

immediately after the completion of the change. He also kept several specimens and saw them moult, assuming a form that was a little larger but similar in all respects, except that the appendages of the pleon were now present as small buds. Some of these were kept until they changed into a form strongly resembling a *Sergestes*.

At this stage it appears that the observations of Willemoes Suhm are more distinctly in the true line of development.

"In August 1875, about 300 miles south of the Sandwich Islands, a young Crustacean was captured which was believed to be a stage in the history of *Leucifer*, and which Dr. Suhm named the *Amphion*-stage. It measured as follows:—

" Length, total,	2.67 mm.
" of rostrum,	0.24 "
" shield without rostrum,	0.63 "
" both together,	0.87 "
" pleon,	1.3 "
" telson,	0.5 "
" ophthalmopod,	0.31 "
Diameter of carapace,	0.66 "

"On the second maxilla I could not find a palpus in three specimens that I examined."

The carapace has undergone a considerable change of form. The rostrum is long and prominent, but the teeth on the posterior margin of the carapace both at the angles and median line have disappeared. But on the anterior margin of the carapace each angle external to the ophthalmopoda is projected into a prominent tooth directed forwards, whence the lateral margins are curved downwards and outwards, and then gradually upwards and backwards to the postero-median dorsal surface of the pereion.

In this stage the development corresponds with that known as the Acanthosoma-stage of *Sergestes*, and corresponds with *Sceletina* of Dana. It differs, however, in having the ophthalmopoda long, and, according to Suhm's measurement, one half the length of the carapace, not including the rostrum. The ocellus is still visible as a spot of pigment in the centre of the cerebral ganglia.

The first pair of antennæ consists of four joints sparsely fringed with hairs; the first joint is long, slender, and cylindrical, excepting for a small process on the outer side near the base, the seat of the future acoustic organ; the second joint is less than half the length of the first and slightly less in diameter; the third is about the same length and thickness as the second; and the fourth joint consists of a small papilliform segment, which is the rudiment of the future flagellum.



FIG. 57.—Mandible, from a drawing by v. Willemoes Suhm.

The second pair of antennæ is biramose, the inner being the primary branch of the future organ, which at present scarcely reaches beyond the extremity of the rostrum, and the outer branch is the scaphocerite in an undeveloped condition.

The mandibles are seen in the form of curved plates with a serrate incisive margin (fig. 57).

The first pair of maxillæ is three-lobed; the first lobe is on the inner side of the first or coxal joint, and is crowned with four long stiff hairs; the second lobe springs from the basis or second joint, and is broad, foliaceous, and crowned with seven or eight strong stiff hairs or spines; the third lobe consists of three small cylindrical joints, each of less diameter than the preceding, and furnished each with two hairs; those at the extremity being the longest. These three joints appear to represent the basis, ischium, and meros of the typically developed appendage.

The second pair of maxillæ consists of a single biarticulate branch; the basal joint is long, broad at the base, and tapers towards the extremity, it is divided on the inner surface into five lobes, the largest at the base, the smallest towards the apex, and each is furnished with three long hairs, except the distal one, which has two; the second



FIG. 58.—First maxilla.



FIG. 59.—Second maxilla, from drawings by v. Willemoes Suhm.

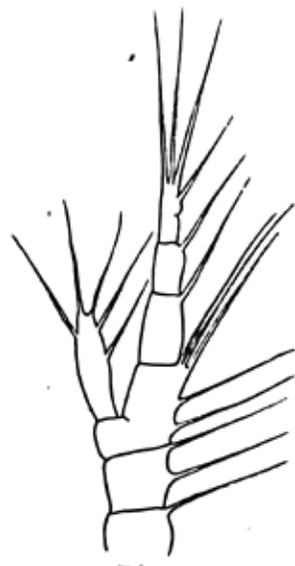


FIG. 60.—Maxilliped.

joint is bilobed, the proximal lobe being furnished with one hair and the apical with three. On the outer margin there is supposed to be an appendage of some sort, as seen in the previous and in future stages, but Suhm says that he could not find it in three specimens that he examined.

The next succeeding pair of appendages is the third siagnopoda or the maxilliped; this Suhm figures as being biramose, the branch springing from the third joint, instead of from the second or basis as is usual. This appendage consists of six joints and a small ecphysis, furnished with several long hairs.

The first pair of gnathopoda has the basal joint long and robust, carrying two branches, one of which, composed of four joints, is the true limb, and the other a multiarticulate branch.

The second pair of gnathopoda resembles the first in form, but is longer and more important.

The pereopoda consist of four pairs and are all formed on the same plan as the gnathopoda, which they closely resemble; the posterior pair, according to Suhm's drawing, has only three joints belonging to the primary division, instead of four, as all the others have.

The pleon consists of six somites and the telson.

The pleopoda are in a rudimentary condition, but the sixth pair is well developed and helps to form an efficient rhipidura.

The telson is long, and armed at the sides and extremity with six or eight stiff hairs, the posterior of which have slightly serrate edges.

In the West Pacific Ocean a specimen (Pl. LXXXV. fig. 2) was taken of a species that corresponds with the genus *Sceletina* of Dana, but which Professor Brooks has shown to be the young of *Lucifer*, corresponding with the Acanthosoma-stage of *Sergestes*.

Our specimen is about 1.5 mm. in its entire length, of which the carapace is 0.4 mm., or about one-fourth of the whole length of the animal.

The frontal margin of the carapace is produced to a flat sharply pointed rostrum, whence it recedes in a concave line to the fronto-lateral angle, which is anteriorly produced to a strong sharp point, from which the lateral margin recedes in a wavy line to the posterior extremity of the pereion.

The pereion is enclosed within the carapace, and the pleon consists of six somites and the telson; the anterior five somites are subequal in length, and are inferiorly produced to a point on each side; the sixth somite is rather more than twice the length of either of the preceding, and is posteriorly produced on the dorsal surface to a strong point.

The telson is about two-thirds the length of the preceding somite.

The ophthalmopoda are pyriform and about twice the length of the rostrum.

The first pair of antennæ is about twice the length of the ophthalmopoda, and the second pair is about half the length of the first.

The oral appendages were not examined, but Professor Brooks has examined them in a slightly older form; the mandibles are still without the synphipod that is so conspicuous in the adult; the pereopoda, which consist of four pairs, are biramous and correspond in form to those of the Acanthosoma of *Sergestes*.

The pleon is yet without any appendages excepting the posterior pair which forms part of the rhipidura, which is biramous and foliaceous, but does not exceed the telson in length.

The next stage, for which we are indebted to Willemoes Suhm's drawing, from which the annexed figure is taken, is described by him as being "a *Leucifer* larva with the divided legs before the moult previous to maturity.

"H $\frac{1}{4}$ \times 55 nat. size, 15 March and 1st September 1875. Pacific.

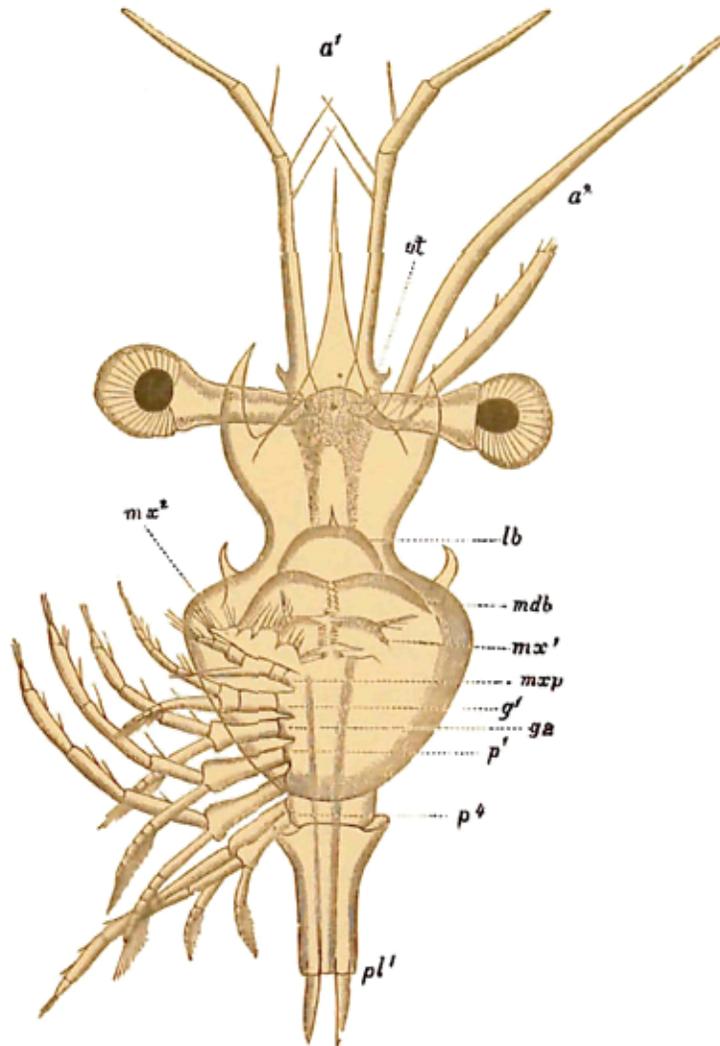


FIG. 61.—*Lucifer*, young, from a drawing by v. Willemoes Suhm; *a*¹, first pair of antennæ; *ot*, otolith; *a*², second antenna; *lb*, labrum; *mdb*, mandible; *mx*¹, first maxilla; *mx*², second maxilla; *mxp*, maxilliped; *g*¹, first gnathopod; *g*², second gnathopod; *p*¹⁻⁴, pereopoda; *pl*¹, first pleopod.

" Length of rostrum,	.	.	.	.	.	0.17 mm.
" carapace,	.	.	.	.	.	0.70 "
" pleon,	.	.	.	.	.	1.92 "
" entire,	.	.	.	.	.	2.79 "
Width of carapace,	.	.	.	.	.	0.52 "
Length of ophthalmopod,	.	.	.	.	.	0.35 "
Greatest width of eye,	.	.	.	.	.	0.22 "
Last (fourth) pereopod very small. Carapace extended. Otolith visible."						

The specimen here detailed is longer than the preceding in the proportion of

2.67 mm. to 2.79 mm.; that is, rather more than one-tenth of a millimetre. All parts appear to have slightly increased in size except the rostrum, which is a little shorter, and the carapace, the width of which has slightly decreased. They may be the young of distinct species, but since both were taken in the Pacific Ocean, they are probably successive stages of the same species.

The great point of interest is the presence of features of the permanent character in the older specimen. The long neck or cervix is for the first time made apparent by means of a deep depression on each side, between the cephalic organs and the oral appendages, and a strong tooth on each side of the oral organs is here distinctly prominent and apparently, from Willemoes Suhm's drawing, relatively more important than in the adult.

The rostrum is still a prominent feature, and projects forwards nearly to the extremity of the first joint of the peduncle of the first pair of antennæ. The tooth on the outer frontal angle is more prominent.

The ophthalmopoda have increased in length, but are not much altered in form, and the ocellus is still visible in the centre above the cerebral mass.

The first pair of antennæ is figured as consisting of three joints, of which the first is long, as in the preceding specimen, the second about one-third the length of the first, and the third longer than the second and terminating acutely as if it were the future flagellum. This probably is divided in the specimen by an articulation that is not immediately distinguishable at the base of the first joint; the future acoustic organ is visible in an incipient condition.

The second pair of antennæ has increased considerably in length, and the scaphocerite has assumed more of the features of the permanent character; the cilia which fringed the inner margin are, however, but few, and very minute and distant.

The carapace has increased but little in length proportionately, but that growth which has taken place is anterior to the oral appendages, thus carrying the antennæ and ophthalmopoda forwards, and commencing the development of that long, neck-like form, which is so peculiar a feature in this genus.

The oral organs do not appear to have undergone any great change, and the pereopoda, which are still four pairs, correspond closely with those of the preceding, all having somewhat increased in length, except the posterior pair, which is relatively smaller than that of the preceding.

The pleon and its appendages appear to be in the same relative proportion of

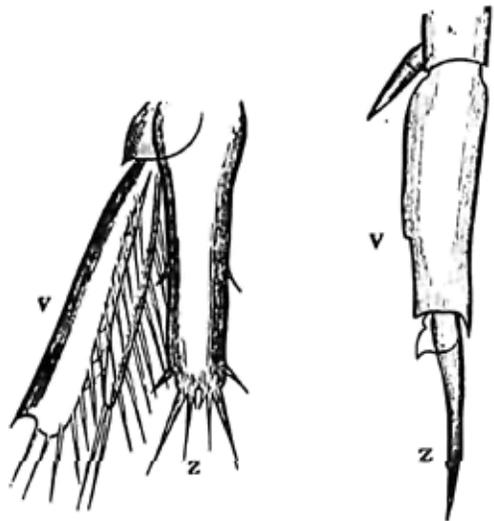


FIG. 62.—“Telson (z) with sixth pleopod (v); seen from above.”

FIG. 63.—v, “Last somite of the pleon with telson attached.”

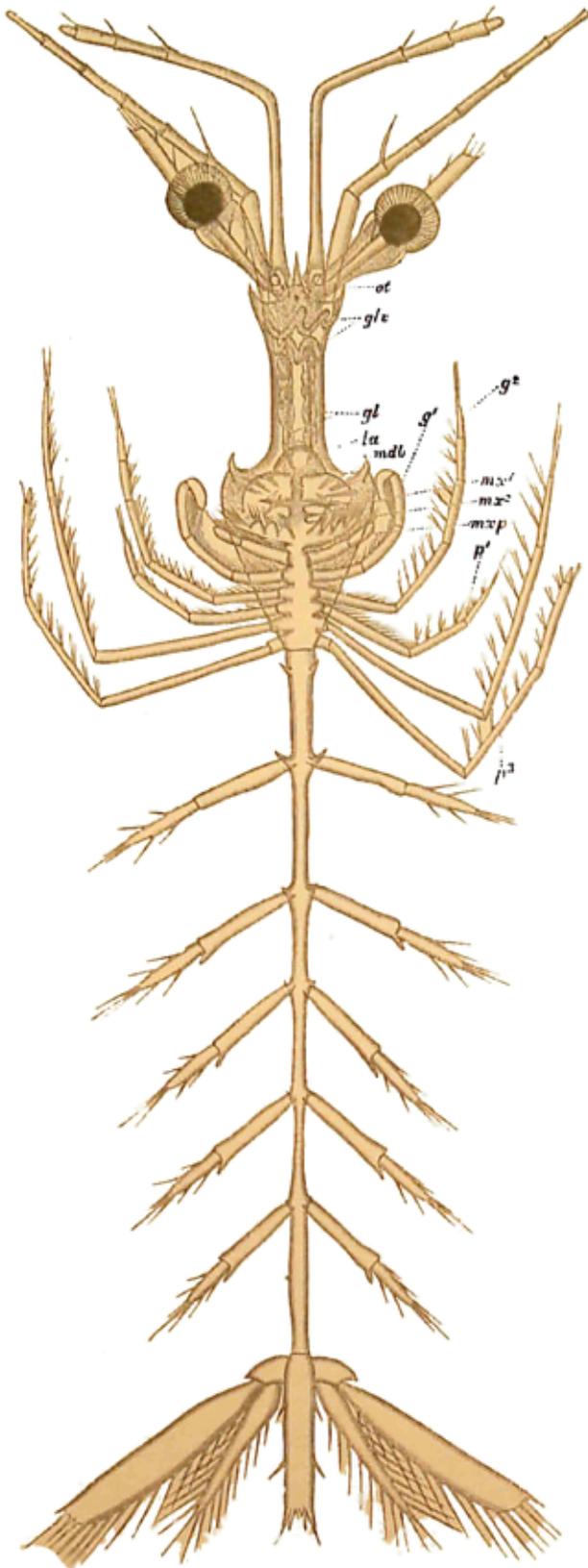


FIG. 64.—*Lucifer reynaudii*, young, from a drawing by Dr. v. Willemoes Suhm. Lettering as before.

development, but the hairs at the extremity of the telson are of a less spinous appearance.

The next drawing to which I have to refer in the development of the species of this genus is one of melancholy interest. It has no date attached, and there are no notes relative to its size and proportions, as all others of Suhm's drawings have. It is labelled by another hand:—

“The last drawing made by R. von Willemoes Suhm. Development of *Lucifer reynaudii*.”¹

The figure is carefully drawn and all its details strictly preserved. It was evidently a labour of love to Willemoes Suhm, and is here faithfully reproduced, one-third smaller to bring it within the compass of the page. The animal in this stage is evidently assuming its permanent characters, but the antennal somite is still shorter and more robust than in the adult. It is evidently the same form as Dana² has described and figured as *Lucifer acicularis*.

The rostrum, which in the previous specimen was subequal in length to the first joint of the first pair of antennæ, now reaches but little beyond the acoustic organs at the base of the same pair of antennæ; the antero-lateral angles are still conspicuous points, but less so in proportion than in the younger stages.

The ophthalmopoda are large and well-

¹ Although there were neither figures nor notes attached to this drawing, I have convinced myself, by comparison with the mounted specimens which were preserved and labelled by von Willemoes Suhm, that the separate figures in the text relate to the same specimen from which this drawing was taken.

² *Loc. cit.*, p. 674, pl. xlv. figs. a-d.

developed organs, probably varying in length in different species, and the ocellus is still conspicuous as a small black spot over the cerebral mass.

The first pair of antennæ consists of four joints, of which the first is very long, nearly equal in length to the carapace, the second and third are short and subequal, while the fourth is but a rudimentary bud; from the inner surface of the inner distal angle of each joint there springs one small hair, and the rest of the appendage is smooth.

The second pair of antennæ is long, apparently longer than is represented in the drawing, which is shortened, and the first pair is bent, probably in order to bring the drawing within the limits of the paper used; the flagellum is multiarticulate, the articuli being long and slender, the first or basal being alone furnished with one small hair; the scaphocerite is long and narrow, with the margins parallel, the inner being fringed with a few separate small hairs or cilia, and the outer produced to a tooth-like point at the distal extremity. With this antenna is connected an internal organ, which is known as the green gland; it consists of a long, tubular ramification folded within a compressed compass smaller than its length. The length of the antennal somite, measured from the



FIG. 65.—Mandible.

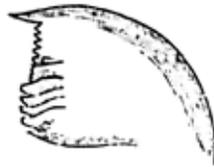


FIG. 66.—First maxilla.

anterior margin of the cephalon to the oral apparatus, equals that of the pereion measured from the anterior surface of the labrum to the posterior extremity of the carapace. The diameter of the animal, viewed dorsally, is greatest across the line of the mandibles, from which point the pereion gradually and rapidly narrows until at the posterior extremity it is of the same width as the narrow, compressed somites of the pleon. The epistoma differs from that of the previous specimens in having the tooth, which is a prominent feature in those, reduced to a small lobe.

According to the drawings of Willemoes Suhm, as shown in the adjoining cuts, the oral appendages are approximating to those of the adult, and may be compared with those given on Pl. LXXIX.

The mandibles have the incisive margins serrate, but not uniformly or symmetrically, the one being more deeply toothed than the other.

The first pair of siagnopoda or maxillæ is two-lobed, the distal lobe being the broader, and fringed on the inner margins with a series of simple spine-like hairs, set thickly together, and the basal lobe is narrow and furnished with three serrate and one simple spine-like hairs, and on the posterior margin is a long blunt styliform process.

The second pair of siagnopoda is four-lobed, each lobe distally decreasing in size, and furnished on the inner margin with a series of simple spine-like hairs, three ciliated spine-like hairs and one small and simple; the basal lobe is broader than the middle one but



FIG. 67.—Second siagnopod or maxilla.

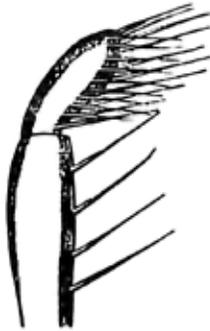


FIG. 68.—Third siagnopod or first maxilliped.

narrower than the distal, and is furnished with four straight, spine-like, ciliated hairs; at the posterior margin, corresponding in position with the middle lobe, is a short but broad ephysis connected near the middle by a short pedicle, and furnished at either extremity with a series of simple hairs, that become ciliated in the adult stage.

The third pair of siagnopoda, or first maxillipeds, is biarticulate, the distal joint being fringed on the inner surface with two rows of simple hairs, and the basal with a few solitary hairs of the same character; this organ approximates to that of the adult, but it is more slender.

The first pair of gnathopoda is six-jointed, the several joints being subequal, the terminal one being broader and reflexed upon the preceding; the inner margin of each joint is fringed with simple hairs, the basal joints sparsely, the distal copiously.



FIG. 69.—First gnathopod.

The second pair of gnathopoda is longer than the first, it has no ephysis and consists of six joints fringed with a series of hairs.

The pereopoda are reduced to three pairs, the fourth not being reproduced in this stage; none of those present is furnished with an ephysis, and in general aspect, though not perfectly in detail, they assume the appearance of those of the adult stage. The first pair consists of four joints, of which the basal is the longest. The second pair is much longer than the second gnathopod, and consists of four joints. The third pair is about the same length as the second, and consists of five joints, of which the terminal is short and rudimentary, and probably becomes in the adult the minute rudimentary dactylos

of the microscopic chela.

Each somite of the pleon is armed with a prominent tooth projecting from the lateral margins.

The pleopoda are all single-branched and biarticulate, the four posterior supporting at the distal extremity of the basal joint a small bud-like process, that ultimately develops into the future secondary ramus. The posterior pair of pleopoda together with the telson is developed into a well-formed rhipidura, that bears a close resemblance to that of the adult, the only immature feature being the greater proportion which the

telson bears to the lateral appendages, which are thickly fringed with long, simple hairs.

On the passage from the Admiralty Islands to Japan, a small specimen was taken that has features suggestive of specific difference, but considered in conjunction with its small size—it is scarcely more than one-eighth of an inch in length—I am inclined to believe it to be only a stage in the progressive growth of the animal.

The carapace in this specimen is about one-third of the length of the animal. The cervix is about half the length of the carapace. Rostrum sharp-pointed and obliquely projecting upwards and forwards. I can detect no tooth on the fronto-lateral margin, but a stout and short one exists above the epistoma on each side.

From this stage the young animal rapidly assumes the permanent appearance of the adult, and even so early that specimens which have only attained the length of about 5 mm. possess features that demonstrate their sexual condition.

On Pl. LXXXII. fig. 1, a young specimen (6 mm. long) is represented, which was taken in the tropical part of the Atlantic in the month of April, and which is evidently an immature male, for the petasma, an organ peculiar to the male, exists in a saccular or bud-like form, conspicuously visible on the first pair of pleopoda. In other respects the animal possesses the external appearance of the female, inasmuch as the two strong blunt teeth, conspicuous on the lateral margins of the sixth somite of the pleon in the adult males, are absent, and a feeble point near the posterior angle of the same somite, which is common to females of both the known species, is alone present.



FIG. 70.—v, sixth pleopod; z, telson.

The pereopoda are as yet in a simple condition; the small dactylos at the extremity of the posterior pair, which gives a minutely chelate character to the appendages in the adult, is wanting. The telson also does not possess the large protuberance on the under surface near the posterior extremity that is apparent in the fully adult male animal, but is smooth and even as in the adult female.

On Pl. LXXXII. fig. 2 represents a specimen about 7 mm. in length, that was taken with several others in which similar features in an incipient condition are present, and the telson is smooth and without any sign of the future protuberance of the adult male, but there are two small teeth, of which the anterior is the larger, on the posterior part of the lateral margin of the sixth somite of the pleon.

On Pl. LXXXII. fig. 3 represents a specimen that was taken in the tropical part of the Atlantic; it is about 8 mm. in length, and in most details corresponds closely with the preceding forms, excepting that it is rather more advanced in development;

the petasma on the first pair of pleopoda is slightly enlarged, and there are three small teeth or points attached to the lateral margins of the sixth somite of the pleon, the central tooth assuming a larger proportion to the others; but the telson still retains the simple condition of the female.

On the same plate, fig. 4 represents another specimen, about 7 mm. in length, that was taken in the tropical part of the Atlantic. This agrees with fig. 2 in most points, and is probably the same stage of a different species; it has, however, lost the minute denticle nearest to the posterior angle of the sixth somite, and apparently retained the larger one anterior to it; it has also lost the small denticle in front of the latter, but further in advance is a small process that appears to be a future tooth; so that we see in an incipient stage the gradual production of the two small teeth that appear to be the constant condition of the males in the species of this genus. The telson still retains its smooth condition.

Whether these several specimens belong to one species or not, it is difficult to determine, but as all species pass through similar stages that resemble each other as far as external evidence enables us to decide, it is most probable that these are derived from the two forms *Lucifer typus* and *Lucifer reynaudii*, which appear to live closely associated together. Dana, speaking of *Lucifer reynaudii*, says:—

“In one male about half grown, the anterior tooth of the sixth segment of the abdomen was obsolete, and the posterior spine was quite short, although of the same general character as to its extremity, as in full grown males. This intermediate character in an immature male seems to confirm our inference, drawn from the general identity of character and their frequent association, that the animals described as such are actually male and female.”

Geographical Distribution.—The genus appears to range all over the tropical and subtropical regions of the Atlantic and Pacific Oceans, within a hundred fathoms of the surface, but according to Professor Brooks they are abundant on shallow shores.

Lucifer typus, Vaughan Thompson (Pl. LXXXIII.).

Lucifer typus, Vaughan Thompson, Zool. Researches, p. 58, pl. vii. fig. 2, 1829.

Leucifer typus, Milne-Edwards, Hist. Nat. Crust., t. ii. p. 469.

Lucifer typus, Faxon, Chesapeake Zool. Lab., 1878, p. 113.

„ *pacificus*, Dana, U.S. Explor. Exped., Crust., p. 673, pl. xlv. fig. 2 (young).

Male.—Antennal somite one-fourth the length of the animal, measured from the frontal margin to the extremity of the telson, and rather more than twice the length of the carapace.

The anterior five somites of the pleon are subequal in length, the first and fifth

¹ U.S. Explor. Exped., Crust., vol. i. p. 673.

being rather longer than the others and a little shorter than the carapace. Each of these somites is furnished with a tooth that projects from the lateral margin, just outside the articulation of the pleopoda (these are not shown in our figure of the male, but they resemble those shown in the female, excepting that they are less prominent and decrease in size posteriorly).

The sixth somite equals in length the two preceding combined, it is dorsally armed with a small tooth at the posterior extremity, and is furnished with two teeth on the lateral margins, the larger of which is about a fourth of the length of the somite distant from its posterior extremity, and the smaller is near the centre; both teeth are straight and directed posteriorly.

The telson is about one-fourth the length of the sixth somite, and is furnished posteriorly on the inferior surface with an obliquely directed lobe.

The ophthalmopoda are long and pyriform, about one-third the length of the antennal somite.

The first pair of antennæ has the first joint of the peduncle rather shorter than the ophthalmopoda; second joint shorter than half the first; third joint shorter than the second, and supports a slender flagellum that is about as long as the antennal somite *and carapace together, and has not even the rudiment of a secondary branch.*

The second pair of antennæ has the first or coxal joint of the peduncle furnished with a long, projecting, slender tubular phymacerite; the terminal joint reaches anteriorly nearly as far as the extremity of the ophthalmopoda, and is both strong and robust, it supports a terminal flagellum that suddenly becomes very slender and equals in length about one-half of the animal. At the base of the peduncle stands a narrow styliform scaphocerite, quite as long as the ophthalmopoda, and ends in a subapical point.

The epistoma anteriorly projects as a strong protuberance, and inferiorly forms the anterior labrum between which and the metastoma the mandibles are impacted; posterior to which the small foliaceous maxillæ are apparent.

The first pair of gnathopoda has the first three joints anteriorly directed and the last three posteriorly reflexed against them, the sixth or last being long and spatuliform, fringed on the inner margin with long, slender hairs, as is also the penultimate joint, while the antepenultimate is furnished with hairs on the lateral surface.

The second pair of gnathopoda is long, slender, and subequal to the next succeeding or first pair of pereopoda.

The second and third pairs of pereopoda are much longer than the first and are subequal in length; the second is simple and terminates in a blunt point, while the third or terminal pair is furnished with a minute, curved, sharp dactylos, which is fringed with long hairs, as is also the inner extremity of the preceding joint.

The first pair of pleopoda is long, slender, and has the basal joint longer than the

terminal; near the centre of the former stands a large petasma, beyond which, on the same surface, is a small projecting calcareous process. The second pair of pleopoda differs from the first in being biramose, the inner branch being short and robust, lobed at the base, obtusely pointed and anteriorly obliquely truncate. The third pair of pleopoda is shorter than the preceding, the two rami are similar in character, but the inner branch is somewhat stouter at the base than the outer. The fourth pair of pleopoda is shorter than the third, and the fifth is shorter than the fourth.

The posterior pair, which forms the outer branches of the rhipidura, has a short basal joint and two long foliaceous branches, the inner of which is fringed with long hairs and is twice the length of the telson, while the outer is about one-fourth longer than the inner and furnished with a small tooth near the distal extremity of the outer margin, the inner margin being fringed with long hairs.

Length, 9 mm. (0.36 in.).

Female.—In general aspect the female bears a close resemblance to the male, and even the differences other than sexual, which I have been able to determine, are such as may not be constant in all specimens. The one under examination is a little larger than the male; it has the ophthalmopoda relatively a little shorter, and the phymacerite slightly longer. It has the first pair of pereopoda shorter than the second pair of gnathopoda. The pointed processes on the lateral margins, at the base of the pleopoda, are larger and more conspicuous than in the male. The sixth somite has the lateral margins furnished with a single tooth, and that a very small one, one-third of the length distant from the posterior extremity. The pleopoda are generally longer and more slender; the first pair is single-branched and free from the secondary sexual appendage; the second and following pairs are biramose and slender; the terminal pair resembles that of the male. The telson is free from the inferior lobe, terminates in two small spines, and is flanked on each side by another still smaller.

Length, 10 mm. (0.4 in.).

Habitat.—Arafura Sea; near Station 270, Mid-Pacific, lat. 2° 34' N., long. 149° 9' W.; Philippine Islands; Port Jackson (female); off Samboangan; West Pacific; Mid-Pacific; St. Paul's Rocks; Tropical part of Atlantic; North Atlantic.

Lucifer reynaudii, Milne-Edwards (Pl. LXXXIV.).

Lucifer reynaudii, Milne-Edwards, Hist. Nat. Crust., t. ii. p. 469.

Male.—Cephalon anteriorly produced in advance of the epistoma to about one-fifth of the length of the animal; dorsal surface produced to a sharp rostrum; a prominent tooth is produced on each side at the inferior antennal angle. The pereion is about one-third shorter than the cephalon; it is deeper posteriorly than anteriorly, and

dorsally protected by a small carapace that rises obliquely from the mandibular region to the posterior margin of the pereion.

The five anterior somites of the pleon are subequal in length and correspond to the length of the pereion. The sixth somite is about half as long again as the preceding one, is posteriorly produced to a small dorsal tooth, and has the under margin armed with two strong teeth, the posterior of which is club-shaped and curved, and the anterior more slender and pointed.

The telson is about one-third the length of the sixth somite and terminates in a small fork, the apices of which are armed with a small spine; on the under surface in the median line is a large protuberance, broad at the extremity and directed forwards.

The ophthalmopoda are nearly as long as the cephalon; the stalk is slender and the ophthalmus bulbous.

The first pair of antennæ has the first joint of the peduncle nearly as long as the ophthalmopod, whereas the second joint is short and reaches just to the extremity of the eye; the third is still shorter, and the flagellum is wanting in every specimen in the collection.

The second pair of antennæ is likewise broken off at the extremity of the peduncle, and supports at the base an extremely slender and pointed scaphocerite.

The appendages of the mouth as well as the pereiopoda exhibit no specific character that enables us to distinguish them from those of the preceding species.

The first pair of pleopoda carries a large leaf-like petasma, has the anterior margin a little below it armed with a strong blunt tooth, and terminates in a single multiarticulate branch. The second pair of pleopoda carries at the extremity of the basal joint, between the two multiarticulate branches, a strong blunt appendage. The third and two following pairs of pleopoda are similar to the preceding, but they do not carry a similar appendage, and each pair is successively shorter than the preceding.

Females.—The female corresponds with the male in general proportions, but is usually a little smaller, although some resemble it closely in size. They can be readily distinguished by the absence of the large teeth on the inferior margin of the sixth somite of the pleon, which are replaced by a small sharp tooth or point situated more posteriorly than are the larger teeth in the male. The telson is also more slender and wants the large tubercle that is so conspicuous in the male.

Their appendages also correspond closely with those of the male, except the pleopoda, which are simple and do not carry a petasma or tooth on the first pair nor a tubular lobe-like appendage on the second, and the outer branch of the rhipidura has the squamous portion produced as far as the extremity of the terminal tooth.

Length, males and females, 10 mm. (0.4 in.).

Habitat.—St. Paul's Rock; North Atlantic; Atlantic; Tropical part of Atlantic (at 200 fathoms, and at night); Fiji Islands; Philippines; Arafura Sea; New

Hebrides; China Seas; near Station 270, lat. $2^{\circ} 34' N.$, long. $149^{\circ} 9' W.$; Tahiti; Hawaii.

A specimen much resembling that represented in fig. 4, Pl. LXXXII., but little more than half its length, and with the anterior tooth broad and rounded instead of being sharp, was taken on the passage from the Admiralty Islands to Japan.

The anterior five somites of the pleon are dorsally smooth, and there exists a tooth-like projection on the infero-lateral margin, such as is figured in the female of *Lucifer typus*, and in the young of some species.

The sixth somite is not quite so long as the two preceding; the dorsal surface is furnished with a small sharp tooth at the posterior extremity, and the inferior margin is armed near the posterior extremity with a minute sharp tooth, just in front of which is an obtusely pointed lobe.

The telson is long, slender, about half the length of the sixth somite, forked at the extremity and armed on each side with a small sharp spine.

The ophthalmopoda are pyriform, stout, and about half as long as the antennal somite.

First pair of antennæ has the first joint of the peduncle subequal in length to the ophthalmopoda; the second and third joints are short and subequal; the flagella are broken off.

The second pair of antennæ carries a long, slender scaphocerite, which terminates subapically in a sharp point, and is subequal in length to the first joint of the peduncle of the first pair; the terminal joint of the peduncle is about half the length of the ophthalmopoda; the flagellum is wanting.

The gnathopoda possess the normal character as in the adult type of the genus.

The pereopoda are broken off at the distal extremity of the carpos, except one of the posterior pair, which shows the existence of the minute dactylos which makes an imperfect chela.

The pleopoda are long, slender, and decrease in length posteriorly.

The plates of the posterior pair are unequal, the inner not being longer than the telson, and the outer being one-third longer and laterally armed with a tooth near the distal extremity, which is broad and fringed with hairs.

Length, 4 mm. (0.16 in.).

Observations.—The general distinction of this specimen from most others lies in its robust appearance, particularly of the antennal somite, or that portion that separates the antennæ from the oral region. This is, however, a feature attributable to an immature condition, as may be seen in those stages, as in *Sceletina*, where the antennal region is not distinctly separated from the oral and gastric.

On the sixth somite of the pleon, the lobe anterior to the small sharp tooth may be,

and most probably is, the first appearance of the larger tooth that is so conspicuous a feature in the adult male. As yet, there is no evidence, even in a rudimentary condition, of the petasma that forms so important a character in the adult male.

Group ABERRANTIA.

The species that are placed in this group differ from those belonging to the Normalia of this division of the Macrura, chiefly in the varying and eccentric condition of the pereiopoda.

In the Penæidea, these appendages in the highest pronounced types are well developed and constant in form, consisting anteriorly of three chelate pairs, and posteriorly of two simple pairs, but these all diminish in value and importance, as they descend in the scale of the various families.

The two posterior pairs of pereiopoda first appear to suffer degradation and become long, slender, and feeble appendages, useless as organs of locomotion either for walking or swimming. This is apparent in the genera *Benthesicymus*, *Gennadas* and *Benthecætus*. In the two former they are long, slender and styliform, whereas in *Benthecætus* they are long, slender, filiform and multiarticulate. In the Sergestidæ they become still further depreciated, losing much of their power in *Sergestes*, and altogether disappearing in the genus *Acetes*.

In this latter family not only do the two posterior pairs disappear, but the others also suffer considerable degradation, the number of the joints of the first pair of pereiopoda being reduced to six, and it loses its chelate state, and the two following pairs are reduced to a feeble and exhausted condition, and although the chelæ are retained, they are microscopical in proportions.

But with this degradation of the pereiopoda we find an increased power and importance given to the gnathopoda. The first pair, especially, becomes a strong and powerful appendage, furnished with a genuflexed carpal joint, which cannot be extended straight, and indicates its usefulness as a powerful organ of prehension. The second pair also is robust, more especially at the basal joints, and is also a long and powerful organ.

In the Luciferinæ, as in the genus *Acetes*, the two posterior pairs of pereiopoda have disappeared altogether. The first pair of pereiopoda also has still further diminished in value than in the Sergestinæ, and the second pair has lost its chelate character, a feature that is only represented by the minute chela of the third pair.

In this division the branchiæ vary from a condition in which they are the most numerous and finely developed in the order, as in *Benthesicymus*, to their entire disappearance, as in *Lucifer*.

Thus we find that important parts vary, change and disappear, yet the animals possess features that clearly demonstrate they belong to one common division.

Their great nervous system, their manner of fertilisation, their reproduction and, so far as known, their plan of development are similar, and those systemic features which unite the Penæidæ and the Sergestidæ they possess in common with the aberrant Schizopoda.

In some genera the ova are carried in a pouch beneath the ventral surface of the pereion, but this is not a universal characteristic of the group, for in his carefully executed Report on the Schizopoda, Professor Sars has pointed out¹ that, "in the Euphausiidæ incubatory lamellæ are wanting; but even here the position of the ova beneath the trunk is precisely the same as in other Schizopoda," and, it may be added, corresponds with the position of the ova in *Lucifer* as shown by Professor Brooks in his memoir on that genus.²

Tribe Schizopoda.

This name as now applied is much more extended, and bears but little reference to the species for which Latreille originally intended it, most of these having been found to be the early stages of some other forms of more or less known adult Crustacea. The name was consequently withdrawn by its author, and, so far as I am aware, does not appear to have been generally adopted until Claus used it in 1862, and it was not employed in any general classification until 1867, when Sars introduced it into his *Histoire Naturelle de Norvège* and in his recent Report on the Schizopoda of the Challenger Expedition. It will henceforth probably continue to be used as the appellation of this tribe.

Professor Sars says³ that, in his opinion, "it is more appropriate at present to assign to this group the rank of a distinct tribe or suborder, there being several well-marked characters distinguishing these Crustacea rather sharply from all other known Decapods," but it appears to me that, with the exception of the variable condition of the pereopoda, the several genera do not possess a single character that is not held in common with some genus of the Macrura.

1. The presence of well-developed basephyses attached to the pereopoda, which Sars calls "natatory branches," is common to many genera, especially in immature forms. It was one of the features that induced Milne-Edwards to place the genus *Oplophorus* among the Penæidea, with which it possesses no other important character in common. These being ephyses, or branches of the pereopoda, they are incapable of free action to any great extent, independently of the limbs of which they are a part. With the exception of the family Mysidæ, in which the pleopoda in many genera are

¹ Zool. Chall. Exp., part xxxvii. p. 8.

² *Loc. cit.*, p. 19, 1882.

³ *Loc. cit.*, p. 7.

in a rudimentary condition, and the pereopoda are in their entirety utilised as natatory organs, it is doubtful if the basephyses be ever used for simply swimming purposes; and, moreover, I think it to be capable of demonstration that in the pelagic Macrura, when these organs are developed, they are mostly employed for ascending and descending through the various strata of oceanic water, and are of importance in enabling the animals to avoid the strong sunlight at the surface, by permitting them to sink during the daytime, and ascend at night, a periodic movement that has been so frequently noticed to be their habit.

2. The large size of the synnhipod attached to the mandibles in many of this tribe is a feature the animals possess in somewhat inferior degree to that which we see in *Lucifer*, *Sergestes*, and other genera of the Penæidea, more especially in *Gennadas* and *Benthescymus*, where they frequently reach to the extremity of the ophthalmopoda, but the size of this appendage cannot be considered as being a condition illustrative of the tribe, inasmuch as it is absent in the genus *Stylocheiron*, just as we find it wanting in some genera of the Phyllobranchiata.

3. The pereopoda are very variable in form and proportion among the several families of which this tribe is composed, when compared with the more normal forms; and the gnathopoda exhibit a persistent tendency to approach to the pediform condition of the pereopoda, thus illustrating a very constant law that, with the depreciation of the functional power in the pereopoda, the gnathopoda increase in importance. This appears to me to be only a continuation of the same process that is visible all through the Macrura, and which is strongly exhibited in the Sergestidæ, and becomes more exaggerated in the Schizopoda—leading through the Eucopiidæ, in which we find the pereopoda departing from the normal form in this division of the Crustacea, and approximating to those of the Amphipoda, in which the first pair of pereopoda and both pairs of gnathopoda are subchelate. To carry the similitude further, all the somites of the pereion in *Eucopia* complete their dorsal arc as in the Amphipoda; the carapace being only a thin and membranous cloak that loosely overlaps the pereion.¹

4. The mode by which the ova are carried by the females in the Schizopoda varies. In the Euphausiidæ it corresponds with that of *Lucifer*, and may be the same in the Penæidæ also, but I am inclined to believe that the weight of evidence is in favour of the belief that the ova in the normal group are deposited in the open waters of the ocean. In other families of the Schizopoda they are supported in pouches of different kinds, developed for the purpose beneath the pereion, similar in kind but varying in different genera, like those of the Edriophthalmous Crustacea, or they are carried in sacs as in Entomos-tracous forms. In the Euphausiidæ, moreover, the males possess a petasma attached to

¹ *Apsenules talpa*, Montagu, appears to approach nearer to this tribe than to the Normal Isopoda. It only wants the extension of the cephalon into the form of a carapace to give it all the characters essential to a perfect Macruran.

the first pair of pleopoda, and this is an appendage that exists in the same peculiar form only in the males of the Penæidea besides. Whether the fertilisation of the female takes place in other Schizopoda in the way it is shown by Sars to occur in the Euphausiidæ, by means of free spermatophores, I do not know, but this is just as it takes place in *Lucifer* (vide p. 447 and Pl. LXXXI. figs. 1, 2 of this Report).

5. The development of this tribe exhibits a very striking resemblance to that which is seen in *Lucifer*, and so far as known to other forms of the Penæidea, all of which appear to pass through complicated morphological changes previous to attaining their adult condition.

For these reasons I am inclined to believe that the natural position of these animals is that of an aberrant tribe of the Dendrobranchiata, more nearly allied to the degraded forms of the Penæidea than to those of any other group.

The species in this tribe belong to several genera. Those procured during the expedition of the Challenger have been described by Professor Sars in his Report on the Schizopoda. These he has arranged in the four families given in the table at page 219.

Division PHYLLOBRANCHIATA.

The species of *Macrura* in this division consist of all those which possess a series of branchial plumes, developed in the form of broad foliaceous plates of extreme tenuity, attached to a central stalk.

They may conveniently be divided into those which are normal in their characteristic features, and those in which there is a greater or less aberrant departure from the more perfect structure.

Group ABERRANTIA.

This group consists of several tribes and families that in their adult condition approach more nearly to the characters common to other divisions, but which nevertheless during the progress of development pass through a stage common to the normal Phyllobranchiate *Macrura*.

This aberrant group has long been distinguished by carcinologists under the name of the *Anomura*, sometimes as a division of the *Macrura*, and sometimes as a distinct order. It is as a separate group of the former that they are here noticed; for undoubtedly in their earlier stages they pass through a morphological change that is essentially *Macrurous*, in which the scaphocerite and rhipidura are both present as well-developed appendages, the latter of which they never entirely lose.

The acknowledged species of this group belonging to the Challenger collection will be reported on by Professor John R. Henderson, M.B., F.L.S.,¹ but there are two or three immature specimens that appear to me not to belong to the normal forms of this division, and I have arranged them under this group, assuming that in their mature condition they may belong to some unknown aberrant species.

Zoontocaris, n. gen.

Carapace less than one-third the length of the animal, not covering the entire pereion, and anteriorly produced to a long rostrum that is broad at the base and sharp at the apex.

First somite of the pleon little broader than the succeeding ones.

Telson gradually increasing in width posteriorly and terminating in a sharp tooth at each angle.

Ophthalmopoda subpyriform and projecting laterally and posteriorly.

First pair of antennæ biflagellate.

¹ Zool. Chall. Exp., part lxi.

Second pair furnished with a long and sharp-pointed scaphocerite.

First pair of pereopoda chelate.

Pleopoda biramose, ultimate pair unequally branched, shorter than the telson.

Observations.—From every point of view this genus is truly Macruran, having the three great and original characters of a long pleon with well-developed pleopoda, a large powerful rhipidura, and a well-developed scaphocerite attached to the second pair of antennæ.

On the other hand the carapace is broad and depressed, and a longitudinal angular ridge traverses it from the orbit to the posterior angle; beyond which on the ventral surface the carapace is bent inwards after the manner in the Brachyura. I have therefore placed this genus here as belonging to the Aberrantia of this division, thereby assuming that eventually it may be shown to be the young of some genus of the Anomura.

Zoontocaris galatheæ, n. sp. (Pl. LXXXV. fig. 3).

Carapace broad, depressed, anteriorly produced to a long rostrum, broad at the base and tapering to the apex; posterior lateral angle produced to a long and slender pointed process, flanked on each side by a row of teeth that meet beneath its base. Pleon narrow; fifth somite produced to a tooth on each postero-lateral angle. Telson broad, flat, and distally produced to two long pointed processes.

Length, ¹ entire,	6 mm. (0·24 in.).
„ of rostrum,	2 „
„ of carapace,	1·5 „
„ of pleon,	4·5 „
„ of telson,	1 „
„ of fork of telson,	0·8 „
„ of sixth somite,	0·9 „
Breadth of carapace,	2 „
„ of pleon,	0·8 „

Habitat.—Off Cape Howe, Australia (Young).

Numerous specimens were taken but that figured and described appears to be the most advanced. They were associated with *Lucifer*, *Oodeopus*, and *Gonerichthys*.

The carapace is short in the median dorsal line, and, measured from the centre of the interorbital space to the posterior margin, it is less than one-fourth of the entire length of the animal. Anteriorly it is produced, unevenly but continuously narrowing from a broad base to the apex, forming a rostrum equal in length to the carapace in the median line. The lateral margins are posteriorly produced to long, pointed, tooth-like processes, and have the margins at their base armed with spine-like teeth that meet beneath the large wing-like processes. The carapace on the dorsal median line recedes

¹ Except when stated otherwise, the measurements are taken in the median line, and the entire length means the length from a point corresponding with the frontal margin of the carapace to the extremity of the telson.

anteriorly considerably beyond the lateral angles, and covers about half the pereion, so that, when viewed dorsally, it appears triradiate, or shaped somewhat like an arrow-head. The somites of the pleon¹ are subequal, gradually lessening in length and breadth posteriorly to the fifth somite, which is slightly longer than the preceding and produced in the form of a blunt tooth on each side at the postero-lateral angles. The sixth somite is a little longer than the preceding and is produced to projecting angles at the postero-lateral extremity. The telson is a little longer than the sixth somite, gradually increases in width posteriorly, and terminates at each angle in a long tooth-like process, the base on the outer side being furnished with two small teeth or spines, and on the inner with five long blunt spines on each side of the median line.

The ophthalmopoda are large, gradually increasing in diameter from the base to the ophthalmus, the peduncle being slightly curved backwards and is longer on the posterior than on the anterior margin.

The first pair of antennæ has the peduncle obscurely divided into three joints, of which the first is short and the others subequal, and terminally supports two very short flagella.

The second pair of antennæ has the flagellum short, and is furnished with a scaphocerite that gradually tapers to a sharp point, and reaches nearly as far as the apex of the rostrum. It is curved, smooth and rigid on the outer margin and fringed with distantly planted hairs on the inner.

The oral appendages have not been examined.

The pereiopoda, which are short and curved inwards, are in an immature condition; the first pair is the largest and subequal and chelate.

The pleopoda are small and biramose but not fully developed. The sixth or posterior pair is furthest advanced but has the rami unequal, the inner branch short and bud-like, the outer long, styliform, and fringed with hairs on the inner margin.

Observation.—The serrature on each side of the postero-lateral angle of the carapace, although not quite similar, is yet suggestive of that in the Zœa form of *Galathea*; hence the specific name.

Zoontocaris approximus, n. sp. (Pl. LXXXV. fig. 4).

Pereion globose. Carapace anteriorly produced to a sharp-pointed rostrum, broad at the base and fringed with small spines; posteriorly produced at each lateral angle to a long and slender tooth, smooth at the base. Pleon narrow, fifth somite armed on each side with a tooth at the postero-lateral angles. Telson broad and terminating posteriorly in sharp-pointed lateral angles.

Ophthalmopoda long, ophthalmus large.

¹ I have erroneously figured the pleon with a somite too few; the lobe shown as the pereion should be divided.

- First pair of antennæ with short flagella.
 Second pair of antennæ with sharp-pointed scaphocerite.
 First and second pairs of pereopoda chelate.
 Sixth pair of pleopoda unequally branched.

Length, entire,	4 mm. (0.16 in.).
„ of rostrum,	1.2 „
„ of carapace,	1 „
„ of pleon,	3 „
„ of sixth somite,	0.6 „
„ of telson,	0.6 „

Habitat.—Taken at the surface, off Mindanao, Celebes, February 6, 1875. One specimen (young).

The carapace only covers part of the pereion, the posterior portion being exposed on the dorsal surface, and together they form a globose or rounded mass. The frontal margin is produced between the ophthalmopoda, where it is wide, to a long and gradually tapering rostrum, which is fringed at the sides with small stout hairs or spines. The postero-lateral angles of the carapace are produced to long teeth, but the margins are smooth and even.

The pleon is less than one-third the width of the carapace and gradually narrows posteriorly. The fifth somite¹ is armed on each side postero-laterally with a small tooth. The last somite is shorter than the preceding, and the telson is broad and flat, gradually increasing in width posteriorly, where it terminates laterally in sharp points surmounted by a strong spine, on the inner side of which the distal margin is fringed with four or five on each side.

The ophthalmopoda are large, curved, and gradually increase in diameter to the ophthalmus, which is obliquely implanted on, and much larger than, the stalk.

The first pair of antennæ has the peduncle three-jointed, the second joint being the shorter and the first and third subequally long; the terminal flagella are short.

The second pair of antennæ has the flagellum subequal in length to the rostrum, and the scaphocerite reaches to the same point, terminating in a sharp extremity.

The oral appendages have not been examined.

The first and second pairs of pereopoda are larger than the others and subequally chelate, the chelæ being long and broad with the margins corresponding. The other pereopoda appear to be short, robust and simple, and lie folded against the ventral surface of the pereion.

The ultimate pair of pleopoda is well developed; the inner branch is about half the length of the outer, which is not quite as long as the telson and has the inner margin fringed with hairs.

¹ I have erroneously figured the pleon with too few somites; the lobe shown as the pereion should be divided.

Observations.—Whatever form the ultimate development of this species may assume, I think there can be little doubt that it approximates to that of the preceding species, from which it differs in size and by being more robust comparatively, in having longer eyes, and in the absence of serrature at the base of the posterior angles of the carapace.

Sestertius, n. gen.

Carapace large, one-third the length of the animal, anteriorly produced to a small rostrum.

Pleon slender.

Telson long, and terminally cleft.

Ophthalmus broad and short.

First pair of antennæ having a single flagellum.

Second pair furnished with a broad foliaceous scaphocerite that is rigid on the outer margin.

The first pair of gnathopoda is long, slender, and terminates in a brush of hairs.

The first pair of pereopoda is robust and chelate; the second is scarcely so robust as the first, and is also chelate; the third, fourth, and fifth pairs are strong but simple.

The pleopoda are biramose; the terminal pair have the branches subequal and well developed as two foliaceous plates.

Observations.—The remarkable feature of this genus exists in the long and slender gnathopod, which is developed somewhat after the manner of that organ in the Schizopod genus *Nematoscelis* as described by Sars;¹ for this reason I have thought it desirable to classify it with the aberrant forms rather than with the more normal types of this division.

Sestertius duplicidentis, n. sp. (Pl. LXXXV. fig. 5).

Carapace dorsally smooth and anteriorly produced to a sharp-pointed rostrum. The pleon is much narrower than the carapace, and each somite except the first is armed with two teeth, one on each side of the median line.

The telson is nearly as long as the sixth somite and terminally cleft.

The ophthalmopoda are short and thick.

The peduncle of the first pair of antennæ is subequal with the length of the rostrum, as is also the scaphocerite of the second pair.

The first pair of gnathopoda is long, slender, and terminates in a few long hairs.

The first pair of pereopoda is robust and chelate; the second is similar but not quite so large; and the three succeeding ones are simple.

¹ Zool. Chall. Exp., vol. xiii. part xxxvii. p. 126.

The terminal pair of pleopoda is about one-third shorter than the telson.

Length, entire,	5 mm. (0·2 in.).
„ of rostrum,	0·5 „
„ of carapace,	2 „
„ of pleon,	3 „
„ of sixth somite,	1 „
„ of telson,	0·7 „
„ of first gnathopod,	4·5 „

Habitat.—October 27, 1874, Samboangan, Philippine Islands. Taken at the surface. One specimen (young).

October 23, 1874; off Sibago, Philippine Islands. Two specimens.

The carapace is oval, smooth, and anteriorly produced to a rostrum that is about one-fourth the length of the carapace. The anterior margin has a large orbital notch, and the fronto-lateral angle is rounded off.

The pleon is much narrower than the pereion, and has the anterior five somites subequal, and except the first armed on the posterior margin with two small backwardly directed teeth, one on each side of the median line. The sixth somite is about equal in length to the four preceding combined, and terminates in two small dorsal teeth.

The telson (fig. 5z) is about two-thirds the length of the sixth somite, and terminates in the posterior projection of the lateral angles, the cleft between them being armed with five serrate spinules on each side, and one small one in the median line.

The ophthalmus is large, and supported on a thick and short ophthalmopod.

The first pair of antennæ has the articulations of the peduncle not clearly defined, and supports only one flagellum, but as this is only rudimentary, the second flagellum may be in an earlier condition, and not yet visible.

The second pair of antennæ has the flagellum subequal in length with the carapace, and within the exuvium, which appears to be entire, the multiarticulate character of the appendage is apparent (fig. 5c); it also supports a scaphocerite that increases distally in breadth, and has the inner margin fringed with hairs, and the outer smooth, rigid, and distally armed with a small tooth.

The mandibles and first two pairs of siagnopoda have not been examined.

The third pair of siagnopoda or the maxillipedes (fig. 5g) are short, the basis carrying a two-jointed ephysis, beyond which there are three small joints.

The first pair of gnathopoda (fig. 5h) has the coxa stout, the basis long and cylindrical, and carries distally a short biarticulate ephysis; the next joint is short, and the succeeding two are remarkably long, slender, cylindrical, and subequal, and terminate in five or six long hairs. The second pair of gnathopoda (fig. 5i) is short; the basis is here rather more robust, narrows distally, and terminates in a two-jointed basecephysis,

the distal joint being tipped with five long hairs, and near the base on the anterior margin supports a single-jointed appendage.

The first pair of pereopoda (fig. 5*k*) has the coxa short and robust, the basis is formed as in the preceding pair, and bears a biarticulate ephysis at the tip, but instead of only one, there are four or five succeeding joints, forming a perfect limb, which gradually increases in thickness to the middle of the propodos, and then gradually tapers to the extremity; the last joint is obscurely chelate. The second pair of pereopoda (fig. 5*l*) resembles the first but is slightly less robust. The third pair (fig. 5*m*) is more slender than the preceding but formed on the same plan, excepting that it terminates in a simple dactylos, which is long, straight, and tapering. The fourth pair (fig. 5*n*) is robust and shorter than the preceding, but the basal joint is short, robust, and without an ephysis or the prominent process on which it stands in the previous appendages. The fifth pair (fig. 5*o*) is like the fourth but the articulations are not so distinctly marked, except those of the coxa and carpos, and the terminal joints are more slender.

The pleopoda are biramose, the branches being short and supported on a long peduncle; the sixth pair is shorter than the telson, and fringed with hairs on the inner margin.

Observations.—Three specimens were captured in the same district. That from which the appendages were taken was a more or less injured specimen obtained off Sibago. The specimens were approaching the time of shedding the exuvium, and are thus interesting, since the outer dermal tissue represents the form in which the animal was in the previous stage, and the inner that to which it was approaching.

The third pair of siagnopoda exist in the form of short, double-branched, imperfect legs, of which the first joint is short, the second long, and the three terminal very short and immature, while the branch or ephysis consists of two laterally compressed joints of subequal length, the distal one being fringed with six hairs. The first pair of gnathopoda is also five-jointed; the joints at the base, together with the ephysis, correspond with those of the preceding pair, but the three succeeding are larger; the first is comparatively short, while the two succeeding joints are each about eight times its length; the second being genuflexed near its articulation.

The second pair of gnathopoda differs in plan from that of the first, inasmuch as the continuation of the true leg consists of only a single, short, unarticulated joint, tipped with two small hairs springing from the base of the second joint and not from its extremity, whereas the ephysis or secondary branch is biarticulate like those of the preceding pair, but unlike them is attached to the distal extremity, which is projected considerably beyond it.

The first three pairs of pereopoda have the basis and its ephysis formed on the same plan, but the five distal joints are present, enclosed within the exuvium. But the posterior two pairs are not branched.

Group NORMALIA.

This group includes many genera that naturally fall into four tribes, and these again into several families, each having distinguishing features that clearly define it from the others.

The three posterior pairs of pereopoda, even in the females, are never chelate, whereas the first two pairs generally are, although in the Pandalidæ the first pair is simple and the second only minutely chelate, and in the Haplopodea all are simple.

The ova are carried by the females attached to the pleopoda, and the brephalos so far as known appears in the Zoea stage, with few exceptions, and these are in the Megalopa condition.

Corresponding modifications take place in the different genera, which lead to their being divided according to their external characters and structural conditions, as shown in the following tabular arrangement:—

	Tribe.	Family.	Genus.	Brephalos.
NORMALIA	Crangonidea, . . .	CRANGONIDÆ, . . .	{ <i>Crangon</i> , . . . <i>Pontophilus</i> . <i>Subinea</i> . <i>Pontocaris</i> .	. Zoea.
			{ <i>Glyphocrangon</i> , . . . <i>Nika</i> .	. Megalopa.
	Polycarpidea, . . .	ALPHEIDÆ, . . .	{ <i>Athanas</i> . <i>Parathanas</i> . <i>Cheirothrix</i> . <i>Alpheus</i> , . . . <i>Betæus</i> . <i>Paralpheus</i> . <i>Synalpheus</i> .	{ Zoea or Megalopa.
			HIPPOLYTIDÆ, . . .	{ <i>Platybema</i> . <i>Latreutes</i> . <i>Hippolyte</i> , . . . <i>Spirontocaris</i> . <i>Nauticaris</i> . <i>Hetairus</i> . <i>Chorismus</i> . <i>Merhippolyte</i> . <i>Amphiplectus</i>.	. Zoea.
	PANDALIDÆ, . . .	{ <i>Heterocarpus</i> . <i>Plesionika</i> . <i>Nothocaris</i> . <i>Pandalus</i> . <i>Pandalopsis</i> . <i>Chlorotocus</i> . <i>Dorodotes</i> .		

	Tribe.	Family.	Genus.	Brephalos.
NORMALIA (continued.)	Monocarpidea,	THALASSOCARIDÆ,	{ <i>Thalassocaris.</i> <i>Diaphoropus.</i> <i>Kyptocaris.</i>	
		ATYIDÆ,	{ <i>Atya,</i> . . . <i>Caridina.</i>	. Zoea.
		PONTONIIDÆ, ¹	{ <i>Pontonia.</i> (<i>Typton</i>).	
		CARIOYPHIDÆ, ¹	{ <i>Caricyphus.</i> <i>Rhomaleocaris.</i> <i>Anebocaris.</i>	
		ACANTHEPHYRIDÆ, ¹	{ <i>Bentheocaris.</i> <i>Acanthephyra.</i> <i>Systellaspis.</i> <i>Oplophorus.</i> <i>Campylonotus.</i>	
		PALEMONIDÆ, ¹	{ <i>Palæmon,</i> . . . <i>Palæmonella.</i> <i>Bithynis.</i> <i>Brachycarpus.</i>	. Zoea.
		NEMATOCARCINIDÆ, ¹	{ <i>Nematocarcinus.</i> <i>Stochasmus.</i>	
		TROPIOCARIDÆ, ¹	{ <i>Notostomus.</i> <i>Tropiocaris.</i> <i>Hymenodora,</i>	. Megalopa.
		STYLODACTYLIDÆ,	<i>Stylodactylus.</i>	
		PASIPHÆIDÆ,	{ <i>Leptocheila.</i> <i>Pasiphæa.</i> <i>Orphania.</i>	
	OODEOPIDÆ,	<i>Oodeopus.</i>		
	Haplopodea,	HECTARTHROPIDÆ,	{ <i>Procletes.</i> <i>Icotopus.</i> <i>Hectarthropus.</i> <i>Eretmocaris.</i> <i>Amphion.</i>	

Tribe Crangonidea.

This tribe contains those normal Phyllobranchiata in which the first pair of pereopoda is subchelate, and the second pair is feeble or imperfect, the carpos being uniarticulate.

Family CRANGONIDÆ.

Carapace dorsally flattened and laterally compressed. Rostrum dorsally flattened; frontal margin laterally extended; posterior margin laterally overlapped by the first somite of the pleon. Pleon laterally compressed posteriorly. Ophthalmopoda short and

¹ I have formed these families since the descriptive part was printed. For their definition see p. 927.

uniarticulate. First pair of antennæ with two flagella. Second with a large scaphocerite and all the joints of the peduncle articulating. Mandibles without a psalidoma or synaphipod. First pair of gnathopoda without a dactylos, and the propodos reduced to a rudimentary condition. Second pair having neither dactylos nor propodos. First pair of pereopoda robust and subchelate; second pair slender, chelate or simple, having the carpos uniarticulate; third slender and styliiform; fourth and fifth simple and robust. Pleopoda biramose; rhipidura well developed.

Crangon, Fabricius.

Crangon, Fabricius, Suppl. Entom. Syst., p. 410.

Rostrum short, not longer than the ophthalmopod, and dorsally flattened.

Ophthalmopoda extremely short, orbicular.

First pair of antennæ furnished at the base with a broad, flattened stylocerite, and terminating at the extremity in two short flagella.

Second pair of antennæ having a broad scaphocerite and a long slender flagellum.

First pair of pereopoda robust, subchelate; second pair slender and chelate; third pair slender, subequal in length to the first, and terminating in a sharp styliiform dactylos. The two succeeding pairs are more robust than the second and third, and terminate in a long and flattened dactylos.

The branchiæ consist of four pleurobranchial plumes and one small arthrobranchial attached to the articulation of the second pair of gnathopoda, which also carries a mastigobranchial plate reduced to a rudimentary condition; one of the latter also exists on the first pair of gnathopoda in a small but less rudimentary form, and a small branchial plume is attached to the membranous articulation. The entire arrangement may be shown in the following table:—

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

I have accepted the genus as restricted by Mr. J. S. Kingsley in the memoir¹ in which he revises the genus as known to the earlier carcinologists. There can be no doubt that Leach,² Westwood,³ Hailstone,⁴ and more recently Kinahan,⁵ felt that a division of the genus must take place, and in this country the separation would sooner have been made, had not Bell, in his work on the British Stalk-eyed Crustacea, reunited

¹ *Proc. Acad. Nat. Sci. Philad.*, p. 411, 1879.

² *Mag. Nat. Hist.*, vol. viii. p. 266, 1835.

³ *Trans. Roy. Irish Acad.*, vol. xxiv. p. 45, Science, 1871.

⁴ *Malaco. Decap. Brit.*

⁵ *Mag. Nat. Hist.*, vol. viii. p. 261, 1835.

Pontophilus with *Crangon*, and Kinahan¹ more recently established his several genera on features that are liable to vary.

Development (Pl. LXXXVI. fig. 4; Pl. LXXXIX. fig. 1).—The brephalos of *Crangon*, as it quits the ovum, exists in a form not very unlike that of the *Zoea* of *Palæmon*.

It has the carapace anteriorly produced to a sharp-pointed rostrum that is about one-third the length of the carapace, but exhibits signs that at its first moult the anterior extremity is lost. The pleon has the posterior margins of the third somite dorsally armed in the median line with a sharp-pointed tooth, and the fifth somite with one on each side of the dorsal surface. The sixth somite is longer than the preceding two, and continuous with the broad and fan-like telson (fig. 4z), the distal margin of which is fringed with seven ciliated spines on each side.

The ophthalmopod exists chiefly as a large ophthalmus, being nearly equal in depth and in breadth, subequal in length to that of the carapace.

The first pair of antennæ consists of a single jointed peduncle that extends beyond the end of the rostrum and terminates in two small flagella, rudimentary in character and tipped with hairs.

The second pair of antennæ has the peduncle consisting of two distinct joints, the extremity of which supports two branches; one, narrow and sharp pointed, represents the future flagellum, the other, broad and distally fringed with hairs, the scaphocerite.

The mandibles are not very dissimilar to those of the adult, and the same is true of the siagnopoda.

The gnathopoda are pediform and seven-jointed, the second joint carrying a long basephysis, and the seventh tipped with three ciliated hairs.

Four pairs of pereopoda exist as sac-like buds.

The pleopoda are also in an incipient condition.

Geographical Distribution.—The range of this genus is very great, but so far as I am aware, it is confined to the northern hemisphere. It is found on the sandy shores all round the coasts of Europe, and we have frequently taken an unspotted variety off the coasts of Devon and Cornwall, in from 10 to 50 fathoms of water. Dana records it from the western coasts of North America, from San Francisco, California, and Puget's Sound. Dr. Stimpson recognised a variety from the Pacific coast of North America as a distinct species from *Crangon vulgaris*, under the name of *Crangon nigricauda*, but as its distinction chiefly rests on the colour of the caudal extremity, with very minor and unimportant structural variations, it can scarcely be accepted as forming a distinct species. *Crangon propinquus*, Stimpson, which I also believe to belong to this species, was obtained off the northern shores of Japan. He says that it differs both from *Crangon vulgaris* and *Crangon nigricauda* only in having the fourth somite of the pleon, and sometimes the third also, carinated in the adult.

¹ *Proc. Roy. Irish Acad.*, p. 354, 1862.

Crangon vulgaris, Fabricius.*Crangon vulgaris*, Fabricius, Suppl. Entom. Syst., p. 410.

Dorsal surface of the posterior somites of the pleon rounded, without a carina.

Telson not channelled.

Length 52 mm. (2 in.).

Habitat.—Off Yokoska, Japan; in from 5 to 20 fathoms.

There are three specimens in the collection that correspond very closely with the European species; one male, one female, one young.

They have no channel on the telson nor a carina on the pleon, but the former is slender and a little larger than the lateral plates—in which point alone they differ from the European type, which has the telson shorter and thicker, and corresponds with those that I take to be *Crangon affinis*, de Haan.

The following are the measurements of the Japanese forms as compared with the British species, and it appears to me difficult to consider them otherwise than as slight variations of the same species:—

	<i>Crangon vulgaris</i> .		=	<i>Crangon affinis</i> .	
	British.	Japanese.		Japanese.	Japanese.
Length, entire, . . .	52 mm. (2 in.).	41 mm. (1.64 in.).		52 mm. (2 in.).	
Width, . . .	8 "	7 "		8 "	
Length of carapace, . . .	12 "	9 "		11.5 "	
" of rostrum, . . .	1.5 "	1 "		2 "	
" of pleon, . . .	40 "	32 "		40.5 "	
" of third somite, . . .	6 "	5 "		5.9 "	
" of sixth " . . .	7.5 "	6 "		8 "	
" of scaphocerite, . . .	10 "	8.5 "		10 "	
" of first pereopod, . . .	16 "	13 "		16 "	
" of second " . . .	16 "	13 "		14 "	
" of third " . . .	17 "	15 "		17 "	
" of fourth " . . .	17.5 "	15 "		17 "	
" of fifth " . . .	19 "	16 "		18 "	
" of telson, . . .	10 "	7 "		10 "	

Crangon affinis, de Haan (Pl. LXXXVI. figs. 1-3).*Crangon affinis*, de Haan, Crust. in v. Siebold, Fauna Japonica, p. 182.*Crangon propinquus*, Stimpson, Proc. Acad. Nat. Sci. Philad., p. 94, December 1858.

Dorsal surface smooth, carapace nearly one-third the length of the animal, measured from the base of the rostrum to the base of the telson. Anterior margin furnished with a small, blunt, flattened, dorsally concave rostrum, that scarcely reaches to the extremity of the ophthalmopoda, with a small tooth at the outer angle of the orbital notch and another more advanced on the outer side of the second pair of antennæ.

The dorsal surface is armed with a sharp tooth on the gastric region and another on the hepatic region, on each side in the same line, corresponding with the anterior extremity of the branchial region.

The pleon is about twice the length of the carapace; the somites gradually increase in length posteriorly, and also become laterally more compressed, particularly from the third somite to the sixth, which is flattened on each side. These somites show a slight tendency to a central elevation, which is not apparent until the specimen is dry; it is faintly visible on the third somite, slightly more defined on the fourth, but on the fifth the median line is depressed, while a slight elevation exists on each side. This central depression is repeated on the dorsal surface of the telson, which is narrow and a little longer than the sixth somite, reaches a little beyond the extremity of the lateral plates of the rhipidura, terminates in a sharp point, and is armed on each side with three spines distantly separated.

The appendages correspond closely with the European *Crangon vulgaris*.

Habitat.—Station 233, May 17, 1875; lat. 34° 39' N., long. 135° 14' E.; Bay of Kobé, Japan; depth, 8 fathoms; bottom, mud. Eight females. Dredged.

Station 233A, May 19, 1875; lat. 34° 38' N., long. 135° 1' E.; off Japan; depth, 50 fathoms; bottom, sand. Four specimens, females. Dredged.

Station 233B, May 26, 1875; lat. 34° 18' N., long. 133° 35' E.; off Japan; depth, 15 fathoms; bottom, blue mud. Three females and one male (?) with *Bopyrus*. Trawled.

Three of the specimens which have been brought from the last locality are females bearing many ova; the fourth is small and slender, and has been attacked by a species of *Bopyrus*.

The only differences that I can recognise between the British *Crangon vulgaris* and these specimens of *Crangon affinis*, are that the latter genus has the rostrum and ophthalmopoda a trifle longer, the ventral tooth between the second pair of pereopoda more slender and perpendicular, and that the posterior somites of the pleon exhibit traces of an elevation in the median line, but certainly not worthy of being called a carina; a depression also exists in the same position on the sixth somite as well as on the telson.

In the typical specimen of *Crangon vulgaris*, the dorsal surfaces of the last somites of the pleon and the telson are smooth and rounded, but there is a certain average number in which there is an indication of a slight dorsal depression in the median line of the sixth somite and at the anterior extremity of the telson, which latter is a little shorter than the lateral caudal plates in the typical British species, but reaches a little beyond them, and is also a little slighter in the Japanese *Crangon affinis*.

Stimpson obtained some specimens, which he named *Crangon propinquus*, from the northern coast of Japan. They were taken on a muddy and sandy bottom, at a depth of from 4 to 20 fathoms. These he describes as closely approximating to *Crangon vulgaris*,

but having the fourth somite of the pleon, and sometimes also the third, carinated in the adult; and the telson is laterally armed with six spinules. This corresponds with the normal condition of *Crangon affinis*, as well as with the European type. The slight variations between the two forms, though constant, do not appear of sufficient importance to lead me to consider them as specifically distinct, and it is doubtful if the Japanese specimens can be considered to possess features that are sufficiently important to warrant specific distinction.

The late Professor Kinahan,¹ however, considered the channelling of the dorsal surface of the posterior somites of the pleon so important that he founded the genus *Steira-crangon* on this feature alone. That it may be sufficiently marked in some forms as to be of specific value is probable, but it is so slight in the Japanese specimens that it is only appreciable when carefully examined, and I do not think we are justified in considering it as more than a variation in form from the normal European species. De Haan states that *Crangon affinis* possesses the fluted telson, and that the lateral spines of the carapace are larger than the median. But this is scarcely the case in our specimens, since in well-formed animals the spines are equally well developed.

The only distinction that is at all appreciable exists in the different lengths of the telson, but this difference is too slight to warrant its recognition as a specific character; it rather demonstrates the line of departure under certain conditions in which variation may proceed. Two of the specimens from Yokoska that I attribute to *Crangon vulgaris* were taken in somewhat shallower water, and approximate nearer to the European form. But since de Haan, Stimpson, and Kinahan have thought the channelling of the dorsal surface of the telson to be sufficiently important to be of specific value, and as the Japanese form has been distinguished by a specific name, I have thought it preferable to retain de Haan's name "*Crangon affinis*," which I have no doubt is also synonymous with *Crangon propinquus*, Stimpson.

Pontophilus, Leach.

Pontophilus, Leach, Malacos. Decap. Brit., Tab. ix.

Like *Crangon*, but has the second pair of pereopoda short and chelate, the third long and styliform. There are seven pairs of branchiæ, including a small podobranchial plume attached to the first gnathopod. The branchial arrangement may be tabulated as follows:—

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

¹ *Loc. cit.*, p. 58.

The species of this genus are generally more slender than in *Crangon*, a circumstance partially due to the increased length of the sixth somite of the pleon. The rostrum is longer and generally extends beyond the extremity of the ophthalmopoda, it is somewhat compressed laterally, and never dorsally flattened as in *Crangon*, and the body of the animal is slightly compressed laterally.

The ophthalmopoda are short and the ophthalmus orbicular.

The first pair of antennæ has the flagella longer than the peduncle, and the stylocerite is more styliform than in *Crangon*.

The second pair of antennæ and the oral appendages offer no very decided character for generic distinction.

The first pair of gnathopoda carries a small podobranchial plume attached to the mastigobranchial lash. The second pair is longer and more slender, but, like that of *Crangon*, is only five-jointed, and supports a small basecephysis and the rudiment of a mastigobranchial organ.

The first pair of pereopoda closely resembles that of *Crangon*, being subchelate and robust; the second also resembles that of *Crangon* in being chelate, yet it differs in being short, slender and feeble; it only reaches to the mouth, to which it most probably carries food. The third pair is long, slender and styliform, the length being chiefly due to the terminal three joints, the carpos, propodos and dactylos. The posterior two pairs are long and robust.

The pleon is ventrally smooth, and the pleopoda are foliaceous, and furnished with two stylamblydes both in the male and female, attached to the inner branch of every pair except the first.

The posterior pair, which forms the outer plates of the rhipidura, is long, narrow, and furnished with a diæresis. The telson is long and narrow, but shorter than the lateral plates.

Geographical Distribution.—The range of this genus is probably cosmopolitan, and in tolerably deep water. Specimens of four species have been taken in the British seas, and in the Challenger collection there are species from the Celebes Sea, mid-south Atlantic, New Zealand, and the Philippine Islands.

Pontophilus gracilis, n. sp. (Pl. LXXXVII.).

Carapace armed with three teeth on the median ridge, two close together on the gastric region and one above the cardiac, one on each side near the middle of the lateral carina, and a hepatic tooth just anterior to the branchial region.

Pleon smooth, third somite longer than the fourth.

Length, entire (female),	64 mm. (2.5 in.).
" of carapace,	17 "
Width between hepatic teeth,	8 "
Length of rostrum,	3 "
" of pleon,	47 "
" of third somite of pleon,	7.5 "
" of sixth " "	10 "
" of scaphocerite (from frontal margin),	10 "
" of first pereopod,	26 "
" of second "	11 "
" of third "	25 "
" of fourth "	25 "
" of fifth "	24 "
" of telson,	12 "

Habitat.—Station 133, October 11, 1873; lat. 35° 41' S., long. 20° 55' W.; near Tristan da Cunha; depth, 1900 fathoms; bottom, Globigerina ooze; bottom temperature, 35°·4. One specimen, female; length 62 mm. Trawled.

Station 168, July 8, 1874; lat. 40° 28' S., long. 177° 43' E.; off New Zealand; depth, 1100 fathoms; bottom, blue mud; bottom temperature, 37°·2. Six specimens; three males and three females, one bearing ova; length 35 mm. Trawled.

Station 184, August 29, 1874; lat. 12° 8' S., long. 145° 10' E.; near Torres Strait; depth, 1400 fathoms; bottom, Globigerina ooze; temperature, 39°·0. One specimen, male. Trawled.

Station 198, October 20, 1874; lat. 2° 55' N., long. 124° 53' E.; near the Philippine Islands; depth, 2150 fathoms; bottom, blue mud; bottom temperature, 38°·9. Two specimens, females. Trawled.

The animal is long, slender, and graceful. The rostrum is sharp-pointed, reaches a little beyond the ophthalmopoda, and is flanked by two small teeth. The median line of the carapace is slightly carinated, armed with three spines, two near together on the gastric region, the third halfway between the second and the posterior margin of the carapace, where the carina fades away. On each side, defining the separation of the branchial from the cardiac regions, is another small ridge or carina running continuously from the posterior margin of the carapace to the orbit, it is armed with a single tooth near the middle, anterior to which the carina is faintly marked. Another small tooth, the hepatic, defines the separation of the branchial from the antennal region. The orbit is deeply excavate, and the frontal margin of the carapace is laterally projected forwards to nearly the same level as the eyes and rostral apex; it is armed with a tooth at the outer canthus of the orbit, and another at the fronto-lateral angle, just beyond the second pair of antennæ. The pleon is smooth, the posterior somite having the sides much compressed.

The telson is long, narrow, dorsally slightly flattened anteriorly, the sides depressed

and the posterior extremity furnished with four hairs. The ventral surface of the pereion and pleon from the oral cavity to the telson is smooth, without any spine or tooth, but a small lobe exists between the second pair of pereiopoda.

The ophthalmopoda are not large, being well hidden within the orbital cavity; the surface of the ophthalmus is smooth, destitute of pigment generally and not visibly faceted.

The first pair of antennæ carries on the outer surface a broad thick stylocerite, which springs from the base and reaches to the distal extremity of the first joint, on the under and inner side of which is a short thick tooth; the second joint is shorter than the first, and the third shorter than the second. The two terminal flagella reach a little beyond the extremity of the scaphocerite of the second pair; the inner flagellum is a little longer than the outer, and furnished on the inner margin with a fringe of long hairs.

The second pair of antennæ has the scaphocerite, which is equal to half the length of the carapace, thick and ridged, with the margins subparallel, the outer terminating in a sharp tooth. The flagellum is broken off near the base in the only specimen procured from this station.

The second pair of gnathopoda does not reach beyond the distal extremity of the scaphocerite and is furnished with hairs, some of which are smooth and others delicately ciliated. The basephysis, or branch springing from the basis (the exognathe of Milne-Edwards), is short, reaching, when extended, to nearly the length of the ischium; the mastigobranchia (epignathe of Milne-Edwards) is reduced to a rudimentary condition.

The first pair of pereiopoda has the anterior margin of the palm broader than the propodos, incisive, convex, not very oblique; pollex long and sharp; dactylos smooth and sickle-shaped. The second pair is short and feeble, extending scarcely to the distal extremity of the meros of the first pair; chela with fingers long, slender, tapering and meeting only at the points. The third pair is long and slender, extending beyond the distal extremity of the scaphocerite of the second pair of antennæ. The fourth and fifth pairs are slender, subequally long and robust.

The first pair of pleopoda ($p \delta$, $p \varphi$) has the internal branch rather more than half the length of the external, and perfectly free from cilia, but with one or two short spines on the outer side; the external branch in the male is long, narrow and leaf-like, and fringed on each side with plumose hairs. In the type specimen all the hairs are rubbed off. The second ($q \delta$, $q \varphi$), third and fourth pairs of pleopoda differ from each other in but a slight degree. Each consists of a pair of nearly equally long, large, ovate, foliaceous plates, fringed with long plumose cilia; the inner branch carries a stylambly attached to it.

The posterior pair, which forms the outer plates of the rhipidura, is rather longer than the telson; the outer branch has a strong ridge on the outer margin which terminates in a subapical tooth; the inner branch is longer, narrower, and more pointed.

Observations.—The type specimen was obtained at Station 133, associated with specimens of *Willemæsia leptodactyla*, and *Hemipenæus spinidorsalis*. The smaller specimens, taken off the eastern coast of New Zealand, at Station 168, in 1100 fathoms, bear a very close resemblance to it, and I am not able to determine any distinction, excepting that the anterior tooth on the gastric region is almost rudimentary.

One specimen only was taken with ova, and that was trawled at Station 168. The ova are larger than those of *Crangon*, oval in form and less numerous, and they are not attached like them to the pleopoda, but connected together by a very slender filament; they lie against the ventral surface of the pleon, protected especially by the inner branches of the pleopoda.

Pontophilus profundus, n. sp. (Pl. LXXXVIII. fig. 1).

Rostrum reaching beyond the ophthalmopoda. Carapace armed with two strong teeth in the median line, one on the gastric region, the other just anterior to the cardiac region, and two on each side on the branchial region. The third somite of the pleon is dorsally produced to an obtuse point; fourth somite short and partially covered by the third.

The second pair of gnathopoda is long and slender, as is also the posterior pair of pereopoda.

Length, entire (male),	15 mm. (0.6 in.).
" of carapace,	3.5 "
" of pleon,	11.5 "
" of sixth somite,	3.5 "
" of telson,	3 "

Habitat.—Station 165, June 17, 1874; lat. 34° 50' S., long. 155° 28' E.; off Sydney; depth, 2600 fathoms; bottom, red clay; bottom temperature, 34°.5. One specimen, male. Dredged.

Body slender, rostrum sharp, extending to a little beyond the extremity of the ophthalmopoda, and flanked on each side at the base by two small teeth, just above the posterior margin of the orbit. Two strong, anteriorly directed teeth, equidistant from each other and from the apex of the rostrum and the posterior margin of the carapace, are situated one before the other in the median line; on each side, just on the margin of the branchial region, there is also a sharp tooth, and anterior to it, separating the branchial from the gastric regions, is another similar tooth. The frontal margin is armed with two short, sharp teeth, one defining the outer angle of the orbit, the other situated just above the infero-anterior angle of the carapace. The ophthalmi are ovate and tolerably large and prominent. The facets (fig. 1α) are squares.

The first pair of antennæ has the first joint of the peduncle rather long, and excavate

on the upper surface for the reception of the ophthalmopod ; second and third joints short, the last supporting the two terminal flagella, which are equal in length and nearly equal in thickness, the outer being rather the larger, which may be due to sexual distinction ; neither reaches much beyond the extremity of the scaphocerite.

The second pair of antennæ has the scaphocerite more than half the length of the carapace, long, narrow, having the inner margin subparallel with the outer, armed with a sharp tooth at the distal extremity of the outer margin ; the flagellum is about the length of the animal and consists of a series of long, naked articuli.

The second pair of gnathopoda (fig. 1*v*) is pediform, terminating in an obtuse point ; the lower or posterior margin of the terminal, as well as of the two preceding joints, is fringed with two rows of short spines minutely ciliated, while the upper or anterior margin bears fasciculi of long, slender hairs, some of which are finely fringed with long cilia.

The first pair of pereopoda has the meros armed on the upper and distal angle with a strong, sharp tooth, and the carpos on the inner and lower distal angle with one not quite so prominent ; the propodus is long, with parallel margins, the anterior margin (fig. 1*k*), which is very oblique, carrying a sharp tooth-like pollex and a row of equidistant hair-like structures impacted in the thin vertical incisive margin ; dactylos sickle-shaped and smooth. The second pair of pereopoda (fig. 1*l*) is short, reaching only to the extremity of the meros of the first pair, slender and chelate ; the pollex and dactylos are equal in length, long, slender and convex, terminating in long, slender ungues that impinge only at their extremities. The two succeeding pairs of pereopoda are partially wanting in the only specimen procured, but the terminal or fifth pair is tolerably robust, longer than the first pair, and terminates in a long, slender, slightly curved dactylos.

First pair of pleopoda (fig. 1*p* ♂) having one branch large and fringed with a few strong hairs, the other short and styliform. The four following pairs have the branches equal, long, ovate, and fringed with long plumose cilia.

The posterior pair, forming the lateral plates of the rhipidura, reaches quite to the extremity of the telson, and has the outer plate armed at the outer distal angle with a short, sharp tooth.

Telson long, narrow, armed at two-thirds distance from the base with two small teeth, and terminating in two stout spines and several strong hairs (fig. 1*z*).

In the same bottle was the second pereopod of a species of *Lyasmata* or a near ally.

Pontophilus junceus, n. sp. (Pl. LXXXVIII. figs. 2-4).

Carapace having two teeth on the dorsal median line behind the rostum, one on the gastric region, the other on the anterior margin of the cardiac. Also one on the lateral

ridge, which is but imperfectly developed, and one on the hepatic region. The pleon is smooth and the caudal appendages are long.

Length, entire,	38 mm. (1.5 in.).
" of carapace,	9 "
Breadth between hepatic teeth,	4.5 "
Length of rostrum,	4.5 "
" of pleon,	29 "
" of third somite,	5 "
" of sixth somite,	6.5 "
" of telson,	7 "
" of scaphocerite,	7 "
" of first pereopod,	12 "
" of second pereopod,	5 "
" of third pereopod,	(?) 20 "
" of fourth pereopod,	16 "
" of fifth pereopod,	16 "

Habitat.—Station 200, October 23, 1874; lat. 6° 47' N., long. 122° 28' E.; between the Philippines and Borneo; depth, 250 fathoms; bottom, green mud. One specimen, female. Trawled.

This species looks very like *Pontophilus gracilis*, but it is only half the length and has but one tooth on the gastric region. The rostrum is sharp, longer than the ophthalmopoda, and has no small denticles on each side of its base. There are six teeth on the carapace, one on the gastric region, one on the cardiac, one on each side on the hepatic, and one near the centre of the lateral wall of the carapace. The sixth somite is scarcely so long as in *Pontophilus gracilis*, but the telson is quite as long, and the appendages generally have a slender appearance, particularly the second and third pairs of pereopoda.

It may be distinguished from *Pontophilus profundus* by the posterior dorsal surface of the third somite of the pleon not being produced so as to almost cover the fourth.

Sabinea, Owen.

Sabinea, Owen, Appendix to Ross's Narrative of a Second Voyage in Search of a North-West Passage, p. lxxxii, 1835.

Carapace about one-fourth the length of the animal, dorsally flattened and laterally compressed, anteriorly produced to a rostrum that is scarcely longer than the ophthalmopoda.

Pleon dorsally interruptedly carinated on the second, third, and fourth somites only. Telson long and tapering.

Ophthalmopoda short and orbicular.

First pair of antennæ biflagellate, short.

Second pair having a long, slender flagellum, and a scaphocerite that reaches beyond the peduncle of the first pair.

Oral appendages as in *Crangon*.

Second pair of gnathopoda four-jointed, the ultimate joint but slightly longer than the penultimate and terminating in an obtuse point.

First pair of pereopoda robust, long and subchelate, like those of *Crangon*, which it much resembles. Second pair of pereopoda short, feeble and simple, terminating in a small obtuse and rudimentary dactylos. Third pair long, slender and styliform; on the ventral surface of the pereon between this pair of appendages there stands a long, slender, spine-like tooth. Posterior two pairs of pereopoda robust, subequal and simple.

The branchiæ consist of seven pairs arranged as in the genus *Pontophilus*, namely, six pleurobranchiæ and one podobranchia, disposed as shown in the following table:—

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

Development.—The brephalos appears to be further advanced than the *Zoea* stage. I only know it as an advanced embryo extracted from the ovum, but even then it has the carapace largely developed, the pleon well formed, the ophthalmopoda large and orbicular, the antennæ assuming their distinguishing character, and the pleopoda in a budding condition. The whole form is suggestive of the genus *Nebalia*.

Geographical Distribution.—This genus was first described by Professor Owen from specimens taken in the Arctic regions. It has since been taken in the Atlantic, off the western coast of America, as far south as 40° of north latitude, and Stimpson records it from the Siberian Seas.

Sabinea septemcarinata (Sabine) (Pl. LXXXIX. fig. 2; Pl. XC. fig. 1).

Crangon septemcarinata, Sabine, Suppl. to Parry's First Voyage for the Discovery of a North-West Passage, p. ccxxxvi, pl. ii. figs. 11-13, 1824.

" " Ross, Appendix to Parry's Polar Voyage, p. 203, 1824.

Sabinea septemcarinata, Owen, Appendix to Ross's Narrative of a Second Voyage in Search of a North-West Passage, p. lxxxii, 1835.

Crangon septemcarinatus, Milne-Edwards, Hist. Nat. Crust., vol. ii. p. 343, 1837.

Sabinea septemcarinata, Sars, Forhandl. Vidensk. Selsk. Christ., 1858, p. 125, 1859.

" " Stimpson, Proc. Acad. Nat. Sci. Philad., p. 94, 1860.

" " Sidney Smith, Trans. Connect. Acad., vol. v. pt. 1, p. 57, pl. xi. fig. 5.

" *sarsii*, Sidney Smith, loc. cit., p. 59, pl. xi. fig. 6.

Length, entire,	53 mm. (2.1 in.).
" of carapace,	13 "
" of rostrum,	4 "
Width of carapace,	10 "
Length of pleon,	40 "
" of third somite,	8 "
" of sixth somite,	8 "
" of telson,	10 "
" of first pereopod,	16 "
" of second pereopod,	8 "
" of third pereopod,	20 "
" of fourth pereopod,	18 "
" of fifth pereopod,	18 "
" of scaphocerite,	10 "
" of ventral tooth,	4 "

Habitat.—Station 49, May 20, 1873; lat. 43° 3' N., long. 63° 39' W.; south of Halifax, Nova Scotia; depth, 85 fathoms; bottom, gravel, stones; bottom temperature, 35°·0. Twenty-two specimens. Both sexes; all sizes from 20 mm.

The Challenger specimens of this species correspond most nearly with Sidney Smith's description of *Sabinea sarsii*, which I take to be a pronounced variety of this species rather than specifically distinct. In a letter to me on the subject Mr. J. S. Kingsley of Salem, in the United States, says:—"We have the same in the Museum of the Peabody Academy, dredged off Salem in 90 fathoms. It differs somewhat in the shape of the rostrum from Sabine's figure, and I have no opportunity of comparing it with Arctic specimens. Professor Smith and I were at first inclined to call it a new species, but I now consider it (and I think Professor Smith has come to the same conclusion) merely a variety of Sabine's species. I find that the sternal spine varies considerably, in some specimens it is sharp, while in others it is stout and obtuse."

In our specimens the sternal tooth (Pl. XC. fig. 1) is generally sharp, and in the young, and in those that I take to be males, the tooth is more compressed against the sternum than in the larger females. The two posterior pairs of pereopoda on the under side of the basal joint are furnished with a small mat of hairs. The rostrum is dorsally flattened posteriorly, and laterally compressed anteriorly, and the dorsal ornamentation shows an approximation to that which is seen in *Pontocaris*.

The pleopoda are foliaceous; in the first pair there is a sexual modification of the inner branch, which in the male (Pl. XC. fig. ♂ 1*p*) is reduced to a rigid flattened appendage, fringed with a few short hairs, mingled with short, sharp pointed, and slightly curved spines, three or four of which are situated at the inner distal extremity of the basal joint; in the female (Pl. XC. fig. ♀ 1*p*) the arrangement is similar, only the hairs are longer and the small spine-like points are represented by long and flexible

membranous hair-like appendages, and the basal joint is fringed on the inner side with a thick mat of ciliated hairs.

The eggs are ovate and larger than in *Crangon*, and the brephalos probably quits the ovum in a more advanced condition, inasmuch as in the embryo I have been able to detect the pleopoda in a budding state of development.

Pontocaris, n. gen.

Rostrum short, not longer than the ophthalmopoda. Fronto-lateral margin of the carapace much dilated and anteriorly produced. Dorsal surface multicarinated. General appearance as in *Crangon*, except that the scaphocerite is not longer than the peduncle of the first pair of antennæ. The second pair of gnathopoda is long, reaching beyond the distal extremity of the first pair of antennæ, and is furnished with a short basephysis but no mastigobranchia.

The first pair of pereopoda is robust, subchelate, and furnished with a short unarticulate ephysis attached to the basis. The second pair is slender, nearly but not quite as long in proportion to the first as in *Crangon*, and chelate. Third pair long, slender and styliform, reaching beyond the extremity of the first pair. The two posterior pairs are simple and robust.

The pleopoda are broad and foliaceous, and the outer plate of the rhipidura has no diæresis.

This genus differs very considerably in its external appearance from *Crangon*, most conspicuously in the development of the antennal region and the frontal margin of the carapace, which is dilated and produced in the form of small wings. But a careful examination of the several parts shows that the two genera approximate to each other in detail. All the appendages of the cephalon and pereion closely agree with those of *Crangon*, and the differences distinguishing the two are of little value. The ophthalmopoda are smaller in *Pontocaris* than in *Crangon*, and the first pair of antennæ has the outer flagellum larger at the base; the scaphocerite of the second pair is short and discoidal, while in *Crangon* it is long and narrow; and the mandibles and oral appendages have no appreciable distinguishing character from those of *Crangon*. The branchial appendages, however, exhibit differences of more importance. In *Crangon* the first pair of gnathopoda carries a small and almost rudimentary mastigobranchial plate, whereas in *Pontocaris* there is a small podobranchial plume attached to the mastigobranchia. On the second pair of gnathopoda I cannot find the rudiment of the mastigobranchial plate, and the arthrobranchiæ are also wanting, but are represented by a pleurobranchial plume.

All the other plumes are pleurobranchial. The branchial arrangement is expressed in the following table:—

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

In this genus the inferior extremity of each branchial plume is thrown forwards (Pl. LXXXVI. fig. 5), and not backwards as in *Crangon* (Pl. LXXXVI. fig. 2) and *Pontophilus* (Pl. LXXXVII. fig. 3).

I only know of two species of this genus, and these are both from the south of New Guinea.

Pontocaris propensalata, n. sp. (Pl. XC. figs. 2, 3; Pl. LXXXV. fig. 5).

Carapace narrower anteriorly than posteriorly; furnished with five longitudinal carinæ, the three dorsal being multidenticulate and converging anteriorly; the lateral are also multidenticulate, the three anterior teeth being very large and culminating in the frontal alæ. Another longitudinal ridge, smooth but not keel-shaped, traverses the infra-lateral wall of the carapace. Rostrum short and pointed, not extending beyond the extremity of the ophthalmopoda. Fronto-lateral margin considerably produced anteriorly. Dorsal surface of the pleon interruptedly carinated in the median line, and corrugated laterally in oblique ridges.

Ophthalmopoda small.

First pair of antennæ short.

Second pair of antennæ having a subcircular or discoid scaphocerite; flagellum a little longer than the carapace.

Telson long, sharp and smooth.

Length, entire (female),	34 mm (1.3 in.).
" of carapace,	11 "
" of rostrum,	1 "
Breadth of carapace,	8 "
Length of pleon,	23 "
" of third somite of pleon,	4 "
" of sixth somite of pleon,	4 "
" of telson,	7 "
" of scaphocerite,	4 "
" of first pereopod,	13 "
" of second pereopod,	9 "
" of third pereopod,	18 "
" of fifth pereopod,	14 "

Habitat.—Station 192, September 26, 1874; lat. $5^{\circ} 49' 15''$ S., long. $132^{\circ} 14' 15''$ E.; off the Ki Islands, south of Papua; depth, 140 fathoms; bottom, blue mud. One specimen, male. Trawled. Associated with *Philonicus lucasii* and *Plesionika rostricrescentis*.

The carapace is furnished with five distinct carinæ, which are armed with strong, pointed, but not very sharp, denticulate processes. There is one on the dorsal median line and one on each side, corresponding to the line of separation between the branchial and visceral regions; these three gradually converge anteriorly towards the rostrum. One on each side passes forwards from the posterior margin of the carapace and terminates in the outer fronto-lateral angle; these carinæ are continuous, except where they are interrupted by the cervical suture, and on them the teeth are larger anteriorly; there being two large and a small one anterior to the cervical suture, and posterior to it there is one larger, the rest gradually decreasing in size and prominence to the posterior margin.

The pleon is furnished with an interrupted, median, dorsal carina.

The first somite has two prominent longitudinal ridges, one on each side of the median line. The second has a median ridge projecting anteriorly in the form of a tooth, and on each side a slightly waved linear prominence that is lost in the posterior margin near the union of the coxal plate with the somite. The third somite has the median ridge more elevated than on the preceding one, and the lateral ridge, which commences at the anterior margin in close approximation to the median carina, gradually diverges posteriorly in a waved line until it reaches the posterior margin, where it is lost. The fourth somite has a median carina posteriorly terminating in a slight point, and flanked by two oblique ridges that terminate in the posterior margin. The fifth somite differs markedly from the anterior four; it has no central carina, but a strong longitudinal ridge on each side, slightly diverging posteriorly and projecting a little beyond the posterior margin, and on its lateral wall there are also two less important longitudinal ridges.

The sixth somite is also without a median carina, and the two lateral ridges are broken into small cusps; a little outside of the terminal extremity of which, a sharp tooth projects backwards from the posterior margin.

The telson is dorsally flat, long, narrow and smooth, having on each side a longitudinal ridge that gradually converge to a point.

On the ventral surface of the pereion (fig. 3), the fifth, sixth and seventh somites are centrally carinated, the carina on the fifth being anteriorly produced to a sharp tooth between the third pair of pereiopoda.

The five anterior somites of the pleon are each armed in the ventral median line with a long, laterally compressed tooth, of which the anterior is the longest and sharpest,

each gradually becoming less prominent until in the fifth it exists as a thin, pointless plate.

The ophthalmopoda are rather small and round, and rest in a concave depression in the upper surface of the first pair of antennæ, where they are protected by a thin stylocerite.

The first pair of antennæ (fig. 2*b*) is short, the extremity of the peduncle reaching scarcely beyond the level of the fronto-lateral angle of the carapace. The first or coxal joint is furnished on the outer side with a sharply pointed stylocerite, the inner margin of which is fringed with fine cilia, while a fasciculus of a few long hairs springs from the surface, and surrounds the eye; the second joint is longer than the first and is produced to a point at the outer distal angle; the third is shorter than the second, and is armed with a short tooth on the outer margin. The flagella are unequal; the outer or primary, which is scarcely twice as long as the peduncle, is very robust, flattened, rapidly tapers to a fine extremity, and is abundantly furnished with membranous cilia. The inner or secondary flagellum is more slender and longer than the primary, and fringed with numerous simple hairs.

The second pair of antennæ (fig. 2*c*) has the last joint of the peduncle long and the other joints short; the scaphocerite, which is almost circular, being as broad as long, is furnished with a small tooth on the distal extremity of the outer margin; the inner margin is fringed with long hairs, and the distal surface minutely pilose. The flagellum is about half the length of the animal and is thickly studded with minute, short, stiff, curved spinules.

The second pair of gnathopoda (fig. 2*i*) is long, slender and four-jointed, reaching beyond the extremity of the first pair of antennæ, and carries a short biarticulate base-physis.

The first pair of pereopoda (figs. 2*k*, 2*k''*) is long and robust and approximates in form to that of *Crangon vulgaris*. The anterior margin of the propodos (fig. 2*k''*) is more oblique than in *Crangon*, the incisive margin being thin, smooth, and fringed with hairs at its base; the dactylos is sickle-shaped. The second pair of pereopoda (fig. 3, *l*) is shorter, being about two-thirds the length of the first; it is chelate and the fingers of the chela impinge only at their apices. The third pair of pereopoda (fig. 3, *m*) is styliform, slender, and twice the length of the second, reaching beyond the extremity of the first.

The first pair of pleopoda (fig. 2*p*) has the rami unequal and foliaceous, and the margins fringed with hairs; the others (fig. 2*q*) have the rami equal and foliaceous, and carry a single stylamblys on the inner margin.

The posterior pair of pleopoda, forming the outer plates of the rhipidura, is long and narrow, but scarcely so long as the telson; the outer branch is armed with a small tooth on the outer distal extremity but has no diæresis; and the inner margin is fringed with hairs.

Pontocaris pennata, n. sp. (Pl. XCI.).

Carapace broader anteriorly than posteriorly; frontal antennal margin obliquely extended outwards and forwards; dorsal and lateral surfaces longitudinally traversed by seven carinæ, of which the three dorsal are multidenticulate and converge anteriorly, the supra-lateral denticulate anteriorly, and the infra-lateral smooth.

The rostrum usually two-pointed, or bifurcate.

There is no tooth on the ventral surface of the pereion between the third pair of pereopoda.

Telson long and slender.

Length, entire (female),	24 mm. (1 in.).
„ of carapace,	7 „
„ of rostrum,	0·7 „
Breadth of carapace between hepatic teeth,	6 „
„ of frontal angles,	6 „
Length of pleon,	17 „
„ of third somite of pleon,	3·5 „
„ of sixth somite of pleon,	3 „
„ of telson,	5 „
„ of scaphocerite,	2 „
„ of first pereopod,	10 „
„ of second pereopod,	6 „
„ of third pereopod,	14 „
„ of fifth pereopod,	11 „

Habitat.—Station 190, September 12, 1874; lat. 8° 56' S., long. 136° 5' E.; Arafura Sea, south of Papua; depth, 49 fathoms; bottom, green mud. Three specimens; two females, one male. Trawled.

The rostrum is short, bidentate at the apex, and supported by a small tooth on each side at its base. The carapace is traversed longitudinally by seven carinæ. The median carina commences on the gastric region, or a short distance behind the rostrum, and is armed with a row of eight bead-like cusps continuing to the posterior margin. The second, or the first on each side of the median carina, is slightly curved outwards; it commences immediately behind the orbit, and extends to the posterior margin of the carapace, and supports nine small teeth, the four anterior being a little longer than the five posterior. The next or third carina forms on each side the dorso-lateral angle of the carapace, and commences in a large, obliquely directed, wing-like process on the outer side of the orbit, behind which are two small pointed teeth which are separated by a notch from other two behind, whence the carina runs as a smooth ridge to the posterior margin of the carapace. Beneath this, on each side on the infra-lateral surface, is the fourth carina, which commences in a tooth just beneath the outer orbital angle, it is

smooth, and runs continuously to the posterior margin, where it unites with the infra-lateral angle of the carapace, except where it is interrupted by a very small tooth opposite the penultimate somite of the pereion.

The pleon has the lateral margins of the five anterior somites produced to an angle.

The first somite is dorsally armed on the anterior margin with two anteriorly directed cusps, one on each side of the median line, which is smooth, outside which are two others, less regular in form; the posterior margin is tolerably smooth. The second somite is armed with a strong, pointed, anteriorly directed, central tooth, which produces a carina in the median line for half the length of the somite; it is transversely divided by a groove, posterior to which the somite is smooth, the lateral surface only being broken up on each side into two anterior and posterior cusps. The third somite is carinated throughout its entire length, the transverse groove or sulcus terminating on each side close to the central carina; the lateral surface is divided into small cusp-like elevations. The fourth somite is carinated throughout its entire length, the transverse sulcus terminating at the central carina, from near the middle of which a lateral carina runs obliquely to the posterior margin. The fifth somite has no central carina, but one on each side runs obliquely backwards and outwards from near the anterior to the postero-lateral margin, and each is interrupted so as to form a sharp tooth near its centre. The sixth somite has no central carina but a longitudinal groove or depression, chiefly due to the lateral elevation which forms a longitudinal carina on each side, which is armed by three sharp teeth in a line; the postero-lateral angle is produced into a strong tooth on each side.

Each of the five anterior somites is produced laterally to an obtuse angle which is bossed on the outer surface. The sixth somite differs from the others in having the posterior angle pointed and directed backwards, and the lateral angle is also sharper than in the preceding somites, and situated more posteriorly, while the boss or tubercle, instead of immediately surmounting the angle, is situated near the frontal margin.

The telson is long, narrow, acuminate and dorsally flattened, and the lateral margins are abruptly depressed.

The ophthalmopoda are short, large, round, and project but slightly beyond the rostrum. The first pair of antennæ is short; the first joint, the outer distal angle of which projects into a sharp tooth, reaches but little beyond the extremity of the ophthalmopoda. It is concave on the upper surface for the reception of the ophthalmopoda, and carries on the outer side, attached to the base, a stiff and pointed stylocerite, the apex of which reaches nearly as far as the distal extremity of the joint; a fasciculus of long cilia is implanted within the margin, and from its position and form is apparently adapted for sweeping the surface of the ophthalmus and protecting it from external injury. The second joint is short, scarcely as long as the anterior margin is broad, and is distally produced externally to a sharp point or tooth. The third joint is

still shorter than the second, and carries two subequal flagella, neither of which is quite as long as the peduncle. In the male the outer branch is more robust and stronger than the inner, while in the female they closely correspond in size and appearance.

The second pair of antennæ has the scaphocerite broad and short, with the margins subparallel, and reaching but very little beyond the extremity of the ultimate joint of the peduncle of the first pair; the external margin terminates in a sharp tooth, beyond the extremity of which the internal or foliaceous portion extends a little, and is fringed with long cilia. The flagellum is slender and about half the length of the animal.

The mandible (*d*) is slightly curved, cylindrical, and terminates at the molar process (*d'*, *d''*) in two sharp, fork-like points, supplemented with a cutting tooth. The organ is not implanted deeply in the surrounding structure by an apophysis, but attached to muscle tendons at the extremity.

The first pair of gnathopoda (*h*) is short and subpediform; it is five-jointed and scarcely as long as the secondary ramus or basecephysis; the whole organ is richly adorned with long cilia.

The second pair of gnathopoda (*i*) is four-jointed. The first joint or coxa is short; the second, which probably consists of the basis, ischium and meros united, is long, slightly excavate on the inner side near the base, corresponding with the oral aperture, and on the outer side supports an ephysis scarcely half the length of the joint to which it is attached; the third joint is more slender than the preceding, and about one-third its length; the fifth is more slender than the third, and slightly longer.

The first pair of pereiopoda (*k*) has the anterior margin of the palm (*k'*) oblique, waved, and separated from the short pollex by a deep notch, in which the extremity of the dactylos rests when closed. The second pair of pereiopoda (*l*) scarcely reaches beyond the carpos of the first, it is slender and terminates in a small chela, the fingers of which are gaping and nearly as long as the propodos; the carpos is uniarticulate, longer and more slender than the propodos, while the meros is about the same length. The third pair of pereiopoda (*m*) is long and slender, reaching considerably beyond the distal extremity of the first, and beyond that of the second pair of gnathopoda or either flagellum of the first antennæ; the dactylos is styliform, long, slender, straight, cylindrical and pointed; the propodos is cylindrical, very little if at all longer than the dactylos, and scarcely more robust; the carpos is subequal in length to the propodos and slightly stouter; the meros and ischium are subequal in length, the latter being the more robust; the basis is short, and the coxa is long and tolerably large. There is no tooth nor rudiment of one on the ventral surface of the somite between this pair of appendages. The fourth and fifth pairs of pereiopoda are similar to each other. They are shorter and more robust than either of the preceding, and terminate in a long, slightly curved, flattened and pointed dactylos. Posterior to the coxa on the ventral surface of the last somite of the pereion is a strong calcified plate.

The pleon is long and gradually narrows posteriorly; a strong tooth stands in the median line on the ventral surface of each of the five anterior somites (see fig. 2), gradually diminishing in size from the first, where it is long and strong, to the fifth, where it is little more than a sharp prominence, while there is no trace of it on the sixth.

The pleopoda are short and articulate with the fixed coxal process of each somite near the lateral extremity. The first pair (*p*) has two unequal rami, one branch being as long as the basal joint, and the other about half its length, the inner being destitute of hairs. The second (*q*) and three following pairs are similar to each other, and consist of two subequal foliaceous branches fringed with long hairs, and bearing a small stylamblys on the inner branch.

The ultimate pair helps to form the rhipidura and is implanted beneath the telson, and when compressed the appendages impinge longitudinally against each other in the median line. The outer plate is the shorter, and terminates subapically on the outer side in a small tooth; the inner plate is more tapering and reaches as far as the extremity of the telson.

Observations.—This species may easily be distinguished from *Pontocaris propensalata* by the extension of the fronto-lateral wing-like processes in an obliquely outward direction, instead of directly forwards.

The carapace has the same number of carinæ, similarly situated, but the infero-lateral ridge is more decided in character. The rostrum is bifurcate at the extremity in the described specimen, which is a female. There are two others in the collection that closely resemble the type; one has the rostrum rounded as if the two apical points had been rubbed down, the third, which I take to be a male, is somewhat more slender in form, less corrugated generally, and has the outer ramus of the first pair of antennæ much more robust; in this specimen the rostrum is sharp pointed and the teeth at the base are obsolete. The posterior margin of the carapace is more compressed than the anterior, and the lateral carina has only two rudimentary denticles posterior to the three or four large ones at the anterior extremity. The dorsal carina on the pleon is interrupted, and the corrugations are as prominent as those of the preceding species, but slightly different in form. The ophthalmopoda are larger, but the oral appendages and pereopoda are very similar. The large tooth on the ventral surface of the pereion in *Pontocaris propensalata* is wanting in *Pontocaris pennata*, but in both species laterally compressed teeth are present on the ventral surface of the pleon. The general character of the integumentary structure is strong and rigid, much more so than we find in any of the species of the genus *Crangon*, and corresponds more with that of the genus *Glyphocrangon*, from which, however, it differs in several essential points of structure.

Tribe Polycarpidea.

This tribe consists of all those normal Phyllobranchiata in which the second pair of pereopoda is slender, and in which the carpos is divided into a greater or less number of articuli. It includes the families Nikidæ, Alpheidæ, Hippolytidæ and Pandalidæ.

Family NIKIDÆ.

This family consists of those genera which have the carapace produced anteriorly to a rostrum that is horizontal with the dorsal surface, the mandibles without a psalistoma or synaphipod, the first pair of pereopoda simple or chelate and stronger than the second pair, which is minutely chelate and has the carpos multiarticulate.

It corresponds nearly with the Lysmatinæ of Dana and Kingsley, but I prefer to consider the genus *Nika*, which Dana places first in his list, as being the type of the family, inasmuch as it exhibits the point of union between the two forms, or those genera which have the first pair of pereopoda on one side simple and on the other chelate. In *Glyphocrangon* we find that both hands of the first pair are simple, with a flexible dactylos, after the manner of the one on the left side in *Nika*, and in *Lysmata* both are chelate as on the right side in *Nika*.

Glyphocrangon, A. Milne-Edwards.

Glyphocrangon, A. Milne-Edwards, Ann. d. Sci. Nat., sér. 6, tom. xi. p. 3, 1884.

„ Sidney Smith, Rep. "Albatross" Dredgings, 1886.

The external tissue of the species that belong to this genus is hard and rigid, and exhibits a tendency to tuberculose ornamentation; the carapace is subcylindrical, scarcely a third the length of the animal, measured from the frontal margin to the extremity of the telson. Anteriorly it is produced to a strong, rigid, and sharp pointed rostrum, dorsally depressed in the median line. The frontal margin has the orbit broadly but not deeply excavate, and armed on the outer canthus with a large spine-like tooth. There is another of similar character corresponding with the second pair of antennæ, and posteriorly to this, but at a slightly higher level, is another tooth that varies in different species and corresponds with a longitudinal ridge. There are eleven longitudinal ridges, one median and five on each side of it, and these ridges are more or less pronounced in the several species, being most distinct in the less tuberculose forms. The median ridge exists only on the rostrum and frontal region as a minute line of elevation, terminating in a transverse groove that separates the frontal from the gastric regions; one on each side of the median, commencing at this groove, traverses the carapace to the posterior margin; on the outer side is another ridge, more conspicuous behind the

cervical fossa than anterior to it; beyond this is another that appears to commence in the hepatic tooth, which varies in importance in different species, and continues to the posterior margin of the carapace; a fourth ridge on each side commences in the post-antennal tooth, is interrupted at the cervical fossa, and then continued to the posterior margin of the carapace; again, beyond this, is another ridge that is generally less conspicuous, and sometimes appears to divide and traverse the carapace from the anterior to the posterior margin, whilst a strong submarginal ridge, commencing at the antennal tooth, traverses a line within, corresponding with the margin of the carapace, and continues from the frontal and approaches in the median line at the posterior margin.

The pleon is generally tuberculose even in the smoother forms, the texture of the somites is universally rigid, and the dorsal surface is elevated in the median line into a strong but broken ridge, the anterior extremity of which is produced into an anteriorly projecting cusp which rests in the extended position of the animal on a smooth depression in the carapace. A similarly formed tooth also exists on each side and similarly rests against the carapace in a line corresponding with the second dorsal ridge. The lateral margins are produced to strongly projecting teeth that vary in number and importance, there being only one on the first, two or three on the second, two on the third, fourth, and fifth, and one on the sixth somite. The four anterior somites are united by a small hinge joint, consisting of a small protuberance at the postero-lateral margin, which rests in a corresponding hollow of the anterior margin of the succeeding somite.

The posterior articulations of the three last somites differ from the preceding. The three anterior articulate by a process projecting from the posterior margin, and which rotates in a cup on the anterior margin of the next succeeding somite. The three posterior somites possess a button-shaped protuberance projecting from the anterior margin, which is lodged in a hollow produced by a curved process projecting from the posterior margin of the one preceding.

A slight modification exists in the last somite; the curved process or articulation is more ovate, and the telson has the anterior process implanted within it; so that by a slight contraction of the flexor muscles, the telson is forced into a fixed position, and is only released when these muscles are relaxed.

The telson is a long bayonet-shaped organ; it is transversely quadrate, each angle forming a longitudinal rigid and elevated carina which converges to a sharp point that is slightly curved upwards. It is generally longer than the lateral plates of the rhipidura, which are membranous, soft and flexible. On the anterior portion of the dorsal groove of the telson is a strong cusp that generally underlies the projecting tooth of the sixth somite, which, when the animal is extended, presses against its posterior surface and strengthens it in its position. The telson in this genus is undoubtedly an offensive weapon, and a very powerful one when the animal wills to strike, but should

the intended blow miss its mark, the several dorsal processes in the median line become structurally protective, for the telson when fixed for striking, is supported in position by the tubercle on the dorsal surface being brought into contact with the posterior tooth of the sixth somite, and in the same way support is given by several successive somites until the first is relieved by the pressure of the antero-central tooth against the postero-dorsal surface of the carapace.

The ophthalmopoda are short and support large and globular ophthalmi. On the inner surface near the ophthalmus in some species a small denticular projection is present that I take to be the representative of a phosphorescent organ. The ophthalmopoda rest in an orbit which is defined by a large projecting tooth on the outer canthus.

The first pair of antennæ is short and terminates in two short flagella; the basal joint is hollowed to receive the eye when at rest, and is without a stylocerite.

The second pair of antennæ carries a scaphocerite that is broad and disc-like, the outer margin being as soft and flexible as the inner; it is fringed with fine hairs. The tooth commonly present on the outer margin of this organ is wanting or reduced to a minute denticle, easier felt than seen, and is situated about one-third the length of the organ from the base. This antenna carries a flagellum that nearly equals half the length of the animal.

The mandibles are similar to those in the genus *Crangon*, they carry no psalidoma or synaphipod, and are enclosed within the lips.

The first pair of siagnopoda are small, three-branched, and closely hug the oral walls on each side. The second pair of siagnopoda consists of two branches; the inner, or that nearest the mouth, is small, tapering and two-jointed, the outer is broad and subfoliaceous, and represents the mastigobranchial plate; it is uniarticulate (and therefore not correctly represented on Pl. XCII., *f*), the anterior extremity being rounded and fringed with hairs, as is the posterior extremity, which projects beyond the articulation, the margin being fringed with hairs centrifugally directed, their extremities being curved towards the anterior end.

The third pair of siagnopoda is four-branched, the inner branch is small and rudimentary, the second is flat, pointed, and fringed with hairs; the third is broad, rounded at the extremity, fringed with hairs, and from the inner margin a slender lash-like process projects anteriorly; the fourth represents the mastigobranchial appendage, and consists of a long, narrow, hairless plate directed both anteriorly and posteriorly.

The first pair of gnathopoda is seven-jointed; the second joint or basis carries a long, gradually tapering, lash-like basephysis fringed with small hairs; the ischium and meros are broad at the base but become narrow towards the distal extremity; the carpos is short and suddenly enlarges, the broader extremity supporting the propodos, which is long, flat, and distally obliquely truncate, the margin bearing a wide and short dactylos.

The second pair of gnathopoda is only five-jointed. The first two joints, the coxa

and basis, articulate with each other, the latter bears a small ephysis, and the succeeding two, the ischium and meros, are closely impacted or fused together, and can be defined by their line of demarcation rather than by their articulation; the carpos is fused either with the meros or propodos, which latter is broad and articulates with the preceding joint obliquely downwards, and is distally united with the dactylos, which is as wide at its base as the propodos; it is fringed with short, strong, rigid spinules, and terminates in a long, stiff, smooth, and sharp pointed unguis.

The first pair of pereiopoda is a stout and powerful appendage; the coxa and basis are short and articulate freely; the ischium is fused with the meros, but is short and clearly defined; it projects on the inner surface to a large tooth, while the meros is long and subcylindrical; the carpos is short but broader distally than at the meral articulation; the propodos is long and ovate, and articulates with a strong and simple dactylos.

The second pair of pereiopoda is long and slender; the coxa and basis are short, the ischium is long, broad, and flat, being longitudinally concavo-convex; the meros is long, narrow and cylindrical; the carpos is long and multiarticulate; the propodos is short and with a minute dactylos forms a small but perfect chela. The two sides are uniform.

The two following pairs are similar to each other, being long, slender, and cylindrical, and terminate in long, slender, and styliform dactyli. The posterior pair is liable to vary specifically in form.

The first pair of pleopoda is unequally biramose, differing in the male from that in the female in being larger and more robust; the inner branch supports a stunted stylamblys tipped with numerous cincinnuli, while that of the female is narrow and foliaceous. The second pair is alike in both sexes, differing only in the male having two stylamblydes attached to the inner ramus, while there is only one in the female, the ova being attached to the hairs, not of the branches, but of the basal joints only. The other pleopoda resemble the preceding, increasing in size posteriorly to the fourth, the fifth pair being smaller, while the sixth forms the outer plates of the rhipidura, and are broad and foliaceous, rounded at the extremity and shorter than the telson.

The branchiæ (Pl. XCIII. fig. 1) consist of six large pleurobranchial plumes, of which the posterior is the largest, and four arthrobranchiæ, and may be best understood by the following table:—

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

Development.—I have not found any specimens of the young at any stage, but one of the females of *Glyphocrangon granulosis*, from the north of New Guinea, had numerous large ovate ova that were nearly ripe for extrusion, so that by extracting the embryo

from the egg I was enabled to arrive at an approximate knowledge of the form of the animal when it first leaves the ovum. The brephalos is in the Megalopa stage (Pl. XCII. fig. 4), and closely resembles that of the common lobster (*Homarus vulgaris*).

My examinations took the form of a series of dissections of several ova, but not the observation of one perfect specimen.

Geographical Distribution.—There are several species of this genus, and those in the Challenger collection are from twelve different localities. The earliest specimen was taken on the 9th of September 1873, off the most easterly point of South America, and A. Milne-Edwards and Mr. Sidney Smith have since recorded specimens from the West Indies and the North Atlantic. Specimens have been taken as far south as the Island of Tristan da Cunha in the South Atlantic and near Kerguelen Island in the Indian Ocean. Among the Islands of the Eastern Archipelago specimens have been taken in the shallow water of the Sea of Banda, and in the greater depths north of New Guinea. They have also been taken as far north as Japan and as far west as the Fiji and Kermadec Islands; in the Pacific others have been taken some few miles south-west of Juan Fernandez, where they were found associated with species of Eryonidæ. Some were taken along with *Polycheles* off the north of New Guinea, and others off the Fiji Islands, also associated with *Polycheles*, in depths varying from 200 to 1715 fathoms.

The various forms of this genus can scarcely be considered as being more than varieties of one great type; the specific differences being little else than a greater or less exaggeration of features common to them all.

Glyphocrangon granulosis, n. sp. (Pl. XCII. ; Pl. XCIII. fig. 1).

Rostrum sharp pointed, subequal in length with the peduncle of the first pair of antennæ, armed with a sharp and strong tooth on each side near the middle, and another at the base, which in the female is supplemented by another smaller one posterior to it. Still more posteriorly, upon the dorsal surface of the carapace and standing on the same ridge which is formed by the continuation of the lateral margin of the rostrum, is a broad, flat, and pointed tooth directed upwards and forwards. The fronto-lateral margin is armed with two large teeth, of which the one external to the ophthalmopod corresponds with the external orbital angle, and the other forms the infero-anterior angle of the carapace; behind the latter stands a smaller but still large, flat tooth which forms the anterior extremity of a ridge. There are five such ridges longitudinally traversing the carapace on each side of the median line, most of them being armed with a series of points or teeth, while the intermediate spaces are covered with strong granulations disposed generally in a longitudinal direction. The posterior margin of the carapace is depressed, smooth, and laterally projecting posteriorly, and is overridden by the anterior margin of the coxal plate of the *first somite of the pleon*.

The pleon is furnished with a strong dorsal ridge that runs down the median line in an interrupted manner, breaking up on each somite and each division of the somite into a longitudinal cusp. The first somite has a central cusp which traverses only the first half of it, and is elevated into a strong laterally compressed tooth, that has its point directed forwards. On each side there is another large laterally compressed cusp that is directed upwards and outwards but does not override the anterior margin of the carapace. The median ridge, which on each succeeding somite is interrupted in the centre by a transverse furrow, is most marked and projecting on the posterior extremity of the fourth somite.

On the fifth somite the median ridge is also present, but it is here a less important feature, and the transverse sulcus is also less conspicuous and divides the carina into an anterior and a posterior portion; the anterior commences at the anterior margin and ends at the sulcus, and is laterally supported by an obliquely placed cusp; the posterior begins at this sulcus and continues on each side obliquely backwards and outwards to the posterior margin of the somite, having a cusp between these.

The sixth somite has the median ridge well developed, divided at the middle, and projecting posteriorly into a sharp tooth that overhangs the telson.

The lateral walls, or coxal plates attached to the several somites of the pleon, are inferiorly and posteriorly produced to a strong tooth, excepting in the case of the first, which, when the pleon is flexed on the pereion, is covered by that of the second somite. The whole surface is coarsely granulated.

The telson is sharp pointed and dorsally grooved; at the anterior extremity of this groove the median dorsal carina is represented by a small tooth, on each side of which a strong slightly serrate ridge traverses the upper surface and meet at the pointed extremity; from the ridge the lateral walls are perpendicular.

Length, entire,	103 mm. (4 in.).
" of carapace,	31 "
" of rostrum,	18 "
Width of carapace,	23 "
Length of pleon,	72 "
" of third somite of pleon,	10 "
" of sixth somite of pleon,	11 "
" of telson,	23 "
" of scaphocerite,	15 "
" of first pereopod,	39 "
" of second pereopod,	35 "
" of fifth pereopod,	48 "

Habitat.—Station 218, March 1, 1874; lat. 2° 33' S., long. 144° 4' E.; between New Guinea and Admiralty Islands; depth, 1070 fathoms; bottom, blue mud; bottom temperature, 36°·4. Two specimens; one male, one female. Trawled.

The rostrum of this species is slightly turned upwards at the extremity and is armed on each side with two strong teeth, one near the middle and another at the base, above the inner canthus of the orbit, and there is a third still more posterior; all stand on an elevated ridge continuous with the lateral margins of the rostrum, and passing back separates the orbital regions from the gastric.

On the frontal margin, external to and forming the outer angle of the orbit, is a large, obliquely situated, triangular tooth pointing upwards and forwards, and there is another just within the fronto-lateral angle of the carapace where it suddenly turns towards the oral region, producing a prominent fold or process between the first and second pairs of gnathopoda, from the base of which a strong ridge runs backwards and downwards and unites with the lateral margin just behind the second pair of gnathopoda.

The visceral regions are well defined on the carapace by a ridge and depression between the gastric and the frontal region; by a depression between the gastric and cardiac, and by a longitudinal ridge formed of strong cusps between the cardiac and branchial regions.

There are five longitudinal ridges that traverse the carapace on each side of the median line, interrupted only by the lines of regional demarcation. The most lateral in this species is the most continuous; it commences at the fronto-lateral tooth, from which it is divided by the fronto-lateral depression, it then forms two long pointed narrow cusps, and is again interrupted by the latero-branchial depression, after which it is continuous nearly to the posterior margin. The next commences in a strong cusp at the branchio-gastric depression, and is continuous in the form of a long narrow ridge of tubercles to the posterior margin. The next commences in a strong tooth posterior to the orbital region, and is represented by five teeth anterior to the cervical fossa, of which the anterior is the largest and the posterior the smallest, and posterior to the cervical suture is continued in the form of six or seven long narrow cusps to the posterior margin of the carapace. Although this ridge is only definable as such posterior to the cervical suture, yet it is continuous with that formed by the lateral margins of the rostrum; departing from a straight line it passes inwards to unite with it anteriorly, and posteriorly it breaks up into several strong teeth connected with the ridge that runs to the posterior margin of the carapace.

The next or dorsal ridge runs one on each side of the median line, and traverses the carapace from the anterior extremity of the gastric region to the posterior margin of the carapace, in the form of a row of sharp narrow cusps, being interrupted only by the cervical suture. Along the median line of the rostrum there is a small thread-like line of elevation, while the median line as a whole appears to be depressed; this however is due rather to the absence of tubercles than to an actual lowering of the surface. Between the several ridges the carapace is covered with a number of small, pointed granulations, running in more or less perfect, longitudinal rows. The only portions of the carapace that are free

from these coarse granulations are immediately behind the eyes, the fronto-lateral margin, the dorsal surface of the rostrum, and the median line.

The somites of the pleon are also coarsely granulated, but the granulations do not run longitudinally except along the median ridge, where every somite has an anterior and a posterior cusped elevation on the exposed portion, more or less prominent continuously to the telson. All the somites exhibit three divisions, an anterior, a median, and a posterior. The anterior is perfectly smooth, and when the animal is extended, as in swimming, it is always covered by the posterior margin of the preceding somite. In the first somite the anterior division passes under the carapace, and a fringe of hair along the anterior margin of the central division assists in closing up the line of junction between it and the carapace. The median division is separated from the posterior by a line of depression, which is again divided into three parts, a central and two lateral, each of which is furnished with a strong pointed cusp or tooth. The central cusp is pointed directly forwards, the lateral obliquely outwards. The coxal plate is produced as deeply as the carapace, which is covered by the anterior margin of the coxal plate, while the posterior is overridden by the next succeeding somite. The postero-inferior angle is rounded off and the anterior is produced to a sharp point. The second somite is longer than the first, and the coxal plate is wider and slightly deeper, and has the margin produced into three sharp teeth, one at the anterior angle, one, the largest, central, and one at the posterior angle. The third somite resembles the second in all but the presence of a tooth at the antero-inferior angle. The fourth somite has the dorsal surface of the posterior division produced posteriorly to an obtuse angle, and the coxal plates resemble those of the third. The fifth differs from the fourth in being narrower, in having the posterior cusps on the median line flanked at the base by two oblique ones, and in having the coxal plate directed inferiorly backwards, the tooth at the posterior angle being the largest. The sixth somite has the coxal plate reduced to a single tooth-like process, between which and the posterior margin the posterior pair of pleopoda articulates.

The telson, besides the central cusp on the anterior portion, has a couple of continuous ridges running longitudinally, well defined, and converging to the extremity of the telson, giving to this somite a fluted appearance.

The three anterior somites of the pleon articulate laterally with those posterior to them by a small prominence on the posterior margin, fitting into a hollow in the anterior margin of the succeeding somite, and the posterior three and telson by a process on the anterior margin being enclosed within a space which is formed by a flat process projecting backwards and upwards, and pressing laterally against the somite posterior to it.

The ophthalmopoda are supported on a free ophthalmic somite implanted immediately beneath the rostrum. The peduncle is extremely small and short, while the ophthalmus is very large and conspicuous, being almost globular, and occupying nearly the entire space between the rostrum and the orbital tooth.

The first pair of antennæ (Pl. XCII. *b* ♂ *b* ♀) has the peduncle extending to the extremity of the rostrum in the male, and a little beyond it in the female. The first joint reaches beyond the anterior margin of the eye, and is excavate in its entire length to receive that organ; near its base it is lobed on the inner side, where the acoustic organ is situated, the opening of which is on the lower external surface, beneath a squamiform process or plate (*b''* ♀). The second joint is about half the length of the first and sub-cylindrical. The third is shorter than the second and terminates obliquely, the inner angle, which is the more advanced, supports the inner, shorter, and less important flagellum, the outer angle, which is broad and oblique, supports the primary or more important flagellum, which in the male is thicker than in the female. It is formed by a large number of short articuli that are broad at the base and for about half the length of the appendage, and then rapidly diminish as the flagellum gradually narrows to a slender lash. The upper side of the thicker portion is flattened, while the lower is rounded and supplied with numerous fine membranous cilia which are more numerous in the male than in the female.

The second pair of antennæ (*c* ♀) has a peduncle that does not reach beyond the extremity of the second joint of the peduncle of the upper. The coxa or first joint is very short and supports a prominent phymacerite on the inner side, the second is broad and at its outer angle supports a large oval scaphocerite, which thins out on each side from the central line, and is fringed all round with long cilia. The outer margin is rigid, and the tooth which is so universally prominent in the *Macrura* is reduced to a rudimentary condition, so as to be invisible to the unassisted eye, but a rigid margin is traceable for some way from the base. The third and fourth joints are oblique to each other and both articulate with the second at the antero-internal margin; the fifth joint is narrow, cylindrical, and as long as the four preceding.

The mandibles (*d*) are small and consist of a molar process only, and are enclosed deeply within the oral cavity so that they are entirely covered over by the cheiloglossa and metastoma.

The first pair of siagnopoda (*e*) is small, lying closely pressed against the posterior surface of the metastoma; it consists of three branches, the central of which is fringed with stiff hairs.

The second pair of siagnopoda (*f*) consists of a rudimentary one-jointed appendage, supplemented by a broad, thick, fleshy plate, which bears a thick fringe of hairs, centrifugally planted on its margin.

The third pair of siagnopoda (*g*) consists of two foliaceous plates, the outer of which supports a lash-like appendage, and a thick, fleshy, smooth margined plate that tapers and projects anteriorly as well as posteriorly.

The first pair of gnathopoda (*h*) is short, subpediform, and consists of seven joints. The coxa and basis are subequally short and wide; from the latter a long, slender, lash-

like cephalis arises, which gradually tapers to the extremity; it is hirsute, more especially near the base; the ischium is also short and broad; the meros is longer and tapers slightly towards the distal extremity, where it articulates with the carpos, which is short, narrow at the base, and broad at its distal margin, where it articulates with the propodos; the latter is long and ovate, to receive the dactylos, which is short and broad and fills up the deficiency in the ovate form of the propodos. The distal margin of the dactylos and the outer margin of the propodos are thickly fringed with stiff hairs interspersed with strong spines.

The second pair of gnathopoda (*i*) is long, robust, and pediform, it consists of only four distinct joints, the homologues of which are difficult to determine, but naming those that remain according to their relative position in the limb, the coxa and the basis are short, the latter, the ischium and meros are united into one long joint, which is concave below and excavate on the upper surface to allow space for the several preceding appendages that surround the mouth, and supports a slender and lash-like cephalis, which articulates immediately beyond the coxal articulation. The next joint, which may be the carpos, articulates at a considerably oblique angle with the preceding; it increases in size slightly towards the distal extremity. The upper surface is transversely rounded, the lower excavate, and the internal perpendicular, the two latter being thickly matted with short hairs; the outer margin is fringed with few hairs and some large strong spines. The terminal joint resembles the dactylos of a true pediform appendage, and is probably the propodos and dactylos united and compressed; it gradually tapers to the unguiculated sharp pointed extremity. The inner, under, and outer sides are studded with strong spines that articulate in thick marginal sockets.

The first pair of pereopoda (*k*) is robust but not very long, being only subequal to the second pair of gnathopoda. The coxa is short and broad; the basis is short and firmly fused with the ischium, which is anteriorly produced on the inner side to a strong sharp process or tooth, the outer side is oblique and articulates for nearly its entire length with the base of the meros, with which it has but little free movement and that only in one direction; the meros is long and slightly tapering to the distal extremity; the carpos articulates at the extremity of the meros, and bends suddenly at a right angle; the propodos is ovate, gradually narrowing to the distal extremity, where it articulates with a sharp pointed, curved, cylindrical dactylos, which, when closed, impinges against the under, slightly flattened, surface of the propodos. The under and upper margins of the palm of the propodos are defined by several fasciculi of short hairs.

The second pair of pereopoda (*l*) is long, slender and feeble. The coxa and basis are short; the ischium is long and traversed on the lower and inner side by a deep thin ridge, thus providing on the upper surface a concave space in which the distal extremity of the reflexed carpos lies protected when folded and at rest; the meros is as long as the ischium, and cylindrical; the carpos is as long as the ischium and meros together and multi-

articulate; the propodos is very short and scarcely broader than the carpos, the inferior distal angle is produced to a sharp polliciform process, against which the small sharp dactylos impinges obliquely.

The three posterior pairs of pereopoda are strong, slender, well-formed, simple appendages. The coxa is short and large, the basis short and narrow and with the outer side oblique, and it articulates with the ischium, which is moderately long and slender, and has the distal extremity oblique and articulating with a long slender meros, the extremity of which slightly increases in size and articulates with the carpos, which just beyond the joint suddenly curves at nearly a right angle; it is about half the length of the meros and cylindrical; the propodos is cylindrical, one-third longer than the meros, and distally furnished with hairs, amidst which a cylindrical dactylos articulates and terminates in a narrow, sharp pointed unguis.

The first pair of pleopoda (δ p φ) articulates with the coxal plate on the inner side, nearly at the extremity, opposite to an external boss or large tubercle; the basis is long, pedicular, and supports two foliaceous plates, of which the inner and posterior is the smaller and carries attached to the inner margin a small stylamblys, furnished towards the extremity with small, obtusely pointed cincinnuli. The four following pairs of pleopoda (δ q φ) are formed upon the same type as the first, but the foliaceous branches are larger and the inner one in the male supports two of the small stylamblydes, one of which is fringed with hairs.

The posterior pair of pleopoda, which helps to form the rhipidura, has the basal joint short and the foliaceous plates long. The inner plate is pointed and fringed with hairs, the outer rounded, having a diæresis near the external marginal tooth, from which point it is fringed with hairs along the distal and inner margins.

The telson is long, narrow, and tapering; it is rudely quadrate in transverse section at the anterior extremity, and cylindrical at the apex; the angles are longitudinally ridged, those on the upper margin being slightly serrate, and the dorsal surface is depressed or grooved but furnished in front with a strong pointed cusp in the median line, which represents the terminal continuation of the dorsal carina of the pleon, with which, when the animal is extended, it is in close apposition.

The animal during life has the power of locking the telson in a fixed position, when undoubtedly it becomes a very powerful weapon of offence, and again unlocking it at its own will. The male and female closely resemble one another, but the female is larger than the male; all the parts in the two sexes have a similar proportional relation except such as may be supposed to be sexually variable.

The first pair of antennæ in the male has the external or primary flagellum broader and more thickly studded with membranous cilia; like the ophthalmopoda these antennæ stand upon a rudimentary ventral arc of the first somite. The acoustic organs appear to be internally well developed and occupy a chamber in the first joint. The upper surface

is excavated for the reception of the large visual organs, and centrally the structure of the integument is reduced to considerable tenuity, through which a longitudinal fissure, like a closed aperture, exists. At the base of the joint on the inner side there is a considerable hollow enlargement with a narrow aperture on the inferior surface, which is protected by a strong but not very prominent ridge. At the opposite extremity of the same joint there is a thin semi-membranous spot that is also probably associated with the acoustic apparatus.

The second pair of antennæ appears to spring from the metope or facial wall, which in both sexes is membranous. The phymacerite exists in the form of a conspicuous tubercle, flattened transversely, the opening of which is on the posterior surface close to and at the end of a long groove in the lateral wall, which is larger and more conspicuous in the female than in the male.

The cheiloglossa is continuous with the epistoma, which in the male is membranous and perpendicular. The metastoma consists of two plates separate from each other longitudinally and obliquely, and produced anteriorly and laterally in the form of large fleshy plates, that cover not only the oral opening but overlap to a considerable extent the posterior lateral margin of the cheiloglossa, so as to cover up and entirely hide the mandibles in the male. In the female the mandibles are seen at the side apparently thrown very far back. In the two sexes the conditions are different, the epistoma in the female is strong and calcified, and the cheiloglossa projects conspicuously beyond its margin, and anteriorly presses between the mandibles. Hence these latter organs appear to have no external biting power. They lie protected between the lateral margins of the anterior and posterior labra, where apparently they have no power to act until the projecting cheiloglossa, which intrudes itself between them, moves from its position, and acting as a tongue, guides the food to its place both for mastication and deglutition.

The third or middle pair of pereopoda in the female carries the oviduct, which is surrounded by a fringe of hairs. The fifth or posterior pair in the male carries the penis, the passage of which is by a large round foramen. Behind this last pair of legs a prominent projection like a broad flat tooth, more decided in the male than in the female, rises from the posterior angle of the ultimate somite of the pereion and rests against the inflected margin of the carapace.

The anterior pair of pleopoda differs in the two sexes. In both they are large, foliaceous, and unequal. In the female there is nothing but their size to distinguish them, while in the male the internal branch is more delicate in structure, broader, and carries a short, obtuse stylamblys armed with a few cincinnuli. The four following pairs of pleopoda are alike in size and general form, each branch being equally important. In the female the inner one carries a single stylamblys fringed on one side with long hairs, and the male carries two, one fringed with hairs the other tipped with cincinnuli. On all the pleopoda the hairs are abundant, and thickly fringed with long cilia.

The posterior pair of pleopoda is long, reaching almost to the extremity of the long slender telson; the external ramus is strengthened on the outer side by a thick margin which terminates in a sharp tooth, coinciding with the outer extremity of an imperfect diæresis that extends halfway across the plate, and is distant from the extremity about one-fourth the length of the appendage, from which point it is fringed with long ciliated hairs round the extremity and inner margin. The inner ramus is about the same length as the outer, terminates in an obtuse point, and is fringed on both sides with long ciliated hairs.

The female bears about thirty or forty ova, in which the embryo in our type specimen is seen to be approaching the stage of extrusion, a circumstance that enabled me, but with some difficulty, to approximately determine the form of the brephalos.

The ovum is oval in form and supported by a membranous filament attached to the hairs of the basal joint of the pleopoda, none being attached to those on the branches.

The brephalos (Pl. XCII. fig. 4) is very unlike that of the genus *Crangon*, as observed in the typical species *Crangon vulgaris* (Pl. LXXXVI. fig. 4). It approximates more nearly to that which I have seen in *Crangon boreas*, Phipps, and bears a close relation to that of *Homarus vulgaris*, the common European lobster. The brephalos of *Glyphocrangon* is in the Megalopa stage, and the absence of the chelate condition of the pereiopoda is probably due to the early stage at which the embryo was examined, for the young must quit the ovum in a very matured condition, since the vitellus was still large at the period when I had the opportunity of examining it, consequently some time would elapse before the embryo would be mature enough to become independent, but even in this immature condition every appendage is present in a more or less advanced condition.

The ophthalmopoda are spherical, and if not small, are certainly not large; the first pair of antennæ is considerably advanced in growth, terminating in a point, tipped with one or two cilia, and supported by a small pointed lobe which I take to be the extremity of the peduncle. The second pair of antennæ has a large scale-like appendage (the scaphocerite), the sides of which are nearly parallel and the extremity oblique, rising to an obtuse point, and a flagelliform appendage that already reaches beyond the extremity of the scaphocerite.

The oral appendages are apparent, but not easily determinable as to their exact form in this immature condition, until we reach the second and third pairs of siagnopoda, the former of which resembles generally that of the adult, and the latter forms an unequally biramosè appendage of the same type as that of the two pairs of gnathopoda next succeeding, which lessen the inequality of their branches as they advance posteriorly. The several pairs of pereiopoda are in an advanced stage of development, and each carries a secondary branch.

The pleopoda are all in an equally advanced condition. The first pair is branched and small. The second and the three following, which are biramose in the adult, have the branches at this stage in a state of gemmation and are scarcely longer than broad. The sixth or posterior pair, which in the adult assists to form the large rhipidura, is further developed than the preceding pleopoda; the two branches are unequal, the outer being much the larger. The terminal somite or telson is broad at the extremity, delicately thin and membranous, and the posterior margin is sparingly fringed with cilia.

Glyphocrangon podager, n. sp. (Pl. XCIII. fig. 2).

Like *Glyphocrangon granulosis*, but having the posterior pair of pereiopoda terminating in a thick cylindrical dactylos that abruptly terminates in two small points.

Length, entire,	63 mm. (2.4 in.).
„ of carapace,	19 „
„ of rostrum,	13 „
Width of carapace,	13 „
Length of pleon,	44 „
„ of third somite of pleon,	6 „
„ of sixth somite of pleon,	6 „
„ of telson,	14 „
„ of scaphocerite,	9 „
„ of first pereiopod,	15 „
„ of second pereiopod { coxa to carpos, 11 mm. }	21 „
{ carpos to dactylos, 10 „ }	
„ of fifth pereiopod,	20 „

Habitat.—Station 146, December 29, 1873; lat. 46° 46' S., long. 45° 31' E.; near Marion Island; depth, 1375 fathoms; bottom, Globigerina ooze; bottom temperature, 35°.6. One specimen; female. Trawled.

This species very closely approximates to *Glyphocrangon granulosis*, and I should most probably have considered it as belonging to that species but for the peculiar form of the dactylos of the last pair of pereiopoda (fig. 2o), which is cylindrical until near the apex, when it suddenly narrows to a blunt end and terminates in two small points.

It further differs in being less tuberculated, more especially between the carinæ on the carapace, where the tuberculations are not prominent, but rather more so than is represented on the plate. The rostrum of the carapace is longer than the peduncle of the first pair of antennæ, while in *Glyphocrangon granulosis* it does not reach so far, and it has the lateral margins less tapering than in the latter species, until they suddenly approach each other near the extremity. The ophthalmopoda are also smaller in proportion than in that species; the scaphocerite is as long as the peduncle of the first

pair of antennæ, ovate, and furnished at the middle of the outer margin with a minute denticle. The telson is straight and longer than the lateral plates of the rhipidura. The appendages are generic in character. The carapace has eight longitudinal carina, of which the two dorsal on each side of the median line are denticulated in their entire length, the other two are smooth except for two hepatic teeth on each side close behind the antennal angle. The first somite of the pleon is furnished with three vertically directed tooth-like cusps, the centre one of which is repeated on the anterior and posterior division of each succeeding somite so as to form an interrupted carina that increases in character by losing its denticulation until it reaches the posterior division of the fifth somite, where it is flanked by two obliquely directed ridges, after which it is continued to the posterior extremity of the pleon, where it is produced to a strong pointed cusp. Each somite after the first has the lateral coxal plates deep and armed with two strong teeth, excepting the last, which has only one.

This species was taken in the southern Indian Ocean, halfway between the Cape and Kerguelen Island.

Glyphocrangon regalis, n. sp. (Pl. XCIII. fig. 3, 4).

Carapace one-half the length of the pleon, produced anteriorly to a strong, pointed rostrum about one-half the length of the carapace, having the apex suddenly curved upwards, furnished with a delicate elevated thread-like line down the middle, traceable as far as the gastric region; it is armed on each side with a strong tooth corresponding with the anterior extremity of the ophthalmopod, with a second anterior to the frontal region, and a third smaller, posteriorly on the same elevated ridge. Frontal margin broad, armed with two large spine-like teeth, one corresponding with the external canthus of the orbit, the other with the fronto-lateral angle of the carapace, posterior to which, on the hepatic region, is a large laterally compressed tooth. The dorsal surface of the carapace is longitudinally traversed on each side of the median line by four strong ridges. The two dorsal are broken up into long flat tubercles, the two lateral are both smooth and even, and without a tooth-like projection on the anterior extremity; posterior to the cervical fossa, between the several ridges, there are coarse granulations arranged in longitudinal rows.

The pleon has a row of teeth forming an interrupted carina that traverses the median line, commencing on the first somite and terminating in a small tooth on the anterior surface of the telson.

The lateral margins of the coxal plates are armed with two large teeth except the first, which has a small point hidden beneath the succeeding somite, and the sixth, which has only one large tooth directed posteriorly.

Third and fourth pairs of pereopoda terminating in a cylindrical pointed dactylos,

which in the fifth pair is laterally compressed and lanceolate. Telson having the apex reaching beyond the distal extremity of the lateral plates of the rhipidura.

Length, entire,	90 mm. (3.5 in.).
" of carapace,	28 "
" of rostrum,	16 "
Breadth of carapace,	25 "
Length of pleon,	62 "
" of third somite of pleon,	10 "
" of sixth somite of pleon,	10 "
" of telson,	19 "
" of scaphocerite,	12 "
" of first pereopod,	23 "
" of second pereopod, { to carpos, 19 mm. }	34 "
{ to dactylos, 15 " }	
" of fourth pereopod,	37 "

Habitat.—Station 194, September 29, 1874; lat. 4° 34' S., long. 129° 57' 30" E.; off Banda Island; depth, 200 fathoms; bottom, volcanic mud. One specimen; female. Dredged.

Station 171, July 15, 1874; lat. 28° 33' S., long. 177° 50' W.; north of the Kermadec Islands; depth, 600 fathoms; bottom, hard ground; bottom temperature, 39°·5. Fragment of male. Trawled.

Station 173, July 24, 1874; lat. 19° 9' 35" S., long. 179° 41' 50" E.; off Matuku Fiji Islands; depth, 315 fathoms; bottom, coral mud. One specimen; female. Dredged.

This species may be distinguished from the preceding by the greater breadth of the anterior portion of the carapace and of the rostrum at its base, and by the presence of a large tooth on the hepatic region immediately posterior to the fronto-lateral tooth. In *Glyphocrangon granulosis* there are two small teeth on the hepatic region, in *Glyphocrangon spinicauda*, A. Milne-Edwards, there are also two, but one is largely produced and laterally dilated.

The branchial region of the carapace is free from tuberculations, and those on the dorsal surface of the carapace are regularly arranged in longitudinal lines, forming conspicuous carinæ; the carinæ on the branchial region are smooth and those on the dorsal surface tuberculated; between these there are other tubercles equally regular but less prominent. In the median line there are none.

The pleon is furnished with a distinct but interrupted carina, of which the moiety on the anterior somite has a strong, central, anteriorly directed tooth, and there is also a similar tooth on each side. The infero-lateral margin of each somite of the pleon is armed with two subequally strong teeth, except in the case of the first and sixth somites,

the former of which has only a point and the latter has also one which is directed outwards and backwards.

The telson is long and very rigid and has a distinctly controllable movement. It is connected with the sixth somite by a peculiar articulation, a small laterally projecting process of the telson being enclosed in a deeply embayed hollow in the posterior margin of the sixth somite; this kind of articulation also exists in the two preceding somites. The movement of these as well as that of the telson is such that by a very slight contraction of the muscles they can be held in a rigid position, and this is undoubtedly voluntary. The power which these animals have of suddenly and rapidly darting backwards makes this sword-like telson a very formidable weapon. Our specimen corresponds in many points with *Glyphocrangon spinicauda*, which Professor A. Milne-Edwards has described as having been taken near the island of St. Kitts at a depth of about 250 fathoms. It may readily be distinguished by the absence of a second tooth on the hepatic region, as also by the absence of a tooth on the branchial region at the anterior extremity of the upper lateral carina, which terminates posteriorly to the cervical fossa.

The female specimen taken at Station 173 varies slightly from the type, but I consider it to belong to this species. It corresponds in all points, excepting that the details are not so well defined, the tuberculation is less conspicuous, the teeth not so strong, and the extremities of the rostrum and of the telson not so decidedly curved; in length it is a little shorter, and there is a minute tooth about one-third the length of the scaphocerite from the base, which is not so conspicuous in the typical specimens.

At Station 171 there was brought up a very broken fragment of a carapace, which, from the stoutness of the outer flagellum of the first pair of antennæ, I take to be that of a male specimen of this species. It is much smaller than the type specimen—judging by the size of the carapace it could scarcely be 50 mm. in length—and it differs from the latter, which is a female, in having the teeth on the frontal margin smaller in proportion to that on the hepatic region.

Glyphocrangon hastacauda, n. sp. (Pl. XCIII. fig. 5).

Carapace slightly tomentose; smooth between the carinæ; all the carinæ smooth except the two dorsal ones, which are imperfectly dentate. Orbital tooth large, flat, long and sharp pointed; tooth on the fronto-lateral angle not so long as the orbital. Hepatic tooth small. The two lateral carinæ on each side terminate anteriorly in a minute denticle just behind the cervical fossa.

Rostrum nearly as long as the carapace, armed with two teeth on each side.

Pleon furnished with an interrupted carinæ in the median line.

Ophthalmopoda orbicular.

Peduncle of the first pair of antennæ scarcely more than half the length of the rostrum.

Second pair of antennæ having the scaphocerite ovate and not longer than the peduncle of the first pair. The other appendages are without important differential characters. Telson longer than the outer rami of the rhipidura.

Length, entire,	64 mm. (2.5 in.).
" of carapace,	19 "
" of rostrum,	18 "
Width of carapace,	14 "
Length of pleon,	45 "
" of third somite of pleon,	8 "
" of sixth somite of pleon,	7 "
" of telson,	15 "
" of scaphocerite,	7 "
" of first pereopod,	15 "
" of second pereopod,	27 "
" of fifth pereopod,	26 "

Habitat.—Station 232, May 12, 1875; lat. 35° 11' N., long. 139° 28' E.; *Hyalonema*-ground, off Japan; depth, 345 fathoms; bottom, green mud; bottom temperature, 41°·1. One specimen, female. Trawl and dredge both used.

This species has the surface covered with a short fur, but is otherwise smooth between the several carinæ on the carapace.

The rostrum is long, nearly equal to the length of the carapace, measured from the orbit to the posterior margin. All the carinæ, which comprise the usual number, eight, are free from denticulations except the two dorsal, which show slight indications of denticular marking.

The surface of the pleon is comparatively smooth, but a lateral light on a dry specimen renders markings visible that correspond with the corrugations on other species.

The ophthalmopoda are round and of moderate dimensions.

The first pair of antennæ has the peduncle scarcely more than half the length of the rostrum, but this difference is due to the length of the rostrum rather than to the shortness of the antennæ.

The second pair has the scaphocerite rather ovate than circular, and possesses no trace of a tooth on the outer margin.

The other appendages show no specific character, except that the dactylos of the posterior pair (fig. 50) is long, laterally compressed and lanceolate, the distal extremity of the propodos being furnished with a fringe of long hairs.

The first somite of the pleon has the dorsal surface armed with three long anteriorly directed teeth, the central forms the anterior extremity of the median carina and extends

to the posterior margin of the somite; in all the other species it is interrupted near the centre. The telson is longer than the branches of the rhipidura, and forms a formidable spear-like weapon.

Observation.—This species may be at once recognised by the large orbital tooth.

Glyphocrangon aculeata, A. Milne-Edwards (Pl. XCIV. fig. 1).

Glyphocrangon aculeatum, A. Milne-Edwards, Ann. d. Sci. Nat., sér. 6, tom. xi. p. 5, 1884.

Carapace one-third the length of the animal, ornamented with eight carinæ. Rostrum long, narrow, and about three-fourths the length of the carapace. Antennal and fronto-lateral teeth are large, but not so broad as the hepatic tooth at their base, which is the largest, extending from the cervical fossa to near the frontal margin of the carapace as a great anteriorly pointed ridge. Behind the cervical fossa, at the anterior extremity of the lateral carina, is a strongly projecting tooth of less size than the previous one. The surface of the carapace between the several carina is generally smooth, a few scattered tubercles being slightly indicated.

Length, entire,	. . . . .	62 mm. (2.4 in.).
" of carapace,	. . . . .	18 "
" of rostrum,	. . . . .	14 "
Breadth of carapace,	. . . . .	12 "
Length of pleon,	. . . . .	44 "
" of third somite of pleon,	. . . . .	6 "
" of sixth somite of pleon,	. . . . .	6 "
" of telson,	. . . . .	13 "

Habitat.—Station 120, September 9, 1873; lat. 8° 37' S., long. 34° 28' W.; off Pernambuco; depth, 675 fathoms; bottom, red mud. One specimen; female. Trawled.

This species was described by Professor A. Milne-Edwards as having been taken in 593 fathoms, off Martinique, during the cruise of the "Blake" in the West Indies. It nearly corresponds with *Glyphocrangon spinicauda*, A. Milne-Edwards, which was taken in 250 fathoms off St. Kitts in the same geographical region. Our specimen, which was taken some degrees further south in the Atlantic, off the eastern coast of South America, is rather smoother than either of the above.

In the Challenger specimen the rostrum is about three-fourths the length of the carapace, and reaches beyond the distal extremity of the peduncle of the first pair of antennæ. The scaphocerite attached to the second pair of antennæ is furnished with a small tooth on the outer margin about halfway between the distal extremity and the articulation. The dactylos of the posterior pair of pereopoda (fig. 1o) is flat and sharply lanceolate.

The pleon has the surface much more tuberculated than the carapace, and more so than the lithographic artist has shown in the plate. The telson is long and well developed, being quite half the length of the pleon.

Glyphocrangon acuminata, n. sp. (Pl. XCIV. figs. 2, 3).

Rostrum nearly as long as the carapace; median carina on the anterior extremity elevated above the lateral margins, extending nearly to the frontal region, and armed on each side with two strong teeth. Carapace smooth, excepting the dorsal carinæ, which are slightly tuberculated. Frontal margin armed on each side with two large teeth, and the hepatic region bearing one small tooth.

Pleon having the teeth on the dorsal median line reduced to very slight elevations, most conspicuous on the posterior somites.

Telson slightly longer than the lateral plates of the rhipidura.

	Largest male.	Female.
Length, entire,	52 mm. (2 in.).	59 mm. (2·3 in.).
" of carapace,	16 "	16 "
" of rostrum,	14 "	14 "
Breadth of carapace, . . .	10 "	11 "
Length of pleon,	36 "	43 "
" of third somite of pleon,	5 "	6 "
" of sixth somite of pleon,	5 "	6·5 "
" of telson,	11 "	13 "
" of scaphocerite, . . .	6·5 "	8 "
" of first pereopod, . . .	12 "	16 "
" of second pereopod, . .	22 "	20 "
" of fifth pereopod, . . .	23 "	23 "

Habitat.—Station 175, August 12, 1874; lat. 19° 2' S., long. 177° 10' E.; near the Fiji Islands; depth, 1350 fathoms; bottom, Globigerina ooze; bottom temperature, 36°. Twenty-two specimens; six males, five well-developed females bearing ova, and eleven others, either small males or immature females. Trawled.

This species corresponds with *Glyphocrangon nobilis*, A. Milne-Edwards, which was taken at a depth of 1131 fathoms off the Island of Dominica in the West Indies. They correspond in the form and length of the rostrum, in the length and upward curve of the telson, particularly in the male, but in *Glyphocrangon nobilis* the surface of the carapace and pleon is covered with a number of "rugose prominences," whereas in the specimens from Fiji the whole of the surface of the carapace is smooth, excepting the dorsal carinæ, which are slightly tuberculated, as well as the outer or second carina, and the general surface of the gastric region, there being a small but

decided tooth in the median line at the anterior extremity of that region. In species of this genus, the teeth along the median line of the pleon are generally so connected longitudinally that when the animal is extended they form a distinct carina, continuous from the anterior margin of the first somite of the pleon to that of the telson. In this species there is no elevation that can be called a tooth, or any ridge capable of being denominated a carina, excepting at the posterior extremity of the sixth somite, which is prolonged to a strong point. The median tooth on the frontal margin of the first somite exists only as an elevation of no great importance, and apparently valueless in checking the backward strike of the pleon; all the other somites have the ridge reduced to a mere thickening of the central tissue, and the tuberculations are reduced to smooth prominences, most conspicuous on the coxal plates.

The first pair of antennæ has the peduncle about half the length of the rostrum and subequal with the scaphocerite; the outer flagellum does not appear to be conspicuously larger in the male than in the female.

The number of specimens taken shows the gregarious habit of the species. The fully grown females were generally laden with ova, and are mostly about one-seventh larger than the males.

Glyphocrangon rimapes, n. sp. (Pl. XCIV. fig. 4).

Like *Glyphocrangon granulosus*, but armed with three teeth on each side of the rostrum, and having the dactylos of the posterior pair of pereopoda terminating in a bifid or cleft extremity.

Length, entire,	104 mm. (4 in.)
" of carapace,	31 "
" of rostrum,	19 "
Width of carapace,	19 "
Length of pleon,	73 "
" of third somite of pleon,	9 "
" of sixth somite of pleon,	10 "
" of telson,	22 "
" of scaphocerite,	15 "
" of first pereopod,	23 "
" of second pereopod,	34 "
" of fifth pereopod,	37 "

Habitat.—Station 300, December 17, 1875; lat. 33° 42' S., long. 78° 18' W.; near Juan Fernandez; depth, 1375 fathoms; bottom, Globigerina ooze; bottom temperature, 35°·5. Two specimens; female. Trawled.

Station 237, June 17, 1874; lat. 34° 37' N., long. 140° 32' E.; near Yokohama;

depth, 1875 fathoms; bottom, blue mud; bottom temperature, $35^{\circ}3$. One specimen, female. Trawled. Length, 74 mm.

Station 331, March 9, 1876; lat. $37^{\circ} 47'$ S., long. $30^{\circ} 20'$ W.; South Atlantic, between Buenos Ayres and Tristan da Cunha; depth, 1715 fathoms; bottom, Globigerina ooze; bottom temperature, $35^{\circ}4$. One specimen; female, bearing ova. Trawled. Length, 87 mm.

This species bears a close resemblance to *Glyphocrangon granulosis*, but the rostrum is comparatively longer, reaching quite to the extremity of the peduncle of the first pair of antennæ; it is armed on each side with three teeth, of which the anterior is long, slender, and situated considerably in advance of the eyes, the second is on a line with the orbital margin, and the third is situated close behind the second; still further back, on the ridge continuous with the lateral margin of the rostrum, is another large tooth. Running along the centre of the rostrum is a minutely elevated thread-like line, as in most species of this genus; in this species it becomes more conspicuous on the frontal region, and gradually passes into a row of small tubercles on the anterior portion of the gastric region, where it gradually fades away. The several carinæ on the dorsal and lateral surfaces of the carapace are more or less tuberculated, and assume a denticulated appearance on the former. The intercarinal surface as well as the hepatic and branchial regions are thickly covered with coarse granulations.

The pleon corresponds nearly with that of *Glyphocrangon granulosis*, but has certain details more decidedly pronounced. The teeth at the extremity of the lateral coxal plates are rather longer, and the boss or large protuberance that corresponds externally with the articulation of the pleopoda on the inner surface is armed with a strong tooth.

The telson is longer than the lateral plates of the rhipidura, is dorsally deeply channelled, and has the lateral margins smooth. The appendages have no specific distinctive character, excepting that the ophthalmopoda are rather smaller, and the dactylos of the posterior pair of pereopoda (fig. 40) is broad, flat, and bifid or cleft at the extremity. Of the two specimens taken at Station 300 one is about twice the size of the other. The larger is that from which the description and figure were taken, whereas the smaller, though corresponding with it in every essential detail, differs somewhat in the degree of the development of several parts, more particularly in the absence of a tooth on the bosses attached to the outer surface of the coxal plates of the pleon.

In the middle of the South Atlantic, at Station 331, another specimen was trawled which was nearly 87 mm. long, and has no teeth on the bosses of the coxal plates of the pleon. Another specimen about the same length was trawled at Station 237, in which teeth on the lateral bosses of the pleon are present. This animal is well developed, and is a female laden with about thirty large ova.

In these several specimens from very distant localities, the presence of an extra tooth on the lateral margin of the rostrum, and the cleft condition of the dactylos of the posterior pair of pereopoda are constant, and the sharp spine-like tooth attached to the boss on the coxal plates of the pleon is present in the best-developed forms, but that its presence is not a specific feature may be inferred from the circumstance that in one specimen it is found to exist on one side and not on the other, the absence in some instances being probably due to friction.

The type of this species was brought up by the trawl in the same locality in the South Atlantic (Station 133) at which *Willemæsia leptodactyla* was obtained, and it is worthy of remark that while in this last-named genus the organs of vision are reduced to a rudimentary condition, those of *Glyphocrangon* are unusually large.

Nika, Risso.

Nika, Risso, Crust. de Nice, p. 84, 1816.

„ Milne-Edwards, Hist. Nat. Crust., t. ii. p. 363.

„ Bell, Brit. Crust., p. 273.

„ Dana, U. S. Expl. Exped., Crust., p. 533.

Processa, Leach, Malacos. Pod. Brit., pl. i.

Carapace smooth, about one-third of the length of the animal; anteriorly produced to a short smooth rostrum, horizontal with the dorsal surface and not laterally compressed. Outer canthus of the orbit defined by a small projection of the margin, beyond which is an antennal tooth, between the two antennæ, whence the margin is smooth to the fronto-lateral angle, which is defined by an imperfect point.

The pleon is smooth and the somites subequal in length, the first being divided, the anterior portion passing under the carapace.

Telson long, slender and tapering.

Ophthalmopoda short, uniarticulate. Ophthalmus subreniform; having no ocellus.

First pair of antennæ having a rounded concave stylocerite at the base, and terminating in two unequal flagella.

The second pair of antennæ is subequal in length with the animal, and carries a long scaphocerite, squamose on the inner side, strengthened and toothed on the outer.

Mandibles without either a psalistoma or synhipod.

The first pair of siagnopoda has three branches, one of which is membranous and rudimentary, the other two short and tipped with hairs.

The second pair has a rudimentary central or primary branch and a large squamose plate of extreme tenuity projecting anteriorly and posteriorly.

The third pair is squamose, having a rudimentary central branch and two squamose plates; the inner is narrow and fringed with strong hairs, the outer broad, rounded

distally, fringed with long hairs, and produced to a long and flat rod-like appendage of great tenuity and fringed with ciliated hairs.

The first pair of gnathopoda is subpediform, short, robust, with the distal joints reflexed, and carries a basecephysis.

The second pair is pediform, long, robust and terminally pointed, without a dactylos.

The first pair of pereopoda is asymmetrical; the appendage on the right side is robust and chelate; that on the left is also robust but simple. The second pair is similar in form but different in length. That on the left side is short, that on the right is long, and both have a long and slender multiarticulate carpos. The posterior three pairs of pereopoda are long, slender and simple, the carpos being as long as the meros and ischium combined, and terminate in a slender, sharp, smooth dactylos.

The pleopoda are biramose, and the terminal pair, which helps to form the rhipidura, has a diæresis on the outer branch.

The branchiæ I have not examined in the only specimen in the collection, but in *Nika edulis*, from the southern coast of England, in my own collection, there are five pleurobranchiæ, which are suspended near the upper extremity of the chamber, but no other plume or mastigobranchial plates; their disposition is shown in the following tabular arrangement:—

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

Being unwilling to injure the only specimen in the collection, I have taken the figures of the different parts separately from a British specimen, which appears to differ in little else than size from that brought home by the Challenger, which I have named "*processa*," the name given by Dr. Leach to the genus previously to his being aware of Risso's description.

The eggs borne by the species of this genus are oval in form and numerous; they differ from those of most other genera in having the vitellus floating in the centre of a quantity of transparent fluid.

The form of the brephalos has not been determined.

Geographical Distribution.—Species have been taken, but sparingly, in various parts of the world. The typical form of the genus was first found by Risso in the Mediterranean in 1816, and by others in the European waters as far north as Scotland. Stimpson records it from Madeira, as well as *Nika macrognatha* from Hong Kong. Dana describes a species, *Nika hawaiiensis*, from the Pacific; the Challenger specimen was taken off Amboina in the Eastern Archipelago; *Nika japonica*, de Haan, was taken further north, off the eastern coast of Asia.