

AUSTRALASIAN ANTARCTIC EXPEDITION

1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, D.Sc., B.E.

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VOL. VI. PART 5.

CEPHYREA INERMIA.

BY

W. B. BENHAM, M.A. (OXON.), D.Sc. (LOND.), F.R.S., F.N.Z. INST.

WITH ONE PLATE.

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CONTENTS.

	PAGE.
Introduction	5
<i>Priapulid</i>	6
<i>Phascolosoma</i>	7
<i>Physcosoma</i>	19
Bibliography	20
Explanation of Plate...	21
Index	22

GEPHYREA INERMIA.

By W. B. BENHAM, M.A. (Oxon.), D.Sc. (Lond.), F.R.S., F.N.Z.Inst., Professor of
Biology, University of Otago, New Zealand.

With Plate 11.

INTRODUCTION.

THE collection of Unarmed Gephyrea contains five species, viz.:—*Priapulus caudatus*, var. *tuberculato-spinosus* Baird; *Phascolosoma margaritaceum*, var. *capsiforme* Baird; *Phascolosoma eremita*, var. *australe* nov.; *Phascolosoma mawsoni* sp. nov.; and *Physcosoma scolops* Selenka and Man.

The last species came not from the Antarctic Sea, but from the neighbourhood of Tasmania—a new record for it, although it is common in the sea round New Zealand, which is its most southerly habitat. As I have mentioned in my Report on the Polychæta, there are some other resemblances between the faunæ of these two areas.

The two first species on the list are well-known Antarctic and Subantarctic forms, and have been recorded by most of the recent expeditions to these southern seas. I have discussed below the question as to whether Michaelsen's three species of *Phascolosoma*, from South Georgia, are or are not to be included in the variety *capsiforme*, and the conclusion I have come to is in the negative.

The discovery of a variety of the arctic species *P. eremita* adds another instance to the list of "bipolar" species, which serves to strengthen, if need be, Théel's views as to bipolarity discussed in his memoir on the Gephyrea of the Swedish Antarctic expedition.

I have been so presumptuous as to analyse the characters usually regarded as diagnostic of species of *Phascolosoma*, but I recognise that a much wider field for comparison is needed before one can come to a final conclusion on the subject. The characters that are available are few in number, and many of them are, I believe, liable to a considerable degree of variation, as a consequence of the contractility of the animals. At the same time the structure of the skin, on which reliance has been placed in recent years, is not always available on account of imperfect preservation of the material and the lack in many cases of careful drawings of the papillæ.

ORDER PRIAPULOIDEA.

PRIAPULUS *Lamarck.*PRIAPULUS CAUDATUS *var. TUBERCULATO-SPINOSUS Baird.*

P. caudatus Lamarck (1801), p. 467.

P. tuberculato-spinosus Baird (1868), p. 106, pl. XI, fig. 2.

P. tuberculato-spinosus de Guerne (1888), p. 9.

P. caudatus var. antarcticus Michaelsen (1889), p. 10, fig. 3.

P. caudatus var. antarcticus Fischer (1896), p. 6 (1914A), p. 22, fig. 12.

P. caudatus Shipley (1902), p. 284.

P. caudatus forma tuberculato-spinosus Théel (1911), p. 18, pl. I, figs. 1-12.

P. caudatus Benham (1916).

Three individuals were included in the collection forwarded to me. Two of these were obtained at Commonwealth Bay in 3 fathoms of water, and one had been removed from the stomach of the fish *Zanclorhynchus spinifer* Gunther, caught near Macquarie Island (Waite). This is a new habitat for the Priapulid.

The specimen is soft and appears to show signs of the commencement of digestion. It is rather larger than the one from Commonwealth Bay, and shows the branching of the gills.

Of the Commonwealth Bay specimens, the larger has a total length of 35 mm., of which the introvert occupies 8 mm. and the caudal appendages 6 mm. So that the body itself is 21 mm. in length. It is 7.5 mm. in diameter, while the introvert is 10 mm.

The smaller individual measures only 10 mm. by 3 mm. The larger is a very pale brown, or perhaps dirty white, in colour with a slight greenish tinge. The gills are much contracted, so as to be short rounded lobes; some are distended into oval bladders; all are crowded together, so as to conceal the tail.

The preanal ring of papillæ presents but a slight "gap," much less noticeable than that shown in Michaelsen's figure, which may perhaps be due to the fact that this specimen is strongly contracted. In the smaller specimen the "gap," indeed, is not recognisable. But, as Théel has shown (1911), the presence of this gap has not the value that Michaelsen assumed, as the northern form also presents it. The real distinction between the typical species and this southern variety lies in the form of the teeth at the entrance to the introvert, which are so admirably illustrated by Théel in the above memoir, in which there is a full discussion on the differences.

Localities.—

Commonwealth Bay, Boat Harbour, 3 fathoms (two).

Macquarie Island (stomach of fish).

Distribution.—South Georgia (Mich.); Tierra del Fuego (Fischer); Cape Adare (Shipley); St. of Magellan, Falkland Islands (Baird, de Guerne) Graham Land Region (Théel).

ORDER SIPUNCULOIDEA.

Family SIPUNLULIDÆ.

PHASCOLOSOMA *Leuckart*.PHASCOLOSOMA MARGARITACEUM, *var. capsiforme* Baird.

(Plate 11, figs. 1, 2.)

P. margaritaceum Sars (1851), p. 25, *cf.* Selenka (1883), p. 25, for synonyms.*P. capsiforme* Baird (1868), p. 83, pl. IX, fig. 3.*P. margaritaceum*, *var. capsiforme* Fischer (1896), p. 3 (1914 A), p. 10.*P. capsiforme* Shipley (1902), p. 285.*P. margaritaceum* Théel (1911), p. 26.

Five individuals were contained in the collection, varying in length from 160 mm. to 28 mm.

The remarks that follow apply to the largest.

The skin is a dirty grey, rather silvery, tending to a pale greyish-brown at the hinder end and on various parts of the body, which suggests that the epidermis had been rubbed off from parts. To the naked eye the skin looks smooth except at the hinder end, which is rather rough owing to circular furrows. One specimen obtained from Station 1 has a white silvery surface.

In the two smallest individuals the body wall is sufficiently translucent to allow the densely-coiled gut to be seen within.

Of the five specimens the majority have the hinder end rounded, but one of them, the next in size to that measured (below), is produced into a point exactly like Baird's figure of *P. capsiforme*. The condition, then, of the hinder end seems to be due to the state of contraction of the muscles of the body wall.

Under a hand lens the whole skin is seen to be traversed by fine, closely-set furrows, running round the body, and in some specimens with delicate longitudinal, undulating, and anastomosing furrows. In the islands between these are minute scattered transparent dots, which are irregularly arranged and widely spaced. These, when studied under the microscope, are found to be the openings of glands, seated on low, rounded papillæ of a pale yellowish colour, and the sides are tessellated (figs. 1, 2). In many cases the gland aperture is flush with the surface of the skin, though whether this is caused by the maceration of the epidermis I am unable to state.

In the various mounts I noted one exceptional papilla, which has a skittle shape: that is, it is constricted at the base. On the introvert and towards the hinder end of the body the papillæ are more densely arranged; and in some cases have the form of a mammilla, the aperture being seated on a teat-like prominence.

The appearance of the skin agrees with that figured by Selenka for the variety (pl. IV, figs. 38, 39) and with that of the species (fig. 37).

The tentacles are in three or four rows of about ten in each row. As I had to cut open the introvert in order to study them, it was impossible to ascertain whether they would have the appearance presented by the figure given by Théel for this form (pl. V, fig. 67), but altogether I estimate that there are thirty tentacles.

Internally, too, the worm agrees with Théel's figure (pl. V, fig. 68), though the number of intestinal coils varies with the length of the animal. Thus, in the largest specimen I counted twenty-eight coils wrapping round a similar number of internal upwardly-directed coils, the whole forming a close spiral measuring 20 mm. across. In a smaller specimen (from Station 1), which is 48 mm., including the introvert, the number of coils is twenty-four, while in the individual D, which is only 28 mm. in length, the number of coils is sixteen. The two dorsal retractor muscles are attached to the body wall at a point 8 mm. behind the anus; the ventrals arise 40 mm. behind that aperture.

There are no contractile tubules on the oesophageal vessel.

Localities—

Station 1, 350-400 fathoms (22 xii 13) (one).

Station 2, 318 fathoms (28 xii 13) (four).

Distribution.—This variety has been obtained from Magellan Strait, Tierra del Fuego, Falkland Islands, Picton Island, Cape Adare, Graham Region.

Remarks.—Five closely-allied species have been obtained from the Antarctic and Subantarctic seas—namely, *P. margaritaceum*, var. *capsiforme* Baird, from the Falkland Islands; *P. fuscum* Michaelsen; and *P. antarcticum* Mich., and *P. georgianum* Mich., from South Georgia; *P. socium* Lanchester, from Cape Adare.

P. georgianum appears to be distinguished from Michaelsen's other species by its short introvert, and its smooth translucent body wall with large dark papillæ on the skin.

The two other species from South Georgia are so closely related that even Michaelsen himself (1889) thought it not unlikely that they are in reality varieties or sub-species of *P. margaritaceum* (as also probably is *P. capsiforme* Baird).

Although a study of Michaelsen's account of these two species makes it difficult to separate them, Herubel was able to do so, for he records specimens of each from Port Charcot, though the differences on which he relies are very slight.

Fischer (1896, 1914) has recognised that *P. capsiforme* is but a variety or sub-species of the northern *P. margaritaceum*, and would even place as varieties of this species the three South Georgian forms of Michaelsen.

Lanchester (1908), in his analysis of the form he calls *P. socium*, seems also to suggest the identity of, at any rate, *P. fuscum* and *P. antarcticum*, and points out that *P. socium* presents some internal features which resemble the one, and others that recall the other of these two forms.

Théel (1911) has gone even further and places all these forms, not as varieties, but as members of the northern species.

Having discussed the characters usually employed in distinguishing species in this genus, Lanchester concludes that they are of "a very vague and unsatisfactory kind," and relies almost wholly on the character of the skin. *P. socium* agrees more nearly with *P. margaritaceum* in this feature than with the South Georgian forms, in which the papillæ are longer. Nevertheless, he separates *P. socium* from *P. margaritaceum* on account of the proportion of introvert to body length; for instead of having an introvert about half the length of the body, as in the northern species, it is in the Cape Adare form, "not much shorter than the length of the body."

My studies of the specimens obtained by the s.s. "Aurora" seems to me to emphasise the unsatisfactoriness of the usual diagnostic features.

When we bear in mind the nature of the body wall and the great contractility of the whole worm, it certainly appears that we cannot put much reliance on proportions of length of the various regions or upon such features as the exact position of the origin of the retractor muscles of the introvert: or these characters must be used in association with other features.

The Sipunculids, as is well known, inhabit the mud and sand of the sea bottom; and as they burrow therein* must be constantly altering the form of the body, pushing forwards the introvert and again retracting it as it moves along through the mud.

When the introvert is fully extended, the circular muscles of the body wall as well as those of the introvert must be in a state of contraction, in order to force the cœlomic fluid into this introvert and so distend it. But the longitudinal muscles may also contract at the same time or immediately after, shortening the hinder part of the body, as the animal progresses forwards, pulling it after the introvert. Now it is conceivable that the muscles of the body and those of the introvert are not contracted to an equal degree

*Andrews, Studies, Johns Hopkins Univ., 1887-1890, vol. iv, p. 389.

for we find in some specimens with the introvert fully extended or fully withdrawn that the hinder end is sometimes rounded and sometimes pointed; in the former case the longitudinal muscles are, of course, in a state of contraction, while in the latter they are relaxed.

It follows, therefore, that the proportion of length of introvert to length of body is a variable, depending on the state of the worm at death, even if the introvert be fully extended, as some of the measurements given below will indicate, as do also those given by Lanchester.

In measuring the length of introvert I have taken the anus as its base; Lanchester and Michaelsen use the nephridiopores, whereas Southern uses the anus, and it appears that Selenka takes this point also. I find the anus more useful, since the nephridiopores are not so easily detected, and, anyhow, they are only a millimetre or so in front of that aperture, so that the difference cannot be material.

The only work in which a definite statement is made as to the extent of the introvert as a morphological feature is Delage and Hérouard's "Zoologie Concrète" (tome V, p. 12), where the anus is taken as marking the limit between the two regions.

Now, although the worms above described are ascribed to the variety *capsiforme*, yet a comparison of measurements shows that the proportion of length of introvert to length of body differs from that given for the species and for this variety by various authors.

The dimensions of the five worms are given below. The length is taken along the mid-dorsal line and not along the outer curve, if the worm is curved, as so often happens.

The largest specimen has the introvert only partially extended, and this is curved over to the right side and the apex bent backward. The total length along this outer curve is 200 mm., but along the mid-dorsal line it is 160 mm. The greatest diameter of the body is 25 mm., and that of the introvert 5 mm. The anus is situated 80 mm. from the hinder end on a brown papilla. Anteriorly to the anus the diameter of the body begins to decrease, and this slenderer region is 80 mm. in length. Its oral end is, however, withdrawn, and on slitting open the introvert it is seen that this internal portion measures 10 mm. and is much contracted, so that during life it would no doubt be much longer.

Only one individual (from Station 1) has the introvert fully extended so as to show the tentacles; the total length is 48 mm. and the anus is just halfway along this length, so that the introvert is equal to the body length.

DIMENSIONS of *P. margaritaceum*, var. *capsiforme*, from
Commonwealth Bay.

Specimen.	Body.		Introvert.	
	Length.	Width.	Length.	Width.
A	80	25	80	5
B	57	20	80	...
C	24	10	24	4
D	11	...	17	...
E	25	...	35	...

NOTE.

In C, from Station I, the introvert is fully extended; in the rest it is more or less invaginated, and the length is that seen externally.

In B the introvert has 20 mm. invaginated.

In the typical *P. margaritaceum* and in the variety *capsiforme* the introvert is stated to be about half the length of the body. Selenka gives for the species the numbers 100 mm. and 50 mm. respectively, and for *P. capsiforme* 26 mm. and 15 mm. Fischer states that the introvert is slightly longer than the body. Lanchester, who measured two specimens of *P. capsiforme*, finds in one of them, in which the introvert is retracted, that when measured "it is markedly less than half the body length," but estimates that when fully extended it would be "about half the length" of the body. In a second specimen, however, he finds the introvert "approximately equal in length to the body."

As will be seen in the above table of the forms from Commonwealth Bay, in the larger individuals in which the introvert is partially withdrawn it exceeds the length of the body, as it does also in smaller specimens. In the single individual with the introvert extended, its length is equal to that of the body.

On comparing these worms with those described by Michaelsen we find approximately the same proportions; it is as long or rather longer than the body, except in *P. georgianum*, where it is short, retracted, or "may in complete extension attain half the length of the body."

With *P. socium*, too, it agrees, in that the introvert is longer than the body; but from this, as from Michaelsen's species, it differs in the character of the skin papillæ, which in *P. socium* have a diameter from half to two-thirds the height, whereas in the Commonwealth Bay worms the width is greater than the height.

So far, then, as external features are concerned, we have to decide whether more importance is to be placed on proportions of body or on the form and size of papillæ. As has already been pointed out, the former necessarily vary according to the degree of contraction of the muscles of the body wall, which may perhaps be so great as to discount the value of these proportional measurements.

What other characters, then, are of use in distinguishing species? The shape, and especially the dimensions, of the nephridia seem to be useless; they, too, are highly contractile, and their shape and length may vary on the two sides of the same worm. The number of intestinal coils varies apparently with the size; that is, with the age of the individual. I have noted that in three specimens differing in length the number of coils is proportional to that length, or rather, is less in the smaller individuals than in the larger. Lanchester found similar differences in his specimens of *P. socium*.

There remains, then, the position of the origin of the retractor muscles of the introvert in relation to the anus or to the nephridiopores. For their distance from the hinder end of the body is more likely to be affected by the contraction of this region of the body and to a greater degree than the shorter distance from the anus.

In the present specimens the ventral retractors arise at or behind the middle of the body length; the origin of the dorsal retractors is within the first quarter of that length.

In order to be able to compare the positions of these points in the different varieties above enumerated, it is necessary to reduce the body length to a common unit, say 100, and to state the position of these origins in percentages of that length.

The only tabulated series of measurements that I have met with is that given by Lanchester for *P. socium*; he takes the distance from the nephridiopores, and it is necessary to deduct from his numbers the distance of these from the anus in order to bring them into line with the measurements given above.

I have excluded from my comparison the specimens marked by him E and F, which differ in other features from the rest of his specimens and about which it is evident he was in some doubt as to their identity. I have reduced Lanchester's numbers to percentages of body length, and plotted them on paper, with the result that the dorsal retractors in all these specimens of *P. socium* originate within the anterior third of the body as they do in my specimens; while the ventral retractors arise in the middle third, but this

point in all lies in front of the 50 per cent. mark. I used the same method in dealing with the specimens from Commonwealth Bay, and find that the ventral retractors in the three individuals measured lie at or behind this halfway mark. It would, of course, be necessary to make measurements of a greater number of specimens in order to make sure that this difference is a real one before one can make use of it as a specific or varietal character.

It appears that in all these southern varieties the dorsals arise in the anterior third, and the ventral retractors approximately in the middle third of the body length. But the mode of statement followed by Michaelsen and by Fischer in reference to these points makes it difficult to tabulate their exact position.

It seems, at any rate, impossible to use these positions for specific or varietal purposes, and we are driven back to the skin, its naked eye appearance and its microscopic structure.

Using this criterion the present specimens agree with *P. margaritaceum*, var. *capsiforme*.

In general appearance to the naked eye, *P. socium* seems to agree with this, for Lanchester states that in it the skin is "smooth, thin, semi-transparent, with minute papillæ, barely visible under a hand lens"; and *P. georgianum* also has a smooth, shining, silvery skin, sufficiently translucent for the internal organs to be seen dimly through it, as is the case with the smallest of my specimens. But the other two species from South Georgia have dark coloured and opaque body walls.

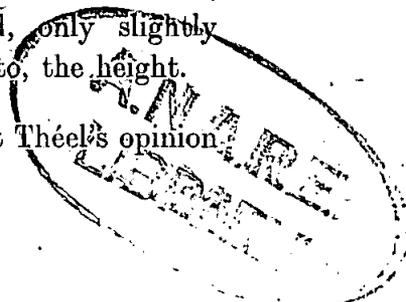
In regard to the form and proportions of the skin papillæ there seem to me considerable differences, for whereas in Michaelsen's species and in *P. socium* the papillæ are pear-shaped, constricted at the base, and have a breadth much less than the height, namely, from one-fourth to one-half, in the Commonwealth Bay forms they are low, rounded, only slightly prominent, with a width greater than, or at least only equal to, the height.

For this reason, therefore, I have been unable to accept Théel's opinion that all of them are to be included in the northern species.

PHASCOLOSOMA MAWSONI, *sp. nov.*

(Plate 11, figs. 3-11.)

More than fifty small Phascolosomids present characters which appear to warrant the formation of a new species. It is true that the recent literature at my disposal is



rather limited, and the only Memoir dealing with Antarctic Sipunculids is Théel's Report of the Swedish Expedition. It does not fit into any of the species therein described, nor with those of Michaelsen.

I therefore take the opportunity of associating with it the name of Sir Douglas Mawson.

The general appearance of this species is very different from the preceding, both in its creamy white colour, in the texture of the skin, and in the general form of body. Although these differences are rather difficult to put into writing, yet when the two species are seen side by side the distinctness is quite evident.

A characteristic feature is the presence at the rounded hinder end of the body of a definite cone, low and rounded (fig. 3). In the extended condition of the animal this is prominent, but when the animal is more or less contracted, this cone, while still retaining its definite form, becomes sunk into a fossa, shallow or deep according to the degree of contraction (figs. 4, 5). Sometimes the cone is sunk to such a depth that it is invisible from the side.

It is a feature that is not unusual in the genus *Dendrostoma*, if one may judge from the figures illustrating the Memoirs of Selenka and of Ikeda, though it does not appear in such a definite form in any species of *Phascolosoma*.

The tentacular crown, however, has the usual arrangement of the latter genus. There is a cushion on the dorsal surface, grooved lengthwise so as to appear double, and around the mouth, which lies excentrically, is a circle of thirty short tentacles: these are connected at their bases in couples, one couple is median-ventral, the rest lateral; actually there are fifteen such couples (figs. 9; 10).

In a series of transverse sections through the crown I was unable to detect any cerebral canal. There certainly is nothing like that figured by Herubel for *P. charcoti* (1908, p. 5, figs. 5, 6).

The animal attains a length of 42 mm., which is the largest in the collection. This figure includes the fully extended introvert. The shortest individual is only 8 mm. in length.

A specimen measured gives the following figures:—Total length, 39 mm., of which the introvert occupies 20 mm., taking the anus as its point of origin. The diameter of the body is 5 mm., while that of the introvert is only 2 mm. Thus the introvert is rather longer than the body, and is distinctly marked off from it by its sudden decrease in diameter.

In the following table I give measurements of other individuals in which the introvert is fully extended, and it will be seen that the amount of contraction of the body is very unequal, especially at the hinder end, hence the comparative uselessness of these proportions as a specific character.

DIMENSIONS of *P. mawsoni*, in which the introvert is fully extended.

Specimen.	Total Length.	Body.		Introvert.	
		Length.	Diameter.	Length.	Diameter.
	mm.				
A	42	20	6	22	3
B	42	12	6	30	4
C	32	10	4	22	2
D	29	13	4	16	1.25
E	24	10	4.5	14	2
F	23	7	3.5	16	2

NOTES.

In C the hinder end is contracted, so that the terminal cone is surrounded by a fossa, but is visible from the side.

B is more contracted, so that the terminal cone is not visible from the side.

In E the introvert is curved, but the specimen seems to be more uniformly contracted than the others. The hinder end is not at all withdrawn.

F has the hinder end much contracted.

The skin is creamy white in colour, opaque and rather rough. The roughness is due partly to the circularly disposed but discontinuous wide furrows and narrow ridges, and partly to the more or less widely and irregularly scattered papillæ, which are nearly white (fig. 6). These have the appearance, under a hand lens, of short columns, and are especially conspicuous when they are seen in profile. Though widely spaced on the body generally, they become more crowded at the hinder end, and also on the introvert, where they become more numerous as the tentacles are approached.

Viewed under the microscope (glycerine preparation), the papillæ over the mid-body are yellower than the surrounding skin; they are skittle-shaped, that is, ovoid and slightly constricted at the base (fig. 7). There is no pigment other than the yellowish secretion from the gland cells, which latter have a tessellated arrangement.

The length of a papilla is about one and a third times its breadth. Neither in fully extended nor in contracted specimens are any longitudinal furrows or ridges visible.

There are no hooks on the skin.

Internal anatomy (fig. 11).—The intestine is rather loosely coiled, the upward and downward limbs of the coils are not so regularly arranged as in *P. margaritaceum*. I counted twelve double coils in one individual, which was fully extended; while in a contracted one of about the same size there are nineteen double coils, and these are more regularly disposed, the up and down coils alternating.

The intestine is free posteriorly, the spindle muscle is very delicate, and I was unable to detect its anterior attachment. The anterior coils of the intestine are held

to the body wall by two, or perhaps three, very slender bridles. The rectum is suspended by a broad sheet of tissue, stretching on each side to a point about midway between the anus and the nephridium.

The œsophagus exhibits no contractile tubules.

The body cavity is filled with eggs in one specimen opened, and these fill the nephridia also. These organs are of a pale pinkish colour, and owing to different degrees of contraction, the two organs differ in shape and size. One reaches back to the level of the origin of the dorsal retractor muscle, the other extends further back.

Of the two pairs of retractor muscles, the ventral originates about 9 mm., the dorsal at a point 2 mm. from the anus.

I give below a table showing the relative positions of these muscles, from which it appears that generally the ventral retractors are attached to the body wall at about halfway along the body, or in the posterior third of the body length; the dorsals at about one-sixth or one-eighth the length, measured from the anus.

Distance from the anus of the attachment of the retractor muscles in *P. mawsoni*.

Specimen.	Body length.	Ventral muscle.	Dorsal muscle.	Notes.
M	mm. 17	7	3	Hinder end flat; introvert withdrawn.
N	14	9	2	Hinder end retracted.
O	14	7	2.5	Terminal cone visible.
P	13	11	3.5	Hinder end retracted.
Q	11	5.5	2	
R	10	5	2.5	

Localities.—

Commonwealth Bay, 25 fathoms (3-4 ix 12) (forty-eight).

Commonwealth Bay, 55-60 fathoms (21 xii 13) (three).

Remarks.—It is clearly distinct from *P. margaritaceum* and its varieties. It is true there are some resemblances between this species and *P. georgianum* where the hinder end of the body appears to bear a rounded knob, as in *P. semperi*. The skin is pale in colour, namely, "silvery grey," but it is also translucent and iridescent; moreover, the papillæ are dark and are pear-shaped, while the internal structures show various differences.

In *P. charcoti* Herubel, too, the colour is whitish, but the cylindrical papillæ truncated terminally; the shorter introvert (less than half the body length), and the peculiar relations of the cerebral canal, mark it off from the rest as a very distinct species.

In Selenka's monograph the only other species with four retractors and without hooks recorded from these southern seas is *P. capense* Teuscher, from the Cape of Good Hope. From this species *P. marvsoni* differs in the absence of villi on the contractile tubules, as well as in the absence of eye spots. The retractors in that species do not appear to be so long, judging from Selenka's figure.

PHASCOLOSOMA EREMITA Sars, var. AUSTRALE NOV.

P. eremita Selenka (1883), p. 12, for synonyms.

P. eremita Chamberlin (1920) p. 4D.

(Plate 11; figs. 12-15.)

A single individual of this northern species was obtained at Station 2, along with *P. margaritaceum*, var. *capsiforme*.

It has the introvert fully extended, but the tentacles are retracted so that only the tips of a few are visible. It is not so definitely marked off from the body as in the previous species, its diameter diminishing gradually. The hinder end of the body is rounded.

The total length is 28 mm., of which the introvert, measured from the anus, is 16 mm. The diameter of body 4 mm., that of the introvert 2 mm.

The body wall is of a dirty-brown colour, thick and opaque; its surface is roughened by circular ridges and the numerous small dark-brown papillae, which are arranged in the intervening furrows.

There are no hooks.

Microscopic examination of the skin.—In the mid-body the circular ridges are yellowish, and the furrows filled with grains of mud, which conceals the bases of the papillae, consequently it is difficult to get a true profile view of these. But by shifting the cover and by pressure one can see that they are long cylindrical, not much constricted at the base, and with a rounded apex. The height is about three times the width. (Figs. 12, 13.)

At the hinder end the skin is much corrugated, for the circular ridges are connected by irregular longitudinal undulating ridges so as to delimit irregularly quadrate areas. The papillae here are rather longer than on the body generally.

But on the introvert the papillae become much shorter than elsewhere, their height being about equal to their breadth (fig. 14); they are paler in colour and more densely arranged. This seems to be a very unusual feature in the distribution of the papillae.

The anus is small, and the surrounding area is rather paler than the general tint of the skin. The nephridiopores are unrecognisable, being covered with mud.

Internal anatomy (fig. 15).—There is only one pair of retractor muscles, which are attached near the nerve cord at about the middle of the body length, viz., 6 mm. behind the anus.

The nephridia are pale pinkish-brown, small in size, only 2 mm. in length; the pores are situated just in front of the anus.

The intestine presents 12–15 visible coils, circularly and tightly coiled in the anterior portion of the spiral, but posteriorly becoming irregularly arranged, so that it is difficult to count them accurately.

The spindle muscle is very delicate, and I did not note any other attachments, except that the rectum is attached to the body wall by only a short membrane on either side.

Locality.—

Commonwealth Bay, Station 2, 318 fathoms.

Distribution of the species.—Widespread in Northern and Arctic seas (Chamberlin).

Remarks.—It agrees almost precisely with Selenka's diagnosis of *P. eremita* Sars, with, however, the following exceptions:—

- (a) The skin is there said to be smooth for a few millimetres behind the introvert, but in this variety the papillæ extend continuously over the surface.
- (b) Selenka found no spindle muscle, whereas in the variety it is present though very delicate and readily broken.
- (c) The papillæ on the introvert are a little longer than on the body, whereas in the variety they are very distinctly shorter.
- (d) Further, Selenka's figures of the papillæ (pl. v, figs. 54, 55) from the hinder end of the body are much shorter than those in the variety, which resemble in their proportions those figured for *P. semperi* (fig. 57), where, however, they are longer than in the present worm.

At first I suspected from the form of the papillæ that I was dealing with *P. charcoti* Herubel, but the whole anatomy of the two differs.

PHYSCOSOMA *Selenka*.PHYSCOSOMA SCOLOPS *Selenka* and *Man*.

P. scolops, Selenka and Man (1883), p. 75.

P. annulatum Hutton, Benham (1904), p. 173.

P. scolops Benham (1912), p. 137.

P. scolops Fischer (1914 B), p. 63.

Two small individuals of this widely distributed sipunculid were obtained off the coast of Tasmania. The label reads "vermes tasmaniae," and nothing more; there is no indication of depth or locality. It is probable that they were collected off Maria Island with certain Polychaetes by Professor Flynn, of Hobart.

One of the two has its introvert extended; its total length is 15 mm. by 2.5 mm.

For remarks on this species, see Benham, *loc. cit.*

Distribution.—New Zealand, Kermadec Island, Philippines, Singapore, Red Sea, Gold Coast (West Africa), Mauritius, Zanzibar, Madagascar, Indian Ocean, Pacific Ocean; that is, it is almost entirely tropical and subtropical, but passes south to the New Zealand and Tasmanian waters.

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EXPLANATION OF PLATE 11.

Figs. 1, 2. *Phascolosoma margaritaceum*, var. *capsiforme*.

Fig. 1.—A yellowish papilla and its underlying gland, viewed from above ($\times 250$). The lines represent ridges running circularly on the skin; the papilla lies in the furrow.

Fig. 2.—An oblique side view of a papilla ($\times 250$).

Figs. 3–11. *P. mawsoni*.

Fig. 3.—The animal with extended introvert and uncontracted posterior, viewed from the side ($\times 2$).

Fig. 4.—The animal with introvert invaginated and the posterior end retracted, broadened and flattened, so that the terminal cone is only partially visible ($\times 2$).

Fig. 5.—Posterior end of the same individual as drawn in preceding figure to show the fossa around the terminal cone, due to the retraction of the hinder end ($\times 2$).

Fig. 6.—Portion of the skin ($\times 35$). The lines represent the circular discontinuous ridges.

Fig. 7.—A skin papilla, side view ($\times 250$).

Fig. 8.—The same in optical section from above ($\times 250$).

Fig. 9.—The tentacular crown ($\times 20$). The dorsal surface with its cushion is directed towards the bottom of the plate; the ventral margin carries the unpaired couple of tentacles.

Fig. 10.—Dorsal view of the tentacular crown ($\times 20$).

Fig. 11.—Dissection from the left side ($\times 4$). The intestine has been cut away; the right dorsal retractor muscle was cut through. The gonads are indicated at the foot of the ventral retractor muscles.

Figs. 12–15. *P. eremita*, var. *australe*.

Fig. 12.—A papilla from the body, obliquely seen from the side. The base was embedded in mud up to the level of the dotted line ($\times 35$).

Fig. 13.—Another papilla in optical section ($\times 35$).

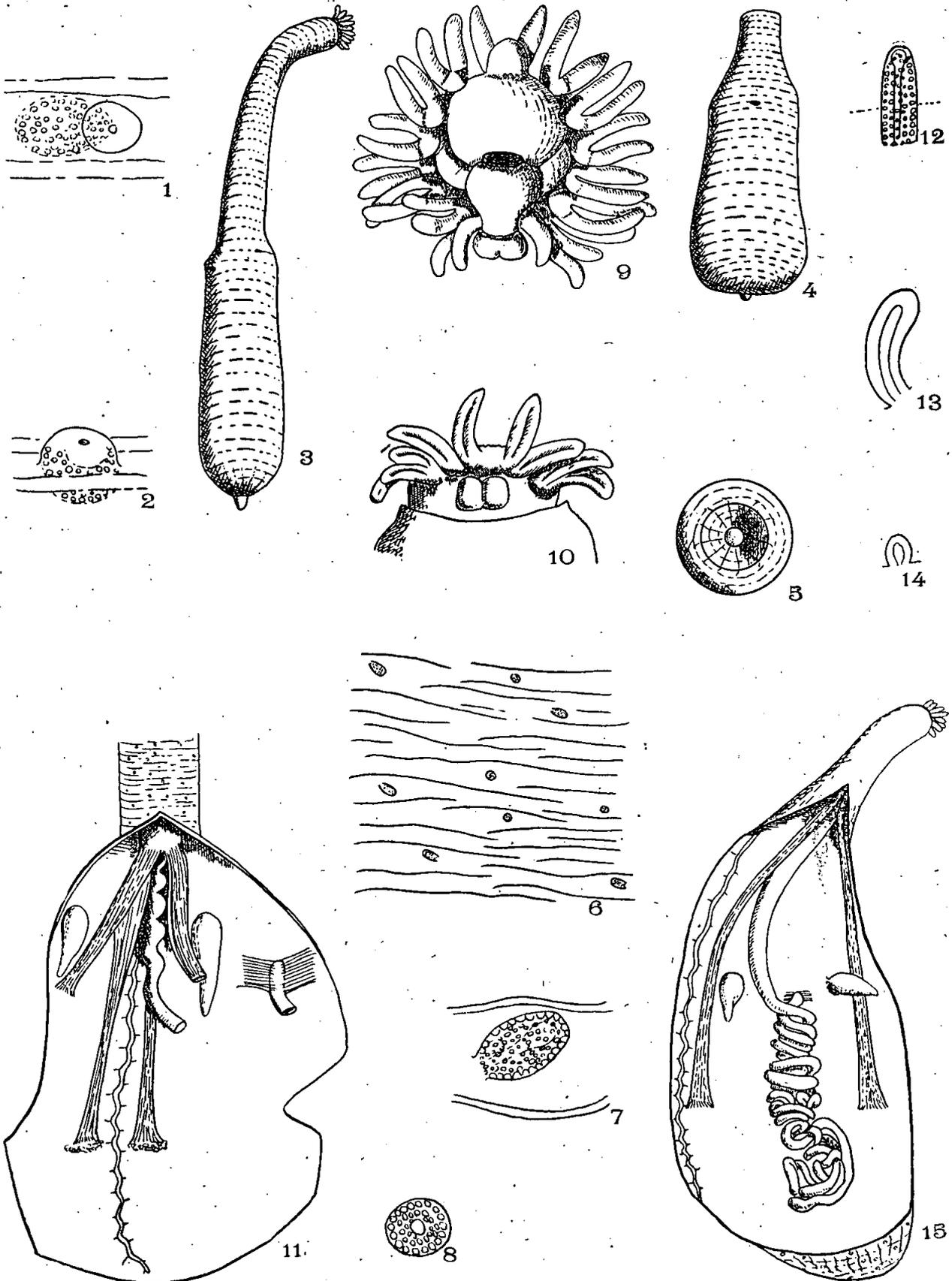
Fig. 14.—One of the papillæ from the introvert, paler and much smaller than those on the body ($\times 35$).

Fig. 15.—Dissected from the left side ($\times 4$).

INDEX.

	PAGE.
<i>annulatum</i> PHYSCOSOMA	19
<i>antarcticum</i> PHASCOLOSOMA	8
<i>antarcticus</i> PRIAPULUS	6
<i>australe</i> var. PHASCOLOSOMA EREMITA	17
<i>capense</i> PHASCOLOSOMA	17
<i>capsiforme</i> PHASCOLOSOMA	7
<i>caudatus</i> PRIAPULUS	6
<i>charcoli</i> PHASCOLOSOMA	16
<i>eremite</i> PHASCOLOSOMA	17
<i>fuscum</i> PHASCOLOSOMA	8
<i>georgianum</i> PHASCOLOSOMA	8, 11
<i>margaritaceum</i> PHASCOLOSOMA	7
<i>mawsoni</i> PHASCOLOSOMA	13
PHASCOLOSOMA	7
PHYSCOSOMA	19
PRIAPULUS	6
<i>scolops</i> PHYSCOSOMA	19
<i>semperi</i> PHASCOLOSOMA	16
<i>socium</i> PHASCOLOSOMA	8, 11
<i>tuberculato-spinosus</i> PRIAPULUS	6

[1. Plate.]



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