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HOLOTHURIOIDEA

BY

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Holothurians (or fragments of such) were collected in nine of the trawlings made by the Swedish Deep-Sea Expedition in the Atlantic in 1948. These animals were thus present in nearly all the successful hauls. At least nine different bottom-dwelling deep-sea species are represented. They belong to three different orders: 1) the Apoda, with the Synaptid *Protankyra brychia* (Verrill), 2) the Aspidochirota, also with one species, the Synallactid *Mesothuria candelabri* Hérouard, and 3) the Elasipoda to which all the remaining species belong, viz. of the family Elpidiidae: *Peniagone lugubris* Théel, *P. porcellus* Perrier, *P. nybelini*[1]) n. sp., *Scotoanassa translucida* Hérouard, and an unidentifiable species of *Peniagone* or perhaps *Scotoanassa* (only represented by some juvenile specimens); and of the family Psychropotidae: *Benthodytes typica* Théel, *Euphronides kerhervei* (Hérouard), and *Psychropotes* aff. *minutus* Koehler & Vaney.

Of the identifiable species, therefore, one is considered new to science, and one species, *Psychropotes minutus*, was hitherto known only from the type-locality in the Indian Ocean, whereas all the other species were recorded previously from the Atlantic deep-sea, three of them, however, only being known from the typelocalities.

Protankyra brychia (Verrill 1885)

Fig. 1.

Synapta brychia Verrill 1885 p. 539.

Synapta abyssicola Théel 1886 a pp. 14—18, pl. 1 11.

Synapta sp. Théel 1886 b p. 20.

Protankyra abyssicola R. Perrier 1902 pp. 538—540.

Protankyra abyssicola H. L. Clark 1908 pp. 25, 105, pl. 4 8—11; 1924 pp. 496—497 (pars).

Protankyra abyssicola Hérouard 1923 p. 140.

Protankyra abyssicola Heding & Ludwig 1935 pp. 146—150 figs. 12—13.

Protankyra brychia H. L. Clark 1908 pp. 25, 105, pl. 4 12—14.

Protankyra brychia Deichmann 1930 p. 209; 1940 pp. 229—230, pl. 41 1—3.

? *Protankyra abyssicola* var. *pacifica* Ludwig 1894 pp. 174—178, pl. 18 13—19.

? *Protankyra pacifica* Ludwig, in Heding & Ludwig 1935, p. 149.

? *Protankyra abyssicola* H. L. Clark 1913 pp. 227—228; 1920 pp. 124—125; 1924 pp. 496—497, pls. 11 6—7, 12 1.

Material: St. 387 (Haul No. 13), N 40° 33′ W 35° 24′—N 40° 34′ W 35° 52′, Sept. 7th 1948; depth 4,540—4,600 m: 5 specimens and 2 fragments.

The largest of the intact specimens measures 37 mm in length. The two fragments, the one a fore part and the other a hind part, originate from considerably larger specimens, or possibly both from the same individual, which in that case was at least 70 mm long. The smallest specimen is only 9 mm in length. All the specimens are much contracted.

The colour of the preserved specimens varies from whitish to a very pale pink, sometimes

[1]) Named after Dr. O. Nybelin, the leader of the biological investigations of the Swedish Deep-Sea Expedition.

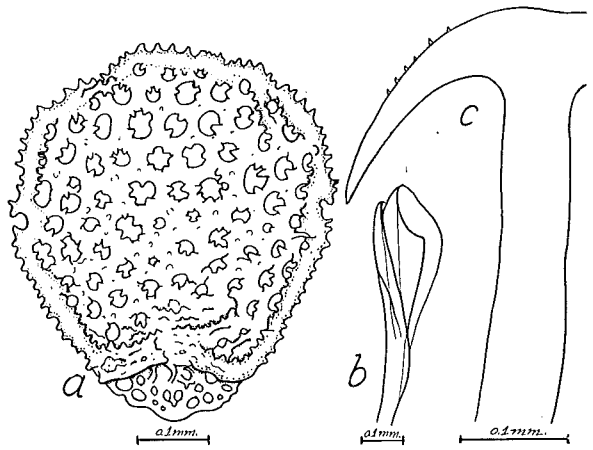

Fig. 1. *Protankyra brychia*. *a*. A fully developed anchor plate, with closed margin, from a specimen about 70 mm long. *b*. Ciliated funnel from a specimen measuring about 30 mm. *c*. Part of an anchor from the specimen about 70 mm long.

with fairly large ochrous areas. The tentacles (twelve, each with two pairs of digits) are whitish or slightly purplish. The oral disc is violet.

Two specimens which were dissected had four and six polian vesicles respectively. Ciliated funnels were found in a longitudinal series in the fore part of the left dorsal interradius. They are much higher than broad and thus differ from those figured by LUDWIG (1894 pl. 18 18—19) for his *P. abyssicola* var. *pacifica*. Their preservation does not allow a closer description but one is sketched in Fig. 1 *b*.

The specimens agree fairly well with the description of *abyssicola* given by LUDWIG & HEDING (1935) for the specimens collected by the Valdivia off West Africa; but the plates, with 50—70 holes, are not quite so large as stated for that material. A fully formed anchor plate is figured here (Fig. 1 *a*) since the illustrations given by LUDWIG & HEDING, op. cit., and by DEICHMANN (1940) only show plates in which the circumference is not yet closed, they apparently still adding holes here. Such plates are, however, the most commonly ocurring ones in the present material also. The spines, about six in number, present on each of the anchor flukes are very small and only clearly discernible at a fairly high magnification; both CLARK's figure (1908 pl. 4 12) and LUDWIG & HEDING's text-fig. 12 3 were apparently drawn at a too low magnification for showing their real appearance, and a figure of an anchor fluke is therefore also included (Fig. 1 *c*).

The species to which these specimens are referred was described by VERRILL in 1885 (as *Synapta brychia*) on a specimen from off the East Coast of N. America (Cape Hatteras) at a depth of 1,715 m. DEICHMANN in 1940 added two new localities in the same area, off New York, 2,021 m, and off Florida, depth unrecorded, and stated that THÉEL's *Synapta sp.* (1886 b) from off New York, 2,549 m, was also a *P. brychia*. DEICHMANN is further of the opinion that THÉEL's *S. abyssicola* also belongs to *P. brychia*.

Synapta abyssicola was described by THÉEL (1886 a) on a fragmentary specimen from off tropical West Africa, 4,298 m. R. PERRIER (1902) added a new locality in the same area, depth: 3,200 m. HÉROUARD (1923) recorded the species from off the Bay of Biscay at 4,870 m; and LUDWIG & HEDING (1935) added three further localities off tropical West Africa at depths of 2,225 to 4,990 m.

LUDWIG in 1894 described a number of Synaptids from off the Gulf of Panama, depth: 3,058 to 3,241 m, as a new variety of *abyssicola*: var. *pacifica*; but later he considered the material to be a distinct species (LUDWIG & HEDING, op. cit. p. 149).

LUDWIG & HEDING thus reckon with three different deep-sea species of *Protankyra*, viz. a Pacific *P. pacifica*, an East Atlantic *P. abyssicola*, and a West Atlantic *P. brychia*. Consequently, they also expect the Synaptid recorded by CLARK (1908 p. 105) from the Gulf of Mexico, 2,259 m, under the name of *abyssicola* to be a *P. brychia*.

H. L. CLARK in 1908 in the same way distinguished between *brychia* and *abyssicola* and further stated that the var. *pacifica*, of which he had re-examined the types, was

entitled to full specific rank. In 1913, 1920, and 1924 CLARK recorded, however, a number of specimens from the Pacific, off America from Monterey in the north to Peru in the south, 869 to 4,755 m, under the name *abyssicola*, since these specimens had anchor flukes with fine thorns; and in his paper of 1913 CLARK apparently is not sure whether *pacifica* can be maintained, as he stated formerly.

DEICHMANN, as has been said above, regards *brychia* and *abyssicola* as synonymous, but thinks that *pacifica* should be maintained as a distinct species.

The examination of the present specimens rather confirms the latter opinion. The identity of THÉELS's *abyssicola* with VERRILL's *brychia* probably cannot be questioned, while *pacifica*, if the difference here recorded in the appearance of the ciliated funnels holds good, must be regarded at least as a distinct subspecies and perhaps be given specific rank.

Distribution: *Protankyra brychia* is probably distributed throughoutth e deep-sea areas of the Atlantic, where it has hitherto been recorded from several localities between 45° N and 16° S (cf. above). Vertical range: 1,715 to 4,990 m.

The related *P. pacifica* is hitherto recorded only from the Eastern Pacific, depths: 869 to 4,755 m.

Mesothuria candelabri Hérouard 1923

HÉROUARD 1923 pp. 17—19, pl. 1 1—10.

Non *M.* (*Allantis*) *candelabri* HEDING 1940 pp. 334—335, Fig. 3 (= *M. cathedralis* Heding 1940, vide HEDING 1942 p. 9).

Material: St. 387 (Haul No. 13), N 40° 33′ W 35° 24′—N 40° 34′ W 35° 52′, Sept. 7th 1948; depth 4,540—4,600 m: 1 specimen.

The specimen in its present contracted state measures about 75 mm in length and about 35 mm in breadth. Its shape is oblong ovoid. There are no appendages. The colour is now whitish grey and was apparently the same when the specimen was captured. The calcareous deposits agree with those of the type, i. e. they are of a delicate appearance, the disk having mostly only the eight primary holes, and with a three- or four-armed spire. More rarely the disk has also an outer ring of secondary holes. More robust deposits with a somewhat larger disk with smaller and more numerous holes (cf. HÉROUARD's fig. 7 on pl. 1) occur scatteredly in the deeper layer of the integument.

Distribution: Apart from the above locality, West of the Azores, *Mesothuria candelabri* is only known from the type-locality in the Bay of Biscay, 45° 07′ N, 7° 06′ W. Vertical range: about 4,550 to 4,870 m.

Peniagone lugubris Théel 1882

Fig. 2—3.

THÉEL 1882 pp. 44—45, pl. 10 1.

Material: St. 329 (Haul No. 3), N 09° 38′ W 26° 20′—N 09° 50′ W 26° 30′, July 3rd 1948; depth 5,610—5,600 m: 5 specimens and some fragments.

These specimens are all much contracted and distorted. It is difficult therefore to judge of their appearance when alive. They range in size of main body from about 20 mm to 35—40 mm. The largest specimen is the best preserved and a somewhat reconstructed sketch of this specimen is given in Fig. 2 *a—b*. The present appearance of two of the other specimens is sketched in Fig. 2 *c—d*.

The largest specimen is a flattened oval. The posterior part of the body bears on either side seven papillae, the most anterior pair placed ventrally (owing to the strong contraction?), the other ones being lateral, the five hindmost pairs forming a kind of brim. Be-

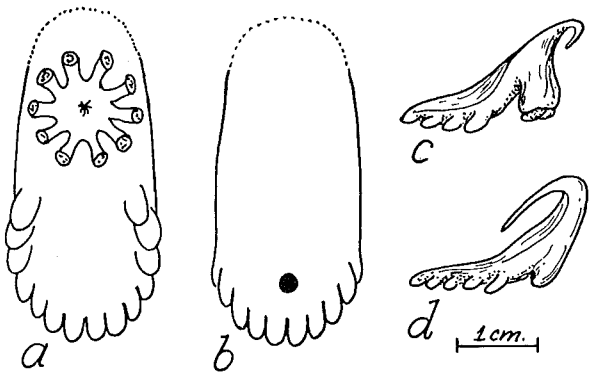

Fig. 2. *Peniagone lugubris*. *a—b*. Sketch (reconstructed) of the largest specimen seen from the ventral and dorsal sides respectively (the veil was so contracted that no idea of its appearance could be formed). *c—d*. Sketches of two of the other specimens in their present state.

tween the tentacle crown and the papillae there is a distinct diastema. In the smaller specimens there are, apparently, fewer papillae, but their number cannot be made out exactly owing to the poor state of the specimens. There is a well developed veil, especially conspicuous in some of the smaller specimens. In one of the specimens it is of the same length as the main body (Fig. 2 *d*). In this specimen the anterior half of the veil is bent backwards, whereas in another specimen it is bent downwards. Apparently the veil is very flexible and capable of considerable extension and contraction. In the largest specimen it is much contracted. One of the fragments seems to show that the veil is divided into four lobes anteriorly. In another fragment the number of lobes seem to be larger, but perhaps this veil has been torn.

All the specimens are now, in alcohol, of a deep violet, almost black colour. When alive they were reddish violet.

The most common sclerites of the body wall (Fig. 3 *a*) are those of the type characteristic of the Peniagoninae (by EKMAN, 1925, designated »Vierfüsse»), viz. the primary rod with four arms bent inwards and each arm with an outwardly directed projection. Their arms are very distinctly bent inwards, about 0.07 mm long and finely spinous in more than half their outer part. The projections are a little more spinous and measure about half the length of the arms or somewhat more. Similar 'Vierfüsse', however often slightly irregularly developed, are to be found in the

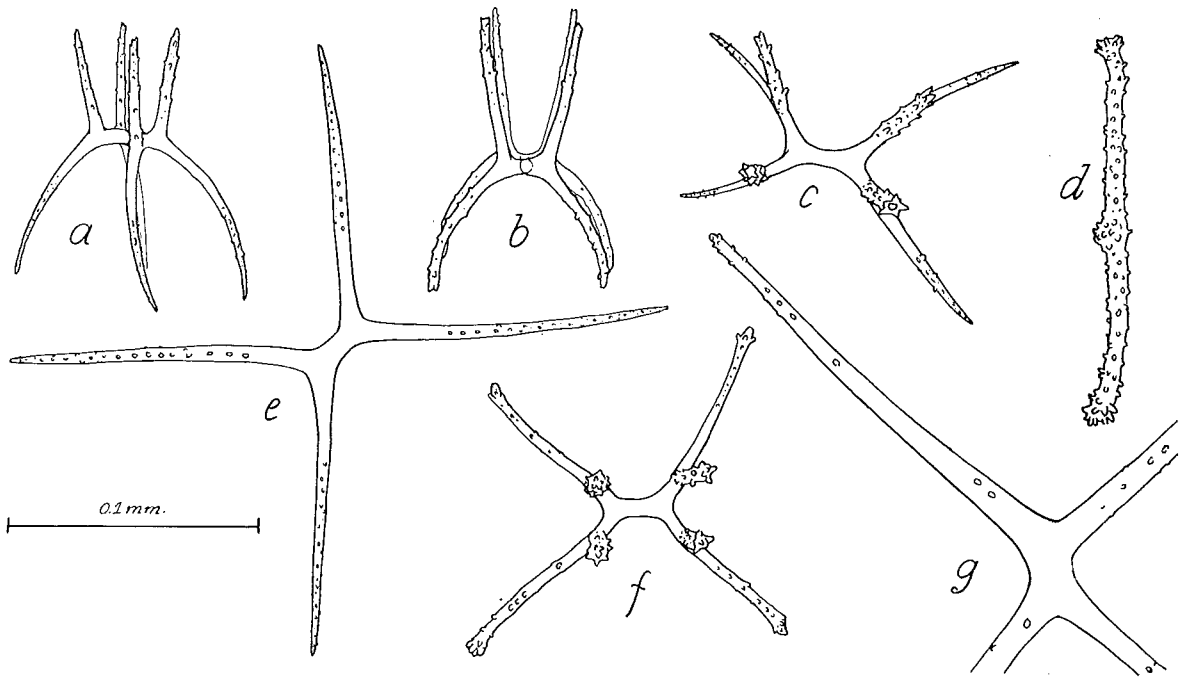

Fig. 3. *Peniagone lugubris*. *a—c, f*. 'Vierfüsse', *a* from the posterior dorsal body wall, *b* from a lateral papilla (seen from the end), *c* from the ventral body wall (seen obliquely from above), and *f* a slightly abnormal one from a lateral papilla (the arms only very slightly bent inwards). *d*. Rod from the gullet. *e, g*. Primary crosses from a lateral papilla.

papillae, the veil, and the tentacles (Fig. 3 *b*, *f*). In these places there are further scattered primary crosses (Fig. 3. *e*, *g*) with straight and more or less spinous arms, and often with a primary rod so short that they become really cross-shaped. Their diameter varies from about 0.2 to 0.4 mm; in the tentacles, where they are rather irregularly developed, they may even be about 0.5 mm in length, or slightly more. In the tentacles there are in addition larger, smooth rods, straight or more or less curved. Spinous rods, about 0.15 mm long, occur in the gullet (Fig. 3 *d*).

The species, *P. lugubris*, to which these specimens are referred, was described by THÉEL (1882) on a specimen collected by the Challenger at a depth of 4,570 m in a locality quite near that recorded above. Hitherto only the type-specimen was known. THÉEL's description is not very exhaustive, his specimen being in a rather bad state of preservation. His description of the sclerites agrees well with those of the present specimens, but, on the other hand, it is written in such general terms that it would agree with not a few species of *Peniagone*. THÉEL does not give any figures of the sclerites, but refers only to those of the sclerites of his *P. wyvillei* which they are said to resemble. The illustration given of the general appearance of the type-specimen agrees fairly well with that of the present specimens; at any rate it does not preclude the identity of the present material with *lugubris*. What especially supports the conviction that these specimens belong to *lugubris* is the colour, which in the type of *lugubris* was also dark violet, almost black, when the specimen was kept in alcohol.

Distribution: *Peniagone lugubris* is only known with certainty from the type-locality in 2° 25' N, 20° 01' W, and the locality recorded above, situated somewhat more to the north in the mid-Atlantic. The depths are 4,570 and 5,610—5,600 m respectively.

To *P. lugubris* may further belong, however, the fragment recorded below from the West Indies, 5,850—5,860 m.

Attention should also be called to *Peniagone ferruginea* of GRIEG (1921 pp. 7—8, text-fig. 3, pl. 1 4—6) from the vicinity of the Canaries, 2,800—3,000 m, which species at any rate stands very close to *lugubris*, the only difference from the descriptions being that *ferruginea* has the hindmost pair of papillae distinctly smaller than the other ones, whereas in *lugubris* the papillae are all of about the same size.

Peniagone sp. (? *lugubris* Théel)

Material: St. 371 (Haul No. 10) N 24° 12' W 63° 23' — N 24° 28' W 63° 18', Aug. 20th 1948; depth 5,850—5,860 m: One fragment.

This fragment, the tentacle-crown and part of the body-wall of a *Peniagone*, cannot be identified with certainty. The sclerites, however, resemble those of the above specimens referred to *P. lugubris*. The dark, greyish blue colour of the fragment also seems to support this identification.

Peniagone porcellus R. Perrier 1902

Fig. 4.

R. PERRIER 1896 p. 901; 1900 p. 118; 1902 pp. 426—429, pls. 13 7—9, 19 15—23.

Material: St. 363 (Haul No. 8) N 12° 22' W 52° 00' — N 12° 13' W 51° 44', Aug. 3rd 1948; depth 5,044—5,033 m: 1 specimen.

The only specimen present is in a very poor state, much torn and very slimy. It may have measured about 7—8 cm in length, but it is not possible to say anything definite about its general appearance when alive. No papillae could be discerned. The body wall is

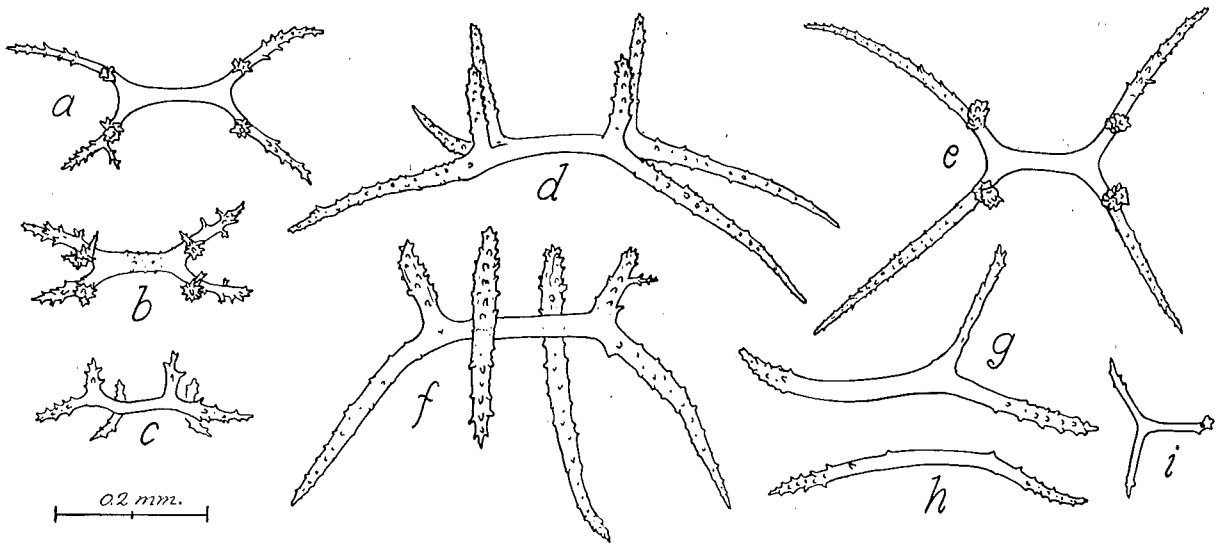

Fig. 4. *Peniagone porcellus*. *a*—*c*. 'Vierfüsse' from the anterior part of the ventral body wall. *d*—*f*. 'Vierfüsse' from the anterior part of the dorsal body wall. *g*—*i*. Rods from the tentacles.

translucent; the colour very light pink. The foremost empty part of the intestine is reddish and easily seen through the body wall. The rest of the intestine preserved is filled with mud and is therefore of a grey colour.

The sclerites of the body wall are exclusively 'Vierfüsse', which in this species are fairly large and with a rather long primary rod. Those of the dorsal body wall (Fig. 4 *d*—*f*) measure about 0.5 to 0.6 (0.7) mm in length. Their arms are about twice as long as the primary rod and provided with short spines in their whole length and bent only moderately inwards. Their projections are fairly stout, of a length about that of the primary rod or somewhat less and more thorny than the arms; often they end rather bluntly. The 'Vierfüsse' of the ventral body wall (Fig. 4 *a*—*c*) are of a more delicate, but at the same time more thorny appearance and somewhat smaller, 0.25—0.45 mm long, than the dorsal ones. This, however, is due to the fact that the arms are only about as long as the primary rod which is itself of almost the same length as in the dorsal sclerites. The arms are only bent very little inwards. Their projections are short and, like the arms proper, provided with fairly longe spines. There are also some sclerites in which the primary rod too is provided with some small spines. In the tentacles there are, besides the usual 'Vierfüsse', also simple, pointed rods, straight or curved, and various intermediate stages between these and the 'Vierfüsse'. (Fig. 4 *g*—*i*).

This specimen, despite its poor condition, can with certainty be referred to R. PERRIER's *P. porcellus*, hitherto only known in the type-specimen. The sizes of the dorsal and ventral 'Vierfüsse' respectively correspond to those recorded by PERRIER; and the appearance of the dorsal ones is exactly as shown for the type-specimen, (R. PERRIER 1902 pl. 19 15—17). But when PERRIER says of the sclerites that 'ils sont à peu près identiques sur la face dorsale et sur la face ventrale' I do not think he does enough justice to the difference actually present, which it has therefore been considered worth while to illustrate by the accompanying figures.

Distribution: Only known from the type-locality between the Azores and Europe, 42° 19′ N, 23° 36′ W, 4,060 m, and the above recorded locality in the Western Atlantic somewhat east of Trinidad, at 5,044—5,033 m depth.

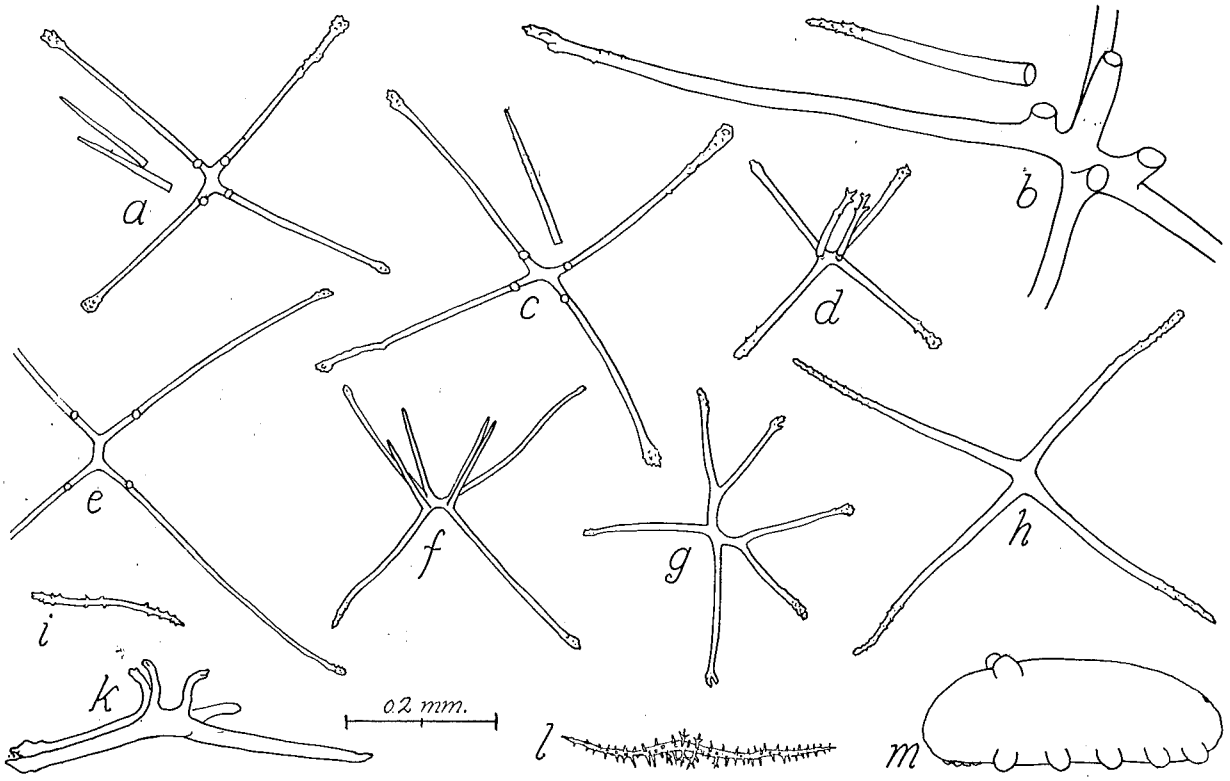

Fig. 5. *Peniagone nybelini*, type-specimen. *a—b*. 'Vierfüsse' from the dorsal body wall, *a* of the usual type. *c—i*. Sclerites from the ventral body wall. *c* the usual type of 'Vierfuss'. *d* abnormal 'Vierfuss' with only two projections. *e* abnormally slender 'Vierfuss' with the projections placed unusually far out on the arms. *g—h*. Primary crosses, *h* the usual type. *i*. Rod from the ventral body wall. *k*. 'Vierfuss' from the tentacles. *l*. Pointed rod from the gonads. *m*. Sketch showing the probable appearance of the specimen when alive.

Peniagone nybelini n. sp.

Fig. 5.

Material: St. 342 (Haul No. 4), N 01° 03′ W 18° 40′ — N 00° 58′ W 18° 37′, July 16th 1948; depth 5,250—5,300 m: 1 specimen.

Diagnosis: *Peniagone* with five (or six) evenly distributed lateral papillae on either side and a pair of dorsal papillae anteriorly. 'Vierfüsse' of body wall almost cross-shaped, usually about 0.6 mm in diameter, their arms bent only slightly inwards, and smooth apart from the knob-like ends; their projections about half to a third of the length of the arms, usually pointed and almost smooth.

Type-locality: The mid-Atlantic near the Equator, 5,250—5,300 m.

Type preserved in the Natural History Museum of Göteborg.

The single specimen collected measures about 5 cm in length. Its colour is light reddish violet, mottled. It seems to be much contracted. Its present shape is ovoid. The papillae are difficult to observe on the outside of the body since they are completely retracted. From the inside of the body wall, however, it could be easily ascertained that there is a pair of dorsal papillae anteriorly, and five evenly spaced lateral papillae along one (the left) side, and along the other side six lateral papillae of which, however, the anterior two are, apparently, an abnormal duplication of a single papilla. There are ten tentacles and one polian vesicle. The specimen was ruptured ventrally, the intestine for the greater part missing, and the whole body-cavity filled with mud. Loose in this mud lay two clusters of now distinctly violet gonads.

The most common sclerites of the body wall are 'Vierfüsse' of a very characteristic appearance (Fig. 5 *a—f*). The primary rod is very short so that the sclerite becomes almost

cross-shaped. The arms are slender, with a knob-like end, and bent only slightly inwards. The knob-like ends are provided with small spines, but otherwise the arms are smooth. The projections are generally placed quite near the primary rod. They are as slender as the arms, usually pointed and almost smooth. Some may be provided with scattered small spines, especially in the distal part, and a few are furnished with some larger spines distally. They are usually about half as long as the arms, but may be about two thirds the length of these. Most of the 'Vierfüsse' have arms about 0.25—0.3 mm long. Smaller ones with arms only 0.15 mm long may also be found; and some very large 'Vierfüsse', with arms up to 0.8 mm long, have been found scatteredly in preparations of the dorsal body wall. On the whole, the sclerites of the dorsal side seem to be larger than the ventral ones. Among the usual 'Vierfüsse' there may also be some with only three, or two, projections; and one sclerite with only a single central projection has been observed. Usually the projections stand rather close to each other, but in some few sclerites they may be placed a small distance out on the arms (Fig. 5 *e*).

Besides the usual 'Vierfüsse' a number of slightly larger primary crosses (Fig. 5 *h*) are also present in the body wall, and further some few similar ones with only three arms and some with as many as six arms. In addition some small, thorny rods (Fig. 5 *i*) occur scatteredly.

The sclerites of the tentacles are essentially of the same type as the 'Vierfüsse' of the body wall, only more or less abnormally developed (Fig. 5 *k*).

The sclerites of the gonads are slender pointed rods, straight or curved, provided with numerous rather long spines of which some of the median ones may bear smaller thorns. The largest of these rods measure about 1 mm in length. Many of them are branched.

As far as I know the type of 'Vierfüsse' described and illustrated for this specimen is unique among the Peniagoninae and thus alone sufficient for the identification of the new species.

Distribution: Known only from the type-locality in the mid-Atlantic at the Equator, depth: 5,250—5,300 m.

Scotoanassa translucida Hérouard 1899

Fig. 6.

HÉROUARD 1899 p. 172 fig. 3; 1902 pp. 43—45, pls. 3 4—6, 6 17—20; 1923 pp. 88—90, pls. 3 7—8, 4 4.

Material: St. 329 (Haul No. 3), N 09° 38′ W 26° 20′—N 09° 50′ W 26° 30′, July 3rd 1948; depth 5,610—5,600 m: 7 specimens and a few fragments.

St. 401 (Haul No. 14), N 43° 40′ W 18° 45′—N 43° 24′ W 18° 59′, Sept. 15th 1948; depth 5,000—5,025 m: 1 specimen (fragmentary).

The two largest specimens measure about 70 mm in length and about 35—40 mm in breadth. The smallest specimens are about 40 mm long and 12—15 mm broad (these specimens are much contracted). The other specimens are intermediate, the third largest being 50 mm long by 25 mm broad. The fragmentary specimen from Haul 14 is 25 mm broad and was probably about 50 mm or a little more in length.

The specimens, when not too much contracted, are extremely flattened. One of the largest has the posterior papillae (four on either side) well expanded, but in the other ones they are contracted and often difficult to discern. The anterior part of the body extends somewhat over the tentacle-crown, and in one specimen four anterior papillae can be distinguished, corresponding to the four distinct papillae of the living specimen illustrated in HÉROUARD's pl. 3 4 (1923).

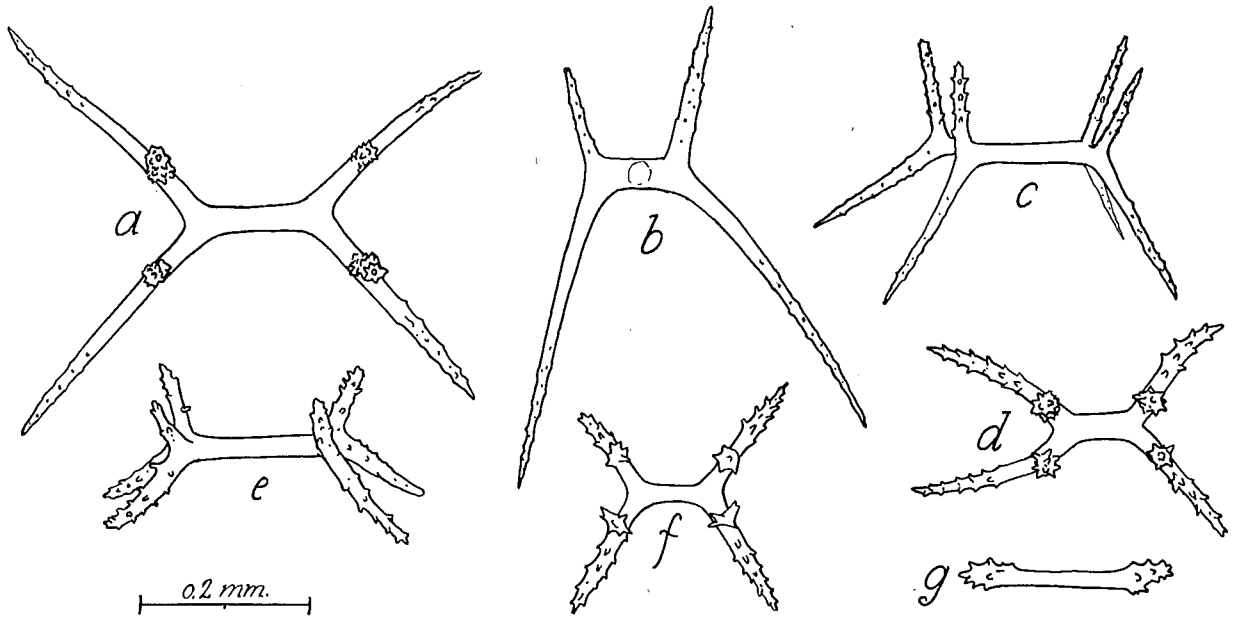

Fig. 6. *Scotoanassa translucida*. *a—b*. Sclerites from the dorsal body wall of the 70-mm-large specimen. *c—f*. Sclerites from the ventral body wall, *c—d* from the 70-mm-large specimen, *e* from one of the fragments, *f* from the midventral part of the 45-mm-large specimen. *g*. Rod from the gullet.

The colour is whitish and transparent, the posterior part of the intestine often shining red through the body wall, as was the case in the living specimen illustrated by HÉROUARD. In the fragment from Haul 14 it is, however, the red oesophageal part of the intestine which shines through.

Only one type of sclerites, the 'Vierfuss', occurs in the body wall. The sclerites of the dorsal side (Fig. 6 *a—b*) are rather slender, and generally with arms 0.3—0.4 mm long. The largest ones, however, have arms about 0.6 mm long and measure almost 1 mm in total length (the distance between two arm-tips on the same side). The arms are moderately spinous in their distal half. The projections are about half the length of the arms and are throughout their length somewhat more spinous than these. The sclerites in the lateral parts of the ventral side resemble the dorsal ones but change gradually towards the mid-ventral part of the body, where they are smaller, i. e. with much shorter arms than the dorsal sclerites, more spinous, and with very short projections (Fig. 6 *f*).

The sclerites in the tentacles and the oesophageal part of the intestine are about 0.2—0.3 mm long, simple rods, smooth apart from the somewhat swollen ends (Fig. 6 *g*).

Distribution: *Scotoanassa translucida* was known previously from a number of localities between the Azores and Europe, at depths from 4,200 m (or less, 0—4,200 m) to 5,005 m. One of the above recorded localities is in the same area, whereas the other one is in the mid-Atlantic between West Africa and Brazil, at a depth of 5,610—5,600 m. The species is undoubtedly distributed throughout the Atlantic deep-sea.

Peniagone (or **Scotoanassa**) sp.

Fig. 7.

Material: St. 370 (Haul No. 9), N 19° 49′ W 65° 01′—N 19° 42′ W 64° 44′, Aug. 17th—18th 1948; depth 7,900—7,625 m: About 20 specimens.

These specimens, together with some more which, however, were not preserved, were found in the meshes of the trawl when it came

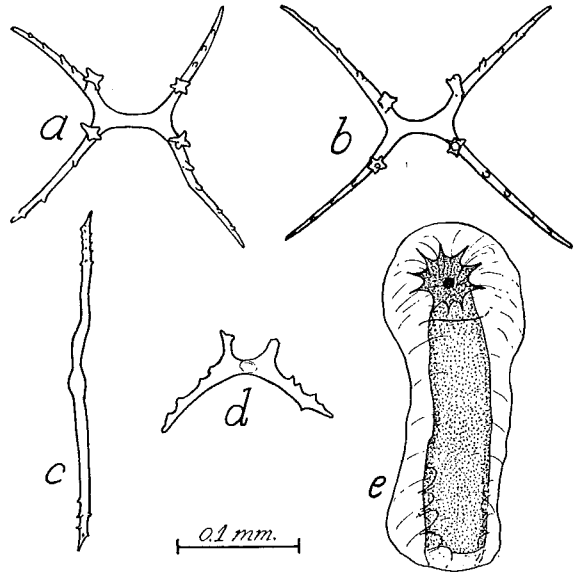

Fig. 7. Juvenile Peniagonid, Sw. Deep-Sea Exp. St. 370. *a—b, d.* 'Vierfüsse' from the ventral body wall. *c.* Rod from the gullet. *e.* Sketch of a specimen.

up at this station from the greatest depth at which zoological collections had hitherto been made. They are juvenile specimens of one or other species probably of the genus *Peniagone*, though their sclerites may also agree with the genus *Scotoanassa*. It is probable that they represent a new species, which I shall, however, refrain from naming owing to the uncertainty, and the impossibility of giving a satisfactory description.

The shape of these juvenile specimens is oblong cylindrical, with the anterior end somewhat swollen and the mouth placed ventrally. Their length varies from about 15 mm to 18 mm. The body wall of most of the specimens is thick and gelatinous, apart from ventrally, with the intestine, the longitudinal muscles and the ten tentacles shining through. Developmental stages of sclerites ('Vierfüsse') (Fig. 7 *a—b*) occur scatteredly in the gelatinous mass. Some specimens are provided with densely crowded sclerites ventrally, and sclerites may also be fairly numerous in other parts of the body, especially posteriorly. Some specimens seem to show sclerites developing in large numbers both in the deeper and in the outer layer of the gelatinous body wall posteriorly, whereas in the anterior swollen part of the body sclerites are only developed in the outer layer. A few of the best developed sclerites are drawn in Fig. 7. In the oesophageal part of the intestine there are pointed rods (Fig. 7 *c*).

A rudiment of an anterior veil seems to be present in some of the specimens; and in a few of the best preserved ones a number (4—6 ?) of lateral papillae could also be descerned posteriorly on either side.

In spite of their gelatinous body wall the specimens have a fairly robust appearance. This together with the fact that all of them seem to have their intestines filled with bottom material indicates that they must have been bottom-dwelling. The Swedish Deep-Sea Expedition has thus by the capture of this holothurian extended the vertical range known for benthonic animals downwards by almost two kilometres.

Benthodytes typica Théel 1882

Fig. 8.

B. typica Théel 1882 pp. 103—104, pls. 27 7, 35 4, 38 5, 44 8.

B. typica ? Théel 1886 b p. 2.

B. typica ? v. Marenzeller 1893 p. 12.

B. glutinosa R. Perrier 1896 p. 903; 1902 pp. 462—465, pls. 13 5, 20 31.

B. glutinosa Koehler & Vaney 1905 pp. 72—74, pl. 12 10.

B. glutinosa H. L. Clark 1920 p. 141.

B. typica + *B. glutinosa* Grieg 1921 pp. 10—11, text-fig. 8, pls. 13 5, 20 31.

B. typica Hérouard 1923 pp. 101—102, pl. 6 4.

B. typica Deichmann 1930 pp. 123—124.

B. typica Heding 1940 p. 368.

Material: St. 313 (Haul No. 1), N 29° 48′ W 17° 39′—N 30° 05′ W 17° 18′, June 16th 1948; depth 4,267—4,255 m: 3 specimens.

St. 357 (Haul No. 6), N 02° 26′ W 39° 26′—N 02° 24′ W 39° 12′, July 26th—27th

1948; depth 4,474—4,430 m: 1 specimen.

St. 387 (Haul No. 13), N 40° 33′ W 35° 24′ —N 40° 34′ W 35° 52′, Sept. 7th 1948; depth 4,540—4,600 m: 1 specimen.

These specimens in their present state range from 44 to 67 mm in length by a breadth of from 9 to 20 mm, but are all extremely contracted, with the longitudinal muscles squeezed together. They are, moreover, much torn. The outer layer of the skin of the dorsal side is for the greater part rubbed off; only the largest specimen (from Haul 13) was sufficient preserved for three very minute papillae to be discerned anteriorly, rather close together to the right side of the midline. In their general appearance the specimens differ much from the type of *B. typica* shown in THÉEL's pl. 27 7, but the difference is easily explained by their very contracted state.

The species *B. glutinosa* was described by R. PERRIER on contracted specimens similar to the present ones, the identity of *glutinosa* with *typica* pointed out by HÉROUARD op. cit. The specimens which THÉEL (1886 b) and v. MARENZELLER (1893), with quieries, refer to *B. typica* were possibly also such contracted specimens; so, at any rate, were two of THÉEL's specimens which I have been able to re-examine. It would seem as if the type of *B. typica* is the only hitherto known specimen preserved in a fairly normal condition.

Sclerites, rods, are fairly numerous in the papillae both on the ventral and the dorsal sides, but very scattered in the body wall itself. A characteristic feature in most of the rods is the slightly thickened middle. The sclerites of the gonads are almost like those of the body wall and papillae, only generally more slender and thorny, and often irregularly curved.

The number of tentacles seems to vary from 15 to 18.

Distribution: The collecting of *Benthodytes typica* on no less than three of the trawlings of the Swedish Deep-sea Expedition is well in accordance with the fact that this species seems to be one of the most common and widely distributed deep-sea holothurians. It was recorded previously from about twenty localities in the Atlantic, viz. the West Indies, the mid-Atlantic, S. W. of Ireland, and off West Africa from Spain to Cap Blanco, depths 1,993 to 3,886 m, from four localities in the Indian Ocean, viz. the Arabian Sea and the Bay of Bengal, 2,754 to 3,652 m, and from one locality in the Eastern Pacific, 5° S, 88° W, 3,667 m (CLARK op. cit.). The new finds recorded above, between Europe and the Azores, east of the Azores, and north of Brazil, show that the species has a vertical range extending from 1,993 m a least down to about 4,600 m.

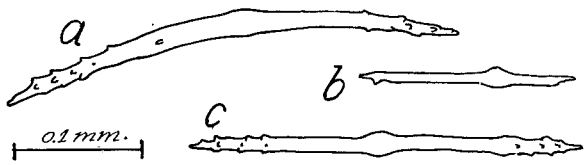

Fig. 8. *Benthodytes typica*. *a—b*. Rods from a ventral pedicel. *c*. Rod from the dorsal body wall near the base of a papilla.

Euphronides kerhervei (Hérouard 1902)

Fig. 9.

Psychropotes kerhervei HÉROUARD 1902 pp. 27—30, pl. 4 1—9; 1923 p. 104, pl. 3 4—5.
Benthodytes kerhervei DEICHMANN 1930 pp. 125—126.
Euphronides kerhervei DEICHMANN 1940 pp. 202—203, pl. 35 9—12.

Material: St. 329 (Haul No. 3), N 09° 38′ W 26° 20′—N 09° 50′ W 26° 30′, July 3rd 1948; depth 5,610—5,600 m: 1 specimen.

St. 342 (Haul No. 4), N 01° 03′ W 18° 40′— N 00° 58′ W 18° 37′, July 16th 1948; depth 5,250—5,300 m: 1 specimen.

St. 357 (Haul No. 6), N 02° 26′ W 39° 26′ — N 02° 24′ W 39° 12′, July 26th—27th 1948; depth 4,474—4,430 m: 3 specimens.

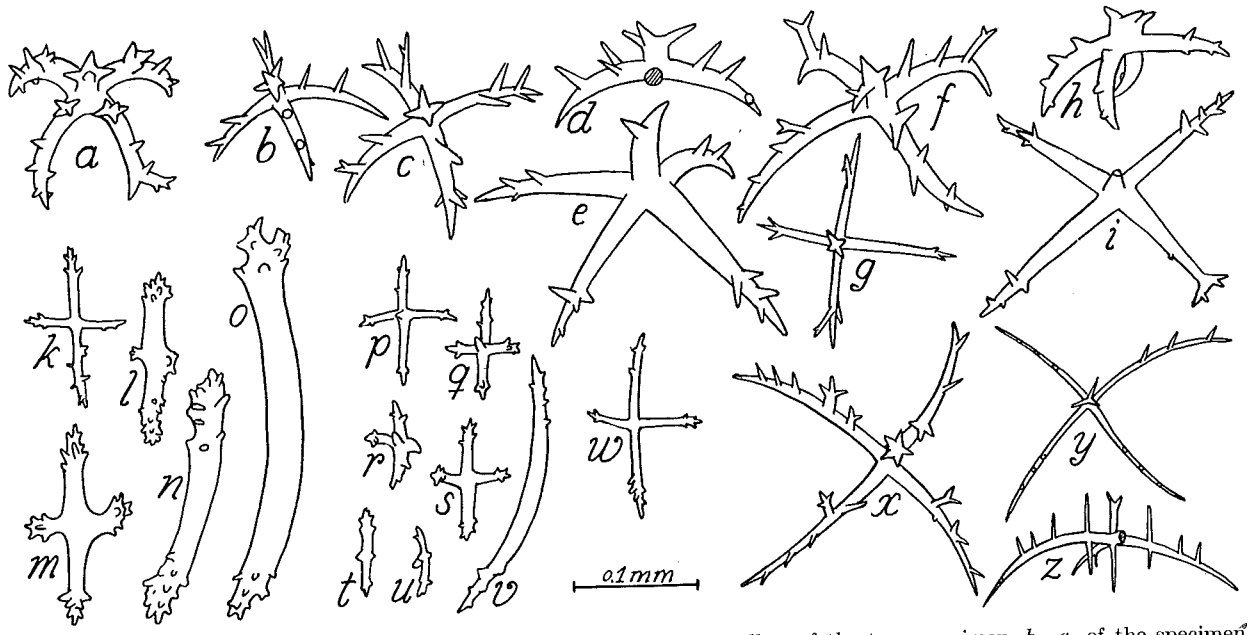

Fig. 9. *Euphronides kerhervei*. *a*—*i*. Sclerites from the dorsal body wall, *a* of the type-specimen, *b*—*g*. of the specimen from Haul 3, *h*—*i* of a specimen from Haul 6 (in *i* the central projection is broken off). *k*—*w*. Sclerites from the ventral body wall, *k*—*o* from the type-specimen (*m* is the type of cross most commonly occurring), *p*—*v* from a specimen from Haul 6, *w* the usual type of cross in the specimen from Haul 4. *x*—*z*. Sclerites from the gonads, *x* of the specimen from Haul 4, *y*—*z* of that from Haul 3.

The specimens at hand range from about 55 mm to about 100 mm in length. They are mostly rather distorted and damaged so that little can be said about their general appearance or appendages. The ventral surface is flattened, framed by the lateral papillae, and in some specimens has the appearance of a sole, whereas the dorsal side is vaulted, usually highest in the posterior part of the body.

The two largest specimens, 100 and 85 mm long, from Haul 4 and Haul 3 respectively, have ventrally about 25—30 pairs of pedicels, and three pairs of minute papillae on the anterior quarter of the dorsal side. The specimens from Haul 6, about 55 to 80 mm long, likewise seem to have had three pairs of dorsal papillae, but here arranged with one pair anteriorly, another pair about one third of the body length from the anterior end, and the third pair behind the middle of the body. None of these specimens, however, had all three pairs of papillae discernible. The arrangement of the dorsal papillae thus differs somewhat in the specimens from the eastern and the western Atlantic respectively. The arrangement of the papillae (four pairs) in the specimen from off the Canaries figured by HÉROUARD, 1923 pl. 3 4, however, agrees best with the condition of the specimens at hand from the western Atlantic. The sclerite-armature is also essentially the same in all the specimens. No importance can thus be attached to this apparent difference.

The posterior dorsal appendages are completely retracted in the largest specimen, in which only two holes for the inverted pair of appendages are present at a distance of about one quarter of the length of the body from the posterior end. In the other specimens the appendages are more or less extended. In one specimen they seem to have a common part, likewise extendable, and in an other one there is, apparently, only a single broad unpaired appendage. This latter specimen is, however, in a very poor condition.

The number of tentacles is usually 16, but in one specimen only 15 could be discerned.

In their present preserved state all the

specimens are dark violet; when alive they were reddish violet or red.

The sclerites of the dorsal side are rather large and robust crosses with a strong central thorny projection and arms bent distinctly inwards and provided with a varying number of large spines (Fig. 9 *b*—*i*). — This kind of sclerites was the only one mentioned by HÉROUARD.[1]) — Ventrally the sclerites are smaller crosses without central projection and with straight arms; and scattered among these there occur larger robust and usually slightly curved rods with the distal parts provided with coarse spines, but otherwise smooth (Fig. 9 *k*—*w*). The sclerites of the gonads are crosses which recall the dorsal ones, but are somewhat larger, much more slender, and besides the usual spines and projections often also have some which are directed inwards (Fig. 9 *x*—*z*).

The tentacles are provided with crosses and rods like those of the ventral body wall.

There is a fairly great variation in the sclerites in each preparation, and both three- and six-armed sclerites may be found among the usual ones. There is also some difference between the sclerites of various specimens. The sclerites of the two specimens from Haul 3 and 4 (those with three anterior pairs of dorsal papillae) would thus seem to be generally more slender than those of the specimens from Haul 6 and of the examined type.

Distribution: *Euphronides kerhervei* was hitherto known from two localities west of the Azores, depth: 5,005 m (type-locality) and 4,275 m, one locality off the Canaries, 3,825 m, and two localities in the West Indies, 1,143 and 4,345 m respectively. To these are added the above-recorded three localities in the tropical mid-Atlantic. The species is thus no doubt distributed throughout the Atlantic deep-sea. Vertical range: 1,143 m to about 5,600 m.

[1]) Through the kind assistance of Dr. CHERBONNIER of the Natural History Museum of Paris I have been able to undertake a reexamination of the sclerites in one of HÉROUARD's original specimens and thus could ascertain the presence also of the other kind of sclerites described here. Otherwise I should not have been certain of the identification.

Psychropotes aff. **minutus**

(Koehler & Vaney 1905)

Fig. 10.

P. minutus KOEHLER & VANEY 1905 pp. 76—78, pls. 8 4—5, 12 23—24.

Material: St. 342 (Haul No. 4), N 01° 03′ W 18° 40′—N 00° 58′ W 18° 37′, July 16th 1948; depth 5,250—5,300 m: 1 specimen.

St. 363 (Haul No. 8), N 12° 22′ W 52° 00′ —N 12° 13′ W 51° 44′, Aug. 3rd 1948; depth 5,044—5,033 m: Only a cluster of detached gonads.

The only specimen present measures about 50 mm in length, but is in such a poor state

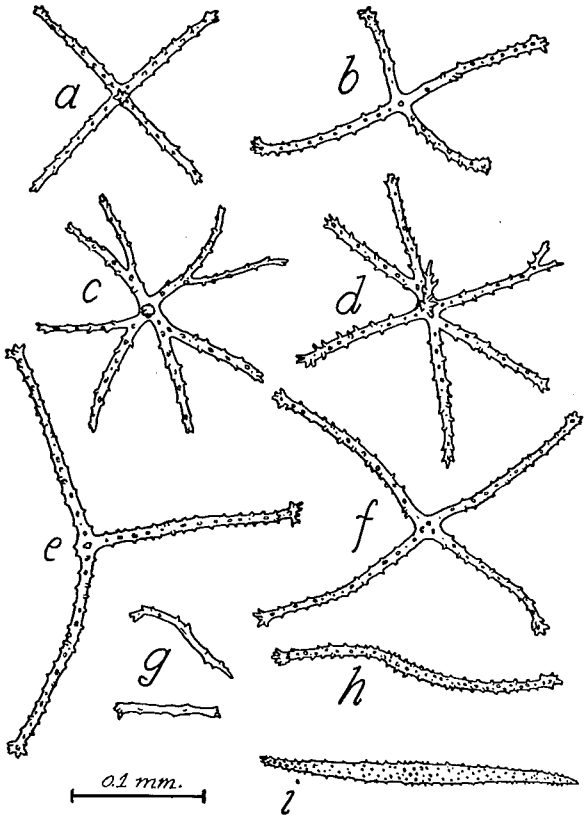

Fig. 10. *Psychropotes* aff. *minutus*. *a*—*d*. Sclerites from the anterior part of the dorsal body wall, *a*—*b* of the usual type. *e*—*f*. Two of the larger sclerites from the ventral body wall. *g*. Sclerites from the intestinal wall. *h*. Rod from the gullet. *i*. Pointed rod from the longitudinal muscles.

of preservation, ruptured and torn, that it is impossible to say anything definite of its appearance when alive. The number of tentacles may have been only eleven. There is no caudal appendage preserved, but a hole, about 3—4 mm in diameter, at the posterior end of the body shows that such an appendage may have been torn off. The colour of the specimen in its preserved state is dark violet; when alive it was bluish violet.

The sclerites of the body wall (Fig. 10 *a—f*) are spinous crosses, usually with the arms subequal and often with a central projection. They vary in diameter from about 0.15 to 0.4 mm. Many of the sclerites are only three-armed. In a preparation made of the body wall from the anterior dorsal side there were also several crosses with the arms bifurcated. In the longitudinal muscles there are spinous pointed rods, 0.2—0.3 mm long, (Fig. 10 *i*) and such rods occur also scatteredly in the mesenteries. Rods of a type (Fig. 10 *h*) recalling the crosses of the body wall occur in the gullet and similar ones are found in the tentacles. The sclerites of the gonads are like those of the body wall, but crosses with bifurcated arms are more common, and a greater number of them is provided with a central projection. Small irregular rods, about 0.1 mm long, (fig. 10 *g*) are present in the intestinal wall.

The fairly large cluster of detached gonads present from Haul 8 was violet with red eggs when alive, but in the preserved state the whole organ is uniformly violet. The eggs measure about 1 mm in diameter. The sclerites are exactly like those of the above described specimen, and the gonads therefore almost certainly belong to the same species.

The species represented here I believe to be the same as *Psychropotes minutus* described by KOEHLER & VANEY (1905) on a specimen from the Indian Ocean, measuring 65 mm in the length of the main body and with an appendage 55 mm long. At any rate the general appearance of the present specimen when alive may have been the same as that of the type shown by KOEHLER & VANEY in pl. 8 4—5. The description of the sclerites given by these authors, also applies in the main to those of the present specimen, though it seems to indicate, as also do the figures given in pl. 12 23—24, that the sclerites of the type had fewer and larger spines. But, on the other hand, the figures are so sketchy that this apparent difference may not exist in reality. *Psychropotes minutus*, at any rate, is the only species described with which the present one can be compared; and I therefore prefer a reference of the above specimens to this species, though with a query, rather than erecting a new species whose validity must be doubted.

The type of *P. minutus* was collected in the Laccadive Archipelago in 2,085 m. The specimen discussed above is from the Tropical mid-Atlantic, depth: 5,250—5,300 m, and the detached gonads from the West Atlantic, north of Guiana, depth: 5,044—5,033 m.

Note: A number of foreign lobated masses were found along one of the lateral muscles in the body cavity of the specimen from Haul 4. They are not unlike an Ascothoracid of the genus *Dendrogaster*, but are attached to the body wall of the holothurian by means of a distinct slender stalk. The true nature of these supposed parasites remains, however, to be cleared up.

General remarks

In their bathymetrical distribution holothurians range from depths so shallow that they are barely covered during ebb-time to the greatest depths explored, their lower known range, as set by the Swedish Deep-Sea Expedition, being almost 8,000 m. As far as we know they play a dominating rôle in the bottom-fauna of the abyss.

About 250 species of holothurians are known from depths beyond the 1,000 m line, about 175 from depths exceeding 2,000 m, and 130 (somewhat more than 10 % of the species recognized) are enumerated in the following

list as recorded from depths greater than 3,000 m. Of these latter species 88 are recorded from depths exceeding 4,000 m, 26 from 5,000 m or more, and a single one, the above mentioned, unfortunately unidentifiable, species of *Peniagone*, from a depth of over 7,000 m (7,900—7,625 m). — The only other collectings hitherto done at depths beyond 6,000 m did not yield any holothurians.

Almost half the species enumerated in the list have only been recorded from a single locality, and many of the other species too are known from a few localities only. A detailed discussion of the zoogeographical composition of the deep-sea fauna of holothurians therefore does not seem to be opportune at present, and, consequently, I shall only make a few general remarks.

A number of deep-sea holothurians have been recorded from the main Pacific as well as from the main Atlantic. This applies e. g. to *Abyssicucumis abyssorum* Théel; but recently CHERBONNIER showed that three distinct species have been mixed up under this name, viz. 1) *A. abyssorum* s. str., occurring not only in the main Atlantic, but also in the Antarctic of the Indian Ocean and the Pacific, 2) *A. albatrossi* Cherbonnier, occurring in the eastern Tropical Pacific, and 3) *A. ingolfi* Deichmann, occurring in the Davis Strait, off the Azores, and perhaps also in the North Pacific, off Japan, (*Cucumaria sluiteri* Ohshima). *Protankyra abyssicola* is another species which has been recorded both from the Pacific and from the Atlantic, but, as discussed above, it may also in this case be due to the mixing up of two different, though closely related, species. A third species recorded from widely distributed localities, *Molpadia holothurioides* (Cuvier) [= *musculus* Risso], may also comprise more than one species, which, however, cannot be separated at present. But still seven other of the deep-sea species listed are recorded from the main Pacific as well as from the main Atlantic (usually also the Indian Ocean), some of them being also known from the Antarctic. Three species are known from both the main Pacific and the main Indian Ocean, but not from the Atlantic. One species is known besides from the main Pacific also from the Antarctic of both the Indian and the Atlantic quadrant, and another species recorded from the Pacific and the Indian Ocean reach just into the South Atlantic, thus probably also occurring in the main Atlantic, which, incidentally, may apply to all of them. Two species known from the main Pacific are recorded also from the Antarctic of the Indian Quadrant. Two species are found in the Antarctic of all three ocean systems, but hitherto not in the main basin of any of them, and one species has been found in the Antarctic of both the Pacific and the Indian Ocean. Probably the antarctic species for the greater will prove to have a circumpolar distribution, some of them also extending into the main basin of circumpolar distribution, some of them also extending into the main basin of thr great oceans.

Altogether it appears from the summary given de that a substantial part of the deep-sea holothurians is cosmopolitan; this in spite of the fact that revisions have proved or indicated that some species have erroneously been considered to have such a worldwide distribution. Only four or maybe six species are common to the Atlantic and the Indian Ocean, but unknown from the Pacific, whereas three species were known from the Pacific and the Indian Ocean, but not from the Atlantic; and the known distribution of the deep-sea holothurians thus does not clearly support the supposition of a division of the deep-sea fauna into two main regions: an Atlanto-Indian region and a Pacific region, which was indicated by the distribution of the deep-sea Asteroidea and Ophiuroidea, as known at present.

Probably, some of the listed species will prove to be invalid if more material is procured for showing their intraspecific variation,

though, as far as I am able to judge, this will only apply to a few of them.

Eighteen of the holothurian species recorded from depths exceeding 3,000 m have been found also at depths of less than 1,000 m, and seven of these also in depths of less than 500 m—this, however, mostly in the Antarctic (or Arctic). Only three of the deep-sea species have been found in depths of 100 m or less, viz. *Molpadia holothurioides* at 35 m in the Antarctic, 140 m otherwise being the shallowest depth recorded (as mentioned above there may, however, be some doubt as to the homogeneity of the species), *Pseudostichopus mollis* at 100 m in the Antarctic, 245 m otherwise being the shallowest depth from which it is known, and *Elpidia glacialis* at 70 m in the Arctic, outside this zoogeographical area, however, never found in depths of less than about 2,000 m.

One of the six orders of holothurians recognized, the *Pelagothurioidea*, is pelagic. The animals of this order caught at the deep trawling stations therefore may not actually have been collected in the deep-sea, for which reason the Pelagothurioidea has been omitted from the list.

The other five holothurian orders are all represented in the deep-sea with a few or more species. The *Apoda* and the *Dendrochirota*, which otherwise are mainly littoral, each have four species reaching down below 3,000 m, all of them probably distinct deep-sea species, only *Abyssocucumis abyssorum* having been recorded from a depth of less than 800 m, viz. 385 m in the Antarctic. The *Molpadonia* include seven species recorded from depths below 3,000 m, and comprise many other species occurring in deeper water as also many from comparatively shallow depths.

The greater number of the deep-sea holothurians known from below 3,000 m belong, however, to the two orders: the Aspidochirota and the Elasipoda. The *Aspidochirota* is thus represented by 27 species, all of them of the family Synallactidae which is a typical deep-sea group, whereas the two other families of the order mainly comprise littoral or sublittoral forms.

The *Elasipoda*, finally, is represented beyond 3,000 m with no less than 88 species (about two thirds of the species described in the order) and is that holothurian order which is most distinctly associated with the deep-sea, only in the polar seas occurring also in comparatively shallow water.

Copenhagen, Dec. 1950.

THE SPECIES OF HOLOTHURIANS RECORDED FROM DEPTHS OF MORE THAN 3,000 M, WITH INFORMATION OF DISTRIBUTION.

(Synonyms in brackets).

	The Atlantic Ocean	The Indian Ocean	The Pacific Ocean	Depths in m
APODA				
Synaptidae				
Protankyra				
brychia (Verrill) [abyssicola (Théel)]	Several localities 45° N to 16° S	.....	.....	1,715—4,990
pacifica (Ludwig)	.....	.....	Eastern Pacific, off California to Peru.	870—4,755
Myriotrochidae				
Myriotrochus				
bathybius H. L. Clark	.....	.....	4°5 S, 88° W	3,665
giganteus H. L. Clark	.....	.....	4°5 S, 88° W	3,665
DENDROCHIROTA				
Cucumariidae				
Abyssicucumis				
abyssorum (Théel)	Off the Azores	About 46° S to 66° S	Off Chili	385—4,070
albatrossi (Cherbonnier)	.....	.....	Eastern Pacific, off California to Peru	1,585—5,690
ingolfi (Deichmann) [? sluiteri (Ohshima)]	Davis Strait; near the Azores	.....	? Off Japan 870 m	2,700—3,230
Ypsilothuria				
bitentaculata (Ludwig)	.....	Bay of Bengal; Arabian Sea; Zanzibar	Off Japan; East Indies; off Lower California to Ecuador	225—4,080
MOLPADONIA				
Gephyrothuriidae				
Gephyrothuria				
alcocki Koehler & Vaney	.....	7° N, 81° E	.....	3,495
Caudinidae				
Hedingia				
albicans (Théel) [arenata var. armata (Théel), mediterranea (Bald.-Bart.)]	S of Iceland; off the NE coast of U. S. A.; Cape Verdes; Mediterranean	Bay of Bengal	37°5 S, 179°5 E [var. glabra (Théel)]	500—3,200
Molpadiidae				
Ceraplectana				
trachyderma H. L. Clark	.....	.....	55° N, 170°5 W; off Peru	3,190—5,205
Molpadia				
bathybia H. L. Clark	.....	.....	Off Peru	5,205—5,870
blakei (Théel) [angulata (Hérouard), spiniferus (Heding)]	Davis Strait to Cape Verdes and West Indies	.....	.....	1,730—5,270

	The Atlantic Ocean	The Indian Ocean	The Pacific Ocean	Depths in m
granulata (Ludwig)	.....	Bay of Bengal	Off Guatemala to Ecuador	2,690—4,080
holothurioides (Cuvier) [musculus Risso, mediterranea (Grube), violacea Studer, perrieri (Petit), hispanicum (Petit), danielsseni (Théel), spinosum (Ludwig), asaphus (Heding)][1]	Davis Strait to West India; off Portugal to the Cape Verdes; the Mediterranean	Arabian Sea; Bay of Bengal; Kerguelen	Off Japan; off California to Peru	35—5,205
ASPIDOCHIROTA				
Synallactidae				
Bathyplotes				
profundens Koehler & Vaney	.....	13° N, 91° E	.....	3,005
Benthothuria				
valdiviae Heding	.....	63° S, 58° E	.....	4,635
Capheira				
sulcata Ludwig	.....	.....	Off Columbia to Peru	2,875—4,335
Mesothuria				
candelabri Hérouard	45° N, 7° W; 40° N, 35° W	.....	.....	4,540—4,870
expectans Perrier	44° N, 19°5 W	.....	.....	4,255
lactea (Théel) [thomsoni (Théel)]	Many localities from S of Iceland to 30° S	50° S, 123° E; East Indies	Off Japan; mid-Pacific; New Zealand	695—5,110
maroccana Perrier	38° N to 20° N	.....	.....	1,000—3,120
megapoda H. L. Clark	.....	.....	0° N, 117° W	4,245
multipes (Ludwig)	.....	Near the Laccadives and Ceylon	East Indies; off Panama to Peru	725—4,065
rugosa Hérouard	Cape Verdes; Azores; West Indies	.....	.....	1,600—3,890
verrilli (Théel) [roulei (Koehler)][2]	Many localities, 45° N to 12° N	.....	.....	550—4,255
Paelopatides				
atlantica Hérouard	38° N, 25°5 W	.....	.....	4,020
confundens Théel	.....	.....	Off California to Chili; (East Indies?)	1,570—4,070 (450—2,796)
gigantea (Verrill) [agassizii Théel, grisea Perrier]	Several localities, 43° N to 2° N	.....	.....	1,100—4,060
Paroriza				
prouhoi Hérouard	46° N, 6° W; 40° N, 20° W	.....	.....	4,360—4,380

[1]) Molpadia holothurioides in the sense given here, in accordance with H. L. Clark and Deichmann, may comprise more forms which, however, at present can not be separated.

[2]) It should be noted that the deep-water species Mesothuria verrilli Théel has often been regarded as identical with the shallow-water species M. intestinalis (Ascanius & Rathke), distributed in the North Atlantic inclusive of the Norwegian Sea and the Mediterranean at depths from about 18 to 1,000 m.

	The Atlantic Ocean	The Indian Ocean	The Pacific Ocean	Depths in m
Pseudostichopus				
atlanticus Perrier	West Indies; 42° N, 23°5 W; 60° N, 54° W	.....	.....	2,920—3,230
[acaudum Heding]				
depressus Hérouard	40° N, 20°5 W; 20° N, 75° W	.....	.....	2,995—4,360
lapidus Hérouard	38° N, 23° W	.....	.....	4,020
marenzelleri Hérouard	37° N, 21° W	.....	.....	4,400
mollis Théel	65° S, 57° W	47° S, 38° E	Many localities off California to Peru	100—5,205
occultatus v. Marenzeller	62° N to 24° N, incl. the Mediterranean	13° N, 91° E	.....	400—3,625
[occultatus var. plicatus Koehler & Vaney, ingolfi Heding]				
villosus Théel	Several localities, 46° N to 70° S	46° S to 65° S	35° N, 170° E; East Indies; off Chili	895—5,305
[globigerina Hérouard]				
Synallactes				
aenigma Ludwig	.....	.....	Off Columbia to Peru	2,420—4,085
horridus Koehler & Vaney	.....	12° N, 89° E	.....	3,195
rigidus Koehler & Vaney	.....	10° N, 91° E	.....	3,520
robertsoni Vaney	66°5 S, 40°5 W	.....	.....	4,435
wood-masoni (Walsh)	.....	Bay of Bengal	New Guinea	310—3,295
[reticulatus Sluiter]				
ELASIPODA				
Deimatidae				
Deima				
atlanticum Hérouard	40° N, 20° W; 29° N, 24° W	.....	.....	2,800—4,360
[? = fastosum Théel]				
blakei Théel	West Indies; off Portugal	Arabian Sea; Bay of Bengal	.....	1,050—3,365
fastosum Théel	.....	3° N, 134° E	.....	3,658
[syn.? atlanticum Hérouard]				
validum Théel	.....	36° N, 178° E; East Indies	.....	880—3,750
Oneirophanta				
affinis Ludwig	.....	.....	Off Columbia	3,240—3,335
alternata Perrier	Between the Azores and the Bay of Biscay	.....	.....	4,060—5,005
[? = mutabilis Théel]				
mutabilis Théel	46° N to 43° S	Some localities S of 45° S	E of Australia; scattered in the mid-Pacific; off Lower California to Chili	1,805—5,305
Orphnurgus				
parvispiculatum H. L. Clark	.....	.....	8°5 S, 85°5 W	4,335
setigerum Ludwig	.....	.....	Off Columbia to Peru	2,150—4,085
Laetmogonidae				
Laetmogone				
wyville-thomsoni Théel	Eastern Atlantic, 50° N to 28° N	46° S, 48°5 E; 50° S, 123° E	East Indies; off Japan; off Chili	650—3,290
Elpidiidae (Elpidiinae)				
Achlyonice				
paradoxa Théel	.....	.....	35°5 N, 157°5 E; 30° N, 116° E	1,610—4,205
[ecalcarea H. L. Clark]				

	The Atlantic Ocean	The Indian Ocean	The Pacific Ocean	Depths in m
Ellipinion				
albida (Théel)	37° S, 19°5 E			3,475
mollis (Théel)		42°5 S, 134° E		4,755
papillosus (Théel)	36°5 S, 36° W			4,845
Elpidia				
glacialis Théel	Baffin Bay; Norwegian Sea; Kara Sea; Barents Sea; off Morocco	(? S of Australia, 4,755 m)		70—2,815 (4,755)
Kolga				
hyalina Danielssen & Koren	Davis Strait; Norwegian Sea			1,880—3,330
Periamma				
insignis (Théel)		62°5 S, 95°5 E		3,610
naresi (Théel)		50° S, 123° E		3,290
robusta (Théel)		54° S, 108°5 E		3,565
roseum Perrier	Between the Azores and the Bay of Biscay			4,060—5,000
tetramerum H. L. Clark			Off Peru	5,870
Scotoplanes				
globosa (Théel)	40° S, 2°5 E	54° S, 108°5 E	33°5 S, 74°5 W	3,565—4,835
murrayi (Théel) [? = globosa (Théel)]		61° S, 80° E	Off Peru	2,305—5,205
Elpidiidae (Peniagoninae)				
Parelpidia				
anamesa H. L. Clark			85° S, 85°5 W	4,335
cylindrica (Théel)			34° S, 74° W	4,070
elongata Théel			33°5 S, 74°5 W	3,950
verrucosa Théel			33°5 S, 74°5 W	3,950
Peniagone				
ambigua (Théel)		54° S, 108°5 E		3,565
atrox Théel		42°5 S, 134° E		4,755
azorica v. Marenzeller	Eastern Atlantic, Iceland to the Azores			2,320—4,020
bispiculata H. L. Clark			1° N, 138° W	4,505
challengeri Théel		50° S, 123° E		3,290
expansa Koehler & Vaney		12° N, 86° E		3,195
ferruginea Grieg	29° N, 24° W			2,800—3,000
foliacea (Hérouard)	37° N, 22°5 W			4,275
horrifer Théel		54° S, 108°5 E		3,565
intermedia Ludwig			Off Mexico to Peru	2,420—5,205
lugubris Théel	2°5 N, 20° W; 10° N, 26° W; (? 24° N, 63° W)			4,570—5,800
mossmani Vaney	69°5 S, 15° W			4,790
nybelini Jensenius Madsen	1° N, 18°5 W			5,250—5,300
obscura Koehler & Vaney		11° N, 85° E		3,295
obsoleta (Hérouard)	40° N, 20°5 W			4,360
pirei Vaney	66°5 S, 40°5 W			4,435

	The Atlantic Ocean	The Indian Ocean	The pacific Ocean	Depths in m
porcellus Perrier	42° N, 23°5 W; 12° N, 52° W			4,060—5,040
purpurea (Théel)		54° S, 108°5 E; 46° S, 48°5 E		2,925—3,565
rigida (Théel)			35°5 N, 157°5 E	4,205
sp. (juvenil) Jensenius Madsen	20° N, 65° W			7,900—7,625
stabilis Koehler & Vaney		12°5 N, 85° E		3,295
vexillum Perrier	An undefined locality in the E. Atlantic	63° S, 58° E		4,635
willemoesi (Théel)		62°5 S, 95°5 E		3,610
wiltoni Vaney	69°5 S, 15° W			4,790
vitrea Théel [setosa Ludwig]		65° S, 80° E	East Indies; mid-Pacific off Panama to Ecuador	1,160—4,335
wyvillei Théel	35° N, 33° W		0°5 S, 151°5 W	2,700—4,435
Scotoanassa				
diaphana Théel		43° S, 134° E		4,755
translucida Hérouard	Many localities between Europe and the Azores; tropical mid-Atlantic			4,000—5,610
Psychropotidae				
Benthodytes				
abyssicola Théel			34° S, 74° W	4,070
browni Vaney	48° S, 10° W			3,185
gotoi Ohshima			46°5 N, 146° E	3,290
incerta Ludwig			0°5 S, 87° W; 15° S, 98°5 W	2,420—3,435
janthina v. Marenzeller	Eastern Atlantic, Greenland to the Cape Verdes			2,250—4,700
mamillifera Théel			33° S to 38° S, 74° W to 94° W	2,745—4,070
papillifera Théel			12° S, 145° E; 0°5 S, 151°5 W; 34° S, 78° W	2,515—4,435
recta Vaney	67°5 S, 30°5 W			4,570
regularis H. L. Clark			5° S, 85° W	4,085
sanguinolenta Théel	(Cape of Good Hope)	Cape of Good Hope; Arabian Sea; Bay of Bengal; S. of Australia	Japan; off California to Chili	770—5,205
selenkiana Théel			7°5 S, 152° W	5,030
sordida Théel		62° S, 95° E; 54° S, 109° E; 50° S, 123° E	34° S, 74° W	3,290—4,070
spuma Vaney	69°5 S, 15° W			4,790
typica Théel [glutinosa Perrier]	Many localities, 50° N to 10° N	Arabian Sea; Bay of Bengal	5° S, 88° W	1,995—4,600
Euphronides				
anchora Hérouard	32° N, 43° W			3,465
bifurcata Koehler & Vaney		12°5 N, 85° E		3,295

	The Atlantic Ocean	The Indian Ocean	The Pacific Ocean	Depths in m
cornuta Verrill [auriculata Perrier]	Off N. E. coast of U. S. A.; off W. Africa, 35° N to 0°	.....	.....	1,915—3,510
dyscrita H. L. Clark	.....	.....	Off Peru	5,205
kerhervei (Hérouard)	Near the Azores and the Canaries; West Indies	.....	.....	1,145—5,610
scotiae Vaney	62° S, 41° W	.....	.....	3,245
verrucosa Ludwig	.....	.....	Tropical Eastern Pacific 138° W to 80° W	2,420—4,505
violacea Perrier [talismani Perrier]	Denmark Strait to the West Indies and the Canaries	.....	.....	955—4,060
Psycheotrephes				
exigua Théel	.....	.....	7°5 S, 152° W	5,030
Psychropotes				
brucei Vaney	67°5 S, 36°5 W	.....	.....	4,570
buglossa Perrier	Between the Azores and Europe and West Africa	.....	.....	2,210—5,000
dubiosa Ludwig	.....	.....	2°5 N, 84° W	3,335
fucata Perrier	43° N, 22° W	.....	.....	4,165
grimaldi Hérouard	38° N, 25°5 W	.....	.....	4,020
laticauda Vaney	68° S, 36° W; 40° S, 3° E	.....	.....	4,570—5,100
longicauda Théel	71° S, 17° W	62° S, 96° E; 54° S, 109° E	34° S, 74° W	2,580—4,070
minutus Koehler & Vaney	Tropical mid-Atlantic	The Laccadives	.....	2,085—5,300
raripes Ludwig	.....	.....	47° N, 146° E; 104° W to 80° W, 1° N to 9° S	2,875—4,335
semperiana Théel	6° N, 14° W; 36° S, 21° W	.....	.....	3,475—4,570

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In addition I have had the opportunity of seeing an unpublished master's thesis, BENT HANSEN 1950: On the geographical distribution of the deep-sea holothurians in relation to their systematic position and the ecological factors. The manuscript, in Danish, is on file in the library of the Zoological Institute of Copenhagen.