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VOLUME 27

PART 4

**SUBMARINE CANYONS OF SOUTHERN
CALIFORNIA**

PART IV

SYSTEMATICS: ISOPODA

BY

GEORGE A. SCHULTZ

DEPARTMENT OF ZOOLOGY

DUKE UNIVERSITY

DURHAM, NORTH CAROLINA



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MARINE ISOPODS OF THE SUBMARINE CANYONS
OF THE SOUTHERN CALIFORNIAN
CONTINENTAL SHELF

by George A. Schultz

INTRODUCTION

The geographical, physical and biological aspects of the submarine canyons of the continental shelf off the coast of southern California have been described in earlier parts of this volume. Isopods were collected in 10 of the 15 canyons. Many benthic species were obtained since the specimens were obtained with a Campbell grab bottom sampler operated from the Hancock Foundation research vessel *Velero IV*. The method of collecting subjected some specimens to fragmentation, resulting in loss of legs and other damage. However all individuals could easily be placed in existing genera or differentiated from the existing genera or species, and they were all placed in their appropriate taxonomic categories. Twenty-five species in eighteen genera, of which fifteen species and two genera are new to science, were identified. Of the ten known species, six have been reported only from California, one is known from Alaska to southern California, and only three can be considered cosmopolitan.

Table 1 lists in systematic order the species identified from all of the canyons; Table 2 lists the species by canyon. The systematic arrangement used is that of Menzies (1962 a, b).

In the ten canyons sampled, an average of five species per canyon was found. Many species were common to several canyons—*Halio- phasma geminata* to five, *Ilyarachna acarina* and *Gnathia crenulatifrons* to four, and other species to three or fewer. The three named species have been called "common mud bottom" species by Menzies and Barnard (1959). Tanner and Santa Cruz canyons yielded nine species each; most of those from Santa Cruz had been described, but seven of the nine species from Tanner were new to science. The other canyons yielded fewer species, and San Clemente Canyon yielded only one. No isopods were found in Dume, Hueneme, Monterey, Mugu Canyons or the San Diego trough. Some of the species described here, plus addi-

tional species from non-canyon stations, were described by Schultz (1964).

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Table 1
Canyon Isopoda

ASELLOTA

Paraselloidea

- Acanthomunna tannerensis*, new species
- Desmosoma symmetrica*, new species
- Eurycope californiensis*, new species
- Ilyarachna acarina* Menzies and Barnard (1959)
- Ilyarachna profunda*, new species
- Jaeropsis concava*, new species
- Jaeropsis dubia paucispinis* Menzies (1951)
- Janiralata solasteri* (Hatch, 1947)
- Munna spinifrons* Menzies and Barnard (1959)
- Nannonisconus latipleonus*, new genus, new species
- Pleurogonium californiense* Menzies (1951)

FLABELLIFERA

Anthuridea

- Bathura luna*, new genus, new species
- Haliophasma geminata* Menzies and Barnard (1959)

Cirolanoidea

- Aega lecontii* (Dana, 1854)
- Cirolana californiensis*, new species
- Cirolana joanneae*, new species
- Eurydice branchuopus* Menzies and Barnard (1959)
- Rocinela belliceps* (Stimpson, 1864)

GNATHIOIDEA

- Gnathia crenulatifrons* Monod (1926)
- Gnathia clementensis*, new species
- Gnathia coronadoensis*, new species
- Gnathia hirsuta*, new species
- Gnathia trilobata*, new species

VALVIFERA

- Microarcturus tannerensis*, new species
- Synidotea calcarea*, new species

Table 2

Isopod Species Listed by Canyon

The species, the station number and the depth at which the sample was taken are listed below. The type localities of the new species are indicated by an asterisk.

Coronado Canyon (6 species)

Bathura luna, n. gen., n. sp., 6851, 812 m.

Cirolana californiensis, n. sp., 6851*, 812 m.

Gnathia coronadoensis, n. sp., 6849, 344 m; 6851*, 812 m.

Gnathia trilobata, n. sp., 6851*, 812 m.

Haliophasma geminata, 6845, 177 m; 6846, 123 m.

Ilyarachna acarina, 6845, 177 m.

La Jolla Canyon (5 species)

Bathura luna, n. gen., n. sp., 7047, 783 m.

Eurydice branchuopus, 7038, 121 m.

Gnathia trilobata, 7049, 976 m.

Haliophasma geminata, 7038, 121 m.

Ilyarachna profunda, n. sp., 7047*, 793 m; 7049, 976 m.

Newport Canyon (3 species)

Eurycope californiensis, n. sp., 7032*, 478 m.

Gnathia crenulatifrons, 7054, 178 m.

Haliophasma geminata, 7052, 420 m.

Redondo Canyon (5 species)

Gnathia crenulatifrons, 2361, 310 m; 2789, 167 m.

Haliophasma geminata, 2361, 310 m; 2725, 107 m; 2727, 122 m;
2789, 167 m; 2793, 465 m; 3385, 120 m.

Ilyarachna acarina, 2725, 107 m; 2727, 122 m; 2793, 465 m; 3385,
120 m.

Nannonisconus latipleonus, n. gen., n. sp., 2793*, 465 m.

Pleurogonium californiense, 3385, 120 m.

San Clemente Canyon (1 species)

Gnathia clementensis, n. sp., 6840*, 1620 m.

San Pedro Canyon (4 species)

Gnathia crenulatifrons, 7174, 221 m.

Haliophasma geminata, 7174, 221 m; 7175, 200-472 m (dredge).

Ilyarachna acarina, 7174, 221 m.

Ilyarachna profunda, n. sp., 5639, 461 m.

Santa Catalina Canyon (2 species)

Ilyarachna profunda, n. sp., 6820, 559 m.

Gnathia crenulatifrons, 6823, 88 m.

Santa Cruz Canyon (9 species)

Aega lecontii, 6805, 218 m.

Cirolana joanneae, n. sp., 6805, 218 m; 6806*, 218 m.

Gnathia hirsuta, n. sp., 6805*, 218 m.

Haliophasma geminata, 6805, 218 m; 6806, 218 m.

Ilyarachna acarina, 6805, 218 m; 6806, 218 m.

Jaeropsis concava, n. sp., 6806*, 218 m.

Janiralata solasteri, 6805, 218 m; 6806, 218 m.

Munna spinifrons, 6805, 218 m; 6806, 218 m.

Rocinela belliceps, 6806, 218 m.

Santa Monica Canyon (4 species)

Gnathia crenulatifrons, 3000, 268 m; 3180, 330 m.

Haliophasma geminata, 2999, 454 m; 3000, 268 m; 3179, 362 m.

Ilyarachna acarina, 2999, 454 m.

Jaeropsis dubia paucispinis, 6781, 116 m.

Tanner Canyon (9 species)

Acanthomunna tannerensis, n. sp., 6833*, 813 m.

Bathura luna, n. gen., n. sp., 6832*, 1298 m.

Cirolana californiensis, n. sp., 6833, 813 m.

Desmosoma symmetrica, n. sp., 6836*, 469 m.

Gnathia crenulatifrons, 6832, 1298 m.

Haliophasma geminata, 6835, 298 m.

Ilyarachna profunda, n. sp., 6832, 1298 m.

Microarcturus tannerensis, n. sp., 6832*, 1298 m.

Synidotea calcarea, n. sp., 6833*, 813 m.

ASELLOTA
PARASELLOIDEA
MUNNIDAE

Acanthomunna Beddard

Acanthomunna tannerensis, n. sp.

(Plate 1)

Diagnosis: Body (except cephalon) covered with large spines which appear to be jointed but are not. Body without pigment; two and one-half times as wide as head at widest point. Pleotelson at widest point about two-thirds as wide as body, becoming abruptly narrow, ending in slightly convex, arched margin with two posterolateral short spines. Cephalon abruptly narrower than peraeon and with large non-stalked eyes. All coxal plates visible in dorsal view except seventh, which is under the upwardly bent pleotelson. Narrow stem connecting peraeon and pleon. Peraeopods two to seven at least one and one-half times as long as body and covered with many spines. Peraeopod one shorter than body with many stout setae; modified for grasping. Dactylus of all peraeopods with one large claw each. Antenna one shorter than body, ending in seven articles of very nearly equal length. Second antenna about twice length of body with about 40 flagellar articles. Maxilliped with long palp and three coupling hooks on endite. Mandible with toothed incisor and setal row of sensory setae; palp with three segments ending in several long setae. Uropod very large with basal segment about as long as width of pleotelson and with exopod and endopod about as long as basal segment. (The type species figured was beginning to molt the anterior part of its body).

Measurements: Holotype female 3.5 mm long. = LACM 60-76.4

Type locality: 6833 (3); Tanner Canyon; 813 m; Jan. 29, 1960; green mud and sand. Lat. 32° 37' 54"N, Long. 118° 58' 40"W.

Distribution: Known only from type locality.

Affinities: *Acanthomunna tannerensis* is very much like *A. hystrix* (Hansen, 1916) except that it has fewer articles on its first antenna and a different setal pattern.

Munna Krøyer

Munna spinifrons Menzies and Barnard

Munna spinifrons Menzies and Barnard, 1959, pp. 13, 14, fig 7.

Materials examined: 6805(3); 6806(2).

Distribution: About 220 m in Santa Cruz Canyon near the region described by Menzies and Barnard (1959).

DESMOSOMIDAE

The definition of this family by Menzies (1962b) should be modified slightly to include species in which the last three peraeonal segments have coxal plates visible in the dorsal view.

Desmosoma G. O. Sars**Desmosoma symmetrica, n. sp.**

(Plate 2)

Diagnosis: Eyeless, pigmentless. Antennal bases deeply set into the cephalon. Anterior edge of cephalon very slightly convex. Third peraeonal segment widest, general body outline gradually tapering towards anterior and posterior ends. Coxal plates visible and acutely pointed on anterolateral edges of first four peraeonal segments. Coxal plates visible on posterolateral edges of last three peraeonal segments. Peraeonal segment five about as long as wide. Pleotelson of single segment with large posterolateral teeth; posterior edge obtusely pointed. Peraeopods, except first, furnished with plumose setae. First peraeopod with stout setae; not modified for swimming; and with one large carpal seta extending half length of propodus. Antenna one with three flagellar articles; antenna two with 12 or 13 articles. Maxilliped with three coupling hooks; triarticulate palp with last segment small and tipped with setae; molar process replaced by tuft of setae. Uropods biramous; exopod very small, endopod with plumose setae.

Measurement: Holotype female with marsupium 3.2 mm long. = LACM 60-77.2

Type locality: 6836(1); Tanner Canyon; 469 m; Jan. 29, 1960; green mud with shale fragments. Lat. 32° 36' 00"N, Long. 119° 05' 18"W.

Distribution: Known only from type locality.

Affinities: The new species is similar to *Desmosoma gracilipes* Hansen (1916), but differs from it in that the coxal plates of peraeonal segments five to seven are visible and the uropods are biramous. It is also similar to *D. tenuimana* Sars (1899), but *D. tenuimana* lacks posterolateral spines on the pleon and does not have the coxal plates visible on peraeonal segments five to seven.

EURYCOPIDAE

Eurycope californiensis, n. sp.

(Plate 3)

Diagnosis: General body configuration oval-oblong with all peraeonal segments distinct. Frontal area of cephalon with acutely rounded medial projection. Pleotelson of one segment; longer than wide, with posterior angle obtusely rounded. Anterolateral edges of first four peraeonal segments acutely pointed and segments of about same size. Next three peraeonal segments with less acute points; seventh segment longest and largest. Antennae missing, but base of first antenna flattened with two spines which project forward. Maxillipedal palp very reduced in size; endite with four coupling hooks. Molar process of mandible with many teeth; incisor with only three teeth; last segment of palp with many setae; second segment of palp with row of spines. Uropods missing.

Measurements: Holotype female 3.5 mm long. = LACM 60-89, 1

Type locality: 7032(2); Newport Canyon; 478 m; May 5, 1960; green mud and gray sand, some very coarse sand. Lat. 33° 31' 28"N, Long. 117° 54' 58"W.

Materials examined: 7032(2). Two females.

Distribution: Known only from the type locality.

Affinities: The species is similar to *Eurycope magalura* Sars (1899) but *E. magalura* has a maxillipedal palp of normal dimensions, whereas the maxillipedal palp of *E. californiensis* is greatly reduced in size. The frontal projection of the cephalon is notched in *E. magalura*, but not in the new species.

ILYARACHNIDAE

Ilyarachna G. O. Sars**Ilyarachna acarina Menzies and Barnard**

Ilyarachna acarina Menzies and Barnard, 1959, pp. 9, 10, fig. 2.

Ilyarachna acarina Schultz, 1964, p. 310.

Materials examined: 2725(2); 2727(1); 2793(2); 2999(2); 3385(19); 6805(2); 6806(3); 6845(2); 7174(10).

Remarks: The species was taken within the depth and distribution extremes listed by Menzies and Barnard (1959).

***Ilyarachna profunda*, n. sp.**

(Plate 4)

Diagnosis: Eyeless, pigmentless. No buccal mass visible from dorsal view. Cephalon longer than and about as wide as first peraeonal segment. First peraeonal segment narrowest of all. Inconspicuous spines on anterior edges of first four peraeonal segments. Small setae on lateral margins of four anterior segments and also on anterolateral margin of pleotelson. Peraeopods probably in general like those of co-generic species, but only first ambulatory pair present on specimens examined. Propodus and distal half of long carpus of first peraeopod with few short spines. Proximal half of carpus, merus and basis with large spines. First antenna with flagellum of approximately 28 articles; second antenna missing on specimens examined. Several plumose setae on first antenna. Maxilliped with four coupling hooks on endite; palp with five segments and large spines. Mandible with triarticulate palp; incisor with few teeth; and molar process with at least four large spines. Second male pleopod with large copulatory organ with long recurved intrusive process. Uropods missing.

Measurements: Holotype male 3.0 mm long. Lengths of females to 3.8 mm. ↗ = LACM 60-87.2

Type locality: 7047(1); La Jolla Canyon; 793 m; May 7, 1960; green silty mud with sand. Lat. 32° 54' 21"N, Long. 117° 29' 53"W.

Materials examined: 5639(2); 6820(1); 6832(1); 7047(1); 7949(1).

Distribution: The species is found in the more southern canyons and was taken between 461 and 1298 m.

Affinities: The general appearance of the new species is much like that of *Ilyarachna clypeata* (Sars, 1899). Both species have a multiarticulate first antennal flagellum of approximately 28 articles. It could also be confused with *I. acarina* Menzies and Barnard (1959), but lacks conspicuous spines on the anterior edges of the peraeonal segments. The male sexual appendage is long and recurved in the new species, and is short and thick in *I. acarina*.

JAEROPSIDAE

Jaeropsis Koehler***Jaeropsis concava*, n. sp.**

(Plate 5)

Diagnosis: Lateral body outline concave, segment five narrowest. Pigmentless except for small eyes of approximately seven ocelli. Small

dactylus on pereopod one with several small spines; large setal spine on merus. First antenna with six segments; few scales on outer margin of first segment. Lateral margin of pleotelson with spines and setae. Maxillipedal palp of five segments; endite with few sensory spines on upper edge. Mandible with handlike toothed incisor; long molar process. Palp triarticulate, proximal segment with at least three setae; middle with at least six and distal segment with comblike row of setae. At least 10 sensory setae in setal row. Uropods with two minute appendages. Base of uropod with medially pointing recurved hook.

Measurements: Holotype male 3.1 mm long. = LACM 59-147.2

Type locality: 6806(2); Santa Cruz Canyon; 221 m; Dec. 22, 1959; rocks and coarse green sand. Lat. 33° 56' 06"N, Long. 118° 52' 17"W.

Distribution: Known only from the type locality.

Affinities: Close to *Jaeropsis dubia paucispinis* Menzies (1951) but longer, thinner and completely without pigment. The eyes are much smaller, and there are six rather than five segments on the first antenna. The number of spines and setae along the edge of the pleotelson is less than in *J. dubia*. *J. dubia* rarely was found below 90 m.

Jaeropsis dubia paucispinis Menzies

Jaeropsis dubia paucispinis Menzies, 1951, p. 155, fig. 30, a, e.

Jaeropsis dubia paucispinis Menzies and Barnard, 1959, p. 11.

Materials examined: 6781(1).

Distribution: Santa Monica Canyon at 116 m within the depth and distribution extremes previously described by Menzies and Barnard (1959).

JANIRIDAE

Janiralata Menzies

Janiralata solasteri (Hatch)

Janira solasteri Hatch, 1947, p. 172, figs. 158-160.

Janiralata solasteri Menzies, 1951, pp. 132-135, figs. 23, e, f, 24.

Janirilata [sic] *solasteri* Menzies and Barnard, 1959, p. 11, fig. 5.

Materials examined: 6805(5); 6806(2).

Distribution: About 220 m in Santa Cruz Canyon. The species has been found previously from Alaska to Southern California.

NANNONISCIDAE

Nannonisconus, n. g.

Diagnosis: Nannoniscidae with last peraeonal segment fused to pleon. Pleon of single somite and at widest point wider than cephalon or peraeon. Lateral outline of body concave. First antenna extending only slightly anterior of cephalon, with bulbous organ attached to apical article. The male first pleopods are different from all other Nannoniscidae in that they are not apically pointed and the proximal part is much narrower than the medial or distal part. Uropods biramous. *Nannonisconus* is very much like *Nannoniscus* G. O. Sars, but the last two peraeonal segments are fused in *Nannoniscus*, whereas the last peraeonal segment and the pleotelson are fused in *Nannonisconus*. The new genus also has a much broader pleotelson. The type species is *N. latipleonus*.

Nannonisconus latipleonus, n. sp.

(Plate 6)

Diagnosis: Eyeless, pigmentless. Cephalon large with large antennal bases. Anterior edge of cephalon with concave margin. Body outline concave, narrowest part anterior part of longest peraeonal segment five. Peraeonal segment one widest peraeonal segment. Posterior third of pleotelson equals widest part of body. Margin of posterolateral edge of pleotelson with large tooth; posterior margin with large bilobed extension. All peraeopods similar to first. Antenna one with bulbous apical segment and many plumose setae. Second antenna missing. Male first pleopodal opercular lamella with enlarged posterior edge with many marginal setae. Male second pleopod with large copulatory organ with short posterior intrusive part. Maxillipedal endite with three coupling hooks. Mandibular palp with three segments. Mandible with tuft of setae replacing molar process. Uropods biramous; exopod shorter than endopod, both with plumose setae.

Measurements: Holotype male 2.8 mm long. → LACA 54-55.1

Type locality: 2793(1); Redondo Canyon; 465 m; May 22, 1954; blue-gray mud and large rocks. Lat. 33° 48' 00"N, Long. 118° 32' 00"W.

Distribution: Known only from the type locality.

Affinities: The species differs from other Nannoniscidae in that there are spines on each of the anterolateral margins of the first four peraeonal segments. The most striking difference is that the pleotelson is proportionately wider. The coxal plates of segments five to seven show in the dorsal view.

PLEUROGONIIDAE

Pleurogonium G. O. Sars**Pleurogonium californiense** Menzies

Pleurogonium californiense Menzies, 1951, pp. 139-143, figs. 25, 26.

Pleurogonium californiense Menzies and Barnard, 1959, pp. 14, 15, fig. 8.

Materials examined: 3385(3).

Distribution: Found in Redondo Canyon at 120 m in fine sandy mud not far from where it was reported by Menzies and Barnard (1959).

FLABELLIFERA

ANTHURIDEA

ANTHURIDAE

Bathura, n. g.

Diagnosis: Eyeless. Dorsal pits and paired statocysts present. Peraeopod one subchelate, enlarged palm with proximal low curved tooth with many lateral setae. Hand of peraeopod four forming strait joint with propodus; carpus slightly underlying propodus on peraeopods five to seven. Carpus about one-half length of propodus on peraeopods four to seven. Peraeopods four to seven laterally compressed. Pleonal segments distinct. Endopod of uropod longer than telson. Telson with pair of statocysts, pointed and with marginal row of several apical setae. Two ridges on telson with medial groove continuous with medial groove of pleonal segment six. Lateral edges of pleonal segments visible in dorsal view. Both first and second antennae with few flagellar articles. *Bathura* is most like *Ananthura*, K. H. Barnard (1925), from which it differs in general pattern of peraeopodal hand with a tooth on palm, and characteristic pattern of setae on apex of telson and uropodal rami, without any conspicuous serrulations on outer margins on endopod. The type species is *B. luna*.

Bathura luna, n. sp.

(Plate 7)

Diagnosis: Eyeless, without pigment; peraeon smooth but with dorsal pits on segments four to seven with two lateral pits on seven. Medial rostral projection not extending as far forward as anterolateral projection. First peraeonal segment about two-thirds as long as fifth;

seventh segment shorter than first. Pleonal segments distinct; lateral edges visible in dorsal view, especially last few. Peraeopods one and two somewhat chelate, but not three to seven. Segment five of peraeopod seven about half as long as segment six. Nine flagellar articles on second antennae; five on first. Maxilliped with palp of five (four free) segments. Mandible with palp of three segments, apical one with large spine and comb of setae and second one with at least one large seta. Telson with pair of statocysts and two ridges running about one-half proximal length with medial groove between ridges continuous with groove of sixth pleonal segment. Uropodal endopod longer than telson; tips of both exopod and endopod with tuft of many long stiff setae originating from apex of margins.

Measurements: Holotype female with marsupium 21 mm long. → LACM 60-80.1

Type locality: 6832; Tanner Canyon; 1298 m; Jan. 29, 1960; green mud. Lat. 32° 33' 36"N, Long. 118° 55' 40"W.

Materials examined: 6832(10); 6851(1); 7047(1).

Distribution: The species was caught in the most southern canyons, at 783 m in La Jolla Canyon and at 812 m in Coronado Canyon, in addition to the type locality.

Affinities: See generic description.

Haliophasma Haswell

Haliophasma geminata Menzies and Barnard

Haliophasma geminata Menzies and Barnard, 1959, pp. 17-19, figs. 11, 12.

Haliophasma geminata Schultz, 1964, p. 312.

Materials examined: 2361(2); 2725(7); 2727(2); 2789(4); 2793(1); 2999(1); 3000(2); 3179(1); 3385(5); 6805(1); 6806(1); 6835(1); 6845(2); 6846(2); 7038(1); 7052(1); 7174(12); 7175(1).

Distribution: The species was taken within the depth ranges previously recorded, but further south (Coronado Canyon) than previously recorded.

Remarks: The mouth parts are chewing, not piercing and sucking as recorded in Menzies and Barnard (1959, p. 17).

CIROLANOIDEA

CIROLANIDAE

AEGINAE

Aega Leach**Aega lecontii (Dana)**

Aegacylla lecontii Dana, 1854, p. 177.

Aega lecontii Richardson, 1905, pp. 176, 177; figs. 158, 159.

Materials examined: 6805(1); Large female, 13 mm long.

Distribution: The species was previously taken in Monterey Bay, California, and is here reported from near that locality, Santa Cruz Canyon, at 218 m.

Eurydice Leach**Eurydice branchuopus Menzies and Barnard**

Eurydice branchuopus Menzies and Barnard, 1959, p. 32, figs. 26, 27.

Materials examined: 7038(1).

Remarks: The specimen was taken in La Jolla Canyon at 121 m, which is the deepest and furthest north that the species has been taken. Examination of this and other specimens, including the type in the Allan Hancock collection, reveals that the uropods are truncate, not rounded. This is different from what is stated by Menzies and Barnard (1959, p. 32).

Rocinela Leach**Rocinela belliceps (Stimpson)**

Aega belliceps Stimpson, 1864, p. 155-56.

Rocinela belliceps Hatch, 1947, pp. 209, 210, figs. 66-69.

Materials examined: 6806(3). Three female specimens, two ovigerous. Largest 12 mm long.

Remarks: The specimens were taken as parasites on fish. The species was previously taken from off San Diego and at Cortes Bank (off southern California) to Alaska (Richardson, 1905; Hatch, 1947).

CIROLANINAE

Cirolana Leach**Cirolana californiensis, n. sp.**

(Plate 8)

Diagnosis: Eyeless, body without pigment. Cephalon set into the first pereopod segment. General body outline oblong-oval, becoming

narrower after the seventh peraeonal segment. Coxal plates present on segments two to seven (only four to seven visible in dorsal view). Coxal plates more acutely pointed and extended farther backward in the more posterior segments. The coxal plate extensions of segment seven enclose first pleonal segment within their lengths. Five pleonal segments distinct with lateral edges of first four visible. Lateral edges of pleonal segment five enclosed under largest pleonal segment four. Lateral extensions of pleonal segments not recurved. Telson pointed with serrated lateral margins. Uropodal base with produced medial margin; exopod and endopod both pointed with spines and plumose setae along the serrated margins. All peraeopods ambulatory although last four are laterally compressed with long plumose setae originating on margin of basis; setae about as long as basis is wide. Many large plumose setae also originate on distal end of basis extending to middle of propodus. All other segments with some setae; dactylus minute. Antennae one with nine flagellar articles; antennae two with about 16 articles. Maxillipedal palp with three segments, endite very small. Mandible with toothed incisor, large lacinia mobilis, large toothed mandibular process. Palp with three articles, last two with many setae.

Measurements: Holotype female 8.0 mm long. U.S. N.M. 60-57.4

Type locality: 6851; Coronado Canyon; 812 m; Feb. 1, 1960; green mud. Lat. 32° 37' 54"N, Long. 118° 55' 40"W.

Materials studied: 6833(3); 6851(1).

Distribution: The species was taken in Tanner Canyon (at 813 m) and in Coronado Canyon from green muddy sand and green mud.

Affinities: The species differs from *Cirolana cubensis* Hay (Richardson, 1905), another blind species, in that its fourth pleonal segment is much wider and the apex of the telson is pointed. It is most like *C. gracilis* Hansen (Richardson, 1905), but *C. gracilis* has more definite peraeonal coxal plates and is not blind.

***Cirolana joanneae*, n. sp.**

(Plate 9)

Cirolana joanneae Schultz, 1964, p. 314, *nomen nudum*.

Diagnosis: Red eyes of moderate size. General body shape ovoid with truncate posterior margin. All body segments distinct and, with exception of pleonal segment one, with pointed posterolateral edges. Peraeonal segments two to seven with distinct coxal plates. Coxal plates forming lateral extensions, each anterior one extending laterally more than that of the preceding segment and continuous in general body outline with the recurved pleonal segment extensions. Pleonal segment five

shorter than others, but with lateral recurved extensions showing in the dorsal view. Telson with squarish posterior edge with medial ridge most of length of segment ending in medial spine. Other spines also present along margins; medial spine longest, medial lateral spines shorter and series of even shorter spines along the lateral edges of telson. Peraeopods all ambulatory with many stout setae. Eight flagellar articles on first antenna; 12 on second. First antenna extends to edge of first peraeonal segment; second to edge of third. Maxilliped with two large plumose setae on endite; many spines on segments of palp. Mandible with toothed incisor, small lacinia mobilis, and toothed molar process. Palp with three articles and apical setae; second article also with many setae. Uropodal base with produced inner angle; exopod about one-half as wide as endopod, but not extending as far posteriorward. Fringe of short plumose setae on margin on uropodal processes; telson with some larger plumose setae.

Measurements: Holotype female 3.0 mm long. = LACM 59-149.4

Type locality: ⁶⁸⁰⁵6806; Santa Cruz Canyon; 218 m; Dec. 22, 1959, rocks and some green sand. Lat. 33° 35' 59"N, Long. 119° 15' 11"W.

Materials examined: 6805(1); 6806(3).

Distribution: Santa Cruz Canyon at 218 m.

Affinities: The species can be distinguished from others of the genus by the general configuration of the telson with its medial ridge and pattern of spines, and by the recurved lateral extensions of the pleonal segments. It can be distinguished from *Cirolana harfordi* from the southern California maritime (Richardson, 1905) by the last pleonal segment, the lateral edges of which are not visible in the dorsal view.

GNATHIOIDEA

GNATHIIDAE

Gnathia Leach

Gnathia crenulatifrons Monod

Gnathia crenulatifrons Monod, 1926, pp. 390-393, figs. 154, 155.

Gnathia crenulatifrons Menzies and Barnard, 1959, pp. 27-29, fig. 22.

Gnathia crenulatifrons Schultz, 1964, p. 314.

Materials examined: 2361(10); 2789(2); 3000(1); 3180(2); 6823(1); 6832(1); 7054(6); 7174(9). (The numbers recorded are for males only.)

Distribution: Found within the depth and distribution ranges recorded by Menzies and Barnard (1959).

Gnathia clementensis, n. sp.

(Plate 10)

Diagnosis: Eyes of medium size and stalked. Cephalon wider than long with many large tubercles. Entire width of peraeonal segment one barely visible in dorsal view. Frontal margin of cephalon with two medial lateral projections and with at least four small lobes on the median anterior projection. First three peraeonal segments and anterior part of fourth covered with tubercles. Body, especially anterior part, with many long hairlike setae. Pleonal segments with some tubercles and with two sets of pointed lateral projections. Pylopod triarticulate with minute apical segment; many large plumose setae along medial margin of opercular segment. First walking peraeopod with two sensory spines on propodus and one on carpus. Antenna one with seven flagellar articles; antenna two with five articles. Maxilliped with many large plumose setae along lateral margin; blade with two coupling hooks; blade slightly longer than third segment. Mandible large, when extended forward about three-fourths length of cephalon; cutting edge inconspicuously toothed. Pleopods without setae. Second male pleopod with small copulatory organ near base of endopod. Uropodal rami with many large lateral setae and with many long plumose setae; endopod longer than telson.

Measurements: Holotype male 8.5 mm long. = LACM 60-82.1

Type locality: 6840(1); San Clemente Canyon; 162 m; Jan. 30, 1960. "Campbell grab took small sample containing manganese nodules". Lat. 32° 44' 35"N, Long. 118° 12' 45"W.

Distribution: Known only from type locality.

Affinities: The new species is somewhat like *Gnathia productatridens* Menzies and Barnard (1959) but differs from it in the general structure of the frons, which is not produced and carries four lobes.

Gnathia coronadoensis, n. sp.

(Plate 11)

Diagnosis: Eyeless. Body smooth without any conspicuous tubercles or hairlike setae. Cephalon longer than wide; posterior part raised with two large dorsolateral projections; anterior part of cephalon greatly depressed. Bottom of cephalic depression with prominent oval ring appearing to communicate with the mouth cavity below. Frontolateral superior process with spinelike setae on margin. First peraeonal segment continuous in outline with cephalon. Lateral margins of pleonal segments bent sharply downwards and slightly incurved. Telson acutely tri-

angulate with several spines on dorsal side. Pylopod with three segments (third minute); whole medial margin with plumose setae. First walking peraeopod with spine on unguis and series of tubercles along inner margin of propodus. Both antennae shorter than cephalon; first with seven flagellar articles; second with five articles. Maxilliped with many large plumose setae; setae longer than width of segment on which located. Mandible large, with lateral marginal notch and many well defined teeth. From lateral view mandibles look especially large because of deep cephalic pit. Pleopods with many plumose setae. Uropodal rami with many long plumose setae; endopod longer than telson.

Measurements: Holotype male 3.5 mm long. = LACM 60-88.1

Type locality: 6851; Coronado Canyon; 812 m; Feb. 1, 1960; green mud. Lat. 32° 30' 42"N, Long. 117° 21' 37"W.

Materials examined: 6849(1); 6851(1).

Distribution: Known only from the two specimens found in Coronado Canyon. The second specimen was taken at 344 m in green mud and gray mud with H₂S smell.

Affinities: The species differs from most of the other *Gnathia* in the lack of conspicuous tubercles and hairs. The two specimens were small uncalcified animals.

***Gnathia hirsuta*, n. sp.**

(Plate 12)

Diagnosis: Eyes prominent, not stalked. Cephalon wider than long, covered with many tubercles. Whole body, especially anterior segments of peraeon, covered with long hairlike setae. Frontal margin of cephalon with acutely rounded medial projection. Frons with some lateral crenulations. Peraeonal segment one continuous in outline with cephalon, but prominent only in mediolateral region. Hairlike setae also found on basis of legs. Pleonal segments each with two (dorsolateral and ventrolateral) projections. Pleonal segment with stiff hairlike setae arising from posterior margins of the segments. Telson long with two pairs of setae, one near apex, another arising from apical margin. Pylopod triarticulate, apical segment minute; medial margin fringed with long plumose setae; ventral side covered with many long hairs. First walking peraeopod with single spine on dactylus. Antennae one and two about as long as cephalon; antenna one with seven flagellar articles; antenna two with five articles. Maxilliped with many plumose setae along lateral margin; two coupling hooks on the blade. Mandible acutely pointed with few teeth and without outer marginal notch. Pleopods without setae.

Uropodal rami both with large plumose setae; endopod about as long as telson.

Measurements: Holotype male about 4.0 mm long. *LACM 52-1092*

Type locality: 6805(1); Santa Cruz Canyon; 218 m; Dec. 22, 1959; rocks and some green sand. Lat. 33° 56' 03"N, Long. 119° 52' 03"W.

Distribution: Known only from type locality.

Affinities: The new species is very similar to *Gnathia crenulatifrons* Menzies and Barnard (1959), except that it has an acutely pointed projection from the anterior margin of the cephalon. The telson of *G. crenulatifrons* is short, not as produced as the telson of *G. hirsuta*.

***Gnathia trilobata*, n. sp.**

(Plate 13)

Diagnosis: Large unstalked eyes. Head with trifold frontal projection with stiff marginal setae. Peraeonal segment one conspicuous; complete width visible in dorsal view. Front half of body covered with many small tubercles, especially prominent on cephalon, anterior four peraeonal segments and postero-lateral border of segment six. Lateral extensions of pleonal segments increasingly more prominent posteriorly in dorsal view; telson produced in acutely rounded apex. Pylopod with three segments (third minute) with long plumose setae on margin and larger plumose setae on ventral side. First walking peraeopod with plumose setae on basis and at least one plumose seta on each segment except dactylus; sensory setae present distally on merus near carpal-meral joint. Both antennae about as long as cephalon; first with seven flagellar articles; second with five articles. Maxilliped with many plumose setae; blade with three coupling hooks, slightly longer than third segment. Mandible with several teeth and outer marginal notch; no setae on mandible. Pleopods without setae. Uropod with many large plumose setae arising from exopod and endopod; endopod and exopod shorter than telson.

Measurements: Holotype male 5.0 mm long. = *LACM 60-8422*

Type locality: 6851; Coronado Canyon; 812 m; Feb. 1, 1960; green mud. Lat. 32° 30' 42"N, Long. 117° 21' 37"W.

Materials examined: 6851(2); 7049(1).

Distribution: Known from Coronado Canyon (type locality) and from La Jolla Canyon where it was taken from a polychaete tube in green sand and mud at 976 m.

Affinities: *Gnathia trilobata* differs from *G. tridens* of Menzies and Barnard (1959) in the presence of a longer frontal projection, and in other characters. It differs from *G. productatridens*, which it resembles most, in the lack of crenulations and setae on the outer marginal notch of the mandibles. No setal hairs arise from the mandibles and the telson is without setal spines.

VALVIFERA

ARCTURIDAE

Microarcturus Nordenstam

Microarcturus tannerensis, n. sp.

(Plate 14)

Diagnosis: Eyeless, pigmentless. Body, including proximal segments of peraeopods, covered with minute hairs. Whole body covered with projecting calcareous spines bearing large beadlike spheres. Cephalon and peraeonal segments with at least two large dorsal projecting spines and several dorsolaterally projecting spines. Last two peraeonal and first two pleonal segments with transverse row of at least six spines. Pleon of three segments, one being only partially separated from the pleotelson. Pleon shorter than last four peraeonal segments and with pointed posterior margin. Pleotelson with many short spines similar to those on peraeon. Two most lateral and posterior spines with large setae. First peraeopod somewhat chelate, bearing many sensory setae on inside margin and large spines on outside margin. First antenna with only four segments; distal segment dorsoventrally flattened, tipped with many setae and three times as long as preceding segment. Second antenna shorter than body, with each peduncular segment longer than preceding, ending in three increasingly shorter flagellar articles. Maxilliped with strongly curved palp carrying many plumose setae. Mandible with toothed incisor.

Measurements: Holotype female 5.5 mm long. = LACM 60-80.2.

Type locality: 6832(1); Tanner Canyon; 1298 m; Jan. 28, 1960; green mud. Lat. 32° 33' 36"N, Long. 118° 55' 40"W.

Affinities: In general appearance the new species is most like *Microarcturus digitatus* Nordenstam (1933), except that the spines do not end in a point but have a beadlike tip. Spinal armature is most like that of *Antarcturus brunneus* as pictured by Nordenstam (1933).

IDOTHEIDAE

Synidotea Harger**Synidotea calcarea**, n. sp.

(Plate 15)

Synidotea calcarea Schultz, 1964, p. 314, *nomen nudum*.

Diagnosis: Abdomen bluntly rounded, spatulate with several small teeth on posterolateral margins. Tubercles in front of eyes and anteromedial tubercles submarginal; dorsum of head bearing two very large conical tubercles. Eyes not stalked, lightly pigmented with few ocelli. Peraeonal segments bearing two or three dorsolateral longitudinal rugae with two large mediolateral tubercles. Whole body covered with fine short hairs and margins of peraeonal segments and cephalon minutely serrated. Pleotelson crossed by three suture lines, indicating presence of four former segments; first pleonal suture continuous with grooves in lateral margins of pleotelson. Peraeopod one with long unguis; dactylus and propodus somewhat chelate. No peraeopods bearing projecting flanges on article two (basis). Antenna one with only four segments; antenna two with five peduncular and six flagellar segments. Maxillipedal palp much wider than endite; endite with several sensory setae. Mandible with toothed incisor; lacinia mobilis with setal row; molar process toothed. Endopod of maxilla one with two sensory projections. Uropods with two sensory dorsolateral setal spines.

Measurements: Holotype female 6.0 mm long. —LACM 60-76.1

Type locality: 6833; Tanner Canyon; 813 m; Jan. 29, 1960; green mud and sand. Lat. 32° 37' 54"N, Long. 118° 58' 40"W.

Materials examined: 6833(3).

Distribution: Known only from type locality.

Affinities: The new species is closely related to *Synidotea magnifica* Menzies and Barnard (1959), but it has fewer ocelli and less pigment and a less rugose appearance. Two very large rounded, conical tubercles are found on the cephalon between the eyes and there are fewer flagellar articles on the second antenna. The pleotelson is widest at the base in *S. magnifica* and at half its length in *S. calcarea*.

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Plate 1

Figure 1. *Acanthomunna tannerensis*, new species. 2. Third Peraeopod. 3. First Maxilla. 4. Second Maxilla. 5. Maxilliped. 6. Mandible. 7. First Antenna. 8. First Peraeopod.

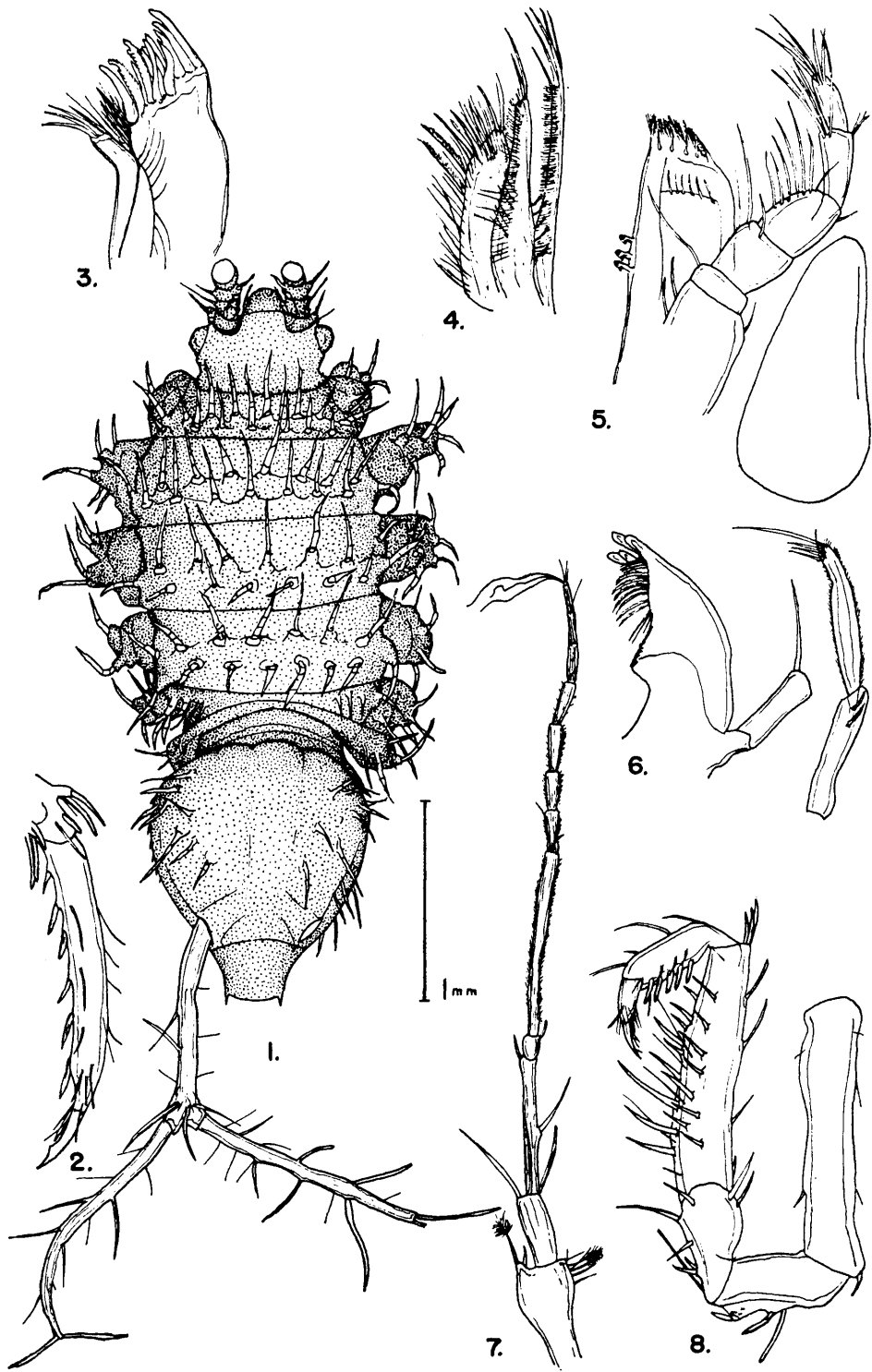


Plate 2

Figure 1. *Desmosoma symmetrica*, new species. 2. Maxilliped (two views). 3. Second Antenna. 4. First Maxilla. 5. Second Maxilla. 6. Mandible. 7. Hypopharynx. 8. First Peraeopod.

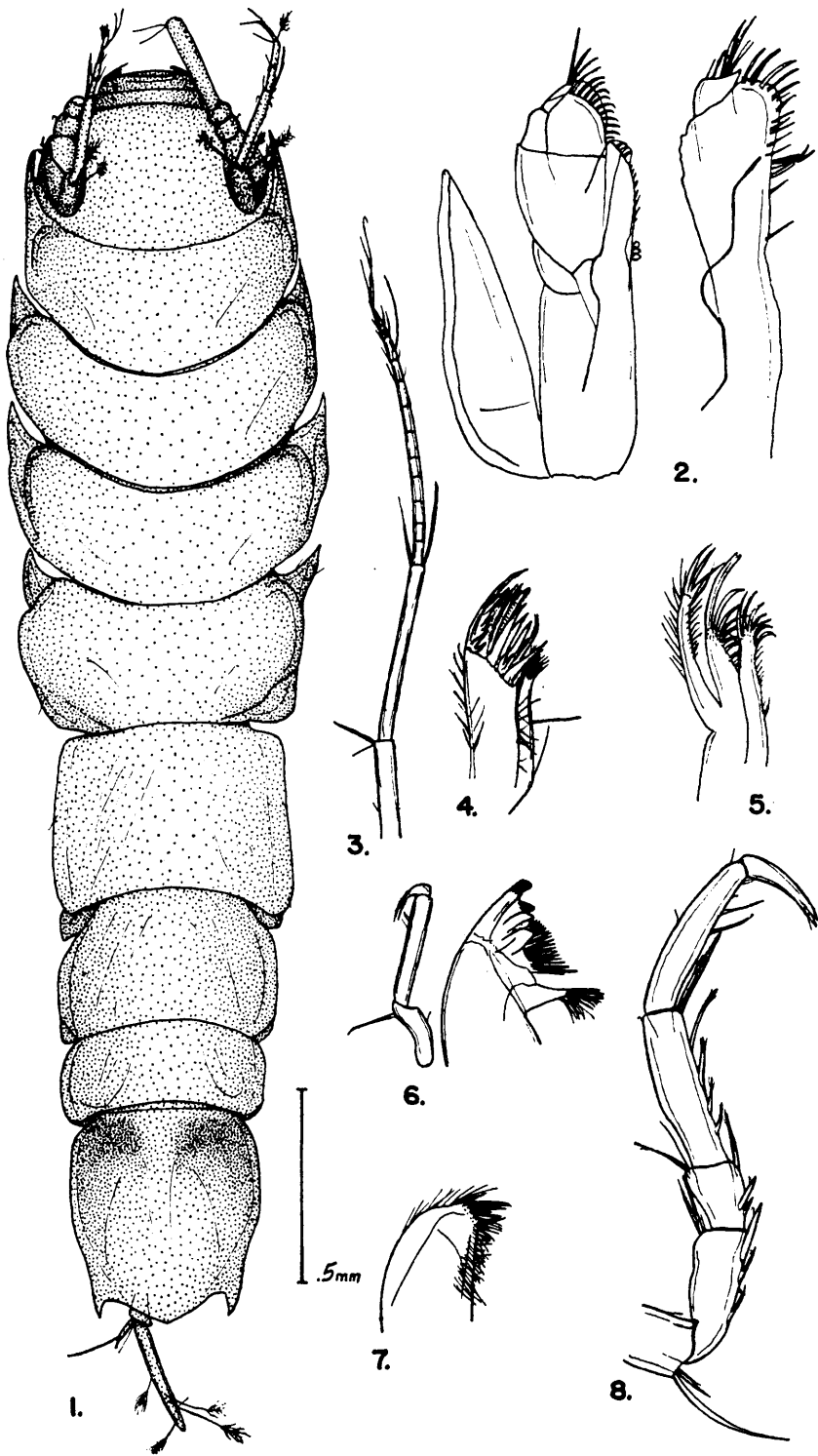


Plate 3

Figure 1. *Eurycope californiensis*, new species. 2. First Maxilla. 3. First Antennal Base. 4. Second Maxilla. 5. Mandible (with detail of molar process). 6. Maxilliped.

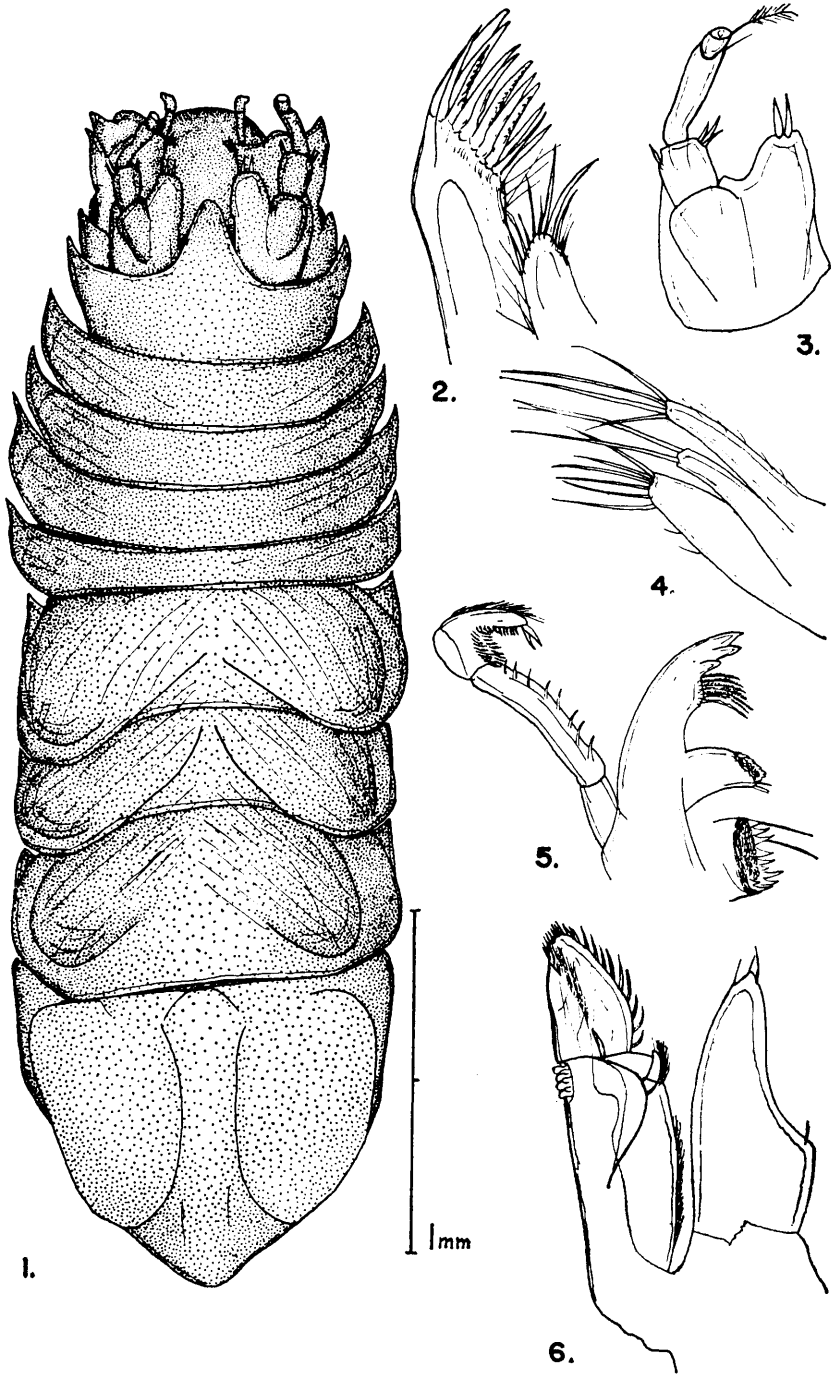


Plate 4

Figure 1. *Ilyarachna profunda*, new species. 2. Mandible. 3. Maxilliped. 4. Second Maxilla. 5. First Maxilla. 6. First Peraeopod. 7. First Antenna. 8. Second Male Pleopod (with copulatory organ). 9. First Male Pleopods (posterior tip).

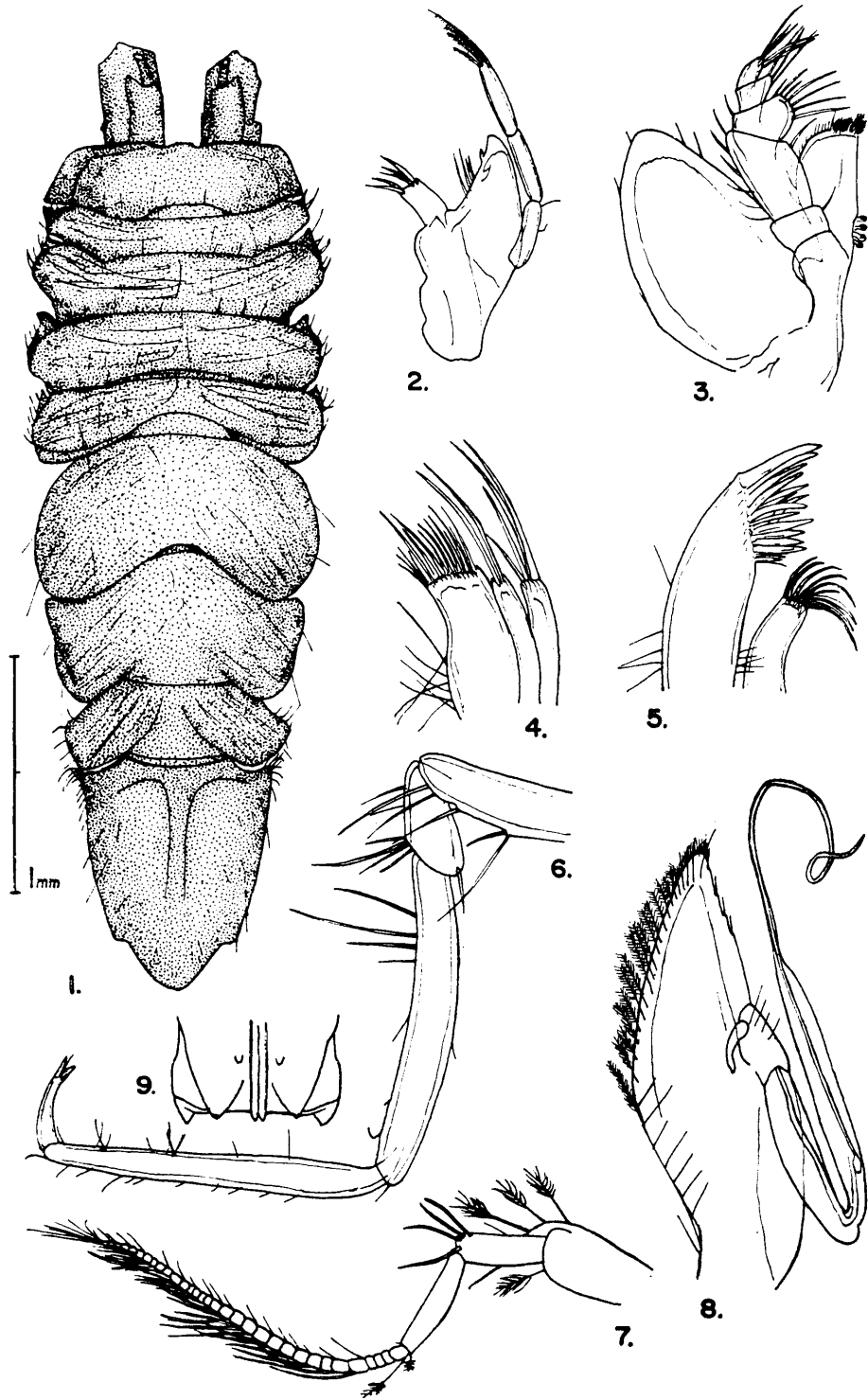


Plate 5

Figure 1. *Jaeropsis concava*, new species. 2. Maxilliped. 3. First Maxilla. 4. Incisor Process of Mandible. 5. Second Maxilla. 6. Mandible. 7. First Antenna. 8. First Male Pleopods. 9. First Peraeopod.

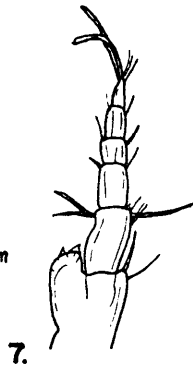
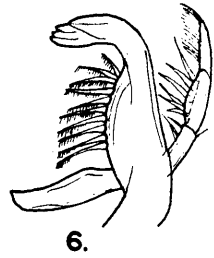
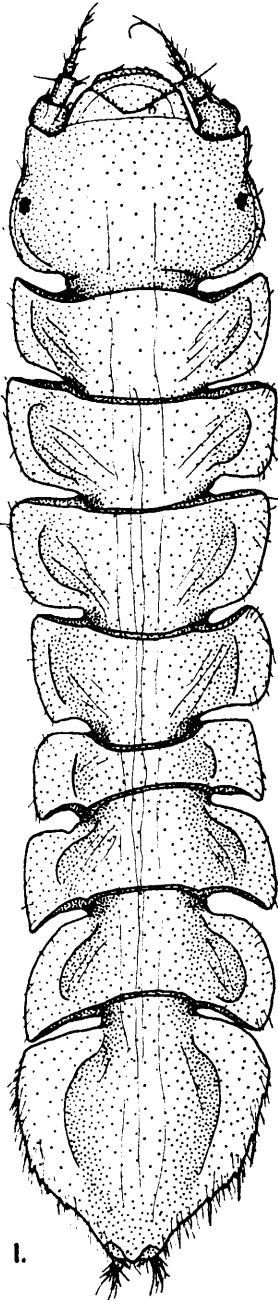


Plate 6

Figure 1. *Nannonisconus latipleonus*, new genus, new species. 2. Maxilliped. 3. First Maxilla. 4. Second Maxilla. 5. Mandible. 6. Hypopharynx. 7. First Antenna. 8. First Male Pleopod. 9. Second Male Pleopod. 10. Uropod. 11. First Peraeopod.

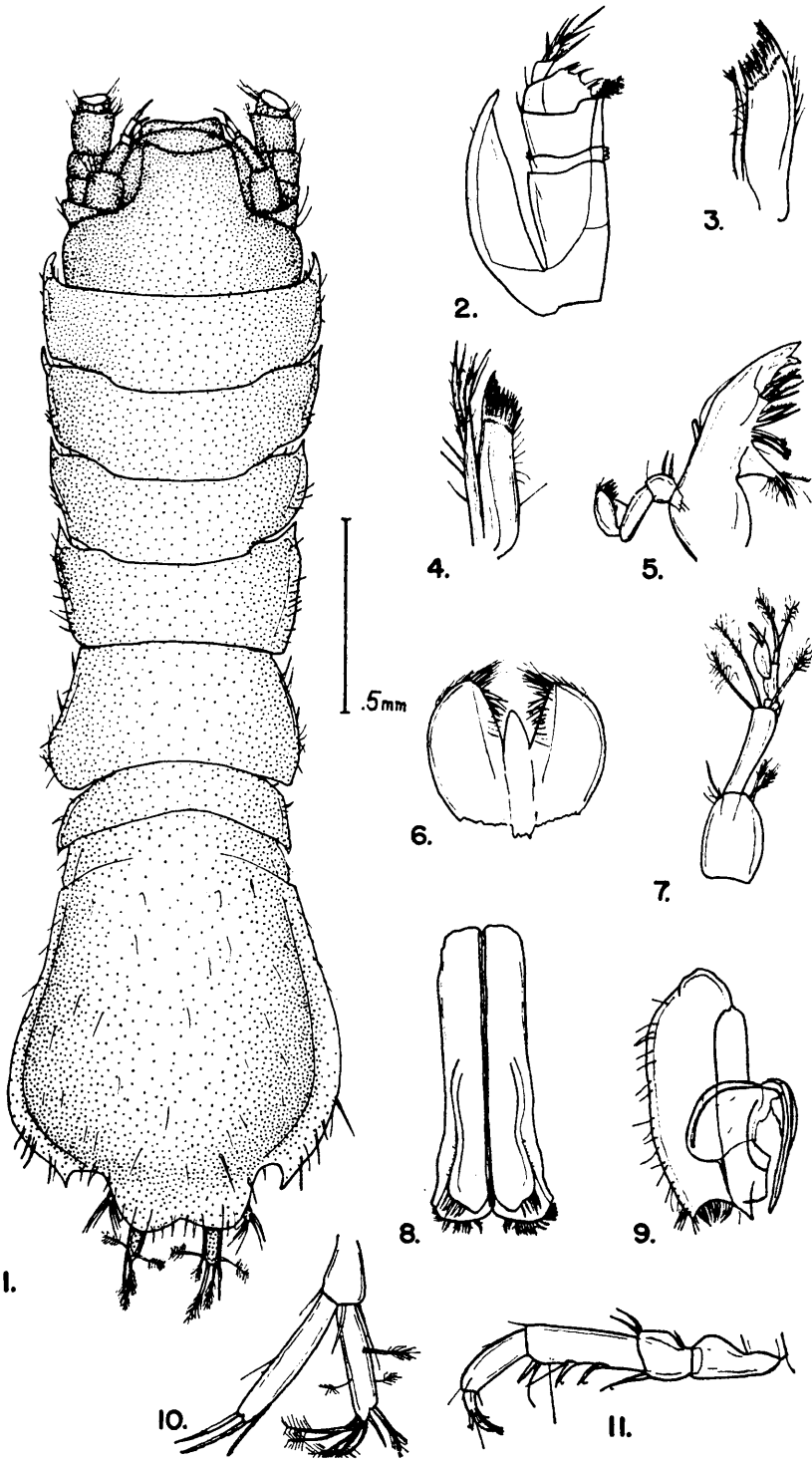


Plate 7

Figure 1. *Bathura luna*, new genus, new species. 2. Maxilliped. 3. Mandible (two views). 4. First Peraeopod. 5. First Maxilla. 6. First (a) and Second (b) Antennae. 7. Second Peraeopod. 8. Sixth Peraeopod. 9. Lateral View of Pleon.

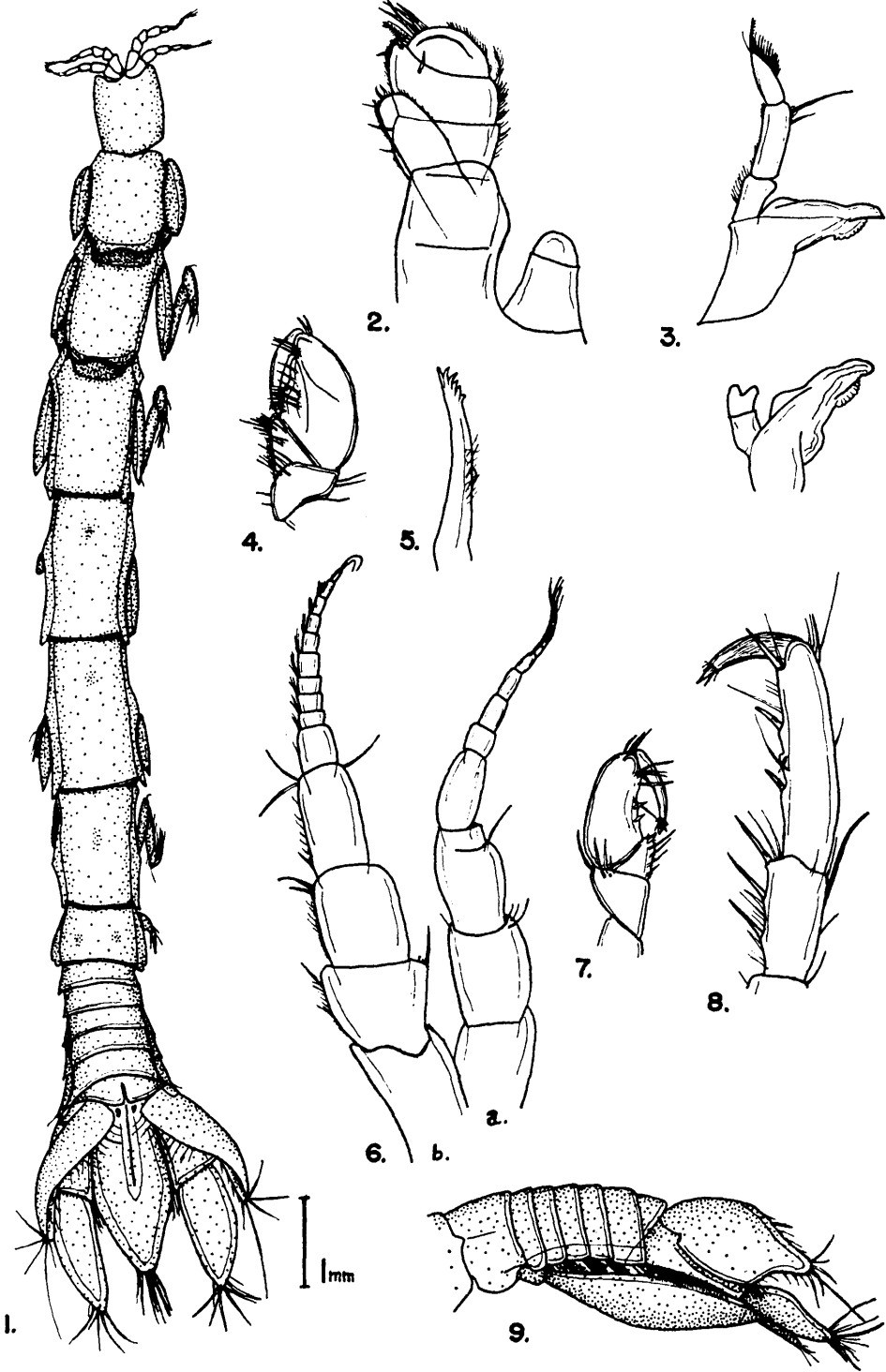


Plate 8

Figure. 1. *Cirolana californiensis*, new species. 2. Maxilliped. 3. First Maxilla. 4. Mandible. 5. Second Maxilla. 6. First Peraeopod. 7. First Antenna. 8. Frontal Lamnia and Clypeus.

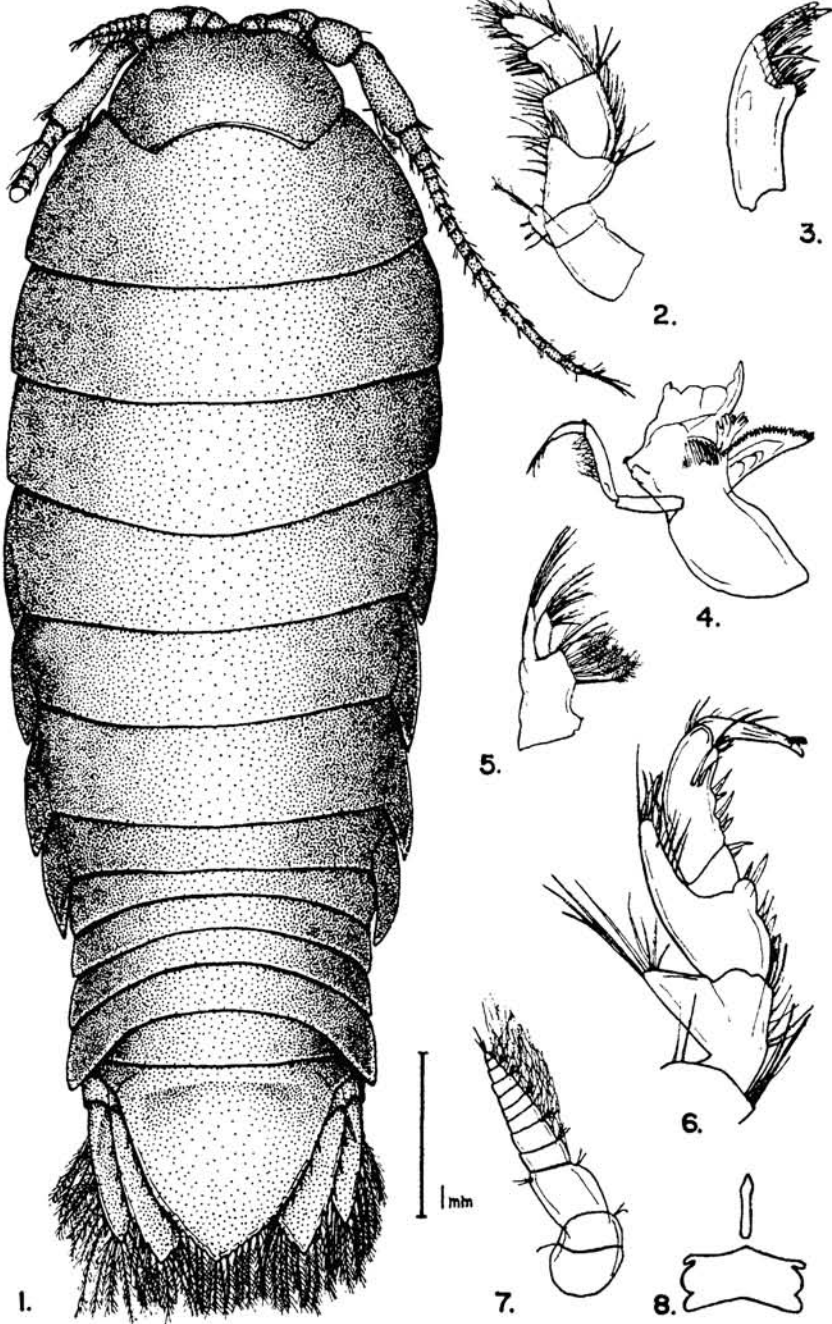


Plate 9

Figure 1. *Cirolana joanneae*, new species. 2. Third Peraeopod. 3. First Peraeopod. 4. First Maxilla. 5. Second Maxilla. 6. Mandible. 7. Maxilliped. 8. Pleopod (female). 9. Frontal View of Antennal Bases, Frontal Lamnia and Clypeus. 10. Uropod.

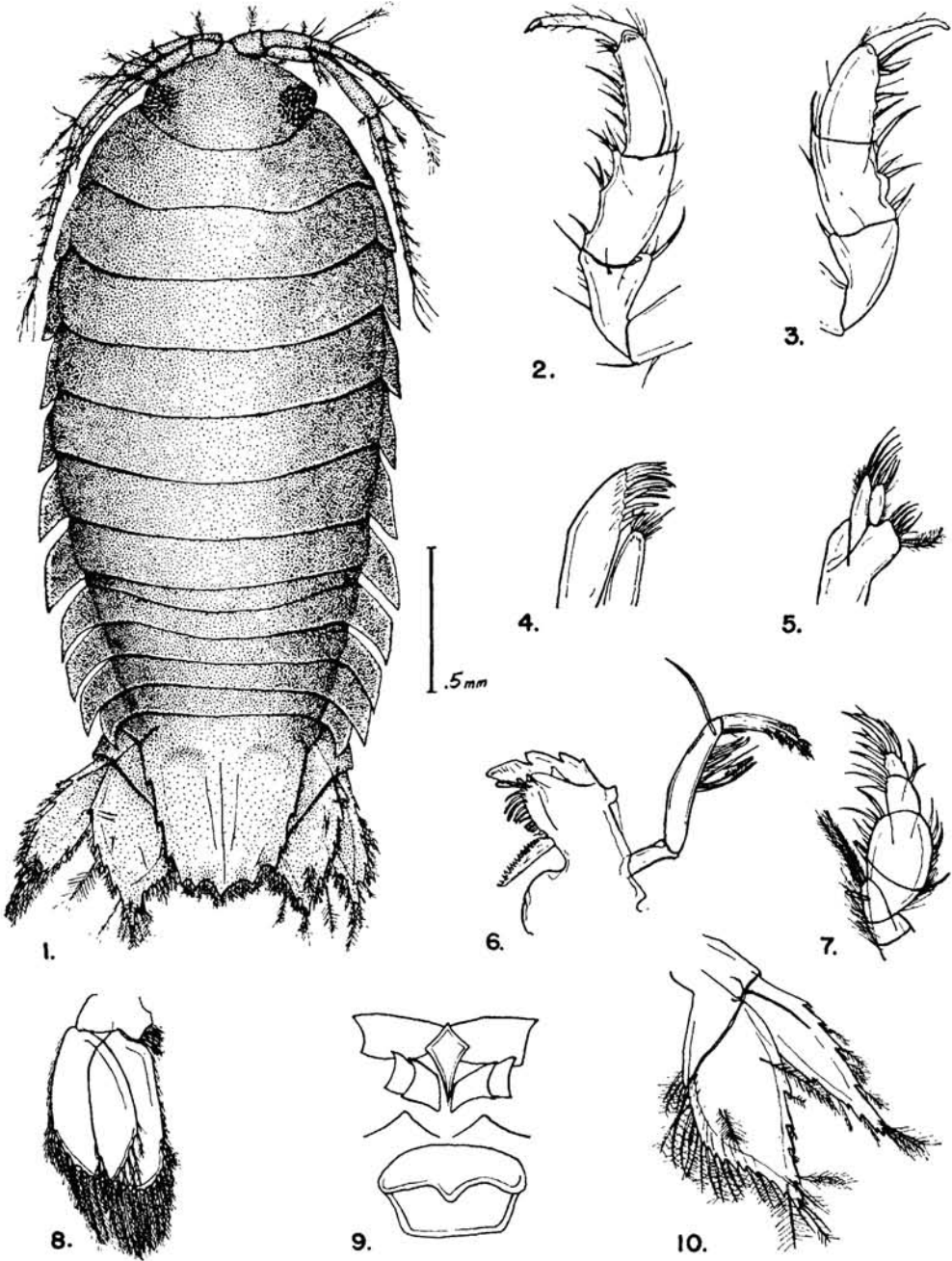


Plate 10

Figure 1. *Gnathia clementensis*, new species. 2. First Antenna. 3. Maxilliped. 4. Second Antenna. 5. Second Pleopod. 6. First Walking Peraeopod. 7. Pylopod.

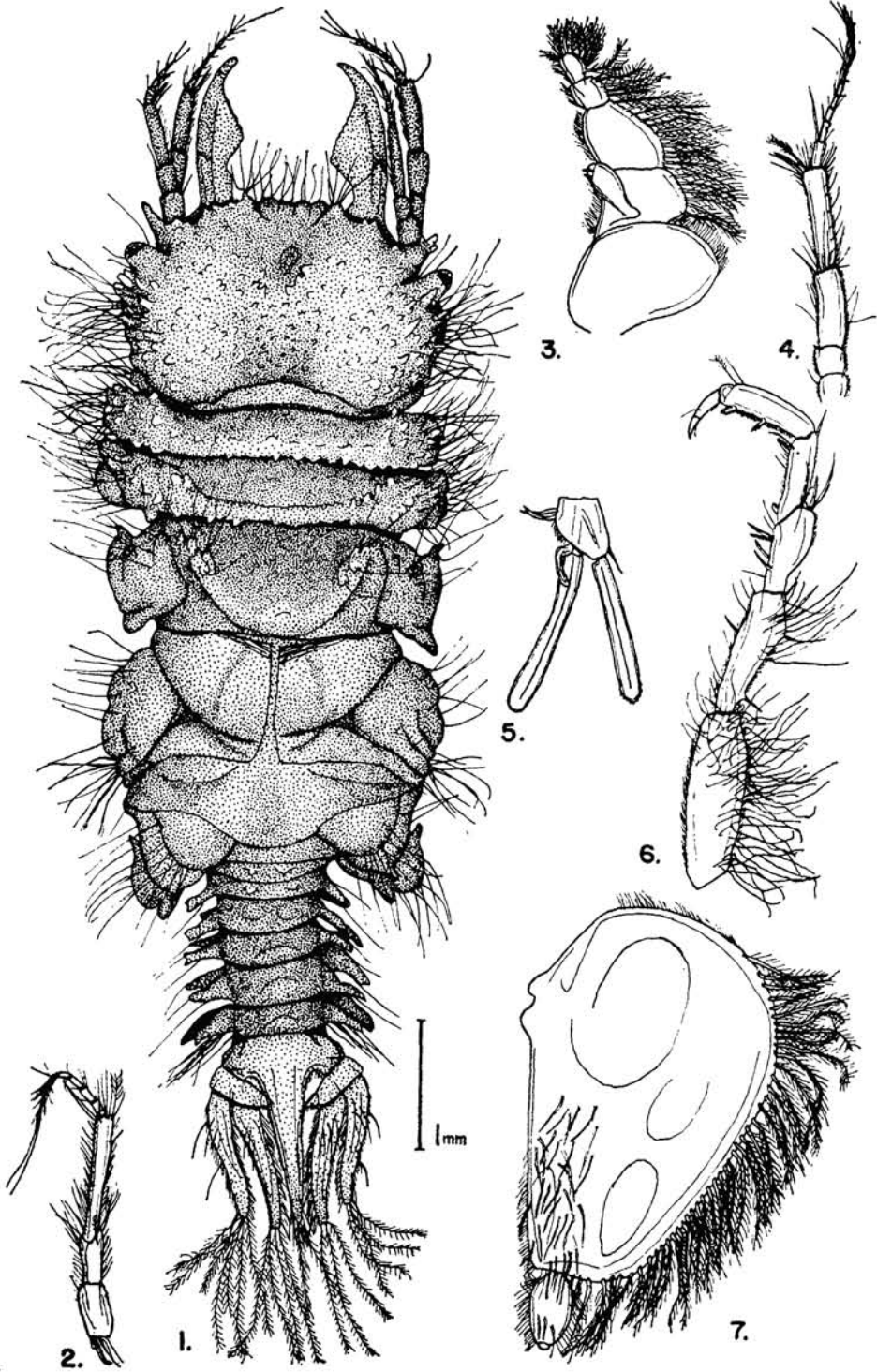


Plate 11

Figure 1. *Gnathia coronadoensis*, new species. 2. Second Antenna. 3. Mandible. 4. Pylopod. 5. Maxilliped. 6. First Antenna. 7. Second Pleopod. 8. Telson and Uropods. 9. First Walking Peraeopod.

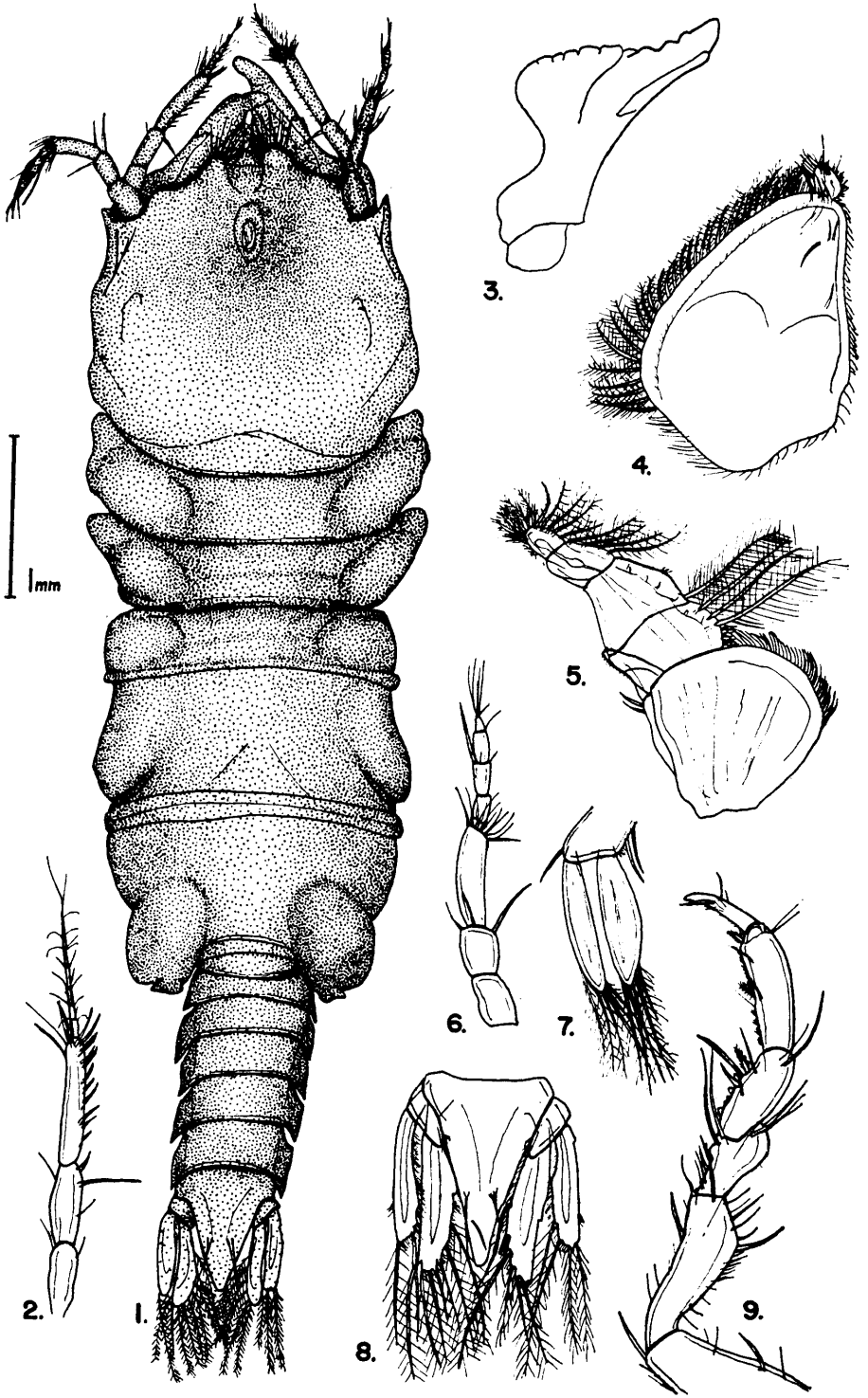


Plate 12

Figure 1. *Gnathia hirsuta*, new species. 2. Second Antenna. 3. Maxilliped. 4. Mandible. 5. Second Pleopod. 6. Pylopod. 7. First Walking Peraeopod. 8. Telson and Uropods (with detail of telson apex).

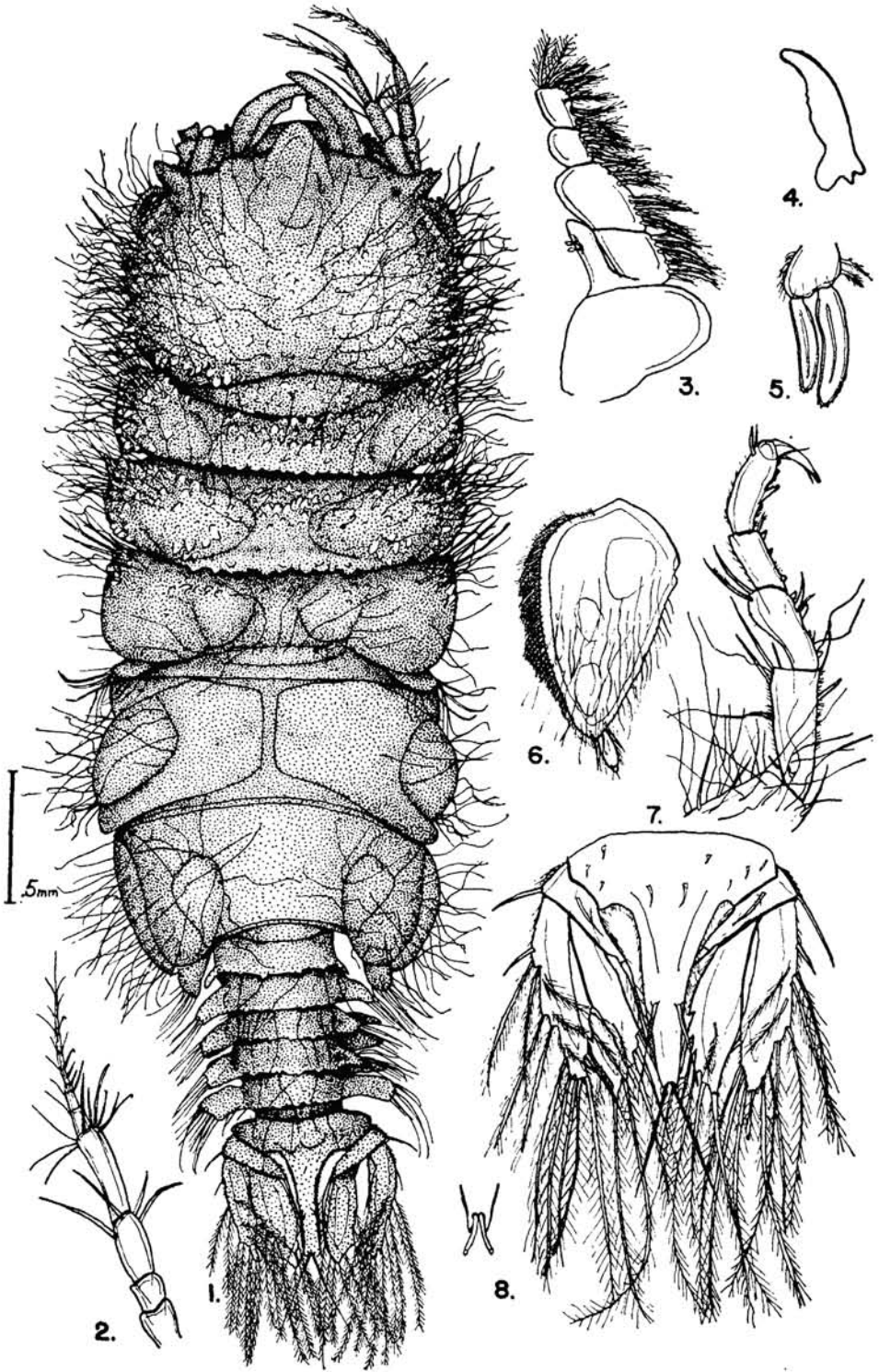


Plate 13

Figure 1. *Gnathia trilobata*, new species. 2. Maxilliped. 3. Mandible. 4. Second Male Pleopod. 5. Pylopod. 6. Second Antenna. 7. First Antenna. 8. First Walking Peracopod. 9. Telson and Uropod.

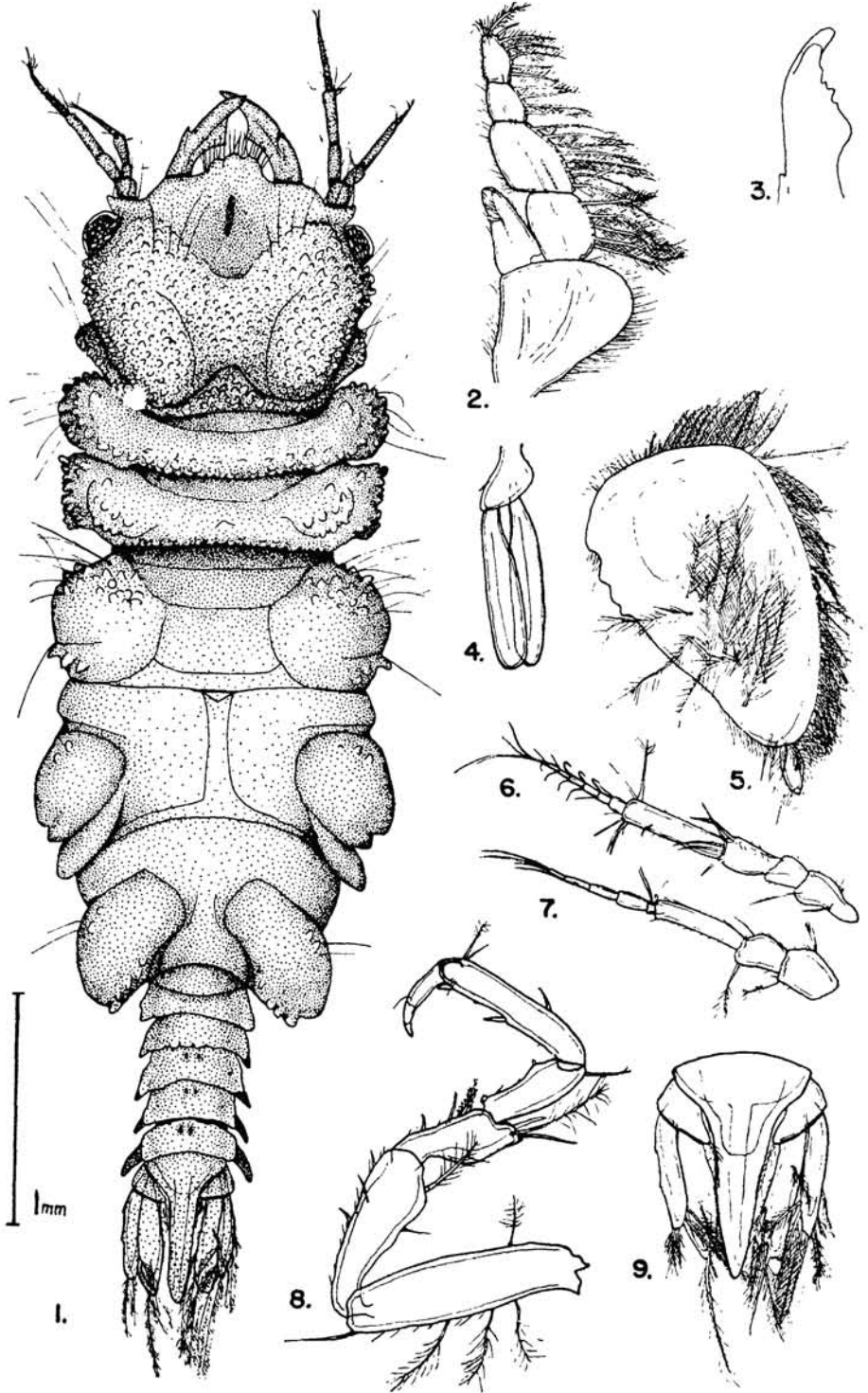


Plate 14

Figure 1. *Microarcturus tannerensis*, new species. 2. Uropod (Valve).
3. Mandible. 4. Maxilliped. 5. First Maxilla. 6. Second Maxilla.
7. First Antenna. 8. Seventh Peraeopod. 9. First Peraeopod. 10.
First Male Pleopods.

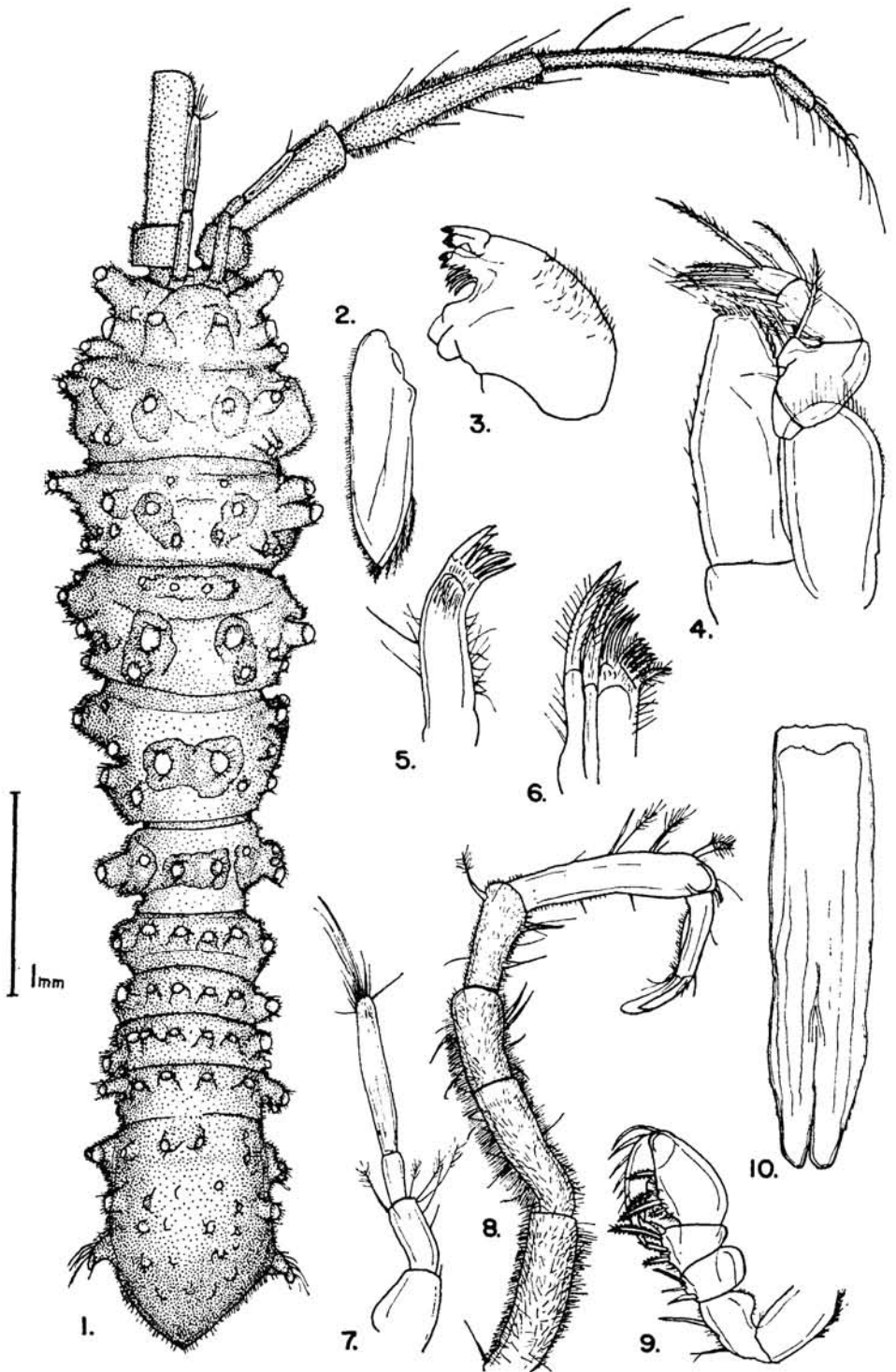
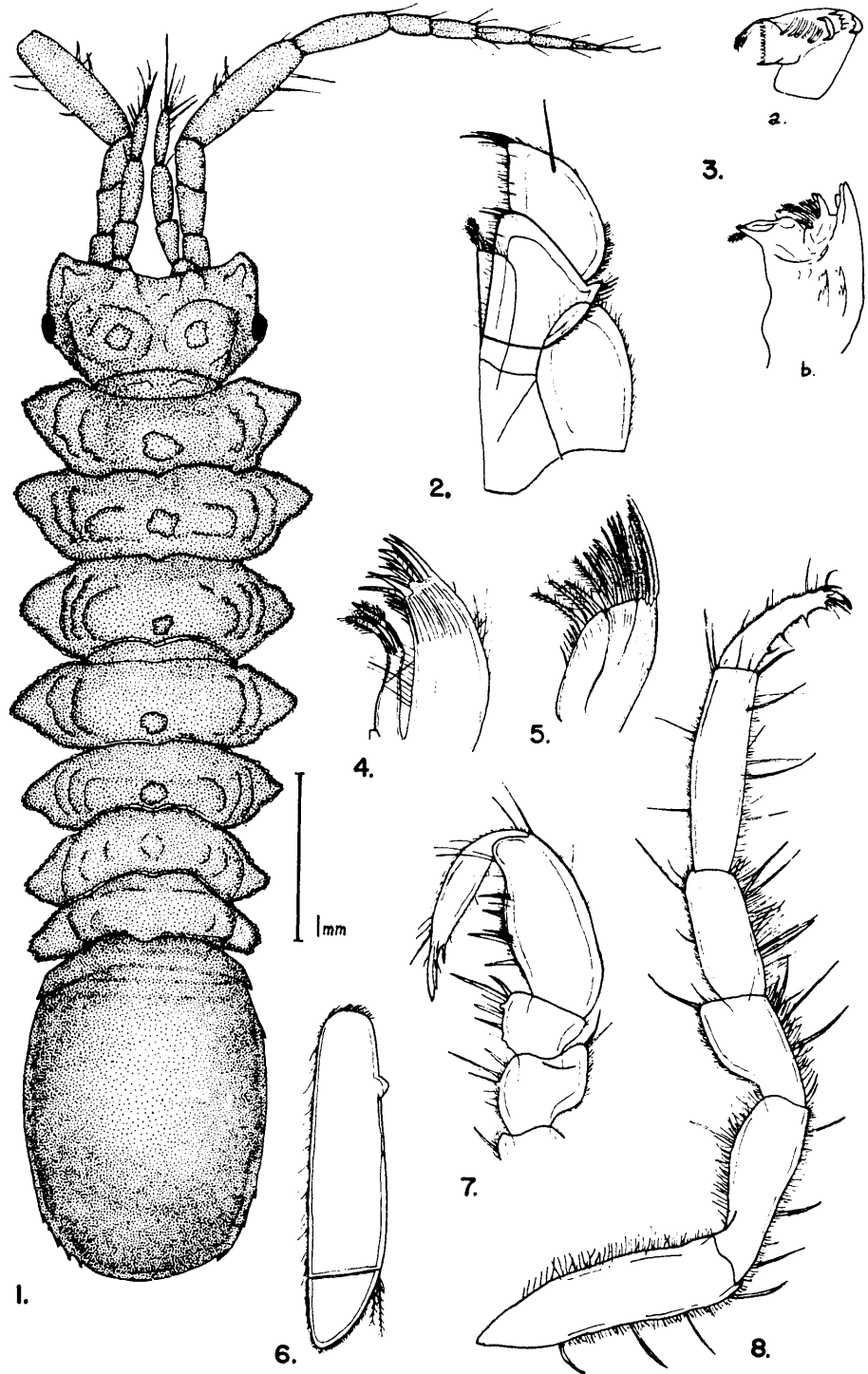


Plate 15

Figure 1. *Synidotea calcarea*, new species. 2. Maxilliped. 3. Mandibles; (a) apical and (b) lateral views. 4. First Maxilla. 5. Second Maxilla. 6. Uropod. 7. First Peraeopod. 8. Seventh Peraeopod.

3. Mandi-
. 5. Second
raeopod.



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