NOTE ON THE GIANT ISOPOD GENUS *BATHYNOMUS* MILNE EDWARDS, 1879 WITH DESCRIPTION OF A NEW SPECIES

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With Text-figures 1–11 and Plates IV–V

Abstract—Specimens belonging to the genus *Bathynomus* Milne Edwards, 1879, are examined. *Bathynomus decemspinosus* n.sp. is described based on a specimen from the Strait of Taiwan. *Bathynomus affinis* Richardson, 1910, is redescribed based on four specimens from the South China Sea. Gut contents of several *Bathynomus* spp. from different oceans are examined.

Bathynomus Milne Edwards, 1879 belongs to the family Cirolanidae of the suborder Flabellifera. Species of this genus have 7 free pereonites and 5 free pleonites and a telson with strongly toothed posterior margin. There are free coxal plates on pereonites 2–7. All pereopods are ambulatory and pleopods swimming and respiratory. Apart from the large size, the most distinct character of the bathynomids is the development of highly ramified branchiae on the posterior surface of inner pleopod rami.

Milne Edwards (1879) had briefly described *Bathynomus giganteus*, the first species of this genus, based on a specimen from the Gulf of Mexico. Ortmann (1895) reported a second species, *B. doederleini*, from Sagami Bay, Japan. Milne Edwards and Bouvier (1902) contributed a monograph on *Bathynomus* with a full description of the two species then known and a discussion of the systematic position of the genus. Richardson (1910) added two new species, *B. affinis* and *B. propinquus*, both from the adjacent waters of the Philippines. Imaizumi (1953) found a fossil specimen of *Bathynomus* from the Middle Miocene of Okayama, Japan and suggested that two other fossil isopods, *Palaega carteri* from Bedfordshire, England (Woodward, 1870) and *P. guadelpiensis* from the Upper Cretaceous of Texas, U.S.A. (Rathbun, 1935) would probably belong to *Bathynomus giganteus*.

Bathynomus giganteus, well known for its large size (largest known: 356 mm), has been found in the tropical Atlantic, including the Gulf of Mexico and the Caribbean Sea (Milne Edwards and Bouvier, 1902; Hansen, 1903; Richardson, 1905; Schmidt, 1931; Bullis and Thompson, 1965) and the Indian Ocean (Wood-Mason and Alcock,

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1891; Annandale, 1906, 1907; Lloyd, 1907, 1908). *B. doederleini* is known, however, only from the North Pacific (Ortmann, 1895; Richardson, 1909, 1910). Both *B. giganteus* and *B. doederleini* are common, but never aboundant in deep-sea otter trawl catches. Because of their lack of economic value, they are usually discarded by commercial fishermen. In additon to the original record for *B. affinis* (Richardson, 1910), Hale (1940) reported a doubtful record of this species from south of Gabo Island, Victoria, Australia. *B. propinquus* has never been found since the record of Richardson (*lit. cit.*).

The present study includes the description of a new species of *Bathynomus* from the Strait of Taiwan and the description of four specimens tentatively assigned to *B. affinis* from the South China Sea. The morphological terminology mainly follows that of Wolff (1962).

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Bathynomus decemspinosus n. sp.

Figs. 1–6, 10; Pl. IV

Material studied–1 adolescent female with rudimentary oostegites, total length 123 mm, Strait of Taiwan west of Tungkang, Taiwan, at a depth of 70–80 m, May 8, 1965, holotype (IZAS Cat. No. 53356).

Description—Body spindle-shaped; ratio of total length (excluding median spine on posterior margin of telson) to width (excluding coxal plates) 3.15. Colour in alcohol light brown, with irregular dark and light areas.

Head, broader than long (5:3), width to that at posterior margin of pereonite 1, 2:3. Frontal margin highly ridged and semicircular but slightly concave in centre where a short median process projects downward to separate antennulae and meets dorsal margin of frontal lamina. Lateral margins embedded in pereonite 1, almost

straight and converging posteriorly. Posterior margin straight. Postero-lateral angles rounded. Eyes, widely separated, situated on antero-inferior surface of head, entirely concealed dorsally by frontal ridges; equilaterally triangular in shape, with concave base on lateral side of head. Frontal lamina pear-shaped, as wide as long, with straight base resting on dorsal surface of clypeus. Clypeus with anterior rounded portion protruded beyond anterior surface of frontal lamina and visible dorsally, and posterior trapezoid portion with postero-lateral angles extended laterally to partially enclose saddle-shaped labrum.

Pereon about 1/2 of total length. Widths of posterior margin largest in pereonites 3 and 4, decreasing anteriorly and posteriorly. Pereonite 1 longest, length of other pereonites decreasing posteriorly. Coxal plates with carinae, postero-ventral angle square in pereonites 2 and 3 and becoming strongly produced in the rest; angle of pereonite 7 reaching to distal end of lateral angle of pleonite 2.

Pleon, about 1/6 of total length. All pleonites subequal in length. Lateral angle strongly produced in pleonites 2–4; those of pleonites 3–5 reaching to the same posterior level.

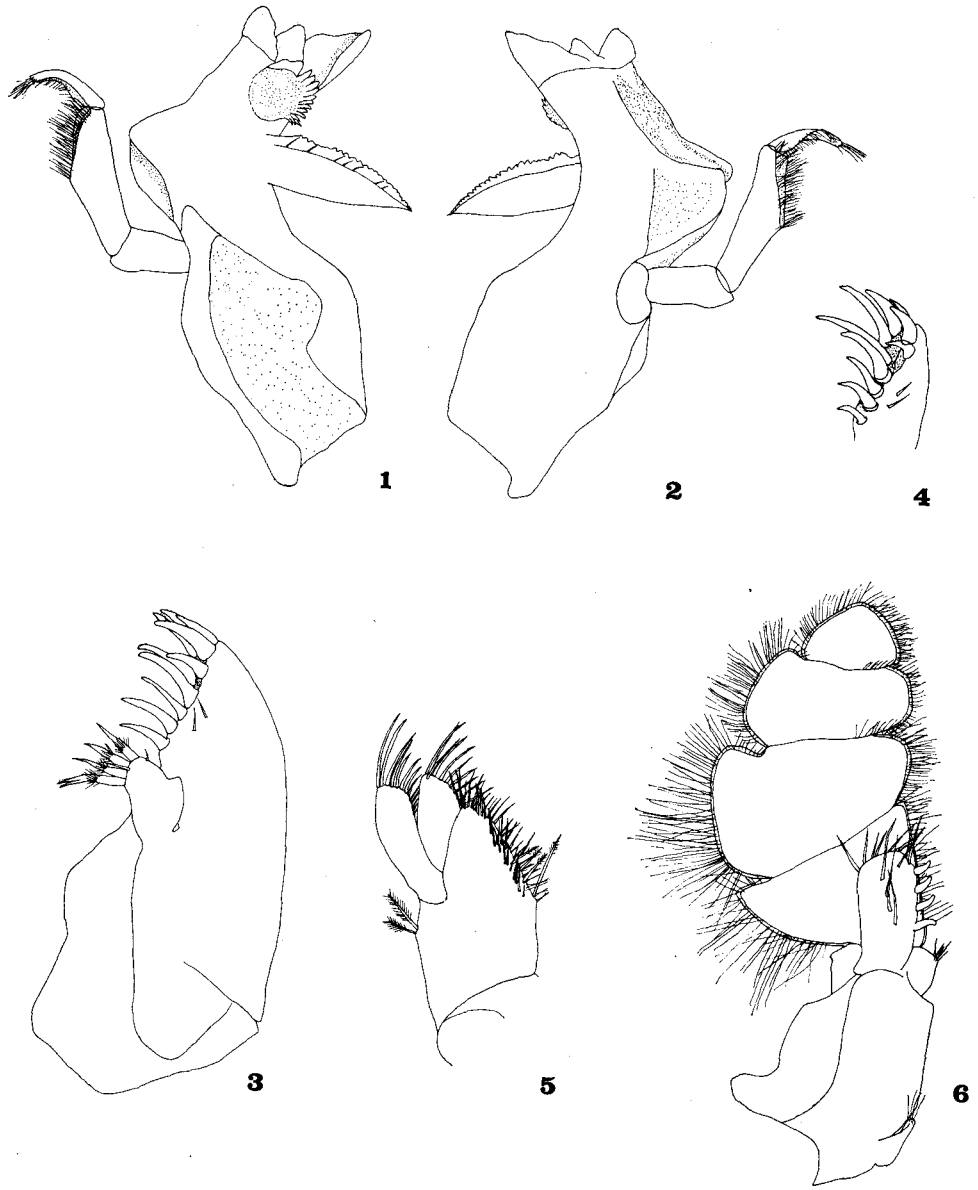
Telson shield-shaped, about 2/9 of total length. Lateral margins almost parallel in anterior third and converging posteriorly. Length (excluding median spine) to width at posterior margin, 5:4. Median logitudinal carina obscure at anterior part but distinct and continuous to tip of median spine. Posterior margin nearly truncate with 7 evenly spaced spines. Median spine strongest, other spines becoming weaker laterally. Soft setae on posterior margin between spines.

Antennula short, reaching to distal end of antennal peduncle, with 3-jointed peduncle and flagellum of more than 50 joints (mutilated at distal end of both sides.) Antenna long, extended slightly beyond posterior margin of pereonite 3, peduncle of 5 joints, first of which are short and almost concealed by clypeus and antennula, flagellum 64–jointed on the right and 53 on the left.

Mandible (Figs. 1 and 2). Left and right symmetrical. Incisor with three teeth, posterior tooth the largest and with a produced posterior angle. Lacinia bifid, bearing posteriorly a row of 13 short but strong spines. Molar process blade-like, length 3 times of the width, pointed at distal end, with strong denticles on medial margin. Palp with three joints, joint 1 thick, most expanded at distal end; joint 2 about 2 times as long as the first, medial margin straight, lateral margin expanded at centre with several rows of setae on thickened anterior part of lateral margin; joint 3 subequal to joint 1 in length, laminar-like, broadest at proximal end and bluntly pointed distally, lateral margin bearing a row of setae.

Maxillula (Figs. 3 and 4). Inner endite wedge-shaped lateral distal margin with nearly a square angle; medial margin bearing 4 spines at distal end, all with plumose centre portion, naked distal portion cone-shaped, proximal spine with bifid distal end; 1 small spine as shown in Fig. 3. Outer endite with 10 strong spines in 2 groups at distal part of medial margin; proximal group with 4 spines in straight row and distal

group with 6 spines in an arch on thickened part of distal medial margin; 3 small spines as shown in Fig. 4.



Figs. 1–6. *Bathynomus decemspinosus* n. sp.

1. Mandible, dorsal view. 2. Mandible, ventral view. 3. Maxillula, ventral view. 4. Maxillula, outer endite, medio-ventral view. 5. Maxilla, dorsal view. 6. Maxilliped, dorsal view.

Maxilla (Fig. 5). Inner endite triangular, as broad as long, lateral part partially hidden under outer endite from ventral view; medial margin and dorsal surface along medial margin invested with long and short naked spines and few proximal plumose spines. Outer endite with 2 rectangular lappets. Inner lappet bearing 12 spines on distal and medial margins and 1 on dorsal surface near distal end. Ourte lappet slightly curved inward, with 13 spines on medial margin, length of spines increasing toward distal end.

Maxilliped (Fig. 6). Endite cylindrical, with rounded distal end, invested with plumose setae on distal margin and 5 isolated plumose setae on dorsal surface; medial margin provided with 4 coupling hooks. Palp with five joints, invested with plumose setae on lateral and naked setae on medial and free portion of distal margins of joints 2–5, setae on lateral margins much longer than those on medial; a small bundle of naked spines on distal medial margin of joint 1.

Pereopod I. Basis slightly longer than 1/2 of next 5 joints combined, naked except few setae and spines on distal margin. Ischium, medial surface of antero-distal angle extended to form laminar structure covering medial part of merus. Merus, anterior margin strongly convex on proximal portion, antero-distal corner produced to form spoon-shaped projecton reaching beyond proximal end of propodus. Dactyl naked, without claw.

Pereopods II and III similar to preopod I. Antero-distal projetions of merus much elongated covering proximal half of anterior margin of propodus.

Pereopods IV–VII alike. Pereopod VI subequal to VII in length, much longer than IV and V; basis nearly as long as next 3 joints combined; ischium, merus and carpus subequal in length and similar in shape.

Pleopod I. Peduncle much broader than long, setae along medial margin; 2 groups of branchiae originating from distal margin on postero-dorsal surface extending distally to cover proximal portion of endopod. Exopod slightly shorter than endopod, narrow at proximal end, with setae along lateral, distal and distal half of medial margins. Endopod mostly covered by exopod antero-ventrally, with setae on distal and distal half of medial and lateral mergins. Pleopods 2–5 similar to but slightly larger than first.

All pereopods and pleopods are similar to those of *Bathynomus doederleini* which were illustrated by Milne Edwards and Bouvier (1902: pl. 7, figs. 6 and 7, pl. 8, figs. 2–6).

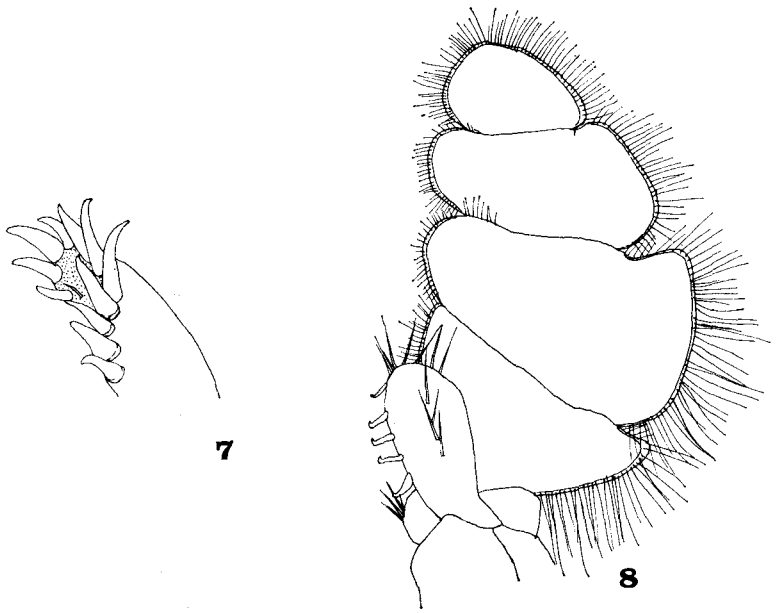
Uropod (Fig. 10). Medial margin of peduncle elongate, about 1½ times length of lateral margin. Endopod longer than exopod, triangular, with lateral angle produced; medial and distal margins forming rectangular angle (about 92°). Exopod narrow and oblong, with pointed distal angle.

The specific name, "*decemspinosus*", refers to the number of spines on the outer lobe of maxillula. The holotype is deposited at the Institute of Zoology, Academia Sinica, Nangkang, Taiwan.

Bathynomus affinis Richardson, 1910

Figs. 7, 8 and 11; Pl. V

Material studied—1 adolescent female with rudimentary oostegites, total length 91.5 mm, southwest of Caluya Island, 11°57′30″N, 121°42′15″E, at a depth of 570 m (312 fathoms), June 3, 1908, holotype (USNM Cat. No. 40908); 3 males with rudimentary penial processes but withourt *processi masculina*, total length 130.3, 130.5, and 131.0 mm, 1 adolescent female with rudimentary oostegites, 120.5 mm, South China Sea, 19°38′N, 113°31′E to 19°35′N, 113°27′05″E, at a depth of 119–126 m (130–138 fathoms), December 19, 1963, all deposited at the British Museum (Natural History).



Figs. 7–8. *Bathynomus affinis* Richardson (South China Sea specimen).
7. Maxillula, outer endite, medio-dorsal view. 8. Maxilliped, dorsal view.

Description—Prominent specific characters based on South China Sea specimens are described below.

Body spindle-shaped, ratio of total length to width, 2.40 to 2.61.

Head broader than long, 2.28–2.50: 1, width to that at posterior margin of pereonite 1, 3:5. Frontal lamina triangular, broader than long, 5:3.

Pereon, length about 4/9 of total length. Coxal plate with carinae, posterolateral angles slightly produced in pereonites 2 and 3, strongly produced in 4 to 7.

Pleon about 1/5 total length.

Telson, about 2/7 total length. Anterior part of lateral margins converging anteriorly. Length and width at posterior margin subequal. Posterior margin slightly convex with 9 evenly spaced spines.

Antennula, reaching to 5–7 joints of antennal flagellum; with a 3-jointed peduncle and a flagellum of 65–67 joints. Antenna, reaching to the posterior margin of pereonite 3, peduncle of 5 joints, flagellum of 55 (female) and 64–65 (male).

Mandible. Lacinia bifid, bearing posteriorly a row of 11–12 stout spines.

Maxillula (Fig. 7). Inner endite bearing 4 undivided, cone-shaped spines on medial margin. Outer endite with 11 strong spines in 2 groups at distal part of medial margin; proximal group with four spines in a straight row and distal group with 7 spines in arch on thickened part of distal margin.

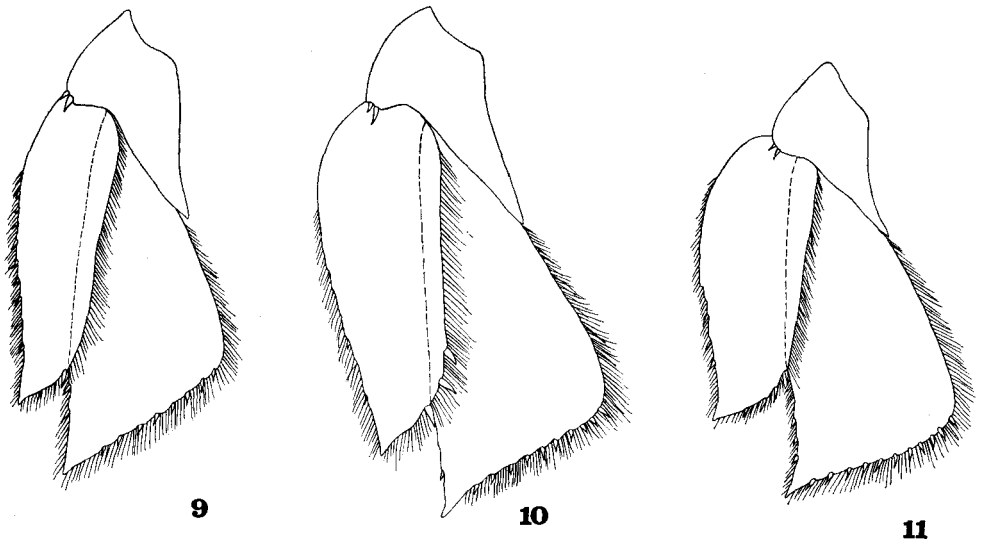


Fig. 9. *Bathynomus doederleini* Ortmann, uropod.
Fig. 10. *Bathynomus decemspinosus* n. sp., uropod.
Fig. 11. *Bathynomus affinis* Richardson (type specimen), uropod.

Maxilla. Inner endite triangular, as broad as long. Outer endite with 2 lappets, inner lappet bearing 13–15 spines on distal and medial margin and 1 spine on dorsal surface near distal end; outer lappet with 10–11 spines on distal and medial margins.

Maxilliped (Fig. 8). Endite cylindrical, distal end rounded, slightly expanded, with 5 coupling hooks on medial margin.

Uropod. Medial and distal margins of endopods forming angle of 83–86°.

Remarks—The size of the South China Sea specimens is much larger than that of the type specimen. If the length ratio of the oostegite to the basis of the corresponding pereopod is used as an indicator of the sexual development, the female specimen of the present study is obviously not much, if any, more advanced than the type. I could

not detect any morphological differences except the size between the present specimens and the holotype and have therefore tentatively assigned the former to the species, *Bathynomus affinis*.

Discussion

Of the five species (including the new species herewith described) known to date within the genus *Bathynomus* there seems to be no doubt of the distinctiveness of the two species, *B. giganteus* and *B. doederleini*. In addition to the morphological differences that have been pointed out in the past, e.g., Ortmann (1895) and Milne Edwards and Bouvier (1902), these two species occupy different geographical areas and reach maturity at distinctly different sizes. The largest specimen of *B. giganteus* available for the present study, with a total length of 288.0 mm, has only very rudimentary oostegites; specimens from the Indian Ocean are known to have a smaller size, e.g., mature male, 270 mm and mature female, 202 mm (Lloyd, 1908) but still far exceed the size of any other bathynomid species. On the other hand, the specimens of *B. doederleini* available for the present study from south of Nojima-saki, Japan, have complete development of oostegites in females as small as 89.0 mm. All 5 male specimens of *B. doederleini* from the same collection, ranging from 93.5 to 101.5 mm, are provided with *processi masculina* on pleopod 2. The number of spines on the posterior margin of the telson seems to be constant in adults of both *B. doederleini* and *B. giganteus*. Variations in number may occur in young specimens but the numbers of spines are always less than the normal number in adults. The type specimen of *B. affinis* (91.5 mm) is an adolescent female with rudimentary oostegites while the specimen of *B. propinquus* (85.0 mm) is sexually indeterminable. *B. affinis* is colse to *B. doederleini* but differs from the latter in the characters listed below:

	B. affinis (Type specimen)	*B. doederleini* (Specimens from Nojima-saki)
Lateral spines on posterior margin of telson	4 pairs	3 pairs
Uropod endopod: medial distal angle	83°	106°
lateral distal angle	abruptly produced	smoothly produced
Carinae on coxal plates of pereonites 4–7	well marked	less well marked
Carinae on telson	less conspicuous	conspicuous

B. porpinquus obviously is different from *B. doederleini* and *B. affinis* in having a much wider body, a wider telson with five pairs of lateral spines on the posterior margin, and a uropod with protruded medial distal angle. The proportionally wider body

and the number of telson spines link it with *B. giganteus*. The speculation that *B. propinquus* is a young specimen of *B. giganteus* could be ruled out because, in addition to the differences listed by Richardson (1910:4), the latter species has never been known to occur in the Pacific. A comparison of the type of *B. propinquus* with young specimens of *B. giganteus* does not support the above speculation.

Bathynomus decemspinosus is morphologically related to *B. doederleini*. It resembles the latter in the elongate body form, in the number of spines on the posterior margin of the telson and in the degree of carination on the coxal plates and telson. It differs from *B. doederleini* in having a sharper medial distal angle (92°) of the uropod endopod, an angle which is intermediate between that of *B. doederleini* and *B. affinis* (Fig. 9–11). The doubtful specimen recorded by Hale (1940) as *B. affinis* has a body form (except the number of marginal spines on the telson) more similar to that of *B. decemspinosus* than to that of *B. affinis*. The number of spines (10) on the outer endite of the maxillula of *B. decemspinosus* is unique in the genus. These spines invariably number 11 in all other bathynomid species.

Nothing has been reported of the feeding habits of bathynomids before the present study. Several specimens of different species of this genus from different oceans were dissected and their gut contents were examined (Table 1). The presence of large quantity of radiolarians and sponge spicules seems to indicate that these isopods are scavengers. The possibility that they can attack living prey such as fish and shrimps in the natural environment is not yet certain. However, it has been known that *Bathynomus* attacked fishes caught in the collecting gear with it (Bowman, *in litt.*).

Table 1. Gut contents of *Bathynomus* spp. from several localities.

Species	Locality	Gut contents
B. doederleini	South of Nojima-saki, Japan	Radiolarians, harpacticoid copeopds
B. doederleini	South of Nojima-saki, Japan	Radiolarians, fish scales
B. affinis	South China Sesa	Triradiate spicules of sponge, fish scales
B. giganteus	Gulf of Mexico	Nematodes, fish scales, bones and muscles
B. giganteus	Gulf of Mexico	Decapod remnant (possibly a pandalid shrimp—identified by A.J.G. Figueira), fish scales

The bathynomids belong to one of the few genera of the isopods which contain species of large size (Menzies and George, 1967). *Bathynomus giganteus* is the largest of all isopod species. In spite of their large size, the species of the genus *Bathynomus* have never been found at great depths and are therefore classified as littoral-bathyal benthos by Wolff (1970). From the known records, their distribution seems to be restricted to latitudes of less than 40° in both Northern and Southern Hemispheres.

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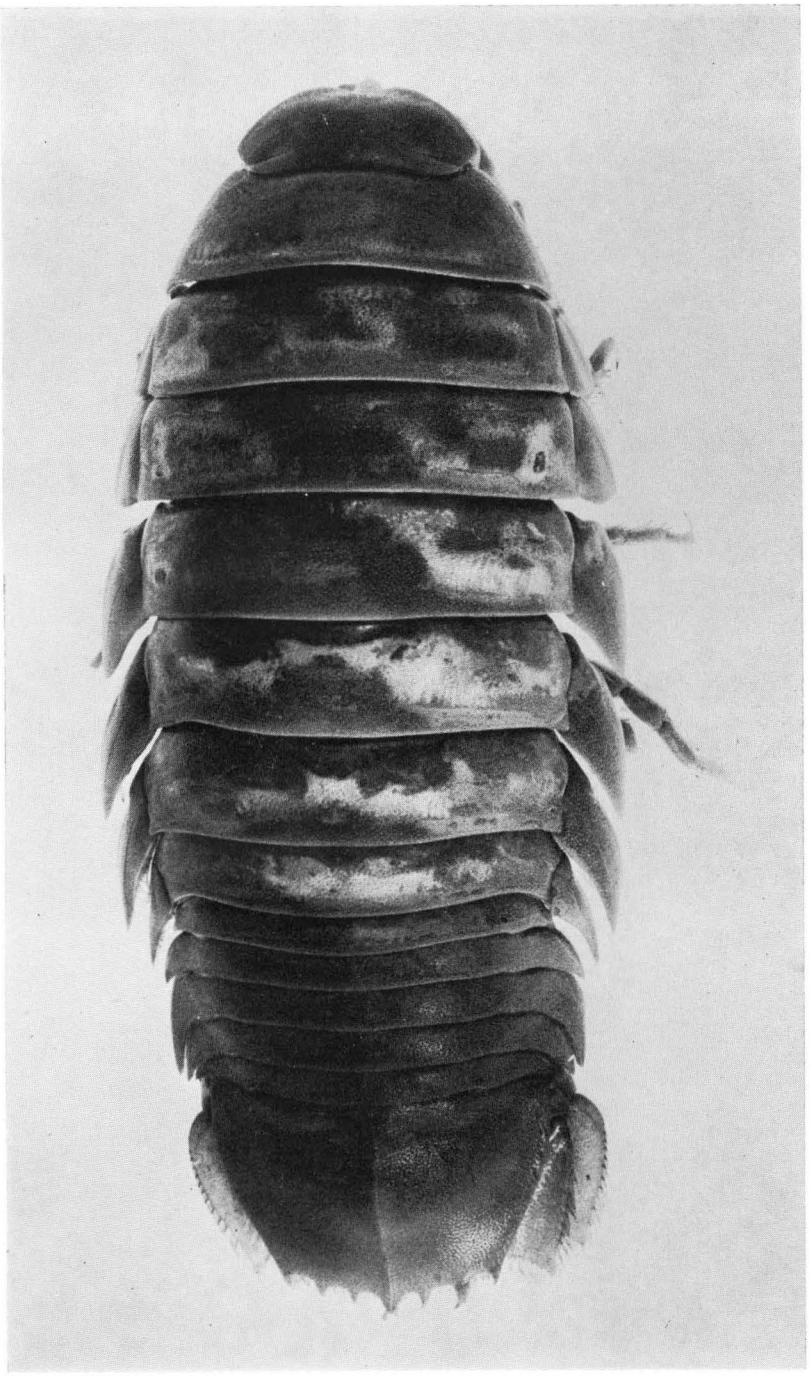
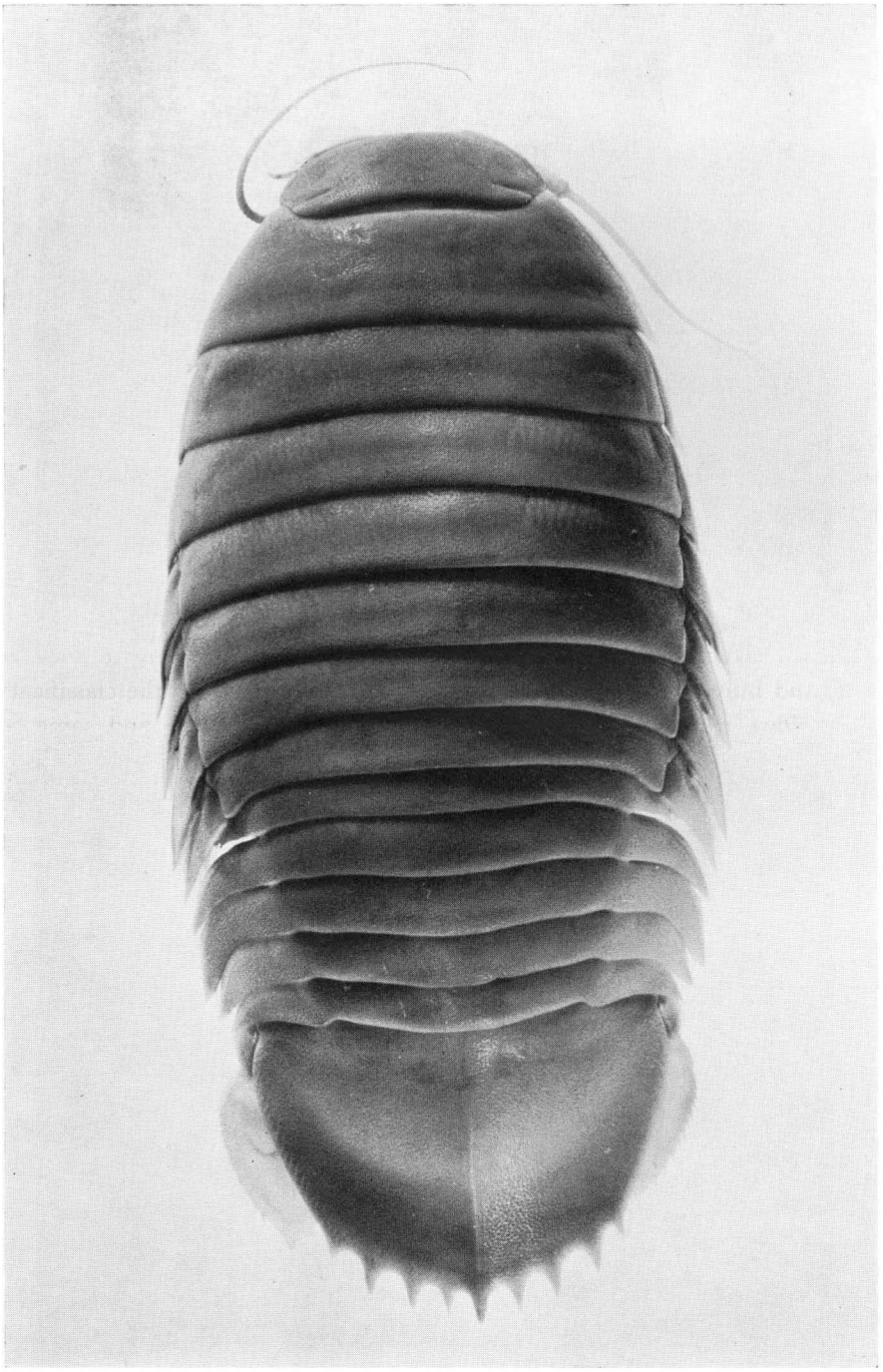
EXPLANATION OF PLATES IV–V

Plate IV. *Bathynomus decemspinosus* n. sp., total length 123 mm.

Plate V. *Bathynomus affinis* Richardson, total length 120.5 mm. South China Sea specimen.



C. SHIH: *Giant Isopod Genus* Bathynomus



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