

ON A COLLECTION OF CRUSTACEA FROM
PUGET SOUND.

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[PLATES XXXI-XXXIV.]

THIS paper presents the results of an examination of the collection of Crustacea made in Puget Sound by the naturalists of the Columbia University Expedition in the summer of 1896, under the leadership of Professor Bashford Dean. I have also included a few additional species from a collection made in the same region by Professor D'Arcy W. Thompson, under whose supervision the paper has been prepared. I am indebted to Mr. N. R. Harrington, Fellow in Zoölogy in Columbia University, for many valuable notes on the specimens collected, the group Crustacea having been in his charge; and I have to thank the Rev. T. R. R. Stebbing for much kind assistance in connection with the AMPHIPODA.

Of the three new species described, the amphipod *Polycheria Osborni* is particularly interesting from the point of view of geographical distribution, since the only other member of the genus comes from the Southern hemisphere. The identification of the Japanese *Philyra pisum* adds another link to the many which already connect the fauna of the Western coast of America with that of the Japanese seas, as we may perhaps say that the first named specific connects it with the fauna of the Southern seas.

The following is a list of species collected by the Columbia University expedition.

DECAPODA.

Metacarcinus magister (Dana).

Cancer productus Randall.

Cancer gracilis Dana.

- Lophozozymus bellus** (Stimpson).
Trichocarcinus oregonensis (Dana).
Telmessus cheiragonus (Tilesius).
Heterograpsus nudus (Dana).
Heterograpsus oregonensis (Dana).
Pinnixa faba (Dana).
Scyra acutifrons Dana.
Hyas lyratus Dana.
Oregonia gracilis Dana.
Epialtus productus Randall.
Pugettia gracilis Dana.
Philyra pisum De Haan.
Eupagurus ochotensis Brandt.
 " **middendorffii** Brandt.
 " **tenuimanus** (Dana).
 " **splendescens** (Owen).
 " **granosimanus** Stimpson.
 " **kennerlyi** Stimpson (?).
 " **newcombei** Benedict (?).
Cryptolithodes typicus Brandt.
Hapalogaster mertensii Brandt.
Petrolisthes cinctipes (Randall).
Pachycheles rudis Stimpson.
Callianassa gigas Dana.
Upogebia pugettensis (Dana).
Sclerocrangon munitus (Dana).
Crangon franciscorum Stimpson.
Crangon affinis De Haan.
Nectocrangon alaskensis Kingsley
Paracrangon echinatus Dana.
Pandalus Danæ Stimpson.
Hippolyte prionota Stimpson.
 " **gracilis** Stimpson.
 " **sitchensis** Brandt.
 " **groenlandica** (Fabr.).
 " **brevirostris** Dana.
 " **lamellicornis** Dana.
 " **stylus** Stimpson.

ISOPODA.

- Livoneca vulgaris** Stimpson.
Cirolana californica Hansen. (?)
Limnoria lignorum (Rathke).
Idotea Wossnessenskii Brandt.
 " **resecata** Stimpson.
Ligia Pallasii Brandt.
Pseudione Giardi n. sp.
Argeia sp. (?)
Phyllodurus abdominalis Stimpson.

AMPHIPODA.

- Hyperia galba** Mont.
Orchestoidea californiana (Brandt).
Polycheria Osborni n. sp.
Mæra dubia n. sp.
Amphithoë humeralis Stimpson.
Amphithoë sp. (?)

COPEPODA.

- Cecrops Latreillei** Leach.

CIRRIPEDIA.

- Pollicipes polymerus** Sowersby.
Coronula diadema (L.).

RHIZOCEPHALA.

- Sylon** sp.

The following additional species occurred in Professor D'Arcy Thompson's collections :

- Raphonotus (=Fabia) subquadratus** Dana.
Paguristes turgidus Stimpson.
Echinocerus cibarius White.
Phyllolithodes papillosus Brandt.
Callianassa californiensis Dana.

BRACHYURA.**Cancer productus** Randall.

Cancer productus Randall, Jour. Acad. Nat. Sci., Philadelphia, VIII, 116. 1839.

Cancer productus Dana, U. S. Expl. Exp. Crust., I, 156, Pl. vii, fig. 3. 1852.

Cancer productus Stimpson, Boston Jour. Nat. Hist., VI, 461. 1857.

Cancer productus Lockington, Proc. Calif. Acad. Sci., VII, 95. 1877.

One of our specimens has the carapace handsomely ornamented with a complex pattern of narrow red lines on a yellowish ground. The general direction of the lines is longitudinal, interrupted here and there by narrow, more or less symmetrical loopings. A series of three lines runs parallel to the anterolateral margin, and at the front end converge, together with the adjacent longitudinal lines into the orbit. Lockington (l. c.) describes several color-varieties of this species from Monterey, Cal., one of which is "yellow with narrow red stripes, giving it a zebra-like appearance." This is no doubt the variety before us, though the complexity of the pattern is hardly sufficiently indicated by the epithet "zebra-like." Miss M. S. Rathbun has been good enough to inform me that there are similar specimens in the U. S. National Museum at Washington.

Philyra pisum De Haan.

Philyra pisum De Haan, Fauna Japonica, Crust., 131, Pl. xxxiii, fig. 7. 1850. 1841

Philyra pisum Ortmann, Zool. Jahrb. Abth., f. Syst., VI, 582. 1892.

A single male specimen lacking both chelipeds and some of the ambulatory legs is referred to this species. I have been able to compare it with two specimens dredged in Yokohama Bay by Professor D'Arcy Thompson, and also with three specimens from the Strassburg Museum identified by Dr. Ortmann (l. c.) and sent to us by the great kindness of Professor L.

Döderlein, by whom they were collected in the same neighborhood. The resemblance in both cases is so exceedingly close that in spite of the imperfection of the Puget Sound specimen I have no hesitation in adding *P. pisum* to the list of species inhabiting both sides of the North Pacific. It is recorded from Japan by De Haan and Ortmann, and Mr. R. I. Pocock informs me that there is a specimen in the British Museum from the Philippine Islands.

MACRURA.

PAGURIDÆ.

The great number of closely allied species of *Eupagurus* occurring in the region under consideration, and the imperfect manner in which many of them have as yet been described, render the determination of the species a matter of difficulty in the absence of named specimens for comparison. In this respect I have derived great assistance from a valuable collection of marine invertebrates recently presented to the museum of University College by the Smithsonian Institution. In one or two of the cases where this help was not available I have marked with a query the names of species whose identification did not appear to be beyond doubt. The largest and commonest species of *Eupagurus* in Puget Sound, at first referred to as *E. alaskensis* Benedict in Messrs. Harrington and Griffin's paper on the Invertebrates of Puget Sound (Trans. N. Y. Acad. Sci., 1897, 159) is apparently, as mentioned in Mr. Harrington's paper on commensal nereids (ibid., p. 214), the *E. armatus* of Dana, which, however, Stimpson has identified with the earlier *E. ochotensis* of Brandt (Stimpson, Proc. Acad. Nat. Sci. Phil., 1858, p. 236).

LITHODIDÆ.

Cryptolithodes typicus, Brandt.

Cryptolithodes typicus Brandt, Bull. Phys. Math. de l'Acad. de St. Petersbourg, VII, 175. 1849.

Cryptolithodes typicus Stimpson, Boston Jour. Nat. Hist., VI, 472, Pl. xx, 1857.

The larger of the two specimens in the Columbia University collection agrees with Stimpson's figures and description of the type species, save that the marginal serrations are almost obsolete. The second very small specimen, however, is strikingly different in general appearance. The carapace is approximately triangular, the postero-lateral margins being nearly in a straight line, while the orbital notches are shallower, and the truncated rostrum more prominent than in any other specimens we have seen. A comparison of these and other specimens in the Museum of University College suggests the probability that some at least of the described species of this genus are based on characters varying with the age of the individual.

HIPPOLYTIDÆ.

The generic name *Hippolyte* has been used in its older and wider signification, since Spence Bate's subdivision of the genus (Challenger Rep. Macrura, p. 576) does not appear to be satisfactory.

Hippolyte prionota Stimpson.

H. prionota Stimpson, Proc. Acad. Nat. Sci. Philad., 1864. 153.

H. prionota Kingsley, Bull. Essex Inst. XIV, (1882), 127,
Pl. ii, f. 9. 1883.

Kingsley's figure of this species shows the serrated dorsal crest passing in an even curve into the rostrum. In our specimens a slight depression separates the crest from the rostrum, and the latter is more truncate at the tip. Kingsley's figure omits the three orbital spines which are characteristic of the species.

Hyppolyte gracilis Stimpson.

H. gracilis Stimpson, Proc. Acad. Nat. Sci. Philad., 1864. 155.

A single somewhat damaged specimen is probably referable to this species. It differs from Stimpson's description in the fact that the most anterior of the four teeth on the rostrum

above is placed considerably in front of the eyes, while the external flagellum of the antennules falls short of the broken tip of the rostrum. As was the case with Stimpson's specimens, no epipod could be discovered on the third maxillipeds.

Hippolyte stylus Stimpson.

H. stylus Stimpson, Proc. Acad. Nat. Sci. Phil., 1864. 154.

Our specimens differ from Stimpson's diagnosis in the fact that the third maxillipeds are slightly longer, reaching a little beyond the extremity of the antennal peduncle to nearly the middle of the rostrum. Some of the smaller specimens show a minute pterygostomial spine, and in this respect resemble the allied *H. camtschatica* Stimpson. (Proc. Acad. Nat. Sci. Phil., 1860. 33.)

AMPHIPODA.

HYPERIIDÆ.

Hyperia galba (Mont.).

Cancer gammarus galba Montagu, Linn. Trans., XI, 4, Pl. ii, f. 2.

Hyperia galba, Sars, Crust. Norway; I—Amphipoda, p. 7, Pl. ii, iii.

Two specimens (♂ and ♀) agree very well with British examples of this somewhat variable species which has not hitherto been recorded from the Pacific.

ORCHESTIIDÆ.

Orchestoidea californiana (Brandt).

(Pl. XXXI, Fig. 1.)

Malorchestia californiana Brandt, Bull. Phys. Math. Acad. Imp. Sci., St. Petersburg, IX, 310—314. 1851.

Orchestia (*Talitrus*) *scabripes* Dana, U. S. Ex. Exp. Crust. II, 860, Pl. 57, f. 4. 1852.

Megalorchestia scabripes Stimpson, Bost. Jour. Nat. Hist. VI, 516. 1857.

M. californiana, Ibid.

Orchestoidea scabripes Spence Bate, Cat. Amph. Brit. Mus. II, Pl. I, f. 3. 1862.

O. californiana, Ibid., p. 14.

Description of Male.—Body robust, glabrous, lower edges of coxal and epimeral plates and all the appendages scabrid with short stiff setæ. Fifth pair of coxal plates having the anterior lobe larger than the posterior, angled below, while the posterior lobe is evenly rounded. Eyes slightly reniform, black. Superior antennæ not reaching the middle of the penultimate joint of the inferior, the three joints of the peduncle subequal, flagellum 9-jointed, hardly longer than half the peduncle. Inferior antennæ longer than the body and very stout. Last joint of the peduncle twice as long as the preceding, increasing in thickness to within a short distance of its distal end, the greatest thickness being nearly one-fifth of the length of the joint. Flagellum more than one and a-half times as long as the peduncle. Palp of maxillipeds three-jointed, second joint expanded inwards as a flat plate, last joint ovate. Inner plate with three conical teeth on distal margin. Anterior gnathopods not subchelate, carpus broader and much longer than the propodus, and having a large tubercle projecting from its lower or posterior edge near the distal end. Propodus cylindrical, having a slight swelling on its lower or posterior face distally. Posterior gnathopods very large, carpus small, propodus ovate, palmar edge oblique and not sharply defined from the posterior edge of hand, bearing a low rounded setose eminence near the articulation of the dactyl, and on the proximal side of this armed with about six short spines with intervening setæ. Dactyl strong, somewhat sharply curved near the base. Claw of second pereopod bearing at about the middle of its concave side a blunt tooth, from within which springs a small seta. On the posterior legs the tooth is obsolete, but the seta remains. First pair of uropods having the rami subequal, not much shorter than the peduncle, both bearing spines on their outer and inner edges. Last pair of uropods having the single ramus lanceolate and longer than the peduncle. Telson small, triangular, rounded at the tip.

Length, 25 mm., superior antennæ 30 mm.

The identity of our species with that described by Brandt can hardly be doubted on comparing his characteristic though somewhat rough figure of the entire animal. His detailed figures are less successful, and in some points so obviously erroneous that we cannot attribute much weight to the discrepancies they show. The most important character in which our specimens differ from both description and figures is the absence from the palp of the maxillipeds of the minute unguiculate terminal joint on which Brandt lays stress as one of the distinctive characters of his new genus. It seems to us, however, that the resemblance in other details, especially in the antennæ and gnathopods, warrants our assuming an error of observation or possibly an abnormal specimen to account for the difference in the maxillipeds.

Our specimens agree closely with Dana's description and figures of his *Orchestia (Talitrus) scabripes*, in general aspect and relative proportions, in the shape and size of the two pairs of gnathopods, and in the scabrous character of the limbs. They differ, however, in the length of the last joint of the peduncle of the inferior antennæ. Dana states this joint to be "more than twice the preceding in length," and his figure (of which a very faulty reproduction is given in *Cat. Amph. Brit. Mus.*, Pl. I, f. 3), shows the proportion to be 2.7:1, while the diameter is one-tenth of the length. In our specimens this joint is only very slightly more than twice the length of the preceding, and its diameter is one-fifth of its length. A minor point of difference is that Dana states the outer ramus of the first pair of uropods to be naked. In our specimens both rami are equally furnished with setæ.

Stimpson, who may have examined specimens referred to both species, records them as distinct, stating that Brandt's species differs from Dana's "among other characters in the great length of the fifth epimeral," a point on which Brandt's figure is obscure, while our specimens agree perfectly with Dana's. Stimpson also states that the feet of *M. californiana* are not scabrous. It seems to us, however, that our present knowledge entitles us to regard the species as synonymous, on the probable

assumption that the last peduncular joint of the antennæ may vary somewhat in length.

Brandt's species formed the type of his genus *Megalorchestia*, and was transferred by Spence Bate to the synonymous *Orchestoidea* of Nicolet. I have not been able to refer to Nicolet's work, but in his definition of the genus quoted in Stebbing's Challenger report (p. 231), it is stated that the palp of the maxillipeds is four-jointed. Mr. Stebbing, however, informs me that this is an error, the figure given by Nicolet showing that only three joints are present. *Talitronus* of Dana is another synonym of *Orchestoidea* (Stebbing, *op. cit.*, p. 262).

The female of *O. californiana* has not been identified. It seems not improbable, as Mr. Stebbing has suggested to us, that Dana's *O. pugettensis* may prove to be the female, the scabrous character of the legs in *O. californiana* being the only character which stands in the way of this supposition.

ATYLIDÆ.

***Polycheria osborni* n. sp.**

(Pl. XXXII, Fig. 2.)

This species closely resembles *Polycheria antarctica* (Stebbing),¹ but differs from it in the following details :

The dorsal processes of the urosome are much less prominent (Fig. 2, *ur*).

In the maxillipeds the outer plates are longer, nearly equalling the palps and bearing each only about eleven spines on the inner edge (instead of 18-19).

The propodus of the first gnathopods is somewhat differently shaped, the palmar edge, against which the dactyl closes, being very short, not more than one-third the length of the dactyl.

In the second pair of gnathopods the hand is more than twice

¹ *Dexamine antarctica* Stebbing, Ann. Mag. Nat. Hist. (4) XV, 184, Pl. XV, A. f. 1. ; *Tritata Kergueleni*, Stebbing. Challenger Report Amphipoda, pp. 941-945, Pl. LXXXIII ; *Polycheria antarctica* (Stebb.) Della Valle. Monogr. Gamm, 580.

as long as broad, and the palmar edge extends to about one-half the length of the dactyl.

The coxal plates of the second pair of pereiopods, which in *P. antarctica* resemble those of the first pair in being produced anteriorly into a long sharp spine, are here different, and have the anterior process reduced to a short blunt lobe.

The propodus of the third pereiopods differs in shape from that of *P. antarctica*, the thumb-like process being much less prominent and the anterior and posterior edges nearly parallel.

The first maxillæ have the palp composed of only one joint, but Della Valle has already pointed out (Monogr. Gammarini, p. 579) that Stebbing was misled in ascribing a two-jointed palp to *P. antarctica*.

Length, 7 mm.

8 specimens, all females bearing ova, "in nests in *Amarœcium*."

The various other species of *Polycheria* which have been described, are probably all referable to one, *P. antarctica* (Stebbing), with a wide distribution in the Southern Ocean (Kerguelen Island, Antarctic Ocean, New Zealand, Australia). The occurrence of a second species in the Northern hemisphere is, therefore, interesting.

At the suggestion of Professor D'Arcy Thompson I have dedicated this interesting species to Professor H. F. Osborn, of Columbia University, New York.

GAMMARIDÆ.

Mæra dubia n. sp.

(Pl. XXXII, Fig. 3.)

Description.—Body moderately slender and compressed, sparsely covered with very small scattered setæ. Lateral lobes of head short, truncate. First pair of coxal plates produced forwards and pointed, slightly less deep than the corresponding segment. Fourth pair nearly twice as long as deep, and about half as deep as the corresponding segment.

Epimeral plates of metasome, each with a slight tooth at the posterior lower corner. Eyes small, dark. Superior antennæ about half the length of the body; first joint of peduncle about one and a-half times as long as the head, short at the base and tapering at the tip, where it is armed below with a small spine; second joint of equal length with the first, much more slender; third joint one-third the length of the second; flagellum about two-thirds the length of the peduncle; accessory flagellum about as long as the last joint of the peduncle, seven-jointed. Inferior antennæ not quite two-thirds the length of the superior; last joint of peduncle three-fourths the length of the preceding and about equalling the short flagellum. Anterior gnathopods of moderate size; hand scarcely broader than, and equal in length to the carpus, ovate in form, the palmar edge oblique and not sharply defined. Second gnathopods large, merus produced into a sharp tooth at its lower distal corner. Carpus triangular, its distal margin equalling in width the adjacent part of the propodus. Propodus oblong quadrangular, twice as long as broad, anterior and posterior margins slightly curved, palmar edge oblique, irregularly serrate, defined by a tooth. Dactyl equalling the palmar edge. Both gnathopods with tufts of long setæ especially on the margins. Last three pairs of pereopods with the basal joints expanded, ovate, with the posterior edge almost smooth. Last pair of uropods longer than the urosome, rami subequal, more than twice as long as the peduncle.

Length, 13 mm.

The only species of amphipod hitherto described from the west coast of North America which appears to resemble the present form is the *Mæra fusca* of Spence Bate (Proc. Zool. Soc. Lond., 1864, p. 667). The few details given by that writer render the recognition of the species very difficult. It is stated, however, that the palmar edge of the gnathopods is without serrations, a character which would seem to distinguish *M. fusca* from the present species. Mr. Stebbing has called our attention to several other species not very different in appearance from the present. Of these *Gammarus furcicornis* Dana,

from the Sooloo Sea, is perhaps the one most closely approaching ours. It differs, however, in the much longer accessory flagellum of the upper antennæ, the shorter and broader hand of the second gnathopods, and the greater hairiness of body and limbs.

Having in view the great difficulty of recognizing with certainty many of the species indicated by the older authors in the difficult group of Amphipoda to which this form belongs, we have judged it best to give a new name to the species described by us, for convenience of reference, at least until it can be shown to be identical with some of the earlier species.

PODOCERIDÆ.

Amphithoë humeralis Stimpson.

Amphithoë humeralis Stimpson, Proc. Acad. Nat. Sci., Philadelphia, 1864, p. 156.

Description.—Body rather compressed. Lateral lobes of head very little prominent, rounded. Anterior pairs of coxal plates about equal in depth to the corresponding segments; fourth pair large, quadrangular, the posterior lobe small and rounded. Eyes small, rounded, close to lateral lobes of cephalon, pigment dark. Superior antennæ more than half the length of the body; first joint of peduncle stout, about equal in length to the head and to the rather more slender second joint; third joint very small, about one quarter the length of the preceding, and much narrower; flagellum two and a-half times the length of peduncle. Inferior antennæ stout, more than half the length of the superior, last joint of peduncle a little shorter than the preceding, flagellum a little more than half the length of peduncle. Lower lip having the posterior cornu of outer lobe large. Palp of mandible having last joint longer than the preceding, not expanded. Outer lobe of second maxilla broader, but scarcely longer than the inner. Palp of maxillipeds having the first joint slightly produced exteriorly where it forms a distinct shoulder tipped with a tuft of long setæ; outer plates hardly reaching beyond second joint of palp. Gnathopods similar in the two

sexes, rather slender, and densely setose. First pair having the carpus longer than the hand, its lower edge convex; propodus quadrangular, about two and a-half times as long as broad, lower edge convex with a shallow concavity distally behind the prominent anterior corner; palmar edge very short, transverse, overlapped by the serrated dactyl. Second pair of gnathopoda having the carpus slightly longer than the propodus, its lower edge produced into a rounded lobe; propodus hardly more than twice as long as broad, shaped as in the first pair, palmar edge somewhat longer but still shorter than the dactyl. First and second pairs of pereopods similar, basal joint expanded, ovate, twice as long as broad; merus with its anterior margin expanded and regularly arcuate, produced distally in front and overlapping the carpus for one-fourth of its length. Third pair of pereopods very short, fourth pair hardly extending to end of carpus of fifth pair which are long and slender. Last pair of uropods not reaching beyond the preceding pair, peduncle three times as long as the rami, outer ramus with two strong hooks, inner ramus lamellate, truncate, bearing setæ. Telson triangular, truncate, with a few setæ on each side.

Length, about 26 mm.

The identity of this form with the species observed by Stimpson is at once suggested by his description of the first two pairs of pereopods, "with the basal joint very large and much expanded, nearly as broad as their epimera; meros-joint in the same pairs small, compressed, with a sharp arcuated anterior margin." The small size of the "subpediform" gnathopoda in both sexes and other less characteristic points are quite in accordance with our specimens. On the other hand, the superior antenna is stated to be "nearly as long as the body." The inferior antenna is "half as long as the body, with its flagellum no longer than the antepenult joint of the peduncle." Though we should probably read "last" or "penultimate" for "antepenult," the length of flagellum indicated is still less than in our specimens. It does not seem to us, however, that these discrepancies are sufficiently important to prevent the identification of our specimens with the species described by Stimpson.

The question whether *Amphithoë humeralis* may be identical with some of the older species is one which it is not possible to answer satisfactorily in the present state of our knowledge. Mr. Stebbing (Chall. Rep. Amph., 351) compares it with Spence Bate's *A. falklandi* (Cat. Amph. Brit. Mus., 237, Pl. XLI, f. 6) and he afterwards (op. cit., p. 1124) notes the resemblance between the latter species and Dana's *A. brevipes* (U. S. Expl. Exp. Crust., II, 941, Pl. 64, f. 5). *A. falklandi*, however, differs, according to Spence Bate's account, from the present species in the fact that the last pair of uropods project much beyond the preceding, while the last two pairs of pereopoda are said to be subequal. In *A. brevipes* Dana the posterior gnathopods of the male are large and quite different in shape from those of the present species.

Amphithoë sp.

A second species of *Amphithoë* is represented by an imperfect female specimen about 18 mm. long. The coxal plates are very large, about twice as deep as the corresponding segments. Both pairs of antennæ rather slender, upper pair half as long as body, lower about two-thirds as long as upper. Flagellum of lower pair about half as long as peduncle. Gnathopoda stronger than in preceding species, second pair larger than first, hands ovate, palm oblique and defined by a tooth. Second pair of pereopods (the first are missing) with basal joints not expanded, merus not strongly arched in front. Fourth and fifth pairs of pereopods rather slender, subequal, with tufts of long setæ especially at tip of propodus. Body and appendages sprinkled with minute reddish-brown pigment spots.

The single mutilated specimen offers no striking characters to differentiate it from several of the other and imperfectly known species, and indeed in this family the distinction of species in the female sex are frequently so obscure that we cannot venture on a more precise determination. It may be noted, however, that in general aspect and particularly in the long setæ of the posterior pereopods it resembles Dana's *A. filicornis*, from Rio Janeiro, and it may not improbably be the species re-

corded under that name by Spence Bate from Esquimalt, in J. K. Lord's "Naturalist in Vancouver Island" (from Zoölogical Record for 1866). It differs, however, from Dana's species in the much shorter lower antennæ and deeper coxal plates.

ISOPODA.

CIROLANIDÆ.

Cirolana Californica, Hansen (?).

C. Californica, Hansen, Cirolanidæ, Vidensk. Selsk. Skr., 6 Række, Naturvid. og Math. Afd., 3, 1890, p. 338. Pl. iii, f. 2.

The specimen which we refer with some doubt to this species is a male, about 20 mm. long. The body is proportionately narrower (7 mm.) than in Hansen's species. The antennæ hardly reach beyond the second thoracic segment. The last segment of the abdomen hardly broader than long, more acute than in Hansen's figure and with only 14 spines on the tip.

BOPYRIDÆ.

Pseudione Giardi n. sp.

(Pl. XXXIV, Fig. 5.)

Description of Female.—The single specimen, measuring 12 mm. in length, was taken from the right branchial cavity of its host (*Eupagurus ochotensis* (Br.)), and it is, accordingly, a dextral individual (*Bopyre droit* Giard & Bonnier), though the outline of its body seems at first sight to indicate a sinistral curvature, from the concavity of the right margin in the region of the posterior thoracic segments. Closer examination, however, shows that the head and the abdominal region are turned towards the left, and that the pleopods of the right side are longer than those of the left, as in a normal dextral individual, so that the peculiar curvature of the body is, in all probability, merely an accidental variation.

The specimen shows no traces of pigmentation. The dorsal surface is flat or slightly concave, the ventral is convex and is covered, except in the region of the abdomen, by the greatly developed brood-pouch. The dorsal swelling of the cephalic region which marks the position of the stomach (*cephalogaster*), is very slight. An irregularly oval, somewhat convex, area, the "ovarian bosse," is marked off by a groove on each side of the first four thoracic segments on the dorsal surface.

The abdominal segments, six in number, are distinctly separated from each other. The ventral surface of the abdominal segments and of the last two or three thoracic segments is roughened by longitudinal rugæ, which are most marked on the adjacent margins of the segments. These rugæ are neither so conspicuous nor so regularly disposed as in the case of the allied *Palægyge borrei* described by Giard and Bonnier (Bull. Scient. Fr. et Belg., XIX, 68, 1888). The anterior margin of the head is bordered by a narrow membranous expansion (*limbe antérieur*, G. & B.), which shows a distinct notch and several fainter undulations on each side of the middle line. No trace could be discovered on the thoracic segments of the pleural lamellæ, which in *Palægyge* are said to be "rudimentaires et à peine visibles."

The antennules (inner antennæ) are short, conical, composed of three joints and bearing a few very minute setæ at the tip. The antennæ (outer antennæ) are composed of five joints, of which the first is indistinctly marked off from the lower surface of the head; the third is longer and much more slender than the second, the fifth is very minute. The mandibles, which are embraced by the upper and lower lips to form the characteristic "beak" of the *Epicaridea*, are of the usual shape. The first pair of maxillæ appear to be absent. After a careful examination we have been unable to find any distinct rudiments of them, though the triangular areas between the base of the mandibles and the lower lips on each side bear some resemblance to the rudiments of these organs in *Palægyge* (Giard and Bonnier, tom. cit., Pl. V, f. 2). The rudiments of the second maxillæ are to be detected further back on the under surface of the head. Immediately in front of each a relatively large opening leads into

a capacious tube lined by an invagination of the chitinous cuticle, the protuberance interpreted as the rudiment of the second maxilla forming the lower or posterior lip of this orifice. Unfortunately, these tubes were not discovered till the soft parts of the head had been removed by caustic potash, so that we are unable to say anything as to their connections inside the body. This is the more to be regretted since we know of nothing analogous to these organs, not only in the *Epicaridea* but even among the *Malacostraca*.

The maxillipeds are similar to those of *Palægyge* but somewhat narrower. Each consists of a flat, roughly quadrangular plate partially divided into two parts by an oblique line. The posterior part has its external angle rounded and pointed as in *Palægyge Borrei*, and the antero-internal angle is produced. The anterior margin of the maxilliped bears a few setæ, and at its inner angle is articulated the small "palp," also setose.

Posteriorly, the lower surface of the head terminates in a freely projecting lamina, the "*limbe postérieur*" of Giard and Bonnier. In the present species this lamina is cut up into a fringe of digitate processes commencing on each side a little way from the middle line and increasing in size outwards. Externally, on each side the lamina is produced into a long process, narrowing gradually from its base to a rounded tip, turned inwards and extending beyond the middle line. In *Palægyge* there are two pairs of shorter processes and no fringe of minute digitations.

The thoracic legs are all similar and of the usual structure. The "adhesive cushions" present on the proximal segments of the first pair in *Palægyge* are here absent. The oöstegites or brood lamellæ were unfortunately injured in the single specimen found. The usual five pairs are present and are much larger than in *Palægyge Borrei*, all the pairs except, perhaps, the third and fourth, overlapping across the median line. The first pair are, as usual, of somewhat complex form. Roughly quadrilateral in shape, the posterior corner is produced into a hook-like process directed inwards. A little behind the middle of its length the lamella is crossed by a transverse fold, form-

ing on its outer or lower surface a deep groove, the anterior margin of which is produced as an overlapping ridge. On the inner, or in its natural position upper, face of the lamella, the fold projects as a strong ridge which for part of its length is fringed with digitate processes. The front edge of the second pair of oöstegites is received into the groove on the lower surface of the first pair. The last two pairs are strongly fringed with setæ on the posterior edge.

Five pairs of biramous pleopods are present, successively diminishing in size posteriorly; those of the right side being, as already mentioned, considerably larger than those of the left. In the first pair the exopodite (lobe *b*, according to the nomenclature of Giard and Bonnier) is roughly quadrilateral in shape and much smaller than the endopodite (lobe *c*), which is long and pointed. In the posterior pairs the exopodite approaches more closely in size and shape to the endopodite. The last segment of the abdomen is very small and bears articulated to its posterior margin a pair of lanceolate lamellæ, of which the right is broader and slightly longer than the left. These lamellæ may possibly represent the sixth pair of pleopods, but a comparison with Giard and Bonnier's figure of the corresponding region in *Palægyge Borrei* suggests that we have here to do with the rudimentary pleural lamellæ (lobe *a* of Giard and Bonnier), which, separated by a distinct suture from the fifth and sixth segments in the last-named species, are here only distinct on the sixth segment. If this view be adopted the sixth pair of pleopods are entirely absent. In all the pleopods the surface of the endopodite is roughened by irregularly transverse rugæ which are most distinct on the anterior pairs.

Male.—A male individual about 3 mm. long was found under the pleopods of the female. The body is symmetrical, lanceolate in outline, the fourth thoracic segment being the widest. A pair of eyes are present near the posterior corners of the head. Both antennules and antennæ are well developed, the former having three, the latter five segments. As in the female, no distinct rudiments of the first maxillæ could be identified. The second maxillæ have the form of rather large, rounded tubercles.

The maxillipeds are present as long slender processes each tipped by a single seta, inserted on each side close to the base of the lower lip. The seven pairs of thoracic feet are all similar and of the usual form, with powerful subchelate terminations.

The six abdominal segments are distinct, regularly diminishing in size posteriorly, and the first five show rudiments of pleopods in the form of slight rounded eminences on the ventral surface. In *Palægyge Borrei*, Giard and Bonnier describe the male as having rudiments of pleopods on the first three abdominal segments only (l. c., p. 70), but in a later paper the same authors speak of the abdominal segments of the male in the genus *Palægyge* as being *all* furnished with these rudiments. (Bull. Scient., XXII, 373. 1890.) The last segment of the abdomen is very small, cordate in form, being very narrow anteriorly and having its hinder margin notched; its greatest breadth is about equal to the length.

Larva.—The brood-pouch of the female was filled with embryos just hatched, and having the form characteristic of the first larval stage of the *Epicaridea*. The head is large and projects in front in a rounded hood-like form. The antennules are in the form of rounded tubercles bearing a number of stout spines among which a narrow pointed process appears to represent the rudiment of the flagellum. The antennæ are about half the length of the embryo, not yet distinctly segmented, and armed at the tip and about the middle of their length with a few spines.

The mouth parts are still in a very early stage, and are difficult to interpret. In the middle the rudiment of the upper lip can be made out, and immediately behind it are a pair of minute lobes in contact with each other in the middle line. Behind this and at some distance from the middle line on each side are three finger-like appendages, the last of these being minutely forked at the tip.

Walz figures (Arb. Zoöl. Inst. Wien. IV, 2, Pl. I, f. 3a) an embryo of *Bopyrina virbii* at a stage apparently corresponding to that of the present specimens. The upper lip and the pair of small lobes close to it are shown, but there are only two pairs

of finger-like processes where our specimens show three. The first pair, Walz states, develops into the mandibles, and he suggests that the second pair corresponds to one of the pairs of maxillæ which by fusion give rise to the lower lip (*l. c.*; p. 14). The latter part of his suggestion appears hardly probable. The minute lobes behind the upper lip are not referred to in the text.

The figure which Giard and Bonnier give of the mouth parts of an embryo of *Cancrion miser* (*Contr. à l'étude d. Bopyriens*, Pl. IX, f. 13), though taken from an earlier stage, corresponds fairly well with our specimens. Two small lobes close to each other, lettered *lb* in their figure, are evidently the same as those which we have lettered *I*. The figure does not seem to be fully discussed anywhere in the text of the monograph, but in the explanation of the plate the interpretation of the letters is given as "première paire d'appendices buccaux (labre)." In their figure of a newly-hatched embryo of *Portunion Kossmanni* (*op. cit.*, Pl. X, f. 1), a pair of appendages exactly similar in shape and position are lettered as mandibles. In *Cancrion* three pairs of appendages follow upon those just discussed. Of these the first two pairs are simple and are interpreted as mandibles and first maxillæ, while the third pair are biramous and are identified as the maxillipeds. In *Portunion* only two pairs of appendages are present in the corresponding position, both simple and lettered as first maxillæ and maxillipeds.

We cannot attempt to reconcile these seemingly contradictory accounts of species which we have not studied, and shall only indicate what seems to be the most probable interpretation of the specimens before us. The rudiments which we have lettered *I* seem, from their position close together in the median line, to be the paragnatha which afterwards fuse to form the lower lip. This leaves three pairs of rudiments to be allotted between the four pairs of appendages from mandibles to maxillipeds, and we may assume one of the pairs of maxillæ to be missing (probably the first pair, which appears to be absent in the adults of both sexes). On the other hand, it is possible that the rudiments *I* may, in spite of their small size and median position, represent the mandibles, in which case the other appendages

are satisfactorily accounted for. In either case the pair iv probably represent the maxillipeds, the minute bifurcation at the tip recalling the biramous character of these organs in the embryos of *Cancerion* and of *Cepon* (Giard and Bonnier, Bopyriens, Pl. III, f. 6 and 7).

The completely segmented abdomen of both sexes, the biramous pleopods of the female and the presence of rudimentary pleopods in the male, would refer this species to the genus *Palægyge* as established by Giard and Bonnier in 1888 (Bull. Scient., XIX, 63). The fact that the species infests a pagurid, and the rugosity of the pleopods in the female would place it in the second division of that genus recognized by these authors in 1890 (Bull. Scient., XXII, 373), to which, adopting Stebbing's suggestion (Hist. Crust., 411), we may apply the earlier name *Pseudione*, Kossmann. Of the species enumerated by Mr. Stebbing as referable to the latter genus, three; *P. Fraisei* (Kossmann), *P. Dohrni* (G. & B.), *P. insignis* (G. & B.), appear to be *nomina nuda*, regarding which no particulars save the names of their hosts are recorded. Of *P. callianassæ* Kossmann, only the male appears to be described, and from the account given by Kossmann (Z. f. W. Z., XXXV, 663, Pl. XXXIII, f. 37), and reproduced by Giard and Bonnier (Bopyriens, pp. 77-8), we learn that that species agrees with our form in the presence of rudimentary maxillipeds in the male, though these rudiments are very much smaller in Kossmann's species than in ours. Moreover, rudiments of the first maxillæ, which we have not found, are figured as present in that species.

In *Pseudione Hyndmanni* (Bate & Westwood), described in the British Sessile-eyed Crustacea (p. 243), as *Phryxus Hyndmanni*, from *Eupagurus bernhardus* (L.), the general features of the female appear to approximate very closely to our species. The pleural lamellæ of the abdomen, however, appear to be rounded instead of pointed, and those of the last segment are shorter and broader. The pleopods are smaller and less unsymmetrical.

In *Pseudione confusa* (Norman), from *Galathea dispersa* Bate, described in the above mentioned work (p. 249) as *Phryxus galatheæ*, the brief description and imperfect figures of the fe-

male offer no marked distinction from the present species. In the male, however, the abdomen tapers much less rapidly and the last segment is twice as broad as long. The thoracic segments are somewhat more expanded laterally, and the last thoracic is considerably wider than the first abdominal segment. It is stated that "the small conical mouth appears to be protected on each side by a minute 2-jointed foot jaw," but it does not seem probable that the appendages figured are really the maxillipeds.

While the few details available in the case of these species render it impossible to enumerate the characters which distinguish *Pseudione Giardi* from the other members of the genus, it appears to be most closely allied to *P. Hyndmanni*, as was, indeed, to be expected from the nature of its host. Its precise specific delimitation can only be effected when we are in possession of fuller information with regard to the last named and other species.

I have recently received by the kindness of the author a copy of Dr. Hansen's beautiful memoir on the Isopoda of the "Albatross" expedition (Bull. Mus. Comp. Zool., XXXI, 5, 1897), in which he describes and figures *Pseudione galacanthæ* from the deep-sea galatheid *Galacantha diomedææ*. In spite of the very different host and habitat the new species appears to differ only in trivial characters from our own. Dr. Hansen however recognizes a rudiment of the first maxilla in both sexes where we have only been able to see the membranous interspace between the mandible and the labrum.

Argeia sp.

Two specimens on *Crangon affinis*, De Haan. Both specimens were in very bad condition, having been apparently allowed to dry, and nothing could be made out of their structure. Relying, however, on the principle of MM. Giard and Bonnier, that no species of the *Epicaridea* infests more than one species of host, we may conjecture that these represent a new species of *Argeia* in addition to the two already known from the west coast of America; *A. pugettensis*, Dana, on *Sclerocrangon munitus* and *A. pauperata*, Stimpson, on *Crangon franciscorum*.

Phyllodurus abdominalis Stimpson.

P. abdominalis Stimpson, Boston Jour. Nat. Hist., II, 511.
1857.

Of this interesting and imperfectly known form a large series of both sexes and different stages of growth was obtained. These it is proposed to describe in detail in a later paper. It may be mentioned that the male of this species was recorded and briefly described by Lockington in 1876, in a paper whose title affords no clue to this part of its contents ("Descr. of a new gen. and sp. of Decapod Crustacean," Proc. Calif. Acad. Sci. (1876), 1877, p. 57).

LIGIIDÆ.

Ligia Pallasii Brandt.

Ligia Pallasii Brandt, Conspectus Monogr. Crust. Oniscid.
Bull. Soc. Imp. Nat., Moscou, VI, 171. 1833.

Lygia dilatata Stimpson, Bost. Jour. Nat. Hist., VI, 507, Pl.
xxii, f. 8. 1857.

Ligia Stimpsoni Miers, Proc. Zoöl. Soc. Lond., 1877. 671.

Ligia Pallasii Budde-Lund, Isop. Terr., 261. 1885.

Of the species described in Budde-Lund's Monograph our specimens approach most closely in the proportions of the uropods to *L. Pallasii* Br., from which they differ only in the much narrower body. Stimpson, however, mentions that the relative width of the body is subject to great variation. The *L. septentrionalis* of Lockington (Proc. Calif. Acad. Sci. (1876), 1877, p. 46), a species not mentioned by Budde-Lund, agrees with our specimens so far as the short description goes, but its distinctness from *L. Pallasii* does not appear to be beyond doubt.

The dimensions of our two specimens are as follows :

Length.	Breadth.	Antenna.	Uropods.
31	16	16	4.5 mm.
21	10	12.5	4 mm.

RHIZOCEPHALA.**Sylon** sp.

A single specimen of a *Rhizocephalan*, probably referable to this genus, was in the collections sent me, and I understand that further specimens were obtained. In Messrs. Harrington and Griffin's paper on the Puget Sound Invertebrates (Trans. N. Y. Acad. Sci., 1897, p. 164) a "*Sacculina*" is recorded as occurring on *Sclerocrangon munitus* (Dana). From a sketch kindly sent me by Mr. Harrington I gather that a specimen occurred on a *Pandalus Danæ* Stimpson. In the specimen sent to me, only the abdomen of the host is preserved and this is certainly not that of a *Pandalus* nor of a *Sclerocrangon*, but apparently belongs to some species of *Hippolyte*.

The parasite is attached as usual to the under surface of the third abdominal segment of its host. It has an ellipsoid shape, the longest axis lying nearly parallel to the longitudinal axis of the host's body and measuring about 4 mm. Transversely to the body of the host the parasite has a diameter of 3.4 mm. and its vertical depth is 3 mm. The base of attachment is about 2 mm. in diameter and somewhat nearer the posterior pole. The genital openings could not be detected (Hoek states, in his appendix to the Challenger Report on the *Macrura*, p. 923, that these openings are closed in young specimens), nor was any trace of the mesenteric line visible. The branched "roots" are easily visible inside the body of the host. Hoek states (Ib., p. 924) that in *Sylon*, contrary to what obtains in *Sacculina*, the roots do not reach the intestine of the host, but are, for the most part, confined to the space between the ventral muscles of the abdomen and the integument. In our specimen, however, the roots penetrate further into the body and form a plexus surrounding the intestine.

APPENDIX.

Since the above paper was written I have received from Mr. N. R. Harrington a few Crustacea which had been overlooked in sorting out the Puget Sound material. Among them is a specimen of a small *Slerocrangon* closely resembling but apparently distinct from *S. muricus* (Dana). I believe it to be identical with a species to be described by Mr. A. O. Walker in a forthcoming paper in the Proc. Biol. Soc. Liverpool, and of which Mr. Walker has been good enough to send me a sketch. His specimens were dredged in Puget Sound by Professor Herdman, of Liverpool.

The collection sent me also includes a second specimen of *Sylon*, attached to a *Hippolyte brevirostris* Dana.

UNIVERSITY COLLEGE, DUNDEE, SCOTLAND.

PLATE XXXI.

(285)

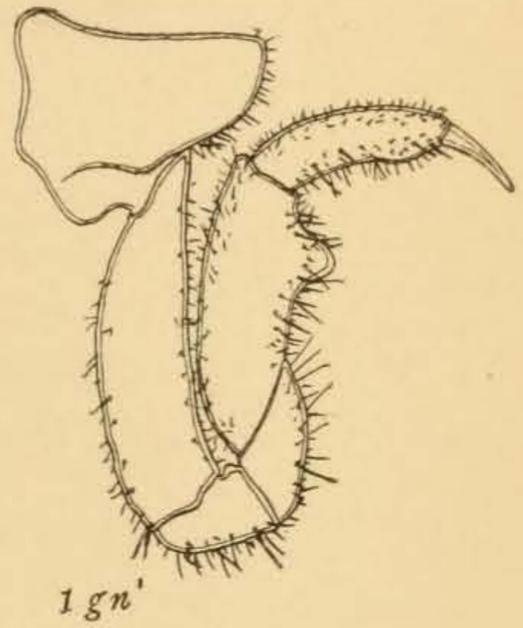
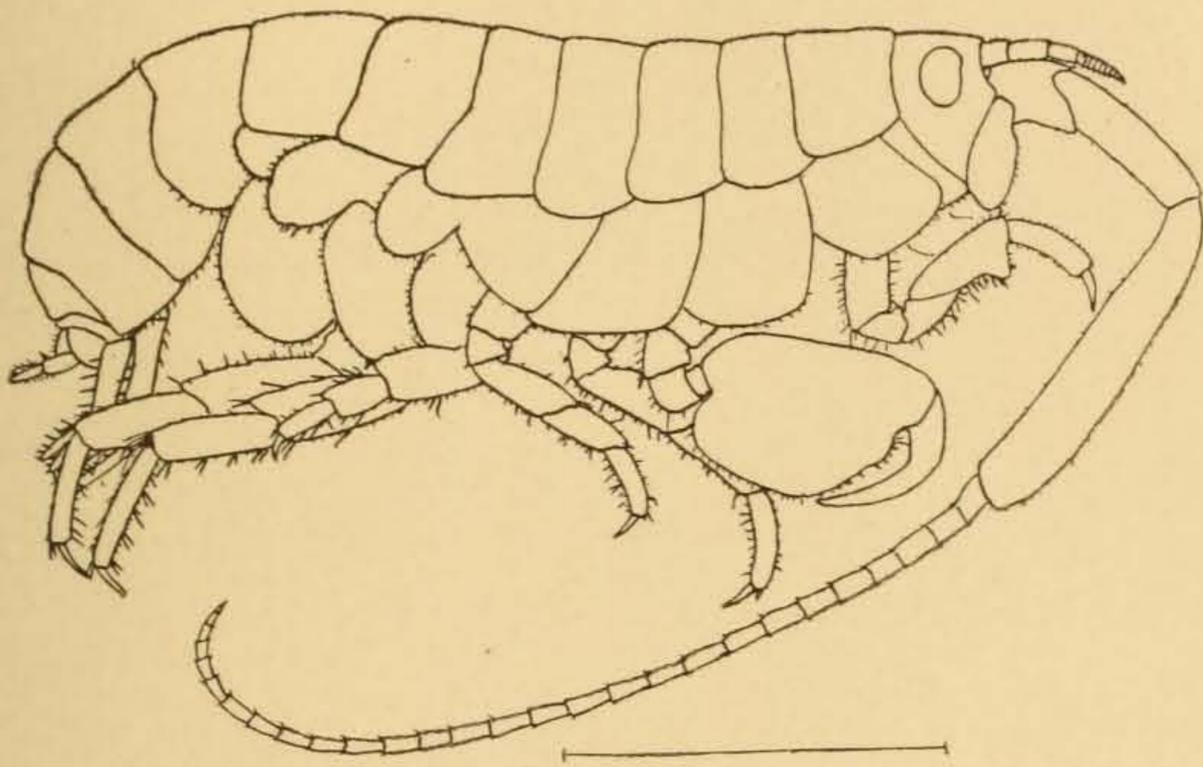
PLATE XXXI.

Fig. 1. **Orchestoidea californiana** (Brandt). Male.

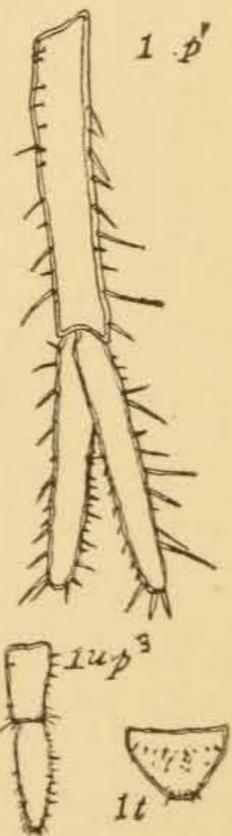
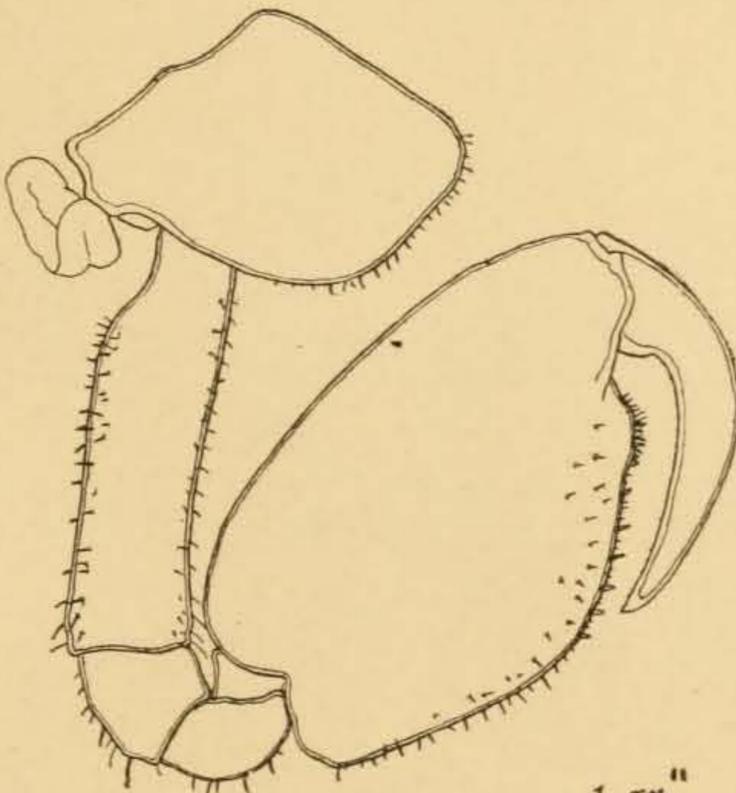
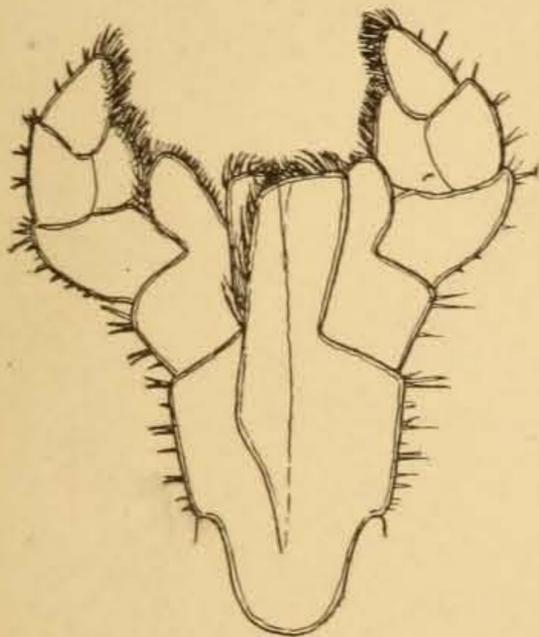
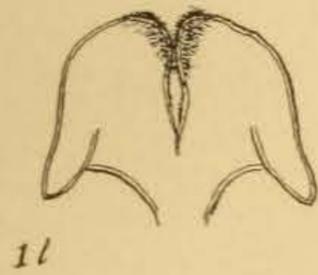
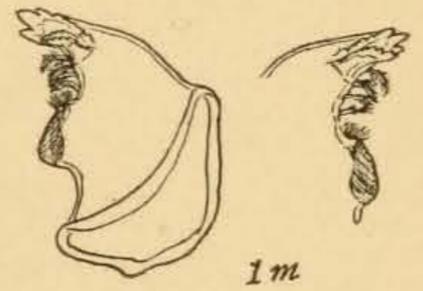
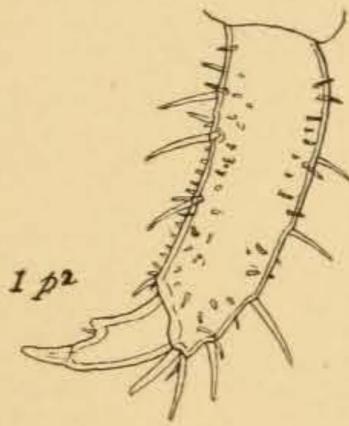
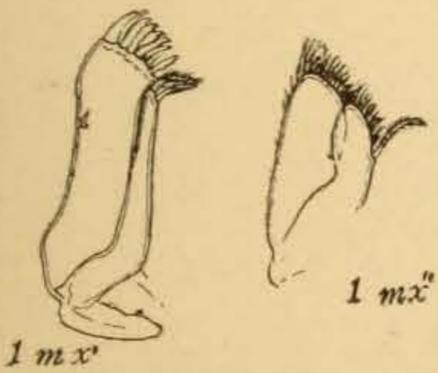
REFERENCE LETTERS.

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<i>ant''</i> .—Antennæ.	<i>lbr.</i> .—Labrum.
<i>as.</i> .—Anal style.	<i>m.</i> .—Mandible.
<i>bucc.</i> .—Mouth parts.	<i>mp.</i> .—Maxilliped.
<i>ceph.</i> .—Under surface of head.	<i>mx'</i> , <i>mx''</i> .—Maxillæ.
<i>emb.</i> .—Embryo.	<i>p'</i> , <i>p''</i> , etc.—Pereiopods.
<i>en.</i> .—Endopodite.	<i>pl.</i> .—Abdomen.
<i>ex.</i> .—Exopodite.	<i>pl^I</i> , <i>pl^{VI}</i> .—Pleural lamellæ.
<i>gn'</i> , <i>gn''</i> .—Gnathopods.	<i>plp.</i> .—Pleopod.
<i>l.</i> .—Labium.	<i>up.</i> .—Uropod.
<i>la.</i> .—"Limbe antérieur."	<i>ur.</i> .—Urosome.
	<i>t.</i> .—Telson.

I, *II*, *III*, *IV*.—Mouth parts of embryo (see text).



I



1 mp

1 gn''

W. T. C. ad nat. del.

PLATE XXXII.

(287)

PLATE XXXII.

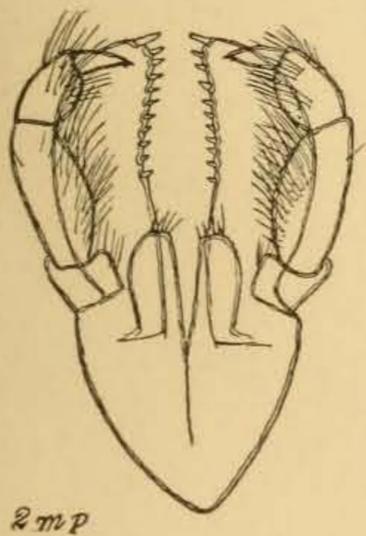
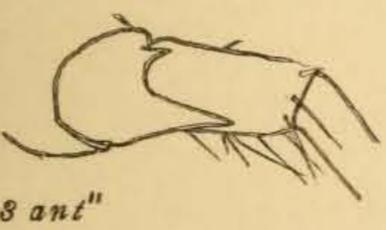
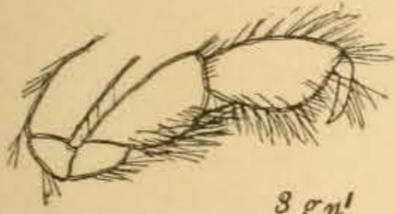
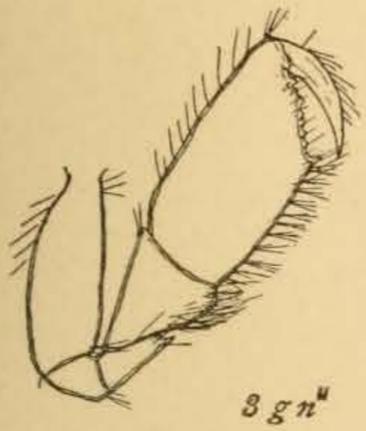
Fig. 2. **Polycharia Osborni** n. sp. Female.

Fig. 3. **Maëra dubia** n. sp.

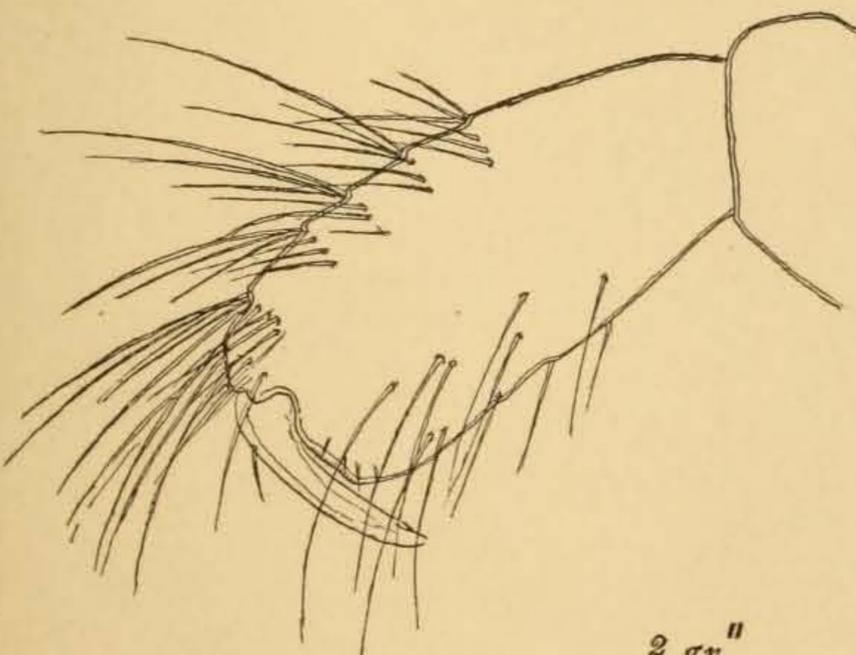
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<i>as.</i> .—Anal style.	<i>m.</i> .—Mandible.
<i>bucc.</i> .—Mouth parts.	<i>mp.</i> .—Maxilliped.
<i>ceph.</i> .—Under surface of head.	<i>mx'</i> , <i>mx''</i> .—Maxillæ.
<i>emb.</i> .—Embryo.	<i>p'</i> , <i>p''</i> , etc.—Pereiopods.
<i>en.</i> .—Endopodite.	<i>pl.</i> .—Abdomen.
<i>ex.</i> .—Exopodite.	<i>pl^I</i> , <i>pl^{VI}</i> .—Pleural lamellæ.
<i>gn'</i> , <i>gn''</i> .—Gnathopods.	<i>plp.</i> .—Pleopod.
<i>l.</i> .—Labium.	<i>up.</i> .—Uropod.
<i>la.</i> .—"Limbe antérieur."	<i>ur.</i> .—Urosome.
	<i>t.</i> .—Telson.

I, *II*, *III*, *IV*.—Mouth parts of embryo (see text).

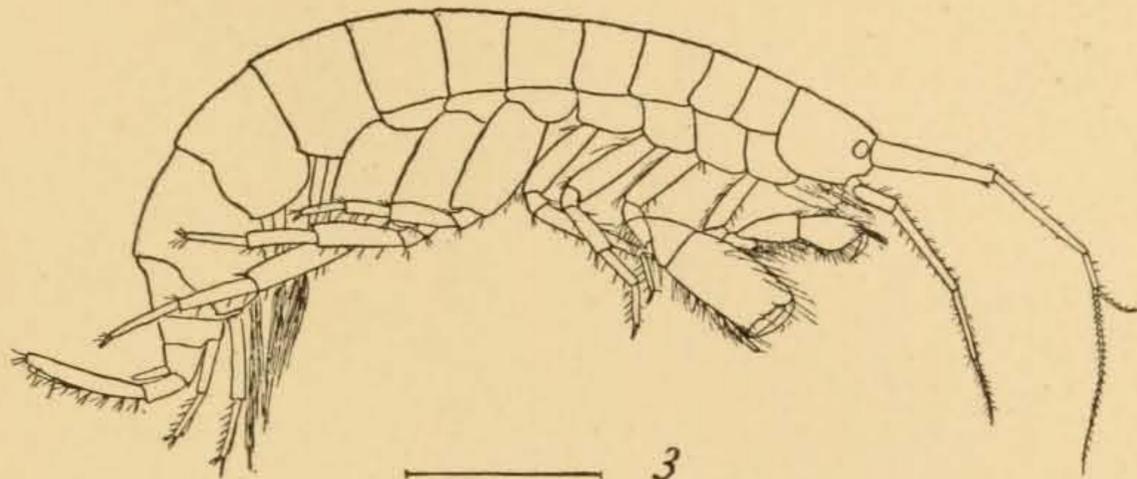


2 mp

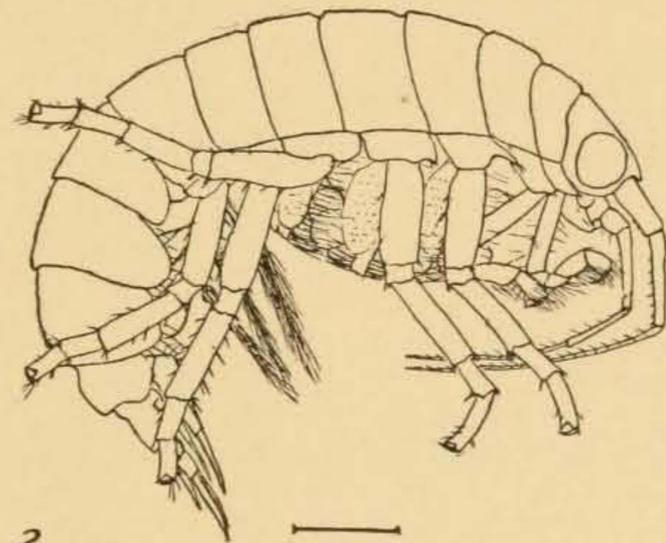


2 gn''

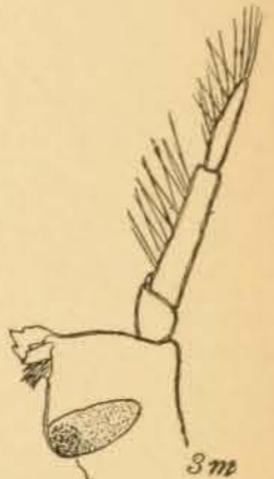
W. T. C. ad nat. del.



3



2



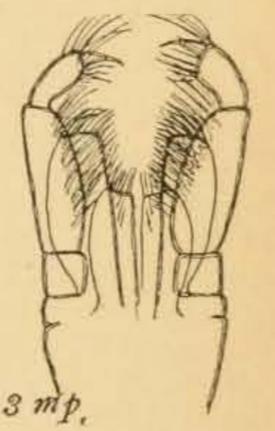
3 m



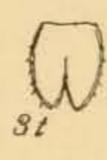
3 mx'



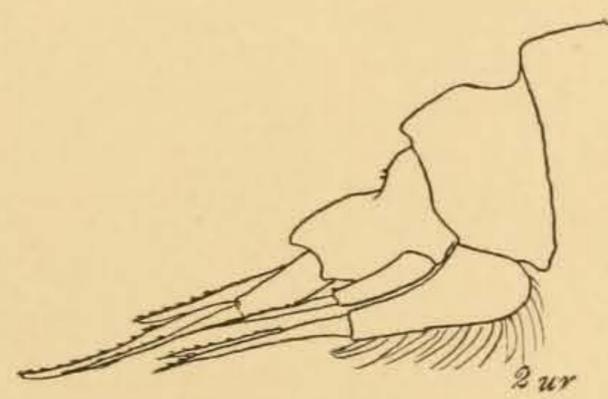
3 up'



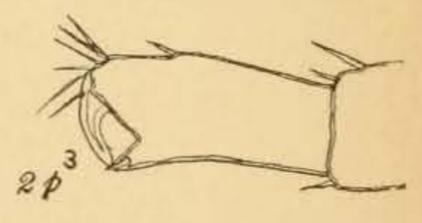
3 mp



3 t



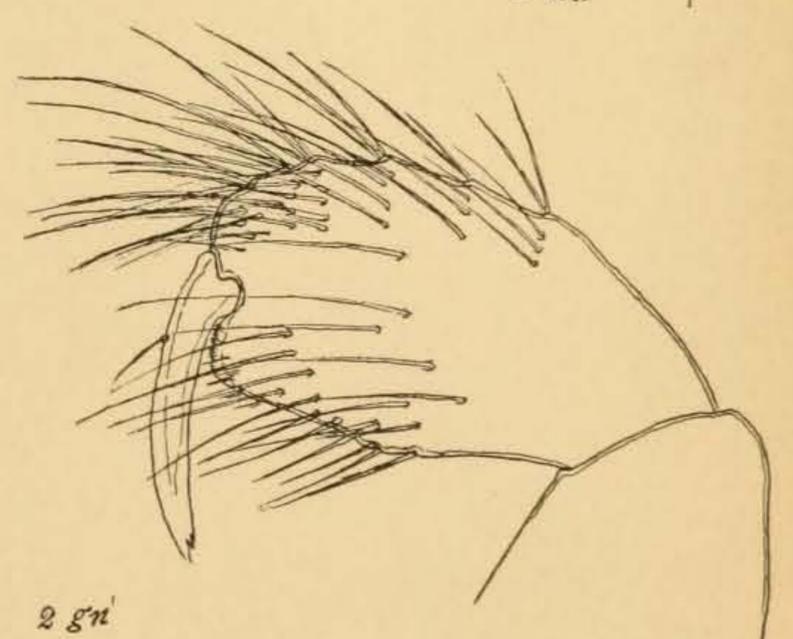
2 ur



2 p'



2 mx'



2 gn'

PLATE XXXIII.

(289)

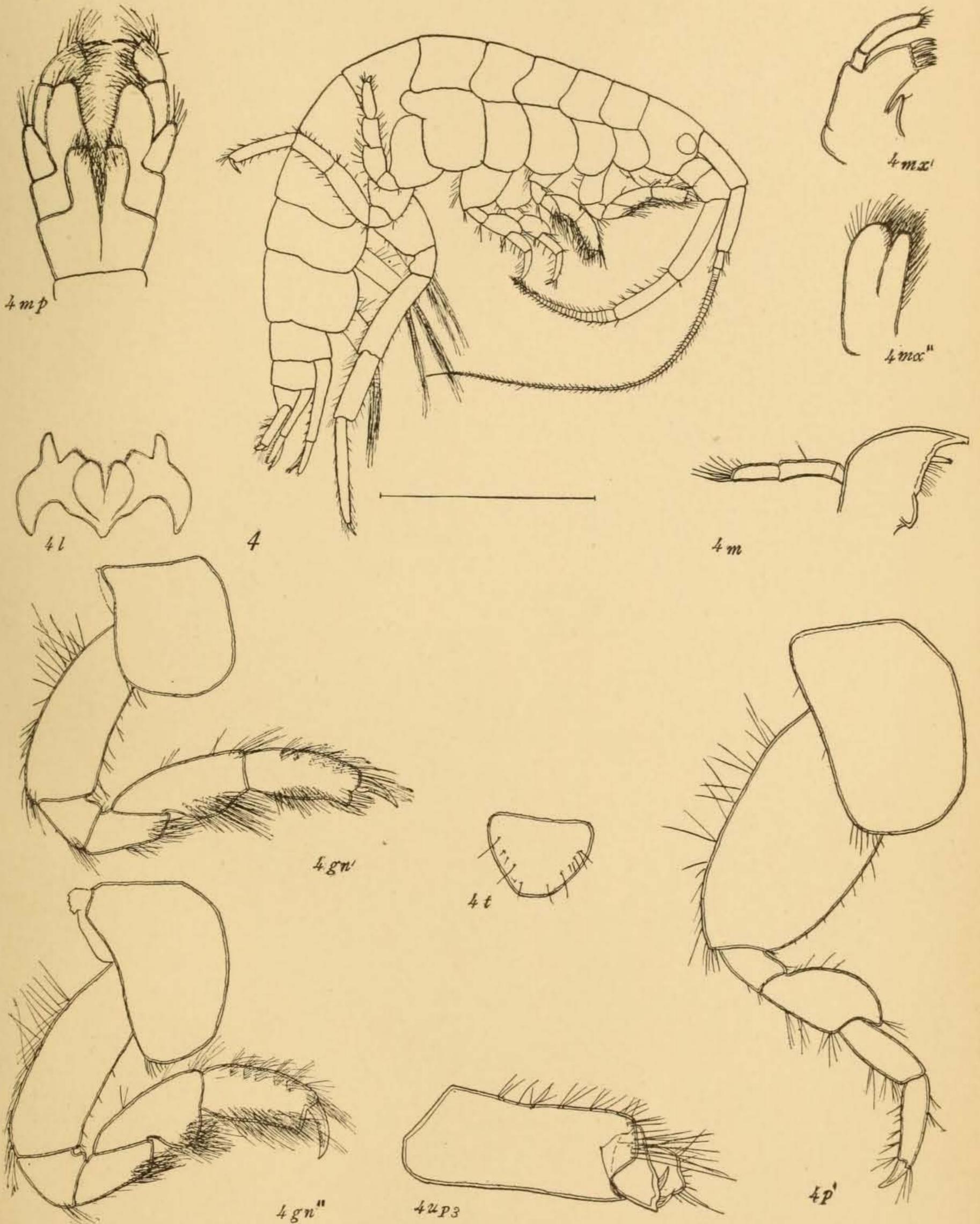
PLATE XXXIII.

Fig. 4. **Amphithoë humeralis** Stimpson.

REFERENCE LETTERS.

<i>ant'</i> .—Antennules.	<i>lp.</i> .—"Limbe postérieur."
<i>ant''</i> .—Antennæ.	<i>lbr.</i> .—Labrum.
<i>as.</i> .—Anal style.	<i>m.</i> .—Mandible.
<i>bucc.</i> .—Mouth parts.	<i>mp.</i> .—Maxilliped.
<i>ceph.</i> .—Under surface of head.	<i>mx'</i> , <i>mx''</i> .—Maxillæ.
<i>emb.</i> .—Embryo.	<i>p'</i> , <i>p''</i> , etc.—Pereiopods.
<i>en.</i> .—Endopodite.	<i>pl.</i> .—Abdomen.
<i>ex.</i> .—Exopodite.	<i>pl^I</i> , <i>pl^{VI}</i> .—Pleural lamellæ.
<i>gn'</i> , <i>gn''</i> .—Gnathopods.	<i>plp.</i> .—Pleopod.
<i>l.</i> .—Labium.	<i>up.</i> .—Uropod.
<i>la.</i> .—"Limbe antérieur."	<i>ur.</i> .—Urosome.
	<i>t.</i> .—Telson.

I, *II*, *III*, *IV*.—Mouth parts of embryo (see text).



W. T. C. ad nat. del.

PLATE XXXIV.

(291)

PLATE XXXIV.

Fig. 5. **Pseudione Giardi** n. sp.

REFERENCE LETTERS.

<i>ant'</i> .—Antennules.	<i>lp.</i> .—"Limbe postérieur."
<i>ant''</i> .—Antennæ.	<i>lbr.</i> .—Labrum.
<i>as.</i> .—Anal style.	<i>m.</i> .—Mandible.
<i>bucc.</i> .—Mouth parts.	<i>mp.</i> .—Maxilliped.
<i>ceph.</i> .—Under surface of head.	<i>mx'</i> , <i>mx''</i> .—Maxillæ.
<i>emb.</i> .—Embryo.	<i>p'</i> , <i>p''</i> , etc.—Pereiopods.
<i>en.</i> .—Endopodite.	<i>pl.</i> .—Abdomen.
<i>ex.</i> .—Exopodite.	<i>pl</i> ^I , <i>pl</i> ^{VI} .—Pleural lamellæ.
<i>gn'</i> , <i>gn''</i> .—Gnathopods.	<i>plp.</i> .—Pleopod.
<i>l.</i> .—Labium.	<i>up.</i> .—Uropod.
<i>la.</i> .—"Limbe antérieur."	<i>ur.</i> .—Urosome.
	<i>t.</i> .—Telson.
<i>I, II, III, IV.</i> —Mouth parts of embryo (see text).	

