinct joints, and of these the most distal is as long as any other two. Of the remaining appendages, the next or third is the longest. It is stoutly built, and the carpus and meros respectively, bear one and two distal spines. The inner margin of the propodos and dactylus bear smaller spines along their entire length, and the latter terminates in two claws. The fourth and fifth are similar, but the propodos in the latter bears a conspicuous tuft of setae at the distal extremity.

In the specimen most closely examined it was found that the second and fourth appendages were obviously replacements due to injury, as they were very much less than normal size.

The pleopods consist of a stout peduncle and a lanceolate exo- and endopodite, the pair forming the caudal fan being large and ovoid. The exopodite is scarcely as long as the endopodite, but is obscurely divided near the extremity; this division is marked by the presence of a stout spine on the outer border. Another stout spine exists at the proximal end, but this belongs to the peduncle.

The telson is long and gently tapering, rounded at the extremity, which bears five spines among the setae. The middle one of these is small, the adjacent pair are very long and the outer of moderate size. The dorsal surface bears two pair of lateral spines and a few stout setae near its junction with the body.

This species is a very close ally of *Hippolyte magellanicus* of Milne Edwards (22, p. F. 46), but the specific descriptions afforded by that work are by no means satisfactory. Four specimens of this species were taken at Auckland Island in ten fathoms. The specimens varied in size from thirty-eight to twelve millimetres, measured from rostrum to telson. The species also appears subject to some variation as regards the rostrum; the specimen examined had $\frac{8}{3}$ teeth, two of the others $\frac{7}{3}$, and in one of these a lower tooth was very small, and the fourth specimen had $\frac{7}{2}$ teeth.

A large member of the Palaemonidae was taken from the stomach of a seal on Duke of York Island, but it is in such a mangled condition that no satisfactory description can be made.

2. SCHIZOPODA.

Professor Sars, in his 'Challenger' Report (27) on this group, gives a synopsis of all the species of *Euphausia* known at the date of publication of that report. Mr. Stebbing (31), in describing a new species from the Falkland Islands, adds the more recently discovered species to the synopsis of Professor Sars. The latter author gives a brief critical summary of the characters usually made use of in determining the species. In spite of deficient information on many points, I have decided to describe the two following species as new; concerning one, *E. glacialis*, there can be no doubt, but with regard to the other, *E. australis*, there may be some question as to whether or no it is not identical, the differences noted being due to age. The locality is the same, the date of capture does not vary by a fortnight (12 days). Size is the most conspicuous difference, and at present it is very much open to question whether the proportions of the joints of the appendages are trustworthy characters.

EUPHAUSIA GLACIALIS.

(Pl. XXX.)

Body about twenty-five millimetres long, from rostrum to telson. The anterior part of the carapace is keeled and produced into a short and broad rostrum, of which the base occupies the entire width of the carapace.

The ventral margin of the carapace bears a small spine anteriorly and a larger one laterally about the middle of its length. The hinder margin is produced backwards to form a pair of lateral rounded wings. The pleon segments are very nearly equal.

Telson comparatively long and slender, lateral appendages large with a slight outwardly directed curve. Uropods approximately two-thirds the length of the telson. Eyes large, pyriform, the cornea very large, and a luminous organ in close connection with it externally.

First antenna. The first joint of the peduncle is at least twice the length of the second, and at its distal extremity it bears a membranous lappet on one side and a spine on the other. The second joint also bears a small lappet, and the third carries two subequal multiarticulate flagella; the outer flagellum has a swollen base and this bears a few sensory setae.

Second antenna. Basal joint of peduncle large and bearing a long slender spine externally at the base of the antennal squame. The spine bears a row of forwardly directed teeth on its inner margin. The squame is of moderate size, outer margin straight, terminating in a small tooth, distal margin somewhat rounded, only very slightly projecting beyond the tooth and like the inner margin setose; setae long. The multiarticulate flagellum is of moderate length and supported on a three-jointed peduncle, the proximal joint is small and the following one the longest, the three together being about three-quarters the length of the squame.

Mandible. Cutting edge irregularly dentate, the two jaws being dissimilar. The molar process is large and its extremity covered with closely set ridges. The palp is very long, three jointed. The basal joint is short, the middle one is the largest, but only by a little, and sparingly setose. The terminal joint is more slender, and near the distal extremity bears a few stout setae, the terminal ones being long and pectinate.

First maxilla normal; the free margin of the coxa is rounded and bears spinose setae, those which are proximally situated being the longest; the inner margin of the basis is truncate and beset with short spines. The palp is ovoid and carries a few stout setae. The epignath is very large and thin, ovoid and without setae.

Second maxilla. The coxa and basis are both bilobed; in the former case the lower lobe is the largest, and in the latter the distal lobe is nearly twice the size of the other. The lower coxal lobe is rounded, the other lobes merely having their angles more or less rounded off. The inner margin of both segments of the two joints are closely beset with stout setae, most of which are spinose, and they occur on the surface of the appendage, some distance from its edge. The palp is ovoid, and a little longer than the basis; it bears comparatively long setae on its inner edge. The epignath is narrow, about as long as coxa and basis together, and is sparingly setose.

Maxillipede. The dactylus is about half the length of the propodus, and the carpus has the same proportion to the meros. The ischium is the longest joint, twice the length of the meros, and slightly exceeds the exopodite in length. Its inner margin is provided rather sparingly with comparatively short setae and long plumose setae throughout its entire length. The exopodite consists of a basal portion, which terminates on the outside in an obtuse point, and a terminal natatory portion setose only on the outer margin. The proportions of the first maxillipede practically hold good for the two following appendages, the ischium, however, increasing in

size to the penultimate limb. In the thoracic appendages, strictly so-called, these proportions fail. In the last three limbs the carpus shortens, and the meros is not only longer in proportion, but of equal size in the three limbs.

The pleopods are subequal in size and of uniform structure, with, of course, the exception of the last. The coxa is very short, its distal margin being very sinuous; the basis is comparatively long and stout. The exopodite is the largest, lanceolate, with long plumose setae on the distal one-third of the outer and two-thirds of the inner margin. The endopodite is smaller, its distal portion being more equally setose on both sides, and the inner margin bears a long finger-like process about the middle of its length.

The uropods are large, the basipodite is broad, and bears on its rounded outer margin a row of plumose setae. The exopodite reaches to the origin of the telsonic appendages, and very closely resembles the antennal squame in structure. The endopodite is about the same length, tapering, and has long plumose setae on both sides.

The telson is proportionately broad at the base; about one quarter of its length it tapers somewhat rapidly for a short distance, and then very gradually. Between the distal half and the origin of the lateral appendages are three teeth on either side. Beyond the third spine, which is the largest, the telson tapers quickly, and then terminates in a lanceolate manner. The appendages are a pair of large, somewhat outwardly curved blades.

Some twenty to thirty specimens of this species were taken between the ice-floes on January 13, 1899, in lat. $65^{\circ}52'$, long. $162^{\circ}32'$ E. Temperature 31° Fahr.

EUPHAUSIA AUSTRALIS.

Body about forty-five millimetres in length from rostrum to telson, and very stoutly built.

In general anatomical details this species so closely resembles the last that I was disposed to regard *glacialis* as the young of this form. Close examination proves that the two forms seem distinct, and it is only necessary here to call attention to the points of difference.

The carapace is precisely similar, save that the rostrum is narrower; its base does not occupy the entire width of the carapace.

First antenna. Occurs both as singular and plural. The lappet at the distal extremity of the first joint is bi-lobed, and that at the end of the second extends to half the length of the third joint.

Mandible. Second joint of palp a little stouter, and sparingly setose.

First maxilla. Very similar.

Second maxilla. Palp somewhat more conical.

Maxillipede. Proportions of the joints differ slightly, and may be represented as follows: dactylus, 4; propodos, 5; carpus, 6, and meros, 11. The two following maxillipedes do not differ conspicuously from this, but in the two first thoracic limbs proper the dactylus is rather less than half the length of the propodos and the carpus is more than half the length of the meros. In the last limb the proportions are, dactylus, 4.5; propodos, 4.5; carpus, 3; meros, 19.5.

The telson is much more slender, but otherwise precisely similar.

A score or so of individuals of this species were taken between the ice floes in lat. 62° S. on the 1st of January, 1899, the temperature not recorded. They were in a terribly bad state of preservation.

3. CUMACEA.

A single specimen of this group was taken off Cape Adare, but it is in a mutilated condition.

CRUSTACEA ARTHROSTRACA.

1. ISOPODA.

TANAIDAE.

Like many others, this family stands much in need of revision. Fifteen genera, containing something like sixty species, have been described, and many of these are only known from single specimens. (Dollfus, 8.) The species are separated by very minute characters, and very little is known concerning their life histories and the extent to which sexual dimorphism occurs. Mr. Beddard has described in the 'Challenger' Reports (2) a species under the name of *Paratanaïs dimorphus*, but this species does not seem to belong to any of

the genera defined by Professor G. O. Sars in his "Crustacea of Norway" (29). The species described below is obviously a close relation of Mr. Beddard's *P. dimorphus*, and, considering the present state of our knowledge, I have preferred to place this '*Southern Cross*' species with his rather than constitute a new genus, merely notifying the fact that Professor Sars' (29) and Mr. Beddard's (2) genus *Paratanais* are not in accord. But for the structure of the uropods I should have placed this and Mr. Beddard's species in Sars' genus *Heterotanaeis*.

PARATANAIS ANTARCTICA.

(Pl. XXXI.)

Cephalon very large, pyriform, eyes distinct at the base of the antennae. Thoracic segments very slightly tapering, the first one is the broadest, and less rounded laterally than the others. The fourth and fifth are sub-equal in length. The abdomen continues uniformly the slight taper of the thorax, and the first segment is longer than the following five, but the last is longest as well as narrowest, and is ovoid in shape, with a terminal setose projection in the middle line. The uropods are conspicuous, and comprise a short and stout peduncle, with two-jointed exo- and endopodites, the former being the largest.

First antenna. Peduncle two-jointed, the first joint being two and a half times as long as the second. The flagellum is three-jointed; the first joint is very small, with two setae; the second also carries two setae distally, and is twice as long as the rounded terminal joint, which carries four long setae.

In the female it is triarticulate.

Second antenna. Peduncle three-jointed. The joints are stout, and not very large; the first is shortest and the second longest, the third carries a slender spine distally. The flagellum is three-jointed. The first joint is about as long as the peduncle, but much more slender, and somewhat curved. The second joint is about half the length, and both bear distally one or two setae. The terminal joint, which carries four setae, is minute.

Mandible. Cutting edge incurved, with fine serrations on the frontal margin. Molar tubercle well developed.

Maxillipede five-jointed. The dactylus small, digitiform, with four long setae, propodos longer and much stouter, inner margin expanded about the middle of the joint, bearing four long setae. Carpus with three long setae near the inner distal extremity, and the meros expanded externally round the carpus.

Thoracic appendages. The first of these in the male reaches an extraordinary development. The dactylus is very long and slender, much curved near its extremity. The propodos is more than half as long, stout, and has articulated to it a piece which is curved through a right angle. This piece bears a tooth at the extremity on the outer margin, and a rounded projection or tubercle on the inner. The carpus is distinctly shorter than the propodos, and is broad, somewhat irregular proximally. The meros is very large and irregular, besides being considerably and irregularly expanded distally. It bears a large lateral wing externally near the proximal end.

The remainder do not present any striking features. The three anterior pairs are a little longer and more delicate than the posterior three. These latter have one or two truncated spines at the termination of some of the joints.

Pleopoda. A rounded basipodite, with ovoid exo- and endopodites arising some little distance apart. The exopodite is smallest, and both have long setae on the inner margin.

Uropoda. The two-jointed exopodite equals in length the first joint of the endopodite. The former terminates in two long setae, the latter possesses four.

Owing to an accident with the preparations further anatomical details cannot be given.

Size about 4 mm.

Eight specimens, four ♂; four ♀, were taken off Cape Adare, in 20 to 24 fathoms, from the roots of seaweed. Temperature 29° Fahr.

GNATHIA.

Of this interesting genus a very large number of species, something like twenty-five, are known, nearly all of them coming from European waters. For our knowledge of these species we are mainly indebted to the works of M. Hesse (11 and 12) and Professor G. O. Sars (29). Mr. Beddard has described four species from the '*Challenger*' collections, and, with the exception of the species described below and another from New Zealand, these are all that are known from extra-European seas.

GNATHIA POLARIS.

(Pl. XXXII.)

Specific character. Pointed cephalon, more pronounced in male. Scythe-like character of the mandibles in male, and the markings on the two penultimate segments of the thorax.

Description of Male.

Body of nearly uniform diameter. The cephalon is broad, roughly quadrangular, the postero-lateral margins being somewhat rounded. The frontal margin bears a broad triangular rostrum in the middle line; it then becomes straight for a short distance on each side the rostrum, and then incurved, to terminate with a stout pre-ocular spine. Eyes small. The anterior portion of the thorax is separated from the posterior by a conspicuous constriction. Of the three posterior segments, the first is marked in the middle line with an ill-defined rectangular patch, the second bears a median longitudinal groove, and the third is very strongly curved. The abdomen comprises the normal number of segments, and terminates in an elongate triangular telson.

Antennae. The first antenna consists of a three-jointed peduncle, the last joint being longer than the other two together, and a four-jointed flagellum. The second has a four-jointed peduncle, the two last being large and sub-equal, and the two proximal ones being much shorter. The flagellum is six-jointed.

Mandible. The mandibles are scythe-like in general appearance, the amount of curvature at the free end being variable. The inner margin is somewhat sinuous, and the outer drops abruptly a little short of its middle.

Maxillipede. This consists of a roughly triangular plate attached by its broad base; the inner margin is straight, the anterior slightly sinuous, and the outer is very oblique. The masticatory lobe is a clavate process bearing two stout knobbed setae, which interlock with those from the opposite side. The palp consists of four rounded segments, tapering from the first, and each bearing some half-dozen long setae on its outer margin.

Gnathopod. This consists of two segments, the first being a large pyriform plate, the more rounded inner margin bearing long plumose setae. The terminal segment is very small, oval, and bears a few long plumose setae towards the extremity, and a few small setae on the inner margin.

Pereiopoda. Sub-similar, sub-equal. They present no very obvious peculiarities, save that the inner margin has a number of button-like tubercles distributed along it.

Description of Female.

The fully developed female possesses an enormously swollen body. The cephalon is comparatively small, obtusely pointed in

front. Two thoracic segments are readily distinguishable, and the other three can at times be made out.

Both pairs of antennae, the pereopoda and the abdomen closely resemble those of the adult male.

In the younger individuals and larvae the cephalon is narrower, and bears very large eyes upon lateral tubercles. The mouth organs, which are at these stages of the normal number, are produced into a more or less conical structure in front of the head.

A fairly large number of specimens of this species were taken at various times off Cape Adare, most of them coming from a depth of twenty fathoms or thereabouts. In one case the tube was labelled: "20-24 fathoms. From the roots of seaweed." But all presented the appearance of living in a similar habitat. They were dirty, and as a general rule more or less covered with some growth, which concealed some structural features and gave them a velvety appearance. The specimens include well-developed males and females, as well as larvae.

SPHAEROMIDAE.

Considering the great confusion that exists among the numerous members of this family, it is with some hesitation that I put forward two new species. The difficult problem is to assign to these species the genus which might meet with general approval. Authors do not appear to be agreed on the subject of generic distinctions, and on that account I may have added to the existing confusion. Notwithstanding the obvious differences in form I have placed both species in the genus *Cymodocea* (Leach). The anatomical details do not appear to me to warrant their separation.

CYMODOCEA ANTARCTICA.

(Pl. XXXIII., fig. 2.)

Body ovoid, about twice as long as broad. Pleon terminating in a triangular shield with the extremity excavated. It is of a greenish colour, more or less irregularly splashed with a warm brown.

Cephalon comparatively small and having a somewhat truncated anterior margin with a small rounded projection between the antennae. Eyes small, at the postero-lateral angle, which is produced on to the succeeding segment.

Thorax. The first segment arches outwards, and is half as broad again as the cephalon. It is as long as the two succeeding segments,

and, in common with all, bears distinct epimera. These are very well developed and prolonged backwards in the three posterior segments.

Abdomen. Four apparent segments are visible, the second of them bearing distinct epimera. The terminal segment is triangular, its extremity being excavated. The uropods arise a short distance from its anterior margin but do not reach the opposite extremity; they are lanceolate in shape.

First antenna. A stout peduncle, of which the second joint is about half the size of the first; this is followed by a larger joint which from its character might belong to the flagellum. The flagellum consists of nine additional joints.

Second antenna. A four-jointed peduncle, of which the joints progressively increase in size, followed by a flagellum of about eight joints.

Mandible strong, cutting edge very prominent, armed with blunt tubercles and a tuft of strong setae close underneath. Molar expansion well developed. Palp large, of three diminishing joints, the middle one laterally expanded, and the two terminal ones setose, the setae of the middle joint being of peculiar structure.

First maxilla. Two parallel plates, the outer one the stoutest and provided with five prominent spines at the extremity, the inner one with three plumose setae, the inner margin of both bears a few slender setae.

Second maxilla. Inner lobe comparatively broad and somewhat pointed, with setae on inner margin and stouter plumose ones at the extremity, the proximal two of this series being larger than the rest. Outer lobe and palp armed at the extremity with a few serrated spines, those of the palp are the longest.

Maxillipede. The masticatory lobe is produced into a large plate, the free terminal margin is irregular and setose, the five terminal joints form a palp, three of them bear a finger-like process on the inner margin, so that with the terminal joint they occupy approximately the same level despite the natural curvature of the organ; these processes are all setose.

Thoracic appendages. The first three slightly increase in size, but the remainder are sub-equal. The first has the last joints short and stout, it terminates in a claw with one, or two, very small accessories. Of the following three, the meros is expanded, the carpus and propus setose. The three posterior limbs are similar and directed backwards.

Uropods lanceolate, smooth, endopodite the largest.

Three specimens were taken off the Auckland Islands in ten fathoms of water.

No conspicuous difference is exhibited by any of these specimens beyond the presence or absence of the two dark spots on the first thoracic segment. This may be, and probably is, a very variable feature.

CYMODOCEA AUSTRALIS.

(Pl. XXXIII., fig. 3, and Pl. XXXIV., fig. 3.)

The body is twice as long as broad and covered, though not very closely, with short and fine setae.

Cephalon is rounded in front, longer than any of the thoracic segments. Eyes moderately large, and that region of the cephalon is produced slightly backwards on to the first thoracic segment.

The first segment of the thorax is the length of the two following, and they all gradually shorten slightly and progressively to the posterior. The pleon is marked in rather a complex manner. The first segment bears a thumb-like elevation directed forwards and outwards which lies between the mid-dorsal line and the lateral margin. The two following segments are incompletely separated and together form a very broad V-shaped structure on the pleon; the extremity of the arms of the V just extend to the margin of the body and are bi-lobed, the posterior lobe being the shorter. The base of the V is a free backwardly-directed spine. The last pleon segment has the postero-lateral margins curved boldly towards the middle line, the extremity is broadly notched, and the notch is almost completely filled with a rounded lobe. A short way in front of this in the middle line is a rounded tubercle. The uropods are very conspicuous and project beyond the extremity of the body. The inner branch is much the largest and lies parallel to the postero-lateral margin of the pleon. It forms an oblong structure, roughly rectangular. The outer branch forms a truncated cone.

First antenna. Peduncle two-jointed, the first being long and stout, widest distally. Second joint small, partly sunk in the extremity of the first, expanded laterally into a somewhat triangular form. Flagellum ten-jointed, first joint longer than the two succeeding, fourth joint conspicuously larger than the second or third and the remainder becoming reduced in size.

Second antenna. Peduncle three-jointed, the third as long as the other two. Flagellum nine-jointed.

Mandible. Cutting edge forms a stout blunt tooth, molar expansion small. Palp three-jointed, first joint fairly stout, the second rather more than half the size, setose laterally and distally, the distal setae being long. The last joint is about the same size, but more slender, and setose along its entire length on one side.

First maxilla. Outer lobe a slightly curved blade, armed at the extremity with some half dozen or more teeth. Inner lobe straight, slender, and tapering, the extremity provided with two long curved setae.

Second maxilla. Inner lobe comparatively broad, rounded at the extremity, where it is armed with stout setae. Two, near the inner extremity, are conspicuously different, have subsidiary setae on one (?) side. The outer lobe and palp bear long spinous setae; they are all sub-equal in length.

Maxillipede. Masticatory lobe long and narrow, slightly curved outwards distally. The extremity forms a blunt point, and there are two or three small teeth a short distance from it; behind these again is a small tuft of setae. Palp of five joints, of which the middle three possess a digitiform lateral process, setose at the extremity. The terminal joint is finger-like, and also setose distally.

Thoracic appendages. In these there is nothing specially striking. In the first, the basal joint is nearly half the length of the entire limb, the remaining joints are short and stout, the meros being laterally expanded outwards, and the inner margin of the meros, carpus, and propodos bear about a dozen long spines and numerous very fine ones, which latter also occur on the dactylus. This last joint bears a stout claw, a small accessory, and two strong setae.

In the following appendage the joints, except the basal, are much longer, and the inner margin is provided with a series of small spines with an occasional large one.

The others are sub-similar, but longer.

Pleopods. Endopodite obovate, with long plumose setae on its inner and distal margin. Exopodite triangular, outer margin straight, and till near the extremity with fine setae, near the extremity and on the inner margin these become long and plumose.

Seven specimens were taken by the dredge off Cape Adare in eight fathoms. Temperature, 30° Fahr., January 17, 1900. Only one of these, the specimen figured, has the abdomen so ornate; in the others the spine is absent, and the terminal notch is not so conspicuous.

ARCTURUS.

This genus received a large number of additions from the 'Challenger' collections (2); and, later, Mr. Benedict (3) added six species to the genus, and gave a synopsis of the whole. Another species has since been described by Miss Richardson (26), and the three described below make a total of twenty-six species. Two other species, described by Haswell, from New Zealand in 1882 (9), have not been noticed by the authors cited.

ARCTURUS POLARIS.

(Pl. XXXIV., fig. 2, and Pl. XXXV.)

Specific character. Spines dorso-lateral. Pleon with two prominent terminal spines, a large lateral spine on each of the three distinguishable segments, the remainder somewhat irregularly covered with short spines, two of which, about the middle of the lateral margin, are more prominent than the rest.

The largest specimens secured by the 'Southern Cross' Expedition measure, exclusive of antennae or spines, some 37 mm. in length, but the average size is about 5 mm., or thereabouts, smaller.

The second antennae are a little shorter than the body.

The mid-dorsal area is smooth; but dorso-laterally there are spines which are more prominent in the anterior thoracic region, and less numerous than elsewhere.

Cephalon. Anterior margin incurved. A prominent spine projects outwards, and somewhat forwards, to protect the eye, which is large. There is a small spine in front of this organ.

The third thoracic segment is the largest, the hinder ones tapering gradually to the pleon. Laterally each segment bears numerous spines of varying size. The spines are most conspicuous on the three anterior segments, and each of these has a large spine more dorsally situated than elsewhere.

Pleon nearly as long as the posterior five thoracic segments.

The first three segments are distinguishable, and bear short spines both dorsally and laterally. A lateral spine is especially prominent on the third segment, and the remainder of the pleon is covered with small spines of approximately uniform size; but two of them, about the middle of the lateral margin, are more prominent than the rest. The mid dorsal line is devoid of spines. The extremity is rounded, and bears two very large and somewhat divergent terminal spines.

First antenna consists of four joints, the first three of which equal the two proximal joints of the second antenna. The first three joints slightly decrease in length from the first, but the proximal one is very broad and irregularly rounded. The last is longer than the two preceding, and is setose along the distal two-thirds of one margin. The setae are stout, tapering, and are borne on a short, slender peduncle.

Second antenna not quite as long as the body and comprises a long peduncle of five joints and a short multiarticulate flagellum. Of the five joints of the peduncle, the two basal are small; the others progressively increase in size, the last one being approximately as long as the two preceding. The second joint has two spines on the outer margin and the third carries two to four; in either case the distal spine is the largest. The fourth joint also bears a distal spine and, with the preceding, it is setose on the inner margin.

Mandible short and stout. The cutting edge bears some half-dozen teeth and a tuft of strong setae below them. The molar process is strongly developed, and there is no palp.

First maxilla. Outer lobe comparatively long and narrow, slightly curved. Armed at the extremity with about nine comparatively long spines. The inner lobe is smaller and more slender, provided with three long plumose setae. The inner margin of both lobes is setose.

Second maxilla. Base is broad, the inner lobe is somewhat rounded, the outer lobe is digitiform, and the palp is similar but broader. All are setose, more particularly the inner lobe, on which three distinct varieties of setae can be distinguished. A tuft of small, simple setae below the inner and distal curve; two or three stout plumose setae come next, and following these distally are the comparatively stout setae, which are more or less plumose.

Maxillipede. Masticatory lobe quadrangular, with rounded angles; anterior margin with stout setae. Palp, the five joints, comparatively short but broad and lamellar, the inner margin richly provided with long setae. The epignath is large, subconical, truncate at extremity.

Thoracic appendages. The first is short and stout, richly setose on the inner margin and on the outer margin of the propus and dactylus. The setae are spinose in places (carpus). The dactylus bears three claws, the middle one being conspicuously the most slender, and is folded in a sub-chelate manner. The three following appendages are sub-similar. With the exception of the two terminal joints all bear distally a prominent spine on the outer margin; the

basal joint bears one or two additional ones. Except this joint, all possess long setae on the inner margin.

The three posterior limbs are of the walking type and also sub-similar. The basis, ischium, and meros are spinose on the outer margin, and, particularly the first of these limbs, the meros to propus inclusive bear numerous small spines on the inner margin.

Pleopods. The first pair are coarse and spinose and form a case protecting the remainder. These consist of a stout basis, spinose on inner side and setose on the other. The ex- and endopodites are large, somewhat widening distally, and having their margins richly clothed with plumose setae.

A large number of individuals were taken off Cape Adare during November and December in from twenty to twenty-six fathoms. In most cases the females had eggs or young in the brood pouch. One fine specimen had no less than sixty young in its pouch.

A small specimen was taken in 6 fathoms off Duke of York Island and at a temperature of 28.75° Fahr.

ARCTURUS ADAREANUS.¹

(Pl. XXXIII., fig. 1.)

Specific character. Body not spinose but minutely tuberculated. Pleon segment uniformly covered with very small blunt spines and terminating with two moderately long and parallel spines.

This species is smaller and more slender than the last. The spines, properly so-called, are confined to a pair on the cephalon, the anterior thoracic segments, and the pleon. Spines are replaced by small tubercles, which, however, take a spinous character in the hinder part of the body.

Cephalon. Anterior margin incurved: a pair of prominent blunt spines arise between and somewhat in front of the large eyes. Behind these is another pair of very much smaller spines.

Thorax. The fourth segment is the largest and all are covered with a number of small, closely-set tubercles: a pair of spines are situated dorsally on the first segment.

Pleon about as large as the four posterior thoracic segments. The first three segments are distinct: these and the terminal shield are covered with small spines. The extremity of this shield is rounded and bears two prominent but blunt spines.

The anatomical details bear a very close resemblance to the last

¹ Name altered, after author had sailed for the Antarctic.—F. J. B.

species, and it will be amply sufficient for all practical purposes to point out the differences.

First antenna. The terminal joint is shorter than the two preceding together.

Second antenna. The first joint is very small and the second about twice the size, with four small blunt spines. The third joint is long and bears three or four blunt spines and a few long setae on the opposite side. The fourth joint bears one or two small spines, and setae are disposed along the inner margin at fairly regular intervals. These also occur on the fifth joint, which is the longest.

The mandibles, maxillae, and maxillipedes very closely resemble those of *A. polaris*. The epignath of the maxillipede is narrower distally, and thus becomes more conical.

Thoracic appendages. The first almost exactly resembles that of *A. polaris*. The three following are also similar, but practically devoid of spines; the spines of *A. polaris* are represented by very inconspicuous tubercles. The last three limbs bear one or two blunt spines on the coxa and basis only and the ischium to the propodos bear a row of small curved spines along the inner margin.

Pleopods. The first pair are large and stout, forming a protecting shield to the remainder. Those which serve the branchial function are less clavate than in *A. polaris*, and the basipodite bears seven slender teeth as against five stouter ones.

Five specimens of this species were taken among large numbers of *A. polaris* off Cape Adare.

ARCTURUS FRANKLINI.

Specific character. A stout spine near the antero-lateral margin of the cephalon, and six long slender spines on the second and third thoracic segments.

Cephalon of normal contour, with two stout spines between the eyes, and directed slightly forwards, and a stout pair near the antero-lateral angle.

Thorax, first three segments with six long slender spines, two dorsal, two dorso-lateral, and two epimeral. These spines are best developed on the second and third segments, where they are particularly prominent; posterior segments of the thorax with numerous small spines, for the most part situated laterally.

Pleon, first three segments with a row of rather small spines across the dorsum, and the last of the three having a very stout lateral spine. The terminal segment bears numerous small spines

throughout its length laterally, and a few inconspicuous ones are scattered dorsally; two above the average size are situated dorsally about the middle of its length. The extremity is rounded, and bears two divergent and prominent terminal spines.

First antenna, normal structure, reaches to about two-thirds the length of the third joint of the second antenna. Setae on terminal joint few.

Second antenna. The two basal joints each with stout spine, the third joint with three stout spines, proximal shortest, distal largest, fourth joint with two spines proximally situated, and the fifth joint is slightly the longest. Flagellum missing.

Thoracic appendages. The three pairs of setose limbs bear a stout spine on the ischium and meros; the basis has several of varying length. The three posterior, which are essentially ambulatory in character, have a few blunt spines on the basal joints. The meros, carpus, and propodos bear a few slender forwardly-curved spines on the inner margin.

The opercular shield of the pleon is covered with short spines.

A single specimen of this species was taken off Franklin Island in 10-24 fathoms of water, and a temperature of 29.8° Fahr. It is a female, and its body is largely concealed by a vigorous growth of *Spirorbis* and other tubicolous worms, as well as diatoms of large size.¹ Exclusive of antennae, the animal measures some 15 mm. in length.

Three other specimens were taken at this locality; they are of smaller size, but I am not as yet disposed to make a new species for them. With the exception of the two frontal spines, the two terminal spines of the pleon, which are only stumps, and a few very small spines on the lateral margin of the pleon, the bodies are quite smooth; they are, in spirit, light-coloured, and covered with minute brown spots. The second antennae of two of the specimens is perfectly smooth, but in the third, and largest, there are obvious traces of developing spines. This would indicate that these specimens are not yet mature, and to give them a specific rank does not seem to me to be desirable.

NOTASELLUS AUSTRALIS.

(Pl. XXXVI.)

Specific character. Uropoda longer than pleon, which is approximately as broad as long, and terminates in a rounded projection.

¹ Mr. V. H. Blackman informs me that the diatom belongs to the genus *Triceratium*.

Body oval, about two and a half times as long as broad, with very large uropoda, covered with small dark coloured spots, which, however, leave small light coloured vacant spaces here and there.

Cephalon, the normal size for the genus. It bears a large prominent median rostrum, the base of which curves outwards to form a stouter if less prominent tooth at the antero-lateral angle. The eyes are large and borne on lateral processes of the cephalon, which is somewhat constricted posteriorly.

Thorax. The segments are all short, the fourth is the broadest and straight, the three anterior ones having a more or less conspicuous forward curve. The lateral margin of these four segments is toothed anteriorly and posteriorly, the intermediate portion being bi-lobed. The three posterior segments are curved backwards, particularly the last one, their lateral margins are rounded but still bi-lobed.

Pleon, lateral margin rounded, posterior truncated, but with a stout rounded projection in the middle line.

First antenna. Peduncle three-jointed; the first is very stout, the other two are more slender, the third being more so. They are sub-equal in length, the flagellum is multiarticulate and reaches about two-thirds the length of the penultimate joint of the peduncle of the second antenna.

Second antenna. Peduncle six-jointed; the first four are short and stout, the third, which is the largest of the four, carries externally a small digitiform scale setose at the distal extremity.

Of the two large terminal joints, the more distal one is slightly the longest, both are sparingly setose, as long again as the proximal four joints. They are followed by a long multiarticulate flagellum.

Mandible. Cutting edge, with a prominent bi-lobed tooth and below a fringe of stout setae. A deep incision between this and the molar expansion. Palp long and slender, second joint twice as long as the first terminal joint, curved and with setae on the inner margin and at the extremity.

First maxilla. Terminal spines of the outer lobe toothed, a series of weaker spines some little distance from the extremity.

Second maxilla. Inner lobe slightly enlarged at its extremity and rounded, the terminal portion densely clothed with rather long setae. The outer lobe and palp are both slender and curved backwards, the former terminates in three, and the latter in two, long setae.

Maxillipede. Inner margin of masticatory lobe quite straight, distal and outer margins slightly rounded, the former bearing a

fringe of spinous setae. The palp has the proximal joints stout, the meros and carpus being laterally expanded, the propodos and dactylus are quite slender. The dactylus, the extremity of the propodos and the inner margins of the carpus and meros all bear comparatively long setae. The epignath is large and ovoid in shape, but the external margin is angular.

Thoracic appendages. The seven pairs are long, sub-equal and much alike. They present no striking features; the meros is expanded distally and bears a tuft of stout setae at its extremity, the carpus and propodos are sub-equal in length, the latter bearing a trianguiculate claw.

The uropods are large and considerably longer than the pleon; the basal joint is distally expanded and almost bi-lobed; the podites are a long oval in shape, the exopods being much the smallest. The entire organ bears tufts of setae at regular intervals.

Three specimens of this species were taken off Cape Adare in 13 fathoms with a temperature of 28.9° Fahr., and three or four more were found on the beach after a gale.

Dr. Pfeffer (24) has described a species from South Georgia which is undoubtedly very closely allied to the '*Southern Cross*' species. He considered himself justified in creating a new genus *Notusellus* for its reception, though it very closely resembles certain northern species of the widely distributed genus *Junira*.

HALIACRIS AUSTRALIS.

(Pl. XXXIV., fig. 1, and Pl. XXXVII.)

Specific character. Pleon ovoid, notched at the insertion of the uropods.

Size. Exclusive of antennae, about 4 mm.

Cephalon. Wide, truncate in front, with deep recess for the origin of the antennae. The lateral margin of this recess forms a stout outwardly curved tooth. Eyes large, situated on a lateral projection of the hinder part of the cephalon. Part of the mouth organs project in front of cephalon and can be seen from the dorsal surface.

Thorax. The first four segments do not conspicuously differ in size, although the first is the smallest. The epimera of the first three segments are pointed and of the fourth truncate. The three posterior segments become reduced in size and more curved in a backward direction in passing to the hinder extremity.

Pleon. Two segments are visible in the curve of the last thoracic, the terminal one is ovoid with the small uropods placed laterally some little distance from the extremity.

First antenna. Small, reaching about one-third the length of the fourth joint of the second antenna. Second joint of peduncle longest.

Second antenna. Very long, half as long again as the body. Peduncle five-jointed, the three proximal ones being short and stout, the two distal ones being long and slender, sub-equal in size. The flagellum is multiarticulate, not so long as the two distal joints of the flagellum.

Mandible. Cutting edge consists of a long slender three-lobed tooth and a group of stout setae. Molar expansion well developed and somewhat widely separated from the cutting edge. Palp three-jointed, rather stout, first and third joint sub-equal, third the longest.

First maxilla. Normal.

Second maxilla. Inner lobe truncate, with two long setae, among others, on the inner margin, outer lobe and palp with very long, stout terminal setae.

Maxillipede. Masticatory lobe with inner margin straight and four small spines just above the middle. Extremity truncate and outer margin rounded. Palp of five joints, of which the distal two are proportionately slender, the next two are much expanded. The epignath is large curved, truncate posteriorly, less so anteriorly.

Thoracic limbs. The first is comparatively short and stout, subchelate, meros and carpus expanded; propodos ovoid, dactylus about half its length and slender. The second pair of appendages were missing, the remainder are long, slender, and increase in length to the last, they are alike in structure.

Uropods. Small, simple.

Three specimens were taken off Cape Adare in 20 to 26 fathoms. Temperature 28·9° Fahr.

This is another species closely allied to a form described by Dr. Pfeffer (24) for which he established the genus *Haliacris*.

ECHINOZONE.

This genus is one of four into which Professor Sars has divided his genus *Ilyarachna* (29). Five species belong to the original genus, but one of them is doubtful; the other genera each contain a single species. All but one are European or Arctic forms.

ECHINOZONE SPINOSA.

(Pls. XXXVIII. and XXXIX.)

Specific character. Four prominent spines on each of the four anterior thoracic segments, two on the cephalon; smaller spines on the epimera and on the posterior thoracic segments.

Body ovoid, truncate in front but pointed behind, divided into two by a deep constriction between the fourth and fifth thoracic segments. Body arched and epimera well developed, both spinose.

Cephalon arched in front, with two prominent spines situated laterally; the epimera are large and angular, with a small spine at the antero-lateral angle and another about the middle of the plate.

Thorax. First segment narrow with the epimera poorly developed; the four large spines are confined to the body portion. The three succeeding segments are similar, but the hinder margin of the epimera are more rounded, passing backwards. Each segment has the four prominent spines and a small one at the antero-lateral angle of the epimera, the first two segments having an additional one just behind this. The three posterior segments and the pleon taper uniformly to a blunt point. The thoracic segments bear a spine on either side the middle line, but on the last segment they are mere rudiments. Of the first of these three segments there are four small spines along the anterior margin.

First antenna. Peduncle two-jointed. First joint large and stout, with long seta on the margin and a spine at the distal extremity. Second joint is very small proportionately, and bears the multiarticulate flagellum.

Second antenna. Five joints are visible from the dorsal surface. The first of these bears a stout spine externally, the two distal joints are very long, particularly the last one; both are setose. The multiarticulate flagellum is about half the length of the entire organ.

Mandible. Anterior margin rounded to the cutting edge, which is represented by a large blunt tooth; a tuft of small setae lies close below it, and the molar process is a long slender appendage setose at its extremity.

First maxilla. Outer lobe comparatively broad, curved. The oblique terminal margin with a series of stout spines, of which the two most distally situated are the longest.

Second maxilla. Inner lobe broad, somewhat curved backwards. One very long seta at the terminal angles. Outer lobe and palp normal but stout.

Maxillipede. Inner margin of masticatory lobe straight, distal and outer margins rounded. Distal part setose, the lateral and outer setae being comparatively long and slender, those near the inner angle being stout and spinose. Palp of the normal number of joints, the meros enormously broad. The carpus bears a large ploughshare-like expansion on its inner margin; the edge of this, and to some extent the sides, bear stout setae. The propodos and dactylus are normal, and both bear setae distally.

The epignath is large, roughly semicircular.

Thoracic appendages. The first is missing. The three following are more distinctly ambulatory, and increase in size passing posteriorly. They are slender, and the first is almost devoid of setae; the second is provided with long setae throughout its length, and has the basis, ischium and meros somewhat swollen. The third is attenuated, and is poorly provided with small setae, except at the extremity of the various joints. The ischium, however, bears numerous delicate spines.

The three posterior appendages present a different appearance, and are sub-equal in length. In the first the basis, ischium and carpus are much swollen; in the second the carpus only is thus modified; both limbs are provided with long setae. The joints of the last appendage do not present any striking feature.

The uropods are minute, and are concealed from the dorsal aspect by a slight projection of the pleon.

Two specimens of this species were obtained off Cape Adare, in 26 fathoms. Temperature 28.8° Fahr.

COPEPODA.

Two genera of Calanids were taken with *Euphausia glacialis* in lat $65^{\circ} 52$ S., long. $162^{\circ} 32$ E., between the ice floes; temperature, 31° F. They were in a terribly bad state of preservation, much macerated and unfit for description.

PYCNOGONIDA.

Of the large number of specimens obtained by the '*Southern Cross*' Expedition, all may be referred to a single species, and that, as might be expected from the locality, a new one.

The genus *Nymphon* is a large one, and a list of twenty-five reliable and eleven doubtful species is given by Dr. Hoek (13) in the 'Challenger' Report referring to this class.

Prof. Sars, in 1891 (28), while adding a few species, divides the genus into three—*Nymphon*, *Chaetonymphon*, and *Boreonymphon*.

NYMPHON AUSTRALE.

(Pl. XL.)

Body robust, with lateral processes of a large size; these are setose, though the body is apparently smooth. Neck short and constricted. Head segment two and a half times as long as the following one. Ocular peduncle long, but very variable, sometimes rounded at the extremity, sometimes obtusely pointed, and occasionally much reduced in size. Lenses apparently rudimentary; sometimes four may be detected, but more commonly only two; a very large proportion of the specimens, however, only show an irregular mass of pigment, the quantity and its precise position being very variable. Proboscis cylindrical, directed downwards.

Mandibles. Scape longer than proboscis, becoming stouter at its distal extremity, and provided with stout setae, many of which are very long.

Chela stout, setose, the claws being longer than the propodus bearing them. They are slender, somewhat abruptly curved at the tips, and beset along their entire biting edge with teeth, which, though conspicuously large and small, are not arranged in strict alternation.

Palp slender, five-jointed; the second joint is the longest, the fifth is a little shorter than the preceding. All are setose; the setae on the two terminal joints being the smallest and the most numerous.

Ovigerous legs, ten-jointed; the first two are very small, and the third is equal in length to the two, the fourth and fifth are much longer, and sub-equal; the last three are also sub-equal in length, the terminal joint bearing a long pectinate claw. The last four segments bear a single row of denticulate spines.

These spines bear three or four lateral teeth on each side. The entire limb is more or less setose. In the ovigerous individuals the first six joints of this appendage are usually much swollen, and this more particularly applies to the fifth joint.

The four walking legs are alike. The second coxa is conspicuously the larger of the three, and the third bears a prominent swelling on

its inner margin. This last joint is more setose than the others. The femur is the stoutest joint of the limb, and is longer than the three coxae together. On its inner margin the setae are short, but on the outer they almost amount to spines, especially at the extremity.

Of the two tarsi, the proximal is both longer and stouter, both exceed the femur in length, setose on the inner margin, the outer is more thickly covered and the setae are almost in the nature of long spines. The distal tibia bears three spines at its extremity; of these the middle one is much shorter than the other two. The tarsus and propus together are a little shorter than the second tibia, they are slightly curved and tapering. The latter bears a long terminal claw with a single minute accessory. The tail is an elongate ovoid.

A very large number of individuals of this species were taken off Cape Adare at various dates and at depths varying between 20 and 26 fathoms. Almost all were in an exceedingly dirty condition, due to a thick growth of diatoms of the genus *Triceratium* or an ally, and other vegetable matter in a more or less decomposed state. This foreign matter is very adherent and it is almost impossible to clean satisfactorily many of them. It gives the animal quite a woolly appearance to unassisted vision. Many specimens, which apparently have recently moulted are quite light-coloured and have a more "refined" appearance, being cleaner, and the spines and setae are much sharper.

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DESCRIPTION OF PLATES.

PLATE XXIX.

MERHIPPOLYTE AUSTRALIS.

- | | |
|--------------------|------------------------|
| 1. Carapace. | 6. Second maxilla. |
| 2. First antenna. | 7. First maxillipede. |
| 3. Second antenna. | 8. Second maxillipede. |
| 4. Mandible. | 9. Third maxillipede. |
| 5. First maxilla. | |

PLATE XXX.

EUPHAUSIA GLACIALIS.

- | | |
|--------------------|-------------------------------------|
| 1. Animal entire. | 6. Second Maxilla. |
| 2. First antenna. | 7. Telson and Uropoda. |
| 3. Second antenna. | 8. Rostrum of <i>E. glacialis</i> . |
| 4. Mandible. | 9. Rostrum of <i>E. australis</i> . |
| 5. First Maxilla. | |

PLATE XXXI.

PARATANAIS ANTARCTICA.

- | | |
|----------|------------|
| 1. Male. | 2. Female. |
|----------|------------|

PLATE XXXII.

GNATHIA POLARIS.

- | | |
|----------------------------|----------------------------|
| 1. Male. | 7. Mandible of male. |
| 2. Female. | 8. Maxillipede of male. |
| 3 and 4. Larva. | 9. Gnathopod of male. |
| 5. First antenna of male. | 10-12. Pereiopods of male. |
| 6. Second antenna of male. | |

PLATE XXXIII.

- | | | |
|----------------------------------|--|---------------------------------|
| 1. <i>Arcturus adareanus</i>. | \| | 3. <i>Cymodocea australis</i> . |
| 2. <i>Cymodocea antarctica</i>. | \| |  |

PLATE XXXIV.

1. HALIACRIS AUSTRALIS.

- | | | |
|---------------------|--|------------------|
| 1a. Second maxilla. | \| | 1c. Mandible. |
| 1b. First maxilla. | \| | 1d. Maxillipede. |

2. ARCTURUS POLARIS.

- | | | |
|--------------------|--|---------------------------------|
| 2a. First antenna. | \| | 2d. Second maxilla. |
| 2b. Mandible. | \| | 2e. Maxillipede. |
| 2c. First maxilla. | \| | 2f. First pereopod (gnathopod). |

3. CYMODOCEA AUSTRALIS.

- | | | |
|---------------------|--|--------------------|
| 3a. First antenna. | \| | 3d. Maxillipede. |
| 3b. Second antenna. | \| | 3e. First maxilla. |
| 3c. Mandible. | \| |  |

PLATE XXXV.

ARCTURUS POLARIS.

PLATE XXXVI.

NOTASELLUS AUSTRALIS.

PLATE XXXVII.

HALIACRIS AUSTRALIS.

PLATE XXXVIII.

ECHINOZONE SPINOSA.

PLATE XXXIX.

ECHINOZONE SPINOSA.

- | | | |
|---------------------|--|----------------------|
| 1. Second pereopod. | \| | 6. Seventh pereopod. |
| 2. Third pereopod. | \| | 7. First antenna. |
| 3. Fourth pereopod. | \| | 8. Mandible. |
| 4. Fifth pereopod. | \| | 9. Second maxilla. |
| 5. Sixth pereopod. | \| | 10. Maxillipede. |

PLATE XL.

NYMPHON AUSTRALE.

- | | | |
|---------------------------------------|--|---|
| 1. Male, with appendages of one side. | \| | 4. Ovipigerous limb, with fringed spine enlarged. |
| 2. Palp. | \| | 5. Chela enlarged. |
| 3. Chela. | \| |  |

XII. POLYCHAETA.

BY ARTHUR WILLEY, D.Sc., F.Z.S.

(Plates XLI.-XLVI.)

THE collection of Polychaeta which has been handed over to me for description is small, and in some cases the state of preservation of the specimens leaves something to be desired; but there is sufficient to indicate the existence of a vigorous Annelid fauna in this region of the farthest south. Fifteen species have been identified, of which three seem to be new. Perhaps the most interesting feature of the collection is the addition of the characteristic northern Maldanid, *Rhodine lovéni*, Mgn., to the Antarctic fauna. Besides this, two other genera, not hitherto recorded in the south, are represented by species slightly different from their northern congeners, namely, *Gattyana* (= *Nychiea*) *cristata*, n. sp., and *Malmgrenia crassicirris*, n. sp.

The three species, *Travisia kerguelensis*, McInt., *Scoloplos kerguelensis*, McInt.,¹ and *Thelepus antarcticus*, Kbg., are hardly distinguishable from the northern types of the respective genera.

A singularity of the collection, which, however, bears no apparent significance, is the absence of Lycoridae and Eunicidae. There are some specimens of *Spirorbis* which I have not identified, as the soft parts are not adequately preserved.

I have introduced, in a form more or less modified from the original sources, compressed diagnoses of most of the genera dealt with, in the hope that this method, while requiring little extra space, will help to avoid ambiguity.

The determined species are the following:—

	PAGE
1. <i>Harmothöe spinosa</i> , Kinberg	264
2. <i>Harmothöe crossei</i> (McIntosh)	266
3. <i>Gattyana cristata</i> , n. sp.	268
4. <i>Malmgrenia crassicirris</i> , n. sp.	269
5. <i>Phyllodoce madecirensis</i> , Langerhans	270
6. <i>Vannalis antarctica</i> (McIntosh)	271

¹ Remarks upon the species of *Travisia* and *Scoloplos*, and other "bipolar" species and genera, are contained in a recent paper by Miss Edith M. Pratt, 'Some notes on the Bipolar Theory of the Distribution of Marine Organisms.' *Mem. Manchester Soc.*, Vol. XLV., Part IV., No. 14, 1901.

	PAGE
7. <i>Typosyllis hyalina</i> (Grube)	274
8. <i>Eusyllis kerguelensis</i> , McIntosh	274
9. <i>Aricia marginata</i> , Ehlers	275
10. <i>Scoloplos kerguelensis</i> , McIntosh	275
11. <i>Travisia kerguelensis</i> , McIntosh	276
12. <i>Rhodine lovéni</i> , Malmgren	276
13. <i>Thelepus antarcticus</i> , Kinberg	278
14. <i>Nicolea agassizi</i> , Kinberg	279
15. <i>Ereutho antarctica</i> , n. sp.	281
Remarks on <i>Hermadion longicirratum</i> , Kinberg.	266
Remarks on <i>Lagisca vesiculosa</i> (Grube)	266
Addendum (<i>Oxydromus aucklandicus</i> , n. sp.)	281

POLYNOIDAE.

The Polynoidae, considered as an independent family of the great division of the Aphroditea, comprise three sub-families, namely, *Iphionina*, Sav., characterised by the absence of a *tentaculum impar* on the prostomium; *Lepidonotina* [n. n.], in which the bases of the lateral antennae arise at the same level as the median tentaculum from the frontal margin of the head; *Harmothoïna* [n. n.], where the antennae arise at a lower level than the tentaculum, below the frontal margin. Both *Lepidonotina* and *Harmothoïna* produce short and long forms,¹ e.g., *Lepidonotus* and *Lepidasthenia* of the former sub-family, *Harmothoë* and *Enipo* of the latter. The present collection contains examples of the *Harmothoïna brevia* only.

SERIES HARMOTHOÏNA BREVIA.

Segmenta pauciora quam XLV; clytra paria XV, in segmentis II, IV, V, VII, IX, XI, XIII, XV, XVII, XIX, XXI, XXIII, XXVI, XXIX, XXXII, obvia.

The buccal segment, whose appendages are the cirrophores, each carrying two tentacular cirri, is reckoned as the first somatic segment by some authors, but not by others. It is not seen in dorsal view.

HARMOTHOË.

Kinberg, 1855, char. emend. Malmgren, 1865.

Setae superiores validae, crassiores quam setae ventrales; setae ventrales apice distincte vel obsolete bidentato; clytra totum dorsum tegentia, segmentis ultimis interdum exceptis.

The insertion of the last reservation in the above diagnosis seems to be rendered necessary by the examination of specimens from the

¹ Oligomeric and polymeric, according to the nomenclature introduced by de Blainville and adopted by Claparède.

Antarctic, but it undeniably obscures the limits of the genera *Harmothoë* and *Lagisca*. Ehlers (1897) has also expressed himself in doubt as to the relations of these two genera in Antarctic waters (see below, p. 266).

1. HARMOTHOË SPINOSA.

(Pl. XLI., figs. 1-4, and Pl. XLIII., figs. 1-2 and 4-8.)

Harmothoë spinosa, Kinberg, J. G. H., 1855. *Ofv. Ak. Forh.*, Stockholm, p. 386. Id., 1857. 'Eugenies Resa,' p. 21, Taf. VI., fig. 31. Ehlers, E., 1897, Polychaeten, *Hamburg. Magalhaens. Sammebreise*, p. 12.

This species seems to be the representative, in the Antarctic regions, of the northern species *H. imbricata* (L.), the principal difference between them, so far as I can ascertain by comparison of specimens, relating to the *situs oculorum*. In the Antarctic species the four eyes are visible from above, while *H. imbricata*, as pointed out by McIntosh,¹ shows only a single pair of eyes in dorsal view, the anterior pair being concealed below the frontal cones. Both species present a very great range of variation in the fimbriation and pigmentation of the elytra, which has been alluded to by Ehlers (1897) and McIntosh (1900).

The number of segments, including the buccal segment, frequently adds up to thirty-seven, but this number possibly represents a particular condition in which the worms are commonly taken, and may not have the significance of a fixed quantity. In one case twenty normal segments are followed abruptly by twelve to thirteen small regenerated segments; another specimen of 40 mm. has thirty-eight segments; in a third specimen of 33 mm. the segments, thirty-four in number, taper to a point behind, but no anal cirri are present.²

Judging from the material at my disposal, the variations would seem to culminate in three principal allotypic modifications, of which a brief description follows. One of these modifications is for the present retained as a distinct species (see p. 266).

¹ McIntosh, W. C., 1900: 'British Annelids,' *Ray Soc. Monograph*, p. 316.

² Ehlers (1897) finds thirty-seven segments with length of body increasing from 12 to 45 mm. In this connection it is interesting to note that the number of segments in *Lagisca vesiculosa* is given both by Grube (1877) and Ehlers (1897) as forty-two. Grube's specimen was 21 mm. in length; Ehlers gives no dimensions. The larger 'Challenger' specimens (named *L. antarctica*, McInt.), measuring up to 36 mm. in body-length, have no more than thirty-nine segments. The number forty-two may very well be final, in which case it will be interesting to learn how it happens that some individuals have less than the normal number of segments, while others nearly half the size have the full complement.

(*α*) *H. spinosa*, var. *fullo*.¹

(Pl. XLIII., figs. 1 and 4, and 6-7.)

Elytra parce vel haud fimbriata, spinulis conicis, interdum prope marginem posticum verrucis crassioribus circa III munita.

The minute conical acuminate spines may be localised in definite patches either in the outer portion or on the anterior portion of the elytra. The most anterior spinules may be quite low and blunt, and sometimes all of them have this character (Pl. XLIII., fig. 7). One specimen which I refer to this variety after attentive consideration deserves special mention. For a long time I thought it was a new species of *Lagisca*, but now regard it as a sub-variety of the form under consideration, and shall refer to it simply as v. *lagiscoides*.² The elytra of this specimen are destitute of marginal fimbriae and sub-marginal verrucae,³ but possess extra-marginal spinules like those of *Lagisca magellanica*, McInt. (fig. 6). There are forty segments, of which the last six project behind the elytra; the lagiscoid appearance of free segments behind the elytra will obviously vary according to the condition of regeneration of the posterior end, and also according to the state of general protraction of the body. This specimen measures 49 mm. in length and 15 mm. over the setae; it was taken outside Cape Adare, 13th November, 1899, in 8½ fathoms.

(*β*) *H. spinosa*, var. *typica*.

(Pl. XLI., figs. 1-3, and Pl. XLIII., fig. 2.)

Elytra prope marginem posticum vel ubique verrucis obtusis munita, margine externo fimbriato.

A comparison of the figures on Pl. XLI. with Kinberg's type-figures,⁴ will convince as to the specific identity of the specimens depicted.⁵ The elytra are marked by the presence of sub-marginal pustules (*spinulae conicae* of Kinberg) along the hinder border and

¹ *Polynoë fullo*, Grube, 1877, *Monatsber. Ak. Berlin*, p. 515; *Lagisca magellanica*, McIntosh, 1885, 'Challenger' Rep., XII., p. 82. Both of these are included by Ehlers (1897) in the synonymy of *H. spinosa*.

² The full designation would be *H. spinosa*, var. *fullo*, sub-var. *lagiscoides*, but it is not yet known whether the establishment of sub-varieties is capable of being carried on with profit in *Polychaeta* taxonomy.

³ These are small wart-like vesicles sometimes present in this variety, but much more abundant in the typical variety.

⁴ 'Eugen. Resa.,' Taf. VI., fig. 31.

⁵ Except that Kinberg found "appendices omnes lobi cephalici laeves"—"vielleicht aber nur in Folge des schlechten Erhaltungszustandes" (Ehlers, 1897, Hamburg, p. 14).

sometimes scattered over the surface, *i.e.*, extra-marginal, as shown in fig. 2, Pl. XLI. The rest of the elytral surface is beset with very minute bosses resembling the pustules on a much smaller scale, but not like the definite spines noted in the preceding variety.

An interesting point is raised by the contemplation of fig. 3, Pl. XLI., namely, as to the probability of *Hermadion longicirratum*, Kinberg, being co-specific with *Harmothoë spinosa*. What makes the former a *Hermadion* appears to be merely the exposure of free segments behind the elytra, as in *Lagisca*.¹ If, however, this character fails to prove a sure guide, as in the case of the lagiscoid variety described above, then the extraordinary resemblance between the posterior and anal cirri of the example figured here and those of Kinberg's specimen of *Hermadion longicirratum* ('Eug. Resa.,' Taf. VI., fig. 33) cannot fail to impress, the chief difference being that, in the latter, some of the posterior segments were not concealed by the elytra.

Prof. Ehlers (1897) is doubtful whether *Hermadion longicirratum* should be separated from *H. magalhaensi*, Kbg., the two forms having been obtained at the same point of the Magellan Strait. As indicated above, my observations rather lead me to believe that Kinberg's *H. longicirratum* is generically distinct from *H. magalhaensi*, and belongs to the series of *Harmothoë spinosa*.

The form known as *Lagisca vesiculosa* (Gr.) is not contained in this collection. It chiefly differs from the typical *H. spinosa* in the presence of vesicular swellings at the posterior border of the elytra in addition to the smaller pustules, some of which are borne upon the vesicular elevations.

Prof. Ehlers (1897, p. 15) has the following suggestive remark: "Bei grösserem Material wird sich feststellen lassen, ob die *Polynoë vesiculosa* [i.e. *Lagisca vesiculosa* (Gr.) = *L. antarctica*, McInt.] nicht ganz in den Varietätenkreis der *Harmothoë spinosa*, Kbg., einzubeziehen ist."

2. HARMOTHOË CROSSETENSIS.

(Pl. XLIII., figs. 3 and 9-11.)

Lagisca crossetensis, McIntosh, 1885, 'Challenger' Rep., p. 88.

Elytra hirsuta parce fimbriata, spinis magnis confertis munita.

The collection contains two specimens dredged in 26 fathoms off Cape Adare in company with *H. spinosa*, var. *typica*, etc. They are well-marked forms, presenting a hirsute appearance, due alike to

¹ The type of *Hermadion* is *H. magalhaensi* (sic), Kbg., a well-marked species not represented in the 'Southern Cross' collection. As employed by Kinberg, his genus *Hermadion* also included Malmgren's conception of *Lagisca*.

the erect setae of the dorsal fascicles and to the abundance and size of the spines on the elytra. It is a variety to which the term *spinosa* would be much more appropriate than to v. *typica*.

I was at first tempted to place this species as a variety in the series of *H. spinosa*, as I could find no essential divergence, except in the character of the elytra, which are known to vary considerably. But besides the fact that the collection contains no appreciable gradation between this extreme variety and the typical form, there is also a slight difference apparent in the setae (Pl. XLIII., fig. 3). It will be interesting to learn, from the examination of a larger series, whether or not the autonomy of this species can be maintained.

With regard to the bidentation of the ventral setae, which is a generic character of *Harmothoë*, in the present variety the sub-terminal denticle is obsolete, but may be seen in very rare cases. Prof. McIntosh describes and figures it. Below the curved tip the inner surface of the seta is convex, a point also noted by the author of the 'Challenger' Report. The 'Southern Cross' specimens, however, are a variety or sub-variety distinct from the 'Challenger' specimens, as shown by the character of the elytral spines, which are acuminate at their tips in the former and laciniate in the latter (figs. 10-11, Pl. XLIII.).

The two varieties are therefore as follows:—

1. *H. crosetensis*, var. *acuminata*, n.
2. *H. crosetensis*, var. *laciniata*, n.¹

I counted thirty-eight segments (including the buccal), with body-length of 23 mm., width 9 mm. over the setae, 6 mm. without the setae. In the v. *laciniata* the slender elytral fimbriae are not merely marginal or sub-marginal, but are scattered over the surface in amongst the spines.

Some of the individuals of *H. spinosa* are infested with crustacean ectoparasites, which are attached to the body of the worm by a rostral process which pierces the integument and appears to end in a disc inside. These parasites superficially resemble the *Saccopsis terebellidis* found on *Terebellides stroemi* rather than the *Herypyllobius arcticus* which occurs on *H. imbricata*.²

Other specimens present peculiar growths upon the head, whose nature I have not determined.

¹ The laciniate tips of the elytral spines of *Lagisca crosetensis* are not noted by Prof. McIntosh, *op. cit.*

² Levinsen, G. M. R.: 'Om nogle parasitiske Krebsdyr, der snylte hos Annelider,' *Vid. Medd. Copenhagen*, 1877-8, p. 351.

GATTYANA.

McIntosh, W. C. 'British Annelids,' Part II., 'Polychaeta. Amphinomidæ to Sigalionidæ.' *Ray Soc. Monograph*, 1900, p. 285.
Syn. *Nyctia*, Malmgren, pre-occupied.

Setae superiores debiles, plerumque tenuiores quam setae ventrales; setae ventrales apice integro; elytra scabriuscula, dorsum tegentia; palpi papillis minutis clavatis truncatis obsiti.

3. GATTYANA CRISTATA.

(Pl. XLIV., figs. 1-4.)

Pars media dorsalis segmentorum omnium crista transversa praedita; setae superiores tenerae asperae interdum apice penicillato; elytra perfimbriata, tuberculis crenatis munita.

Three specimens of this interesting species, the first representative of the genus to be recorded from Antarctic waters, were dredged off Franklin Island in 10 to 20 fathoms.

Length of largest specimen 24 mm.; width from below, including parapodia, but not including setae, 8 mm.; number of segments, thirty-five.

Characteristic for the species are (1) the cristate dorsum of each segment; the first crest on the first elytra-bearing segment is rotund, the rest becoming more drawn out transversely until the maximum is reached.

(2) The crenate tubercles of the sub-orbicular elytra. These tubercles are of large size and comparatively few in number in the posterior half of the elytron, graduating in size from the more numerous smaller verrucae of the anterior half. The elytra also carry numerous long filiform fimbriae, both marginal (external and posterior) and extra-marginal.

(3) The tufted tips of the larger dorsal setae. The tip of the setae is produced into a slender flagellum surrounded by a tuft of fine long setulae; often the flagellum is absent, either lost or undeveloped, and then the setae terminate in a brush. These setae resemble the penicillate setae of *Panthalis oerstedii*.¹

The most dorsally placed setae are feeble and flexible.

MALMGRENIA.

McIntosh, 1876, char. emend.

McIntosh, W. C., 1876. *Tr. Zool. Soc., London, IX.*, p. 376. *Id.*, 1900, *Ray Soc. Mon.*, p. 379.

Prostomium lyriforme; processus omnes corporis (viz., palpi, tentaculum, antennae, cirri, elytra) glabri vel subglabri; setae ventrales distincte vel obsolete bidentatae.

¹ Cf. McIntosh, *op. cit.*, 1900, p. 403, and Pl. XLI., fig. 51.

In his recent diagnosis of this genus, Prof. McIntosh speaks of "the median and lateral tentacles springing from the front as in *Lepidonotus*." It was Grube¹ who first drew attention to the divergent series of Polynoids typified respectively by *Lepidonotus* and *Harmothoë*. In Prof. McIntosh's monograph the reader is left in doubt as to which series the genus is to be assigned, and on turning to the figure of the head (Pl. XXVIII., fig. 15) it seems to me that the median and lateral tentacles do not arise from the frontal border as in *Lepidonotus*.

In a still more recent memoir on the Aphroditidae written by M. Darboux² we find the genus *Malmgrenia* included among the synonyms of *Harmothoë* itself. Under these circumstances it is unfortunate that there should be ambiguity in the definition and illustration of the genus. The bases of the tentaculum and antennae in *Malmgrenia* are contiguous, but the latter are inserted at a distinctly lower level.

4. MALMGRENIA CRASSICIRRIS.

(Pl. XLII., figs. 3-4, and Pl. XLIV., figs. 5 and 6.)

Elytra reniformia brunnea albolineata striis candidis duabus longitudinalibus; setae ventrales apice bidentato denticulo accessorio intermedio; cirri ventrales tumidi subulati.

The two white stripes upon a dark madder-brown background on each elytron give this species a characteristic appearance totally unlike anything else in the collection. Seen from below, the whitish fleshy ventral cirri convey an equally distinctive impression. When the elytra are removed, the intensely white prostomium and the whitish elyptrophores stand out prominently from the general dark madder-brown ground colour.

The largest specimen was unfortunately mutilated behind, only thirty-one segments being preserved with the fragment, which measured 17 mm. in length and 6.5 mm. over the setae. A complete specimen, 14 mm. long by 4.5 mm. wide (over the setae), had forty segments.

The dorsal setae are much shorter and stouter than the ventral

¹ Grube, E.: 'Bemerkungen über die Familie der Aphroditeen III., Polyonina,' see p. 59. *Jahresber. Schles. Ges.*, 1875 (Breslau, 1876).

² Darboux, J. G.: 'Recherches sur les Aphroditiens,' *Bull. Sci. France et Belgique*, XXXIII, 1900, see p. 106.

setae, in this respect bearing a resemblance to Malmgren's genus *Laenilla*.¹

The dorsal setae are nearly smooth, but faint serrations can be observed along the convex border with a high magnification. The greatest peculiarity in the parapodial armature is presented by the ventral setae, which have gaping bifid tips with a small accessory tooth between the larger prongs. The number of paired alternating spinous rows on the ventral setae is about twelve, the eighth row occurring at the point of maximum dilatation.

Several specimens were obtained off Cape Adare in 20 to 26 fathoms at a temperature of 29° Fahr. In the state of preservation in which they arrived they proved to be excessively fragile, the cirri and elytra breaking off with the greatest ease and even the intersegmental junctions giving way.

PHYLLODOCEIDAE.

5. PHYLLODOCE MADEIRENSIS.

(Pl. XLII, fig. 5, and Pl. XLIV., fig. 7.)

Phyllodoce (*Anaitis*) *madeirensis*, Langerhans, P., 1880. *Zeitschr. wiss. Zool.*, XXXIII., p. 307. Ehlers, E., 1897, *op. cit.*, p. 25.

Prof. Ehlers pointed out that the Antarctic representative of the Madeiran *Phyllodoce* differs from the original type in the character of its setae, the terminal spiniform process of which is very much longer than in the latter.

On account of the serial distribution of papillae on the extruded proboscis, this species should presumably be regarded as a *Phyllodoce*, s. str., and not as an *Anaitis*.²

The proboscis has six lateral rows of papillae, ten to twelve in a row, and a median dorsal series of seven. All the papillae are characterised by a patch of chocolate-brown pigment on their posterior faces only (Pl. XLII., fig. 5).

¹ Many of Malmgren's genera have been rejected by subsequent systematists, and among others the type species of *Laenilla*, *L. glabra*, is now named *Harmothoë setosissima* (Sav.), McIntosh, 1900, p. 345. I do not quite see the necessity for sinking the name *Laenilla* in *Harmothoë*, especially since the type species turns out to be valid (apart, of course, from synonymy), and, in fact, the distinction between *Laenilla* and *Malmgrenia* is drawn extremely fine, the cirri of *Laenilla* being sparsely papillose, and the head of a different shape.

² Cf. Malmgren, 1865, *Ofv. Ak. Forh. Stockholm*, pp. 94, 95, and Grube, 1880, *Jahresber. Schles. Ges. für 1879*, p. 208.

The posterior border of the prostomium is emarginate, with a nuchal papilla in the notch.¹ With regard to the tentacular cirri, Langerhans states that the first (buccal) segment carries three pairs of tentacular cirri with annulate bases,² while the second segment bears one pair of tentacular cirri and one *cirrus ventralis foliaceus*, but no setae. This description tallies with Malmgren's diagnosis of *Anaitis*, but is not in accord with my observations. In the 'Southern Cross' specimen, with proboscis three parts extruded, it is quite evident that the dorsum of the true buccal segment is invisible from above, unless it is represented by the nuchal papilla. Below and at the sides, however, the buccal segment is clearly visible and bears laterally a pair of cirri;³ the second segment bears two cirri on each side, namely, the most dorsally placed long cirrus in the figure and the shortest pair of cirri below it;⁴ the third segment bears a pair of tentacular cirri, namely, the long cirrus immediately below the most dorsally placed cirrus on each side in the figure; below this last tentacular cirrus there is a *cirrus ventralis foliaceus*, as described by Langerhans.

The following table recapitulates the foregoing observations:—

- Segment I. One pair of tentacular cirri and a median dorsal nuchal papilla.
 Segment II. Two pairs of tentacular cirri, namely, a dorsal and a ventral pair.
 Segment III. One pair of tentacular cirri and a paired *cirrus ventralis foliaceus*.

One specimen, 72 mm. long, 3 mm. wide over the parapodia, was taken off Cape Adare in 20 to 24 fathoms.

ALCIOPIDAE.

VANADIS.

Appendix terminalis pedum cirriformis; setae compositae capillares; antennae V.

6. VANADIS ANTARCTICA.

(Pl. XLIV., fig. 8, and Pl. XLVI., figs. 1-2.)

Alciopa antarctica, McIntosh, 1885, 'Challenger' Rep., p. 175.

Vanadis antarctica, Apstein, 1900. 'Die Alciopiden und Tomopteriden der Plankton Exped.,' Bd. II., H. b., p. 11.

¹ The notch is deeper and more acute than shown in the figure.

² The annulation of the cirrophores cannot be discerned in the 'Southern Cross' specimen.

³ The longer of the two short cirri on each side in the figure.

⁴ It is necessary to examine in side view to see these relations properly.

Apstein transferred this species tentatively to the genus *Vanadis* on account of the presence of "a short filiform cirrus" (McInt.) on the parapodium. But one of the essential characters of *Vanadis* is the possession of *setae compositae*, while Prof. McIntosh attributed *setae simplices* to his *Alciopa antarctica* which, if correct, would have justified the constitution of a new genus.

A true *Vanadis* had already been recorded from the Southern Seas, namely, *V. grecciana*, Grube, 1877,¹ taken between Kerguelen and Australia.

In the present species the buccal segment resembles that of *Vanadis formosa*, figured by Apstein. It does not appear in dorsal view, but seen from below it consists of two broad lobes, each bearing a stout tentacular cirrus at its outer edge and meeting in the middle line in a small triangular piece. Behind the bilobed buccal segment follow two narrow segments, each with a pair of tentacular cirri borne upon cirrophores. The fourth segment bears a pair of dorsal cirri with rounded tips and a rudimentary parapodium, but no setae. The fifth and sixth segments in the female bear large spherical dorsal cirri modified to form *receptacula seminis*. A small mammilla on each receptaculum represents the apex of the modified cirrus. In addition to these remarkable organs² the fifth and sixth segments likewise bear a small *pharetra setarum*, from which the long slender setae project, and a small ventral cirrus. In *Vanadis formosa* the receptacula are borne upon different segments (viz., 4th and 5th), and there are no setae on these segments (Apstein).

The occurrence of a pinnigerous but apparently achaetous segment, between the segments which carry the tentacular cirri and those which bear the receptacula seminis, is a distinctive feature of *Vanadis antarctica* ♀.

An incomplete female with 115 segments measured nearly 9 inches in length.

The anterior portion of the body, including the first eight or nine setigerous segments, is slender, cylindrical, and porrect. The sexes are easily distinguished by the absence of the enlarged dorsal cirri of the anterior setigerous segments in the male and their presence in the female. Behind, and at the base of the more posterior parapodia, there are large black glands more prominent in the male. The general colour in spirit is translucent brown, banded in the abdominal region.

¹ Pharetra setarum in appendicem brevem filiformem exeunte; setae compositae. (Grube, *Monatsber. Ak. Berlin*, 1877, p. 524.)

² Originally described by Hering in 1860; cf. Hering, 'Zur Kenntniss der Alciopiden von Messina,' *S.-B. Akad. Wien*, Bd. 101, Abth. 1, 1892.

If the long slender setae are gathered into a 'bunch' it is almost, if not quite, impossible to determine their composite nature, but when spread out there is seen to be a very long appendix jointed to a still longer shaft (Pl. XLIV., fig. 8).

Numerous examples, male and female, were obtained at Cape Adare "on the surface along the beach," during latter end of April and beginning of May, 1899; temperature 28.6° Fahr.; "very plentiful for a few days but afterwards not seen again."

The downwardly directed lens of the specimen figured by McIntosh (*op. cit.* Pl. XXVIII., fig. 4) is evidently due to unnatural shrinkage. It is stated in a footnote that the Alciopidae of the 'Challenger' collection were in an indifferent condition, but it is true that the lens has a downward inclination.

The achaetous segment which I have described between the third pair of tentacular cirri and the first pair of receptacula seminis (or the corresponding segment in the ♂) is represented in the figure quoted above, but is not referred to in the text; also the setae in the minute parapodia of the receptaculiferous segments were not observed by Prof. McIntosh. These setae are shorter and finer than the rest and might easily be overlooked, even if they were not lost from the specimen.

One of the 'Southern Cross' specimens had the proboscis exerted; it is seen to be surmounted by a crown of twelve soft conical papillae of which four are dorsal, six ventral and two lateral, the last being larger than the rest (Pl. XLVI., fig. 2). The skin of the dorsal surface is loose, and below it occurs an infusion of blood rendering it probable that the proboscis is protruded by fluid pressure as with *Phyllodoce*, according to Ehlers.

Grube appears to have based his description of *V. greeffiana* on a male specimen which was re-examined and figured by Dr. Apstein (*Arch. Naturg.* Bd. 59 (1), 1893, p. 145), who, more recently (1900), has declared it synonymous with *V. formosa*, Claparède. Apstein's earlier figures of *V. greeffiana* do not quite agree with his later figures of *V. formosa* in regard to the number of anterior achaetous segments in the male, and, in the absence of the female, it is difficult to say why *V. greeffiana* should be regarded as co-specific with *V. formosa* rather than with *V. antarctica*. Apstein (*op. cit.* 1893) gives the information that the precise locality in which *V. greeffiana* was taken was Long. 67° 30' E., Lat. 35° 20' S.

SYLLIDAE.

7. TYPOSYLLIS HYALINA.

(Pl. XLV., figs. 1-3.)

Syllis hyalina, Grube, 1863, *Arch. Naturg.*, p. 45; Marenzeller, 1875, *SB Ak. Wien*, LXXII., Abth. 1, p. 129; Ehlers, 1897, *op cit.*, p. 36.

Typosyllis hyalina, Langerhans, 1879, *Zeitschr. wiss. Zool.* XXXII., p. 535.

A single specimen was dredged in company with Maldanids and Ariciids off Cape Adare, January 17, 1900, in 8 fathoms.

The body, 34 mm. in length by 2 mm. average width, maintains an even transverse diameter until near the hinder end, where it tapers to a point terminated by two breviarticulate anal cirri with thirteen to fourteen joints.

The tentaculum impar has about seventeen joints indistinct towards the base. Dorsal cirrus II is longer than the tentacular cirri and than all the rest, having twenty clear joints and two or three indistinct joints at the base. Cirrus III has about sixteen joints, cirrus IV eighteen, and then the cirri somewhat lessen and become fusiform with about fifteen joints, and equal in length to little more than half the width of the body, again becoming somewhat longer and slenderer towards the posterior end.

The eyes are in a wide trapezium, the anterior pair, as usual, being the larger.

This species belongs to a section of the genus characterised as follows:—

Cirri dorsales breves; setae bidentatae.¹

The anterior segments present a banded appearance due to two reddish-brown pigment tracts bounding a clear transverse space which occupies the crest of each segment; the posterior band is generally interrupted in the middle line (fig. 2).

8. EUSYLLIS KERQUELENSIS.

Eusyllis kerguelensis, McIntosh, W. C., 1885, 'Challenger' Rep., p. 191
Ehlers, E., 1897, t. c., p. 42.

This is a Syllid of large size, long cirri and smooth convex dorsum, resembling in its habitus a Hesionid, as Ehlers points out.²

¹ Carus, J. V., 1885, 'Prodromus Faunae Medit.', Vol. I., p. 227. In the present species the bidentation of the setae is often obscure.

² It is curious that a minute Syllid belonging to the same sub-division, *Eusyllina*, namely, *Syllides longocirrata*, Oerst., should have been also compared to a Hesionid by Langerhans (1879, *Zeitschr. wiss. Zool.* XXXII., p. 549). Besides being a minute species the dorsal cirri are articulate except the first three, which are shorter and clavate.

The single specimen, obtained off Cape Adare in 20 to 24 fathoms, is a fragment with thirty-six anterior segments, upwards of 12 mm. in length and nearly 3 mm. across the body without the feet; 5 mm. over the setae. The dorsal cirri are long and smooth, but under the microscope faint articulations can be discerned near the free end. They stretch across the dorsum, measuring therefore about 3 mm. in length. The dorsal cirri of the first three segments are shorter than the succeeding, graduating in size from the first, until at the fourth segment the normal filiform dorsal cirri commence. The stout antennae are equal to or slightly exceed the length of the palps which meet together quite at the base. The eyes are in a wide sub-rectangle, the anterior pair the larger.

ARICIIDAE.

9. *ARICIA MARGINATA.*

(Pl. XLV., fig. 4.)

Aricia marginata, Ehlers, 1897, *op. cit.*, p. 95.

A poorly preserved incomplete specimen was taken off Cape Adare in 8 fathoms, January 17, 1900.

The anterior body-region comprises the achaetous buccal segment and thirteen setigerous segments which carry dorsal fascicles of long slender capillary setae, one side of which is notched like a file, the notches slightly imbricating; and oval dorso-ventrally elongated neuropodial fascicles of stout aciculiform crochets, which present a tristichous arrangement. The ventral crochets are stout dark-brown spines with a curved blunt end and low serrations on the convex border.

10. *SCOLOPLOS KERGUELENSIS.*

Scoloplos kerguelensis, McIntosh, 1885, *op. cit.*, p. 355; Ehlers, 1897, *op. cit.*, p. 97.

One specimen washed up after a gale with *Harmothoe* at Cape Adare, January 25, 1900; others dredged in 8-10 fathoms.

Both dorsal and ventral setae are simple and capillary; after the ninth setigerous segment the *pharetrae setarum* become dorsal.

Length 7.25 mm.; segments fifty-six, the last few being achaetous.

OPHELIIDAE.

11. TRAVISIA KERGUÉLÉNSIS.

(Pl. XLII., figs. 1-2.)

Travisia kerguelensis, McIntosh, 1885, *op. cit.*, p. 357; Ehlers, 1897, *op. cit.*, p. 97.

In this worm the mouth lies between the first and second setigerous segments, and in front of the first setiger there is an achaetous segment presumably homologous with the peristome of other forms, but here in front of the buccal orifice. In the figures given by McIntosh and Ehlers the lateral organs (Seitenorgane), which superficially resemble those of the Capitellidae,¹ are not shown. They lie between the notopodial and neuropodial fascicles and appear as pits in the pleural wall, commencing in the first postoral segment and ending in the twenty-first postoral (Pl. XLII., fig. 2).

The segmental nephridiopores are seen below the ventral fascicles, commencing at the fifth postoral and ending at the thirteenth postoral segment. The posterior segments give rise to rounded papillae which eventually form a fringe round the pygidium.

Two specimens were obtained from Cape Adare in 7 to 10 fathoms; length 20 mm., maximum width nearly 8 mm.

MALDANIDAE.

RHODINE.

Malmgren, 1865, *op. cit.*, p. 189, Char. emend.

Uncini in segmentis uncinigeris anterioribus biseriales, in ceteris uniseriales, sine fasciculo setularum sub rostro, in segmentis IV anticis setigeris nulli, in ceteris numerosi.

In his description of *Rhodine sima*, Ehlers² seems to have been the first to indicate that the uncini are biserial in a limited number of segments only, uniserial in the rest.

12. RHODINE LOVÉNI.

(Pl. XLVI., figs. 3-5.)

Rhodine lovéni, Malmgren, A. J., 1867, 'Annulata Polychaeta,' Taf. X., fig. 61.

Several specimens of this interesting species were obtained off Cape Adare in 8 fathoms, 17th January, 1900; sea temperature 30° Fahr.

¹ Cf. Eisig, 'Monograph der Capitelliden.' They closely resemble the corresponding organs in a *Dasybranchus* which I have examined.

² Ehlers, 1887. 'Florida-Anneliden,' p. 189.

The tube consists of agglutinated particles of black and red sand.

The prostomium has two grooves above, separated by a low keel; there is no limbus. The head is not only coalescent with the achaetous buccal segment, but also with the first setigerous segment, so that the animal is provided with a long porrect neck. The plane of fusion of the buccal with the first setigerous segment is indicated dorsally by a peculiar transverse crest, which is apparently obsolete in some, though present in most specimens. Of course the length and appearance of the segments will depend upon the state of contraction of the worm during preservation.

The second and third setigerous segments are each provided with a collar which embraces the segment in front; the seventeenth to the twenty-fourth setigerous segments are elegantly campanulate, the bell becoming deeper in the posterior segments.

There are not more than twenty-four segments on the most complete specimen, but the worm is fragile, the campanulate segments especially separating with great ease.

Segments four to ten are not longer than they are broad; from the eleventh they increase in length, commencing to decrease again after the twenty-first setigerous segment. Segments four to nine inclusive carry ventral shields (*scuta ventralia*).

The uncini commence with a biserial disposition on the fifth setigerous segment and become uniserial at the fifteenth.¹

I should estimate that the total length would be about 70 to 80 mm.

TEREBELLIDAE.

SUB-FAMILY AMPHITRITEA. Malmgren.

THELEPUS.

Leuckart, 1849; char. emend. Malmgren, 1865; sens. ampl., Grube, 1877.

a. Leuckart, R., 1849: 'Zur Kenntniss der Fauna von Island.' *I. Arch. Naturg.*, XV. 1, p. 169.

β. Malmgren, A. J., 1865: 'Nordiska Hafs-Annulata.' *Öfv. Ak. Forh.*, p. 386.

γ. Grube, A. E., 1877: 'Anneliden-Ausbeute S.M.S. "Gazelle."' *Monatsber. Ak. Berlin*, p. 544.

Branchiae filiformes, acervis transversis filorum simplicium compositae, paria duo (*Thelepus*, s. str.) vel tria (*Neottis*); fasciculi setarum capillarium a segmento tertio (II^{do} branchifero) incipientes, per segmenta numerosa (plura quam XXX) obvii.

¹ I have ascertained from material in the National Collection that the uncini are uniserial in the abdominal segments of the northern type.

Since Grube's amplification of the scope of the genus *Thelepus* there has been a tendency to drop the name *Neottis* Malmgren. It can be shown, I think, in several ways that this is ill-advised, but for the present it is sufficient to point out that there is a *Neottis antarctica*, McInt.,¹ and a *Thelepus antarcticus*, Kbg., which are two different species.² Whenever a species of *Thelepus*, s. ampl., is recorded from any locality, the first question that rises to my mind is, "Is it not a *Neottis*?"

13. THELEPUS ANTARCTICUS.

(Pl. XLV., fig. 6.)

Thelepus antarcticus, Kinberg, J. G. H., 1866, 'Annulata Nova,' *Ofv. Ak. Forh.*, p. 345.

It is noteworthy that not one of the three collections of Antarctic Polychaeta recently examined by Prof. Ehlers³ contained this highly characteristic species. Not only is it a true *Thelepus*, s. str., but it is probably co-specific with the northern type, *Thelepus cincinnatus* (Fabr.).

One fragment, comprising the head and thirty setigerous segments, upwards of 2 inches long, was dredged off Cape Adare in 8 fathoms, January 17, 1900.

The fore-part of the body or thoracic region comprises approximately the first twenty-five setigerous segments, which differ from the abdominal segments in their greater girth, but not in respect of the parapodial armature.

A mid-thoracic segment measures 7 mm. crosswise by 2 mm. lengthwise; an abdominal segment, $3\frac{1}{2}$ mm. \times 4 mm.; so that an average abdominal segment is equal to half the width and twice the length of a typical thoracic segment.

The entire dorsal surface is characterised by a rich glandular pustulose structure which still preserves a slimy surface. The

¹ *Neottis antarctica*, McIntosh, 1876, = *Neottis spectabilis*, Verrill, 1875, = *Thelepus spectabilis* (Verr.), Ehlers, 1897.

² Unless I am quite mistaken, M. Malaquin (1894, 'Annélides . . . de la goëlette *Melita*,' *Rev. biol. Nord France*, VI., p. 418) completely confused them, and I do not know what species he had before him.

³ Ehlers, E., 1897. 'Polychaeten.' *Ergebnisse Hamburg. magalhaensischen Sammelreise*, 11th Lief.

Ehlers, E., 1900. 'Magellanische Anneliden der schwedischen Expedition.' *Nachr. Ges. Göttingen*, Heft 2, p. 206.

Ehlers, E., 1901. 'Die Anneliden der Sammlung Plate.' 'Fauna Chilensis,' Ed. II., Heft 2, p. 251 (Suppt. V., *Zool. Jahrb.*).

translucent hypodermal pustules are of varying sizes, irregular in their distribution, larger and more abundant than in the specimens of *Thelepus cincinnatus* which I have examined.

The *tori uncinigeri* commence on the third setigerous segment, and thereafter the tori and capillary fascicles co-exist to the end of the specimen (and of the body, Kinberg), there being no mutation of segments in regard to the distribution of setae, except that the *tori* become more pro-eminent in the abdominal segments, while the dorsal capillary fascicles suffer a slight reduction.

The simple filiform branchiae are more numerous on the second than on the third segment, the latter being the first setigerous segment.

The specimen offered certain chaetographical abnormalities. In the nineteenth setigerous segment there was no *torus* on the left side; the twenty-fourth and twenty-fifth *pharetrae* (*notopodium* and *neuropodium*) of the right side had no antimeres on the left side; finally, the twenty-fifth right capillary fascicle was not subtended by the usual *torus*.

The uncini are uniserial throughout and exactly resemble those of *Thelepus cincinnatus* figured by von Marenzeller,¹ being characterised by the presence of two rows of accessory uncinules at the vertex and by a rounded process (*mucro*) at the distal end of the basal portion.

NICOLEA.

Malmgren, 1865, *op. cit.*, p. 380.

Branchiae arborescentes, paria duo; fasciculi setarum capillarium a segmento quarto [*i.e.* first postbranchial] incipientes, in segmentis circa XV-XVII obvii.

The relations of this genus to the *Phyzelia* of Savigny, Quatrefages and Kinberg have been dealt with by the Baron de St. Joseph.²

14. NICOLEA AGASSIZI.

(Pl. XLV., fig. 5.)

Phyzelia agassizi, Kinberg, 1866, *op. cit.*, p. 345.

Nicolea agassizi (Kbg.), Ehlers, 1897, *op. cit.*, p. 132.

The collection contains five specimens taken off Franklin Island in 10 fathoms and Cape Adare in 20 to 24 fathoms. The larger

¹ Marenzeller, F. von, 1884. 'Zur Kenntniss der adriatischen Anneliden,' III. *S.-B. Akad. Wien*, Bd. 89, p. 206.

² *Ann. Sci. Nat.* (7th Sér.), T. XVII., p. 180 *et seq.*

specimens from Cape Adare measure up to 60 mm. in length, of which about two-thirds go to the attenuated abdominal region and one-third to the tumid thoracic region.

The *tori uncinigeri* commence on the second setigerous segment. The *uncini* are uniserial at first, but at the seventh uncinigerous segment their vertices become turned alternately in opposite directions, a condition which is thus described by Kinberg:—“*Uncini breves, series simplices fingentes, in segmentis posterioribus regionis anterioris antrorsum et retrorsum vergentes alternantes.*” This alternation of the *uncini* occurs in ten uncinigerous segments, from the seventh to the sixteenth (the last thoracic segment) inclusive.

The *uncini* are fringed at their vertices by two rows of uncinules, those of the front or major series being not less than five in number in a transverse row, when seen in frontal view; the distal end of the basal portion of the *uncinulus* is obtusely rounded, and there is a low protuberance in the concave border of the basal portion.

The second gill is smaller than the first, and commences to branch from the base; the first gill has a stout stipe, the branches, which spread out in a more or less palmate manner, occupying the upper three-fifths of it.

In the intersegmental grooves behind the third and fourth capillary fascicles there is a low whitish ovate body which possibly has relation to the reproductive system. In one of the larger specimens, these bodies have the form of short, stout, subulate, cirriform papillae, which occur near the posterior dorsal border of the respective capillary fascicles in the intersegmental grooves.

SUB-FAMILY **POLYCIRRIDEA.** Malmgren.

EREUTHO.

Malmgren, A. J., 1865, ‘Nordiska Hafs-Annulater,’ *Öfv. Ak. Forh.*, p. 391.

Pars antica corporis solummodo fasciculis setarum capillarium praedita; pars postica toris uncinigeris munita; pinnulae uncinigerae a segmento XIV^{mo}, i.e. primo pone segmentum ultimum setigerum incipientes; caput cirris tentacularibus longis numerosis obsitum; branchiae nullae.

The above diagnosis is Malmgren’s, slightly altered so as to include a species based upon a single specimen, whose autonomy must remain a matter of doubt until more examples are obtained.

15. EREUTHO ANTARCTICA.

(Pl. XLII., fig. 6, and Pl. XLVI., fig. 6.)

Fasciculi setarum capillarium a segmento tertio incipientes in segmentis XI obvii.

Capillary setae in eleven segments followed by twelve uncini-gerous segments; specimen measuring about 15 mm. in length over all, apparently incomplete behind; posterior three-fifths of thoracic region swollen and ovigerous, ova showing through the body-wall; uncini uniserial, confined to abdominal region; tentacles grooved on their inner faces.

The form of the uncini (Pl. XLVI., fig. 6) curiously resembles that of the uncini of *Polycirrus kerguelensis*, McInt.,¹ rather than those of other species of the genus,² more especially in regard to the length of the manubrium, thus indicating the validity of the species.

One specimen was taken at Cape Adare, 25th January, 1900, washed up after a gale.

ADDENDUM.

Besides the material obtained in the neighbourhood of Cape Adare, there is a very small tube of worms from the Auckland Islands. These include a small Nereid, of which the proboscis is not extruded, and a Hesionid allied to *Oxydromus*. As the latter is of some interest zoogeographically I append a brief description, naming it *Oxydromus aucklandicus*.

The antennae and the styles or terminal joints of the biarticulate palps are fusiform with filiform acuminate tips; the median antenna (tentaculum) is much shorter than the paired antennae and, like them, frontal in origin; eyes in a wide trapezium, the anterior larger and crescentic; the tentacular cirri are all lost, only their bases remaining, and repeated examination only revealed traces of six pairs; the dorsal rami of the parapodia are inseparably connate with the cirrophores of the dorsal cirri, as in *Podarke viridescens*, Ehl., and are armed with a few delicate simple setae; ventral setae with long graduating falciform appendix with finely serrulate edge and bidentate apex; there are forty-two setigerous segments; length 15 mm.; width over the setae 4 mm., without the setae, 3 mm.

Locality.—Auckland Islands, one specimen from ten fathoms.

¹ 'Challenger' Rep., Pl. XXVIII_A, fig. 22.

² E.g., *Ereutho smitti*, Malmgren, 1865, from Spitzbergen, and *E. kerguelensis*, McIntosh, 1885, from Kerguelen.

EXPLANATION OF PLATES.

PLATE XLI.

All figures relate to *Harmothoë spinosa*.

Fig. 1.—Anterior end of specimen of 43 mm. and 37 segments. (N.B.—The fimbriae of the elytra are not shown in the figure.)

Fig. 2.—Three of the middle segments of another to show extra-marginal as well as sub-marginal verrucae.

Fig. 3.—Posterior end of a third example; total length 22 mm., 37 segments.

Fig. 4.—Several segments with elytra removed and seen from above, showing parasites.

PLATE XLII.

Fig. 1.—*Travisia kerguelensis* from the left side; the position of the mouth is indicated by the dark shading between the first and second setigerous segments.

Fig. 2.—Portion of lateral body-wall of same showing areolation of the epidermis, the laminated branchia behind the dorsal fascicle, the lateral organ (*Seitenorgan*) between the dorsal and ventral fascicles and the segmental orifice below.

Fig. 3.—*Malmgrenia crassicirris*. Several segments seen from below showing thickened ventral cirri and pigment markings.

Fig. 4.—Same. Anterior end. The second elytron on the left side of the figure is really the third, the second being lost from the specimen.

Fig. 5.—Head of *Phyllodoce madeirensis* with proboscis partially extended.

Fig. 6.—*Ereutho antarctica* from the left side.

PLATE XLIII.

Fig. 1.—Tip of ventral seta of *H. spinosa*, var. *fullo*, × Zeiss, 4D.

Fig. 2.—Tip of ventral seta of *H. spinosa*, var. *typica*, × 4D. (The sub-apical denticle is represented by a shoulder.)

Fig. 3.—Tip of ventral seta of *H. crossetensis*, var. *acuminata*, × 4D.

Fig. 4.—Tip of ventral seta of *H. spinosa*, sub-var. *lagiscoides*, × 3D. (The rows of setulae commence far down as in 3.)

Fig. 5.—Tip of ventral seta of *H. spinosa*, another specimen. × 3D. (The rows of setulae commence high up as in 2, but the bidentation of the tip is obsolete, being indicated by a convex limbus or border somewhat resembling No. 3.)

Fig. 6.—Elytral spine of *H. spinosa*, sub-var. *lagiscoides*, × 3D.

Fig. 7.—Hamate boss from elytra of a specimen apparently intermediate between var. *fullo* and var. *typica*, × 3D.

Fig. 8.—Head of *H. spinosa* (drawn from specimen dredged off Cape Adare in six fathoms, December 16th, 1899; thirty-eight segments, all elytra, lost; in this case the tentacular cirri are unequal, in others they are equal); same individual as No. 5.

Fig. 9.—Prostomium with tentaculum and antennae of *H. crossetensis*, var. *acuminata*.

Fig. 10.—Portion of elytral margin of same, showing unequal acuminate spines and fimbriae.

Fig. 11.—Portion of an elytral scabrilla of *H. crossetensis* (McInt.) from the Crozet Islands, showing the lobed tip (var. *laciniata*).

PLATE XLIV.

Fig. 1.—Prostomium with ceratophore and antennae, and first elytraphoral segment of *Gattyana cristata*. The first dorsal crest has a rounded knob-like appearance.

Fig. 2.—Dorsal penicillate seta of *G. cristata*, $\times 3c$.

Fig. 3.—Ventral seta of same, $\times 3A$.

Fig. 4.—Crenulate scabrilla of elytra of same, $\times 3c$.

Fig. 5.—Head of *Malmgrenia crassicirris*.

Fig. 6.—Ventral seta of same, $\times 3D$.

Fig. 7.—Seta of *Phyllodoce madeirensis*, $\times 3c$.

Fig. 8.—Seta of *Vanadis antarctica*, $\times 3D$.

PLATE XLV.

Fig. 1.—Head of *Typosyllis hyalina* with proboscis extruded; *t* = tooth seen through dorsal wall of proboscis.

Fig. 2.—An anterior segment (about 19th) of same to show the pattern of pigmentation.

Fig. 3.—Dorsal cirrus of 19th segment of same.

Fig. 4.—Seta from one of the anterior ventral fascicles of *Aricia marginata*, $\times 3D$.

Fig. 5.—Uncinus of *Nicolea agassizi*, $\times 3D$.

Fig. 6.—Uncinus of *Thelepus antarcticus*, $\times 3D$.

PLATE XLVI.

Fig. 1.—Anterior end of *Vanadis antarctica* (\varnothing) from below; *l* = lens; 1, 2, 3 = tentacular cirri; *r. s.* = receptacula seminis.

Fig. 2.—Coronary papillae on the extruded proboscis of same.

Fig. 3.—Anterior end of *Rhodine loveni* from above.

Fig. 4.—Nineteenth setigerous segment of same from above.

Fig. 5.—Uncinus of same, $\times 3D$.

Fig. 6.—Uncinus of *Ereutho antarctica*, $\times 4D$.

XIII. GEPHYREA.

BY A. E. SHIPLEY, M.A.

PRIAPULOIDEA.

PRIAPULUS CAUDATUS. Lam.

(For early synonymy, see Baird, Proc. Zool. Soc. Lond. 1868, p. 104.)

? *Priapulus tuberculato-spinosus*. Baird, *op. cit.*, p. 106.*Priapulus tuberculato-spinosus*. De Guerne.¹

Two specimens of this species were found washed upon the beach at Cape Adare. The larger one was injured anteriorly, the smaller measured 6·5 cm. in total length, to which the tail contributed 1·5 cm. It is thus recorded for the first time from the shores of the Antarctic land. I follow Fischer in regarding these Antarctic forms as belonging to the species *P. caudatus*, Lam. The species seems widely distributed in the southern hemisphere. Dr. Fischer's specimen came from Navarin Island.² M. de Guerne records the species from Orange Bay, from the Straits of Magellan, and from the Falkland Islands, where indeed a specimen had been obtained by the Antarctic Expedition under Sir James Ross,³ and Dr. Michaelsen⁴ has described and figured two examples from South Georgia.

The distribution of this species is a striking case of what is termed the phenomenon of bipolarity. *P. caudatus* occurs along the coasts of Greenland, Norway, and Great Britain, and in both the North and Baltic Seas, but, except for two specimens referred to

¹ 'Mission Scientifique du Cap Horn,' 1882-1883, p. G. 9. Paris, 1891.² 'Ergebnisse der Hamburger Magalhaensischen Sammelreise.' Gephyreen, p. 6. (1896.)³ Baird, P. Zool. Soc., London, 1868, p. 106.⁴ Jahrb. Hamburg. Anst., VI. Jahr., 1888, p. 80.

in full in Dr. Michaelsen's article recorded from the Mediterranean and Indian Oceans, the species has not been met with again until we reach a latitude of about 50° S. The genus too seems also bipolar in its distribution. *P. bicaudatus* lives in the North Sea and Arctic Ocean, and is represented in habits and its two tails by M. de Guerne's *Priapuloides australis* from the neighbourhood of the Magellan Straits. *P. glandifer*, Ehlers, and *P. brevicaudatus*, Ehlers, are, in the opinion of Koren and Danielsen¹ and of Dr. Michaelsen, not specifically distinct from *P. caudatus*, and in fact Professor Ehlers² himself regarded these species as requiring confirmation.³

Mr. Shipley was also good enough to determine three specimens of *Phascolosoma capsiforme* (Baird, Proc. Zool. Soc. Lond. 1868, p. 83) from Cape Adare, 20–24 fathoms.—F. J. B.

XIV. NEMATODA.

Dr. von Linstow has been so good as to examine the few round worms in the collection. They all belong to *Leptosomatum antarcticum* (see v. Linstow, JB. Hamburg. wiss. Anstalt IX. (1892), 2, p. 59.

XV. CESTODA.

Dr. von Linstow is also my authority for recording *Bothriocephalus tectus* (t.c., p. 73) from Ross's Seal.

¹ 'Fauna littoralis Norwegiae.' III. Heft. Bergen, 1877.

² Zeitschr. wiss. Zool., XI., 1862, p. 205.

³ It is not Mr. Shipley's fault that this report did not appear before Feb. 15th, 1902, when were published Mr. Storikow's remarks on the geographical distribution of some Priapulids (Zool. Anzeig., xxv. p. 155).—F. J. B.

XVI. POLYZOA.

BY R. KIRKPATRICK.

THE Polyzoa obtained from the Antarctic region comprise eight species and one variety, one species being new. The seven known species have all been found before in the Southern hemisphere, either off Australia, Kerguelen Island, or Cape Horn. The specimens encrust seaweed and tubes of *Spirorbis antarctica*. The list of species is as follows:—

1. *Porella hyadesi*, Jullien.
2. *Inversiula nutrix*, Jullien.
3. *Schizoporella hyalina* (Linn.), normal form.
- 3A. " " " var. *discreta*, Busk.
4. " " *eatonii*, Busk.
5. *Smittia landsborovii*, Johnston.
6. *Idmonca organizans*, d'Orbigny.
7. *Lichenopora canaliculata*, Busk.
8. *Alcyonidium flabelliforme*, sp. n.

PORELLA HYADESI.

1888. *Porella hyadesi*, Jullien, 'Mission Scientifique Cap Horn.' Zoologie. Tom. VI., 'Bryozoaires,' p. 56, Pl. III., fig. 5.

The two specimens in the present collection differ from the description and figure by Jullien in having a wall-like prolongation on each side of the orifice; but this feature is much more pronounced in one specimen than in the other; in oöcial cells the lateral walls fuse with the mucronate avicularian cell and with the oöcia to form a square secondary orifice. There is a specimen from Port Phillip in the Busk Collection labelled (wrongly, I think) *Porella rostrata* (Hincks), which differs from Jullien's type only in having minute rounded mammillae on the surface.

Locality.—Cape Adare, 8 fathoms, encrusting seaweed.

Distribution.—Port Phillip, Victoria; Tierra del Fuego; Cape Adare.

INVERSIULA NUTRIX.

1888. *Inversiula nutrix*, Jullien, 'Mission Scientifique Cap Horn.' Zoologie. Tom. VI., 'Bryozoaires,' p. 44, Pl. IV., fig. 8.

The single example of this species encrusts the coils of a specimen of *Spirorbis antarctica*. The median pore differs slightly from that of the specimens from Cape Horn figured by Jullien (Bryozoa, Cape Horn, p. 44, Pl. IV., fig. 8) in being orbicular rather than semi-lunar, and in having three or four denticles instead of only two. The operculum (0.192 mm. in long. diameter) has a thickened rim and a shagreened surface.

The bosses are probably degenerate avicularia; incineration reveals oval depressions for mandibles. No oecia are present.

Locality.—Cape Adare, 10 fathoms.

Distribution.—Cape Horn; Cape Adare.

SCHIZOPORELLA HYALINA.

1766. *Cellepora hyalina*, Linnaeus, Syst. Nat., Ed. XII., p. 1286.

1880. *Schizoporella hyalina*, Hincks, Brit. Mar. Pol., p. 271.

Several patches occur, encrusting seaweed.

Locality.—Cape Adare, 8 fathoms.

Distribution.—Cosmopolitan.

SCHIZOPORELLA HYALINA, var. *discreta*.

1854. *Lepralia discreta*, Busk, Brit. Mus. Cat., p. 85, Pl. CI., figs. 3, 4.

1879. *Lepralia hyalina*, var. *discreta*, Busk. Phil. Trans., Vol. CLXVIII., p. 197.

1889. *Schizoporella hyalina*, var. *discreta*, Jelly, 'Syn. Cat. Bryozoa,' p. 228.

Patches encrust seaweed.

Locality.—Cape Adare, 8 fathoms.

Distribution.—Falkland Islands; Fuegia; New Zealand (Brit. Mus. Coll.); Swain's Bay, Kerguelen; Cape Adare; California.

SCHIZOPORELLA EATONI.

1879. *Lepralia eatoni*, Busk. Phil. Trans., Vol. CLXVIII., p. 196, Pl. X., figs. 7, 8.

1889. *Schizoporella eatoni*, Jelly, Syn. Cat. Mar. Bryozoa, p. 226.

A prominent umbo is present on the front surface of each zoecium, and at a little distance from the umbo is a double row of pores separated by a sharp line. A well-marked shield-like area is marked off on the front of each cell. The pores are semi-circular and sharp-edged in the younger, but square and with crenulated edges in older cells; the pores are not continued round the orifice, but stop short at the ends of the proximal edge; a row of pores is present, however, round the base of the oecium.

The stout oral spines, usually four in number, are articulated at the base.

The double row of pores is present in the type specimen from Kerguelen, but they are not nearly so apparent or well defined.

Locality.—Cape Adare, 8 fathoms, on seaweed.

Distribution.—Kerguelen Island; Cape Adare.

SMITTIA LANDSBOROVI.

1849. *Lepralia landsborovii*, Johnston, Brit. Zooph., Ed. II., p. 310.

1880. *Smittia landsborovii*, Hincks, Brit. Mar. Pol., p. 341.

A small avicularium with spatulate mandible is sunk deep in the peristome, the secondary orifice of which is clithriate and flush with the front surface of the zoecium. An umbo is present on each cell just below the orifice, and also on the oecia.

Locality.—Cape Adare, 18 fathoms, encrusting *Spirorbis antarctica*.

Distribution.—Arctic Regions, Kara Sea, Jan Mayen, East Greenland; Norway; Great Britain; Florida; Australia; Falkland Islands; Cape Adare.

IDMONEA ORGANIZANS.

1839. *Tubulipora organizans*, d'Orbigny, Voy. Amér. Mérid., Vol. V., Part IV., p. 19, Pl. IX., figs. 1-3.

1879. *Tubulipora organizans*, Busk. Phil. Trans., Vol. CLXVIII., p. 198, Pl. X., figs. 20-25.

This species is represented by a minute fragment of a colony encrusting seaweed. The zoecia are arranged here, as in the Kerguelen specimen, in regular alternating series, with about four to eight zoecia in each row.

Locality.—Cape Adare, 8 fathoms, on seaweed.

Distribution.—Kerguelen Island; Falkland Islands; Cape Adare.

LICHENOPORA CANALICULATA.

1879. *Discoporella canaliculata*, Busk. Phil. Trans., Vol. CLXVIII., p. 199, Pl. X., figs. 12-14.

1889. *Lichenopora canaliculata*, Jelly, Syn. Cat. Mar. Bryozoa, p. 134.

The specimen forms a circular disc, 3·25 mm. in diameter. In the centre is a space clear of zoecia and with the cancelli closed, but with a thin walled expanded funicular spout—the orifice of the oecium.

The orifice in complete cells is bi-denticulate, and the fillet, which is a well-marked feature on the type specimen from Kerguelen, is here often reduced to a mere ridge.

Locality.—Cape Adare, 8 fathoms, encrusting seaweed.

Distribution.—Kerguelen Island; Cape Adare.

ALCYONIDIUM FLABELLIFORME.

Zoarium forming a flabelliform bilaminar expansion, spreading out from a short sub-cylindrical stem. Colour olive-brown. Texture soft and fleshy; surface smooth. Zoecia polygonal, about 0·75 × 0·55 mm., in circular groups, each group being composed of six or seven zoecia arranged concentrically round a small central zoecium 0·2 mm. in diameter.

Locality.—Cape Adare; washed up on the beach.

The new species is nearly related to *A. flustroides* (Busk), obtained by the 'Challenger' from Station 142, south of Cape of Good Hope, 150 fathoms. In both species the zoarium is bilaminar, but the form of the colony in each case is very different; again, in Busk's species the zoecia are much more elongated and are arranged in irregular longitudinal lines.

The solitary specimen is 14 cm. in height, 12 cm. in breadth, and 1 to 1·5 mm. in thickness. The stalk is 1 cm. in height and 0·9 cm. in diameter. The surface, which is probably quite smooth in the living animal, is much wrinkled by the action of alcohol. The margin is rounded, but deeply incised in three places, thus giving rise to two smaller laminae growing in nearly the same plane as, and partly apposed to, the main lamina. On holding the specimen up to the light the zoecia and "brown bodies" are clearly visible. The orifices of the zoecia are flush with the general surface, and barely distinguishable. The tentacles appear to be about fourteen in number.

XVII. ANTHOZOA.

ALCYONARIA.

CLAVULARIA.

PAR LE DR. LOUIS ROULE.

CLAVULARIA FRANKLINIANA.

(Plate XLVII., Figs. 1-3c.)

Habitat.—Île Franklin, par 10 brasses.

Diagnose.—Colonies à stolons membraniformes, irréguliers, courts. Zooïdes assez rapprochés par leurs bases, volumineux, mesurant à l'état de contraction jusqu'à 25 millimètres de longueur sur 4 à 5 millimètres de diamètre. Paroi de la colonne mince, assez transparente sur les zooïdes contractés pour laisser discerner les cloisons internes; les espaces intermédiaires se montrent comme huit bandes parallèles, plus foncées. Tentacules courts, mesurant 4 à 5 millimètres de longueur; 9 à 10 branches latérales, assez courtes, de chaque côté. Spicules tentaculaires mesurant de 70 à 200 μ de longueur, couverts d'épines minimes. Spicules de la région colonnaire sous-tentaculaire nombreux, serrés, mesurant de 300 à 400 μ de longueur, couverts d'épines assez fortes. Spicules de la région colonnaire basilaire et des stolons mesurant de 250 à 300 μ de longueur, couverts de fortes épines parfois bilobées et trilobées.

Les espèces connues du genre *Clavularia* sont nombreuses. Walther May les énumère dans son travail récent ('Beiträge zur Systematik und Chorologie der Alcyonaceen': *Jenaische Zeitschrift für Naturwissenschaft*, 1900). Hickson a décrit voici peu plusieurs

types de l'hémisphère austral ('A Revision of the genera of the Alcyonaria Stolonifera': *Transactions of the Zoological Society of London*, 1895). Malgré cela, je n'ai pu rapporter à aucune d'elles, avec précision, les échantillons que j'ai étudiés. Force m'est de créer avec ces derniers une espèce nouvelle, au risque de faire double emploi avec des formes déjà observées par les auteurs, mais décrites insuffisamment.

En pareil cas, les figures explicites importent surtout. Afin d'éviter de mettre, à mon tour, quelque obscurité dans ma description, afin de permettre aussi une identification possible, j'ai pris le parti de dessiner avec soin les caractères saillants exprimés par la diagnose, et je vais à nouveau insister sur eux.

Les colonies, du moins celles que j'ai eues à ma disposition, se composent d'un petit nombre de zooïdes, une dizaine en moyenne, rapprochés par leurs bases, et rayonnant en dehors d'elles comme les fleurs d'un capitule. Ces groupes s'attachent à de menus objets, brins d'algues ou autres. Les individus d'une même colonie n'ont point une taille identique; les uns mesurent parfois le double des autres, et je n'ai observé en cela aucune disposition régulière. Les plus grands comptent 25 millimètres de longueur sur 5 millimètres de diamètre. Les échantillons, conservés dans l'alcool, étaient très contractés. Les dimensions des individus vivants sont donc plus considérables de beaucoup. Ces Clavulaires se signalent ainsi par la grande taille de leurs zooïdes, et par leur faible quantité dans chaque colonie.

La paroi de la colonne est fort mince. Les zooïdes vivants doivent être d'une grande transparence. Même contractés par l'action de l'alcool servant à les conserver, et rendus opaques, les espaces interseptaires tranchent en sombre. Ils dessinent huit bandes longitudinales, parallèles, qui parcourent la colonne entière de la base au sommet.

Les tentacules sont assez courts; souvent leur état de contraction est tel qu'ils se laissent à peine discerner. Les plus grands mesurent 4 à 5 millimètres de longueur. Leur forme est celle d'un cône aplati, à large base. Chacune des deux rangées de leurs branches latérales comprend huit à dix éléments. Les branches sont courtes, et sensiblement cylindriques. Les plus élevées, voisines du sommet du tentacule, sont moins longues que les autres, et aussi larges. Un espace encore considérable sépare ces branches terminales, au nombre de deux ou de trois, de celles qui sont situées plus bas. Ces dernières se placent souvent, dans les deux rangées, à des niveaux différents, et ne se font pas rigoureusement face.

Les spicules des tentacules, assez nombreux, surtout dans la région basilaire de ces organes, sont très variables. Ils ne se ressemblent que par leurs épines, abondantes et petites. Ils diffèrent par leurs formes et leurs dimensions. Les uns sont gros et courts, à peine deux fois plus longs que larges. D'autres sont courts et fort minces. Les plus nombreux ont l'aspect de baguettes échinulées, dont la longueur égalerait six à dix fois la largeur. Les dimensions en longueur oscillent entre 70 et 200 μ .

Les spicules de la moitié supérieure de la colonne, abondants et serrés, ont une allure plus uniforme. Ils ressemblent à des baguettes cylindriques, faiblement amincies à leurs deux extrémités, dont la longueur égale, en moyenne, douze à quinze fois la largeur. Certains, plus rares que les précédents, sont plus gros, plus courts, et possèdent une extrémité élargie; dans ces spicules en massue, la longueur (300 à 400 μ) vaut, en moyenne, sept à huit fois la largeur. Les épines sont assez fortes; elles ont l'aspect de mamelons saillants, largement coniques, tournés en divers sens.

Les spicules de la moitié inférieure de la colonne et ceux des stolons ont des dispositions moins variées. Leur forme est celle de bâtonnets noueux, tellement leurs épines sont grandes et fortes; plusieurs de ces dernières sont bilobées. A cet égard, une progression régulière se manifeste des parties supérieures aux zones basilaires de l'individu: les spicules tentaculaires ont les épines les plus petites, presque comparables à des granules superficiels; les spicules du sommet de la colonne portent des épines plus longues; enfin les spicules inférieurs ont les épines les plus grosses. Chez ces derniers, la longueur mesure huit à dix fois la largeur; elle compte en moyenne 250 à 300 μ .

La *Clavularia Frankliniana* se rapproche surtout de trois espèces connues et décrites: 1° *Cl. inflata*, Schenk (Abh. Senck. Ges., XXIII. (1896), p. 48), et sa variété *Cl. luzoniana*, W. May (*Jenaische Zeitschrift für Naturwissenschaft*, 1900), de Ternate et de Luzon; 2° *Cl. rosea*, Stüder, de Kerguelen (*Monatsbericht der königlich preussischen Akademie der Wissenschaften*, 1878, p. 633); 3° *Cl. elongata*, Stüder et Wright, des Açores, par 1000 brasses ('Report of "Challenger,"' vol. 31, 1889, p. 257). La *Cl. Frankliniana* diffère de la première par ses spicules de forme un peu différente et de taille plus restreinte; de la deuxième par ses zooïdes plus grands et groupés d'une autre manière; de la troisième par l'allure dissemblable de ses spicules.

EXPLICATION DES DESSINS.

- Fig. 1.—Une colonie de *Clavularia Frankliniana*. Grossissement, 2/1.
 Fig. 2.—Un tentacule. Gross., 6/1.
 Fig. 3a.—Spicule des tentacules. Gross., 300/1.
 Fig. 3b.—Spicule du sommet de la colonne. Gross., 300/1.
 Fig. 3c.—Spicule de la base de la colonne. Gross., 300/1.

ALCYONIUM PAESSLERI.

By SYDNEY J. HICKSON, F.R.S., *Owens College, Manchester*.

Three specimens and a fragment of an *Alcyonium* were sent to me.

The largest is 40 mm. in height and about 55 mm. in greatest breadth.

The spicules of the anthocodière are long narrow spindles 0·3–0·4 mm. in length; the spicules of the cœnenchym are clubs 0·15 mm. in length and short spindles 0·2 mm. in length.

The colour of the spicules is pale yellow and of the colony orange.

The specimens should be included in W. May's species *Alcyonium paessleri*, from Smyth Sound (see Hamburger Magalhaensischen Sammelreise, *Alcyonarien*, 1899, p. 6), but differ from the types in their orange colour.

They were taken in 24 fathoms off Franklin Island.

XVIII. ACTINIAE.

WITH AN ACCOUNT OF THEIR PECULIAR
BROOD CHAMBERS.

By JOSEPH A. CLUBB, M.Sc.,

(Plates XLVIII.-LII.)

A SMALL collection of Actinians was made by the '*Southern Cross*' Expedition of 1899-1900. All the specimens were collected off Cape Adare, South Victoria Land, the winter quarters of the expedition, and were dredged at a depth of from 20 to 30 fathoms, in water having a temperature ranging from 28·8° Fahr. in November, 1899, to 29·2° Fahr. in January, 1900. The preservatives used were formaline and spirit, and the specimens in the former fluid were in better preservation than in the latter, where, owing to inefficient corks to the bottles, the volatile spirit had evaporated, leaving a fluid which could not be called preservative.

Although there are upwards of sixty specimens, it is somewhat remarkable that there appear to be but two closely allied species, and, as the females of both possess special brood chambers, they are of great biological interest. I wish here to record my thanks to Professor Jeffrey Bell for placing the collection in my hands, and thus affording me the opportunity of investigating them, for the large number of specimens has enabled me to work out in some detail the appearance and structure of these remarkable chambers, which are apparently peculiar to Arctic and Antarctic species. As the brood chambers are almost identical in both species, I have appended this part of the work after the description of the species.

The two species belong to the family *Bunodactidæ*,¹ and, while possessing the typical hexamerous arrangement of mesenteries and

¹ I have adopted the suggestion of Prof. Verrill (7, II., p. 42) that, as the name *Bunodes* is preoccupied for a genus of Eurypteroids, the actinian genus *Bunodes* should be changed to *Bunodactis*, and in accordance with the usual custom the family name *Bunodidæ* becomes *Bunodactidæ*.

tentacles, the character of the sphincter muscle in both species is more in accordance with that of *Urticina crassicornis*, the paradigm¹ of the genus *Urticina*, than with that of *Bunodactis verrucosa*, the paradigm of the genus *Bunodactis*. I consider the character of the sphincter of more importance than the pentamerous or decamerous² arrangement of the tentacles and mesenteries, and am of opinion that this latter character should not be retained as diagnostic of the genus *Urticina*, as suggested by Mr. Haddon (3 p. 445), and I have therefore placed the two new Antarctic species under the genus *Urticina*.

FAMILY BUNODACTIDÆ.

Urticina sulcata.

External characters.—The specimens are all greatly contracted, and in most cases the oral disc and tentacles are entirely hidden. The colour of the preserved specimens is a dirty brown with a distinctly green cast. There is no record on the collectors' labels as to colour of this species when living. The column is soft to the touch and is covered with verrucae, which in the contracted state of the specimens are closely packed together. They are largest in the equatorial zone and slightly diminish in size above and below. There are forty-eight vertical rows, corresponding in position with the inter- and intra-mesenteric spaces.

In female specimens a distinct modification of the upper portion of the column is noticeable. The body-wall in its upper third is less firm to the touch, thinner, and the verrucae are almost obliterated by longitudinal furrows which run from a well-marked constriction³ (fig. 1) to the parapet, where they are deepened and intensified in the more contracted specimens. Male specimens also show this modification of the body-wall, but in a much less marked degree.

On some of the specimens gravel and sand particles are still adherent to the verrucae. In the healthy living condition, doubtless, a continuous layer of foreign particles is formed around the column.

The foot disc is distinct and muscular.

The largest specimens measure 5 cm. in height, 5 cm. in diameter at widest part, and 3 cm. diameter of foot disc.

¹ [The author prefers this word to the more generally used "type."—F. J. B.]

² Prof. Verrill states (7, IV., p. 216) that he has found many specimens of *Urticina crassicornis* hexamerous, both as to tentacles and mesenteries, and other workers have shown that whenever it was possible to examine a large number of specimens of the same species a great amount of variation existed in this respect.

³ This constriction marks the zone of invagination of the body-wall to form the "brood chambers" (see p. 301).

Tentacles.—These are forty-eight in number, in four cycles, $6 + 6 + 12 + 24$. Fig. 8 diagrammatically represents the arrangement of the cycles of tentacles in relation to the inter- and intra-mesenteric spaces. It will be seen the older and inner three cycles ($6 + 6 + 12$) open from the intra-mesenteric spaces, while the outer marginal and youngest cycle opens from the inter-mesenteric spaces. In most cases there is a distinct longitudinal grooving, and transverse sections of the tentacles show in well-marked instances that the mesogloea participates in the formation of the grooves (fig. 3), although this is not always the case. The muscles of the tentacles are ectodermal and are well developed.

Œsophagus.—This extends fully three-fourths the length of the retracted column. Two well-marked siphonoglyphs are present at opposite angles.

Cæloenteron and Mesenteries.—There are twenty-four pairs of mesenteries in three cycles, $6 + 6 + 12$, all complete. There is no trace even in the largest specimens of a fourth cycle. The presence of a cycle of tentacles communicating with the inter-mesenteric spaces suggests the final and adult condition of mesenteries and tentacles.

Two pairs of directive mesenteries are present in the usual relation with the siphonoglyphs. All the mesenteries except the directives are fertile.

One variation from the typical arrangement of tentacles and mesenteries was dissected. The specimen, which possesses brood chambers containing embryos, had but eighteen pairs of mesenteries and thirty-six tentacles, and the two pairs of directives were asymmetrically placed, being separated from one another on the one side by ten pairs and on the other by six pairs of mesenteries.

The longitudinal muscles of the mesenteries are very well developed, and form large swellings which stand out prominently from the surface and are quite distinctly seen with the naked eye even in young specimens. (The longitudinal muscles on the mesenteries of embryos taken from the brood chambers are surprisingly well developed) (see fig. 20). Transverse sections of the muscle of the adult specimen show (fig. 5) a compact mass of mesogloéal supporting lamellæ, many greatly branched and all invested with muscle fibres. The parieto-basilar muscle (fig. 5, *p.b.m.*) is seen arising from the mesentery some distance from the body wall, as the section is taken rather low down near the foot disc. The arrangement of the muscles on the mesenteries is quite regular—the longitudinal muscles on the sides facing the intra-mesenteric spaces, and the

parieto-basilar muscle on the sides facing the inter-mesenteric spaces, in all except the directives, where the arrangement is reversed.

Sphincter Muscle.—There is a strongly circumscribed endodermal sphincter, which projects into the cœlenteron and is constricted off from the body-wall to such an extent that in transverse section the connection appears but a mere stalk (fig. 2). As here shown it is oval in section, but doubtless it may vary in shape with the degree of contraction. There is a single median supporting trunk of mesoglœal connective tissue springing from the mesoglœa of the body-wall, from which radiating lamellæ arise covered with an investing layer of muscle fibrillæ (fig. 2, *m.*).

Body-wall.—Sections of the body-wall show the mesoglœa comparatively thin, especially in the upper portion. There are, however, strong circular endodermal muscles present, supported by mesoglœal lamellæ (fig. 4) which are often branched. These strong circular muscles of the body-wall form one of the principal characters distinguishing this species from the following one, where the corresponding endodermal muscles are much feebler, supported by short, simple, mesoglœal lamellæ, and where, however, the mesoglœa itself is thicker and firmer, thus compensating for the weaker muscles (fig. 9).

*Brood Chambers.*¹—Each adult female possesses peculiar brood chambers completely separated from the cœlenteron and formed by invaginations of the body-wall from a zone completely surrounding the body, about one-third of the distance below the parapet (fig. 1). Usually four embryos are present, and in later stages of development they form conspicuous prominences symmetrically placed around the column. In some instances the contained embryos are so large that in contraction the whole of the oral disc and tentacles of the mother, as well as the upper third of the column itself, are withdrawn so as to lie below the level of the ridge formed by the contained embryos.

Habitat.—Dredged from a gravelly bottom in 20–24 fathoms of water, off Cape Adare, South Victoria Land.

Urticina carlgreni.

As one of the distinctive characters of this as well as the preceding species is the presence of "brood chambers," I have ventured to name this species after the Swedish naturalist, Oskar Carlgren of Stockholm, whose valuable work on the Actinozoa has

¹ For more detailed account, see p. 299.

added so much to our knowledge of the group; it was he who in 1893 (1 p. 231) first called attention to the presence, in some Arctic actinians then under observation, of special "Bruträumen" quite distinct and separated from the cœlenteron.

External characters.—Like the preceding species all the specimens are greatly contracted. The colour, when living, as noted on collectors' labels, was light red (large specimens) and white (small specimens), but all trace had disappeared in the preserved specimens. Verrucae present, arranged in forty-eight vertical rows, but smaller and less distinct than in *U. sulcata*. There is also less modification of the upper portion of the column, but there is a tendency to form similar longitudinal furrows, although the body-wall retains its firmness and is no thinner than the lower portion. Some of the specimens still retained foreign particles adhering to the verrucae (fig. 6).

This species is somewhat taller and more slender than *U. sulcata*. The largest individual measured 6 cm. in height and but 3·4 cm. in breadth at its widest part (fig. 6).

Tentacles.—Similar in arrangement and number to *U. sulcata* (6 + 6 + 12 + 24) (fig. 8). There is a slight tendency observable, in some individuals only, to a longitudinal grooving, but in no case have I observed that the mesoglaea participates.

Œsophagus.—The œsophageal wall is much corrugated, and the œsophagus extends into the cœlenteron for a considerable distance. Two well-marked siphonoglyphs are present.

Cœlenteron and Mesenteries.—There are twenty-four pairs of complete mesenteries, including two pairs of directives in relation with the siphonoglyphs. All the mesenteries except the directives are fertile. The longitudinal muscles are well developed and are seen as distinct swellings on the faces of the mesenteries. Fig. 10 gives details of structure in transverse section, also showing structure of ovary (*ov.*) and mesenterial filament (*m.f.*). The parieto-basilar muscle (*p.b.m.*) is large and distinct.

Sphincter.—The sphincter muscle is strongly circumscribed, endodermal, and projects as a strong band into the cœlenteron. In transverse section (fig. 7) the main supporting mesoglaeal trunk is seen to break up into two secondary branches, a small one near the base and a large one running the length of the muscle. From each of these main trunks mesoglaeal outgrowths radiate, supporting the muscle fibres.

Body-wall.—The body-wall is thick and firm to the touch. The mesoglaea forms a stout supporting lamella (fig. 9), but the circular

endodermal muscles are feeble, supported by short simple outgrowths of the mesoglaea, and contrast greatly with those of *U. sulcata*.

Brood Chambers.—The adult females possess brood chambers similar in position and appearance to those of *U. sulcata*, except that the contained embryos do not form such distinct prominences on the body-wall, nor are there any instances where the oral disc, tentacles and upper third of the column have sunk by contraction below the level of the top of the brood chambers. One individual has been preserved in a very interesting stage, showing one of the embryos partly out of the brood chamber, and two others visible from the outside, the opening to the chamber extending round almost half of the circumference of the column (figs. 18 and 19). Each individual in this species usually contained six embryos.

Habitat.—Dredged from a gravelly bottom in 20–28 fathoms of water, off Cape Adare, South Victoria Land.

Several of the specimens dissected had a single specimen of a species of Amphipoda among the retracted tentacles, apparently commensal. My friend Mr. Alfred O. Walker, to whom I submitted it, informs me it is a new species of *Jassa*—*J. goniamerus*.

THE APPEARANCE AND STRUCTURE OF THE BROOD CHAMBERS DISTINCT FROM THE COELENTERON.

In the year 1869 Professor Verrill (6 p. 490–492) described in two species of Actinia (*Phellia arctica*, Verrill, and *Epiactis prolifera*, Verrill) from the Arctic seas, a series of well-defined pits scattered over the surface of the body-wall, in which the eggs are retained until hatched, when the young embryos are provided with tentacles. Later, in 1899, he described some additional species (7, V. p. 375) belonging to the *Bunodactidae*, also possessing these peculiar pits, and gives figures. Each pit is formed by a hollow in the mesoglaea into which the ectoderm is invaginated.

In 1893 Dr. Carlgren published a preliminary announcement, "Über das Vorkommen von Bruträumen bei Aktinien" (1 p. 231). Here he described two types of brood chamber: (1) when the coelenteron itself acts as such—a condition of things which obtains in some British species; and (2) the formation of pit-like depressions generally scattered on the lower part of the column. These latter apparently are similar structures to those described by Verrill in 1869 and 1899. But Carlgren goes on to describe how

these pit-like depressions, each containing an embryo and involving at first only an invagination of the ectoderm into a hollow in the mesogloea, may be gradually enlarged, by the growth of the embryo carrying the body-wall inwards, invaginating all three layers—the ectoderm, mesogloea and endoderm, and forming cavities lying completely within the column. He gives a figure (1 p. 237) showing a section through such a chamber containing an embryo, measuring from 1 to 1.5 mm. in diameter, and illustrates the condition of the invaginated ectoderm, mesogloea and endoderm forming the wall of the cavity. The figure also shows the opening to the exterior, and that the chamber is completely separated from the coelenteron. In the general relation of the wall-layers this chamber greatly resembles the brood chambers, about to be described, of the two species from the Antarctic, but is of very much smaller dimensions.

Professor Verrill's specimens do not appear to exhibit this further development of the ectodermal pits into sac-like invaginations of the whole body-wall, involving all three layers, such as Carlgren describes, although the external appearance of the specimens figured by each author are very similar and certainly suggest the same structures.

Dr. Kwietniewski in 1898 (5 p. 121) mentions that a new species of *Leitealia* from Spitzbergen, which he describes, possesses a similar "Brutraum" in the body-wall, containing a developing embryo, but differing from the species described by Carlgren in 1893, in having it placed immediately below the parapet in the upper part of the column instead of on the lower portion.

In 1899 Dr. Carlgren (2 p. 14) gave some further particulars, but no figures, of "Bruträumen" found in *Condylactis georgiana* from the collection of the German South Polar Expedition of 1882-83, which he says are of similar character to those he described in a *Tealia* in 1893 (1 p. 234). They extend generally over the whole body-wall, are numerous, and contain from one to three embryos. Such then is a brief account of the literature¹ on brood chambers distinct from the coelenteron, in Actinians.

¹ Dr. Carlgren, in a quite recent paper, published in August, 1901 (2a p. 468), gives additional particulars and figures of the specimens mentioned in his "Vorläufige Mitteilung" (1 p. 231), published in 1893. He here describes these specimens under the names of *Actinostola sibirica* and *Epiactis marsupialis*, both new species. In addition he describes a new genus of Paractid under the name of *Marsupifer Valdivia*, which possesses six brood pouches arranged radially, and opening by separate apertures on the body-wall about two-thirds the height of the column from the foot-disc. Each brood chamber contains a large number of embryos, the smallest about thirty and the largest about one hundred. An important character of this new genus *Marsupifer* is the presence of two sphincter muscles, one placed about the normal position, and the other just above the openings of the brood pouches.

In both the species from the Antarctic that I have described the brood chambers are practically identical, differing only in minor details, so that the description here given must be understood to apply to both species, unless otherwise noted. Specimens possessing brood chambers in these two species may be at once recognised, in whatever stage of development they may be in, by the presence of a constriction or groove more or less marked, in the body-wall, running completely around the animal at a distance from the parapet of about one-third in the total height of the column. In addition the body-wall above the constriction is more or less wrinkled, and the verrucae become confused with vermiculate furrows, especially in *Urticina sulcata*, where also the body-wall is thinner than in the lower part of the body. In this last-named species, specimens having well-developed embryos in the brood chambers have this upper thin-walled portion of the column, as well as the oral disc and tentacles, withdrawn in the contracted condition to the level of the top of the brood chambers. The thinning of the body-wall above the invagination constriction is not so noticeable in *U. carlygreni*.

The earliest phase in the development of the brood chambers that I find among these Antarctic specimens shows a series of invaginations of the body-wall along the line of this constricted zone. The invaginations are already considerably advanced and form distinct sacs from 2 to 3 mm. deep, projecting on the inside of the body-wall into the coelenteron (fig. 11). They appear to have arisen by invaginations of the body-wall corresponding to the mesenteric spaces, for, when looked at from below, the lower ends of the invaginations are seen projecting between the mesenteries. Horizontal sections, however, show that the partition walls between adjacent invaginations have broken down and the cavities are more or less continuous, but extend deeper in the mesenteric spaces. This last feature—the sending of prolongations down between the mesenteries—is characteristic of all stages in the development of the chambers that I have examined, and suggests their method of gradual enlargement. As seen from the figure, which is taken from a specimen of *U. carlygreni* (fig. 11), the chambers are absolutely empty and open freely directly to the outside. The walls consist of invaginated ectoderm, mesoglaea, and endoderm, which three layers are fairly thick, except at the innermost parts, where both mesoglaea and endoderm are thinned out somewhat, especially the former.

The junction of adjacent cavities appears to go on until there

remains but from four to six larger cavities. Horizontal sections, through specimens which exemplify the next stage of development of the brood chambers, taken through the animal just below the zone of invagination, show at that level several cavities (usually four in *U. sulcata*, six in *U. carlygreni*), filled with compact solid masses, and occupying the same relative position as the cavities in the earlier stage. Vertical sections passing through the invagination zone show these cavities at this stage to be more or less closed to the exterior. Figs. 12 and 13 are illustrations of such sections, the former of *U. carlygreni*, the latter of *U. sulcata*. In the former there are curious interlacing outgrowths of the mesogloea carrying the invaginated ectoderm with them, and in this way a complete closing of the brood chamber to the outside world is effected. In the latter case, which is taken from the specimen figured (fig. 1), although the mouth is closed by the juxtaposition of the invaginated ectoderm, there is only very slight indication, at the lower end of what was the opening to the chamber, of the interlacing outgrowths of mesogloea shown as being present in the *U. carlygreni* example. It is probable that this latter condition is a slightly earlier stage in development. Of the two examples figured the brood chamber in *U. carlygreni* is 11 mm. deep, while that of *U. sulcata* is about 6 mm., measured from the invagination constriction. The walls are fairly stout, the layers being of average strength except at the innermost parts where the mesogloea and endoderm appear somewhat thinned out. The invaginated ectoderm is formed of tall columnar cells for the greater part, but they become somewhat lower towards the bottom of the chamber.

A series of horizontal sections through the brood chambers illustrates their relation at this stage to the adjacent organs of the body. Two of these sections are represented in figs. 14 and 15, which are taken through the chamber, the upper part of which is represented in vertical section in Fig. 12. Here it is seen that the chamber completely severs each mesentery into two parts, passing between them on the outer side of the longitudinal muscle. It is interesting to notice that although the invaginated endoderm investing the brood chamber has already become continuous with the corresponding layers of the divided mesenteries, the mesogloecal layers have not yet so joined, and on the inner side of the brood chamber the mesogloea of each mesentery is turned back upon itself, away from the mesogloea investing the brood chamber (fig. 14). Fig. 15 represents a section of the horizontal series near the bottom of the chamber, and shows the same mesenteries; but each is now entire

from body-wall to œsophagus, with lobes of the chamber projecting between them. It will be noted from the two sections figured that this consecutive series of horizontal sections includes a pair of directive mesenteries. Each chamber is completely filled with a compact mass of rounded cells, exceedingly rich in food yolk and measuring from 0.3 to 0.4 mm. in diameter. Usually distinct cell membranes are present, but in one specimen examined the limiting membrane is very indistinct. I examined three specimens of about this stage and find each somewhat different in the character of these cells. The difference is mainly in the appearance of the cell membrane and the greater or lesser granular appearance of the cell contents. In one specimen the outer layer of cells abutting on the wall of the brood chamber are roughly cuboidal in shape and very much freer from food yolk than the more centrally placed cells, suggesting a more rapid assimilation of the food yolk into protoplasm in these cells.

I cannot but regard each of these cell masses, notwithstanding the relatively enormous size of the constituent cells, as a developing embryo. It is known, although considerable uncertainty still prevails regarding the earlier developmental processes, that in many cases among the Anthozoa cleavage results in the formation of a solid morula, and Kowalevsky's observation (4) on *Actinia parasitica* (*Adamsia roudaletii*) supports this. He says: "Cleavage is regular, but as the result of it there arises not a blastodermic vesicle, but only an aggregation of cells, which becomes covered with cilia and swims about as a larva." The researches of E. B. Wilson on the development of *Renilla* (8) show that here also a solid morula is formed, consisting of irregularly rounded cells, heavily charged with food yolk, and in which at first no differentiation exists, but where later an outer layer gradually becomes marked off in character by appearing less granular, through the conversion of the contained food yolk into protoplasm, and so forms the ectoderm. Unfortunately, except the specimen showing a slight differentiation of the outer layer of cells, I have found no intermediate stages between the condition just described and the larva with all the primitive layers formed.

A specimen of *U. sulcata* possesses four embryos in the brood chambers, which may be described as bilaminar, pyriform, or more elongated vermiform planulæ, possessing an ectoderm and an endodermic epithelium, with a sustentative lamella (mesogloea) secreted between them, but with no trace of cilia so characteristic of *free-swimming* planulæ. The interior is filled with a dense mass

of food yolk. The embryos are exceedingly irregular in form and lie abutting one with the other—the end of one fitting into a socket in the adjacent one, and they appear moulded to the contour of the chamber by pressure due to the contraction of the mother animal. The cavities containing the larvæ appear to be continuous one with the other at this stage, and thus form a continuous chamber lying in the coelenteron surrounding the œsophagus. The invagination opening is still effectually closed to the outside. One of the larvæ when sectionized showed in a longitudinal section the invagination to form the œsophageal opening (fig. 16), and transverse sections revealed the presence of mesenteries, in an early stage of development, arising from the body-wall and projecting into the solid food yolk mass (fig. 17). Near the oral end twelve mesenteries representing the first cycle are apparent, and as the sections approach the aboral end these gradually increase in size, and between each pair there appear slight indications, also in pairs, of the second cycle. These larvæ are from 1 cm. to 1.5 cm. in length and from 0.5 to 1 cm. in diameter.

Much older embryos than these, measuring from 1 cm. to 1.5 cm. in diameter, were found in brood chambers of both *U. sulcata* and *U. carlgreni*. Several of these specimens have the brood chambers opening freely to the outside through the original invagination opening, the contained embryos evidently approaching the stage when they are set free and begin an independent existence. One specimen of *U. carlgreni* had been killed with one of the embryos escaping from the brood chamber (figs. 18 and 19), others of the contained embryos being also visible. The opening extended almost half way round the body and showed every appearance of further extension. On sectionizing these older embryos they are found to possess three cycles of mesenteries. Fig. 20 represents a sixth part of a transverse section through an embryo of corresponding age of *U. sulcata*, including a pair of directive mesenteries. As there shown the first cycle of mesenteries is complete and the second cycle is well advanced. The longitudinal muscles are well developed and already give indication of the strength of the adult structures. The parieto-basilar muscle is also plainly visible. The third cycle has as yet no indication of muscle-structure. From a close examination of the consecutive series of sections I can make out the existence of twenty-four tentacles, of which six appear to be larger than the others and to be in communication with the intra-mesenteric spaces of the first cycle. In all the embryos the oral disc and tentacles are entirely retracted

and hidden, as is the case with most of the adult specimens. This denotes the presence of an already functional sphincter, a figure (fig. 21) of which is shown taken from a longitudinal section as well as functional mesenterial muscles. There is little or no food yolk now left in the cœlenteron, another fact which denotes the early approach of a separation from the parent.

There are thus four distinct stages in the appearance of the brood chamber and its contents, represented by the specimens of these two Antarctic species. The earliest condition shows the developing invagination of the body-wall of the parent, forming cavities from 2 to 3 mm. in depth, but absolutely void of contents, and freely open to the outside through the invagination openings. Then comes the second stage, with the chamber considerably increased in size (6-11 mm. in depth), completely closed to the outside and now containing developing embryos in the solid morula stage. Then follows the condition shown by the specimen of *U. sulcata* (the only specimen found illustrating this stage), with the embryos greatly advanced in development, possessing a three-layered body-wall, developing mesenteries, invagination to form œsophagus, and filled with a dense mass of food yolk, but with the brood chamber still completely closed to the outside. The fourth and last condition shows the embryo just about to be set free, with three cycles of mesenteries (one cycle complete), well-developed muscles, twenty-four tentacles, all or almost all the food yolk absorbed, and the chamber generally freely open to the outside through the original invagination opening. From the fact that a specimen of *U. carlgreni*, containing embryos of this last stage in brood chambers open to the outside, possesses in addition, between the older brood chambers, a series of new invaginations corresponding to the first stage described, there is reason to believe that each brood chamber only serves for one embryo, and that on its escape the walls of the chamber atrophy and new chambers are formed for the next brood.

Dr. Carlgren (1 p. 237) suggested that possibly the occurrence of these special brood chambers may be connected with an external fertilization of the ova, but, while not denying the possibility of such in these species, there is no evidence in the appearance of either his specimens or the '*Southern Cross*' specimens of any departure from the usual internal impregnation. In all probability, after fertilization in the body cavity, the eggs in early stages of cleavage are transferred directly, by the aid of the tentacles, to the brood chambers, the entrances to which are soon afterwards closed.

From the fact that, so far as yet observed, the possession of these

special brood chambers in Actinians is limited to Arctic and Antarctic species, there certainly is reason to believe that some common conditions of environment have brought about their development. Among Echinoderms, species from Kerguelen Island and other points in the southern and northern oceans have been shown to possess similar chambers for the protection of the developing embryo. But in this group, not only are there in these species special nurseries formed, but the embryos themselves develop *directly*, without the intervention of a locomotive pseud-embryonic stage, and with no trace of pseudembryonic appendages or provisional organs, so characteristic of echinoderm development as we are acquainted with it in our own seas. In Sir Wyville Thomson's words (9 p. 245), "It is a significant fact that while in warm and temperate seas 'plutei' and 'bipinnariæ' are constantly taken in the surface net, in the southern seas they are almost entirely absent." There is therefore some justification for Kwietniewski's suggestion (5 p. 122) that the surface ice affects the plankton and is especially fatal to free-swimming larvæ, and hence it becomes necessary that special protection should be provided, so that development may take place without free-swimming larval stages. But viviparous Actinians, in which the cœlenteron acts as a brood chamber, and where the young are only set free when they are in a position to at once attach themselves by the muscular foot disc, are fairly widely distributed. It is therefore difficult to advance a reason why these particular Arctic and Antarctic species have not followed the apparently more economical habits of their fellows, but have evolved along special lines, and formed brood chambers distinct and entirely separated from the cœlenteron. It may be that the young in these special chambers are retained for a much longer period than would be convenient in the cœlenteron, and this, no doubt, is of considerable importance to the species when possibly the struggle for existence is severe.

In conclusion I wish to record my appreciation of the kindness of the Committee of the Liverpool Museums in granting me permission to use the Museums' laboratory and apparatus in carrying out the work, and to express my thanks to Dr. Forbes, Director of Museums, for his cordial co-operation in procuring me access to the necessary literature—always a very great difficulty to workers in the provinces.

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EXPLANATION OF PLATES.

With the exception of figs. 1, 6, 18 and 19, which are represented natural size, and the diagrammatic drawing (fig. 8), all the figures have been drawn from sections as seen under Swift’s 1-in. obj., No. 2 eye-piece, slightly enlarged. The sections were made by the Cambridge rocking microtome, from tissues stained in picrocarmine, embedded in the usual way, and mounted in Canada balsam.

LIST OF ABBREVIATIONS.

<i>b. c.</i>	. . . . .	brood chamber.
<i>c.</i>	. . . . .	coelenteron.
<i>d.</i>	. . . . .	directive mesenteries.
<i>ec.</i>	. . . . .	ectoderm.
<i>em.</i>	. . . . .	embryos.
<i>en.</i>	. . . . .	endoderm.
<i>in. ec.</i>	. . . . .	invaginated ectoderm.
<i>in. en.</i>	. . . . .	invaginated endoderm.
<i>in. mg.</i>	. . . . .	invaginated mesogloea.
<i>in. o.</i>	. . . . .	invagination opening.
<i>l. m.</i>	. . . . .	longitudinal muscle.
<i>mes.</i>	. . . . .	mesenteries.
<i>m. f.</i>	. . . . .	mesenterial filaments.
<i>mg.</i>	. . . . .	mesogloea.
<i>m. l.</i>	. . . . .	muscle lamellæ.

<i>oe.</i>	. . . . .	oesophagus.
<i>oe. in.</i>	. . . . .	oesophageal invagination.
<i>ov.</i>	. . . . .	ovary.
<i>p. b. m.</i>	. . . . .	parieto-basilar muscle.
<i>s.</i>	. . . . .	siphonoglyph.
<i>v.</i>	. . . . .	verruca.
<i>y.</i>	. . . . .	food yolk.
I., II., III., IV.	. . . . .	cycles of mesenteries or tentacles.

PLATE XLVIII.

Urticina sulcata.

- Fig. 1.—Reproduction from photograph of young female specimen (natural size), showing invagination constriction and well-marked sulcation of body-wall above it.
 Fig. 2.—Transverse section of the sphincter muscle.
 Fig. 3.—Transverse section of one of the tentacles.
 Fig. 4.—Longitudinal section of a portion of the body-wall.
 Fig. 5.—Transverse section of mesentery near aboral end, showing the longitudinal and parieto-basilar muscles.

PLATE XLIX.

Urticina carlgreni.

- Fig. 6.—Reproduction from photograph (natural size) showing foreign bodies still adherent to verruca.
 Fig. 7.—Transverse section of sphincter muscle.
 Fig. 8.—Diagrammatic figure illustrating the arrangements of the cycles of tentacles in relation with the intra- and inter-mesenteric spaces. Although the tentacles are somewhat larger according to age, the difference in the diameter as represented by the circles in the drawing is exaggerated. (The same arrangement as here depicted pertains in *U. sulcata* also.)
 Fig. 9.—Longitudinal section of a portion of the body-wall.
 Fig. 10.—Transverse section of a fertile mesentery.

PLATE L.

Brood Chambers and Embryos.

- Fig. 11.—Longitudinal or vertical section of body-wall of a specimen of *U. carlgreni* passing through a brood chamber in an early stage of invagination and quite empty.
 Fig. 12.—Longitudinal or vertical section through the body-wall of a specimen of *U. carlgreni* passing through the opening to a brood chamber of an older stage than Fig. 11, containing a developing embryo and closed to the outside.
 Fig. 13.—Similar section through the specimen of *U. sulcata*, figured (Fig. 1) with brood chamber of a little earlier stage to Fig. 12.

PLATE LI.

Brood Chambers and Embryos.

- Fig. 14.—Transverse or horizontal section of the same specimen as Fig. 12 (*U. carlgreni*), passing through about the middle of the brood chamber.
 Fig. 15.—Similar section of the same individual, passing through the brood chamber near its lower end, showing the prolongation of lobes of the chamber into the mesenteric spaces.

PLATE LII.

Brood Chambers and Embryos.

Fig. 16.—Longitudinal section through larva of *U. sulcata* taken from brood chamber.

Fig. 17.—Transverse section of the same, showing developing mesenteries.

Fig. 18.—Specimen of *U. carlgreni* killed with brood chamber open and with an embryo escaping.

Fig. 19.—The same with incision through outer wall of chamber and body-wall.

Fig. 20.—Transverse section through advanced embryo of *U. sulcata* showing about one-sixth of the section.

Fig. 21.—Transverse section through the sphincter muscle of the same.

XIX. HYDROZOA.

A PRELIMINARY ACCOUNT,

By EDWARD T. BROWNE,

University College, London.

THE '*Southern Cross*' specimens arrived whilst I was working through a large collection of Medusae made by Mr. R. Vallentin in the Falkland Islands. The closeness of these islands to the Antarctic Circle led me to make at once a preliminary examination of the '*Southern Cross*' Collection to see if the medusoid fauna at Cape Adare, where all the specimens had been taken, bore any resemblance to the Medusae of the Falklands. I may here say that the Medusae of the Falklands are closely related to the Medusae of Great Britain, and that the Cape Adare specimens belong to other types.

It was sad work to open bottle after bottle and to find the specimens more or less macerated and often in fragments. Most of the specimens are absolutely useless, and only a few show generic characters. The collection gives just a glimpse of a rich and most interesting medusoid fauna at Cape Adare, and it is unfortunate that more care has not been taken over the preservation and storage.

It is quite probable that most of the specimens looked in excellent condition when first preserved, and that the mischief occurred later—maceration through not using sufficient formaline or alcohol, and fragmentation through not filling up the bottles to the brim and excluding air-bubbles. All the bottles contained a large air space, and most were only about two-thirds full of fluid. For animals so delicate as jelly-fish, using the term in its old and widest sense, it is absolutely necessary to reduce air-bubbles to their smallest dimensions. A large air-bubble in constant motion, either through the rolling of a ship or the shaking on a railway journey, quickly reduces such delicate organisms to fragments.

Formaline is an excellent preservative for Medusae (but bad for

Ctenophores), and if very weak solutions are used, the fluid must be changed several times. Specimens should never be stored in a solution of less than 10 per cent. (formaldehyde, 40 per cent., 10 c.c., and water 90 c.c.; either fresh water or sea water may be used), and if there should be any doubt a few drops of strong formaldehyde may be added to each ounce of fluid in the bottle before finally storing away. Mr. Vallentin's collection of Medusae from the Falklands reached London in excellent condition owing to his taking the necessary precautions in using plenty of formaline and filling the bottles up to the stoppers with fluid.

When working over the '*Southern Cross*' Collection I made rough notes on the contents of each bottle, and finally wrote a report upon the collection for the use of Mr. T. V. Hodgson, the Zoologist on the '*Discovery*.' I pointed out to him the importance of making another collection, and gave to him full instructions on the preservation and storage of specimens. As the '*Discovery*' is bound for Cape Adare and its adjacent shores it is probable that most of these Medusae will again be taken, and, let us hope, will be brought safe home in good condition.

It was not my original intention to publish at present any descriptions of the specimens in this collection, but as the Editor of the Reports on the '*Southern Cross*' Collection wishes to include an account of the Medusae, I have considered it is best simply to give a copy of the notes which I supplied to Mr. Hodgson and to leave the naming of the species until the '*Discovery*' Collection has been investigated. This course will probably lessen the addition of new species based upon material which can only give imperfect and perhaps useless descriptions.

Nearly all the specimens were taken close in shore. The surface temperature of the sea was between 28·6° Fahr. and 30° Fahr.

ANTHOMEDUSÆ.

Borchgrevink's Medusa.

Three specimens in fairly good condition.

Umbrella globular. About 20 mm. in height and 15–18 mm. in width.

Sub-umbrella cavity, small, very long and cylindrical.

Eight radial canals. Stomach about $\frac{1}{3}$ – $\frac{1}{2}$ the length of umbrella cavity.

Gonads on the stomach. Mouth with lips (8?).

Tentacles 16, with a terminal knob.

Taken on 1st, 17th and 20th November, 1899.

I consider this medusa to belong to the *Anthomedusæ*, and to be probably a new type. The margin of the umbrella has not yet been carefully examined for sense-organs, and this must be done before the generic position can be decided. The margin of the umbrella is badly contracted and turned inwards. It is so badly contracted that all the tentacles meet and form a dense cluster in the centre. The margin from one of the specimens will have to be removed and an attempt made to unroll it.

LEPTOMEDUSÆ.

THAUMANTIIDÆ.

Laodice.

One specimen about 60 mm. in diameter.

Four radial canals, four large gonads.

Margin of umbrella crowded with tentacles, over 200. There is a *cordylus* (sensory club) between every two tentacles.

This specimen is fairly well preserved, but unfortunately useless. There is a hole through (as if cut with a knife) the top of the umbrella. The stomach is clean gone, and half the gonads.

Taken 27th November, 1899. Surface.

There are also two smaller specimens, about 25 mm. in diameter, which may be earlier stages. They are rather rotten, and the margin of the umbrella is in bad condition and contracted; it is crowded with tentacles, over 100, similar in form to those of the large specimen described above. I cannot find any cordyli to settle the point.

Stomach very large, occupying nearly the whole umbrella cavity. Radial canals meet in the centre. Gonads upon them.

Taken on 10th May, 1899. Surface.

EUCOPIDÆ.**Phialidium.**

Two specimens in fairly good condition.

It is impossible to determine the species, as the marginal sense organs are not visible. The occurrence of this medusa at Cape Adare indicates that hydroids belonging to the genera, *Clytia*, *Campanulina*, etc., are likely to be found in the neighbourhood.

Taken on 27th November, 1899.

NARCOMEDUSÆ.**SOLMARIIDÆ.****Solmundella.**

Three specimens.

Umbrella about 5 mm. in height, 6 mm. in width. Two tentacles. Large marginal lobes.

The specimens are in rather bad condition and contracted. Sense organs are not visible. It is impossible to determine the species. The position of the tentacles clearly shows that these medusæ belong to the genus *Solmundella*.

Taken on 10th May, 1899.

STAUROMEDUSÆ.**LUCERNARIIDÆ.****Lucernaria.**

There are two very fine specimens, fortunately in an excellent state of preservation.

Both specimens are, however, in a contracted condition, and have the eight arms curved inwards, completely hiding the interior of the umbrella.

The largest measures 60 mm. × 60 mm. in its present condition.

When expanded I estimate its height to be about 90 mm. or more, and its width about 50 mm.

The second specimen is about one-third smaller.

Dredged off Cape Adare on 9th January, 1900. 28 fms.

The specimens look like *Lucernaria pyramidalis*, Haeckel, except that the stalk is shorter. To judge from the contracted state of the stalk, I am inclined to think that it is much shorter when expanded than that of *L. pyramidalis*.

Haeckel ("System der Medusen," Taf. XXII.) figures *L. pyramidalis* with a very long thin stalk, and states that it is always longer than the umbrella.

It will be necessary to dissect the smaller specimen to determine the species. The white opaqueness of the substance of the umbrella and the contracted state of the arms prevent the internal anatomy from being seen.

PEROMEDUSÆ.

PERIPHYLLIDÆ.

Periphylla.

Five specimens.

The largest about 180 mm. in height and 140 mm. in width.

Unfortunately not one of the specimens is in a good state of preservation, and all are more or less damaged. One has the appearance of having been partly dissected and then preserved; it is now quite rotten. One was placed or rather squeezed into a bottle much too small for it, and has become a cylindrical mass of jelly. Another has lost all its tentacles and has the margin of its umbrella in tatters.

The other specimens are far from being perfect, but show the characters of the genus *Periphylla*. No attempt has yet been made to determine the species, and the condition of the specimens leaves but little hope of success.

Taken on 28th December, 1899, at 5 fms., and 15th-17th January, 1900, 4-6 fms.

DISCOMEDUSÆ.

An Ephyra, at rather an advanced stage, was taken on 10th May, 1899.

Umbrella about 25 mm. in diameter. About 12 tentacles on the margin of the umbrella. Tentaculocysts present, but complete number uncertain, as the margin is torn in places.

The specimen looks like the Ephyra of a *Chrysaora*. It is rather rotten and too damaged for a proper description.

CYANEIDÆ.

Desmonema?

Four large specimens in the collection, which probably belong to this genus.

All the specimens are in very bad condition, and very rotten. They were apparently stored in tins or an iron drum containing formaline, and consequently were found covered with a heavy deposit of iron rust which has deeply stained the jelly. They are also badly compressed, and have the appearance of having been placed under a weight. There are eight groups of tentacles inside the margin of the umbrella, each group with two or more tentacles in a single row. Probably eight sense organs present, but the full number cannot be found.

Taken on 20th and 27th December, 1899, and 17th January, 1900. Near the surface.

SIPHONOPHORA.

CALYCONNECTIDÆ.

Diphyidae.

Several bottles containing nectocalyces only of a large Diphyid. Taken during November, 1899, and January, 1900.

PHYSONECTÆ.

AGALMIDÆ.

Halistemma ?

Only one colony, and in a good state of preservation, but the main stem is broken up, and nectocalyces, hydrophyllia, etc., detached. The pneumatophore is missing.

Colony probably 6-10 inches in length when fully expanded.

Taken on 23rd January, 1900. Surface.

CTENOPHORA.

There are ten bottles containing fragments and macerated remains of *Ctenophores*. All are quite useless.

Apparently there are two kinds present, and they belong to the families *Pleurobrachiidæ* and *Beroidæ*.

The remains show that the original specimens must have been fairly large, probably over an inch in diameter.

Taken: *Pleurobrachiidæ*, 14th-30th November, 1899; *Beroidæ* 10th May, 1899.

XX. PORIFERA.

BY R. KIRKPATRICK.

THE three specimens of Antarctic Sponges which were obtained represent the following three species:—

- ' *Leucosolenia variabilis*, Haeckel.
Halichondria panicea, Johnston.
Halichondria sp.

LEUCOSOLENIA VARIABILIS.

1872. *Ascetta variabilis*, Haeckel. Kalkschwamme II., p. 106.

1896. *Leucosolenia variabilis*, Minchin, Ann. Mag. Nat. Hist. (6), XVIII., p. 359.

The specimen consists of a single tube about 3 mm. in length and 0·5 mm. in breadth, growing in a crevice formed by the coils of *Spirorbis antarctica*.

The Antarctic specimen shows slight variations from the Mediterranean form, the larger monaxons, with double-edged lance-shaped terminations, being thicker, and the smaller monaxons much less abundant in the former. With respect to the arrangement and general characters of the tri-radiates and quadri-radiates the Antarctic specimen exhibits no noteworthy variation.

Locality.—Cape Adare, 18 fathoms (dredged). Sea temperature 29° Fahr.

Distribution.—Arctic Ocean (Barent's Sea); Norway; Great Britain and Ireland; Mediterranean; Cape Town; Cape Adare.

HALICHONDRIA PANICEA.

1842. *Halichondria panicea*, Johnston, 'Brit. Sponges,' p. 114, Pls. X. and XI., fig. 5.

The specimen consists of a friable amorphous fragment of pale yellow colour. The skeleton, as in the case of specimens from

Kerguelen, shows a more regular arrangement than exists in British specimens, and the spicules ($450 \times 14 \mu$) are larger.

Locality.—Franklin Island, 20 fathoms. Temperature 29.8° Fahr.

Distribution.—Cosmopolitan.

HALICHONDRIA sp.

The sponge consists of an irregular basal mass, from which a tubular cylinder with thin fenestrated walls rises to a height of five inches; the tube is half an inch in diameter and open at the summit. A small patch of tough dermal membrane, easily detachable, remains near the base of the tube. Texture rather tough. Colour dirty yellow.

Skeleton composed of a network of oxeote spicules, with primary longitudinal lines of bundles about four spicules thick, the rest of the network being very irregular and confused, and with unispiculate meshes. Spongin apparently absent, the spicules being to some extent supported by membrane. The flesh has been almost macerated away. Spicules oxea, slightly curved, sharp-pointed, $348 \times 15 \mu$.

Locality.—Cape Adare; washed up on the beach.

The species appears to be new, but the specimen is in too bad a condition to warrant a specific name being given.

XXI. CRYPTOGAMIA.

MUSCI.

BY A. GEPP, M.A., F.L.S.

MR. BERNACCHI very truly remarks, in his work 'To the South Polar Regions' (p. 210):—"The appalling poverty of the flora of the Antarctic regions stands out in glaring light when compared with that of the Arctic regions: for whilst various species of flowering plants are found in high northern latitudes, only the minutest forms of vegetable life, such as lichens and mosses, have been found in high southern latitudes, and so scantily as only to be found in a few places on the northern slopes."

Mr. Borchgrevink mentions (see 'First on the Antarctic Continent,' p. 258) that on the Possession Islands he "again found vegetation and secured very satisfactory specimens of it." Again (p. 259), he "collected specimens of vegetation on Coulman Island." Vegetation was also found on the rocks of Franklin Island (p. 268) and at the foot of Mount Terror, where he "collected specimens of the rocks and vegetation" (p. 271); and he again speaks of the "splendid collection of rocks and vegetation" which was made in the same locality (p. 276).

As will be seen below, it is evident from the localities attached to the specimens which have reached the Museum, that some of the collections above recorded by Mr. Borchgrevink were not among those submitted to us.

Barbula fuegiana, Jaeg. Sterile. Geikie Land, Spring, 1900.

Barbula, sp. A few small immature specimens. Geikie Land, Spring, 1900.

Bryum argenteum, Linn. Sterile. Mount Melbourne and Sir George Newnes Land, February, 1900.

LICHENES.

By V. H. BLACKMAN, M.A., F.L.S.

Lecanora melanophthalma, Ram. Geikie Land, Spring, 1900.*Lecidea geographica*, L. Geikie Land, Spring, 1900.*Neuropogon Taylori*, Nyl. Geikie Land, Spring, 1900.*Placodium elegans*, Achar. Geikie Land, Spring, 1900.

ALGÆ.

By Miss E. S. BARTON.

Halimeda Tuna, Lam. Cape Adare.*Chaetomorpha Darwinii*, Kütz. Adventure Bay, Tasmania.*Codium mucronatum*, J. Ag. Adventure Bay, Tasmania.*Sargassum vestitum*, J. Ag. Adventure Bay, Tasmania.*Cystophora spartioides*, Ag. Adventure Bay, Tasmania.? *Fucus platycarpus*, Thur. Adventure Bay, Tasmania.*Desmarestia aculeata*, Lam. ? Cape Adare.*Desmarestia Rossii*, Hook. et Harv. Cape Adare.*Desmarestia viridis*, Lam. Franklin Island.*Callophyllis*, sp. No fruit. Auckland Island.*Rhodymenia*, sp. No fruit. Auckland Island.*Horea polycarpa*, Harv. Adventure Bay.*Plocamium coccineum*, Lyngb. Cape Adare.? *Gracilaria confervoides*, J. Ag. No fruit. Auckland Island.*Polysiphonia*, sp. Adventure Bay.*Dasya*, sp. Adventure Bay.*Lenormandia Mülleri*, Sond. Auckland Island.*Ballia callitricha*, Ag. Cape Adare.

PERIDINIEÆ.

By V. H. BLACKMAN, M.A., F.L.S.

Peridinium divergens, Ehrbg. Adventure Bay, Tasmania,
December, 1898.

XXII.

REPORT ON THE ROCK-SPECIMENS

COLLECTED BY THE 'SOUTHERN CROSS' ANTARCTIC
EXPEDITION.

BY G. T. PRIOR, M.A., F.G.S.,

Assistant in the Mineral Department, British Museum.

(PLATE LIII.)

THE collection consists mainly of specimens of scoriaceous and compact hornblende-basalts, pale-green siliceous slates and quartz-grits, and boulders of granitic rocks. According to Mr. Borchgrevink, it is "to a great extent a more complete series of the rocks which he secured at Victoria Land in 1894." That collection, which included basaltic and trachytic rocks from Cape Adare and Possession Island, has been very fully described by Prof. T. W. E. David, W. F. Smeeth, and J. A. Schofield.¹ Descriptions of basalts together with granitic and phonolitic rocks from Possession and Franklin Islands have already been given in my "Petrographical Notes on the Rock-Specimens collected in Antarctic Regions during the Voyages of H.M.S. 'Erebus' and 'Terror' in 1839-43 (Min. Mag., XII., pp. 69-91).

The specimens in the present collection for the most part have no locality-labels attached to them, and are accompanied by no lists or geological details as to their mode of occurrence and mutual association in the field.

The following list of the localities from which they were collected depends partly upon oral statements made by Mr. Borchgrevink, and partly upon a comparison of the rocks with localised specimens

¹ See 'Notes on Antarctic Rocks collected by Mr. C. E. Borchgrevink,' Proc. Roy. Soc. N.S.W., XXIX., pp. 461-492, 1895.

collected by Mr. Bernacchi and Lieutenant Colbeck, and kindly placed at my disposal for the purpose:—

- (1) Cape Adare (plateau, 900 feet above sea-level).....granitic and felsitic boulders, hornblende-basalts, and phonolitic trachytes.
- (2) Duke of York Island, Robertson Bay.....pale green siliceous slate containing patches of iron pyrites and traversed by quartz veins.
- (3) Geikie Land, Robertson Bay.....pale green slates and quartz-grits and hornblende-granite (probably a boulder).
- (4) Protection Cove, near Cape Cod, Robertson Bay.....amygdaloidal basalts and tuffs.
- (5) Possession Island.....large boulder of haplite containing garnets and tourmaline, hornblende-basalts.
- (6) Franklin Island.....magma-basalt (limburgite) containing large olivine-nodules.
- (7) Coulman Island.....hornblende-basalts and basalt-agglomerate.
- (8) Newnes Land (foot of Mt. Melbourne).....basalt-scoria and also (according to specimens collected by Lt. Colbeck) kentyte-like rocks.¹
- (9) Foot of Mt. Terror.....hornblende-basalts.

For purposes of description the specimens will be arranged under species, beginning with what are presumed to be ancient Archaean and Palæozoic rocks, viz., the granites, felsites and slates, followed by the basalts and phonolitic rocks, which appear to have been erupted through them, most probably in comparatively recent geological times.

GRANITES.

Many of the boulders found on the plateau of Cape Adare are of gray and pink medium to coarse-grained biotite granites, biotite-muscovite granite, and biotite-hornblende granites. They were doubtless brought down by the ice from the interior, and the parent rocks, with gneisses and schists,² probably constitute the basement-rocks of Victoria Land.

The most remarkable of the specimens is a large mass of very coarse-grained biotite granite, with extremely large Carlsbad twins of feldspar (up to 2 in. long by $\frac{3}{4}$ in. broad), which constitute the main bulk of the rock. The feldspars of this rock consist partly of orthoclase (extinction on cleavage flakes were, c (001), straight; b (010), 6°), and partly of oligoclase, with symmetrical extinction of 12° in twin lamellæ.

Another specimen of porphyritic granite is less coarse-grained. It is a biotite granite, somewhat resembling the well-known granite

¹ According to Mr. Bernacchi, slate is also found at the foot of Mt. Melbourne.

² A mica-schist in Mr. Borchgrevink's previous collection is described in Proc. Roy. Soc. N.S.W., XXIX., p. 481, 1895.

from Shap Fell, Westmoreland, with large pink porphyritic feldspars. The latter have a curious mottled extinction, and are probably to be referred to microcline (moirée-microcline of Brögger); oligoclase, with fine twin striations, is also present, with quartz, biotite, and a little brown hornblende. A pleochroic (pale rose to colourless) sphene is fairly plentiful, while small apatites and zircons occur as accessory constituents. There are also present one or two small prismatic sections of a reddish-brown mineral, closely resembling the *Allanite* described by Hobbs,¹ in the granite of Ilchester, Maryland. They have extinctions of 34° – 37° to their length, and are pleochroic, from reddish-brown along the line of extinction, to yellow at right angles to it; they show a zonal structure hexagonally round a central nucleus similar to that figured by Hobbs. These characters, as well as the strong refraction and weak double refraction, agree with those of allanite (see Pl., LIII., fig. 2).

A biotite-hornblende granite from Geikie Land has no porphyritic feldspars, but in other respects is somewhat similar to the preceding, and also contains allanite in small amount. The feldspar is mainly microcline, but some oligoclase is also present. Sphene occurs in large amount, in some sections showing polysynthetic twinning.

Another specimen from Geikie Land presents some of the characters of an epidiorite. It contains biotite and much pleochroic reddish-brown hornblende in large ragged plates, sometimes surrounding a nucleus of colourless augite, with which it is in optic continuity. The rock is much altered and contains kaolinised idiomorphic feldspars and some clear quartz; a little calcite and some needles of apatite are also present.

A large granitic block from Possession Island is a garnetiferous haplite with tourmaline, and is identical with the rock from Possession Island in the Ross collection described in *Min. Mag.* XII., 79, and also probably with the rock described as from Cape Adare in *Proc. Roy. Soc., N.S.W.*, XXIX., 471.

PLAGIOCLASE-OLIVINE-AUGITE-BIOTITE ROCK.

A small rolled pebble, probably from Cape Adare, has the aspect of a gabbro, and shows in a ground of clear colourless prismatic feldspars dark patches of ferro-magnesian minerals, amongst which olivine and biotite are conspicuous. Under the microscope

¹ *Ann. J. Sci.*, XXXVIII., p. 223, 1889.

the long prismatic feldspars show very fine albite twin striations: symmetrical extinctions in the twin lamellæ were as low as 10° : in cleavage flakes the extinction on c (001) was about 5° , and on b (010) about 13° : the specific gravity was between quartz and labradorite from Labrador (about 2.67). Most of the feldspar therefore consists of a rather acid labradorite, but some patches of feldspar also occur without twin-striations and moulding the labradorite: these have a refractive index (as determined by the Becke method) lower than that of the labradorite, and may consist of orthoclase, or possibly anorthoclase. The ferro-magnesian patches consist of fairly large irregular grains of a pale yellow olivine, a pale green diopside-like augite with high angles of extinction, and plates of biotite, with some apatite and ilmenite. (See Pl. LIII, fig. 1.)

This rock is here doubtfully referred to the *essexites*; it has some affinities with the *augite-syenites*, such as the olivine-bearing *laurdalite* of Brögger. In the absence of data as to its mode of occurrence, it is only possible to suggest that it might very well represent the plutonic magma, from which were derived both the hornblende-basalts and also the olivine-bearing anorthoclase rocks or *kenytes* described later.

QUARTZ-FELSITES.

The felsitic rocks found as boulders at Cape Adare probably occur in association with the granites. They are mostly pale yellow *hällfinta*-like rocks, but some show small phenocrysts of quartz, feldspar and muscovite. Other specimens are more coarsely-grained. One of these is a red porphyritic granophyre, showing under the microscope large hexagonal sections of quartz (sometimes much corroded and penetrated by the groundmass) and kaolinised feldspar (orthoclase and oligoclase) in a holocrystalline groundmass of interlocking quartz and feldspar grains with micropegmatic structure in parts.

Another coarse-grained specimen from Geikie Land is a pale greenish-gray rock speckled with small phenocrysts of quartz and feldspar. Under the microscope it shows large and plentiful phenocrysts of corroded quartz and orthoclase in a holocrystalline groundmass, consisting of a mosaic of quartz and feldspar. Scattered through the slide both in phenocrysts and groundmass are shreds of a micaceous mineral and chlorite, similar to those in the quartz grits to be described later: epidote grains have also been developed at the expense of the feldspars.

Of the more finely-grained hällflinta-like felsites, one specimen without phenocrysts is seen under the microscope to consist of minute rectangular feldspars and interstitial quartz, with shreds of the same micaceous or chloritic mineral as in the preceding rock.

Another specimen has a somewhat similar base, but contains phenocrysts of rounded and corroded quartz, orthoclase, oligoclase and muscovite: occasionally the quartz and feldspars are aggregated together in patches looking like inclusions of granite: one orthoclase phenocryst has a remarkable micropegmatic intergrowth of quartz.

A third honey-yellow hornstone-like specimen shows the same phenocrysts, only smaller and in less amount, in a dense microfelsitic base showing in parts imperfect spherulitic structure.

SLATES AND QUARTZ-GRITS.

These rocks are of interest as being apparently the only sedimentary rocks found *in situ* in Victoria Land.

The pale-green slate, of which a very large number of specimens were collected, constitutes the main mass of Duke of York Island. It also occurs together with quartz-grits on the neighbouring mainland (Geikie Land), and the same formation extends along the coast towards Cape North. According to Mr. Bernacchi, pieces of slate were also seen at the foot of Mount Melbourne in Newnes Land.

The slate of Duke of York Island is in parts traversed by veins of quartz, near the contact of which with the slate much vermicular chlorite has been developed. Some of the specimens of slate are much contorted into sharp folds in which the quartz veins are involved, showing that the latter were formed prior to the folding of the slate. Iron pyrites in sharply-defined cubic crystals is disseminated in patches abundantly through these rocks.

A careful examination of the numerous specimens of the slate has unfortunately not led to the discovery of any fossil remains.

Under the microscope the slate is seen to consist of a colourless muscovite-like mica, shreds of green pleochroic chlorite which gives the colour to the rock, and small quartz grains. It varies in texture from a very fine-grained rock in which quartz grains are scarcely apparent, to one approaching a quartz-grit in which quartz grains seem to be the main constituent.

The quartz-grits are of the same pale green colour as the slates, but are more coarsely-grained and show no slaty cleavage. A boulder

from Cape Adare consists of a fragmental aggregate of sub-angular grains of quartz and a little felspar with shreds of muscovite and green altered biotite: deep red doubly-refractive grains of rutile and rounded grains of zircon are also present.

A specimen from Geikie Land is nearly colourless, as it contains very little chlorite. Besides angular grains of quartz showing undulose extinction, it contains grains of twinned oligoclase in a paste of what appears to be secondary quartz, with shreds of muscovite and a little chlorite.

The fragmental material of these grits has probably been derived from granitic or gneissic rocks.

BASALTS.

These rocks are for the most part fine-grained, compact, glassy, hornblende-basalts, similar to those from Cape Adare and Possession Island in Mr. Borchgrevink's earlier collection, and in the Ross collection, which have been previously described. They contain small phenocrysts of basaltic hornblende, undergoing reabsorption, and often only represented by pseudomorphs of magnetite and augite, in a deep brown glassy base of sharply-defined felspar laths, grains of magnetite, minute rhombic sections of olivine, and a little augite (see Pl. LIII., fig. 5). Only rarely is a much corroded phenocryst of felspar seen in these rocks, and small pale purple augite phenocrysts accompanying the hornblende are only present in some specimens in small amount.

Basalts of this character come from Coulman Island and from the foot of Mount Terror, as well as from Cape Adare and Possession Island, and all probably belong to contemporaneous and recent flows.

A chemical analysis of the hornblende-basalt from the foot of Mount Terror gave the following result:—

SiO ₂	= 47·40
TiO ₂	= 0·63
Al ₂ O ₃	= 20·27
Fe ₂ O ₃	= 5·38
FeO	= 5·48
MnO	= 0·17
CaO	= 7·59
MgO	= 2·91
Na ₂ O	= 5·78
K ₂ O	= 2·73
P ₂ O ₅	= 0·85
ign.	= 0·23

99·45

The red glassy scoriaceous hornblende-basalt at Cape Adare was seen by Mr. Bernacchi to be traversed by small dykes of a black basalt showing columnar structure (see fig. below). This basalt is more coarsely-grained than the hornblende-basalt, and consists of a medium-grained aggregate of felspar-laths and pale purple augites with only a little magnetite and no interstitial glass.

Other specimens from the neighbourhood of Cape Adare show numerous and fairly large phenocrysts of clear olivine and pleochroic



BASALT-DYKE AT CAPE ADARE.

(From a Photograph by L. Bernacchi.)

(pale purple to yellow) augite in a glassy base of felspar laths, magnetite grains and purple augite. One specimen also shows large phenocrysts of deep red basaltic hornblende together with phenocrysts of olivine and augite.

These porphyritic basalts, to judge from a specimen collected by Lieutenant Colbeck, were taken from a cliff in Robertson Bay, about

four miles south of the camp. According to his description, they occur in small dykes three feet wide, traversing the cliff from top to bottom at various angles.

A large mass of basalt from Franklin Island is remarkable for the number and large size of the olivine-enstatite nodules, such as occur, *e.g.*, in many of the basalts of Rhenish Prussia, and also in the nepheline-basalts of Fernando Noronha.

The rock in which these nodules occur approaches a limburgite: it consists of a pale brown glass containing small idiomorphic olivines, purple prismatic augites, magnetite grains, and only a few felspar laths.

The olivine-nodules are as large as the fist. In composition they are precisely similar to those which have been described in other basalts, and consist of a fairly coarse-grained aggregate of pale greenish olivine, yellow enstatite showing polysynthetic twinning, brilliant green chrome-diopside, and picotite.

Specimens from Protection Cove, near Cape Cod, south of Robertson Bay, present somewhat different characters to most of the other basalts. They are more felspathic and altered, with vesicles filled with calcite. Under the microscope they show fairly large and numerous phenocrysts of labradorite with fine twin striations (symmetrical extinction about 20°), in a dense brown glassy base containing smaller felspars, some in laths, others in more isometric forms. These specimens appear to have been collected near the junction of the basalt with the slate, and are accompanied by tuffs (see p. 330). One specimen shows basalt in contact with a mass of green opaline silica, and under the microscope, besides this opaline silica, are seen fragments of what appears to be altered slate, which are inter-penetrated by the basalt.

PHONOLITIC TRACHYTES AND KENYTES.

Of these phonolitic rocks there are only three rolled fragments in the collection. These probably came from Cape Adare, but no information is forthcoming as to their connection with the basalts in the field. The "trachyte" from Cape Adare, described by Prof. David (*l. c.* p. 473), with its abundant ægirine, is of a phonolitic type. A phonolitic rock from Possession Island was also found in the Ross Collection (*l. c.* p. 78).

Of the present specimens one is of a dark greenish-brown compact rock, showing small phenocrysts of lath-shaped felspar. Under the

microscope long clear Carlsbad twins of anorthoclase, with characteristic minute twin striations, and one or two small crystals of ægirine-augite, are seen in a trachytic groundmass composed of felspar laths showing flow structure, with interstitial tufts of a dull green ægirine-augite, a little magnetite, and shreds of a deep red decomposed mineral, probably altered cossyrite or catophorite. Amongst the phenocrysts olivine in rounded fragments surrounded by ægirine-augite occurs very sparingly (see Pl. LIII., fig. 4).

These characters are almost precisely similar to those presented by phonolitic rocks from the Canary Islands and from the Rift Valley, near Mount Kenya, in Tropical East Africa.¹

A chemical analysis of the phonolytic trachyte gave the following result:—

SiO ₂	= 64·13
TiO ₂	= 0·65
Al ₂ O ₃	= 14·32
Fe ₂ O ₃	= 5·58
FeO	= 0·70
MnO	= 0·12
CaO	= 2·36
MgO	= 0·72
Na ₂ O	= 5·29
K ₂ O	= 4·86
P ₂ O ₅	= 0·39
ign.	= 0·79

99·91

Another dark green and brown specimen is a somewhat similar rock, but approaches more closely to the rocks from Mount Kenya to which Prof. Gregory has given the name “Kenyte.”² In this rock, large porphyritic anorthoclase-felspars (sometimes in glomeroporphyritic groups round grains of magnetite, augite and olivine) and smaller phenocrysts of a pale dull green diopside-like augite, and a few red altered crystals of olivine occur in a very fine-grained groundmass, consisting partly of minute felspar-laths and partly of interlocking felspar grains, with a little augite and magnetite. Magnetite grains occur as inclusions in all the phenocrysts and are especially abundant in the augites (see Pl. LIII., fig. 3).

The third specimen shows an approach to the hornblende-basalts. It is a gray rock, showing one or two fairly large phenocrysts of basaltic hornblende. Under the microscope small dull bluish-green phenocrysts of ægirine-augite (with high angles of extinction, up to 40°), and a few partially reabsorbed basaltic hornblendes, precisely

¹ See Min. Mag., XIII., p. 89, 1901.

² Quart. Journ. Geol. Soc., LVI., p. 205, 1900.

similar to those in the basalts, are seen in a groundmass of felspar laths, magnetic grains and ragged shreds of dull green ægirine-augite.

These rocks certainly have very similar characters to those of the phonolitic rocks from Africa, but they also present perhaps even more striking resemblances to rocks from a nearer locality, viz., the Dunedin District, New Zealand. Phonolitic rocks from the top of Flagstaff Hill, Dunedin, in the Museum Collection, show phenocrysts of anorthoclase, partially reabsorbed basaltic hornblende, and pale green augites in a ground-mass of felspar laths and feathery tufts of ægirine-augite, as in the case of the rocks described above; phenocrysts of olivine, surrounded by ægirine-augite, are also generally present in small amount. These rocks which occur with basalts are of early Tertiary age, and are, in fact, associated with Palæozoic rocks, consisting of clay-slates and schists, as in the case of these Antarctic rocks.

A pumiceous rock, found by Mr. Bernacchi on the top of Cape Adare, probably belongs to the same "kenyte" series. It consists of a highly vesicular, nearly colourless glass, crowded with gas-pores and dark, dusty inclusions, and containing phenocrysts of large, much corroded anorthoclase felspars, pleochroic (pale yellow to pale green) diopside-like augites, and, very sparingly, olivine and basaltic hornblende.

A pale rhyolitic-looking rock, found by Lieutenant Colbeck at Wood Bay, Newnes Land, is of a somewhat similar character, but less glassy. The same phenocrysts of anorthoclase, together with olivine and pale green augite in very small amount, occur in a very fine grained base, consisting of minute felspar laths showing flow structure.

A tuff from Protection Cove, near the junction of the basalt with the slate, contains, besides fragments of basalt, also small fragments of a glassy rock speckled with magnetite; it shows in some cases perlitic structure, and also rarely phenocrysts of felspar and a pale greenish-yellow augite (see Pl. LIII., fig. 6).

CONCLUSIONS.

The granite rocks found as boulders on Cape Adare, together with mica-schists and gneisses, such as were dredged by the '*Challenger*,' probably constitute the basement rocks of Victoria Land, underlying the slate.

Slates and quartz-grits appear to be the prevailing rocks beneath the basaltic lavas over a large part of Victoria Land. They constitute the main-mass of Duke of York Island, and occur on the opposite mainland (Geikie Land). According to Mr. Bernacchi, the junction of the slates and the basalts occurs at a place about two miles south of Duke of York Island in the bottom of Robertson Bay, where the basalt is seen to have flowed over the sedimentary formation and hidden its southern prolongation. To the east of the junction extends the basalts forming the mass of Cape Adare, while along the coast to the west towards Cape North occur only slates. That the slates continue southward underneath the basalts towards Mount Erebus is considered probable by Mr. Bernacchi, since slates were seen by him at the foot of Mount Melbourne in Newnes Land.

As regards the basalts, apart from the dyke rocks, the lavas of Cape Adare, Possession Island, Coulman Island, and Mount Terror are all very similar fine-grained glassy basalts, characterised by the presence of basaltic hornblende, so that it is reasonable to suppose that, as Mount Erebus still shows signs of volcanic activity, they have all been erupted at a comparatively recent date.

As to the connection between the phonolitic rocks and the basalts, their presence together in the tuff described on p. 330 suggests that they belong to one period of eruption; and it is probable, from the result of the analyses given on pp. 326 and 329, that both are differentiation products of one magma, fairly rich in soda and poor in magnesia. Such a magma might have the composition of a basic nepheline-syenite, like that which helps to form the core of Mount Kenya (see Gregory, 'Quart. Journ. Geol. Soc.,' lvi. (1900), p. 208), or it might possibly be represented by the olivine biotite rock described on p. 323.

An important point to be considered in the examination of this collection is the light it may throw upon the supposed connection between the Antarctic lands and the neighbouring continent of Australia. Prof. J. W. Gregory, in 'Nature' (Vol. lxiii., p. 609), refers to Ritter's suggestion that Wilkes Land is a southern extension of the Australian plateau, and that the volcanic chain of Victoria Land is the continuation of the volcanic line which passes through New Guinea, New Caledonia, and New Zealand. As regards the more ancient rocks in the present collection, in support of this suggestion is the fact that they are very similar to, and are even stated by Prof. Gregory to be "practically identical with some of the Lower Palaeozoic rocks of Victoria"; while in the case of the more recent

volcanic rocks, as already pointed out, the phonolitic trachytes present striking analogies with the phonolitic rocks of New Zealand.

As far as it is possible to judge from the present collection, the geology of Victoria Land in its threefold character (Archæan and Palæozoic rocks, long uneventful period of terrestrial conditions, followed by recent volcanic eruptions) is similar to that of East Africa and Southern India. Too much stress, however, must not be laid on this apparent similarity, since so little is known of the interior, the future exploration of which may possibly lead to the discovery of fossiliferous Mesozoic rocks which may help to bridge over the long interval between the Palæozoic slates and the recent basalts.

EXPLANATION OF PLATE LIII.

MICROSCOPE-SECTIONS OF ANTARCTIC ROCKS.

- Fig. 1.—Plagioclase-olivine-augite-biotite rock.
Finely-striated plagioclase feldspars with patches of olivine (large irregular crystal near the centre and smaller fragments), pale green augite (small fragments showing cleavage), and biotite.
Magnification, 10 diam., 2-in. objective.
- Fig. 2.—Biotite-hornblende-granite with allanite.
Two crystals of allanite are seen at the top, and a smaller rounded fragment below on the right.
Magnification, 10 diam., 2-in. objective.
- Fig. 3.—Kenyte-like rock.
At the top on the right is a crystal of anorthoclase showing the fine twin-striations as seen between crossed nicols; immediately below is a rounded fragment of red altered olivine; the other two phenocrysts are of augite with magnetite inclusions.
Magnification, 18 diam., 1-in. objective.
- Fig. 4.—Phonolitic trachyte.
At the top on the left is a rounded crystal of yellow olivine with an inclusion of apatite and a border of agirine-augite; below is a phenocryst of anorthoclase; the dark shreds and patches in the groundmass consist of agirine-augite.
Magnification, 18 diam., 1-in. objective.
- Fig. 5.—Hornblende-basalt.
The section shows small phenocrysts of basaltic-hornblende surrounded by a zone of magnetite, feldspar laths, and rhombic sections of olivine in a glassy base.
Magnification, 18 diam., 1-in. objective.
- Fig. 6.—Tuff with fragments of perlitic kenyte and basalt.
Most of the section is occupied by a fragment of kenyte showing perlitic structure; on the right is a fragment of glassy basalt.
Magnification, 35 diam., $\frac{1}{2}$ -in. objective.

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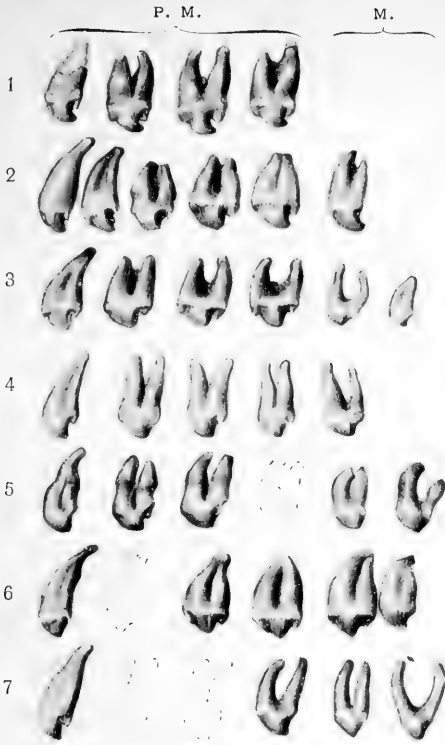
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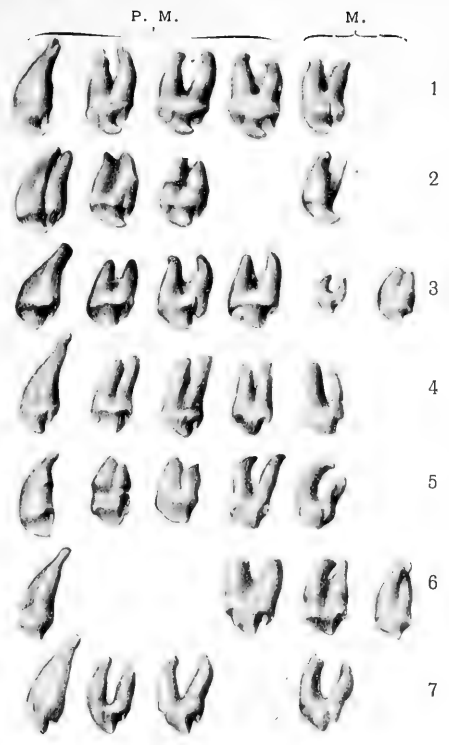
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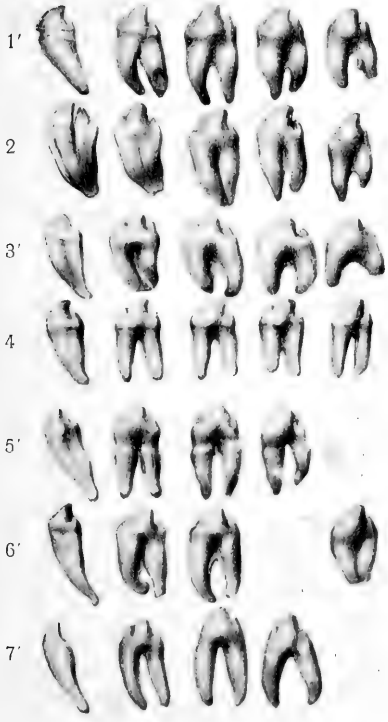
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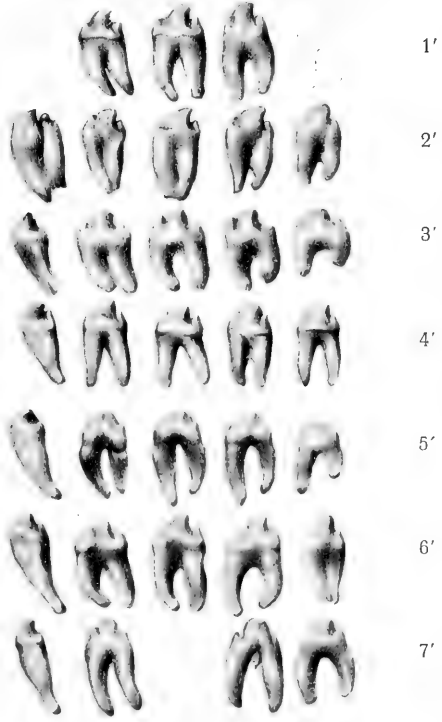
TEETH OF LEFT UPPER JAW FROM OUTSIDE.



TEETH OF RIGHT UPPER JAW FROM INSIDE.



TEETH OF LEFT LOWER JAW FROM OUTSIDE.



TEETH OF RIGHT LOWER JAW FROM INSIDE.



A. W. Pinx. H. Grönvold del.

LEFT: UNCHOTES WIDEELLI





E. A. W. Fitz,
H. Greenfold del.

♂
OGMORHINUS LEPTONYX.

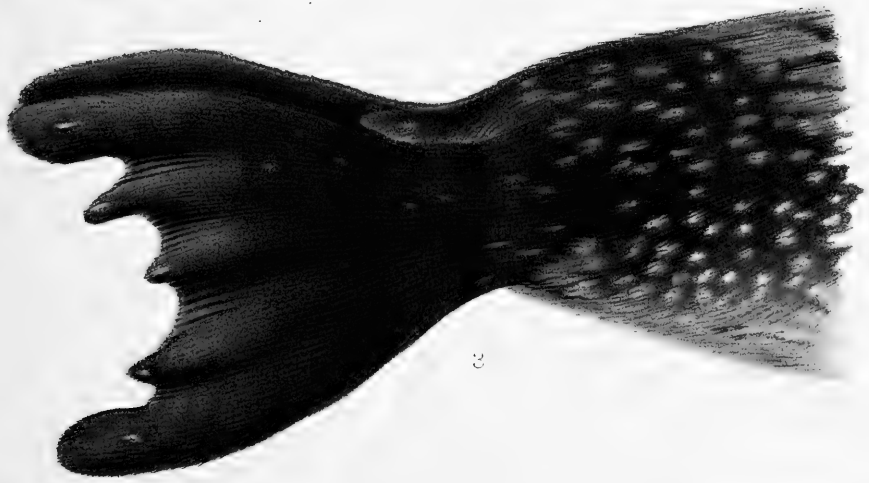
From Newman's sketch.



1



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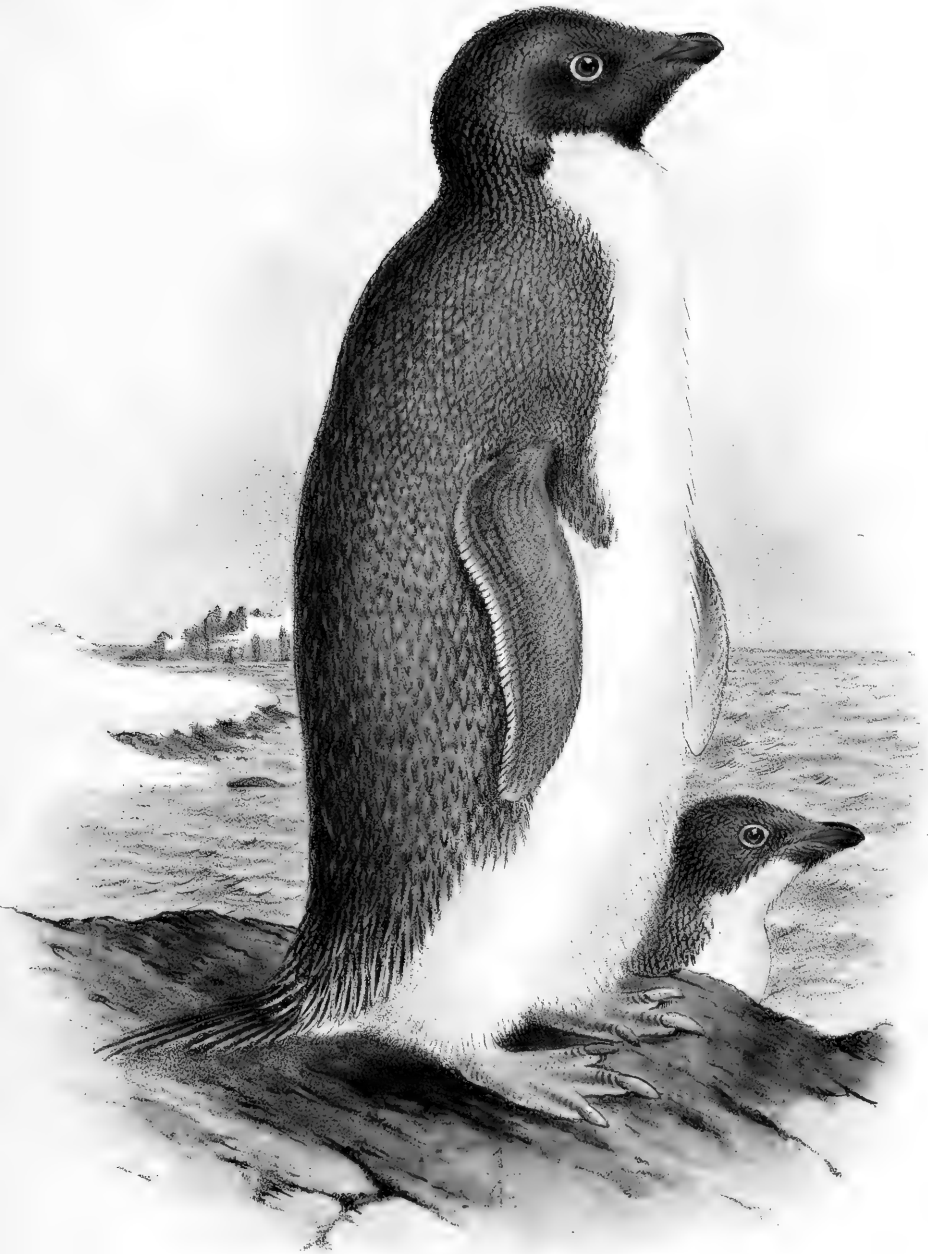
E. A. W. pinx
H. Gronvold del

LOBODON CARCINOPHAGUS.

W. C. Cresson, det.







H.Cronwald del et lith.

West Newman imp

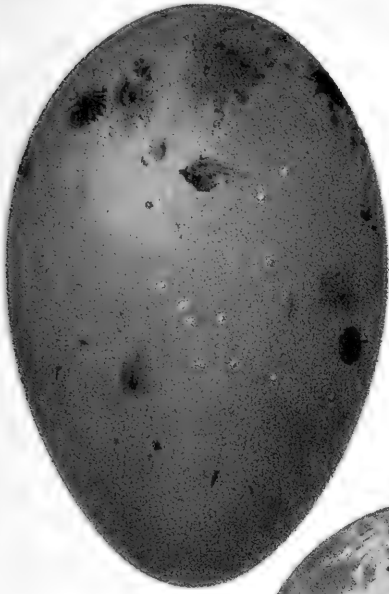
PYGOSCELIS ADELIAE. *ad. et imm.*



H. Grønvald del et lit.

Wes. Neumann imp.

SYGOSCELIS ADELIAE. Jacq.



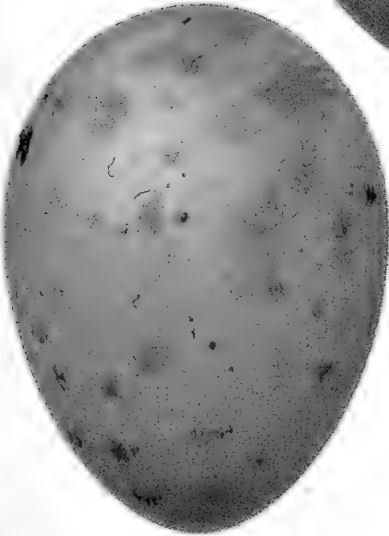
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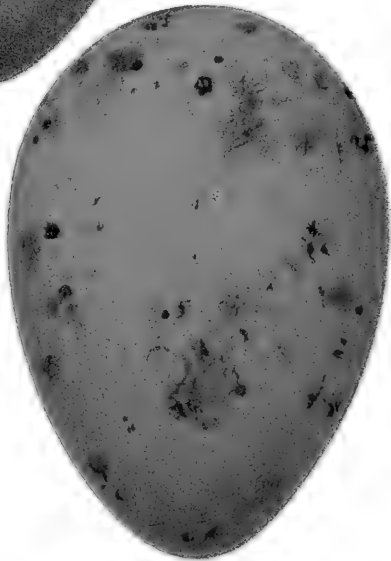
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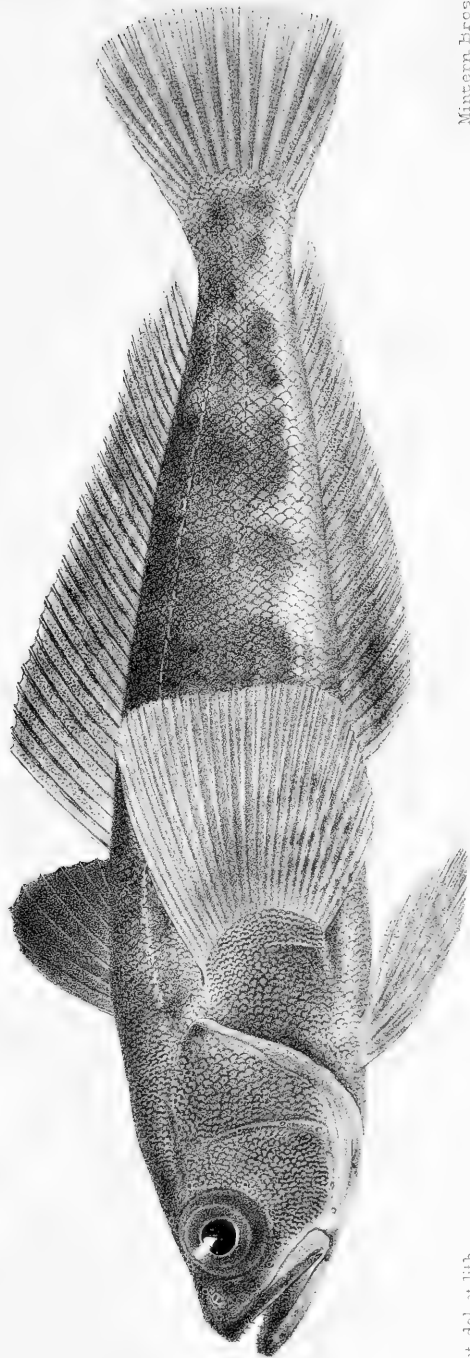
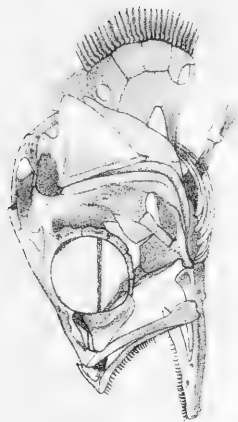
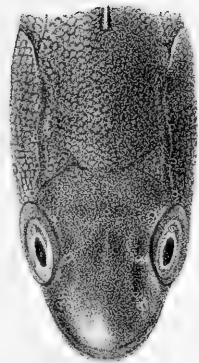
5



H.Grönvold ad nat.del.

1-3. EGGS OF PAGODROMA.
4-6. EGGS OF PYCNOSCELI.

West,Newman chromo.



F. J. Smit del et lith.

Mintern. Bros. amp.

TREMATOMUS NEWNESI.

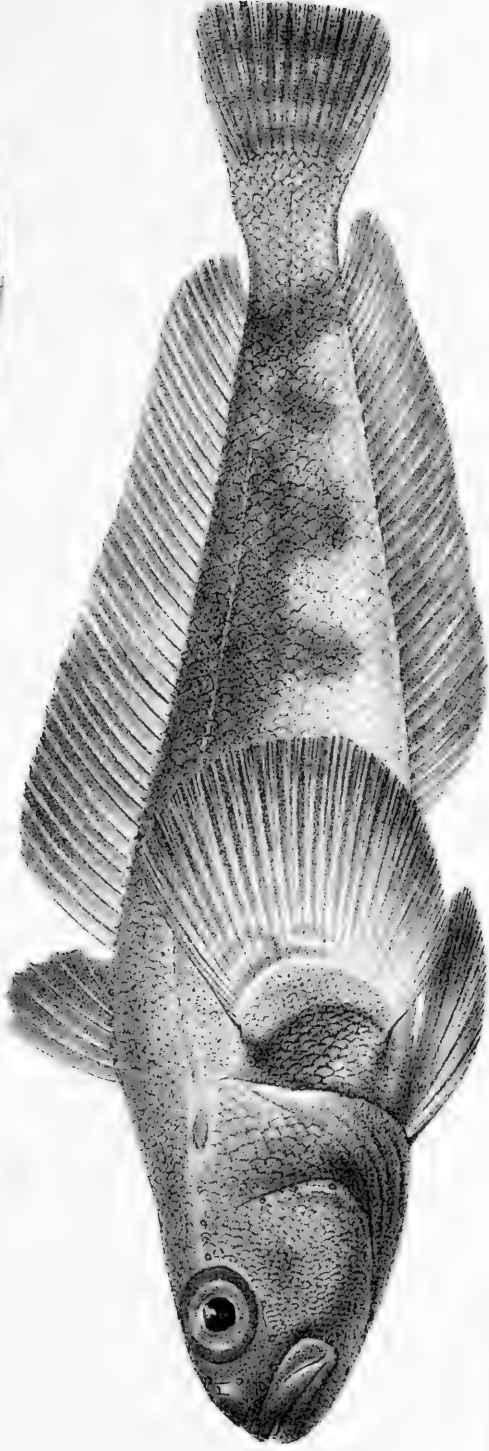
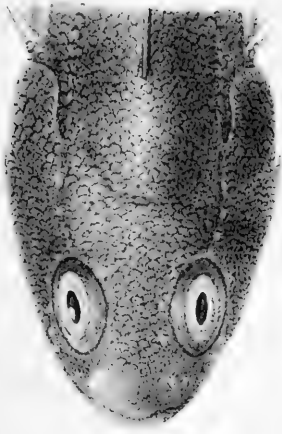
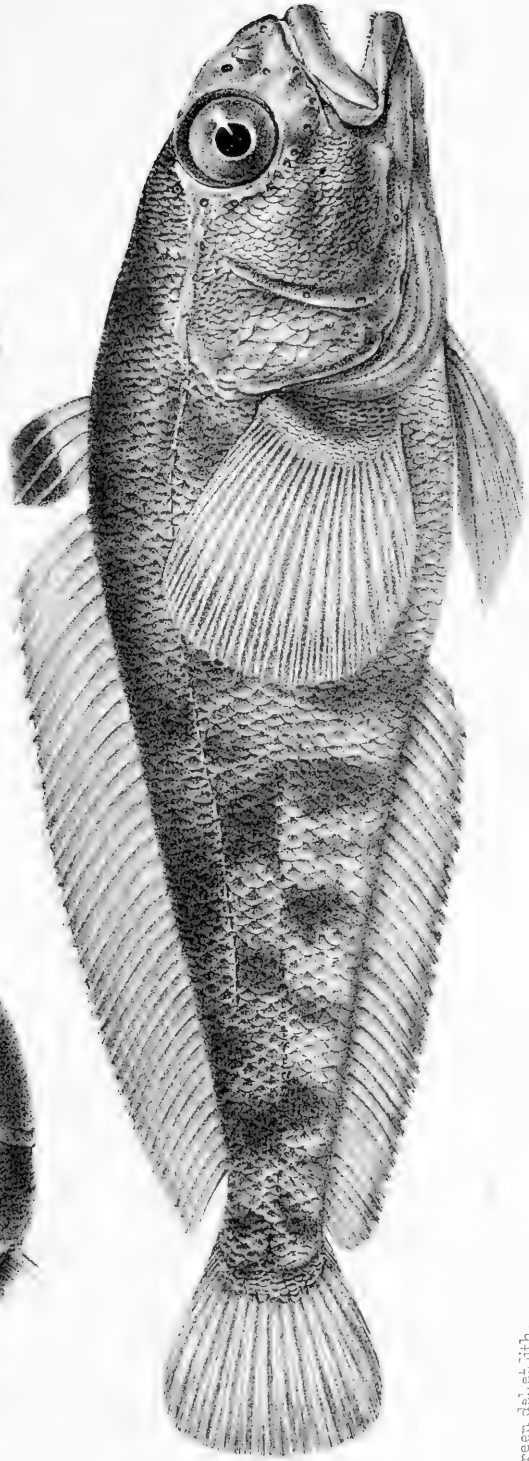
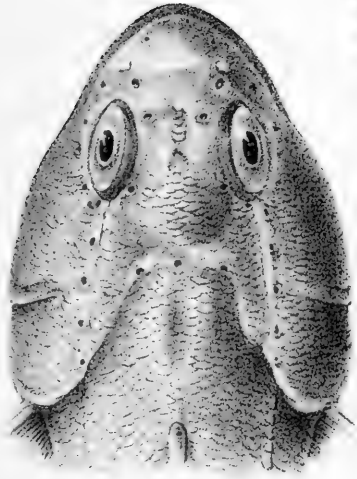


PLATE XIII.

TREMATOMUS HANSONI.

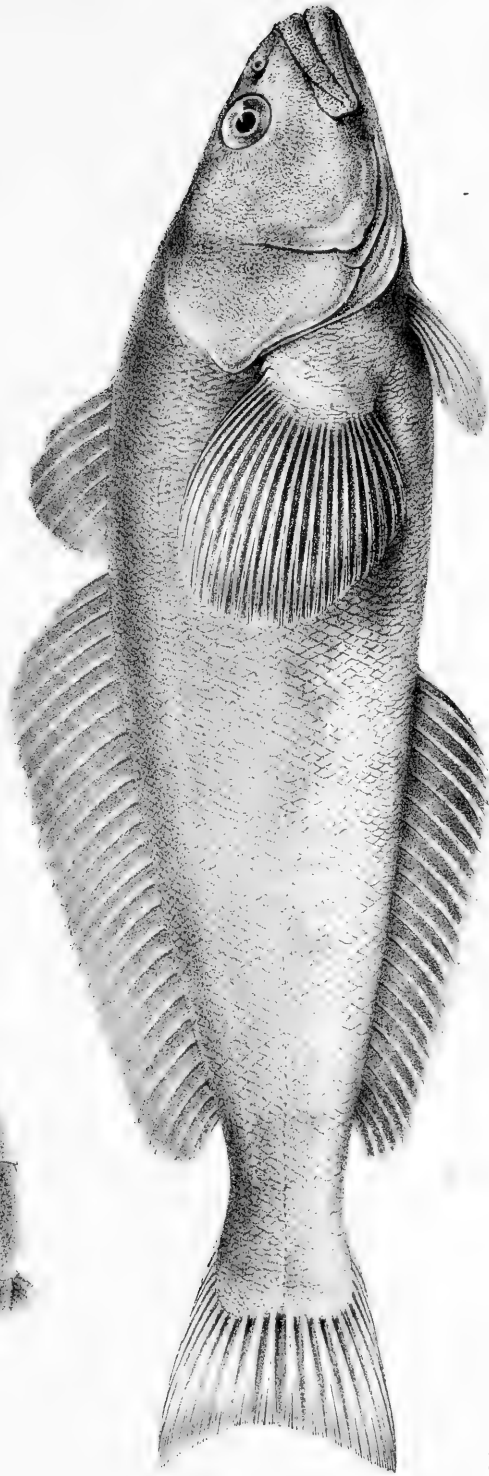
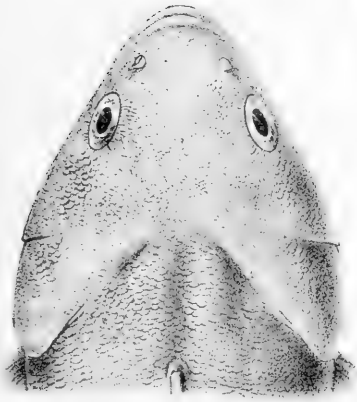
Mintern, Bros imp.



J Green, del. et. lith.

Mintern, Bros. imp.

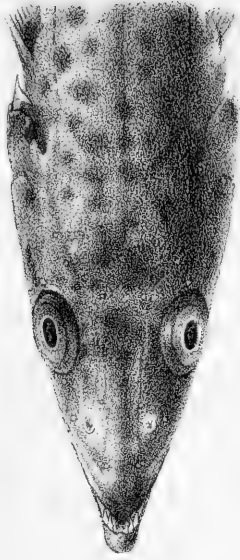
TREMATOMUS BELLEACCHII



J Green del. et lith.

Mintern Bros. imp.

NOTOGENIA COLBECKI.





1.



2.



3.

Mantle.



8.



6.



7.



5.

W.A.H. del.

A.S. Huxley London

BOLTENIA PACHYDERMATINA.
 STYELA LACTEA.



1.



2.



3.



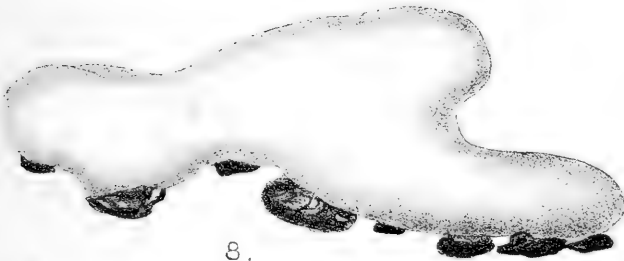
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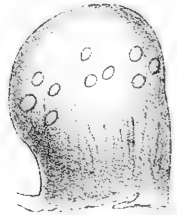
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6.



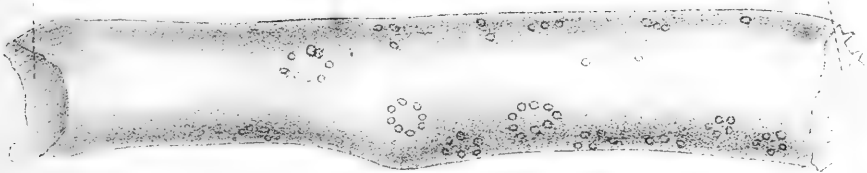
8.



7.

?Attached here.

Torn here

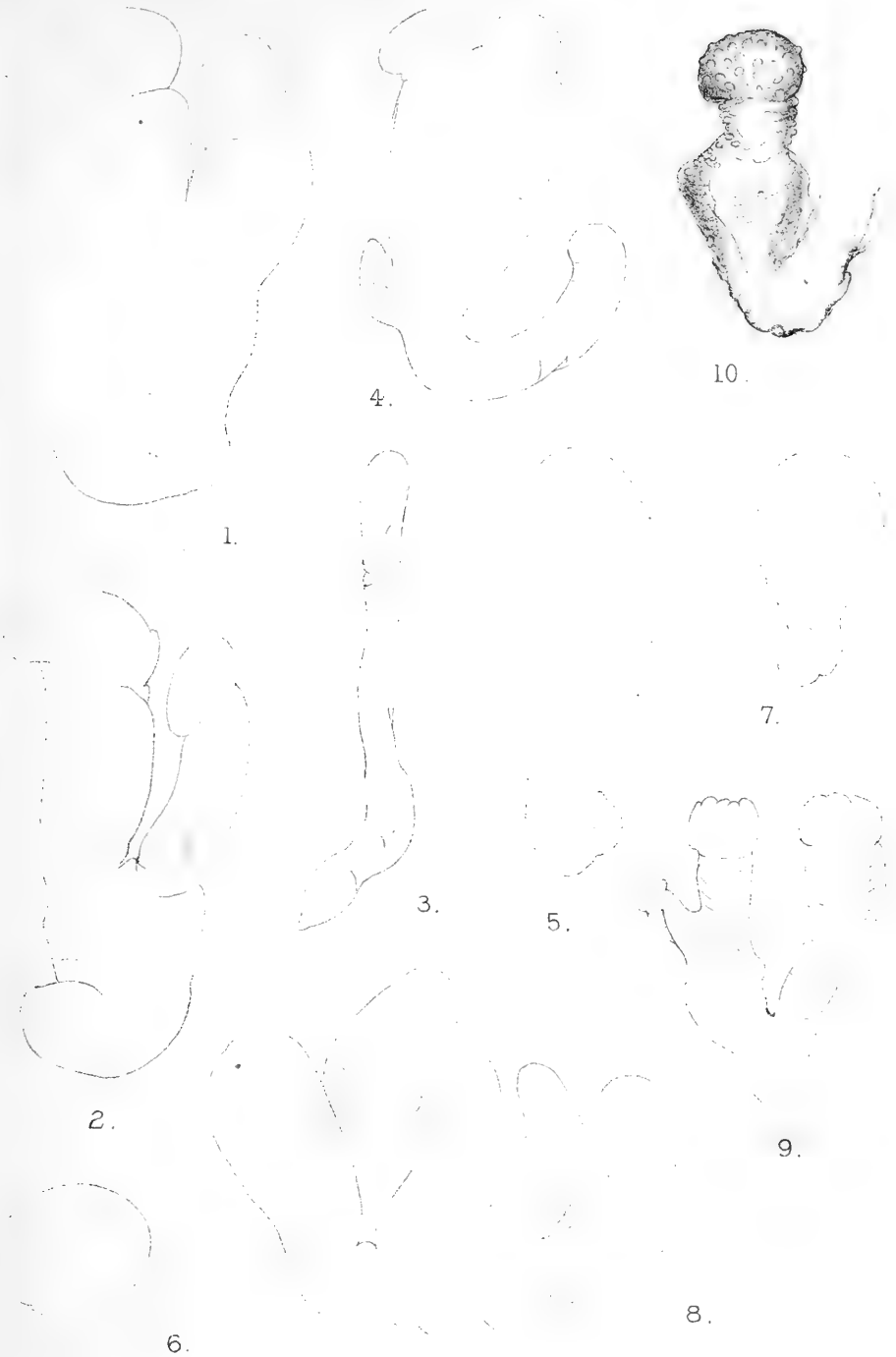


9.

W.A.H. del.

A.S.Huth, Litt.^r London

TYLOBRANCHION ANTARCTICUM.
DISTAPLIA IGNOTA.

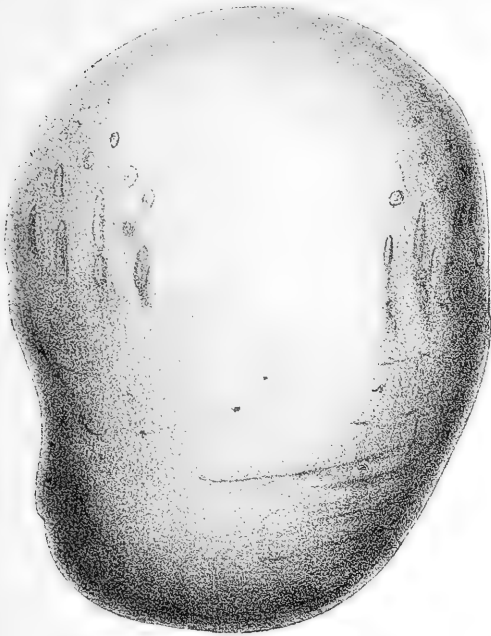


W.A.H. del.

A.S. Hatt. Lith. London.

ATOPOGASTER ELONGATA.

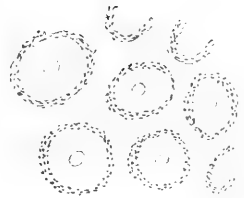




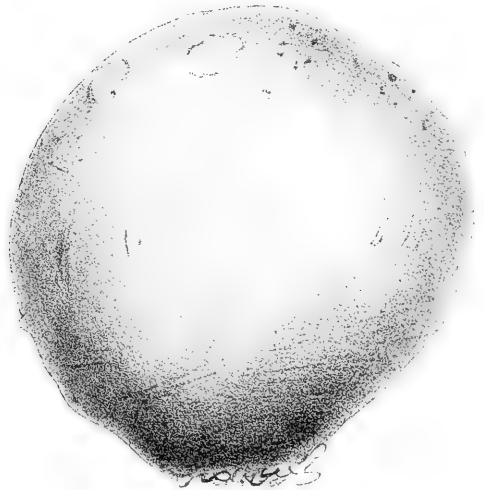
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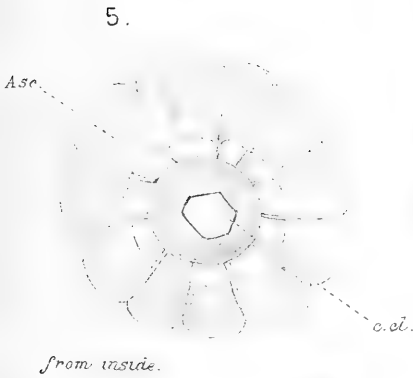
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4.



2.

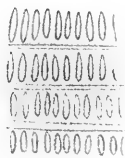


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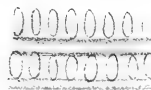


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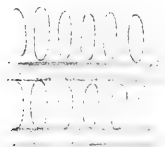
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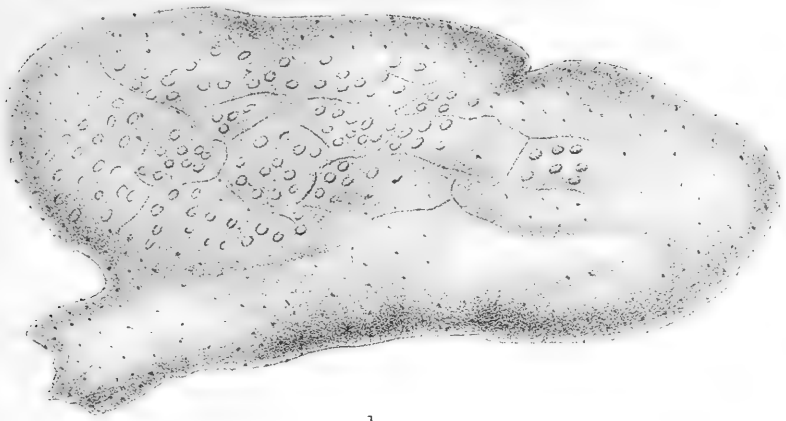


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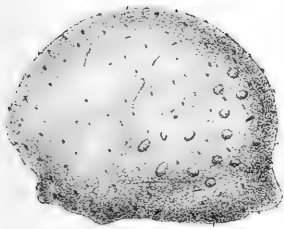


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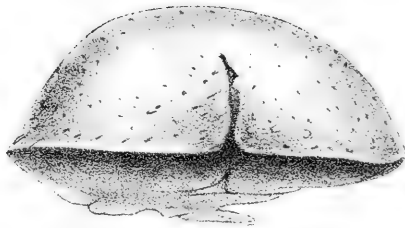
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2.



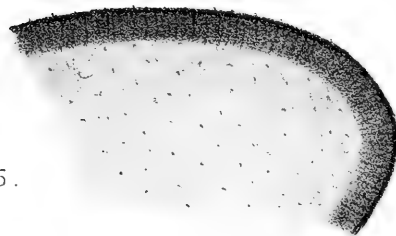
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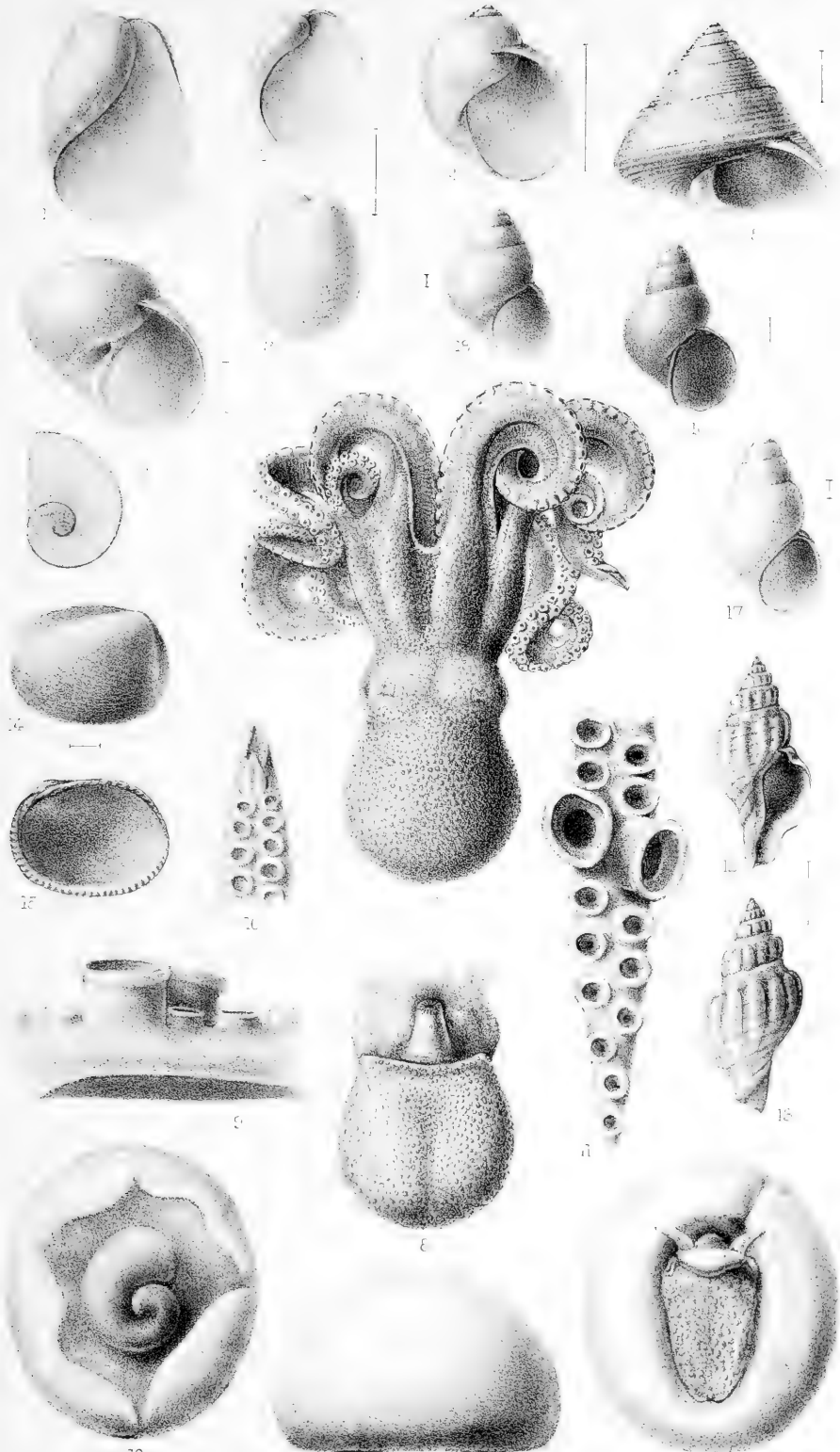


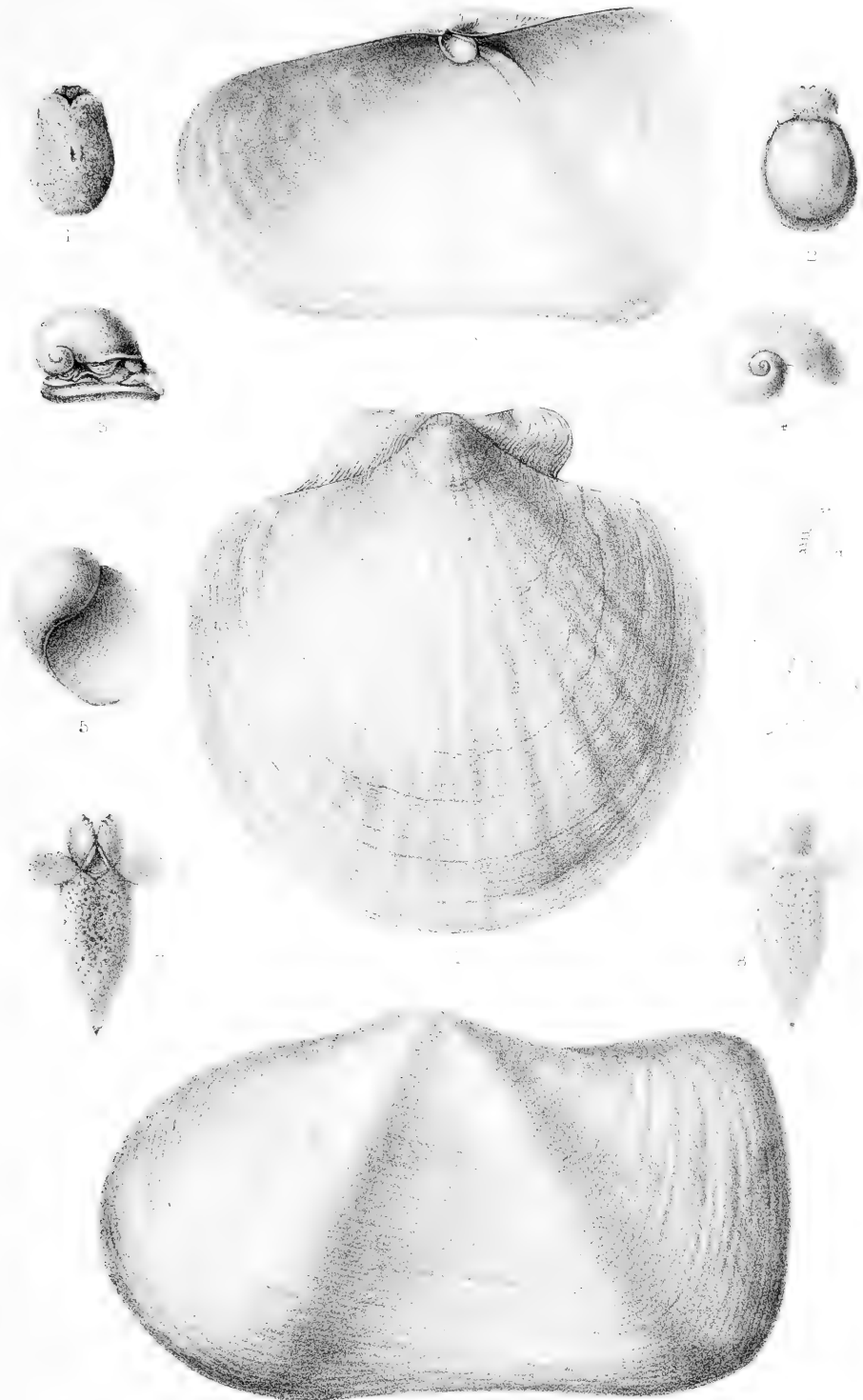
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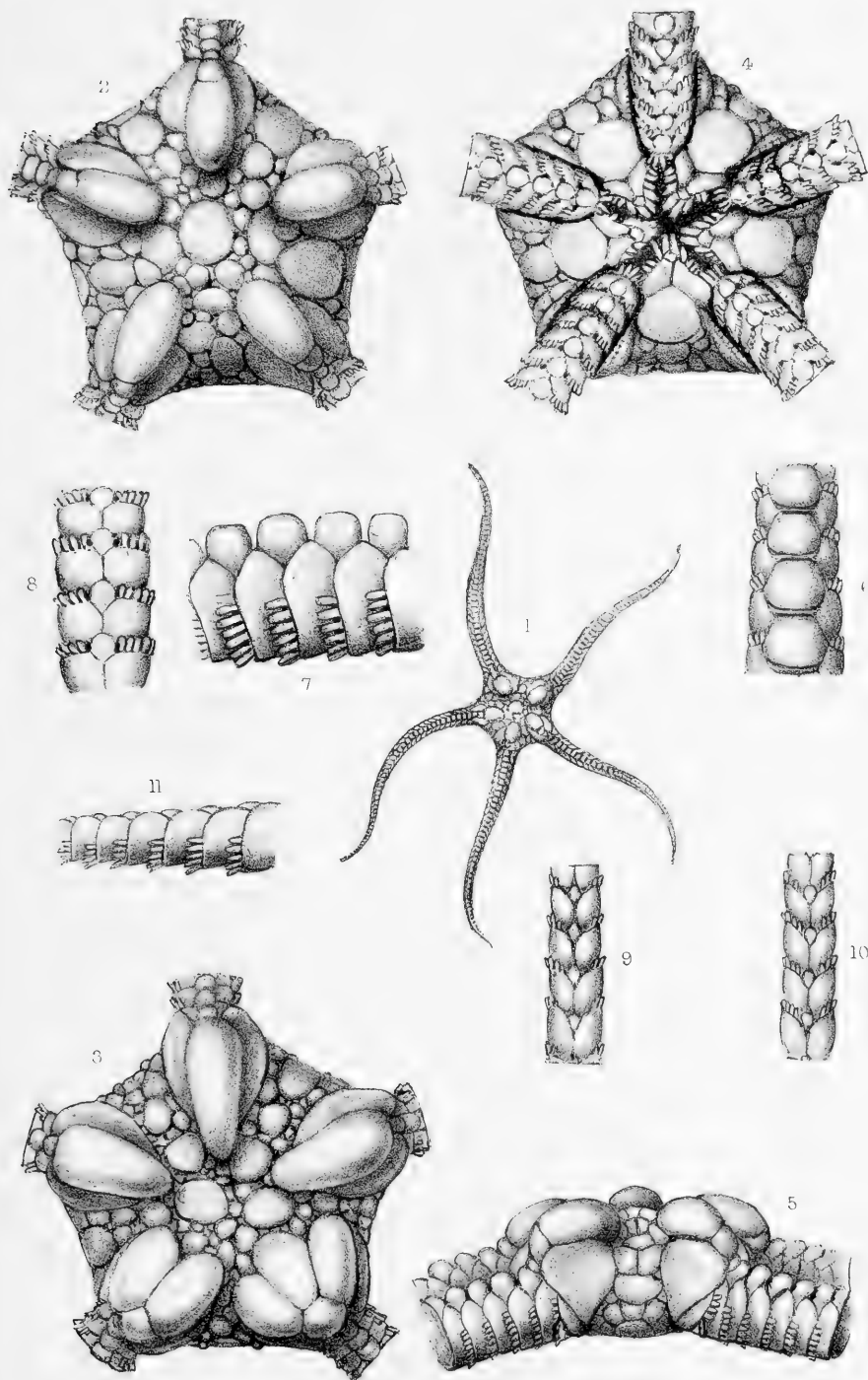
W.A.H. del.

A.S. Huth, Lith. London.

PSAMMAPLIDIUM NIGRUM.
P. ANTARCTICUM.

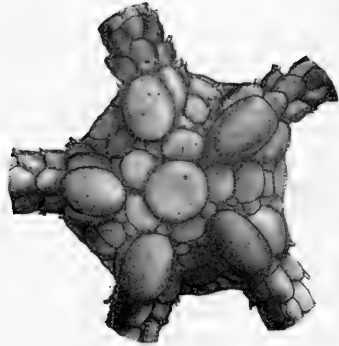
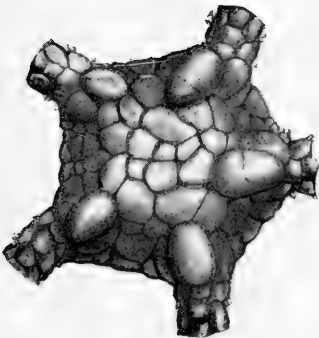
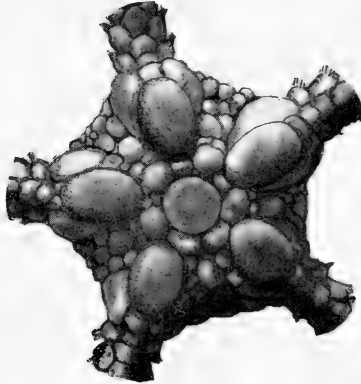
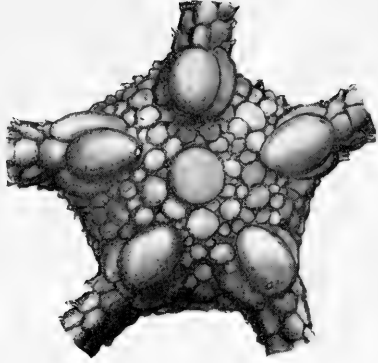
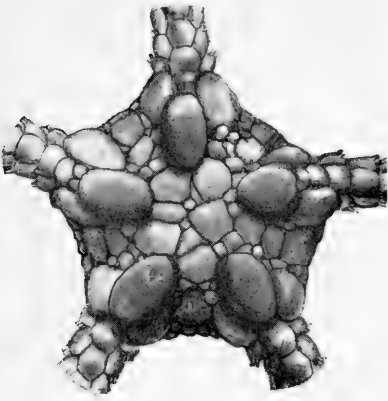






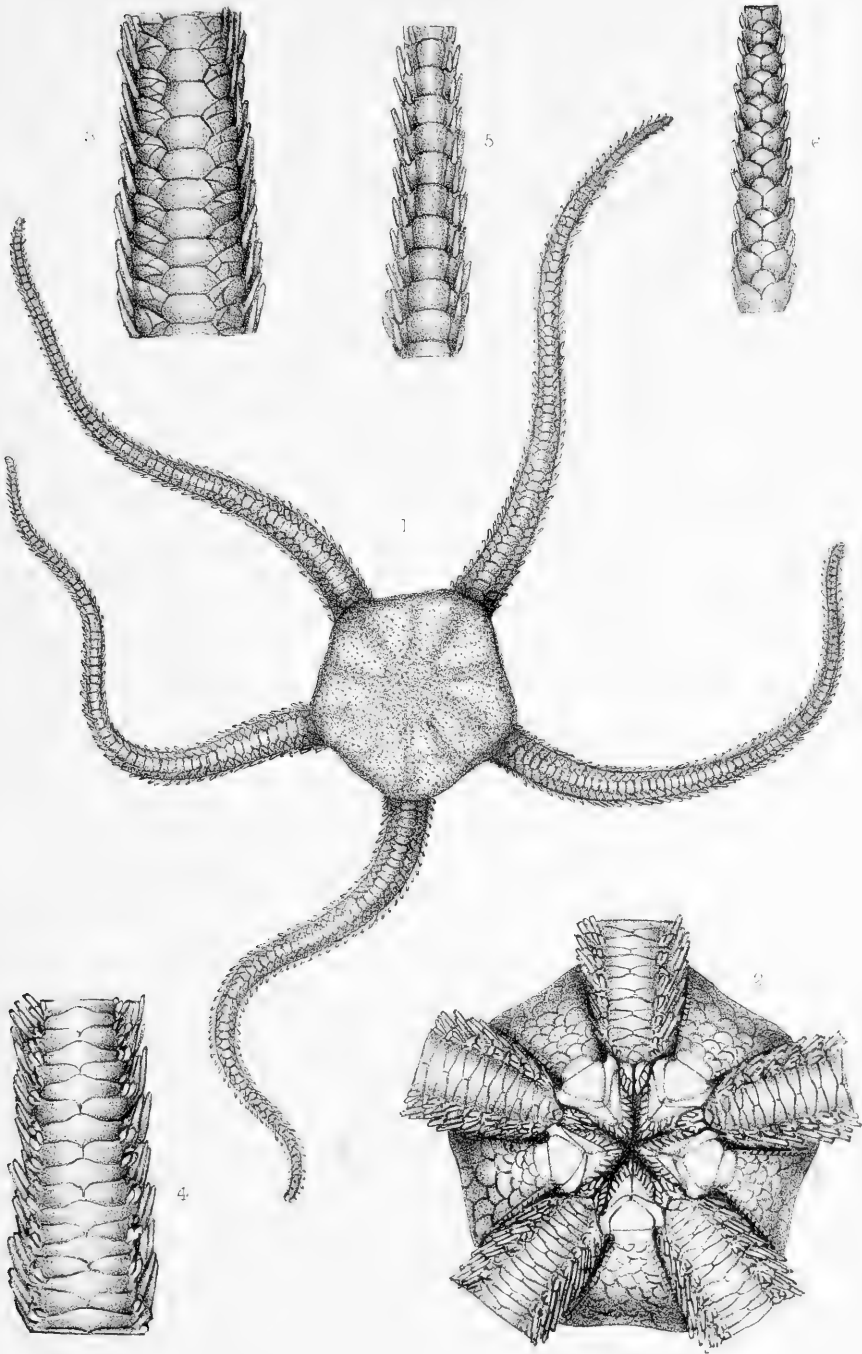
C. Berjeau del. et lith.

West, Newman imp



West, Newman imp.

OPHIOSTEIRA ANTARCTICA.
VARIETIES OF PLATES OF DISC.



C. Berjean del. et lith

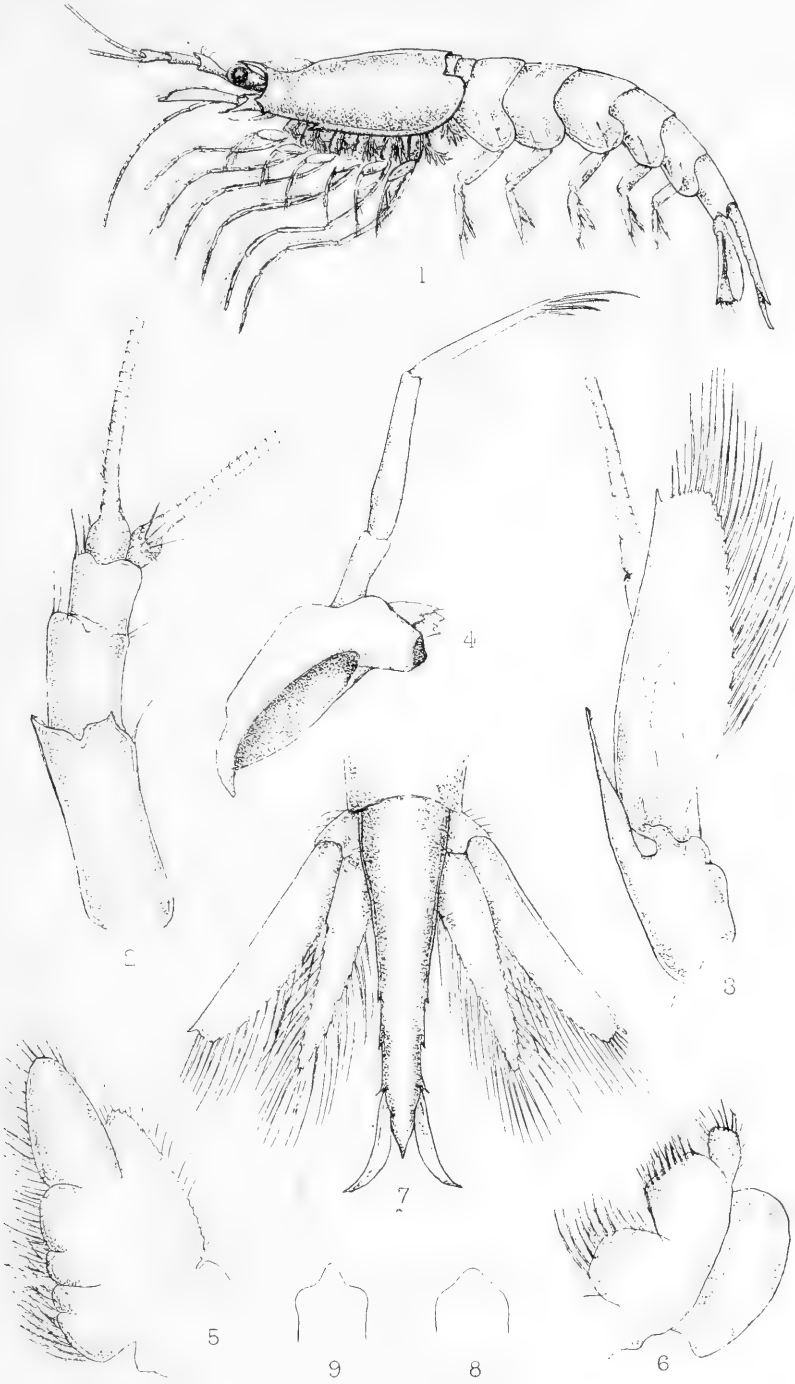
West. Newman imp

OPHIONOTUS VICTORIAE.



E.W. Sexton del. ad nat

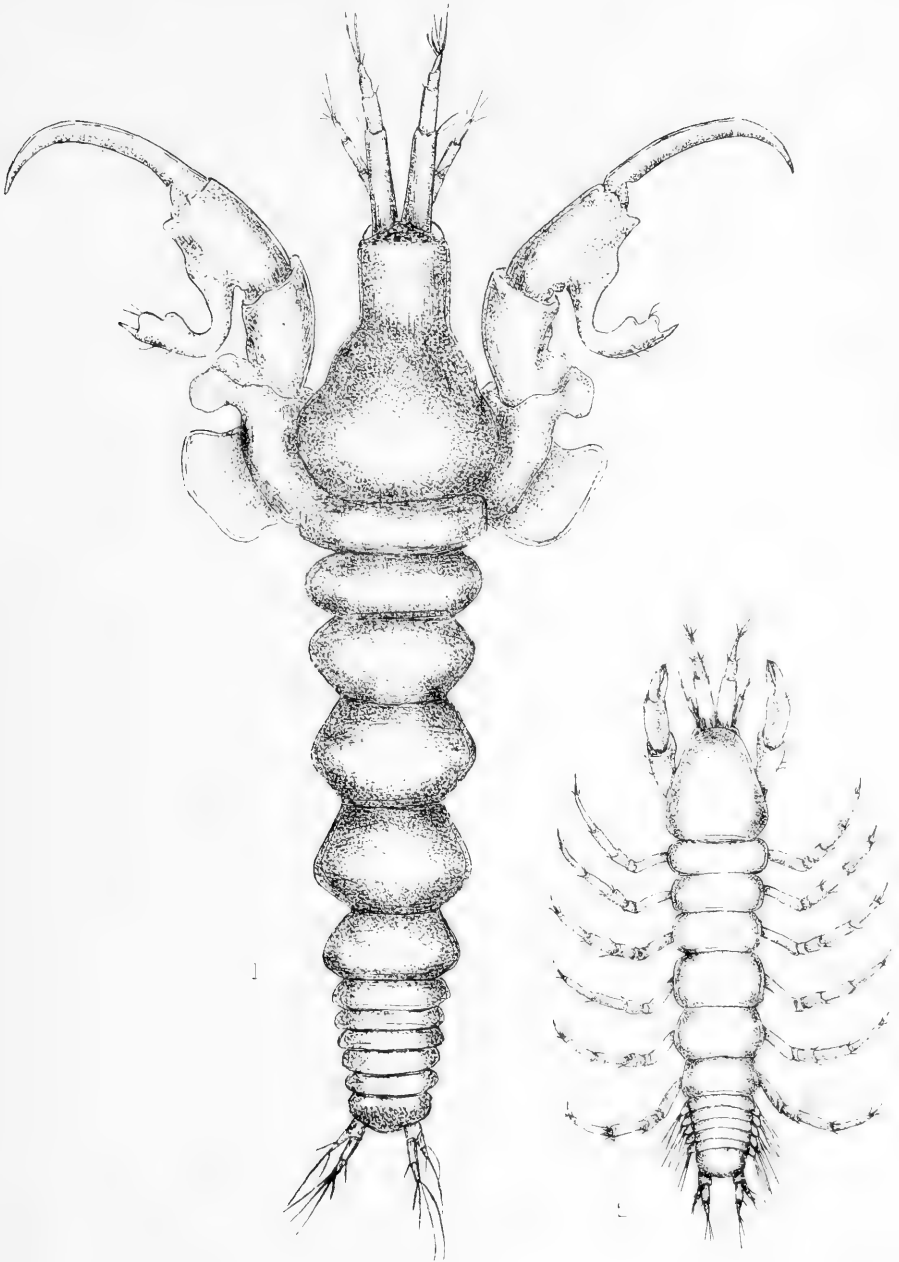
HIPPOLYTE AUSTRALIS



E.W. Sexton del. ad nat.

West, Newman photo-lith.

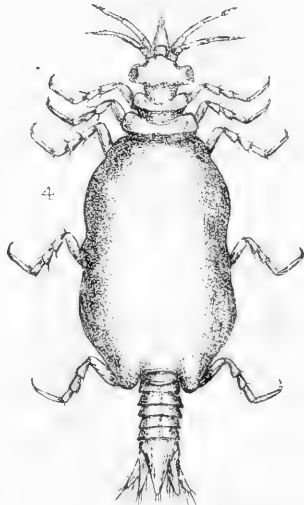
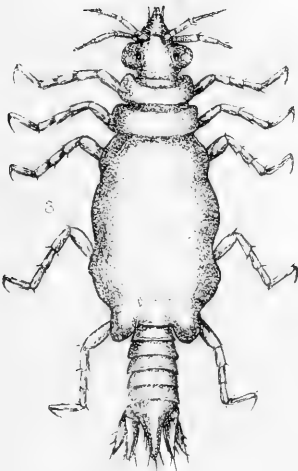
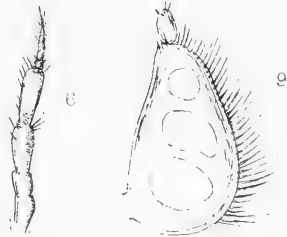
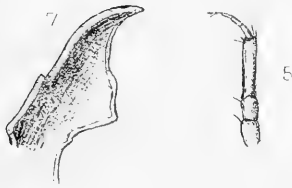
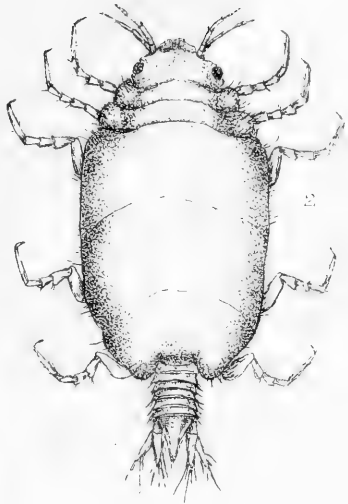
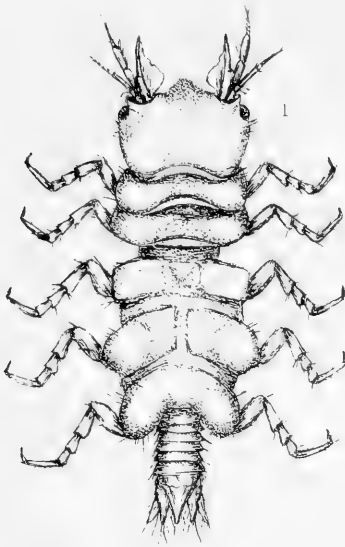
1-8 EUPHAUSIA GLACIALIS.
 9 EUPHAUSIA AUSTRALIS.



E.W.Sexton del. ad nat.

West, Newman photolith

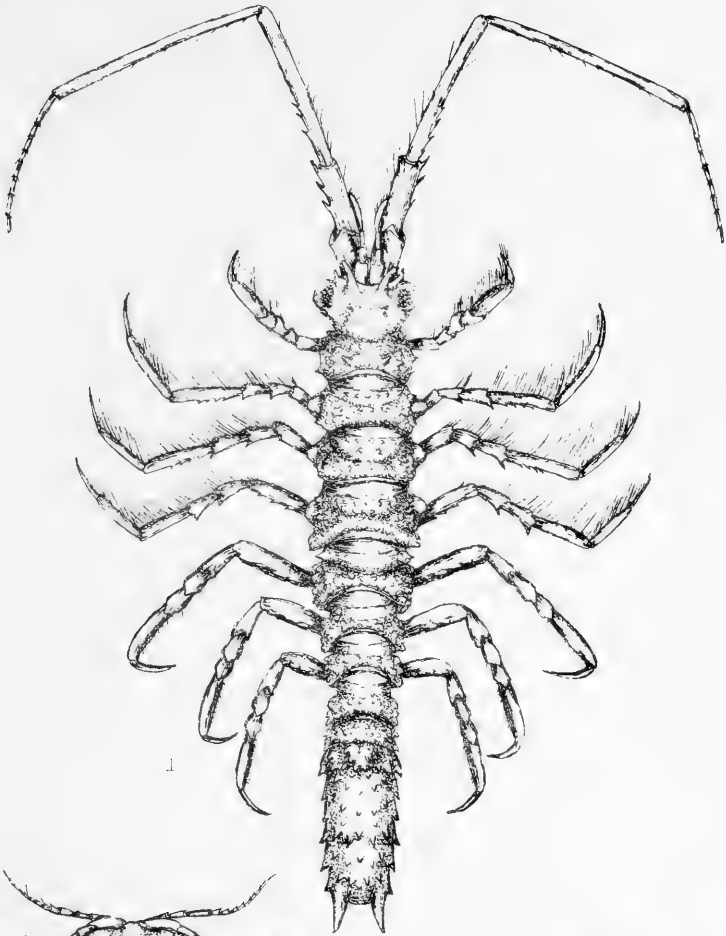
PARATANAIS ANTARCTICA



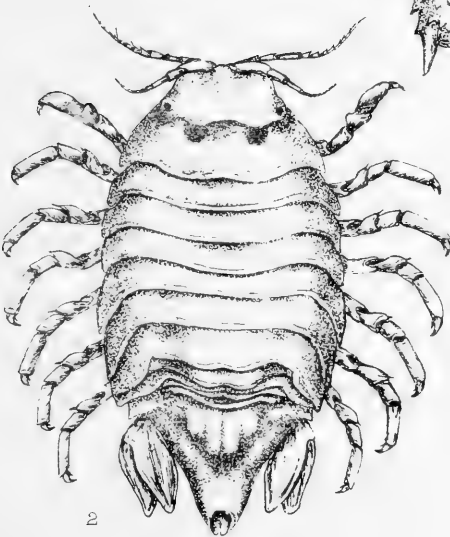
EWSexton, del ad nat.

West. L. ...

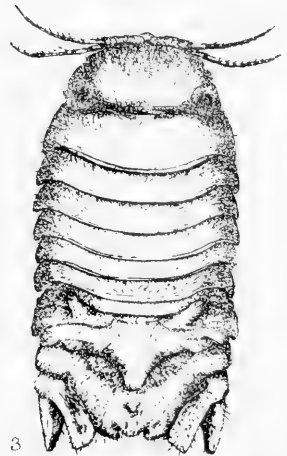
GNATHIA POLARIS



1



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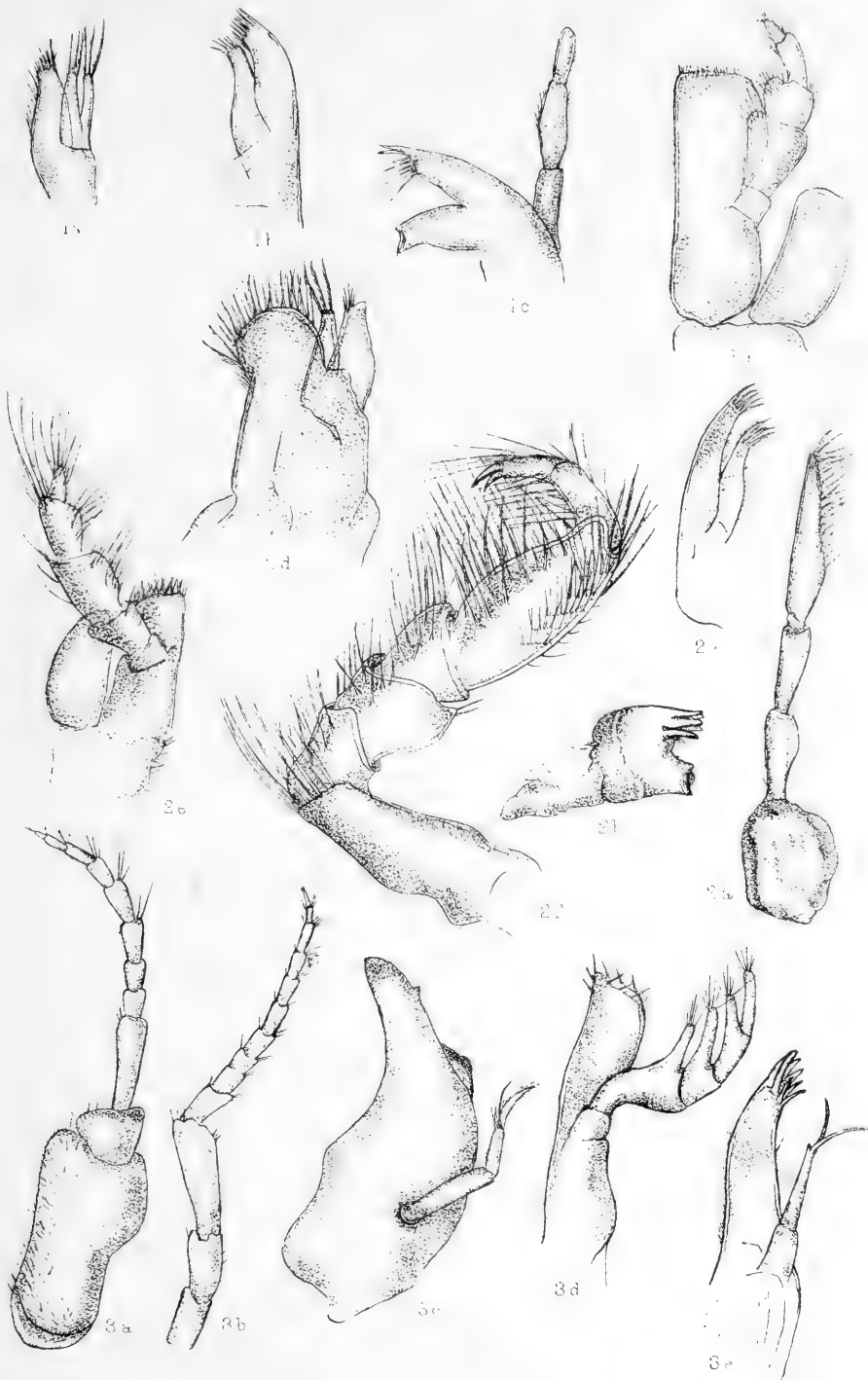


3

EWSexton del. ad.nat.

West, Newman photo. lith.

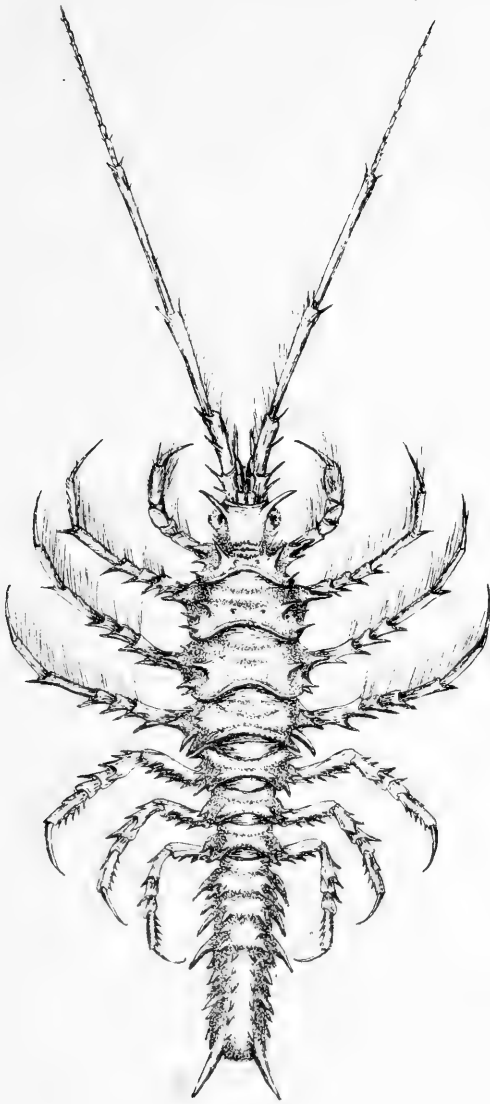
1. ARCTURUS ADAREI 2. CYMODOCEA ANTARCTICA
3. CYMODOCEA AUSTRALIS



E.W.Sexton del. ad nat.

West, Newman photo-lit.

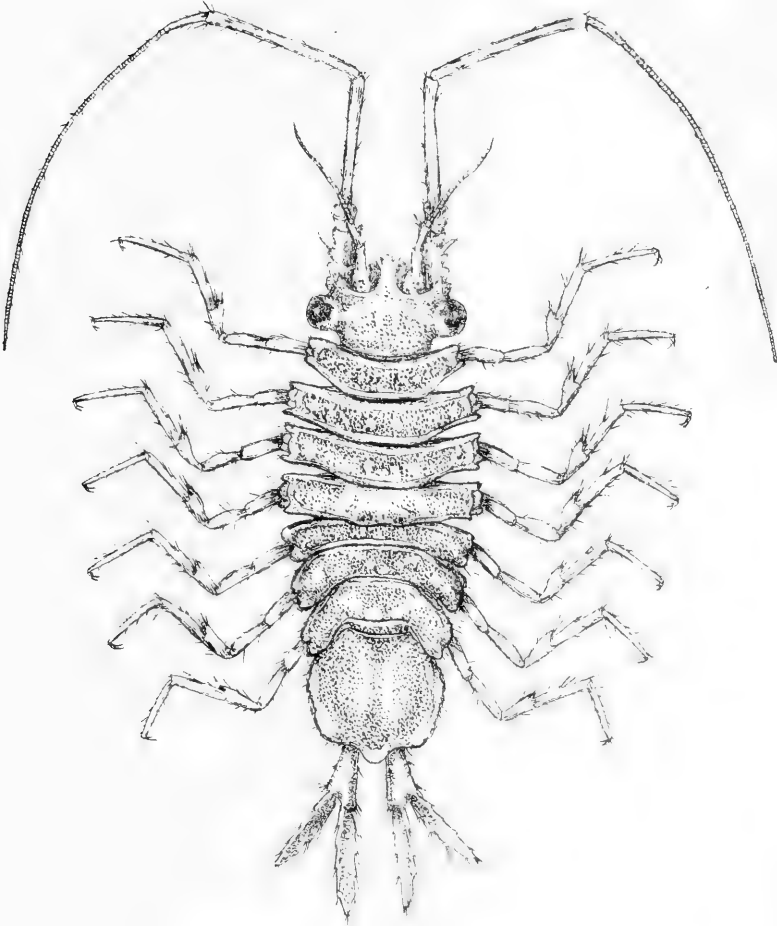
1 HALIACRIS AUSTRALIS. 2 ACTURUS POLARIS.
 3 CYMODOCEA AUSTRALIS



E. W. Sexton del. ad. nat.

West Newman photo. h. l.

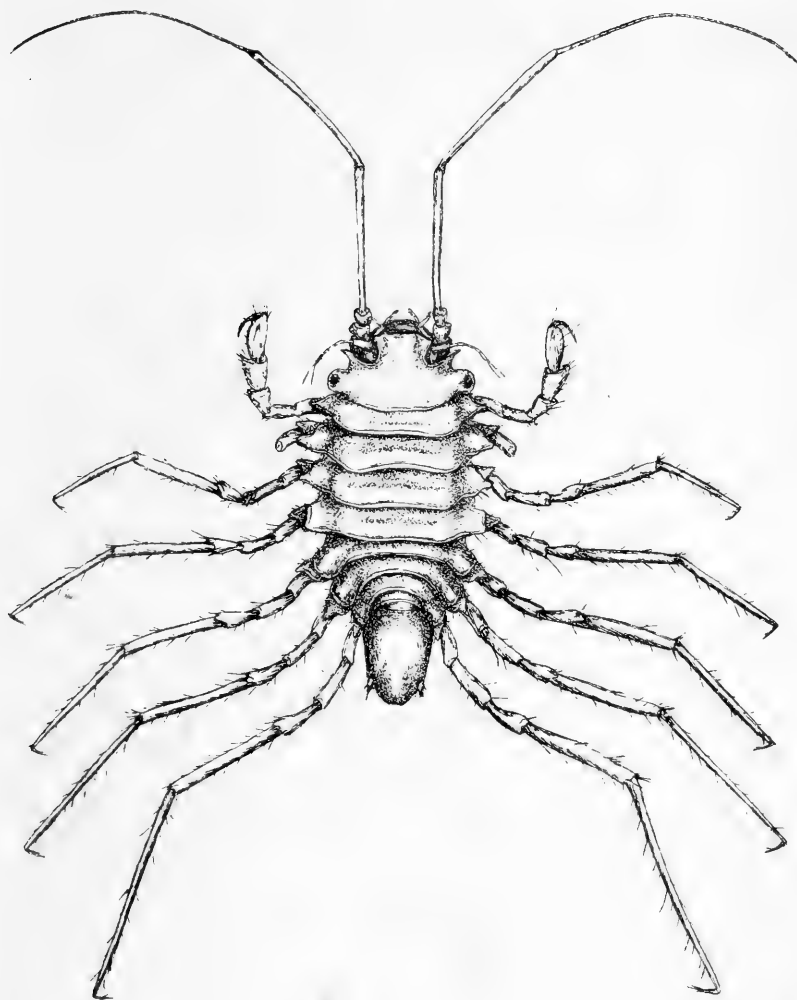
ARCTURUS POLARIS.



EWSexton. del. ad nat.

West Newman photo. Dur.

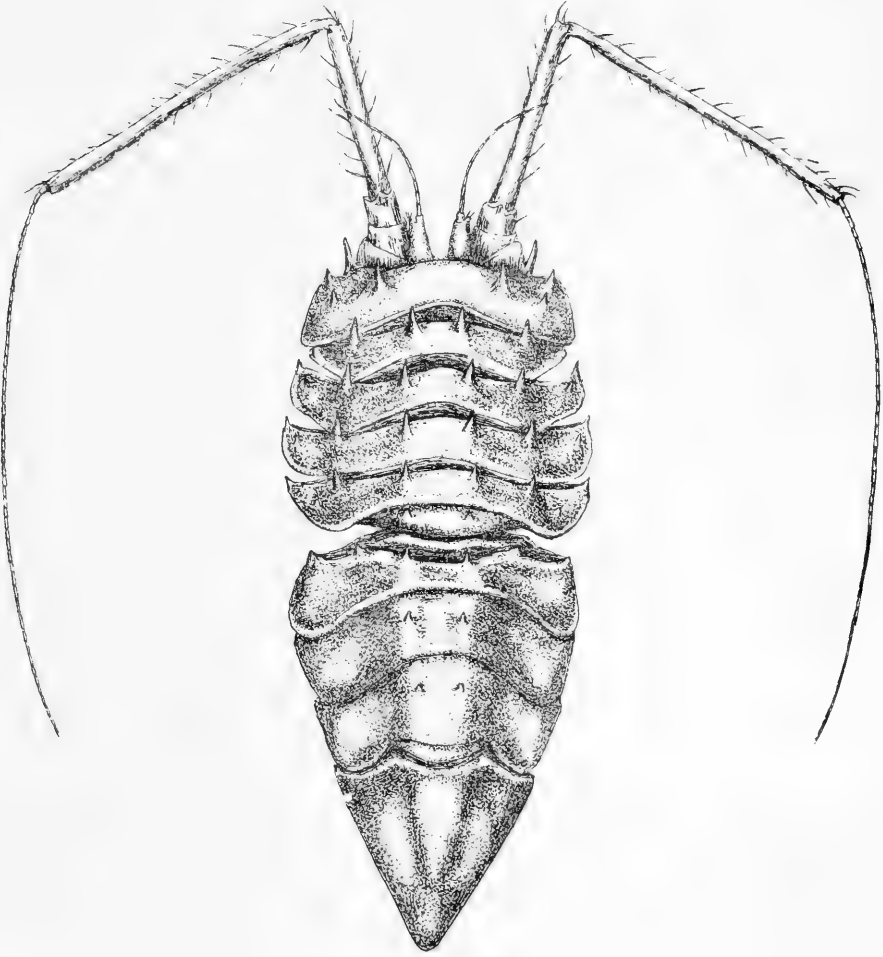
NOTASELLUS AUSTRALIS



EMV. Sexton del. ad nat.

West. Newman photo lith

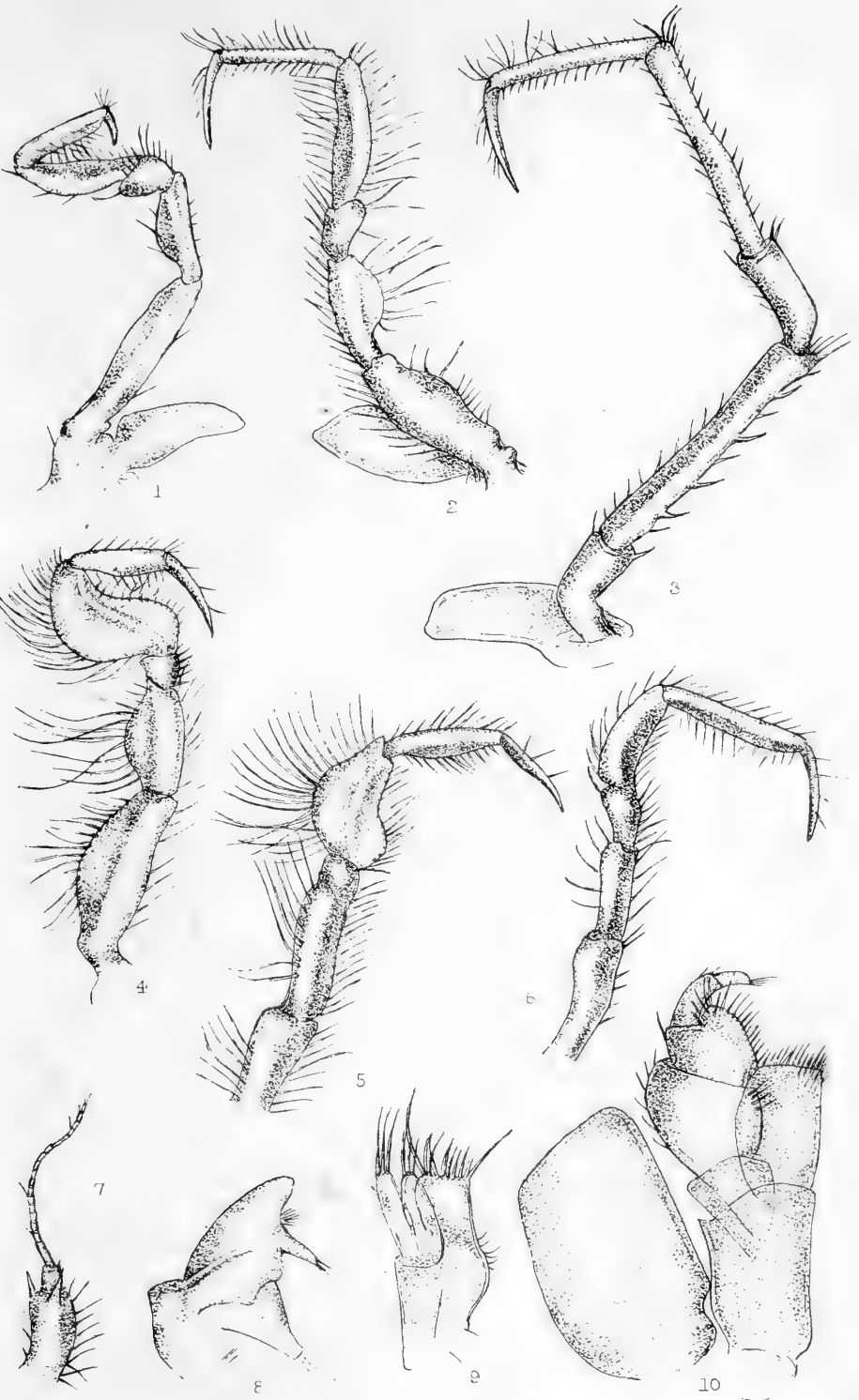
HALIACRIS AUSTRALIS.



EWSexton del ad nat.

West, Newman photo lith.

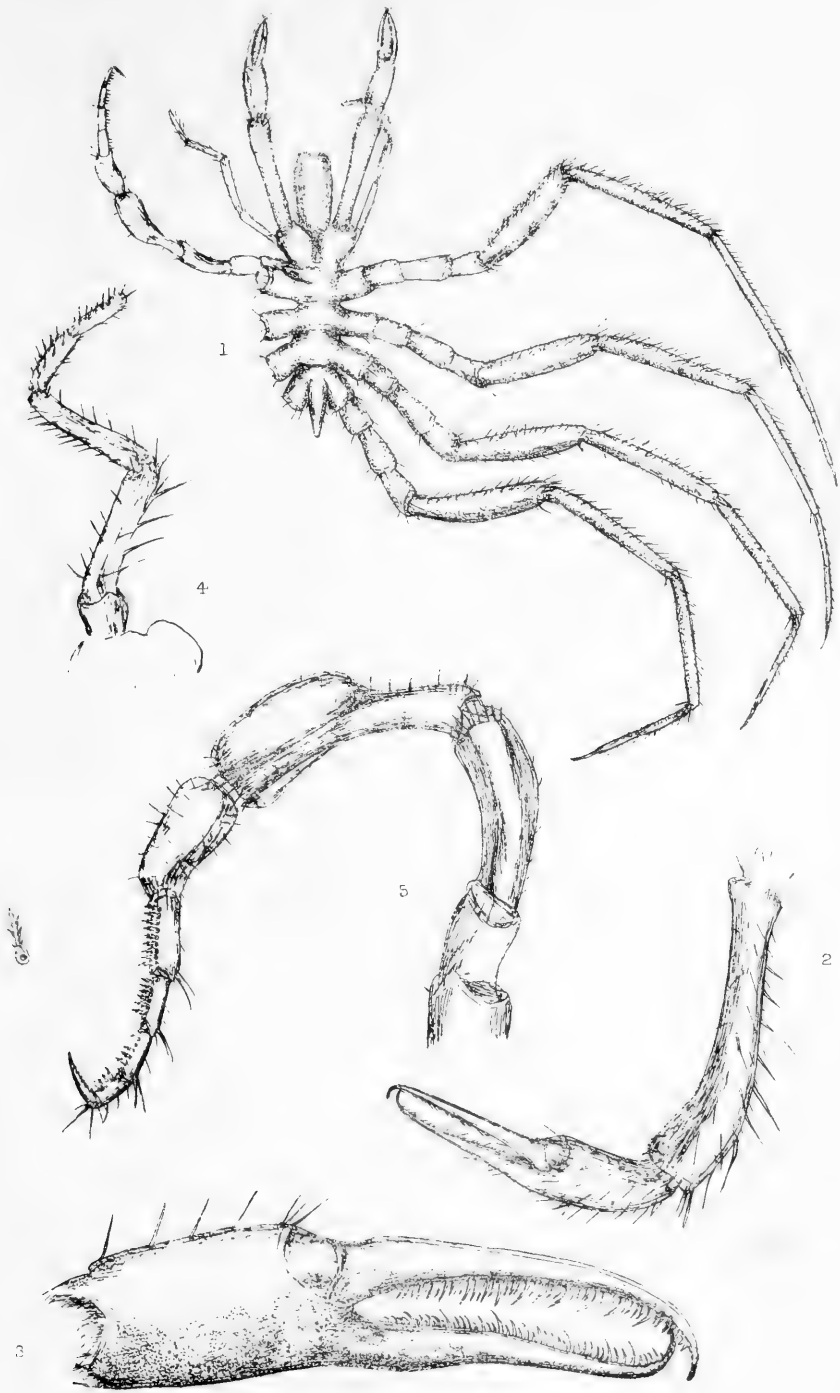
ECHINOZONE SPINOSA



EWSexton del. ad nat

West Newman photo lith.

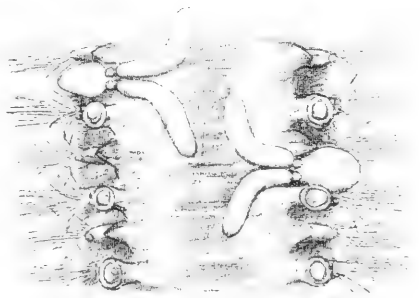
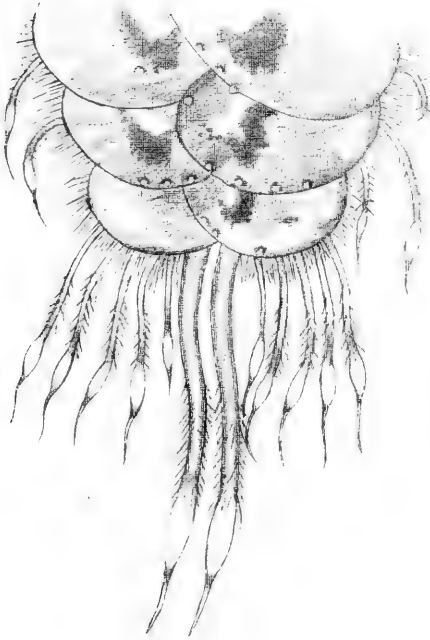
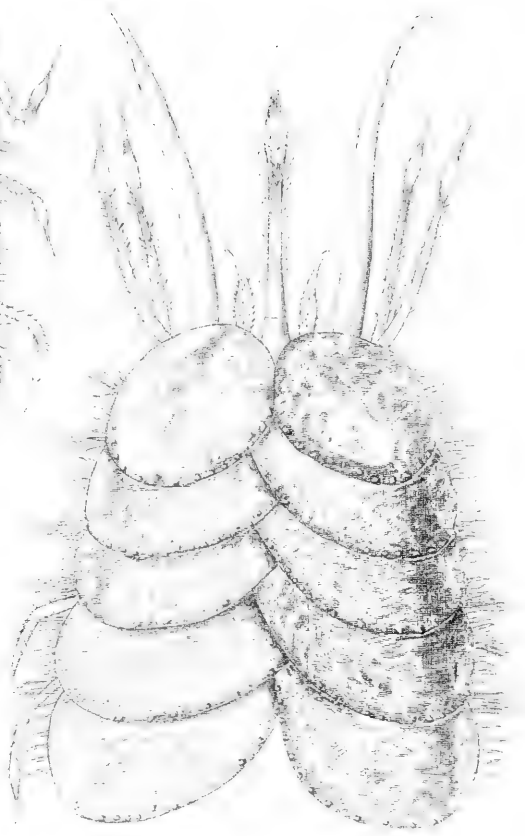
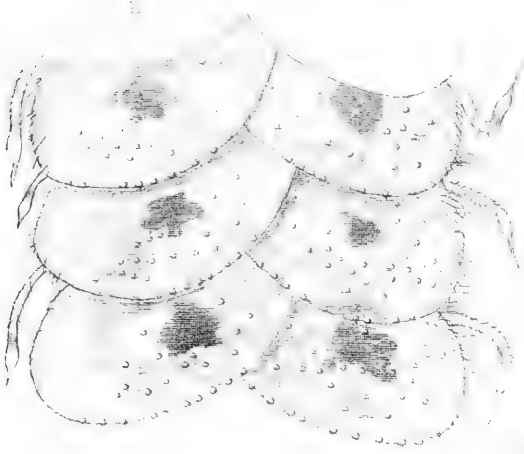
ECHINOZONE SPINOSA.



W.Sexton del. ad. nat.

West Newman photolith

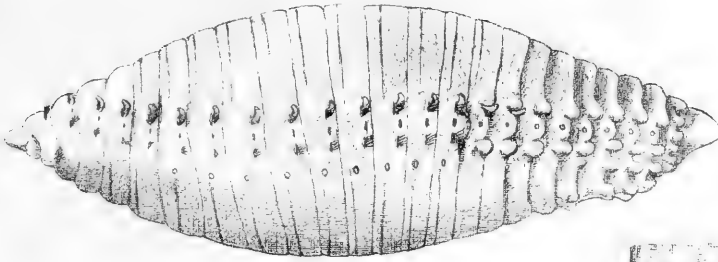
NYMPHON AUSTRALE



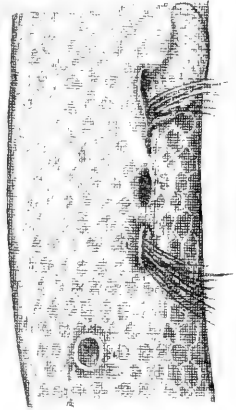
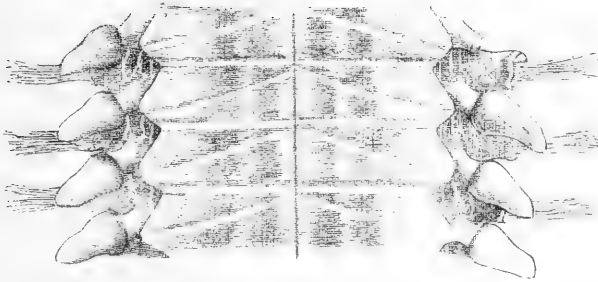
T.G. Stevens del.

West Newman plate 114.

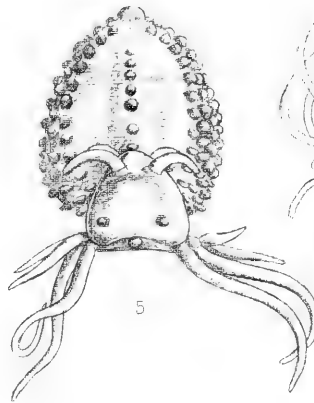
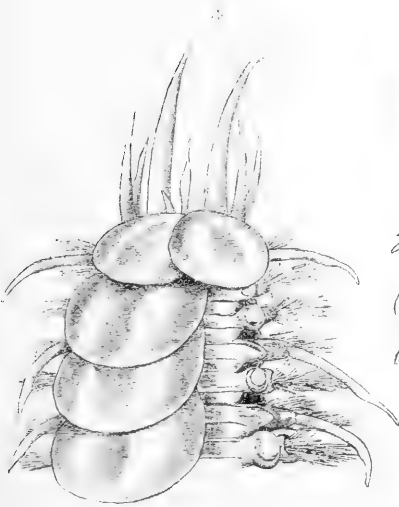
HARMOTHOE SPINOSA.



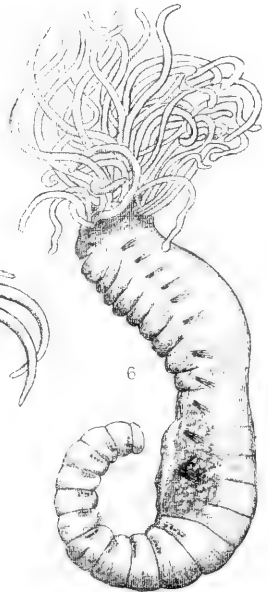
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2



5

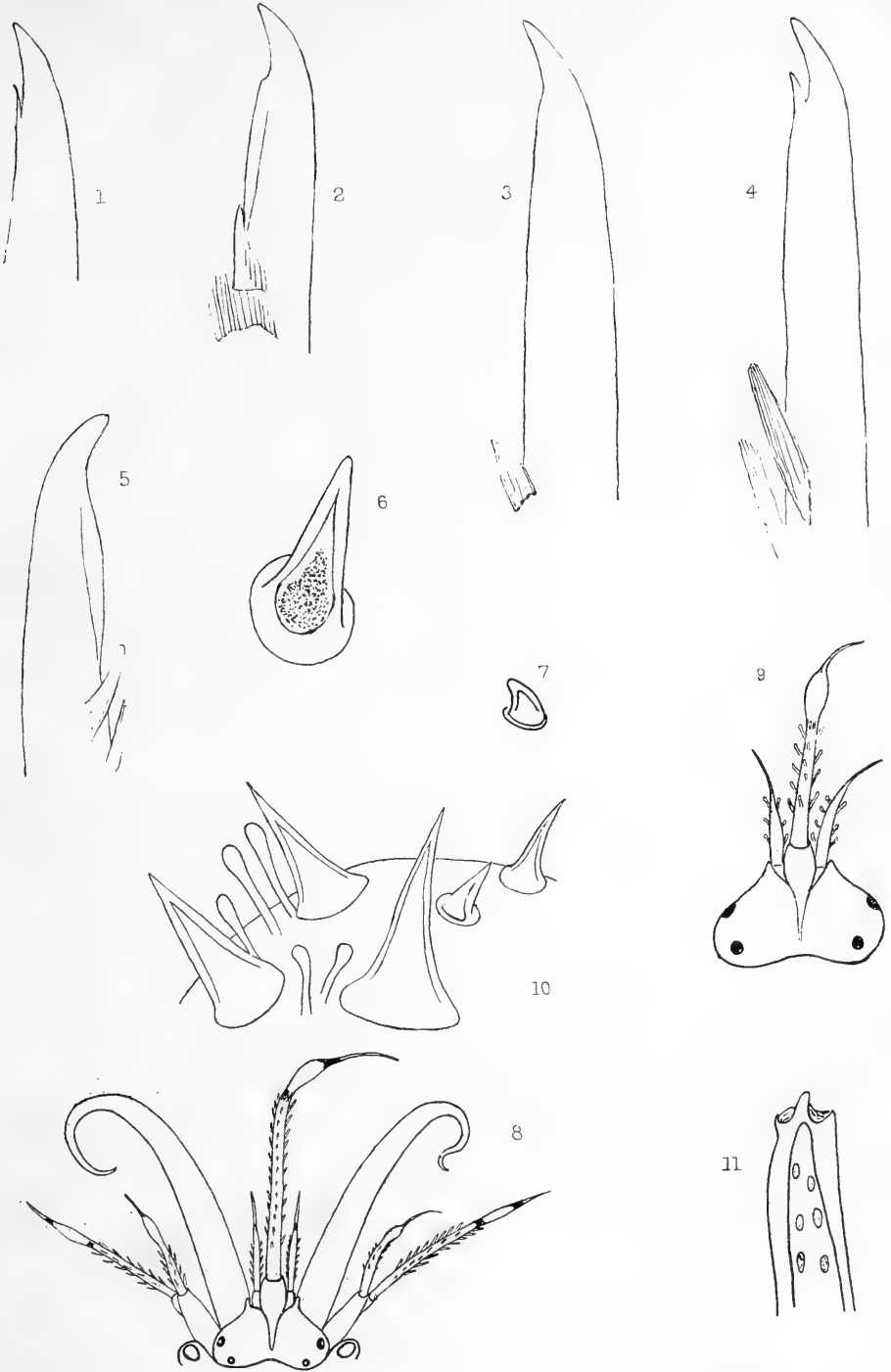


6

T.C. Stevens del.

West, Newman photo lith.

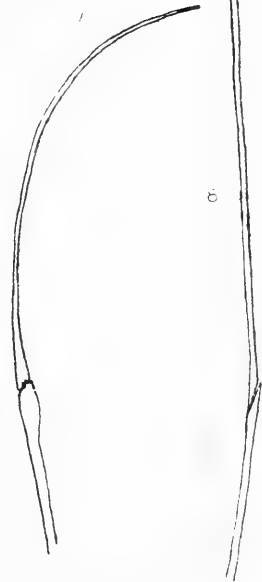
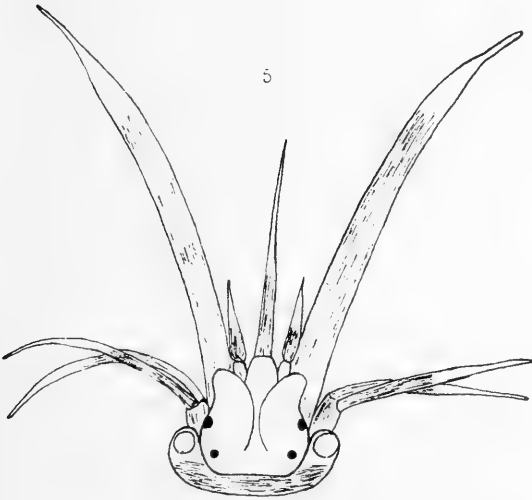
1. *PHYLLODOCE KERGUELENSIS*.
 2. *PHYLLODOCE CRASSICIRRIS*.
 3. *PHYLLODOCE MADEIRENSIS*.
 4. *EREUTHO ANTARCTICA*.



A.Willey del.

West, Newman photo lith

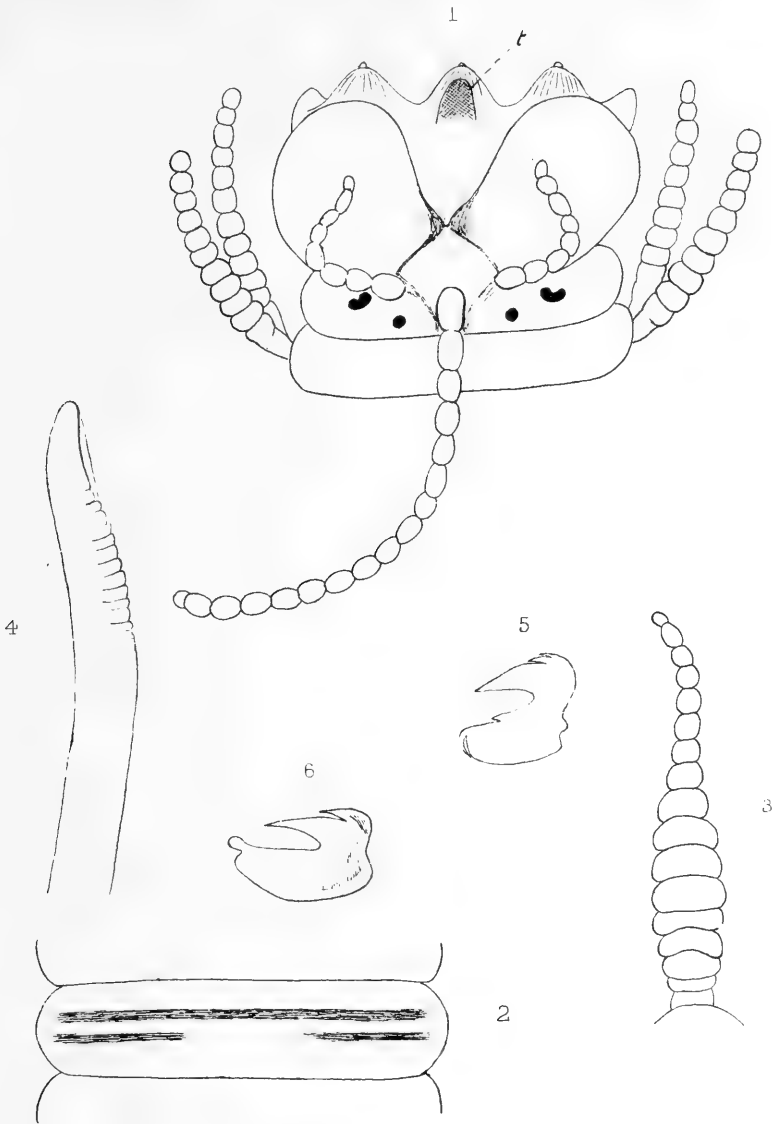
1 & 2, 4 - 8. HARMOTHOE SPINOSA.
3, 9-11 H. CROSSETENSIS.



A. Willey del.

West, Newman photo lith.

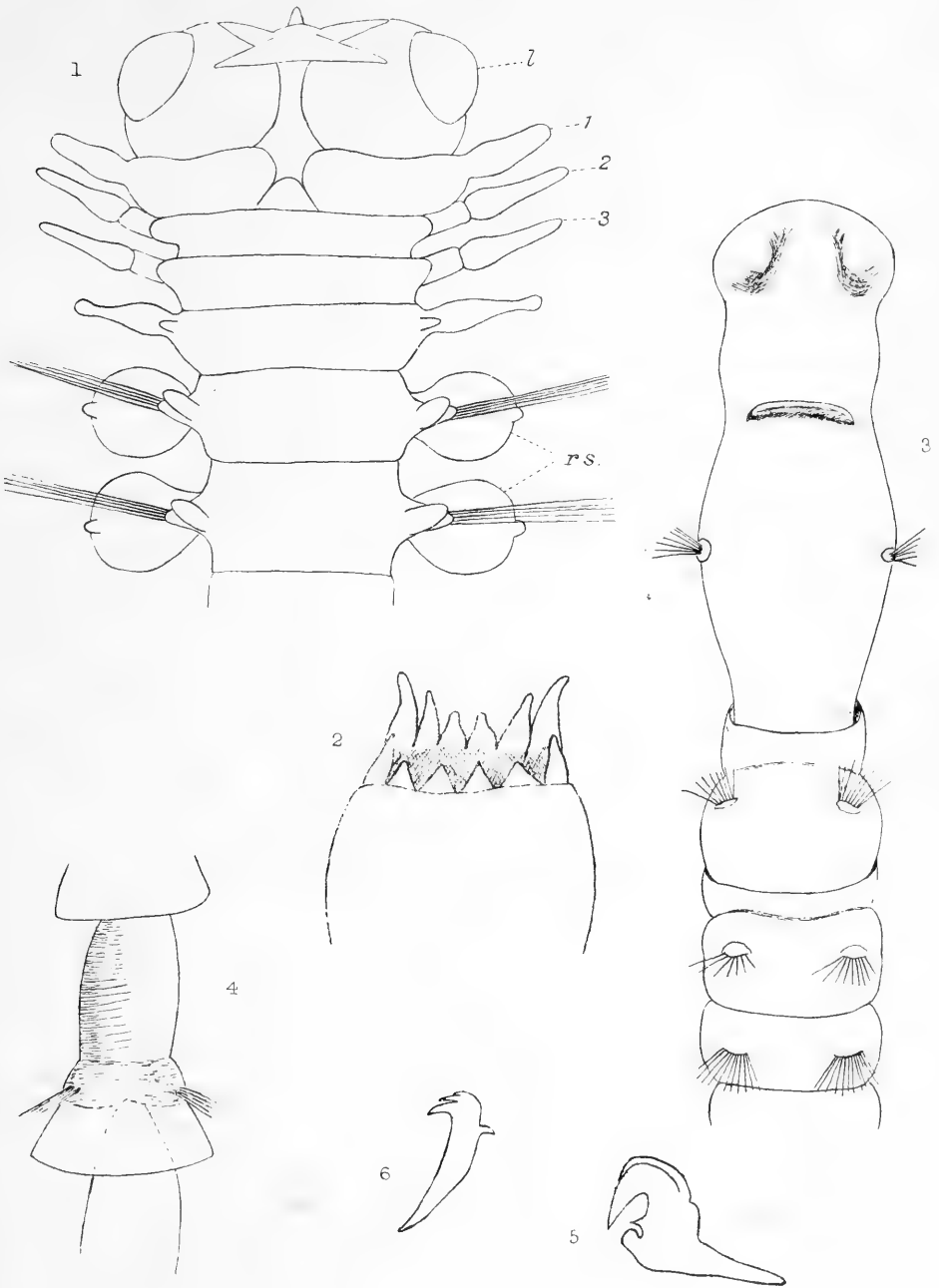
- 1-4. GATTYANA CRISTATA.
- 5&6. MALMGRENIA CRASSICIRIS.
- 7. PHYLLODOCE MADEIRENSIS.
- 8. VANADIS ANTARCTICA.



A. Willey del.

West, Newman photo lith.

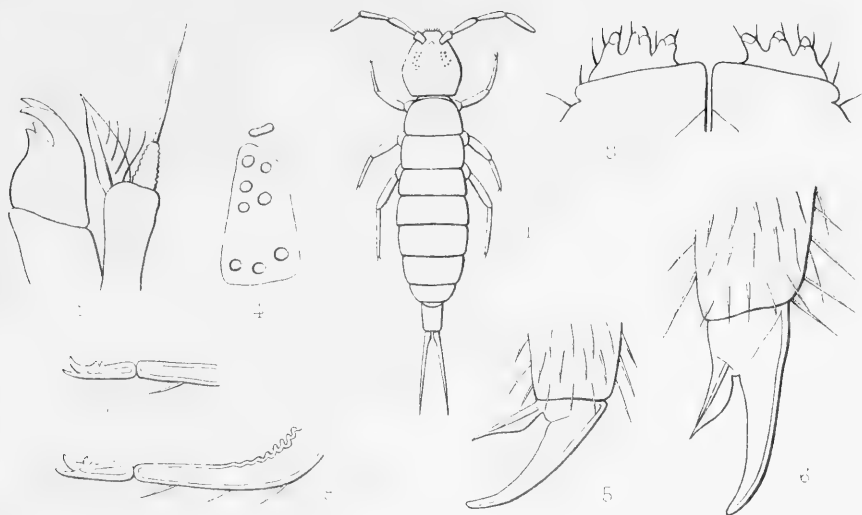
- 1-3 TYPOSYLLIS HYALINA
- 4. ARICIA MARGINATA.
- 5. NICOLEA AGASSIZI.
- 6. THELEPUS ANTARCTICUS



A Willey del.

West, Newman photo lith

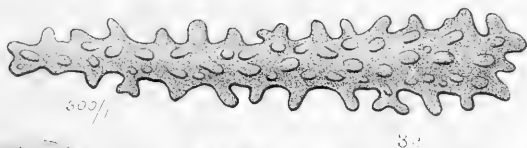
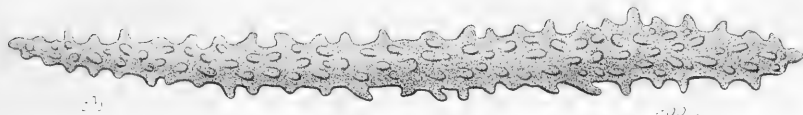
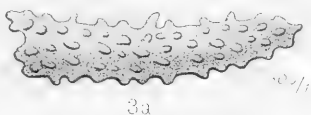
1 & 2. VANADIS ANTARCTICA
 3-5. RHODINE LOVENI.
 6. EREUTHO ANTARCTICA.



G.H.C.del.

West,Newman lith

ISOTOMA KLOVSTADI.



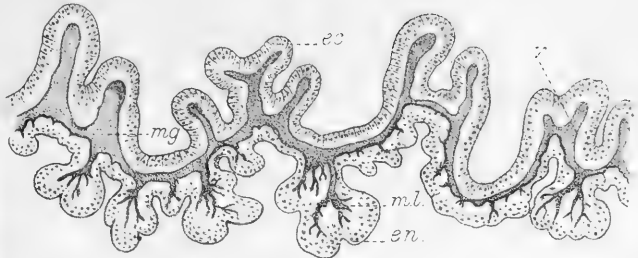
L.Roule del

West,Newman lith.

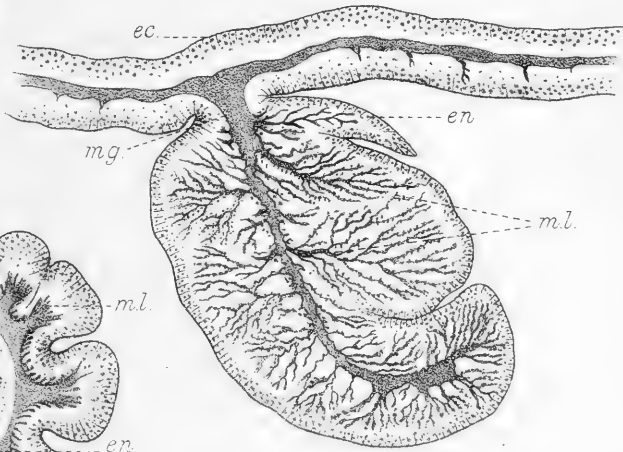
CLAVULARIA FRANKLINIANA.



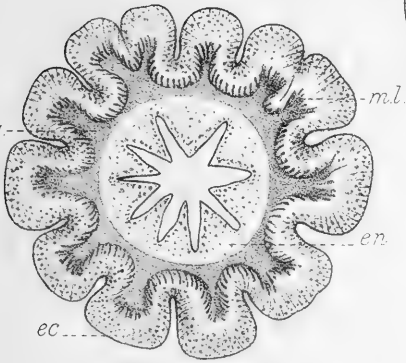
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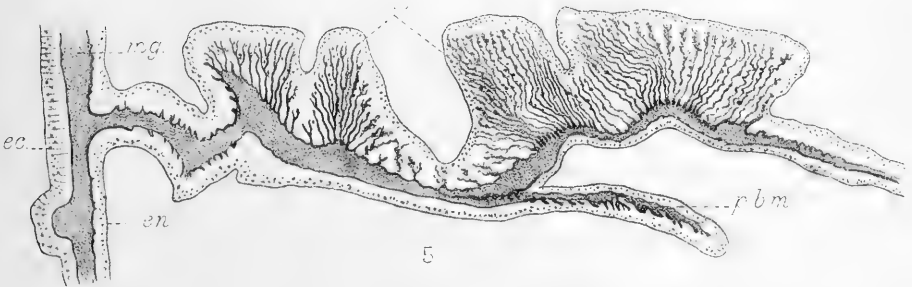
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2



3

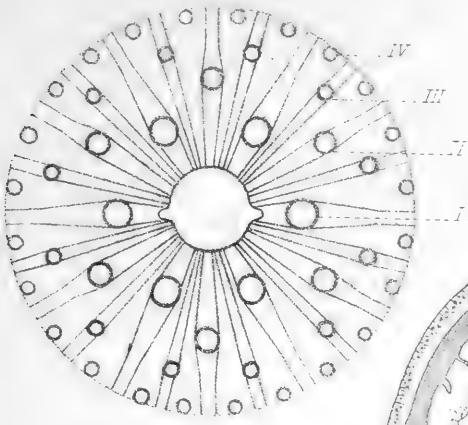


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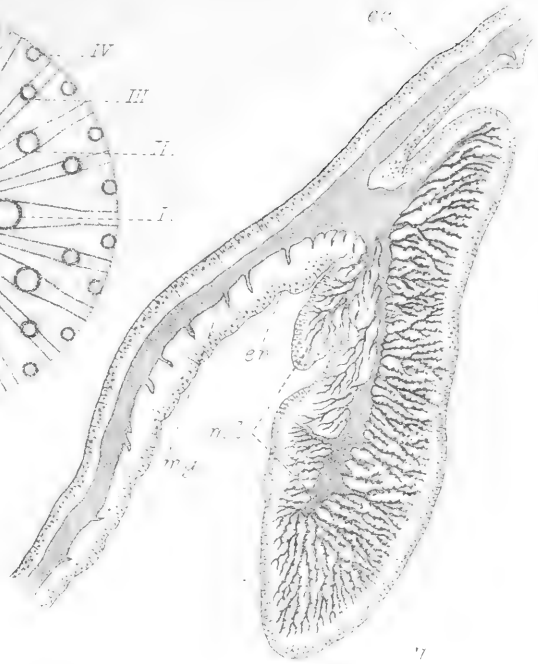
J.A.C. del.

West, Newman lith

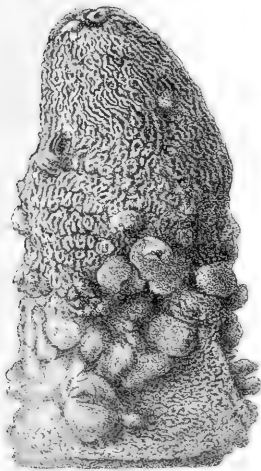
URTICINA SULCATA.



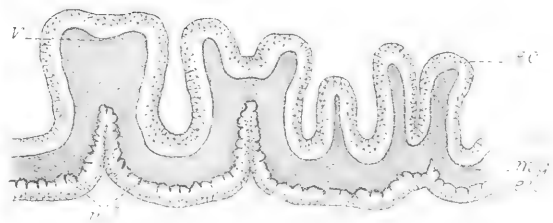
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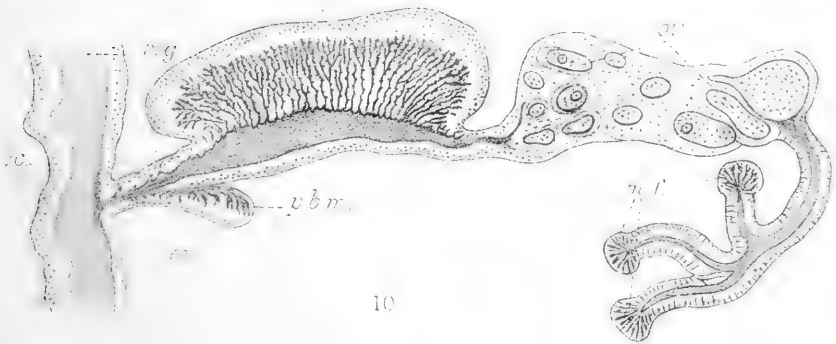
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6



9

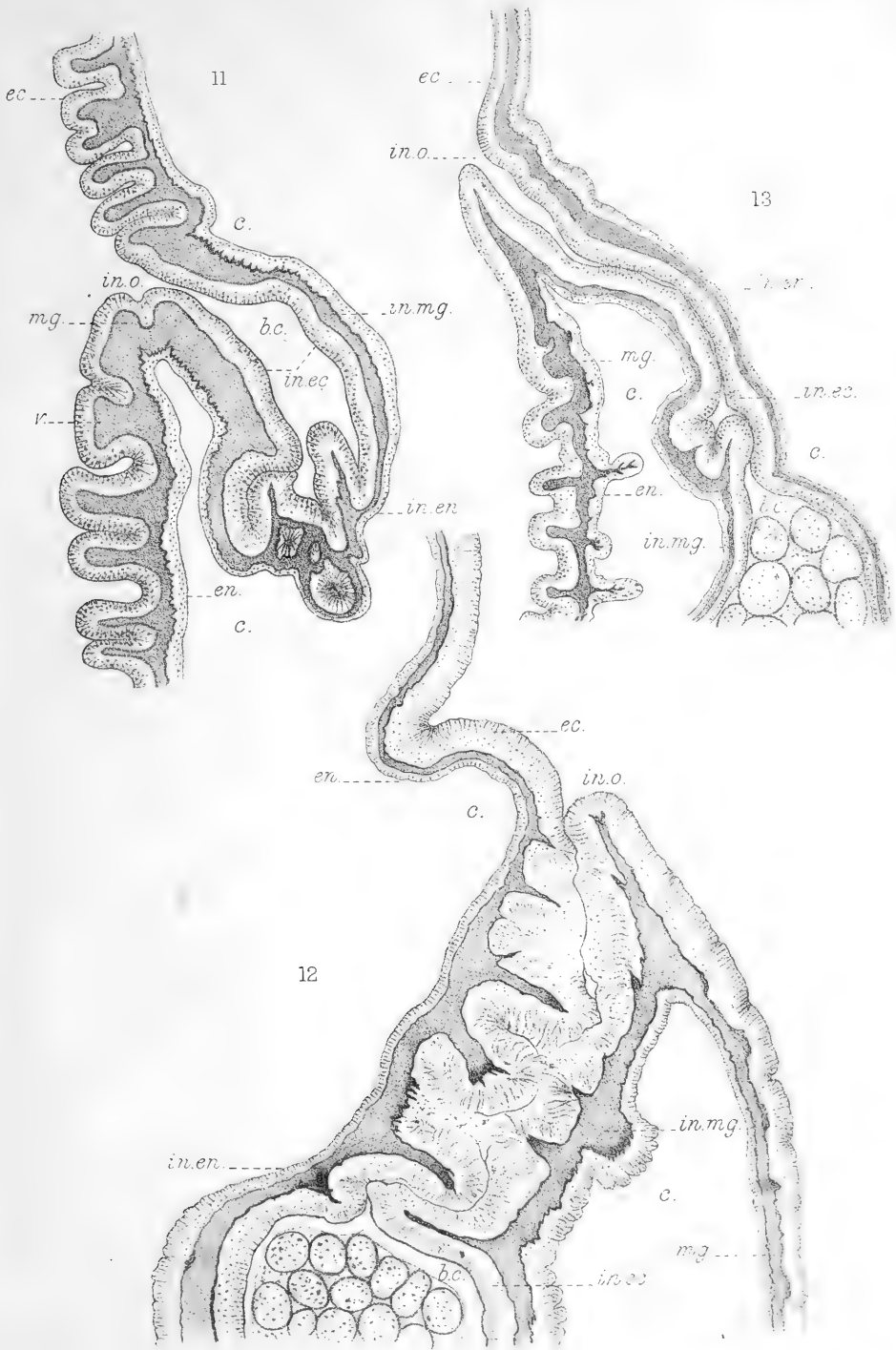


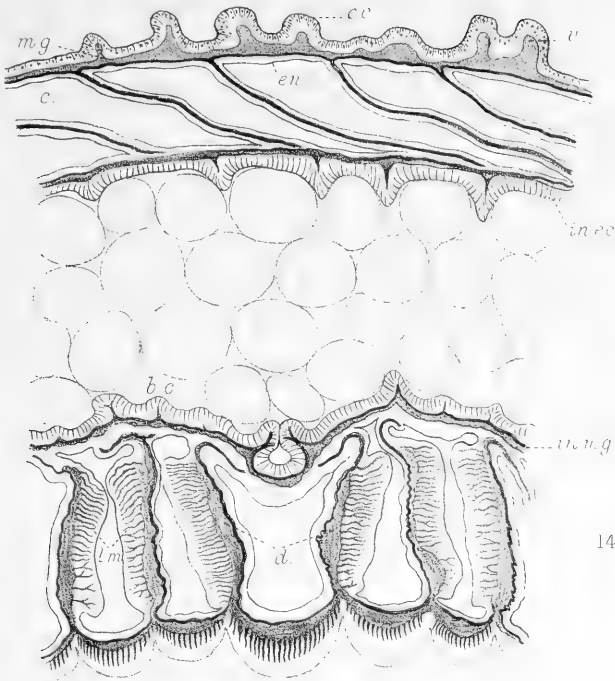
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J.A.C. del

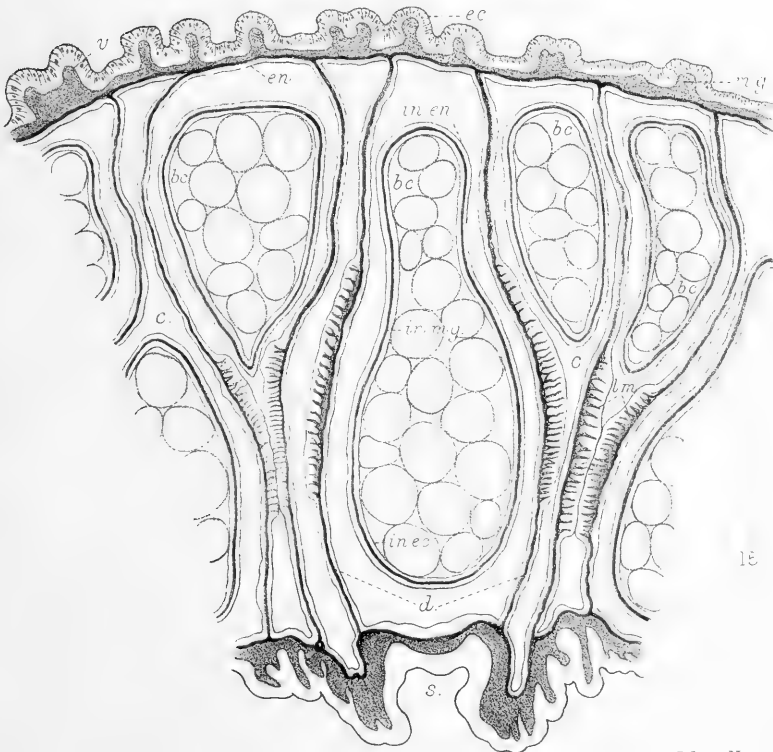
West, Newman lith

URTICINA CARLGRENI.

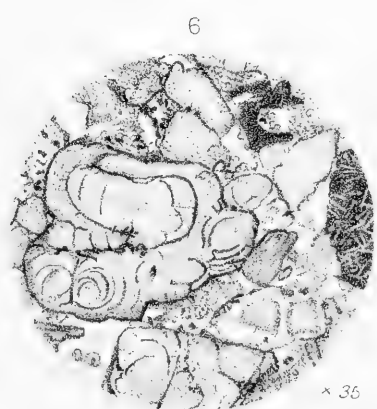
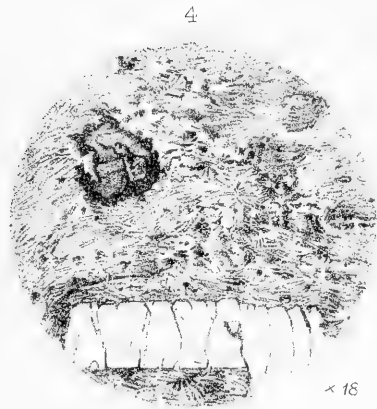
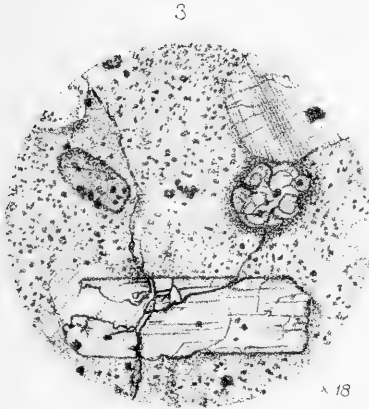
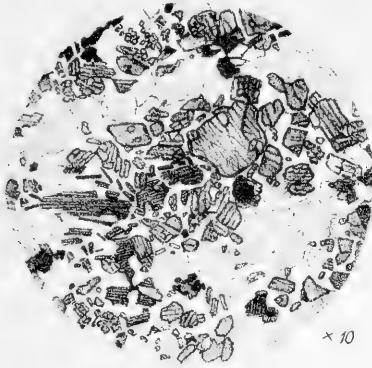




14



15



E. Drake del. et lith.

West, Newman imp.



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