

Two New Deepwater Species of Hermit Crabs (Crustacea: Decapoda: Anomura: Paguroidea) from Japan

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Abstract Two new species of hermit crabs, *Bathynarius izuensis* sp. nov. (Diogenidae) and *Bathypaguropsis carinatus* sp. nov. (Paguridae) are described and illustrated on the basis of specimens from Sagami-Nada Sea and/or the adjacent area. *Bathynarius izuensis* sp. nov. is the first representative of *Bathynarius* from the northwestern Pacific. Comparisons with other congeneric species are made.

Key words: Crustacea, Decapoda, Anomura, Diogenidae, Paguridae, new species, Japan.

A joint survey of the benthic fauna of Sagami-Nada Sea, central Japan, carried out by the National Science Museum and the Tokyo University of Marine Science and Technology (formally Tokyo University of Fisheries) in 2002, using TRV *Shin'yo-Maru*, provided abundant material of decapod crustaceans from lower sublittoral to upper bathyal zones. The study of this interesting collection revealed the presence of two distinctive undescribed species of hermit crabs from depths over 150 m. A specimen from off the Boso Peninsula preserved in the collection of the Natural History Museum and Institute, Chiba, was found to represent a same species as one of the undescribed species. The first, *Bathynarius izuensis* sp. nov. of the family Diogenidae, is described on the basis of a single male specimen from off Izu-Oshima Island, Sagami-Nada Sea. The genus *Bathynarius* Forest, 1988 contains four species, one from the western Atlantic and three from the tropical Indo-Pacific. This is the first representative of the genus from the northwestern Pacific. The second, *Bathypaguropsis carinatus* sp. nov. of the family Paguridae, is described on the basis of a pair of specimens, one male from off the Boso Peninsula and one

ovigerous female from off Izu-Oshima Island. Six species of *Bathypaguropsis* McLaughlin, 1994 are known from the Indo-Pacific. The new species is a third of the genus from Japan and brings the number of species in the genus to seven.

The specimens examined in this study are deposited in the Natural History Museum and Institute, Chiba, Japan (CBM, with a code of ZC) and Showa Memorial Institute, National Science Museum, Tokyo, Japan (NSMT, with a code of Cr S). The shield length, abbreviated as SL, is measured from the tip of rostrum to the midpoint of posterior margin of the shield. For detailed observation of the surface structure on the integument, the specimens (including removed appendages) were stained with methylene blue solution. Terminology used in the description, for the most part, follows that of McLaughlin (1997), with exception of the posterior carapace lineae (Morgan & Forest, 1991), gill structure (McLaughlin & de Saint Laurent, 1998), dactylus (dactyli) for dactyl (dactyls), and numbered thoracic sternites. The drawings were made with the aid of a drawing tube mounted on a Leica MZ8 stereomicroscope.



Fig. 1. A, *Bathynarius izuensis* sp. nov., holotype male (SL 3.7 mm; NSMT-Cr S 005). B, *Bathypagurosis carinatus* sp. nov., paratype female (SL 2.8 mm; NSMT-Cr S 006).

Taxonomic Account

Family Diogenidae

Bathynarius izuensis sp. nov.

(Figs. 1A, 2–5)

Material examined. Holotype, male (SL 3.7 mm; NSMT-Cr S 005); TRV *Shin'yo-Maru*, 2002 cruise: stn 35, SW of Izu-Oshima Island, Sagami-Nada Sea, 34°43.24'N, 139°16.84'E, 171–181 m, 24 October 2002, dredge, coll. T. Komai.

Diagnosis. Posteromedian plate of carapace entire, without transverse suture. Chelipeds subequal; palm with irregular rows of moderately large to large spines. Propodus and carpus of second pereopod unarmed on dorsal surfaces. Posterior margin of sixth abdominal tergite unarmed. Telson with roundly triangular posterior lobes.

Description. Thirteen pairs of biserial phyllobranchiae present (2 pairs of arthrobranchiae above third maxilliped and first to fourth pereopods and 1 pair of pleurobranchiae above second to fourth pereopods (fifth to seventh thoracic somites).

Shield (Fig. 2A) 1.1 times as long as wide; anterior margin between rostrum and lateral projections slightly concave, anterolateral margins sloping, posterior margin roundly truncate; dorsal

surface with few tufts of setae laterally and with shallow pits anteriorly; distinct median groove present on anterior half; 'Y' linea distinct. Rostrum broadly rounded, not reaching base of ocular acicles. Lateral projections not reaching rostrum, with very small submarginal spine. Interocular lobe weakly bilobed. Posterior carapace (Fig. 2B) with few scattered tufts of long setae; posterolateral and ventrolateral parts of branchiostegite membranous, otherwise weakly calcified; posteromedian plate entire, weakly calcified; sulci cardiobranchialis long, reaching nearly to posterior margin of carapace; middle part of branchiostegite divided into several weakly calcified plates; dorsal and anterior margins of branchiostegite with row of spinules.

Ocular peduncles (Fig. 2A) slightly unequal (left longer than right), left about 0.8 times of shield length, moderately broad basally and with corneas not dilated, dorsal surface naked. Ocular acicles subtriangular, terminating in very small spine, moderately separated basally.

Antennular peduncles (Fig. 2A), when fully extended, reaching distal margins of corneas. Ultimate segment about 1.2 times as long as penultimate segment, notably broadened distally in lateral view, with row of widely spaced short setae

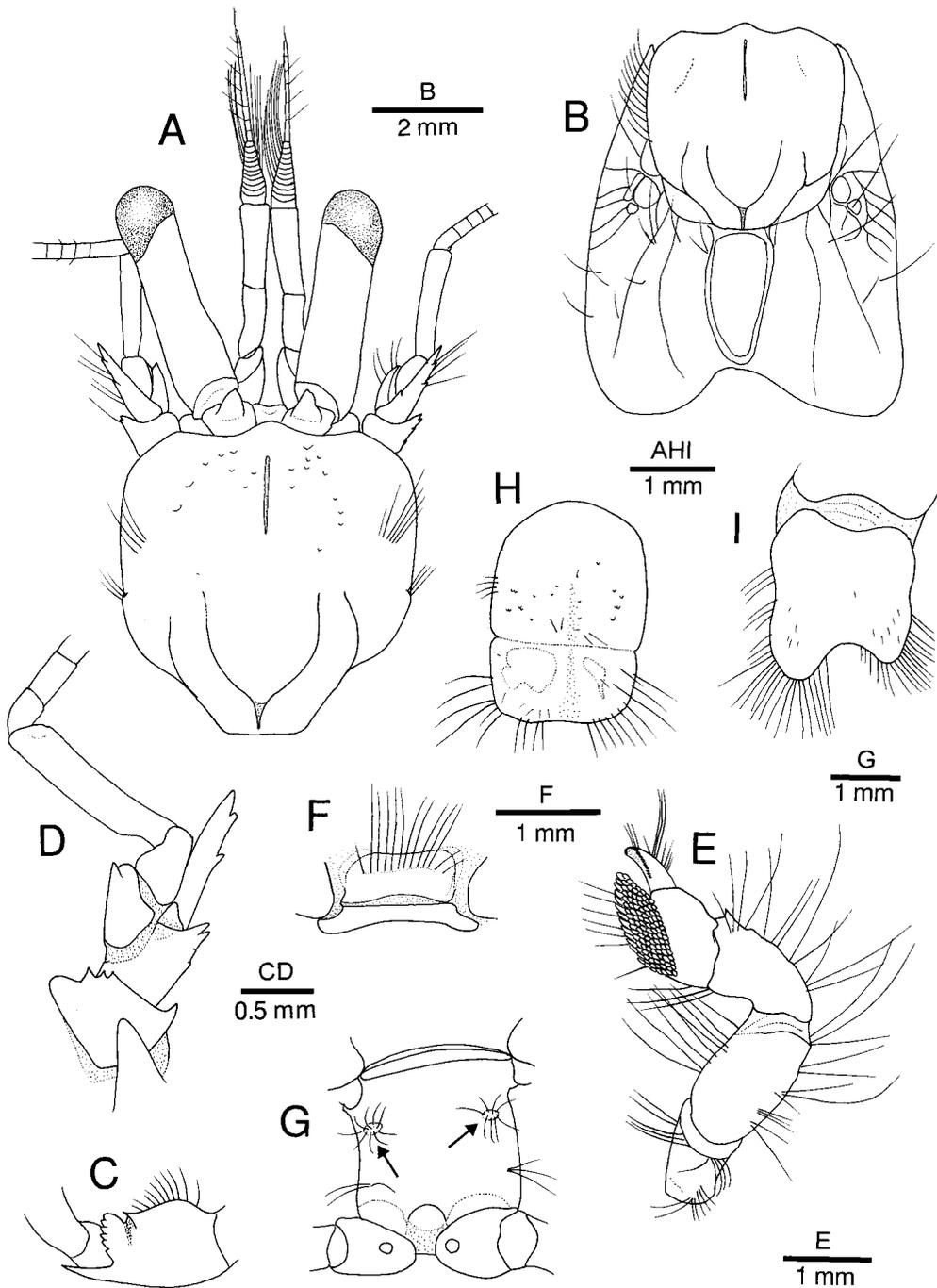


Fig. 2. *Bathynarius izuensis* sp. nov. Holotype male (SL 3.7 mm; NSMT-Cr S 005). A, shield and cephalic appendages, dorsal view; B, carapace, dorsal view; C, basal segment of left antennular peduncle, ventral view; D, left antennal peduncle, ventral view; E, left fourth pereopod, lateral view; F, sixth thoracic sternite, ventral view; G, seventh and eighth thoracic sternites and coxae of fifth pereopods, ventral view; H, sixth abdominal tergite, dorsal view; I, telson, dorsal view.

on dorsal surface. Basal segment (Fig. 2C) with ventrolateral margin distinctly bilobed, posterior lobe with row of stiff setae marginally and small spine distally, distal lobe with 5 small spines on distal margin, ventromesial distal angle with large spine.

Antennal peduncles (Fig. 2A, D) reaching to base of cornea or slightly beyond. Fifth segment naked. Fourth segment unarmed. Third segment with small spine at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in bifid spine; dorsomesial distal angle rounded. First segment produced ventromesially and with 3 spinules on ventrodistal margin; lateral face with small distal spine. Antennal acicle reaching proximal 0.2 of fifth peduncular segment, terminating in acute spine, mesial margin unarmed (left) or with small spine subproximally (right), lateral margin armed with 2 spines in distal half and row of stiff setae. Flagellum reaching chelipeds; articles each with several minute setae at distal margin.

Mandible with 3-segmented palp. Maxillule (Fig. 3A) with 2 bristles on internal endopodal lobe, external lobe basally articulated, slender, recurved; coxal endite tapering distally, with cluster of spiniform setae mesiodistally. Maxilla (Fig. 3B) with basal endite composed of single lobe; posterior lobe of scaphognathite triangular. First maxilliped (Fig. 3C) with simple endopod; exopod broadened posteriorly, with rudimentary flagellum; epipod present. Second maxilliped (Fig. 3D) with basis-ischium suture faintly delineated; dactylus with long spiniform setae distally; exopod relatively slender. Third maxilliped (Fig. 3E, F) with endopod moderately stout; merus with dorsodistal spinule and few small spinules on ventral margin; ischium with well-developed crista dentata composed of row of small, blunt or subacute corneous teeth, but no accessory tooth; basis-ischium fusion incomplete; exopod broadened proximally, overreaching distal margin of merus.

Chelipeds (Figs. 1A; 4A–C) subequal, similar in armament and ornamentation. Dactylus and fixed finger each with strong, hoof-shaped cor-

neous claw, cutting edges with 1 or 2 large calcareous teeth and 3 or 4 smaller calcareous teeth. Dactylus longer than palm, dorsal surface slightly convex, with median row of small, corneous-tipped spines or tubercles, dorsomesial margin also with row of small spines, surfaces with short, often spiniform setae or bristles, particularly on distal part. Palm slightly longer than carpus; dorsomesial margin with 3 widely spaced large, corneous-tipped spines; dorsal surface sloping laterally, with 5 irregular rows of moderately large to large, often corneous-tipped spines or tubercles (2 rows extending onto fixed finger) and many tufts of long setae arising from spines or tubercles; mesial face with several low protuberances or tubercles, and few tufts of short setae; ventral surface convex, also with several low protuberances and tufts of long setae. Carpus short, about half length of merus; dorsodistal margin with row of small tubercles, dorsolateral surface with few small spines laterally and large low protuberances and tufts of long setae, weakly delimited dorsomesial margin with few small spines; mesial surface with low protuberances dorsally and few tufts of shorter setae. Merus triangular in cross section, somewhat deeper than carpus and palm; dorsal margin with row of short transverse ridges (distal 1 or 2 ridges spinulose, extending onto lateral face) and tufts of short setae or bristles, distal margin unarmed; lateral face with low, short ridges or protuberances ventrally and few short setae, ventrolateral margin with row of tiny tubercles in distal half; mesial face nearly smooth, with subsemicircular suture in proximal one-fourth, ventromesial margin with row of small spines or tubercles; ventral surface nearly flat, unarmed, with few stiff setae. Ischium with row of spinules on ventromesial margin, otherwise unarmed. Coxa (Fig. 4D) with distinct longitudinal suture on ventral surface; ventromesial distal margin with spinule.

Second and third pereopods (Fig. 5A–D) slightly overreaching chelipeds, terminating in large corneous claws. Dactyli subequal to propodi (second) or slightly longer than propodi (third); dorsal, lateral and mesial surfaces with

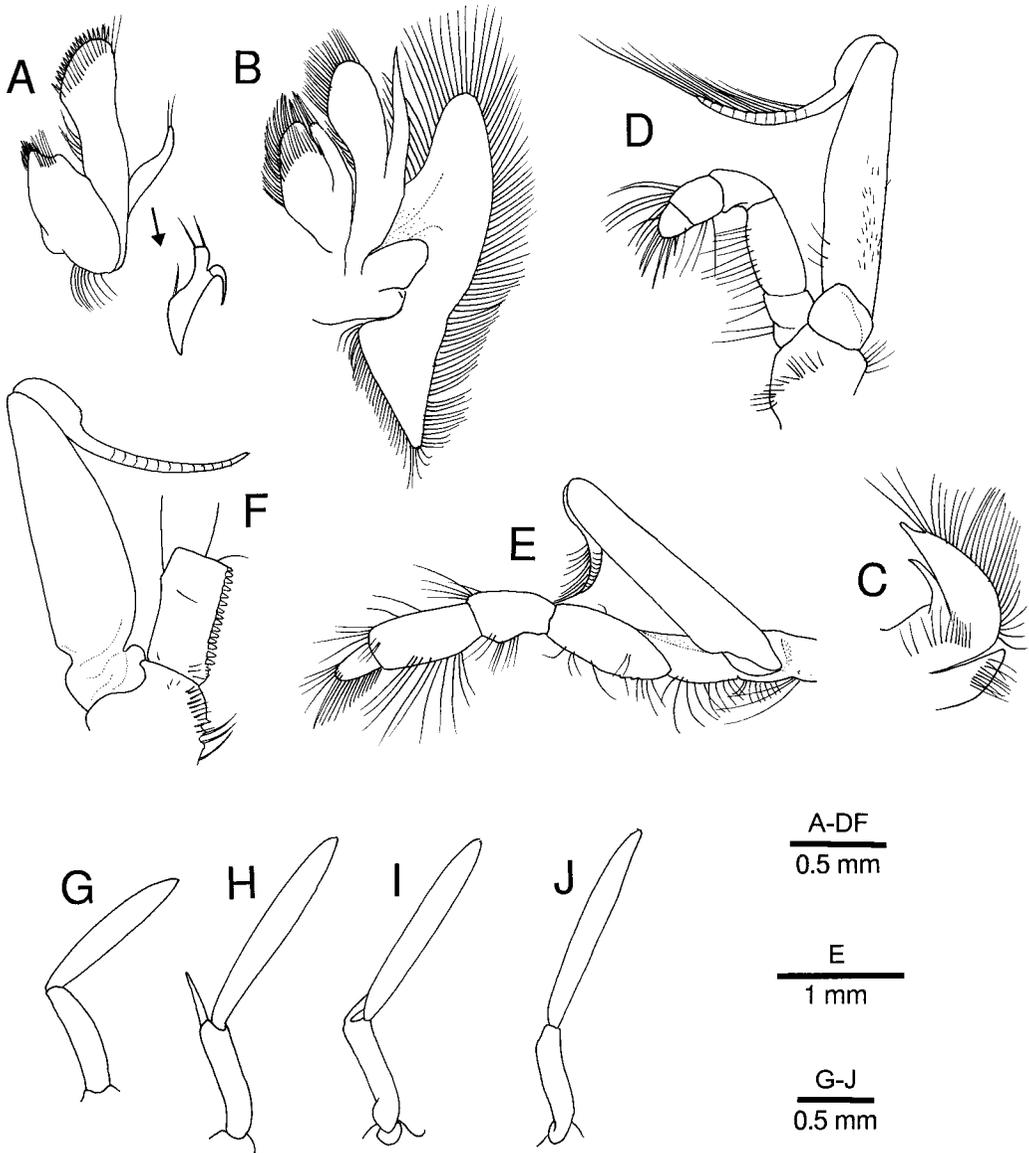


Fig. 3. *Bathynarius izuensis* sp. nov. Holotype male (SL 3.7 mm; NSMT-Cr S 005). Left appendages. A, maxillule, ventral view; inset, palp, lateral view; B, maxilla, ventral view; C, first maxilliped, ventral view (endites broken off; arrow indicates epipod); D, second maxilliped, ventral view; E, third maxilliped, lateral view; F, same, ischium, basis and exopod, ventral view; G, second pleopod; H, third pleopod; I, fourth pleopod; J, fifth pleopod.

row(s) of short, often spiniform bristles, and moderately long to long setae, ventral margins each with 8 corneous spines; mesial face unarmed in second, armed with 2 subdistal corneous spinules adjacent to dorsal margin and row of corneous spinules along ventral margin in

third. Propodi distinctly longer than carpi, dorsal surfaces each with row of low protuberances or short ridges and tufts of long setae, but without distinct spines; lateral faces with few tufts of setae; mesial face with rows of tufts of setae along dorsal and ventral margins and on midline;

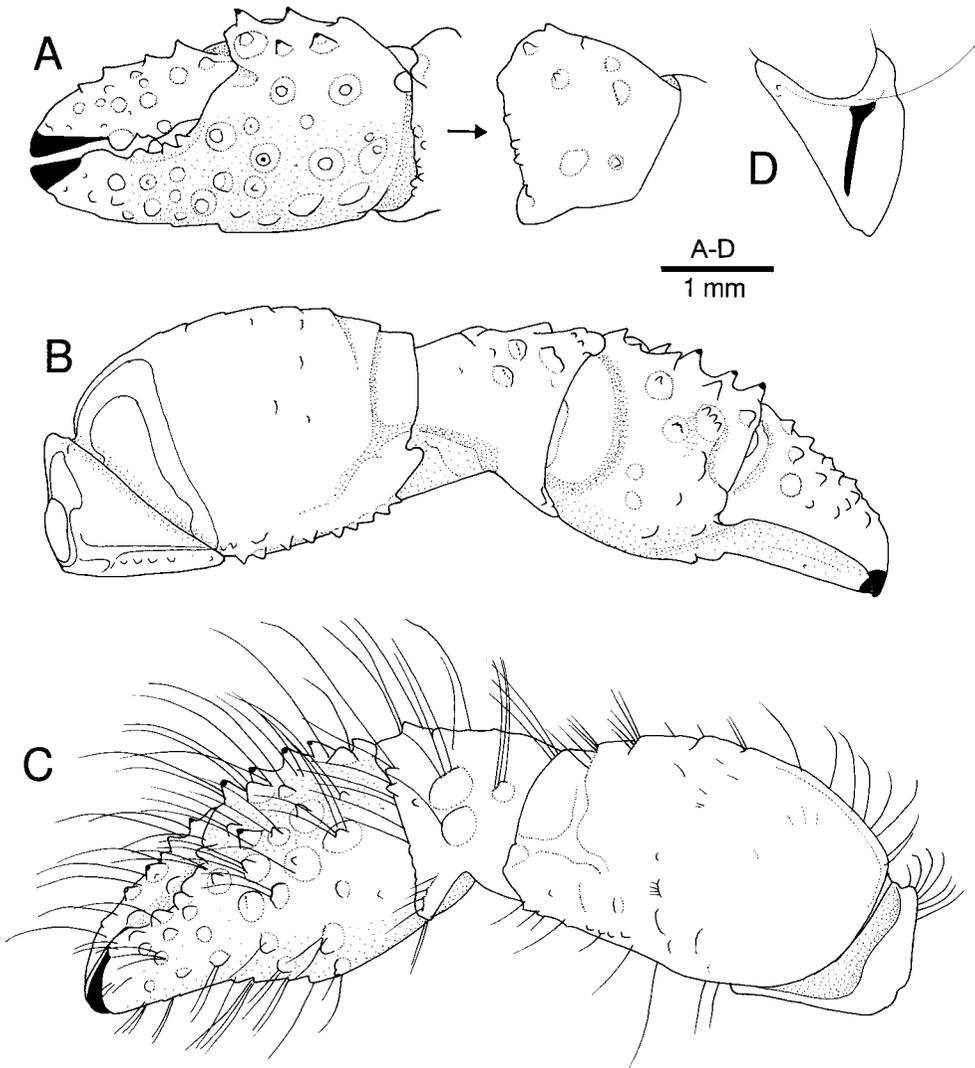


Fig. 4. *Bathynarius izuensis* sp. nov. Holotype male (SL 3.7 mm; NSMT-Cr S 005). A, chela and carpus of left cheliped, dorsal view; B, left cheliped, mesial view (setae omitted); C, same, lateral view; D, coxa of right cheliped, ventral view (setae omitted).

ventral surface with widely spaced long setae and few small corneous spinules distally. Carpi distinctly shorter than meri; dorsal surfaces with row of low protuberances and tufts of long setae, distal margins each with small acute spine (second) or unarmed (third), mesial faces (second) with spinules or tubercles dorsally; lateral face convex, with 2 rows of tufts of setae; ventral surface with few long setae. Meri with row of low protuberances and tufts of long setae on dorsal

margin; ventrolateral distal margins each with few spinules, ventromesial margin with row of spinules (second) or nearly smooth (third), and with widely spaced long setae. Ischia unarmed on dorsal and ventral margins.

Fourth pereopod (Fig. 2E) semichelate, with long setae on dorsal and ventral surfaces of carpus and merus. Dactylus somewhat hoofed distally, with row of very small corneous spinules on lateral cutting edge. Propodus with well-pro-

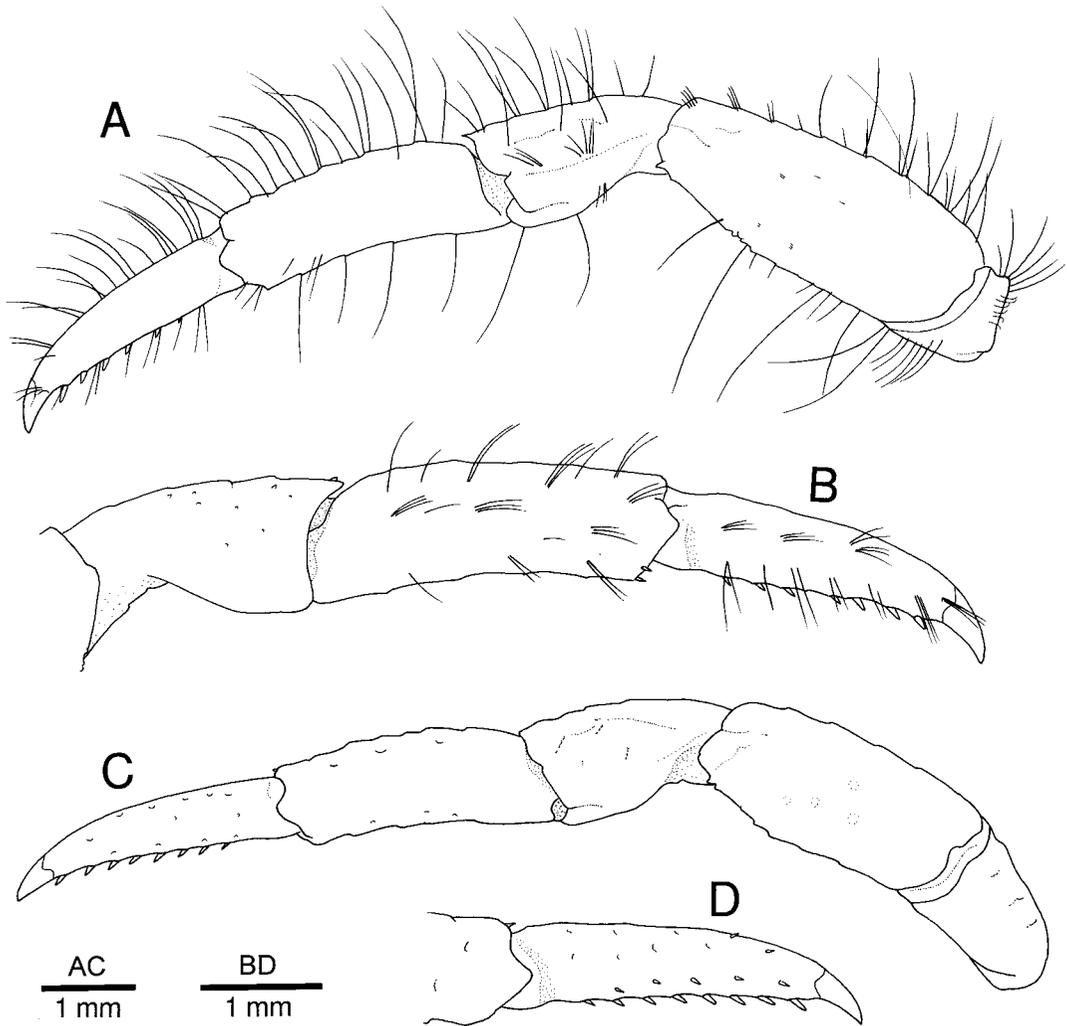


Fig. 5. *Bathynarius izuensis* sp. nov. Holotype male (SL 3.7 mm; NSMT-Cr S 005). A, left second pereopod, lateral view; B, same, dactylus to carpus, mesial view (setae on dorsal and ventral surfaces omitted); C, left third pereopod, lateral view (setae omitted); D, same, dactylus, mesial view (setae omitted).

duced fixed finger overreaching mid-length of dactylus; propodal rasp well-developed, composed of 5 or 6 rows of corneous scales. Carpus with small dorsodistal spine and low protuberances on dorsal surface.

Fifth pereopods chelate.

Sixth thoracic sternite (Fig. 2F) with anterior lobe transversely elongate subrectangular, with many setae on anterior surface; eighth thoracic sternite (Fig. 2G) showing as rounded lobe flanked by moderately separated coxae of fifth pereopods. Membranous part of seventh thoracic

somites with pair of widely separated small protrusions each bearing short setae (Fig. 2G).

Abdomen (Fig. 1A) dextrally twisted. Second to fifth tergites clearly discernible as large, transversely oval, chitinous plates, each with setae laterally; sixth tergite (Fig. 2H) well calcified, rounded, divided in 2 unequal sections by transverse suture; anterior section with trace of median suture in posterior half, surface with scattered minute granules; posterior section shorter than anterior, with faint median suture, unarmed on slightly concave posterior margin. No paired

pleopods modified as gonopods. Four unpaired left pleopods (second to fifth) (Fig. 3G–J) present, all well-developed with exopods longer than protopods, second shortest. Second and fifth pleopods uniramous, third and fourth pleopods biramous with rudimentary endopods.

Telson (Fig. 2I) slightly constricted at middle; posterior lobes roundly triangular, left produced more than right, margins unarmed but with row of short to long setae.

Color in life (Fig. 1A). Carapace, abdomen, telson and fifth pereopods entirely white. Ocular peduncle generally reddish orange, but with large white patch of white on distal half of dorsal surface; ocular acicles also reddish orange. Antennular peduncle with white ultimate segment, basal 2 segments with tinge of orange. Antennal peduncle light orange generally; flagellum becoming reddish distally. Chela generally reddish orange, with patch of white proximally on dorsal, lateral and ventromesial surfaces, and fingers becoming white toward base of corneous claw; spines on dactylus and palm paler; carpus reddish orange in distal two-thirds, white in proximal one-third; merus reddish orange in distal half and white in proximal half; ischium white, but with tint of orange ventrally. Second and third pereopods banded with reddish orange and white; dactyli generally reddish orange, with narrow white band basally; propodi reddish orange in distal four-fifths and white in proximal one-fifth; carpi reddish orange in distal three-fourths and white in remainder, with white blotch dorsodistally; meri reddish orange in distal two-thirds, remainder white, with white patch distoventrally; ischia with tint of orange distally on lateral face. Fourth pereopod also banded with reddish orange and white; propodus white with some orange patches; carpus orange in distal half and white in proximal half; merus orange in distal two-thirds and white in proximal one-third.

Distribution. Known only from the type locality, southwest of Izu-Oshima Island, 171–181 m.

Etymology. The given specific name, *izuensis*, is derived from the region, Izu Islands,

embracing the type locality of the new species.

Remarks. *Bathynarius* was established by Forest (1988) for two deep-water species, *Clibanarius anomalus* A. Milne-Edwards & Bouvier, 1893 from off Barbados (type species) and *C. albicinctus* Alcock, 1905 from the Indo-Pacific. The third and fourth species, *Bathynarius pacificus* Forest, 1992 and *B. wolffi* Forest, 1992, were described from the Marquesus Islands, French Polynesia, and Indonesia, respectively (Forest, 1992). *Bathynarius wolffi* was also recorded from the Seychelles by Forest (1995). The new species raises the number of species in the genus to five and represents the first record of the genus from the northwestern Pacific.

The new species is assigned to *Bathynarius* on account of the following characters (Forest, 1988; 1992; McLaughlin, 2003a): 13 pairs of biserial phyllobranchiate gills are present; the ocular acicles are simple; the first maxilliped bears a clearly delineated epipod; the chelipeds are subequal; each coxa of the chelipeds bears a distinct longitudinal suture on the ventral surface; no paired pleopods modified as gonopods are present; and the fifth pleopod is subequal in size to the fourth pleopod. In her key to the all known genera of Diogenidae, McLaughlin (2003a) included the armament of the sixth abdominal tergite in distinguishing *Bathynarius* and *Clibanarius*. However, as already mentioned by Forest (1992), the armament of the sixth abdominal somite is interspecifically variable within *Bathynarius*. The presence of a distinct longitudinal suture on each coxa of the chelipeds is one of the easily recognizable characters in distinguishing *Bathynarius* from *Clibanarius*.

Bathynarius izuensis appears most similar to *B. pacificus* in the unarmed posterior margin of the sixth abdominal tergite and the unarmed dorsal surface of the propodi of the second pereopods. However, the new species appears unique within the genus in the unarmed dorsal surface of the carpus of the second pereopod. In the other four congeneric species, the carpus of the second pereopod is armed with a row of small spines on the dorsal surface (Forest, 1992). Furthermore,

the other four species do not have an anterior median groove on the shield as observed in the new species. The coloration in life is considerably different between *B. izuensis* and *B. pacificus*. In *B. izuensis*, the chelipeds and ambulatory legs are banded with reddish orange and white, while in *B. pacificus*, these appendages are generally white with scattered red spots or patches (Poupin, 1996; 2003).

In addition to the two morphological characters cited above, the present new species appears unusual within the genus in the simple basal endite of the maxilla and the rudimentary flagellum of the exopod of the first maxilliped. Usually in other *Bathynarius* species, as well as other diogenids, the basal endite of the maxilla is bilobed with a deep incision; and the exopod of the first maxilliped is provided with a well-developed flagellum (personal observation). However, because only a single specimen is available for study, it cannot be assessed whether these characters are typical for this species.

The other three Indo-Pacific species of *Bathynarius* are scattered in the tropics, i.e. la Réunion, India, Indonesia, and French Polynesia (Forest, 1992). Therefore, it was surprising to find the first representative of the genus from temperate Japan. All five species are known only from depths in excess of 150 m.

Family Paguridae

Bathypaguropsis carinatus sp. nov.

(Figs. 1B, 6–8)

Material examined. Holotype, male (SL 2.8 mm; CBM-ZC 2481); RV *Tansei-Mar*, KT 95-5 cruise: stn TB14, off Taito-saki, Boso Peninsula, 35°09.6'N, 140°49.4'E, 311–325 m, beam trawl, 26 April 1995, beam trawl, coll. T. Komai.

Paratype, 1 ovigerous female (SL 2.9 mm; NSMT-Cr S 006); TRV *Shin'yo-Mar*, 2002 cruise: stn 28, SW of Izu-Oshima Island, Sagami-Nada Sea, 34°40'N, 139°17.54'E, 327–333 m, 24 October 2002, dredge, coll. T. Komai.

Diagnosis. Ocular peduncles broadened proximally, corneas narrower than greatest width

of peduncles. Right cheliped operculate, chela subcircular in outline; dactylus with sharply carinate dorsomesial margin; palm with sharply carinate lateral margin, unarmed on ventral surface; carpus smooth on dorsal surface. Dactyli of ambulatory legs each with 7–10 small corneous spines and with few tufts of short setae on mesial face.

Description. Thirteen pairs of quadriserial phyllobranchiae present.

Shield (Fig. 6A) about 1.1 times longer than wide; anterior margin between rostrum and lateral projections concave, anterolateral margins sloping; posterior margin roundly truncate; dorsal surface with decalcified area medially, and with few tufts of very short or short setae laterally. Rostrum triangular, not reaching mid-length of ocular acicles, terminating in acute spine. Lateral projections obtusely triangular, with large submarginal spine.

Ocular peduncles (Fig. 6A) about half length of shield, broad basally, tapering to somewhat reduced corneas, dorsomesial surface with row of tufts of long stiff setae; slight constriction apparent at base of cornea laterally; corneas not dilated, very slightly directed laterally, basal corneal diameter about 0.25 peduncular length. Ocular acicles simple, triangular, with tiny submarginal terminal spinule; dorsal surface convex.

Antennular peduncles (Fig. 6A), when fully extended, overreaching ocular peduncles by 0.8 length of ultimate segment. Ultimate segment about half of shield length, somewhat widened distally in lateral view, with tuft of long setae dorsodistally. Basal segment with small but prominent spine on dorsolateral margin distally.

Antennal peduncles (Fig. 6A) distinctly overreaching ocular peduncles. Fifth segment moderately slender, with few short setae. Fourth segment with few short setae. Third segment with prominent spine at ventrodial angle. Second segment with laterodistal projections triangular, moderately elongate, not reaching distal margin of fourth peduncular segment, terminating in simple or bifid spine, mesial margin unarmed, lateral margin with 2 spinules, dorsomesial distal

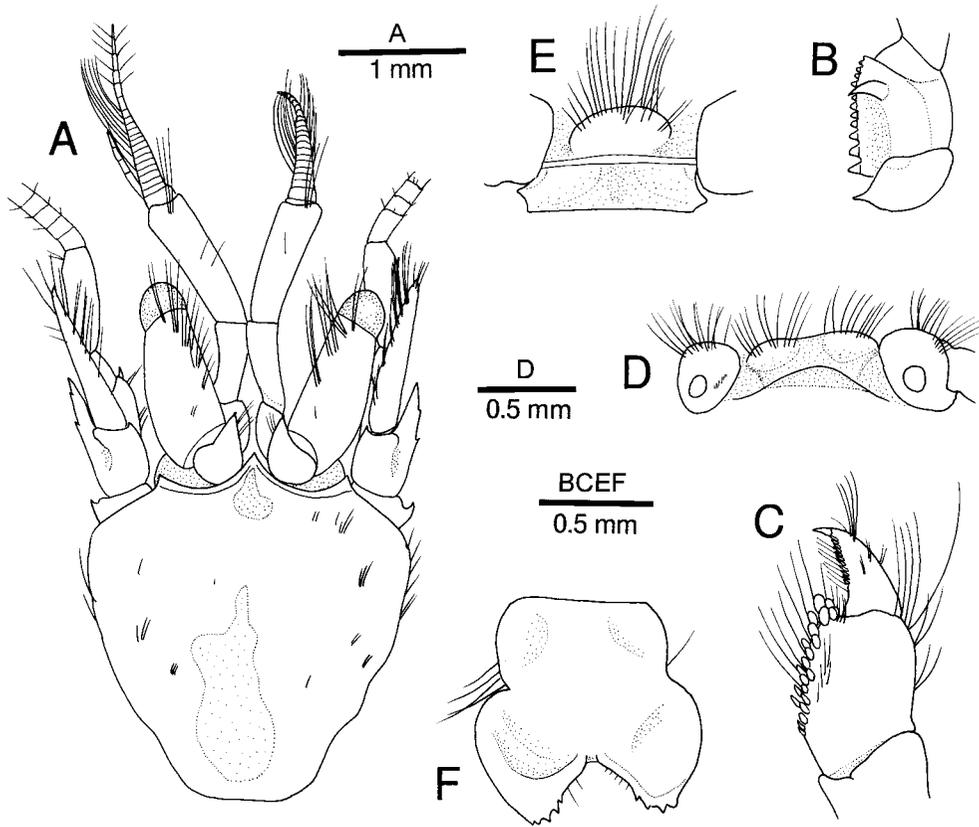


Fig. 6. *Bathypaguropsis carinatus* sp. nov. Holotype male (SL 2.8 mm; CBM-ZC 2481). A, shield and cephalic appendages, dorsal view; B, ischium and basis of third maxilliped, ventral view (setae omitted); C, dactylus and propodus of left fourth pereopod, lateral view; D, coxae of fifth pereopods and eighth thoracic sternite, ventral view; E, sixth thoracic sternite, ventral view; F, telson, dorsal view.

angle with small spine. First segment with large spine on lateral surface, ventromesial distal angle produced, with 1 spinule laterally. Antennal acicle slightly overreaching ocular peduncle, nearly straight, terminating in spinule, with row of tufts of stiff setae on mesial margin. Flagellum slightly overreaching right cheliped; each article with few to several, short to long setules on distal margin.

Mouthparts not dissected. Third maxilliped overreaching antennular peduncle; carpus unarmed; merus with small dorsodistal spine, ventral surface unarmed; ischium (Fig. 6B) with well-developed crista dentata composed of corneous teeth increasing noticeably in size proximally and with 1 strong accessory tooth; basis (Fig. 6B) clearly separated from ischium, with 1

small acute tooth on mesial margin.

Right cheliped (Fig. 7A–E) massive, operculate; chela subcircular in general outline, length subequal to width. Dactylus broad, longer than dorsomesial margin of palm, terminating in small corneous claw; articulation with palm strongly oblique; cutting edge with few low calcareous teeth; dorsal surface slightly convex, with some tufts of short setae; dorsomesial margin sharply carinate, smooth in male holotype, faintly tuberculate in female paratype; ventral surface slightly elevated in midline, smooth, ventromesial margin slightly upturned, opposite face sloping to cutting edge. Palm and fixed finger with scattered tufts of very short to short setae on convex dorsal surface, otherwise almost smooth; dorsolateral margin weakly elevated, sharply carinate, unarmed;

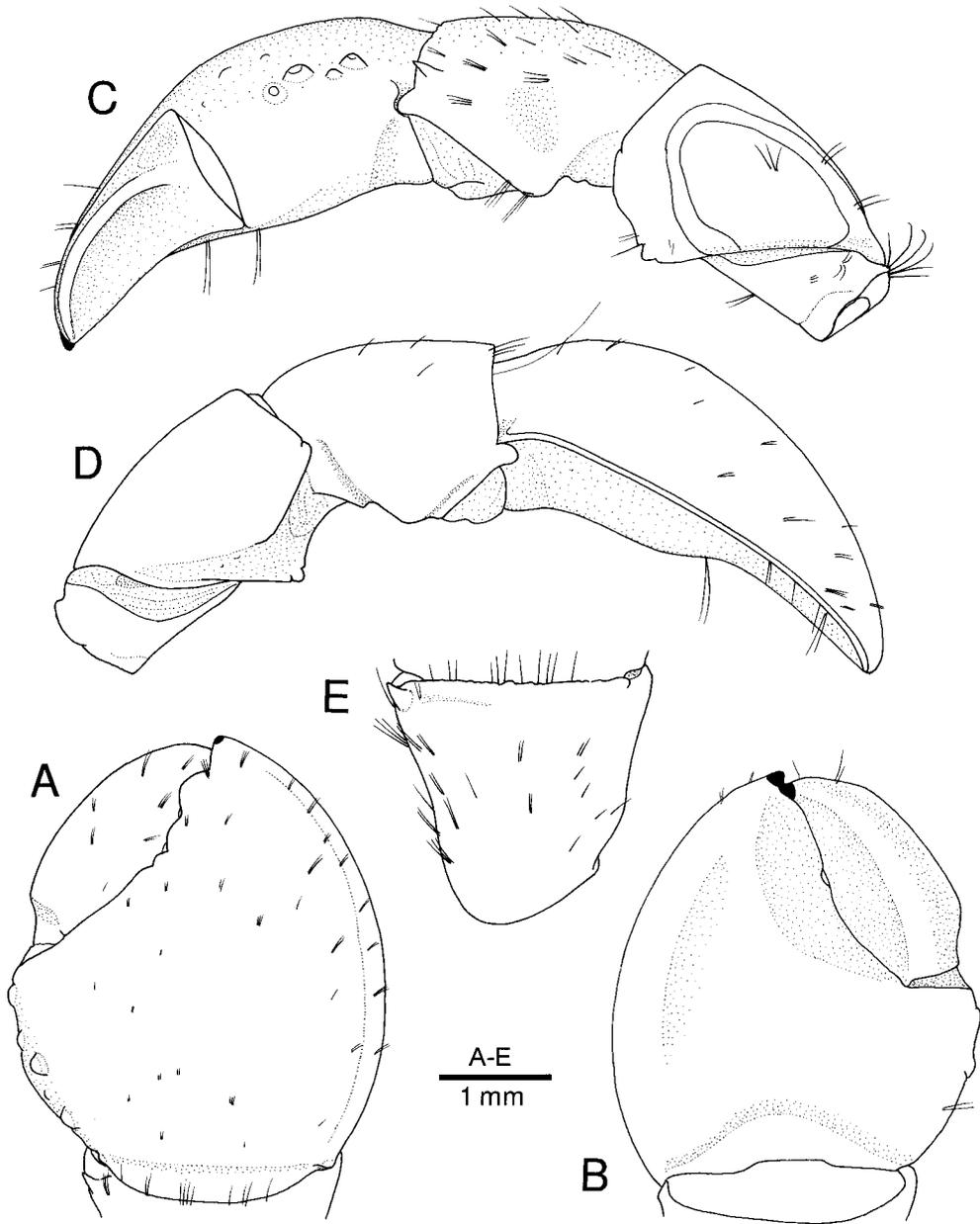


Fig. 7. *Bathypaguopsis carinatus* sp. nov. Holotype male (SL 2.8 mm; CBM-ZC 2481). Right cheliped. A, chela, dorsal view; B, same, ventral view; C, entire cheliped, mesial view; D, same, lateral view; E, carpus, dorsal view.

dorsomesial margin with row of small, rounded tubercles occasionally with corneous tips; mesial face smooth; ventral surface weakly convex, unarmed, ventral surface of fixed finger sloping to cutting edge; fixed finger slightly deflexed in lat-

eral view, terminating in small corneous claw. Carpus approximately same length as merus, subtrapezoidal in dorsal view; dorsomesial distal angle with 1 large spine, dorsodistal margin with few low tubercles; dorsal surface convex, un-

armed, but with sparse tufts of short setae (mesial setae longer); dorsolateral margin not delimited; ventrolateral and ventromesial margins unarmed; ventral surface narrow, convex. Merus roundly subtriangular in cross section; dorsal surface smooth, only with few tufts of short setae proximally; ventrolateral margin unarmed; ventromesial margin with 1 prominent blunt spine and few low tubercles; ventral surface weakly concave, nearly smooth. Ischium with tuft of setae at dorsodistal angle; ventromesial margin smooth.

Left cheliped (Fig. 8A–C) slender; rotation of propodal-carpal articulation approximately 30° counterclockwise from perpendicular. Dactylus subequal in length to palm; surfaces unarmed, but with scattered tufts of short setae; cutting edges of dactylus and fixed finger each with row of small corneous teeth, terminating in small corneous claw. Palm about 0.7 times as long as carpus; dorsal surface weakly convex, unarmed, but with few short setae, dorsolateral and dorsomesial margins not delimited; lateral and mesial faces smooth, with few tufts of setae on lateral face of fixed finger; ventral surface also smooth, with few tufts of setae. Carpus subequal to merus in length, armed with 1 small spine at dorsomesial distal angle; dorsal surface with few tufts of short setae, unarmed; dorsolateral and dorsomesial margins not delimited; lateral and mesial faces smooth; ventral surface weakly convex, smooth. Merus with unarmed dorsodistal margin; dorsal, lateral and ventral surfaces all smooth, with few tufts of setae; ventrolateral margin with 1 spinule near distal angle, ventromesial margin slightly tuberculate proximally; ventral surface with few tufts of setae. Ischium unarmed on ventromesial margin.

Second and third pereopods (Fig. 8D, E) similar. Dactyli 1.2–1.6 times propodi length; in dorsal view, straight; in lateral view, slightly curved; dorsal margins each with sparse tufts of short, simple setae; lateral and mesial faces each with faint longitudinal sulcus; mesial faces with row of corneous spinules dorsally and sparse tufts of short setae ventrally (Fig. 8F, G); ventral margins each with 7–10 corneous spines. Propodi dis-

tinctly longer than carpi, each with row of widely spaced tufts of setae on dorsal and ventral surfaces; ventrodistal margins each with 1 small corneous spine. Carpi each with tiny dorsodistal spine, dorsal surfaces otherwise unarmed, but with few tufts of setae; lateral and ventral surfaces smooth, with few setae. Meri with row of widely spaced tufts of long setae on dorsal and ventral surfaces; lateral and mesial faces smooth, only with few short setae; ventrolateral distal margins unarmed. Ischia with row of tufts of setae on dorsal and ventral surfaces.

Fourth pereopods semichelate (Fig. 6C), moderately stout. Dactylus terminating in slender corneous claw, armed with closely set corneous teeth on ventral margin; preungual process absent. Propodus with weakly produced ventrodistal projection; rasp consisting of 2 irregular rows of corneous scales on distal 0.8 of ventral margin.

Anterior lobe of sixth thoracic sternite (Fig. 6E) subsemicircular, with marginal fringe of long setae. Eighth thoracic sternite consisting of 2 somewhat separated, rounded lobes, each with marginal fringe of setae.

Male with paired gonopores (Fig. 6D), not masked by tuft of setae; no paired pleopods or sexual tubes. Female with paired gonopores; no paired pleopods.

Abdomen (Fig. 1B) dextrally twisted, with 4 unpaired pleopods (second to fifth pleopods) in both male and female; in male, exopods moderately well-developed, while endopod markedly reduced; in female, second to fourth pleopod with both rami well-developed, fifth reduced as in male. Tergite of first abdominal somite with weakly calcified short rectangular lobe; second to fifth tergite indicated by transverse bands of fibrils; sixth tergite well calcified, divided by deep transverse furrow in posterior third. Uropods markedly asymmetrical; protopods unarmed.

Telson (Fig. 6F) with distinct lateral indentations; anterior lobe narrower than posterior lobes; posterior lobes slightly asymmetrical, marginally weakly calcified, separated by small median cleft; terminal margins each with row of 5 or 6 small

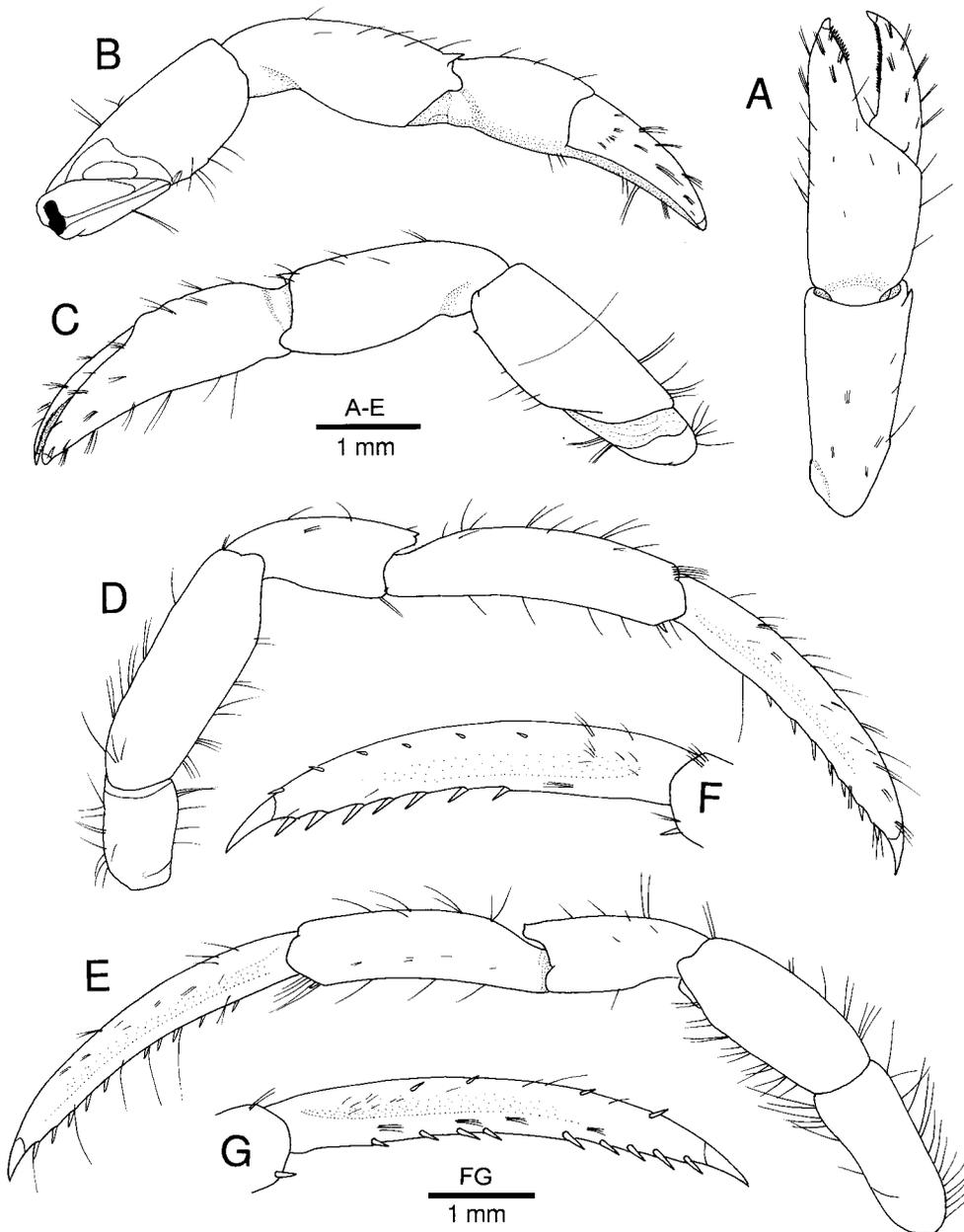


Fig. 8. *Bathypaguropsis carinatus* sp. nov. Holotype male (SL 2.8 mm; CBM-ZC 2481). A, chela and carpus of left cheliped, dorsal view; B, left cheliped, mesial view; C, same, lateral view; D, right second pereopod, lateral view; E, left third pereopod, lateral view; F, dactylus of right second pereopod, mesial view (setae on dorsal and ventral margins omitted); G, dactylus of left third pereopod, mesial view.

spines or denticles, not extending onto lateral margin; left posterior lobe with submarginal ridge on dorsal surface, right lobe apparently lacking submarginal ridge.

Few large eggs, numbering about 20.

Color in life (Fig. 1B). Shield with tinge of reddish brown on anterior half, white on posterior half. Posterior carapace and abdomen colorless. Ocular peduncles light brown, becoming somewhat darker distally. Antennular and antennal peduncles generally light reddish brown. Chelipeds with light reddish brown tint on dorsal surface of chelae and carpi; ventral surfaces white. Second and third pereopods light brown dorsally and whitish ventrally.

Distribution. So far known only from off Taitosaki, Boso Peninsula, and Izu-Oshima Island, 311–333 m.

Etymology. The Latin *carinatus* (carinated) refers to the sharply carinate dorsolateral margin of the right chela, characteristic of this new species.

Remarks. *Bathypaguropsis* was initially established for two species from the Southern Ocean, *B. marionensis* McLaughlin, 1994 and *B. yaldwyni* McLaughlin, 1994 (type species of the genus). Since then, three specific taxa have been described in the genus, *B. rahayuuae* McLaughlin, 1997 from the Banda Sea, Indonesia, *B. cruentus* de Saint Laurent et McLaughlin, 2001 from New Zealand, and *B. foresti* Komai et Lemaitre, 2002 from Japan. Furthermore, *Pagurus kuroshioensis* Miyake, 1978, originally described from Japan, was transferred to *Bathypaguropsis* (de Saint Laurent & McLaughlin, 2001; Komai & Lemaitre, 2002). Komai and Lamaitre (2002) considered *B. rahayuuae* to be a junior synonym of *B. kuroshioensis*. Recently, McLaughlin (2003b) reassigned *Pagurus microps* (Balss, 1911) to *Bathypaguropsis* based on an examination of the holotype from Somalia and an additional specimen from the Solomon Islands. At present, seven species, including the new species, are recognized in *Bathypaguropsis*.

Bathypaguropsis carinatus is known from only a pair of specimens, one male and one female,

but there is no question regarding their assignment to *Bathypaguropsis* because of the following characters: 13 pairs of deeply quadriserial phyllobranchiae present; right cheliped massive, operculate; and no paired pleopods in female. This new species is distinctive within the genus in having the sharply carinate dorsomesial margin of the dactylus and dorsolateral margin of the palm of the right cheliped. All other six species have rounded dorsomesial margin of the dactylus and dorsolateral margin of the palm of the right cheliped (McLaughlin, 1994, 2003b; McLaughlin & de Saint Laurent, 2001; Komai & Lemaitre, 2002). The total absence of ventral armament of the right chela is also characteristic to the new species. Degree of reduction of the cornea of the eye is substantial in *B. carinatus* sp. nov., although weaker than in *B. microps*.

Species of *Bathypaguropsis*, as the generic name implies, are primarily deep-water inhabitants, known from depths in excess of 100 m. Only *B. cruentus* is known from shallow waters at depths of less than 100 m (de Saint Laurent & McLaughlin, 2001). The specimens of this new species were taken at depths of 311–333 m, indicating that it is a bathyal species.

The large size and small number of eggs would seem to suggest that this new species has an abbreviated larval development.

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References

- Alcock, A., 1905. Anomura. Fasc. I. Pagurides. Catalogue of the Indian decapod Crustacea in the collections of the Indian Museum, 2: i–xi, 1–197, pls. 1–16.
- Balss, H. 1911. Neue Paguriden aus den Ausbeuten der deutschen Tiefsee-Expedition ‘Valdivia’ und der japanischen Expedition Prof. Dofleins. *Zool. Anz.*, **38**: 1–9.
- Forest, J., 1988. Sur le genre *Bathynarius* gen. nov. (Decapoda, Diogenidae). *Bull. Mus. Natn. Hist. Nat., Paris*, (4), **10** (A): 759–784.
- Forest, J., 1992. Présence du genre *Bathynarius* (Crustacea, Decapoda, Diogenidae) en Indonésie et dans le Pacifique central, avec la description de deux espèces nouvelles. *Bull. Mus. Natn. Hist. Nat., Paris*, (4), **14** (A): 483–500.
- Forest, J., 1995. Présence aux îles Seychelles de *Bathynarius wolffi* Forest, 1992, espèce décrite d’Indonésie (Decapoda, Diogenidae). *Crustaceana*, **68**: 518–522.
- Komai, T. & R. Lemaitre, 2002. A new species of *Bathypaguropsis* McLaughlin, 1994 from Japan, and redescription of *B. kuroshioensis* (Miyake, 1978) (Decapoda, Anomura, Paguridae). *Crustaceana*, **75**: 423–441.
- McLaughlin, P. A., 1994. A new genus and two new species of deep-water hermit crabs (Decapoda: Anomura: Paguridae) from the Southern Ocean. *Proc. Biol. Soc. Wash.*, **107**: 469–481.
- McLaughlin, P. A., 1997. Crustacea Decapoda: hermit crabs of the family Paguridae from the KARUBAR cruise in Indonesia. In A. Crosnier & P. Bouchet (eds.), Résultats des campagnes MUSORSTOM, 16. *Mém. Mus. Natn. Hist. Nat., Paris*, (172): 433–572.
- McLaughlin, P. A., 2003a. Illustrated keys to families and genera of the superfamily Paguroidea (Crustacea: Decapoda: Anomura), with diagnoses of genera of Paguridae. In R. Lemaitre & C. C. Tudge (eds.), Biology of the Anomura. Proceedings of a symposium at the Fifth International Crustacean Congress, Melbourne, Australia, 9–13 July 2001. *Mem. Mus. Victoria*, **60**: 111–144.
- McLaughlin, P. A., 2003b. Reassignment and redescription of “*Eupagurus*” *microps* Balss, 1911 (Crustacea, Decapoda, Paguridae), with notes on *Bathypaguropsis kuroshioensis* (Miyake, 1978). *Zoosystema*, **25**: 635–642.
- McLaughlin, P. A. & M. de Saint Laurent, 1998. A new genus for four species of hermit crabs heretofore assigned to the genus *Pagurus* Fabricius (Decapoda: Anomura: Paguridae). *Proc. Biol. Soc. Wash.*, **111**: 158–187.
- Milne-Edwards, A. & E. L. Bouvier, 1893. Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico (1877–78), in the Caribbean Sea (1878–79), and along the Atlantic coast of the United States (1880), by the U.S. Coast Survey Steamer “Blake”, Lieut.-Commander C. D. Sigsbee, U.S.N., and Commander J. R. Bartlett, U.S.N., commanding. XXXIII. Description des Crustacés de la famille des paguriens recueillis pendant l’expédition. *Mem. Mus. Comp. Zool., Harvard Coll.*, **14**: 5–172.
- Morgan, G. J. & J. Forest, 1991. A new genus and species of hermit crab (Crustacea, Anomura, Diogenidae) from the Timor Sea, north Australia. *Bull. Mus. Natn. Hist. Nat., Paris*, (4), **13**(A): 189–202.
- Poupin, J., 1996. Atlas des crustacés marins profonds de Polynésie française récoltes du navire Marara (1986/1996). Service Mixte de Surveillance Radiologique et Biologique, Montlhéry, 59 pp.
- Poupin, J., 2003. Database of Crustacea (Decapoda and Stomatopoda), mainly from the French Polynesian Islands. <http://decapoda.ecole-navale.fr/index.php> and <http://decapoda.free.fr>.
- Saint Laurent, M. de & P. A. McLaughlin, 2001. Superfamily Paguroidea, family Paguridae. In J. Forest, M. de Saint Laurent, P. A. McLaughlin & R. Lemaitre (eds.), The marine fauna of New Zealand: Paguridea (Decapoda: Anomura) exclusive of the Lithodidae. NIWA Biodiversity Memoir, 114, pp. 104–209. National Institute of Water and Atmospheric Research Ltd., Wellington.