ISOPODA
FROM DEPTHS EXCEEDING 6000 METERS

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* Collected by the Galathea Expedition.

A. INTRODUCTION

The Galathea Expedition investigated five deep-sea trenches with depths greater than 6000 m. In three of these, the Philippine, the Banda, and the Kermadec Trenches Isopoda were collected. The present contribution deals only with the Isopoda from depths exceeding 6000 m, and is the first part of a treatment of all the deep-sea Isopoda of the Galathea Expedition.

Until recently the deepest recorded isopods were *Storthyngura intermedia* (BEDDARD 1886, p. 69) from 5010 m, *Antarcturus abyssicola* (l. c., p. 99) from 4360 m and *Ilyarachna abyssorum* (RICHARDSON 1911, p. 17) from 4060 and 4165 m, being at the same time the only Isopoda known from depths greater than 4000 m. Some months ago NORDENSTAM'S work on a new species of *Bathyopsurus (B. nybelini)* from the Swedish Deep-Sea Expedition was published. This species was caught at three stations in the Central Atlantic at the following depths: 5500-5987, 5850-5860, and 7625-7900 m. Moreover, in 1949 and 1953, the Russian Oceanologic Institute Pacific Expedition on board the Vitjaz investigated the Kuril-Kamtchatka Trench north of Japan. Apart from a few papers on the bottom fauna and some on pelagic forms only preliminary results have been published so far (ZENKEVITCH, BIRSTEIN & BELJAEV 1954, and ZENKEVITCH 1954). According to the former paper Isopoda have been caught at depths down to 8400 m.

In the present work on the Isopoda from the greatest depths no less than twelve different species are treated. According to the papers of the present Galathea Report, hitherto published on the trench fauna (or in preparation), this number of species is only surpassed by the Polychaetes which comprise 18 species, and the Holothurians and Amphipoda of which there are 13 species from depths greater than 6000 m (KIRKEGAARD 1956, B. HANSEN 1956 and E. DAHL (in press)). However, the collection of specimens of Isopoda in most cases numbers only a single or a few of each species. Most of the material is fairly well preserved considering the rough handling during the several hours' hauling of the trawl. When dredging a robust bucket was attached to the cod-end of the trawl and often several litres of material (clay, ooze, etc.) from the ocean floor was retained in the bucket, thus serving to protect the often extremely fragile bottom-living crustaceans and other invertebrates.

Only two of the six marine sub-orders of Isopoda are represented in the material: the Asellota account for eleven species, and the Anthuridea for one only. All species seem to belong to known genera, but the following had to be described as new species: *Ischnomesus bruuni, I. spärcki, Macrostylis galatheae, M. hadalis, Storthyngura benti, S. furcata, Eurycope madseni, E. galatheae,* and *Leptanthura hendili.*

During the investigation a great many related species were examined. The majority of them were kept in the rich collections of this Museum, but several had to be borrowed from foreign institutions. I take the opportunity of thanking the following colleagues for placing this material at my disposal: Dr. I. GORDON (London), Dr. J.-G. HELMCKE and Dr. H.-E. GRUNER (Berlin), Mr. N. KNABEN (Oslo) and Professor K. LANG (Stockholm). In order to be able to undertake a satisfying comparison several of these species (especially those from the Challenger and the German Antarctic Expeditions) had to be redescribed and even revised; I found it most appropriate to include this part of the investigation in the present contribution, which also contains the diagnosis of a new genus, *Stylomesus,* and the description of a new species, *Eurycope gaussi* which it was found necessary to establish on the material borrowed from the German Antarctic Expedition.

The bottom-temperatures given are according to BRUUN & KIILERICH (1955). In most cases the Expedition obtained records of temperatures for depths exactly corresponding to those from which the bottom-living isopods were dredged. Sometimes no temperature records were available from just the depth at which the animals were caught; in such cases the average figures and graphically interpolated figures recorded in BRUUN & KIILERICH'S paper have been used.

The salinity has not been stated for each species, since it is practically constant everywhere in the abyssal zone. In the trenches it was found to be 34.7 ‰ ± 0.2 ‰.

The illustrations were drawn by the author, except figs. 5, 13, 25, 29, and 43a which were drawn by the artist POUL H. WINTHER. The English text was revised by Mrs. AGNETE VOLSØE.

All type specimens are kept in the Zoological Museum of the University, Copenhagen.

Finally, I wish to express my gratitude to Dr. A. F. BRUUN, the leader of the Galathea Expedition, for help and inspiration during the preparation of the present work.

B. SYSTEMATIC PART

1. Asellota

PARASELLIDAE

The systematic position of the great number of genera within this family has not yet been finally decided. In his great work on the Isopoda from the Ingolf Expedition HANSEN (1916) divided this family into 12 groups without daring to give them a definite systematic value. NORDENSTAM (1933) added one more group and several sub-groups, while GURJANOVA (1933) united several groups into altogether 9 families without giving any arguments for this classification. NIERSTRASZ (1941) followed HANSEN'S original division which has also been maintained in the present paper.

Ischnomesini Hansen

The Ischnomesini form a very characteristic group within the Asellota and can at once be recognized by the backwards produced fourth pereion somite and the forewards produced fifth somite which is always very long.

The two present species agree with all the group characters given by HANSEN (1916, p. 54). The only exceptions are presence of a mandibular palp in *Ischnomesus bruuni* n. sp. and relative length of the pereiopods in this species and in *I. spärcki* n. sp. According to HANSEN pereiopods IV and V are »subequal in length and conspicuously longer than the second and seventh pairs.« HANSEN united altogether 21 species within the Ischnomesini, but only in six of these are the pereiopods known and described or figured. Apparently HANSEN was not aware that prior to his paper VANHÖFFEN had described another Ischnomesin which is also complete and has shorter pereiopods II and VII. Since then only one more species has been reported (by BARNARD), but the only specimen available was incomplete and lacked the greater part of the appendages. In all the seven complete species pereiopods II and VII are shorter than IV and V. However, in one of the present new species, *I. bruuni,* pereiopods III-VII which are all preserved are exactly equally long. Only basis of II is present, and it is definitely shorter than basis of all the following pereiopods and thus in agreement with the group character. In the other new species, *I. spärcki,* basis is again the only segment present in most of the pereiopods. It is nevertheless evident that pereiopod VII is as long as III, IV and VI, while II (and V) are somewhat shorter. Furthermore, Dr. GORDON, on my request, has studied the type specimen of *I. bacillus* Beddard, kept in the British Museum (Nat. Hist.). The specimen is a fragment, existing of somites 5-7 and pleon only. Even if it has been mounted on a slide and the appendages are bunched together, Dr. GORDON is able to state that pereiopods IV-VII seem to be of nearly equal lenth, the only difference being that dactylus seems to increase progressively from IV to VII.

Therefore, absence of mandibular palp and relative length of pereiopod VII cannot be maintained as group characters. On the other hand, pereiopod II is, in all known cases, shorter than at any rate some of the succeeding pereiopods.

In 1908 (p. 81) RICHARDSON replaced the invalid generic name *Ischnosoma* G. O. Sars 1866 by *Ischnomesus,* and at the same time she established three new genera, *Haplomesus, Heteromesus,* and *Rhabdomesus.* The latter and *Ischnomesus* agreed in having two segments in the uropods and the third segment of antenna 2 less than twice as long as the fourth. The reasons for separating *Ischnomesus* and *Rhabdomesus* were according to RICHARDSON: 1. One pleon somite in the former, two in the latter; 2. The pereion somites 4 and 5 not produced in spines in the former, but with lateral spines in the latter. *Ischnomesus,* being a substitute name for *Ischnosoma,* retained the type species *bispinosus* G. O. Sars (by monotypy). She placed the two imperfect specimens from the Challenger, described by BEDDARD as *Ischnosoma bacillus* and *bacilloides,* in the genus *Rhabdomesus.*

In his paper on the isopods of the German Antarctic Expedition VANHÖFFEN (1914, p. 560) described a new species which, with some doubt, he referred to *Rhabdomesus (R.inermis).* He stated that it had two segments in the pleon. But at the same time the third segment of antenna 2 was more than twice as long as the fourth, thus differing from RICHARDSON's diagnosis. Since, however, the heads of the two original representatives of *Rhabdomesus (bacillus* and *bacilloides)* are missing RICHARDSON could know nothing about the shape of the antennae which in those two species might very well have had an elongate third segment.

In 1916 (p. 55) HANSEN showed that also *Ischnomesus bispinosus* has two pleon somites, and that the main difference between *Ischnomesus* and *Haplomesus – Heteromesus* consists in the fact that the pleon somites in the former are free and movable, while in the latter two species they are coalesced and moreover fused with the posterior pereion somites. Having thus demonstrated the concordance in number of pleon somites in *Ischnomesus* and *Rhabdomesus* he proposed to incorporate the latter genus under the former one. In *Ischnomesus* he also included two new species from the Ingolf, *I. profundus* and *I. armatus.* He does not, however, mention *inermis,* because he was not aware of VANHÖFFEN's paper, published two years earlier (certainly on account of the war); probably he would have transferred *inermis* as well to *Ischnomesus* since VANHÖFFEN expressly states that it has two pleon somites without mentioning whether they are coalesced or not.

Through the courtesy of Dr. H.-G. HELMCKE and Dr. H.-E. GRUNER of the Berlin Museum I have been able to borrow the type specimen of *inermis* Vanh. A thorough examination showed that *not only are the two pleon somites clearly fused, but there is also a definite fusion between pleon and the seventh pereion somite.* Therefore, *inermis* cannot belong to the genus *Ischnomesus* but must represent a distinct genus which forms a connecting link between *Heteromesus* (with pereion somites 6 and 7 fused with the abdomen) and *Ischnomesus* (with all pereion somites and the two pleon somites free and movable).

The generic name *Rhabdomesus* under which *inermis* was described is, as shown above, a synonym of *Ischnomesus,* since the two species on which the genus was based by RICHARDSON *(bacillus* and *bacilloides)* definitely belong to *Ischnomesus,* having the posterior pereion somites and the two pleon somites free and movable. I therefore propose *Stylomesus* for the species *inermis.*

The species described as *Rhabdomesus bacillopsis* by BARNARD (1920, p. 412) must also be transferred to *Ischnomesus* because of the non-coalesced posterior pereion and pleon somites.

Before continuing to the treatment of the separate genera it may be useful to give a key to the four genera of Ischnomesini.

1. Three posterior pereion somites movable; pleon consists of two movable somites. Third segment of peduncle of antenna 2 not twice as long as the fourth. Uropods with two segments. *Ischnomesus* Rich. 1908
At least the posterior pereion somite and pleon immovably fused, constituting a single piece. Third segment of antenna 2 more than twice as long as fourth 2
2. Only the posterior pereion somite and pleon fused. Uropods with two segments . *Stylomesus* nov. gen.
At least the two posterior pereion somites and pleon fused. Uropods with one segment 3
3. Only the two posterior pereion somites and pleon fused. Body moderately slender or proportionately robust. Antenna 1 with reduced third peduncular segment and flagellum .... *Heteromesus* Rich. 1908
The three posterior pereion segments and pleon completely fused. Body slender to extremely slender. Antenna 1 with well-developed peduncle and flagellum, each consisting of three segments ....
.... *Haplomesus* Rich. 1908

Ischnomesus Richardson, 1908

As shown above altogether six species belong to *Ischnomesus,* and the Galathea obtained two more species. The general appearance of these eight species is, however, rather different. I have therefore tried to find valid characters of generic value which might justify the establishment of one or a couple of new genera.

As material I had before me the type specimens of six of the eight species and a large collection of *I. bispinosus* in this Museum. The result of the study is given in the following table in which I have included all varying characters of major significance. The table clearly shows that only two of the species *(bispinosus* and *profundus)* agree in almost all respects. None of the other six species resemble these two or each other to the same extent (except perhaps the two very incomplete Challenger species). It might therefore seem necessary to split up these eight species into several genera (even up to five or six). However, the characters common to these eight species and different to those of the other three genera of this group *(Haplomesus, Heteromesus* and *Stylomesus)* are so essential that I have found it most natural to combine these eight species in one genus only, *Ischnomesus.*

Generic characters of Ischnomesus Richardson

Body slender or very slender, pereion somites 4 and 5 being longer or much longer than any other pereion somites. All somites mutually free and movable. Pleon consists of two movable somites; the first is very short. Antennae 1 well developed, with at least six segments. Antennae 2 with third segment moderately short, not twice so long as the fourth. Maxillipeds with second segment rather large, its lobe at least as long as broad, and less than half as broad as the segment; the palp at least as long as the second segment, the lobe not included. Pereiopod I with the carpus more or less expanded, broadest before the middle. Uropods with two segments.

During the investigation of generic characters I have carefully studied the type specimens of HANSEN's *Ischnomesus profundus* and *I. armatus* in this Museum and of BEDDARD's *I. bacillus* and *I. bacilloides* in the British Museum. Before describing the two new Galathea species I shall point out some features not mentioned by those authors.

Ischnomesus profundus Hansen, 1916

The only specimen known is a male. The shape of pleopoda 1 and 2 is given in fig. 1 a & b. When in the natural position as part of the operculum the outer margins of the first pair of pleopods are partly covered by the second pair as shown by HANSEN (pl. IV, 5 f). Actually the outer margin of *pleopod 1* has a marked incision about half way from the base. From here on towards the end the margin is convex.

Table 1. Variation of specific characters within the genus *Ischnomesus*

	I. bispinosus (G. O. Sars)	*I. profundus* Hansen	*I. armatus* Hansen	*I. (R.) bacillus* (Beddard)	*I. (R.) bacilloides* (Beddard)	*I. (R.) bacillopsis* (Barnard)	*I. bruuni* Wolff	*I. spärcki* Wolff
Spines on somites 4 and 5	**absent**	**absent**	present	present	present (?)	present	present	present
Number of segments in flagellum of antenna 1	3	3	**4-5**	?	?	3	**7**	3
3rd segment on antenna 2 more or less than twice as long as 4th segment	less	less	less	?	?	less (?)	less	less
Palp on mandible	absent	absent	absent	?	?	absent	**present**	absent
Width of 2nd and 3rd segment of palp on maxilliped in relation to lobe	broader	broader	broader	?	?	broader (?)	**not broader**	broader
Shape of carpus of periopod I	expanded	expanded	**not much expanded**	?	?	?	**not much expanded**	**not much expanded**
Length of pereiopod VII in relation to IV and V	shorter	?	?	**not shorter**	?	shorter (?)	**not shorter**	**not shorter**
Shape of pleopod 1 in male	**simple**	**simple**	with calcified plates	?	with calcified plates	with calcified plates	with calcified plates	**simple**
Width of pleopod 2 in male	**broad**	**broad**	narrow	narrow	narrow	narrow	narrow	narrow
Penial filament (stylet) of pleopod 2	**short**	**short**	long	?	very long	long	very long	**short**
Exopodite on 1st segment of uropod	**present**	?	absent	absent	absent	absent	absent	absent
Total length of animal	2.5-3 mm	4 mm	4.8-4.9mm	**13-14 mm**	**14-15 mm**	7 mm	**13.5 mm**	**16 mm**

The outer corner of the apex is produced like in *I. bispinosus* and its median part furnished with three short setae.

Pleopod 2 (fig. 1 b) is broad and rounded and the copulatory organ (stylet) is very short and abruptly acute.

Right mandible (fig. 1 c) has a simple cutting edge with only one conspicuous denticle and another, almost invisible denticle below it. There are only four spines in the spine-row. The molar process is very short.

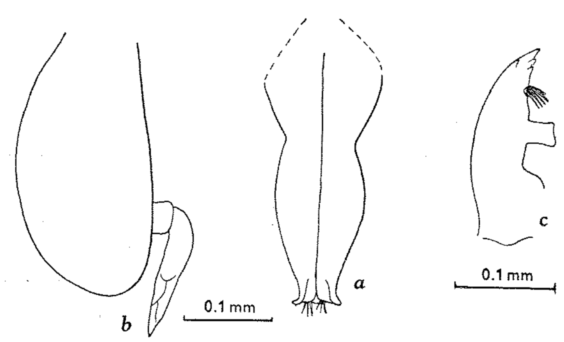


Fig. 1. *Ischnomesus profundus* Hansen ♂, type specimen; a, pleopoda 1; b, left pleopod 2; c, right mandible.

Maxillae 1 and 2 of the ordinary shape.

All other characters were sufficiently described and illustrated by HANSEN.

Ischnomesus armatus Hansen, 1916

Of this species two specimens were preserved in the type collection, one purely white male and another male, apparently discoloured by rust. HANSEN mentions one specimen only which was no doubt the white one (mouth parts dissected). This one has therefore been regarded as the holotype by me and further necessary dissection was made on this specimen.

Differences between the holotype and specimen II: The length of the rusty coloured specimen (specimen II) is 4.9 mm, i.e. 0.1 mm longer than the type. It is

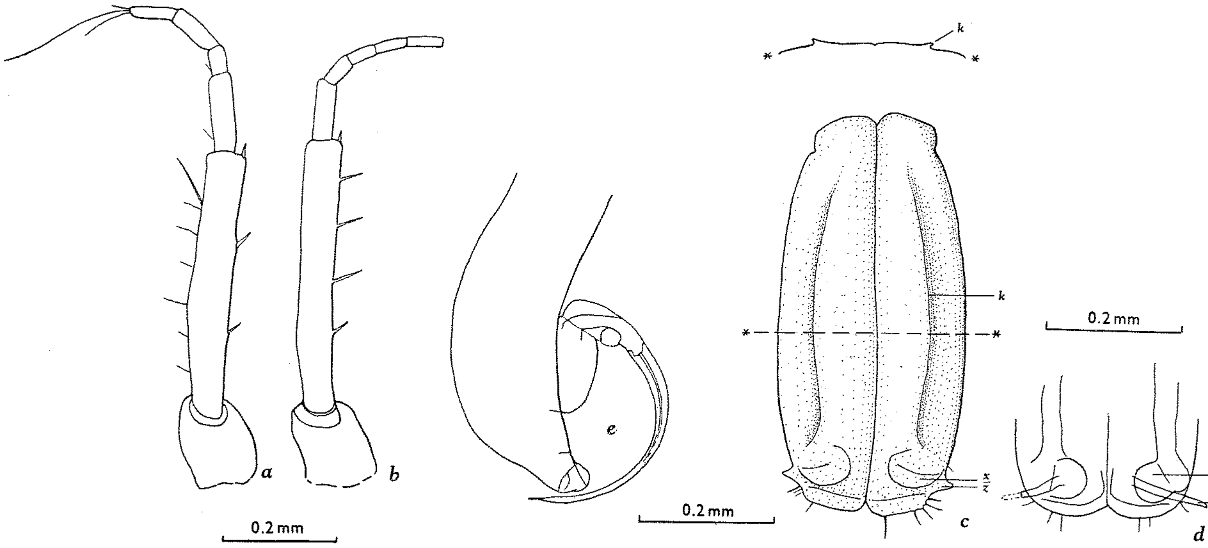


Fig. 2. *Ischnomesus armatus* Hansen; a, left antenna 1 of type specimen, seen from above; b, left antenna 1 of specimen II; c, male pleopoda 1 of type, seen from inside (dorsal view); d, apex of male pleopoda 1 of specimen II (k, keel; x-z, see the text); e, left male pleopod 2 of type specimen.

a little less slender than the type; the ratio between the total length of the animal and the width of somite 2 (at base of spines) is 8.9 in the type and 8.5 in specimen II. – Antennae 1 show a marked difference in the two specimens (fig. 2a & b). In the type it agrees with HANSEN's description except for the fact that the second segment on the interior, lower corner of the distal end is furnished with a short, strong spine. In specimen II only the left antenna 1 is preserved. The second segment is a little longer than in the type and has four spines along the inner margin. The third segment is shorter by one fourth than in the type, and there are at any rate four segments in the flagellum of which the two proximal ones are a little shorter than the two distal ones.

Pleopod 1 has in both specimens an outer shape according to HANSEN's description. On the dorsal (interior) side there is an almost invisible calcified plate near the distal end (x in fig. 2 c & d), corresponding to the one described in *I. bruuni* (p. 93). This plate seems to cover a transversal groove in which a non-calcified organ (z) can be seen at very great magnification (most clearly in specimen II). In both specimens it projects beyond the rounded, outer margin of the pleopod. It will be further discussed on p. 93. The strongly calcified, vaulted end of the pleopod found in *I. bruuni* (y) is here indicated by a very faint seam. Finally, the dorsal (inner) side of the pleopod is furnished with a longitudinal keel, k, visible from near the base of the appendage to the calcified plate.

Pleopod 2 (fig. 2e) is very narrow. The copulatory organ is longer and much more slender than in *I. profundus* and *bispinosus*.

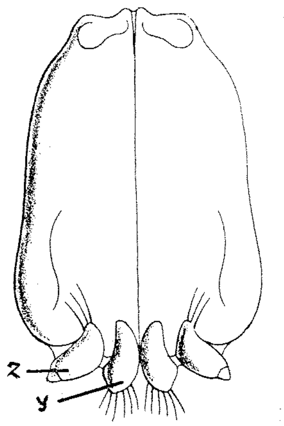
Pleopod 3 like that of *I. bruuni* (p. 94).

All other characters according to HANSEN's description.

Ischnomesus bacilloides (Beddard), 1886

During a visit to London I studied the incomplete type specimen of which only the pereion somites 4-7 and the pleon are preserved.

BEDDARD gives a good description of pleopods 1 and 2 (p. 46) and his figures (pl. VI, 10-11) agree well with the description. The arrangement of calcified plates shows a marked difference to that of *I. armatus* (described above) and *I. bruuni* (p. 93). Unfortunately, the pleopods have not been kept, so we must fully rely on BEDDARD's figure. By comparing the arrangement of plates in the three species it is easily seen that *armatus* and *bruuni* agree in almost all details. BEDDARD, however, gives the following description of the plates in *bacilloides:* "At the upper extremity of the operculum are two minute calcified plates . . ." A corresponding illustration (fig. 3) shows that they project beyond the terminal end of the pleopod. In my opinion plate y in BEDDARD's figure is homologous with y in the two other species. BEDDARD's "plate" z resembles z in *bruuni* and seems to have the same terminal segmentation. However, BEDDARD gives this plate as calcified which it is clearly not in *bruuni* and *armatus*. The calcification of z may be a miscomprehension



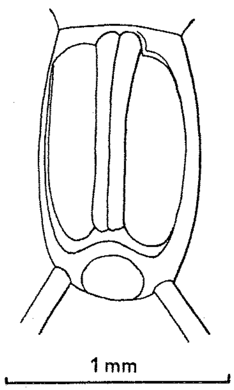


Fig. 3 Fig. 4

Fig. 3. *Ischnomesus bacilloides* (Beddard) ♂; pleopoda 1; y-z, see the text (after BEDDARD 1886, pl. VI, 11).
Fig. 4. *Ischnomesus bacillus* (Beddard) ♂; pleon of type specimen, seen from below.

by BEDDARD. I found it very difficult to get a proper impression of these minute organs which can only be seen when shutting down the transmitted light etc. Plate x in *bruuni* and *armatus* was probably also present in *bacilloides,* but may have been overlooked. BARNARD (1920, p. 414) described pleopod 1 in *I. bacillopsis* as "very similar to BEDDARD's figure of that of *bacilloides,* but apices of peduncles and rami not prominent". Unfortunately, BARNARD gives no figure. – The longitudinal line in the middle of each pleopod (fig. 3) seems to indicate a similar groove and keel as in *bruuni* and *armatus* (k), but they are not mentioned in BEDDARD's description.

All pereion and pleon somites are free and movable.

The length of the fragment is 11 mm. By comparison with the two species from the Galathea the total length of the animal can tentatively be given as 14-15 mm.

Ischnomesus bacillus (Beddard), 1886

Also the present species is known only from the type specimen which is incomplete, comprising – like *I. bacilloides* – somites 4-7 and the pleon only. It has been mounted on a slide. BEDDARD gives the fragment as a female but it is definitely a male.[1] The male pleopoda 1 can be clearly seen when the transmitted light is shut down (fig. 4). Pleopoda 1 are a little longer than 2, being inserted a little more anteriorly. At the distal end the two pairs of pleopoda reach almost equally far backwards. The uropod has two segments.

The rest of BEDDARD's description is correct. All pereion and pleon somites are free and movable. Relative length of pereiopods IV-VII is mentioned on p. 87.

The length of the fragment is 10 mm, which indicates a total length of 13-14 mm.

1. In his description of *Ischnosoma spinosum (= Heteromesus spinosus)* BEDDARD gives the only specimen existing as a female, but on plate VI it is mentioned as a male. The individual *is* a female.

Ischnomesus bruuni n. sp.

Material:

St. 651, Kermadec Trench (32°10′S, 177°14′W), 6960-7000 m, 16. Febr. 1952. Gear: herring otter trawl. Bottom: brown clay with pumice. Bottom temperature: 1, 3° C. – 1 complete male.

Description:

Body (figs. 5 & 6a) very long and slender and quite smooth. Rate between total length of animal and width of second pereion somite (at base of spines) is 8.7.

Head broader than long and somewhat immersed in the first pereion somite, the suture being slightly convex.

Pereion somites 1-3 subequal in size and shape. Somite 1 a little shorter than 2; its lateral parts embracing the base of the head and furnished with a pair of spines directed outwards and forwards and shorter and stouter than those in *I. bacillopsis* (BARNARD 1920, pl. XVII, 13) and *I. armatus* (HANSEN 1916, pl. IV, 6 b). Somites 2 and 3 somewhat broader (between base of spines) than long and with spines which in somite 3 are directed more outwards than

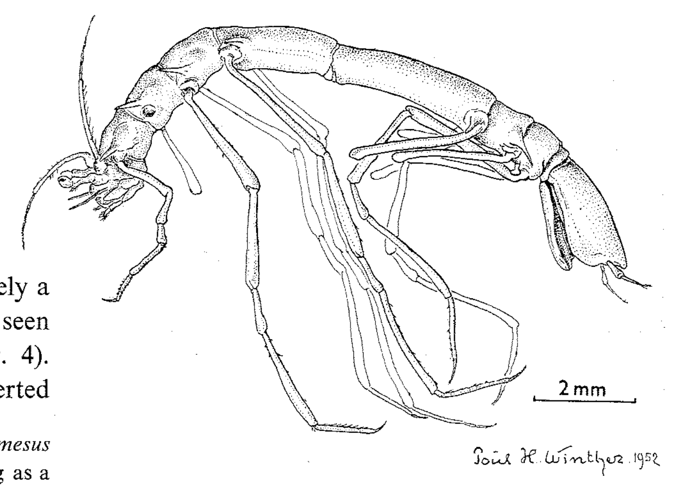


Fig. 5. *Ischnomesus bruuni* n. sp. ♂; type specimen from the Kermadec Trench, 7000 m.

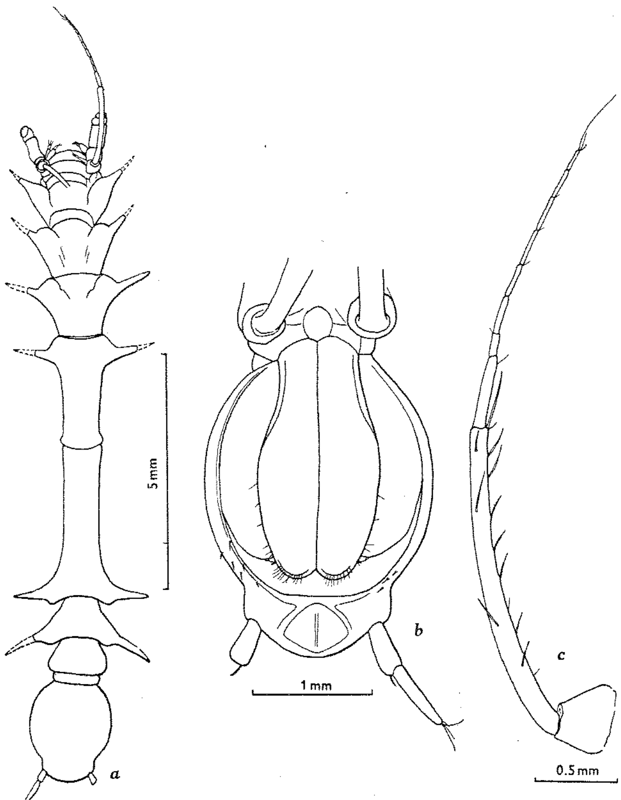


Fig. 6. *Ischnomesus bruuni* n. sp. ♂; a, dorsal view; b, pleon from below; c, lateral view of left antenna 1.

in 1 and 2. The tips of most of the spines have been broken off.

Somite 4 typically T-shaped; it is as long as 2 and 3 together; the spines are directed outwards and a little forwards. *Somite 5* as long as somites 1-3, with the spines directed outwards at right angles to the longitudinal axis of the body and much shorter than in *bacilloides*. *Somite 6* shorter than any of the preceding somites. The spines are directed outwards and backwards and are moreover curved slightly backwards; they are probably a little longer than any of the preceding spines, but not so long as those in *armatus*. *Somite 7* is a trifle shorter than 6, rounded and without spines.

Pleon consists of two segments which are free and movable. The first is very short and only three-fifths as wide as the second. This one is of almost the same shape as in *bacilloides* (BEDDARD 1886, pl. VI,9) and *armatus*. It differs from *bacilloides* in having the outer, convex margin rounded equally much near the base and towards the end. In *armatus* the posterior end has the margins bent somewhat outwards, while in *bruuni* they are parallel and relatively shorter. The somite is one-fourth as long as broad and also one-fourth longer than thoracic somites 6 and 7. The posterior margin is convex, with the uropods inserted at its end.

On the ventral side of pleon (fig. 6b) the cavity containing the pleopods occupies a comparatively bigger area than in *bispinosus* (SARS 1899, pl. 52), *bacilloides*, and *armatus;* the bar separating the cavity from the anal opening is therefore narrower than in those species. Its anterior margin is straight, not convex as in *bacilloides*.

Antenna 1 (fig. 6c) reaches backwards a little beyond the anterior end of pereion somite 4. The first segment is short and thick, the second a little longer than all the succeeding segments together, with numerous thin setae and a long terminal spine on the ventral side. 3rd segment scarcely one fifth of the second. The flagellum consists of seven segments. In the left antenna segment 4 is short, segments 5-8 are equally long, while 9 and 10 are again somewhat shorter. There is one long and two short, terminating, sensory hairs. In the right antenna segment 4 resembles that of the left antenna, segments 5 and 6 are shorter than the corresponding segments in the left antenna, 7 is twice as long as 4, and segment 8 is still longer, being twice as long as 5. The two last segments are broken off.

Antenna 2 (fig. 6a) is on both sides represented by the peduncle only, consisting of four segments. Segments 1, 2 and 4 are subequal in size and about as long as broad. Segment 3 is twice as long as broad and a trifle less than twice the length of segment 4.

Left mandible (fig. 7a) has a very broad, 6-dentate cutting edge. The movable lacinia is 3-dentate and the spine-row has eleven spines. Molar process is very prominent, resembling that of *armatus*. There is a 3-segmented palp which is not found in any other species of Ischnomesini in which it has been looked for. The palp on the right mandible is a little different and is shown in fig. 7b.

Maxillae 1 and 2 are of the typical shape. At the base of maxilla 2 there is a tuft of long hairs (fig. 7c).

Maxilliped (fig. 7d) very much like in *bispinosus* and *armatus*, but the first three segments of the palp are narrower.

Pereiopod I (fig. 7e). The length of basis is four-fifths of the three following segments together, slender and without spines. Ischium somewhat less than half as long as basis. Merus short and broad with a short stout spine on the antero-interior corner. Carpus only moderately broad (as in *inermis* (VANHÖFFEN 1914, p. 561) and *armatus)*, more than twice as long as broad. Along the inner margin there is a fairly short cutting edge and five longer and three shorter spines. Propodus narrow, seven times longer than broad. Dactylus short.

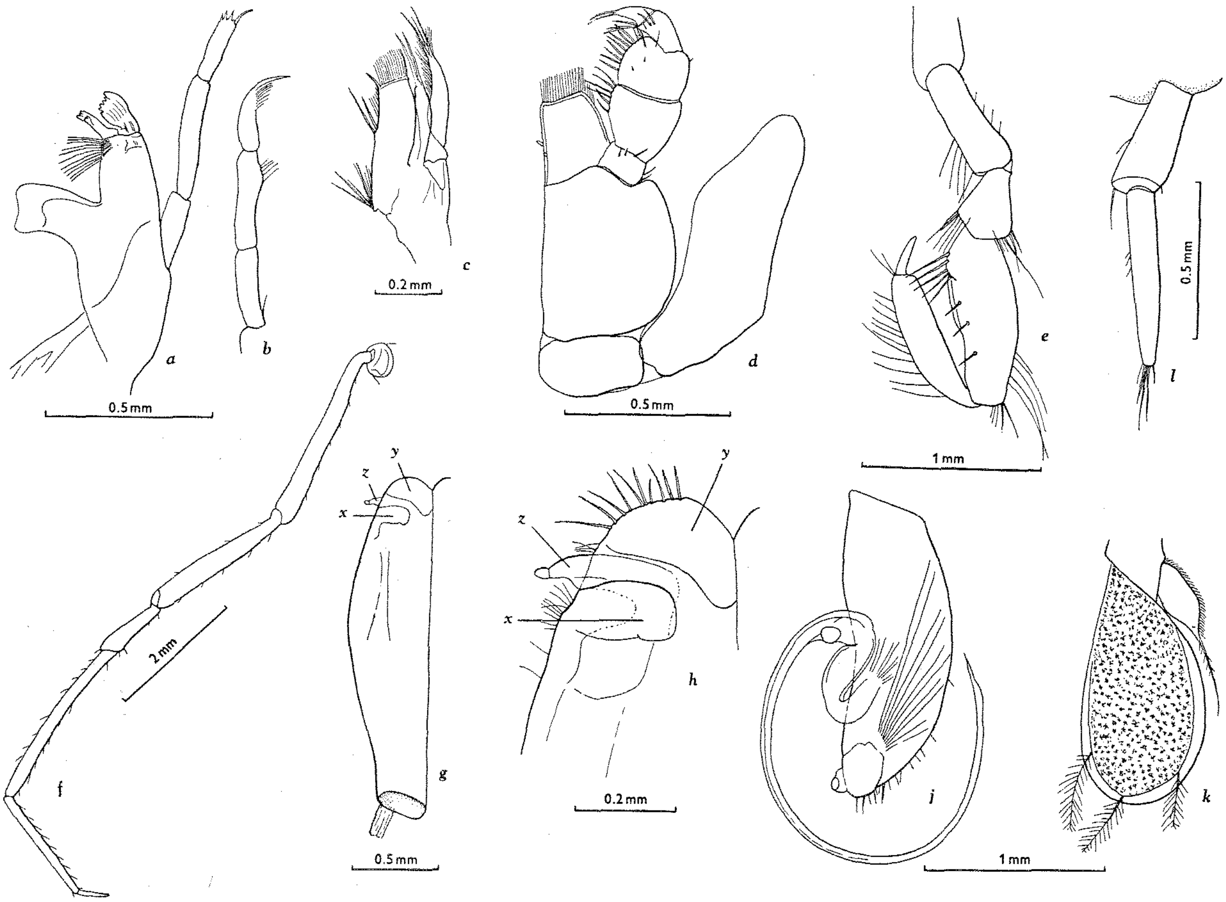


Fig. 7. *Ischnomesus bruuni* n. sp. ♂; a, left mandible; b, palp of right mandible; c, left maxilla 2; d, left maxilliped; e, right pereiopod I, seen from below; f, pereiopod IV; g, right pleopod 1, seen from inside (dorsal view); h, apex of the same (x-y-z, see the text); j, right pleopod 2; k, right pleopod 3; l, left uropod.

Pereiopod III, IV (fig. 7f), *and VII* are all present and of equal shape and length, III being only a trifle shorter than the others. Basis of pereiopod V and VI are also present and are exactly like basis of the three other appendages. Total length of pereiopod IV is 10.5 mm. The mutual length of the segments can be seen in fig. 7f. This appendage is more slender than in *bispinosus*, less spiny than in this species and *inermis* and dactylus is much shorter than in any of these species and in *bacillus* (BEDDARD 1886, pl. VI, 7).

Male operculum somewhat longer than broad and as usual consisting of the first and the outer two thirds of the second pair of pleopods.

Pleopod 1 (figs. 6b & 7g-h) is four times as long as broad, with rounded base and apex; the outer margin is concave near the base, convex towards the end. It is somewhat vaulted both longitudinally and transversely. On the dorsal side (fig. 7g & h) are found the peculiar calcified plates which are also present in *armatus, bacilloides* and *bacillopsis* and are described and compared on p. 90. In the present species the calcified plate x is very distinct and nearly twice as broad as long. It is only in connexion with the pleopod along the anterior (basic) margin, being inserted in a slightly oblique position so that a low cavity is formed beneath it. The apex of the pleopod consists of another calcified plate (y) which is strongly vaulted and furnished with long setae on the outer corner. The two plates x and y partly cover a transverse groove in which a non-calcified organ (z) is faintly visible. As in *armatus* it projects beyond the rounded outer margin of the pleopod and is distinctly seen here. Near its end there seems to be a segmentation. This organ probably represents the distal segments of the highly modified first pleopod. I can hardly believe that it plays any rôle in the copulation; in this as in other Asellota the main purpose of the first pair of pleopods is to protect the fragile inner part of pleopoda 2 which are modified into the copulatory organs.

Pleopod 2 (fig. 7j) is narrow and furnished with a very long penial filament, although not quite so long as in *bacilloides*. It is considerably longer and more slender than in *armatus* (p. 90). BEDDARD mentions that the second pleopod in *bacilloides* "terminates posteriorly in two longish spines of a yellow colour, one arising from the ventral, the other from the dorsal side of the joint". In the present species I have found at the outer corner of the base of pleopod 1 a similar yellow-coloured projection which is, however, a short and strong muscle. Possibly this is also the case with these peculiar "spines" on pleopod 2 in *bacilloides*.

Pleopod 3 (fig. 7k) is much more rounded than in *bispinosus*, the only *Ischnomesus* species in which it was hitherto fully described. The exopodite is also much shorter and terminates more abruptly in the comparatively long, hairy filament. According to BEDDARD's description of the exopodite in *bacilloides* it is of the same general shape as in *bruuni*, but the filament is considerably longer in the former species (pl. VI, 12).

Uropod (fig. 7 l) with two segments, the first about two thirds of the second and twice as broad. At the end of the second segment there are five shorter or longer setae.

Size: Total length 13.5 mm.

Remarks:

In general appearance *I. bruuni* mostly resembles *armatus* and *bacilloides*, which have the same armament with spines on the pereion somites. From *armatus* it differs in having the spines on somites 3-5 directed outwards instead of forwards, and all spines are shorter and more slender; besides, the shape of pleon and of pleopod 1 is somewhat different, palp on mandible is present, the total length is almost four times the length of *armatus*, etc. – From *bacilloides* it differs in being less slender and having much shorter pereion spines; there are some differences in the shape of the pleon; shape and arrangement of calcified plates on pleopod 1 are quite different; first segment of uropods is shorter and broader; besides, there are still a few minor differences. However, these two species are certainly very closely allied and it is much to be regretted that only the posterior half of *bacilloides* was preserved and that later on the significant pleopoda 1 have been lost.

The presence of a mandibular palp in *bruuni* only should not involve that this species is made the type of a separate genus. It is now generally accepted that within the Parasellidae presence or absence of a palp on the mandible is not of generic value. For instance, the well defined genera *Desmosoma* and *Ilyarachna* both comprise species with and species without a mandibular palp (HULT 1936 a).

The present species is named after Dr. ANTON FR. BRUUN, Scientific Leader of the Galathea Expedition.

Distribution:

So far only known from the Kermadec Trench NE of New Zealand, 6960-7000 m, 1.3°C.

Ischnomesus spärcki n. sp.

Material:

St. 651, Kermadec Trench (32°10′S, 177°14′W), 6960-7000 m, 16. Febr. 1952. Gear: herring otter trawl. Bottom: brown clay with pumice. Bottom temperature: 1.3°C. – 1 complete male.

St. 658, Kermadec Trench (35°51′S, 178°31′W), 6660-6720 m, 20. Febr. 1952. Gear: 6 m sledge trawl. Bottom: brown sand with clay and stones. Bottom temp.: 1.3°C. – Anterior half of 1 specimen.

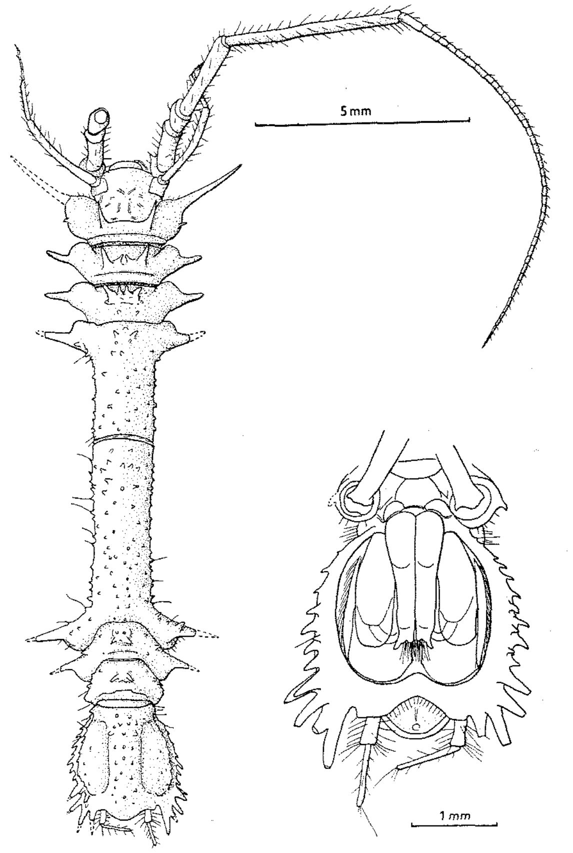


Fig. 8. *Ischnomesus spärcki* n. sp. ♂; type specimen from the Kermadec Trench, 7000 m; dorsal view (left); pleon from below (right).

Description:

Body (fig. 8) is not so slender as in *I. bruuni*, the ratio between total length of animal and width of second pereion somite (at base of spines) only being 5.9. Besides the stout lateral spines, especially somites 4 and 5 and the pleon are furnished with a great many small tubercles on the dorsal and lateral sides.

Head broader than long and somewhat immersed in the first somite.

Pereion somite 1 with vaulted lateral parts, embracing the base of the head and furnished with a pair of long, slender spines, being more than half as long as the width of the somite and directed outwards and forwards. On the dorsal side of the somite there are moreover two shorter spines, directed upwards and a little forwards and outwards; they are connected by a low keel.

Somites 2 and 3 subequal, with vaulted lateral parts, furnished with rather short spines which are directed outwards and a little forwards. On the dorsal side of somite 2 there are two spines which are almost as long as those on somite 1 and with the same direction. Between them are two shorter spines, directed upwards and inwards towards each other. The same arrangement of dorsal spines is found on somite 3, but here all four spines are more distinctly placed on a common base and the two lateral spines are shorter than the preceding ones. Furthermore, there are behind them two median spines which are shorter and directed upwards.

Somite 4 of the same general shape as in the other species of the genus. It is somewhat longer than somites 1-3 together and the width at the posterior end is about half the length of the somite. Besides the lateral pair of spines, which are a little longer than the preceding pair, there are two median spines, directed upwards and somewhat outwards and as long as the median pair on the preceding somite.

Somite 5 is as long as somites 2-4 together and more than three times longer than wide. The lateral spines are directed outwards and a little backwards and are longer and stouter than any other lateral spines. There are no significant median spine-pairs but a great many small spines and tubercles are found on the dorsal and lateral surfaces of this somite as well as on the preceding one.

Somites 6 and 7 are broad and short, the former with a pair of rather slender lateral spines, directed outwards and somewhat backwards. Both somites with a median pair of spines, which are quite short on somite 6.

Pleon has two free and movable somites the first of which is very short. The second somite has a peculiar shape. As in *Storthyngura furcata* (p. 119) the pleotelson is divided by two longitudinal furrows into three almost equally broad convexities, the median being a little narrower than the lateral ones. The median convexity widens anteriorly and is thus T-shaped. The two lateral ones are of an oval shape and terminate a little in front of the hind margin of the pleon, while the median convexity continues on the rounded process which forms the median part of the hind margin. Along the lateral margins are rows of spines, increasing in size to-

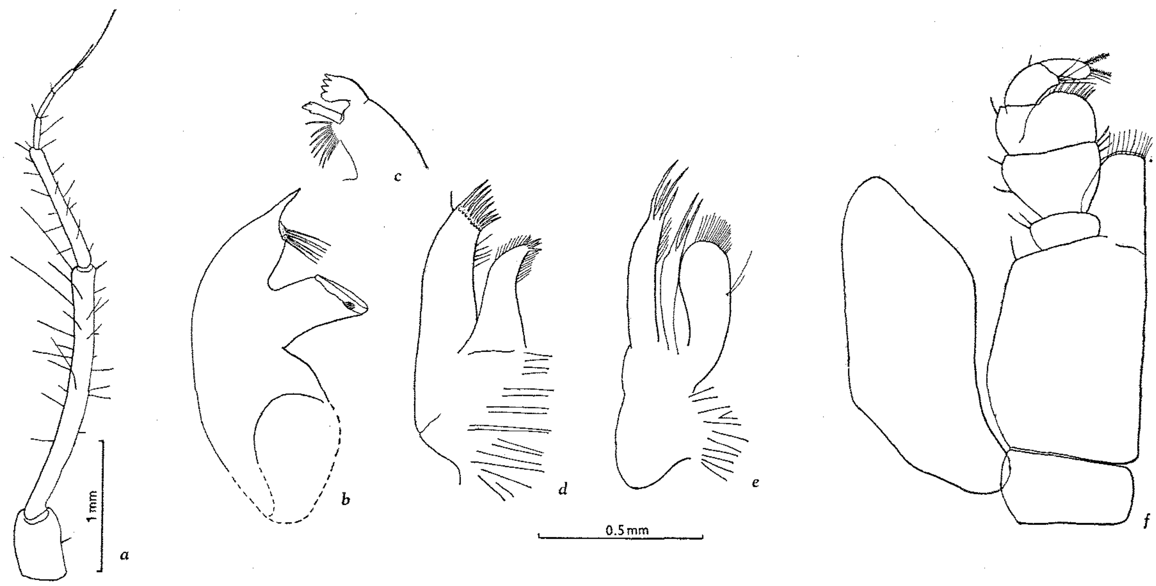


Fig. 9. *Ischnomesus spärcki* n. sp.; a, lateral view of right antenna 1; b, right mandible; c, cutting edge, movable lacinia, and spine-row of left mandible; d-e, right maxillae 1 and 2; f, right maxilliped.

wards the posterior end and being asymmetrically arranged.

On the ventral side of pleon (fig. 8) the bar separating the cavity in front from the anal opening behind is bent somewhat forwards.

Antenna 1 (fig. 9a) reaches backwards a little beyond somite 3. Second segment very slender and somewhat longer than all succeeding segments together, with numerous thin setae. Segment 3 a little less than half as long as 2. The flagellum consists of three equally long segments which are together shorter than segment 3. There are three terminal, sensory hairs.

Antenna 2 (fig. 8) is complete on the right side. The first segment is very short. Segments 2 and 4 are equally long, the former a little broader and with a spine on the antero-interior, distal corner. Segment 3 less than twice as long as 4. Segment 5 a little more slender than 4 and longer by one sixth than the preceding four segments together. The next segment still more slender and one and a half times as long as segment 5. The flagellum with about 43 segments of which the first is the longest. The total length of the flagellum is slightly greater than the rest of antenna 2.

Right mandible (fig. 9b) has a simple, spine-like cutting edge as in *profundus* (fig. 1c). There are six spines in the spine-row and the molar process is very prominent and obliquely cut off. *Left mandible* (fig. 9c) has a broad cutting edge, with four blunt teeth of which the uppermost is very broad. The movable lacinia is also broad and has three major, terminal teeth and a fourth small, upper tooth. Nine spines in the spine-row and a prominent, straightly cut off molar process. There is no palp on any of the mandibles.

Maxillae 1 and 2 (figs. 9d & e) typically shaped.

Maxilliped (fig. 9f) has a narrower second segment than all the other species, but the first three segments of the palp of the usual width. The epipodite is broader than in the other species except *bispinosus*.

Pereiopod I (fig. 10a) short as in the rest of the species, only less than half as long as pereiopod VII. Basis somewhat shorter than the three succeeding segments together. Ischium half as long as basis. Merus is broader than wide and carpus is rather narrow, somewhat more than twice as long as wide, with a row of rather short, stout spines along the antero-interior, concave margin.

Pereiopods II-VII. Only basis of all succeeding pereiopods is present – except VII, which is complete. Basis of II and V are shorter by one sixth than in the rest of the pereiopods, which no doubt means that these two pereiopods were shorter on the whole. Pereiopod VII (fig. 10b) has a total length of almost 12 mm. Ischium is relatively shorter than in any other *Ischnomesus* species in which the pereiopods are preserved, being only three-fifths of carpus. Dactylus is longer than in *bruuni* but shorter than in *bispinosus*.

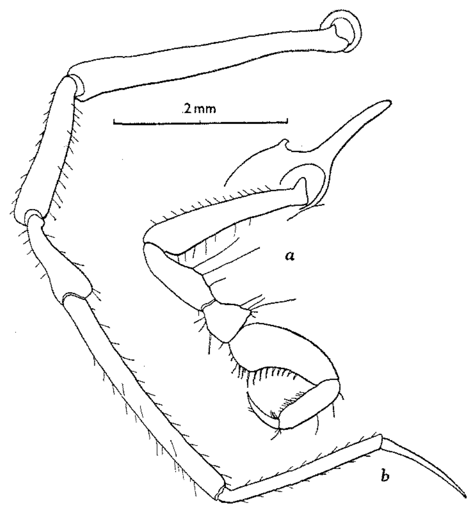


Fig. 10. *Ischnomesus spärcki* n. sp.; a, right pereiopod I; b, right pereiopod VII.

Male operculum (fig. 8) shorter than in any other *Ischnomesus* species in which it is known; it is only one fifth longer than wide. Rest of the cavity is occupied by pleopods 3 and 4.

Pleopod 1 of male (fig. 11a) is narrow and of the same general shape as in *bispinosus* and especially *profundus* (fig. 1). The base is rounded, and the outer corner of the apex is still more produced than in *profundus*. Also the endopodites are slightly projecting and furnished with many long hairs. The ventral (outer) side of the pleopod is somewhat vaulted and more highly calcified in the anterior third than in the remaining part of the pleopod, especially towards the apex. In the anterior third of the dorsal (inner) side there is a pair of concavities, separated by a median keel. The middle part of the pleopod is concave with raised lateral margins which continue as low keels towards the central part of the posterior end where they disappear.

Pleopod 2 (fig. 11b) has the apex cut off almost straightly, thus obtaining a somewhat rectangular shape. The apex is furnished with several long setae. The copulatory organ is extremely short, only a little longer than in *profundus*.

Pleopod 3 (fig. 11c) resembles that of *bispinosus*, having a similar exopodite tapering towards the end,

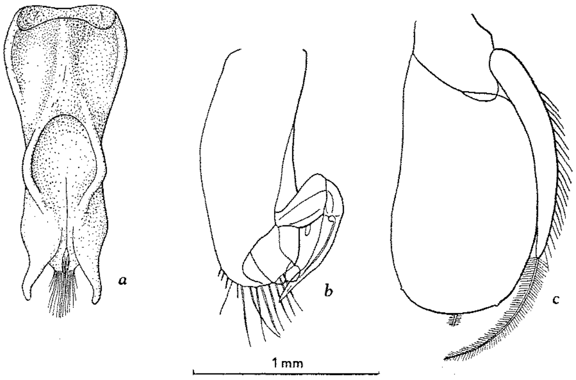


Fig. 11. *Ischnomesus spärcki* n. sp. ♂; a, pleopoda 1, seen from inside (dorsal view); b, left pleopod 2; c, left pleopod 3.

but the endopodite is more rounded, although not so rounded as in *bruuni*.

Uropod (fig. 8) with two segments; the first about half as long as the second and more than three times as broad. Both segments with long, thin setae.

Size: The total length is 16 mm and *I. spärcki* is thus the biggest hitherto known species of *Ischnomesus*.

Variation:

The anterior half of one more specimen from another station in the Kermadec Trench is preserved. The head and somites 1-4 are present, and both pairs of antennae are complete. The size of the two specimens is exactly the same, and this also applies to the shape of head and somites as well as to length and arrangement of the lateral and median spines on the somites. The only difference is found in the length of the antennae. Both the first and the second pairs are longer in the type specimen, the first pair even longer by one fourth. This seems to indicate that the present fragment is of a female.

Remarks:

Especially the shape of the pleon and the armament with median spines on pereion and lateral spines on pleon clearly separate this species from any other *Ischnomesus*. On the other hand, it falls well within the limits of the genus. In some respects it seems to be more nearly related to *bispinosus* than to any of the other species. Agreement with *bispinosus* exists in the shape of the male pleopods and to some extent of the mandible. On the other hand, it differs decidedly in many characters, such as armament with principal spines, shape and length of pereiopods, lack of exopodite on uropod, etc. From *bruuni*, the other species from the Kermadec Trench, it differs first and foremost in lack of palp on mandible and shape of male pleopods, but the general appearance is rather equal.

The species is named after Professor Dr. R. Spärck, Vice-President of the Committee of the Galathea Expedition.

At Galathea Station 663 (Kermadec Trench, 4410 m) a female was caught which is very near to *I. spärcki*. After a careful comparison I decided to regard the female as a separate species, mainly on account of the following differences: Presence of principal spines on the epimera and the posterolateral corners of somite 4, the lateral parts of somite 7, and the hind margin of pleon which are all missing in *spärcki;* lack of median spine-pair on the dorsal part of somites 2 and 3; four segments in the flagellum of antenna 1; carpus of pereiopod 1 expanded; basis of pereiopod V as long as that of III, IV, and VI and basis of VII shorter than any of these.

At Galathea Station 575 (Tasman Sea, 3710 m) a fragment consisting of pereion somite 1-4 and pereiopod I was caught. The shape of these few remaining parts are very near to *spärcki* although not near enough to refer the fragment to this species. There is, however, no doubt that it is very closely related to *spärcki*.

The female from St. 663 and the fragment from St. 575 will be described later.

Distribution:

Kermadec Trench NE of New Zealand, 6660-7000 m, 1.3°C.

Stylomesus nov. gen.

Diagnosis:

Body slender, pereion somites 4 and 5 being longer than any other somites. All pereion somites mutually free and movable but the seventh is fused with pleon which consists of two, likewise fused somites. Antennae 1 well developed, with six segments. Antennae 2 with third segment elongate, more than twice as long as the fourth. Maxillipeds with second segment extremely large and its lobe more than half as broad as the segment and much shorter than broad; the palp more than two thirds as long as the segment itself – the lobe not included – and its three proximal segments not expanded, being only a little broader than long. Pereiopod I with carpus of normal shape. Uropods with two segments.

Remarks:

The reasons for erecting this genus are given on p. 87. It comprises one species, *S. inermis* (Vanhöffen), of which only one female is known. Since VANHÖFFEN's description is rather insufficient I have included a redescription of the species in the present Report.

Stylomesus inermis (Vanhöffen), 1914

Rhabdomesus inermis Vanhöffen, 1914, p. 560, fig. 88.

Description:

Body elongate, 5.3 times longer than broad (width of pereion somite 1).

Head deeply immersed in the first pereion somite and sloping gently downwards. The antennae are inserted on a stout projection which is twice as broad as the third segment of antenna 2 and nearly as long as broad, measured along the outer margin. Only in *Heteromesus dentatus* (HANSEN 1916, pl. 5, fig. 6b) a similar, but not nearly so pronounced projection is found. VANHÖFFEN's fig. 88 shows it in lateral view at the base of the antennae.

Pereion somite 1 is broader than any other pereion somites. Laterally it is as long as each of the two succeeding somites, dorsally it is only a little more than half as long as any of these. On the strongly vaulted antero-lateral corners is a pair of tiny spines with a terminal seta.

Pereion somites 4 and 5 are elongated. The width between the vaulted postero-lateral corners of somite 5 is a little less than the width between the vaulted antero-lateral corners of somite 4; this width is again a trifle less than that of somites 3, 2, and especially 1. The elongate parts of somites 4 and 5 are almost equally broad and circular in section. The length of somite 4 is somewhat shorter than 2 + 3, while 5 is twice as long as somite 4.

Pereion somites 6 and 7 are narrower than the preceding ones, 7 being only half the width of somite 1. Somite 6 is a little shorter than 2 or 3, and 7 is again a little shorter than 6.

Pleon consists of two coalesced somites the anterior of which is one third of the whole pleon. The original segmentation between the pleon and pereion somite 7 and between the two pleon somites is clearly visible as a furrow continuing the whole way round. The shape of the posterior pleon somite is almost circular and the median part is somewhat more vaulted than the lateral sections, almost like the pleon of *Heteromesus schmidti* (HANSEN 1916, pl. 6, fig. 3d). Along the convex posterior and lateral margins are a few setae. The total pleon is nearly as long as somites 2 + 3 and the largest width is like that of somite 6.

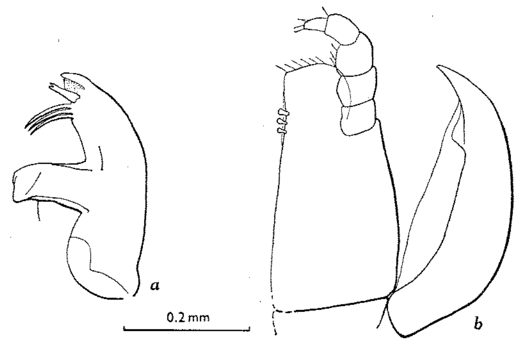


Fig. 12. *Stylomesus inermis* (Vanhöffen); a, left mandible; b, left maxilliped.

Antenna 1 has a thick, oval, basal segment which is half as long and almost three times as thick as the elongate second segment which rises on its upper, interior corner. On the interior margin of segment 2 are two extremely long hairs. Segment 3 is only a trifle narrower than 2 and one third in length. The flagellum consists of three very narrow segments of which the proximal is one third of each of the equally long, distal segments. The whole flagellum is about as long as the two distal peduncular segments together.

Antenna 2 (VANHÖFFEN's fig. 88) has two very short proximal segments; the distal one is furnished with a long spine on its ventral side. Segment 3 is very elongated and widest at the base. It is almost three times longer than segment 4. The flagellum is lost on both antennae.

Left mandible (fig. 12a) is small and slender. The cutting edge is broad and concave and with tiny rounded denticles. The movable lacinia is slender and bi-furcate and there are three long spines in the spine-row. The molar process is long and slender. There is no palp.

Maxilliped (fig. 12b) has the lateral margins of the second segment deflected inwards at right angles, the segment thus forming a kind of a through; the deflected inner margin is concave, the outer convex. There are three globular coupling hooks. The palp is very slender, although not so slender as in *Heteromesus*. The epipodite curves inwards and somewhat upwards towards the apex thus forming on each side a rounded frame which makes the buccal cavity almost circular. The interior part of the epipodite is almost hyaline.

Pereiopods are all present and are well figured by VANHÖFFEN. Carpus of pereiopod I is only slightly expanded. II and VII are almost equally long and about one fifth shorter than IV and V.

Female operculum is moderately vaulted and almost circular having a slight convexity at base and being somewhat concave along the distal margin. The lower surface is quite smooth.

Uropod is somewhat more than half as long as abdomen. The two segments are equally long. The first segment is only a little narrower distally than proximally while segment 2 tapers evenly towards the end.

Size: Total length is 5.1 mm and largest width (somite 1) is 0.9 mm.

Remarks:

In shape of body, mandibles and maxillipeds *S. inermis* resembles the species of *Heteromesus* more than those of *Ischnomesus*.

Distribution:

So far known only from the Antarctic Indian Ocean (65°31'S, 85°17'E), at a depth of 2450 m.

Macrostylini Hansen

Macrostylis G. O. Sars

Macrostylis G. O. Sars, 1864, p. 13
Macrostylis G. O. Sars, BEDDARD 1886, p. 173
Vana Meinert, 1890, p. 195
Macrostylis G. O. Sars, 1899, p. 120
Macrostylis G. O. Sars, HANSEN 1916, p. 75

Since HANSEN's revision of the generic characters of *Macrostylis* three more species belonging to this very well defined genus have been collected, viz. *M. spiniceps* Barnard (1920) and the two species described below. They all agree in almost all details with HANSEN's careful diagnosis of the genus. The only two exceptions are that *M. hadalis* n. sp. has only one segment in the uropod and that the first three pereion somites in *M. spiniceps* do not "constitute together a separate sub-quadrangular section, with each lateral margin forming a nearly uninterrupted, distinctly convex line"; both according to BARNARD's description and figure (pl. 17, fig. 10) their postero-lateral angles are acute or sub-acute and nearly as well marked off from each other as are the succeeding four somites in *spiniceps* as well as in the other *Macrostylis* species.

Altogether ten species of the present genus are now known. Most of them are deep-sea forms caught in one or a few specimens only and often more or less incomplete. In the following key the main stress is therefore laid upon characters of head and body rather than on the appendages which so easily break off.

1. Head broader than pereion; its postero-lateral angles acutely produced . . . . *M. spiniceps* Barnard, 1920
   Head as broad as or narrower than pereion . . . 2
2. Tip of pleon convex between uropods, but not obtusely produced 3
   Tip of pleon obtusely produced 5
3. Pereiopod VII much longer than body. Antenna 1 almost as long as head *M. longipes* Hansen, 1916
   Pereiopod VII shorter than body. Antenna 1 only half as long as head 4
4. Ventral spines on pereion somites 1 and 6-7 small or missing. Uropods only a little more than half as long as pleon . . . *M. subinermis* Hansen, 1916
   Ventral spines or processes on pereion somites 1 and 6-7 long and slender. Uropods almost as long as pleon. . . . . *M. longiremis* (Meinert), 1890
5. Pereion somite 4 narrower than all the others. Uropods almost as long as pereion + pleon, with many segments *M. elongata* Hansen, 1916
   Pereion somite 4 as broad as or broader than the succeeding ones. 6
6. Anterior margin of pereion somite 1 straight and lateral margins of somites 1-3 (when seen from the side) irregular. The margins of the ventral pleon excavation curved upwards and forwards distally, thus forming a deep notch (fig. 20a, p. 104). Pereiopods I and II equally long. Uropods with one segment and only two fifths as long as pleon. . . . . *M. hadalis* n. sp.
   Anterior margin of somite 1 concave and lateral margins of somites 1-3 straight. No deep notch at distal end of pleon. Pereiopod II longer than I. Uropods with two segments and longer than pleon[1] 7
7. No ventral process on pereion somite 1. Pereion somite 5 shorter than 6 and 7. Ischium of pereiopod III with a strong hook-like process on upper margin. Length of basis of pereiopod V only half of succeeding three segments. . . . . *M. galatheae* n. sp.
   A forward directed median process on ventral side of pereion somite 1 (at any rate in *M. abyssicola).* Pereion somite 5 not shorter than 6 and 7. Ischium of pereiopod III with a more or less strong spine on upper margin. Length of basis of pereiopod V $^2/_3$-$^3/_4$ of succeeding three segments 8

1. Pereiopod I and uropods missing in *M. latifrons.*

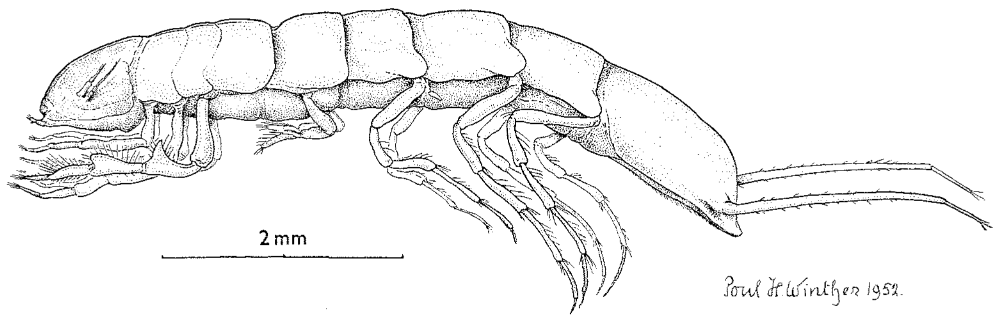


Fig. 13. *Macrostylis galatheae* n.sp.; deepest recorded isopod (Philippine Trench, 9790 m).

8. Pleon as long as pereion somites 6-7. Length of antenna 1 about $^1/_2$-$^1/_3$ of width of head at insertion; number of segments 5 .... *M. latifrons* Beddard, 1886
Pleon as long as pereion somites 5-7. Antenna 1 only $^1/_4$-$^1/_5$ of width of head; number of segments 3 .... *M. abyssicola* Hansen, 1916.

Macrostylis galatheae n. sp.

Material:

St. 435, Philippine Trench (10°20'N, 126°41'E), 9790 m, 7. Aug. 1951. Gear: triangular dredge. Bottom: very stiff clay. Bottom temperature: 2.6°C. – Anterior half (head + 4 somites) of 1 specimen which is probably a male; posterior half of 2 females (respectively 5 and 3 pereion somites + pleon); posterior half of 1 male (3 pereion somites + pleon).

Description:

Body (figs. 13 & 14a-b) slender, more than five times as long as broad, in general aspect mostly like that of *M. subinermis.*

Head (fig. 14a) separated from the first pereion somite by a very marked constriction. Its shape is somewhat squarish with a rather produced section just in front of the very slight sinus for the insertion of the antennae. The frontal part is straight.

Pereion somites 1-3 (fig. 14a) of the characteristic appearance and not movable. The concave anterior and convex posterior borders of the first somite are parallel; the posterior border of the second somite is a little more convex than that of the first; in the third somite the posterior border is straight and has no spines on its angles.

Pereion somites 4-7 (fig. 14b) are separated from each other (and the fourth from the third) by a deep lateral notch and are very movable. In the present, somewhat disentangled, material it is impossible to make out whether they are still in connexion with each other in quite the original way; their relative size is therefore disregarded in this description, but the sixth is definitely the longest and the seventh the longest but one. The lateral regions of the three last somites are widest posteriorly and form a produced, vaulted angle. This is furnished with one spine on somite 5, two spines (male) and three (female) on somite 6, and three spines on somite 7. There are no spines on somite 4.

On the ventral side none of the somites are furnished with keels or the strong spines found on some or all the somites of all other species of *Macrostylis* (except *M. latifrons?).*

Pleon (fig. 15a & b) somewhat less than twice as long as wide and a little longer than the two preceding somites combined. The width at the base is the same as at the insertions of the uropods. The greater part of the lateral margins is distinctly convex. The posterior border is produced backwards as a rounded, median lobe with concave sides towards the uropods. The peculiar organ observed by HANSEN (1916, p. 75) on each side near the posterior end of the pleon is apparently not present in this spe-

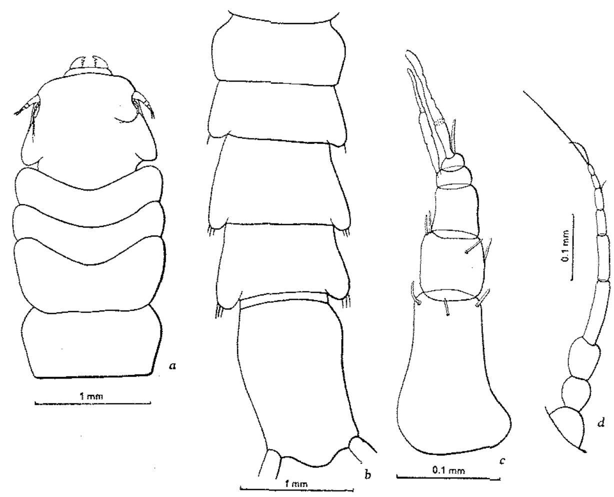


Fig. 14. *Macrostylis galatheae* n.sp.; a, dorsal view of head and pereion somites 1-4 of ? male; b, dorsal view of pereion somites 4-7 and pleon of female; c, antenna 1; d, antenna 2.

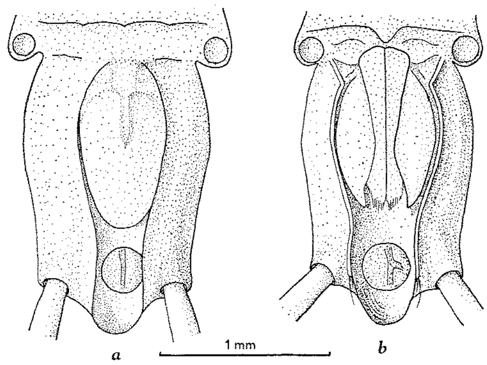


Fig. 15. *Macrostylis galatheae* n.sp.; a, abdomen of female from below; b, abdomen of male from below.

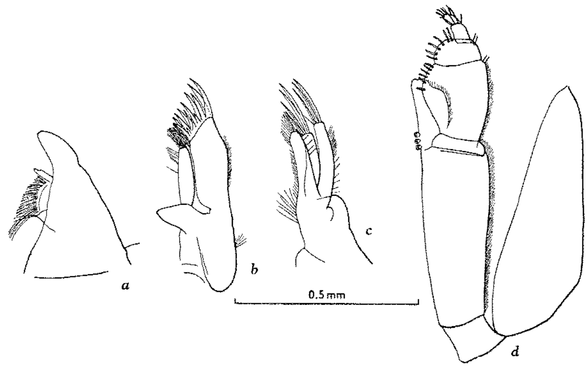


Fig. 16. *Macrostylis galatheae* n.sp.; a, left mandible; b-c, left maxillae 1 and 2; d, left maxilliped.

cies. – Only about three fifths of the narrow, ventral excavation is covered by the female or the male operculum. Almost in the middle of the uncovered, distal part of the excavation the two anal doors are visible. The excavation is broader in the male than in the female and lined with a conspicuous seam, ending off the anal doors and at the termination furnished with a short and a longer seta.

Antenna 1 (fig. 14c) moderately long, with 5 segments, the first of them being a little longer than the remaining four together. Segments 4 and 5 very small and each with a stout olfactory filament. I regard the present, broken specimen as a male, because the first antenna has the same number of segments and placement of the sensory filaments as the first antenna of the male of *M. hadalis,* the most closely related species (see p. 104).

Antenna 2 (fig. 14d) unusually short, being not half the length of the head. First three segments subequal in size, rounded. The remaining six segments cylindrical, decreasing in length and width towards the sixth which is furnished with one rather long and one very long seta.

Left mandible (fig. 16a) rather different from that of *M. spinifera,* the only species in which the mandibles of this genus was hitherto described (by SARS 1899, pl. 51). It is very short and broad and has a blunt cutting edge. The movable lacinia is slender and has two teeth as in *spinifera.* There are a great many spines and setae in the spine-row, at least 25. The molar process is still smaller than in *spinifera* and almost triangular; it has only two setae.

Maxillae 1 and 2 (fig. 16b & c) of almost the same shape as in *spinifera.*

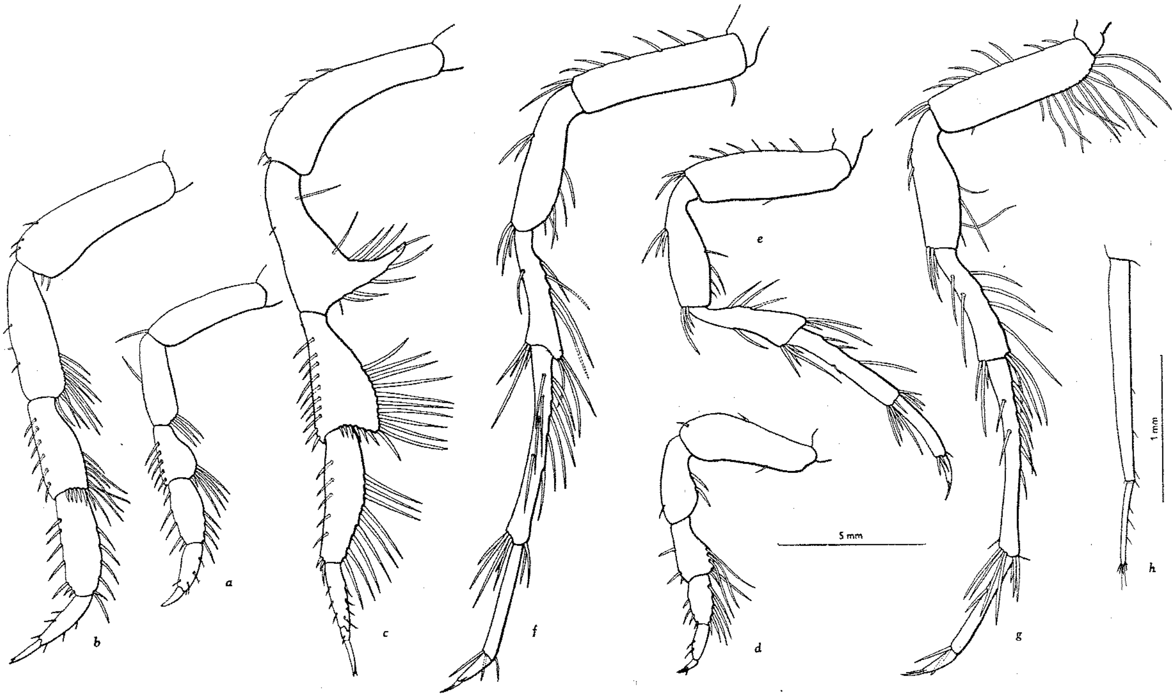


Fig. 17. *Macrostylis galatheae* n. sp.; a-g, left pereiopoda I-VII; a-c, of ? male; d-g, of female; h, left uropod.

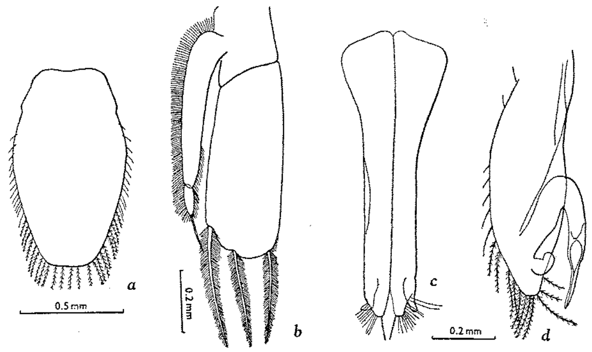


Fig. 18. *Macrostylis galatheae* n. sp.; a, female operculum; b, pleopod 3 of female; c, male pleopoda 1; d, pleopod 2 of male.

Maxilliped (fig. 16d) more slender than in *spinifera* and *subinermis,* the second segment being three times longer than broad instead of about two and a half times. In the diagnosis of the genus SARS states that the two distal segments of the palp are rudimentary; this is, however, neither the case in *subinermis* (HANSEN 1916, pl. 7, fig. 4c) nor in the present species. There are three coupling hooks.

Pereiopods I and II (fig. 17a & b) subequal in shape, except for the merus, which is broadened in pereiopod I. Also the furnishment with setae is similar, but there are about twice as many in II. The size of I is about three fifths of II.

Pereiopod III (fig. 17c) is one sixth longer than II and has the ischium and merus extended laterally. Beyond the middle of ischium is on the upper (inner) margin a strong, recurved, spiniform process, even stouter than in *M. spinifera,* and replacing the strong spine found in the same place in most of the other species. Along the upper margin of merus and carpus are rows of long and robust setae.

Pereiopod IV (fig. 17d) is only half as long as III.

Pereiopods V-VII (fig. 17e-g) are long and much more slender than the anterior legs. They are furnished with a great many more or less robust setae; basis of VII has besides a row of long and thin hairs.

Female operculum (fig. 18a) is relatively much shorter than in all other *Macrostylis* species, except *abyssicola.* It is oblong ovate with the distal end somewhat cut off. It is almost twice as long as broad and has a low median keel stretching from the proximal part to the middle of the operculum (fig. 15a).

Pleopod 3 of female (fig. 18b) is much more slender than in *spinifera,* and the outer ramus has a second segment, terminating in one seta.

Male operculum is also short. The first pair of pleopods (fig. 18c) very long and slender and broadest at base. On the apex there is an outer, shorter, and narrower lobe and an inner, longer, and broader lobe; the latter is furnished with a row of setae. *Pleopod 2* (fig. 18d) is not quite so narrow as in *spinifera* and *longipes* and has a rounded apex. The copulatory organ is short and stout, reaching only a little beyond the apex.

Uropod of male (fig. 17h) is somewhat longer than the pleon. It has two segments, the proximal being almost twice as long as the distal, which terminates in a few setae. Uropod of female not preserved.

Size: Total length about 5.5 mm.

Remarks:

As will appear from the key given above *M. galathea* is well separated from the rest of the *Macrostylis* species (affinity to *M. hadalis* will be discussed under that species). Apart from *hadalis* it seems to be most closely related to those two species of the genus which till now were known from the greatest depths, viz. *abyssicola* and *latifrons* (both from about 3500 m). Besides the differences pointed out in the key a few more can be given. For *abyssicola:* Postero-lateral corners of head sharp (instead of rounded in *galathea);* antenna 1 with three segments (instead of five) and considerably shorter; female operculum with a regularly rounded, distal end in *abyssicola.*

Concerning *M. latifrons* a comparison has been difficult and not quite satisfying. BEDDARD's description (1886, p. 173) was based on a single female from the Challenger and is not very exhaustive; his figure is without any value at all.

During a recent visit to the British Museum (Natural History) in London I had an opportunity to examine the holotype of *latifrons* which is the only specimen known. Unfortunately, it was mounted on a slide and had suffered so badly from the process that it cannot be unmounted any more. It therefore seems impossible to give a quite satisfying revision of BEDDARD's description. It is very regrettable that it cannot be stated for instance whether or not there is a process on the ventral side of pereion somite 1 and a keel on the succeeding ones, whether somite 2 really has parallel anterior and posterior margins (as claimed by BEDDARD), and what the under side of pleon looks like.

M. latifrons is relatively broader than *galatheae.* I found it 4.7 times as long as wide while *galatheae* is at least 5.5 times longer than wide.

The head of *latifrons* is very cracked, but the po-

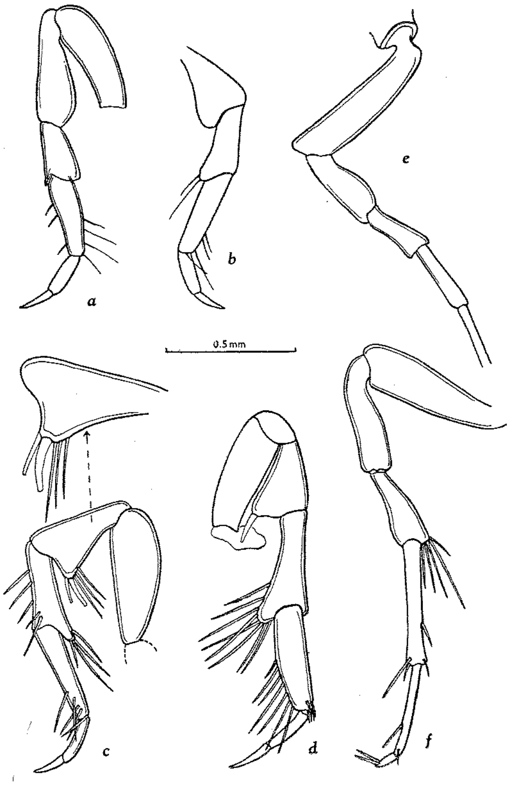


Fig. 19. *Macrostylis latifrons* Beddard; a-b, left and right pereiopod II; c-d, left and right pereiopod III; e, left pereiopod V; f, left pereiopod VI. Some setae omitted.

stero-lateral corners are intact and are at least as rounded as in *galatheae*. The head seems to be somewhat narrower than the three succeeding thoracic somites. One antenna 1 is visible and resembles that of *galatheae* but the first segment seems to be shorter (only about three fourths of the succeeding four segments). The equipment with olfactory filaments is rather obscure. There seems to be one stout, terminal filament and a short terminal seta as in *galathea,* while the subterminal olfactory filament of the latter species apparently is lacking in *latifrons*. This difference may be due to the fact that the two specimens are probably not the same sex.

Four of the pereiopods were sufficiently exposed to be drawn. In some of the figures the setae are totally or partly omitted since they were very obscure.

Pereiopod II (fig. 19a & b) does not differ very much from that of *galatheae* except for a marked process on the distal, outer corner of merus, visible both on the right and the left, second pereiopod of the type specimen. Besides, carpus is comparatively longer in *latifrons*.

Pereiopod III (fig. 19c & d). One of the greatest differences between *latifrons* and *galatheae* is found in the shape of ischium of this leg. The latter is described above. The former is triangular and furnished with one stout and one somewhat shorter and thinner spine on the distal, inner corner. Both spines have the distal end rounded or even truncate. These spines are probably very little calcified, since they are quite difficult to focus on the slide. Basis of pereiopod III is also comparatively shorter and broader in *latifrons,* and merus is distinctly broader at the proximal and narrower at the distal end than in *galatheae*.

Pereiopod V (fig. 19e) has a very long basis as mentioned in the key. Moreover, it has a projection on the distal, outer corner, which is absent in *galatheae*.

I found the operculum extremely broken. It could, however, be made out that the specimen is a female, and that the operculum is definitely broader than in *galatheae*.

Although the only specimen existing of *M. latifrons* is so badly preserved there is, however, hardly any doubt that sufficiently many characters indicate that *latifrons* and *galatheae* must be two distinct species.

Distribution:

M. galatheae is known only from the type locality in the Philippine Trench at a depth of 9790 m, being thus the deepest isopod find ever recorded. Together with a single specimen of an amphipod from Galathea St. 418 (10.190 m) this species is so far the only crustacean which has been dre ¹ged at depths of about 10.000 m.

Macrostylis hadalis n. sp.

Material:

St. 496, Banda Trench (05°36′S, 131°06′E), 7280 m, 23. Sept. 1951. Gear: Petersen grab (bottom sampler) 0.2 sq.m. Bottom: soft clay. Bottom temperature: 3.6°C. – 1 female and 1 male. The female is the type specimen.

Description:

Body (fig. 20a & b) more elongated than in any other species of *Macrostylis,* being six times longer than broad. The margins are subparallel, the width being almost uniform from first pereion somite to end of pleon.

Head almost semicircular, considerably more rounded than in *galatheae*. It has the same marked constriction posteriorly as this species.

Pereion somites 1-3 immovably coalesced. Seen from above they have the same general shape as in

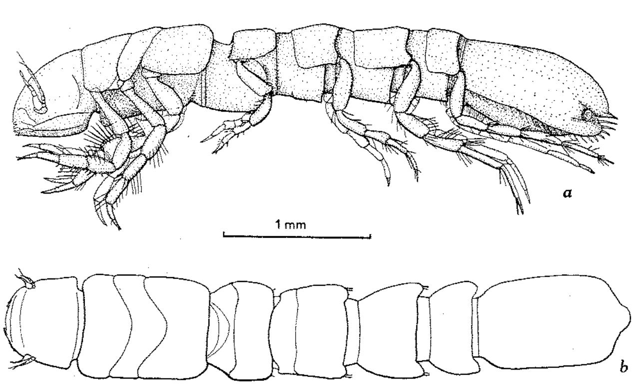


Fig. 20. *Macrostylis hadalis* n. sp. ♀; type specimen from the Banda Trench 7280 m; a, lateral view; b, dorsal view.

galatheae, but they are comparatively longer, being together one sixth longer than broad, while in *galatheae* they are a little broader than long. The anterior margin of the first somite is also straight, not concave as in *galatheae*. The three somites are exactly as in *subinermis* (HANSEN 1916, pl. 7, fig. 4a). Seen from the side the lateral margin in *galatheae* is almost straight (fig. 13), while in *hadalis* somite 1 reaches furthest down towards the ventral side, somite 2 becomes quite narrow, and somite 3 is considerably shorter than especially 1 (fig. 20a). Ventrally the anterior part of the first somite is considerably deeper than the posterior end of the head.

Pereion somites 4-7 look as if they had been stretched dorsally, since the strongly calcified dorsal plates are much smaller than the entire somites. However, the ventral integument shows no sign of molestation at all, so the present outlook must be considered the normal one; I also prepared the figure of *hadalis* in dorsal view after having mounted the specimen on a slide so that it was perfectly straight. As in *galatheae* the postero-lateral corners of somites 5-7 are rounded and vaulted, but their equipment with spines is somewhat different. There is also a considerable difference in the relative length of somites 4-7, when seen in dorsal view. In *galatheae* 6 is definitely the longest and 7 the longest but one. In *hadalis* somites 5 and 6 are about equally long and 7 is shorter than any of the three preceding somites.

Ventrally the anterior three fourths of each of the somites 4-7 is somewhat raised compared with the remaining fourth of the somite. Thus, on each somite a conspicuous notch is formed. Moreover, the median part of the raised area is slightly keeled and ends posteriorly in a tiny spine which corresponds to the stout ventral, backwards curved spines found in almost all the northern species of the genus.

Pleon somewhat less than twice as long as broad and somewhat longer than the two preceding somites together. The general shape is like that of *galatheae;* nor in this species are the peculiar organs, mentioned by HANSEN, visible. – The excavation on the ventral side of pleon is narrow (broadest in the male) and only three fifths of it is covered by the female and the male operculum (fig. 21a). In both sexes the margin between the ventral surface of pleon and the excavation curves forwards and upwards near the distal end. The proximal part of the margin is furnished with setae, while the distal bend has a row of strong spines. The roof of the excavation forms a projection which reaches further backwards than the above lying part of the pleon, thus looking almost like the upper "beak" of a dolphin (fig. 20a).

Antenna 1 of female (fig. 21b) moderately long, with four segments of which the proximal is very large and longer than the other three together. There is only one stout olfactory filament terminally. The male antenna 1 has five segments of which the third and the fourth are equally broad, and the former twice as long as the latter. There are two subterminal and two terminal olfactory filaments which are all of the same length.

Antenna 2 (fig. 21b) almost as short as in *gala-*

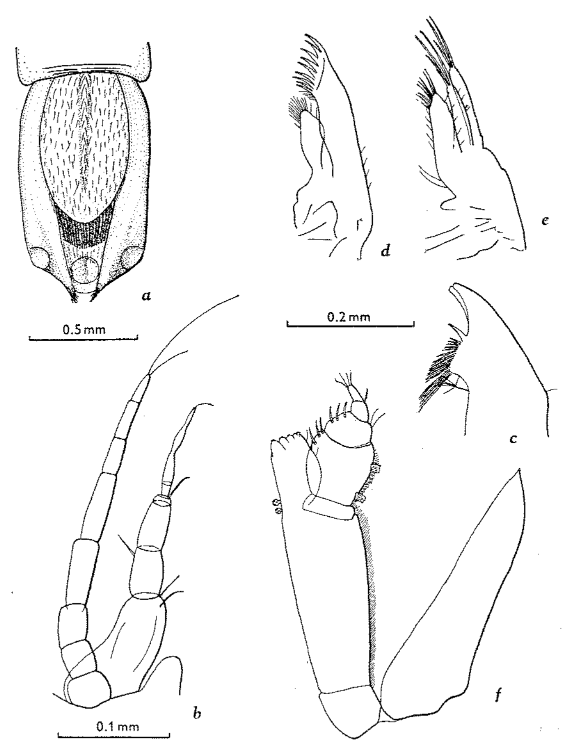


Fig. 21. *Macrostylis hadalis* n. sp. ♀; a, pleon from below; b, antenna 1 (to the right), antenna 2 (to the left); c, left mandible; d-e, left maxillae 1 and 2; f, left maxilliped.

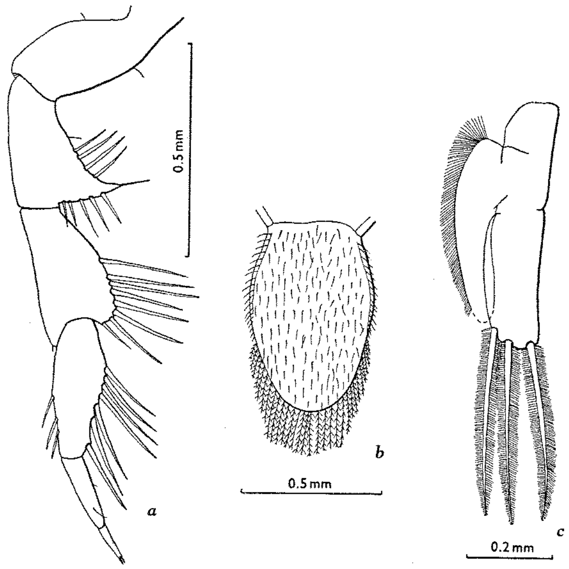


Fig. 22. *Macrostylis hadalis* n. sp. ♀; a, pereiopod III; b, operculum; c, pleopod 3.

theae, being only a little more than half the length of the head. The shape of the antenna is also similar in the two species, except that *hadalis* has only three segments in the flagellum in both sexes.

Left mandible (fig. 21 c) shaped almost as in *galatheae.* The only differences are that it is a little more slender, has a double-toothed cutting edge, a single-toothed movable lacinia, and five fine setae on the triangular molar process.

Maxillae 1 and 2 (fig. 21 d & e) similar to those of *galatheae,* except that maxilla 1 has fewer spines.

Maxilliped (fig. 21 f) is not quite so slender as in *galatheae.* This does not, however, hold good for the epipodite which is distinctly narrower and hyaline along the outer margin. There are only two coupling hooks.

Pereiopods I and II (fig. 20 a) are equally long. In both legs basis is relatively longer and ischium relatively shorter than in *galatheae.*

Pereiopod III (fig. 22 a) has rather broad segments, especially ischium which is almost triangular with straight margins, and the spiniform process on the upper (inner) margin is much less pronounced than in *galatheae.* The armament with long and robust setae is almost the same in the two species.

Pereiopods IV-VII (fig. 20 a) are almost equal both in shape and relative length in the two species. The only major differences are that basis of all four legs is somewhat broader in *hadalis* and carpus of pereiopods VI and VII relatively longer in *galatheae.*

Female operculum (fig. 22 b) is ovate and a little less than one and a half times longer than broad. The rounded distal margin is furnished with rather long, feathered setae, and the lower surface covered with a great number of short hairs. There is a low, median keel, stretching from the base almost to the distal end (fig. 21 a).

Pleopod 3 of female (fig. 22 c) is slender and the three terminal, feathered setae are very long, even longer than the second segment. The tip of the outer ramus was broken off, but apparently the ramus does not have two segments as in *galatheae.*

Male pleopoda 1 (fig. 23 a) are extremely slender and have the outer, distal lobe longer than the inner one which bears a few setae. The pleopods are somewhat excavated dorsally; almost halfway between the apex and base the raised lateral margins bend inwards and run towards the base as a pair of low keels in the same way as on the dorsal surface of the first pair of male pleopods in *Ischnomesus spärcki* (fig. 11 a, p. 97).

Male pleopod 2 (fig. 23 b) is broader than in *galatheae,* and the inner margin is slightly concave instead of convex. The copulatory organ is also much shorter, reaching only a little beyond the coupling hook.

Uropod (fig. 23 c) was only preserved on the left side of the male. It is, as far as could be made out, with one segment only; even at the greatest magnification it was impossible to find any articulation. Moreover, the uropod is only two fifths of the length of pleon, i. e. even shorter than in *subinermis.* Along both margins it is furnished with some very long and partly feathered setae.

Size: The total length of the female is 4.4 mm, and the largest width 0.7 mm. The male is 4.6 mm long.

Variation:

Apart from the sexual dimorphism in shape of the first pair of antennae, the pleopods, and the excavation of the ventral part of pleon there are no differences between the present two specimens.

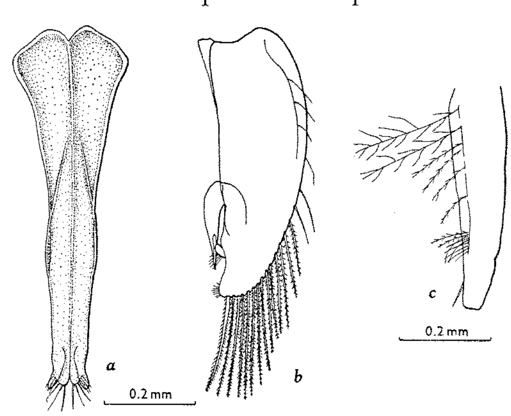


Fig. 23. *Macrostylis hadalis* n. sp. ♂; a, pleopoda 1 from inside (dorsal view); b, pleopod 2; c, uropod.

Remarks:

Disregarding the very imperfect *M. latifrons* Bedd. there is hardly any doubt that *galatheae* and *hadalis,* so far two of the deepest recorded species of Isopoda, are very closely related. They agree in several main characters such as general shape, lack of armament with strong spines on the ventral side of the pereion somites, shape of pleon and narrowness of its ventral excavation which in both species is only partly covered by the opercula, shape of antenna 1 and mandible, length of antenna 2, and, finally, presence of two pairs of lobes on the distal end of the male pleopoda.

On the other hand, it is possible to point out a great many differences, several of which are essential enough to justify the separation into two distinct species. A brief summary of the major differences may be useful; the characters of *hadalis* are mentioned first in each heading:

Head semicircular instead of almost squarish; somites 1-3 longer than broad, their lateral margins (seen from the side) irregular instead of straight, and anterior margin of somite 1 straight, not concave; somites 5 and 6 longest and 7 shortest in *hadalis* while somite 6 is the longest and 7 the longest but one in *galatheae;* part of the ventral side of somites 4-7 raised and slightly keeled in *hadalis* which has also a rather complicated termination of the excavation on the ventral side of pleon, not found in *galatheae;* antenna 2 has eight segments instead of nine, and there are two close, blunt teeth on the cutting edge of the mandible instead of one; pereiopod I is as long as II, and ischium of pereiopod III is differently shaped; the female operculum is rounded posteriorly and covered with a great many short hairs instead of being cut off posteriorly and naked; outer, distal lobes of male pleopoda 1 longer than inner lobes, and plp. 2 with much shorter copulatory organ; finally, the uropod has only one segment and is less than half as long as pleon.

Like *galatheae,* also *hadalis* resembles *latifrons* in some of the few characters which it is still possible to study on the single, poor specimen of that species. In shape of pereiopod III *hadalis* resembles *latifrons* even more than does *galatheae*. However, *hadalis* has only a thin seta on the inner, distal corner of ischium instead of the two thick, blunt spines in *latifrons,* and merus is much broader in *hadalis.*

Distribution:

So far known only from the Banda Trench west of New Guinea, at 7280 m and 3.6°C.

Ilyarachnini Hansen

Ilyarachna G. O. Sars

Mesostenus G. O. Sars, 1864, p. 211
Ilyarachna G. O. Sars, 1869, p. 44
Ilyarachna G. O. Sars, 1899, p. 134
Echinozone G. O. Sars, 1899, p. 139
Aspidarachna G. O. Sars, 1899, p. 140
Ilyarachna G. O. Sars, Hansen 1916, p. 121
Echinozone G. O. Sars, Hansen 1916, p. 128
Aspidarachna G. O. Sars, Hansen, 1916, p. 128
Ilyarachna G. O. Sars, Hult 1936 a, p. 12
Echinozone G. O. Sars, Hult 1936 a, p. 12
Aspidarachna G. O. Sars, Hult 1936 a, p. 12

Hansen was the first to point out that the three genera *Ilyarachna, Echinozone,* and *Aspidarachna* were probably identical, and in 1936 Hult made the final cancellation of the two latter genera. Thus, the group Ilyarachnini now comprises two genera only, *Pseudarachna* G. O. Sars 1899 with one species and *Ilyarachna* with 18 valid species, namely: *I. abyssorum* Richardson 1911, *affinis* and *crassiceps* Barnard 1920, *antarctica, aries,* and *magnifica* Vanhöffen 1914, *arctica, bicornis, dubia,* and *spinosissima* Hansen 1916, *bergendali* Ohlin 1901, *longicornis* G. O. Sars 1864, *clypeata* and *coronata* G. O. Sars 1869, *quadrispinosa* Beddard 1886, and *starokadomskii* and *zachsi* Gurjanova 1933. Furthermore, I have transferred *Eurycope fusiformis* Barnard 1920 to this genus – see p. 123.

Ilyarachna antarctica Vanhöffen, 1914

Ilyarachna antarctica Vanhöffen, 1914, p. 591, fig. 124 a & b.
Ilyarachna antarctica Vanhöffen, Nordenstam 1933, p. 265, fig. 76 a-e.

Material:

St. 651, Kermadec Trench (32°10'S,177°14'W), 6960-7000 m, 16. Febr. 1952. Gear: herring otter trawl. Bottom: brown clay with pumice. Bottom temperature: 1.3°C. – 1 complete but broken female + 1 female with mutilated somite 7 and pleotelson + posterior half of 1 female; 1 complete male + anterior half of 1 male.

St. 658, Kermadec Trench (35°51'S,178°31'W), 6660-6720 m, 20. Febr. 1952. Gear: 6 m sledge trawl. Bottom: brown sand with clay and stones. Bottom temp.: 1.3°C. – 1 complete male + posterior half of 1 male.

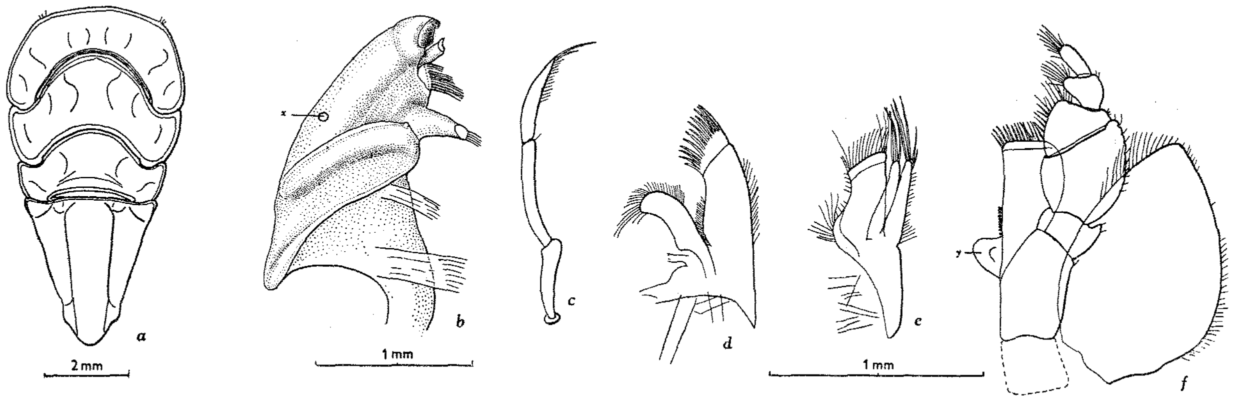


Fig. 26. *Ilyarachna antarctica* Vanhöffen; a, three posterior pereion somites and pleon, seen directly from above; b, left mandible (x, insertion of the palp); c, palp of left mandible; d-e, left maxillae 1 and 2; f, left maxilliped; the rounded plate (y) has been forced inwards.

have also 1 spine only, the third (from 4500 m) has 1 large and 1 smaller while two of the S. Georgia females have 5 (in two rows), and the third female has even 10 (two rows) on each side. On the other hand, the two males from S. Georgia have only 1 spine each, one of the Kermadec males has only 1, the second has 2-3 (two rows), and the third has 3 spines (fig. 25) on each side of the head. Thus, the number of spines on the head can by no means be reckoned as a specific character which has previously been the case.

The side-part of the head is somewhat vaulted, and in the Gauss and the Kermadec specimens furnished with many tiny protuberances, each with a short hair.

Pereion somites 1-4 increase in width from 1 to 3 which is the broadest. Length of somite 1 is a little more than half the length of 4; somites 2 and 3 are equally long, a little longer than 1 and shorter than 4. All somites have a low, transverse keel along the anterior and posterior margin.

The side-parts of somite 1 decrease in width; on the rounded end there is a short, conical process. The antero-lateral corners of somite 2 are rounded. In the Kermadec specimens the antero-lateral corners of somite 3 have a broad, almost squarish process with a minute spine which is missing in the Gauss and S. Georgia specimens. All specimens have a marked process on the antero-lateral corner of somite 4; in the Kermadec specimens it is very strong and rather pointed (fig. 24 b).

First and second epimera of the Kermadec and the Gauss specimens with a conical, fairly strong process which is missing in the material from S. Georgia. The two following epimera have in all cases a characteristic, rounded keel along the anterior and upper margin.

On the anterior margins of somites 1-4 there is a row of very minute spines which are difficult to count. In the Kermadec specimens there are about twenty-five on somite 1, twenty on 2, fifteen on 3, and ten on 4. In the Gauss and S. Georgia specimens there are only about half as many on each somite. They are not nearly so strong as shown in VANHÖFFEN's figure.

Pereion somites 5-7 (fig. 26 a) are slightly decreasing in width. Somite 6 is much longer than 5 and a good deal longer than 7. The antero-lateral corners of 6 and 7 have a rounded lobe which covers the posterior corner of the preceding somite and are furnished with hairs in the Gauss and the S. Georgia specimens. This lobe is missing in the Kermadec specimen from 4500 m. There are no spines on the anterior margins, nor on any of the epimera.

Pleon consists of two somites of which the anterior is narrow and very short. The second is as long as pereion somites 6 + 7 and is only a little narrower at the base than somite 7. The shape is triangular with the anterior margin almost straight. The lateral margins are straight except for a convexity above the insertion of the uropods. The apex is subacute. The median part of pleotelson is raised as a longitudinal convexity, continuing right to the end of the apex (not very pronounced in the S. Georgia males). Also the lateral parts are vaulted; in the Gauss and the Kermadec specimens they are separated from the slightly convex anterior corners of the pleotelson by an oblique, transverse furrow.

The vaulted lateral parts continue round on the ventral side of the pleon and are separated from the ventral cavity by a keel which grows narrower and finally disappears towards the insertion of the uropods (fig. 27 a). The inner margin of the keel has

St. 664, Kermadec Trench (36°34'S,178°57'W), 4510-4570 m, 24. Febr. 1952. Gear: herring otter trawl. Bottom: brown sandy clay with pumice. Bottom temp.: 1.1°C. – 1 complete, but somewhat mutilated, female.

Even if most of the specimens from the Galathea are more than twice as big as the largest, previously known specimens of *I. antarctica,* they must belong to the present species. This could hardly be decided alone by a comparison with the very short description and the figures given by VANHÖFFEN; but through the courtesy of Dr. J.-G. HELMCKE and Dr. H.-E. GRUNER of the Berlin Museum, I have been able to compare VANHÖFFEN's three type specimens with the present material from the Galathea. Moreover, the Swedish Antarctic Expedition also took this species, and NORDENSTAM has given a detailed description and good figures of antennae, mouthparts and pleopods. Through the courtesy of Professor K. LANG I have also been able to examine the five specimens caught by the Swedish Expedition and kept in the Riksmuseum, Stockholm.

Since neither VANHÖFFEN nor NORDENSTAM have given a full description of this interesting species it is described in detail below. For the sake of convenience the type and the other specimens from the German South Pole Expedition (described by VANHÖFFEN) are called the Gauss specimens (caught near the Gauss-station), the material from the Swedish Expedition is named the S. Georgia specimens, and the present collection from the Galathea the Kermadec specimens.

Type material:

According to VANHÖFFEN (1914, p. 591) the Gauss collected three specimens. One of them was 6 mm long, 2 mm broad and caught 30. March 1903 at a depth of 3397 m. The other two were 5.5 and 3.5 mm long, caught 3. April 1903 at 3423 m depth.

By an examination of the material I found that all three of them were females. The largest specimen is actually 6.3 mm long and 2.1 mm wide, the medium one 5.6 mm and the small one 3.2 mm long. Unfortunately, there is a disagreement between VANHÖFFEN's statement and the labelling, since the two large specimens were both labelled "3 IV 03, 3423 m" while the small one had no label at all. It seems most likely that the labels were exchanged after VANHÖFFEN published his report.

I have chosen the largest specimen as lectotype. It is the one figured from the left side in VANHÖFFEN's fig. 124 b. Fig. 124 a shows the other large female seen from above. They can be distinguished by means of the number of pereiopods still left and the number of spines on the head.

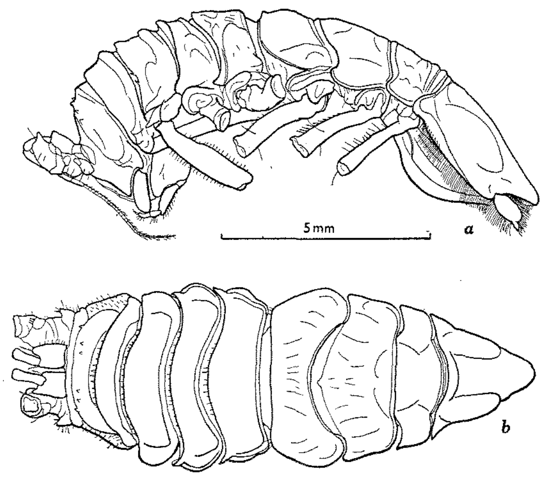


Fig. 24. *Ilyarachna antarctica* Vanhöffen; ♂ from St. 651 (Kermadec Trench, 7000 m); a, lateral view; b, dorsal view.

Description:

Body (fig. 24 a & b) rather oblong, 3.4 times longer than broad, and fairly strongly curved.

Head (fig. 25 and VANHÖFFEN's fig. 124 a, b) posteriorly broader than the first somite. Most of it is covered with a pair of oval, vaulted areas, the surface of which has a peculiar, net-like pattern like that of a giraffe. On the vaulted areas there are on each side one or two rows of robust, conical protuberances, each furnished with a translucent spine. Their numbers vary not only within the sexes, but also from one specimen to another. In the type specimen and one of the other Gauss females there is 1 spine on each side, the third Gauss female has 3 on each side; two of the females from Kermadec

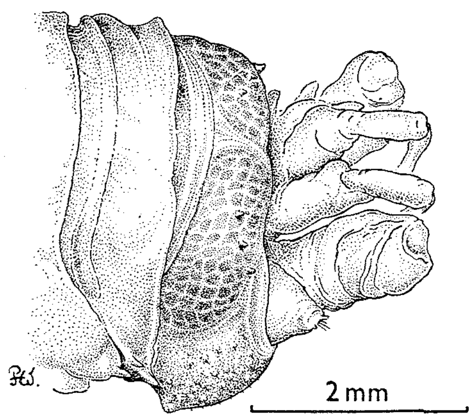


Fig. 25. *Ilyarachna antarctica* Vanhöffen; head of male with probable rudiment of eye.

a row of closely set, long hairs, and there is another, shorter row of hairs on the median, anterior part of the keel.

Antenna 1 (fig. 27 b & c and NORDENSTAM's fig. 76a). The first segment is broad, almost squarish in shape. The outer, distal corner is triangularly produced and furnished with one or two small spines and a feathered seta at the tip. Inner corner with one spine and a similar seta. Lateral margin has a row of setae which may be two-pointed (Gauss and S. Georgia specimens). Second segment is much smaller than the first; in the male it is proportionately stouter than in the female. Third segment longer than second, fourth very short. The flagellum has a varying number of segments in specimens from the three localities: Gauss and Kermadec ♀♀: 5; S. Georgia ♀♀: 8-10; Kermadec ♂♂: about 35; S. Georgia ♂♂: 9-10 segments.

Antenna 2 is broken off at the distal end of the fourth segment except in one ovigerous female in the S. Georgia collection. The first four segments are very short. The prominent outer corner of the first segment has one or two spines, the outer margin of the third one spine. The squama on the third segment is small but distinct (fig. 24b). Segment 5 (S. Georgia) is slender and more than twice as long as the first four segments together; it is sparsely provided with small hairs. Segment 6 is twice as long as 5 and almost smooth. The flagellum consists of 36 segments. The whole antenna 2 attains a length of somewhat more than twice the length of the whole animal.

Mandible (fig. 26b) of the usual type in the genus. On the anterior side of the mandible corpus there is a somewhat bright-golden carina. The cutting edge is rounded and strongly chitinized. On the left mandible there is a well developed, movable lacinia; it has previously been mentioned only in one species of *Ilyarachna (I. spinosissima)*. The spine-row consists of seven spines in the S. Georgia, eight in the Gauss and about twelve in the Kermadec specimens. The molar process tapers conically towards the end which is furnished with three to five setae. In the palp the middle segment is the longest (fig. 26c). On the interior side of the last segment there is a row of short setae in the Kermadec specimens; it is not present in the Gauss specimens.

Maxillae are shown in figs. 26d & e. They are absolutely identical in all specimens studied.

Maxilliped (fig. 26f) is long and narrow. In the Gauss specimens there are four coupling-hooks on the right, five on the left side, while the S. Georgia

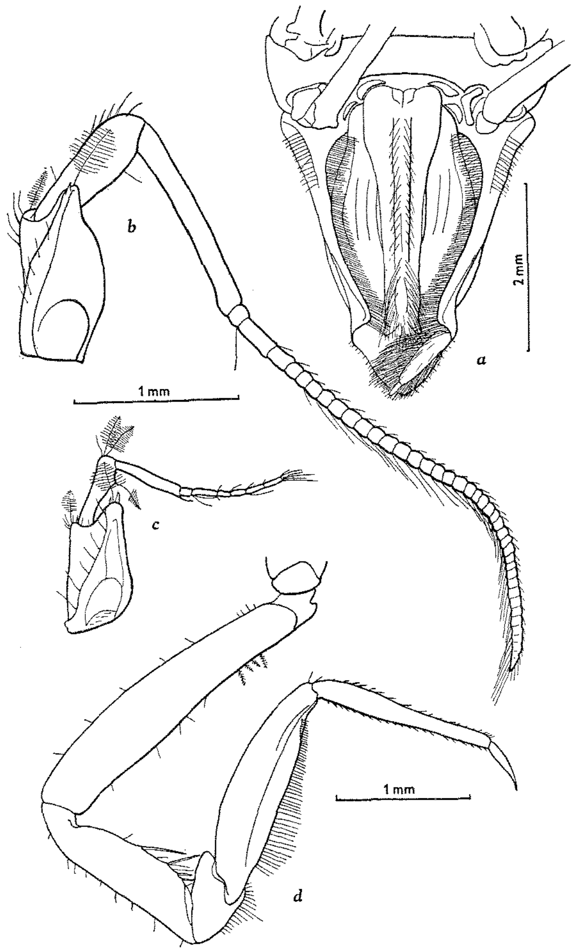


Fig. 27. *Ilyarachna antarctica* Vanhöffen; a, abdomen of male from below; b, right antenna 1 of male; c, right antenna 1 of female; d, pereipod I of male.

animals have five and six, and the Kermadec specimens have nine and ten respectively. Epipodite obtusely pointed distally and only one and a half times longer than broad. Under the coupling hooks a rounded plate stands at right angles to the general plane of the maxilliped (y in fig. 26f).

Pereiopod I (fig. 27d) short and rather stout, considerably stouter, however, in the Gauss and the Kermadec than in the S. Georgia specimens. Ischium of the latter is comparatively longer than in the Gauss and the Kermadec material (VANHÖFFEN's fig. 124b not reliable in this respect). There are three (Kermadec) or seven (Gauss and S. Georgia) long spines along the anterior margin of ischium.

Pereiopod II was broken off beyond basis in all specimens except one from S. Georgia. Basis is a trifle longer than in pereiopod I. In the Kermadec and Gauss specimens it is five times, in the S. Georgia specimens less than four times as long as broad. Ischium in the said specimen has the same width as basis, but is a little shorter. Merus is about half

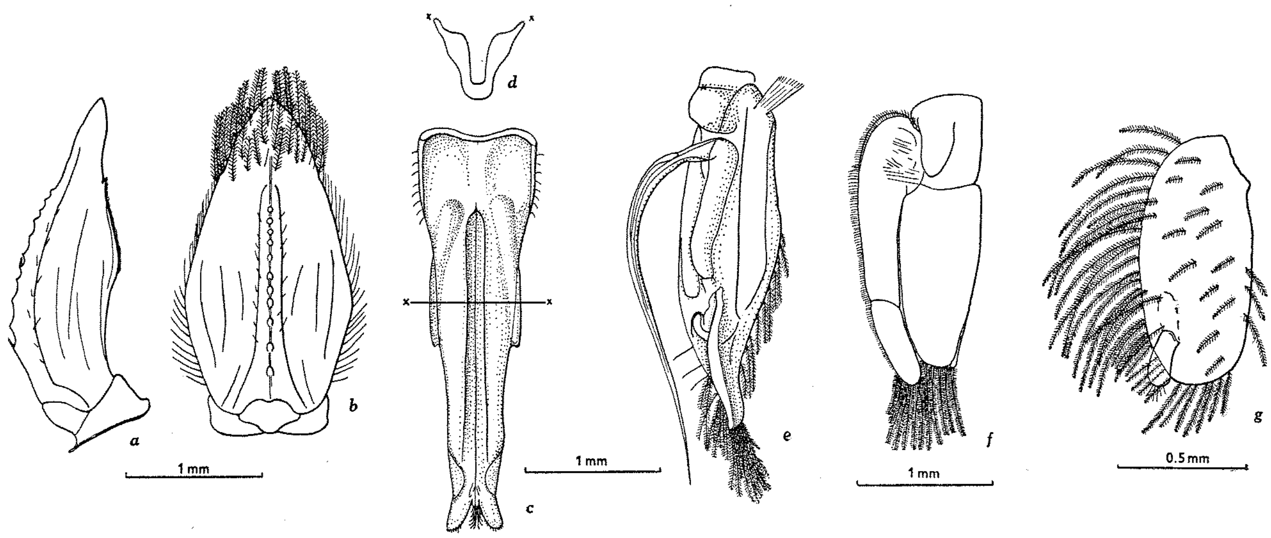


Fig. 28. *Ilyarachna antarctica* Vanhöffen; a, female operculum, lateral view; all setae have been omitted; b, female operculum from outside; c, male pleopoda 1; d, section of pleopoda 1 at x-x; e-f, male pleopoda 2 and 3; g, left uropod of male.

as long as ischium and somewhat narrower. Carpus is as long as the two preceding segments and 6-7 times as long as broad. Propodus somewhat narrower and as long as basis. The tip of dactylus is broken off, but the segment is at least two thirds of the preceding one. All segments except dactylus, with a great many, rather long setae.

Pereiopod III and IV have only basis preserved in all specimens. It is curved outwards and only about half the length of basis of pereiopod II. VANHÖFFEN figured basis of IV as if straight, but this is not the case.

Pereiopod V and VI (VANHÖFFEN's fig. 124b) are almost identical; the only difference is that carpus is as broad as long in V, while it is longer than broad in VI. Basis is one fifth longer than ischium which has a low convexity on the posterior margin which makes it less than three times as long as wide. Propodus is somewhat shorter than carpus. Dactylus is shorter than propodus in the type specimen, but longer in the S. Georgia material in which it is as long as carpus. VANHÖFFEN's figure of pereiopod V is correct except that the long swimming setae on ischium-propodus are feathered. In the Kermadec specimens V and VI are broken off.

Pereiopod VII is also missing in the Kermadec material. Basis is as long as in pereiopod VI, but only half as broad. Ischium a little longer than carpus; propodus longer than merus + carpus and shorter than basis; dactylus as long as ischium. All segments (except dactylus) with long and partly feathered setae.

Female operculum (fig. 28 a & b and NORDENSTAM's fig. 76d). Its shape is ovate, and it is convex both longitudinally and transversely. Along the middle line there is a sharp, longitudinal carina which only bears small, scattered hairs in the S. Georgia females, while the carina of the Gauss and Kermadec specimens is furnished with about 12 low tubercles, each with a spine which is mostly broken off. The lateral margins of the operculum have a row of closely set setae, while the distal end is covered with stout, feathered setae.

Male operculum is about twice as long as broad. There is a marked difference between the *first pair of pleopods* in the S. Georgia and in the Kermadec males (all Gauss specimens are unfortunately females). The former are "of almost uniform width" (NORDENSTAM's fig. 76b), but in the Kermadec males (fig. 28c) they are more than twice as wide at base as distally and strongly curved from base to end. From a place not far from the proximal end a very deep furrow runs along the dorsal (inner) side, continuing to the base of the coalesced endopodites; the furrow is especially deep in the middle part of the pleopods (see section in fig. 28d). The middle third of the lateral margins is shaped like a keel. Near the base of the somewhat backwards bent exopodites the lateral margins are furnished with a pair of inward bent, rather short, plaits which almost meet and close the inner side of the two pleopods; they are also found in the S. Georgia males.

On the outer (ventral) side of pleopoda 1 a very fine furrow is found along the median line where the pleopods are coalesced; on each side of the furrow there is a row of long, closely set setae.

Second pair of male pleopods (fig. 28e) are about four times as long as broad. On the dorsal (inner) side there is a high and narrow keel running from the base of the copulatory organ to the end of the apex which is furnished with many long and stout, feathered setae. The copulatory organ reaches a little beyond the apex; it is more slender in the S. Georgia males than shown by NORDENSTAM in his fig. 76 c. The pleopods of the Kermadec males are strongly calcified (except the copulatory organ).

Pleopods 3-5 of this genus were previously figured by BONNIER (1896, pl. 34 – *I. polita*), by SARS (1899, pl. 60 – *I. hirticeps* (= *longicornis*) and by NORDENSTAM (fig. 77 j & k – *I. quadrispinosa*). Pleopod 3 in the male of *antarctica* (fig. 28f) has the basipodite longer than broad. The endopodite is more than twice as long as broad and with the distal end narrower than in *quadrispinosa*. The distal end is furnished with five feathered setae, while *polita* and *longicornis* have only three and *quadrispinosa* about twelve. The exopodite has about ten feathered setae on the tip, and a great many hairs along the outer, convex margin. Pleopod 4 is very much like that of *longicornis*, the only differences being that the two segments of the exopodite are almost equally long and a little narrower, and that the distal segment has about six feathered setae instead of four only in *longicornis*. Pleopod 5 is a broad rounded plate like the one figured by SARS for *longicornis* (pl. 60).

Uropod of female with almost straight outer margin, i. e. not convex as in NORDENSTAM'S figure. Uropod of male (fig. 28g) with more than twice as many feathered setae as the female.

Size: Largest Gauss female: 6.3 mm long, 2.1 mm broad; largest S. Georgia female: 5.3 mm and largest male: 3.9 mm long; largest Kermadec female: 15.2 mm long, 4.5 mm broad and largest male: 8.7 mm long, 3.3 mm broad.

Eggs: Two of the S. Georgia females have eggs in the marsupium, each about 25. The size is about 0.3 × 0.2 mm. A few larvae have developed a short pleon which is bent under the body; the budding antennae 1 can be seen. The total length of these tiny larvae is 0.7 mm.

Variation:

Previously much attention was paid to the armament with spines on head within this genus. As will be seen above (p. 107) this character is highly variable, not only between males and females, but also within the same sex from the same population. Besides, the number of the mainly tiny spines along the anterior margin of somites 1-4 differ considerably both in this species and in others, such as *I. affinis* Barnard.

There is one difference in the present material which seems essential to me, i. e. the shape of the proximal part of pleopoda 1 in the males from Kermadec and those from S. Georgia. Since, however, the general appearance of this appendage is the same the said difference cannot be regarded as specific.

The variation in size is considerable, the largest antarctic females being 5.3 and 6.3 mm long, while the largest female from Kermadec is 15.2 mm. This difference is, however, not so big as that found within females of *Ilyarachna (Echinozone) quadrispinosa* (Beddard), even from the same area; according to NORDENSTAM (1933, p. 273) the largest females (all with marsupial plates) from four stations are: 4.7 – 8.3 – 9.7 and 17 mm long.

The careful examination of the total material of *I. antarctica* has of course revealed several differences of minor importance or of none at all. In a few cases there are differences between the specimens from all three localities (for instance number of coupling hooks in maxilliped and of spines in spine-row of mandible). Mainly the Gauss and the Kermadec specimens agree but differ from the S. Georgia material (e. g. spines and protuberances on head, epimera of somites 1 and 2, flagellum of antenna 1, and stoutness of pereiopod 1 as well as length of its ischium). Finally, the shape of somites 3 and 4 show the greatest resemblance between the Gauss and the S. Georgia specimens.

Remarks:

When comparing *antarctica* to the other species of this genus VANHÖFFEN stressed the difference in armament with spines on head and body. As shown above these characters are non-specific, but even without them there are sufficiently many peculiarities for the separation. The only species with which *antarctica* agrees in general appearance (shape of body and abdomen, length of somites, etc.) is *I. bicornis* Hansen. Moreover, the shape of and armament with spines on antennae 1 and 2 as well as on female operculum is quite equal. However, the fact that somite 2 in *bicornis* is the broadest somite and much broader than somite 5, as well as the absence of exopodite on the uropod clearly separates the two species.

Distribution:

South Georgia (252-310 m; 1.5°C); Antarctic Indian Ocean (65° S, 80° E; 3397 and 3423 m); Kermadec Trench (4510-7000 m; 1.1-1.3°C).

Eurycopini Hansen

Storthyngura Vanhöffen

Storthyngura Vanhöffen, 1914, p. 583
Storthyngura Vanhöffen, HANSEN 1916, p. 132

This genus was erected by VANHÖFFEN (1914) to include all forms of *Eurycope* with a jagged pleon and with a more or less spiny body. HANSEN (1916) added four more characters of greater generic value, but pointed out that having only personally seen two of the altogether nine species ranked within this new genus he could not feel absolutely sure about the validity of the said characters. The genus therefore needs revision, although it seems to be fairly well defined. As already pointed out by HANSEN many years ago, especially the Challenger and the Albatross material should be revised.

The nine species which according to our present knowledge belong to *Storthyngura* are: *S. novae-zelandiae* (Bedd.), *S. fragilis* (Bedd.), *S. atlantica* (Bedd.) *S. intermedia* (Bedd.), *S. pulchra* (Hansen), *S. truncata* (Rich.), *S. magnispinis* (Rich.), *S. elegans* Vanhöffen, and *S. robustissima* Monod. *Storthyngura caribbea* (Benedict) is synonymous with *S. pulchra* (Hansen) (see below).

All the present specimens from the Galathea fit well within the limits of *Storthyngura,* as they are indicated by HANSEN and definitely belong to this genus.

Besides, another species from the Challenger, *Eurycope spinosa* (BEDDARD 1886, p. 68) should be included, even if it is mutilated so that the posterior half of the animal is absent. During a visit to the British Museum (Natural History), London, I had an opportunity to examine the type specimen of *spinosa.* It was easy to see that the presence of spines and the unarticulated antennal scale (squama) places the species nearer to the genus *Storthyngura* than to *Eurycope*. The main difference between *spinosa* and the species belonging to *Storthyngura* is the exceedingly strong armament with spines. Not only are the spines which correspond to the dorsal and epimeral spines in the *Storthyngura* species much longer in *spinosa,* but on each of the somites present is a pair of equally long, dorso-lateral spines which are not found in any *Storthyngura* species. However, so long as only one incomplete specimen is known it would be absurd to establish a new genus. – It is not my intention to redescribe *spinosa* in this paper. I shall confine myself to point out that only one of the figures given by BEDDARD (pl. X, fig. 6-7) is nearly correct, viz. fig. 7, the side view of the animal. However, not even this figure is correct in all details. For instance the lateral spines on thoracic somites 1-3 are epimeral; there is no spine on the second segment of antenna 2; on the other hand there are three spines on the third segment, instead of one only in fig. 7. Finally, it should be stated that the type is a female with marsupial plates as in *S. benti* n. sp. (see below) and that the legs on the first four thoracic somites are present and exactly like those in other species of *Storthyngura.*

Finally, I found in one of the type specimens of *Storthyngura ("Eurycope") novae-zelandiae* (Beddard), kept in the British Museum, several embryos which are discussed on pp. 121-123, after the descriptions of the new species of *Storthyngura* from the Galathea.

Storthyngura benti n. sp.

Material:

St. 651, Kermadec Trench (32°10'S, 177°14'W), 6960-7000 m, 16. Febr. 1952. Gear: herring otter trawl. Bottom: brown clay with pumice. Bottom temperature: 1.3°C. – 10 complete females + anterior half of 8 and posterior half of 3 more females; anterior half of 2 males and posterior half of 2 males; 1 detorated marsupium.

St. 658, Kermadec Trench (35°51'S, 178°31'W), 6660-6720 m, 20. Febr. 1952. Gear: 6 m sledge trawl. Bottom: brown sand with clay and stones. Bottom temp.: 1.3°C. – 2 complete females, one with well developed marsupium; 2 complete males + anterior half of 1 male.

St. 650, Kermadec Trench (32°20'S, 176°54'W), 6620 m, 15. Febr. 1952. Gear: 6 m sledge trawl.

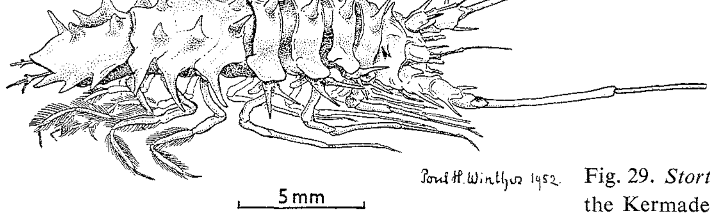


Fig. 29. *Storthyngura benti* n. sp., the Kermadec Trench, 7000 m.

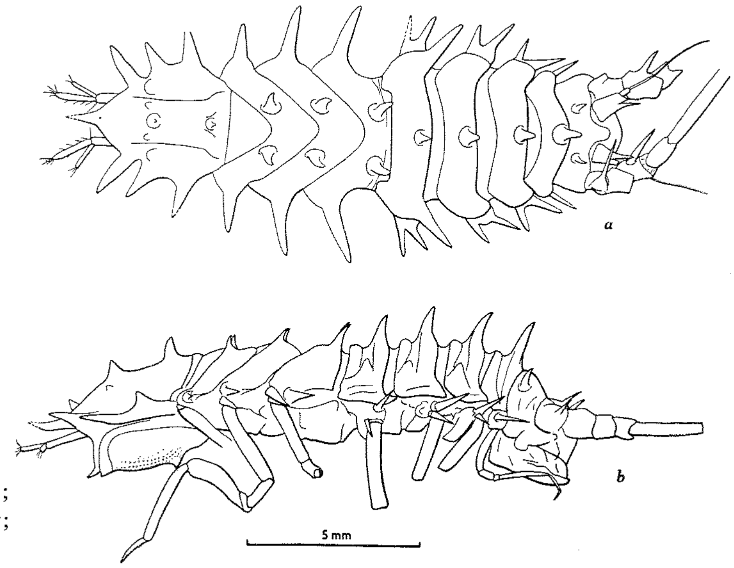


Fig. 30. *Storthyngura benti* n. sp.; ♀, type specimen; a, dorsal view; b, lateral view.

Bottom: brown clay with pumice. Bottom temp.: 1.3 °C. – 1 female without pleotelson.

St. 654, Kermadec Trench (32°10'S, 175°54'W), 5850 m, 18. Febr. 1952. Gear: herring otter trawl. Bottom: brown clay with pumice. Bottom temp.: 1.2°C. – 1 female with well developed marsupial plates.

St. 661, Kermadec Trench (36°07'S, 178°32'W), 5340 m, 23. Febr. 1952. Gear: 6 m sledge trawl. Bottom temp.: 1.1 °C. – 1 juvenile female.

Type specimen:

A well preserved female from St. 651 was selected as type.

Description:

Body (figs. 29 & 30a-b) rather oblong, slightly convex, about three times as long as broad.

Head with a limited front area separated from the posterior part by a suture which forms a marked, forward pointing lobe between the first antennae. Behind this suture there are two comparatively short and slender, forward directed spines on each side of the median line.

Pereion somites 1-4 of the same general appearance, saddle-shaped, and each with a median, very high, acute dorsal spine, pointing obliquely forward and rising just behind the anterior margin. The first somite is shorter and narrower than the three succeeding ones; its antero-lateral angles are rounded and unarmed, but the epimera have a slender, outward and forward directed spine. Also in somites 2 and 3 the antero-lateral angles are unarmed, but in somite 4 they are furnished with a very strong acute spine turned outward and forward. Epimera of somites 2-4 each with two acute spines, of which the anterior is the longer, is directed somewhat outward, and is placed dorsally to the other spine. On the inner side of all epimera of somites 1-4 marsupial plates are found like those figured by STEPHENSEN 1947, p. 9, fig. 1, but only half as wide as long. One female from St. 658 has a fully developed marsupium with large, transparent, oblong-ovate plates.

Pereion somites 5-7 immovably coalesced and subequal in length and width. Each somite is vaulted both longitudinally and transversely and furnished with a pair of strong, forward directed spines, longest on the fifth, shortest on the seventh somite. The antero-lateral angles are produced into acute spines of which those on somite 5 are the longest and directed somewhat forward while those on somite 7 are the shortest and turned directly outward. All epimera unarmed.

Pleon (fig. 31 a) oval in shape. As in several other species two somites can be distinguished, the anterior being short and triangular. Just behind the furrow between the first somite and the rest of the pleon a rather short, stout, median spine, pointing slightly forward is situated. In the centre of the pleotelson there is another spine or process which is short and conical. Immediately posterior to it a small tubercle is situated on each side of the median line. Pleotelson has three lateral spines on each side. The middle ones are the shortest and are placed nearest to the hindmost spines which may have a slight expansion towards the base. All three lateral spines are directed outwards and a little backwards seen from above; a side view shows that the foremost and the hindmost are also directed somewhat

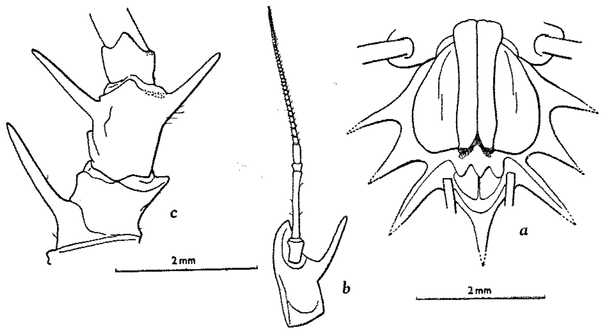


Fig. 31. *Storthyngura benti* n. sp.; a, pleon of male from below; b, dorso-lateral view of antenna 1 of female; c, dorsal view of peduncle of antenna 2 of female.

upwards. The median part of the pleotelson is raised as a longitudinal convexity, occupying somewhat more than one third of the width of the pleotelson and terminating a little in front of the hind margin of pleon.

On the ventral side of pleon (fig. 31 a) a conspicuous, arched keel connecting the underside of the two hindmost lateral spines separates the terminal face from the operculum. In the median part of this keel there is a crest with two or three projections bent downwards and backwards. In the middle of the terminal face, between the insertion of the uropods, the semicircular anal doors are seen.

Antenna 1 (fig. 31 b) reaches backwards to pereion somite 4 in the male, but only to somite 2 in the female. The first segment is twice as long as broad, with the distal outer part produced into a broad and rounded process at the base of which the second segment is inserted. From the antero-interior angle a very long and slender spine is directed upwards and somewhat inwards. Segment 2 is one and a half times as long as broad and has a small, distal process on the anterior side. Segment 3 is slender and about three times as long as 2. The flagellum with numerous segments.

Antenna 2 in males between two and three times as long as body; total length in females unknown. The first segment (fig. 31 c) is very short and has on the outer margin an extremely long and slender spine. The next segment is unarmed but the third which is longer than broad, is furnished with two, somewhat shorter spines, one on the outer and one on the inner margin. Segment 4 is about as long as broad, while segments 5 and 6 are exceedingly long and slender, the latter being the longer.

Left mandible (fig. 32 a) has a compressed cutting edge with two distinct teeth and below them a small one. The movable lacinia is long and pointed. Below it is a row, consisting of numerous spines. The molar process is somewhat compressed so that it is broader when seen from the front than when seen from below as in the figure; the end is obliquely cut off. The palp is of the ordinary shape, the second segment being more than twice as long as the first.

Maxillae 1 and 2 and maxilliped (fig. 32 b-d) are of the typical shape found in this sub-family.

Pereipods I-IV (fig. 32 e) long and slender as in *S. robustissima,* the first pair being as usual by far the shortest (only two fifths of the succeeding leg). All four legs similar in shape.

Pereiopod V-VII (fig. 32 f) with much narrower carpus and propodus than is usually the case, being between four and five times as long as broad and furnished with swimming setae along both margins.

Female operculum (figs. 30 b and 33 a) seen from below semicircular, with a median keel which has a short spine not far from its base. The keel and the median parts of rest of the operculum have a granulate surface.

Pleopod 3 of female (fig. 33 b) with four setous bristles on inner ramus. Outer ramus has two segments, the distal one with several long and very thin setae at the end.

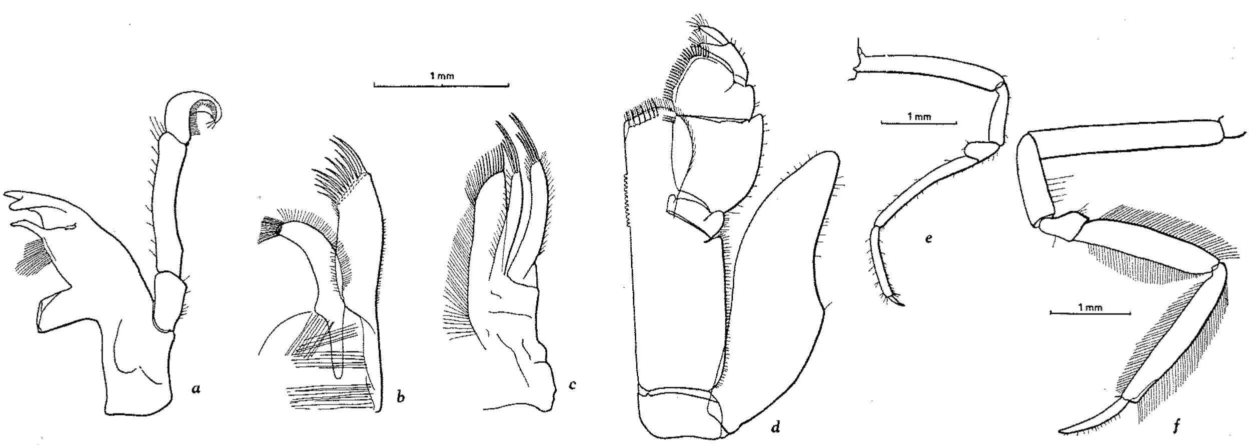


Fig. 32. *Storthyngura benti* n.sp. ♀; a, left mandible; b-c, left maxillae 1 and 2; d, left maxilliped; e, pereiopod I; f, pereiopod VII.

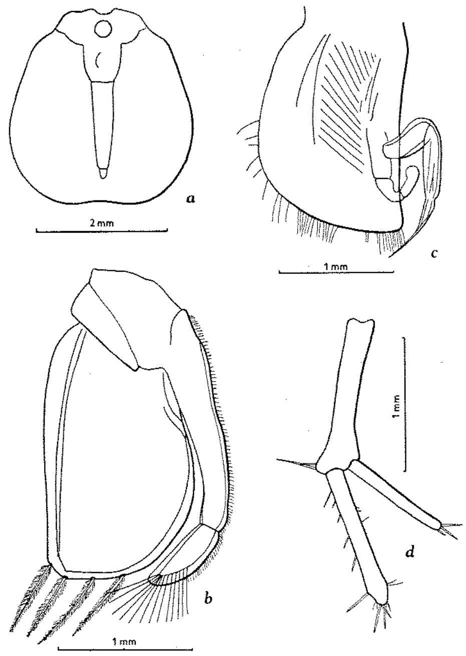


Fig. 33. *Storthyngura benti* n.sp.; a, female operculum; b, pleopod 3 of female; c, pleopod 2 of male; d, left uropod of female.

Male operculum (fig. 31a) a little longer than broad, owing to the fact that the median first pair of pleopods is considerably longer than the second pair, which comprises the rest of the operculum. The median lamella (pleopoda 1) is somewhat narrower in the middle than towards the ends; in the terminal part the outer corner is slightly produced. The copulatory organ in pleopod 2 (fig. 33c) is slender, with the distal filiform end reaching well beyond the end of the pleopod.

Uropod (fig. 33d) reaching a little beyond the terminal spine on the pleotelson. The endopodite is almost as long as the peduncle, but somewhat more slender, and is longer and stouter than the exopodite.

Size: Only the total lengths of the 17 unbroken specimens can be given; they are: St. 651, 10 ♀♀: 14-14-14.5-15-15.5-15.8 (type specimen) – 16.5-17-19, and 19 mm. – St. 658, 2 ♀♀: 15 and 15 mm. – St. 650, 1 ♀: about 19 mm. – St. 658, 2 ♂♂: 13 and 18 mm. – St. 654, 1 ♀: 14.3 mm. – St. 661, 1 ♀ juv.: about 7 mm.

Variation:

Three of the specimens from St. 651 are a little aberrant. A male and a female (of which only the anterior halves are present) have a slender spine not only on the antero-lateral angles of somite 4 but also on somite 3; the latter is half as long as that on somite 4. Besides, a female (only posterior half present) has an extra spine on the left side of the pleotelson between the two foremost lateral spines, being shorter than either of these. In all other respects the three specimens agree with the description given above.

The five specimens from St. 658 are identical with the type from St. 651 except in two respects: 1) All spines are a little longer and more slender and 2) the middle, lateral spine on pleotelson is somewhat shorter and thicker. The female from St. 650 agrees with the type in all respects (pleotelson is absent).

The female from St. 654 has all the dorsal, lateral and epimeral spines on the pereion and pleon furnished with rather long, closely set setae, except near the base. Moreover, the dorsal and lateral spines on pereion somites 5-7 and pleon are considerably longer and stronger than normally; the lateral spines are about one and a half times longer than in the type, and the dorsal spines are between two and three times as long. On the contrary, the operculum has no median spine at all and the projections on the keel, separating the terminal face from the operculum, are very small. Finally, the uropods are more slender.

The female from St. 661 is a somewhat mutilated juvenile. In that specimen not only the spines on the posterior half of the pereion and on pleon are longer; the same applies to all the spines on pereion somites 1-4 as well. Nor is there any median spine on the operculum in this female. The very thin and brittle integument has a fine, net-like pattern which gives a general white-greyish colour. But all the edges have a row of purely white, very tiny protuberances which are not found in the adults.

Remarks:

The present species can be distinguished from most of the other species of *Storthyngura* by means of one or more of the following conspicuous characters: 1) presence of dorsal spines a) on head, b) on first pereion somite and c) on pleotelson; 2) shape of pleon, which is furnished with three instead of the usual two pairs of lateral spines. Only *S. elegans* (Vanhöffen 1914, p. 584) has also three pairs of lateral spines on the pleon which, however, terminates with an incision instead of the conspicuous spine found in *S. benti;* besides, there are no spines on head and on the first pereion somite of *elegans,* and the species is much smaller. In *S. magnispinis* (Rich.) three dorsal spines or tubercles are found on pleotelson (as well as spines on head and first pereion somite). The pleon has, however, only two pairs of lateral spines, and the terminal part is broad and squarish instead of pointed (Hansen

1916, pl. XII, 3). *S. atlantica* (BEDDARD 1886, pl. IX, 13) has two distinct dorsal spines on pleotelson (and on head) but lacks the spine on the first pereion somite, and an examination of the type specimen in London showed that also the dorsal pair of spines on somite 7 is absent; furthermore, the pleon has only two pairs of lateral spines, and the spine on the basal segment of antenna 2 is lacking.

Nearest to the present species is definitely *S. robustissima,* described by MONOD (1926, p. 18) on a female dredged at a depth of 400 m in the antarctic Sea, SE of Cape Horn (71 °S) and later recorded by STEPHENSEN (1947, p. 8) from a depth of 750 m at the South Shetland Is. In general appearance, size and armament with both lateral and dorsal spines on head and pereion the two species are quite identical. Through the courtesy of Mr. N. KNABEN, Oslo Museum, I have been able to examine the male and female from the S. Shetlands and found that *S. benti* shows the following major differences: 1) There are only two median dorsal spines on the pleon of *benti* instead of four. 2) Pleon with only three distinct lateral spines instead of four spines or processes. 3) Terminal spine almost straight instead of strongly curved upwards. 4) No lateral spine on inner side of basal segment of antenna 2. 5) Mandible with a distinct molar process which seems to be absent in *robustissima* (MONOD 1926, fig. 11 A); the other mouth appendages equal or subequal. 6) Carpus and propodus of pereiopod V-VII between four and five times as long as broad instead of a little less than three times. 7) Copulatory organ on male pleopod 2 almost as long as operculum instead of less than three fifths of the operculum.

This species has been named after Mr. BENT HANSEN, M. Sc., Assistant Zoologist on the Galathea.

Distribution:

So far known only from the Kermadec Trench NE of New Zealand, 5340-7000 m; 1.1-1.3 °C.

Storthyngura pulchra (Hansen), 1897

Eurycope pulchra Hansen, 1897, p. 98, pl. I, 1.
Eurycope caribbea Benedict, in: RICHARDSON 1901, p. 559, fig. 29.
Eurycope carribbea Benedict, RICHARDSON 1905, p. 493, fig. 548.
Storthyngura caribbea (Benedict), VANHÖFFEN 1914, p. 584.
Storthyngura pulchra (Hansen), HANSEN 1916, p. 132.
Storthyngura caribbea (Benedict), HANSEN 1916, p. 132.

Material:

St. 650, Kermadec Trench (32°20′ S, 176°54′ W), 6620 m, 15. Febr. 1952. Gear: 6 m sledge trawl. Bottom: brown clay with pumice. Bottom temp.: 1.3 °C. – 4 females, one without pleotelson; 2 males, one very mutilated, both without pleotelson; 1 very mutilated specimen; 1 juv. female.

St. 716, off Pacific Central America (9°23′N, 89°32′W), 3590 m, 6. May 1952. Gear: herring otter trawl. Bottom: dark, muddish clay. Bottom temp.: about 2.0°C. – 3 males.

St. 724, Gulf of Panama (5°44′N, 79°20′W), 2650-3250 m, 12. May 1952. Gear: 6 m sledge trawl. Bottom: dark clay and stones. Bottom temp.: about 2.0°C. – 1 female + 1 juv. female.

HANSEN's very careful description and figures made it possible for me to decide without hesitation that the above-mentioned 13 specimens belong to *S. pulchra* (Hansen). Moreover, I feel convinced that *S. caribbea* (Benedict) also belongs to this species. The only cases of disagreement will be pointed out in the following description. For the sake of convenience the specimens described as *S. pulchra* are called the Galapagos specimens (although some were caught in the Gulf of Panama), *caribbea* the Windward, and the Galathea material is called the Kermadec and the Panama specimens respectively.

Description:

Head: The general descriptions given by HANSEN and BENEDICT agree with each other and with the Kermadec and Panama specimens in all details except two: HANSEN speaks about a »rather good-sized process« situated in the median line, behind the deep furrows (cf. figs. 1 & 1 a). This process is also present in the Panama specimens, but is absent both in the Windward and the Kermadec specimens. Besides, there are in the Galapagos specimens two »rather small«, acute processes behind antenna 1 which are also present in the Panama specimens. However, in the Kermadec material a rounded and rather inconspicuous process is found in this place, being the most elevated part of the oblong tubercle, found on each side behind the antennae. This tubercle was also described by BENEDICT, who does not, however, mention any process at its antero-interior corner.

Body: The very characteristic shape of the seven pereion somites and their armament with spines is almost identical, the only differences being that in the Kermadec specimens the three median spines and the small protuberances immediately behind them are not especially compressed laterally at the base, and the latter are not very conspicuous in some of the specimens. Moreover, according to BENEDICT's description of the Windward specimen, the second somite has a short, sharp spine on the antero-lateral angles like those found in segments 3 and 4, but it is not given in the figure and is probably due to a confusion with the epimeral spines on that segment.

According to BENEDICT, there is on the median line of the ventral surface of pereion somite 1 a sharp, curved spine and prominent, longitudinal ridges on somites 2-4. In all the Panama specimens the ridges are furnished with forward directed spines, almost as long as the likewise forward pointing median spine on somite 1. In the Kermadec material ridges and small spines are present in a few of the males and females (including the juvenile) but are completely or almost absent in the other specimens. On the median ventral side of the coalesced somites 5-7 there is in the Windward and Panama specimens a compressed, forward directed spine anteriorly, followed by a longitudinal ridge, which is separated in five places by transverse grooves. In the Kermadec specimens there is a low ridge and corresponding low grooves; most of the specimens have no anterior spine, but those with spines on somites 1-4 have a rather stout, not compressed spine which is directed only moderately forward. HANSEN does not mention these ventral spines and ridges in his description; this is rather strange, since at any rate the interrupted ridge on somites 5-7 is clearly visible on his fig. 1 a. The ventral spines are probably also present in HANSEN's Galapagos material, the more so since they are well developed in the Panama specimens.

Pleon has the same shape in all the specimens in which it is preserved. The terminal spine in the Kermadec specimens is not so decurved as in the Panama, the Galapagos, and the Windward materials. The animals from Panama have an oblong terminal face, exactly corresponding to the one figured by HANSEN (1 i). In the Kermadec specimens, however, it is considerably more rounded; the anal doors are much closer to the ventral keel of the terminal face and consequently occupy a greater part of it.

Antennae 1 and 2 in the Kermadec and Panama specimens agree with the descriptions; in no case are more than the four proximal segments of antenna 2 present.

Mandibles. The second segment of the palp is comparatively longer in the Kermadec than in the Galapagos and Panama specimens (not described in the Windward specimen), being two and a half to three times as long as the first segment. In one of the Kermadec males the incisive part of the mandibles has only one tooth instead of the normal three. All the other mandibles as well as the remaining mouth parts of this male and of the other Kermadec specimens, are, however, almost perfectly identical with those of the Galapagos animals.

Pereiopods I and V-VII are present both in the Galapagos, the Panama, and the Kermadec materials and are identical. These appendages are nearly equally long within the same specimen. In one of the males from Panama also pereiopods II-IV are preserved. They are extremely long and slender. Pereiopod II is twice as long as I, III more than three times as long, and IV almost four times as long as I and more than twice as long as the whole animal. Especially propodus is very elongated in pereiopods III and IV. BENEDICT's figure of pereiopod IV is uncorrect, the elongate propodus having been omitted.

The female and male opercula agree with HANSEN's description and also the uropods are equal (BENEDICT says nothing about terminal face, opercula, uropods, etc.). HANSEN's fig. 1 i of the ventral side of the male pleon may give the impression that the postero-lateral angles of the operculum are strongly produced. This is, however, not the case, each pleopod 2 being almost semicurcular as shown in fig. 34 b of the present report. This misconception is due to the fact that the two second pleopoda are set at right angles, when in situ. Fig. 34 b also shows the copulatory organ (not described by HANSEN); the filiform end reaches a little beyond the apex.

Size: St. 650, 4 ♀♀: about 21, 25, 25, and 27 mm. 2 ♂♂: about 18 and about 22 mm. Sex unknown: about 26 mm. Juv. ♀: 9 mm. – St. 716, 3 ♂♂: 22,2, 25.3, and 26.0 mm. – St. 724, 2 ♀♀: 25.4 and about 11.5 mm.

Juvenile female. In the Kermadec collection there is a juvenile specimen 9 mm long, only 1/3-1/4 as long as the adults. Since young forms of the genus *Storthyngura* are quite unknown – except for the doubtful young figured by BEDDARD (1886, pl. IX,2) – this specimen is of considerable interest, and I

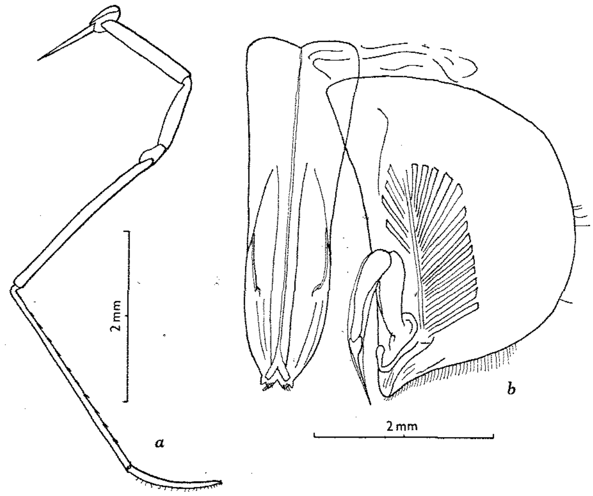


Fig. 34. *Storthyngura pulchra* (Hansen); a, pereiopod II of juvenile female from St. 650; b, operculum of adult male, seen from inside (dorsal view).

shall give an account of all the characters in which it differs from the adult females:

Almost all spines are longer and more acute than in the adult, this being especially the case with the epimeral spines, the lateral spines on pereion somites 5 and 6, the median, ventral spine on somite 5, the first pair of lateral spines on the pleotelson, and the spine on the operculum. The terminal spine on the pleon is also longer and more decurved, even longer and stouter than in the adult figured by HANSEN (fig. 1 a).

Pereion somite 7 is much smaller than the two preceding ones, being both narrower and only about half as long. The median part of it is quite convex, and there is no trace of the two spines on either side of the median line. The lateral spines of this somite are also much shorter than in the adult, being less than half as long as the spines on somite 6.

The second segment of the palp of the mandibles is less than half as long as the first, just as in the Galapagos and Panama specimens, but otherwise than in the rest of the Kermadec material. Also the shape of the movable lacinia is more similar to that of the former than to that of the latter specimens.

Finally, pereiopod II is preserved (fig. 34a). The relative length of the segments is almost the same as the adult (from Panama), but the entire leg is a little shorter than the entire animal, while in the Panama specimen it is a little longer.

Of the above-mentioned characters greater length of spines and late development of the last thoracic somite are typical of juvenile isopods. It is, however, interesting to note that in two of the significant characters in which the adult Kermadec specimens differ from the Galapagos specimens, the juvenile from Kermadec is identical with the animals from Galapagos, viz. in the decurved shape of the terminal spine and in the shape of the mandibles.

Variation:

Above have been mentioned all the known differences between specimens of *S. pulchra* from various localities. As will be seen, the specimens from the Gulf of Panama and from near the Galapagos are quite equal, while some differences are found in the other two materials. This must also be expected when the great distances are taken in account. I have, however, not found them of specific value. The following table gives a summary of these differences.

Table 2. Varying characters of *S. pulchra* from different localities in the Pacific and the Atlantic.

Characters	Galapagos	Panama	Kermadec	Windward
Median process on head	+	+	÷	÷
Ventral ridge on somites 2-4	+?	+	(±)	+
Ventral spine on somite 5	?	+	±	+
Terminal face oblong or round	o.	o.	r.	?
Segment 2 of mandibular palp short or long	s.	s.	l.	?

Remarks:

S. pulchra is not very far from *fragilis* (Beddard) from which it differs mainly in the shape of the pleon, i. e. absence of the deep notch in front of the distal lateral spines and absence of the conspicuous spine on the proximal part of the pleon, found in *fragilis*.

Distribution:

Known from several widely separated localities in the Atlantic and the Pacific Ocean. 1) Windward Is. in the West Indies, 1260 m (BENEDICT). 2) Off Pacific Central America (9°23'N, 89°32'W), 3590 m, about 2°C. 3) Gulf of Panama (6°10'N, 83° 06'W), 2690 m (HANSEN) and 5°44'N, 79°20'W, 2650-3250 and about 2°C; 4) north of Galapagos Is. (2°34'N, 92°06'W), 2490 m (HANSEN); 5) Kermadec Trench NE of New Zealand (32°20'S, 176° 54'W), 6620 m, 1.3°C.

Storthyngura furcata n. sp.

Material:

St. 658, Kermadec Trench (35°51′S, 178°31′W), 6660-6720 m, 20. Febr. 1952. Gear: 6 m sledge trawl. Bottom: brown sand with clay and stones. Bottom temperature: 1.3°C. – 1 complete female + mutilated posterior half of 1 female; 1 complete male, but broken.

St. 654, Kermadec Trench (32°10′S, 175°54′W), 5850 m, 18. Febr. 1952. Gear: herring otter trawl. Bottom: brown clay with pumice. Bottom temp.: 1.2°C. – Pleon of 2 females + 1 smaller female without pleon.

Type specimen:

The complete female from St. 658 was selected as type.

Description:

Body (fig. 35a) oblong, more than three times as long as broad.

Head with a pair of broad and low tubercles behind the antenna. Posteriorly these vaulted areas are separated from a median triangular patch by a pair of convergent furrows which extend laterally a little in front of the hind margin of the head. As in *Ilyarachna antarctica* (fig. 25, p. 107) these vaulted areas probably indicate the extension of the original eyes. The surface of the tubercles has a corroded appearance. The sides of the head are somewhat swollen. There are no spines on the head.

Pereion somites 1-4 almost agreeing with the description of *S. benti* (p. 113), but the transverse furrows which make the somites saddle-shaped are more pronounced. The median spines are fairly short, only about one sixth of the width of the somites, and the antero-lateral spine on somite 4 is minute. Also the epimeral spines are shorter and weaker than in *benti,* this especially being the case with the posterior spine on epimera 2-4 which is only about one fourth of the anterior.

Pereion somites 5-7 almost as in *benti,* but the dorsal pairs of spines are set closer together, and those on somites 6 and 7 are shorter, being only about half as long as those on somite 5. Also the lateral spines are somewhat shorter and directed a little more forward.

Pleon (fig. 35 a & b). The pleotelson is shaped like a shield. In this species the terga of coalesced pleon somites are more numerous than in any other species of *Storthyngura.* Anteriorly the usual

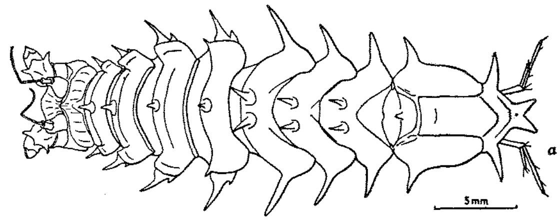
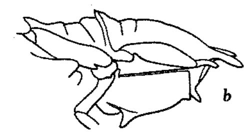


Fig. 35. *Storthyngura furcata* n. sp. ♀; type specimen from Kermadec Trench, 6700 m; a, dorsal view; b, lateral view of pleon.



triangular area, found for instance also in *benti,* is placed. Then follows a short, rod-shaped tergum, and behind that a third one which extends to the antero-lateral corners of the pleotelson; this third tergum is separated posteriorly from the median convexity by a broad transverse furrow and has a median tubercle, as in *S. fragilis* (BEDDARD 1886, pl. IX, 8). The pleotelson is furnished with three pairs of lateral spines; the first two pairs are long and turned somewhat forwards and upwards. The posterior pair is shorter and stouter; the spines rise very close to each other, forming a characteristic, v-shaped terminal part of the pleotelson. They are bent slightly downwards. The pleotelson is divided into three equally broad convexities by two longitudinal furrows. The median one ends a little in front of the hind margin of the pleotelson and has an indistinct transverse furrow near its anterior end. The two lateral convexities are shorter and suboval, terminating with a short, deep, transverse furrow just in front of the base of the middle pair of lateral spines.

On the ventral side of the pleon a keel similar to that in *benti* is found; the median crest has two strong downward and backward directed processes. The terminal face is surrounded by a projecting edge on all sides; when seen directly from the ventral side of the animal (at an oblique angle) it is diamond-shaped, when seen at a right angle it is almost circular. Nearly the whole surface is occupied by the semicircular anal doors.

Antenna 1 reaches backwards to pereion somite 3 in the female and to somite 4 in the male. The first segment is subcylindrical, but somewhat broader and with a depression at the proximal end. Along the outer margin there is a low keel. The second segment is longer than broad, with a small process at the interior, distal angle. The following segment is cylindrical and several times longer than broad. The segments of the flagellum are very short, especially in the male, and very numerous.

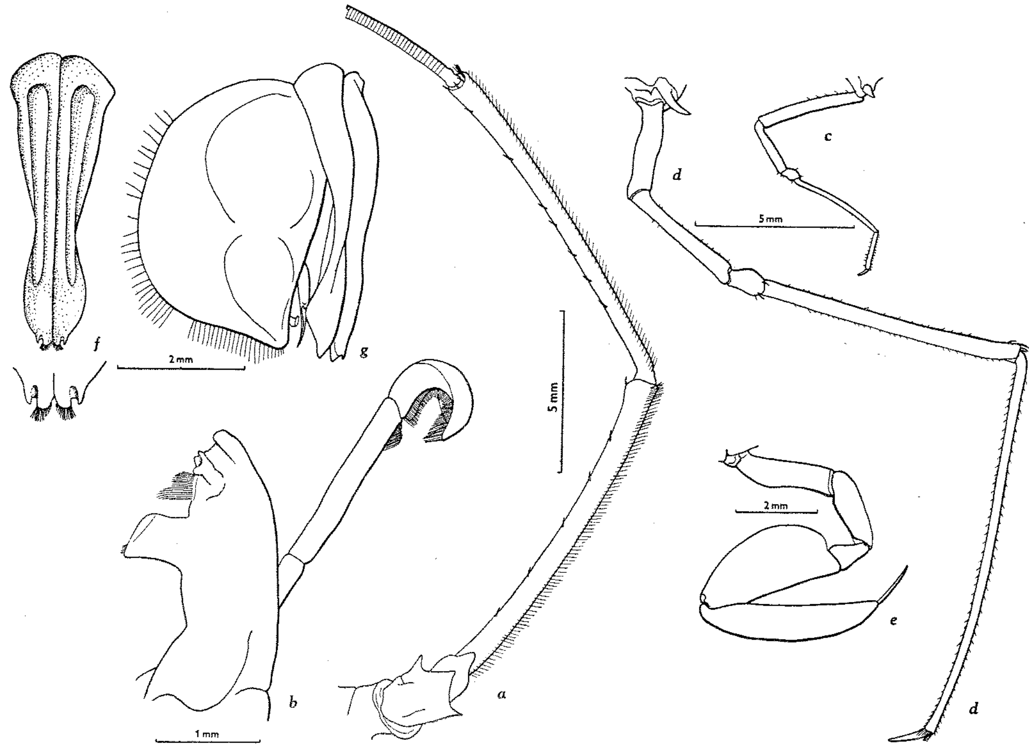


Fig. 36. *Storthyngura furcata* n. sp.; a, right antenna 2 of female; b, left mandible of female; c-d, pereiopoda I and III of male; e, pereiopod V of female; f, male pleopoda 1, seen from inside (dorsal view); g, male pleopod 2 and edge of pleopoda 1 (to the right).

Antenna 2 (fig. 36a) has the first and second segments unarmed. On the third there is a stout distal spine directed inward and forward and also a spine-like squama, marked off from the segment by a conspicuous suture on the outer side. Between these two spines the distal upper margin is strongly produced. Segments 5 and 6 are very elongated, 6 being a little longer than 5. The flagellum is stout, and the segments are short and exceedingly numerous.

Left mandible (fig. 36b) has only one tooth in the cutting edge. The movable lacinia short and blunt with very inconspicuous teeth. The second segment of the palp more than twice as long as the first.

Maxilla 1 and 2 and maxilliped typically shaped. In maxilla 2 the inner lobe on basis is somewhat longer than the outer.

Pereiopod I (fig. 36c) is very short, only one third of pereiopod III. Merus not so extended as in *benti* and propodus less than half as long as carpus.

Pereiopod III (fig. 36d) very slender with the two ultimate segments about as long as segments 3-5. Pereiopods II and IV are absent.

Pereiopod V-VII (fig. 36e) as in *pulchra,* except that propodus is somewhat narrower, being five times as long as broad instead of about three times in *pulchra.*

Female operculum (fig. 35b) of the same shape as in *benti.* Surface of keel and median parts corroded rather than granulated.

Pleopod 3 of female as in *benti,* but outer ramus a little longer.

Male operculum somewhat longer than broad. The first pair of pleopods (fig. 36f & g) only a little longer than the second and with a very conspicuous narrowing a little beyond the middle, due to the concave outer margins. The apex has a short and acute outer process, and the inner lobe furnished with hairs. On the ventral surface of the operculum (pleopod 2) the median half has two vaulted areas of which the proximal one is the bigger. The filiform end of the copulatory organ hardly reaches to the end of pleopod 2 (fig. 36g).

Uropod reaches far beyond the two terminal spines on pleotelson. Endopodite almost twice as long as peduncle, but somewhat more slender and almost three times as long as the exopodite and a little stouter (fig. 35a).

Size: 1 ♀ (type specimen): 30.5 mm. 1 ♂ about 25 mm. 1 ♀ (only posterior half): between 26 and 29 mm.

Variation:

The three specimens from St. 658 are quite equal. The two fragments of larger females from St. 654 have conspicuously smaller lateral spines on pleon, while, on the contrary, the median spine on the operculum of one of these females is longer and more slender than in the type from St. 658. The median spine in the other female is like that of the type. It was not possible to see any notable differences between the smaller, mutilated female and the type specimen.

Remarks:

VANHÖFFEN (1914, p. 584) has described a species of *Storthyngura, S. elegans,* on a single female from the Antarctic Sea (3423 m). In some respects it seemed related to *furcata,* but a sufficiently detailed comparison could not be made on the basis of VANHÖFFEN's short description and single figure.

Through the courtesy of Dr. J.-E. GRUNER of the Berlin Museum I have borrowed the type specimen of *elegans*. It is only 2.3 mm long and certainly juvenile.

A comparison with *furcata* shows the following resemblances:

1. Shape of pleon with three pairs of spines of which the last pair is terminal in both. There are, however, some differences even if they are alike in the general appearance: In *elegans* the pleon is about one fourth broader than long (measured to end of spines) while in *furcata* it is about as long as broad. Further, the spines are comparatively longer in *elegans* (especially the anterior pair) and much broader, as shown in VANHÖFFEN's fig. 114. Besides, the margin between the base of the middle pair of spines and the apex of the terminal spines is only slightly concave in *elegans,* while it has a conspicuous angle in *furcata.* Finally, the median part of the pleotelson is not so much vaulted in *elegans,* and there are no longitudinal convexities laterally in that species. – 2. Armament with lateral and epimeral spines is identical.[1] There are, however, no epimeral spines on the first somite in *elegans,* and the lateral spines on somites 5-7 are much broader. – 3. Shape of peduncle of antenna 2 is equal.

The main differences (besides those given above) are:

1. Lack of paired dorsal spines on pereion somites 5-7 in *elegans*. This may, however, be due to the fact that *elegans* is a juvenile. Above (p. 118) a juvenile of *S. pulchra* is described which has not yet developed the dorsal spines on the seventh somite, found in the adult. – 2. The conspicuous dorsal spine on first pereion somite in *furcata* is absent in *elegans*. – 3. The same applies to the dorsal process on the proximal part of the pleon in *furcata.* – 4. There is no keel separating the operculum from the terminal face on the ventral side of the pleon of *elegans*. – 5. First segment of antenna 1 in *elegans* has a distal, interior spine not found in *furcata.* – 6. Carpus of pereiopods VI and VII is somewhat longer than propodus in *elegans,* while in *furcata* it is somewhat shorter. – 7. Dactylus of the same legs in *elegans* almost as long as propodus, but only about one fourth as long in *furcata.* – 8. Lower surface of female operculum of *elegans* rounded both longitudinally and transversely, i. e. without any median keel and spine. – 9. Uropods reach far beyond the terminal spines of the pleon in *furcata* while they are only a little longer than the spines in *elegans* and also have comparatively shorter inner rami.

As will be seen, the differences between the two species are rather significant and justify the establishment of a new species, especially since the variation within this genus seems to be so slight (cf. *pulchra* and *benti)*. On the other hand, *furcata* is probably nearer to *elegans* than to any other species of *Storthyngura.*

The pleon of *S. magnispinis* (Rich.) resembles that of *furcata* except that the posterior part in *magnispinis* is produced and transverse instead of furnished with two spines, but morphologically these features are not far from each other. The two species differ, however, in a good many characters, for instance in tubercles on head and pleotelson, antero-lateral spines on pereion somites, spine on female operculum, keel round the terminal face, first segment of antenna 1, etc.

Distribution:

Known only from the type locality, Kermadec Trench NE of New Zealand, 6660-6720 m, 1.3°C.

Storthyngura novae-zelandiae (Beddard)[2]

Description of embryos.

While studying the type collection of *Storthyngura ("Eurycope")* species from the Challenger, kept in the British Museum (Nat. Hist.) in London I found

1. The lateral spines on somites 2-4 do not – as shown in VANHÖFFEN's figure – emerge from the terga, but are true epimeral spines – except the antero-lateral spine on somite 4.

2. The correct spelling of this specific name would seem to be *novae-zealandiae,* but since BEDDARD consistently uses *novae-zelandiae* this spelling cannot be regarded as an inadvertent error, and must stand.

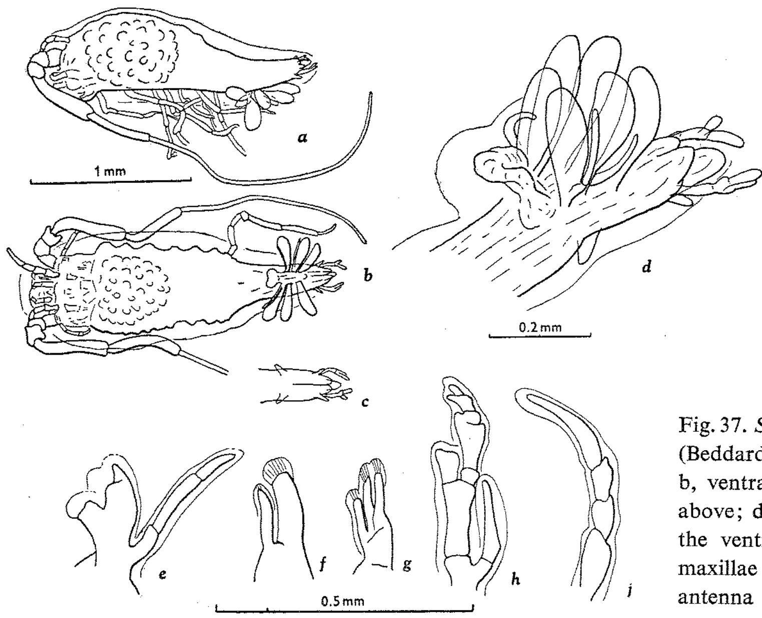


Fig. 37. *Storthyngura novae-zelandiae* (Beddard); embryos; a, side view, b, ventral view; c, pleon of b from above; d, pleon, seen obliquely from the ventral side; e, mandible; f-g, maxillae 1 and 2; h, maxilliped; j, antenna 1.

a female specimen of *S. novae-zelandiae* with a marsupium partly filled with embryos which were still quite firmly packed together. There were 43 specimens in all, but there may originally have been twice as many, judging from the size of the marsupium.

The female is 14.4 mm long (Beddard (1886, p. 61) gives the maximum size of this species as 12 mm); it was dredged together with several other specimens of this species at Challenger Station 168, off New Zealand (40°28′ S, 177°43′ E), 8. July 1874. The depth was 2102 m, and the bottom temperature is given as 2.8° C.

Since no other embryos of this deep-sea genus have so far been described I found it useful to give a description of these embryos. I take the opportunity to thank Dr. I. Gordon for lending me the material.

The embryos are still so undeveloped that antennae and legs are very soft and greatly entangled in each other.

The *body* of each embryo is surrounded by a transparent cover which is indicated on the illustrations. In each body a yellowish yolk-sack is clearly visible and shown on fig. 37a & b. The general shape of the body is narrower than in the adult (pl. IX, 1), especially towards the pleon. The sharp distinction between somites 1-4 and 5-7 is not yet visible, nor have lateral and dorsal spines been formed.

The *pleon* is much narrower than in the adult in which it is triangular with almost equally long sides. In the embryos it is about twice as long as broad. On the dorso-lateral side there is one pair of processes towards the anterior end and another pair just in front of the uropod (fig. 37c). These processes presumably later develop into the two pairs of lateral spines on the pleon. The posterior end of the pleon has three stout, rounded processes, two on the ventral side and one dorsally, which is somewhat longer.

The *antennae* of embryo and adult are rather different. First segment of antenna 1 (fig. 37j) is not much broader than second and third, and the flagellum is still very short. Antenna 2 has three basal segments like those in the adult, but segments 4 and 5 are much shorter, while the flagellum, on the contrary, is very much larger than in the adult.

Mouth-parts (fig. 37e-h). The mandibles have not yet developed the strong secondary tooth and the spiny row found in the adult (pl. IX, 3), nor has the terminal segment of the palp become curved. The maxilliped is still more slender than in the adult in which, according to Beddard, it is like that in *Eurycope sarsii* (pl. XI, 6).

The *pereiopods* seem to have reached their full length, but the three posterior pairs have not yet become natatory (fig. 37a).

In about half the embryos the pleon is sufficiently well preserved to show that there is a thick, bilobed plate on the ventral side (fig. 37b and d), succeeded constantly by dispositions to three pairs of pleopods. This plate probably developes into the operculum, but I could see no difference in male and female embryos (both must certainly be present among forty specimens), even if the male operculum is composed of two pairs of pleopods and the female operculum of one pair only.

All three pairs of *pleopods* posterior to the above mentioned plate are subequal in size and shape, except that the two anterior pairs have a well developed exopodit.

According to BEDDARD the *uropods* are "very minute and biramose; the inner branch is much shorter and more slender than the outer branch . . .". In the embryos the uropods are, however, very long compared to the total length of the animal, and the inner branch is definitely longer and stouter than the outer.

Size: The majority of the embryos are 1.5 mm long. A few are less developed, being only about 1.2 mm.

Eurycope G. O. Sars

Eurycope G. O. Sars, 1864, p. 4 (208)
Eurycope G. O. Sars, 1899, p. 144
Eurycope G. O. Sars, HANSEN 1916, p. 137

Even if the genera *Storthyngura* Vanhöffen and *Munnopsurus* Richardson have later been established on species originally included in *Eurycope,* the latter genus still contains 31 species to which it has been necessary now to add three new species.[1] Perhaps a few of all these species, some of which are known in one specimen only, may at a closer examination turn out to be synonymous. It is also questionary whether they should all be included in one genus. For instance, it is probable that not all species have the seventh pair of legs natatory *(E. frigida* Vanh. seems to be one of these) and might therefore – in connexion with other possible features of generic value – be transferred to a new genus. However, the pereiopods are missing in several species which prevents a revision until more material is available. But on the whole *Eurycope* is a well defined genus which presumably dates far back and has developed into some of the best swimmers within the Asellota. In spite of this it must be regarded as a typical bottom-living genus, since till now all species except one have been captured with dredges or trawls only. This single pelagic species is *E. murrayi* Walker which has always been caught in nets, towing in the free water masses.

1. *Eurycope fusiformis,* described by BARNARD (1920, p. 423), is definitely a species of *Ilyarachna.* This can be judged both from the description, the figure (pl. 17, fig. 20) and from BARNARD's comparison with *Ilyarachna plunketta* and *I. abyssorum* which *fusiformis* "likes in general appearance" and is "very close to".

The present material from the Galathea contains three specimens, two males and one female, belonging to three different species.[2] One of them proved to be identical with *E. nodifrons* Hansen. The second is a new species, *E. madseni,* but is rather close to *E. ovalis* Vanh. Also the third species, *E. galatheae* was hitherto unknown but is nearly related to *E. vicarius* Vanh. Since VANHÖFFEN's description of *ovalis* and *vicarius* seemed to me to be insufficient for a comparison, I have given a description of them below, based on the types and cotypes, originating from the German Antarctic Expedition (Gauss) and kindly lent to me by the Berlin Museum. Moreover, the study of the material of *vicarius* showed that some of the specimens could not belong to that species. One of these had to be regarded as a new species, and the remaining specimens proved to be antarctic representatives of *E. brevirostris* Hansen. For the sake of convenience I have included the description of *E. gaussi* n. sp. and the discussion of the material of *brevirostris* in the present Report.

Eurycope nodifrons Hansen, 1916

Eurycope nodifrons Hansen, 1916, p. 140, pl. 13, 1 a-d.

Material:

St. 651, Kermadec Trench (32°10′ S, 177°14′ W), 6960-7000 m, 16. Febr. 1952. Gear: herring otter trawl. Bottom: brown clay with pumice. Bottom temperature: 1.3°C. – 1 female, complete but broken, with well developed marsupial plates.

The present specimen has suffered rather badly during the dredging and has lost all pereiopods and pleopods as well as the flagella of the antennae. The body was very much shrunk, but after a careful stretching it could be studied, and reliable drawings made of head, all pereion somites, pleon, mouthparts, etc. This meant that I could undertake a sufficiently careful comparison with the type specimen, the only specimen of the present species hitherto known.

Description:

Female. Body (fig. 38 a) oval in shape and rather broad. Owing to the originally shrunk state of the specimen the ratio between total length and largest

2. Of one of the species also a very mutilated posterior half was captured.

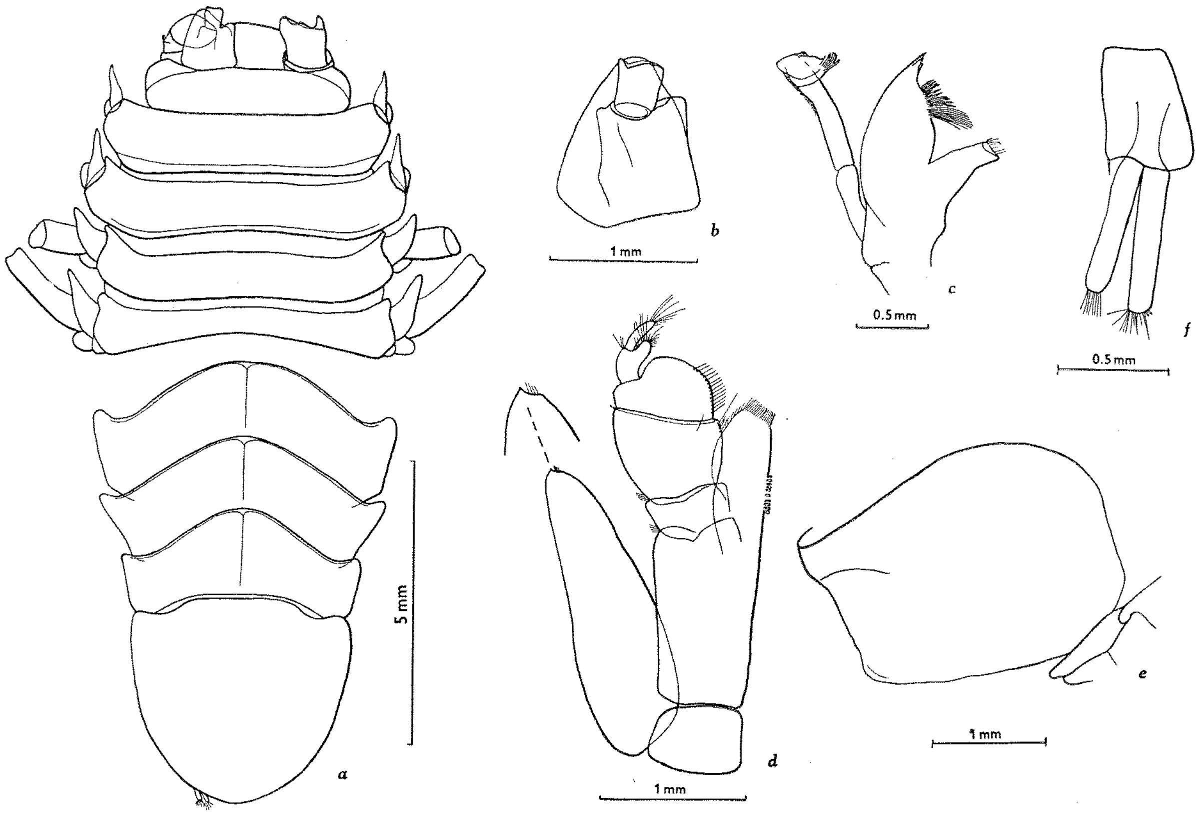


Fig. 38. *Eurycope nodifrons* Hansen; ♀ from the Kermadec Trench, 7000 m; a, dorsal view; b, left antenna 1; c, right mandible; d, right maxilliped; e, lateral view of operculum; f, right uropod.

width cannot be given exactly. The whole integument of body and appendages is covered with a very fine structure of faintly waved lines, also found in the type.

Head shaped exactly as in the type specimen with the characteristic straight frontal part (a very rare feature within the group), the rounded keel, and the lateral protuberances.

Pereion somites 1-4 of the same general shape, and decreasing in length from 1 to 4. Somite 1 is about one fourth longer than 2 in both specimens. In HANSEN's fig. 1a (pl. 13) it is drawn much too long. The only difference between the type and the Kermadec specimen is that the latter has the anterior epimeral plates still a little longer than in the type; they are triangular and acute when seen obliquely from the side.[1]

Pereion somites 5-7 are a little broader in proportion to the length than in the type, but are otherwise quite corresponding. They also have the same faint longitudinal impression in the middle.

Pleon (of the type) is by HANSEN given as "nearly as long as broad". According to my measurements it is a little longer than broad. The pleon of the Kermadec female is rather damaged, but it seems as if it was a little shorter, i. e. at most as long as broad.

Antenna 1 (fig. 38b) has the first segment shaped as a flat, triangular plate. The second segment, which is much smaller and a little longer than broad, is inserted on a raised, almost squarish portion of the first segment. The only difference between the two specimens is the relative length and width of the first segment. In the type it is exactly as long as broad (not "slightly broader than long" as stated by HANSEN), while in the Kermadec female it is one fifth longer than broad. In the type there are a few setae on the antero-interior corner of segment 1 and on the distal end of segment 2; they are not found in the Kermadec specimen. Rest of the left antenna 1 and the entire right antenna 1 lost.

Antenna 2 equal except that the squama of the Kermadec specimen is missing the two setae or tiny spines found in the type. The distal segments of the peduncles and the flagella are lost.

Left mandible has the cutting edge furnished with a row of six spines in the Kermadec female and

1. In fig. 38a the epimera and first segments of pereiopods 3 and 4 have been turned outwards and are seen in an unnatural position. Epimera 1 and 2 are still in their right position.

about four in the type. In both specimens the movable lacinia has a similar row of fine spines. The spine-row below the incisive part consists of eleven stout, dentate spines (only three-four in the type) and about ten longer setae behind them (about three in the type). The molar process is prominent and semicircular in section. The palp is of the usual type with the third segment bent backwards. Segment 2 is one and a half times as long as 1. Cutting edge of *right mandible* (fig. 38 c) with two larger terminal spines and two minor spines along the outer margin.

Maxilliped (fig. 38 d) of the same general shape in the two specimens, but the penultimate segment of the palp is broader and more expanded laterally in the Kermadec specimen than in the type. The epipodite of the former has a very slight bend at the apex, furnished with four tiny hairs. A very close examination of the epipodite of the type specimen showed a rounded apex without any bend. But at the same time I found the general shape of the epipodite in full accordance with that of the Kermadec specimen, i. e. not quite so broad and with less sharp corners proximally than in HANSEN's fig. 1 c.

Pereiopods. Unfortunately, the majority of all the pereiopods is lost in both the type and the Kermadec specimen; only basis of all legs is still present. I have compared the relative length and width of these segments in the two specimens. In both cases basis of pereiopod I is the longest and most narrow, basis of V the shortest, and basis IV-VI the broadest. There are, however, a few differences between the two specimens: basis of III and VI of the type are relatively shorter than in the Kermadec female (about one fifth) and basis of II-IV about one fourth broader in the type. This seems to indicate that on the whole the type had shorter and stouter legs.

Female operculum (fig. 38 e) longer than broad and almost rectangular seen from the side. On the lower surface there is a median keel, stretching from the anterior margin to somewhat in front of the posterior margin where it suddenly ends in a rounded protuberance.

Uropod (fig. 38 f) reaches a little beyond the pleon. It has a thick basal segment which is somewhat longer than broad. The exopodite is a little shorter and thinner than the endopodite. The uropods are missing in the type specimen.

Size: The type specimen is 5.1 mm long and 1.9 mm broad. The total length of the Kermadec female can only be given tentatively as 13-13.5 mm and the width as about 7.5 mm.

Variation:

As pointed out above the two specimens agree, to a remarkable degree, when the enormous distance between the two localities (NW Atlantic and SW Pacific) is taken into account. The specimens are conformable to each other in all the essential specific characters: lack of frontal projection and presence of lateral protuberances on head; shape and relative size of pereion somites and pleon; presence of long epimeral plates; shape of first segment of antenna 1; shape of mandible and maxilliped. The differences are: somites 5-7 and pleon, first segment of antenna 1, epimeral plates, and most of the pereiopods a little longer in the Kermadec specimen than in the type, and the pereiopods at the same time a little more slender; number of spines on cutting edge and in spine-row somewhat greater in the Kermadec specimen; shape of penultimate segment of mandibular palp and apex of epipodite in the maxilliped slightly different.

Remarks:

HANSEN (1916, p. 140) regarded *nodifrons* as intermediate between *murrayi* Walker and *inermis* Hansen and pointed out the main differences between these three species. Also *crassa* Vanh. is rather similar to *nodifrons*. It differs in having an obtuse rostral projection, an extremely long first somite (almost as long as the three succeeding somites – MONOD 1926, fig. 12 A), no epimeral plates, and the penultimate segment on palp of maxilliped equally broad from base to end.

Distribution:

So far known only in two specimens, the type from the NW Atlantic (Davis Strait – 61°50′N, 56° 21′W) at a depth of 2702 m and a bottom temp. of 1.5°, and a female from the Kermadec Trench (32° 10′S, 177°14′W) at 6960-7000 m depth and 1.3°C.

Eurycope madseni n. sp.

Material:

St. 651, Kermadec Trench (32°10′S, 177°14′W), 6960-7000 m, 16. Febr. 1952. Gear: herring otter trawl. Bottom: brown clay with pumice. Bottom temperature: 1.3°C. – 1 male, complete but posterior half rather mutilated.

Description:

Body (fig. 39 a) egg-shaped, twice as long as broad, with the greatest width at pereion somite 6.

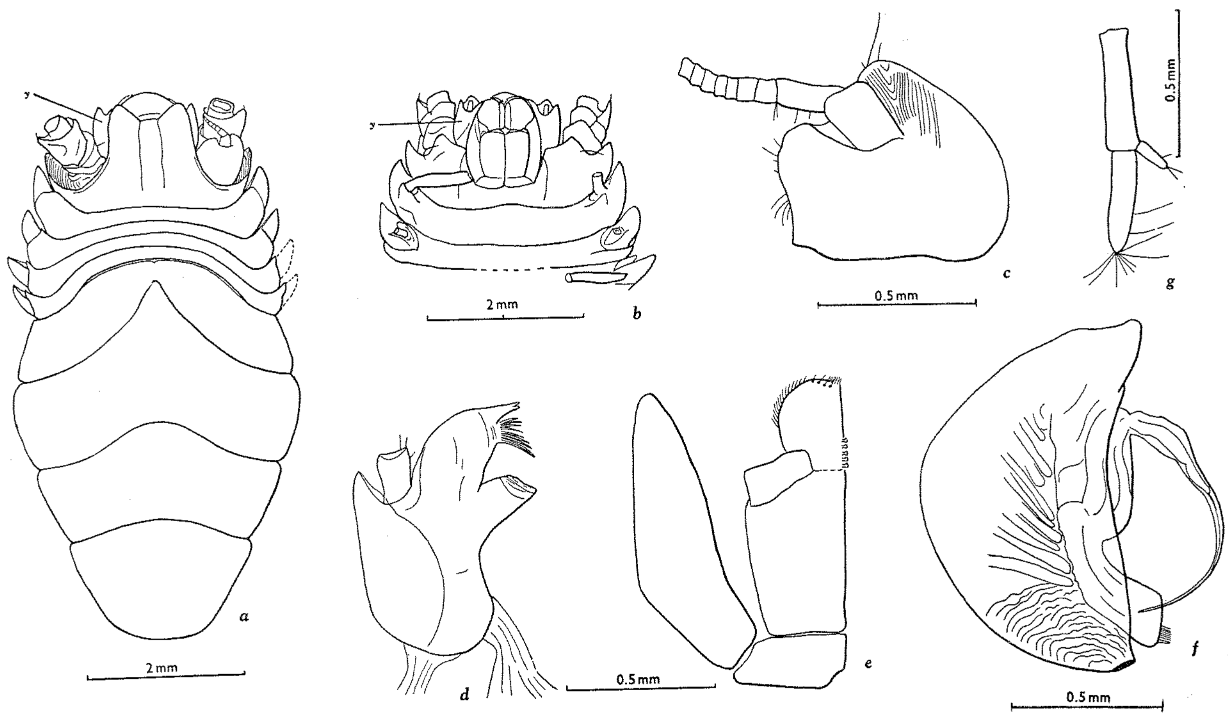


Fig. 39. *Eurycope madseni* n. sp. ♂; type specimen from the Kermadec Trench, 7000 m; a, dorsal view; b, head and pereion somites 1 and 2 from below (y, visible part of mandible); c, right antenna 1; d, right mandible; e, right maxilliped; f, left pleopod 2; near the apex the pattern of the integument has been indicated; g, uropod.

Head rather long, being twice as long as somites 1-4. The frontal projection is larger than in any other species of *Eurycope,* except *ovalis* Vanh. The lateral margins are raised like keels, each of which projects as a rounded triangular tooth. The area between the keels is about one fourth of the width of the whole projection, and its anterior margin is slightly convex. Towards the lateral margins of the head the frontal seam bends forwards and ends in a conspicuous projection which forms the outer boundary of a deep, rounded incision which gives room for the antennae. Between the lateral margin of the frontal projection and antenna 2 the outer margin of the mandible can be seen (y).

When the head is viewed from below (fig. 39b) the two lateral projections appear very similar in size and shape to the epimeral plates of the following segments. Between the projections and the base of the maxillipeds there is another broad projection reaching a little further forwards than the lateral one.

Pereion somites 1-4 are extremely short in comparison with the length of head and especially somites 5-7, which are four and a half times as long. Only in *ovalis* and, to some extent, in *furcata* G. O. Sars and females of *antarctica* Vanh. a body-shape similar to the present one is found. Somite 1 is a little longer than the three succeeding somites which are equally long. The anterior margin of the first somite is almost straight, while it becomes more and more convex in somites 2-4. Laterally somite 1 is rounded, somite 2 has a minute antero-lateral spine, which becomes more prominent in 3 and 4. The epimeral plates are triangular and pointed. They are also triangular in section and decreasing in width from 1 to 4.

Pereion somites 5-7 (fig. 39 a) are extremely long and broad. 5 and 6 are immovably fused. The seam between the two somites is, however, clearly visible. Towards the median part it is pointing forwards in an extraordinary way found only in this species and in *ovalis.* Somite 5 is longest laterally and gradually becomes shorter to near the median part where it suddenly narrows. Correspondingly somite 6 is extremely long in the middle; it is somewhat less than twice as long in the middle as laterally. Somite 7 is of the ordinary shape in the genus, i. e. somewhat broader in the middle than laterally. Along the median line somite 5 is only one sixth of somite 6 which is again one and a half times as long as 7. Laterally the length of the three somites is more equal, somite 6 being only a little longer than 7 which is again slightly longer than 5.

As in *ovalis* the dorsal muscles under the transparent integument form a characteristic pattern which is shown in fig. 40 a.

Pleon, when seen exactly from above, is one and a half times broader than long. Although it is somewhat mutilated there is no doubt that it is rather flat dorsally as well as ventrally. The cavity occupying the pleopods is apparently very small as in *E. furcata* (SARS 1899, pl. 67); the width and length of it is less than one third of the total width and length of pleon.

Antenna 1 (fig. 39c) has the first segment very broad, about one fifth broader than long. It has a dorsal concavity for segment 2 which is much smaller and a little longer than broad. Segment 3 is only half the width of 2. Most of the flagellum was broken off. The appearance of the fine stripes in the integument is shown in the upper corner of the first segment.

Antenna 2 (fig. 39a) has lost the distal segments of the peduncle and the entire flagellum on both sides. The squama is conspicuous and triangular.

Both mandibles (fig. 39d) have an unusual shape, since the outer margin is furnished with a thick, triangular process at the insertion of the palp. On the dorsal side of the mandible a convex seam continues from the base of the process towards the proximal end of the mandible. This process and the outer margin of the mandibles are clearly visible when the animal is seen from above or from below (figs. 39 a and b). A similar process is not known in any other species of *Eurycope* in which the mandible has been studied. The cutting edge has two teeth and there are nine spines in the spine-row. *Left mandible* has three-four teeth on the cutting edge and about the same on the movable lacinia. There are only about seven spines in the spine-row. Both palps were lost except the first segment on both mandibles.

Maxilliped (fig. 39e) is fairly slender, the second segment being one and a half times as long as broad. There are five coupling hooks on the right and four on the left maxilliped. Unfortunately, all the distal segments of the palp are lost on both maxillipeds. The epipodite is also very slender, with a rather pointed apex.

Pereiopods are lost except basis of III-VII. Of these III and IV are long and narrow, IV being a little longer but much broader than III. Basis of V is only half the length of the preceding one and almost as broad as long. Basis of VI and VII are somewhat longer and only about half as broad as long.

Pleopod 2 (male) was the only pleopod preserved (fig. 39f). It is almost semicircular with a rather short and stout copulatory organ.

Uropod (fig. 39g) is long and slender. The endopodite is almost as long as the proximal segment, while the exopodite is a little more than one third of the endopodite.

Size: Total length 6.9 mm and maximum width 3.6 mm.

Remarks:

E. madseni and *ovalis* Vanh. are identical in many features, and the similarities and differences are discussed after the redescription of *ovalis* (p. 129). Only one other species of *Eurycope, E. furcata* G. O. Sars, has a rostrum to some extent similar to that found in these two species; it is, however, not so broad and only "minutely bifurcate at the tip" (SARS). Also the shape of the pereion somites shows many similaritites between *furcata* and *madseni,* even if somites 1-4 are somewhat longer and 5 much longer in *furcata.* SARS (1899, pl. 67) does not show the seam between the fused somites 5 and 6. In specimens from the Ingolf Expedition the seam is, however, clearly visible and almost parallel to the posterior margin of somite 6, i. e. without the characteristic, forward directed projection found in *madseni* (and *ovalis*). The ventral side of the pleon in *furcata* and *madseni* is practically identical; in both species the cavity for the pleopods is unusually small. Finally, the shape of the maxilliped is quite equal in the two species.

Besides the differences in shape of rostrum and relative length of thoracic somites a few other dissimilarities should be pointed out. HANSEN (1916, p. 151) described the antennal squama of *furcata* as unusually long and slender, and his fig. 9a (pl. 13) shows that it is quite different from that of *madseni.* Moreover, the mandibles of *furcata* lack the strong triangular process found in *madseni,* and the second pair of male pleopods in *furcata* have a convexity near the distal end and a concavity near the proximal while they are semicircular in *madseni;* besides, the copulatory organ is somewhat larger in the former species. Finally, the exopodite of the uropod in *furcata* is much longer compared with the endopodite than in *madseni.*

The present species is named after Mr. FRITZ JENSENIUS MADSEN, M. Sc., Assistant Zoologist on the Galathea.

Distribution:

So far known only from the Kermadec Trench NE of New Zealand, 6960-7000 m, 1.3°C.

Eurycope ovalis Vanhöffen, 1914

Eurycope ovalis Vanhöffen, 1914, p. 587, fig. 118 a-c.

Since VANHÖFFEN's description of this species is very insufficient I have given below a supplementary description, based on the only known specimen, a female from the Antarctic, caught by the Gauss on 3. April 1903 at 3423 m depth, and lent to me by the Berlin Museum.

Description:

Body (VANHÖFFEN 1914, fig. 118a) egg-shaped, a little more than twice as long as broad, with the greatest width at pereion somite 5.

Head exactly of the same size compared with the pereion somites as in *madseni*. The same applies to the shape of the frontal and lateral projections. There are on the underside of the head the same projections between the base of the maxillipeds and the lateral projections as found in *madseni,* but they are somewhat larger and more rounded than those shown in fig. 39b.

Pereion somites 1-4 have the same relative size and shape as in *madseni,* and this is also the case with the epimeral plates.

Pereion somites 5-7 (fig. 40 a) have the same general appearance as in *madseni*. In his fig. 118a VANHÖFFEN does not show the seam between the immovably fused fifth and sixth somites, but it is as clearly visible as in *madseni* and agrees in all details. There is, however, a remarkable difference between the relative length of these three somites (especially 5 and 7) in the two species, as shown in table 3.

Table 3. Figures giving the relative length of somites 5-7 in *Eurycope ovalis* Vanh. and *E. madseni* n. sp., measured along the median and the lateral lines.

	Median line		Lateral line	
	E. ovalis	*E. madseni*	*E. ovalis*	*E. madseni*
Somite 5	3	4	15	10
Somite 6	27	24	13	14
Somite 7	14	16	8	12

The pattern of the muscles as seen through the transparent integument of somites 5 and 6 is shown in fig. 40 a.

Pleon is, when seen directly from above, exactly as long as broad (not only half as long as broad as in VANHÖFFEN's fig. 118 a). There is a slight bend

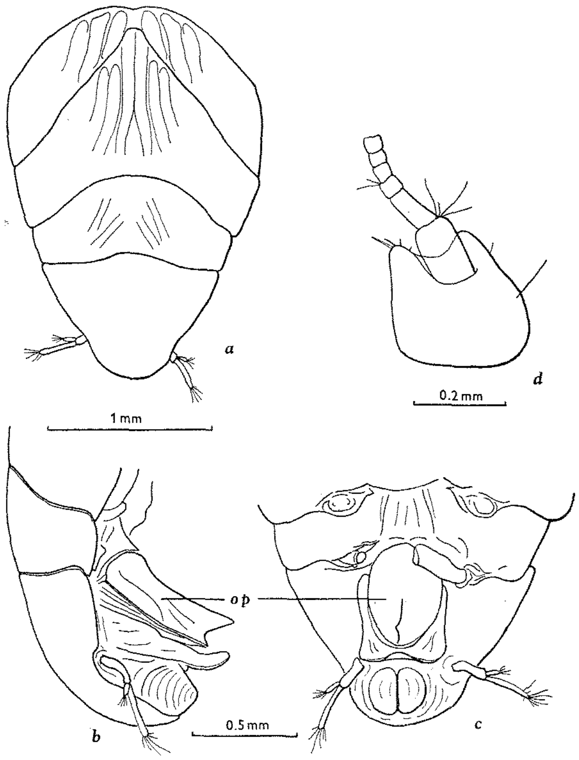


Fig. 40. *Eurycope ovalis* Vanhöffen ♀, type specimen; a, pereion somites 5-7 and pleon; b, lateral view of pleon; c, ventral view of pleon (op, operculum); d, right antenna 1.

on each side near the rounded apex. The dorsal surface is rather strongly vaulted longitudinally as well as transversely, much more than in *madseni*.

The ventral side of the pleon is shaped in a way which seems to be unique within the genus *Eurycope* and points in the direction of *Storthyngura*. I have studied the females of the fourteen species of *Eurycope* kept in this museum without finding anything similar. In the descriptions of five more species the authors have given an illustration of the female seen from the side or from below and also in these cases the ventral pleon seems to be of the ordinary shape. In the following eleven species, however, nothing definite can be said, since the authors do not describe or figure the underside of the pleon: *E. antarctica* Vanh., *crassa* Vanh., *curta* Vanh., *frigida* Vanh., *laevis* Bened., *nobili* Rich., *pavlenkoi* Gurj., *quadrata* Barnard, *scabra* Hansen, *spinifrons* Gurj., and *sulcifrons* Barnard.

When comparing the present fig. 40 b and c with fig. 30 b of *Storthyngura benti* (p. 113) and fig. 35 b of *S. furcata* (p. 119) it will be seen that also in the present species there is a prominent keel or rather crest separating the terminal face from the operculum. Owing to the strong downward inclination of the distal end of the pleon this crest does not, however, stand at right angles to the longitudinal direction of the operculum, but has become almost parallel to it. The median part of the crest, when seen from the side (fig. 40 b), is shaped like a tongue and bent a little forwards. The uropods are inserted in a depression on each side of the dome-shaped terminal face.

Antenna 1 (fig. 40 d) is of the same general appearance as in *madseni,* but the first segment is only as broad as long, and the antero-interior corner is more prominent; the shape is very near to that of *E. cornuta* G. O. Sars. Segment 2 is relatively longer and more slender, but this may be a sexual difference like the one found in *cornuta* (HANSEN 1916, pl. 12, 8 b-d).

Antenna 2 as in *madseni.*

Right mandible (fig. 41 a) has the ordinary shape of the genus, i. e. no triangular process as in *madseni.* The cutting edge has four small teeth of which two are terminal. There are several slender spines in the spine-row, but they are set so close together that they cannot be counted even at the greatest magnification. The molar process is very prominent.

Maxilliped (VANHÖFFEN'S fig. 118 c) is considerably broader than in *madseni.* There are three coupling hooks in the right and presumably only two in the left maxilliped. The penultimate segment of the palp is unusually broad and short. The epipodite has an incision on the inner side of the apex which thus forms a conspicuous process. This is not found in any other species of *Eurycope* except in the Kermadec specimen of *nodifrons* (fig. 38 d, p. 125) where there is a similar, but much smaller, incision or rather bend but no conspicuous process.

Pereiopods. IV is totally lost and of I-III only basis is preserved. Basis of pereiopod I is somewhat longer than basis of II and III which are equally long. Pereiopods V and VI are almost identical (fig. 41 b), and VII is also of the same shape but one third smaller.

Female operculum (fig. 40 b and c) is egg-shaped in ventral view; when seen from the side it is almost rectangular and nearly three times longer than broad. The rounded protuberance found on the operculum of several other females of the species of *Eurycope* has here developed into a very prominent pointed process. On the lower surface there is a not very conspicuous keel stretching from this process towards the proximal margin.

Uropod (VANHÖFFEN'S fig. 118 b) is long and even more slender than in *madseni.* Exopodite one third of the length of the endopodite.

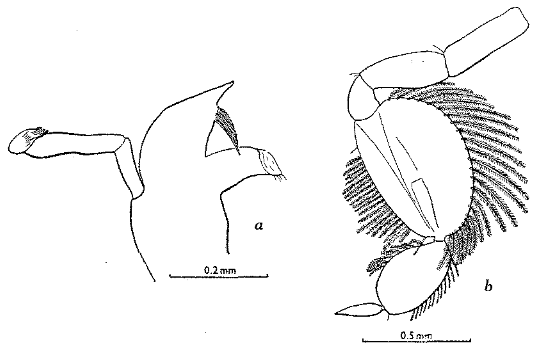


Fig. 41. *Eurycope ovalis* Vanhöffen ♀; type; a, right mandible; b, pereiopod VI.

Size: Total length is 3.2 mm, maximum width 1.6 mm.

Remarks:

In many respects this species is identical with *madseni.* The main similarities are:

1. Size and shape of head, except that no outer margin of the mandibles is visible from above or below in *ovalis.* – 2. Size and shape of pereion somites 1-4 and of epimeral plates. – 3. General appearance of somites 5-7 and of the course of the seam separating the fused fifth and sixth somites. –4. Shape of the first four segments of antenna 2 and of the squama. – 5. Shape of uropods.

The differences which are important enough to separate the two species are as follows:

1. Relative length of somites 5-7 as shown in table 3. I do not regard this point as very essential because the difference may be due to the fact that the type specimen of *ovalis* is juvenile so that these somites may not yet have obtained their final shape. – 2. Pleon is as long as broad, i. e. much longer than in *madseni.* Moreover, it has a bend on each side near the apex and is much more vaulted. On the ventral side there is in *ovalis* a crest between the operculum and the deeply downward bent terminal face while the ventral side of the pleon in *madseni* is quite flattened. – 3. First segment of antenna 1 much narrower in *ovalis.* – 4. Mandible without the strong process at the insertion of the palp and spine-row with very slender spines. –5. Maxilliped broader and with an incision near the apex of the epipodite.

The question about a relationship between the two species is rather intricate. Superficially they are very alike, even identical in shape of head and somites 1-4. On the other hand such fundamental features as shape of mandible and pleon show such pronounced difference that one might be tempted to place them even in two different genera. In my opinion the two species have been separated for such a long period that the mandibles of *madseni* and the pleon and the mandibular epipodite of *ovalis* have developed into the present shape which is unlike all other species of *Eurycope*. For some reason or other the head and most of the pereion somites have retained their original identical shape or have developed along parallel lines.

Distribution:

Known only from the Antarctic Indian Ocean (65°15′S, 80°19′E) at a depth of 3423 m.

Eurycope vicarius Vanhöffen, 1914

Eurycope vicarius Vanhøffen, 1914, p. 586, figs. 116 & 117 a-f.

Material:

Of the three specimens caught by the Gauss Expedition I have chosen the largest and best preserved female as the lectotype. This is also the specimen which was drawn by VANHÖFFEN in his fig. 116. It has half-developed marsupial plates.

Description:

Body in adults slender, three times longer than broad.

Head almost as long as broad and only a little narrower than the pereion somites. The frontal rostrum (fig. 42b) is small and concave at the end which slopes somewhat downwards as in *E. inermis* Hansen. On the antero-lateral corners the frontal seam is furnished with six short spines.

Pereion somites 1-4 (VANHÖFFEN'S fig. 116) are equally broad and rather short, together a little more than two thirds of somites 5+6. In the adults the antero-lateral corners of somites 1 and 2 are rounded while in somites 3 and 4 they have a process as seen in the figure. The epimeral plates are well developed. The anterior half of each plate is pointed, and the posterior, rounded half is unusually broad so that it is clearly visible also in dorsal view.

Pereion somites 5-7 are rounded and almost smooth, with the anterior margin somewhat raised. Somite 5 is a little broader than 6, while the two somites are equally long and have their anterior and posterior margins parallel. Somite 7 is two thirds longer than 6 and has the posterior margin almost straight. The antero-lateral corners of all three somites have a broad process pointing forwards and

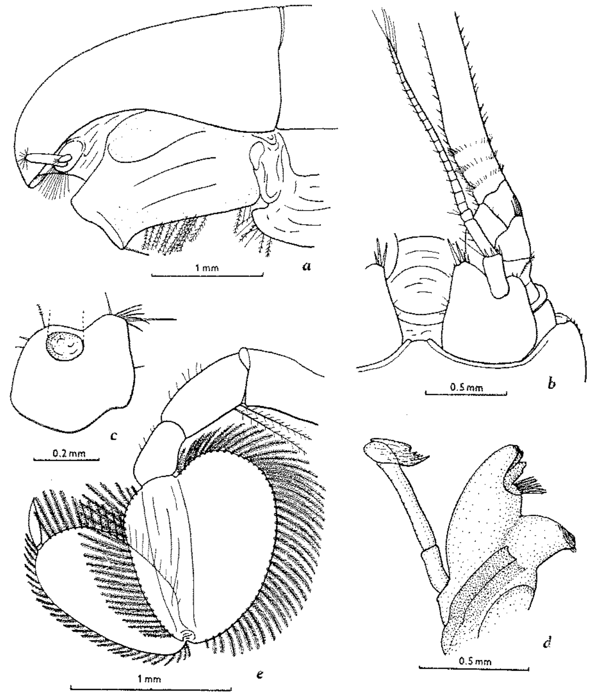


Fig. 42. *Eurycope vicarius* Vanhöffen; a, pleon and operculum of female type specimen; b, frontal projection and right antennae 1 and 2 of female type; c, left antenna 1 of male; d, left mandible of female type, seen from above; e, pereiopod VII.

a little upwards and furnished with a slender spine. Round the coxa especially of pereiopods V and VI there is a conspicuous ring which is clearly visible in lateral view.

Pleon is, when seen exactly from above, about as long as broad. It consists of two fused somites of which the anterior is extremely short and only one third as broad as the posterior. This is smooth and strongly vaulted both transversely and longitudinally so that the rounded apex is pointing downwards (fig. 42a). The cavity for the pleopods is almost squarish and not much smaller than the pleon.

Antenna 1 of the female (fig. 42b) has the first segment a little longer than broad, with the antero-interior corner strongly projecting and furnished with two long spines. Segment 2 is twice as long as broad, segment 3 of the same length, but only half as broad. The flagellum is a little longer than the peduncle and has about twenty segments.

As in *E. cornuta* (HANSEN 1916, pl. 12, 8b-d) there is some variation in the shape of the first segment of antenna 1. In the male (fig. 42c) it is broader than long and with considerably less projecting antero-lateral corners. Segment 2 and the rest of the antenna were unfortunately lost.

Antenna 2 has a squama which is as broad as long and is furnished with three long spines on the blunt

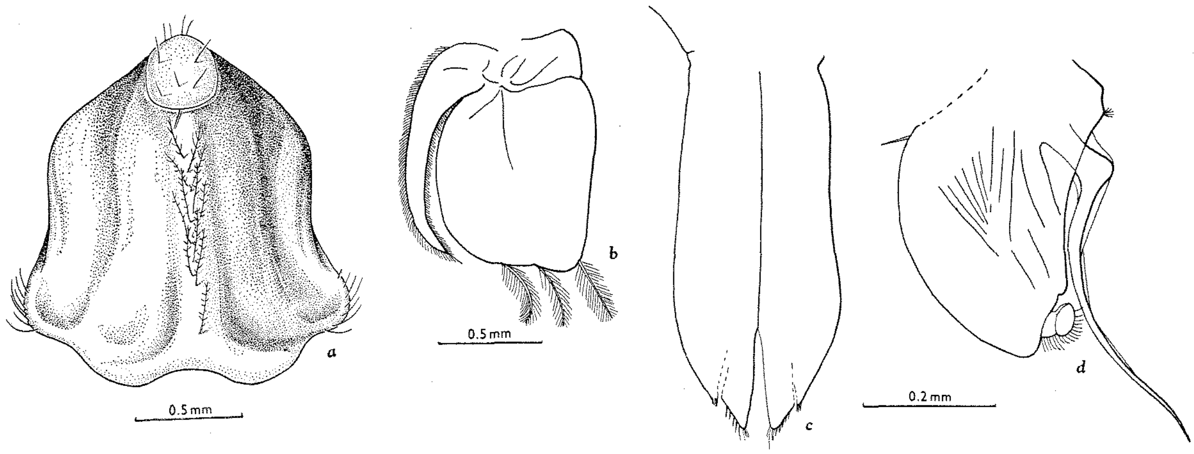


Fig. 43. *Eurycope vicarius* Vanhöffen; a, operculum of female type specimen, seen from below; b, pleopod 3 of female; c, pleopoda 1 of male; d, pleopod 2 of male.

apex. The proximal end of segment 5 seems to have a secondary segmentation (fig. 42 b) lined with short, closely set hairs. Segment 5 is more than three times as long as the first four segments combined, segment 6 is again almost one third longer than 5 and the flagellum is almost twice as long as 5+6. The entire antenna 2 is exactly twice as long as the whole animal.

Left mandible (fig. 42 d) has two very stout and blunt teeth on the cutting edge. The movable lacinia is much more feeble than the incisive part and has three small, blunt teeth on the end. There are six or seven spines in the spine-row and the molar process is short and stout. Along the upper surface of the proximal half of the mandible there is an oblique ridge with a very sharp edge.

Maxilliped is in accordance with VANHÖFFEN's fig. 117 a. Second segment is less than one and a half times longer than broad. The epipodite has the same characteristic shape as in *cornuta, producta, brevirostris,* and *inermis,* but differs in having the projection on the outer margin broader and more rounded, as shown in fig. 44 d.

Pereiopods I and III are shown on VANHÖFFEN's fig. 116; the figure is correct except that basis of all four anterior legs are equally long and slender.

Pereiopod VII (fig. 42 e) has a comparatively wide propodus, which is more than half the width of carpus.

Female operculum (figs. 42 a & 43 a), when seen from below, is almost rectangular. The median keel ends posteriorly in a peculiar, straightly cut off area which is oval in shape and unique within the genus. It substitutes the rounded protuberance found in many other *Eurycope* species, for instance *inermis* and *nodifrons*. Besides the median keel there are on the lower surface two longitudinal, low convexities, and the anterior margin as well as the rounded corners are also somewhat raised. (Concerning variation in female operculum see below).

Pleopod 3 of female (fig. 43 b) has the second segment almost squarish.

Male operculum (of the only male) had been mounted on a slide and was not very well preserved. The outline of *pleopoda 1* is given in fig. 43 c which shows that their length is 2.3 times their total width. The distal end has two lobes, but no more details than shown in VANHÖFFEN's fig. 117 d could be seen. *Pleopod 2* (fig. 43 d) is almost semicircular in shape with a very long and slender copulatory organ which has the segmentation very near the base of the pleopod.

Uropod (fig. 42 a) with a short and very broad basal segment crowned with a row of long setae. Endopodite three times as long as exopodite.

Size: The largest female (with half-developed marsupial plates) is 8.8 mm long and 2.8 mm broad. The male is 5.0 × 1.6 mm.

Variation:

Together with the female and male one more female was caught which is probably juvenile and differs from the female type in having the anterolateral corners of pereion somites 3 and 4 rounded. Further, the shape of operculum is oval rather than squarish. Almost in the centre of its lower surface the median keel divides into two divergent keels. The triangular area between these corresponds to the characteristic oval, straightly cut off area in the adult. The shape of the first segment of antenna 1 is half way between that of the adult female and male. In all other respects the two females are identical.

Remarks:

VANHÖFFEN pointed out the similarity between *vicarius* and *cornuta* G. O. Sars. Still greater is, however, the accordance with *inermis* (HANSEN 1916, p. 142-144 and pl. 13, 2 a-i). A study of the rich material of this species in the Copenhagen Museum[1] shows that the shape of head, frontal projection, and pereion somites is quite identical except that the body of *inermis* is relatively broader than that of *vicarius*. The pleon is also somewhat broader and more rounded posteriorly in *inermis*, but its height is the same in the two species. *E. inermis* has more produced antero-lateral corners on the first segment of antenna 1, its shape is the same in the two sexes, and segment 3 is comparatively longer. The mandibles of *inermis* are longer and more slender, the cutting edge has three-four rather pointed teeth instead of the two stout and blunt ones in *vicarius*, etc. The varying shape of the epipodites of the maxillipeds is shown in fig. 44 b and d.

The greatest difference is to be found in the shape of the female and male opercula. The former, when seen from below, is triangular in shape in *inermis* and almost squarish in *vicarius*, and the characteristic oval area on the median distal part of the latter is substituted by a blunt, projecting widening of the median keel in *inermis*, as shown in HANSEN's fig. 2 k. At the same time, the median keel in *inermis* is much sharper and quite naked. The male pleopoda 1 in *inermis* are narrower and constricted in the middle, being broadest at the base. The terminal lobes seem to be almost equal in the two species. Much differing are, however, the second pair of pleopods. In *vicarius* the plate is almost semicircular with a very long copulatory organ. In *inermis* the shape of the plate is almost triangular with a broad and rounded outer and a pointed distal corner which has concave margins; the copulatory organ has the second segment only half as long as the plate and it only reaches the apex (HANSEN's fig. 2 h).

Thus, the differences seem to me to be sufficient to distinguish the two species which must, however, be very closely related.

From *brevirostris* it differs in being much more slender, in shape of pleon, rostrum and epipodite of maxilliped as well as in the very different female and male opercula and uropods.

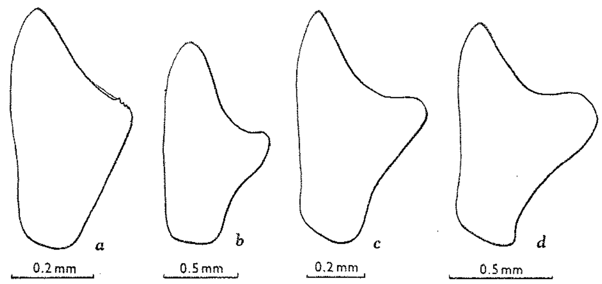


Fig. 44. Epipodite of left maxilliped in four species of *Eurycope;* a, *E. gaussi* n.sp.; b, *E. inermis* Hansen; c, *E. galatheae* n.sp.; d, *E. vicarius* Vanhöffen.

The reason for separating *vicarius* from the two new species, *gaussi* and *galatheae*, will be discussed in connexion with the description of these species.

Distribution:

Known from one locality only in the Antarctic Indian Ocean (65°15′S, 80°19′E) at a depth of 3423 m.

Eurycope brevirostris Hansen, 1916

Eurycope vicarius Vanhöffen, 1914, p. 586 (pars).
Eurycope brevirostris Hansen, 1916, p. 146, pl. 13, 5 a-i.

When studying the material labelled by VANHÖFFEN as *E. vicarius* it struck me that not only were the five smaller specimens relatively broader than the adult, but the pleon was at the same time broader than long, semicircular in shape and flattened, the frontal rostrum was comparatively longer, the female operculum differently shaped, and the exopodite of the uropod was two thirds of the endopodite. These specimens could therefore hardly belong to *vicarius*, nor could they be reckoned to the two other antarctic *Eurycope* species of a similar appearance *(crassa* and *antarctica)* because of shape of rostrum, maxilliped, etc.

By comparison with the type material of HANSEN's *E. brevirostris* from the Ingolf Expedition these five antarctic specimens show a remarkable agreement with this species, so close that I could see no reason for describing them as a new species.

The ratio between length and width of *vicarius* and the five specimens of *brevirostris* from the Gauss as well as ten from the Ingolf is given in table 4. It is seen that while *vicarius* is at least three times as long as broad, *brevirostris* is at most 2.7

1. As part of the examination of the material of *E. inermis* Hansen I have chosen a female, 8.3 mm long, from Ingolf St. 120 (with altogether 7 females and 1 mutilated male) and 1 male, 9.2 mm long, from Ingolf St. 103 (with altogether 5 females and 5 males) as lectotypes; they have been deposited in the type collection of the Copenhagen Museum.

Table 4. Relative length and width in *Eurycope vicarius* Vanh. and *E. brevirostris* Hansen from the Gauss and the Ingolf Expeditions.

	Sex	mm		Length/width	
		Length	width	Total animal	pleon
E. vicarius	♀	8.8	2.8	3.0	1.1
	♂	5.0	1.6	3.1	> 1[1]
	♀	3.7	1.2	3.2	1.1
E. brevirostris Gauss-Exp.	♀	2.6	1.0	2.6	0.8
	?	2.1	0.9	2.3	0.8
	♀	1.7	0.9	1.9	0.8
	♀	1.6	0.6	2.7	0.8
	♀	1.4	0.8	1.8	0.7
E. brevirostris Ingolf-Exp.	♀[2]	2.7	1.2	2.2	0.7
	♀[3]	2.6	1.1	2.3	0.7[4]
	♀[3]	2.5	1.1	2.2	0.7
	♀[2]	2.3	1.1	2.0	0.7
	♂	2.2	1.0	2.2	0.7
	♂	2.1	1.0	2.2	0.6
	♂	1.9	0.9	2.1	0.7
	♀	1.8	0.8	2.1	0.7
	♂	1.6	0.8	2.1	0.6
	♂	1.3	0.6	2.2	0.6

1. Pleon a little mutilated so that an exact ratio cannot be given.
2. With fully developed marsupial plates.
3. Ovigerous.
4. This female from Ingolf St. 138 was chosen as lectotype; it has been deposited in the type collection of the Copenhagen Museum.

times longer than broad and preferably only twice as long as broad. The variation in length/width is, however, considerably greater in the Gauss than in the Ingolf material of the latter species.

The difference between *brevirostris* and *gaussi* n.sp. is discussed below.

A careful study of the Gauss and the Ingolf materials of *brevirostris* revealed the following differences:

1. Pleon a little more rounded in the Gauss than in the Ingolf material even if it in direct dorsal view is somewhat more rounded in the latter material than can be seen from HANSEN's fig. 2a.

2. Antenna 1 has the antero-interior corner on segment 1 somewhat more projecting in the Gauss material (almost as much as in *inermis*).

3. Mandibles are – although of the same type – somewhat different in stoutness, the Gauss mandible being more slender, especially the molar process, and with three spines in the spine-row instead of four in the Ingolf specimens.

4. Carpus of pereiopods VI and VII a little more slender in the Gauss material.

5. Exopodite of uropod only two thirds of endopodite in the Gauss specimens – instead of four fifths in the Ingolf material.

As a matter of fact, nothing definite can be said about the identity before males have been obtained from the Antarctic. However, the females from the North Atlantic and from the Antarctic agree in all major features (frontal projection, relative size of pereion somites and pleon, shape of mandibles and maxillipeds, shape of operculum). I do not, therefore, hesitate to regard them as belonging to the same species or at any rate to consider them very close to each other.

Distribution:

North Atlantic (between lat. 61° and 66° N and long. 8° and 28° W), from 887 to 1505 m depth and at temperatures from 4.5°C to ÷ 0.6°C; Antarctic Indian Ocean (65°15′S, 80°19′E) at 3423 m depth.

Eurycope gaussi n. sp.

Eurycope vicarius Vanhøffen, 1914, p. 586 (pars).

Material:

When examining the material labelled *Eurycope vicarius* Vanh., which I had borrowed from the Berlin Museum, I found that one specimen, caught at the Gauss Station of the German Antarctic Expedition 1901-1903, on 6. December 1902 could hardly belong to this species. Nor was it identical with any other *Eurycope* species and therefore had to be described as new.

Description:

Body (fig. 45a) of a peculiar shape, the anterior half being one fourth narrower than the posterior and asymmetrically connected with it. At first it seemed probable that the animal had been captured while in moult,[1] but after having cleared it with methyl benzoate I could see no trace of a new integument under the old one. On the contrary, the clearing showed that the animal, when seen from below (fig. 45b), in a remarkable way had healed what seems to have been a former injury. In fig. 45b is indicated the pattern of very fine stripes on the inte-

1. HULT (1942, p. 131) observed moulting in *Eurycope mutica*. The integument of the posterior part was shed first and 24 hours later the head and the four anterior somites were moulted.

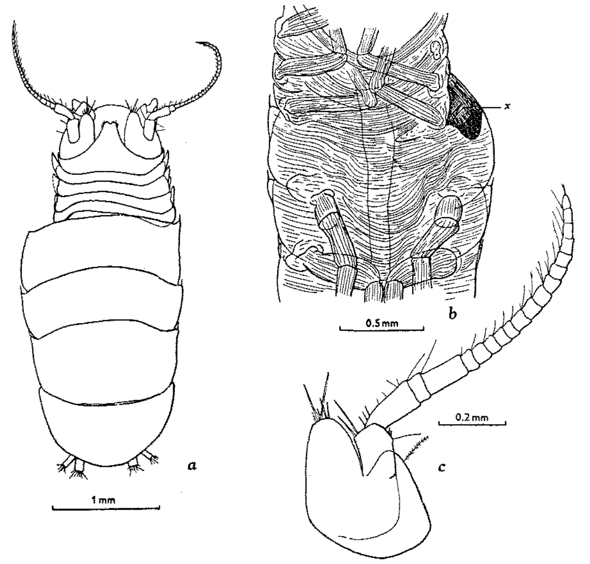


Fig. 45. *Eurycope gaussi* n. sp. ♂; type specimen; a, dorsal view; b, pereion somites 2-6 from below; c, right antenna 1.

gument of the lower surface. Their irregular course on the left part (right in the figure) of pereion somite 5 shows the locality of the supposed injury. On the left side of the animal the antero-lateral margin of somite 5 is strongly vaulted over the postero-lateral margin of somite 4, leaving a rounded cavity the bottom of which is covered with an integument without any pattern (× in fig. 45b). According to the asymmetrical structure the intestine has a bend at the transition between somites 4 and 5. Nothing seems to speak in favour of the first four somites being normally much more narrow than the three succeeding ones, like in *E. beddardi* (Bonnier 1896, pl. 33, fig. 3a). Owing to the peculiar shape of the body it is impossible to say anything exact about the ratio between length and width. In the present specimen it is 2.3, while in the type of *vicarius* it is 3.0. It is, however, more correct to compare length/width of pereion somites 5-7 + pleon with the same ratio in *vicarius*. This gives a ratio of 2.2 in *vicarius* and only of 1.8 in *gaussi* which seems to identicate that also normally shaped specimens of the latter species are relatively broader than *vicarius*.

Head with a conspicuous frontal projection the dorsal surface of which is slightly concave to near the apex, where it becomes groove-shaped and continues in a median ridge which runs vertically downwards to the clypeus, at right angles to the horizontal rostrum. Each of the raised margins has three small spines near the bend. Laterally, the distance between the frontal seam and the anterior margin of somite 1 is much shorter than in *vicarius*.

Pereion somites 1-4 are equally long and increasing in width from 1 to 4. They are shorter than in most other species of *Eurycope*. The posterior ones have the front margin fairly convex. Epimeral plates of somites 3 and 4 are rather small.

Pereion somites 5-7 are strongly vaulted and quite smooth. Somite 5 is a little longer than 6 and two thirds as long as 7. The antero-lateral corners as in *vicarius*, but each with a slender spine.

Pleon consists of an extremely short anterior segment and a large posterior one which is only three fifths as long as broad, when seen exactly from above. Towards the end it is bent as much downwards as in *vicarius*. In direct dorsal view the anterior margin is almost straight. The cavity for the pleopods is rounded and one third longer than broad.

Antenna 1 (fig. 45c) has on the first segment a very projecting antero-interior lobe which is longer than broad. There is no visible outer lobe. The whole segment is somewhat longer than broad. The third segment is broader than usual, almost as broad as the second. The flagellum has 17 segments.

Antenna 2 has a small squama which is shorter than half the width of segment 3. The majority of the antenna is lost.

Left mandible has a very broad cutting edge with two rounded teeth which are seen from the side in fig. 46a. The movable lacinia is also broad and has four minute tubercles along the straightly cut off, distal end. There are only about four spines in the narrow spine-row. The molar process is very stout. There is the same sharp-edged ridge on the upper surface of the mandible as in *vicarius*. The palp is stouter than is usually the case in *Eurycope*. Its first segment is broad and furnished with a row of short spines along the lower margin.

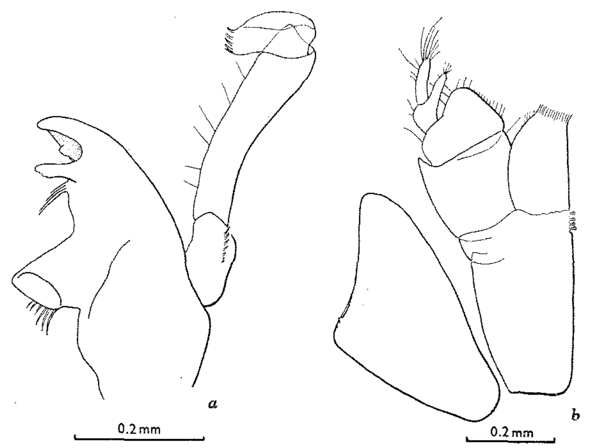


Fig. 46. *Eurycope gaussi* n. sp. ♂; a, left mandible; b, right maxilliped.

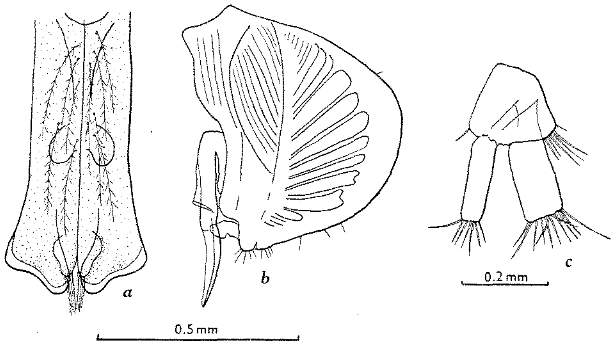


Fig. 47. *Eurycope gaussi* n.sp. ♂; a, pleopoda 1 from outside (ventral view); b, pleopod 2; c, uropod.

Maxilliped (fig. 46 b) is very near to that of *vicarius*, but the epipodite is rather different (fig. 44 a). The projection on the outer margin is small and subacute and of the same shape as in *producta*. On its distal margin there are a few, low teeth.

Pereiopods are all present. II, III and IV are quite equal and differ from I in having propodus twice as long and dactylus four times as long, while the proximal segments are almost equally long. A comparison between pereiopods I and III in *vicarius* and *gaussi* shows that merus and dactylus of both legs are about one and a half times longer in *gaussi*, while ischium of pereiopod III is one and a half times longer in *vicarius*. The remaining segments show slight differences only, and the same applies to the natatory legs.

Male pleopoda 1 (fig. 47 a) are subparallel, with projecting, rounded corners near the distal end. This is somewhat raised and split up in two pairs of lobes, a broader outer pair which is naked and a somewhat narrower and shorter median pair which is furnished with a bunch of fine hairs. Halfway between base and apex a pair of low, hook-like protuberances is found on the dorsal (inner) side of the pleopods. The surface of the pleopods has several scattered, long and feathered hairs.

Pleopod 2 (fig. 47 b) is almost as broad as long, with the inner margin of the plate somewhat concave and a rounded projection just proximal to the slender coupling hook. The copulatory organ is short and thick, the second segment being only about half as long as in *vicarius*.

Uropod (fig. 47 c) has a broad and almost triangular basal segment which is shorter than the equally long endo- and exopodites. The former is almost twice as broad as the latter.

Size: Total length is 3.3 mm and largest width 1.4 mm.

Remarks:

Some of the differences between *gaussi* and *vicarius* were pointed out in the above description. They are – together with other differences – summarized in table 5. In shape of body, epipodite of maxilliped, second male pleopod, and the uropod *gaussi* resembles *brevirostris*, but the vertical ridge connecting the rostrum and clypeus, the short lateral parts of the head, the downward bent distal part of the pleon, the shape of antenna 1, the palp of the maxilliped, and especially the very differently shaped male pleopod 1 serve to separate them. Also *inermis* and *complanata* have similarities with *gaussi* in shape of body, especially the pleon, and in other features. Here again, however, pleopoda 1 are quite different, and the same applies to the mandibles, the uropods, etc., and to pleopod 2 in *inermis*.

Distribution:

Antarctic Indian Ocean (66°02′S, 89°38′E) at 385 m depth.

Table 5. Differences between *Eurycope vicarius* Vanhöffen, *E. gaussi* n. sp., and *E. galatheae* n. sp.

	E. vicarius	*E. gaussi*	*E. galatheae*
Ratio between length and width of body	3.0–3.2	c. 2.3	3.0
Ratio between length and width of pleon	1.0	0.8	1.0
Cavity for the pleopods	almost squarish	rounded	almost squarish
Lateral projection on epipodite of maxilliped	big, very broad	small	big, broad
Relative length of merus and dactylus of prp. I	0.7	1.0	–
Relative length of merus and dactylus of prp. III	0.7,0.6	1.0	–
Relative length of ischium of prp. III	1.0	0.6	–
Distal lobes on male pleopoda 1	inner lobe the longer	outer lobe the longer	equally long
Second segment of copulatory organ	longer than plate	$^2/_3$ of plate	$^3/_5$ of plate
Exopodite of uropod	$^1/_3$ of endopodite	as long as endopodite	$^1/_4$ of endopodite

Eurycope galatheae n. sp.

Material:

St. 651, Kermadec Trench (32°10'S, 177°14'W), 6960-7000 m, 16. Febr. 1952. Gear: herring otter trawl. Bottom: brown clay with pumice. Bottom temperature: 1.3°C. – 1 male without head + posterior half of one more specimen without pleopods.

Description:

Body (fig. 48a & b) as slender as in *vicarius,* i. e. about three times longer than broad, provided the missing head has about the same dimensions as in *vicarius.*

Head absent, only the maxillipeds were preserved.

Pereion somites 1-4 of the same length, but increasing in width from 1 to 4. Antero-lateral corners of the anterior somites rounded and all corners without processes. Epimeral plates of moderate size.

Pereion somites 5-7 like in *vicarius.*

Pleon is as long as broad and somewhat higher than in *vicarius.* It has the distal part bent downwards. The cavity for the pleopods is almost squarish, only slightly broader than long.

Maxillipeds are both without the palp. The epipodite (fig. 44c, p. 132) resembles that of *vicarius,* but the lateral lobe is narrower.

Pereiopod VII (fig. 49a) is the only leg present. Carpus is like that of *vicarius,* but propodus is somewhat narrower and the lateral margins are subparallel.

Male pleopoda 1 (fig. 49b) have a conspicuous convexity not far from the distal end which is split up in two equally long lobes (as in *furcata*). The outer lobe is somewhat broader than the inner one; both lobes have a terminal tuft of thin hairs. Like in *gaussi* there is on the dorsal (inner) side of the pleopods a pair of low, hook-like protuberances halfway between the base and the apex.

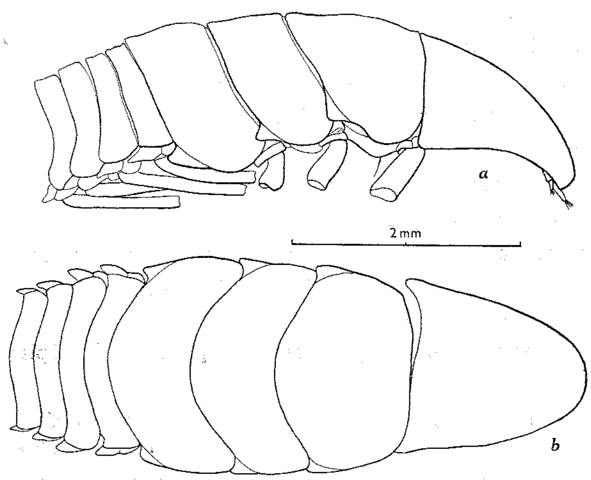


Fig. 48. *Eurycope galatheae* n. sp. ♂; type specimen from the Kermadec Trench, 7000 m; a, lateral view; b, dorsal view.

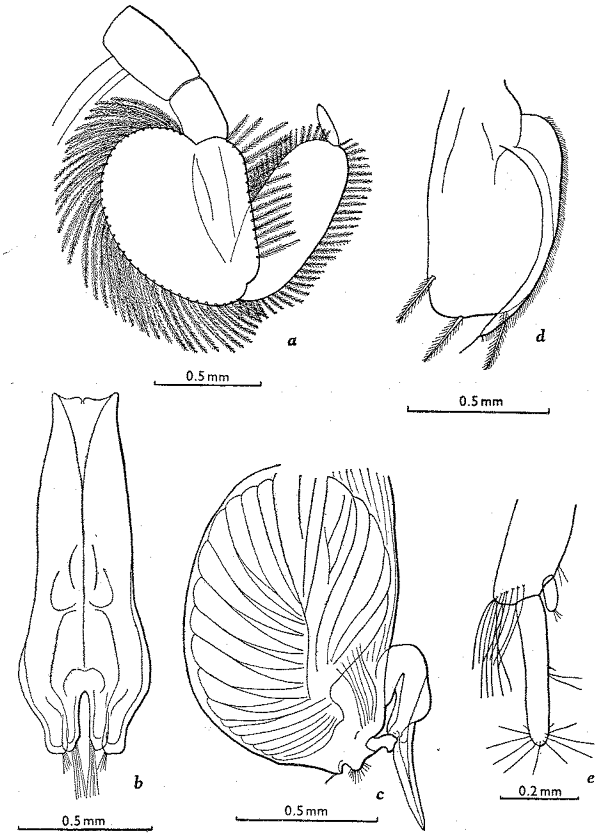


Fig. 49. *Eurycope galatheae* n. sp. ♂; a, pereiopod VII; b, pleopoda 1; c, pleopod 2; d, pleopod 3; e, uropod.

Pleopod 2 (fig. 49c) is almost oval in shape. On the inner, distal corner there is a rounded projection with thin hairs (as in *gaussi*). The copulatory organ is very short and thick, much shorter than in *vicarius* and *brevirostris* and even shorter than in *gaussi.*

Pleopod 3 (fig. 49d) has both rami longer and narrower than in *vicarius.*

Uropod (fig. 49e) has a rather long basal segment, furnished with a distal row of long hairs. The exopodite is only one fourth of the endopodite.

Size: Without head *E.galatheae* is 5.0 mm long. Since the length of the head in most *Eurycope* species is about one sixth of the whole length, the total length of the present male of *galatheae* was probably about 5.8 mm; the largest width is 1.9 mm.

Remarks:

It was with some hesitation that I based the description of a new species on a specimen without head. However, the unique shape of the male pleopods separates *galatheae* from any hitherto known species of *Eurycope*. Notwithstanding the absent head this species seems to be most nearly related to *vicarius*. Some of the differences were pointed out in the above description. A summary of the variation between *vicarius, gaussi* and *galatheae* is given in table 5.

Distribution:

So far known only from the Kermadec Trench NE of New Zealand, 6960-7000 m, 1.3°C.

2. Anthuridea

While all the hitherto mentioned Isopoda belonging to the trench fauna are representatives of the sub-order Asellota the following species is the only representative of Anthuridea, a sub-order which is considerably less abyssal than Asellota.

ANTHURIDAE

Leptanthura G. O. Sars

Leptanthura G. O. Sars, 1899, p. 47.
Leptanthura G. O. Sars, BARNARD, 1925, p. 149.

In his revision of the Anthuridae in 1925 BARNARD gave a good diagnosis of this clearly defined genus. It was based on SARS' original description with some alterations, caused by the greater number of species which BARNARD included in the genus. The present species fits well within the limits of *Leptanthura* except for two characters: firstly, antennae 1 do not have a brush-like flagellum in the male; this is, however, neither the case in *L. truncata* Richardson nor in *chiltoni* (Beddard); in both, the first antennae seem closely to resemble those of the present species; nor in *glacialis* Hodgson in which the flagellum is rudimentary. Secondly, the exopodites of the uropods are much narrower in the present species in which they do not meet in the middle. BARNARD (1925, p. 150) states in his description of *L. orientalis* that the exopodites are narrower than usual, but since he gives no figure and the uropods are missing in the type specimen (kept in the Copenhagen Museum) it is impossible to tell whether they meet in the middle or not in *orientalis*. I have not found these two varying characters of generic significance; in shape of body and pleon, of mouth-parts, pereiopods, etc. the present species agrees in almost all details with the other species of *Leptanthura*.

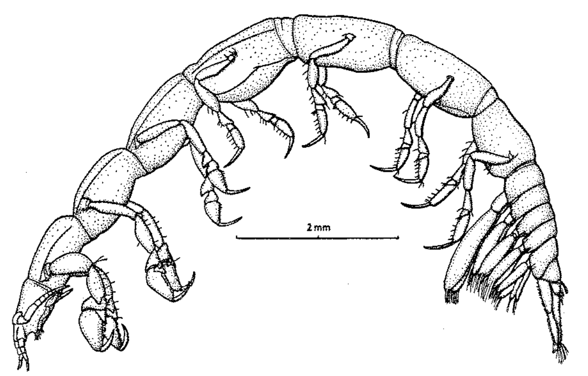


Fig. 50. *Leptanthura hendili* n. sp. ♂; type specimen from the Banda Trench, 6580 m.

Leptanthura hendili n. sp.

Material:

St. 499, Banda Trench (5°21'S, 131°17'E), 6580 m, 24. Sept. 1951. Gear: Petersen grab (bottom sampler) 0.2 sq.m. Bottom: greenish clay. Bottom temperature: 3.5°C. – 1 complete male.

Description:

Body (fig. 50) very elongated, almost fifteen times longer than broad.

Head (fig. 51 a) a little longer than broad with a straight posterior margin and a tiny rostrum at the base of the second pair of antennae. Eyes absent.

Pereion somites are narrower than in all other species, but of almost the same relative length as in

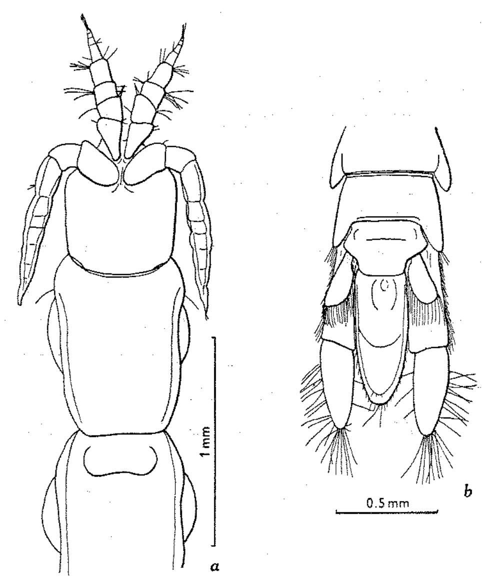


Fig. 51. *Leptanthura hendili* n. sp. ♂; a, head, pereion somites 1-2, and antennae; b, pleotelson and uropoda.

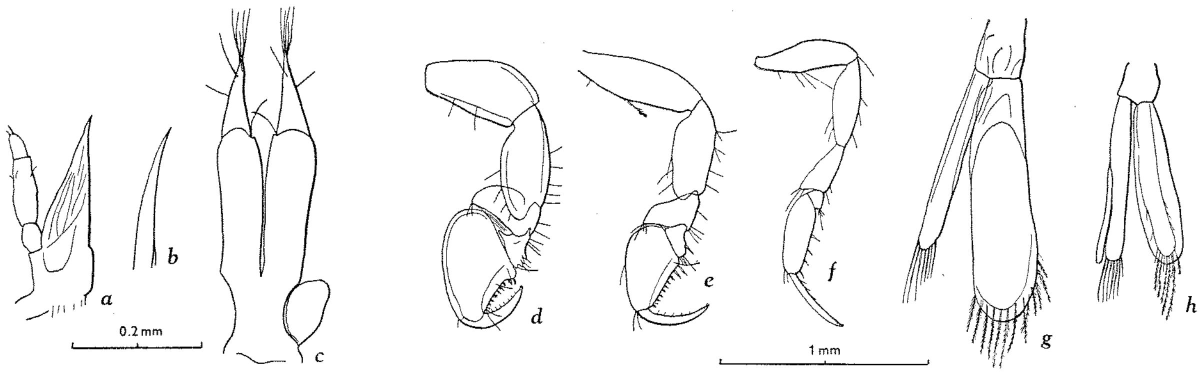


Fig. 52. *Leptanthura hendili* n. sp. ♂; a, right mandible; b, right maxilla; c, maxillipeds; d-f, pereiopoda I,II, and VII; g-h, pleopoda 1 and 2.

these, except *L. truncata*. Somites 1 and 7 are equally long, 2 is somewhat longer than these, 3 somewhat longer again, 4 and 6 equally long and one and a half times longer than 1 and 7; somite 5, finally, is the longest of all, i. e. almost twice as long as 1 and 7. The somites are broadest at the insertion of the pereiopods. A low, dorso-lateral keel is found on the four anterior somites. There are no ventro-lateral spines or processes on the posterior somite as in *truncata* and *tenuis*.

Pleon (telson included) is a little shorter than pereion somites 6+7. Like in *glacialis* the first and fifth somites are equally long and a little longer than those in between. When seen from above (fig. 51 b) the rounded epimera of each of the first five somites are clearly visible.

Telson is two and a half times longer than broad, slightly decreasing in width towards the rounded apex which has no notch. The telson thus differs from all the other species except *thori*, but it has no tuft of setae apically, only two moderately long setae.

Antenna 1 (fig. 51 a) is somewhat longer than the head. The number of segments amounts to about ten only, but cannot be stated exactly. The antenna is practically naked, as mentioned above.

Antenna 2 (fig. 51 a) has five segments in the peduncle. The second is the largest, the fifth the narrowest. The flagellum is very short and consists of four segments, decreasing in length towards the end. The shape of the antenna seems to be very near to that of *truncata* and especially to that of *chiltoni*, both of which also have antenna 1 very similar to the one found in *hendili*.

Mandible (fig. 52 a) was previously described only in *tenuis* G. O. Sars and *laevigata* (Stimpson); in *hendili* it differs from these in being regularly triangular. The palp is equal in the three species, i. e. with segment 2 more than twice as long as the almost equally long segments 1 and 3 and with two terminal setae.

Maxilla (fig. 52 b) is almost as in *tenuis* (Sars 1899, pl. 20).

Maxilliped (fig. 52 c) is of the typical shape of the genus, with three segments of which the second is by far the longest and has subparallel margins, except at the base where there is a concavity for the rounded epipodite.

Pereipod I (fig. 52 d) has almost the same shape as in *laevigata* (= *faurei*, Barnard 1914, pl. 29 B) and *glacialis*, i. e. with an exceedingly large and almost rectangular propodus. The rather scarce equipment with setae is also practically identical in *glacialis* and *hendili*; especially the palm of propodus has exactly the same row of highly specialized spines like those described by Hodgson (1910, p. 10) and aptly figured by Monod (1926, fig. 44 C). They resemble a bunch with a filiform seta which also in *hendili* seems to be inserted laterally to the apical tooth (fig. 53 a). There are more short setae along the inner margin of dactylus in *hendili* than in *glacialis*.

Pereiopod II (fig. 52 e) has a shape which is between that of *glacialis* and *tenuis*, i. e. the propodus is not nearly so rectangular (or even quadrangular) as in *glacialis*, nor is it so narrow and pointed as in *tenuis*. However, the equipment with setae and bunch-shaped spines on propodus (fig. 53 b) is very much the same in *glacialis* and *hendili*.

Pereiopod VII (fig. 52 f) is somewhat more slender than in the three other species in which it was previously figured. There are four short spines on the inner margin of propodus in this pereiopod as well as in the three preceding ones.

Pleopod 1 (fig. 52 g) is considerably longer and narrower than in *tenuis*, especially the inner ramus. The outer ramus is four times longer than broad and almost three times as broad as the inner ramus.

Pleopod 2 (fig. 52 h) is shorter in proportion to

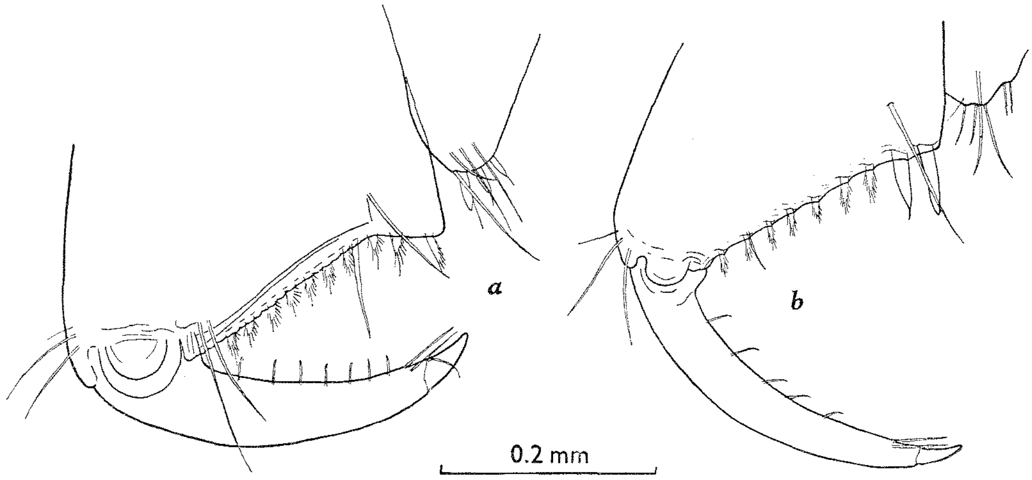


Fig. 53. *Leptanthura hendili* n. sp. ♂; a-b, inner margin of propodus and dactylus of pereiopods I and II.

pleopod 1, than is the case in *tenuis*. The shape is almost equal, the only difference being that the inner ramus is as long as the outer in *hendili*.

Uropod (fig. 51 b) has the endopodite somewhat longer than the telson. The second segment is shorter and a little narrower than the first and is rounded apically; it is shaped very much as in *tenuis*, but there are only a few scattered setae along the inner margin. The exopodite is short and narrow, only about half as long as the first segment of the endopodite; its width is two thirds of its length. Along the distal and inner margins are some very long and slightly plumose setae.

Size: Total length (to end of telson) is 11.3 mm and greatest width is 0.8 mm.

Remarks:

This species cannot be confused with any other species of *Leptanthura*, the shape of antennae 1, pleopods, telson, and especially the small exopodites of the uropods clearly separating it from the other species. It seems to be most closely related to *glacialis* with which it agrees in shape of pleon and pereiopod I, and in shape and number of the peculiar spines on propodus of pereiopods I and II. On the other hand, it greatly differs from *glacialis* in the shape of the telson (which resembles that of *thori)* and the antennae (which are like those of *chiltoni* and *truncata)*. Most of the other species of *Leptanthura* are, however, imperfectly described, and the range of variation within the single species of the genus is practically unknown so that it is still impossible to say anything definite about the relationship of *hendili*.

This species has been named after Mr. Leif B. Hendil, Secretary General to the Danish Expedition Fund.

Distribution:

So far known only from the Banda Trench west of New Guinea, at a depth of 6580 m and a temperature of 3.5°C.

C. GENERAL REMARKS

1. The deep-sea element of the Isopoda

Till now ten species of Isopoda have been described from depths greater than 6000 m[1], i. e. they are true hadal[2] species. Besides, three more species have representatives which have been able to penetrate into the hadal zone.

It might seem surprising that no less than twelve of these altogether thirteen species belong to the sub-order Asellota. However, in his great work on the deep-sea Isopoda of the Ingolf Expedition Hansen (1916) recorded altogether 59 species as representatives of the five sub-orders Flabellifera, Gnathiidea, Anthuridea, Valvifera, and Epicarida, while all the remaining 105 species belonged to the Asellota.

The same predominance of Asellota in the deep-sea appears from a list of the species of Isopoda occurring at depths greater than 3000 m, given by Nordenstam (1955, p. 212). This list includes al-

1. One species from the Swedish Deep-Sea Expedition (Nordenstam 1955) and nine from the Galathea.
2. The term hadal has been adopted for all members of the real trench fauna; the abyssal fauna is found between about 6000 m and about 3000 m (the latter limit also depending on the temperature being 4°C. or less).

together 41 Isopoda. In my opinion the following revisions and amendments are, however, necessary: The pelagic *Paramunnopsis oceanica* (Tattersall) was taken twice by the German Antarctic Expedition during vertical hauls from 3000 m depth to the surface; therefore it should be cancelled in a list of isopods from depths beyond 3000 m.[1] On the other hand, the list does not include the following eleven bottom-living species: Caught by the U.S.S. Albatross Expedition: *Janira pulchra* (Rich.) (3230 m), *Janirella lobata* Rich. (3230 and 3190 m), *Haploniscus excisus* Rich. (3230 m), *Heteromesus spinescens* Rich. (3340 m), *H. granulatus* Rich. (3230 m); species caught by the German Antarctic Exp.: *Janthopsis nodosa* Vanh. (3420 m), ? *Microprotus antarcticus* Vanh. (3400 m), and *Haploniscus antarcticus* Vanh. (3400 m); caught by the German Plankton Exp.: *Iolanthe decorata* Hansen (4000 m); caught by the Travailleur and the Talisman: *Heteromesus similis* Rich. (3000 m) and *Pseudanthura lateralis* Rich. (3200 m). Finally, the present report has – besides describing the hadal species – extended the vertical range of the following species beyond 3000 m: *Storthyngura pulchra* (Hansen) (to 6620 m), *Eurycope nodifrons* Hansen (to 7000 m), and *E. brevirostris* Hansen (to 3420 m).

According to this revision of NORDENSTAM's list, and including the hadal species, the various sub-orders are represented by the following numbers at these great abyssal and hadal depths:

Asellota:	53	species
Flabellifera:	2	–
Anthuridea:	3	–
Valvifera:	4	–

In other words, the Asellota constitute 86% of the Isopoda from depths greater than 3000 m.[2]

1. The Epicarid *Notophryxus longicaudatus* Vanh., *Microniscus ornatus* Vanh., and *Asconiscus simplex* G. O. Sars as well as *Paramunnopsis spinifer* (Vanh.) were also taken by the German Antarctic Exp. under the same conditions as *P. oceanica*, but are not included in NORDENSTAM's list. Nor are the two Epicaridea *Holophryxus giardi* and *Arthrophryxus beringanus* (RICHARDSON 1908 c) included; they were taken by the U. S. S. Albatross Expedition as parasites on *Gennadas borealis* Rathbun and *Eucopia australis* Dana, respectively, at a depth of 4900 m. In my opinion these two isopods should also be disregarded, since it is almost certain that the two species of prawns occur above 3000 m depth and thus have been caught while hauling the trawl from the very great depths.
2. Also the Russian deep-sea expedition to the Kurile-Kamtchatka Trench found exclusively Asellota at the greatest depths at which Isopoda were dredged, 7200-8400 m (ZENKEVITCH *et al.* 1954).

It is remarkable that the Anthuridea, a sub-order with principally littoral species and genera, includes a hadal species. However, firstly the sub-order counts two other species from depths greater than 3000 m and two more from depths between 2000 and 3000 m, and secondly it must still be taken into account that this being the very first major attempt at making known the hadal isopod fauna it is very likely that later investigations will find some representatives of the other sub-orders as well.

Within the Asellota nine genera had beforehand two or more representatives beyond 3000 m. It is interesting that only one of the hadal species belongs to a genus of its own (*Bathyopsurus* from the Swedish Deep-sea Expedition). All the other eight species belong to four of the nine genera with two or more abyssal species. This means that the already acknowledged deep-sea nature of these four genera has now become still more emphasized.

2. The distribution of the hadal genera and species

Vertical distribution and range of temperature of the genera found in the hadal zone.

In the following it is attempted to make a survey not only of the actual bathymetrical range of all the species belonging to genera with hadal representatives, but also of the range of temperature at which they occur. In some cases records of temperature were given by the expedition which collected the animals, and even if records older than about 40-50 years are not very reliable they should be exact enough for biological purposes. In other cases it has been necessary to acquire information about the temperatures from hydrographical results of other expeditions working in the same area. These records were taken from SCHOTT (1902, 1926 & 1935), DRYGALSKI (1927), SCHMIDT (1929), THOMSEN (1937), and EKMAN (1953). All such records as well as old records from the actual locality have been printed in italics in the following tables.

Ischnomesus.

Certainly the most homogeneous and best defined group within the Asellota is the Ischnomesini. I have therefore found it useful to include not only *Ischnomesus* in the table below, but also the other three genera of Ischnomesini. In the table is included the yet undescribed *Ischnomesus* spp. from the Galathea Sts. 663 (Kermadec Trench, 4410 m) and 575 (Tasman Sea, 3710 m), which were mentioned on p. 97.

Table 6 shows that except for *Ischnomesus bispinosus* – *Heteromesus greeni* and *I. spärcki* – *I. bruuni* the species of Ischnomesini range from about 1000 m to about 3000 m, according to our present knowledge. Apart from the two first named species none seems to occur at temperatures higher than some 5°C.

Table 6. Vertical distribution of Ischnomesini.
Available temperatures are given in °C. (the not fully reliable ones are in italics).

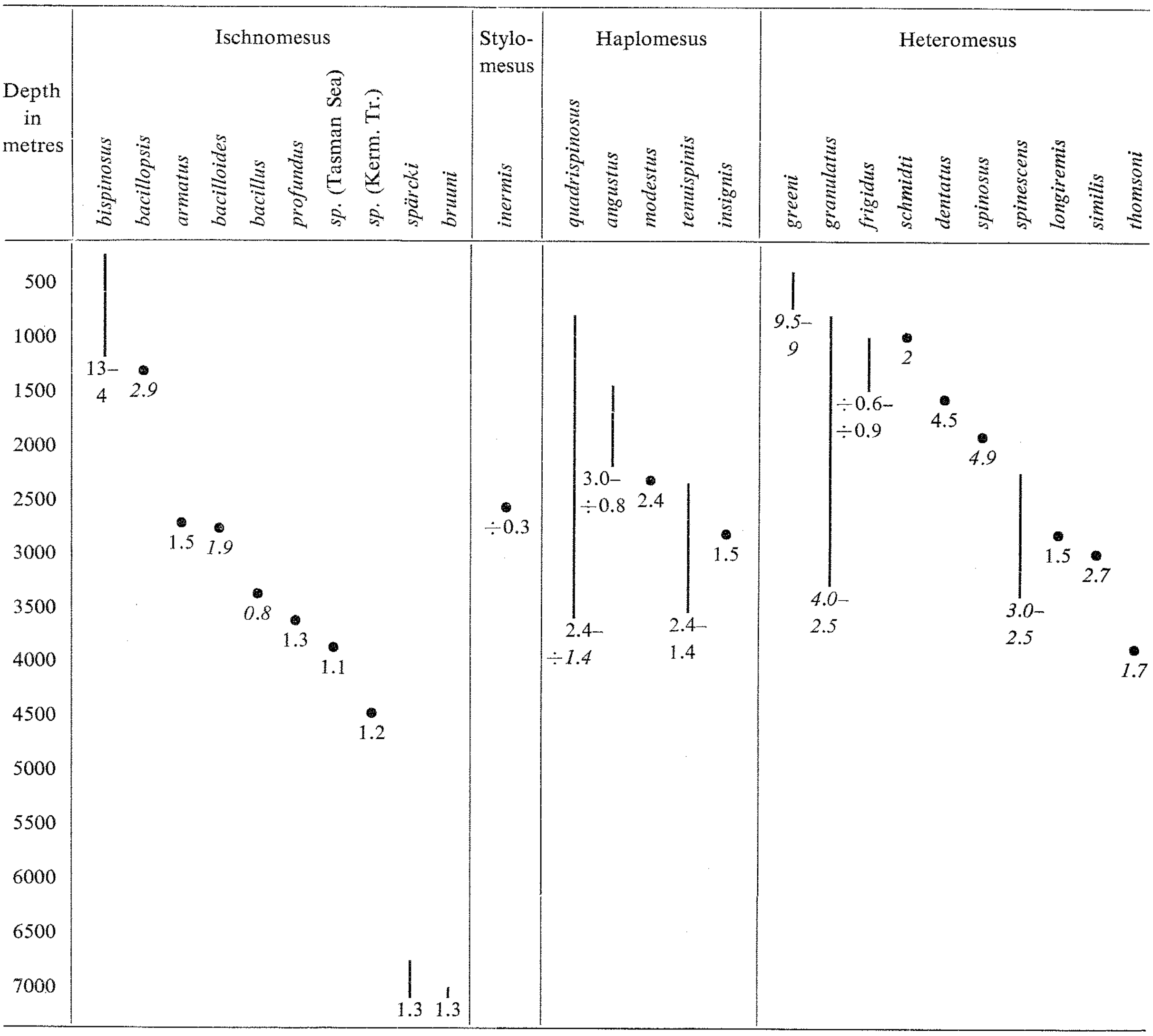
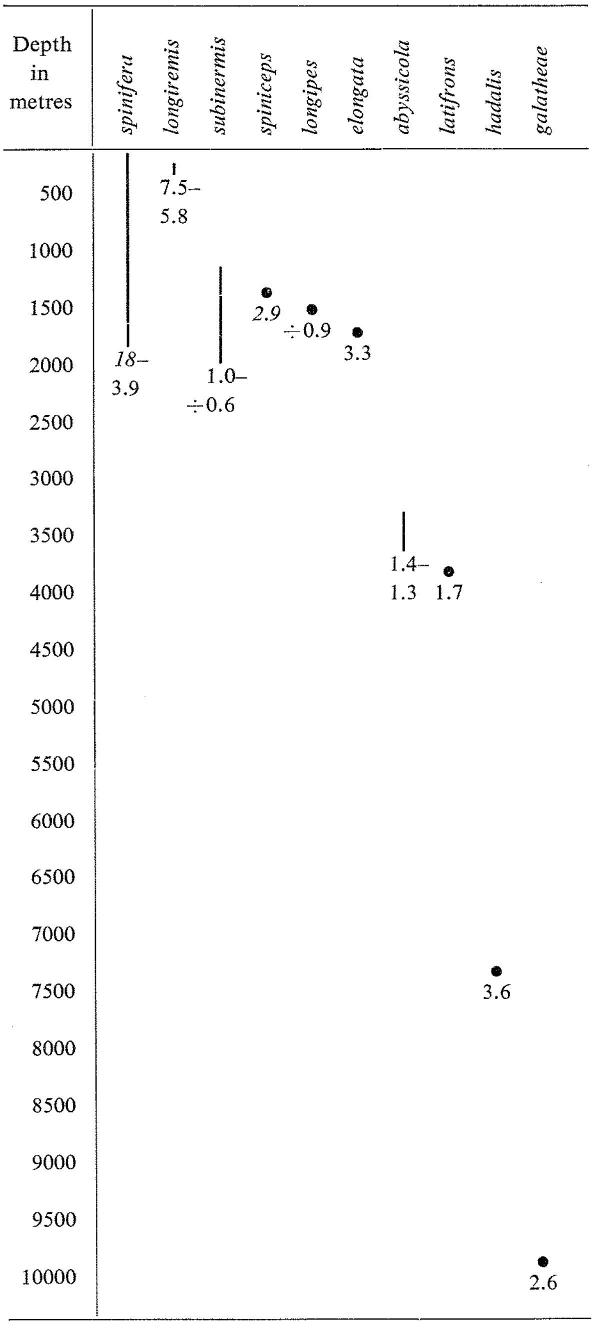


Table 7. Vertical distribution of *Macrostylis*. Available temperatures are given in °C. (the not fully reliable ones are in italics).



Macrostylis.

This genus which includes the deepest record of isopods has a vertical distribution as shown in table 7.

Also in this case a few species are known from shelf areas, while the majority range between depths of 1000 and 3500 m and temperatures below 4°C.

Ilyarachna.

This genus is not very well defined and possibly includes species which are not very closely related. Table 8 shows that *Ilyarachna* has considerably more shallow water representatives than the two preceding genera, more than half the species occuring at depths of less than 500 m. However, none of these are known from temperatures above 10°, and only three occur in water of more than 4°C.

Storthyngura.

In table 9 is given the vertical distribution of the well defined genus *Storthyngura*. It is seen that no species have so far been taken at depths of less than 400 m and only the antarctic *S. robustissima* is found above 1250 m depth. This is the most pronounced

Table 9. Vertical distribution of *Storthyngura*. Available temperatures are given in °C. (the not fully reliable ones are in italics).

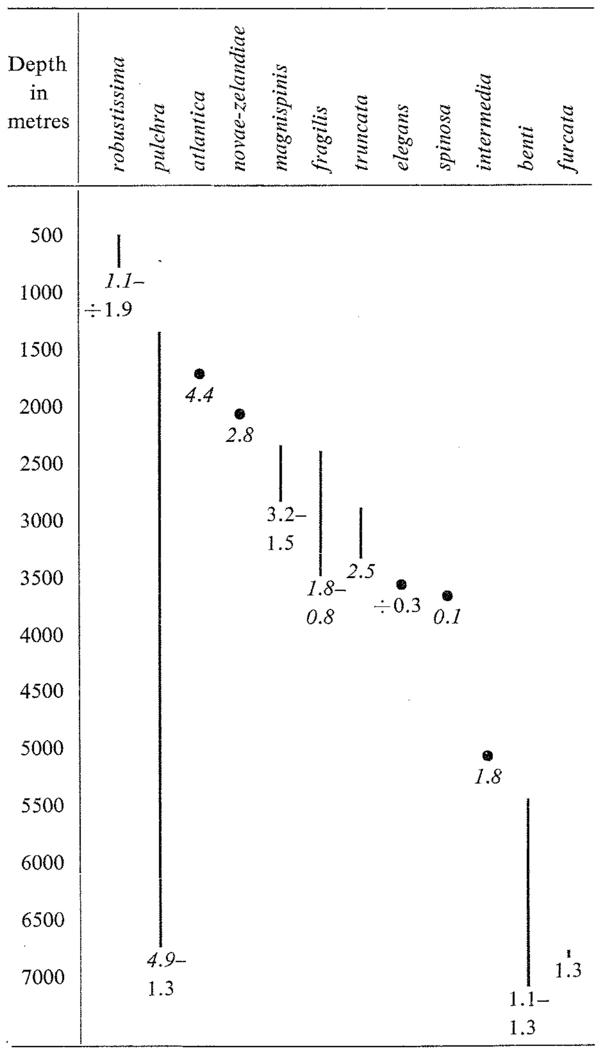
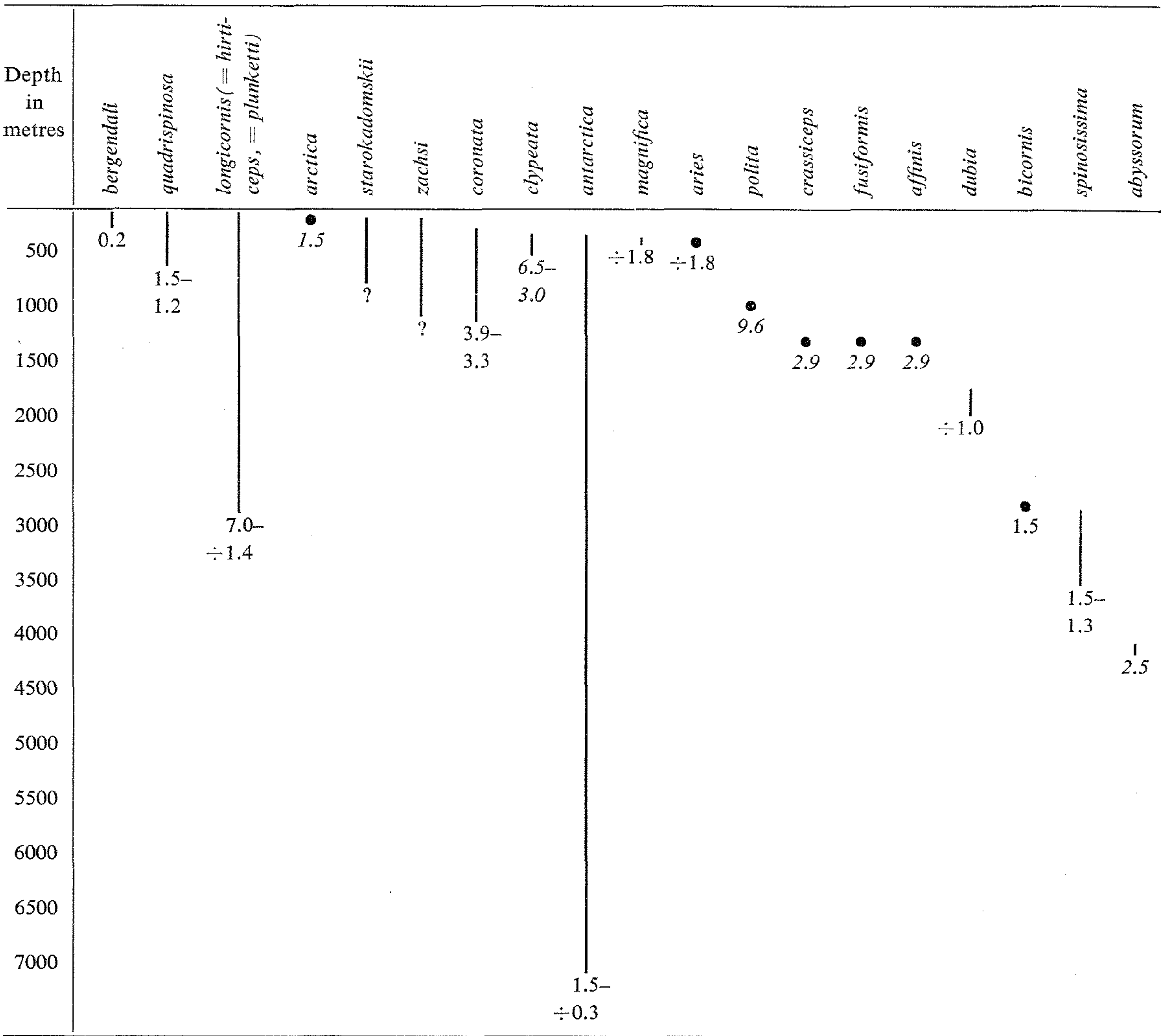


Table 8. Vertical distribution of *Ilyarachna*. Available temperatures are given in °C. (the not fully reliable ones are in italics).



deep-sea genus in question and at the same time within the Isopoda on the whole. Hitherto *Nannoniscus* was regarded as the most characteristic, polytypic deep-sea genus of this group. Even if four of the altogether sixteen species of *Nannoniscus* are known only from depths greater than 2000 m, five species occur at depths of less than 400 m, one of them even in shallow water in the Caspian Sea. No species of *Storthyngura* has been taken at temperatures higher than about 5°.

Eurycope.

As mentioned above, this genus is very rich in species and rather heterogeneous. As shown in table 10 it includes several species which are confined to the upper 500 m only or have at any rate these depths as part of their vertical distribution, even if the percentage of such species is not so high as in *Ilyarachna*. On the other hand, some of the species are definitely abyssal. Regarding the thermal conditions, altogether seven species have been taken at temperatures up to 9-10°. Six species do not occur in water of more than 7-7.5°; this upper limit is probably very reliable, being a result of HULT's careful investigations on the isopods of the Skagerrak (1942). Apart from a few species which occur at temperatures up to 4-5°, all the remaining 15 species (44%) have never been taken in water of more than 2-3°, and 21% never in water above 0°.

Table 10. Vertical distribution of *Eurycope*. Available temperatures are given in °C. (not fully reliable ones are in italics).

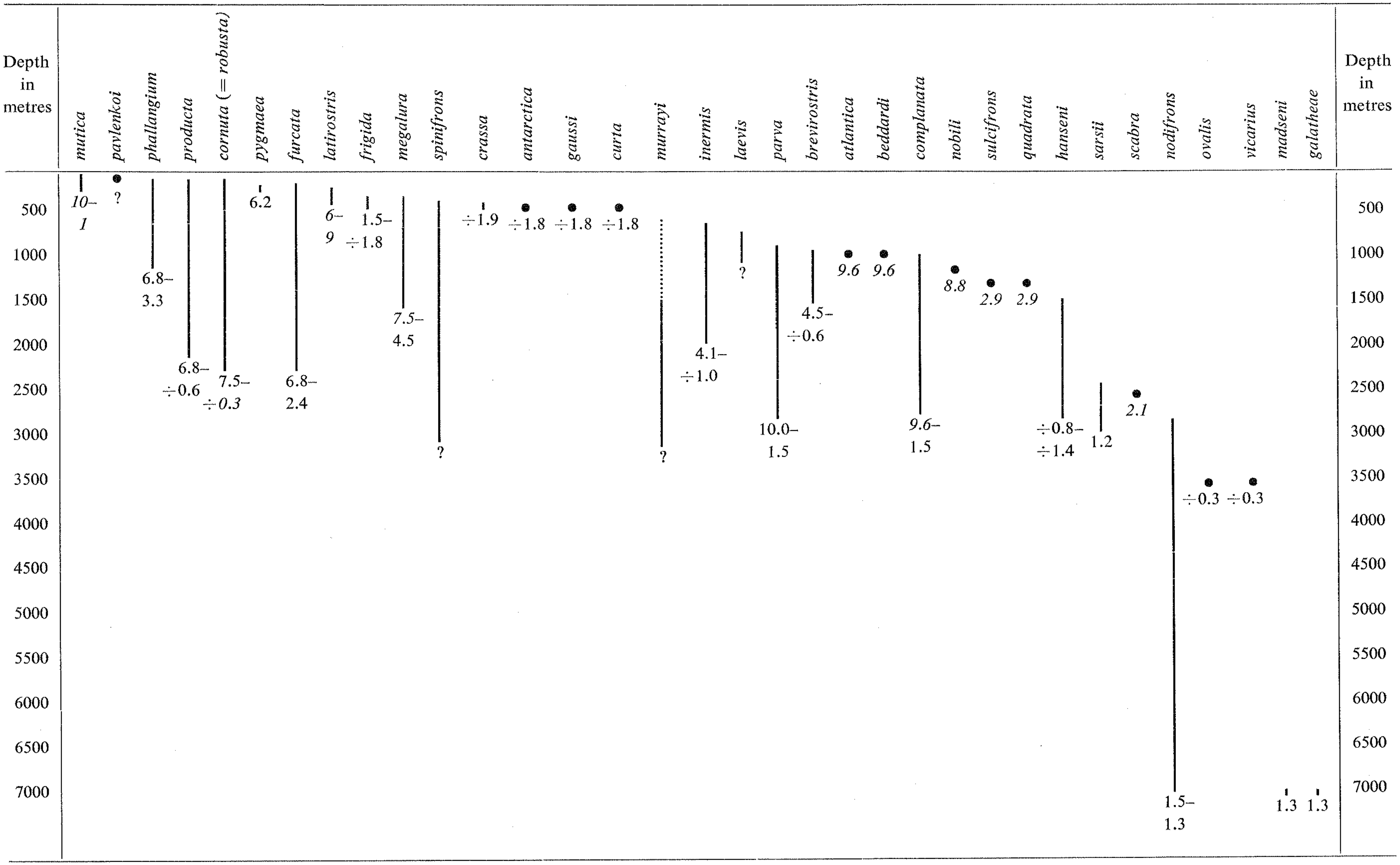


Table 11. Vertical distribution of *Leptanthura*. Available temperatures are given in °C. (not fully reliable ones are in italics).

Depth in metres	*orientalis*	*australis*	*crassicornis*	*diemenensis*	*laevigata*	*glacialis*	*tenuis* (= *affinis*)	*truncata*	*thori*	*chiltoni*	*hendili*
500	*29*	*25–15*	*25–15*	*20–10*	*18–10*	÷1.9					
1000								7	4.5		
1500							7.0–6.3			*4.4*	
2000											
2500											
3000											
3500											
4000											
4500											
5000											
5500											
6000											
6500											
7000											3.5

Leptanthura.

Table 11 clearly shows that this genus is not comparable to the five preceding genera of Asellota. Four species are littoral and three of them moreover tropical or subtropical, i. e. living in water which even in winter is above about 15°. As stated by BARNARD (1925), the genus is well defined, and at any rate one of the littoral species, *L. orientalis* (from Singapore), definitely belongs to this genus, while it is more questionary whether *diemenensis* and especially *australis* and *crassicornis* (from Port Jackson at Sydney) belong to *Leptanthura*. Only about half of the species occur at temperatures below 7° which is the lower limit for almost all species in the five other genera with hadal representatives. The temperature range within the genus is also much greater than in any of the preceding genera, covering from about + 29° to ÷ 2°.

If we consider the five genera of Asellota we find that in all of them except *Storthyngura* there are one or a few species which occur in shallow water of less than about 200 m depth. Most of these species have a comparatively great vertical distribution, going down to 1500-2000 m or even more. There are only a few exceptions. *Eurycope mutica* and *E. pygmaea* (*E. pavlenkoi* is very imperfectly known), *Macrostylis longiremis* and *Ilyarachna bergendali* and, to some extent, *I. quadrispinosa*.

Two of the shallow water species were taken at temperatures above 10°, but since they are boreal the winter temperatures at which they live are much less. The same is probably the case with several of the maximum temperatures of 7-8°, recorded for almost all the other shallow water representatives. It is very likely that these species reproduce in winter, when the temperatures are lower by 5-15° than during the summer.

The total number of species of the five genera of Asellota is 85. 78 % of these have so far only been known from depths greater than about 250 m, i. e. outside the shelf area. 54 % live exclusively outside the 1000 m curve and 36 % outside the 2000 m curve, i. e. are restricted to the abyssal and hadal regions. 21 % have only been taken at depths exceeding 3000 m, while 13 % are known only from depths greater than 4000 m. – When considering the lower limit of the 85 species we find that only 6 % are exclusively confined to the shelf area. 51 % do not go deeper than 2000 m, 69 % not deeper than 3000 m, and 87 % not deeper than 5000 m, while the remaining 13 % penetrate into the hadal zone of the trenches.

If we look at the temperature preference of the species of the five genera of Asellota we find that about two thirds of the species (66 %) have always been taken at temperatures below 3°, about half of them (51 %) below 2°, and 15 % have been taken only at negative temperatures. In fig. 54 are given the maximum and minimum temperatures recorded for the species of the five genera of Asellota as well as the temperatures of the species of *Leptanthura*, which – as mentioned above – do not follow the general pattern of the other genera.

It is rather difficult to say anything definite about the stenothermi of the present species of Asellota, because about half of them are known from one locality only. However, of the 39 species which have been recorded from more than one locality only 11 have a range of temperature of more than 4°. A few species have been collected at several localities, but always at nearly the same temperatures. This applies

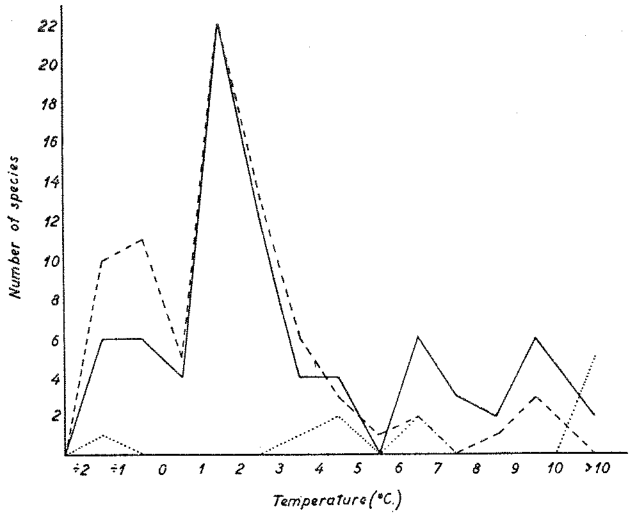


Fig. 54. Maximum (——) and minimum (- - - -) temperatures of the species of the five hadal genera of Asellota, and temperatures (· · · ·) of the species of *Leptanthura*.

to especially *Storthyngura pulchra* which is known from six different localities at depths between 1250 and 6600 m; the range of temperature is nevertheless only from 1.3° to about 4.9°C.

Vertical distribution of the hadal species.

When considering the vertical distribution of deep-sea animals it must always be kept in mind that our knowledge of this fauna rapidly decreases with increasing depth. The last word about the vertical distribution of most of (if not all) the present Isopoda has not yet been said, and the records of bathymetrical range are all minimum values. No less than 46% of all the species of the six genera with hadal representatives have been recorded only once so that nothing definite can be said of their vertical range.[1]

It goes without saying that the upper limit of the vertical range of the remaining species is considerably more exact than the lower, due to the extreme paucity of trawlings made at depths exceeding 3000-4000 m. It is my hope that the future study of the Galathea collections of isopods from these depths will prove profitable.

However, already our present knowledge shows a surprisingly great vertical range of some species covering several thousand metres. Till now the greatest range was found within *Eurycope spinifrons* (the records of which (GURJANOVA 1936) are, however, rather approximate) and *Ilyarachna hirticeps* which both have a bathymetrical distribution of about 2700 m. The three species which penetrate into the hadal region and are treated in the present report have a still greater range. *Eurycope nodifrons* was taken at 2700 m in the North Atlantic and at 7000 m in the Kermadec Trench which gives a range of 4300 m. *Storthyngura pulchra* is known from several localitites with depths between 1250 and 6600 m (a range of 5400 m). The greatest vertical distribution is that of *Ilyarachna antarctica* which has been taken at depths between 250 and 7000 m, thus covering not less than 6750 m, a vertical range which equals that of some of the hadal Holothurians and Polychaetes, treated by B. HANSEN and KIRKEGAARD (1956). Firstly, however, it is a question whether these species are able to breed at all these, highly different depths; it is possible that they actively ascend or descend to other depths outside the breeding period (as many littoral and bathyal species are known to do) or passively are carried to greater depths where they are not able to reproduce. Secondly, it is of course subjective whether two specimens from various localities belong to the same species or not. Moreover, we do not know whether for instance physiological differences of specific value exist among specimens showing no or only very slight morphological variations. According to our present knowledge we are at any rate forced to unite such specimens from widespread localities and probably rather different environments, as I have done in the three above cases. Under all circumstances it can, however, be stated as a general rule that the present Isopoda have a much smaller vertical range than that recorded for the Pycnogonida (FAGE 1954), for the Holothurians (l. c.), and especially for the Polychaetes (l. c.).

One of the probably true hadal species has a rather extensive vertical distribution within a restricted area, namely *Storthyngura benti*, which has a range of 1650 m in the Kermadec Trench (from 5350-7000 m).

The vertical distribution of the remaining five hadal species in this trench is restricted to at most 400 m. The distribution of isopods at the various stations beyond 4000 m in the Kermadec Trench is rather puzzling. As will be seen in table 12 no iso-

1. About the same percentage of Echinoderms is also known from a single locality only. JENSENIUS MADSEN (1954, p. 34) draws attention to the fact that even if very few new deep-sea genera and to some extent -species have been added to the fauna since the days of the Challenger Expedition, the majority of the species of Echinoderms has been caught only once and again in the deep-sea, while some species occur extremely often in the trawls. This probably means that some species are much more common (or perhaps more easily caught) than others.

Table 12. Number of Isopoda and Amphipoda in the Kermadec and Kurile-Kamtchatka Trenches, compared with the total number of bottom-living animals.

	Station	663	664	661	654	653	650	658	651	649	–	–	–
Kermadec	Depth in metres	4400	4550	5350	5850	6150	6600	6700	7000	8250	–	–	–
	Species of Isopoda	4 } 6	3 } 3	2 } 2	3 } 9	0 } 1	2 } 3	4 } 7	7 } 12	0 } 2	–	–	–
	Species of Amphipoda . .	2	0	0	6	1	1	3	5	2	–	–	–
	Total of all spp.	51	58	27	33	9	21	34	29	21	–	–	–
	% Isopoda.	8	5	7	9	0	10	12	24	0	–	–	–
	% Isopoda + Amphipoda	12	5	7	27	11	14	21	41	10	–	–	–
Kurile-Kamtchatka	Depth in metres	–	5100	5150	–	–	–	6850	7200	8400	8650	9000	9800
	Spp. of Isop. + Amphip.	–	1	0	–	–	–	1	8	6	1	0	0
	Total of all spp.	–	53	26	–	–	–	43	40	20	8	17	6
	% Isopoda + Amphipoda	–	2	0	–	–	–	2	20	30	13	0	0

pods were caught at the deepest station at 8200 m which yielded 21 other species of bottom-living animals. The number of isopods at the three stations between 4400 and 5400 m is also remarkably low when compared with the percentage of isopods at the deeper stations. The table also shows that the number of Amphipods has the same relative maximum at stations between 6000 and 7000 m.

Of course this peculiarity may be accidental, the material being very small indeed. On the other hand, it is interesting to note that the Russians apparently found something similar when trawling at increasing depths in the Kurile-Kamtchatka Trench. Zenkevitch *et al.* in table 1 (1954, p. 70) have given the number of species of the various trawling depths in that trench.[1] As will appear from table 12 the Russians also found a pronounced predominance of Isopoda-Amphipoda at great depths, but none of these animals at the greatest depths. The only major difference seems to be that in the Kurile-Kamtchatka Trench the predominance of Isopoda-Amphipoda is found somewhat deeper, i. e. between 7000 and 8500 m instead of between 6000 and 7000 m in the Kermadec Trench.

Also the extensive trawlings by the Galathea outside the Kermadec area at depths between 4000 and some 5800 m yielded a remarkably small number of species of isopods. Altogether 30 successful trawlings and 7 successful quantitative bottom samplings were carried through at these depths, but no more than eleven species of isopods (in one or a few specimens) was the result. This gives on an average 1 species of isopods per 2.5 dredgings. In the real trenches (deeper than 6000 m) thirteen species of isopods were caught once, twice or three times in the altogether 16 successful trawlings and 4 successful bottom samplings. This gives 1 isopod species per less than 1 dredging, i. e. almost three times more isopods per dredging than at the more moderate depths between 4000 and 5500 m.

It should also be mentioned that only three species of isopods were till now known to occur deeper than 4000 m (apart from the only hadal species *Bathyopsurus nybelini).* Even if the smaller number of trawlings beyond 4000 m is considered these three species form a striking contrast to the altogether 45 isopod species which have been collected between 3000 and 4000 m.

It thus seems as if the abyssal isopod fauna is quickly thinning when we move downwards beyond some 4000 m, but in the trenches – at depths greater than some 6000-7000 m – there is apparently a conspicuous increase of species. Together with the vertical limitation and the regional endemism of most of the hadal isopods (and amphipods) this fact indicates a special trench fauna of these animals.

Regional distribution of the genera found in the hadal zone.

Ischnomesus.

This genus has two species in the northern Atlantic, one is boreoatlantic-mediterranean, and the other seven species are from the southern hemisphere: one from Cape, three from the Kermadec Trench, one from the Tasman Sea, and two species from subantarctic areas. When the group Ischnomesini is

1. Since the Russians have given the number of Isopoda and Amphipoda only in total, I have for comparison included in table 12 the number of species of Amphipoda at the various trawling depths in the Kermadec Trench as well.

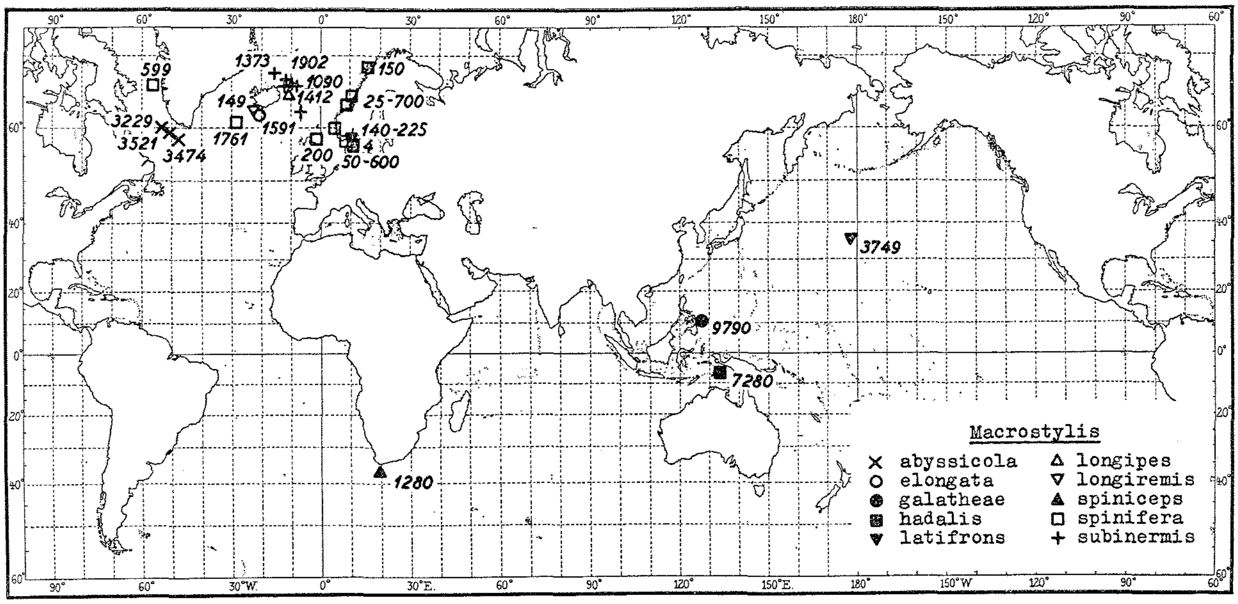


Fig. 55. Distribution of the deep-sea genus *Macrostylis*. Depths in metres.

considered as a whole the predominance of North Atlantic species is clear: almost two thirds occur in this area, while the remaining ten species are distributed as follows: one species in the central Pacific, two at Cape, three in the Kermadec Trench, one in the Tasman Sea, two in the subantarctic and, finally, one species in the antartic region.

Macrostylis.

The genus which includes the deepest known Isopoda has a somewhat scattered geographical distribution (fig. 55). The apparent predominance of species in the North Atlantic (six out of a total of ten species) is certainly due to the fact that the Ingolf Expedition succeeded in securing many extremely small species of isopods, six of which are the present species of *Macrostylis*. A closer investigation of especially the North Pacific will probably reveal several species there. On the other hand, it is not very likely that the genus is represented by very many, if any, species in the antarctic and subantarctic regions. These waters have, next to the North Atlantic, been comparatively well studied, and especially the German Antarctic Expedition collected many small forms (for instance of *Eurycope),* but never a single species of *Macrostylis*.

Ilyarachna.

Also this genus has a wide distribution. Ten of the nineteen species are North Atlantic (three of them penetrating into the North Polar Sea), and two more species are from the northern hemisphere, namely one from the Sea of Japan only and another from this sea and the Sea of Okhotsk as well. Of the remaining seven species three are from the Cape, three from the antarctic region and one species from this region as well as from the Kermadec Trench.

Storthyngura.

As mentioned above, this is the most pronounced abysso-hadal genus within the Isopoda. Fig. 56 gives the horizontal distribution. The even distribution in all oceans and in all latitudes is evident. It is very characteristic that in this genus there is no predominance in the North Atlantic (and the Antarctic) such as in *Macrostylis, Ilyarachna,* and *Eurycope*. This may be explained by the fact that the size of the species of *Storthyngura* is considerably larger than of those of the other three genera. In my opinion this genus, therefore, gives a more correct picture of the actual distribution, of course with the distinct reservation that still very much work is left to be done in the deep-sea.

Eurycope.

Half of the 34 species occur in the North Atlantic and are so far known only from that area. Three of them penetrate into the North Polar Sea, while the great majority are from the N. E. Atlantic. Strange enough, only two species are known from the N. W.

Atlantic south of Cape Cod and none from the central North Atlantic. In the North Pacific there are two species known from the Sea of Japan and one ranges from the Bering Sea to off Southern Japan. In equatorial areas one species was taken in the Gulf of Panama. From south of the equator twelve species have been described, namely two from the Kermadec Trench, two from Cape, and eight from antarctic regions. Finally, one species only has a very wide distribution, being known from Davis Strait in the North Atlantic and from the Kermadec Trench in the S. W. Pacific.

The knowledge of no less than eighteen of the very small species of *Eurycope* was the result of the careful collecting activity of G. O. SARS and of the Ingolf and the German Antarctic Expeditions, and there is no doubt that several are still to be found, especially in the North Pacific.

Leptanthura.

This genus has a distribution different from that of all the preceding genera. While they predominated in the North Atlantic and to some extent in the Antarctic, *Leptanthura* has only two species out of eleven in all in the former area and one in the latter. Three species are found in the tropics and – as mentioned above – only two of them show submergence. Four species occur between latitudes 30 and 40° South (one at Cape, two at Sydney and one off New Zealand) and one species is known from Tasmania. Thus, *Leptanthura* has a distribution similar to the Anthuridea on the whole, with much fewer representatives in the temperate and subarctic-subantarctic areas than the Asellota.

As a general rule it can be stated that all the six genera with hadal representatives are cosmopolitan, but that very few of their species are so far found in more than one ocean or even part of an ocean. As a matter of fact, this only applies to four species or 5% of the total number. Of course, further information about the distribution of the present species as well as increased knowledge of their taxonomy, which may mean increased numbers of synonyms, will without doubt raise this percentage. However, there is hardly any doubt that the general picture of cosmopolitan genera and non-cosmopolitan species is correct. This agrees well with the abyssal Pycnogonida of which 9 genera are cosmopolitan, while all the 43 species (except 3) are restricted to one ocean, or part of it (FAGE 1954 & 1956). Within the Crustacea Decopoda it is also in accordance with the bathyal and abyssal Galatheidae of which only

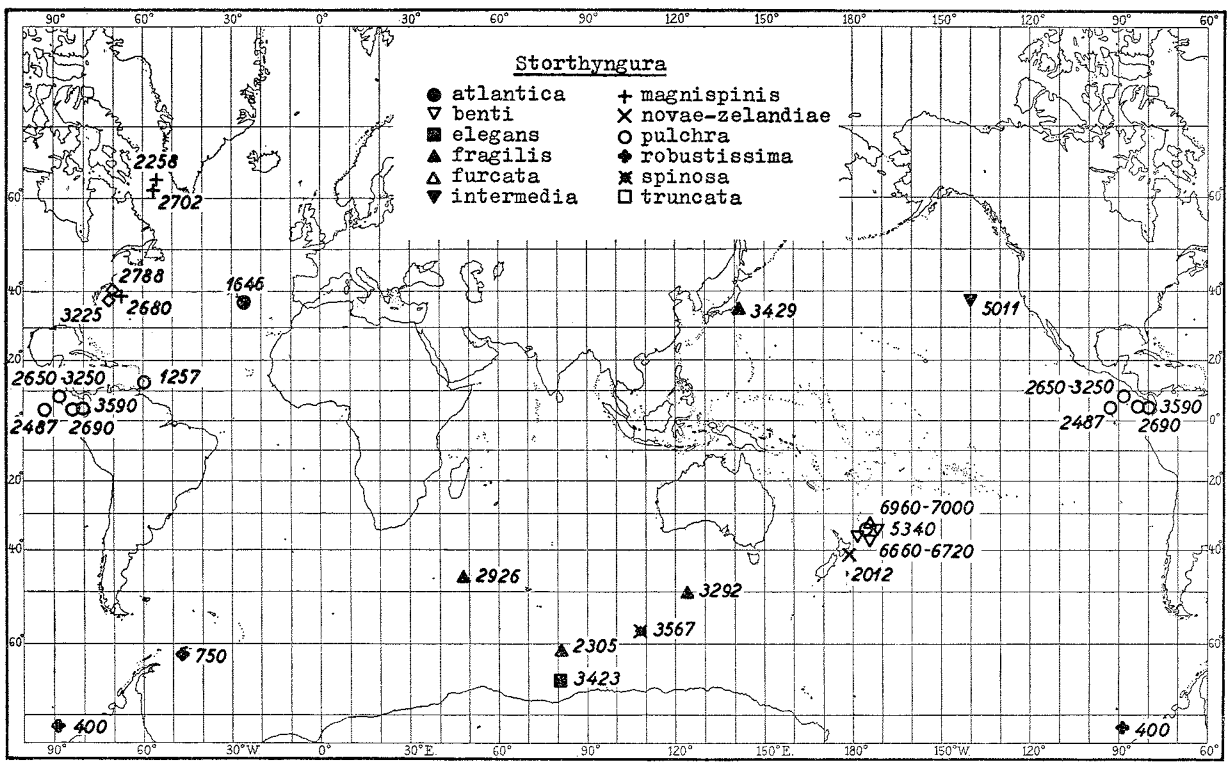


Fig. 56. Distribution of the deep-sea genus *Storthyngura*. Depth in metres.

3 out of 146 species are cosmopolitan (BALSS 1913, p. 181); on the other hand, BALSS (1925, p. 309) has enumerated a considerable number of cosmopolitan species of other abyssal decapods, mainly among the deepest known species. Also in the Echinoderms, which is one of the most characteristic elements of the deep-sea, the abyssal genera are typically cosmopolitan (MADSEN 1954). The percentage of cosmopolitan species of abyssal Asteroids, Ophiuroids, and Holothurioids is about 7% and of species occurring in more than one ocean about 13%.

Besides the cosmopolitan nature of the present deep-sea genera of Isopoda they have also (except *Leptanthura)* surprisingly many representatives in the arctic and antarctic regions; this is also the case with the deep-sea genera of Pycnogonida as pointed out by FAGE (1954).

Regional distribution of the hadal species.

The distribution of the hadal isopods in the various trenches is remarkable. In table 13 is shown the number of successful trawlings and bottom samplings ("hauls") at depths exceeding 6000 m, and the number of species of Isopoda compared with that of other invertebrates so far published or worked up (including Amphipoda,[1] Echinodermata, Polychaeta and "other invertebrates": Actinaria, Octocorallia, Pycnogonida, and Mollusca).

Without considering the very difficult and therefore less successful haul by the Swedish Deep-Sea Expedition in the Porto Rico Trench the table clearly shows that the representation of Isopoda in the various trenches does not follow that of most of the other hadal animal groups known at present. Only the Amphipoda have a similar predominance in the Kermadec Trench compared with the number in the other trenches. As far as the Isopoda are concerned this may perhaps be due to the fact that most of the deep-sea species from which the hadal species may have originated occur in high latitudes so that the rather close Kermadec Trench was most easily populated by an Isopodan fauna.

Table 13. Number of species of Isopoda and other invertebrates in relation to number of successful "hauls" (trawlings and bottom samplings) in the hadal zone of the various trenches investigated.

Trench	No. of successful "hauls"	Number of species						
		Isopoda	Amphipoda	Total	Echinodermata	Polychaeta	Other invertebrates	Total
Porto Rico	1	1	3	5	1	1(2)	0	2(3)
Philippine	4	1	2	3	2	1	2	5
Sunda	3	0	0	0	3	4	4	11
Banda	5	2	2′	4	6	10	5	21
New Britain	3	0	0	0	3	0	0	3
Total of Phil.-New Br.	**15**	**3**	**4**	**7**	**14**	**15**	**11**	**40**
Kermadec	**5**	**9**	**10**	**19**	**9**	**12**	**14**	**35**

1. According to information given by Dr. E. DAHL.

Conclusive remarks on the distribution.

Both the vertical and the regional distribution of the six genera with hadal representatives (and especially the five genera of Asellota) show many resemblances.

Firstly, all the genera are cosmopolitan, while almost all the species have so far only been found within a restricted area.

Secondly, all the genera of Asellota show submergence of those species which have been recorded from the equatorial areas, none of these species having been caught at depths above 700-1000 m and the majority living at 2000 m or deeper.

Thirdly, considerably fewer species are eurybathic than in other groups with hadal species, such as Polychaeta, Pycnogonids and Holothurians.

Two of the three species which have penetrated into the trenches are probably cosmopolitan, having been taken in the E. and S. W. Pacific and W. Atlantic *(Storthyngura pulchra)* and in the S. W. Pacific and N. W. Atlantic *(Eurycope nodifrons),* while the third *(Ilyarachna antarctica)* is known from the Antarctic and the S. W. Pacific.

All the ten really hadal species have been taken only in the trenches, and six of them at two or more stations (in the same trench). This seems to indicate that the trench fauna has a certain element which is peculiar to it.

Four other major groups with representatives in the trenches have been or are being worked up. These are: Actinaria (CARLGREN 1956), Amphipoda (SCHELLENBERG 1955 and information kindly supplied by Dr. E. DAHL), Echinodermata (MADSEN 1953 & 1956 and B. HANSEN 1956), and Polychaeta which count about 32 trench species, of which, however, only 22 are identifiable (ELIASON 1951, USCHAKOV 1955, and KIRKEGAARD 1956). Table 14 shows that the number of species restricted to the trenches is

Table 14, Species peculiar to the trenches in proportion to the total number of species, so far recorded from the trenches (from depths greater than about 6000 m).

Group	Total no. of trench species	Species known only from the trenches	
		Number	%
Actinaria	6	6	100
Isopoda	13	10	77
Amphipoda	16	9	56
Echinodermata	18	7	39
Polychaeta	22	8	36
Total	75	40	53

extremely varying within these four groups and the Isopoda.

The small number of species dealt with in this paper and their restricted distribution do not justify any speculations regarding the general, regional distribution of abyssal and hadal species.

3. Relationship and possible origin of the hadal species

Before trying to answer the interesting question of the origin of the hadal isopod species it is worth while considering to which other species the present hadal species are most closely related.

Only two of the hadal species which belong to the same genus *(Macrostylis galatheae* and *M. hadalis)* are near relatives. The other species of the same genera seem to be more nearly related to one of the bathyal or abyssal species than to the other hadal species of the genus. *Leptanthura hendili* does not show special affinity to any of the other species of *Leptanthura*.

In table 15 is given the nearest relatives of the hadal and abysso-hadal species as well as their distribution.

It will be seen from the table and from the above (p. 147f) given distribution of all the other species of the present genera that in nine of these eleven species the nearest relative is at the same time one of

Table 15. Regional and vertical distribution of seven hadal and three abysso-hadal species and their nearest relatives.

Hadal or abysso-hadal species	Nearest relative(s)	Hadal (abysso-hadal) species		Nearest relative(s)	
		Distribution	Depth (m)	Distribution	Depth (m)
Ischn. bruuni	*I. bacilloides*	Kermadec Trench	7000	S. E. Pacific	2650
Ischn. spärcki	*Ischn.* sp.[1] *Ischn.* sp.[1]	Kermadec Trench	7000	Kermadec Trench Tasman Sea	4400 3700
M. galatheae	*M. hadalis* *M. latifrons*	Philippine Trench	9800	Banda Trench Central N. Pacific	7300 3750
M. hadalis	*M. galatheae* *M. latifrons*	Banda Trench	7300	Philippine Trench Central N. Pacific	9800 3750
Il. antarctica	*Il. bicornis*	Antarctic Atl. & Ant. Ind. Oc. & Kermadec Trench	250-7000	N. W. Atlantic	2700
S. benti	*S. robustissima*	Kermadec Trench	5340-7000	Antarct. Atl. & Ant. E. Pac.	400-750
S. pulchra	*S. fragilis*	Trop. W. Atl., Trop. E. Pac. & Kermadec Trench	1250-6600	Ctr. N. Pac. & Ant. Ind. Oc.	2300-3450
S. furcata	*S. elegans*	Kermadec Trench	6700	Antarctic Indian Ocean	3400
E. nodifrons	*E. crassa*	N. W. Atl. & Kerm. Tr.	2700-7000	Antarctic Indian Ocean	350-400
E. madseni	*E. ovalis* *(E. furcata)*	Kermadec Trench	7000	Antarctic Indian Ocean (N. Atlantic)	3400 (150-2250)
E. galatheae	*E. vicarius*	Kermadec Trench	7000	Antarctic Indian Ocean	3400

1. The two yet undescribed species, mentioned on p. 97.

the species which is nearest to them geographically. This is especially clear in the genus *Macrostylis* in which the two hadal species (from the Philippine and the Banda Trenches) are very similar; they are furthermore very near to the third Pacific species, *M. latifrons* (see map on p. 148) which is at the same time the deepest recorded, non-hadal species. There is hardly any doubt that these three species have the same ancestor (which was probably near to *latifrons)* and that *galatheae* and *hadalis* after having descended into the two trenches have changed to such a degree that they must now be regarded as different, but nearly related species. The place of origin of *Macrostylis* may have been arctic or subarctic (boreal) regions, where the majority of the species are found to-day. Only two species have been recorded from the southern hemisphere and none of these from south of lat. 35°.

Also the two nearest relatives of *Ischnomesus spärcki* are found very near to it geographically. One of these is the yet undescribed species from the same trench, and the other (likewise undescribed) species was caught in the Tasman Sea which is not separated from the Kermadec Trench by any ridges. The finding places of *I. bruuni* and *bacilloides* are also connected by vast areas with great depths.

The genus *Storthyngura* has also a restricted distribution of the related species (except *benti)*. The genus seems to be rather young, having been branched off from *Eurycope* fairly recently, and it is notably more specialized than *Eurycope*. Somehow we here find the same circumstances as within the Galatheidae, of which the original and most primitive genera *(Galathea* and *Munida)* are littoral and bathyal, while the true deep-sea genera *Uroptychus* and *Munidopsis* are more highly specialized (Balss 1913, p. 181). The evolution of the genus *Storthyngura* certainly took place in the Antarctic where all the abyssal species except three still live. The Kermadec Trench is within fairly easy reach of the antarctic species, of which two (related to or perhaps identical with *S. elegans* and *robustissima)* spread northwards and descended into the trench. Here they gave rise to the two hadal species *furcata* and *benti*. *S. pulchra* (or its ancestor) spread northwards into abyssal parts of the Atlantic and the Pacific (and the Indian Ocean?), and this species also invaded the Kermadec Trench. Possibly this invasion happened fairly recently, since the Kermadec population is almost identical with the populations of the Atlantic and Pacific deep-sea near the equator.

The two hadal species of *Eurycope, madseni* and *galatheae,* have probably also their origin in the Antarctic, even if the majority of the other species of *Eurycope* are from the northern hemisphere. The origin of *nodifrons* is very dubious; it has been caught in two localities almost as far from each other as possible (Davis Strait and Kermadec). It seems to be most nearly related with the antarctic species *crassa,* but is also closely allied to species in the North Atlantic from where it possibly originated. Almost as peculiar is the relationship of *Ilyarachna antarctica* which is certainly most closely related to a likewise North Atlantic species, *bicornis*.

Thus, there is hardly any doubt that the present, still very small number of hadal isopods has derived from cold areas in the arctic and especially in the antarctic regions. This place of origin agrees with the suggestions put forward by Dahl (1954). The slight variation in hadal species from one locality to another in the same trench may indicate a fairly recent invasion. On the other hand, the undoubtedly stable character of the environments in the trenches may have served to prevent or retard genetically induced variations, more likely to occur in more changing environments.

4. Special peculiarities of the hadal Isopoda

Even if the material of Isopoda from the greatest depths is still very small, it seems possible to establish some general rules as to the nature of the hadal species.

Size.

It has long been known that the deep-sea fauna comprises many species which are larger than their shallow water – or perhaps rather warm water – representatives. This is also the case with the isopods. By far the largest isopod is *Bathynomus giganteus* (A. M.-Edw.) which reaches a length of 270 mm and a width of 120 mm and lives at depths of between 1350 and 1700 m. The two biggest members of the family Serolidae are *Serolis bromleyana* Suhm (54 mm long, 56 mm wide) and *S. neaera* Bedd., the only two Serolids which go beyond the 3000 m curve.

Within the Asellota the 33 mm long *Munnopsurus giganteus* (G. O. Sars) is still the largest; it occurs in the Arctic, from 40-1470 m and at temperatures between + 1.1 and ÷ 1.1 °C. Of special interest is the fact that the 60 specimens of *Eurycope inermis* Hansen (1916, p. 143) which were caught in the cold area of the N. W. Atlantic, covered by the Ingolf Expedition, were from 9-11.5 mm long, while the 40 specimens from the warm area were only from 5.5-7 mm long. The former all occurred at temperatures between ÷ 0.5 and ÷ 1.0°C, and at depths between 550 and 1900 m, while the temperatures of the latter ranged from + 1.2 to + 4.1 °C, and the depths from 680 to 1520 m. In this case it seems as if the temperature (and amount of food) is the deciding factor. Also *Storthyngura fragilis* (Bedd.) is interesting in this respect. As shown in table 16 the species was caught by the Challenger at four stations, one off Japan and the other three in the Antarctic Indian Ocean. The table shows that not only does the size increase with decreasing temperature, but it is apparently quite independent of the pressure factor, the smallest individuals (of which only one reaches the length of 12 mm) having been caught at the greatest depths, and the largest specimen at the lowest depth. At the same time, there seems to be a tendency of increasing size passing southwards (see later).

When the present material of isopods from the hadal fauna is considered it is very striking that most species are larger than almost all hitherto known species within the same genera.[1] This fact is clearly to be seen from the following summary which gives the maximum length of all the species in genera with hadal species.

Ischnomesus. 3-5 mm: 3 species; 5-10 mm: 1 species; 13-15 mm: 2 spp.; the two hadal spp. *(bruuni* and *spärcki)*: 13.5 and 16 mm.

Macrostylis. 2-3 mm: 5 spp.; 3-4 mm: 2 spp.; 4-5 mm: 1 sp.; *M. hadalis:* 4.6 mm; *M. galatheae:* 5.5 mm.

Table 16. Size and occurrence of *Storthyngura fragilis* (Bedd.)

Challenger Station	Lat.	Depth in m	Temp. °C	Max. length in mm
237	35°N	3430	1.8	12
147	46°S	2930	1.2	17
158	50°S	3290	0.8	17
152	61°S	2310	÷0.3	30

1. In the preliminary paper on the Russian deep-sea investigations, Zenkevitch *et. al.* (1954, p. 65) mention that the Asellota from 7200-8400 m are "very large".

Ilyarachna. 2-5 mm: 9 spp.; 5-10 mm: 7 spp.; 10-13 mm: 2 spp.; 17 mm: 1 sp.; *I. antarctica* in the Antarctic: 5.3 and 6.3 mm, in the Kermadec Trench: 15.2 mm.

Storthyngura. 2-5 mm: 3 spp.; 5-10 mm: 2 spp.; 10-12 mm: 1 sp.; 3 spp. from the Antarctic: 20-28-30 mm; *S. benti:* 19 mm, *S. pulchra:* 27 mm; *S. furcata:* 30.5 mm.

Eurycope (2 spp. have no records of size and 1 is pelagic). 1-5 mm: 17 spp.; 5-10 mm: 7 spp.; 10-12 mm: 1 sp.; 1 sp. from the Antarctic: 24 mm; 1 sp. from the Gulf of Panama: 25.6 mm; *E. galatheae:* 5.8 mm; *E. madseni:* 6.9 mm; *E. nodifrons* in the Arctic Atlantic: 5.1 mm and in the Kermadec Trench: 13-13.5 mm.

Leptanthura. 5-10 mm: 3 spp.; 10-15 mm: 2 spp.; 15-20 mm: 3 spp. (one at 900 m off West Africa, one at Cape of Good Hope, and one in the Antarctic); 1 sp. is 26 mm long (Cape); *Leptanthura hendili* is only 11.3 mm and is thus (together with the two species of *Eurycope)* the only hadal species which are not among the largest representatives of their genus.

It is worth while mentioning in this place that in some of these genera the dominance of southern species among the largest members of the genus is very pronounced. In *Ischnomesus* the three smallest species are from the northern Atlantic, the three largest (besides the two hadal species) from off Cape of Good Hope and the Antarctic. *Ilyarachna* has its largest representative in the Antarctic (but also one very small and one moderately large species are from that region). The four largest species of *Storthyngura* are from antarctic waters, while the two smallest are North Atlantic.[1] The comparatively small size of the three hadal representatives of *Eurycope* indicates that this genus does not follow the general pattern, possibly because *Eurycope* may not constitute a natural genus. Neither the other species of that genus show any convincing correlation between size and locality. Altogether 25 species of *Eurycope* occur in high latitudes, either of the northern or of the southern hemisphere. Nine of these are from the southern, and although none of them are among the smallest species, only three of them are among the nine largest. In *Leptanthura* the 4 smallest species are tropical or North Atlantic, and 3 of the 4 largest are antarctic.

1. As mentioned on p. 121 the only 2.3 mm long specimen of *S. elegans* Vanh. from the Antarctic is certainly juvenile.

Armament with spines.

The bathyal and abyssal isopod faunas, especially in the Antarctic, are characteristic in that many of the species and genera are, on the whole, more abundantly armed with spines and processes than are their relatives in shallow water. Most remarkable in this respect are *Mormomunna spinipes* Vanh. and *Echinomunna horrida* Vanh. from the antarctic deep-sea. However, when comparing such spiny forms to their nearest relatives among the hadal species, it seems as if the latter are preferably less spiny and the spines are shorter. Also within the same trench the specimens and species with the shortest spines are found deepest down, for instance *Storthyngura benti* and *Ischnomesus spärcki;* especially the latter is much less spiniferous than the nearly related, still undescribed species from 4400 m (cf. p. 97). The reason for this apparent reduction is difficult to explain. The spines may – together with the often very elongate legs – serve to prevent the animals from sinking into the soft ooze on the bottom. There is, however, hardly any reason to believe that the sediments of the trenches are more solid than those of the bathyal and abyssal slopes and plains. Moreover, the legs of the hadal species do not seem to have undergone a corresponding reduction in length.

Eyes.

As could be expected, none of the hadal species have eyes. Some of the shallow water species of one genus, *Leptanthura,* have small, reduced eyes, but all other species of the present genera with hadal species are blind, as are normally the Asellota.

In some of the species (for instance *Ilyarachna antarctica,* p. 107) a conspicuous eye rudiment was found; unfortunately, the present material does not allow a study of this interesting feature.

Calcification.

Some of the species are extremely brittle, viz. the species of *Ischnomesus* and *Macrostylis,* and they are definitely more fragile than their bathyal and abyssal relatives. The species of *Eurycope* have also a very weak integument, but in this genus it is due to the fact that it is almost not calcareous at all. Finally, the species of *Storthyngura* are very robust, being apparantly not less calcified than the abyssal species of the same genus. It is interesting to note that Jensenius Madsen has found a similar brittleness in some deep-sea Echinoids, while others "have skeletons of a consistency comparable to those of the shallow-water forms" (1954, p. 32).

Colour.

As well the brittle as the robust hadal isopods have, both when freshly caught and in alcohol, a pure white, sometimes even shining white colour, which is rather characteristic. The same, totally white colour of hadal isopods has been noted by Zenkevitch *et al.* in their preliminary report on the investigations of the Kurile-Kamtchatka Trench (1954, p. 65).

General appearance.

On the whole, however, the present hadal species are remarkably similar to their abyssal, bathyal and even sublittoral relatives. This is also emphasized by the fact that none of them belong to a genus of their own. They may be characterized as being preferably somewhat larger, less spiny, and more purely white representatives of the mainly bathyal and abyssal genera to which they belong.

5. Biology

Reproduction.

Unfortunately, none of the present hadal females were egg-bearing so that nothing can be said about the number and size of eggs in the marsupium, etc.

Food.

There is hardly any doubt that most of the hadal animals are filter-feeders or mud-swallowers, feeding on bacteria, plant débris, etc. Some are, however, definitely predators. This applies to the Polychaetes and most of the Crustaceans. Even a superficial investigation of the mouth-parts of the present hadal isopods shows that they are perfectly like those of shallow water forms, the Asellota having crushing and grinding mouth-parts, while in the Anthuridea they are suctorial.

On account of the fairly rich material of *Storthyngura pulchra* an investigation of the contents of the intestine of a specimen from St. 650 (Kermadec Trench, 6620 m) has been made. It revealed a rather great variety of remains but few of them could be identified. There were without doubt shells of Radiolaria and chaeta and a single jaw of Polychaetes. Moreover, there seemed to be spicules of Spongia and remains of Crustacea (for instance a few fragments of legs and integuments).

D. SUMMARY

1. The Galathea Expedition collected altogether twelve species of Isopoda from depths greater than 6000 m, namely one from the Philippine Trench, two from the Banda Trench and nine from the Kermadec Trench. Nine of them are described as new species, but all belong to already known genera. Besides, several species, especially from the German Antarctic Expedition, are redescribed for comparison – see list of contents.

2. Eleven of the species belong to Asellota and one to Anthuridea. Of the altogether 62 species of isopods which are now known from depths greater than 3000 m the Asellota include 86 %, the Anthuridea only 5 %.

3. Tables 6-11 give the vertical distribution and range of temperature of all species of the six genera here treated, with one or more representatives in the trenches (hadal species). In the five genera of Asellota only 6 % of the altogether 85 species are exclusively confined to the shelf area (always in high latitudes), while 75 % never occur on the shelf. 51 % do not go deeper than 2000 m, and 36 % are only found beyond this depth, thus being confined to the abyssal and hadal regions. 9 % have so far exclusively been found in the latter of these zones. 66 % of the species have always been taken at temperatures below 3 °C, and 15 % only at negative temperatures. Most of the species seem to be rather stenotherm. *Storthyngura* is the most pronounced deep-sea genus (with none of the twelve species above 400 m and 5 °C). In *Leptanthura* (Anthuridea) half of the species live in shallow water and at high temperatures.

4. The three abysso-hadal or bathyo-hadal species have a vertical range of several thousand metres (4300, 5400, and 6750 m). The remaining nine species are exclusively confined to the trenches (one with a vertical range of 1650 m, the others with at most 400 m). In the Kermadec Trench the great majority of specimens were caught at depths between 6000 and 7000 m; a similar accumulation of isopods within a special depth-interval seems to occur in the Kurile-Kamtchatka Trench, recently investigated by the Russians.

5. All the genera with hadal representatives are cosmopolitan, but only 5 % of their species have so far been found in more than one ocean. Remarkably many species (except of *Leptanthura)* are found in arctic-subarctic or antarctic-subantartic regions; all those caught in equatorial areas show submergence, none of then having been taken above 700-1000 m, and the majority living deeper than 2000 m.

6. None of the hadal species are found in more than one of the trenches investigated. The predominance of isopods in the Kermadec Trench – compared to the number in the other trenches surveyed by the Galathea Expedition – is extraordinary and in contrast to most other major groups with hadal representatives. 77 % of the isopod species, so far recorded from the trenches, are peculiar to these; this is more than in any other of the above named, major groups (except Actinaria).

7. In most cases the nearest relative of each of the hadal species is one of the species which is nearest to it geographically. The place of origin of the hadal species is certainly cold areas in the arctic and especially the antarctic regions from where the ancestors have spread into the abyssal region and from there descended into the trenches. This invasion of Isopoda probably took place fairly recently.

8. The general appearance of the hadal species is remarkably similar to that of their abyssal, bathyal, and even sublittoral relatives. They are almost all considerably larger, less spiny, and generally less calcified than these. The colour is preferably purely white, and they are all blind.

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