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LIX.—Preliminary notice of the Cephalopoda collected by the fishery cruiser 'Goldseeker,' 1903-1908

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White, and differs from the other genera of the family in the character of the pleopods in the female sex.

(2) The remaining species assigned to *Puerulus*, *P. pellucidus*, Ortm., *P. spiniger*, Ortm., and *P. atlanticus*, Bouvier (= *Panulirus inermis*, Pocock), are founded on specimens in a stage of development intermediate between the *Phyllosoma* and the adult form, called by Boas the "Natant-stage."

(3) *Puerulus spiniger*, Ortmann, is the Natant-stage of *Panulirus versicolor* (Latreille), and it passes into the adult form without any perceptible increase of size, while preserving unchanged the general pattern of coloration.

(4) *Jasus* passes through a Natant-stage differing from those which have been referred to *Puerulus* in possessing a median rostral tooth.

LIX.—*Preliminary Notice of the Cephalopoda collected by the Fishery Cruiser 'Goldseeker,' 1903-1908.* By E. S.

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THE collection of Cuttlefish made by the 'Goldseeker' under the International Committee for the Investigation of the North Sea (Scotland), and entrusted to me by Professor D'Arcy W. Thompson for description, contains representatives of sixteen species, of which three are new. The collections were made on the east and north coasts of Scotland, round the Shetlands, and between the Shetlands and the Faeroes.

OCTOPODA.

Polypus arcticus (Prosch).
 — *piscatorum* (Verrill).
 — *faeroensis*, sp. n.
Moschites cirrosa (Lamarck).

DECAPODA.

Loligo forbesii, Steenstrup.
 — *media* (L.).
Rossia macrosoma (Delle Chiaje).
 — *glaucopis*, Lovén.

Sepiola rondeletii, Leach, var. *scandica*, Stp. (= *S. oweniana*, Pfeffer, 1908).
 — *atlantica*, D'Orbigny.
 — *aurantiaca*, Jatta.
Calliteuthis reversa, Verrill.
Brachiotheuthis bowmani, sp. n.
Tracheloteuthis riisei, Steenstrup (including *T. behnii*, Stp.).
Desmoteuthis hyperborea (Steenstrup).
Taonidium pfefferi, sp. n.

Polypus faeroensis, sp. n.

The body is very plump and is much larger than the head. There is a distinct constriction between head and body. The breadth of the head is about three-quarters that of the body, its depth about three-fifths.

The colour is a fine reddish purple, of a deep shade on the

back and sides, becoming paler on the ventral surface and on the funnel. The colour is due to minute chromatophores, which are closely crowded together on the dorsal surface of the head, body, arms, and web, more scattered on the ventral surface, and sparsely dotted on the funnel. Chromatophores occur also to a slight extent on the sides of the arms outside the limit of the web, especially on the inner (dorsal) aspect. Chromatophores are completely absent from the internal (oral) surface of the arms and web, except for a few at the tips of the arms.

The skin is of a firm consistency and there is no lateral fold of the mantle.

The papillation is characteristic. All over the dorsal surface of head, body, and web there are papillary areas; these are more or less circular patches of a lighter colour than the surrounding skin, having in the centre a low conical papilla, while round the periphery stand six or seven smaller papillæ. In a large female these areas are as much as 7 mm. in diameter, and the peripheral papillæ are distant from the central one; but in two smaller males the areas are smaller and less well defined, and the peripheral papillæ are set close round the base of the central papilla. The papillæ are whitish in colour, owing to the absence of chromatophores from their tips. These papillary areas are not found at the sides nor on the ventral surface of the web.

Above the eyes, which are small, there is a large conical cirrus, 2-3 mm. high, on which are set a number of small papillæ (much as in some specimens of *Polypus arcticus*, figured by Verrill). Round the eyes, but not extending to the lower lid, are a number of large papillæ, which may have subsidiary papillæ at their base.

It is not improbable that the "papillary areas" are directly comparable with the papillated cirrus above the eyes. One has only to suppose them erectile to have the homology clearly demonstrated. In the two small males the areas have indeed much the look of half-collapsed papillated cirri.

The ventral surface is perfectly smooth.

The funnel is large, 1.6 cm. long in the smallest male. The free margin below the mantle-flap shows a broad sinus.

The arms are stout and well developed. The order of size is 1, 2, 3, 4, but the differences are not great. The dorsal arms (measured from the beak) are a little more than three times the length of the mantle (measured dorsally to the eye). There is a strong web which occupies from one-quarter to one-third of the length of the arms. It is more or less equally developed between all the arms, except between the ventral

pair, where it is less developed. The suckers are in two rows slightly alternating, and are perfectly formed, though small, at the extreme tips of the arms. Near the mouth three or four suckers stand in a single row. There are about 60–70 suckers on each arm of the large female, and the largest of them measures 4 mm. in diameter.

The hectocotylistation closely resembles that of *P. arcticus*, but it is, relatively to the length of the arm, very much smaller. Thus it measures 14 mm. in length on an arm measuring 11·4 cm. The calamus brachialis is small and triangular, the ligula copulatoria is broadly oval and comes to a blunt point. There are 11–13 ridges on the ligula. The hectocotylist arm is little shortened; the web is developed especially on the ventral side; there is a sperm-canal (21 mm. long) running down the ventral edge of the web to midway between the third and fourth arms.

I give below the dimensions of a large female and of a male:—

Dimensions (in cm.).

	♀.	♂.
Length of mantle, dorsally, to eyes	4·8	4·2
Breadth of mantle.....	4·0	3·6
" head, dorsally, across eyes	3·0	2·5
Depth of body	3·7	3·0
" head	2·2	1·8
Length of first arm, from beak	17·0	13·2
" second arm, from beak	16·0	12·6
" third (non-hectocotylist)	15·0	12·5
" " (hectocotylist)	11·4
" fourth arm	14·0	11·0
" web between first pair of arms	4·2	3·8
" " fourth pair of arms ..	3·0	3·3
Number of suckers on first (right) arm	73	67

The hectocotylist arm of the male measures 11·4 cm. in length, of which 10 cm. bear suckers (to the number of 40). The hectocotylist part is 1·4 cm. long and 9 mm. broad. The ligula bears 13 transverse ridges.

Polypus faeroensis is fairly closely allied to *P. arcticus* (Prosch), but it differs in certain well-defined ways. The body is not so broad, and the distinction between head and body is very much better marked. The arms are longer in proportion to the body. The hectocotylist arm is much longer and the hectocotylist part much shorter than in *P. arcticus* (*Octopus bairdii* of Verrill), in which the hectocotylist part is one-third the length of the arm. Finally, the papillation is distinctive.

In a large female of *P. arcticus*, measuring in overall length 17 cm., the breadth of the mantle was 5.5 cm., of the head 4.1 cm., while the longest arm was only 12.5 cm. in length (Verrill, Rep. U.S. Comm. Fish. for 1879 (1882), p. 395, pl. xli. figs. 1, 2, 3 a, pl. xlii. figs. 1-5). In a large male (16.3 cm. overall) the hectocotylised arm was 8.5 cm., the hectocotylisation 3.3 cm. long.

With the North Atlantic species, *P. ergasticus* (Fischer), *P. sponsalis* (Fischer), and *P. profundicola*, Massy, this species shows no points of special similarity.

One large female and two smaller males were taken by the 'Goldseeker' on Aug. 24th, 1908, in 1030 m. at Sta. 19 A (Faeroe Channel), associated with half a dozen specimens of *P. piscatorum* (Verrill).

Brachioteuthis bowmani, sp. n.

The body is fusiform and runs out into a sharp point behind. The anterior border of the mantle is free all round, almost straight or slightly convex above, not produced in an obtuse angle. At the sides, just above the level of the lower border of the eye, the mantle-border projects slightly, the mantle-cartilage, which articulates with the funnel, running to the end of this projection.

The pen is clear brown in colour and is plainly visible along the mid-dorsal line, where it is 1 mm. broad. At the insertion of the fin it broadens out and the margins become folded down; near the tip the margins fuse to form a hollow cone, 11 mm. in length and 2 mm. in breadth at the base.

The fin resembles in shape that of *Ommatostrephes sagittatus*. It occupies the posterior third of the mantle.

The funnel is rather broad and is free only at the tip. The hinder margin is thin and shows a shallow sinus. The connective cartilage exhibits a longitudinal groove, 7 mm. in length, slightly enlarged at the posterior end. The connective on the mantle is a linear ridge, 10 mm. in length.

There is a pair of long and broad adductor muscles.

The sides of the funnel run up as broad bands to the mid-dorsal line, where they fuse with the neck. At the line of fusion there is a longitudinal horny piece with two lateral grooves like those of the connective cartilage on the funnel. This piece is 6.5 mm. long and lies directly below the front end of the pen, whose incurved margins articulate with the grooves.

The head is very large, with enormous eyes. It is broader than the mantle-opening.

The actual visceral sac is very small, being narrowly triangular and not extending back much beyond the insertion of the fins. The gills are very long and slender.

The mantle is covered with small pale red chromatophores, which are present also on the dorsal aspect of the fins. The head is more deeply coloured in shades of brown and crimson, the chromatophores being aggregated especially at the antero-ventral border of the eye. The eye is covered over by a skin set with chromatophores and resembling the skin of the head. In front there is a deep transverse groove with puckered edges; it is 3 mm. long, has a muscular margin, and marks the opening from the anterior chamber of the eye to the exterior.

Chromatophores are present also on the arms and tentacles.

The order of the arms is 2, 3, 4, 1. They are without web or keel, except the ventral pair, which have a narrow fin on their extero-ventral edge. The second pair are about two-thirds the length of the mantle. The suckers are in two slightly alternating rows, and they are not continued right down to the mouth, 2-3.5 mm. being without suckers. The cups of the suckers are nearly globular, inserted very obliquely on pedicels, slender above, swollen below. The horny ring is higher above, has 5-8 square teeth on its upper half, and is smooth on its lower half.

On the second and third arms, and to a less extent on the first arms also, the swollen part of the pedicels of the external row of suckers gives off a slender cirrus, whose length may equal the diameter of the cup. The cirri are not free, but are bound to the arm throughout their length by a fold of thin skin. Tentacles are fairly stout, 60 mm. in length, more or less triangular in cross-section. The club is 13 mm. long, 5 mm. broad, and is thin and flattened from above downwards for 10 mm. of its length, then at the tip the plane of the club is twisted inwards through a right angle, so that its ventral surface becomes vertical and looks inwards. This terminal part is 4.5 mm. long and has a thin vertical suckerless crest. The axis of the tentacle is not itself expanded to form the club, the lateral portions of which are formed rather by the long pedicels of the marginal suckers, which are bound together in a membranous expansion of the axis. In the terminal portion the axis is without suckers, but its ventral expansion bears three rows, of which the lowest are the largest. At the twist of the club there are two irregular transverse rows of large suckers, about five suckers in each row. These are the largest suckers on the club. The main body of the club bears on its ventral surface numerous thin-stalked minute suckers irregularly disposed in about 12-15

rows. Towards the proximal end of the club the suckers stand in fewer rows. Sessile suckers extend in about four scattered rows halfway down the internal face of the tentacle; these are very minute and become very sparsely scattered as they reach the middle of the tentacle.

The cups of the suckers on the club are hemispherical and the horny ring bears in its upper half fine pointed teeth.

There is a well-developed buccal membrane with about eight ill-defined angles.

A single specimen, apparently a female, was taken on June 9th, 1908, at Sta. 15 c in 778 m.

Dimensions.

	mm.
Length of mantle (and pen)	61
Breadth of mantle at collar	16
Length of fin in middle line	29
Breadth of fin	41
" head across eyes	17
" " in front of eyes	12
Vertical diameter of eyeball	11
Horizontal diameter of eyeball	13
Length of head	12
" first arm	24
" second arm	40
" third arm	36
" fourth arm	35
" tentacles	60

This species, which is named after Dr. Alex. Bowman, naturalist on board the 'Goldseeker,' is very close to the only other species of the genus, *B. beanii*, Verrill. It is described as new because it seems to offer several points of difference and because it does not resemble at all closely Verrill's figures (Rep. U.S. Comm. Fish. for 1879 (1882), p. 424, pl. xlv. figs. 3-3 b, pl. xlv. figs. 2, 2 a). The great size of the eyes, the pigmented cornea, the shape of the anterior margin of the mantle, the peculiarities in the structure of the suckers and of the tentacular club seem to warrant its separation from *Brachioteuthis beanii*.

Taonidium pfefferi, sp. n.

The body is flattened dorso-ventrally. It is oval in outline, the sides curving in sharply at the posterior end, where the terminal part of the pen runs out, fringed by the small fins, which together form a broad ellipse. This terminal portion is 3 mm. long by 2.7 mm. broad. The tip of the pen extends a very little way beyond the fins. The length

of the mantle mid-dorsally to the insertion of the fins is 16.5 mm.; its greatest breadth is about halfway along the back, where it measures 11.5 mm. In front the dorsal edge of the mantle is transverse, with a sinuous margin, and measures 6.5 mm. across. It is distinctly produced at the corners and curved sharply back in the middle line, where it is fused with the head. The ventral margin of the mantle exhibits two deep bays laterally where it is fused with the siphon, and in the middle it is produced forward in a small flap-like process. The mantle is very delicate and translucent, of a clear whitish tinge in formalin, probably quite transparent during life. On the back there are a few oval chromatophores of large size (up to 2 mm.): one is situated at the fusion of mantle and neck, and along the lateral margins there are about five on each side. On the ventral surface the chromatophores have a similar arrangement—a pair opposite the base of the funnel, a pair behind and external to these, then two or three on each lateral margin, and three or four near the base of the tail.

The organs of the body seem confined to the anterior two-thirds of the mantle-sac. The musculature is reduced. In the posterior third there are delicate transverse bands or hoops of muscle; the anterior two-thirds are more muscular.

The neck and head are continuous and very narrow; the distance from the mantle to the circle of arms is 3 mm., and the head is only slightly swollen at the insertion of the large stalked eyes. It is only 1.4 mm. broad below the arms. In the median line dorsally are two chromatophores, and another lies close below the origin of the first pair of arms. Ventrally the funnel covers over another small chromatophore.

The eye-stalks are very large, 3 mm. in length, 1.8 mm. broad in the middle, while external to their insertion on the head they exhibit a swelling. There is a large and conspicuous squarish chromatophore on the dorsal surface of each stalk, red round the edges, but appearing dark in the centre owing to the pigment of the eye shining through. The eyes show iridescent pigments—red, yellow, green, purple, and dark blue.

The funnel is large and reaches forward to about half the length of the eye-stalks. It measures 4.5 mm. across at its base.

The arms form a circle round the mouth, which in this specimen protrudes a little and is surrounded by a thick frilled sheath. The arms are very small, and are unwebbed and without fins. The two lateral pairs are the largest. The lengths of the arms are 2 mm., 2.5 mm., 2.7 mm., and

2 mm. The suckers are in two irregular rows and have a smooth horny ring.

The tentacular arms are long (17 mm.) and stout, not expanded distally to form a club. On the terminal 3.5 mm. there are four rows of subequal suckers, which bear mostly a few irregular blunt teeth on the upper half of their horny ring. All along the ventral aspect of the stalk there are 2-3 rows of very small suckers. These are not too well preserved, but they seem to have had minute cups and delicate stalks.

There are half a dozen chromatophores on the back of the "club" and one or two on the back of the stalk. The pen is apparently very delicate, being clearly visible only at the posterior end between the fins, where it forms a cone. It is traceable up the mid-dorsal line as a transparent streak.

A single specimen was taken on Aug. 31st, 1907, in 60° 3' N., 3° 53' W., in 505 m. It is, however, very probably a surface form.

Taonidium pfefferi is not unlike *Taonidium suhmi* (Lankester), and, indeed, Dr. Hoyle, who examined the specimen, put it down to that species. Dr. Pfeffer, however, was of opinion that the specimen was specifically distinct, and examination of the question has led me to share his opinion. It differs from *Taonidium suhmi* in its broader shape, in the order of the arms, structure of tentacle-stalk, arrangement of chromatophores, and in the outline of the anterior mantle-margin. In *T. suhmi* (Hoyle, Chall. Rep. xvi. (1886) p. 192, pl. xxxii. figs. 5-11) the body is fusiform, with the length more than three times the breadth; the order of the arms is 4, 3, 2, 1, there are no suckers on the stem of the tentacles, the chromatophores are in about eight rows, and the mantle-margin is straight.

In some respects *Taonidium pfefferi* approaches close to the genus *Owenia*, Pfeffer, with its single species *Owenia megalops* (Prosch); but the two genera are probably hardly distinct from one another.

The species is named in honour of Dr. Georg Pfeffer, Hamburg.

Moschites cirrosa (Lamarck).

Examination of specimens from Naples and from Plymouth has convinced me of the identity of the common *M. cirrosa* of our shores with the Mediterranean *M. aldrovandi*. Among the specimens of *Moschites* collected by the 'Goldseeker' there are two distinct types—one the true *aldrovandi* form, with its reddish colour and its arms all closely bound

together to form a deep conical "umbrella-cavity"; the other a greyish form, with the arms connected up by a loose web, so that the "umbrella-cavity" is very flat and open. The latter form seems to occur chiefly in the north of Scotland and in the Shetlands. I hesitate to assign to it specific rank, but it will be described and figured in the complete account as a new variety.

The majority of the specimens were females, but one or two small males also occurred. One male of the *aldrovandi* type showed a small hectocotylation exactly resembling that figured by Jatta for *M. aldrovandi*. I have had an opportunity of examining also a male of this same type, 11 cm. in length, in the Museum of University College, Dundee. It had been taken at Aberdeen in October 1893, and showed quite clearly the hectocotylation typical of *M. aldrovandi*. One small male belonging to the other form of *M. cirrosa* showed a slight hectocotylation of the same general character. In no case did I observe the paired cirri on the tips of the arms of the male which are described by Steenstrup and by Posselt as distinctive features of *M. cirrosa*. There can be no doubt, I think, that Lamarck's *Octopus cirrhosus* and Rafinesque's *Eledone aldrovandi* are identical, and that the *Eledone cirrosa* described by Steenstrup and by Posselt is quite a different species, probably a northern form.

It is unfortunate that the rule of priority demands the naming of our common British species *Moschites cirrosa*, when the identical Mediterranean form has been so beautifully described and figured by Jatta under the name of *Moschites aldrovandi*.

Rossia glaucopsis, Lovén.

This is distinctly a northern form, being recorded from the Norwegian coast, Spitzbergen, Greenland, and in British waters hitherto only from the Shetlands and (as *R. sublevis*) from 250 fath. to the south-west of Ireland (*Smith*). It was taken by the 'Goldseeker' chiefly in deep water in the Faeroe Channel and near the Shetlands, but one small specimen was taken in 200 m. as far south as Kinnaird Deep. Eggs of this species, imbedded in a mass of soft sponge and containing the remarkably large embryos (6-7 mm. long), were taken in 110 m. at 60° 23' N., 0° 14' W.

Sepiola aurantiaca, Jatta.

This is undoubtedly a good species of *Sepiola*. About

twenty specimens were taken at various localities on the east coast of Scotland, near Shetland, and in the Faeroe Channel, which agree closely with Jatta's descriptions and figures. The only point of difference which should be mentioned is that the two adult males in my possession show foliaceous processes at the base on the first left arm only. Jatta describes these as occurring to a slight extent on the first right arm also. The distinctive characters of this beautiful species are the full red colour of the back, due to the numerous small and crowded chromatophores, the deeply sinuous outline of the inferior margin of the mantle, the deeply incut fins, and in the male the foliaceous hectocotylistation. The tentacular club bears in my specimens 8-10 rows of small suckers.

Sepiola aurantiaca has hitherto been recorded only from Mediterranean waters.

Calliteuthis reversa, Verrill.

Two small examples of this remarkable species were taken with the Petersen young-fish net at Sta. 59° 54' N., 7° 6' W., in 250 m. They are only 14 mm. and 17 mm. in length. They lack the dark brown colour inside the arms, on the buccal membrane, and along the edge of gill, which Verrill describes for this species, but they show the typical arrangement of the luminous organs on the ventral surface and on the ventral and ventro-lateral arms. Dr. G. Pfeffer, who very kindly examined my specimens of Oigopsida, has confirmed this identification.

Calliteuthis reversa has not previously been recorded from British waters. Verrill records it from the deep water off the north-eastern coast of America in 365-2369 fath. It has been found in New Zealand and Japanese waters (*Hoyle*) and also in the Mediterranean (*Pfeffer*).

The collection was worked over in the Embryological Laboratory of Glasgow University during the winter sessions 1907-8 and 1908-9. A full account of the collection, with figures of the new species, will appear in connexion with the 'Reports of the North Sea Fisheries Investigation Committee (Northern Area).'

March 1909.