

INTRODUCTION

The leucosiid genus *Oreophorus* Rüppell, 1830, has been considered to include 13 species. MIERS (1884) and ALCOCK (1896) recognised a close relationship between *Oreophorus* Rüppell, 1830, and *Tlos* Adams & White, 1848. ALCOCK (1896) stated that the only difference between the two genera was the cup-shaped carapace of *Tlos* as opposed to the highly inflated one of *Oreophorus*. MIERS (1884) commented that *Tlos petraeus* A. Milne Edwards, 1874, probably represented an intermediate form between *Oreophorus* and *Tlos*, being more closely allied to *Oreophorus* in terms of carapace structure. However, neither worker made any taxonomic amendments at the generic level.

IHLE (1918) was the first to recognise *Oreophorus* and *Tlos* as subgenera of the genus *Oreophorus*. He also established a new subgenus *Oreotlos*. He observed that *Oreophorus* and *Tlos* were closely related and considered that there was a natural gradation from *Oreophorus* to *Tlos*, with *Oreotlos* as the intermediate form linking the two. In what he felt to be a natural classification, IHLE differentiated the subgenera largely on the basis of carapace morphology, particularly the presence of grooves on the surface and fissures extending inwards towards the centre of the carapace. According to him, the subgenus *Oreophorus* consisted of three species, *Oreophorus (Oreophorus) ornatus* Ihle, 1918, *Oreophorus (Oreophorus) rugosus* (Stimpson, 1858) and *Oreophorus (Oreophorus) patella* (Alcock, 1896). In *Oreotlos*, IHLE recognised two species: *Oreophorus (Oreotlos) angulatus* (Rathbun, 1906) and *Oreophorus (Oreotlos) latus* (Borradaile, 1903). He expressed uncertainty over the placing of a third species, *Oreophorus (Oreotlos) frontalis* (Miers, 1884) in the subgenus. For *Tlos*, IHLE recognised three species, *Oreophorus (Tlos) havelocki* (Laurie, 1906), *Oreophorus (Tlos) petraeus* (A. Milne Edwards, 1874) and *Oreophorus (Tlos) muriger* (Adams & White, 1848). IHLE'S comprehensive work has generally been accepted by most workers with only a few disagreeing on the subgeneric ranks, e.g. *Tlos* was regarded as being a distinct genus by itself and not a subgenus of *Oreophorus* by SAKAI (1965, 1976).

SERÈNE (1954) provided a key to the three subgenera, based mainly on carapace features: the fissures on the borders, the grooves parallel to the borders; and presence or absence of mushroom-like granules. SAKAI (1976) provided a similar key to separate *Oreophorus* and *Oreotlos*, using the additional character of cheliped granulation. These characters are often inadequate and sometimes ambiguous. CHEN (1989) described one new species, *Oreophorus (Oreotlos) speciosus*, without any comment on the classification of the genus. TAN and RICHER de FORGES (1993) reappraised the taxonomic position of *Tlos petraeus* and removed it from *Tlos* into a new genus, *Dolos*. In addition, they treated *Oreotlos* as a full genus for their new species, *Oreotlos etor* Tan & Richer de Forges, 1993; this action was taken in the knowledge that it would be properly justified by the present revisionary paper. Similarly, TAN and NG (1993) described two new species of *Oreotlos*, *O. encymus* and *O. potanus* from French Polynesia.

As part of our revision, the types of most of the recognised species have been examined. The substantial collection of ORSTOM made available via the kind offices of Alain CROSNIER and Bertrand RICHER de FORGES, has been invaluable in solving many outstanding problems.

In this paper, two new genera are established - *Alox* and *Cateios*, and the existing three genera; *Oreophorus*, *Oreotlos* and *Tlos* are recognised as full genera and are redefined on the basis of the carapace ornamentation, form of the frontal region of the carapace, antennule structure, G1 and G2 structures, and form of the male abdomen; and keys to all six related genera are presented.

MATERIALS AND METHODS

Specimens examined are located in the following repositories: Alan Hancock Foundation, University of Southern California, Los Angeles, California (AHF), Bernice P. Bishop Museum (BPBM), Honolulu, Hawaii; British Museum (Natural History) (BMNH), London, U. K.; Muséum Nationale d'Histoire Naturelle de Paris (MNHN), France; Personal collection, S. Nagai, Japan (NC); National Science Museum, Tokyo (NSMT), Japan; Rijksmuseum van Natuurlijke Historie (RMNH), Leiden, Netherlands; Senckenberg Museum (SMF), Frankfurt, Germany; the National Museum of Natural History, Smithsonian Institution (USNM), Washington, D. C., U. S. A.; University of Cambridge Museum (CMZ), Cambridge, U. K.; Zoological Museum, University of Copenhagen, Denmark (ZMUC); Zoological Reference Collection (ZRC), Department of Zoology, National University of Singapore, Singapore; Zoological Survey of India (ZSI), Calcutta, India and Zoologisch Museum, Amsterdam (ZMA), Netherlands.

The way specimens are tilted when viewed affects their appearance and is a potential cause of mis-identification. For this paper, specimens were drawn with the abdomen parallel to the horizontal plane such that the front is slightly tilted downwards and its form is easily seen. In certain specimens (e.g. species of *Oreophorus*), the male abdominal segment 6 appears to be fused to segments 3-5 when viewed from the outer surface, an illusion caused by either calcareous deposits or the overlapping of the abdominal granules between segments on the outer surface. When viewed from the margin or inner surface, an obvious articulated joint can be seen. Hence, in reality, segment 6 is free but with limited mobility. This group of crabs is prone to calcium deposits and other forms of fouling which may obscure important taxonomic features. This can lead to mis-identification if due care is not taken. Measurements (in millimeters) are of carapace length and breadth respectively.

Terms used in descriptive accounts are as in Fig. 1.

The following abbreviations were used throughout the text: G1, male first gonopod; G2, male second gonopod; ORSTOM, Institut Francais de Recherche Scientifique pour le Développement en Coopération, Paris.

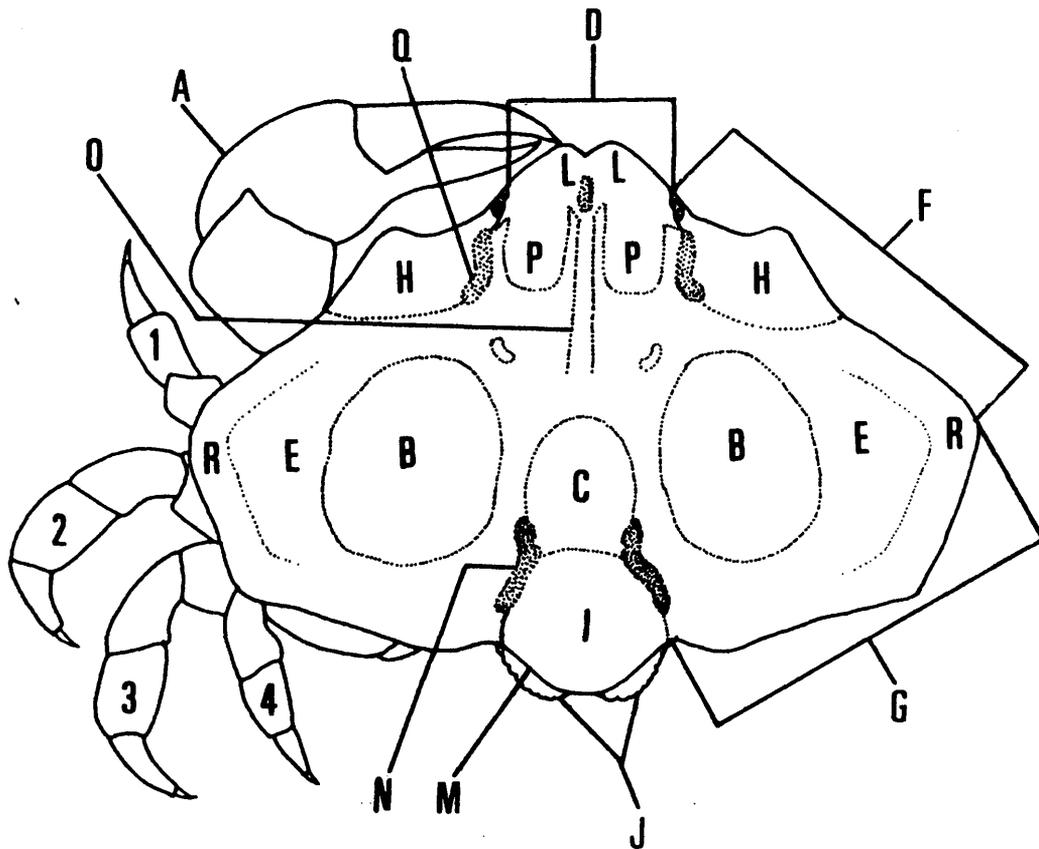


FIG. 1. — Terms used in descriptive accounts. A, cheliped; B, branchial region; C, cardiac region; D, frontal region; E, lateral expansion; F, anterolateral margin; G, posterolateral margin; H, hepatic region; I, intestinal region; J, posterior lobes; L, frontal lobes; M, posterior margin; N, groove on side of cardiac region; O, median keel; P, post-orbital prominences; Q, groove posterior to eye; R, rim around border of carapace; 1-4, ambulatory legs.

SYSTEMATIC ACCOUNT

FAMILY LEUCOSIIDAE Samouelle, 1819

KEYS TO GENERA AND SPECIES

A key to the six genera recognised in this study is presented below. Keys to species are provided below each genus for *Oreophorus* Rüppell, 1830, *Alox* gen. nov. and *Oreotlos* Ihle, 1918. *Cateios* gen. nov., *Dolos* Tan & Richer de Forges, 1993, and *Tlos* Adams & White, 1848 are monotypic.

KEY TO GENERA

- 1.- Basal segment of antennule fully occupying fossa when closed 2
 — Basal segment of antennule occupying half or slightly more than half of fossa when closed 4
- 2.- Groove parallel to border of carapace present; lateral and/or frontal border(s) with rim; post-orbital prominences present; fingers usually much longer (about 1.5 times) than palm; lateral expansions of carapace usually never smooth and plate-like; G1 1.6-4.3 times longer than G2 *Alox* gen. nov.
 — Groove parallel to border of carapace absent; lateral and frontal border(s) without rim; post-orbital prominences absent; lateral expansions of carapace usually smooth and plate-like; G1 2.0-2.5 times longer than G2 3
- 3.- Margins of carapace, including frontal, upturned to form cup-shaped structure; front entire; median longitudinal ridge very distinct and narrow; sutures on lateral borders of carapace open; male abdomen coarsely granular *Tlos* Adams & White, 1848.
 — Margins of carapace not upturned; front bilobed; median longitudinal ridge indistinct and broad; sutures on lateral borders of carapace closed, leaving only small holes; male abdomen finely granular *Dolos* Tan & Richer de Forges, 1993.
- 4.- Dorsal surface of carapace with large, distinct fossae on anterior half, connected by sub-surface channels, floor of fossae covered with mushroom-like granules; lateral borders of carapace not swollen to form rim; branchiostegite regions with large mushroom-like granules; immovable finger of cheliped massive relative to movable finger and flattened to form blade-like structure; G1 2.6-3.2 times longer than G2
 *Oreophorus* Rüppell, 1830.
 — Dorsal surface of carapace without large, distinct fossae on anterior half; branchiostegite regions finely granular, without large mushroom-like granules; immovable finger usually never massive relative to movable finger; G1 2.1-2.4 times longer than G2 5
- 5.- Male abdomen arrow-shaped; G1 relatively short, very stout with densely hairy distal half; lateral borders of carapace not swollen to form rim *Cateios* gen. nov.
 — Male abdomen triangular, not arrow-shaped; G1 relatively long, moderately narrow with sparsely hairy distal half; lateral borders of carapace swollen to form conspicuous rim *Oreotlos* Ihle, 1918.

Genus *OREOPHORUS* Rüppell, 1830

Oreophorus Rüppell, 1830: 18. — H. MILNE EDWARDS, 1837: 130. — BELL, 1855a: 306. — ALCOCK, 1896: 173.
Oreophorus (Oreophorus) — IHLE, 1918: 211. — SERÈNE, 1954: 464. — SAKAI, 1976: 80.

Type species. — *Oreophorus horridus* Rüppell, 1830, by monotypy.

DIAGNOSIS. — Carapace broader than long, surface finely granulated, with scattered large mushroom-like granules, pits or short furrows present which may be in series linked by short grooves, groove parallel to border of carapace absent, 6 large, deep, granule-lined unevenly oval fossae near antero- and posterolateral margins with anterior pair usually largest; system of sub-surface channels linking fossae; fossae separated by two over-arching processes which meet, forming thin groove on dorsal surface and sub-surface channel below; median longitudinal ridge wide, indistinct, branchiostegite covered with irregularly spaced, large, mushroom-like granules and smaller flatter granules in between, sometimes these granules restricted to sub-region; cardiac region partially or completely separated from rest of carapace by surrounding deep, granule-lined excavation; branchial regions with rounded to sharp oblique transverse crests, sometimes very pronounced, conferring an angular appearance to carapace. Front narrow, produced and moderately upturned, weakly bilobed with shallow to moderate median cleft, shallow groove present on dorsal surface immediately after front; granules covering lobes large, flat; antero- and postero-lateral margins of carapace expanded, granule-lined, sinuous; posterior margin with two lobes projecting posteriorly, rim absent. Antennule folds obliquely into large oval fossa distinctly rimmed with small granules; basal segment covered with small granules, occupies half of fossa when closed. Eyes visible in dorsal view. Sternites with large, granule-lined fossae. Male abdomen thickly covered with large granules, with shallow to deep irregularly shaped furrows between granules; G1 2.6-3.2 times longer than G2, distal half straight, moderately covered with short setae, apex simple with small flap; G2 short, glabrous with long, petaloid terminal process.

REMARKS. — IHLE (1918) considered the genus *Oreophorus* Rüppell, 1830, to consist of 13 species in three different subgenera. After examination of *O. horridus*, the type species, we believe that *Oreophorus* should be restricted to the following four species: *O. horridus* Rüppell, 1830, *O. reticulatus* Adams & White, 1848, *O. crosnieri* sp. nov., and *O. fenestrus* sp. nov. These species are mainly characterised by their possession of large distinct carapace fossae, the distinctive branchial crests, the form of the basal antennular segment (occupying half the fossa), the absence of the groove parallel to the carapace border and the structure of G1 and G2.

ETYMOLOGY. — From the Greek “oreos” meaning “mountain” or “hill” and “phoras” meaning “bearing”. *Oreophorus* is thus “mountain-bearing”, referring to the highly convex carapace. Gender is masculine.

Key to the species of *Oreophorus* Rüppell, 1830

- 1.- Median longitudinal ridge wide (measured at region in between fossa) relative to carapace width, ridge width 0.14 times that of carapace; branchial regions of carapace highly raised, with distinct oblique crests; frontal rim narrow; carapace 1.2 times broader than long; G1 2.6 times longer than G2 *Oreophorus crosnieri* sp. nov.
- Median longitudinal ridge narrow relative to carapace width, ridge width 0.07-0.13 times that of carapace; branchial regions of carapace moderately raised or relatively flat; frontal rim broad or absent; carapace 1.4-1.5 times broader than long; G1 2.7-3.2 times longer than G2 2

- 2.- Median longitudinal ridge very narrow relative to carapace width (ridge width 0.07-0.08 times that of carapace); front bilobed; branchial regions moderately raised and coarsely granulated; apex of G1 ending in small papillate projection; ischium of third maxillipeds 2.0-2.2 times longer than merus measured along inner margin **3**
- Median longitudinal ridge moderately narrow relative to carapace width (ridge width 0.13 times that of carapace); front entire; branchial regions relatively flat, finely granulated, appearing smooth; apex of G1 ending in angular projection; ischium of third maxillipeds 1.7 times longer than merus measured along inner margin
..... *Oreophorus fenestrus* sp. nov.
- 3.- Front weakly bilobed and upturned; dorsal surface of carapace with network of granules and depressions; branchial crests indistinct; median longitudinal ridge very distinctly separated from rest of carapace by fossae on dorsal surface of carapace; granules rimming fossae large and distinct
..... *Oreophorus reticulatus* Adams & White, 1848.
- Front strongly bilobed and not upturned; dorsal surface of carapace without network of granules; branchial crests distinct; median longitudinal ridge not distinctly separated from rest of carapace by fossae on dorsal surface of carapace; granules rimming fossae indistinct *Oreophorus horridus* Rüppell, 1830.

Oreophorus horridus Rüppell, 1830

Fig. 2, Pl. 1

Oreophorus horridus Rüppell, 1830: 18 (Tor, Red Sea). — A. MILNE EDWARDS, 1865: 151 (no new record). — NOBILI, 1906: 150 (Djibouti, Red Sea).

MATERIAL EXAMINED. — Red Sea, Tor. coll. RÜPPELL, 1827: 1 ♀, holotype, 16.2 x 23.2 mm (SMF-4735). — Tor. coll. RÜPPELL, 1831: 1 ♂ 9.5 x 13.7 mm (SMF-4735). — Aden Golf, Djibouti. coll. JOUSSEAU, 1897, det. G. NOBILI, 1905: 4 ♀ 7.2 x 10.4 mm, 8.7 x 12.7 mm, 9.9 x 14.3 mm, 13.5 x 20.3 mm (MNHN-B16996). — Djeddah. coll. KRUYT, 1881: 1 ♂ 6.8 x 9.6 mm, 1 ♀ 11.6 x 16.1 mm (RMNH 791).

HOLOTYPE FEMALE. — Carapace 1.5 times broader than long, regions not well-defined; entire dorsal surface covered with large, coalesced granules enclosing scattered small, rounded, granule-lined depressions; 3 large fossae near lateral borders decreasing in size posteriorly, not distinctly rimmed by large pearly granules, connected by system of sub-surface channels; anterior pair of fossae irregularly tear-drop shaped, with long axis parallel to border of carapace, separated from second pair of fossae by two over-arching processes which meet forming dorsal groove and ventral circular channel, second and third fossae from front connected, separated only by two opposing conical projections; median longitudinal ridge flat, and relatively narrow (c. 0.08 times carapace width) relatively smooth, with shallow depressions close to posterior end, distinctly demarcated from rest of carapace by anterior fossae on either side; branchial regions swollen and raised, with central oblique crests, causing angular appearance, posterior region sloping downwards; transverse, deep, rounded M-shaped groove separating lateral borders of intestinal region from rest of carapace, and partially separating it from posterior border of cardiac region; rounded grooves bordering cardiac region with scattered mushroom-like granules; branchiostegite with distinct region of large, mushroom-like granules. Front moderately bilobed, not upturned, slightly produced, without rim, with shallow longitudinal depression after median fissure; margin of hepatic region slightly concave, margin of subhepatic region protruded to form obtuse angle; posterolateral margin with two protruding, rounded lobes separated by a fissure margin; beside cardiac region forming small, posteriorly pointed angle; posterior margin bilobed, confluent with posterior margin of cardiac region. Basal segment of antennule occupies half of fossa when closed; fossa and basal segment of antenna lined by granules.

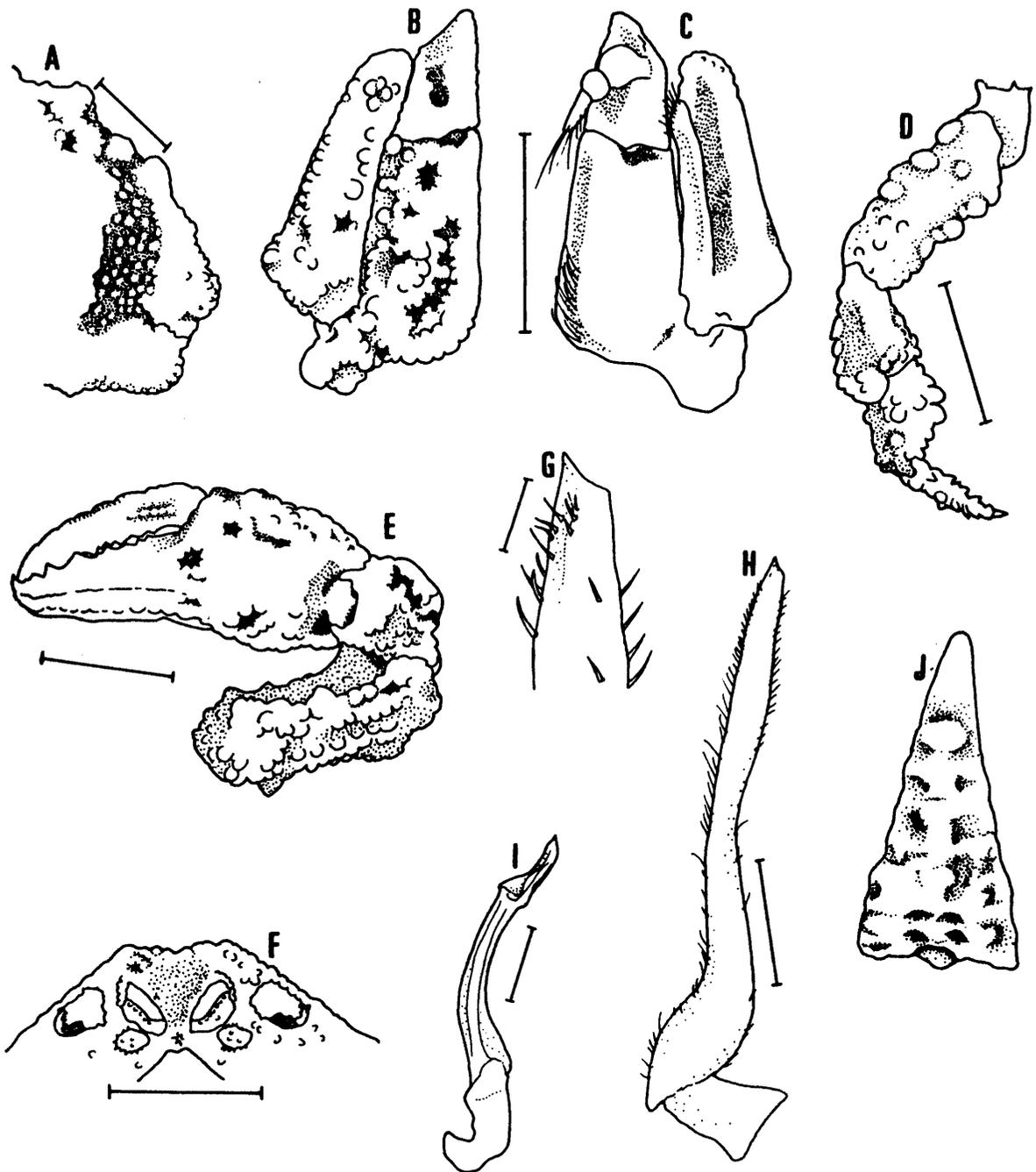


FIG. 2. — *Oreophorus horridus*, Rüppell, 1830, female (MNHN, 8.7 mm by 12.7 mm), male (SMF - 4735, 9.5 mm by 13.7 mm). A, female left branchiostegite region; B, female right third maxilliped outer surface; C, female right third maxilliped inner surface; D, female left last leg upper surface; E, female right cheliped outer surface; F, female frontal view; G, apex of right G1; H, right G1; I, right G2; J, male abdomen (scale not provided). Scales = 1.0 mm.

Third maxillipeds densely covered with large granules and irregularly-shaped grooves; merus with pointed apex, outer edge forms obtuse angle at distal third; ischium 2 times longer than merus along inner margin. Surfaces of chelipeds covered with large granules and shallow depressions; fingers 1.2 times longer than palm; immovable finger broad, inner surface concave, with row of granules parallel to cutting edge, outer surface also with 2 faint rows of granules parallel to cutting edge, inner edge lined by large granules; outer surface of movable finger with short row of granules close to proximal end, inner surface with granulated ridge parallel to cutting edge; cutting edges of fingers toothed with triangular teeth; inner edge of inner surface of palm with group of large distinct granules; edges of merus with large pointed granules, outer edge with 3 large rounded projections, the distal 2 being larger and closer together.

Last pair of ambulatory legs with scattered large round granules, outer surface more granular than inner surface; anterior and posterior edges of merus, carpus and propodus lined by large, round granules; proximal half of posterior edge of propodus with larger raised granules; dactylus narrow, covered with pointed granules.

Abdomen granulated, with shallow scattered pits on either side of median line; telson with pointed, triangular apex.

REMARKS. — The figure and description of *Oreophorus horridus* given by RÜPPELL (1830), which was based on only one female specimen, is inadequate in terms of details of the carapace ornamentation and the chelipeds, and the size of the antennules appears to be exaggerated. However, the crests on the branchial regions were distinctly shown. Two specimens (one male, one female) of *Oreophorus horridus* Rüppell, 1830, labelled as "syntypes" and collected in "1827?" were examined. According to Dr M. TÜRKAY (*in litt.*), the female specimen is the holotype whilst the male specimen was collected at a later date (1831) from the same locality and is not a type. Nevertheless, RÜPPELL (1830) stated that he examined only one female specimen which he figured. This female agrees in all aspects, including size, with the female in SMF. RÜPPELL (1830) stated the type locality as "Tor". It appears that Tor is probably El Tûr (28°14'N, 33°37.4'E), which is a small settlement on the Sinai Peninsula used by pilgrims coming from Egypt to go to Mecca (M. TÜRKAY, *in litt.*). HOLTHUIS (1977:144, 147, 176) equates "Tor" with a place named "Et Tûr" in his study of the Red Sea crabs. The authors were also able to examine NOBILI'S (1906) specimens in the MNHN. NOBILI had listed three males and two females from Obock and Aden and one female from Djibouti in his description. Four specimens were found, all female, one being a juvenile. Given that there is a label by Nobili with the date of determination as 1905 and the data matches one of the localities given in the publication, and that no other specimens of *O. horridus* determined by NOBILI were found in the MNHN, it is likely that these are the specimens he referred to. Whether the specimens from the two different locations may have been mistakenly placed together in the same bottle cannot be determined. NOBILI may have mistaken the juvenile and the smaller specimen for males whilst two specimens may have been misplaced. NOBILI'S specimens agree well with the type specimen except for the relatively more numerous depressions on the carapace of the latter.

The front of *Oreophorus horridus* is by far the least upturned of all the species of *Oreophorus* as it is here defined (Fig. 6). In addition, it differs from the other species by the proportionately narrower median longitudinal ridge (c. 0.08 times carapace width) [with the exception of *O. reticulatus*], the shape of the posterior lobe on either side of the cardiac region, and the distinctly bilobed front.

DISTRIBUTION. — Red Sea (RÜPPELL, 1830; A. MILNE EDWARDS, 1865; NOBILI, 1906).

Oreophorus alcornis Alcock, 1896

Oreophorus reticulatus var *alcornis* Alcock, 1896: 175 (off the Ganjam Coast, India).

MATERIAL EXAMINED. — None.

REMARKS. — The authors have been unable to obtain any specimens of this species and the holotype (and only specimen known) supposedly deposited in ZSI cannot be located.

ALCOCK (1896) stated that this species "... differs from the common form [*O. reticulatus*] in the following particulars: — (1) The caverns are much larger, the two just behind the front being separated by a narrow bridge. (2) On either branchial region is three coarse spines — one on the summit and two on the lateral border: the spine on the summit is vertical and has a bifid tip. (3) The eyes are not at all visible in the dorsal view". From studying other specimens of *Oreophorus* sp., characters (1) and (2) are not reliable. On the other hand, character (3) may be valid (if it is not an artifact or epizoid growth) and it is necessary to check the type specimen to confirm the validity of this character. His specimen is of an exceptionally large size (14 x 19 mm), being even larger than the holotype female of *O. reticulatus* (12.3 x 16.7 mm). ALCOCK's (1896) variety is provisionally regarded here as a separate species.

DISTRIBUTION. — India (ALCOCK, 1896).

Oreophorus crosnieri sp. nov.

Fig. 3, Pl. 2A-C

MATERIAL EXAMINED.— **New Caledonia.** LAGON : St. DW 455, 18°30'S-163°08'E., Surprise Atoll, 40 m, 28.02.85: 1 ♀, holotype, 10.2 x 13.0 mm (MNHN - B 24856). — St. DW 1189, 19°32.1'S-163°34.2'E., Lagoon North, 20 m, 01.11.89: 1 juvenile ♂ 8.3 x 10.0 mm (MNHN).

Chesterfield Is. CORAIL 2: St. DW 94, 19°06'00"S-158°50'00"E, 36-53 m, 27.08.88: 1 ♀ 11.7 x 14.9 mm (MNHN). — St. DW 128, 19°27'89"S-158°30'44"E., 38 m, 29.08.88: 1 juvenile ♂ 7.2 x 8.6 mm (MNHN). All specimens collected by B. RICHER de FORGES.

HOLOTYPE FEMALE. — Carapace 1.2 times broader than long, regions not well-defined; dorsal surface, particularly branchial regions, covered with network of pearly granules enclosing small, shallow, granule-lined depressions; three large granule-lined fossae of decreasing size from front on either side of carapace near borders, fossae (excluding anterior pair) distinctly rimmed by large granules, connected by system of sub-surface channels, fossae on each side separated from each other by overhanging projections which meet to form groove dorsally and sub-surface channel below, floor of each fossa bumpy with irregular clumps of flat granules; two most frontal fossa each kidney-shaped with border closest to margin of carapace straight, long axis along anterolateral border of carapace; median longitudinal ridge flat, broad relative to carapace width (ridge width 0.14 times that of carapace) and not as distinctly demarcated from rest of carapace by anterior fossae as in *O. reticulatus*, without clear network of large granules, appearing smoother than rest of carapace; branchial regions swollen, raised, with irregular ridges of large granules especially at the apices, oblique crests present on branchial regions but not distinct; two shallow depressions on either side of median in between branchial regions; shallow, unevenly eroded, rounded indistinct M-shaped groove separating lateral cardiac region from rest of carapace, bottom of groove with scattered mushroom-like granules, cardiac region indistinctly separated from intestinal region by groove; branchiostegite region with distinct region of large, mushroom-like granules, distinct shallow groove demarcates anterior boundary of granulated region. Front produced, very weakly bilobed, slightly upturned, frontal border covered with large granules forming a slight rim, shallow longitudinal depression on dorsal surface after median fissure; margin of hepatic region slightly protruded to form small lobe, margin of subhepatic region protruded strongly to form large, prominent rounded lobe pointing backwards; posterolateral border beside cardiac region protruded to form lobe with pointed apex pointing posteriorly. Basal segment of antennule occupies half of fossa when closed; fossa and basal segment of antenna lined by granules.

Third maxillipeds densely covered with granules; merus with pointed apex, outer edge forms slight obtuse angle halfway down from apex; ischium 2 times longer than merus along inner margin, outer surface of proximal end with large granules.

Surfaces of chelipeds (excluding fingers) with network of granules and depressions, inner surface being more coarsely granulated than outer surface; fingers 1.7 times longer than palm; immovable finger large,

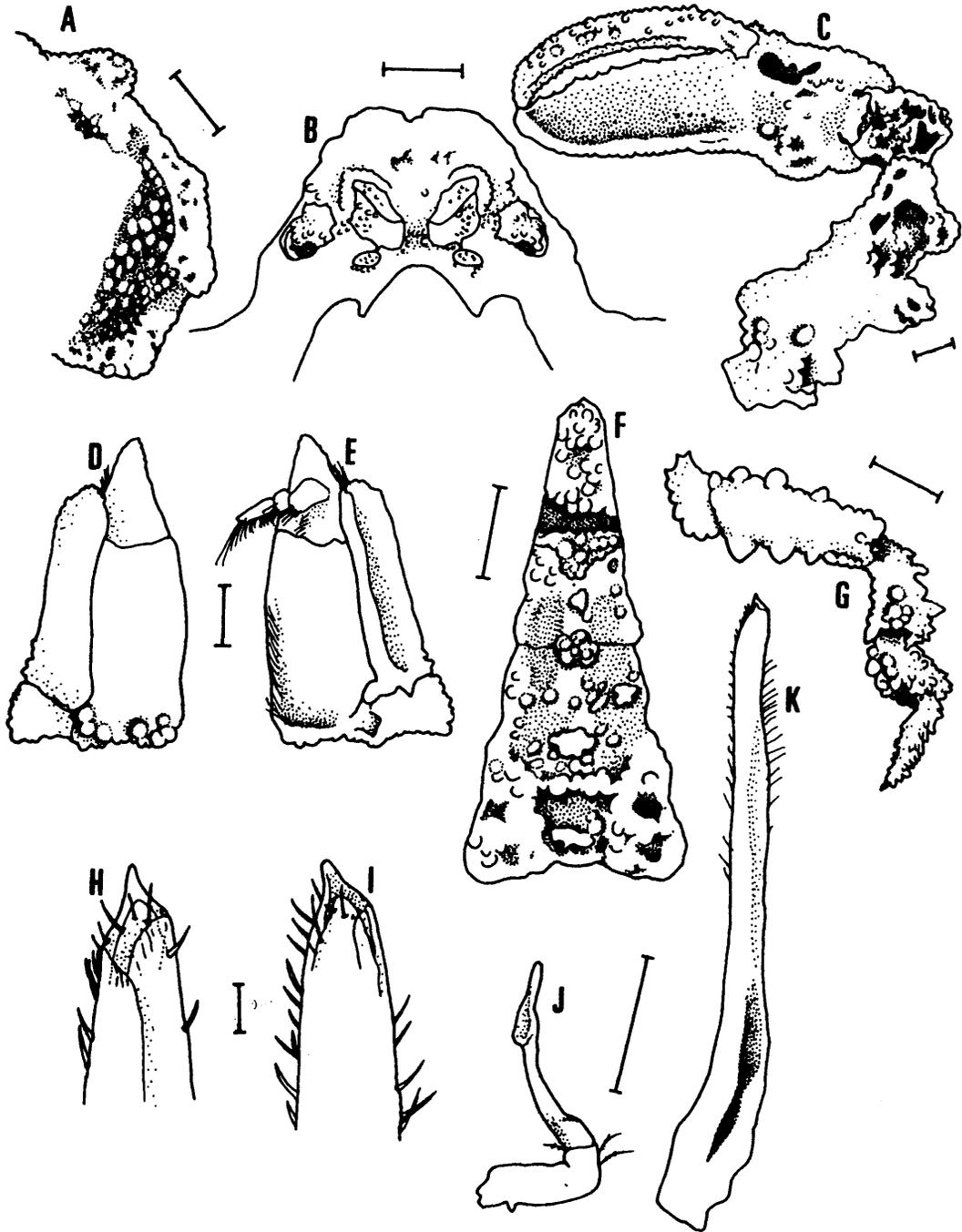


FIG. 3. — *Oreophorus crosnieri*, sp. nov., holotype female (MNHN, 10.2 mm by 13.0 mm), male (MNHN, 8.3 mm by 10.0 mm). A, female left branchiostegite region; B, male frontal view; C, female right chela inner surface; D, female right third maxilliped outer surface; E, female right third maxilliped inner surface; F, male abdomen, excluding segments 1-2; G, female right last leg upper surface; H, I, apex of right G1; J, right G2; K, right G1. Scales: A = 2.0 mm; B-G, J, K = 1.0 mm; H, I = 0.15 mm.

about twice as broad as movable finger and concave on inner surface along cutting edge, outer surface rounded and swollen, with faint rows of granules parallel to cutting edge, inner edge lined by small granules, forming a sharp crest, short row of granules parallel to cutting edge running from proximal end to about one-third of finger; inner surface with short row of granules running obliquely from proximal end to about one-third of finger; inner surface of movable finger granulated, with row of granules parallel to cutting edge, inner edge lined entirely by row of granules, forming sharp crest; cutting edges of fingers toothed with small denticulate teeth throughout; palm with large distinct granule on inner surface close to inner margin of distal end, inner and outer margins flattened to form crests with crest on outer margin being thicker; outer edge of carpus also flattened to form thick crest; angles of distal end of merus enlarged and rounded, outer edge with three large, rounded, granule-tipped rounded projections, the distal two being larger than the proximal projection, inner edge with large rounded projection close to proximal end, lined by scattered large, pointed granules. Basal segment of antennule occupies half of fossa when closed; fossa and basal segment of antenna lined by granules.

Last pair of ambulatory legs nodular, outer surface being more granular than inner surface; anterior edge of merus with a few large, raised mushroom-like granules, proximal two-thirds of posterior edge with large pointed granules, distal one-third with large, round granules; outer surface with large round granules; anterior edge of carpus with large raised granules, posterior edge with large round granules; anterior edge with medium-sized pointed granules, posterior edge of propodus with large round granules; dactylus narrow, covered with small pointed granules.

Abdomen granulated and with shallow scattered pits, two interrupted grooves present on either side of median line; terminal segment long and with sharp, triangular apex.

PARATYPE MALES (young). — Smaller and less coarsely granulated than female holotype. Abdomen covered with large granules, proximal end of segment 3 with central region excavated to form shallow depression with two higher rounded regions of granules on either side, short transverse row of granules forming ridge in centre of depression close to proximal end of segment; rest of segments (up to half of segment 6 and excluding segment 7) with shallow longitudinal depressions on either side of median line; segment 7 with pointed triangular apex. G1 2.6 times longer than G2; G1 narrow, straight, tapering gradually to apex, distal half sparsely covered with short hairs, rest of G1 glabrous; apex with three lobes, lobes with sparse short spines, on lobe with rounded projection at tip; G2 narrow with petaloid distal process.

REMARKS. — *Oreophorus crosnieri* sp. nov. resembles *Oreophorus reticulatus* but differs from the latter species in having proportionately larger and more prominent subhepatic angles, a smoother and broader (ridge width 0.14 times carapace width) median longitudinal ridge, proportionately narrower immovable finger of the cheliped, a more produced and broader front relative to carapace width [c. 0.11 times carapace width in *O. reticulatus* and c. 0.15 times carapace width in *O. crosnieri*], a more angular posterior margin on either side of cardiac region, the posterior margin confluent with the posterior margin of the cardiac region and the male telson with a triangular apex [rounded apex in *O. reticulatus*]. It is difficult to compare the G1 and G2 structures of the males of *O. crosnieri* with those of *O. reticulatus* as all known males of both species are rather young.

DISTRIBUTION. — New Caledonia.

ETYMOLOGY. — This species is named after Dr Alain CROSNIER who kindly permitted the authors to examine a substantial number of specimens from the ORSTOM expeditions.

Oreophorus fenestrus sp. nov.

Fig. 4, Pl. 2D-F

MATERIAL EXAMINED.— Red Sea, Muscat. pres. Col. J. B. MILES: 1 ♂, holotype, 7.7 x 10.8 mm (BMNH 87.16).

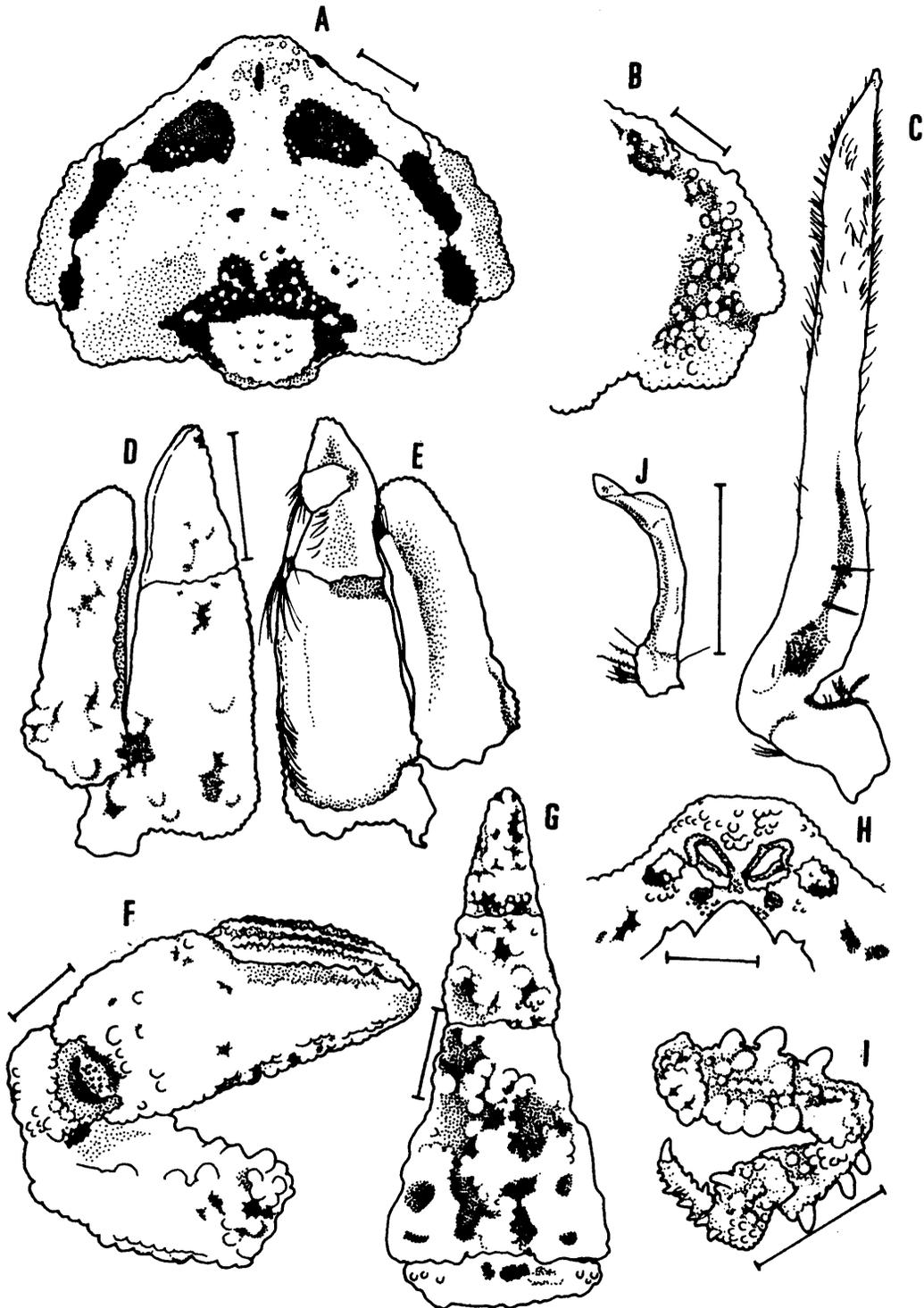


FIG. 4. — *Oreophorus fenestrus*, sp. nov., holotype male (BMNH 87.16, 7.7 mm by 10.8 mm). A, carapace dorsal surface; B, left branchiostegite region; C, right G1; D, right third maxilliped outer surface; E, right third maxilliped inner surface; F, right chela outer surface; G, abdomen, excluding segment 1; H, frontal view; I, right last leg; J, right G2. Scales = 1.0 mm.

HOLOTYPE MALE. — Carapace 1.4 times broader than long, regions not well-defined; dorsal surface with small flat granules, appearing quite smooth to the naked eye, network of granules absent; three large fossae of decreasing size from front on either side of carapace near borders, fossae indistinctly rimmed by large granules, connected by system of sub-surface channels, fossae on each side separated from each other by overhanging projections which meet to form thin groove dorsally and sub-surface channel below, floor of each fossa with scattered mushroom-like granules, two most frontal fossa each semi-lunar with border closest to margin of carapace straight, long axis along anterolateral border of carapace, inner posterior border with rounded notch, floor of fossa near notch with short row of mushroom-like granules; median longitudinal ridge flat and moderately broad relative to carapace width (c. 0.13 times carapace width), distinctly demarcated from rest of carapace by anterior fossae; branchial regions moderately swollen, slightly raised, without irregular ridges of granules, oblique crests rounded and only faintly visible, shallow rounded depression on either side of median line between branchial regions; deep, relatively evenly eroded, rounded distinct M-shaped groove separating entire cardiac region from rest of carapace, bottom of groove with scattered mushroom-like granules, cardiac region indistinctly rimmed by granules, posterior cardiac region surrounded by M-shaped groove such that it projects out as narrow, tongue-shaped structure; branchiostegite region with scattered large, mushroom-like granules. Front slightly produced, not bilobed, slightly upturned, with a few shallow depressions, frontal border without granule-covered rim, shallow longitudinal depression on dorsal surface after median fissure; margin of hepatic region not at all protruded, margin of subhepatic region protruded slightly to form weak, rounded lobe; posterolateral border beside cardiac region protruded slightly to form angular lobe. Basal segment of antennule occupies half of fossa when closed; antennal fossae lined by granules.

Third maxillipeds densely covered with granules; merus with pointed apex, outer edge slightly rounded; ischium 1.7 times longer than merus along inner margin.

Surfaces of chelipeds covered with large granules, inner surface being more coarsely granulated than outer surface; fingers 1.3 times longer than palm, with smaller granules than rest of chelipeds; immovable finger large, about twice as broad as movable finger and concave on inner surface along cutting edge, outer surface rounded and slightly convex, with faint rows of granules parallel to cutting edge, inner edge lined by small granules; inner and outer surface of movable finger with rows of granules parallel to cutting edge, granules on inner surface being smaller; cutting edges of fingers toothed with triangular teeth; inner surface of palm with large distinct granules close to inner margin, inner and outer margins flattened to form sharp crests; centre of inner margin of carpus with large prominent granule; outer edge of merus with row of three projections tipped with large pointed granules nearer proximal end, inner edge with a few large pointed granules. Basal segment of antennule occupies half of fossa when closed; fossa lined by granules.

Last pair of ambulatory legs nodular, outer surface being more granular than inner surface; anterior edge of merus with a few large, raised mushroom-like granules, posterior edge with large pearly granules, outer surface with large round granules; anterior edge of carpus with large raised granules; posterior edge of propodus also with large raised granules; dactylus moderately stout, covered with small pointed granules.

Abdomen covered with large granules and with scattered shallow, rounded pits; segment 7 with rounded apex. G1 3.2 times longer than G2, distal three-quarters of G1 with short hairs, becoming increasingly denser on approaching apex; apex with small angular projection; G2 narrow, with petaloid terminal process.

REMARKS. — *Oreophorus fenestrus* sp. nov. differs from *O. reticulatus*, the most similar species, in the following features: 1) the carapace is relatively smoother without the network of granules present on the carapace of *O. reticulatus*, 2) the front is not at all bilobed (weakly bilobed in *O. reticulatus*), 3) the median longitudinal ridge is proportionately broader (c. 0.13 times carapace width, whilst that in *O. reticulatus* c. 0.07 times), 4) the flatter branchial regions with less distinct oblique crests, and 5) the shorter fingers relative to length of the palm (fingers 1.7 times longer than palm in *O. reticulatus*, 1.3 times longer than palm in *O. fenestrus*).

DISTRIBUTION. — Red Sea.

ETYMOLOGY. — The species name is derived from the Latin “fenestratus”, alluding to the large, window-like fossae on the carapace.

Oreophorus reticulatus (Adams & White, 1848)

Figs. 5-6, Pl. 3A-C

Oreophorus reticulatus Adams & White, 1848: 54, pl. 6, Fig. 1 (Straits of Sunda). — BELL, 1855a: 307 (examined type specimen in BMNH). — BELL, 1855b: 19. — A. MILNE EDWARDS, 1865: 151. — WALKER, 1890: 111. — ALCOCK, 1896: 174-175. — BORRADAILE, 1903: 436. — RATHBUN, 1911: 199, pl. 15 Fig. 4. — DAI & XU, 1991: 3, Fig. 2.

MATERIAL EXAMINED. — **Indonesia**. 6°0'S-105°50'E., Sunda Strait, coll. ARTHUR ADAMS, pres. Capt. Sir E. BELCHER: 1 ♀, holotype, 12.3 x 16.7 mm (BMNH 1847.21). — Java. “DANSKE EXPED. TIL KEI-ØERNE 1922”: St. 67, 38 m, sand “skaller”, 27.07.1922: 1 ♂ 6.5 x 8.4 mm (ZMUC). — St. 118, 27 m, sand, “skaller”, Sigsbee Trawl, 07.08.1922: 1 ♂ 9.0 x 11.5 mm (ZMUC). — Java. st. 106, 32 m, sand, “skaller”, Sigsbee Trawl, 05.08.1922: 1 ♂ 9.2 x 11.6 mm (ZMUC). — Jolo, “Udgar”(?). TH. MORTENSEN'S PACIFIC EXPEDITION 1914-1916, 17.03.1914: 2 ♀ 10.9 x 13.4 mm, 15.1 x 19.1 mm (ZMUC) (not other data).

India, off Ceylon [Sri Lanka], 62 m, off Malabar Coast, 51 m: 1 ♀ 7.3 x 9.7 mm, 1 ♂ 7.8 x 10.7 mm (ZSI 1996-98/7:2145-48/7:5298/9).

Maldives, Fadifolu Atoll. coll. J. S. GARDINER, M. A., 20.06.1900: 1 ♂ 3.0 x 3.7 mm (CMZ). — Kolumadulu Atoll. coll. J. S. GARDINER, M. A.; 20.06.1900: 1 ♂ 7.8 x 10.3 mm (CMZ). — “DANSKE EXPED. TIL KEI-ØERNE 1922”. St. 61, 50 m, coll. ‘by OZOV’, 14.05.1922: 1 ♂ 6.3 x 7.5 mm (ZMUC).

HOLOTYPE FEMALE. — Carapace 1.4 times broader than long, regions not well-defined; entire dorsal surface covered with network of large pearly granules enclosing small, rounded, granule-lined depressions; three large fossae of decreasing size from front on either side of carapace near borders, fossae distinctly rimmed by large pearly granules except for border along each side of median longitudinal ridge, lined by small flat granules, connected by system of sub-surface channels, two most frontal fossae each ovalish, “semi-lunar” with long axis along border of carapace, with concave notch on inner posterior margin, separated from second, more posterior pair of fossae by two over-arching processes which meet to form groove dorsally and circular channel below, second and third fossae from front connected dorsally, separated only by conical projection; median longitudinal ridge flat and narrow relative to width of carapace (c. 0.07 times carapace width), also with network of granules and depressions, distinctly demarcated from rest of carapace due to anterior fossae on either side; branchial regions swollen and raised, bearing larger granule-lined depressions than rest of carapace, with central oblique crests causing regions to appear more angular; deep, wide, rounded M-shaped, granule-rimmed groove separating entire cardiac region from rest of carapace, posterior border of cardiac region forming tongue-shaped projection with the two rounded parts of the groove on either side and lined by pearly granules, entire border of cardiac region also lined by large pearly granules, bottom of groove with scattered mushroom-like granules; branchiostegite region with scattered large, mushroom-like granules, not forming distinct region. Front very weakly bilobed, slightly upturned, with coarse granules forming slight rim around frontal border, with shallow longitudinal depression after median fissure; posterior margin of hepatic region slightly convex to form indistinct lobe, margin of sub-hepatic region protruded slightly to form small acute angle, ventral anterolateral border with shallow fissure posterior to sub-hepatic angle; posterolateral margin with shallow concavity two-thirds down from anterolateral angle, shallow groove extends from concavity onto branchiostegite region; posterolateral border beside cardiac region slightly protruded to form lobe with rounded apex pointing away from centre of carapace; true posterior margin separate from posterior margin of cardiac region. Basal segment of antennule occupies half of fossa when closed; fossa and basal segment of antenna lined by granules.

Third maxillipeds densely covered with granules; merus with pointed apex, outer edge forms obtuse angle halfway down from apex, outer surface with central rounded depression; ischium 2.2 times longer than merus along inner margin, outer surface with central, broad, granular, longitudinal ridge on proximal half, ridge with shallow depressions on either side, edge of inner proximal angle lined by large raised granules. Surfaces of chelipeds (excluding fingers) with network of pearly granules and scattered large granules; fingers 1.7 times longer than palm; immovable finger large, slightly more than twice as broad as movable finger and

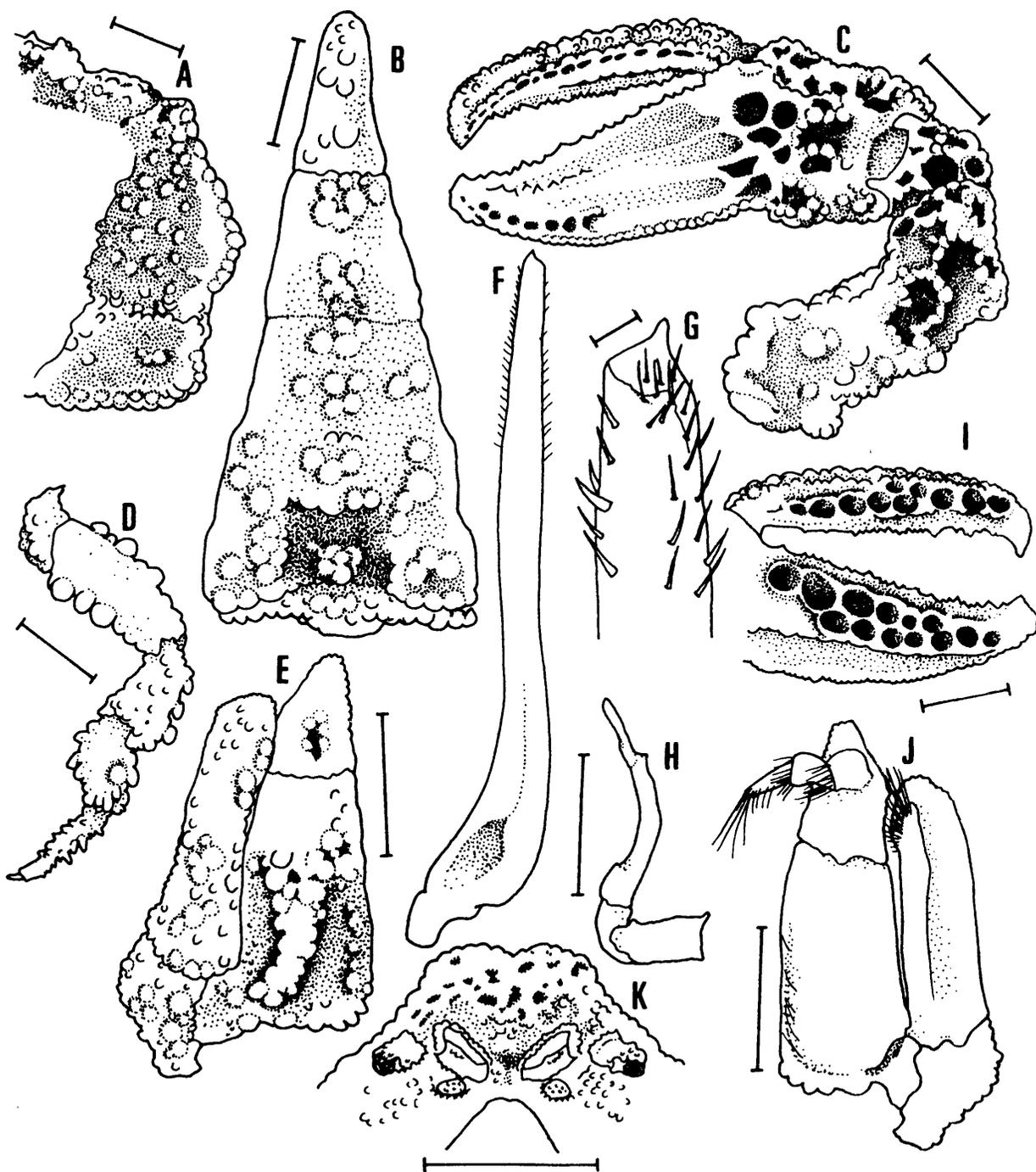


FIG. 5. — *Oreophorus reticulatus* Adams & White, 1848, holotype female (BMNH 1847.21, 12.3 mm by 16.7 mm), male (ZMUC, 9.2 mm by 11.6 mm). A, female left branchiostegite region; B, male abdomen; C, female right cheliped inner surface; D, male right last leg; E, female right third maxilliped outer surface; F, right G1; G, apex of right G1; H, right G2; I, female right cheliped fingers outer surface; J, female right third maxilliped inner surface; K, female frontal view. Scales: B, D, F, H, K = 1.0 mm; A, C, E, I, J = 2.0 mm; G = 0.1 mm.

concave on inner surface along cutting edge, outer surface with three shallow grooves from base, grooves gradually tapering and becoming indistinct on approaching tip of finger, inner edge lined by large granules, forming a sort of crest, half of inner border with row of small pits, short row of denticles parallel to cutting edge close to distal end; inner surface with two parallel rows of large, deep pits with raised continuous rim beginning from proximal end and ending close to tip; outer surface of movable finger with parallel rows of granules, inner edge with row of small, shallow pits; cutting edges of fingers toothed with small denticulate teeth throughout; outer and inner surface of palm and merus with shallow granule-lined depressions as on carapace; outer edge of merus with three rounded granule-tipped rounded projections.

Last pair of ambulatory legs nodular, outer surface being more granular than inner surface; anterior edge of merus with a few large, raised mushroom-like granules, posterior edge with large pearly granules, outer surface with large round granules; anterior edge of carpus with large raised granules; anterior and posterior edge of propodus also with large raised granules; dactylus narrow, covered with pointed granules.

Abdomen granulated and with shallow scattered pits on either side of median line; terminal segment long and with triangular apex.

MALESPECIMENS (young). — Much smaller and with generally less granulose and depressed than female holotype. Abdomen covered with large scattered granules, longitudinal part of central region more distinctly granulated; proximal end with central circular clump of granules separated from rest of segment by shallow, squarish granule-lined depression; segment 7 long and rounded at apex. G1 2.7 times longer than G2; G1 narrow, straight, tapering gradually to apex, distal third sparsely covered with short hairs, rest of G1 glabrous; apex tipped with several short spines, ending in short projection; G2 narrow with petaloid distal process. Margins of last leg with scattered mushroom-like granules, surfaces covered with large granules; dactylus long, narrow, covered with small raised, pointed granules.

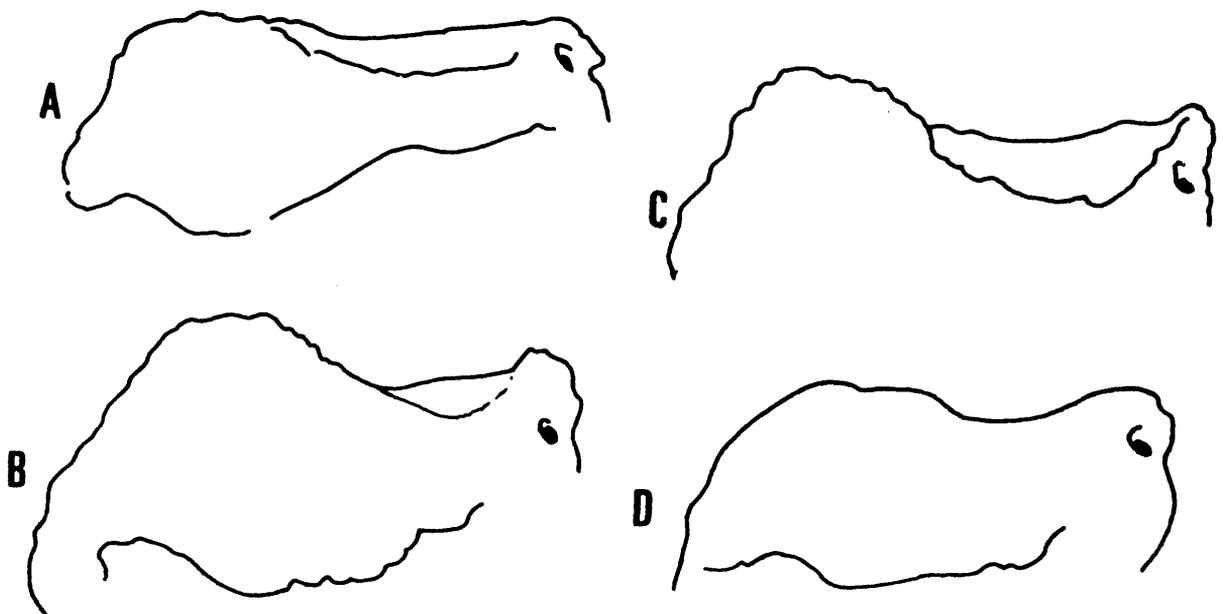


FIG. 6. — Schematic diagram showing side profiles of *Oreophorus* species. A, *Oreophorus horridus*; B, *Oreophorus reticulatus*; C, *Oreophorus crosnieri*; D, *Oreophorus fenestrus*.

DISTRIBUTION. — Indonesia (ADAMS & WHITE, 1848), Singapore (WALKER, 1890), Maldives (BORRADAILE, 1903), Seychelles (RATHBUN, 1911), Persian Gulf (ALCOCK, 1896).

REMARKS. — *Oreophorus reticulatus* differs from other congeners in having branchial regions which are more weakly crested (with the exception of *O. fenestrus* sp. nov.), carapace fossae which are both lined and distinctly rimmed by granules, a proportionately broader and less produced front, a proportionately wider carapace relative to the length, and the distinct form of the carapace granulation.

The male specimens examined in this study were all young and their G1's and G2's were not fully developed. Thus, detailed comparisons with the G1 and G2 of the other species in the genus could not be made. They differ from the female holotype by being less granular and less strongly grooved, absence of pits on the fingers, less distinct granulation lining the carapace fossae and relatively narrower immovable finger. The abdomen of the male is sunken below the level of the sternum as stated by ALCOCK (1896). Two specimens (one male and one female) of *O. reticulatus* from ZSI with locality stated as "off Ceylon" and "off Malabar Coast" were examined by ALCOCK (1896) and their identity is confirmed here. STEPHENSEN (1945) recorded a female specimen of *O. reticulatus* from the Iranian Gulf, but as no description or figure accompanies his record, its identity cannot be confirmed.

ALOX gen. nov.

Oreophorus — STIMPSON, 1858: 161 (part) (*nec* RÜPPELL, 1830).

Oreophorus (*Oreophorus*) Ihle, 1918: 212 (part). — SERÈNE, 1954: 464 (part). — SAKAI, 1976: 80 (part).

TYPE SPECIES. — *Alox glene* sp. nov., designated herein.

DIAGNOSIS. — Carapace broader than long, surface rugose with numerous mushroom-like granules, granule-lined excavations and furrows; irregularly shaped ridges present, may be lined by small granules; deep granule-filled groove present parallel to border of carapace, groove usually branching into smaller furrows along border; median longitudinal ridge narrow and distinct, separated from rest of carapace by granule-lined excavations; branchiostegite region gently sloping, slope in posterior region more sudden and smoothens out on approaching edge of carapace, distinct eroded region slight distance from edge of carapace covered with large mushroom-like granules. Front narrow, produced and moderately upturned, weakly to moderately bilobed with shallow median cleft; granules covering lobes large and flat. Antero- and postero-lateral margins of carapace expanded, rim absent or thin and distinct; fissures cutting into border of carapace absent or present only as closed fissures ending in small holes. Basal segment of antennule covered with small granules and entirely occupies fossa when closed. Eyes visible from dorsal view. Male and female abdomen covered with large mushroom-like granules; male abdominal segments 3-6 never with large, prominent, central raised granule. G1 1.6 - 4.3 times longer than G2, straight along entire length, tip may be slightly dilated, distal half covered sparsely or moderately with long/short hairs, apex simple and pointed, with slit-like opening; G2 short and glabrous with petaloid terminal process.

REMARKS. — *Alox* is characterised mainly by the pattern of grooves and the position of mushroom-like granules on the carapace. *Alox ornatum* (Ihle, 1918), *A. patella* (Alcock, 1896) and *A. rugosum* (Stimpson, 1858) were originally placed in *Oreophorus* (*Oreophorus*) by IHLE (1918) and this was followed by subsequent authors. By present re-definitions of the genera, the three species are excluded from *Oreophorus* due to the absence of large granule-lined fossae on the carapace and on the female abdomina, the complete enclosure of the antennular fossae by the basal segment and the presence of a groove parallel to the border of the carapace. The genus *Alox* contains six species: *A. glene* sp. nov. [type species], *A. rugosum* (Stimpson, 1858), *A. patella* (Alcock, 1896), *A. ornatum* (Ihle, 1918), *A. antheos* sp. nov., *A. somphos* sp. nov.

ETYMOLOGY. — The name *Alox* is Greek for "furrow", with reference to the furrowed appearance of the carapace. Gender neuter.

Key to the species of Alox gen. nov.

- 1.- Carapace very much broader than long (1.7 times); groove parallel to border of carapace branches into anterior end of branchial regions, forming "dimples"; median longitudinal ridge usually running posteriorly on the dorsal surface of carapace to merge with cardiac region *Alox glene* sp. nov.
- Carapace moderately broader than long (1.2-1.5 times); groove parallel to border of carapace branching outwards at intervals or indistinct towards posterior half; median longitudinal ridge usually ending anterior to region between branchial regions **2**
- 2.- Frontal and posterolateral borders of carapace without rim; frontal lobes swollen and covered with large granules; carapace not much broader than long (1.2 times); posterolateral margins scalloped; branchial regions rounded, with crested ridges
..... *Alox ornatum* (Ihle, 1918).
- Frontal and posterolateral borders with rim; frontal lobes not swollen; carapace much broader than long (1.4-1.5 times); posterolateral margins entire; branchial regions rounded, ridges may be present but are not crested **3**
- 3.- Groove parallel to margin of carapace branching at regular intervals to meet margin of carapace, thus forming 4 rounded lobes on either side on carapace borders **4**
- Groove parallel to margin of carapace branching irregularly or indistinct, not forming lobes on carapace borders **5**
- 4.- Borders of carapace flattened, upturned to form cup *Alox patella* (Alcock, 1896).
- Borders of carapace swollen and lobate, not upturned *Alox antheos* sp. nov.
- 5.- Groove parallel to border of carapace very broad; post-orbital prominences triangular; anterior region of branchial region eroded and on a lower level than rest of branchial region; rim on frontal and lateral borders broad and indistinct, frontal rim not forming M-shape *Alox zalion* sp. nov.
- Groove parallel to border of carapace narrow; post-orbital prominences rectangular or indistinct; entire branchial region unevenly eroded all over; rim on frontal and lateral borders narrow and distinct, frontal rim forming M-shape **6**
- 6.- Front with central shallow, round depression on dorsal surface; posterolateral border extends horizontally on either side ending in right angles with rounded apices
..... *Alox latusoides* (Sakai, 1937)
- Front without central shallow, rounded depression on dorsal surface; posterolateral border extends obliquely towards the front, ending in acute angle with pointed apices **7**
- 7.- Distal lateral margins of last female abdominal segment straight, forming a distinctly triangular apex; dorsal surface of carapace covered with small coalesced granules with pitted surfaces and rounded depressions, giving beaded appearance; anterior margin of post-orbital prominences distinctly sunken below level of frontal rim; G1 terminal segment with triangular apex, 4.3 times longer than G2; terminal segment of male abdomen with rounded apex *Alox somphos* sp. nov.
- Distal lateral margins of last female abdominal segment gently but distinctly convex, forming tongue-shaped structure with sharp tip; dorsal surface of carapace covered with large coalesced granules and shallow depressions, giving heavily eroded

appearance; anterior margin of post-orbital prominences confluent with, or only slightly, sunken below level of frontal rim; G1 terminal segment with pointed apex, 2.9 times longer than G2; terminal segment of male abdomen with triangular apex

..... *Alox rugosum* (Stimpson, 1858).

Alox glene sp. nov.

Fig. 7, Pl. 3D-F

Oreophorus rugosus – BOUVIER, 1915: 47. — MICHEL, 1964: 36 (nec STIMPSON, 1858).

MATERIAL EXAMINED. — **Mauritius**: 1 ♂, holotype, 7.2 x 11.9 mm (BMNH 88.2).

Madagascar, Tuléar, Ifaty. St 213, South of Grande Passe, 12 m, "Sable dans sillon étroit" [sand in narrow grooves], coll. B. THOMASSIN, 26.09.1969: 1 ♂ 6.7 x 10.3 mm (MNHN - B 18331).

Yemen, Aden. coll. Maj. YARBURY: 1 ♂ 5.2 x 7.5 mm, 1 ♀ 8.9 x 14.5 mm (BMNH 85.14).

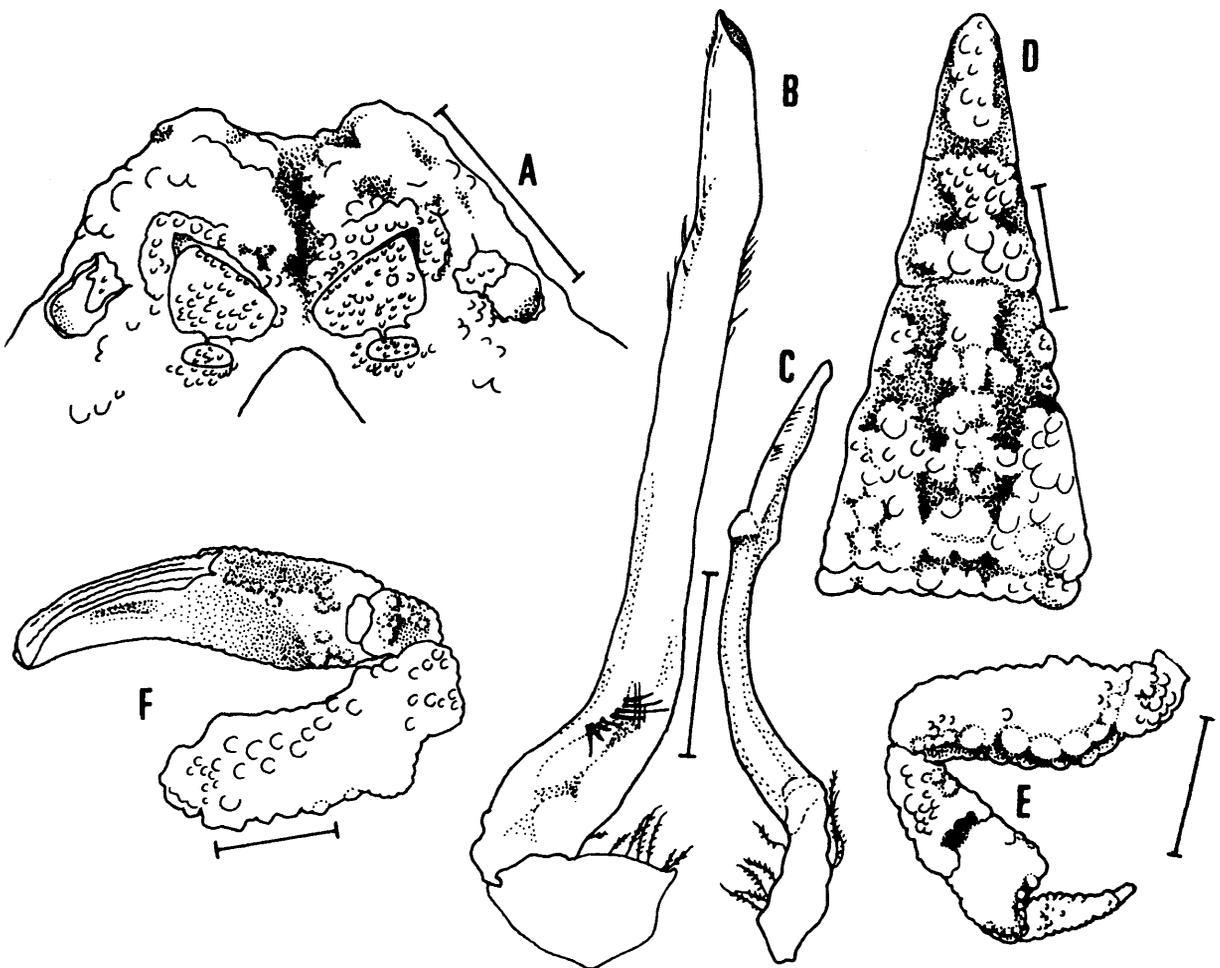


FIG. 7. — *Alox glene* sp. nov., holotype male (BMNH 88.2, 7.2 mm by 11.9 mm). A, frontal view; B, right G1; C, right G2; D, abdomen excluding segment 1; E, left last leg, upper surface; F, right cheliped inner surface. Scales: A-E = 1.0 mm; F = 2.0 mm.

HOLOTYPE MALE. — Carapace 1.7 times broader than long, covered with mushroom-like granules which may be coalesced; broad groove parallel to border of carapace present, bottom of groove with scattered mushroom-like granules; lateral borders of carapace swollen to form granulated rim which has granulated branches that extend into groove; post-orbital protuberances rounded and extending into groove parallel to border of carapace; branchial regions swollen, each divided into three raised, granulated lobes: one anterior, one lateral and one posterior, short longitudinal groove anterior to and extending slightly into anterior lobe of each branchial hump, resembling “dimples”; median longitudinal ridge very distinct and unbroken, merging with anterior of cardiac region; M-shaped groove separating lateral sides of cardiac and intestinal regions from rest of carapace, groove also separates posterior margin of cardiac region from anterior margin of intestinal region, cardiac region with slight cleft centrally on posterior margin; posterolateral margin next to cardiac region protruded to form lobe. Front distinctly bilobed with broad cleft, upturned portion of front forms part of rim running all round carapace, frontal rim with shallow grooves; margin of hepatic region slightly protruded to form rounded obtuse angle, corresponding larger, more acute angle in the sub-hepatic region, shallow groove parallel to border of carapace on ventral surface posterior to sub-hepatic angle; branchiostegite region with large mushroom-like granules. Basal segment of antennule occupies fossa completely when closed; anterior margin of fossa raised to form granulated rim.

Outer surface of third maxillipeds coarsely granular and eroded, inner surface smooth and glabrous; merus with pointed apex, outer edge slightly convex; ischium 2.4 times longer than merus along inner margin.

Outer surface of chelipeds more granular than inner surface; fingers 1.2 times longer than palm, inner and outer surface of both immovable and movable fingers with transverse rows of small granules parallel to cutting edges; cutting edges with small denticulate teeth.

Merus of last pair of ambulatory legs covered with large granules, posterior edge lined by row of large pointed granules; dactylus moderately stout, tapering gradually to claw, covered with small raised granules.

Abdomen covered with large flat granules, lateral borders of segments 5-7 eroded, leaving central raised granulated area; terminal segment with slightly pointed apex.

G1 moderately stout, 1.6 times longer than G2, distal half sparsely covered with short hairs, apex ending in a papillate structure; G2 with very long petaloid terminal process.

PARATYPE FEMALE. — Abdomen with scattered large granules, sutures faintly visible, other aspects similar to male.

DISTRIBUTION. — Mauritius (MICHEL, 1964), Madagascar, Yemen (present records).

REMARKS. — *Alox glene* generally resembles *A. rugosum*, but differs in several important characters. The median longitudinal ridge extends all the way to the cardiac region in *A. glene* whilst in *A. rugosum*, it is distinct only over the anterior third. The branchial regions are divided into raised lobes in *A. glene* whilst they are complete in *A. rugosum*. The rim around the frontal and lateral borders of the carapace is much narrower and distinct in *A. rugosum* when compared to *A. glene*. G1 ends in a papillate process in *A. glene* whilst in *A. rugosum*, it ends in a broad tip; and G2 in the former species also has a proportionately longer terminal process compared to that of the latter species.

The records of *Oreophorus rugosum* by MICHEL (1964) from Mauritius and BOUVIER (1915) from Port Louis, “Iles Maurice”, are tentatively identified with this species. *Oreophorus rugosum* is not known to occur in the Indian Ocean.

Alox antheos sp. nov.

Fig. 8, Pl. 4 A-C

Oreophorus (Oreophorus) rugosus — IHLE, 1918: 213, Fig. 121 (*nec* STIMPSON, 1858).

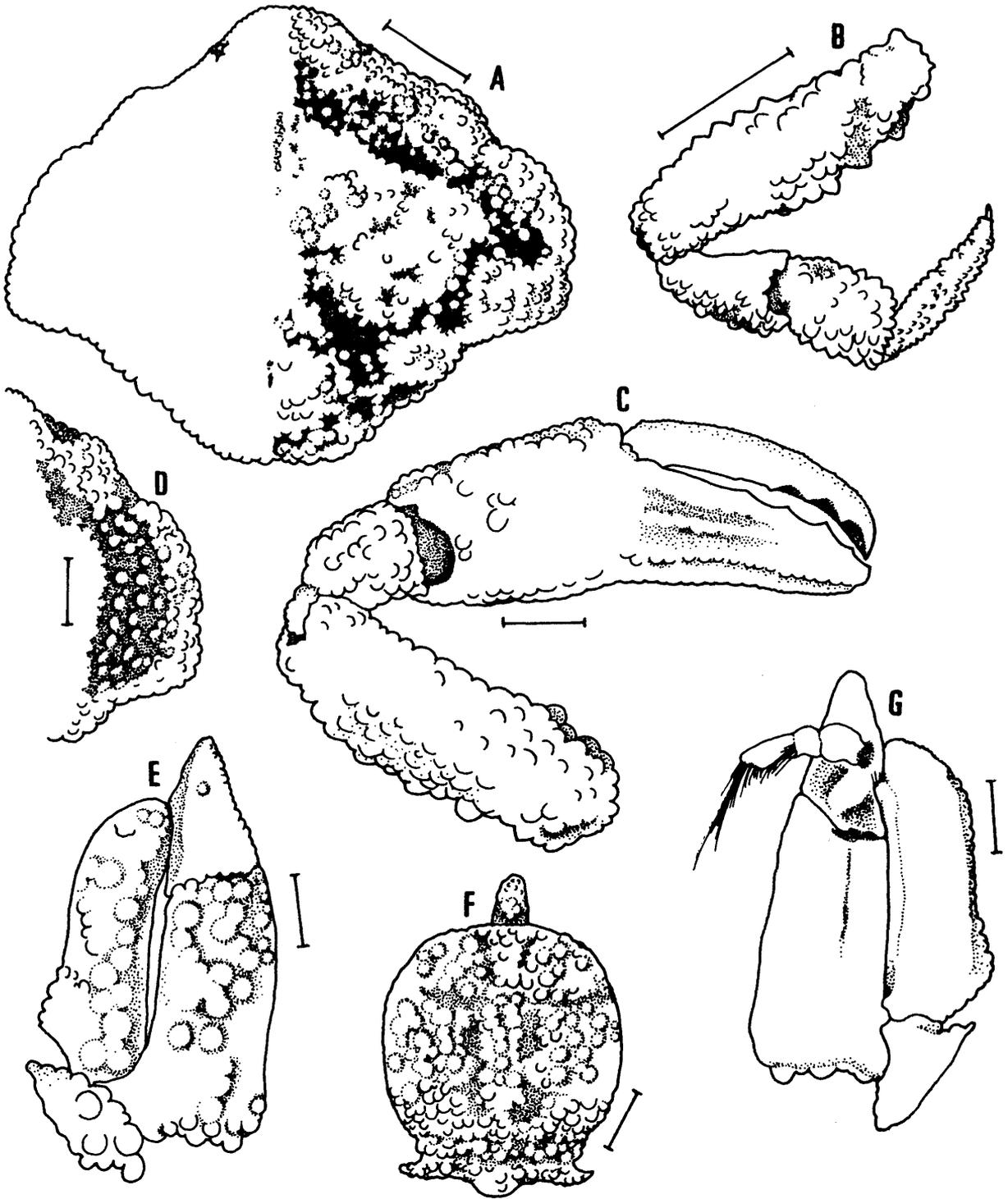


FIG. 8. — *Alox antheos* sp. nov., holotype female (MNHN - B 19048, 6.7 mm by 8.4 mm). A, carapace dorsal surface; B, left last leg upper surface; C, right cheliped outer surface; D, left branchiostegite region; E, right third maxilliped outer surface; F, abdomen excluding segment 1; G, right third maxilliped inner surface. Scales = 1.0 mm.

MATERIAL EXAMINED.— **Indonesia**, Moluccas, Aru Is. MARIEL KING MEMORIAL EXPEDITION 1970: St. AW 1/H 5, off West Coast of Wasir Is., 5°30'S-134°12'E., 55-59 m, mud, coll. W. WOKAM : 1 ♀, holotype, 6.7 x 8.4 mm (MNHN - B19048). — SIBOGA : St. 49a, 8°23'5"S-119°4'6"W., 69 m: 1 ♀, paratype, 6.1 x 7.5 mm (ZMA).

HOLOTYPE FEMALE. — Carapace 1.2 times broader than long, border rimmed with numerous small granules; dorsal surface thickly covered with both large and small granules; broad, deep groove parallel to border of carapace present, groove branching at regular intervals around carapace to touch margin of carapace, forming four distinct granulated oval lobes (excluding frontal and cardiac lobes) on border on either side of carapace; shallow longitudinal groove lined with granules on region posterior to orbit present, joins groove parallel to border of carapace; branchial regions moderately swollen, covered with large granules and irregularly shaped shallow grooves, slightly raised patch of granules anterior to each branchial hump, small patch of large granules between branchial humps; distinct longitudinal grooves on either side of intestinal region separating intestinal region from rest of carapace, extending up to anterior end of intestinal region, intestinal region not clefted in middle; two granulated lobes immediately posterior to cardiac region separated by shallow median fissure. Front entire, shallow fissure absent when viewed from front, upturned portion of front does not form rim running all round carapace; margin of hepatic region slightly protruded to form rounded obtuse angle two-thirds from the front, corresponding larger angle in the sub-hepatic region, shallow groove parallel to border of carapace on ventral surface posterior to sub-hepatic angle. Basal segment of antennule occupies fossa completely when closed; basal segment of antenna embedded and almost invisible in orbital hiatus.

Outer surface of third maxillipeds covered with large raised granules except for merus, inner surface smooth and glabrous; merus with pointed apex, outer edge forming slight obtuse angle one-third down from apex, inner edge lined by small granules, outer surface with large flat granules; ischium 2.3 times longer than merus along inner margin.

Outer surface of chelipeds thickly covered with large raised granules except for fingers; fingers 1.1 times longer than palm, immovable finger with a transverse row of small granules close to inner edge of outer surface, two shallow transverse ridges running through proximal half of outer surface above row of granules, cutting edge of fingers toothed along distal half; slightly raised oblique ridge on palm extending from base of movable finger to median portion of proximal end of palm.

Merus of last pair of ambulatory legs covered with large granules, entire anterior edge and proximal three-quarters of posterior edge of merus of last pair of legs lined with row of large pointed granules; dactylus stout, almost as long as propodus, covered with small pointed granules.

Abdomen covered with large flat granules, sutures between segments faintly visible; two shallow discontinuous grooves on either side of median line; terminal segment with central small clump of granules.

REMARKS. — This species closely resembles *Alox patella* in the shape of the carapace and form of the female abdomen. The granulated lobes on the border of the carapace in *A. antheos* are absent in *A. patella*, which has, instead, a distinct, thin, rim formed by the upturned margins of the carapace. *A. antheos* has a broad groove parallel to the border of the carapace, but *A. antheos* has a narrow groove which becomes indistinct in places. There are no male specimens of either species available for examination.

DISTRIBUTION. — Moluccas, Indonesia (IHLE, 1918).

ETYMOLOGY. — From the Greek "antheos" meaning "flower", referring to the flower-shaped lobate margins of the carapace. Used as a noun in apposition.

Alox latusoides (Sakai, 1937)

Fig. 9, Pl. 4 D-F

Oreophorus (Oreotlos) latusoides, SAKAI, 1937: 119, text Fig. 14. — MIYAKE, 1961: 14. — SAKAI, 1976: 81, pl. 25, Fig. 1. — MIYAKE, 1983: 201.

Tlos petraeus – ALCOCK, 1896: 176 (*nec* A. MILNE EDWARDS, 1874).

Tlos latus – SANKARANKUTTY, 1962: 157, Fig. 4, 5.

MATERIAL EXAMINED. — **Japan**, Nagasaki. Donated by the Imperial University, Tokyo: 1 ♀ 8.1 x 11.3 mm (USNM uncat.).

Andamans: 2 ♀ 5.7 x 8.0 mm, 5.5 x 7.8 mm (ZSI 5660/9:8951/6).

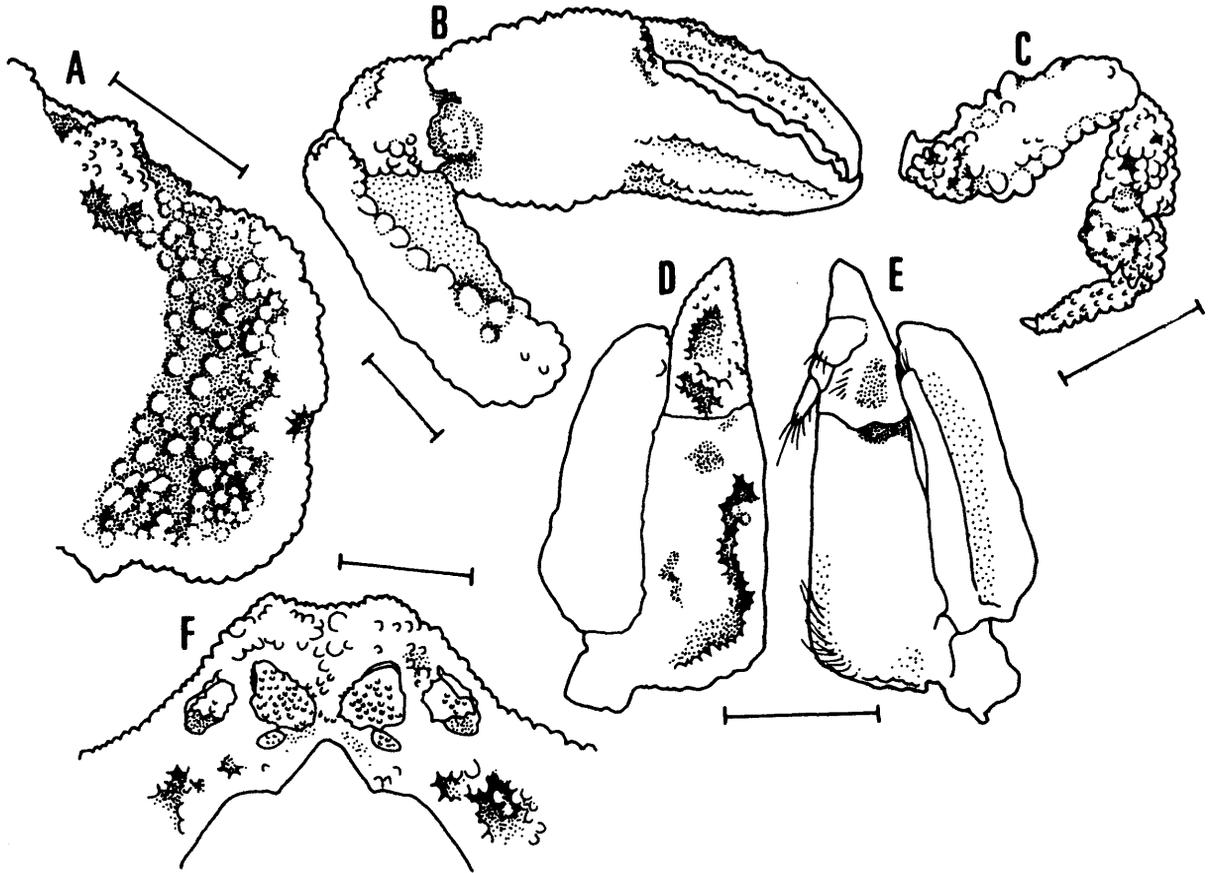


FIG. 9. — *Alox latusoides* (Sakai, 1937), female (USNM, 8.1 mm by 11.3 mm). A, left branchiostegite region; B, right cheliped outer surface; C, right last leg upper surface; D, right third maxilliped outer surface; E, right third maxilliped inner surface; F, frontal view. Scales: A = 2.0 mm; B-F = 1.0 mm.

FEMALE SPECIMEN (8.1 X 11.3 mm). — Carapace 1.4 times broader than long, regions not well-defined; dorsal surface covered with small granules; groove parallel to carapace border indistinct, resulting in narrow rim along margin of carapace, rim along antero- and posterolateral borders with scattered shallow granule-lined circular depressions; shallow longitudinal groove lined with granules on region posterior to orbit, groove extends posteriorly to one quarter length of carapace; dorsal surface of anterolateral border with longitudinal groove halfway down from front; distinct, narrow median longitudinal ridge running posteriorly to one-third carapace length; two short, oblique row of granules immediately behind posterior end of ridge, anterior to branchial humps; two, shallow rounded depressions on either side of anterior end of cardiac

region; branchial regions raised and covered with irregularly shaped granulated ridges which enclose small circular depressions; shallow, irregularly shaped, granule-lined groove on either side of cardiac and intestinal regions. Front moderately bilobed, with circular depression immediately after median cleft; margin of sub-hepatic region protruded to produce obtuse angle, with triangular depression anterior to it; shallow, granule-lined groove on ventral surface, posterior to sub-hepatic angle; branchiostegite with distinct patch of mushroom-like granules; posterolateral border beside cardiac region quite straight. Basal segment of antennule entirely occupies fossa when closed; basal segment of antennae linked to antennular fossa by means of short groove.

Third maxillipeds densely covered with granules; merus with pointed apex, outer edge slightly convex, centre with round circular depression; ischium 1.9 times longer than merus along inner margin, inner border of outer surface with shallow granule-lined groove along three-quarters of inner edge.

Outer surface of chelipeds more granular than inner surface; fingers as long as palm; immovable finger with two parallel transverse rows of small granules on outer surface forming shallow groove in between, inner row reaching halfway to tip from proximal end, outer row reaching tip from proximal end, inner surface concave along inner edge; inner surface of movable finger with single transverse row of granules a slight distance from cutting edge; cutting edges of both fingers sparsely lined by denticulate teeth; distal end of inner surface of palm with scattered granule-lined depressions, inner edge with scattered large granules; inner edge of carpus and all edges of merus lined by scattered large granules.

Outer surface of last pair of legs coarsely granulated, inner surface with flatter granules; proximal three-quarters of anterior edge and entire posterior edge of merus lined with row of large granules; posterior half of outer surface of propodus with clump of large granules; dactylus narrow and long, covered with small granules.

Abdomen granulated, with two parallel, interrupted longitudinal grooves on either side of median line; sutures indistinct; terminal segment with very pointed apex.

REMARKS. — *Alox latusoides* was considered (as *Oreophorus*) by SAKAI (1937) to be closely related to *Oreotlos latus*, however, despite superficial similarities, they are generically distinct.

A specimen of *A. latusoides* from the USNM has the correct collection data and sex given by SAKAI (1937) for the holotype of *A. latusoides*. The specimen was donated by the Imperial University of Tokyo for which SAKAI had identified material. As far as is known, SAKAI only had one specimen (the holotype female) of *A. latusoides*. Labels indicates that the specimen was presented to USNM as part of an exchange program between the Imperial University of Tokyo and USNM, however, type status is not indicated. Nevertheless, the USNM specimen matches SAKAI's description and figures of *A. latusoides* well and it is the authors' opinion that they are conspecific. SAKAI (1976: 81) notes that the holotype female is in the collection of one Mr. I. KANEKO but the whereabouts of this collection is uncertain.

ALCOCK (1896) reported eight specimens of "*Tlos petraeus*" from Andamans (62 m depth) and Pedro Shoal (37 m depth). We examined two specimens from ZSI labelled as "*Tlos petraeus*" from the Andamans and found them to be *Alox latusoides*. Although the date of collection is not mentioned on the label, it is likely that these two were part of the eight specimens mentioned by ALCOCK (1896). However, ALCOCK (1896:181) stated: "... in the abdomen of the male ... there is a denticle in the middle line on the 4th and 6th [terga]". This is a typical character of males of *Oreotlos* species. We have not examined a male *Alox latusoides* but in all other features, this species is typical of our new genus *Alox*. The male "*Tlos petraeus*" which ALCOCK examined could be an *Oreotlos* and may not have been conspecific with the female specimens.

SANKARANKUTTY (1962) recorded a female specimen (6.0 x 9.0 mm) from Aberdeen Bay, Andaman and Nicobar Islands, as *Tlos latus* Borradaile, 1903. From the photograph and the description, his specimen is probably *Alox latusoides*.

DISTRIBUTION. — Japan (SAKAI, 1937), Andamans, Bay of Bengal (ALCOCK, 1896).

Alox ornatum (Ihle, 1918)

Fig. 10, Pl. 5

Oreophorus (Oreophorus) ornatum Ihle, 1918: 214, Fig. 122. — SAKAI, 1937:118 ; 1965: 34, pl. 15, Fig. 2 ; 1976: 81, pl. 25, Fig. 3. — GRIFFIN, 1972, 2: 63. — TAKEDA, 1979: 155, 156, Fig. 2b. — CHEN, 1989: 193, Fig. 32 c-d, pl. VI 6. — MIYAKE, 1983: 201.

MATERIAL EXAMINED. — **Indonesia**, Kai Is., st. 260, 5°36'5"S-132°55'2"W, 90 m: 1 ♀, lectotype, 6.8 x 8.5 mm, 1 ♂, paralectotype, 5.8 x 6.8 mm (ZMA).

Coral Sea, GALATHEA EXPEDITION 1950-52, st. 539, D100, 26°33'S-153°31'E, 86 m, gravel: 1 ♂ 6.8 x 8.2 mm (ZMUC).

Philippines, MUSORSTOM 3, st. DR 137, 12°03'N-122°06'E, 56 m, 06.06.1985, det. CHEN Huilian, 1987: 1 ♂ 5.5 x 6.5 mm (MNHN-B18193).

Japan, Kushimoto, Kii Peninsula, st. DR-79-5, 01.1979: 1 ♀ 6.7 x 9.4 mm (NSMT-Cr. 6457).

New Caledonia. LAGON : st. 375, 22°32'S-167°08'E., Grand Récif Sud, 67-71 m, 21.01.1985: 1 ♀ 8.4 x 10.6 mm (MNHN - B 19167). — St. 397, 22°39'S-167°11'E., Grand Récif Sud, 125 m, 23.01.1985: 1 ♀ 8.4 x 10.8 mm (MNHN - B 19161). — St. 829, 20°48'5"S-165°18'4"E., Lagoon West, 160-200 m, coll. B. RICHER de FORGES (CB 439), 10.01.1987: 1 ♀ 7.8 x 10.0 mm (MNHN - B24852).

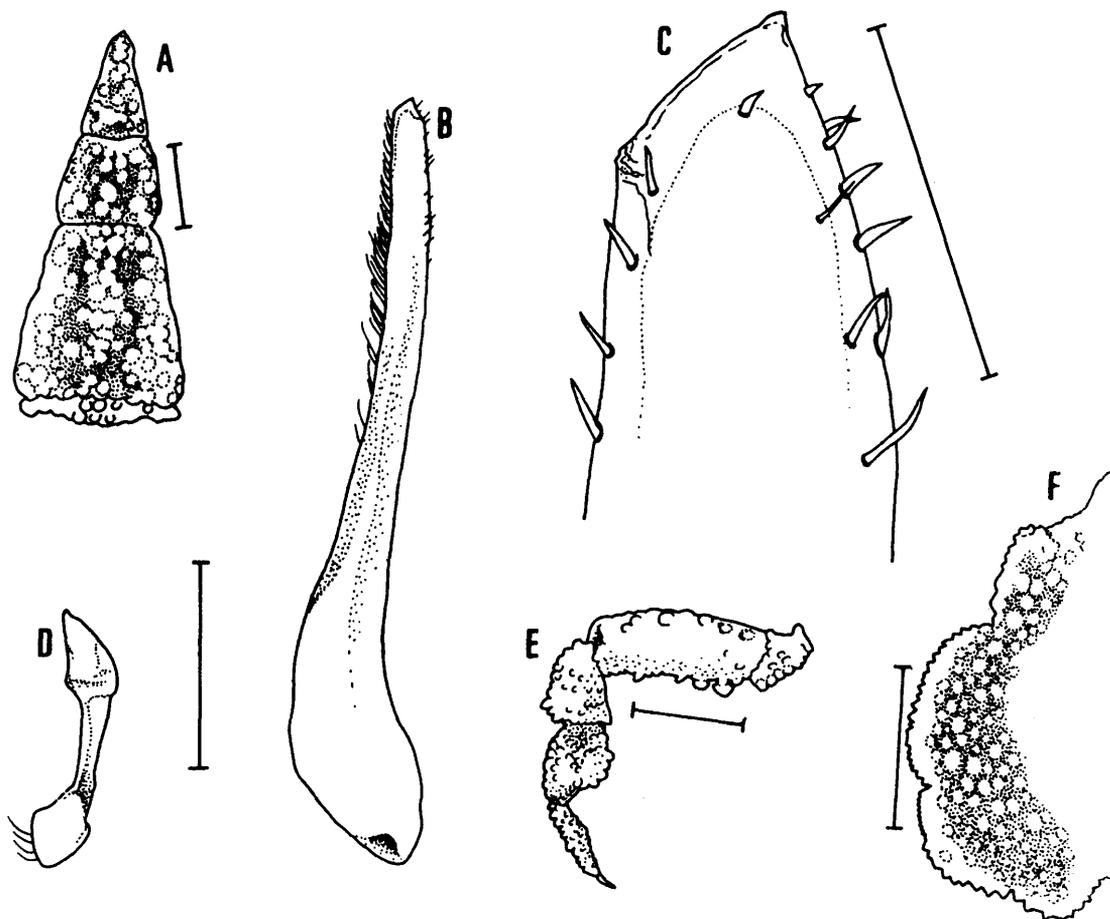


FIG. 10. — *Alox ornatum* (Ihle, 1918), paralectotype male (RMNH, 5.8 mm by 6.8 mm). A, abdomen excluding segment 1; B, right G1; C, apex of right G1; D, right G2; E, left last leg upper surface; F, right branchiostegite region. Scales: A, B, D-F = 1.0 mm; C = 0.1 mm.

PARALECTOTYPE MALE. — Carapace 1.2 times broader than long; dorsal surface covered with mushroom-like granules, post-orbital prominences rather indistinct; branchial regions swollen, with raised granulated lobes and crested ridges; median longitudinal ridge formed by large mushroom-like granules, ending anterior to branchial regions; shallow, broad depression demarcating lateral sides of cardiac and intestinal regions from rest of carapace, cardiac region with central raised clump of granules with central groove, cardiac region with central circular clump of granules, posterior margin indistinct from true posterior margin; posterolateral margin next to cardiac region protruded to form lobe. Front produced, slightly upturned, distinctly bilobed with broad cleft, frontal lobes swollen and covered with large mushroom-like granules; lateral and posterior margins lined by raised granules with pointed apices, conferring a scalloped appearance; centre of margin of hepatic region flattened to form triangular “plateau” surrounded by row of small granules, sub-hepatic margin protruded to form obtuse angle; branchiostegite region covered completely with large mushroom-like granules. Basal segment of antennule occupies fossa completely when closed; anterior margin of fossa raised to form granulated rim.

Outer surface of third maxillipeds granular, inner surface smooth and glabrous; merus with pointed apex, outer edge protruded to form rounded obtuse angle halfway down from apex halfway down from apex; ischium 1.8 times longer than merus along inner margin, margin of proximal end lined by large granules.

Outer surface of chelipeds more granular than inner surface, surface coarsely granular; fingers as long as palm, inner and outer surface of both immovable and movable fingers with transverse rows of small granules parallel to cutting edges; cutting edges with small denticulate teeth; inner and outer edges of merus lined with large pointed granules.

Merus of last pair of ambulatory legs covered with large granules, posterior edge lined by row of large mushroom-like granules; dactylus narrow, tapering gradually to sharp pointed claw, covered with small raised granules.

Abdomen covered with large mushroom-like granules, with two interrupted, parallel eroded depressions on either side of median line running from segment 3-6; terminal segment with triangular sharp apex.

G1 thin, narrowing gradually to apex, 3 times longer than G2, distal half covered with short hairs, apex ending in a triangular flap; G2 stout, with broad petaloid terminal process.

FEMALES. — Ridges on branchial regions not as crested as in male; other aspects similar to male.

REMARKS. — Distinctive characters for recognising *Alox ornatum* are: a relatively narrow carapace, the prominent and swollen front, the pattern of granulation on the branchial regions, the shape of the male abdomen and the shape and proportions of G1 and G2.

IHLE'S (1918) two type specimens in ZMA were examined and the female is here designated the lectotype; it is the one figured by IHLE (1918: Fig. 122), the figure slightly differing from the actual specimen only in the positions of the closed sutures on the carapace.

On the basis of the descriptions and figures of SAKAI (1937; 1965; 1976), his records of this species from Japan are probably valid. TAKEDA'S (1979) female specimen (NSMT Cr. 6457) is clearly *A. ornatum* but his male specimen (NSMT Cr. 5784) belongs to an undescribed species, here named *A. zalion* sp. nov. CHEN (1989) figured the G1 and G2 of *A. ornatum* for the first time. Her specimen in the MNHN was examined and its identity is confirmed.

DISTRIBUTION. — Japan (SAKAI, 1937), Philippines (CHEN, 1989), Moluccas, Indonesia (IHLE, 1918), Australia (GRIFFIN, 1972), .

Alox patella (Alcock, 1896)

Fig. 11, Pl. 6 A-C

Tlos patella Alcock, 1896: 176, pl. 28, Fig. 5.

Oreophorus (Oreophorus) patella — SERÈNE, 1954: 476, Fig. 3(8), 4(c,d), pl. 9.

MATERIAL EXAMINED. — **Andamans**, coll. ZSI: 1 ♀, lectotype, 6.2 x 8.5 mm (BMNH 96.9.8.17) ; 2 ♀ 6.3 x 8.8 mm, 8.6 x 11.9 mm (ZSI 911/10).

New Caledonia. LAGON : st. 626, 21°51'9"S-166°52'5"E, 47-48 m, 06.08.1986: 1 ♀ 6.8 x 9.1 mm (MNHN-B18230). — St. 865, 20°38'75"S-165°04'4"E, coll. B. RICHER de FORGES : 1 ♀ 9.4 x 12.6 mm (MNHN-B24855).

Australia, Queensland, st. 153, Friday Is., 18 m, st. 165, Thursday Is., 7-9 m, coll. COPPINGER: 2 ♀ 7.1 x 10.4 mm, 11.4 x 17.6 mm (BMNH 82.7).

LECTOTYPE FEMALE. — Carapace 1.4 times broader than long, covered with large mushroom-like granules which may be coalesced; narrow groove parallel to border of carapace present, bottom of groove with mushroom-like granules, groove branches outwards, circumventing post-frontal regions to from post-frontal prominences, hepatic regions and posterior half of anterolateral border; frontal and lateral borders of carapace upturned to form granulated rim; post-orbital protuberances rectangular; branchial regions swollen, with irregular ridges of granules; median longitudinal ridge very distinct and unbroken, merging with anterior of cardiac region; 2 clumps of large granules on either side of ridge slightly anterior to branchial regions; cardiac region with central clump of large granules; 2 irregularly-shaped granule-lined grooves separating lateral sides of intestinal and posterolateral sides of cardiac regions from rest of carapace; cardiac region with 2 circles of granules laterally and triangular cleft centrally on posterior margin; posterolateral margin next to cardiac region protruded to form rounded lobe, portion of margin anterior to lobe extends into dorsal surface of carapace as granulated ridge. Front broadly bilobed with median cleft; margin of hepatic region not protruded to form angle, margin of sub-hepatic region protruded to form slight convexity, triangular depression extending from margin of carapace into ventral surface immediately after subhepatic convexity; branchiostegite region with distinct region of large mushroom-like granules demarcated from less granulated region by shallow groove circumventing region. Basal segment of antennule occupies fossa completely when closed; anterior margin of fossa raised to form granulated rim.

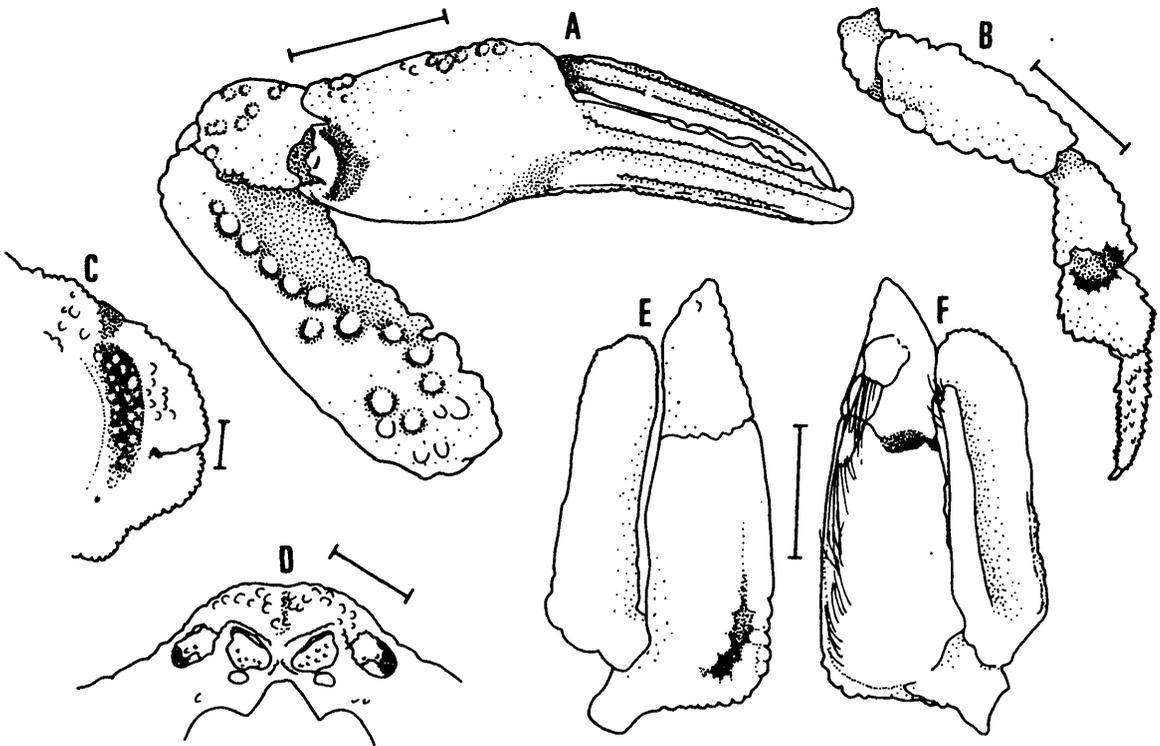


FIG. 11. — *Alox patella* (Alcock, 1896), lectotype female (BMNH 96.9.8.17, 6.2 mm by 8.5 mm). A, right cheliped outer surface; B, right last leg upper surface; C, left branchiostegite region; D, frontal view; E, right third maxilliped outer surface; F, right third maxilliped inner surface. Scales: A = 2.0 mm; C-F = 1.0 mm.

Outer surface of third maxillipeds coarsely granular, inner surface smooth and glabrous; merus with pointed apex, outer edge slightly convex, outer surface with central shallow depression; ischium 2 times longer than merus along inner margin, outer surface with distinct large granules close to inner edge of proximal half, granules lined by shallow groove along inner edge, proximal third of inner edge lined by large granules.

Outer surface of chelipeds more granular than inner surface; fingers 1.2 times longer than palm, inner and outer surface of both immovable and movable fingers with transverse rows of small granules parallel to cutting edges, inner edge of immovable finger flattened to form granulated crest; cutting edges with small denticulate teeth; outer border of both inner and outer surfaces of palm with scattered large granules; inner edges of merus line by large granules, proximal end with scattered large granules.

Merus of last pair of ambulatory legs covered with large granules, edges lined by row of large rounded granules; edges of carpus lined by rounded granules; edges of propodus lined by large pointed granules; dactylus narrow and long, covered with small pointed granules.

Abdomen with scattered large granules, sutures faintly visible, two interrupted grooves on either side of median line; terminal segment narrow, with triangular apex.

OTHER FEMALES. — Other female specimens examined are larger than the lectotype female. In larger specimens, the granulation on the carapace appears less distinct. The ridges and clumps of granules are more distinct and well-defined. The carapace margins are more distinctly lobate and less upturned.

REMARKS. — *Alox patella* is remarkable within the genus because the carapace margins are upturned, forming a “cup”, and it was probably due to this feature that ALCOCK (1896) originally placed it in the genus *Tlos*. Nevertheless, the other characters of the species are typical for *Alox*.

ALCOCK'S diagram (ALCOCK, 1896: pl. 28, Fig. 5) is accurate but somewhat schematic and some parts are difficult to discern. He examined seven females and all are syntypes. Two females from the “Andamans”, on loan from ZSI agree well with the description given by ALCOCK (1896). The larger has similar dimensions to those given by ALCOCK for the largest adult female he examined. They are probably syntypes. A syntype female specimen is in BMNH, donated by the Indian Museum, Calcutta, and this specimen is here designated the lectotype. From SERÈNE'S (1954) description and figures, it is likely he also had *A. patella* s. str.

DISTRIBUTION. — Australia, New Caledonia (new records), Vietnam (SERÈNE, 1954), Andamans (ALCOCK, 1896),

***Alox rugosum* (Stimpson, 1858)**

Fig. 12, Pl. 6D-F, 7

Oreophorus rugosus Stimpson, 1858: 161. — A. MILNE EDWARDS, 1874: 49. — ORTMANN, 1892: 575. — STIMPSON, 1907: 159, t. 19, Fig. 6, 6a. — IHLE, 1918: 212. — SAKAI, 1934: 285. — TAKEDA, 1973: 87 (part), pl. 2, Fig. C. — TAKEDA, 1982: 96, fig. 280. — TAKEDA, 1989: 140. — TAN & RICHER de FORGES, 1993: 128.

Oreophorus (Oreophorus) rugosus Sakai, 1937: 117. — MIYAKE, 1961: 14. — SAKAI, 1976: 80, text Fig. 41. — MIYAKE, 1983: 201.

MATERIAL EXAMINED. — **Japan**, Oshima Passage, Amami-oshimu Is., 35 m, coll. and det. M. TAKEDA, 1989: 1 ♀, neotype, 12.2 x 17.8 mm (NSMT-Cr. 9660).

Singapore, Southern Is. dredge, 10 minutes from Jurong Fish Port, coll. P. K. L. NG, 13.01.1984: 1 ♀ 8.6 x 13.0 mm (ZRC 1989.2951). — Southern Is., gravel bottom, 04.85: 1 ♀ 9.6 x 14.1 mm (ZRC-1985.1730).

New Caledonia, coll. MILNE EDWARDS, 1879: 1 ♀ 5.7 x 7.7 mm (RMNH 792). — LAGON: st. 251, Sector Nouméa, 22°19'S-166°25'E., 20 m: 1 ♀ 10.1 x 15.4 mm (MNHN). — St. DW 950, 20°21'3"S-164°10'6"E., 12-13 m, 28.04.1988: 1 ♀ 8.9 x 13.0 mm (MNHN). — St. DW 951, 20°29'6"S-164°09'6"E., 12 m, 28.04.1988: 1 ♀ 10.4 x 14.9 mm (USNM). — St. DW 1008, 20°11'0"S-163°53'4"E., 27 m, 02.05.1988: 1 ♀ 10.6 x 15.7 mm (MNHN). — St. DW 1045, 20°06'5"S-

164°04'6"E., 12 m, coll. B. RICHER de FORGES, 04.05.1988: 1 ♀ (13.8 x 19.9 mm (MNHN). — St. A6, 22°19'3"S-166°24'95"E., 20 m, stones "dalle"; coll. B. RICHER de FORGES, 11.02.1985: 1 ♀ 12.9 x 19.5 mm (MNHN-B 19176).

Thailand, Koh Kam, 9 m, gravel, coll. TH. MORTENSEN, 06.02.1900, det. M. J. RATHBUN, 1906: 1 ♀ 7.8 x 11.1 mm (ZMUC). — SIBOGA EXPEDITION, stn. 172: 2 ♂ 8.1 x 12.6 mm, 9.3 x 14.3 mm (ZMA).

Madagascar, West Coast, Pracel Shoal, 55 m, sand, coll. A. CROSNIER: 2 ♀ 11.1 x 16.3 mm, 11.1 x 16.4 mm (MNHN B-18329).

NEOTYPE FEMALE. — Carapace 1.5 times broader than long, covered with coalesced granules and shallow depressions; groove parallel to border of carapace narrow, bottom of groove with large mushroom-like granules, region of groove posterior to hepatic angle with hole which may penetrate ventral surface of carapace; lateral borders of carapace swollen and crested to form granulated rim; post-orbital prominence broad, anterior confluent with frontal border and sunken slightly below level of crest of frontal rim, posterior margin coalesced with a few granules; branchial regions large and swollen; median longitudinal ridge very distinct, narrow, widening slightly posteriorly; irregularly-shaped eroded groove separating lateral sides of cardiac and intestinal regions from rest of carapace; posterior half of cardiac region with two lateral rings of granules; posterolateral margin next to cardiac region almost straight. Front produced, upturned, distinctly bilobed with broad cleft, upturned portion of front forms part of crested rim running all round carapace, frontal rim angular, forming M-shaped ridge over frontal lobes; margin of hepatic region slightly protruded to form rounded obtuse angle with shallow oval depression at apex, corresponding larger, more acute angle in the sub-hepatic region; shallow, eroded groove parallel to border of carapace on ventral surface posterior to sub-hepatic angle, bottom of groove lined by mushroom-like granules; anterolateral margin of carapace immediately after hepatic angle with line of 3-4 large granular teeth slightly ventral to crest of rim; branchiostegite region with distinct region of large mushroom-like granules. Basal segment of antennule occupies fossa completely when closed; anterior margin of fossa raised to form granulated rim.

Outer surface of third maxillipeds coarsely granular and eroded, inner surface smooth and glabrous; merus with pointed apex, outer edge protruded to form obtuse angle one-third from apex; ischium 2.6 times longer than merus along inner margin.

Inner surface of chelipeds more granular than outer surface; fingers 1.5 times longer than palm, inner and outer surface of both immovable and movable fingers with transverse rows of small granules parallel to cutting edges; cutting edges lined with irregularly triangular teeth; outer edge of merus with 3 large angles in a row.

Proximal half of posterior edge of merus of last pair of legs lined with row of large granules; dactylus narrow, tapering gradually to claw, covered with small pointed granules.

Abdomen covered with large flat granules, sutures faintly visible; two parallel interrupted grooves on either side of median line; terminal segment broad, with pointed apex.

MALES. — Smaller than female neotype, carapace more eroded and pitted, with granules and crest of rim less distinct; abdomen covered with large granules, with two parallel interrupted indistinct grooves running from proximal end to (and inclusive of) segment 6, terminal segment with rounded apex. G1 moderately stout, 2.9 times longer than G2, distal half covered with short hairs, apex broad, wedge-shaped; G2 with short, petaloid terminal process. Other aspects similar to female neotype.

REMARKS. — *Alox rugosum* is very similar to *Alox somphos* and we believe that the two species have frequently been confused with each other. STIMPSON (1907) remarked that his specimen of *Oreophorus rugosus* was "... perhaps specifically the same as the example figured by ADAMS & WHITE ... which is considered by the authors to be the young of their *O. reticulatus*". BORRADAILE (1903) also mentioned that the young "*O. rugosus*" figured by ADAMS & WHITE, 1848, did not resemble a small specimen of *O. reticulatus* Adams & White, 1848, he had examined. A. MILNE EDWARDS'S (1865) specimen from "Conchinchine" could not be located in MNHN. His description is inadequate by modern standards and although, from the figure given (A. MILNE EDWARDS, 1865: pl. 6, Fig. 3), it appears that the frontal region of the specimen is sunken in as in *A. somphos*, other characters cannot be determined as the diagram is rather

schematic. Thus, his specimen's identity cannot be ascertained. His record from New Caledonia (A. MILNE EDWARDS, 1874) is probably *A. rugosum* as *A. somphos* is not yet known from New Caledonia and all the material examined from there was *A. rugosum*. *Alox somphos* is also not known from Japan and both ORTMANN'S (1892) and SAKAI'S (1934; 1937; 1976) records from Japan are also tentatively listed under *A. rugosum*. Figures were not provided for the specimens reported by HASWELL (1882) from Port Denison, Australia, ORTMANN (1894) from Thursday Island, RATHBUN (1910) from Thailand and BALSS (1938) from Fiji, and therefore none of these records can be confirmed as well. IHLE'S (1918) specimen was found to be *Alox antheos* sp. nov. YOKOYA (1933) recorded a specimen, from Kagoshima-Ken, Japan, which has since been identified by TAKEDA (1973) as *Actaeomorpha morum* (Alcock, 1896). The specimens of MICHEL (1964) and BOUVIER (1915) from Mauritius are likely to be *A. glene* sp. nov. as Mauritius is the type locality for this species. TAKEDA (1973) appears to have had both *A. rugosum* (pl. 2, Fig. C) and *A. somphos* (pl. 2, Fig. D) from the Palau Islands, although he believed all his material to be *A. rugosum*. From his description of the male G1 and G2, "The male first pleopod is simple and very stout with the yellowish distal part, and the second is short", the male specimens he had were probably *A. rugosum*. TAKEDA'S (1989) record was from Oshima Passage (TAKEDA, 1989), the neotype locality, and close to the original type locality, and is probably a true *A. rugosum*.

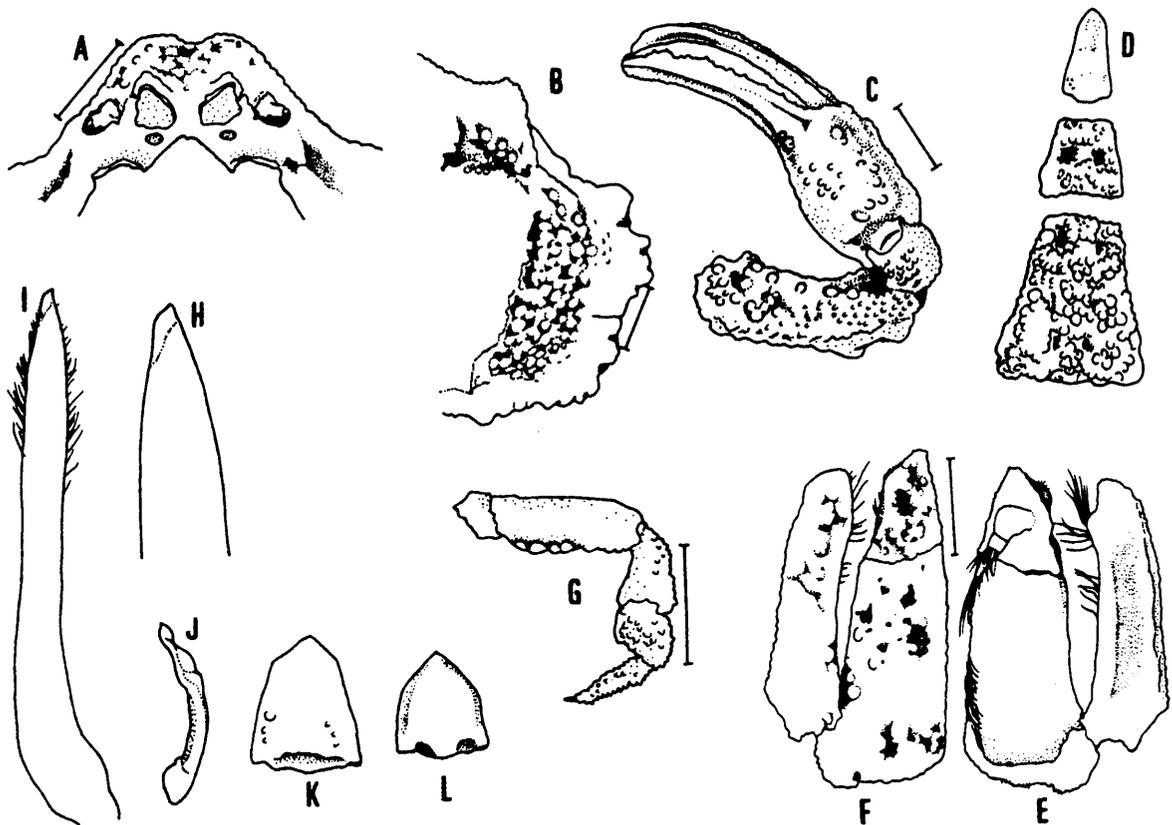


FIG. 12. - A-J : *Alox rugosum* (Stimpson, 1858), neotype female (NSMT Cr. 9660, 12.2 mm by 17.8 mm), male. A, frontal view; B, left branchiostegite region; C, right cheliped inner surface; D, male abdomen (broken); E, right third maxilliped inner surface; F, right third maxilliped outer surface; G, right last leg upper surface; H, apex of right G1; I, right G1; J, right G2; K, *Alox somphos* sp. nov., holotype female (ZRC 1984.5644-5645, 14.1 mm by 20.7 mm); terminal abdominal segment; L, *Alox rugosum*, neotype female, terminal abdominal segment; . Scales: A-E = 2.0 mm, H-L scales not included.

As *Oreophorus rugosus* has not been listed among STIMPSON'S (1858, 1907) surviving material (see EVANS, 1967), it is considered lost. In view of the taxonomic problems encountered with this species, we feel a neotype is necessary. A female specimen (NSMT Cr. 9660, 12.2 x 17.8 mm) from Oshima Passage, Japan, is here designated as the neotype of *Oreophorus rugosus* Stimpson, 1858. STIMPSON (1858, 1907) cited the locality of his specimen as "Loo Choo". According to Dr Y. NAKASONE (University of the Ryukyus, Okinawa, Japan), "Loo Choo" was widely used for the Ryukyu Islands during the last century. Dr. S. SHOKITA (University of the Ryukyus, Okinawa, Japan) has also mentioned (*in litt.*) that there is a small island off southwestern Taiwan, Hsiao-LiuChiu, which might perhaps be Loo Choo (22°21'N-120°22'E). However, in the absence of any other information, we believe the type locality to be the Ryukyu Islands. The presently designated neotype was collected from the Oshima Passage, just north of the Ryukyus. The specimen conforms well with the description by STIMPSON (1858, 1907) for *O. rugosum*.

The differences between *A. rugosum* and *A. somphos* are :

1 - In *A. somphos*, the post-orbital prominence is sunken below the frontal crest and narrower, being separated from the frontal crest by a shallow, but distinct, uneroded groove and there is a more distinct groove separating the posterior border of the prominence from the rest of the carapace; whilst in *A. rugosum*, the anterior border of the post-orbital prominence is confluent with the frontal crest and is only slightly sunken below its level; and the groove separating the frontal crest from the prominence is indistinct.

2 - The granulation in *A. somphos* is more intricate and the granule surfaces are pitted, giving it a sponge-like appearance whilst the carapace of *A. rugosum* does not have a sponge-like appearance, the granules being more coalesced and indistinct.

3 - The terminal segment of the female abdomen in *A. somphos* has a distinctly narrower and more angular apex whilst that in *A. rugosum* is broader and more rounded; both the male abdomina and G1 and G2 of the two species were observed to differ in the three male specimens examined. In the single male specimen of *A. somphos*, the terminal segment of the male abdomen is triangular. This is more rounded in that of the two male specimens of *A. rugosum*. The distal half of the G1 in *A. somphos* is narrow and elongate with a pointed apex whilst that in *A. rugosum* is not elongate and has a wedge-shaped apex. The G1 is much longer (4.3 times) relative to the G2 in *A. somphos* as compared to that in *A. rugosum* (2.9 times). A larger series of male specimens of these two species should be obtained to confirm if the differences in structure of the male abdomina, and the G1 and G2 are valid.

STIMPSON (1907) gave the colour of his specimen as "an ashy-white hue, but much discoloured by sordes". SAKAI (1976) and TAKEDA (1982) figured a similar coloured animal. The preserved neotype is dirty white but other specimens vary in colour, ranging from ivory to pale ochre.

DISTRIBUTION. — New Caledonia (A. MILNE EDWARDS, 1874; TAN & RICHER de FORGES, 1993), Japan (ORTMANN, 1892; STIMPSON, 1907; SAKAI, 1934, 1937, 1976; TAKEDA, 1989), Palau Is. (TAKEDA, 1973), Thailand, Madagascar (new records).

Alox somphos sp. nov.

Fig. 12 K, Pl. 8 A-D

Oreophorus (Oreophorus) rugosus — SERÈNE, 1954, 22(3): 468, Fig. 3 (2,3,4), 4 (a,b), pl.8. — ROMIMOHTARTO, 1967: 13. — YANG, 1979: 4 (*nec* STIMPSON, 1858).

Oreophorus rugosus — TAKEDA, 1973: 87 (part), pl. 2, Fig. D (*nec* STIMPSON, 1858).

MATERIAL EXAMINED. — Singapore, Sentosa Reef, coll. P. K. L. NG, 25.05.1982: 1 ♀, holotype, 14.1 x 20.7 mm, 1 juvenile ♀ 8.8 x 12.8 mm (ZRC-1984.5644-5645). — Raffles Lighthouse, coll. and det. R. SERÈNE (*Oreophorus rugosus*), 15.06.1964: 1 ♀, paratype, 9.4 x 13.3 mm (ZRC-196461817). — Sentosa Reef, coll. P. K. L. NG, 03.1986: 1 ♀, paratype, 13.9 x 20.2 mm (ZRC 1989.3685). — Dredge, 1992: 1 ♀, paratype, 10.5 x 15.4 mm (ZRC). — East Coast, dredge, coll. D. VANDENSPIEGEL, 1992: 1 ♀, paratype, 11.1 x 16.5 mm (ZRC). — Malacca Strait, off Pisang Is., 10-15 m, coll. M. W. F. TWEEDIE: 1 ♂, paratype, 8.7 x 12.2 mm, 01.1934 (ZMA-100.605).

HOLOTYPE FEMALE. — Carapace 1.5 times broader than long, covered with coalesced small granules with pitted surfaces and rounded depressions, giving dorsal surface a beaded appearance; groove parallel to border of carapace narrow, bottom of groove with large mushroom-like granules, region of groove posterior to hepatic angle with hole which may penetrate ventral surface of carapace; lateral borders of carapace swollen and crested to form granulated rim, crest on rim very distinct; post-orbital prominence broad, anterior confluent with frontal border with shallow uneroded groove in between and sunken below level of crest of frontal rim, posterior margin separated from rest of carapace by moderately deep granulated groove; branchial regions large and swollen; median longitudinal ridge very distinctly demarcated from post-orbital prominences, narrow, widening slightly posteriorly; irregularly-shaped groove separating lateral sides of cardiac and intestinal regions from rest of carapace; posterior half of cardiac region with two lateral rings of granules; posterolateral margin next to cardiac region almost straight. Front produced, upturned, distinctly bilobed with broad cleft, upturned portion of front forms part of crested rim running all round carapace, frontal rim angular, forming very distinct M-shaped ridge over frontal lobes; margin of hepatic region slightly protruded to form rounded obtuse angle with shallow oval depression at apex, corresponding larger, more acute angle in the sub-hepatic region; shallow, eroded groove parallel to border of carapace on ventral surface posterior to sub-hepatic angle, bottom of groove lined by mushroom-like granules; anterolateral margin of carapace immediately after hepatic angle with line of 3-4 large granular teeth slightly ventral to crest of rim; branchiostegite region with distinct region of large mushroom-like granules. Basal segment of antennule occupies fossa completely when closed; anterior margin of fossa raised to form granulated rim.

Outer surface of third maxillipeds coarsely granular and eroded, inner surface smooth and glabrous; merus with pointed apex, outer edge protruded to form rounded angle one-third from apex; ischium 2.4 times longer than merus along inner margin.

Inner surface of chelipeds more granular than outer surface; fingers 1.4 times longer than palm, inner and outer surface of both immovable and movable fingers with transverse rows of small granules parallel to cutting edges; cutting edges lined with irregularly triangular teeth; proximal portion of outer edge of merus with row of large granules followed distally by 2 large protruberances, inner edge of proximal end with clump of large granules.

Proximal half of posterior edge of merus of last pair of ambulatory legs lined by large granules, half of anterior edge with large pointed granules; posterior edge of carpus with pointed granules; dactylus moderately narrow and long, covered with small, pointed granules.

Abdomen covered with large flat granules, sutures faintly visible; 2 parallel interrupted grooves on either side of median line; terminal segment narrow, with triangular apex.

PARATYPE MALE. — Smaller than female holotype, carapace more eroded and less obviously pitted; abdomen covered with large granules, terminal segment with triangular apex. G1 4.3 times longer than G2, covered sparsely with short hairs along entire length, tapering suddenly along distal half, apex narrow and pointed; G2 with short, petaloid terminal process. Other aspects similar to female holotype.

REMARKS. — The differences between this species and *A. rugosum* have been discussed under *A. rugosum*. The record of *A. rugosum* by TAKEDA (1973) from Palau also includes this species.

DISTRIBUTION. — Vietnam (SERÈNE, 1954), Palau Is. (TAKEDA, 1973), Malacca Strait (present record), Singapore (YANG, 1979), Indonesia (ROMIMOHTARTO, 1967).

ETYMOLOGY. — The Greek “somphos” means “porous, spongy” and refers to the sponge-like, heavily pitted carapaces. Used as a noun in apposition.

Alox zalion sp. nov.

Fig. 13, Pl. 8 E, F, 9 A

Oreophorus (Oreophorus) ornatus — TAKEDA, 1979: 155, 156, Fig. 2b, male specimen (*nec* IHLE, 1918).

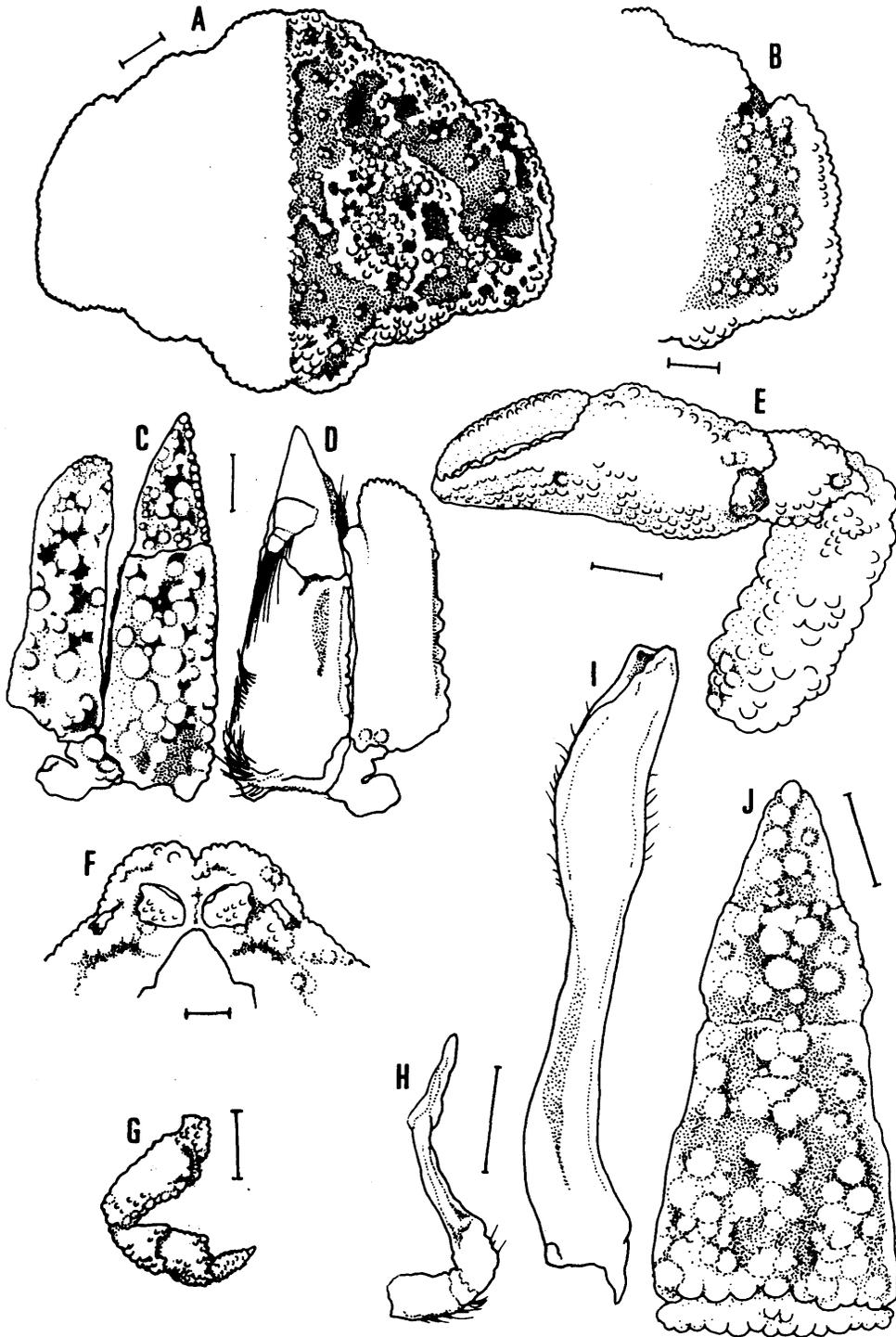


FIG. 13. — *Alox zalion* sp. nov., holotype male (NSMT Cr. 5784, 6.9 mm by 9.5 mm). A, carapace dorsal surface; B, left branchiostegite region; C, right third maxilliped outer surface; D, right third maxilliped inner surface; E, left cheliped outer surface; F, frontal view; G, left last leg upper surface; H, right G2; I, right G1; J, abdomen. Scales = 1.0 mm.

MATERIAL EXAMINED. — **Japan**, Kii Peninsula, Shionomisaki, 20.07.1978: 1 ♂, holotype, 6.9 x 9.5 mm (NSMT-Cr. 5784).

HOLOTYPE MALE. — Carapace 1.4 times broader than long, regions not well-defined; dorsal surface covered with large pearly, mushroom-like granules which may be coalesced; groove parallel to carapace border broad; rim around border of carapace with scattered shallow granule-lined circular depressions, short rows of granules extending from rim towards centre of carapace; distinct, narrow median longitudinal ridge running posteriorly to half carapace length; 2 short, oblique row of granules immediately behind posterior end of ridge, anterior to branchial humps; branchial regions raised and covered with irregularly shaped granulated grooves amongst large mushroom-shaped granules; deep granule-lined groove on either side of cardiac and intestinal regions. Front slightly produced and upturned, moderately bilobed, with longitudinal depression immediately after frontal cleft; post-frontal prominences triangular with apices pointing towards centre of carapace; lateral borders of carapace with 3 shallow clefts, separating borders into 4 broad lobes; margins of hepatic and sub-hepatic regions protruded to form rounded angles; shallow, triangular groove on ventral surface, posterior to sub-hepatic angle; branchiostegite with distinct patch of well-spaced mushroom-like granules; posterolateral border beside cardiac region protruded to form lobe. Basal segment of antennule covered with small granules and entirely occupies fossa when closed.

Third maxillipeds densely covered with granules; merus with narrow and pointed apex, outer edge slightly convex, inner edge lined by large granules; ischium 1.9 times longer than merus along inner margin, inner edge lined by large granules, with larger granules proximally.

Surface of chelipeds covered with small raised granules; outer surface of chelipeds more granular than inner surface; fingers short, palm 1.2 times longer than fingers; immovable finger with transverse parallel rows of small granules on outer surface forming shallow grooves in between, inner surface slightly concave along cutting edge; inner border of outer surface of palm with larger granules than rest of palm; edges of carpus lined by scattered large granules; large granules present close to proximal end of merus; cutting edges of both fingers sparsely lined by small, denticulate teeth.

Outer surface of last pair of legs coarsely granulated, inner surface with flatter granules; entire posterior edge of merus lined with row of large granules; dactylus short and stout, covered with small granules.

Abdomen densely covered with large pearly granules; segment 6 very broad, lateral margins expanded beyond general outline of abdomen; terminal segment with rounded apex.

G1 stout, 2.3 times longer than G2, distal half slightly bulbous and sparsely covered with short hairs, apex simple with triangular opening; G2 narrow, with long and thin petaloid terminal process.

REMARKS. — *Alox zalion* closely resembles *A. glene* sp. nov. by its eroded and granular carapace. It differs from *A. glene* by having large pearly granules on the carapace, a less compact and weaker median longitudinal ridge, a broader front relative to carapace width, a proportionately longer carapace (relative to width), fingers of cheliped shorter than palm, branchial regions which are less obviously lobed and less raised, proportionately less pronounced sub-hepatic angles, stouter dactyli of the last pair of ambulatory legs, the male abdomen proportionately broader and with a rounded terminal segment and the G1 with a swollen distal half.

Alox zalion may also be mistaken for *A. ornatum* which occurs in the same area but *A. zalion* does not have the scalloped and expanded posterior and posterolateral borders of *A. ornatum*. In addition, the carapace of *A. zalion* is proportionately broader than that in *A. ornatum*, which appears rounded. The front of *A. ornatum* is more produced and the dactylus of the last pair of ambulatory legs is narrower and more elongated than that in *A. zalion*.

DISTRIBUTION. — Japan (TAKEDA, 1979).

ETYMOLOGY. — The name “zalion” is derived from the Greek “zale” which means “the surging sea”, alluding to the appearance of the animal’s carapace. It is used as a noun in apposition.

CATEIOS gen. nov.

Oreophorus — MIERS, 1884: 254 (part) (*nec* RÜPPELL, 1830).

Oreophorus (Oreotlos) — IHLE, 1918: 216 (part).

TYPE SPECIES. — *Oreophorus frontalis* Miers, 1884, designated herein.

DIAGNOSIS. — Carapace distinctly broader than long, dorsal surface granulated with large and/or small granules and irregular short ridges but not rugose; groove parallel to border of carapace absent; median longitudinal ridge narrow and very distinct, branchiostegite region slightly swollen, covered with small granules as rest of carapace, no distinct region of large mushroom-like granules. Front narrow, very produced and weakly upturned, strongly bilobed with deep median cleft; granules covering frontal lobes small; antero- and postero-lateral margins of carapace expanded, margins scalloped with large pointed granules; rim absent. Antennule folds obliquely into large triangular fossa lined by small granules, basal segment covered with small granules and occupies half or slightly less than half of fossa. Eyes visible from dorsal view. Male abdominal segment 7 spear-shaped with constricted base. G1 stout, usually 2 times longer than G2, distal half straight or curved, covered densely with long hairs, apex simple, sometimes with chitinous pieces; G2 short with petaloid terminal process with pointed apex. Sternum granular, without large granule-lined excavations; sternites interrupted, sternal suture lines distinct.

REMARKS. — *Cateios* is quite distinct from the other associated genera considered in this study particularly due to the strongly produced and deeply clefted front, spear-shaped male abdomen and short, stout G1 with densely hairy distal half. It resembles *Oreotlos* in that the basal segment of the antennules occupies half the fossa, the branchiostegite region is without large mushroom-like granules, and it has raised granules on the male abdominal segment 5; but it differs by the absence of a distinct granular carapace rim, the possession of a spear-shaped male telson and the deeply clefted front. The genus *Cateios* as presently defined consists solely of *C. frontalis* (MIERS, 1884).

ETYMOLOGY. — The name is derived from the Latin "*cateia*" meaning "a kind of spear", alluding to the very distinct spear-shaped abdomen of the male. Gender masculine.

Cateios frontalis (Miers, 1884)

Fig. 14, Pl. 9 B-F

Oreophorus frontalis Miers, 1884: 254, pl. XXVI, Fig. B. — CALMAN, 1900:26.

Oreophorus (Oreotlos) angulatus — CHEN, 1989: 194, pl. VI 2 (*nec* RATHBUN, 1906).

MATERIAL EXAMINED. — **Australia**, Queensland, Torres Straits, pres. Univ. Coll. Dundee, coll. Prof. A. C. HADDON: 2 ♂ 4.7 x 6.4 mm, 5.0 x 7.0 mm, 4 ♀ 5.3 x 7.4 mm, 5.8 x 8.0 mm, 5.9 x 8.8 mm, 6.4 x 8.9 mm (BMNH-1954.9.14.95-101). — Port Molle, 9-22 m: 1 ♂, holotype, 6.0 x 8.0 mm (BMNH).

Indonesia, Moluccas, Kai Islands, North of Du Rowa Island, MARIEL KING Memorial Expedition 1970, St. KR VI/H3-10, 5°32'S-132°41'E, sand and rubble, 28-37 m: 1 ♀ 4.9 x 7.2 mm (MNHN - B 19047). — Ceram Is., South of Tg. Tutuhuhun, Piru Bay, coarse sand, lithothaminion and rubble or mud, 28-64 m: 1 ♀ 5.9 x 8.8 mm (MNHN - B 19046).

Japan, Oshima Passage, Amami-oshimu Is.: 1 ♂ 8 x 8.0 mm (NSMT-Cr. 9659).

Philippines, MUSORSTOM 3: St. 142, 11°47.3'N-123°03'E, 26-27 m: 1 ♂ 6.1 x 8.5 mm (MNHN).

HOLOTYPE MALE. — Carapace 1.5 times broader than long, regions not well-defined; dorsal surface covered with small flat granules; larger granule on dorsal surface directly posterior to the hepatic angle, short, shallow rounded groove on ventral surface posterior to sub-hepatic angle almost completely encircling sub-hepatic angle; shallow longitudinal groove lined with granules on region posterior to orbit, groove extends to encircle hepatic angle, ending in rounded depression close to margin of carapace; branchial regions

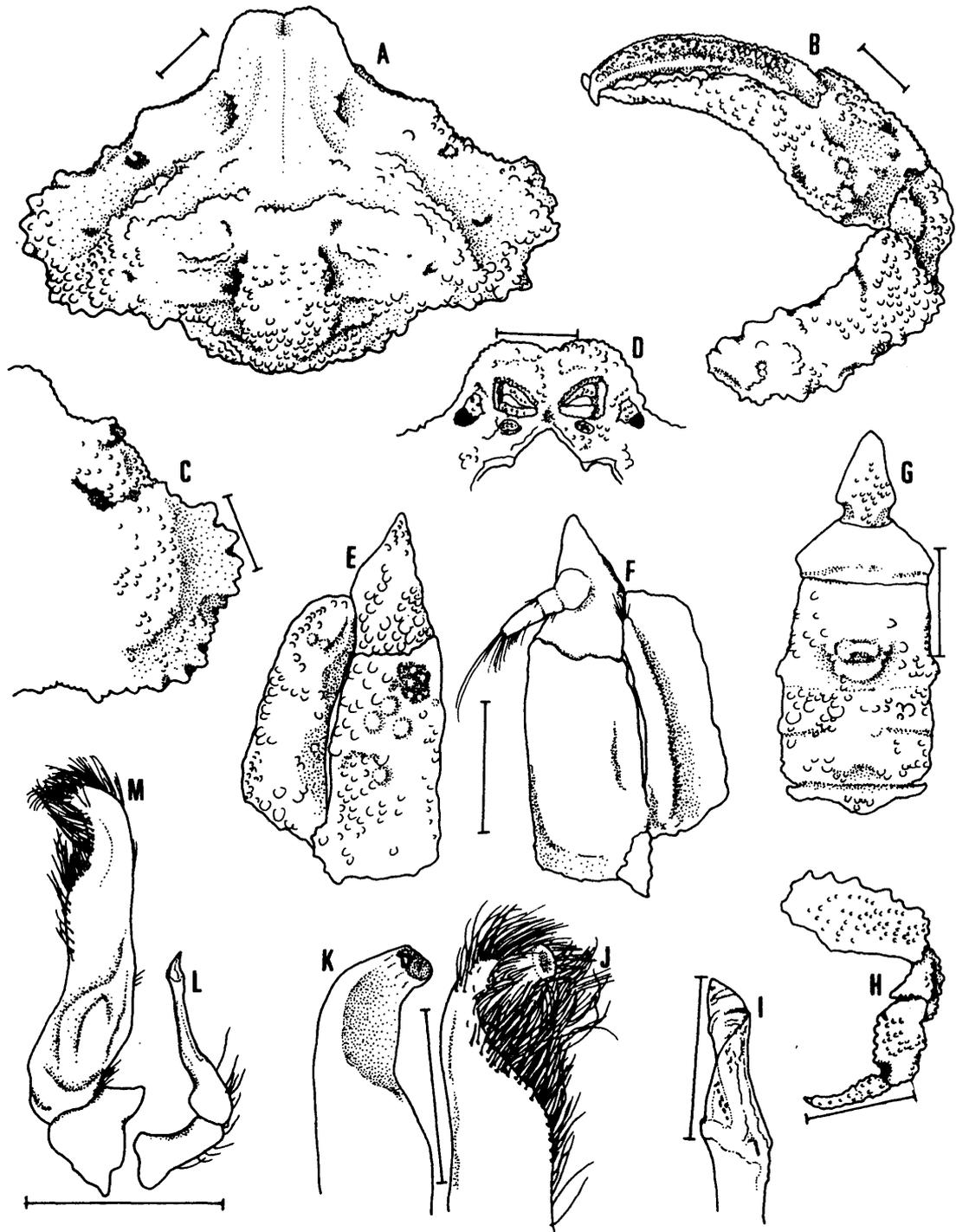


FIG. 14. — *Cateios frontalis* (Miers, 1884), holotype male (BMNH, 6.0 mm by 8.0 mm). A, carapace dorsal surface; B, right cheliped inner surface; C, left branchiostegite region; D, frontal view; E, right third maxilliped outer surface; F, right third maxilliped inner surface; G, abdomen, excluding segment 1; H, right last leg upper surface; I, apex right G2; J, apex right G1; K, apex right G1 denuded; L, right G2; M, right G1. Scales: A-D, G, H, L, M = 1.0 mm; I = 0.2 mm; E, F, J, K = 0.5 mm.

moderately swollen, posterior half covered with large granules, small row of three large granules anterior to each branchial hump, row of large granules on median line halfway between branchial humps almost meeting granulation on humps; deep, irregularly shaped, granule-lined groove on either side of anterior half of cardiac region, separating cardiac region from rest of carapace, scattered large granules on surface. Front with deep cleft ending in small rounded depression; margin of hepatic region slightly protruded to form rounded angle halfway from the front, corresponding larger, more pointed angle in the sub-hepatic region, anterolateral and posterolateral borders bearing large pointed granules conferring a scalloped appearance; posterolateral border of carapace with small rounded granule-lined depression on either side of carapace. Basal segment of antennule occupies half of fossa when closed.

Third maxillipeds densely covered with granules; merus with pointed apex, outer edge forms obtuse angle halfway down from apex; ischium 1.8 times longer than merus along inner margin, rounded granulated depression close to inner distal angle.

Fingers 2 times longer than palm; movable finger with two parallel rows of granules extending from base to tip of anterior edge; immovable finger with two parallel row of small granules on inner surface inside cutting edge; outer surface of palm with scattered large granules, ovalish shallow depression close to base of movable finger, inner surface with oblique row of large granules beginning from base of movable finger and ending as a group of large granules at inner proximal angle of palm; cutting edge toothed with small triangular teeth throughout; outer edge of merus with large pointed granules throughout, inner edges with smaller pointed granules.

Outer edge of merus of last pair of legs lined with large pointed granules, inner edge with obtuse angle one-third from proximal end; dactylus narrow, covered with small granules.

Male abdomen entirely covered with large granules; short raised ridge on median distal portion of segment 4 and similar ridge on proximal median portion of segment 5 joining to form prominent raised portion; segment 7 tapering gradually to apex, with constricted base, about half as broad and slightly longer than segment 6 measured along median line.

G1 2.1 times longer than G2, stout, curved at apex, deep concavity extending one-third downwards from apex, distal half densely covered with long hairs, rest of G1 glabrous, with irregularly shaped shallow grooves; apex rounded with small chitinous pieces.

FEMALES. — Two females larger than holotype, other two smaller. Females generally similar to the males except that the scalloping on the anterolateral and posterolateral margins of carapace in females is less distinct due to smaller size/absence of granules lining margins. Front in smaller females less prominent and clefted. Abdomen covered with large flat granules, sutures indistinct.

REMARKS. — MIERS' record (1884) of *O. frontalis* was the first male ever reported for any *Oreophorus* s. lato. However, as we show here, the shape of the male abdomen of *O. frontalis* is not shared by any other species of *Oreophorus*, and is a major reason for creating a new genus *Cateios* to receive this species.

CALMAN (1900) remarked that "... MIERS' figure does not represent quite accurately the proportions of the carapace, the relative length, and especially the prominence of the whole frontal region, being considerably exaggerated". His comments are valid. We have examined CALMAN'S specimens and they are *Cateios frontalis*.

DISTRIBUTION. — Japan (new record), Australia (MIERS, 1884; CALMAN, 1900), Philippines (CHEN, 1989).

DOLOS Tan & Richer de Forges, 1993

Tlos — A. MILNE EDWARDS, 1874: 51 (part).

Oreophorus (Tlos) — IHLE, 1918: 217 (part). — SERÈNE & UMALI, 1972: 53 (part).

Dolos Tan & Richer de Forges, 1993: 120.

TYPE SPECIES. — *Tlos petraeus* A. Milne Edwards, 1874, by monotypy.

DIAGNOSIS (after TAN & NG, 1993). — Carapace distinctly broader than long, dorsal surface finely granulated, granules invisible to naked eye; groove parallel to border of carapace absent; median longitudinal ridge very indistinct/absent; branchial regions concave; branchiostegite region gently sloping, with distinct small, concave region bearing large mushroom-like granules; front narrow, produced and weakly upturned, strongly bilobed with deep median fissure; granules covering lobes small and flattened; antero- and postero-lateral margins of carapace expanded, lined by small granules, without thick granulated rim; carapace borders with six closed fissures, with only depressions remaining. Antennule folds obliquely into large trapezoidal fossa with dorsally pointed apex, basal segment covered with small granules and occupies all of fossa. Male abdominal segments without large, prominent granule(s). G1 usually 2-2.5 times longer than G2, distal half straight and may be slightly dilated, distal portion may be covered with short spines or hairs, apex with ovalish opening which may be sparsely rimmed by spines; G2 short with petaloid terminal process. Sternum smooth, without large granule-lined excavations.

REMARKS. — *Dolos* resembles *Tlos* by: 1) the presence of closed sutures on the margins of the carapace, 2) the concave and plate-like lateral expansions of the carapace and branchial regions, 3) the structure of the basal segment of the antennules (completely occupying the fossae), and 4) the presence of two knob-like projections on either side of the cardiac region.

Dolos petraeus (A. Milne Edwards, 1874)
Fig. 15, Pl. 10A-E

Tlos petraeus A. Milne Edwards, 1874: 51, pl. 3, Fig. 4.

NEOTYPEMALE (after TAN & RICHER de FORGES, 1993). — Carapace 1.4 times broader than long, regions not well-defined; dorsal surface with very small, flat granules invisible to naked eye; branchial regions concave, smooth and plate-like, with two irregularly shaped knob-like projections on either side of cardiac region; shallow, irregularly shaped, granule-lined groove on either side of cardiac and intestinal regions, separating cardiac and intestinal regions from rest of carapace, grooves with scattered mushroom-like granules. Front very strongly bilobed, with deep median cleft and triangular groove on dorsal surface; margin of hepatic region not protruded to form angle, sub-hepatic region with small triangular depression; carapace border with 6 closed fissures, with only circular depressions visible: 2 small groove-like depressions (frontal fissures) on frontal margin extending posteriorly on dorsal surface of carapace from orbits, 2 larger rounded depressions (anterior fissures) between frontal and hepatic regions and 2 between hepatic and branchial regions (posterior fissures); posterolateral border beside cardiac region slightly protruded to form rounded angle. Basal segment of antennule occupies entire fossa when closed.

Third maxillipeds finely covered with small granules; merus with pointed apex, outer edge forms rounded angle one-third down from apex, inner surface with median tuft of hair near proximal end; ischium 1.9 times longer than merus along inner margin, outer surface with shallow depression on proximal three-quarters of inner edge.

Fingers shorter than palm, 0.9 times length of palm; distal end of outer surface of immovable finger with short row of small granules; cutting edge of immovable finger with small, far-set teeth on distal half, cutting edge of movable finger lined by small raised granules; inner upper edge of merus lined by large granules, with larger ones proximally, distal third of outer edge also with large granules.

Proximal third of posterior edge of merus of last pair of legs with large prominent raised granule followed by 4 large granules distally; carpus and propodus covered by large granules; dactylus thin, longer than propodus, covered by small granules, .

Abdomen entirely covered with small flat granules; proximal end of immovable piece made up of segments 3, 4, 5 with two shallow grooves on either side of median line, narrowing suddenly about two-thirds from proximal end; segment 6 with lateral margins slightly convex; segment 7 about as long as segment 6, tapering gradually to triangular apex.

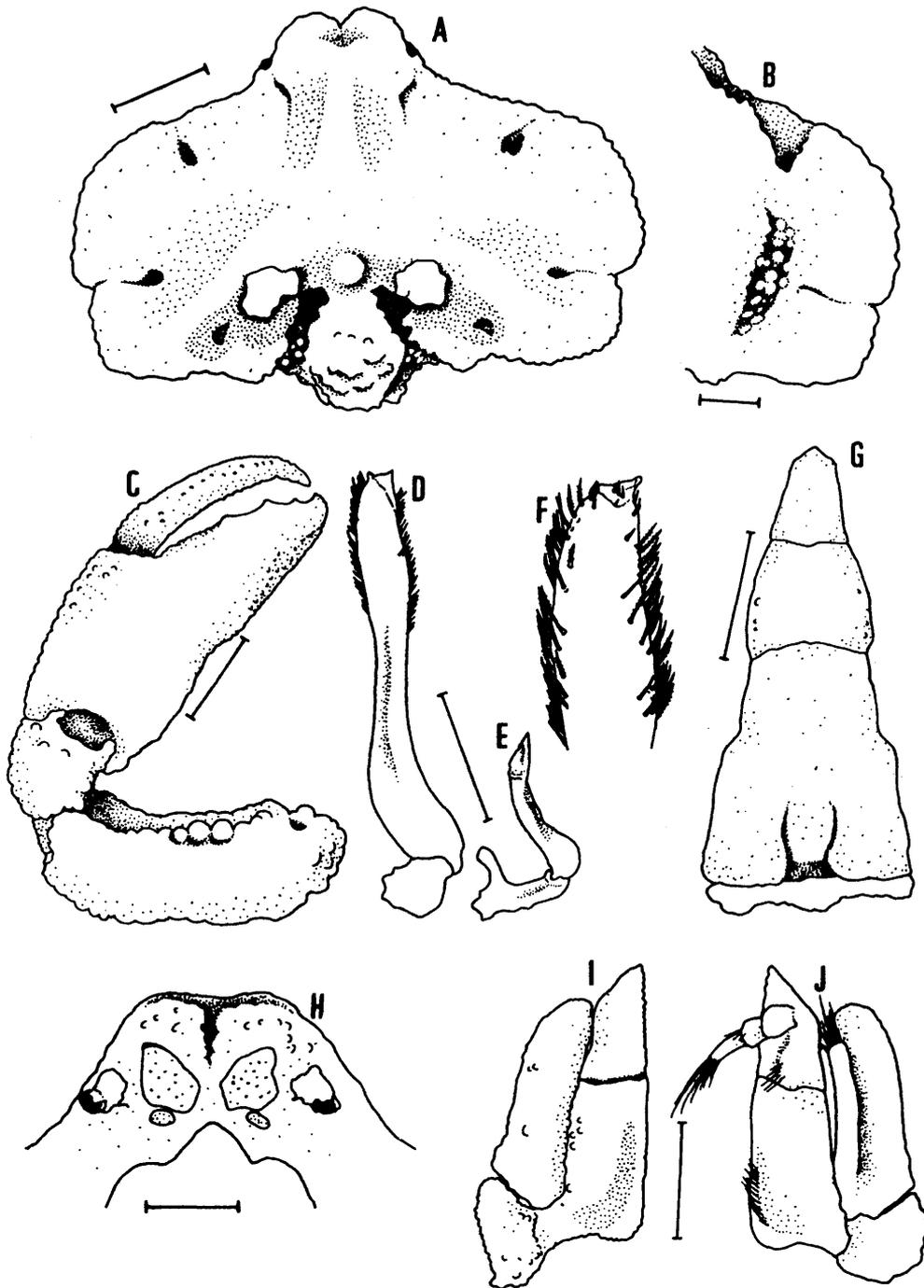


FIG. 15. — *Dolos petraeus* (A. Milne Edwards, 1874), neotype male (MNHN - B24850, 5.9 mm by 8.3 mm). A, carapace dorsal surface; B, left branchiostegite region; C, right cheliped outer surface; D, right G2; E, right G2; F, apex right G1; G, abdomen; H, frontal view; I, right third maxilliped outer surface; J, right third maxilliped inner surface. Scales = 1.0 mm.

G1 stout, straight, slightly constricted in middle, distal third densely covered with short, branched spines and hairs, rest of G1 glabrous; apex ends in triangular tip surrounded by scattered short spines.

REMARKS. — *D. petraeus* is very similar externally to *Oreotlos etor*. Both have smooth, plate-like carapaces whose borders are not upturned, and prominent, bilobed fronts. *O. etor* differs from *D. petraeus* by: 1) the antennular basal segment occupying only half of the fossa when closed (fully occupying fossa in *D. petraeus*), 2) the immovable piece of the male abdomen has a median tubercle, 3) the carapace is more rounded at the lateral margins, 4) the two round projections on either side of the cardiac region found in *D. petraeus* are absent, but are replaced in *O. etor* by raised crested ridges on either side of the cardiac region, 5) the branchial regions are flatter, and 6) the triangular frontal groove is absent. ALCOCK's (1896) specimens of *D. petraeus* (at least in part) are here referred to *Alox latusoides*.

DISTRIBUTION. — New Caledonia (A. MILNE EDWARDS, 1874), Chesterfield Is.(present record).

OREOTLOS Ihle, 1918

Oreophorus (*Oreotlos*) Ihle, 1918: 216. — SAKAI, 1976: 82.

TYPE SPECIES. — *Tlos angulatus* Rathbun, 1906, designated herein.

DIAGNOSIS. — Carapace distinctly broader than long, dorsal surface granulated with large and/or small granules but not rugose; groove parallel to border of carapace broad, shallow and indistinct; median longitudinal ridge wide and indistinct or absent, branchiostegite region gently sloping, covered with small granules as rest of carapace, sometimes with large, sparsely distributed granules, no distinct region of large mushroom-like granules. Front narrow, produced and strongly upturned, weakly to moderately bilobed with shallow median cleft; granules covering lobes large and flattened. Antero- and postero-lateral margins of carapace expanded usually with thick granulated rim. Antennule folds obliquely into large oval fossa with dorsally pointed apex, basal segment covered with small granules and occupies half or slightly more than half of fossa when closed. Eyes visible from dorsal view. Male abdominal segment 4 with large prominent central raised granule, segments 3, 5, 6 sometimes with smaller central prominent granule. G1 usually 2.1-2.4 times longer than G2, distal half straight or curved, covered sparsely with short hairs, apex simple with ovalish opening; G2 short with petaloid terminal process. Sternum granular, without large granule-lined excavations; sternites interrupted, sternal suture lines distinct.

REMARKS. — The present generic definition is an expansion of that given by IHLE (1918) for his subgenus *Oreotlos*. Additional characters have been included, such as the form and relative lengths of the male G1 and G2, the structure of the front, basal segment of the antennule, granulations on the branchiostegite and the granulation pattern on the male abdomen. IHLE (1918) recognised two species as belonging to *Oreotlos*: *Tlos angulatus* Rathbun, 1906, and *Tlos latus* Borradaile, 1903, and doubtfully a third species, *Oreophorus frontalis* Miers, 1884. He did not designate a type species. On examination of IHLE'S specimens, the authors discovered that some were incorrectly identified. What IHLE (1918) had identified as *O. angulatus* and *O. latus* were actually both *Oreotlos heuretus* sp. nov. We have examined the types of *Tlos angulatus*, *T. latus* and *T. frontalis*. *Tlos frontalis* has several distinctive characters and in our opinion belongs to a separate monotypic genus, *Cateios*. *Tlos latus* has some atypical features such as the slightly raised branchial regions of the carapace, ill-defined cardiac region and weakly upturned front. As *T. angulatus* appears to be the best representative of what we consider typical *Oreotlos*, it is hereby designated as the type species.

In *Oreotlos*, there appear to be four subgroups that can be differentiated by carapace features. The first group is formed by *Oreotlos potanus* and *O. havelocki*, which have large plate-like extensions of the carapace, the second group by *O. latus* and *O. etor*, which have highly flattened carapaces with relatively low branchial regions, the third group consists of only *O. pala*, with its unique carapace and flattened frontal

margin, and the rest of the *Oreotlos* species make up the fourth and final group. Although these four groups are distinct, the differences between them are insufficient to be considered important at the genus level.

The genus *Oreotlos* (Ihle, 1918) contains the following 12 species: *O. angulatus* (Rathbun, 1906) [type species], *O. latus* (Borradaile, 1903), *O. havelocki* (Laurie, 1906), *O. speciosus* (Chen, 1989), *O. encymus* Tan & Ng, 1993, *O. etor* Tan & Richer de Forges, 1993, *O. potanus* Tan & Ng, 1993, *O. bertrandi* sp. nov., *O. heuretos* sp. nov., *O. lagarodes* sp. nov., *O. pax* sp. nov., and *O. pala* sp. nov. *Oreotlos havelocki* and *O. potanus* differ from typical *Oreotlos* species in possessing distinctly plate-like, smooth lateral extensions of the carapace. In all other respects, they appear to be *Oreotlos* and to transfer them to any other genus would be unwarranted.

Key to the species of *Oreotlos* Ihle, 1918

- 1.- Lateral expansions of carapace plate-like, concave on the dorsal surface, with no distinct depressions; edge thin **2**
- Lateral expansions of carapace thick and level, distinct depressions may be present; edge thick **4**
- 2.- Branchial regions convex and smooth; posterolateral margins upturned, forming two triangular ridges which are flattened at the top to form “plateau”, ridges connected by central transverse ridge; region posterior to “plateau” concave and sloping **Oreotlos havelocki** (Laurie, 1906).
- Branchial regions swollen; posterolateral margins not upturned, no “plateau-like” triangular ridges evident; region posterior to branchial regions only slightly sloping and not concave **3**
- 3.- Carapace heart-shaped, about 1.4 times broader than long; branchial regions relatively flat, finely granulated; margins of hepatic and sub-hepatic regions only slightly convex; grooves on either side of intestinal region shallow and indistinct **Oreotlos etor** Tan & Richer de Forges, 1993.
- Carapace transversely oval, about 1.6 times broader than long; branchial regions raised and coarsely granulated; margins of hepatic and sub-hepatic regions protruded to form angles, with the sub-hepatic angle very pointed; grooves on either side of intestinal region deep and distinct **Oreotlos potanus** Tan & Ng, 1993.
- 4.- Shape of carapace broadly ovoid/rectangular; anterolateral margins nearly parallel to posterolateral margins **5**
- Shape of carapace pentagonal; anterolateral margins and/or posterolateral margins oblique **6**
- 5.- Lateral expansions of carapace with 3 moderately deep depressions on either side which increase in size (from the posterior-most depression); branchial regions very flat when viewed from front **Oreotlos pala** sp. nov.
- Lateral expansions of carapace with small, shallow, irregular depressions and/or grooves; branchial regions moderately flat when viewed from front **Oreotlos latus** (Borradaile, 1903)
- 6.- Dorsal surface of carapace finely granular with a few scattered larger granules **7**
- Dorsal surface of carapace coarsely granular with scattered clumps of large granules **8**

- 7.- Front with deep median cleft; carapace 1.3 times broader than long; lateral borders of carapace divided into three broad lobes on each side by two clefts; cutting edges of fingers of cheliped with long narrow teeth *Oreotlos bertrandi* sp. nov.
- Front without deep median cleft; carapace 1.5-1.6 times broader than long; lateral borders entire; cutting edges of fingers of cheliped with triangular broad teeth **9**
- 8.- Front strongly produced beyond eyes, narrow relative to carapace width (ratio of front to carapace width=1:10); very distinct inverted 'Y' shaped ridges of granules on branchial regions; prominent clump of granules immediately after hepatic angle
..... *Oreotlos encymus* Tan & Ng, 1993
- Front slightly produced beyond eyes, broad relative to carapace width (0.1 times width of carapace); irregularly-shaped clumps of granules on branchial regions; large prominent granule immediately after hepatic angle
..... *Oreotlos angulatus* (Rathbun, 1906).
- 9.- Front entire and squarish; carapace borders with small pointed granules, giving carapace angular appearance; fingers of cheliped narrow
..... *Oreotlos speciosus* Chen, 1989
- Front bilobed and rounded; carapace borders with rounded granules, giving carapace more rounded appearance; fingers of cheliped stout **10**
- 10.- G1 2.1 times longer than G2; surface of abdomen of female without distinct grooves on either side of median line; first segment of palp of third maxilliped equal in size to rest of segments of palp *Oreotlos pax* sp. nov.
- G1 2.4 times longer than G2; surface of abdomen of female with distinct grooves on either side of median line; first segment of palp of third maxilliped about twice as broad as other segments *Oreotlos heuretus* sp. nov.

Oreotlos angulatus (Rathbun, 1906)

Fig. 16, Pl. 10 F, 11 A, B

Tlos angulatus Rathbun, 1906: 889, Fig. 42, t. 16, Fig. 5.

MATERIAL EXAMINED. — **Hawaii**, Vicinity of Kuai Is. Albatross, stn. 3987, 91-101 m; coll. 11.06.1902, det. M. J. RATHBUN (1906) as *Tlos angulatus*, type: 1 ♀, holotype, 7.6 x 11.4 mm (USNM-29854).

Japan, Kii Peninsula, Kushimoto, coll. 1982: 1 ♀ 7.2 x 10.5 mm (NSMT).

HOLOTYPE FEMALE. — Carapace 1.5 times broader than long, regions not well-defined; dorsal surface coarsely granulated, with large pearly granules on carapace borders and branchial regions; lateral borders of carapace swollen to form rim covered with large pearly granules; large prominent granule on dorsal surface directly posterior to the hepatic angle, short, shallow oblique groove on ventral surface posterior to sub-hepatic angle; short, shallow, longitudinal groove lined with granules on region posterior to orbit, small longitudinal clump of granules on median line in between grooves; branchial regions swollen, covered with irregularly-shaped shallow grooves and clumps of large, pearly granules; shallow, irregularly shaped, granule-lined groove on either side of cardiac region, separating lateral margins of cardiac region from rest of carapace, central longitudinal clump of large granules centrally on cardiac region. Front very weakly bilobed, almost straight; margin of hepatic region protruded to form rounded angle, corresponding larger angle ventrally in the sub-hepatic region, large granules clustered at apices of both angles, posterolateral border beside cardiac region slightly protruded to form lobe. Basal segment of antennule occupies half of fossa when closed; fossa rimmed with small granules.

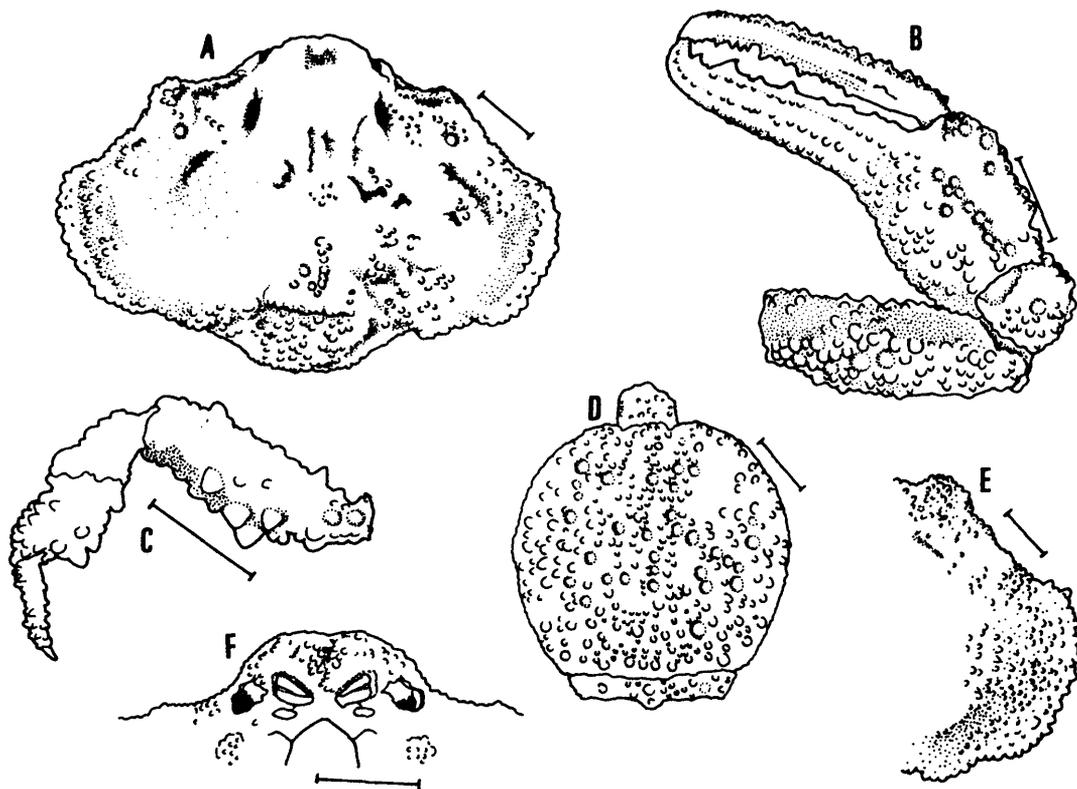


FIG. 16. — *Oreotlos angulatus* (Rathbun, 1906), female (NSMT, 7.2 mm by 10.5 mm). A, carapace dorsal surface; B, left cheliped outer surface; C, left last leg upper surface; D, abdomen; E, left branchiostegite region. Scales = 1.0 mm.

Third maxillipeds coarsely granulated with scattered large granules; merus with pointed apex, outer edge forms obtuse angle one-third down from apex; ischium 2 times longer than merus along inner margin, central region of outer surface with larger granules.

Fingers 1.6 times longer than palm; immovable and movable fingers with rows of small granules parallel to cutting edge; outer surface of palm with larger granules centrally; cutting edge toothed with large irregularly shaped teeth.

Edges of last pair of legs lined by large granules; dactylus narrow and long, covered with small raised granules.

Abdomen entirely coarsely granulated with scattered large pearly granules.

REMARKS. — RATHBUN'S original figure (1906) of *Tlos angulatus* is inaccurate in that the pointedness of the hepatic angles and the frontal cleft are exaggerated. The record of *O. angulatus* by IHLE (1918), later cited by ESTAMPADOR (1937, 1959), belongs to *O. heuretios*. Similarly, the record of *O. angulatus* by CHEN (1989) from the Philippines belongs to *Cateios frontalis* (Miers, 1884) instead.

Oreotlos encymus Tan & Ng, 1993, bears the closest resemblance to *Oreotlos angulatus*. The differences are: 1) the front is more pronounced and bilobed in *O. encymus* than in *O. angulatus*, 2) the distinct patches of large granules on the carapace of *O. encymus* are absent or indistinct in *O. angulatus*, 3) the grooves on either side of the cardiac region are more shallow and less eroded in *O. angulatus* as compared to those in *O. encymus*, and 4) the granulation on the carapace of *O. angulatus* is coarser and more raised than that in *O. encymus*.

The male G1 and abdomen cannot be compared with that of the other *Oreotlos* species as no males are known.

DISTRIBUTION. — Hawaii (RATHBUN, 1906), Japan (new record).

Oreotlos bertrandi sp. nov.

Fig. 17, Pl. 11C-E

MATERIAL EXAMINED. — New Caledonia, Chesterfield Is., CORAIL 2, St. DW 4, 20°52'30"S-161°36'56"E., 64 m, coll. B. RICHER de FORGES, 20.07.1988: 1 ♂, holotype, 6.2 x 8.1 mm (MNHN - B24851).

HOLOTYPE FEMALE. — Carapace 1.3 times broader than long, regions not well-defined; dorsal surface covered with small flat granules invisible to the naked eye thereby appearing smooth; one large prominent granule on dorsal surface directly posterior to the hepatic angle; shallow, triangular depression on region posterior to orbit; median longitudinal ridge indistinct; two short, oblique rows of larger granules on either side anterior to branchial regions; branchial regions swollen, surface smooth, posterior region with oblique granulated ridge on either side, short row of larger granules in between branchial regions; shallow, unexcavated, irregularly shaped, groove on either side of cardiac and intestinal regions; cardiac region with two circles of granules on posterior region; branchiostegite region finely granulated with no distinct granulated region. Front produced and very strongly bilobed with deep median cleft, median cleft U-shaped; margin of hepatic region beaded and protruded slightly to form lobe, margin of sub-hepatic region protruded to form obtuse angle, with larger granules at the tip; lateral borders with two notches on either side, dividing lateral borders into three broad lobes (inclusive of hepatic lobe). Basal segment of antennule occupies half of fossa when closed, anterior margin of fossa with raised rim.

Third maxillipeds covered with fine granules as on carapace; merus with pointed apex, outer edge slightly convex about one-third down from apex; ischium 1.7 times longer than merus along inner margin, proximal margin lined by large granules.

Inner surface of chelipeds more granular than outer surface; fingers 2.1 times longer than palm; immovable finger with central longitudinal denticulate ridge ending one-fifth from tip in a tubercle on inner surface, outer surface with two parallel rows of coalesced granules; movable finger with one transverse row of coalesced granules on proximal half of inner surface, outer surface with two rows of coalesced granules, outer edge with scattered, pointed large granules; cutting edges of both fingers with sharp, pointed, unevenly-sized teeth; inner surface of palm with oblique row of large granules close to inner edge near proximal end.

Anterior edge of merus of last pair of legs lined with row of large granules, prominent pointed granule about one-third from proximal end, posterior edges also lined with large granules, with prominent granule one-third from proximal end; posterior edge of propodus with clump of large, pointed granules; dactylus long and moderately narrow, covered with small pointed granules.

Abdomen very smooth; terminal segment with narrowly triangular pointed apex.

REMARKS. — *Oreotlos bertrandi* is very distinctive. Being not much longer than broad, it appears rounded in outline compared to other species. Its strongly bilobed front with the U-shaped median cleft, the small subhepatic angles and the unusually long, narrow teeth on the cheliped cutting edges further distinguish it from others. By its carapace smoothness and the presence of the large prominent granule on the hepatic region, it somewhat resembles *O. pax* sp. nov., but in all other respects, the two species are dissimilar. Male is unknown.

DISTRIBUTION. — New Caledonia.

ETYMOLOGY. — This species is named after its collector, Bertrand RICHER de FORGES from ORSTOM (New Caledonia) who referred a substantial number of specimens to the authors for this study.

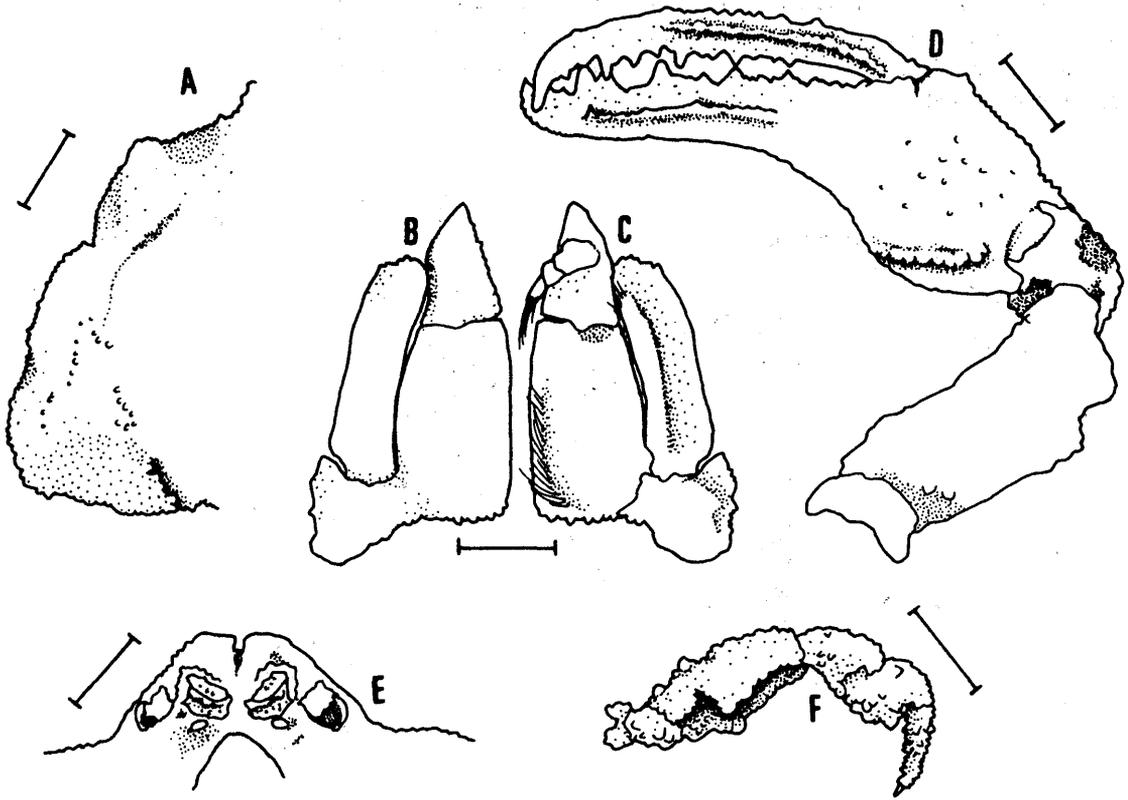


FIG. 17. — *Oreotlos bertrandi* sp. nov., holotype female (MNHN, 6.2 mm by 8.1 mm). A, right branchiostegite region; B, right third maxilliped outer surface; C, right third maxilliped inner surface; D, right cheliped inner surface; E, frontal view; F, right last leg upper surface. Scales = 1.0 mm.

Oreotlos etor Tan & Richer de Forges, 1993

Fig. 18, Pl. 12C-E

HOLOTYPE FEMALE (after TAN & RICHER de FORGES, 1993). — Carapace 1.4 times broader than long, heart-shaped, regions ill-defined; dorsal surface finely granulated, appearing smooth to the naked eye; depression on region posterior to orbit absent; median longitudinal ridge very wide and indistinct; branchial regions gently convex, surface smooth, posterior region on either side of cardiac region swollen to form crested ridge; very shallow, unexcavated, groove on either side of intestinal and cardiac regions; branchiostegite region finely granulated with no distinct granulated region. Front produced and bilobed with moderately deep median cleft; margins of hepatic and sub-hepatic regions only slightly convex; margin immediately after hepatic region with closed suture. Basal segment of antennule occupies half of fossa when closed, anterior margin of fossa with raised rim.

Third maxillipeds covered with fine granules as on carapace; merus with pointed apex, outer edge with obtuse angle about halfway down from apex; ischium 1.3 times longer than merus along inner margin.

Surfaces of chelipeds granular; fingers 1.4 times longer than palm, dorso-ventrally flattened to form spatulate structure; inner edge of immovable finger and outer edge of movable finger lined by sharp pointed granules; immovable finger slightly dilated in middle; cutting edges of both fingers with denticulate teeth; inner surface of palm with oblique ridge of large granules; edges of merus and carpus lined by sharp pointed granules.

Anterior edge of merus of last pair of legs lined with row of sharp pointed granules, posterior edges also lined with pointed granules, proximal half with larger granules; posterior edge of propodus with clump of large, pointed granules; dactylus long and narrow, covered with small pointed granules.

Borders of abdominal segments lined by larger granules than rest of segments; segment 5 with tubercle close to proximal end.

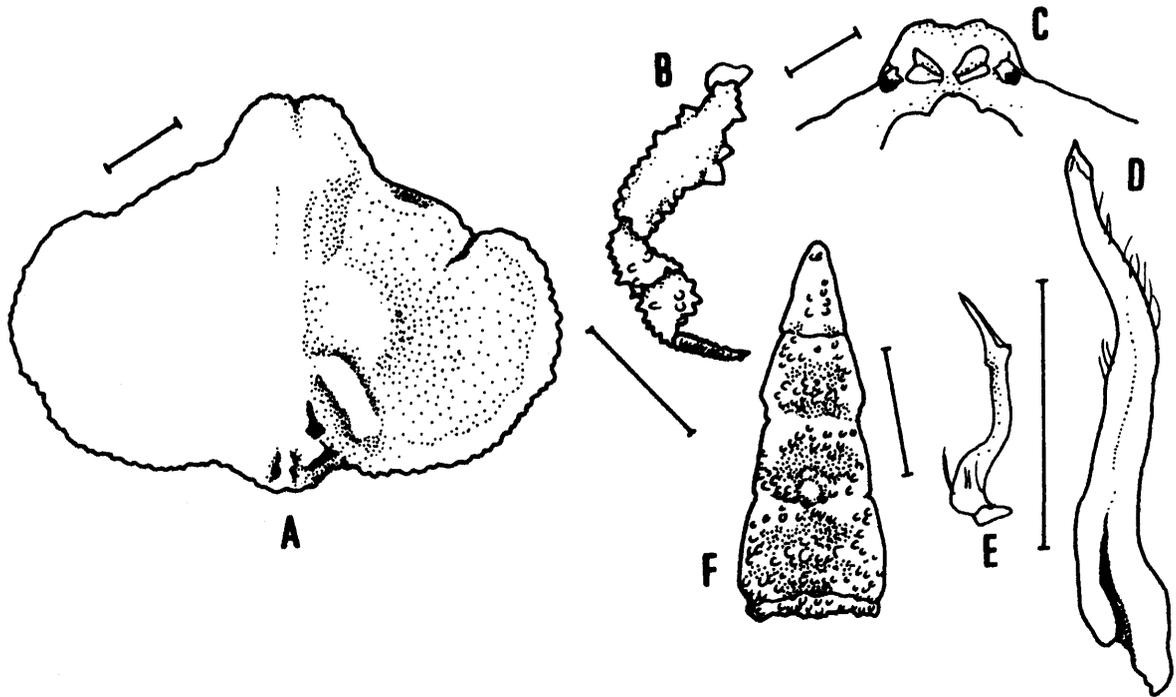


FIG. 18. — *Oreotlos etor* Tan & Richer de Forges, 1993, holotype male (MNHN, 5.5 mm by 7.5 mm). A, carapace, dorsal surface; B, left last leg, outer surface; C, frontal view; D, right G1; E, right G2; F, abdomen.

G1 moderately stout and tapering to a point, 2.4 times longer than G2, distal third with sparse hairs, apex simple and pointed; G2 with petaloid terminal process.

PARATYPE FEMALES (after TAN & RICHER de FORGES, 1993). — All larger than male holotype; abdomen covered with granules, raised granular patch present on segment 6, immediately posterior to terminal segment; terminal segment triangular; other characters being similar to holotype male.

REMARKS. — This species is found in the same locality (New Caledonia) as *Dolos petraeus* and may be mistaken for *D. petraeus* (see remarks for *D. petraeus*).

Although it possesses all the characteristics of *Oreotlos*, *O. etor* is a distinct species unlikely to be confused with any other in *Oreotlos*.

DISTRIBUTION. — Chesterfield Is.; New Caledonia (TAN & RICHER de FORGES, 1993).

***Oreotlos havelocki* (Laurie, 1906)**

Fig. 19, Pl. 12 F, 13 A, B

Tlos havelocki Laurie, 1906: 357, pl. I, Fig. 2, text Fig. 1. — SAKAI, 1965: 35, pl. 15, Fig. 1; 1976: 82, pl. 25, Fig. 2. — MIYAKE, 1983: 201 (no new record).

MATERIAL EXAMINED. — **India**, Gulf of Manaar [Sri Lanka], coral reefs, pres. W. A. HERDMAN: 1 ♂, holotype, 5.4 x 7.8 mm (BMNH 1907.5.22.24).

Madagascar, Tuléar. St. 330 or 411, leg B. THOMASSIN: 2 juvenile ♂ 2.4 x 3.8 mm, 4.4 x 6.5 mm (MNHN-B 18528). — Tuléar; coll. B. THOMASSIN: 1 ♂ 4.8 x 7.2 mm (MNHN-B 18526). — Tuléar. St. 240, Grand Récif, "cuvette de sediment dans dalle" [sediment of stone in basin], 36 m, coll. B. THOMASSIN, 08.10.1969: 1 ♀ 6.6 x 10.6 mm (MNHN - B 18342).

Indonesia Moluccas, MARIEL KING MEMORIAL EXPEDITION 1970: St. AM 11/H 4-5, approx. 8 miles SW of Tg Ratoe, Maikoor, Aru Is., 6°7'S-133°57'E., 46 m, sand and rubble: 1 juvenile ♂ 5.2 x 7.8 mm (MNHN-B 19059).

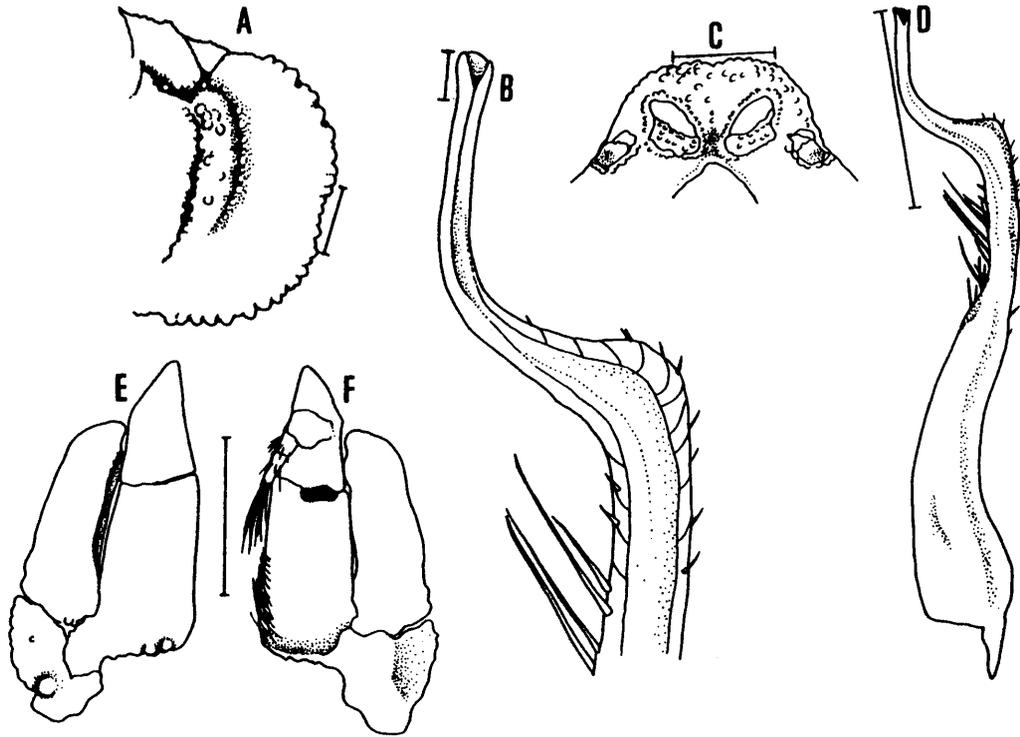


FIG. 19. — *Oreotlos havelocki* (Laurie, 1906), holotype male (BMHN 1907.5.22.24, 5.4 mm by 7.8 mm). A, left branchiostegite region; B, apex right G1; C, frontal view; D, right G1; E, right third maxilliped outer surface; F, right third maxilliped inner surface. Scales = 1.0 mm.

HOLOTYPE MALE. — Carapace 1.4 times broader than long, broadly pentagonal, regions not well-defined; dorsal surface almost smooth, covered with small flat granules; lateral expansions plate-like; median longitudinal ridge raised and distinct; short, shallow semi-circular groove on ventral surface encircling to sub-hepatic angle, groove meets two shallow, parallel, granule-lined grooves on branchiostegite region; branchiostegite with scattered large granules between parallel grooves, other regions quite smooth; shallow longitudinal groove lined with granules on region immediately after orbit on either side; branchial regions concave; posterolateral margins upturned to form two granular triangular ridges on either side, top of ridges flattened to form "plateau" covered with large granules, ridges connected horizontally across by narrow ridge of large granules, posterior ends of oblique ridges continuous with lateral margins of carapace; region posterior to ridges sloping and concave, less granulated than "plateau"; deep, irregularly shaped, granule-lined groove on either side of cardiac and intestinal regions, does not reach posterior margin of carapace, posterior end of cardiac region bilobed with shallow groove in between lobes extending halfway anteriorly. Front produced, slightly upturned, weakly bilobed with shallow depression directly after median cleft;

margin between hepatic and branchial regions on either side with closed shallow suture extending slightly into carapace (anterior sutures), posterolateral margins with concavity halfway down from anterior angles of carapace; sub-hepatic angle obtuse and tipped with large raised granules; sternum with scattered large granules. Basal segment of antennule occupies half fossa when closed, fossae rimmed with small granules.

Outer surface of third maxillipeds densely covered with small granules, inner surface glabrous; merus with pointed apex, outer edge forms obtuse angle one-third down from apex; ischium 2 times longer than merus along inner margin; outer surface with two large granules along proximal edge.

Outer surface of chelipeds covered with small flat granules and scattered large granules, inner surface less granulated; fingers as long as palm; immovable finger with one transverse row of small granules on outer surface, outer surface of movable finger with three parallel transverse rows of small granules forming two grooves; inner edges of merus lined by large granules, proximal end of outer edge with a few large granules.

G1 slim and long, distal quarter curved sharply, sparsely covered with short spines, long hairs immediately posterior to sharp curve extending to half of G1, rest of G1 glabrous; apex with triangular, funnel-shaped opening; lateral borders with parallel short grooves.

Male specimen (4.8 x 7.2 mm, MNHN-B 18526). — G1 2.8 times longer than G2; G2 short, with distal petaloid structure.

Other male specimens. — Abdomen with median tubercle on immovable piece, other aspects being similar to holotype male.

REMARKS. — *Oreotlos havelocki* (Laurie, 1906) was originally described as a *Tlos*. By the current definition of genera, *T. havelocki* must be referred to *Oreotlos* instead. SAKAI (1976:82) compared his specimen with the type of *O. havelocki* and mentioned that on his specimen “... the suture between the hepatic and branchial margins is not so well marked, and the area on either side of the depressed intestinal region is rather smooth instead of being eroded in that species (*O. havelocki*)”.

The abdomen, last legs and G2 of the male holotype of *O. havelocki* are missing. However, an adult male from Madagascar was available for examination by the authors. Externally, it conforms very well with the holotype male and we have little doubt of its conspecificity with *O. havelocki*.

DISTRIBUTION. — India (LAURIE, 1906), Madagascar (new record), Japan (SAKAI, 1965, 1976), Moluccas, Indonesia (new record).

Oreotlos heuretos sp. nov.

Fig. 20, Pl. 13 C-F, 14 A

Oreophorus (Oreotlos) latus - Ihle, 1918: 217. — TAKEDA, 1977: 119, pl. 1C (*nec* BORRADAILE, 1903).

Oreophorus (Oreotlos) angulatus — IHLE, 1918: 216. — ESTAMPADOR, 1937: 514. — ESTAMPADOR, 1959: 65 (*nec* RATHBUN, 1906).

MATERIAL EXAMINED. — **Japan**, 05.07.1977: 1 ♂, holotype, 6.2 x 9.4 mm, 1 ♀, paratype, 5.3 x 7.8 mm (NSMT).— Ogasawara Is., st. 7, 47 m; coll. M. TAKEDA & M. IMAJINA, 15.06.1976: 1 juvenile ♂ 4.0 x 5.3 mm (NSMT-Cr. 5492).

Sulu Archipelago, Tonkil. SIBOGA EXPEDITION, st. 282: 1 ♂ 4.8 x 7.5 mm (ZMA). — Tonkil. SIBOGA EXPEDITION : st. 109: 1 ♀ 6.1 x 9.7 mm (ZMA) .

Malay Archipelago, north of Waigeu, SIBOGA EXPEDITION: 1 ♀ 4.9 x 7.3 mm (ZMA).

HOLOTYPE MALE. — Carapace 1.5 times broader than long, regions not well-defined; dorsal surface finely granulated, with larger pearly granules on posterolateral border; lateral borders of carapace swollen to form rim covered with larger granules; large prominent granule on dorsal surface directly posterior to the hepatic angle; short, shallow, longitudinal groove lined with granules on region posterior to orbit, longitudinal ridge of granules on median line in between grooves; branchial regions swollen, covered with irregularly-shaped shallow grooves and clumps of granules, giving branchial regions a wrinkled appearance; shallow, irregularly shaped, granule-lined groove on either side of cardiac region, separating lateral margins of intestinal and



FIG. 20. — *Oreotlos heuretos* sp. nov., holotype male (NSMT, 6.2 mm by 9.4 mm). A, right third maxilliped outer surface; B, right third maxilliped inner surface; C, right G1; D, apex right G1; E, right G2; F, male abdomen side view; G, male abdomen; H, right last leg upper surface; I, left branchiostegite region. Scales = 1.0 mm.

posterolateral margins of cardiac regions from rest of carapace, cardiac region with shallow median groove separating two clumps of granules on either side of cardiac region; central circular clump of granules on cardiac region. Front broadly bilobed, with shallow cleft; margin of hepatic region protruded to form obtuse angle, anterior margin of angle lined by granules, corresponding larger angle ventrally in the sub-hepatic region, larger granules clustered at apices of both angles; posterolateral border beside cardiac region protruded to form lobe. Basal segment of antennule occupies half of fossa when closed; fossa rimmed with small granules.

Third maxillipeds finely granulated with scattered large granules; merus with pointed apex, outer edge forms obtuse angle one-third down from apex; ischium 1.8 times longer than merus along inner margin, outer half of outer surface with scattered large granules.

Fingers 1.7 times longer than palm; immovable and movable fingers finely granular, with rows of small granules parallel to cutting edge, cutting edges toothed with small irregularly shaped teeth; outer edge of merus with slight lobe immediately after outer distal angle.

Anterior edge of merus of last pair of legs lined by large pointed granules, posterior edge lined by large rounded granules; posterior border of outer surface of propodus with clump of large granules; dactylus narrow and long, covered with small raised granules, claw very small.

Abdominal segments broad, covered with scattered large granules; segments 5 and 6 with large central prominent granules, that on segment 6 being larger; segment 7 narrower than segment 6, with pointed apex.

G1 2.4 times longer than G2, stout, distal half sparsely covered with short hairs, apex simple with funnel-shaped opening; G2 short, stout, with narrow, pointed, petaloid terminal process.

PARATYPE FEMALE. — Smaller than male specimen, carapace more wrinkled in appearance as it is covered with more granulate ridges and grooves; rim around carapace with shallow depressions which are absent in holotype male, groove posterior to orbital more triangular than longitudinal; fingers are proportionately shorter relative to the palm than in male. Other aspects similar holotype male.

REMARKS. — This species differs from *Oreotlos latus* in the proportions of the carapace, being not as broad. In addition, the front of *O. heuretios* is more produced and upturned than that in *O. latus*. The carapace of *O. heuretios* is also more sculptured than *O. latus*. Proportions and ornamentation of the chelipeds also differ in the two species. *O. angulatus* has a less prominent and bilobed front than *O. heuretios*. The carapace of *O. angulatus* appears more coarsely granular and is without the characteristic wrinkled appearance caused by the irregularly-shaped grooves and ridges on the carapace of *O. heuretios*. The female abdomina of both *O. angulatus* and *O. latus* lack distinct grooves on either side of the median line whilst *O. heuretios* has two longitudinal granulated grooves on either side of the median line. Males of both *O. angulatus* and *O. latus* are unknown and therefore cannot be compared.

DISTRIBUTION. — Japan (TAKEDA, 1977), Malay Archipelago, Philippines (IHLE, 1918).

ETYMOLOGY. — The name *heuretios* is the Greek for “discovered, found out”.

Oreotlos encymus Tan & Ng, 1993

Fig. 21, 21bis, Pl. 11 F, 12 A, B

MATERIAL EXAMINED. — **French Polynesia**, Marquesas Is., SMCB, st. D 83, 8°47.60'S-140°05.00'W., Nuku Hiva, 140 m, coll. J. POUPIN, 25.01.1991: 1 ♂, holotype, 9.5 x 13.3 mm (MNHN - B24853), 1 ♂ 7.1 x 10.3 mm (MNHN - B24854).

HOLOTYPE MALE (after TAN & NG, 1993). — Carapace 1.4 times broader than long, regions not well-defined; dorsal surface covered with small round granules; three to four larger granules on dorsal surface directly posterior to the hepatic angle, short, shallow oblique groove on ventral surface posterior to sub-hepatic angle; shallow longitudinal groove lined with granules on region posterior to orbit, lining inner boun-

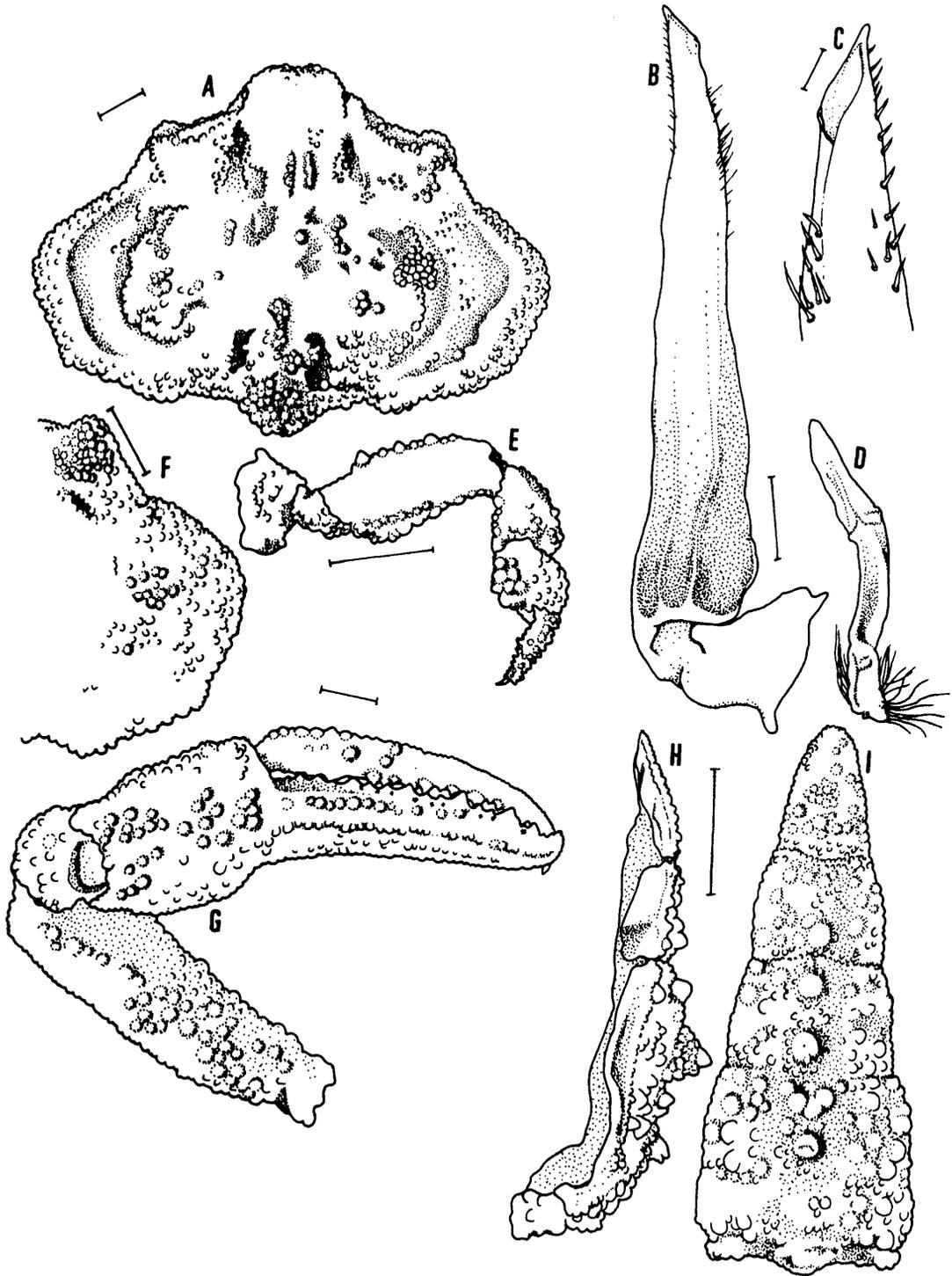


FIG. 21. – *Oreatlos encymus* Tan & Ng, 1993, holotype male (MNHN, 9.5 mm by 13.3 mm). A, carapace dorsal surface; B, right G1; C, apex right G1; D, right G2; E, right last leg upper surface; F, left branchiostegite region; G, right cheliped outer surface; H, abdomen side view; I, abdomen.

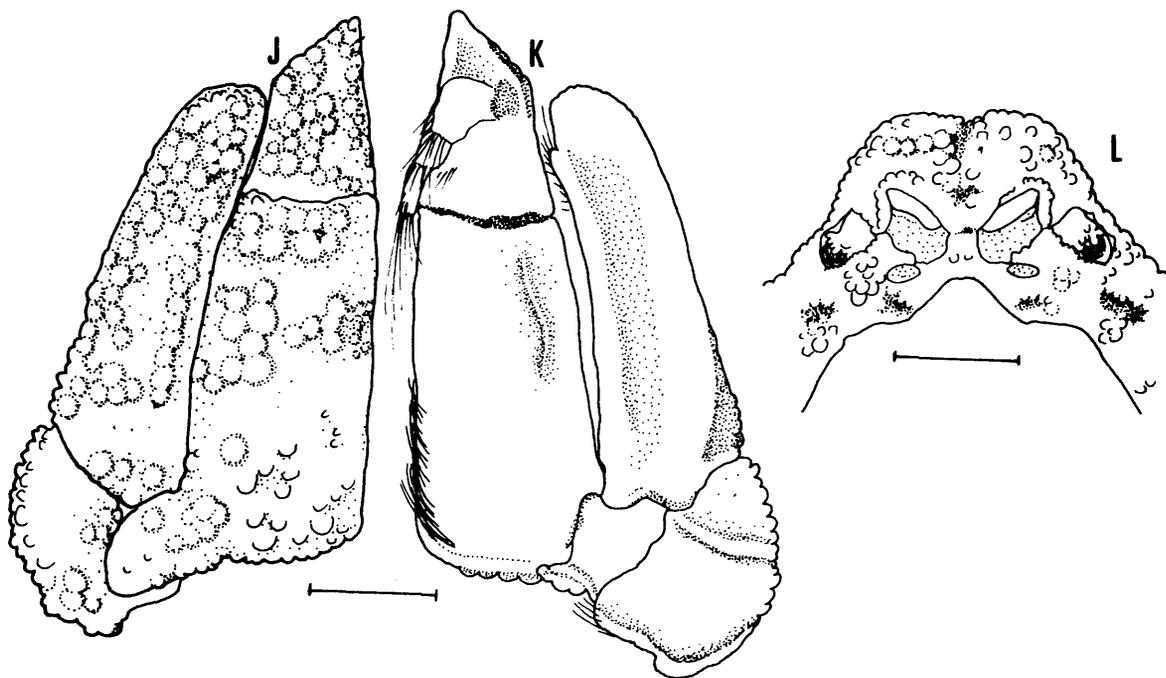


FIG. 21 bis. - *Oreotlos encymus* Tan & Ng, 1993. J, right third maxilliped outer surface; K, right third maxilliped inner surface; L, frontal view. Scales: A, B, D-L = 1.0 mm; C = 0.1 mm.

dary between hepatic and gastric regions, groove extends posteriorly to two-thirds length of carapace, small longitudinal clump of large granules on median line in between grooves; branchial regions swollen, covered with irregular ridges of large granules, small patch of large granules anterior to branchial humps, large prominent central granule on median line between branchial humps; shallow, irregularly shaped, granule-lined groove on either side of cardiac region, separating cardiac region from rest of carapace, central longitudinal clump of large granules in centre. Front moderately bilobed, with shallow depression directly after median cleft; margin of hepatic region protruded to form an angle two-thirds from the front, corresponding angle ventrally in the sub-hepatic region, large granules clustered at apices of both angles, posterolateral border beside cardiac region slightly protruded to form obtuse angle with large granules at and around apex; posterior margin lined with large granules. Basal segment of antennule occupies three-quarters of fossa when closed; basal segment of antenna linked to orbital fossa only by means of a short groove; short groove also links antennulary fossa to orbital fossa.

Third maxillipeds densely covered with granules; merus with pointed apex, outer edge forms obtuse angle one-third down from apex; ischium 1.9 times longer than merus along inner margin.

Fingers 1.6 times longer than palm; immovable finger with two parallel transverse rows of small granules on outer surface; outer surface of palm with scattered large granules; cutting edge toothed with large triangular teeth throughout.

Central portion of anterior edge and entire posterior edge of merus of last pair of legs lined with row of large granules; posterior half of outer surface of propodus with clump of large granules; dactylus stout, covered with small granules.

Male abdomen entirely covered with small flat granules; median large tubercle and median small clump of large granules on segment 4, segment 5 with two large granules on median line, large tubercle on basal

median portion of segment 6; segment 7 tapering gradually to apex, narrower and slightly longer than segment 6 measured along median line.

G1 2.1 times longer than G2, stout, straight, tapering gradually to apex, distal third sparsely covered with short hairs, rest of G1 glabrous; apex simple with oval, funnel-shaped opening.

REMARKS. — This species is close to *Oreotlos pax* sp. nov. in regard to the general shape of the carapace and the form of the male gonopods. We have examined several specimens of *Oreotlos pax* (including males) from New Caledonia. The carapace of *O. encymus* is more distinctly granular, with very distinct patches of large granules on the carapace, particularly on and near the branchial regions. These distinct patches are absent in *O. pax*. The sub-hepatic angle in *O. encymus* is also proportionately larger (relative to the carapace) compared to that in *O. pax*. This is largely due to the more abundant granulation on *O. encymus*. The outer surface of the palm of the chela in *O. encymus* is also more granular and less swollen than in *O. pax*. In addition, the male abdomen in *O. pax* is proportionately wider compared to that of *O. encymus*. These differences are valid for specimens of equivalent sizes and similar sexes for both species. The G1 and G2 in *O. encymus* differ little from those of *O. pax* and are of little use as distinguishing characters.

DISTRIBUTION. — French Polynesia.

Oreotlos lagarodes sp. nov.

Fig. 22, Pl. 14 B-D

Tlos latus — RATHBUN, 1906: 888 (*nec* BORRADAILE, 1903). — EDMONDSON, 1925: 30.

MATERIAL EXAMINED.— **Hawaii**, Mekuleia, Oahu, T. H., reef, shallow water, coll. 1938: 1 ♀, holotype, 6.4 x 10.3 mm (USNM Acc. no. 152940).

Laysan Is., coll. THAANUM & BALL, 1923: 1 juvenile, paratype, 3.2 x 4.9 mm, 1 ♀, paratype, 4.9 x 7.3 mm (BPBM 1253).

Rongelap Atoll, South side of Burok Id., From algae, outer reef flats, coll. W. R. TAYLOR, 18.07.1946: 1 ♂, paratype, 5.1 x 7.4 mm (USNM Acc. no. 172224, 4825).

Guam, Asan. Intertidal reef flat West of Camel Rock-under rocks, coll. R. K. KROPP, 03.06.1981: 1 ♀, paratype, 5.2 x 8.2 mm (USNM Acc. no. 255984, 359474, UGI-3370).

Saipan, in coral heads, coll. A. H. BANNER, 1945: 1 ♂, paratype, 5.8 x 8.9 mm (USNM Acc. no. 172818).

HOLOTYPE FEMALE. — Carapace 1.6 times broader than long, regions ill-defined; dorsal surface finely granulated, circular depressions present; no prominent granule on dorsal surface posterior to the hepatic angle; longitudinal groove on region posterior to orbit; median longitudinal ridge indistinct; branchial regions moderately swollen, with scattered circular depressions; very shallow, irregularly shaped, groove on either side of cardiac and intestinal regions, which becomes interrupted on reaching cardiac region; branchiostegite region finely granulated with no distinct granulated region; true posterior margin entire. Front produced, upturned and bilobed, groove present on dorsal surface immediately after frontal cleft; margins of carapace without rim; margin of hepatic region protruded to form slight convexity, margin of sub-hepatic region protruded to form lobe; deep, oblique granulated groove on ventral surface posterior to sub-hepatic angle. Basal segment of antennule occupies half of fossa when closed, margin of fossa lined with granules.

Third maxillipeds covered with fine granules as on carapace; merus with pointed apex, outer edge with slight obtuse angle one-third down from apex; ischium 1.2 times longer than merus along inner margin.

Inner surface of chelipeds more granular than outer surface; fingers 1.5 times longer than palm, inner edge of immovable finger lined by row of granules, both movable and immovable finger with transverse rows of granules parallel to cutting edges; row of teeth present parallel to cutting edges of both fingers, cutting edges with denticulate teeth; outer edge of merus with large granules.

Proximal half of anterior edge of merus of last pair of legs lined with large granules, posterior edge also lined by granules; posterior edge of propodus with clump of granules; dactylus long and narrow, covered with small pointed granules.

Abdomen covered with small granules and depressions as on carapace; terminal segment triangular.

MALE PARATYPE. — Smaller than holotype female; median tubercle present on fused piece of abdomen (segments 3-5), segment 7 tongue-shaped; G1 2.1 times longer than G2, distal half sparsely covered with short hairs, apex simple with funnel-shaped opening, G2 with long petaloid terminal process; other characters similar to holotype female.

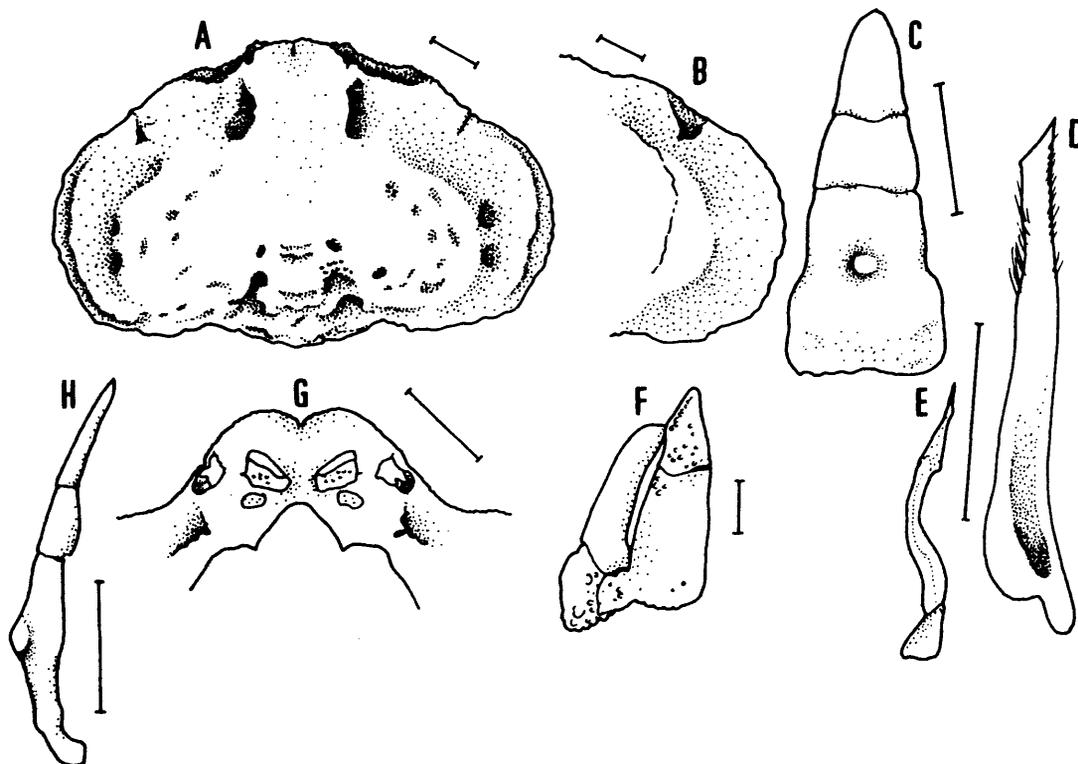


FIG. 22. — *Oreotlos lagarodes* sp. nov., holotype female (USNM, 6.4 mm by 10.3 mm). **A**, carapace dorsal surface; **B**, branchiostegite; **C** (paratype male USNM, 5.8 mm x 9.9 mm), abdomen, outer surface (excluding segments 1 and 2); **D**, right G1; **E**, right G2; **F**, right third maxilliped, outer surface; **G**, frontal view; **H**, abdomen, side view (excluding segments 1 and 2).

REMARKS. — Only two species of *Oreotlos* are known with certainty from Hawaii: *O. angulatus* RATHBUN, 1906 and *O. lagarodes* sp. nov. RATHBUN (1906) recorded a specimen of *Oreotlos latus* Borradaile, 1903, from Auau Channel, Hawaii, but we consider that she mistook *O. lagarodes* for *O. latus* considering the close affiliation between the two (see below). Therefore, her record is tentatively placed under this species until her specimens can re-examined.

O. lagarodes is closely related to *O. latus* in terms of the carapace granulation, the relative flat branchial regions and the proportions of the carapace. Nevertheless, *O. lagarodes* differs from *O. latus* in possessing a more produced front and less angular carapace. The hepatic and sub-hepatic angles are less well developed in *O. lagarodes* compared to that in *O. latus*. In addition, the very characteristic wrinkle-like grooves on the dorsal surface of the carapace found in *O. latus* are replaced by pits in *O. lagarodes*. No male specimen has been collected for *O. latus* and therefore, the G1 and G2 cannot be compared with that of *O. lagarodes*.

The discovery of male specimens of *O. lagarodes* supports the idea that the closely related *O. latus* should be placed in the genus *Oreotlos*. The fused piece of the male abdomen of *O. lagarodes* has the median tubercle so characteristic of *Oreotlos* species.

DISTRIBUTION. — Hawaii (RATHBUN, 1906; EDMONDSON, 1925), Guam, Saipan (present records).

ETYMOLOGY. — The Greek “lagarodes” means “sunken, flat”, alluding to the flat carapace of the species.

Oreotlos latus (Borradaile, 1903)

Fig. 23, Pl. 14 E, F, 15 A

Tlos latus Borradaile, 1903: 437, Fig. 115.

Oreophorus (Oreotlos) latus — MIYAKE, 1983: 201.

Oreophorus (Oreophorus) latus — NAGAI & NOMURA, 1988: 121.

MATERIAL EXAMINED. — **Maldives**, North Male Atoll, Hulule, Dredge 64 m: 1 ♀, holotype, 7.8 x 11.5 mm (CMZ).

Eniwetok : 1 ♀, 7.4 x 11.9 mm (AHF 0824E1).

Japan, Kuroshiwa, Okinawa, low tidal, coll. Nagai: 1 ♀, 8.0 x 12.5 mm (NC).

HOLOTYPE FEMALE. — Carapace 1.9 times broader than long, regions ill-defined; dorsal surface covered with small flat granules barely visible to the naked eye, shallow, irregularly-shaped grooves and circular depressions present; prominent granule on dorsal surface posterior to the hepatic angle; triangular depression on region posterior to orbit; median longitudinal ridge very wide and indistinct; branchial regions mildly swollen, short row of transverse larger granules in between branchial regions; shallow, irregularly shaped, groove on either side of cardiac and intestinal regions; branchiostegite region finely granulated with no distinct granulated region; true posterior margin entire. Front slightly produced and moderately bilobed; margins of carapace with surrounding rim; margin of hepatic region beaded and protruded slightly to form obtuse angle, margin of sub-hepatic region protruded to form obtuse angle, with larger granules at the tip; deep, oblique granulated groove on ventral surface posterior to sub-hepatic angle. Basal segment of antennule occupies half of fossa when closed, margin of fossa with granules.

Third maxillipeds covered with fine granules as on carapace; merus with pointed apex, outer edge with slight angle halfway down from apex; ischium 2 times longer than merus along inner margin, proximal third of inner edge lined by large granules.

Inner surface of chelipeds more granular than outer surface; fingers 1.5 times longer than palm; inner surface of palm with 3 large granules close to proximal end; distal half of cutting edges of fingers with small denticulate teeth.

Anterior edge of merus of last pair of legs lined with large granules; anterior and posterior edge of propodus with large, pointed granules; dactylus long and narrow, covered with small pointed granules.

Abdomen covered with small granules and depressions as on carapace; terminal segment broadly triangular.

REMARKS. — BORRADAILE's description (1903) and figure of the type specimen of *Tlos latus* (here recognised as *Oreotlos latus*) are accurate, except that the branchial regions appear more swollen on the figure than they are in the specimen. Both RATHBUN (1906) and EDMONDSON (1925) reported specimens of *Oreotlos latus* from Hawaii, but all Hawaiian material that we examined deposited in BPMP and USNM (including EDMONSON's material) proved to be *O. lagarodes* sp. nov. We therefore also refer RATHBUN'S (1906) record of *O. latus* to *O. lagarodes*.

IHLE (1918) and TAKEDA (1977) both recorded specimens of *Oreophorus (Oreotlos) latus*. From the plate provided in TAKEDA (1977), it is difficult to determine the identity of the female specimen and his record is recorded as “indeterminate”. The young male (NSMT-Cr. 5492) was examined and found to be *O. heuretios* sp. nov. IHLE'S specimen was also examined and found to belong to *O. heuretios*.

Oreotlos latus is a somewhat atypical *Oreotlos* as it has a carapace which is much broader than other species, branchial regions which are relatively flat, and a weakly produced and upturned front. However, in the structures of the antennules (which occupy half the fossa when closed), the presence of a rim around the border of the carapace, and absence of a distinct groove parallel to the carapace margins, the species fits into *Oreotlos* as presently defined.

DISTRIBUTION. — Maldives (BORRADAILE, 1903), Japan (NAGAI & NOMURA, 1988).

ETYMOLOGY. — The Latin “*latus*” means “broad, wide” and was probably meant to denote the wide carapace of the animal.

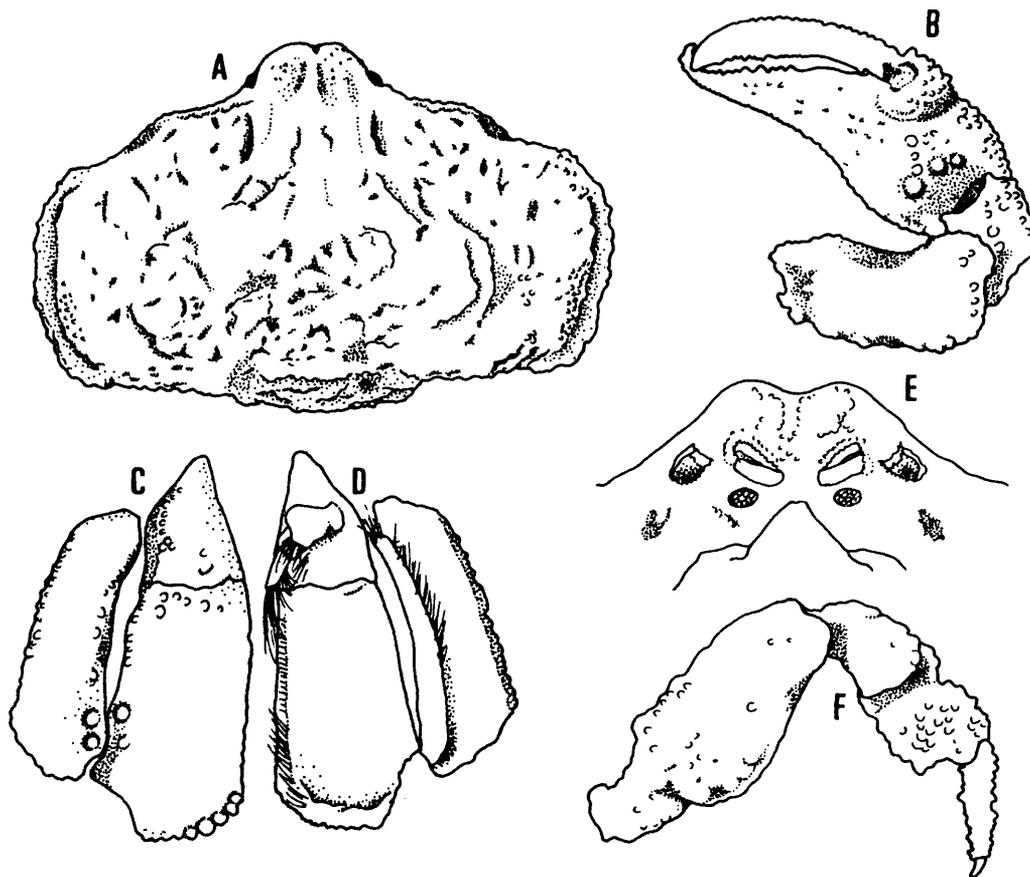


FIG. 23. — *Oreotlos latus* (Borradaile, 1903), holotype female (UCM, 7.8 mm by 11.5 mm). A, carapace dorsal surface; B, right cheliped inner surface; C, right third maxilliped outer surface; D, right third maxilliped inner surface; E, frontal view; F, right last leg upper surface. Scales not provided.

Oreotlos pala sp. nov.

Fig. 24, Pl. 15 B-D

MATERIAL EXAMINED. — Guam, Asan, West of Camel Rock. Under rocks, intertidal depth, pres. ALCOCK, coll. R. K. KROPP, 03.06.1981: 1 ♀, holotype, 6.2 x 11.5 mm (USNM 255984).

HOLOTYPE FEMALE. — Carapace 2 times broader than long, regions not well-defined; lateral expansions with 3 moderately deep depressions on either side which increase in size (from the posterior-most depression), frontal depressions most irregularly-shaped, depressions not linked in any way; fissure posterior to hepatic angle indistinct; median longitudinal ridge absent; branchial regions moderately flat, covered with small granules; very shallow, transverse depression lining posterior margin of cardiac region, extending on either side to line posterior edges of branchial regions. Front entire, margin slightly posterior to edge of buccal cavern; anterior, anterolateral and posterolateral margins lined by coarse granules; margin of hepatic region protruded to form an obtuse angle, shallow depression on ventral surface close to subhepatic angle, branchiostegite region finely granular; posterolateral angle beside cardiac region absent; posterior margin lined with coarse granules.

Outer surface of third maxillipeds finely granulated, inner surface smooth and glabrous; merus with pointed apex, outer edge slightly convex; ischium 2.2 times longer than merus along inner margin.

Abdomen smooth. Terminal segment 1.5 times longer than broad.

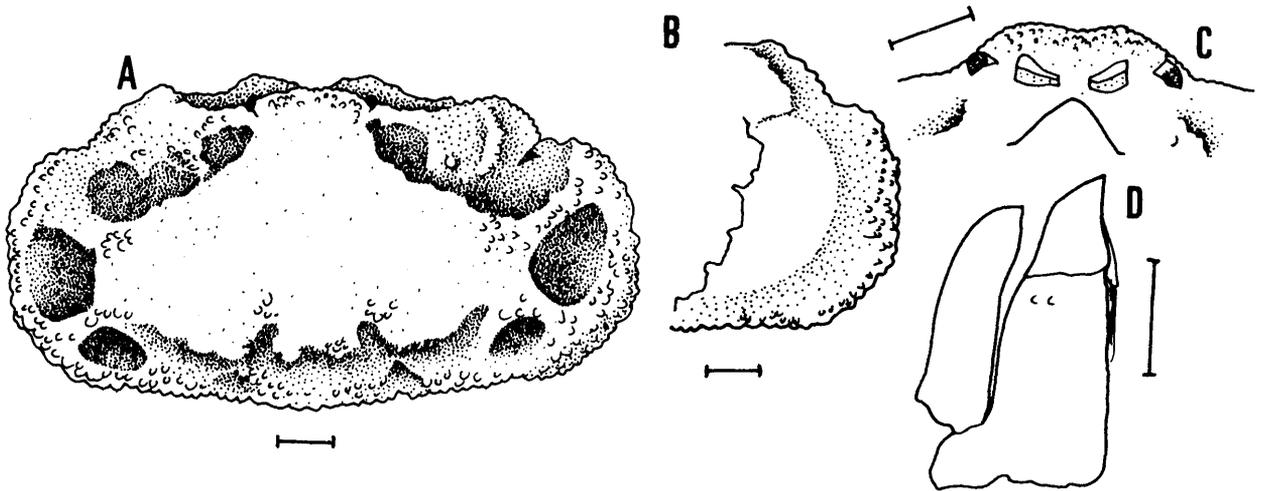


FIG. 24. — *Oreotlos pala* sp. nov., holotype female (USNM 255984, 6.2 mm by 11.5 mm). A, carapace, dorsal surface; B, left branchiostegite region; C, frontal view; D, right third maxilliped outer surface. Scales = 1.0 mm.

REMARKS. — This is the most unusual of the *Oreotlos* species in terms of the relatively low carapace, the protrusion of the frontal edge of the buccal cavern beyond the level of the frontal margin, the short and level rather than upturned condition of the front, the presence of large depressions on the lateral expansions of the carapace and the very wide carapace (relative to the length). However, in all other aspects, *O. pala* agrees with the description of *Oreotlos* as provided herein. The unusual features of the species and the absence of a male makes its precise generic placement difficult. When males of the species are found, the position of the species within *Oreotlos* may have to be re-evaluated.

DISTRIBUTION. — Guam.

ETYMOLOGY. — The Latin “*pala*” refers to “socket of a ring for a jewel” and alludes to the large depressions on the lateral expansions of the carapace. Used as a noun in apposition.

***Oreotlos pax* sp. nov.**

Fig. 25, Pl. 16 B-E

MATERIAL EXAMINED. — Marshall Is., 0.5 mile South of Bikini Is., West end. Sand, 18 m, coll. MORRISON, 26.06.1947: 1 ♂, holotype 6.3 x 10.0 mm (USNM Acc. no. 176603, 3605).

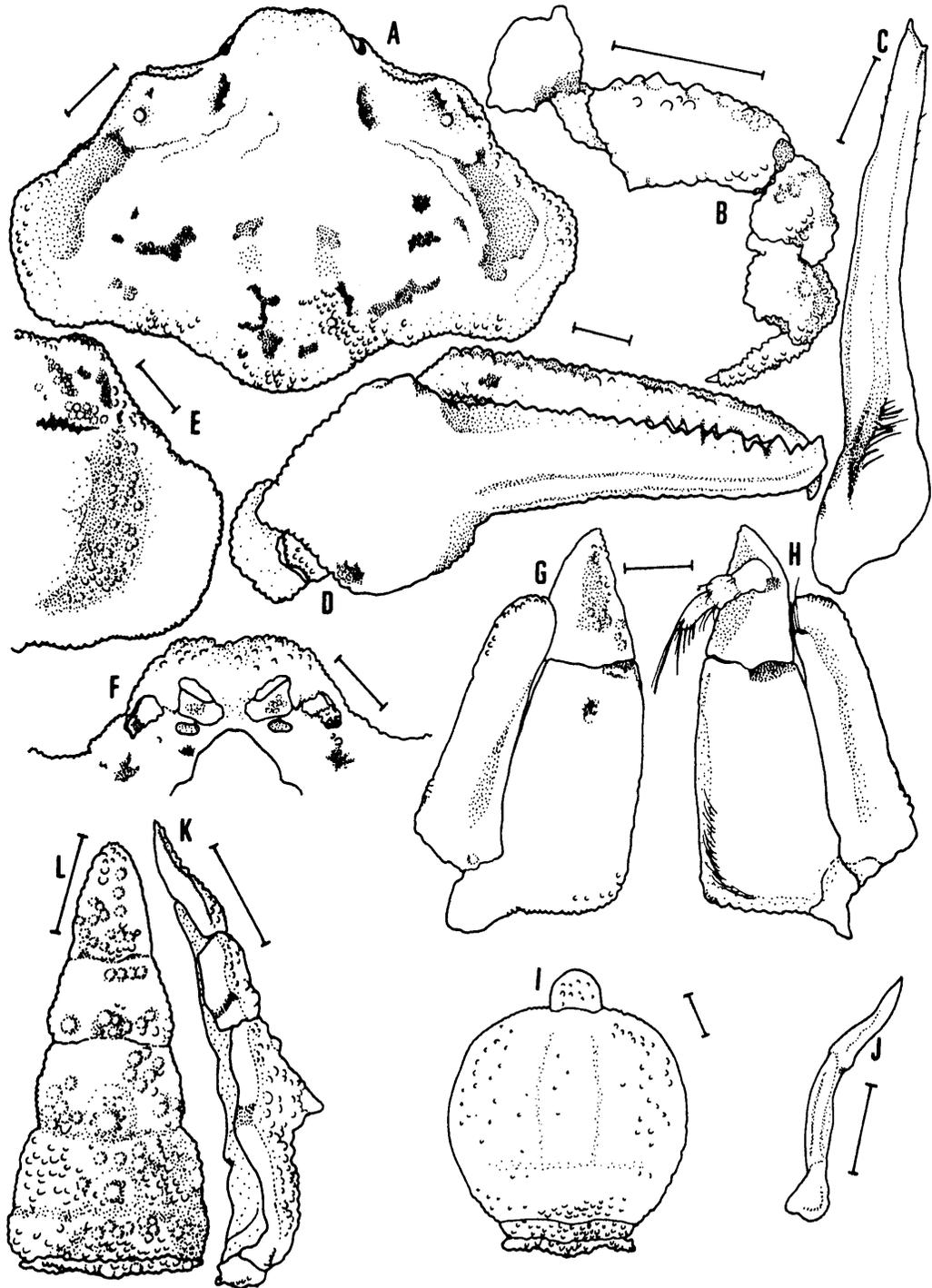


FIG. 25. — *Oreotlos pax* sp. nov., 1 male (MNHN, 7.1 mm by 10.6 mm); 1 female (MNHN, 7.5 mm by 12.7 mm). A, carapace dorsal surface; B, right last leg upper surface; C, right G1; D, right cheliped outer surface; E, left branchiostegite region; F, frontal view; G, right third maxilliped outer surface; H, right third maxilliped inner surface; I, female abdomen; J, right G2; K, male abdomen side view; L, male abdomen. Scales = 1.0 mm.

New Caledonia, Chesterfield Is., CORAIL 2, DW 9, 20°53.00'S-161°35.32'E., 62 m, coll. B. RICHER de FORGES, 20.07.1988: 1 ♂ paratype, 7.1 x 10.6 mm (MNHN B 24849). — St. DW 18, 20°44.08'S-160°59.92'E., 69 m, 21.07.1988: 1 ♀ 8.7 x 14.4 mm (MNHN). — St. DW 19, 20°41.72'S-161°00.17'E., 77 m, 21.07.1988: 1 ♀ 8.5 x 14.2 mm (MNHN). — St. DW 103, 19°01.01'S-158°31.94'E., 58 m, 27.08.1988: 1 ♀ 6.7 x 10.8 mm (MNHN). — St. DW 144, 19°27.73'S-158°23.28'E., 50 m, 30.08.1988: 1 ♀ 7.5 x 12.7 mm (MNHN).

HOLOTYPE MALE. — Carapace 1.5 times broader than long, regions not well-defined; surface finely granular with edges slightly more distinctly granulated, a few very shallow depressions scattered throughout; margin of hepatic region protruded to form an obtuse angle halfway from the front, corresponding angle ventrally in the sub-hepatic region, large distinct granule on dorsal surface a short distance posterior to hepatic angle; shallow longitudinal indistinct groove lined with granules on region posterior to orbit, lining inner boundary between hepatic and gastric regions, groove extends posteriorly to one-third length of carapace; branchial regions swollen; posterolateral border beside cardiac region very slightly protruded to produce small hump; posterior margin of cardiac region lined with slightly larger granules, groove between posterior border of carapace and border of cardiac region indistinct; front very weakly bilobed.

Basal segment of antennule occupies three quarters of antennulary fossa; antennulary fossa linked to orbital fossa only by means of a short groove; short groove also links antennules to antennal fossa.

Outer surface of third maxillipeds finely granulated, inner surface glabrous; merus with pointed apex, outer surface with shallow concavity centrally, row of four to five granules on inner edge close to apex, outer edge slightly protruded to form weak obtuse angle halfway down from apex; inner distal angle of outer surface of ischium with small clump of large granules; exopod with row of two to three larger granules on outer edge near proximal end.

Outer surface of chelipeds slightly more granular than inner surface; fingers 2 times longer than palm, outer surface of immovable finger with two faint parallel transverse grooves close to inner edge, cutting edge of fingers toothed with triangular teeth throughout, smaller teeth proximally.

Proximal half of anterior and posterior edge of merus of last pair of legs lined with large pointed granules, proximal third of posterior edge with large distinct angle; carpus and propodus with scattered large granules on outer surface.

Male abdomen finely granulated with large granules scattered throughout, margins lined with small granules; sutures indistinct; granule on proximal median portion of segment 4, segment 5 with most prominent large median tubercle proximally, clump of large granules on basal median portion of segment 6, segment 7 tapering gradually to apex, narrower and slightly longer than segment 6 measured along median line.

G1 2.1 times longer than G2, stout, straight, tapering gradually to apex, distal third very sparsely covered with short hairs, rest of G1 glabrous; apex simple with oval funnel-shaped opening with pointed opposing ends.

REMARKS. — This species closely resembles *O. angulatus* and *O. encymus*, particularly in the form of the carapace, the large hepatic angles, the G1 and G2, and the weakly bilobed front. However, *O. pax* has the smoothest carapace amongst the three being only finely granulated with few/no large granules. *O. pax* also differs from *O. encymus* in possessing a thinner dactylus on the last pair of ambulatory legs.

Two specimens from New Caledonia (2 females; 8.5 x 14.2 mm, 8.7 x 14.4 mm) appear to have shallow excavations on the carapace. On scraping lightly with an insect pin, these were found to be just darker coloured granules that, although they were on the same level as the surrounding lighter coloured granules, gave the impression that they were deeper. In all other respects, the specimens were sufficiently similar to be regarded as conspecific with *O. pax*.

DISTRIBUTION. — Marshall Is., New Caledonia.

ETYMOLOGY. — The Latin “*pax*” means “peace, tranquility”, alluding to the animals’ seemingly peaceful disposition.

Oreotlos potanus Tan & Ng, 1993

Fig. 26, Pl. 15 E, F, 16 A

HOLOTYPE FEMALE (after TAN & NG, 1993). — Carapace 1.6 times broader than long, regions not well-defined; lateral expansions smooth, plate-like and shallowly concave; closed fissure posterior to hepatic angle extending slightly into dorsal surface of carapace, shallow, granule-lined groove encircling sub-hepatic angle correspondingly, forming semi-circular line ending at edge of buccal cavern; shallow longitudinal groove lined with tiny granules on region posterior to orbit, groove extends posteriorly to one-quarter length of carapace, edge of median longitudinal ridge sharp, ridge extends posteriorly to one-third length of carapace, small granules on either side, two short, oblique ridges of three large granules immediately after ridge; branchial regions raised, rounded in cross-section and covered with large granules, posterior half of branchial regions sloping sharply down posteriorly, not concave; two large prominent granules in centre of carapace, between branchial regions; oblique granular ridge extending from posterolateral margin on either side, connecting each branchial region to posterolateral margins; very shallow, median depression present at posterior end of cardiac region, tapering in width anteriorly; deep, irregularly shaped, granule-lined groove on either side separating cardiac region from rest of carapace, grooves extending anteriorly from posterior margin to one-quarter length of carapace. Front moderately bilobed, dorsal surface with shallow rounded depression between frontal lobes; anterior, anterolateral and posterolateral margins lined by raised granules with pointed apices, conferring a scalloped appearance; margin of hepatic region protruded to form an obtuse angle tipped with 3-5 large, raised pointed granules one-third from the front, anterior edge of sub-hepatic angle with row of smaller granules, larger granules clustered at apex, making sub-hepatic angle much more prominent than hepatic angle; posterolateral border beside cardiac region almost straight; posterior margin lined with large granules.

Basal segment of antennule occupies half fossa; fossa linked to orbital fossa by means of a short groove; short groove also links basal segment of antenna to orbital fossa.

Outer surface of third maxillipeds covered with small granules, inner surface smooth and glabrous; merus with pointed apex, outer edge slightly convex; ischium 2.1 times longer than merus along inner margin, proximal third of inner edge with long hairs, larger granules on distal two-thirds of ischium.

Fingers of chelipeds 1.2 times longer than palm; inner surface of immovable finger with two transverse rows of small granules, a third shorter row of granules extends from distal two-thirds to tip of finger; inner surface of palm with scattered large granules.

Both anterior and posterior edge of merus of last pair of legs lined by large granules with smaller ones distally; dactylus thin, longer than dactylus and covered with small granules.

Abdominal segments moderately covered with large granules, sutures between segments 3-4 and 5-6 visible only in median region, rest of sutures not visible at all.

REMARKS. — *Oreotlos potanus* differs from *O. havelocki* largely in the cross-section and external appearance of the branchial regions (see TAN & NG, 1993). The branchial regions are rounded in cross-section in *O. potanus* and triangular in *O. havelocki*. In the case of *O. havelocki*, the area behind the branchial regions is concave whereas this area is just sloping down posteriorly in *O. potanus*. The external differences are sufficient to render the two species distinct.

DISTRIBUTION. — French Polynesia.

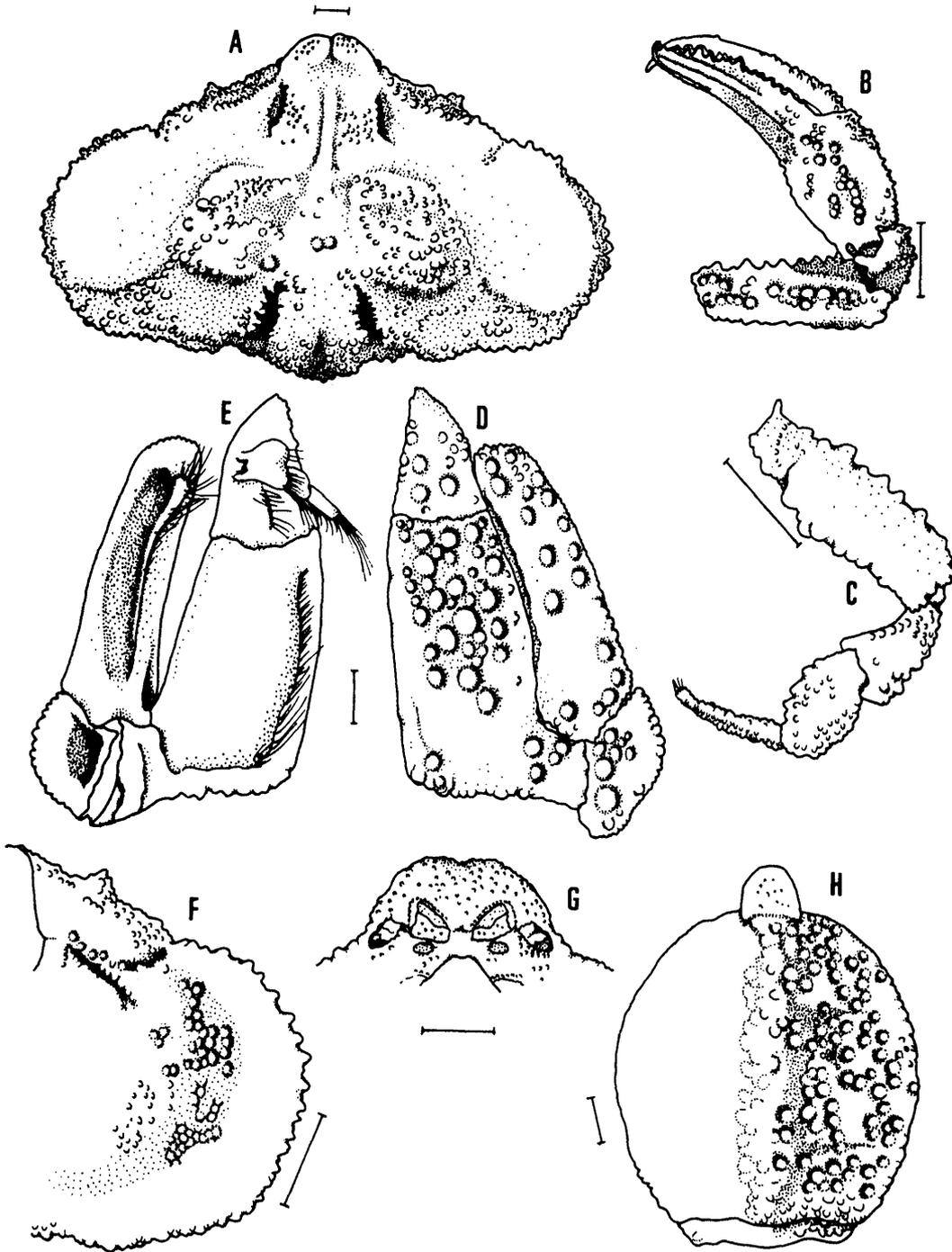


FIG. 26. – *Oreotlos potanus* Tan & Ng, 1993, holotype female (MNHN - B24851), 7.3 mm by 12.2 mm). A, carapace dorsal surface; B, left cheliped outer surface; C, right last leg upper surface; D, right third maxilliped outer surface; E, right third maxilliped inner surface; F, left branchiostegite region; G, frontal view; H, abdomen. Scales = 1.0 mm.

Oreotlos speciosus Chen, 1989

Fig. 27

Oreotlos speciosus Chen 1989: 194, pl. XI 1.

MATERIAL EXAMINED. — **Philippines.** St. 117, 12°31.3'N-120°39.5'E., 97-92 m, coll. 03.06.1985: 1 ♀, holotype, 4.6 x 6.9 mm (MNHN-B18188).

HOLOTYPE FEMALE. — Carapace 1.7 times broader than long, regions not well-defined; dorsal surface finely granulated; large granule posterior to hepatic angle, indistinct, shallow longitudinal groove on region posterior to orbit; branchial regions moderately swollen, finely granulated, higher than cardiac and intestinal regions; shallow, irregularly shaped, granule-lined groove on either side of cardiac region, separating cardiac region from rest of carapace, gastric and cardiac regions moderately convex. Front thick and entire; margin of hepatic region protruded to form an angle two-thirds from the front, larger granules clustered at apices of hepatic angles, anterior part of posterolateral borders swollen and oblique, posterior part concave with central low and wide granule giving the border a sinuous appearance; posterior border narrow and very slightly convex.

Third maxillipeds finely granulated; merus with rounded apex, outer edge forms obtuse angle halfway down from apex; ischium 1.8 times longer than merus along inner margin.

Fingers 2 times longer than palm, tips strongly crossed, borders with acute granules, cutting edges with small teeth more developed on the distal half; immovable finger with two parallel transverse rows of small granules on outer surface; palm swollen, outer surface of palm finely granulated, a few larger granules spaced on transverse row near base of palm; merus somewhat curved, anterior border lined by sparse teeth which are more or less rounded or triangular.

Ambulatory legs short and rather slender, all segments finely granulated; anterior border of merus of last pair of legs lined by sharp, pointed granules, proximal half of posterior border with larger pointed granules than distal half; dactylus short.

Abdomen finely granulated; terminal segment narrow, with pointed apex.

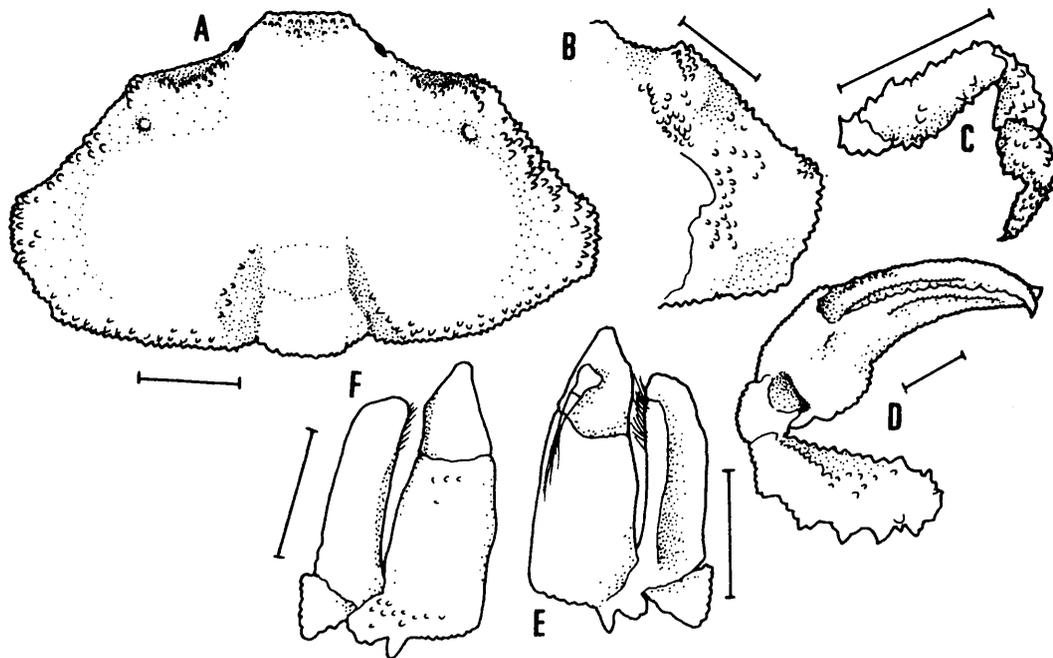


FIG. 27. — *Oreotlos speciosus*, Chen 1989, holotype female (4.6 mm by 6.9 mm, MNHN-B18188). A, carapace; B, branchiostegite; C, right last leg, upper surface; D, left cheliped, upper surface; E, right third maxilliped, inner surface; F, right third maxilliped outer surface. Scales: A-F = 1.0 mm.

REMARKS. — As the holotype was badly damaged with almost the entire posterior half of the specimen crushed, we have provided a composite description from our observations of the holotype and from the original description and plates of *O. speciosus* given by CHEN (1989). *Oreotlos speciosus* is similar to *O. pax* sp. nov. in terms of the fine granulation covering the carapace, the moderately swollen branchial regions and the presence of a large granule behind each hepatic angle. However, the carapace of *O. speciosus* appears to be relatively more angular than that of *O. pax* due to the presence of pointed granules lining the carapace borders of *O. speciosus*. Also, the front of *O. speciosus* is distinctly entire whilst that of *O. pax* is weakly bilobed. The fingers of the chelipeds of *O. speciosus* are more curved and slender compared to those of *O. pax* which are stouter. In addition, the branchiostegite regions of *O. speciosus* are finely granulated and without large granules whereas in *O. pax*, the branchiostegite regions possess only a few larger granules.

DISTRIBUTION. — Philippines (CHEN, 1989).

TLOS Adams & White, 1848

Tlos Adams & White, 1848: 57. — A. MILNE EDWARDS, 1874, 10: 51. — ALCOCK, 1896, 65: 175. — HASWELL, 1882: 130. — SAKAI, 1976: 82 (part).
Oreophorus (Tlos) – IHLE, 1918: 217 (part). — SERÈNE & UMALI, 1972: 53 (part).

TYPE SPECIES. — *Tlos muriger* Adams & White, 1848, by monotypy.

DIAGNOSIS. — Carapace distinctly broader than long, dorsal surface finely granulated, appearing smooth to the naked eye, not rugose; groove parallel to border of carapace absent; median longitudinal ridge narrow and distinct; branchial regions concave, with 2 large, finely granulated opposite facing D-shaped, knob-like projections on either side close to cardiac region, edge of each lobe facing centre of carapace being straight whilst outer edge is semi-circular; posterior third of carapace sloping and covered with small raised granules; branchiostegite region gently sloping, covered with small raised granules as posterior region of dorsal surface of carapace, sometimes with large, sparsely distributed granules, no distinct region of large, mushroom-like granules; front produced and strongly upturned, completely flattened; small raised granules covering front; antero- and postero-lateral regions of carapace expanded and thin without thick granulated rim; margins lined by small granules; border with 6 sutures: 2 small sutures (frontal sutures) on frontal margin extending posteriorly on dorsal surface of carapace from orbits, 2 larger sutures (anterior sutures) between frontal and hepatic regions and 2 between hepatic and branchial regions (posterior sutures); region of carapace behind posterior sutures may overlap region in front. Antennule folds obliquely into large rectangular fossa, basal segment covered with small granules and occupies all of fossa. Eyes not visible from dorsal view. Male abdomen without prominent central granule(s) on any segment, terminal segment may have raised, granulated central portion; G1 usually 2-2.4 times longer than G2, distal half straight, covered sparsely with short hairs, apex bilobed and slightly angled; G2 short with large petaloid terminal process.

REMARKS. — We regard *Tlos* as a distinct genus due to the following characters: a cup-shaped carapace, absence of the groove parallel to the carapace border, the structure of G1 and G2, the distinctly sloping posterior region of the carapace and the presence of two D-shaped knob-like projections in the branchial regions. *Tlos* is monotypic, consisting only of *Tlos muriger*. Of the two other species placed in *Tlos* by IHLE (1918), *T. petraeus* was transferred to a new genus *Dolos* by TAN & RICHER de FORGES (1993), while *T. havelocki* is here referred to *Oreotlos*.

ALCOCK (1896) commented that “*Tlos* differs from *Oreophorus* chiefly in having the anterior and lateral parts of the carapace flat and the margin of the carapace turned up so that although the cardiac and parts of the branchial regions are convex, the carapace as a whole is cupped. This is in marked contrast with the inflated form of *Oreophorus*, and constitutes the only difference between the two forms”. However, ALCOCK only examined two species of *Tlos*: *T. petraeus* A. Milne Edwards, 1874 and *T. patella* Alcock, 1896. His specimens of *T. petraeus* are actually *O. havelocki* (Laurie, 1906) (see remarks for *Dolos petraeus*) and his

species, *T. patella* has since been transferred to the new genus *Alox* in this present study (see remarks for *A. patella*).

ETYMOLOGY. — ADAMS & WHITE (1848) named this genus after a town of the same name in Lycia, Turkey, described by Sir Charles FELLOWES. Gender is masculine by inference from that of the species name (“muriger”).

Tlos muriger Adams & White, 1848

Fig. 28. Pl. 16 F, 17

Tlos muriger Adams & White, 1848: 58, Fig. 2. — HASWELL, 1882: 130. — WALKER, 1890, 20: 111 (Singapore). — RATHBUN, 1910, 5: 306.

Oreophorus (Tlos) muriger — IHLE, 1918: 218. — SERÈNE & UMALI, 1972: 53-36, Fig. 46-47.

MATERIAL EXAMINED. — **Singapore** Straits, B 41, Angler Buoy, off Changi, 7-13 m, mud substratum, coll. Singapore Fisheries Research Station, 1955-1956: 1 ♀, neotype, 8.8 x 14.1 mm (ZRC-1985.89). — B 28, Shoal West of Raffles Lighthouse, 9-11 m, mud.shell/sand substratum, coll. Singapore Fisheries Research Station, 1955-1956: 1 ♂ 5.2 x 8.1 mm (ZRC-1985.88). — Pulau Semakau West, sledge, coll. Reef Ecology Study Team, National University of Singapore, 06.07.1992: 1 ♀ 8.3 x 14.2 mm (ZRC-1991.9669). — Pulau Semakau West, sledge, coll. Reef Ecology Study Team, National University of Singapore, 18.04.1992: 1 ♀ 9.4 x 14.8 mm (ZRC-1991.9443).

Indonesia, Java. “DANSKE EXP. TIL KEI-ØERNE”, St. 116, 5°57'S-106°34'E., sand, “skaller”, 22 m, 07.08.1922: 1 ♀ 8.0 x 12.5 mm (ZMUC). — Java, Pulo Bulo. “DANSKE EXP. TIL KEI-ØERNE”, St. 66, 5°54'S 106°12'W, “sandey Dynd, skaller”, coll. 27.07.1922: 1 ♀ 7.5 x 11.6 mm (ZMUC).

Gulf of Siam, Koh Chuen. 55 m, shell bottom, coll. Th. MORTENSEN, 02.1900: 1 ♂ 5.0 x 8.1 mm (USNM-39629). — Q.f. Cap Lians, 6 km, coll. TH. MORTENSEN, 01.02.1900: 1 ♀ 9.8 x 15.1 mm (ZMUC) (other data on label undiscernable).

Australia, Holothuria Bank, 70 m: 1 ♂ 7.6 x 12.0 mm (BMNH 92.3.26).

MALE (ZRC 1985.88). — Carapace 1.5 times broader than long; dorsal surface covered with small flat granules, appearing smooth to naked eye; branchial regions convex and plate-like, with two large, raised D-shaped knob-like projections on either side, vertical surfaces of projections more distinctly granulated than horizontal surface; deep, irregularly shaped, groove lined by mushroom-like granules on either side of dorsal surface, separating cardiac and intestinal region from rest of carapace, cardiac region covered with raised granules, with wide median cleft posteriorly. Front entire, frontal surface with shallow granule-lined groove and raised granules; margin of hepatic region straight, not protruded to form an angle, sub-hepatic angle obtuse and small; carapace border with 6 open sutures: 2 small sutures (frontal sutures) on frontal margin extending posteriorly on dorsal surface of carapace from orbits, 2 anterior sutures between frontal and hepatic regions and 2 posterior sutures between hepatic and branchial regions, sutures lined by small granules; posterolateral border slightly rounded. Basal segment of antennule occupies all of fossa when closed; basal segment of antenna and antennular fossa not linked to orbital fossa.

Third maxillipeds densely covered with medium sized granules; merus with pointed apex, outer edge forms rounded angle halfway down from apex, distal half of inner edge lined by small raised granules; ischium 2.1 times longer than merus along inner margin, distal third of inner edge of outer surface with shallow irregularly-shaped depression, inner surface with tuft of short hairs on middle of inner edge; exopod with scattered large granules close to apex.

Outer surface of chelipeds with scattered large granules, inner surface less granular; fingers 1.1 times longer than palm; immovable finger with two parallel transverse rows of small granules on outer surface running through proximal three-quarters of finger, entire inner edge with thin, flattened scalloped expansion with granulated edge; outer surface of palm with scattered large granules, upper edge with row of large granules and clump of granules at proximal end; upper edge of carpus also lined by large granules, outer surface with clumps of large granules; distal three-quarters of cutting edge of both fingers toothed with small triangular teeth.

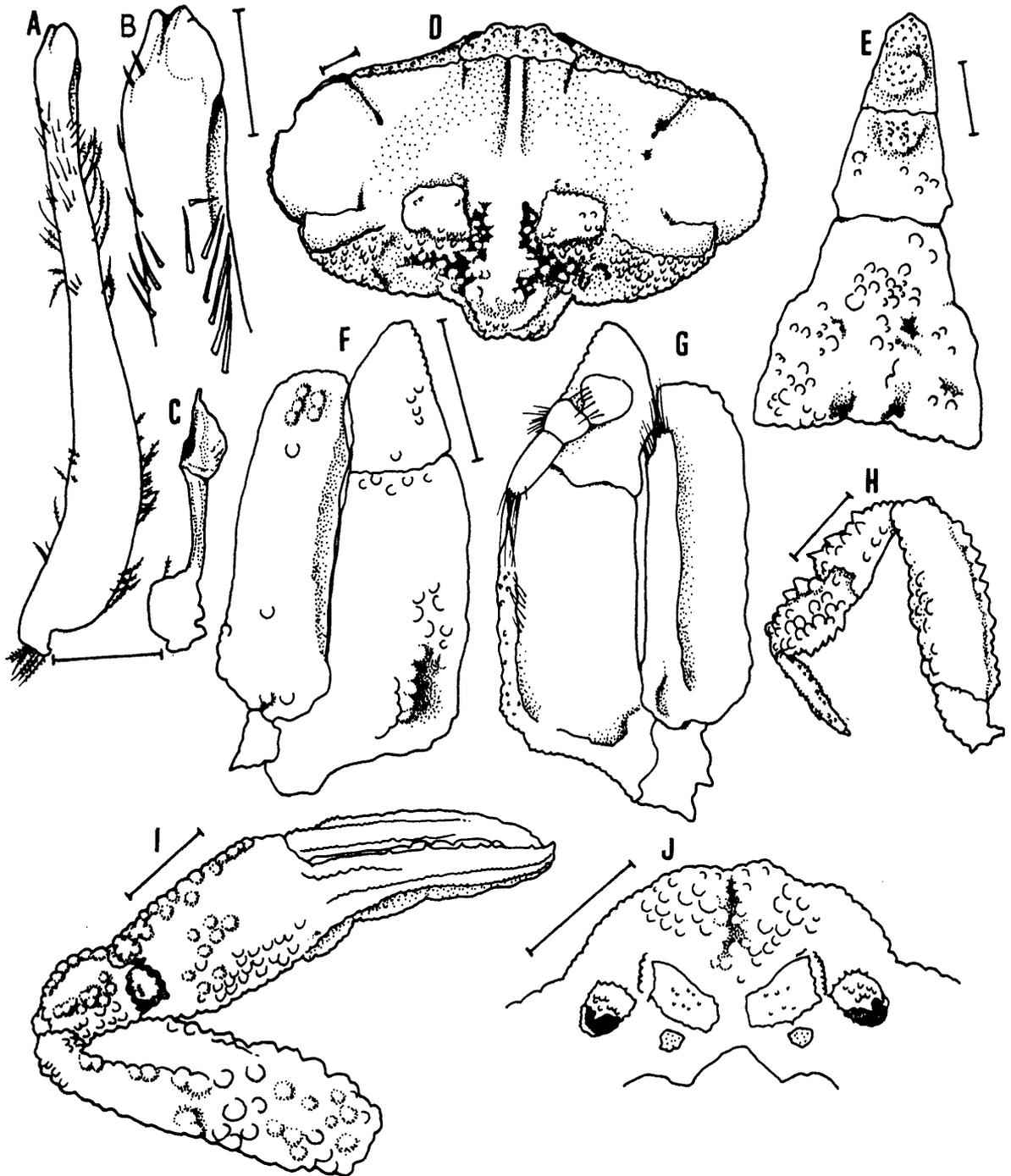


FIG. 28. — *Tlos muriger* Adams & White, 1848, male (BMNH 92.3.26, 7.6 mm by 12.0 mm). A, right G1; B, apex right G1; C, right G2; D, carapace dorsal surface; E, abdomen; F, right third maxilliped outer surface; G, right third maxilliped inner surface; H, left last leg upper surface; I, right cheliped outer surface; J, frontal view. Scales: A, C, D-J = 1.0 mm; B = 0.5 mm.

Four-fifths proximal portion of anterior edge of merus of last pair of legs lined by large pointed granules, posterior edge with large rounded granules; anterior edge of carpus and both anterior and posterior edge of propodus lined with similar large pointed granules, outer surface of carpus very granular; dactylus long and thin, covered with small raised granules.

Male abdomen entirely covered with medium-sized raised granules; segment 3, 4, 5 with a few shallow furrows, segment 3 with shallow indentation on either side of median line on proximal end; distal end of segment 6 with raised clump of granules; segment 7 with similar clump of granules in centre.

G1 2.4 times longer than G2, slim, straight, tapering gradually to apex, distal third and proximal third sparsely covered with long hairs which are simple or branched, rest of G1 glabrous; apex bilobed, slightly angled, with lateral groove; G2 short and thin, petaloid terminal process on apex with pointed tip, base bulbous.

FEMALES. — Carapace generally larger and less angular than that in males, other characters being the same.

REMARKS. — ADAMS & WHITE (1848) described *Tlos muriger* on the basis of a single adult female from Borneo. The type specimen has not been found in BMNH, and it must be presumed lost. Several specimens were obtained which fit the original description of the species very well. The G1 and G2 are described and figured for the first time. A female specimen from Singapore is hereby designated the neotype.

HASWELL (1882) recorded *T. muriger* from Port Molle, Australia but his description was insufficiently detailed and without a figure. Nevertheless, it is from a similar locality as a male specimen (BMNH 92.3.26) from Holothuria Banks, Australia, and, his record is considered to be probably valid. WALKER (1890) merely listed the species as present in Singapore waters. His specimen (part of the ARCHER collection), presumably in BMNH (see JOHNSON, 1967, 1970) was not found. Considering its location, it is also likely to be *T. muriger*. RATHBUN'S (1910) specimens in ZMUC have been examined and there is no doubt that they belong to *T. muriger*. From the detailed description given, IHLE'S (1918) specimen from Sumbawa is likely to be this species, but his specimen could not be located in ZMA.

DISTRIBUTION. — Australia (HASWELL, 1882), Borneo (ADAMS & WHITE, 1848), Philippines (SERÈNE & UMALI, 1972), Singapore (WALKER, 1890), Thailand (RATHBUN, 1910), Indonesia (IHLE, 1918).

ETYMOLOGY. — The word "muriger" is likely to have been a compound word from two Latin words: "muria" meaning "brine" and "-ger" as a suffix for "bearer".

DISCUSSION

Little of the behaviour and habits of *Oreophorus* s. lat. is known. TAN & RICHER de FORGES (1993) provide a general discussion on this and comment specifically on how *Dolos petraeus* and *Oreotlos etor* mimic the algae *Halimeda*.

The characters used in distinguishing both subgenera and species in *Oreophorus* s. lat. in the past were largely based on carapace morphology. Examples of such characters are: the presence/absence of grooves parallel to the border of the carapace, the carapace granulation pattern, the presence/absence of sutures on carapace margins, etc. Such characters were useful under certain circumstances. Nevertheless, carapace morphology often cannot be the sole aspect used to differentiate the main groups and can sometimes prove to be misleading. In the course of this revision, we have found them to be frequently insufficient for distinguishing clearly between the taxa, particularly at the generic level. This necessitated the search for additional stable characters which could be included within a suite of characters for separating the groups. Two noteworthy characters were the structure of the antennular basal segment and the presence of a median tubercle/granule on the fused section (segments 3-5) of the male abdomen.

The partial or complete closure of the antennular fossa by the basal antennular segment was found to be highly reliable in distinguishing the generic groups within *Oreophorus* s. lat., this being substantiated by the marked similarity of other characters within the groups separated. In the past, a few workers (IHLE, 1918; ALCOCK, 1896; SERÈNE, 1954) made mention of this character but neither elaborated on it nor used it in their keys to genera or species. It is interesting to note that SAKAI (1937) used the position of the antennal second segment relative to the orbital and antennal fossa to differentiate between *Oreophorus* and other genera in his key to the leucosiid genera but did not consider using the antennules.

It was recently proposed that the formation of a large basal segment of the antennule for closure of the fossa is probably an adaptation to a muddy environment (OVAERE, 1989). Such a condition is found in *Alox*, *Dolos* and *Tlos* but from available information, their habitats seem to be quite different. Both *Alox* and *Tlos* specimens have been found covered with mud and other material whilst most of the *Dolos* specimens were relatively clean except for the frequent layer of calcium deposit. Nevertheless, the fine calcium coralline sediments where *Dolos* is found may also act like "mud" (P. DAVIE, pers. comm.). Other additional factors may also be involved in the evolution of the structure and more studies should be done to elucidate them (Fig. 29).

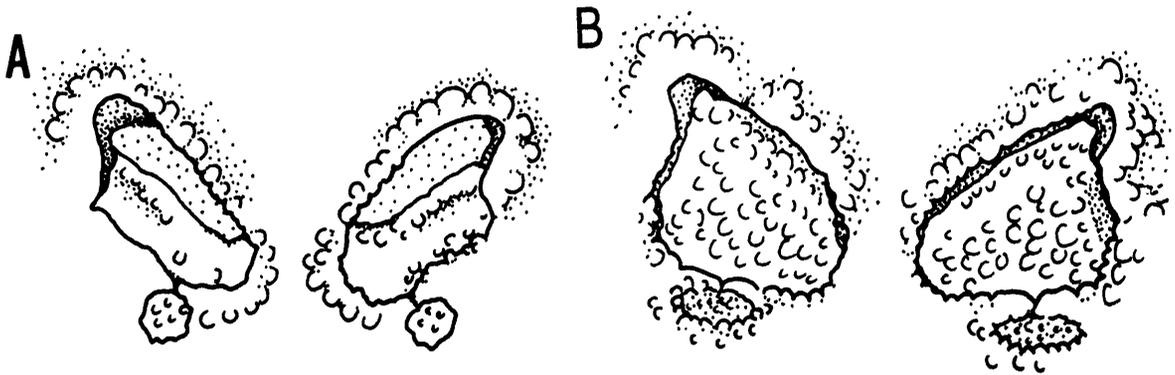


FIG. 29. – Diagram of two kinds of closure of antennular fossae by basal segment. A, partial closure of fossae as found in *Oreophorus*, *Oreotlos* and *Cateios*; B, complete closure of fossae as found in *Alox* and *Dolos*.

All the males of the genus *Oreotlos* examined possess a prominent median tubercle on the fused portion of the abdomen. This character is highly diagnostic, being absent in all other associated genera considered in this study. The male of *Cateios frontalis* has a similar structure but it is a ridge-like structure rather than a prominent tubercle as in *Oreotlos*.

The G1 and G2 are more useful between genera than within genera. For example, the short, stout and densely setose G1 in *Cateios* clearly distinguishes it from all the other associated genera. On the other hand, in *Oreotlos*, the G1 and G2 are so similar it would be unwise to use them as primary characters for the majority of the species, with the exception of *Oreotlos havelocki* whose G1 has an unusually curved distal portion. Of course, it must be emphasised that this character was used in conjunction with a suite of additional characters to avoid ambiguity as much as possible.

Although it has been mentioned that carapace morphology is usually inadequate, there is one exception and that is in the case of *Oreophorus* s. str. The large distinct fossae on the dorsal surface of the carapace in this genus is found in none of the other associated genera. However, to avoid any ambiguity, additional characters were used together with the presence of these fossae for distinguishing this genus. It remains to be seen if potential exists for these characters to be used for other genera and even at the subfamily level in the Leucosiidae, whose taxonomy is still quite unstable.

Recognising the groups as subgenera as in the past (IHLE, 1918; SERÈNE, 1954; SERÈNE & SOH, 1976; CHEN, 1989) would carry the implication that the groups were monophyletic, the similarities observed amongst them being due to their phylogenetic relationship. However, it seems very possible that the groups are polyphyletic, with their similarities in carapace morphology and other characters being due to convergence more than anything else. Hence, the six groups resulting from this study were recognised as separate genera, not subgenera, pending future phylogenetic studies.

The genus *Oreophorus* s. lat. has been placed in the subfamily Ebaliinae STIMPSON, 1858, due to the form of the antennules and antennae, the length of the merus of the cheliped relative to the ischium and the general shape of the carapace (ALCOCK, 1896). However, this subfamily appears to contain genera which are heterogeneous in composition and much has to be done to stabilise the taxonomy of these groups before any conclusions may be made concerning the taxonomic position of *Oreophorus* s. lat. within the Leucosiidae. The group is here recognised as part of the Ebaliinae pending further taxonomic studies.

In terms of carapace morphology, members of *Oreophorus* s. lat. appear related to *Actaeomorpha* MIERS, 1878, *Drachiella* GUINOT, 1976, *Speleophorus* A. Milne Edwards, 1865, and *Uhlias* Stimpson, 1871. MIERS (1879) stated that the genus *Actaeomorpha*, was closely related to *Oreophorus* s. lat., however, *Actaeomorpha* belongs to the family Parthenopidae. GUINOT (1966) transferred the following *Actaeomorpha* species: *A. aglyphus aglyphus* (Laurie, 1906), *A. aglyphus angulatus* (Ihle, 1918), *A. sculptus* (Haswell, 1879), *A. morum* (Alcock, 1896) and *A. lapillus* (Alcock, 1896), to "Aff. *Oreophorus*" as she felt they were more similar to the Ebaliinae in Leucosiidae than the rest of *Actaeomorpha*. Finally, GUINOT (in SERÈNE & SOH, 1976) established *Drachiella* for the "Aff. *Oreophorus* group", which she considered to be a true leucosiid. *Drachiella* differs from *Oreophorus* s. lat. in the presence of distinct extensive grooves on the dorsal surface of the carapace and the short fingers relative to the palm length of the cheliped (SERÈNE & SOH, 1976).

The Atlantic genera *Uhlias* and *Speleophorus* also bear a striking similarity to *Oreophorus* s. lat. in terms of the carapace shape and ornamentation. However, the fingers of the cheliped are shorter relative to the palm length in these two genera as compared to *Oreophorus* s. lat. *Speleophorus* also has a backward pointing spine on the sixth segment of the male abdomen and two deep hollows on the posterior half of the carapace. *Uhlias* has an elliptical carapace with ill-developed hepatic and sub-hepatic angles as compared to the more angular carapace in *Oreophorus* s. lat. *Oreophorus* s. lat. species have not been found outside the Indo-Pacific region.

The confused state of *Oreophorus* s. lat. prior to this revision is a reflection of the current state of taxonomy within the family Leucosiidae which is in urgent need of revision at all levels.

INDETERMINATE RECORDS

The following list includes all records of specimens encountered in this study whose identities cannot be ascertained:

Tlos petraeus – MIERS, 1884: 254.

Oreophorus (Oreotlos) latus – TAKEDA, 1977: 119, pl. 1C (Ogasawara Is., Japan).

Oreophorus reticulatus (junior) – ADAMS & WHITE, 1848: t. 6, Fig. 2 (Sunda Straits).

Oreophorus reticulatus – MIERS, 1884: 185, 254 (Torres Strait, Thursday & Friday Is.).

Oreophorus reticulatus – STEPHENSEN, 1945: 68 (Iranian Gulf. Exact locality not noted).

Oreophorus rugosus – HASWELL, 1882: 130 (Port Denison).

Oreophorus rugosus – ORTMANN, 1894: 35 (Thursday Is.).

Oreophorus rugosus – RATHBUN, 1910, 5: 305 (Koh Kam, Siam).

Oreophorus rugosus – BALSS, 1938: 9 (Fiji Is., Viti Levu, Bau; Gibert Is., Taritori, Apamama, Aranuka, Nukunoa).

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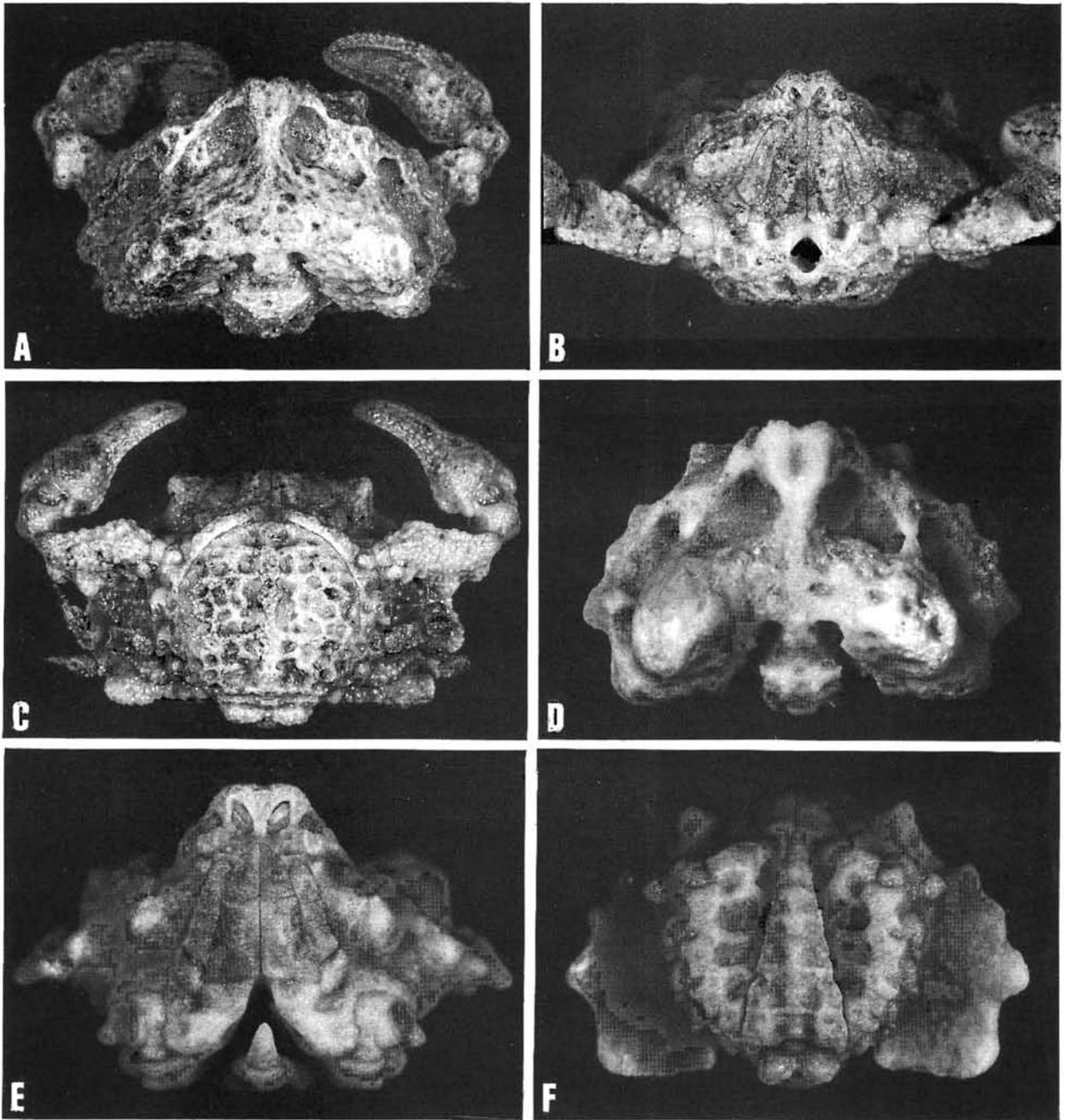


Plate 1. — *Oreophorus horridus* Rüppell, 1830, holotype female (SMF) 16.2 mm by 23.2 mm, male (SMF) 9.5 mm by 13.7 mm.
A, Holotype female, carapace dorsal view; B, Holotype female, frontal view; C, Holotype female, carapace ventral view;
D, Male, carapace dorsal view; E, Male, frontal view; F, Male, carapace ventral view.

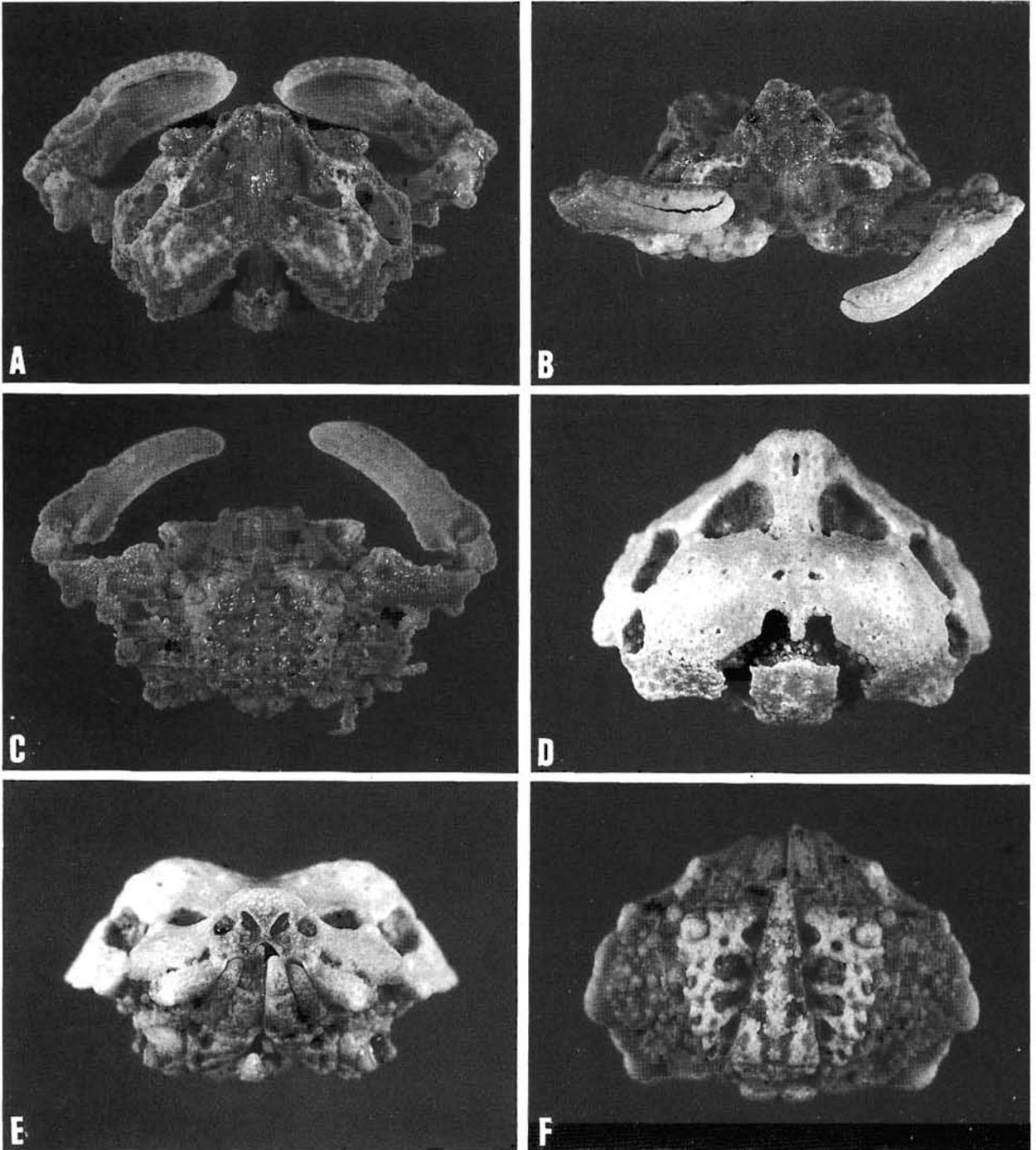


Plate 2. - *Oreophorus crosnieri* sp. nov., Holotype male (MNHN) 10.2 mm by 13.0 mm. **A**, Carapace dorsal view; **B**, Frontal view; **C**, Carapace ventral view. *Oreophorus fenestrus* sp. nov., Holotype male (BMNH 87.16) 7.7 mm by 10.8 mm. **D**, Carapace dorsal view; **E**, Frontal view; **F**, Carapace ventral view.

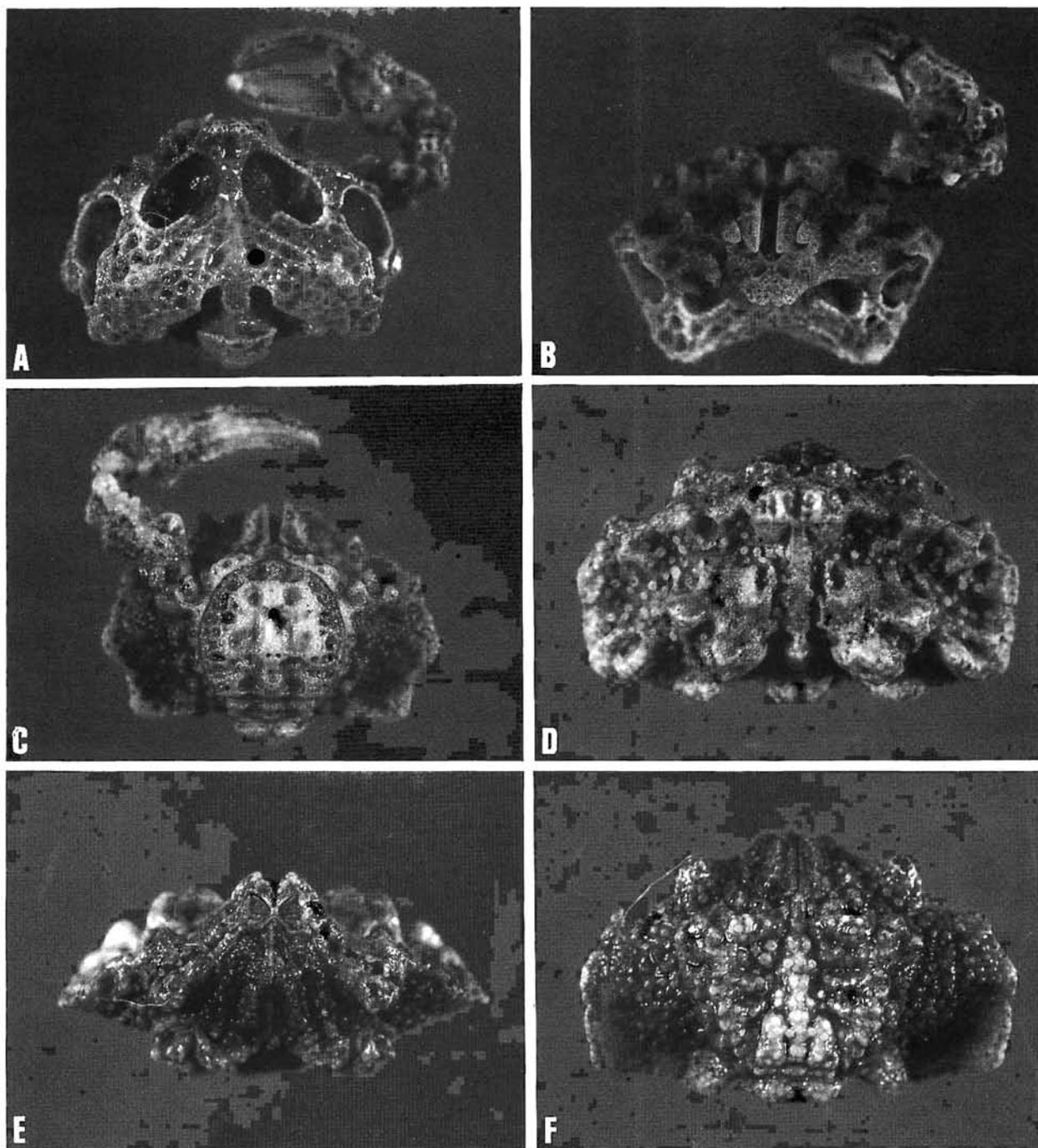


Plate 3. - *Oreophorus reticulatus* Adams & White, 1848, Holotype female (BMNH 1847.21) 12.3 mm by 16.7 mm. **A**, Carapace dorsal view; **B**, Frontal view; **C**, Carapace ventral view. *Alox glene* sp. nov., Holotype male (BMNH 88.2) 7.2 mm by 11.9 mm. **D**, Carapace dorsal view; **E**, Frontal view; **F**, Carapace ventral view.

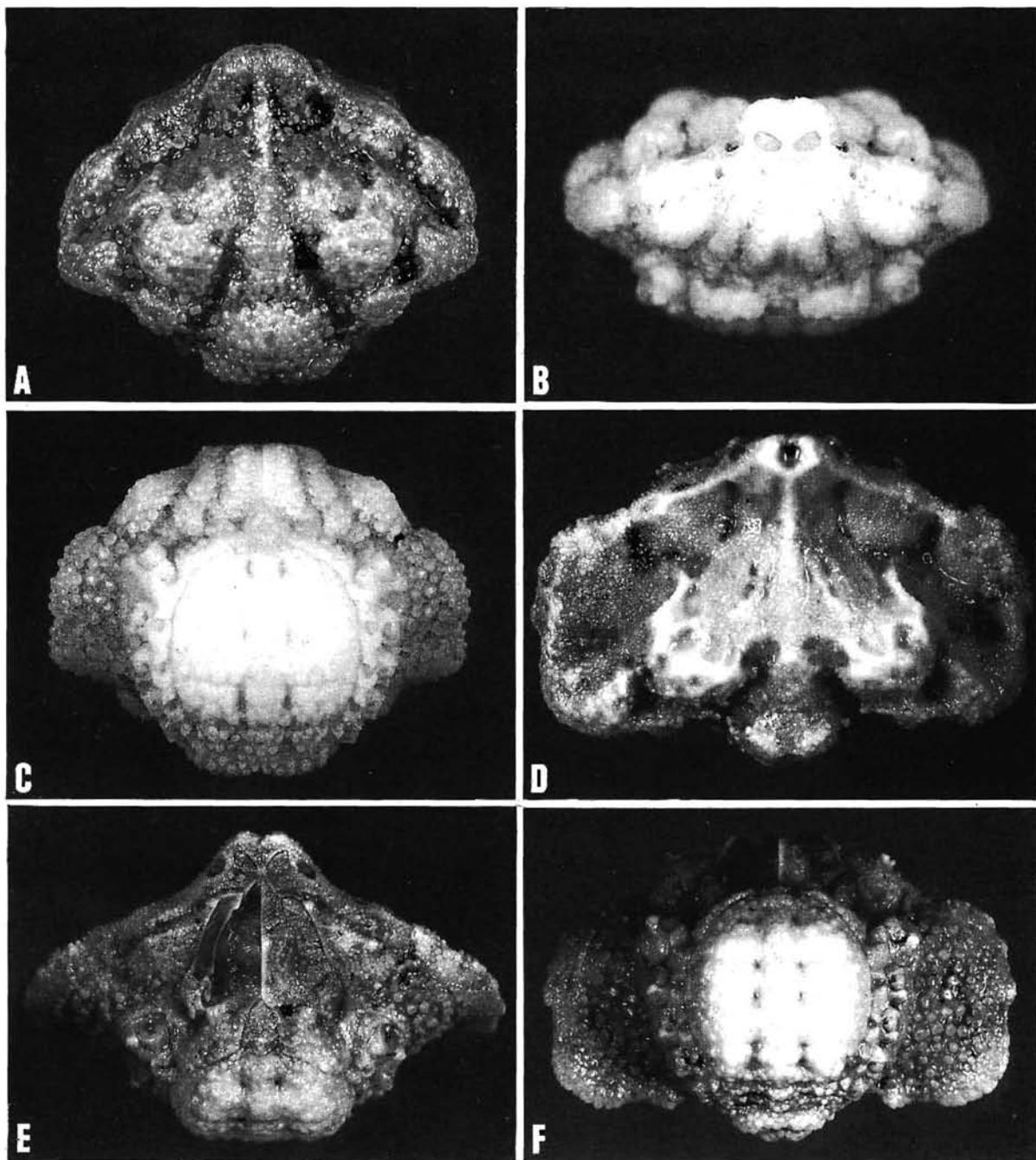


Plate 4. - *Alox antheos* sp. nov., Holotype female (MNHN-B 19048) 6.7 mm by 8.4 mm, Paratype female (6.1 mm by 7.5 mm). **A**, Holotype female, carapace dorsal view; **B**, Paratype female, frontal view; **C**, Paratype female, carapace ventral view. *Alox latusoides* (Sakai, 1937), female (USNM uncat.) 8.1 mm by 11.3 mm. **D**, Carapace dorsal view; **E**, Frontal view; **F**, Carapace ventral view.

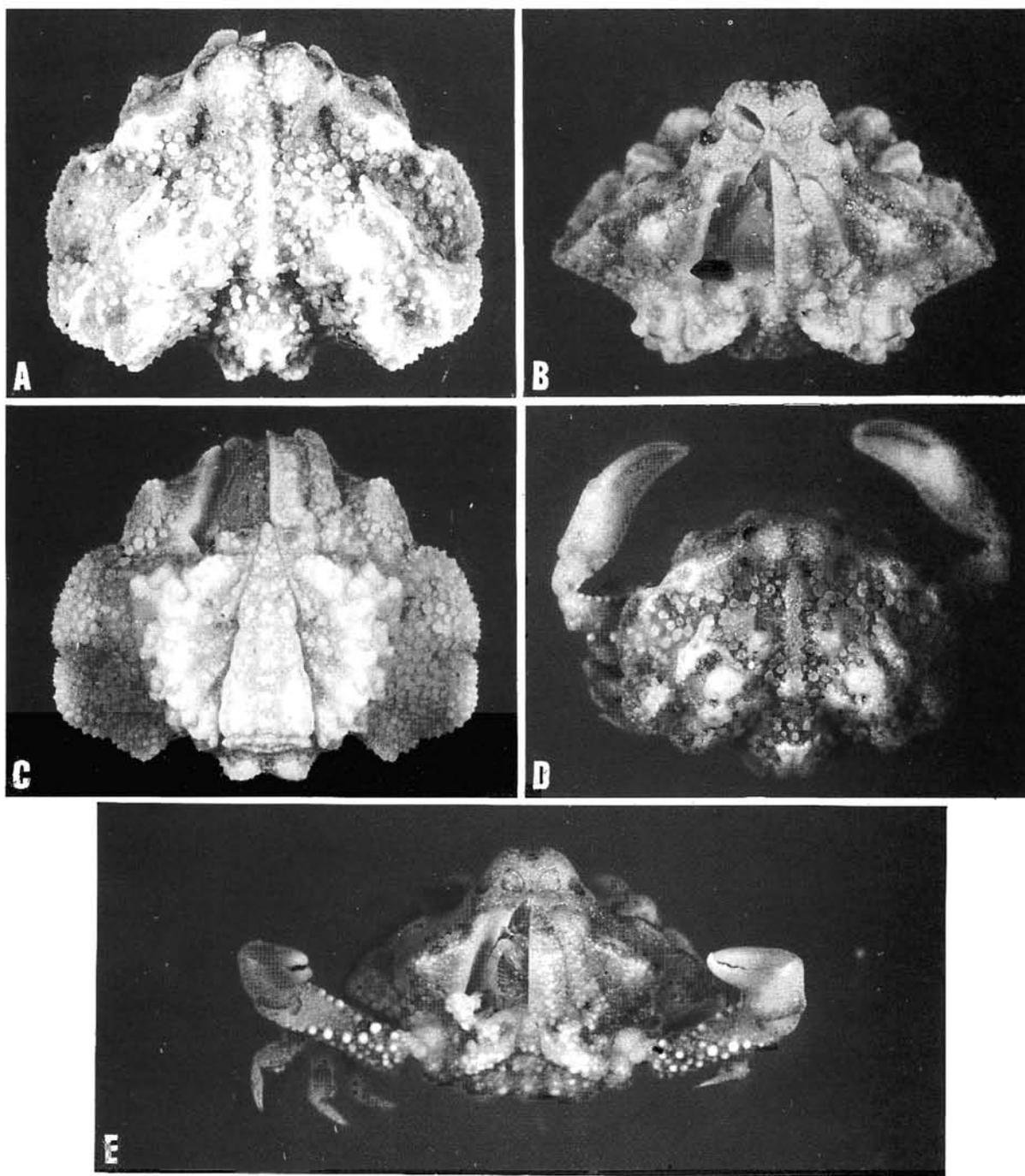


Plate 5. - *Alox ornatum* (Ihle, 1918), male (ZMUC) 6.8 mm by 8.2 mm, female (NSMT Cr-6457) 6.3 mm by 7.6 mm. **A**, Male, carapace dorsal view; **B**, Male, frontal view; **C**, Male, carapace ventral view; **D**, Female, carapace dorsal view; **E**, Female, frontal view.

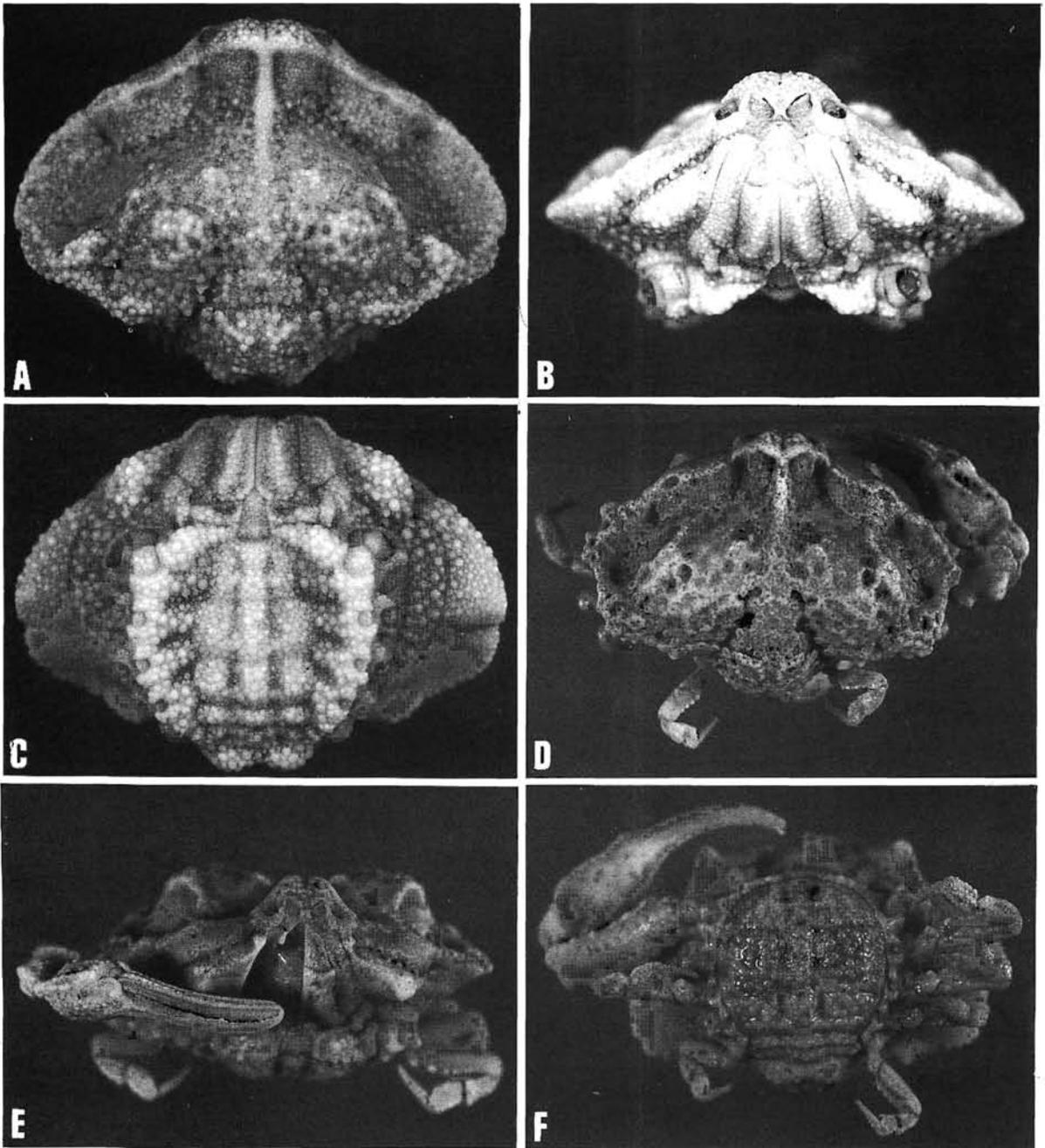


Plate 6. - *Alox patella* (Alcock, 1896), Lectotype female (BMNH 96.9.8.17) 6.2 mm by 8.5 mm. **A**, Carapace dorsal view; **B**, Frontal view; **C**, Carapace ventral view. *Alox rugosum* (Stimpson, 1858), Neotype female (12.2 mm by 17.8 mm). **D**, Carapace dorsal view; **E**, Frontal view; **F**, Carapace ventral view.

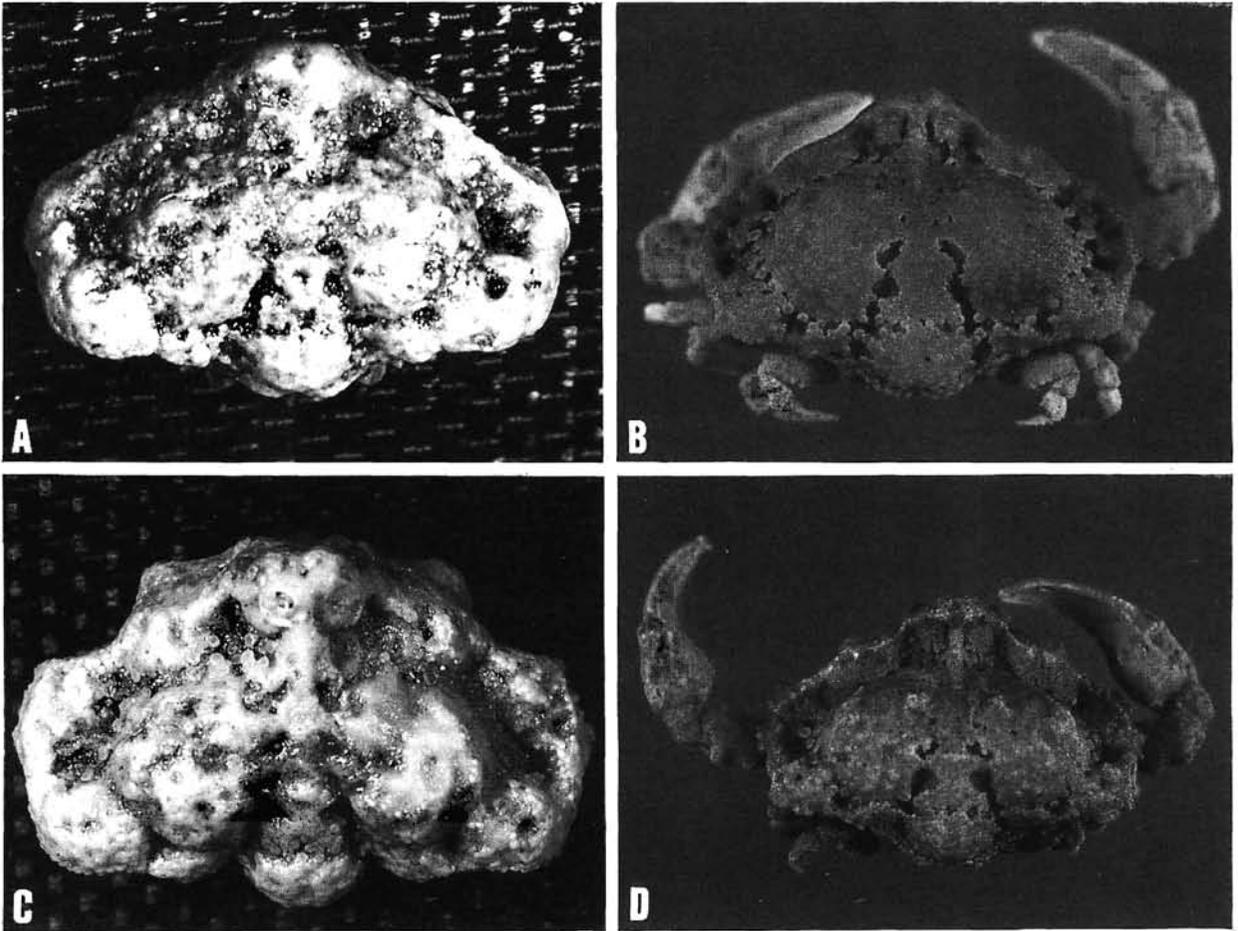


Plate 7. - Dorsal view of carapace of specimens of *Alox rugosum* (Stimpson, 1858), **A**, male (ZMA) 8.1 mm by 12.6 mm; **B**, female (ZRC 1989.2951) 8.6 mm by 13.0 mm; **C**, male (ZMA) 9.3 mm by 14.3 mm; **D**, female (ZRC 1985.1730) 9.6 mm by 14.1 mm.

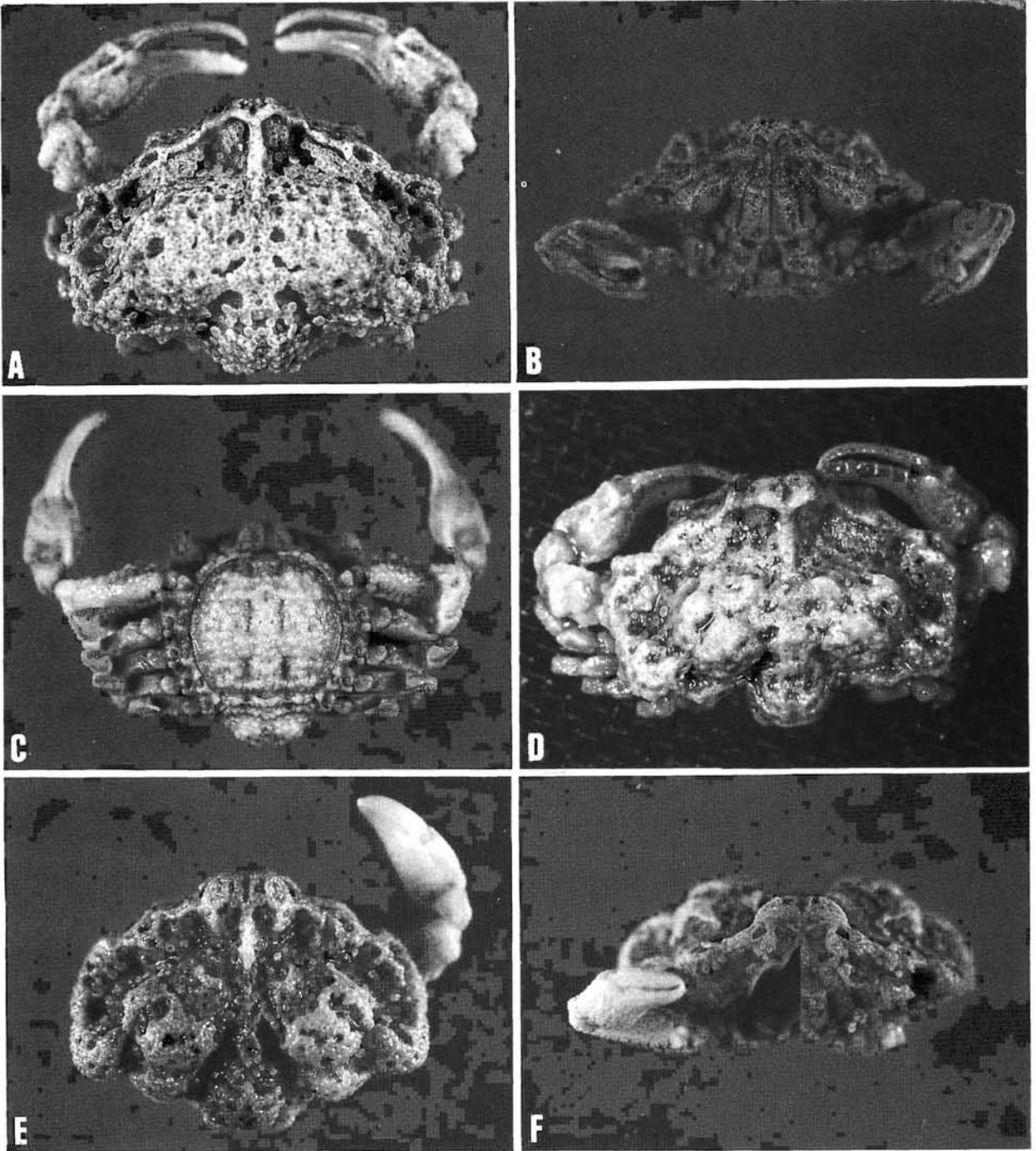


Plate 8. – *Alox somphos* sp. nov., Holotype female (ZRC 1984.5644-5645) 14.1 mm by 20.7 mm, Paratype male (ZMA) 8.7 mm by 12.2 mm. **A**, Holotype female, carapace dorsal view; **B**, Holotype female, frontal view; **C**, Holotype female, carapace ventral view; **D**, Paratype male, carapace dorsal view. *Alox zalion* sp. nov., holotype male (6.9 mm by 9.5 mm). **E**, Carapace dorsal view; **F**, Frontal view.

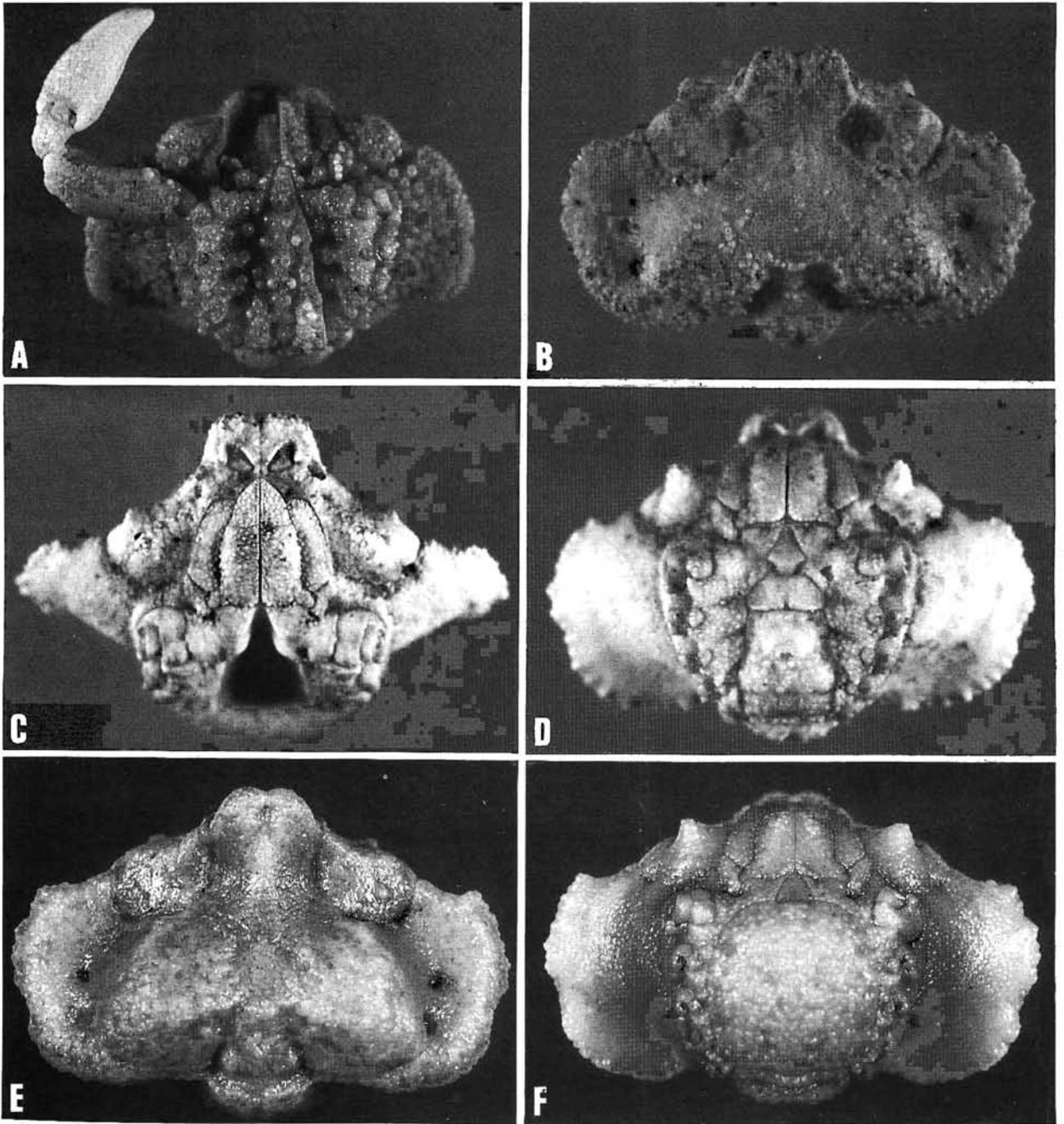


Plate 9. — *Alox zalion* sp. nov., Holotype male, 6.9 mm by 9.5 mm (NSMT-Cr. 5784). A, Carapace ventral view. *Cateios frontalis* (Miers, 1884), Holotype male, 6.0 mm by 8.0 mm, female (BMNH-1954.9.14.95-101) 5.9 mm by 8.8 mm. B, Holotype male, carapace dorsal view; C, Holotype male, frontal view; D, Holotype male, carapace ventral view; E, Female, carapace dorsal view; F, Carapace ventral view.

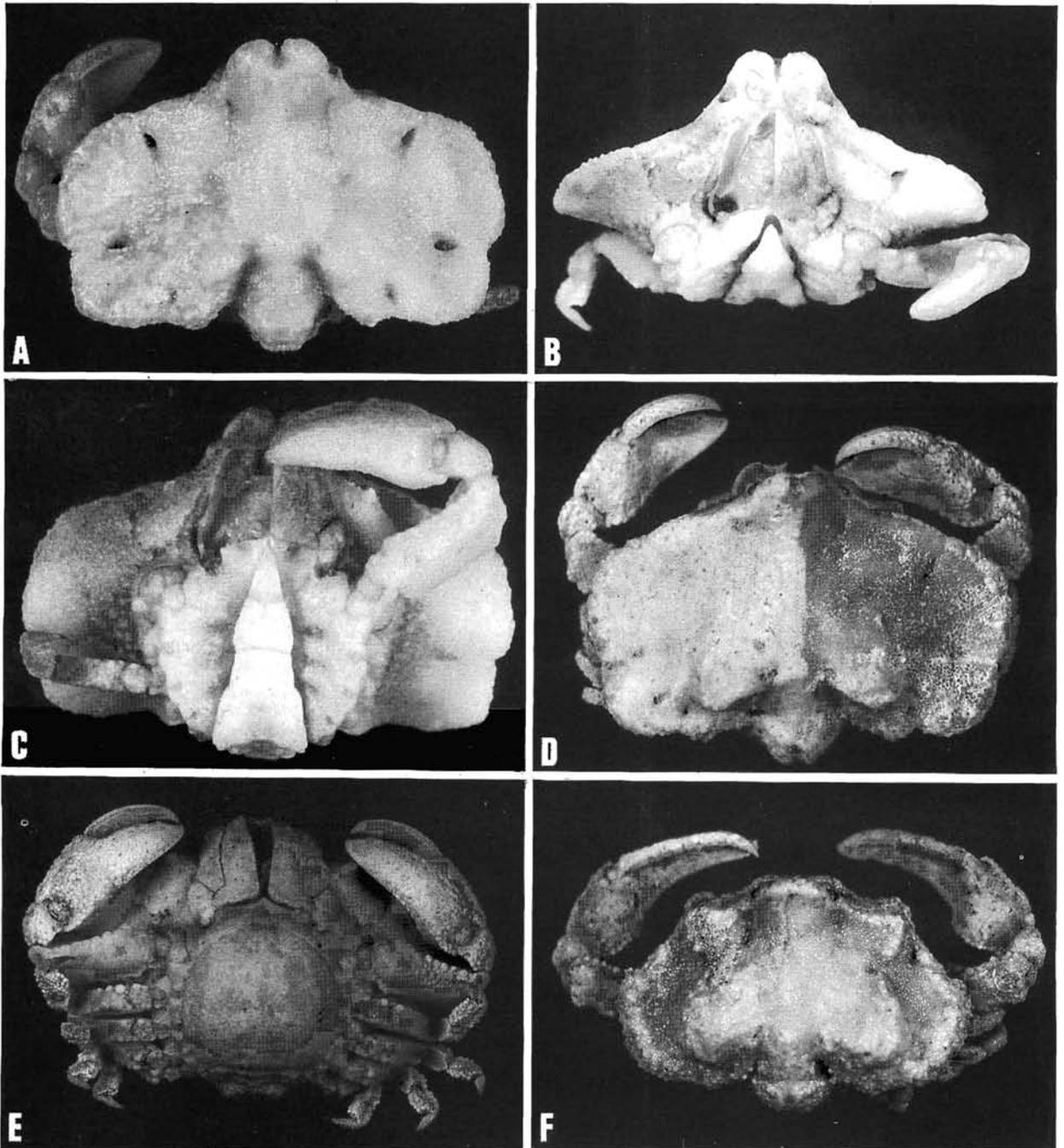


Plate 10. - *Dolos petraeus* (A. Milne Edwards, 1874), male (MNH), 5.5 mm by 7.5 mm, female (MNH), 6.5 mm by 9.4 mm. A. Male, carapace dorsal view; B. Male, frontal view; C. Male, carapace ventral view; D. Female, carapace dorsal view; E. Female, carapace ventral view. *Oreotlos angulatus* (Rathbun, 1906), Holotype female (USNM-29854) 7.6 mm by 11.4 mm. F. Carapace dorsal view.

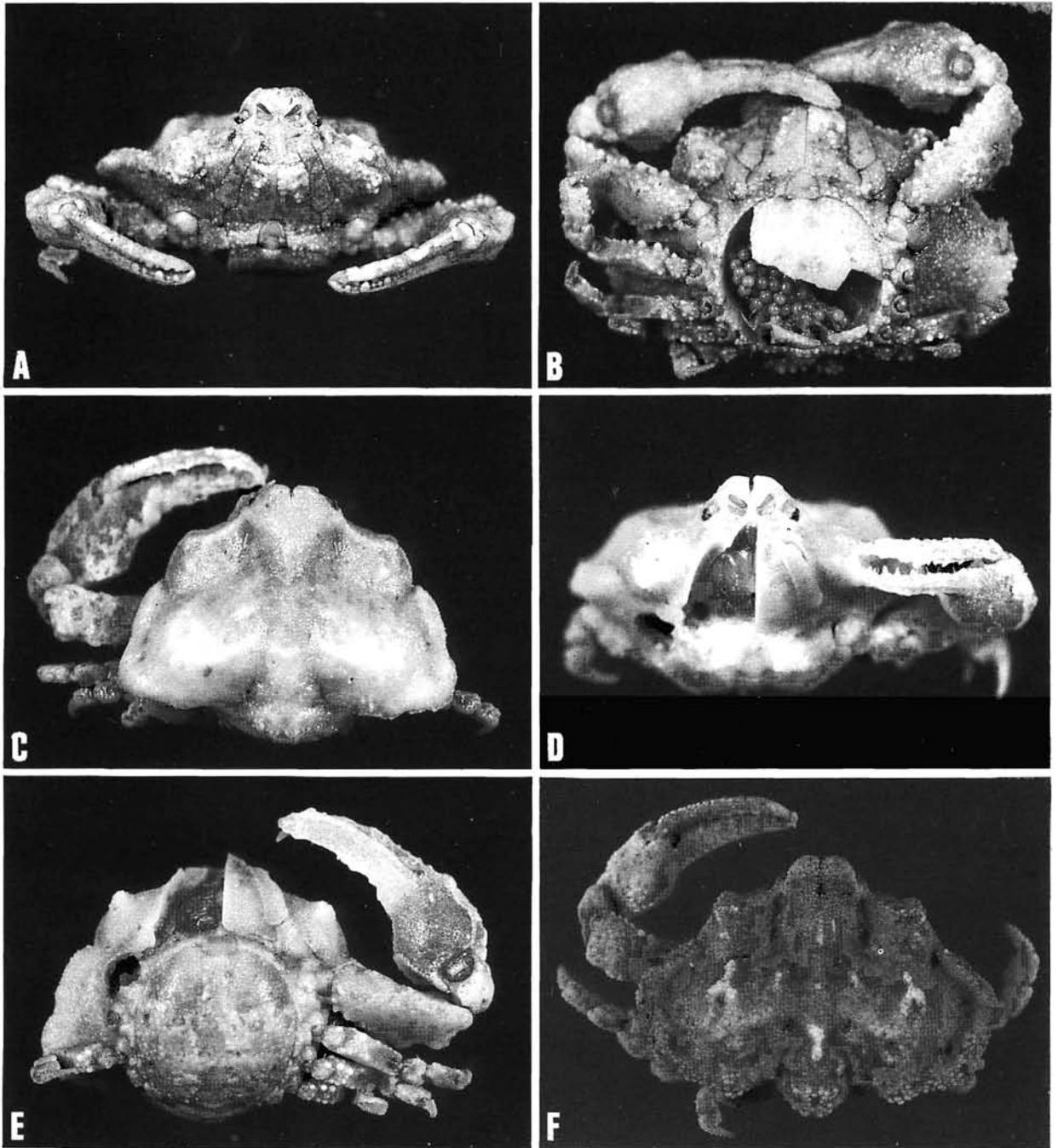


Plate 11. - *Oreotlos angulatus* (Rathbun, 1906), Holotype female (USNM-29854) 7.6 mm by 11.4 mm. **A**, Frontal view; **B**, Carapace ventral view. *Oreotlos bertrandi* sp. nov., Holotype female (MNHN) 6.2 mm by 8.1 mm. **C**, Carapace dorsal view; **D**, Frontal view; **E**, Carapace ventral view. *Oreotlos encymus* TAN & NG, 1993, Holotype male (MNHN) 9.5 mm by 13.3 mm. **F**, Carapace dorsal view.

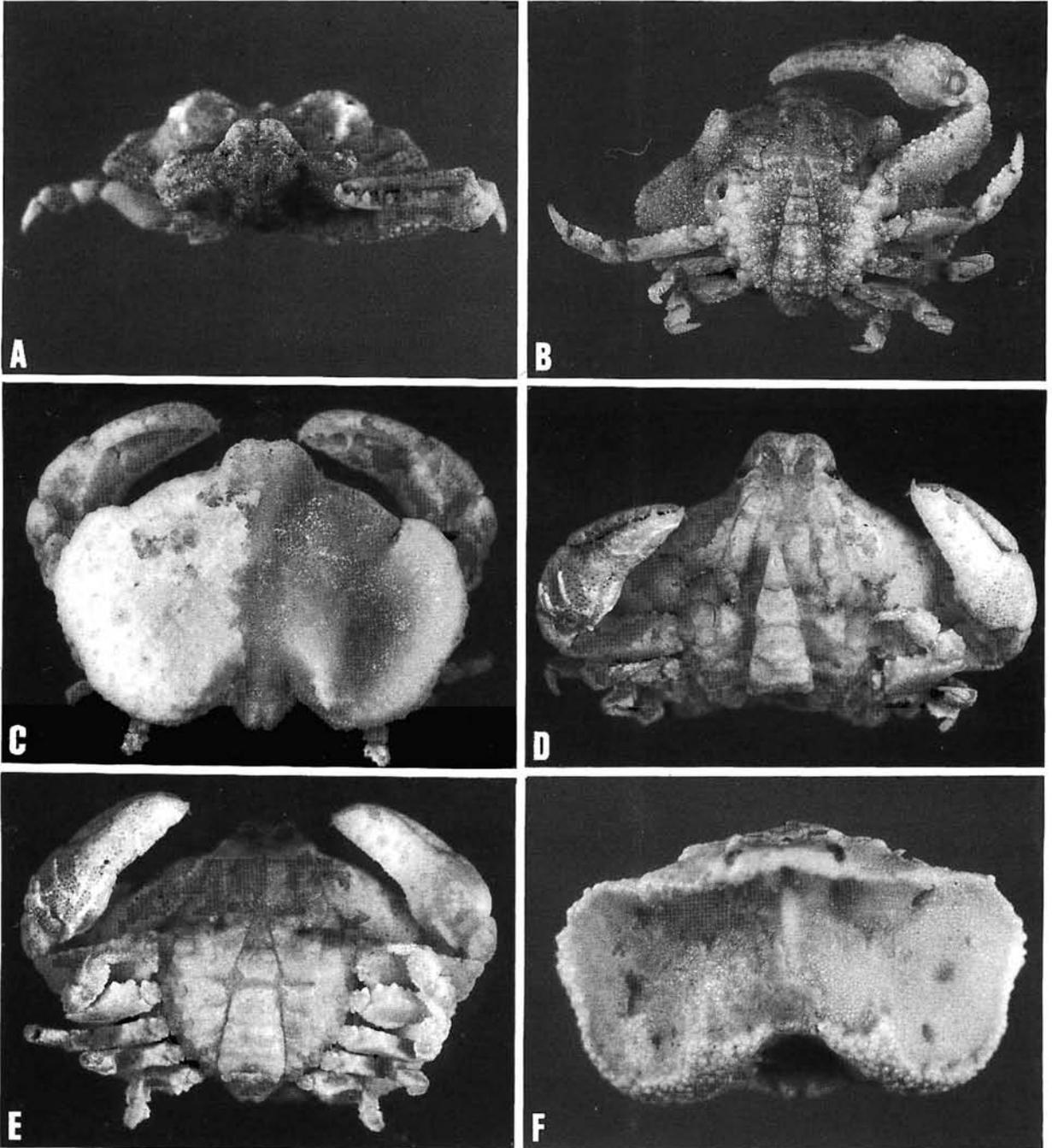


Plate 12. - *Oreotlos encymus* TAN & NG, 1993, Holotype male (MNHN) 9.5 mm by 13.3 mm. **A**, Frontal view; **B**, Carapace ventral view. *Oreotlos etor* TAN & RICHER DE FORGES, 1993, Holotype male (MNHN - B24848), 5.5 mm by 7.5 mm. **C**, Carapace dorsal view; **D**, Frontal view; **E**, Carapace ventral view. *Oreotlos havelocki* (LAURIE, 1906), Holotype male (BMNH 1907.5.22.24) 5.4 mm by 7.8 mm. **F**, Carapace dorsal view.

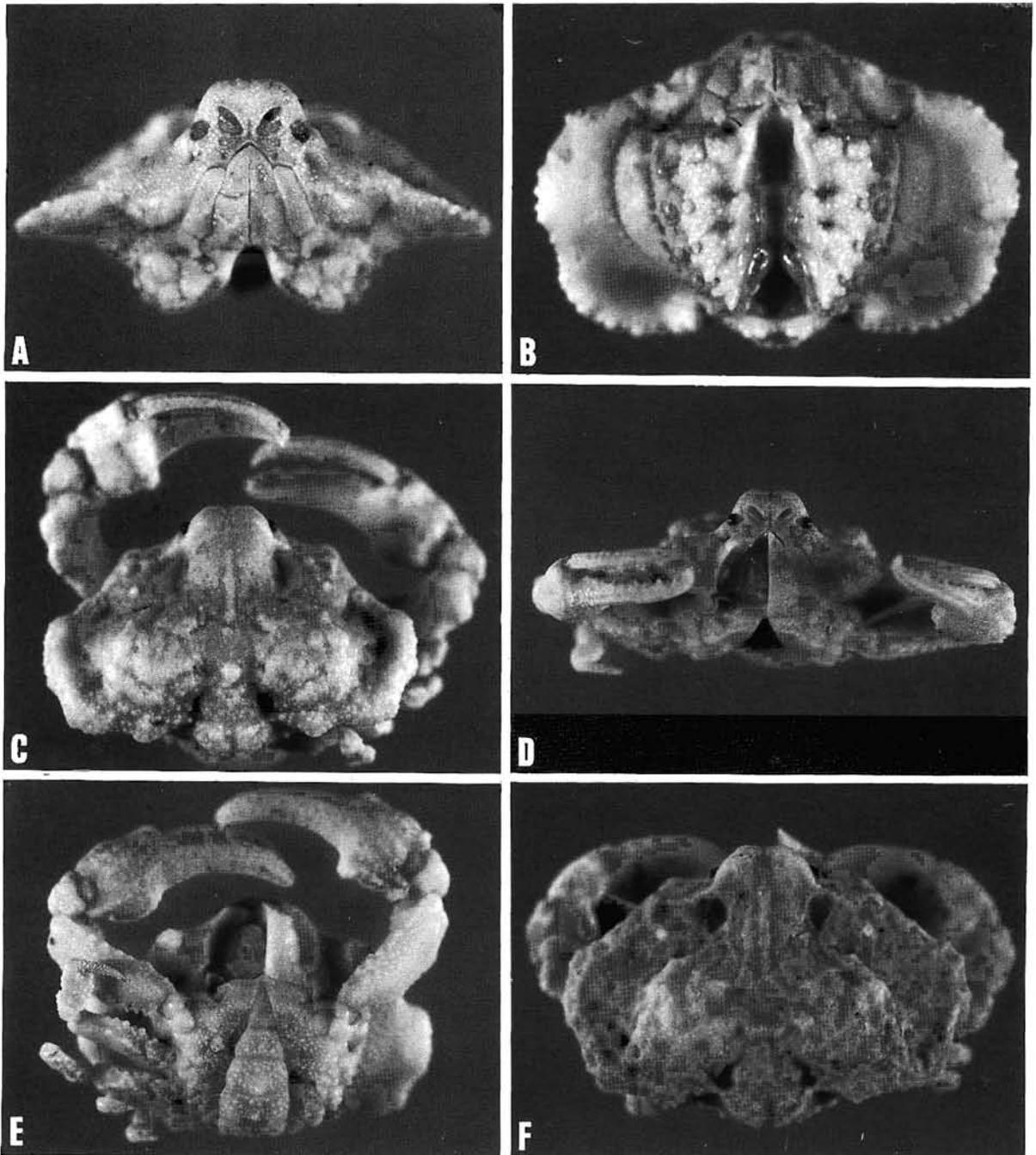


Plate 13. - *Oreotlos havelocki* (Laurie, 1906), Holotype male (BMNH 1907.5.22.24) 5.4 mm by 7.8 mm. A, Frontal view; B, Carapace ventral view. *Oreotlos heuretios* sp. nov., Holotype male (NSMT), 6.2 mm by 9.4 mm, Paratype female (NSMT), 5.3 mm by 7.8 mm. C, Holotype male, carapace dorsal view; D, Holotype male, frontal view; E, Holotype male, carapace ventral view; F, Paratype female, carapace dorsal view.

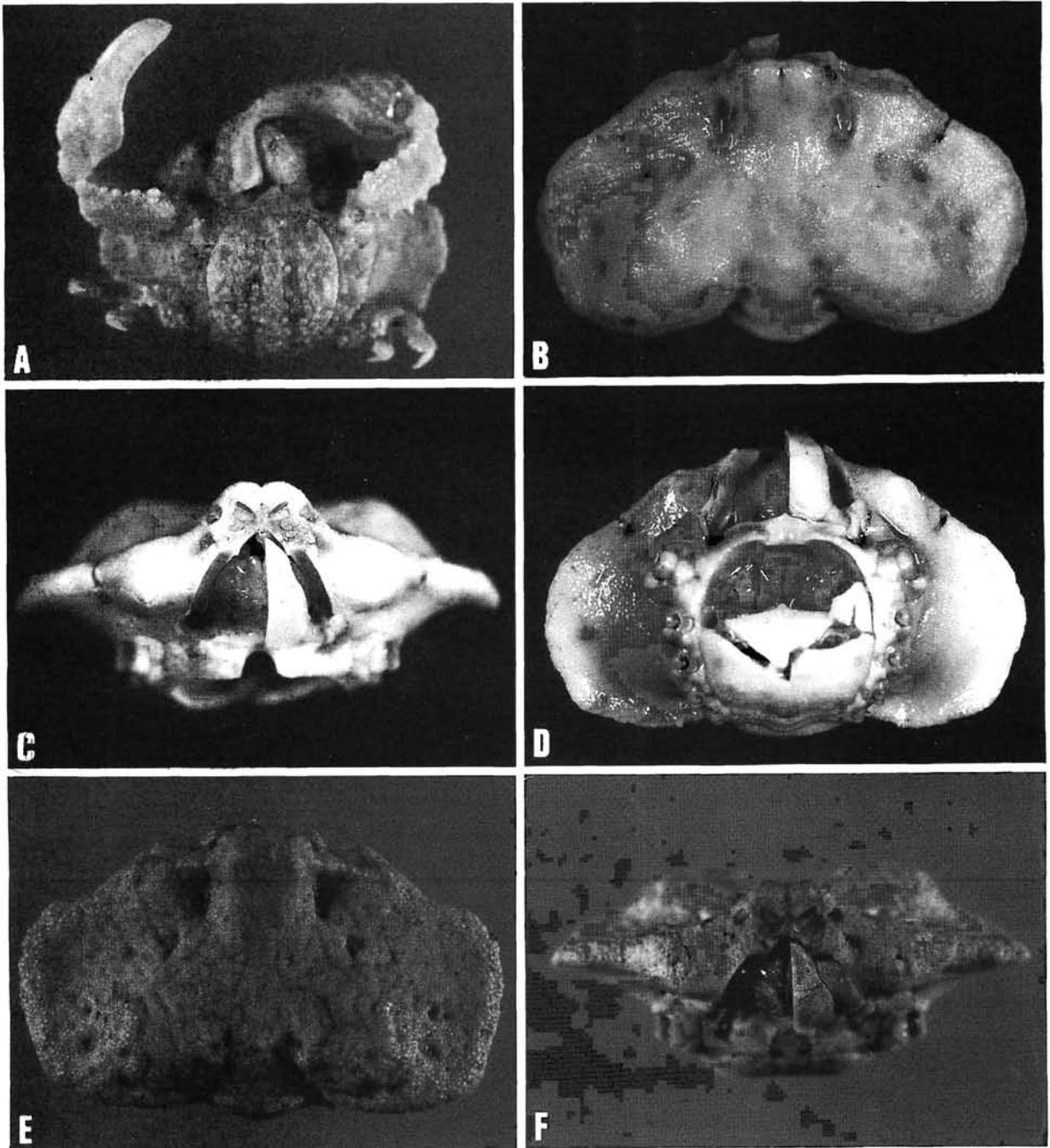


Plate 14. - *Oreotlos heuretios* sp. nov., Paratype female (NSMT), 5.3 mm by 7.8 mm. **A**, Carapace ventral view. *Oreotlos lagarodes* sp. nov., Holotype female (USNM Acc. no. 152940) 6.4 mm by 10.3 mm. **B**, Holotype female, carapace dorsal surface; *Oreotlos lagarodes* sp. nov., Holotype female (USNM Acc. no. 152940) 6.4 mm by 10.3 mm. **C**, Holotype female, frontal view; **D**, Holotype female, carapace ventral view. *Oreotlos latus* (Borradaile, 1903), Holotype female (CMZ) 7.8 mm by 11.5 mm. **E**, Carapace dorsal view; **F**, Frontal view.

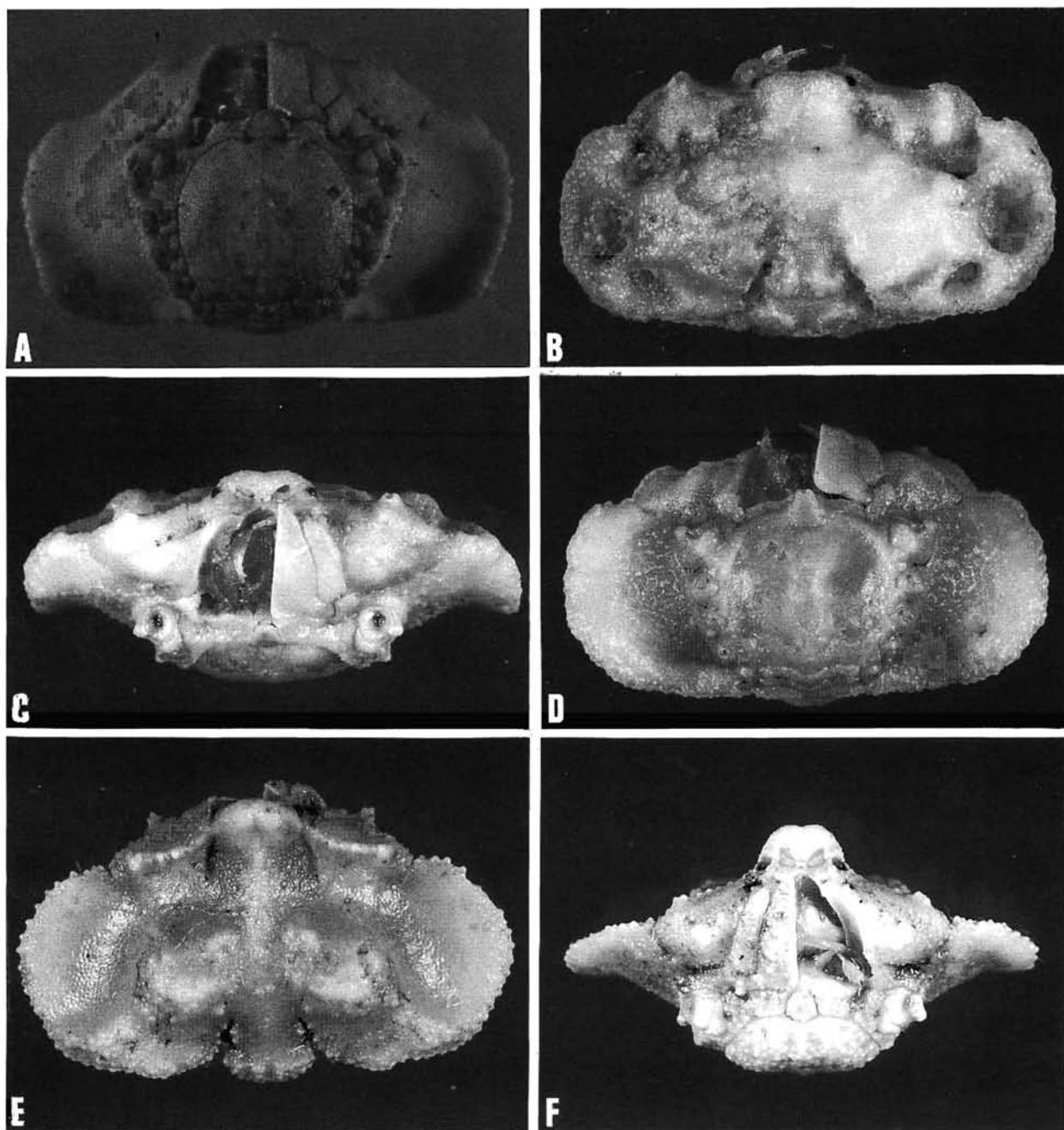


Plate 15. - *Oreotlos latus* (Borradaile, 1903), Holotype female (CMZ) 7.8 mm by 11.5 mm. **A**, Carapace ventral view. *Oreotlos pala* sp. nov., holotype female (USNM 255984) 6.2 mm by 11.5 mm. **B**, Carapace dorsal view. *Oreotlos pala* sp. nov., holotype female (USNM 255984) 6.2 mm by 11.5 mm. **C**, Frontal view; **D**, Carapace ventral view. *Oreotlos potanus* Tan & Ng, 1993, Holotype female (MNHN) 7.3 mm by 12.2 mm. **E**, Carapace dorsal view; **F**, Frontal view.

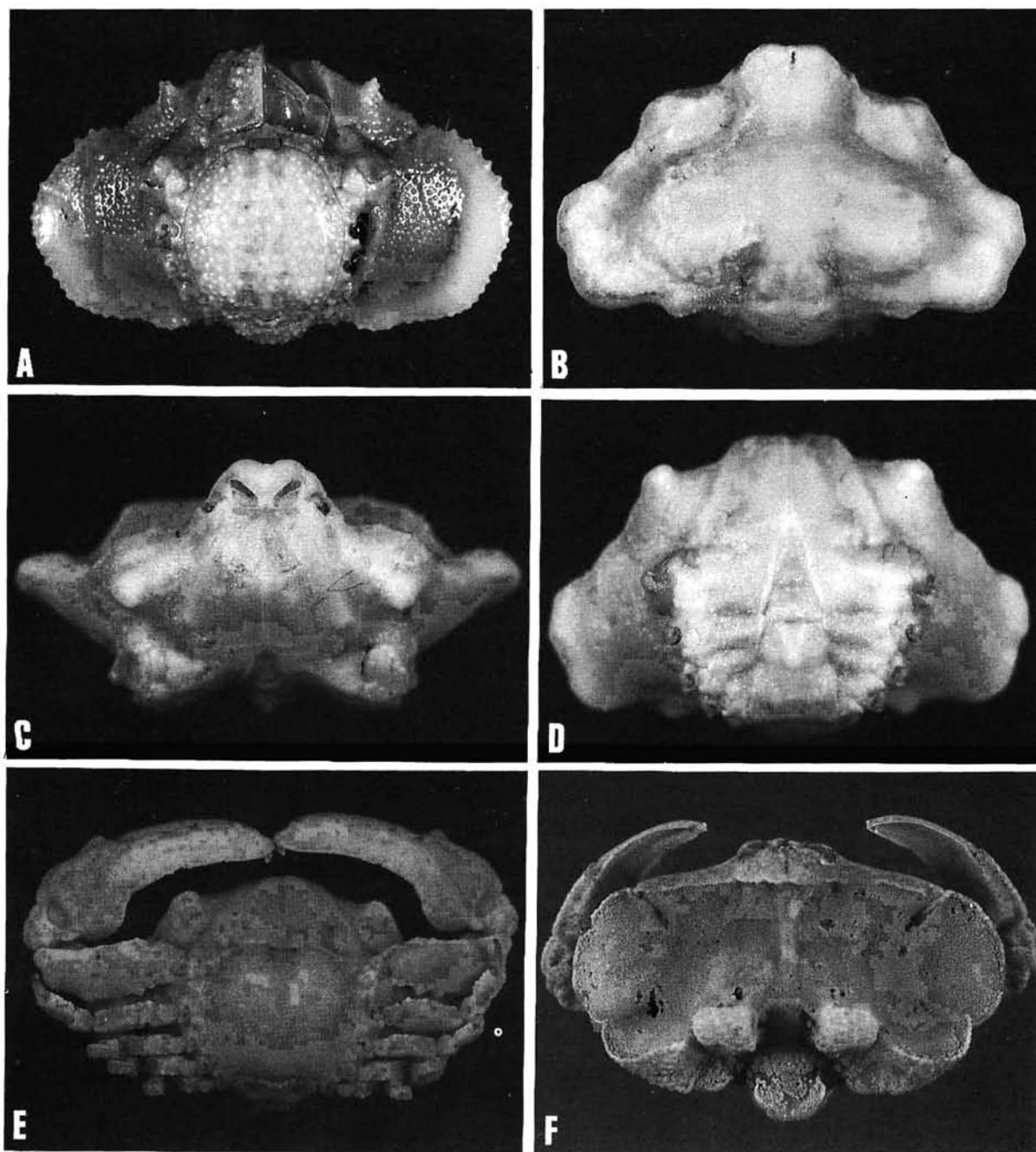


Plate 16. - *Oreotlos potanus* Tan & Ng, 1993, Holotype female (MNHN) 7.3 mm by 12.2 mm. A, Carapace ventral view. *Oreotlos pax*, sp. nov., Holotype male (USNM Acc. no. 176603, 3605), 6.3 mm by 10.0 mm, Paratype female (MNHN), 8.5 mm by 14.2 mm. B, Holotype male, carapace dorsal view; C, Holotype male, frontal view; D, Holotype male, carapace ventral view; E, Paratype female, carapace ventral view. *Tlos muriger* Adams & White, 1848, male (BMNH 92.3.26) 7.6 mm by 12.0 mm. F, Carapace dorsal view.

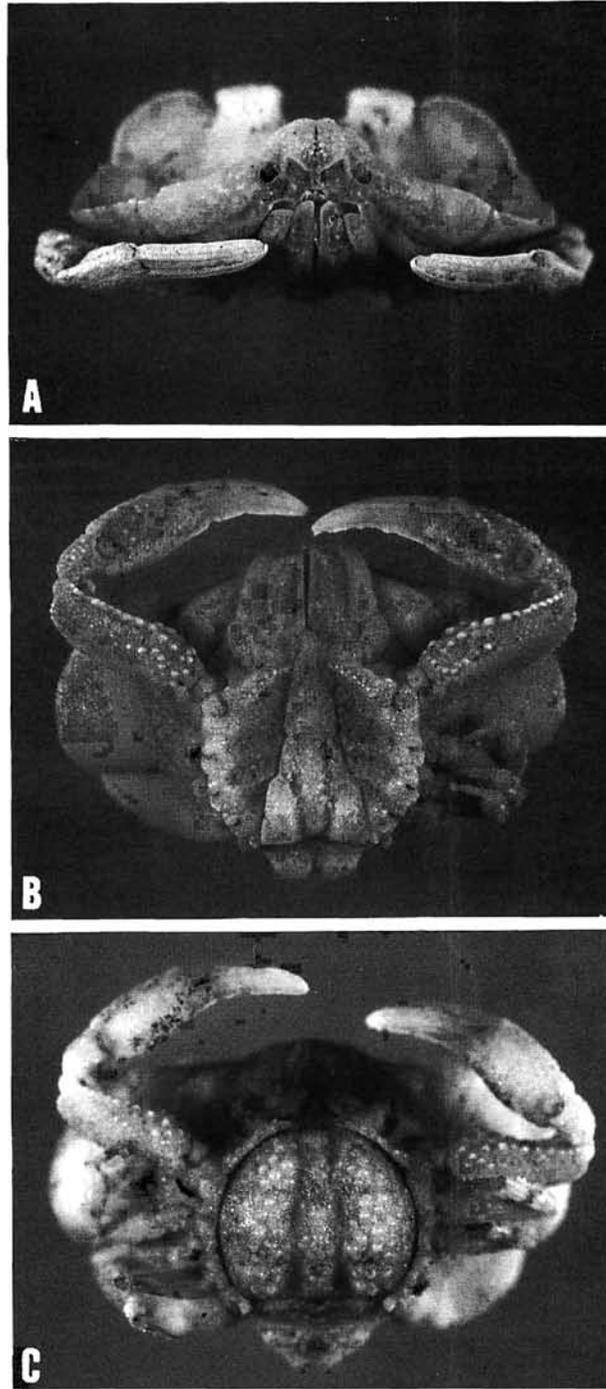


Plate 17. - *Tlos muriger* Adams & White, 1848, male (BMNH 92.3.26) 7.6 mm by 12.0 mm. female (ZRC 1991.9669) 8.3 mm by 14.2 mm. A, Male, frontal view; B, Male, carapace ventral view; C, Female, carapace ventral view.

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