

are anteriorly produced beyond the frontal margin. The anterior and two-thirds of the lateral margins are smooth, whereas the posterior portion is armed with five prominent teeth. The median dorsal line is longitudinally armed with three or four prominent teeth, one being strongly marked on the frontal margin, a second imperfectly present over the gastric region, a third and fourth over the pyloric and cardiac regions, and evidence exists of a double row of bead-like tubercles longitudinally traversing the median line from the posterior to probably the anterior margin.

The inner line of the branchial region is posteriorly defined by a low ridge furnished with three or more small points or tubercles. From the gastric region to the lateral margins of the carapace, a strong ridge traverses the line of the cervical fossa in recent Crustacea, a circumstance that I believe is due to compression during fossilisation; the weaker parts yielding while the more rigid and stronger resist. Thus the fossa which is due to a reflexion or folding of the dermal tissue resists more decidedly the superincumbent pressure and remains rigid, while the surrounding structure yields. The cervical fossa, or as it may be called in this specimen, ridge, bifurcates into an anterior and a posterior branch, between the fork of which lies what Stimpson has called the hepatic region.

The posterior portion or pleon is broad, and symmetrically tuberculated; each somite generally carries, or is supposed to carry one large tooth or tubercle on the posterior margin in the median line, a similar but larger one near the lateral margin, centrally situated above the coxal plate, and another smaller in dimensions between this and the central, is situated on the posterior margin.

The animal appears to have no ophthalmopoda, although a semicircular notch in the frontal margin of the carapace seems to represent the orbit of the missing organ. This absence may, and I believe does arise from the soft and perishable nature of the eye when compared with the surrounding tissue, during the period of fossilisation, or it may be from the organ being hid, or reduced to a minimum condition as observed in the *Willémæsia*, or from its entire absence, as in *Eryoneicus*, but the presence of an orbital cavity determines that this ancient form has departed from a species in which the eye was an important feature.

Magazine, for the drawing of which the author is not responsible, a note and additions to the text were added by the editor after the paper had been seen by the author. A comparison of the figure in the magazine with that on pl. xxv. in the *Quarterly Journal of the Geological Society*, both of which were drawn under the superintendence of the editor of the Geological Magazine, will show that the form of the large chela and the ornamentation at the branchial margin of the carapace cannot belong to the same species. More than twenty species of *Eryon* have been described, but these are so various in their external form that it is difficult to imagine that they are not structurally, more than specifically distinct. As an example, Dr. Woodward, in a note to his *Memoirs on the Species of the Genus Eryon* (Desm.) from the Lias and Oolite of England and Bavaria (*loc. cit.*, p. 494), tells us that the diæresis "is absent in the outer caudal lamellæ of the Solonhofen species—a most important distinction: they differ also widely in form," and he describes all the English species as possessing it, "as in other Astacidae." The diæresis is absent from the following recent families: Eryonidae, Palinuridae and Scyllaridae, all of which belong to the Astacidea.

The first pair of antennæ has three short joints to the peduncle and the remains of a slender multiarticulate flagellum, to which I have given its probable length as well as a second branch, because I am not aware of any species of *Macrura* that has not a second flagellum attached to the first pair of antennæ.

The second pair of antennæ has very little of it represented in the specimen, but it evidently carried an ovate scaphocerite; that on the right side of our figure is half lost, whereas of that on the left there is the impression only; the rest of the organ is wanting on each side except what I take to be the impression of the distal joint of the peduncle, and the first articulus of the flagellum on the right side.

The first pair of large chelæ is well shown on the right side, although part of it is expressed by the impression only. That on the left I have restored in outline from that of a specimen of *Polycheles crucifera*, in order to show the near resemblance of the same part in the two genera.

All the other appendages are lost, or hidden beneath the body of the animal, excepting those that go to form the rhipidura, the outer plates of which are only determinable by the impression left on the rock. They are broad, leaf-like, and rounded at the extremity, without any sign of a diæresis or division in the outer plate, or a tooth at the outer distal angle; telson is broad at the base, and tapers abruptly to the extremity.

This species bears a generic resemblance to *Polycheles* of the recent seas, especially to *Polycheles crucifera*, in the form of the carapace, although it is deprived of its strong lateral armature, of which a trace only remains at the posterior branchial margin.

It bears, however, a nearer resemblance to *Polycheles helleri* and *Polycheles baccata* in the form and breadth of the pleon, but differs from all in the absence of a prominent longitudinal carina which is conspicuous in most of all the known recent species of the Eryonidæ, excepting the genus *Eryoneicus*, on the median dorsal surface of the pleon.

The fossil also differs from the recent species of the same family in having a broad and open orbital notch, instead of a narrow cleft in the dorsal surface of the carapace, which is filled up with the upper surface of the base of the rigidly attached ophthalmopod.

The first pair of antennæ, so far as I am able to interpret the evidence at my disposal, has not the inner margin of the first joint of the peduncle produced to an elevated ridge, a circumstance that is largely due to the distance at which these appendages are separated from each other.

The second pair of antennæ, if I understand correctly the parts represented in the specimen, approximates more nearly to the recent forms than to those of any fossil *Eryon* that I have met with, differing from the latter in carrying a distinct scaphocerite at the base. It is true Desmarest states that the second pair of antennæ is provided with a large scale, but he does not show it in his figure of the animal, and although it has been, I believe, generally accepted by authors who have written on the subject, I am not aware

of a specimen or figure excepting those that have been restored in which it has been determined.¹

Taken as a whole, the specimen that I have here described resembles the form of the recent *Polycheles* as nearly as it does that of the type of the ancient *Eryon*. But in the breadth of the pleon and the absence of the dorsal carina, it exhibits a condition that demonstrates it to be no very distant departure from the genus *Astacus*, to which the great chela, notably in *Cambarus simulans*, Faxon, and *Cambarus clarkii*, Bajer, bears a near and characteristic resemblance, and the likeness would be more apparent if the animal, instead of being dorsally depressed, had, like *Astacus*, a more rounded or laterally compressed form.

It appears to me that the family of the Eryonidæ was a departure under deteriorating circumstances from some marine ancestor of *Astacus*, and that the recent genera are in direct descent from the *Archæastacus* of the European Lias.

The fossil genus *Palæocarabus*, from the Glasgow and Shropshire coal measures, appears to possess characteristic forms in the several genera of *Arctus*, *Polycheles*, and to be represented most closely by the recent genus *Synaxes*, from which it seems to differ chiefly in the laterally compressed rostrum, and it is interesting to notice that, separated as these genera are in time, as widely as the period when the coal-plants were living and growing in their native soil is from that of the present day, there is very little beyond specific distinction in character separating the oldest fossil from the most recent Macrurous Crustacea of the same family, and if we are, as is but reasonable, to judge of the alteration of parts unknown from the parts that are known, there is very little variation in structure also. So that in this group of animals whatever specific changes may have successively been produced, they are small in degree and unimportant in character; and therefore we may assume that the conditions of life on the globe, so far as relates to the present class of animals, can have undergone but little change.

Geographical Distribution.—The recent genera that belong to this family are widely distributed, but all of them appear to require certain conditions of depth, temperature, and character of sea bottom.

The genus *Polycheles* has been taken in the Mediterranean, and in the Atlantic off the coast of Spain;² in the West Indies, and in the longitude of the Fiji and Kermadec

¹ In the *Quart. Journ. Geol. Soc.*, vol. xxii. pl. xxv. fig. 1, Dr. Woodward delineated "by the help of the fine examples in the cabinet of the Rev. P. B. Brodie, F.G.S., and those in the British Museum," a completely restored figure of *Eryon barrovensis* (McCoy) in which the scaphocerite is fixed at the extremity of a peduncle that is independent of that of the antennæ. This condition not being in accordance with the anatomical structure of the Macrurous Decapoda, I am induced to think that the small pedicular plate at the extremity of the third pair of maxillæ is intended, of which a drawing is given at fig. 31, p. 135, in this Report, and which in some recent species extends beyond the frontal margin. It may be seen on Pl. XIX. fig. C''', which represents the under surface of the head in *Willemosia leptodactyla*.

² Norman, On the Willemosia group of Crustacea, *Ann. and Mag. Nat. Hist.*, ser. 5, vol. ii. p. 384, 1878.

Islands, at an average depth of 500 fathoms, on a muddy bottom, with a temperature approximating to $39^{\circ}5$.

The genus *Pentacheles* appears to range as far as the limits of the great Pacific Ocean. Species have been taken among the Australasian Islands, the Philippine and New Guinea groups, near the middle of the ocean, about the Fiji and Kermadec groups, and along the south coast of South America, from Juan Fernandez to Cape Horn. Most of these were taken in the open ocean some distance from land, and generally on a muddy or oozy bottom formed of the débris of *Globigerina* and other Foraminifera. The depth at which they were taken varied from 120 to 1375 fathoms, but generally it was about 500. Belonging to exceptionally shallow water was *Stereomastis* (*Pentacheles*) *suhmi*, a species which, together with *Stereomastis* (*Pentacheles*) *auriculata*, I have been induced to separate from the other species and establish as an independent genus, in consequence of their having no mastigobranchial plates attached to the podobranchiæ (see p. 14). *Stereomastis suhmi* was captured within the narrow channels that separate the numerous rocky islets from the coast of Western Patagonia. The species from exceptionally deep water are *Pentacheles obscura*, a much damaged specimen taken north of New Guinea, in 1070 fathoms, and *Pentacheles lavis*, obtained off Juan Fernandez, at a depth of 1375 fathoms, but this latter species is represented by a second specimen taken south of the Philippine Islands, at a depth of only 500 fathoms. The temperature at the bottom varied from $35^{\circ}5$ to $41^{\circ}8$, according to the greater or less depth of the ocean, and the sea bottom, with one or two exceptions, is recorded as being formed either of mud or *Globigerina* ooze.

The general aspect of the animals, even when specifically distinct, bears a general close resemblance, and the alteration of the branchial apparatus appears to have no important influence on the external appearance. In *Pentacheles euthrix* the mastigobranchial plates are of extreme tenuity, and reduced in size, while they are absent in *Stereomastis auriculata* and *Stereomastis suhmi*. Yet the general character of their habits appears to correspond.

Willemæsia has been found in the middle of the North and South Atlantic Oceans. It was also taken in the Pacific, about 500 miles from the coast of South America, at a depth very nearly as great as that in the Atlantic, and at nearly similar temperatures, namely, $34^{\circ}6$ and $35^{\circ}5$ at a depth of 1375 and 2225 fathoms, as compared with a temperature of $36^{\circ}8$ in the North, and $36^{\circ}4$ in the South Atlantic Ocean, at 1900 fathoms. As in the preceding genera, the sea bottom where they were taken consisted of *Globigerina* ooze, a deposit sufficiently constant to induce us to believe that it is the common home of all the species of the genera that make up this group. The exceptions to these are few, only three, I believe, and these are in relation to *Pentacheles euthrix* and *Polychæles baccata*, which were taken on a rocky and red clay bottom.

Within certain limits it is therefore presumable that the family is represented by

species beyond certain depths, wherever a Globigerina bottom is to be found, a circumstance that is suggestive of the idea that in natural selection the character of the food is one of the most permanent influences in their geographical distribution.

Eryoneicus, Spence Bate.

Eryoneicus, Sp. B., Ann. and Mag. Nat. Hist., ser. 5, vol. x. p. 457, December 1882.

Carapace globose, dorsally hemispherical, nearly as broad as long: pleon narrow and folded beneath the pereion: rhipidura well-developed: telson as long as the lateral plates: ophthalmopoda absent.

First pair of antennæ having the first joint of the peduncle cylindrical, like the second and third, which terminates in two flagella.

The second pair of antennæ is scarcely longer than the first and carries a small scaphocerite and a long phymacerite.

The first pair of pereopoda is long, and terminates in a narrow and slender chela; the second and following pairs are successively shorter and are chelate, except the last, which terminates in a short and simple dactylos.

Eryoneicus cæcus, Spence Bate (Pl. XIIE).

Eryoneicus cæcus, Sp. B., Ann. and Mag. Nat. Hist., ser. 5, vol. x. p. 457.

Carapace orbicular and circular, dorsally and laterally armed with numerous long, slender, spine-like teeth that appear to be symmetrically arranged on each side of the median line, the smaller being anterior and the larger posterior; the largest are situated near the postero-external angles of the carapace, the lateral walls of which are inflected on the ventral aspect from the frontal to the posterior margins.

The pleon is narrow, being about one-fifth the diameter of the carapace, and is similarly furnished dorsally as far as the extremity of the telson with long and slender spine-like teeth.

The ophthalmopoda are absent.

The first pair of antennæ has the flagella unequal.

The second pair is not much longer than the first; it carries a small scaphocerite and a long, straight, cylindrical phymacerite.

The second pair of gnathopoda is pediform, moderately long and slender.

The first pair of pereopoda is smooth, long and slender, the chela being scarcely broader than the meros; the second pair is short, slender and armed with a few long spines; the third and fourth are shorter and furnished with a few corresponding hairs; the fifth is still shorter and terminates in a short and simple dactylos.

The anterior or first pair of pleopoda is wanting, and the others are biramose and foliaceous.

The rhipidura is symmetrical; both outer plates are fringed with ciliated hairs.

The telson terminates in a sharp point furnished with numerous ciliated hairs on each side, and with many long and slender spines on the dorsal surface.

Length, 13 mm. (0.5 in.), measured from the frontal margin to the extremity of the telson.

Habitat.—Station VII. v., off the Canary Islands, February 11, 1873; lat. 27° 58' N., long. 17° 39' W.; depth, 1620 fathoms; bottom, volcanic mud.

This unique specimen in general appearance is very unlike any other genus in the family.

The dorsal surface of the carapace, instead of being compressed, is elevated and has a globular appearance, while the lateral walls are bent under the ventral surface and lie flat in the same plane, apparently, with that of the sternum. It is dorsally covered with spines, or long, slender, sharp teeth, of which two stand longitudinally in the central line on the frontal region, and two on each side, one on each side of the gastric region and two on each side of the cardiac region, two on the upper and anterior portion of the branchial region, and several, which increase in length posteriorly, on the lateral angle formed by the sudden inflection of the carapace.

The pleon is very narrow and generally lies folded against the ventral surface of the pereion; it is dorsally armed with long and slender spines, one on each side of the median line and one on the lateral wall of the four posterior somites, just above the margin, which also is armed with a long posteriorly-directed tooth and two smaller ones, except in the case of the sixth somite, in which the margin is produced to a single, long and slender tooth: the telson is likewise armed with long and slender spine-like teeth, of which there is one in the median line near the base, and one on each side still nearer; these three are the largest, the others are smaller and ranged in rows on each side of the median line from the base to the extremity, which terminates in a small tooth on the dorsal surface, and is flanked with several ciliated hairs on each side.

The ophthalmopoda are absent, and no trace of organs of vision can be determined; there is a slight depression on each side near the central line of the frontal margin; and more laterally, beyond the outer antennæ, corresponding with the position of the eyes in *Willemæsia*, is a dark spot on each side that is suggestive of being an organ of vision, but the want of specimens for a close examination precludes me from being able to confirm the supposition.

The first pair of antennæ (*b*) has the first joint short and stout, armed on the inner side with a strong and sharp-pointed tooth that is broad at the base, and on the outer with a fine, anteriorly-directed, spine-like tooth; the second joint is very short but narrower than the first, and the third is yet shorter and narrower, and supports two unequal slender flagella that are not very long and only sparingly multiarticulate.

The second pair of antennæ (*c*) has the basal joint supporting a cylindrical rod that is longer than the peduncle of the antennæ; it is obliquely truncate at the extremity,

hollow, and contains a membranous canal; I think there can be no doubt that it is a peculiarly developed phymacerite; the second joint supports a long, straight-sided, foliaceous scaphocerite, tipped with a few hairs, but not armed with a tooth on the outer margin; the third or terminal joint of the peduncle is but little more important than the first joint of the flagellum, which is slender, tapering, sparingly multiarticulate, and about one-fourth longer than the longest of the first pair.

The mandibles and supporting oral appendages I have not examined, as, without destroying an interesting form, they could not be determined.

The second pair of gnathopoda is long, slender, seven-jointed and pediform, it terminates in a sharp-pointed dactylos, and is sparsely fringed with hairs.

The first pair of pereiopoda (*k*) is long and slender, and terminates in a slender chela that has the fingers longer than the palm, and impinging closely together throughout their entire length, and free from hairs or spines.

The second pair (*l*) is formed on the same type as the first, but is much shorter, being only half as long, and is adorned with long slender spines of which the two largest stand at the distal extremity of the carpos, and the others on the outer margin of the carpos and meros, and bears at the base a small appendage that I believe to be a baseophysis.

The third pair of pereiopoda (*m*) is little more than half the length of the second, but is rather more robust; it is chelate, but the fingers are short, with the pollex stouter than the dactylos.

The fourth pair (*n*) resembles the third, but is shorter and slighter, and like it, sparingly furnished with hairs.

The fifth pair (*o*) is short, robust, and simple, it is slightly shorter than the preceding, and terminates in a short, stout-pointed dactylos.

There is no appendage attached to the first somite of the pleon; but each of the four succeeding ones bears a pair of pleopoda that have two long, narrow, leaf-like branches fringed with hairs attached to a long and narrow peduncle; the inner plate carries a small cylindrical stylamblys.

The fifth pair, which helps to form the rhipidura, consists of two subequal, foliaceous plates fringed with hairs, and does not reach quite to the length of the telson.

Observations.—Dr. v. Willemoes-Suhm, who had the opportunity of examining this specimen when fresh from the sea, and from whose drawing the accompanying figure is taken, says, in his notes, that it is transparent, and that the alimentary canal, including the œsophagus and stomach, is of a bright red colour, while the hepatic lobes are yellow, represented by dots in the figure; the elongated tissue marked (*t*) is white; to this he appends the query, "Can it be a muscle?" which, from its position, I think there can be little doubt it is.

He also says that the dorsal spine-like teeth are arranged in longitudinal rows, one of which traverses the median line, the others running in pairs making a series of four. The posterior margin of the carapace is also similarly armed with teeth.

The pleon has similar spine-like teeth on each somite, both laterally and in the median line.

The telson is spinous, and has the terminal extremity beautifully fringed with hairs.

The branchiæ I have not been able to enumerate with certainty, but they exist rather in an impoverished than in a developing condition; the central stalk is long and robust, while the lateral filaments exist as globular papillæ, diminishing gradually from the base to the extremity, and are of less length than the diameter of the stalk to which they are attached.

The possibility has occurred to me of its being a young and immature form of some species allied to *Polycheles*, a hypothesis that was supported by the bottle containing it being labelled "Zoea of Brachyura," but there are certain features that seem to be opposed to this supposition.

The brephalos of *Willemasia* has not been observed, but I have been able to determine by examination of an embryo in an advanced condition (Pl. XX. fig. 2), that the ophthalmopoda at that period are well developed, and I have no doubt that when it quits the ovum the brephalos is in the megalopa stage, with the ophthalmopoda developed as in the young of *Astacus*. But the specimen that I have before me has no ophthalmopoda or trace of one. The frontal margin on each side of the median line, in the place where the ophthalmopoda are situated in the normal species of Astacidea, is slightly excavate, and this is suggestive of an orbital impression, but there is not the slightest trace of an organ of vision here, but on the outer side of the frontal margin, beyond the position of the antennæ, and corresponding with the ophthalmopoda in *Willemasia*, is a dark circular spot that is suggestive of being such an organ, but without any structural indication of its function.

The first pair of antennæ differs from that in *Polycheles* and in *Willemasia* in not having the inner margins, from the base to the distal extremity of the first joint, produced laterally so as to be brought into contact with each other and elevated upwards into a crest-like form, but only a large spine-like tooth at the inner distal angle.

The second pair of antennæ is peculiar, and, so far as I know, unique in character. The first or coxal joint carries a phymacerite, developed in the form of a long, straight, cylindrical tube that is obliquely truncate at the distal extremity. If we examine the same organ in *Willemasia* we shall find it, though different in form, to be analogous in character, since it consists of a long cylindrical organ, but so curved that,

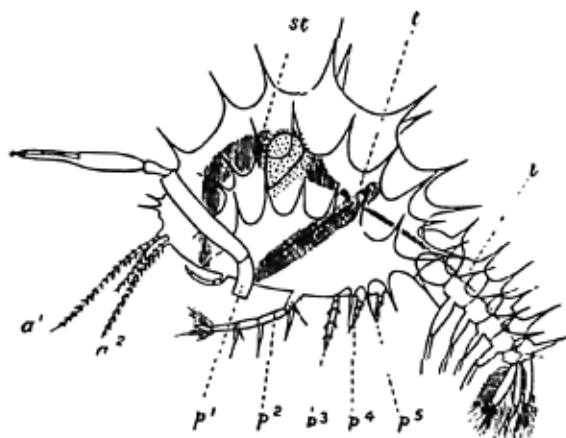


FIG. 30.—*Eryoneicus cæcus*. After a drawing by von Willemoes-Suhm. a^1 , first antenna; a^2 , second antenna; p^1 , p^2 , p^3 , p^4 , p^5 , pereopoda; st , stomach; t , testis(?); i , intestinal canal.

being directed upwards (Pl. XIX. fig. c, *ot*), the extremity of the organ rests against the under surface of the first joint of the first pair of antennæ (fig. C'''), producing a depression on the surface.

As I have previously stated, the desire not to injure this interesting and unique specimen has kept me from examining the oral appendages.

The second pair of gnathopoda and the succeeding pereopoda closely resemble in proportion and general character the corresponding appendages in the genus *Pentacheles*.

The pleon differs in being considerably narrower than is generally the case in species of the Eryonidæ, of which, so far as I am aware, there are only two resembling it, namely, the recent *Polycheles rosea*, and the fossil *Eryon curvieri*. It may, therefore, be considered that this form, whether immature or fully developed, adds another link to the connection between the recent and fossil Eryonidæ.

Polycheles, Heller.

Polycheles, Heller, Crustaceen des südlichen Europa, p. 209, 1863.

„ Sp. B., Ann. and Mag. Nat. Hist., ser. 5, vol. ii. p. 276, 1878.

Dorsal surface of the carapace flattened and depressed. Latero-anterior angles projecting beyond the anterior margin. Pleon not longer than the carapace. Ophthalmopoda obscure, immovably lodged in an orbit excavated in the dorso-frontal margin of the carapace, more or less covered by the antero-lateral margin of the carapace.

First pair of antennæ furnished with two long slender flagella, of which the outer is the shorter.

Second pair of antennæ having a scaphocerite, and terminating in a long and slender flagellum; four anterior pairs of pereopoda chelate, the anterior being the largest, and the fifth pair in the male terminating in a simple styliform dactylos.

First pair of pleopoda in the male having a long and slender biarticulate stalk, terminating in a broad and spoon-like extremity; in the female, biarticulate, slender and feeble throughout.

The second and four posterior pairs biramose, the branches fringed with long ciliated hairs, the inner branch, in the male, supporting two subequal stylamblydes, in the female, one.

The rhipidura is symmetrical and well developed, outer branch broad. Telson tapering.

Geographical Distribution.—This genus ranges from the Mediterranean to the West Indies. Heller's typical species, *Polycheles typhlops*, was first taken off the coast of Sicily, and by the Rev. Dr. Norman off the Portuguese coast, and *Polycheles sculptus*, S. Smith, was obtained in 250 fathoms off the coast of Nova Scotia; while other species are

recorded from the West Indies, the Fiji and the Celebes Islands, at depths varying from 220 to 1070 fathoms.

The Rev. Dr. Norman,¹ says that the females of *Polycheles typhlops* are characterised by the posterior pair of pereopoda terminating in small and feeble but perfect chelæ, similar to those that exist in *Arctus*, *Ibaccus*, and most species of *Palinuridæ*. This is also the case in *Polycheles baccata*, but it does not appear to be persistent in every species, as may be seen in *Polycheles helleri*.

Polycheles crucifera (Willemoes-Suhm) (Pl. XIII.).

Willemoesia crucifera, Willemoes-Suhm, Trans. Linn. Soc. Lond., ser. 2, vol. i. p. 52, pl. xii. fig. 11; pl. xii. figs. 10, 11.

Willemoesia crucifera, Sp. B., Ann. and Mag. Nat. Hist., October 1878, p. 277.

Carapace ovate, lateral margins fringed with large teeth; frontal margin armed with a single rostriform tooth, and two sharp teeth on the inner angle of the orbital notch; dorsal median ridge without teeth, but minutely nodulated, as also is the dorsal surface, where lines of nodules correspond with the limits of the calcareous formation of the pereion. Pleon with a spinous carina traversing the median line, each somite being armed with two strong teeth. The eye is lodged in a narrow cleft of the dorsal surface of the carapace, and projects beneath the antero-lateral angle of the carapace, in the form of an obtuse point.

Length, 45 mm. (1.5 in.).

Habitat.—Station 23, off Sombrero Island, West Indies, March 15, 1873; lat. 18° 24' N., long. 63° 28' W.; depth, 450 fathoms; bottom, Pteropod ooze.

The dorsal surface of the carapace is marked with a cruciform line formed by a nodulated ridge that traverses the median line from the anterior to the posterior margin, and a transverse ridge along the posterior margin of the cervical furrow. Another nodular ridge on each side leads from the posterior extremity of the orbital notch to the cervical furrow, and another diagonally towards the lateral margins. Posterior to the cervical furrow the nodules are larger and more isolated; a row of these nodules, separated from each other, traverses the line of the internal margin of the branchial region, the others are more generally scattered, and the entire surface between the nodules is covered with a number of minute, rather stiff, curved hairs. The anterior division is a little narrower than the posterior, and is again, particularly at the margin, divided into two portions, each of which is armed with a series of long, slender, spinous teeth.

The rostral tooth in the median line of the anterior margin, instead of being horizontal, is nearly perpendicular to the dorsal surface, and is long and slender; on the

¹ *Ann. and Mag. Nat. Hist.*, ser. 5, vol. iv. p. 177, 1879.

inner angle of the orbital notch are two small sharp teeth arising from nearly the same base, between which and the rostral tooth the anterior margin of the carapace is fringed with long hairs, as it is also between the outer angle of the orbit and the latero-anterior angle, which is directed obliquely forwards, curving outwards and upwards, the first division or antennal region thins out into a marginal ridge, which is surmounted by a series of six long outwardly and upwardly-curved teeth; the second division which is known as the hepatic region, is surmounted by five outwardly-directed and upwardly-curved teeth, of which the anterior is the most prominent. Posterior to the cervical suture the margin proceeds slightly outwards and then downwards, and is surmounted by a series of seventeen teeth directed outwards, upwards, and forwards, except those on the posterior margin, which are directed backwards and radiate in a curve corresponding with the rest. The posterior margin bends in a manner corresponding with the form of the animal, and supports a short curved spine near the articulation of the posterior margin of the carapace with the first somite of the pleon, between which and the median line on each side there are three or four small sharp teeth.

The first somite of the pleon is longitudinally short, narrower than the second, and supports one sharp tooth on the median line; it has no coxal plate, the outer extremity terminating in a nodular cusp that articulates with a corresponding cup in the carapace (peltecleis) and locks it in position.

The second somite is longitudinally longer than the first, and is bisected by a furrow on each side of the median line, the central crest of which carries two sharp teeth, placed one behind the other, the anterior of which is directed obliquely forwards, while the posterior is nearly perpendicular; the third, fourth, and fifth somites resemble the second except that each gradually narrows in succession, and the coxal plates become more pointed; the sixth somite has no dorsal teeth, but protuberances only: the telson is long and tapering, with two small longitudinal ridges on each side of the median line.

The ophthalmopoda (*a*) are small, obscure, and immovable, the upper portion is bulbous and fills a small notch or cleft in the anterior margin of the dorsal surface of the carapace, whence it narrows to a point and lies impacted in a hollow on the outer side of both antennæ (*b*, *c*), beneath the projecting antero-lateral angle of the carapace; a small tooth projects from the anterior surface of the upper or bulbous portion of the ophthalmopod. It is impossible in the present condition of the animal to state with certainty, but from the appearance of the organ I am inclined to believe that vision existed at two points, namely, at that part of the upper surface exposed within the orbital notch, and inferiorly at the extremity of the ophthalmopod. The animal, however, can have had only a very limited range of vision outwardly, by the aid of one lens above, and another below and a little in advance, and even this, from the apparent density of the cornea, must have been of a very imperfect character.

The first pair of antennæ (fig. *c*, *b*) has the first or coxal joint thick and bulbous on the

outer side, where it is armed with one slender sharp-pointed tooth, beyond which is a long, narrow, transverse slit or opening leading to the auditory chamber. On the inner side the margin thins out and curves upwards to a crest, and is fringed with four anteriorly-directed teeth, of which the posterior is the smallest and the anterior the largest; the second joint is shorter and narrower than the first, and the inner anterior angle is produced to a sharp tooth; the third joint is shorter and narrower than the second, and has also the inner anterior angle produced to a sharp tooth; the surfaces of these three joints are sparsely covered with short thick hairs: the inner flagellum is about as long again as the outer, it is more robust, and divided into numerous small articuli, each of which bears three or four small stiff hairs at every articulation.

The second pair of antennæ (fig. c, c) is situated on the outer side of and a little below the first pair; it consists of only four joints, the second and third being fused together: the first joint is closely impacted in the metope but not fused with it, and carries a long curved phymacerite that passes inwards and upwards, terminating in an obtuse extremity that is laterally flattened against a sub-membranous depression on the under side of the first joint of the first pair of antennæ; the second joint is diagonally fused with the third, which carries on its outer angle a short lanceolate scaphocerite, the extremity of which reaches beyond the penultimate joint of the peduncle; the fourth and fifth joints are cylindrical, and terminate on the inner distal angle in a small tooth: the flagellum is slender, and resembles in length and form the longer branch of the first pair of antennæ.

I did not dissect the oral appendages in this species, inasmuch as the specimen, which is a very beautiful one, is unique, and I expected to obtain similar observations from other species of which specimens were more numerous.

The second pair of gnathopoda (*i*) is six-jointed, the basis and ischium being apparently fused into one. The coxa is furnished with a short, curved, rigid mastigobranchia, sparsely fringed with hairs on the convex side; the basis is fused with the ischium, and carries no ecphysis; the ischium is long and robust; the meros also, but not so stout or so long as the ischium; the carpos is short and small; so also is the propodos, but longer than the carpos; and the dactylos is styliform and as long as the propodos; the inner and outer margins of all the joints are fringed with hairs.

The first pair of pereopoda are much larger than the rest. The coxa is large, being broader in diameter than the basis, which is narrow and curved, so that the ischial articulation is directed outwards and slightly backwards; the ischium is round and small at the basal articulation, and gradually enlarged and flattened towards the meros, with which it articulates; the meros is longitudinally arcuate, flattened, increases in breadth, and again narrows and thickens towards the carpal joint; the carpos is triangular, narrowest at the meral extremity, broadest at the propodal, and is armed with a small tooth at the inner distal angle; the propodos is long, broad, and flattened, widest just beyond the carpal extremity, where it bulges out to give insertion to the flexor muscle of

the dactylos; the outer margin is armed with several small teeth, of which the largest is at the anterior angle, the others irregularly lessening until they disappear near the middle. The pollex is long, slender, gradually narrowing to the apex, where it is pointed and curves to meet the dactylos: it stands at a slight angle with the propodos, and gradually curves upwards. The dactylos corresponds in form and length conversely with the pollex, against which it impinges when closed throughout the entire length by a series of small leaf-like plates closely impacted sideways against each other, the points being directed posteriorly. These fade away towards the extremities of the pollex and dactylos, which overlap each other when closed.

The second pair of pereiopoda is considerably smaller than the first, to which it otherwise bears a general resemblance, excepting that the propodos is much more slender, being not broader than the carpos, and has the margins fringed with long hairs.

The third and fourth pairs are also chelate, but differ from the preceding in having the curve of the dactylos in the opposite direction. The pollex is long and slender, and armed with a row of short spines on the posterior margin. The dactylos is longer than the pollex, smooth on both margins, except for a few delicate hairs near the base, and slightly curved posteriorly.

The fifth pair of pereiopoda (*o*) is shorter than the preceding, which is due to the three last joints being each slightly shorter than their homotypes in the preceding pairs, more especially the dactylos, which is thicker and shorter and sub-lanceolate, there being no polliciform prolongations to the propodos. This pair is simple in the male, the only sex with which we are acquainted.

The first pair of pleopoda (*p*) is biarticulate, the first joint being a three-sided stem, which, when pressed against the ventral surface, lies compactly in a curved groove formed between the ventral surface of the pereion and the projecting inferior margin of the carapace. This joint reaches as far as the coxa of the posterior pair of pereiopoda, where it articulates with the second, which is narrow at the base, and at a short distance from it suddenly widens into a long, hollow, spatuliform organ, the distal extremity of which reaches as far as the coxa of the third pair of pereiopoda. This form only exists in the male; and, from its position and relative proportions, it undoubtedly fulfils an effective purpose. But of this I shall be enabled to speak more fully when writing of another species which I have had better opportunities of examining.

The second pair of pleopoda (*g*) is biramose, the two branches being foliaceous, narrow, flattened, flexible, tapering, and fringed at the margin with fine hairs; the inner ramus near the base supports two stylamblydes of unequal length, the longer of which is furnished with two or three rather obscure cincinnuli.

The third, fourth, and fifth pairs of pleopoda resemble the second except in having only one stylamblys instead of two.

The sixth pair articulates with the posterior margin of the sixth somite of the pleon;

it aids the long and lanceolate telson in forming a well-developed rhipidura. The basal joint is short; while the rami are long, broad, foliaceous, and lanceolate, the margins being fringed with a row of closely-planted, evenly-set hairs.

Observations.—The specimen is the only one of this species taken. According to Dr v. Willemoes-Suhm, when obtained it “was red, which is I believe the prevailing colour of all deep-sea Crustacea.” This colour, however, rapidly disappeared when the specimen had been for a certain time in spirit.

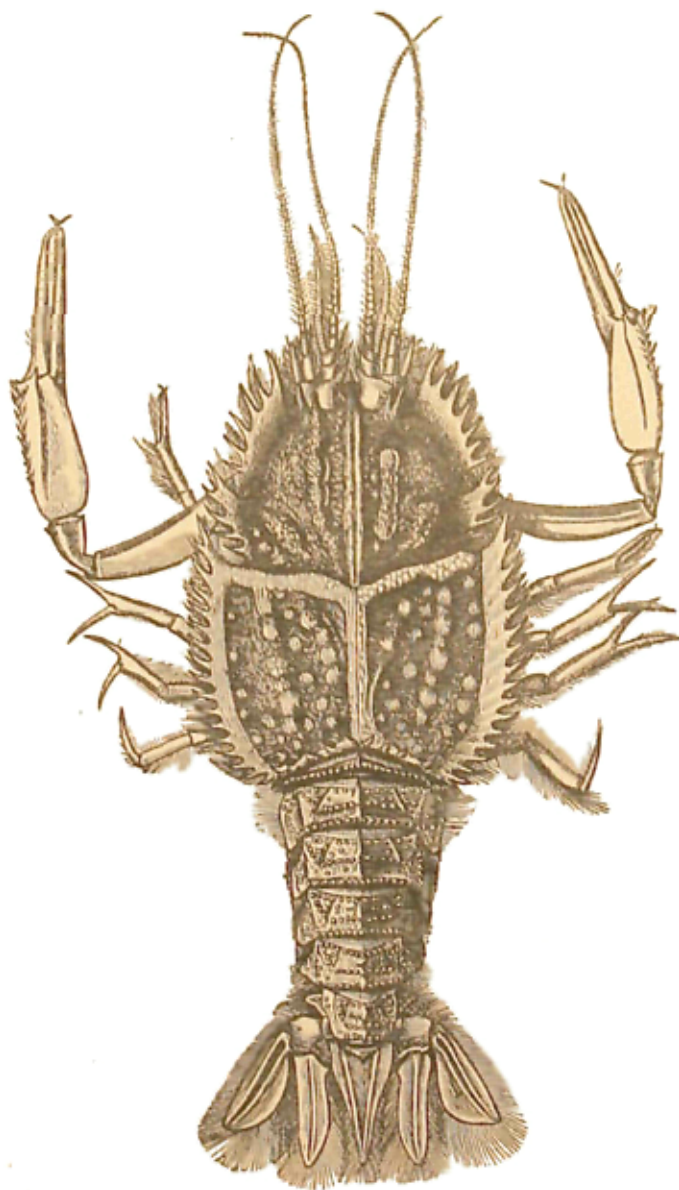


FIG. 31.—*Polycheles crucifera*. From a drawing by Dr. v. Willemoes-Suhm.

Polycheles baccata, Spence Bate (Pl. XIV. fig. 1).

Polycheles baccatus, Sp. B., Ann. and Mag. Nat. Hist., ser. 5, vol. ii. p. 278, 1878.

Carapace scarcely broader than the pleon at its anterior extremity, lateral margins subparallel, anterior division armed with twelve teeth, the median, which is but imper-

fectedly separated from the anterior with five, and the posterior with twenty-five, more or less small teeth. The anterior frontal margin is furnished with one large and two small rostral teeth. Dorsal ridge without teeth or spines, but bead-like tubercles traverse the median line and the posterior margin of the carapace. Pleon carinated, the four anterior somites each projecting to an anteriorly-directed tooth. Ophthalmopoda lodged in a deep notch in the dorsal surface of the anterior margin of the carapace. Meros of the first pair of pereopoda smooth except a small tooth on the outer distal angle, and two near the external distal angle of the carpos, and one small one on the inner. Fifth pair of pereopoda terminating in the male in a long, slender, sharp, styliform dactylos, and in the female in a short and stunted chela (fig. 1 o, ♀).

The dorsal armature of the carapace may be thus formulated—

Marginal,	.	.	.	.	.	.	12—5—25
Rostral,	.	.	.	.	.	.	3
Dorsal crest,	.	.	.	.	.	.	0

Length—male, 80 mm. (3·3 in.); female, 85 mm. (3·6 in.).

Habitat.—Station 173, July 24, 1874; lat. 19° 9' 35" S., long. 179° 41' 50" E.; off Matuku; depth, 310 to 315 fathoms; bottom, coral mud.

The carapace is of a long quadrate form, the lateral margins being nearly parallel, slightly converging at each extremity, and adorned with a great number of small teeth. The anterior division has ten or twelve, but between them is a considerable quantity of small hairs that fill the intervening spaces, particularly in the younger animals. The central division has four or five similar teeth, and hairs, but their separation from the anterior is not always very perfectly defined. The posterior division is more distinctly separated, and carries about twenty-five or twenty-six teeth, not very clearly defined, which gradually diminish in size. The lateral wall of the carapace below the serrate margin is perpendicular for some distance, and then flattened inwards at almost right angles. The perpendicular portion is covered with long hairs, especially visible on the lower margin, where there is a row just above a line of very fine teeth that form a ridge between the vertical and the horizontal portion of the lateral wall of the carapace; the horizontal part is slightly granular, and between the granules the surface is perfectly smooth.

The anterior margin of the carapace (fig. 1 c) has the lateral angles projecting slightly in advance of the central or rostral point, which consists of a strong tooth arising from the metope, directed obliquely upwards and forwards, and flanked by two small teeth, one on each side behind on the frontal margin of the carapace, and a row of hairs, on the outer side of which a serrate margin passes outwards and forwards to a point, from which it recedes also as a serrate margin to the inner angle of the orbit, where a short and slender tooth projects. The outer angle of the orbit is also armed with a sharp and slender tooth, whence obliquely to the outer angle of the carapace are several small, sharp teeth.

The posterior margin is deeply excavated in the centre, from which the margin, fringed with a row of minute hairs, recedes posteriorly and outwardly on each side to a strong tubercle, the peltecleis, which overrides and articulates in a hollow or socket formed in the coxal plate of the first somite of the pleon. From this tubercle the posterior margin passes downwards and outwards, and becomes continuous with the lateral margin. From this point also an obscure line, slightly baccated in appearance, passes in a flexuous direction forwards on the dorsal surface of the carapace, corresponding with the internal wall of the branchial chamber.

The first somite of the pleon has the anterior division long and the posterior short; the former is smooth, and passes beneath the carapace, when the animal is extended; the latter is granulated, and is armed with a strong anteriorly-directed tooth in the median line, and extends laterally until it reaches the coxal plate, which is produced obliquely forwards, and overlaps the posterior margin of the carapace, external to the tuberculated process or peltecleis, and thus secures or bolts the carapace in position. The second somite is not longer than the first, but has the first or anterior division shorter and covered almost entirely by the previous somite when the animal is extended; the posterior division is longer, granulated, and divided transversely by a *groove or furrow that runs obliquely from near the anterior margin at the median line to the postero-lateral margin, where it joins with the coxal plate.* A large sharp anteriorly-directed tooth longitudinally traverses the posterior division in the median line; the coxal plate is extremely large, being produced forwards to an obtuse point beyond the margin of the carapace downwards and inwards, and rounded inferiorly and posteriorly in a continuous line; the upper portion of the surface is granulated, the lower smooth, and the margin fringed with long hairs. The third, fourth, and fifth somites resemble the second, excepting that they gradually narrow posteriorly, and the tooth on the dorsal median line becomes less important in the fourth, and only appears as a ridge or crest on the fifth somite, and also in the form of the coxal plates, which are not produced anteriorly, but have the anterior margin hollowed, uniting with the posterior margin so as to form an obtuse angle with it. The sixth somite is narrower and slightly longer than the preceding; the coxal plate is more pointed and posteriorly excavate, to admit of the articulation of the posterior pair of pleopoda; the dorsal median line instead of being armed with a vertical tooth is furnished with a double row of small bead-like tubercles. The telson is long, pointed, horizontally ribbed, and fringed with long hairs. There appears to be no feature in the dorsal structure that distinguishes the male from the female, which is slightly the larger in our specimens.

The ophthalmopoda (fig. 1c, a) are small, obscure, anteriorly armed with a small tooth, and lodged in an orbit excavated in the anterior margin of the carapace, compressed on the under side by the membranous articulation of the second pair of antennæ, and point outwards, covered by the projection of the latero-anterior angle of the carapace, and

protected by a mass of hair on the under and outer side of the orbit, as well as by a fringe of the same on the upper surface, that almost hides it from view, more especially in the female.

The first pair of antennæ (fig 1 c, b) has the first joint dorsally concave, the inner margin projecting upwards so as to form, with the corresponding inner margin on the opposite side, a crest, which is fringed with small teeth and long hairs, and produced forwards to a point; the second joint is small, narrow, and fringed with hairs on the inner and outer sides; the third is small, and similarly fringed with hairs, and carries at the extremity two flagella; the outer is more slender, and built up of numerous small bead-like articuli; the inner has the articuli longer and broader.

The second pair of antennæ (c), including the coxa, articulates with the metope, it carries a long projecting phymacerite, the extremity of which is flattened, turned upwards, fringed with hairs, and covered by a membranous tissue, which impinges against the lower surface of the coxa of the first pair of antennæ, where a hollow impression exists to receive it; the second joint carries at its outer distal extremity an obtusely-pointed scaphocerite fringed with long hairs, and on the inner a short, strong tooth; the next joint is narrower than the preceding, is thinner on the inner than the outer side, and fringed with a row of very long hairs, and is anteriorly produced to a short but strong tooth; the terminal joint is cylindrical, narrower, and shorter than the preceding, and is also fringed with long hairs; the flagellum is long and slender, and resembles the inner of the first pair.

The mandibles are large and powerful, and are deeply serrate along the incisive margin of the psalisiform blade, the centre of which is furnished with a strongly projecting pointed tooth, advanced considerably beyond the others, which gradually recede to the upper and lower extremities, which are also armed with a strong and pointed tooth; the mandibles carry a biarticulate synhipod, which folds and lies within the hollow of each mandible.

The first pair of siagnopoda consists of a biramose uni-articulate appendage, flat, thin, rigid, and curved longitudinally, the extremities armed with long spines and hairs, lying closely against the metastoma or posterior lip, which consists on each side of a long and slender styliform membranous process, closely impacted diagonally against the mandibles.

The second pair of siagnopoda consists of a large foliaceous plate extending both anteriorly and posteriorly, and two small branches, one slender and pointed, the other flat and spatuliform, and folded back upon the larger plate. The two smaller have the edges smooth, but the largest is surrounded by a closely-set fringe of equally long hairs, and has the surface flecked with fine cilia, sparsely distributed.

The third pair of siagnopoda (fig. 32) is foliaceous and convolute; the upper extremity is constricted so as to form a chamber or pocket into which a triangular articulated joint

falls, being attached by one angle: the moveable plate does not close as an operculum, but is inserted marginally, and both chamber and plate are fringed with rather long, finely ciliated, thickly-set hairs. At the foot of the appendage is a broad, flat, curved plate, thinly fringed with long hairs. The anterior extremity of this siagnopod reaches forwards beyond the base of the antennæ; it passes beyond the mandibles, and it is through this channel that the water of expiration passes out of the branchial chamber, the moveable plate at the extremity being probably a valve which admits of its more or less rapid egress. I have not determined the exact form of the mastigobranchial plate in this appendage, as it was partially ruptured.

The first pair of gnathopoda is short, not reaching beyond the mandibles, and seven-jointed, but carries no ecphysis. The coxa is short, the basis is scarcely more important, and, without close observation, appears united with it; the ischium is short and cylindrical; the meros long, ovate, very slightly flexed, concave below; the carpos is transversely triangular, being broader at the propodal extremity than at the meral; the propodos is short, narrow and cylindrical, and the dactylos is reduced to a strong slightly curved spine; all the joints are fringed on the inner side with hairs, stiff and firm on the propodos and carpos, soft, yielding, and ciliated on the meros and ischium.

The second pair of gnathopoda is as long again as the first, and reaches forwards as far as the first joint of the antennæ. It is long and slender, and consists of six joints. The coxa is broad, and carries a rudimentary mastigobranchia, consisting of a minute sharp-pointed membranous plate, supporting a few short hairs; the basis and ischium are fused into one long joint, arched on the outer side and flattened on the inner, and longitudinally curved; the meros is long, and continues the arch of the previous joints; the carpos is cylindrical and short; the propodos is also cylindrical and short, but longer than the carpos; the dactylos is lanceolate and thickly fringed with hairs, as is the entire appendage, but more sparingly, with long ciliated hairs, mostly on the inner side.

The first pair of pereiopoda is as long as the animal, slender, flattened, and chelate.

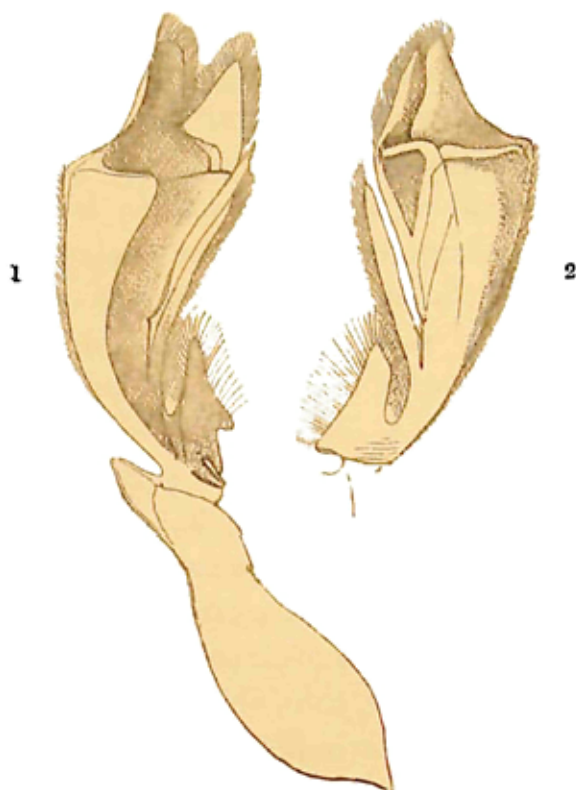


FIG. 32.—Third siagnopod, (maxillipede) of *Polychaetes baccata*. 1 outer, 2 inner surface.

The coxa is broad, the basis small and cylindrical; the ischium is long and flat, cylindrical at the basal joint, and broad and flat at the meral; the meros is long and flat, straight on the inner margin and wavy on the outer, increasing in breadth from the ischial joint, from whence it again narrows, and then widens at the carpal, where it is armed with one small curved tooth; indications of teeth along the posterior margin are visible only under a lens; the carpos is cylindrical and narrow where it articulates with the meros, whence it increases in diameter gradually until it reaches the propodal articulation; the inner margin is straight and smooth, but armed with an inner and outer sharp cusp near the propodal joint; the outer margin is also straight, but not parallel, being divergent; it is grooved longitudinally, each side of the depression being minutely serrate, the upper ridge terminating anteriorly in two curved sharp teeth. The propodos is long, ovate, longer than the carpos, rounded on the under side, and armed with a double row of very small denticles, and straight on the upper, which is fringed with a number of small sharp teeth; the polliciform process is as long as the palm of the propodos; it is straight until close to the extremity, when the point suddenly thins and turns upwards; the dactylos is straight, long, and slender; it resembles the pollex reversed, the two meeting and impinging against each other on the inner margin throughout their entire length; each of them is armed with a series of closely packed, thin, obliquely and transversely placed plates, except at the long thin curved points which cross and pass each other.

The second pair of pereopoda is short, being not more than one-third the length of the first pair; the joints are proportionately robust and less flattened; the carpos is armed at the outer anterior angle with a strong spine; the propodos is long and transversely triangular, with a ridge longitudinally traversing the outer surface, the inner being flattened; the pollex, instead of being in line with the propodos, is slightly bent inwards and downwards, a direction followed by the dactylos, the inner margins of which when closed, impinge against each other in their entire length, and are armed with a series of minute thin plates similar to those in the first pair, but somewhat more pointed; a few long hairs planted in rows on the margins give the limb a more hirsute character than the preceding.

The third pair of pereopoda is smaller than the second, the joints are rather more slender, and the propodos is not larger in diameter than the carpos; the pollex and dactylos are long, slender, and slightly curved reversely, so that the dactylos, instead of being flexed towards the pollex, is turned from it, and the pollex is curved parallel with the dactylos.

The fourth pair of pereopoda resembles the third very closely.

The fifth pair is still smaller and terminates in a styliform dactylos. The coxa of this pair of limbs in the male (fig. 1 ♂, o, o) is large, and is perforated by a foramen, through which the vas deferens protrudes. In the female the fifth pair of pereopoda (fig. 1 o, ♀)

differs from that in the male in being imperfectly chelate instead of terminating in a simple styliform dactylos. The propodos is long, fringed with very long hairs on the internal margin, and terminates abruptly. It is only on close inspection that the dactylos is found to be present. The distal extremity of the propodos is produced to a blunt, internally hollowed pollex. The dactylos is not longer than the pollex, flat, double-pointed, blunt, and fringed with a few hairs.

The branchiæ are in accordance with others of the genus, and may be tabulated as follows :—

Pleurobranchiæ,	.	.	.	.	...	...	...	1	1	1	1
Arthrobranchiæ,	.	.	.	.	...	...	2	2	2	2	...
Podobranchiæ,	.	.	.	.	...	...	1	1	1	1	...
Mastigobranchiæ,	.	.	.	.	...	1	1	1	1	1	...
						h	i	k	l	m	n	o

The first pair of pleopoda in the male is two-jointed (fig. 1 ♂, *p.p.*) ; the basal joint is cylindrical, the next commences as a small stalk and suddenly expands into a broad thin spoon-like plate, the convex surface of which presses against the ventrum. They meet in the median line, the inner margin of one overlying that of the other to form a hollow groove, in which, I presume, the flexile extension of the membranous organ of the male animal is supported at certain periods.

In the female this same pair of pleopoda (fig. 1 ♀, *p.*) is long, slender, compressed, and fringed with fine hairs.

The second pair of pleopoda (fig. 1 ♂, *q.*) consists of a long, straight, basal joint, that supports two flattened branches, to the inner margins of which, in the male, two rigid stylamblydes are attached. In the female (fig. 1 ♀, *q.*) it resembles that of the male except that it carries a single stylamblys, as is the case in both sexes in the several succeeding pairs of pleopoda, except the sixth, which combines with the telson to make a broad and well-formed rhipidura.

Observations.—There were six specimens of this species taken about 100 miles south-east of the Fiji group of islands, associated with *Pentacheles euthrix* and *Benthescymus*. Two were 80 mm. and 85 mm., and three from 37 mm. to 40 mm. in length. Of the larger, one is a male, the other a female. The above description has been drawn from the male or smaller of these two specimens. Of these smaller specimens the largest one is a male, characteristically though not fully developed ; the two others are females. The vulva in each is apparent ; the form of the first pair of pleopoda, as characteristic of the female, is distinguishable in each, and there is but a single stylamblys on the second pair of pleopoda. In connection with the smaller females, the posterior pair of pereopoda terminates in a single styliform dactylos, a condition that is characteristic of the male. I am therefore induced to believe that the chelate structure in the female only exists in adult forms, or in those approaching maturity.

The branchiæ in this species are of the normal character, but there is no evidence of even a rudimentary mastigobranchial lash attached to the first pair of gnathopoda, as we see in *Pentacheles euthrix*; in the second pair it is in a more rudimentary condition than in that species. The mastigobranchiæ attached to the several pairs of pereopoda are of great tenuity, and shorter than the podobranchiæ.

Polycheles helleri, Spence Bate (Pl. XIV. fig. 2; Pl. XV. fig. 1).

Polycheles helleri, Sp. B., Ann. and Mag. Nat. Hist., ser. 5, vol. ii. p. 276, 1878.

Pentacheles helleri, on pl. xv.

Carapace not broader than the first and second somites of the pleon, lateral margins subparallel, anterior division armed with seven teeth, median with four, and posterior with four or five well-developed teeth near the anterior extremity, from which they gradually decrease in size posteriorly; dorsal central ridge armed with two rostral teeth directed upwards on the anterior margin, which, with the series in the median line, may for convenience be formulated, commencing anteriorly, as 2-1-1-2-1, fossa 2-2-2.

The pleon (Pl. XIV. fig. 2P) is carinated on the five anterior somites, the anterior margin of the crest of each somite culminating in an anteriorly-directed point.

Habitat.—Station 170, near the Kermadec Islands, north of New Zealand, July 14, 1874; lat. 29° 55' S., long. 178° 14' W.; depth, 520 fathoms; bottom, volcanic mud; bottom temperature, 43°. One specimen.

Length, about 36 mm. (1.5 in.).

Station 218, north of New Guinea, March 1, 1875; lat. 2° 33' S., long. 144° 4' E.; depth, 1070 fathoms; bottom, blue mud; bottom temperature, 36°.4. One specimen.

Length, 50 mm. (2 in.).

This species is rather more slender than *Polycheles baccata*, and is readily distinguishable in having a double rostral tooth arising from the anterior margin of the carapace, and none from the metope between the first pair of antennæ; the anterior margin of the carapace is smooth and recedes gradually to the orbit, which forms a rather large notch in the dorsal surface of the carapace, and thence it advances obliquely outwards to a sharp tooth that forms the latero-anterior angle of the carapace. The lateral margin is furnished with six teeth on one side, and seven on the other in the anterior division; three on the median; on the posterior, or that portion of the margin of the carapace that lies behind the cervical fissure, there are two or three tolerably conspicuous teeth situated anteriorly, and so also near the posterior margin, but in the space between these two points, the teeth are only represented by small notches or are entirely wanting.

The median line of the carapace is armed with a series of distal teeth, on the anterior margin are two rostral teeth that stand obliquely upwards and forwards, behind which in

a line with the posterior margins of the orbits is a single sharp tooth; at an equal distance behind is a second, behind which, at a similar space, are two side by side, posterior to which is another single tooth. These are all anterior to the cervical fissure, on the posterior margin of which two teeth stand close together, while scarcely half way between these and the posterior margin are two others placed side by side, and two others wider apart stand upon a protuberance on the ridge of the posterior margin. The line of demarcation that separates the branchial chamber from the internal viscera is clearly defined, and armed with a tolerably strong tooth near the posterior extremity, and indications of others exist along the line.

The pleon gradually narrows towards the posterior extremity of the animal, and is armed in the median line of the five anterior somites with a series of strong anteriorly-directed teeth which gradually increase in size posteriorly, so that the fifth is the largest. On the sixth somite there is no tooth, but there is a double ridge that unites in front of the posterior margin.

The telson is long, narrow, and pointed.

The ophthalmopoda (Pl. XIV. fig. 2c, *a*) are rather broad and distinct on the dorsal surface, the anterior margin of which is armed with a small outwardly-directed tooth. Judging by the translucent appearance of the external tissue, one lens appears to be situated at the posterior dorsal extremity of the orbit, and another on the anterior point of the ophthalmopod, which is depressed and covered by the anterior angle of the carapace, and projects outwards between it and the second or outer pair of antennæ.

The first pair of antennæ (fig. 2c, *b*) has the first joint produced internally and anteriorly to a point that reaches as far as, or beyond, the extremity of the third joint of the peduncle, and thins out to a ridge that is directed obliquely upwards, and is not armed with teeth but fringed with hairs only. A large round lobe, containing the auditory apparatus, exists within the outer margin, the opening to which consists of a narrow transverse slit armed at the outer margin with two sharp, strong teeth, one anterior and the other posterior to the opening. The second and third joints are cylindrical and successively smaller, and support two flagella of which the inner is as long as the carapace, the other is slender and short, being but little longer than the peduncle of the antenna.

The second pair of antennæ (fig. 2c, *c*) articulates with the metope entirely; the coxa being free carries a long and prominent phymacerite, the extremity of which is compressed against the surface in a depression on the under side of the first pair of antennæ. The second joint carries on the outer anterior extremity a long narrow ovate centrally-pointed scaphocerite; the third and fourth joints are cylindrical and equal in length, and the terminal flagellum is as long as and resembles that of the internal of the first pair.

I have examined the oral appendages on the left side and find that the variation from those of the preceding species is but small; the mandibles are of the same form, with the same kind of synphipod, while the anterior lip or cheiloglossa fills up the concave hollow within their blades.

The first pair of siagnopoda differs in having the inner branch a little more slender than the outer.

The second pair has the margin of the mastigobranchia more densely fringed with hair.

The third pair is less constricted towards the apex, and the chamber or pocket is less defined, the movable valve is ovate, and the hairs on the inner margin are more numerous.

The gnathopoda are alike, except that in the second pair the dactylos terminates in a sharper extremity.

The first pair of pereopoda is long, narrow, and not unlike that of the preceding species, excepting some small points of armature. There are two small but conspicuous teeth on the outer margin of the meros, and one on the external distal angle; the carpos is unarmed excepting a small tooth on the outer distal angle, and the propodos is smooth and free from armature.

The second, third, and following pairs of pereopoda do not differ in any marked feature from those of the preceding species, excepting that the dactylos of the last pair is shorter and fringed with hairs. There is no striking difference in the appendages of the pleon from those of *Polycheles baccata*.

Observations.—The specimen from which this description was taken was the only one found at Station 218. The only other Crustacean of this group associated with it was one that I have named *Pentacheles obscura*, from the uncertainty I feel as to its true character; it may be a degraded representative of the female of the above. But at Station 170, near the Island of Kermadec, there was taken an imperfect specimen of what I consider may be the female of *Polycheles helleri*, and the cephalon of which is figured in Pl. XV. fig. 1. It corresponds in general character with the male, the ornamentation being slightly different and more distinct. The dorsal surface of the carapace is covered with more defined granular points, from each of which a minute hair springs. The arrangement of small teeth on the median dorsal line is similar in both. There are two small teeth just within the anterior margin at the interior angle of the orbit. The serratures on the lateral margins correspond, but are more pronounced, and are seven in the anterior region, four in the median, and fourteen in the posterior, which gradually lessen in degree and disappear at the posterior margin. The denticulation on the dorsal median ridge of the pleon corresponds with the male specimen, but the increase in size posteriorly is not so conspicuous, and the sixth somite is smooth.

The tooth on the ophthalmopod is small and there are two teeth (although I have only figured one) near the auditory fissure of the first pair of antennæ.

The flagella of the antennæ as well as the structure of the peduncles correspond in the two specimens, and there is no important variation in the structure of the appendages of the mouth.

The first pair of pereiopoda is imperfect, but the meros is armed with two small teeth on the outer and two on the inner margins, which last differ from those in the male specimen.

The other pairs correspond, but the posterior pair has the last joint broken off.

The specimen, as I before said, is imperfect. Besides the fingers of the large pair of claws the posterior pair of pereiopoda is only perfect as far as the propodos, and there is no evidence to determine the character of the appendages in this specimen, which is undoubtedly a female, the vulva being visible on the third pair of pereiopoda.

The first pair of pleopoda is small, slender, and feeble; the second pair carries but a single stylamblys. This specimen was taken at half the depth of the preceding, at a temperature of 43°, on a bottom of volcanic mud.

The branchial arrangement corresponds with that of *Pentacheles* in the delicate character of the mastigobranchia, which is of great tenuity and shorter than the plume with which it is associated.

It will be interesting to compare with this species that which is described by Smith as *Polycheles sculptus*,¹ and with *Pentacheles sculptus*,² and *Pentacheles spinosa*³ of A. Milne-Edwards.

Professor A. Milne-Edwards' description is short and agrees with *Polycheles helleri* in every point mentioned. But Mr. Sidney Smith's description is more complete and is fully illustrated by good figures of the entire animal in both dorsal and ventral aspects, as also of most parts in detail. After studying the paper and figures carefully I can detect no distinction of sufficient importance to separate *Pentacheles sculptus* from *Polycheles helleri*, nor would it have taken much consideration to decide their identity had it not been for the generic character of the fifth pair of pereiopoda, and that the specimens were procured from localities so widely apart. *Polycheles helleri* lives in the Eastern Pacific at depths of from 500 to 1000 fathoms, and *Pentacheles sculptus* in the Western Atlantic, at about 600 fathoms.

It is highly probable that many of the animals that we determine as specifically distinct, because they are found in widely separated localities, and exhibit some greater or less deviation from each other, would cease to be considered such if they lived side by side, and there can, I think, be little doubt that many of our museum specimens are not really species.

A comparative examination of the Atlantic *Pentacheles sculptus* with that of the Pacific *Polycheles helleri*, will elucidate clearly the point in question.

¹ *Ann. and Mag. Nat. Hist.*, ser. 5, vol. v. p. 269, 1880.

² *Bull. Mus. Comp. Zool.*, vol. x. p. 23, pla. iii., iv., 1882.

³ *Bull. Mus. Comp. Zool.*, vol. viii. p. 66, 1880.

The armature of the two species may be best appreciated side by side, and formulated as below.

The marginal fringe of the carapace is

Male, <i>Polycheles helleri</i>,	.	.	.	.	7-4-5, gradually decreasing.
Female, <i>Polycheles helleri</i>,	.	.	.	.	7-4-14, gradually decreasing.
Female, <i>Pentacheles sculptus</i>,	.	.	.	.	6-3-6, gradually decreasing.

Median dorsal ridge

Male, <i>Polycheles helleri</i> (counting the rostral teeth),	.	.	.	2·1·1·2·1 = 2·2·2.
Female, <i>Polycheles helleri</i> (counting the rostral teeth),	.	.	.	2·1·1·2·1 = 2·2·2.
Female, <i>Pentacheles sculptus</i> (counting the rostral teeth),	.	.	.	2·1·2·1 = 2·2·2.

On the inner side of the orbital notch the frontal margin is armed with a small tooth in *Pentacheles sculptus*, and so in the female of *Polycheles helleri*.

"In front of the cervical suture there is an irregular longitudinal dorso-lateral line of five minute spines; on each side of and behind these, a single spine on each side on the posterior edge of the cervical suture." The last of these alone is present in the male of *Polycheles helleri*, in the female there is, besides, a small tooth on the inner side of the orbital notch, and one or two nearer the median line, but not in a line corresponding with those given in Sidney Smith's plate.

"Extending from the posterior margin nearly to the cervical suture, there is a sharp sublateral carina parallel to the lateral margin, about a third of the way from it to the median carina and armed with five or six small spines."

These also exist in *Polycheles helleri*, and traverse the line corresponding with the upper edge of the inner wall of the branchial chamber.

The character of the ophthalmopoda is similar, and the passage in this description (page 137) relating to the translucent appearance of the external tissue of the eye was in type before Smith's remarks on the same were published. I do not mention this to plead for priority of observation, but to demonstrate, from independent sources, how close the relationship between the two animals from antipodal regions really is, and that Mr. Smith's observation supports this opinion.

Excepting the termination of the fifth pair of pereopoda in the males there is no structural distinction between the two forms, so far as I can determine, but that of a tooth or two on the outer surface of the carapace, and I think there are few naturalists but must feel that the two specimens, except for the generic feature, might have been classified as belonging to one and the same species, so closely does *Polycheles helleri* resemble *Pentacheles sculptus*.

Pentacheles, Spence Bate.

Pentacheles, Sp. B., Ann. and Mag. Nat. Hist., ser. 5, vol. ii. p. 276, 1878.

All the pereiopoda are more or less perfectly chelate in both sexes, the ophthalmopoda are immovably lodged in a notch in the anterior dorsal surface of the carapace, and the anterior portion projects beneath the antero-lateral angle of the carapace, which is produced anteriorly to a level with the central rostral tooth.

Geographical Distribution.—The range of this genus comprises probably the whole Pacific and Atlantic Oceans, as species have been taken in the sea around the Philippine Islands as well as on the western coast of South America and at the intermediate stations of the Fiji and Kermadec Islands. A. Milne-Edwards describes two, *Pentacheles validus* and *Pentacheles agassizii*, from the West Indian region of the Atlantic, and Sidney Smith has taken *Pentacheles sculptus* in Mid Atlantic.

Pentacheles obscura, Spence Bate (Pl. XV. fig. 2).

Pentacheles obscura, Sp. B., Ann. and Mag. Nat. Hist., ser. 5, vol. ii. p. 279, 1878.

Carapace furry on the dorsal surface. Lateral margins furnished with few teeth, not conspicuous from being intermingled with hairs. Regions not well defined marginally. Anterior division furnished with three or four small teeth separated from each other, median with three, posterior division with five or six. Anterior median armed with two rostral teeth; half way to the cervical suture are two more, posterior to which is one small one, and the rest of the median ridge is either smooth or crested with small granulations. Pleon carinate; central ridge tuberculate rather than denticulate.

Length, 25 mm. (1 in.).

Habitat.—Station 218, March 1, 1875; lat. 2° 33' S., long. 144° 4' E., north of New Guinea; depth, 1070 fathoms; bottom, blue mud; bottom temperature, 36°·4.

This specimen is in a very poor condition, and has much the appearance of one that had recently cast its skin. The dorsal surface of the carapace is of a rougher character than usual, the small granulations that carry the short curved hairs being rather prominent. The median ridge is furnished with a double row of granulations, except at the anterior extremity where there are two small teeth side by side, and there are two others similarly placed on the gastric region. The denticulation of the lateral margin is not clearly determinable in consequence of its hirsute character.

The ophthalmopoda support a strong tooth, rather longer than usual, and are implanted in a wide-mouthed but not deep notch.

The first pair of antennæ has the inner margin of the first joint of the peduncle

very thin, smooth, turned upwards, and the anterior angle rounded, and fringed with hairs; the outer anterior angle is armed with a small tooth anterior to the auditory fissure.

The second pair of antennæ has the peduncle quite as long as that of the first, and the scaphocerite is narrow, lanceolate, scarcely reaching to the extremity of the peduncle.

The several organs of the mouth, so far as they could be observed, appear to have a close resemblance to those of *Polycheles helleri*; so also has the gnathopoda.

The first pair of pereiopoda has the meros smooth to ordinary vision, but a low magnifying power shows several minute points on both the inner and the outer sides.

The fifth pair of pereiopoda (fig. 2 o, ♀) is imperfectly chelate, induced by a short pollex; the posterior and distal angles of the propodos are produced to half the length of the dactylos; the dactylos is long, and curved in the same direction as the pollex, its convex or proximal side is smooth, the concave or outer side being hirsute, both forming an imperfect grasping claw. Somewhat similar is the condition of the three posterior pairs; that is, the dactylos and pollex curve in a direction parallel with each other, and impinge together so that they lie in the same direction instead of opposing each other as finger and thumb.

The first pair of pleopoda is that of a female, as this specimen undoubtedly is; and I was much inclined to believe it to be that of *Polycheles helleri*, but the finding of a specimen, which is evidently the female of *Polycheles helleri*, off Kermadec Island, has compelled me to hesitate as to the relationship of this specimen. I have, consequently, associated it with those species in which the form of the fifth pair of pereiopoda more nearly resembles this.

The mastigobranchia attached to the coxa of the second pair of gnathopoda, and the well-developed character of those attached to the pereiopoda, are similar to the same in *Pentacheles lævis*.

Pentacheles lævis, Spence Bate (Pl. XV. fig. 5).

Pentacheles lævis, Sp. B., Ann. and Mag. Nat. Hist., ser. 5, vol. ii. p. 278, 1878.

Dorsal surface of the carapace long-ovate, free from any armature on the surface except two small teeth equidistant and longitudinally placed on the median line anterior to the cervical fossa. Rostral margin bi-dentate; inner frontal angle of the orbital notch produced to a strong tooth, serrate on the outer margin. The lateral marginal denticulation is bold anteriorly, gradually decreasing posteriorly. The anterior division is but imperfectly defined from the median, and together they are armed with nine teeth, and the branchial or posterior with fifteen or sixteen. Dorsal median line of the pleon but slightly elevated and imperfectly dentate. The posterior pair of

pereiopoda is imperfectly chelate in the female, the pollex being shorter than the dactylos.

Habitat.—Station 214, February 10, 1875; lat. $4^{\circ} 33' N.$, long. $127^{\circ} 6' E.$; between Samboangan and New Guinea; depth, 500 fathoms; bottom, blue mud; bottom temperature, $41^{\circ} 8$. Length, 38 mm. (1.5 in.), female.

Station 300, December 17, 1875; lat. $33^{\circ} 42' S.$, long. $78^{\circ} 18' W.$; west of Valparaiso; depth, 1375 fathoms; bottom, Globigerina ooze; bottom temperature, $35^{\circ} 5$. Length, 47 mm. (1.75 in.), female.

Although the animal is named *lævis*, there is a short, sparsely-scattered fur on the surface of the carapace; but, with the exception of two small teeth on the median line anterior to the cervical fissure, the dorsal surface of the carapace is free from armature. The teeth on the lateral margins are very even and regular, and gradually increase in importance from the posterior margin of the carapace to the anterior angle, where they become tolerably large and decided. In the median line of the frontal margin are two divergent upwardly-pointed rostral teeth. Outside these, on the inner angle of the orbital notch, is a strong tooth pointing forwards and slightly upwards; it is serrate on the outer side. The orbital notch is narrow. The somites of the pleon are dorsally smooth, and are slightly elevated into a median carina, the four anterior somites of which only possess dentations (fig. 5P).

The ophthalmopod is armed on the anterior surface with a sharp tooth.

The first pair of antennæ has the inner margin of the projecting scale of the first joint of the peduncle serrate, with its anterior point reaching as far as the distal extremity of the third joint of the peduncle.

The second pair has the flagellum broken short, and has a small scaphocerite that does not reach beyond the ultimate joint of the peduncle.

The mandible and oral appendages correspond closely with those of other species.

The first pair of gnathopoda much resembles that of *Stereomastis suhmi*.

The second pair is damaged in this specimen, the joints beyond the ischium being wanting; the coxa is broad and hairy, and carries a tolerably long mastigobranchia, but no branchial plume.

The first pair of pereiopoda is broken off at the coxa, to which is attached a podobranchia and a mastigobranchia, the latter being as long as the plume; to the articulation are joined two arthrobranchiæ, but I could not detect a pleurobranchial plume.

The second pair of pereiopoda likewise carries a long podobranchial plume and an equally important mastigobranchial plate, two arthrobranchiæ, and a pleurobranchia.

The third and fourth pairs carry similar branchial plumes to the second; but the fifth pair is shorter than any of the preceding pereopoda, and has no branchia attached except a small pleurobranchial plume. The whole may be tabulated as follows:—

Pleurobranchiæ,	.	.	.	...	...	...	1	1	1	1
Arthrobranchiæ,	.	.	.	...	...	2	2	2	2	...
Podobranchiæ,	.	.	.	...	...	1	1	1	1	...
Mastigobranchiæ,	.	.	.	...	1	1	1	1	1	...
				h	i	k	l	m	n	o

The first pair of pleopoda in this specimen, which is a female, is small and feeble. The second is biramose, and the inner branch carries a single stylamblys fringed with ciliated hairs, as do all the other pairs of pleopoda until the sixth, which forms part of the rhipidura.

Observations.—The first specimen of this species, which was not a very perfect one, was taken south-east of the Philippine Islands, at about seventeen degrees west and seven degrees north of where *Pentacheles obscura* was taken.

The second specimen was taken near Juan Fernandez, at three times the depth, on a similar bottom but at a temperature six degrees lower.

The two localities of this species, being more than ten thousand miles apart, induced me to compare the specimens with great care.

Pentacheles gracilis, n. sp. (Pl. XVI. figs. 1, 2).

Carapace long-ovate; anterior margin furnished with two sharp rostral teeth directed obliquely upwards; a similar strong, sharp tooth is directed forwards at the inner angle of the orbit. Outside the orbital notch is a similar tooth directed obliquely inwards, beyond which the lateral angle of the carapace projects anteriorly in the form of a strong, sharp tooth, passing obliquely upwards, outwards, and anteriorly beyond the extremity of the median or rostral teeth. The lateral margins of the carapace are evenly denticulate, and divided at the cervical and hepatic fissures. There are ten teeth on the anterior, three on the median or hepatic, and fourteen on the posterior or branchial margins. These last lessen in size as they proceed posteriorly. Between the several teeth are a few hairs. The median dorsal ridge is armed with a row of single teeth, gradually decreasing in size as they proceed posteriorly. The general surface is polished and sparsely covered by small granular points, from which spring short, curved hairs; the branchial region is clearly defined by a baccate or minutely denticulate line.

The dental armature of the carapace may for convenience be formulated as—

Marginal,	10—3—14
Dorsal ridge,	2·1·1·1·1·1·1·1·1—1·1·1·1·1·1·1

The pleon is smooth and carinated in the median line; the carina in the three anterior somites culminates into anteriorly-directed teeth.

The first pair of pereopoda has the meros smooth on the outer margin, with a strong tooth at the external carpal angle, and armed on the inner margin with several small teeth, of which in our specimen four are well defined.

Length (female), 60 mm. (2·25 in.).

Habitat.—Station 174c, August 3, 1874; lat. 19° 7' 50" S., long. 178° 19' 35" E.; off Kandavu Island; depth, 610 fathoms; bottom, coral mud; bottom temperature, 39°. One specimen.

This species is of a very beautiful and graceful form. The lateral margins are slightly curved outwards, and the carapace possesses a somewhat ovate shape. The teeth on the lateral margins of the carapace are very even and regular, with a tendency to diminish gradually in size as they approach the posterior margin. The tooth at the anterior angle of the carapace is very strong and prominent, and projects beyond the line of the median or rostral teeth. There is a sharp and prominent tooth on the inner and outer angles of the orbital notch. There is a single row of many teeth in the median line. Several of the anterior are well defined, but posteriorly they diminish, and become mere protuberances.

The internal margin of the branchial region is defined by a wavy, baccated line, separating the branchial from the cardiac region.

The posterior margin of the carapace is smooth and free from armature, and is overlapped by the lateral extremity of the first somite of the pleon.

The first somite of the pleon is very short and narrower than the carapace. The anterior half is depressed, and slides under the carapace when the animal is extended. The posterior half is elevated, armed in the median line with a strong, sharp, anteriorly-directed tooth, and fringed along the posterior margin with a row of fine cilia. The lateral extremity consists of the coxal plate reduced to a strong calcified mass that is curved forwards, and, as a pleocleis, overlaps and holds down the posterior margin of the carapace.

The second somite is longer and slightly narrower than the first, articulating with it at each lateral extremity by a small ball-and-socket joint, beyond which the coxal plates are large, and project downwards and extend forwards to the margin of the carapace, and posteriorly overlap the anterior half of the coxal plate of the third somite; a well-defined fossa passes obliquely from the postero-lateral angle of the somite to the central line of the posterior or elevated portion, where it is armed with a strong, sharp and

anteriorly-directed tooth: the third, fourth, and fifth somites are similar, except that posteriorly they become narrower, carry a smaller coxal plate, and have the dorsal median tooth diminishing gradually to a cusp: the telson is long and tapering, armed on the median line near the base with a small posteriorly-directed cusp.

The ophthalmopod is situated in a wedge-shaped cleft, which is narrower at the base than at the anterior margin, where it is armed with a sharp and rigid tooth, and projects downwards and outwards, being compressed between the upper surface of the second pair of antennæ and the extension of the latero-anterior angle of the carapace.

The first pair of antennæ has the anterior extremity of the inner squamiform process produced to a sharp tooth, and armed along the inner margin, which is curved upwards, with two or three small teeth and a few hairs, and carries one sharp tooth on the outer anterior angle above the auditory slit; the two succeeding joints of the peduncle are short, not reaching so far as the apex of the inner tooth of the first joint; the outer flagellum is about one-fourth the length of the inner, and more slender.

The second pair of antennæ has the phymacerite long, and compressed closely against the inferior surface of the first joint of the first pair of antennæ; the extremity of the peduncle reaches beyond that of the first pair; the flagellum is as long as the inner branch of the first pair; and the scaphocerite, which is long, narrow, and pointed, does not extend beyond the extremity of the last joint of the peduncle, although so figured in the plate (fig. 1c. c). The surface of the peduncle is covered with hairs, and so is the margin of the scaphocerite.

I have not disturbed the oral appendages, as the specimen is unique, and the general similarity of the external parts is suggestive of no great variation in hidden structure.

The second pair of gnathopoda carries a small and slender mastigobranchia, but has no podobranchial plume attached. It corresponds closely with the same organ in *Pentacheles lævis*.

The first pair of pereiopoda is long and slender. The meros is smooth upon the outer margin, except that it is armed with a single tooth on the distal or carpal extremity; the inner margin is furnished with a row of small teeth, the three or four nearer the ischium being sharp and well defined; the carpos is long, slender, and smooth, except for one small tooth at the external distal angle; the propodos is fringed with fine teeth on the external margin and a few rudimentary ones on the inner; the dactylos is parallel with the pollex, excepting that both are curved laterally inwards and overlap each other when closed. The coxa carries a long and broad mastigobranchia, with a podobranchial plume attached to it. At the articulation are two arthrobranchiæ, a large posterior and a small anterior, but no pleurobranchia.

The second pair of pereiopoda is tolerably robust. It is short and carries two arthrobranchiæ, a podobranchia, and a mastigobranchia.

The two following pairs are more slender, and possess a similar branchial arrangement.

The posterior pair of pereopoda is smaller than either of the preceding, and terminates in an unequal and imperfect chela, the pollex being shorter than the dactylos, and curved in the same direction, so that the pollex seems to impinge posteriorly against the dactylos. This pair supports no podobranchia or arthrobranchia; but a pleurobranchial plume is attached to the inner wall of the chamber, and the whole may be tabulated as follows:—

Pleurobranchiæ,	.	.	.	...	...	...	1	1	1	1
Arthrobranchiæ,	.	.	.	...	...	2	2	2	2	...
Podobranchiæ,	.	.	.	...	...	1	1	1	1	...
Mastigobranchiæ,	.	.	.	...	1	1	1	1	1	...
				h	i	k	l	m	n	o

The first pair of pleopoda in the female is small, slender, and uni-branched, while the four succeeding pairs are large and biramose, carrying on the inner side of the inner branch a single stylamblys, fringed with a few plumose hairs on the approximate side, and tipped with a bunch of cincinnuli.

The rhipidura offers no distinctive variation from the same in allied genera.

Observations.—This species was taken about one degree south-west of the Fiji Islands, associated with *Pentacheles euthrix* and *Stereomastis auriculata*.

Pentacheles euthrix, (Willemoes-Suhm, MS.) (Pl. XVII.).

Willemoesia euthrix, Willemoes-Suhm, MS.

Pentacheles euthrix, Sp. B., Ann. and Mag. Nat. Hist., ser. 5, vol. ii. p. 280, 1878.

Margins of the carapace slightly convex; antero-lateral angles slightly approximating, and somewhat abruptly turned upwards; anterior division armed with eight teeth, and defined from the central, which has four, and the posterior, which has twelve or thirteen. The anterior margin has two rostral teeth, two small ones above the first pair of antennæ and one within the margin of the internal angle of the orbit. The median longitudinal ridge is armed posterior to the two rostral teeth by two single and one double and another single one before the cervical ridge, and behind it a double and after a space another double, and on the anterior edge of the posterior margin three stout teeth or cusps on each side. All of which may be formulated as—

Marginal,	.	.	.	.	.	.	8—4—13
Dorsal crest,	.	.	.	.	.	.	2·1·1·2·1—2·2·2

On the pleon the carina is produced to a sharp tooth on all the somites anterior to the fifth, where it is reduced to a strong cusp, and is almost lost on the sixth somite.

The first pair of pereopoda has the meros armed with two small teeth on the outer margin near the base, and a small one near the distal external angle; and in some

specimens there are several small teeth on the inner margin; the propodos is also fringed on both margins with several minute denticles, and the external or dactyloid angle is armed with a strong cusp or tooth. The posterior pair of pereopoda is chelate, the dactylos and pollex being subequal in both sexes.

Length (male and female), 57 mm. (2.25 in.).

Habitat.—Station 170, July 14, 1874; lat. $29^{\circ} 55' S.$, long. $178^{\circ} 14' W.$; off the Kermadec Islands; depth, 520 fathoms; bottom, volcanic mud; bottom temperature, 43° .

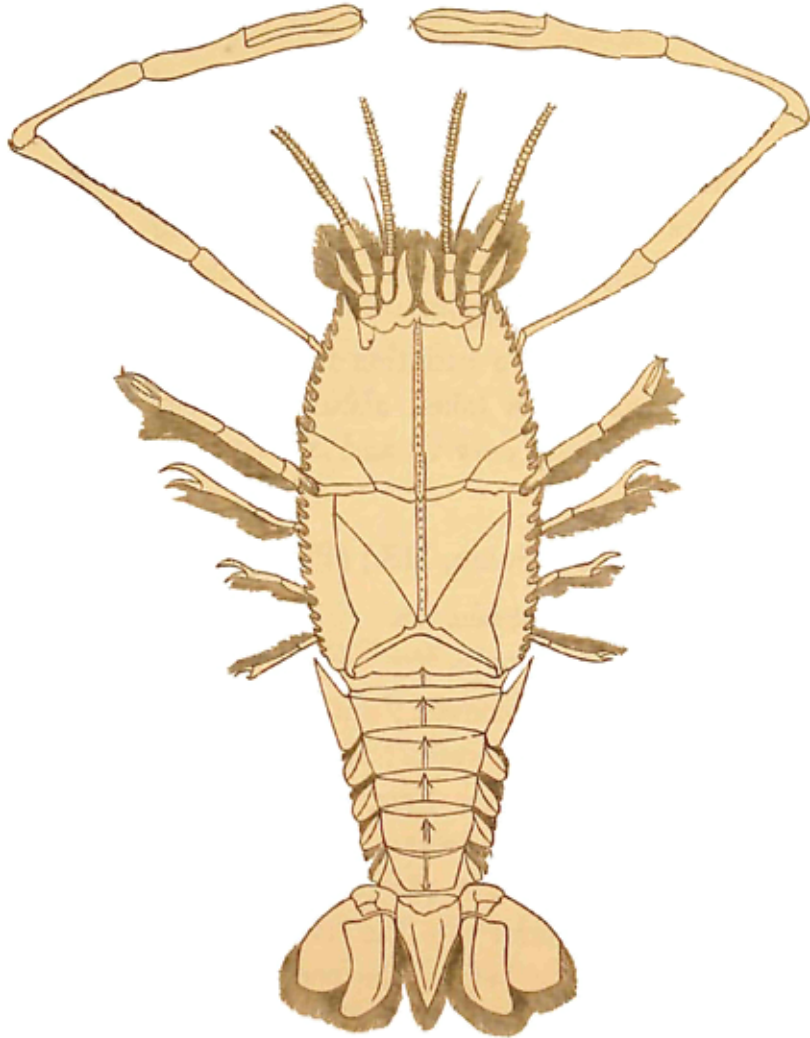


FIG. 33.—*Pentacheles euthriz*. From a drawing by Dr. v. Willemoes-Suhm.

Station 170A, July 14, 1874; lat. $29^{\circ} 45' S.$, long. $178^{\circ} 11' W.$; near the Kermadec Islands; depth, 630 fathoms; bottom, volcanic mud; bottom temperature, $39^{\circ} 5$. Two female specimens.

Station 173, July 24, 1874; lat. $19^{\circ} 9' 35'' S.$, long. $179^{\circ} 41' 50'' E.$; off Matuku; depth, 315 fathoms; bottom, coral mud. Male.

The surface of the carapace is granulated; out of each granulation springs a small

curved hair. The lateral margins of the carapace are very nearly parallel; anteriorly they converge slightly towards each other, and the anterior angle is produced slightly in advance of the anterior margin. The lateral margins are furnished with well-defined teeth throughout their entire length, the several divisions being well marked; the anterior, which is turned somewhat abruptly upwards, has eight teeth including the anterior angle; the second or central division has four or five. There were four on each side in one specimen, and four on one side and five on the other in another, so that there is a tendency to variation. The posterior has thirteen teeth. The anterior or frontal margin between the orbits is convex, and armed with two rostral teeth, one on each side of the median ridge; four or five small denticles arm the frontal margin between the rostral teeth, and two larger ones behind and above the first pair of antennæ, outside which are two other small denticles, then a tolerably large one is situated within the margin at the inner angle of the orbital notch, the outer margin of which as far as the extremity of the latero-anterior angle of the carapace being smooth. The longitudinal median ridge is furnished with a double row of small bead-like granulations, and also, at some distance behind the rostral teeth, with a single tooth, a little behind it with another, then two side by side, then a single one anterior to the cervical fossa, behind which the double baccated row still continues to the posterior margin, and is armed close behind the cervical fossa with two teeth side by side, and at about one-third of the length of the ridge with two more similarly arranged in the female, but without any in the male. On the anterior edge of a ridge along the posterior margin of the carapace, on each side of the median line, is one sharp, strong, obliquely and anteriorly directed tooth; at a little distance is a second, and then a third, but the two latter are smaller and less important. The first somite of the pleon has a small, central, anteriorly-directed tooth, and on the anterior margin, just within the peltecleis, is another small and slender tooth; outside the peltecleis the marginal extremity of the somite terminates in a rounded protuberance fringed with cilia, that overlaps the postero-lateral angle of the carapace. The second somite of the pleon is armed in the centre with a tooth a little larger than that of the preceding; the rest of the somite is smooth and polished, as is also the coxal plate at the sides. The two succeeding somites resemble the second, nor are any of the central teeth more important; that on the fifth is less so, and is little more than a cusp, while on the sixth somite the slightest indication of a carina only exists at the posterior margin, and on the telson there is a small bead-like cusp near the anterior margin.

The ophthalmopod is lodged in a notch in the carapace that is much broader at the anterior margin, and narrows posteriorly; it carries a small, pointed cusp on the anterior surface, and passes outwards beneath the projecting angle of the carapace, and terminates in two small nodules, one on the outer, the other on the lower side.

The first pair of antennæ (C, b) has the squamose process of the first joint produced

to a strong, sharp tooth, directed upwards obliquely and anteriorly, extending beyond the extremity of the third joint of the peduncle, having the margin serrate with several small teeth, mingled with long hairs; the fissure leading to the auditory chamber is armed on the outer extremity of the posterior margin with one strong, sharp



FIG. 34.—Inner antenna of right side, seen from above. From a drawing by v. Willemoes-Suhm.



FIG. 35.—Outer antenna of right side, with scale, seen from below. From a drawing by v. Willemoes-Suhm.

tooth; the second and third joints of the peduncle are cylindrical, and the third is shorter than the second; the terminal flagella are unequal, the outer being much more slender than, and about one-fourth the length of the inner.

The second pair of antennæ (*c*) is implanted just outside the first, and the coxa carries a large curved phymacerite (*o.p.*) the extremity of which is rather smaller in diameter than the rest of the shaft, and is bent up against and lodged in a depression on the outer and under surface of the first joint of the first pair of antennæ; the second and third joints are closely impacted into one, so that it is difficult

to determine which is the second and which the third; the inner anterior angle is armed with a strong sharp tooth, and the outer supports a long and pointed scaphocerite fringed with hairs; on the under surface, behind the scaphocerite, is a large fasciculus of soft hairs; the last two joints of the peduncle are subcylindrical, and each produced to a strong, pointed cusp or tooth at the outer distal angle, the most distant of which reaches beyond the extremity of the scaphocerite; the flagellum is of about the same length and size as the inner branch of the first pair.

The mandibles and other oral appendages offer nothing to distinguish them from those of the other species.

The first pair of gnathopoda supports a small rigid process fringed with hairs, attached to the outer distal angle of the coxa, the rudiment apparently of a mastigobranchial appendage; the basis is armed on the inner surface with a row of strong cusps or blunt teeth; the ischium is short; the meros long and ovate; the carpos is cylindrical, slightly curved, broader at the distal extremity than at its meral; the propodos is short, cylindrical, smaller in diameter than the carpos, and armed with a few spine-like hairs; the dactylos is slender, sharp, and styliform. The entire appendage is fringed with long and strong hairs on the inner and distal surfaces, and with short, fur-like hair on the outer.

The second pair of gnathopoda carries a rudimentary membranous mastigobranchial appendage attached to the outer extremity of the coxa: the basis is short, the ischium long; the meros half the length of the ischium; the carpos shorter than the meros; the propodos

subequal to the carpos, but not so great in diameter; the dactylos sharp, long and styliform.

The first pair of pereiopoda exhibits, upon close inspection, the presence of small points or cusps on the inner and outer margins of the propodos, carpos, and meros, in some specimens more abundant than in others, but there are two that, although they vary in proportion, are tolerably constant in position on the outer surface of the meros. There is also one at the outer distal angle of the meros that appears to be constant; those on the inner and outer distal angles of the carpos are not so constant, more especially that on the outer. There is a strong tooth also at the outer or dactyloid angle of the propodos. It carries a small podobranchial plume attached to a long stalk, that supports a small and delicate mastigobranchial appendage, behind which are two small arthrobranchial plumes.

The second, third, and fourth pairs of pereiopoda offer no appreciable distinction from those in other forms of this group. The gills that each support are the podobranchiæ, a small and delicate mastigobranchial lash, two arthrobranchiæ, and a pleurobranchial plume. These increase in proportion as they proceed posteriorly, and those of the fourth pair are large and well developed, but all the mastigobranchiæ are of extreme tenuity, except at the stalk, which is flat and more rigid.

The fifth pair of pereiopoda is shorter than the others, and terminates in a subequally fringed chela, of which the pollex is rather shorter than the dactylos, and is concave or spoon-shaped. Above this pair, attached to the pleuron on a prominent protuberance, is a pleurobranchial appendage that is not equal in proportion to the podobranchia of the preceding pair.

The branchiæ may be tabulated as follows:—

Pleurobranchiæ,	.	.	.	...	...	...	1	1	1	1
Arthrobranchiæ,	.	.	.	...	...	2	2	2	2	...
Podobranchiæ,	.	.	.	...	...	1	1	1	1	...
Mastigobranchiæ,	.	.	.	...	...	1	1	1	1	...
				h	i	k	l	m	n	o

The first pair of pleopoda is of the form common to the male and female. The others are biramose.

Observations.—Dr. v. Willemoes-Suhm, in his notes on this species, says, "July 14, 1874. ♀. Two specimens were taken off Kermadec Island in 500 fathoms; one, the smaller, being 35 mm. in length, and the other 47 mm. The carapace was 22 mm. long and 19 mm. wide. The length of the large chela was 65 mm. but does not equal that of *Willemoesia leptodactyla*, and is distinguished from it:—



FIG. 36.—Two hairs on a section of chitin, showing their structure. From a drawing by v. Willemoes-Suhm.

"*Firstly*, by the absence of a tooth on the chela.

"*Secondly*, by the pointed tooth-like formation of the first joint of the inner antennæ.

"*Thirdly*, by the concavity where we might expect the eye. The spot is covered only by a thin chitinous skin, and not by the granular mass on the carapace.

"*Fourthly*, by the various divisions on the carapace.

"*Fifthly*, by the pointed tooth on each side of the first somite of the pleon; and

"*Finally*, by several details."

This species has a close general resemblance to *Polycheles baccata*, and had I not been able to determine both sexes of this latter species, I should have considered myself justified in believing them to be the two sexual forms of the same species. Our specimens were taken north of the Kermadec Islands, and one about 100 miles south-east of the Fiji group.

Stereomastis,¹ n. gen.

This genus differs in nothing externally from *Pentacheles*, but is established to receive those species in which the mastigobranchial lash does not exist.

Difference of internal structure as a specific character is of more value than any external distinction, which, though more convenient for classification, is of little importance if it does not represent structural variation.

Stereomastis suhmi, Spence Bate (Pl. XV. figs. 3, 4).

Pentacheles suhmi, Sp. B., Ann. and Mag. Nat. Hist., ser. 5, vol. ii. p. 278, 1878.

" " on Pl. XV. figs. 3, 4.

Carapace with lateral margins subparallel; anterior division armed with five strong teeth, median with two, and the posterior with eight or nine teeth equally strong, continuing to the posterior margin. Frontal margin with a sharp tooth at the inner angle of the orbit, and two central rostral teeth; posterior to which on the central dorsal ridge are two teeth, one behind the other; then at an equal distance two side by side, and a similar pair behind them, and then one single tooth anterior to the cervical fossa, on the posterior margin of which is a prominent pair, behind which, near together, are two single teeth, and then after a considerable space on the posterior ridge of the carapace is another strong pair, more widely separated from each other.

The armature of the carapace may be expressed as—

Marginal teeth,	5—2—8
Dorsal ridge,	2·1·1·2·2·1—2·1·1·2

¹ The name is derived from *στειναι*, to be deprived of, and *μάστιξ*, a lash (Ionic, *μάστις*).

On the pleon the dorsal median teeth are very prominent, and continue to the telson; they are all anteriorly directed, and exhibit a tendency, which increases posteriorly, to carry a second small tooth, which on the sixth somite breaks into a serrate arrangement, and this is repeated on the telson, though to a less extent.

The first pair of pereopoda is long and slender, and has the meros armed with one, two, or three sharp teeth on the outer margin, and one at its outer distal angle, and the carpos armed with a sharp tooth on the outer margin, a little behind the propodal joint.

The posterior pair of pereopoda has the pollex in both sexes shorter than the dactylos.

Length—male, 46 mm. (1·8 in.); female, 50 mm. (2 in.).

Habitat.—Station 305B, January 1, 1876; lat. $47^{\circ} 48'$ S., long. $74^{\circ} 46'$ W.; southwestern coast of South America; depth, 160 fathoms; bottom, blue mud.

Station 311, January 11, 1876; lat. $52^{\circ} 45' 30''$ S., long. $73^{\circ} 46'$ W.; near Magellan Strait; depth, 245 fathoms; bottom, blue mud; bottom temperature, 46° . Nine specimens.

There was only a single specimen of this species, and that a male, taken at Station 305B, in the channel between the coast and the islands that lie upon the Pacific side of Patagonia. But at Station 311, where the situation was very similar, though nearer the Strait of Magellan by some three hundred miles, on a similar sea-bottom, and within the same chain of littoral islands, there was a larger number taken, a circumstance that has allowed me to examine in detail the structure of this species more minutely than in most of the other forms, of which the specimens were fewer.

The lateral margins are nearly parallel to each other, the denticulation is bolder than usual and slightly curved upwards and forwards, and the anterior angles approaching a little towards each other; the surface is sprinkled with small denticles, and a row of more important ones runs from the post-orbital angle posteriorly and inwardly. In some specimens the anterior tooth is larger than either of the others, and at the opposite extremity they are connected on the outer side with a group of others; on the ridge of the cervical suture, half way between the median line and the lateral margin, is another group of three or four small sharp teeth. Corresponding with the line of separation between the branchial region and that of the internal viscera, is a curved row of small teeth, commencing just behind the cervical fossa and running nearly parallel with the lateral margin to the posterior extremity of the carapace. On the inner side, between this row of denticles and the median ridge of the carapace, is a group of several other teeth sparsely scattered about, and the entire surface is sprinkled with short hairs, the longest of which are on the branchial region. Besides the rostral teeth there is one situated on the anterior margin at the internal angle of the orbital notch.

The somites of the pleon are all dorsally armed with strong anteriorly-directed teeth, each carrying a more or less conspicuous denticle behind it, of which that on the third

somite is the most prominent, while on the sixth somite the larger tooth is represented by a number of small denticles, a condition that is repeated to a less extent on the anterior surface of the telson. At the lateral margins of the several somites, and fused with them, is a large flat coxal plate, of which that of the second is the largest, and the proportions gradually diminish to the sixth, while that of the first somite is either absent or reduced to a minimum.

The first somite of the pleon is not so wide as to reach to the lateral margins of the carapace, but the extremities are directed forwards and overlap the posterior margin, from which a strong cusp is posteriorly produced and rests upon the upper surface of the posterior division of this somite, on the inner side of which is a second cusp or tooth. Thus we find that the lateral extremity of the somite keeps down the margin of the carapace, whereas a cusp of the latter presses down the surface of the somite, each retaining the other in its place by a specially-formed cusp or bolt (the *peltecleis*). A corresponding cusp exists on the posterior margin of the somite articulating with a smaller one on the anterior margin of the second somite, in a limited ball and socket articulation, and this is repeated on each somite successively.

The ophthalmopod is fixed in a long and narrow orbit in the frontal margin of the carapace, and carries a tooth on the anterior surface, from which it suddenly narrows laterally, becoming depressed so as to pass beneath the latero-anterior angle of the carapace, which is produced anteriorly, and elevated to the plane of the dorsal surface of the carapace, and so passes over the eye and protects it. The ophthalmopod appears to be firmly united to the carapace at the inner margin of the orbit, but not on the outer, against which it is closely compressed, passing through a cavity on the under side, formed by the frontal region folding back against the antennal. Here it appears small and pointed, and the lens, I presume, exists in the extremity beneath a semi-translucent cornea, protected and almost hidden by a mass of hairs.

The first pair of antennæ has the inner process of the first joint of the peduncle anteriorly pointed; the margin is but slightly curved upwards, thickly fringed with ciliated hairs and armed with two small teeth, as also is the outer margin, as well as that of the second and third joints; on the outer distal angle are two strong teeth, one before, the other behind the auditory fissure (fig. 3c). The under surface is at right angles with the inner, and is hollowed to receive the extremity of the phymacerite. The second joint is short and cylindrical, and the third, still shorter, supports one long and one short flagellum. The articuli of the inner flagellum are long and slender, and sparsely ciliated; those of the outer are short and thickly ciliated.

The second pair of antennæ has the first joint or coxa articulating freely with the metope, and on the under surface supports a long phymacerite, the extremity of which turns upwards and impinges against a depression on the inferior surface of the coxal joint of the first antenna. The orifice is therefore curved upwards, and is covered by a

thin chitinous membrane, which appears to be perforated by a small horse-shoe fissure, somewhat out of the centre, and unevenly surrounded by a ring of thickened tissue, that is probably muscular and therefore contractile (see fig. 13, p. 104). The length of the metope is small, and the organs that cover the mouth are produced anteriorly, so as to reach beyond the anterior margin of the carapace.

The cheiloglossa or anterior lip is thick and fleshy; in the centre, anteriorly directed, is a thin, flexible, styliform process, while the mass of the structure fills up and lies compactly in the hollow between the mandibles. The metastoma or posterior lip is likewise a thick and fleshy mass, internally and centrally produced to a small vertical process; externally and posteriorly the mass overlies the posterior portion of the psalisiform blades of the mandibles, and extends laterally in a slender digital process on each side, and lies in close contact with the mandibles, just where the psalisiform blades are connected with the apophyses. The mandibles consist of a pair of interlocking, scissor-like, serrate blades, differing very little from those in *Willemæsia* and *Polycheles*, carrying a two-jointed synaphipod, thickly fringed with hairs, and moved by a long and pointed apophysis, of which the extremity articulates with an underfold of the anterior surface of the carapace.

The first pair of siagnopoda consists of a double-branched appendage, curved, rigid, and fringed with stiff hairs that become spiniform at the apex of the outer and larger branch; on the external surface, near the base, there exists a fasciculus of short, thickly ciliated, slender hairs, springing apparently from a common centre.

The second pair of siagnopoda resembles that of other species; it consists of two short and small branches on one base, which fold back against a large, flat, foliaceous plate, that is produced anteriorly further than the two previous rami, and posteriorly to an equal extent, and is fringed with cilia that radiate in an anterior direction.

The third pair of siagnopoda corresponds with that of *Polycheles*, as shown at p. 135, fig. 32. It consists of three thin foliaceous branches; the basal one is short, broad, concave, and truncated, and has the margin fringed with hairs; the middle branch is narrow, and coincides with the curve of the inner margin of the third branch, the corresponding sides being smooth and free from hair, while the outer edge is thickly fringed with short, fine hairs. This and the preceding branch turn outwards and fold back against the next or distal joint, which is much longer and broader than either of the others; it is hollow internally, folding like a leaf upon itself, and this convolution increases considerably towards the apex, where it causes a cup-like appearance; at the outer margin a small bat-shaped flap, thickly and evenly fringed with hairs, is articulated, and acts like a movable valve at the exit of the branchial chamber; from the root or base of the three joints arises a broad, thin, and long membranous plate, the homotype of the mastigobranchia attached to the several pairs of pereiopoda, the epignathite of Milne-Edwards.

The first pair of gnathopoda is short and pediform, and consist of only six joints; the coxa and basis appear to be closely impacted, but not fused together; the ischium and meros are broad and flattened, the external margin forming a continuous arch, the internal exhibiting signs of an articulation between the two joints; the carpos is pear-shaped, and articulates at its smaller extremity with the external angle of the meros; it is furnished with strong, stiff hairs, all of which are fringed with short, stiff, sub-conical spines; the propodos appears to be fused with the dactylos, between which and it there is no definite articulation, but at the position where it normally exists, there are two large, strong, slightly curved spines on the outer surface, and one similar on the inner; the meros and ischium are similarly armed, but mostly on the inner margin.



FIG. 37.—Second gnathopod of *Stereomastis suhmi*.

The second pair of gnathopoda is as long again as the first, and has seven joints. The coxa is short and broad, supporting a rudimentary mastigobranchial plate (fig. 37), which is very minute, long-ovate in form, and attached to the coxa by a short pedicle; it is furnished with a few short, ciliated, stunted hairs; the basis is short and closely associated, if not fused, with the ischium; the ischium is long, flat, and slightly curved; the meros is narrower and shorter than the ischium; the carpos is one-third the length of the meros, and a little thinner; the propodos is about the same length as the carpos, and not broader; the dactylos is sharp and styliform. The entire limb is fringed with hairs of different forms: on the inner side of the propodos they are short and fur-like; on the inner side of the carpos they are longer and closely set, as they are on the meros, but still longer; on the outer side of the carpos and meros they are long, and fringed with small cilia that are perpendicular to the stalk; the ischium is fringed with a few long ciliated hairs on the outer side, and short, stiff ones on the inner.

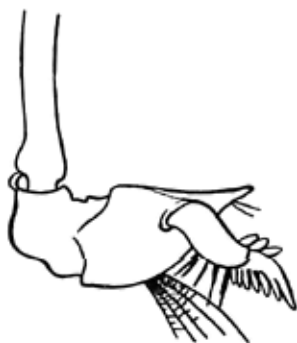


FIG. 38.—First pereopod of *Stereomastis suhmi*.

The first pair of pereopoda carries no mastigobranchial appendage and only a small podobranchia (fig. 38), but attached to the coxo-pleural articulation are two very small and feeble plumes, the anterior and posterior arthrobranchia, but no pleurobranchia.

The second pair of pereopoda has a podobranchia of tolerable size, attached to a calcified pedicle, that thins out as a central rib, furnished with a few hairs, but with no mastigobranchia; two larger arthrobranchiæ, and a short pleurobranchia, that is attached very near to the peduncles of the arthrobranchial plumes.

The third and fourth pairs of pereopoda have podobranchiæ similarly formed to the preceding two arthrobranchiæ, and a pleurobranchia, which are longer than those of the

second. The posterior pair has only one long pleurobranchial plume, situated high within the chamber. The branchial apparatus may therefore be arranged as in the following table :—

Plourobranchiæ,	.	.	.	...	...	...	1	1	1	1
Arthrobranchiæ,	.	.	.	...	...	2	2	2	2	...
Podobranchiæ,	.	.	.	...	...	1	1	1	1	...
Mastigobranchiæ,	.	.	.	...	r	...	...	...	...	...
				h	i	k	l	m	n	o

The plumes not only increase in number, but also in length, as they proceed posteriorly.

The fifth pair of pereiopoda has a very large coxal joint in the male, which approaches nearer to that on the opposite side than in the female, and is perforated by a large foramen, through which a flexile and probably erectile vas deferens projects (fig. 30, ♂) at certain periods to a very considerable extent, and rests upon the broad concave surface of the first pair of pleopoda, which in the male is narrow at the base as far as the extremity of the first joint, forming a cylindrical stalk, whereas the second joint gradually thins out to a hollow, spatuliform plate, probably serving to support the long and membranous vas deferens in its relation to the female.

This appendage in the male, from its formation, is of much interest, inasmuch as its relation to the vas deferens shows the simplest form of the organ that in the *Brachyura* fulfils the duties of an intromittent organ. In the present instance the small size of the orifice in the coxa of the third pair of pereiopoda in the female precludes the idea of any connection between the sexes by intromission; but it appears certain, from the great length of the extended vas deferens in some specimens after death, that the extremity of the male organs are during connection brought into close proximity with the external aperture of those in the female.

On the ventral surface of the pereion of many specimens, especially females, I found a layer of thin, gelatinous, and transparent material. In some places it was of thicker substance, as if the centres of extending growth. Sparsely scattered through the mass were stellate spicules, which consisted of branches variously radiating from a single centre, forming a star with six or eight rays. Each ray slightly tapers towards the extremity until it bifurcates, and forms a series of small holes, varying in numbers from three to six, that externally surrounds a large central hollow.

Stereomastis auriculata, Spence Bate (Pl. XVI. figs. 3, 4).

Pentacheles auriculatus, Sp. B., Ann. and Mag. Nat. Hist., ser. 5, vol. ii. p. 280, 1878.

„ *auriculata* on Pl. XVI.

Carapace narrow; lateral margins subparallel, armed with five teeth on the anterior region, three on the median, and seven posterior to the cervical fossa. The anterior

margin is armed with a small tooth within the internal orbital angle, two rostral in the median line, behind which on the central dorsal ridge are successively three single teeth, then two, then a single one anterior to the cervical fossa, posterior to which are two on the margin and two a little behind, the rest of the ridge is smooth to the posterior margin, on each side of which is a small sharp tooth.

The armature may be tabulated as—

Marginal,	.	.	.	.	.	.	5—3—7
Dorsal crest,	.	.	.	.	.	.	2·1·1·1·2·1—2·2· 2.

The pleon is carinated, and the first two somites are armed with small anteriorly-directed teeth; the third and fourth with large and sharp ones; the fifth has no tooth, but a small cusp; the sixth has a double baccated ridge that becomes confluent at the posterior margin, and the telson is furnished with a small central carina and two small ones on each side, a little posteriorly.

The first pair of pereopoda has the carpos armed at the distal or propodal extremity with a small sharp tooth on the inner and outer angles; the meros is smooth on the inner margin and armed on the outer with a single small tooth near the external distal or carpal angle, and a second small solitary tooth, one-third distant from the ischial joint.

The posterior pair of pereopoda is chelate, the pollex being shorter than the dactylos. Length (male), 50 mm. (2 in.).

Habitat.—Station 174c, August 3, 1874; lat. 19° 7' 50" S., long. 178° 19' 35" E.; off Kandavu Island; depth, 610 fathoms; bottom, coral mud; bottom temperature, 39°. One specimen.

Compared with others this species is narrow across the carapace. The teeth on the margins are slender and sharp; that on the anterior angle particularly so. The several divisions are clearly defined. The frontal margin is armed with four teeth between the orbits, the two central are rostral, and the one on the inner angle of the orbit is within the margin; posterior to the orbital notch is a row of three small sharp teeth situated diagonally between it and the median line; three other small teeth, two of which are not shown in the figure, stand in a triangle, the posterior being on that part of the ridge formed by the cervical fossa, where it bifurcates to form the median division, the second stands on this branch, and the third is anterior and internal to it. Twelve teeth, including the two anterior or rostral ones, traverse the central ridge of the carapace. The branchial region is defined by a waved ridge, armed with small teeth.

The first somite of the pleon is slightly narrower than the carapace; the dorsal portion is armed on the median line with a small sharp tooth directed forwards; the lateral extremity is armed with a tooth to the inner side of the peltecleis or shield-bolt

that projects from the carapace and overlaps the anterior margin of the first somite of the pleon, and another on the extremity of the somite, where it overlaps the posterior margin of the carapace.

The second somite is longer than the first, and has the anterior margin of the elevated portion armed with a small anteriorly-directed tooth.

The third and fourth somites are armed with dorsal teeth that are very large, sharp, and curved forwards; the coxal plates of these and of the second somite have on the surface an elevated curved line or ridge that somewhat resembles in form the outline of the human ear (fig. 4), from which its specific name is derived. The anterior margin of the coxal plate of the second somite is anteriorly produced to a point or cusp; posteriorly these plates diminish in size and become less round.

The fifth somite carries no tooth, but a small carina-like ridge. The sixth somite has neither ridge nor cusp, but a central depression, produced by a baccated ridge on each side of the median line, the two becoming confluent at the posterior margin somewhat as in *Polycheles euthrix*, *Polycheles helleri*, and *Polycheles baccata*. The telson has two small cusps in the median line.

The orbital notch (fig. 3C) has the inner and outer margins nearly parallel, and the ophthalmopod is armed on the anterior margin with an obtuse cusp; the lateral portion passes outwards beneath the antero-lateral projection of the carapace.

The first pair of antennæ has the squamiform process smooth on the inner margin and produced anteriorly to a sharp point; the outer margin near the anterior angle is armed with two sharp teeth, one before, the other behind the fissure that opens into the auditory chamber; the second joint is long, the third short and terminating in two unequal flagella, of which the inner is rather more than half the length of the carapace and the other is very slender and of about the same length as the peduncle.

The second pair of antennæ (fig. 3c, c) carries a long phymacerite that turns inwards and upwards, with its extremity lying in a depression in the under surface of the first joint of the first antennæ. The scaphocerite is slender and obtusely pointed.

The oral appendages have not been disturbed, but, so far as observation could be made, there is no reason to suppose any variation from the common character.

The second pair of gnathopoda supports a rudimentary mastigobranchia, but otherwise does not vary much from the common type.

The first pair of pereiopoda is delicate and generally free from armature, excepting one small tooth on the outer margin of the meros, at a little distance from the basal articulation, another near the external distal angle of the same, and one on the inner and one on the outer angle of the propodal extremity of the carpos.

The other pairs of pereiopoda have the common typical form, except in the chelate character of the posterior pair. This appendage is shorter than the preceding, and

terminates in an unequal-fingered chela; the dactylos is long, but the pollex or terminal process of the propodos is scarcely half the length of the dactylos.

The mastigobranchiæ are absent from all the pereopoda, and the podobranchiæ are attached to scale-like stalks; in other respects the several branchial plumes correspond with those of *Stereomastis suhmi*, and agree with the tabulation given for that species.

The first pair of pleopoda in our specimen, which is that of a male, is long, slender, delicate, and spatuliform, but not so broad as in most male forms of other species; the second and following pairs are biramose and foliaceous. The inner branch of the second pair carries two stylamblydes, one long and straight, terminating in an enlarged point, the other short and rudimentary; in all the other pairs the smaller or rudimentary stylamblys is absent.

Observations.—This species is one of considerable interest, since it offers a very great difference in the structure of some of its parts from others found associated with it in the same locality. It is usual for the male to carry two stylamblydes attached to the inner ramus of the second pair of pleopoda, but although in this species we have two, one of them is almost rudimentary, and all the other pleopoda have only one.

The first pair of pleopoda is very narrow, and its spatuliform character is much diminished; it is only by close observation it can be determined to be that of a male animal, a circumstance that is corroborated by an examination of the foramen on the coxa of the posterior pair of pereopoda.

The second pair of gnathopoda has no mastigobranchia but only the rudimentary bulb of one. In all the pereopoda the mastigobranchia is wanting as a free appendage, while from the squamous and ridged stalk the podobranchial plume is developed; but this, though sufficiently large in the third pair of pereopoda, is smaller than the arthrobranchia. The condition of the branchiæ was such as to preclude a very close examination, the more so as the specimen is unique, and it was desirable not to injure it more than was absolutely necessary. I have no doubt that the general arrangement of the several branchial plumes corresponds with the table as shown in *Stereomastis suhmi*.

It was taken in the same locality as *Pentacheles gracilis* and *Pentacheles euthrix*, about 70 miles south-west of the Fiji Islands, at a depth of about three-quarters of a mile, and associated with *Penæus* and *Oplophorus*.

Willemæsia, Grote.

Willemæsia, Grote, Nature, vol. viii. p. 485, October 1873.

„ Sp. B., Ann. and Mag. Nat. Hist., ser. 5, vol. ii. p. 276, October 1878; Rep. Brit. Assoc., 1878.

Deildamia, Willemoes-Suhm, Notes from the "Challenger," Nature, vol. viii. p. 51, 1873.

Carapace depressed, armed on the frontal margin with a single rostral tooth projecting obliquely upwards; lateral margins subparallel, anteriorly and posteriorly converging,

pleon slightly narrower than the carapace, median dorsal line carinated; ophthalmopoda rudimentary, not lodged in a notch in the dorsal surface of the carapace, but situated in the metope and not produced beneath the latero-anterior angle of the carapace.

First pair of antennæ having the first joint of the peduncle produced to a scale-like process, which, being laterally compressed against the corresponding margin of the opposite appendage, is forced upwards into a crest-like ridge. The two succeeding joints are cylindrical, and the last supports two very unequal flagella.

The second pair of antennæ carries a pointed, ovate scaphocerite and a long terminal flagellum. The mandible has a serrate margin to the psalisiform blade, and carries a biarticulate synhipod, but no molar tubercle, or ridge. The first and second pairs of gnathopoda have no ecphysis, but the second pair carries a moderately long mastigobranchia.

The pereopoda are all chelate in both sexes; the anterior pair is long and slender, the posterior short and moderately robust.

The pleopoda, excepting the first pair, which is modified according to sex, are biramose. The rhipidura is well developed, the outer rami being broad and strong; the telson triangular, tapering, and terminally pointed.

Geographical Distribution.—This genus has been taken in the Mediterranean Sea, in the middle of the North and South Atlantic Oceans, and in the Pacific at a distance of about 500 miles from the south-western coast of South America, at depths ranging from 1300 to 2000 fathoms. The chief structural features that separate the species in this genus from their congeners are the form and position of the ophthalmopoda.

Willemæsia leptodactyla (Pls. XVIII., XIX., XX.).

Willemæsia leptodactyla, Willemoes-Suhm, Trans. Linn. Soc. Lond., ser. 2, vol. i. p. 50; Sp. B., Rep. Brit. Assoc., 1878; Ann. and Mag. Nat. Hist., ser. 5, vol. ii. p. 280 and pp. 484-7, 1878.

Deidamia leptodactyla, Willemoes-Suhm, Notes from the "Challenger," pt. 2, Nature, vol. viii. p. 51, May 15, 1873.

The carapace has the lateral margins subparallel, slightly approximating anteriorly and posteriorly. The antero-lateral angles are produced anteriorly to a sharp tooth that reaches beyond the centre of the frontal margin. The frontal margin is furnished anteriorly with an obliquely-directed rostral tooth, on one side of which, within the inner angle of the orbital notch, is a small solitary tooth; beyond it the margin to the outer angle is smooth. The median dorsal ridge is armed with six or seven strong teeth anterior to the cervical fossa, and four or five posterior to it. The lateral margins are separated into

three divisions, of which the anterior is serrate with eight teeth, the middle with five, and the posterior with eighteen or twenty teeth. The armature may be tabulated as—

Marginal,	8—5—18
Dorsal ridge,	111211—2111

The pleon is carinated, and furnished on each somite with an anteriorly-directed tooth, of which those on the second, third, fourth, and fifth somites are the largest.

The first pair of pereopoda is long and slender, smooth on the outer side of the meros, excepting the distal angle, where there are two small teeth; the inner margin is furnished with a number of small denticles; the carpos is slender, smooth on the inner side, but fringed with small denticles chiefly at the propodal extremity on the outer; the propodos is serrate on the outer margin, and armed with a strong, sharp, straight tooth on the inner surface of the pollex, one-third distant from the apex.

The succeeding pairs of pereopoda are all chelate, but much shorter than the first.

Habitat.—Station 13, March 4, 1873; lat. $21^{\circ} 38' N.$, long. $44^{\circ} 39' W.$; depth, 1900 fathoms; bottom, Globigerina ooze; bottom temperature, $36^{\circ} \cdot 8$. Length (female) 75 mm. (3 in.).

Station 133, October 11, 1873; lat. $35^{\circ} 41' S.$, long. $20^{\circ} 55' W.$; depth, 1900 fathoms; bottom, Globigerina ooze; bottom temperature, $35^{\circ} \cdot 4$. Length (female) 75 mm. (3 in.).

Station 298, November 17, 1875; lat. $34^{\circ} 7' S.$, long. $73^{\circ} 56' W.$; depth, 2225 fathoms; bottom, blue mud; bottom temperature, $35^{\circ} \cdot 6$. Length (female with ova) 75 mm. (3 in.).

Station 300, December 17, 1875; lat. $33^{\circ} 42' S.$, long. $78^{\circ} 18' W.$; between Valparaiso and the Gulf of Penas; depth, 1375 fathoms; bottom, Globigerina ooze; bottom temperature, $35^{\circ} \cdot 5$. Length (male), 110 mm. (4.5 in.).

In August 1881 Prof. Giglioli¹ recorded a specimen of this species from the west coast of Sardinia, at a depth of 3000 metres.

The dorsal surface of the carapace is depressed, nearly flat, and is minutely granulated; from the apex of each granule springs a small, stiff, slightly curved hair. Lines of elevation armed with small teeth traverse the post-lateral median line, and define the regions of the internal organs. The ridge which traverses the post-lateral dorsal surface of the pereion, and marks the internal boundary of the branchial chamber, is longitudinally armed with a number of small teeth, all of which are directed forwards. The ridge corresponding with the cervical fossa is smooth, and free from teeth; so also is its anterior lateral branch, while that which runs from the inner angle of the orbit posteriorly in a flexuous line commences in a small but sharp and strong tooth. The frontal and

¹ *Nature*, vol. xxiv. p. 358, 1881; *Ann. d. Sci. Nat.*, ser. 6, vol. xiii. p. 5.

latero-frontal margins are smooth except for a fringe of hairs similar to those that cover the carapace. Posterior to the cervical fossa are from eighteen to twenty-three teeth. The number of the marginal teeth in our specimens is not constant on both sides. In some there are twenty-one on one side and twenty-three on the other, but since there is more than one hiatus on the side with the less number, the greater is probably normal.

The pleon gradually narrows dorsally from the posterior margin of the carapace to the extremity of the telson; the central ridge is carinated, and each somite is armed with a well-formed and prominent tooth, the apex of which is at the anterior extremity of the posterior half of each somite, and is produced to a sharp point and directed forwards. The first somite is shorter and narrower than the others, and its coxal plate is reduced to a solid protuberance that is hollowed in the anterior margin to receive the peltecleis of the carapace, which, instead of projecting over the anterior margin of the first somite of the pleon, as in *Polycheles*, falls into a hollow, and so forms an articulating joint between it and the posterior margin of the carapace, as shown on Pl. XX. fig. 1. The articulation of all the succeeding somites with one another takes place by a tubercular process, which projects forwards from the anterior margin of each somite and fits into a depression in the posterior margin of the preceding. The articulation of the first somite with the carapace is well covered and protected by a thick brush of fine, short hairs; a row of similar hairs, but less densely placed, fringes the posterior edge of the carapace, and that of all the somites of the pleon. There is no orbital notch, but there is a slight emargination in the anterior margin of the carapace, and the ophthalmopoda, which are small and almost rudimentary, are not lodged in it as in *Polycheles* and *Pentacheles*, nor are they laterally produced and covered by the projecting antero-lateral angle of the carapace; they are armed on the anterior surface as shown at Pls. XIX. c, c'', c''' a, and XX. c, a, with a small cusp or tooth, and lodged in the metope, above the antennæ Pl. XX. c, a.

The first pair of antennæ (Pl. XIX. b) has the first joint of the peduncle expanded on the inner side into a thin plate which is driven upwards by the pressure of the corresponding expansion on the opposite side into a crest, the margin of which is serrate with thin, spine-like teeth, and rounded off anteriorly; the outer portion is thick and distended, containing an internal auditory apparatus, which consists of a rounded calcified chamber (a.c.), flattened on the anterior and posterior surfaces, and connected with the walls by a calcified channel, that opens by a long, narrow, slit-like foramen, just behind the upper and anterior margin of this first joint, the surface of which is smooth and free from any tooth-like processes such as exist in all the species belonging to *Polycheles* and *Pentacheles*; the second and third joints are subcylindrical; the third is shorter than the second, and supports two flagella, of which the inner is tolerably robust, and about as long as the carapace; the outer is small and slender, being scarcely longer than the peduncle of the antennæ on which it stands.

The second pair of antennæ (c) carries a long, projecting phymacerite (o, t) that curves

upwards so that its orifice, which is protected by a thin membrane, rests against and is inserted into a depression or hollow in the lower side of the first joint of the peduncle of the first pair of antennæ; the second joint supports on the outer distal angle a long, narrow, and pointed scaphocerite fringed with long hairs; the fourth and fifth joints are cylindrical and subequal.

The mandibles (Pl. XVIII. *d*) are large and powerful organs, having a deeply serrate margin surrounding the hollowed or concave psalisiform blade, which is separated into three parts by a tooth between each that is larger and more prominent than the others. The upper and outer surfaces are flattened, and at the base a two-jointed synaphipod articulates, which generally lies folded within the hollow under the blade, and is covered with a brush of tolerably long hairs, with which probably it sweeps the contents of the mouth into position for manducation; at the base is a long and powerful apophysis, the internal or distal extremity of which is produced to a right angle, and strengthened by lateral attachment. This projecting process is united to the inner surface of the carapace with which it is connected by two calcified tendons, one of which is on the inner side, just beyond the psalisiform blade, and the other on the outer side, at the extremity of the apophysis: by the aid of these the siagnos or mandibles are opened and shut at will.

The first pair of siagnopoda (*e*) are small, two-branched, and offer no characteristic distinction from those of *Polycheles* or *Pentacheles*.

The second pair (*f*) consists of two small foliaceous rami, fringed with hairs; both articulate with and fold back upon a large foliaceous plate that is fringed with a closely packed row of soft, fine hairs. The mastigobranchia is broad posteriorly, and formed to act as an operculum for accelerating or decreasing the current of water in the branchial chamber.

The third pair of siagnopoda (*g*) consists of a long and foliaceous plate, its extremity extending so far forward as to reach beyond the metope; the extremity is longitudinally folded on itself, and forms a hollow cavity at the inferior angle of which a small triangular foliaceous plate articulates; this plate folds back and falls into the chamber formed by the involution of the larger plate, and thus acts as a movable valve, which during life is probably in constant play in the outgoing current from the branchial chamber, and which it controls. In the hollow formed by the curve of the preceding branch is a narrow and shorter one, lying in contact with its inner wall. The several margins of these foliaceous plates are fringed with a closely packed row of fine hairs; attached to the base, on the anterior surface, is a broad, flat, foliaceous plate, fringed with long hairs, and on the posterior margin is a long and broad mastigobranchial plate that projects back and falls within the anterior opening of the branchial chamber.

The first pair of gnathopoda (*h*) is short, and moderately robust. It consists of seven joints. The coxa is large and robust, and carries no ephysis or branch of any kind;

neither does the basis, which is short, and closely associated with the meros, and has the inner margin fringed with four or five cusp-like teeth; the ischium is short, and armed with two short cusps on the inner margin; the meros is long, ovate; the carpos is curved and triangular; the propodos is narrower than the carpos, cylindrical, and continuous with the dactylos, but defined from it by a strong spine on the upper and one on the lower margin; the dactylos is sharp-pointed.

The second pair of gnathopoda (*i*)—represented relatively too small in the figure—is long and slender, being twice the length of the first pair. The coxa is broad, fringed along the upper margins with long ciliated hairs, and carries a slender mastigobranchia, fringed with ciliated hairs near the base, and throughout the rest of the surface with hairs in which the cilia are differentiated into small points; the basis is short, armed with three small cusps, and fringed with long ciliated hairs; the ischium is ovate, long, flat, and covered with long hairs fringed with cilia, which are longer on the posterior than on the anterior surface; the meros is long, ovate, but shorter than the ischium, and not quite so broad; the carpos is shorter and narrower than the meros; the propodos is rather shorter than the carpos, and cylindrical; the dactylos is as long as the propodos, and terminates in a styliform unguis, supported by a secondary one on the lower or concave margin. There is no branchial plume connected with this pair of appendages.

The first pair of pereopoda (*k*) is long and slender, being about once and a half as long as the animal measuring from the rostrum to the extremity of the telson; the coxa is broad, and supports an ecpysis in the form of a mastigobranchial plate on a long stalk, and a short podobranchial plume attached to its outer or posterior margin; the basis is short, and carries no ecpysis, it articulates with the coxa, which is attached to the ischium; the ischium is long, slender, flattened and curved, gradually increasing in width as it proceeds from the basal joint; the meros is flat and very long, being three times the length of the ischium, from the extremity of which it gradually widens, and then more gradually narrows to comparative tenuity; continuing so for some distance, it again gradually enlarges a little at the carpal extremity, where it is armed on the outer angle with two curved unequal teeth; the inner margin is straight and fringed with numerous small denticles, every third one of which is larger than the intermediate ones; the outer margin is wavy and smooth; the carpos is long and slender, very nearly as long as the meros, the margins are parallel from one extremity to the other, the inner is smooth but the outer is fringed with a few denticles and has its distal angle, where it widens for the purpose of articulation, furnished with a moderately strong tooth. There is a slight curve near the meros, which must prevent the appendage from being extended in a straight line; the propodos is long, and including the pollex, longer than the carpos; its sides are parallel, and the pollex is continuous with the inner margin of the palm, and armed with one straight, perpendicular tooth (*k'*) on the inner surface one-fourth from the

extremity; the outer margin is fringed with denticles that become more conspicuous towards the dactyloid extremity of the propodos, where they exist in two rows; the dactylos resembles the pollex reversed, the lateral or palmate margins approximating, and having the extremities curved to overlap each other, and there is no tooth on its inner margin. The inner margins of the dactylos and pollex are throughout fringed with a narrow row or series of upright plates of extreme tenuity, the sides of which overlap each other and form a delicate cutting edge.

The mastigobranchiæ attached to this pair of appendages (*k*) are short and of extreme tenuity from the base. Each is slightly longer than the coxa is wide; it widens increasingly and terminates in an obtuse point covered with hairs that are subspinose. The podobranchial plume (*k'''*) attached is a small and feeble structure, shorter than the mastigobranchia. One of the arthrobranchiæ is also rudimentary, consisting only of a few small branchial processes. The other is moderately developed.

The second pair of pereopoda is very much shorter than the first, and has the several joints comparatively robust and flattened on the surface nearest the body, against which the ischium and meros lie arched beneath the lower margin of the carapace. The pollex and dactylos impinge against each other throughout their length, except the apices, which cross one another. The inner surfaces of the pollex and dactylos are fringed with a row of thin plates somewhat similar to those in the first pair, except that each plate is produced to a sharp point, which gives a serrate character to the structure. Most of the joints are fringed with rows of long hairs. This pair carries a mastigobranchia that supports a podobranchial plume, above which are two arthrobranchiæ and a pleurobranchia.

The third (Pl. XX. *m*) and fourth pairs of pereopoda are smaller than the second, which they generally resemble, particularly in the form of their chelæ, except that the curved unguis at the extremities of the antagonising pollex and dactylos are longer, so that the apices meet or cross one another. These two pairs support branchial arrangements similar to the preceding.

The fifth pair of pereopoda is shorter than either of the others, and lies directed posteriorly. It terminates in a small chela that is similar in both sexes, and does not support any branchial lash or plume, except a moderately developed pleurobranchia situated high up beneath the carapace. The general arrangement of the branchiæ may be tabulated as follows:—

Pleurobranchiæ, . . . . .	...	...	...	1	1	1	1
Arthrobranchiæ, posterior, . . . . .	...	...	1	1	1	1	...
Arthrobranchiæ, anterior, . . . . .	...	...	1	1	1	1	...
Podobranchiæ, . . . . .	...	...	1	1	1	1	...
Mastigobranchiæ, . . . . .	...	1	1	1	1	1	...
		<i>h</i>	<i>i</i>	<i>k</i>	<i>l</i>	<i>m</i>	<i>n</i> <i>o</i>

The first pair of pleopoda in the female is two-jointed, uni-branched, long, slender, and flat, with parallel sides, the margins being sparsely ciliated with hairs, and the

extremity terminating in an obtuse apex. That of the male (Pl. XIX. *p*) is also unbranched and biarticulate. The first joint is subcylindrical; the second is subcylindrical at the base, but gradually widens into a broad and thin spatuliform plate, that is strengthened by a rib longitudinally traversing the centre.

The second pair of pleopoda (*q*) is biarticulate; the first joint is long, the second biramose, and the inner branch carries a single stylamblys in the female and two in the male on the anterior pair, and one on each of the three following, on all of which a group of cincinnuli exists at the apex in both sexes, while the margins are fringed with a row of ciliated hairs particularly on the outer side. The posterior pair of pleopoda and the telson form a powerful and well-developed rhipidura, the outer rami of which are broad and rounded at the extremity, bear a tooth on the outer margin, and are strengthened with a longitudinal median rib, as also is the internal plate. The telson is triangular and pointed.

Observations.—A female which I have used for this description was taken in the middle of the North Atlantic Ocean, half-way between the western coast of Africa and the West Indies. A second was taken in the middle of the South Atlantic, near Tristan da Cunha, about the latitude of the Cape of Good Hope and Buenos Ayres; and a male of the same species was taken near the island of Juan Fernandez, off the south-western coast of South America, in the same latitude as that which was captured near Tristan da Cunha. With this last specimen were also taken a species of *Pentacheles* and a very fine male specimen (Pl. XIX. *c*) of a decided variety of *Willemæsia leptodactyla*. It is larger than the female of the type specimen, being quite 4.5 inches in length, and thus half an inch longer than the largest female taken, and 1.5 inch longer than the only other male captured, and which was taken in the same locality. The dorsal surface, instead of being granulated and furry, is covered with numerous small sharp points or denticles, that are most numerous and closely packed on the anterior half of the carapace, but larger and more important on the posterior. All the teeth on the carapace are more conspicuous, and there are ten on the anterior division of the lateral margin, eight on the middle, and twenty-four on the posterior. The frontal margin is more advanced, and the internal orbital angle armed with more conspicuous teeth. The median crest, formed by the approximation of the upturned inner margins of the scale-like processes of the first pair of antennæ, is armed with longer and more conspicuous teeth, and the hairs that fringe it in the type-specimen are wanting. In all other respects it agrees with the typical form, except, perhaps, in having the telson longer and more pointed, and the outer foliaceous plates of the rhipidura somewhat pointed at the extremity.

One of the specimens was taken about 130 miles distant from the coast of South America, off Valparaiso. It carried a great number of ova attached to its pleopoda, in a somewhat advanced stage of embryonic development; a circumstance that enabled

me to determine that the brephalos when it first leaves the ovum, is in the Megalopa stage, as shown in Pl. XX. fig. 2. The ophthalmopoda are clearly defined as well-developed lobes of conspicuous proportions, as are the two pairs of antennæ.

The mandibles are less conspicuous but distinguishable, and the pereiopoda are visible in their position on each side of the folded caudal extremity, which terminates in two rounded lobes, one on each side of a central excavation.

The ovum is about 1.5 mm. in diameter, and perfectly spherical, and not at all suggestive of *Amphion*, which genus Boas¹ thinks may probably be the young of *Willemæsia*.

Family HOMARIDÆ.

Cephalon subcylindrical. Carapace anteriorly rostrated, posteriorly produced over the anterior half of the first somite, but not kept down by a pleocleis.

Pleon with somites dorsally overlapping each other.

Pereiopoda seven-jointed, anterior three pairs chelate, first pair largest. Rhipidura well-developed, outer ramus having a diæresis.

Mastigobranchiæ large, having a well-developed podobranchial plume attached to all the pereiopoda except the posterior pair.

This family consists of the following genera:—*Phoberus*, *Nephropsis*, *Nephrops*, *Homarus*.

Phoberus, A. Milne-Edwards.

Phoberus, A. Milne-Edwards, Ann. d. Sci. Nat. (Zool.), sér. 6, vol. ii. p. 45, 1881.

Carapace slightly compressed laterally, armed anteriorly with a long and narrow rostrum furnished with lateral teeth. Pleon laterally compressed, coxal plates deep. Rhipidura large and well-developed, outer ramus of the posterior pair of pleopoda having a well-marked diæresis. Telson quadrate, terminal angles slightly rounded off. Eyes small, close together, implanted on short rudimentary ophthalmopoda. First pair of antennæ short, supporting two long and slender subequal flagella. Second pair of antennæ supporting a large and well-developed scaphocerite, of which the outer margin is produced to an acute point.

First pair of pereiopoda long, slender, and chelate; second and third pairs also chelate, but slightly shorter and much more slender; fourth pair simple, styliform; the fifth not chelate, but a polliciform process is produced at the inner distal angle of the propodos.

Geographical Distribution.—The specimens in the Challenger collections were taken in the Papuan Seas. Others closely allied have been taken by Alexander Agassiz in the West Indies.

¹ *Zool. Anzeiger*, ii. pp. 256–258.

Phoberus tenuimanus, Spence Bate (Pls. XXI., XXII.).

Acanthacaris tenuimana,¹ on Pls. XXI., XXII.

Carapace about one-third the length of the animal, cylindrical, laterally compressed, with deep sides. Rostrum long, narrow, laterally compressed anteriorly, armed on the upper distal extremity with three short, stout teeth, and on the under surface with five or six others, elsewhere it is smooth, the median dorsal line being depressed or grooved, and the entire surface spinous, strongly marked on the lateral margin where there are several large teeth in pairs running back in line with the margins of the rostrum, and continued almost to the cervical fossa, which deeply divides the carapace near the centre of the dorsal surface. The entire carapace is covered with short, sharp, prickle-like teeth, coarser and sharper on the anterior and dorsal surface, and less so on the branchial and posterior regions.

The pleon is long, and with the telson is nearly twice the length of the carapace exclusive of the rostrum. The entire surface is spinous, and the coxal plates are well defined in their connections with their respective somites. The telson is a long, quadrate plate, narrowing slightly towards the extremity, which is fringed with fine hairs.

The ophthalmopoda are small and in close proximity with each other at their base.

The first pair of antennæ reaches beyond the extremity of the rostrum.

The second pair equals in length that of the entire animal, and supports a scaphocerite that is as long as the rostrum.

The first pair of pereiopoda is long, slender, and cylindrical; the propodos is not broader than the carpos and is continuous with it; the pollex and dactylos are subequally long, slender, and flattened, the inner or impinging margin of each being armed with long and short spine-like teeth.

The second pair of pereiopoda is chelate, long, and very slender, more slender than the first but not quite so long; the third pair is not so long, more slender than the first, rather stouter than the second, and chelate; the fourth pair is simple, and as long as the preceding; the fifth is shorter than the fourth, and has the inferior distal angle produced to a sharp polliciform point.

Length, including the rostrum, 203 mm. (8 in.).

Habitat.—Station 191, September 23, 1874; lat. 5° 41' S., long. 134° 4' 30" E.; south of New Guinea; depth, 800 fathoms; bottom, green mud; bottom temperature, 39°·5. Taken associated with *Nephropsis orientalis*.

The entire surface of the animal is spinous, the spines consisting of short, sharp-pointed teeth, closely and evenly distributed both on the carapace and pleon, and larger

¹ This name was given and the plates printed off previous to M. A. Milne-Edward's description of the genus, above alluded to, being published.

on the former than on the latter, while more especially on the dorsal surface of the second and third somites they are diminished in size, most probably from friction; on the anterior portion of the carapace they increase in size in a little ridge on the median line, which is slightly represented posterior to the cervical fossa; this ridge is anteriorly lost in the rostrum, which is flattened and dorsally concave at the frontal margin, whence it narrows laterally and becomes subcylindrical and then elevated into a compressed rostrum (Pl. XXI. c). Anteriorly the rostrum is armed with three strong teeth above and six below; a smooth space intervenes, more especially on the upper surface, until posteriorly the margins diverge, when several strong teeth, of which the second is the largest, and all are much larger than those on the general surface, continue in two subparallel conspicuous rows nearly to the cervical fossa. On the carapace the spines or teeth point anteriorly, on the antero-lateral parts of the pleon they point outwards and downwards, and on the rhipidura and posterior somites of the pleon they point posteriorly.

The eyes (*c. a. a.*) are very small, not larger than the diameter of the small ophthalmopoda on which they are supported. They are situated immediately beneath the rostrum, and have no orbit, although there is a depression on the upper surface of the first pair of antennæ similar to that which exists in those species in which the organ of vision is well developed.

The first pair of antennæ (*c. b.*) consists of three subequally long joints and two short terminal flagella, which are subequal in length and a little longer than the peduncle; the inner flagellum is only very slightly stouter than the outer, and both are nearly free from cilia; the first joint of the peduncle is a little broader than the others, particularly at its base, where a small flat tubercular process projects on the outer surface, near which on the upper surface is a diagonal fissure, protected by cilia, that forms a passage to the auditory chamber, which is lined with numerous short, robust, ciliated hairs planted in rows, and contains a quantity of calcareous and silicious particles.

The second pair of antennæ (*c. c.*) is large and robust at the base, and is implanted a little below and outside the first pair. The coxa or first joint articulates freely with the metope, and carries a short phymacerite directed obliquely inwards and downwards, anterior to which is a short, stout-based, sharp-pointed tooth; the second joint is produced to a sharp point on the outer side, and supports a large scaphocerite about one-third the length of the carapace, and has its outer margin slightly curved outwards, stout, and fringed on the under surface with a dense row of inwardly-directed short cilia; the extremity is produced to a short tooth-like point from whence the anterior and inner margins, fringed with long cilia, curve to the base; the upper surface is covered with short, sharp, anteriorly and obliquely directed spinules; the under is much smoother, but possesses more sparsely scattered spines; the third joint is long, dorsally and ventrally flattened, and fringed on the under side with a dense row of

moderately long cilia; the terminal joint is short and reaches to the extremity of the scaphocerite, and nearly as far as the distal extremity of the rostrum; the flagellum is slender and free from hairs, and is four or five times as long as the peduncle.

The metope is smooth, and terminates in a deep ante-oral ridge or epistoma. The mandibles (Pl. XXII. *d*) are large and powerful, have a serrate margin on the psaliform blade, and support a triarticulate synnhipod, of which the terminal joint is broad and hirsute.

The first siagnopod (*e*) is three-branched, the two inner branches being foliaceous and of extreme tenuity, the first being fringed with soft cilia on the inner margin, and the second with short, stiff, tooth-like spines; the third branch is biarticulate, narrow, and cylindrical, fringed with hairs on each side, and supports a second joint, which is flexed and turned outwards. The whole is in close contact with the mandibles.

The second siagnopod (*f*) is large, broad, and foliaceous, consisting of three branches, two of which are longitudinally divided, and a broad mastigobranchial plate that reaches forwards as far as the other branches, and only a little behind the basal articulation.

The third siagnopod (*g*) is three-branched, and supports a long mastigobranchial plate. The first branch is broad, of great tenuity, foliaceous, and thickly fringed with cilia; the second is biarticulate, cylindrical, and fringed with cilia; the third branch consists of a long basal joint, fringed with many cilia on the outer margin only, and supports a multiarticulate flagellum. The mastigobranchial plate is long and tapering, the distal margin serrate, and the surface having numerous long fine hairs.

The first pair of gnathopoda (*h*) is six-jointed, the dactylos being absent or represented by several short, stout, tooth-like spines; the propodos is short and obtuse, the carpos broad, much more so than the propodos or meros; the ischium is long and broad, straight on the outer, and arched on the inner side, which is fringed with marginal hairs, and submarginal tufts of hairs; the basis carries an ecphysis, of which the extremity for more than half its length is multiarticulate; the mastigobranchial plate is long, tapering, and sparsely covered with long delicate hairs, and the podobranchia is short and small, less than one-third the length of the mastigobranchia.

The second pair of gnathopoda (*i*) is long and slender, more especially the three distal joints; the meros and ischium are broad, subequal in length, and armed on the inner side with a row of short obtuse teeth, mingled with numerous fine hairs; the basis supports a slender uni-articulate ecphysis, and the coxa carries a mastigobranchia with a long podobranchial plume.

The first pair of perciopoda (Pl. XXI. *k*) is long, cylindrical, and chelate. The ischium is short, and articulates freely with the meros; the meros is long, and articulates freely with the carpos; the carpos is short, continuous, but with a slight articular movement with the propodos, which is cylindrical at the base, and becomes horizontally flattened

towards the distal extremity, where it is prolonged into a flat and narrow pollex that articulates with a similarly formed dactylos. The entire appendage is spinous, the spines being of a similar character to those on the body of the animal. They are larger on the upper and lower margins of the meros, the largest existing at the upper distal or carpal angle. A large tooth or spine exists on each side at the base of the dactylos. The dactylos is spinous on the inner and outer margins, having very regularly three short to one long tooth on the outer margin, and four or five short to one long one on the inner side; this is the case with the inner side of the pollex also, the outer side of which is smooth.

The second pair of pereopoda is very slender, smooth, chelate, and cylindrical; the meros and carpos are subequally long, and the propodos is short.

The third pair is slightly spinous, much more so than either of the others, and more robust than the second; the carpos is shorter than the meros, but larger than the propodos.

The fourth pair is about the same length as the third; the five first joints are spinous; the propodos is slender, longer than the carpos, and smooth; the dactylos is slender and styliform; the meros is armed with a strong tooth at the upper distal angle.

The fifth pair resembles the fourth in most points, except that the propodos is still longer than the carpos, and has the inferior distal angle (*o*) produced to a point that resembles a short, obtuse pollex; the dactylos is fringed with hairs on the outer side.

Each of these pairs of appendages, except the posterior, carries a mastigobranchia and its corresponding podobranchial plume, and two arthrobranchiæ. The four posterior pairs carry, moreover, a corresponding pleurobranchial plume.

The branchiæ may be arranged according to the following table:—

Pleurobranchiæ,	.	.	.	...	...	...	1	1	1	1
Arthrobranchiæ,	.	.	.	...	2	2	2	2	2	...
Podobranchiæ,	.	.	.	1	1	1	1	1	1	...
Mastigobranchiæ,	.	.	.	1	1	1	1	1	1	...
				h	i	k	l	m	n	o

The podobranchiæ and pleurobranchiæ are the largest, and the arthrobranchiæ are the least important; the four plumes correspond to each other according to the position shown in the diagram on Pl. XXII. The podobranchiæ (*pl. b.*) overlie the others, and the pleurobranchiæ (*pl. br.*) are below them; lying between them on each side, anteriorly (*ar. b.*) and posteriorly (*arth*), are the arthrobranchiæ, having but a single row of digital processes on the inner side, and these lie between the base of the podobranchia and the upper surface of the pleurobranchia; the outer surface of each is furnished with a number of closely-packed digital processes, the various parts being kept separate by numerous long and slender hairs attached to the base or stalk of the podobranchial plume, and also to the surface of the anterior and posterior mastigobranchiæ (*m. b.*) which divide and separate

the branchiæ that belong to one pair of limbs into a distinct compartment from those of the succeeding.

The first pair of pleopoda in the female (Pl. XXI. *p*) is very slender, uni-branched, and biarticulate.

The four succeeding pairs (*q*) are biramose, the branches narrow and flat, the inner one carrying a rudimentary stylamblys in a well-defined notch.

The posterior pair is biramose, both branches, broad and flat, form the outer plates of the rhipidura (z., v, v); they are spinous, more especially on the upper surface; each being armed with a sharp tooth on the outer distal angle, and the outer is divided by a diæresis, the anterior margin of which is minutely crenated.

Observations.—This animal in its details corresponds closely with *Nephrops*, from which it is separated chiefly by the immature character of the ophthalmopoda, the form of the chela of the first pair of pereopoda, the compressed character of the rostrum, and the general spinous condition of the surface of the animal. It was taken at a depth of nearly a mile, associated with *Nephropsis orientalis*, with which I may have to compare it when writing of that species. In general form it closely approaches *Phoberus cæcus*, A. Milne-Edwards, which was taken in the same locality as *Nephropsis agassizii*.

Nephropsis, Wood-Mason.

Nephropsis, Wood-Mason, Journ. Asiat. Soc. Bengal, vol. xliii. pt. 2, 1873.

Carapace, not including the rostrum, rather more than half the length of the pleon, bisected by a deep cervical sulcus. Pleon dorsally smooth. Telson quadrate.

Ophthalmopoda small, situated close together beneath the rostrum.

First pair of antennæ furnished with two slender flagella; first joint of the peduncle without a stylocerite.

Second pair of antennæ without a scaphocerite.

Mandibles robust and furnished with a three-jointed synhipod.

First pair of gnathopoda subpediform, seven-jointed, supporting a two-jointed basiphysis, as long as the appendage, and a mastigobranchia; on the rest a podobranchial plume.

The second pair of gnathopoda long, slender and pediform, carrying a small and delicate mastigobranchia and a large podobranchial plume.

The first pair of pereopoda is large and chelate; the second slender and chelate, and the third slender and minutely chelate. The last two pairs are slender and simple.

The first pair of pleopoda is uni-branched and almost rudimentary; the others are long, slender and biramose.

The rhipidura is symmetrical, with broad and disc-shaped, foliaceous plates, the outer of which is marked with a diæresis.

This genus was first established to receive a species, *Nephropsis stewarti*, dredged by Mr. Wood-Mason, which that author, in the above work, as well as in the Ann. and Mag. Nat. Hist. (vol. xii. p. 60), described as the typical species, and was taken 25 miles off Ross Island, on the eastern coast of the Andamans. He says "That the specimen was really brought up from this great depth (260 to 300 fathoms) is certain from the unmistakable signs of crushing from contact with the lip of the dredge, from its position in the dredge-bag, and from its firmly adhering greenish coat, which appears to indicate that, like *Calocaris macandrewæ*, it is a burrower."

Mr. Wood-Mason further adds that, "The discovery in these warm seas of a very near, the nearest ally, in fact, of so characteristic a cold-water species, remarkable though it is, will not appear so surprising when I mention that my Crustacean lived and burrowed in the mud of the sea-bed at a depth of nearly 300 fathoms, in a temperature certainly not exceeding 50° Fahr."

The Challenger's specimen was taken at a depth of 800 fathoms, a few leagues south of New Guinea, at a temperature of 39°·5, which represents some 10°·5 of temperature still lower.

The same naturalist further remarks that "One of the chief points of interest attaching to this new form lies in the loss of its organs of vision by disuse, as in *Calocaris macandrewæ*, Bell, in *Cambarus pellucidus* (a member of the same family as that to which *Nephropsis* belongs), and in the other Crustaceans and animals inhabiting the caves of Carniola and Kentucky. I not only agree with Mr. Darwin in attributing the loss of the eyes to disuse, but I also regard the great length and delicacy of the antennæ, and the great development of the auditory organs, as modifications effected by natural selection."

It appears, both from Wood-Mason's own figures and from an examination of the Challenger specimens, that this genus cannot be described as being without organs of vision. That the ophthalmus does not occupy a greater space than the diameter of the peduncle, and the absence of the dark pigment, that generally gives colour to the eye may be evidences of degradation; but I have little doubt that the power of vision is equal to the animal's requirement. The ophthalmopoda are slender, but in Mr. Wood-Mason's figure they are about one-fourth the length of the rostrum, that is, equal to the average length. In *Calocaris macandrewæ*, to which he compares his species, the peduncle seems wanting, but the ophthalmus is figured by Bell as being quite equal in diameter to the eyes of similarly proportioned Crustacea, but the absence of colour prevents our readily detecting the form of the organ. In the genus *Alpheus* the peduncle of the eye is often shorter than in either *Calocaris* or *Nephropsis*, but since the organ is lined with black pigment no one would think of describing it as

sightless. And recently a young specimen of *Homarus* has been taken in the English Channel that corresponds with the description of *Nephropsis* in most points, except that it has well-developed organs of vision, and that the retina at the back of the lenses is lined with black pigment.

Geographical Distribution.—The Challenger brought home specimens of this genus from Bermuda and from the Papuan Seas.

Mr. Wood-Mason records his specimens from the Andaman Islands, in the Gulf of Bengal. The Rev. Dr. Norman has described a new species, *Nephropsis atlantica*,¹ with small and immature eyes, obtained by Mr. Murray in the Færøe Channel, during the cruise of the "Knight Errant" and of the "Triton."

But for the absence of the scaphocerite from the second pair of antennæ, I should be much inclined to believe that the species of this genus are only young forms of *Nephrops* or of some nearly allied genus. The specimen that I described as *Nephropsis cornubiensis*, in the report of the British Association for 1880, with the reservation, "but as we know so little of the young of any of the Macrura after they have passed the earliest stages, we are induced to believe it to be no other than an immature condition of *Nephrops*," I have recently been able to determine to be a stage in the development of *Homarus marinus* of the European Seas. Now, as *Nephropsis suhmi* was taken associated with *Phoberus tenuimanus*, at Station 191, it is not improbable that the two are the same species at different ages. The Rev. Dr. Norman in writing to me says, "The genus is certainly not the young of *Nephrops*. I have specimens of *Nephrops* of very much smaller size than the *Nephropsis*, and the pleon though very like is different." But it is remarkable that of all the specimens taken in the cruises of the "Knight Errant" and "Triton," there is no spawn on any.

The fossil genus *Hoploparia* is undoubtedly closely allied to this genus, and probably represented it in the ancient seas; for *Hoploparia belli*, as figured by Salter and Woodward in their Chart of Fossil Crustacea, and by Bell in his Fossil Malacostracous Crustacea, although of larger dimensions, is very closely related to, and probably is a direct ancestor of the recent species. Our specimens of the genus *Nephropsis* are certainly immature forms, if we may judge from the fact that the external sexual foramina are not appreciable, and we may consequently assume that the internal organs are not fully developed in their present state. All the specimens recorded have been taken at a great depth in the sea.

Nephropsis stewarti was taken at 300 fathoms, *Nephropsis suhmi* at 800 fathoms, *Nephropsis rosea* at 700 fathoms; the temperature ranging from 39°·5 to 50° Fahr. (Wood-Mason), *Nephropsis atlantica* was taken in great abundance in the Færøe Channel, North Atlantic, and *Nephropsis agassizii* in the West Indies.

¹ *Proc. Roy. Soc. Edin.*, vol. xi. p. 684, 1882.

Nephropsis rosea (Willemoes-Suhm, MS.), (Pl. XXIII. figs. 1, 2; Pl. XXIV. fig. 1).

Astacus rosea, Willemoes-Suhm, MS., Notes and Drawings made during the Expedition.

Carapace slightly granular. Rostrum about half the length of the carapace, armed with a strong tooth on each side near the middle, another at the base just above the eye, and a smaller one in a line behind the last-mentioned. First pair of pereiopoda armed with a small tooth on the lower distal angle of the meros, and another on the upper distal angle of the carpos. Coxal plates of the pleon infero-posteriorly terminating in a sharp point, the anterior margin of the first plate being slightly serrate, the others smooth.

Length, 25 mm. (1 in.), one specimen (male).

Habitat.—Station 57, May 30, 1873; lat. $32^{\circ} 11' 7''$ N., long. $65^{\circ} 3' 20''$ W.; off Bermuda; depth, 690 fathoms.

Carapace granular; cervical sulcus well defined; rostrum long, wide, dorsally flat, narrowing to a sharp point anteriorly, arched posteriorly, depressed anteriorly, with the apex turned slightly upwards, armed on each side near the middle with a strong, long, sharp, anteriorly directed tooth, and on the continuous ridge posterior to the orbit, with one large, and behind it one small tooth. The orbital notch is flanked on the outer and lower sides with a long, simple, straight tooth.

The pleon is dorsally smooth, but granulated in texture, and has the coxal plates distinctly defined from the body of each somite.

The ophthalmopoda are small, and situated closely together beneath the rostrum, supporting a scarcely appreciable ophthalmus.

The first pair of antennæ (Pl. XXIV. b.) in the male consists of a peduncle which originates immediately on the outer side below the base of the ophthalmopoda, the first joint of which is excavated on the upper surface for the greater freedom of movement of the eye, and a blepharis or row of strong cilia fringes the upper and distal extremity of the excavated portion of the antenna, and forms a valuable protection to the visual



FIG. 39.—*Nephropsis rosea*. From a drawing by Willemoes-Suhm.

extremity of the ophthalmopod when at rest; the second joint is shorter than the first, and the third is as long as the two preceding put together, and bears at the extremity two long flagella, of which the inner is slender and thread-like, and the outer thicker and gradually increasing in size until near the extremity, when it rapidly decreases to a fine point; along the thicker portion the flagellum is fringed with membranous cilia.

The second pair of antennæ (*c*) in our unique specimen has the flagellum broken off at the extremity of the peduncle, which is tolerably robust and nearly as long as that of the first pair. The first or coxal joint articulates freely with the metope, supported on the outer side by a strong tooth; and supports a prominent and well-defined phymacerite.

The mandible (*d*) is large, having a smooth incisive plate, and a short, strong, three-jointed synhipod.

The first pair of siagnopoda (Pl. XXIII. fig. 1*e*) consists of two single foliaceous plates, fringed on the inner distal margin with a double row of short, closely planted spines and a few short, stiff hairs within, both on the upper and under surfaces; also a group of longer ciliated hairs on the inner basal margin. The plate is articulated to a short joint, which from analogy I take to be the basis, on the outer side of which articulates an ephysis, terminating in a flagelliform lash ending in two long, sweeping hairs. At the base of the branch is a small bundle of ciliated hairs.

The second pair of siagnopoda (fig. 1*f*) consists of three plates, besides the mastigobranchia; two are foliaceous, divided, and fringed on the inner distal margins with a thickly-set brush of hairs, some of which are stiff and simple, some ciliated, and some curved; the third plate is narrow and gradually tapers to a point, which turns slightly inwards and terminates in two or three long, simple hairs; the mastigobranchia is foliaceous, produced anteriorly as far as the extremity of the slender tapering ramus of the same appendage, and is fringed anteriorly with long ciliated hairs that are curved like a hook at the extremity, and posteriorly with a few that are much longer than the rest.

The third pair of siagnopoda (fig. 1*g*) has three branches and a mastigobranchia. The inner is foliaceous and fringed on the inner margin with a copious brush of thick hairs, and with a second row evenly arranged behind it on the outer surface: the middle branch is slender and biarticulate, fringed on the outer margin with a few stiff, simple hairs, and on the inner with others that are long and ciliated: the outer branch is also long and slender, half as long again as the middle; it is likewise divided into two parts: the basal is fringed on the outer margin with numerous short, ciliated hairs, the inner side is smooth; the distal division of the branch is multiarticulate, and terminates in a few long, simple hairs; the mastigobranchia is short, broad, and of extreme tenuity, sparsely protected by a few isolated simple hairs.

The first pair of gnathopoda (fig. 1*h*) is subpediform and seven-jointed; the coxa

supports a short mastigobranhia of great tenuity, fringed with long slender hairs; the basis carries a long ecphysis, the first joint of which reaches nearly to the extremity of the ischium, and terminates in a multiarticulate extremity that is tipped with one or two hairs, and reaches to the propodos; the ischium is short; the meros is long and somewhat narrowing to the carpos; the carpos, propodos, and dactylos are subequal, the propodos being somewhat the larger of the three, and is fringed on the inner and outer margins with long hairs, among which on the inner side are a few spines, armed with short, stout teeth; the dactylos terminates in four or five short, stiff, simple, spine-like hairs.

The second pair of gnathopoda (fig. 1*i*) is long, pediform, and seven-jointed. The coxa supports a short and delicate mastigobranhia, a podobranhial plume, and two arthrobranchiæ; the basis carries a slender ecphysis that is about half the length of the gnathopod, reaching to about the extremity of the meros; the first joint is single, long and slender, reaching to three parts the length of the ischium; the second is multiarticulate, and terminates in a few long hairs; the ischium is long and has its margins parallel, the inner being thickly fringed with long simple hairs, beneath which is a row of small cusps; the meros is shorter than the ischium, but is formed as a continuation of it, and the inner margin, which is smooth, has a fringe of long hairs; the carpos is about the same length as the meros, but is slightly more robust and fringed on the inner side with long hairs; the propodos is a little shorter than the carpos, and the dactylos is shorter than the propodos; both are fringed on the inner side with long slender hairs interspersed among which are others that are strong and fringed with spines.

The first pair of pereiopoda is long, moderately robust, and chelate. The coxa is short, and supports a mastigobranhia, a podobranhia, and two arthrobranchiæ, all of which are very short and delicate; the basis is small, and visible only on the inner and lower surfaces; the ischium is robust and short, and articulates continuously with the meros, which has the outer and inner margins nearly parallel, the surface is granulated with small tubercles and armed with a strong tooth on the upper and lower angles of the distal extremity; the carpos is about half the length of the meros, and is armed at the upper distal angle with a sharp anteriorly-pointed tooth; the propodos is long and narrow; and the pollex, which is half the length of the palm, is about the same length as the dactylos, and antagonises it throughout its entire length, the apices overlapping each other.

The second pair of pereiopoda is more slender and feeble, and about a third shorter than the first. The coxa supports a small mastigobranhia, a podobranhia, and two arthrobranchiæ; the basis, unlike that of the first pair, forms a distinct but short joint; the ischium is considerably longer though still short, and the meros is three times its length; the carpos is long and slender; the propodos is longer than the carpos, and has its margins parallel, the lower being produced anteriorly into a sharp, straight pollex,

which corresponds with a dactylos of its own length; the three posterior pairs of pereopoda are long and slender, the dactylos remarkably so, and fringed with a few long hairs; the antepenultimate and penultimate pairs support each a podobranchia, mastigobranchia, and two arthrobranchiæ, but the posterior pair has none.

The first pair of pleopoda (Pl. XXIV. *p*) is situated near the ventral median line, and consists of two joints rigidly connected and directed forwards.

The second pair (*q*) is attached to the inner side of the posterior margin of the coxal plate, and consists of a long basal joint carrying a pair of long, flattened, narrow branches, fringed with long ciliated hairs, the inner branch being furnished with a long, cylindrical, slender stylamblys, armed with a few obtuse hooks at the apex.

The three following pairs of pleopoda are similarly formed, but the stylamblys becomes gradually more slender in each successive pair.

The ultimate pair of pleopoda has a short basal joint carrying the two large, squamous plates of the tail-fan, the outer one having a diæresis which divides the plate near the middle, and both are armed on the outer side by a strong, sharp, posteriorly-directed tooth.

The telson is long, quadrate, with the sides subparallel, terminating in two sharp spines, which are continuous with two strong ridges that begin at the base near the median line; the posterior margin is thin, convex, and fringed with long simple hairs.

Nephropsis agassizii, A. Milne-Edwards,¹ is probably this species.

Nephropsis suhmi, n. sp. (Pl. XXIII. fig. 3; Pl. XXIV. fig. 2).

Carapace coarsely granulated. Rostrum more than half the length of the carapace, armed on each side with two large and seven small teeth, also one on each side of the base and one on the antennal region.

First pair of pereopoda having three teeth on the upper distal margin of the meros and one on the lower; carpos armed at the distal extremity with one large tooth above and one below. Pleon, having the coxal plates produced to a point, the anterior margin being furnished with a small point or sharp cusp.

Length 38 mm. (1.5 in.); sex undetermined; associated with *Phoberus tenuimanus*.

Habitat.—Station 191, Sept. 23, 1874; lat. 5° 41' S., long. 134° 4' 30" E.; off Dobba, Arrou Island; depth, 800 fathoms; bottom, green mud; bottom temperature, 39°·5.

The carapace, from the posterior margin to the extremity of the rostrum, is rather longer than the posterior division of the animal. Rostrum two-thirds as long as the

¹ *Ann. d. Sci. Nat. (Zool.)*, sér. 6, vol. ix. p. 124, 1879.