

# BEAUFORTIA

INSTITUTE OF TAXONOMIC ZOOLOGY (ZOOLOGICAL MUSEUM)  
UNIVERSITY OF AMSTERDAM

Vol. 41, nr. 4

October 22, 1990

## A NEW GENUS AND SPECIES OF HADZIOIDEAN AMPHIPOD CRUSTACEAN FROM ANCHIALINE POOLS IN HAWAII

E. L. BOUSFIELD

*Canadian Museum of Nature, Ottawa, and Royal Ontario Museum, Toronto, Canada*

### ABSTRACT

*Carnarimelita janstocki*, new genus, new species, a large predatory melitid amphipod (Gammaridea: Hadzioidea), is described from anchialine pools on the island of Hawaii.

### INTRODUCTION

Hadzioidean amphipods form one of the most numerous and most diverse groups of gammaridean amphipod crustaceans that live in anchialine habitats of warm-temperate and tropical regions, especially of Mediterranean and Caribbean areas (Stock, 1977; Holsinger, 1982). Such habitats typically consist of brackish or salt-water, tidally influenced, underground pools (Holsinger & Yager, 1985; Maciolek, 1986). Within gammaridean superfamily Hadzioidea, family-level classification is presently incomplete and controversial (Stock, 1977; Bousfield, 1982; Schram, 1986), but ongoing revisions are steadily diminishing these problems. Thus, as presently classified, most anchialine species are members of family Hadziidae, and of closely related, typically eyeless, hypogean families and family groups such as the weckeliid group (Stock, 1985); the *Pseudoniphargus* group (Notenboom, 1988), and the Metacrangonyctidae (Boutin & Messouli, 1988). However, a few members of the typically eyed, epigeal, marine family Melitidae (e.g. species of *Rotomelita*, *Tegano*, and *Anchialella*)

have also been recorded from such habitats, especially in the Indo-Pacific region (Barnard & Barnard, 1983).

Among crustacean materials from an anchialine pool near Hilo, Hawaii, provided recently through the courtesy of Dr. John A. Maciolek, was noted a mature female specimen of a large, blind, hadzioidean amphipod; it was assignable to family Melitidae. Additional collections from this pool confirmed its relationships, abundance, and general feeding style (below). Later, collections from anchialine pools in lava beds on the western side of Hawaii (Kahanaiki District) were obtained through Dr. Maciolek, with the assistance of Dr. David Chai (for details, see Maciolek, 1987). This material contained many more females and a few adult males that also lacked pigmented eyes. Morphological features of this form, especially the strongly raptorial nature of both pairs of gnathopods in both sexes, are unlike those of previously described species and genera within family Melitidae. Therefore, with the warm concurrence of Dr. Maciolek, I take great pleasure in naming this new species, within a new genus, in honor of Dr. Jan H. Stock,

whose extensive field work and systematical-biogeographical studies have contributed so perceptively and voluminously to knowledge of anchialine amphipods of the world.

#### ACKNOWLEDGEMENTS

The author is much indebted to Dr. John C. Maciolek, Mammoth Lakes, California, whose field studies on the aquatic biota of the Hawaiian Islands have yielded several new taxa of amphipods and other crustaceans, and valuable insights into their ecology and life style. Norma E. Jarrett commented helpfully on a previous draft of the manuscript, and Susan Laurie-Bourque very capably rendered the line illustrations.

#### SYSTEMATIC DESCRIPTION

Family Melitidae Bousfield 1977

Melitidae Bousfield, 1977, p. 61; 1977, p. 299; 1982, p. 281.

Melitidae Lowry & Fenwick, 1983, pp. 210-211.

Gammaridae Ledoyer, 1982, p. 418 (partim).

Hadzioids Barnard & Barnard, 1983, p. 612 (partim).

Taxonomic commentary: Members of family Melitidae are typically medium to large, free-living, coastal marine animals with pigmented eyes, sexually dimorphic gnathopods, and pre-amplexing reproductive life style. The antennae and accessory flagellum are strongly developed or conspicuous, the lower lip bears large, well-defined inner lobes, and some (or all) urosome segments bear dorsal spines and/or teeth. Uropod 3 is usually large, aequiramous (magniramous), but often inaequiramous (parviramous), as in the type genus *Melita*.

Content of inaequiramous Genera: *Abludomelita* Karaman, 1981; *Anchialella* Barnard, 1979; *Dulichieilla* Stout, 1912; *Eriopisa* Stebbing, 1890; *Galapsiella* Barnard, 1976; *Maleriopa* Barnard & Karaman, 1982; *Melita* Leach, 1814; *Melitoides* Gurjanova, 1934; *Nainola* Karaman & Barnard, 1979; *?Paraniphargus* Tattersall, 1925; *?Psammogammarus* S. Karaman, 1955; *Rotomelita*

Barnard, 1976; *?Tagua* Lowry & Fenwick, 1983; *Tegano* Barnard & Karaman, 1979; *Victoriopisa* Karaman & Barnard, 1979; and *Carnarimelita*, new genus.

#### *Carnarimelita*, new genus

Species content: *Carnarimelita janstocki*, new species (TYPE).

Diagnosis: Body large, elongate; abdominal segments dorsally lacking teeth, but urosome 2 bears a pair of small widely separated spines. Pigmented eyes lacking. Lateral head lobe prominent, rounded. Antennae slender, elongate, peduncles strong. Accessory flagellum short. Gland cone normal.

Buccal mass shallow, directly beneath head. Lower lip broad, inner lobes fleshy. Mandible, molar medium strong, flake small; blades few; incisor 5-dentate; palp segment 3 slender, shorter than 2, setose. Maxilla 1, outer plate with 7 apical spines. Maxilla 2, inner plate with few submarginal facial setae. Maxilliped, plates large, strongly spined; palp large, raptorial.

Coxal plates 1-4 medium, 1 rounded antero-distally, 4th weakly excavate behind, lower margins (finely) setose. Gnathopods 1 & 2 powerfully raptorial, subchelate, similar in form but unequal in size (2 larger, both sexes); carpus short, lacking sensory pubescence; merus shallow, hind margin with pubescence.

Peraeopods 3 & 4 slender, margins spinose, dactyls short. Peraeopods 5-7 slender, homopodous in form, increasing in length posteriorly; coxae anterolobate (coxa 6 of female lacking copulatory process); bases narrow, hind lobes small; segment 6 longest; dactyls short, antero-distally with tightly spaced setae.

Pleon large, segments increasing in length posteriorly. Pleopods large, not sexually in length, margins of peduncle and rami weakly spinose. Uropod 3 large, inaequiramous, outer ramus elongate, 1-segmented, margins spinose; inner ramus short. Telson lobes short, broadly acute, with apical and inner marginal spines.

Coxal gills large, sac-like (not pedunculate), on peraeopods 3-5, slender on peraeopod 2,

small on peraeopod 6. Brood plates narrowly and uniformly linear, margins with long simple setae.

Eymology: A combining form of the Latin "carnarius" (killer) and "melita" (bee-like [amphipod]).

Taxonomic commentary: Barnard & Barnard (1983) have provided a key to world genera of melitids in which *Carnarimelita* would "run to" couplet 12, between *Maleriopa* and *Paraniphargus*. *Carnarimelita* is also close to the genus *Anchialella* in the general form of mouthparts and body appendages, and lack of pigmented eyes. However, *Carnarimelita* differs from these three genera (and from all other parviramous melitids) in the enlarged subchelate and raptorial form of both gnathopods of both sexes, and the lack of sensory pubescence on the carpus (occ. also propod) of gnathopod 1. A parallel (and almost certainly convergent) situation apparently occurs in the weckeliid complex of Haiti (Stock, 1985) and perhaps within the *Phreatogammarus* complex of New Zealand (Hurley, 1954). In some hypogean/anchialine members (e.g. *Crangoweckelia* and *Pintaweckelia* in Haiti, and *Phreatogammarus fragilis* in New Zealand) the gnathopods are raptorial and powerfully developed in both sexes, quite unlike the typically "weak-handed" gnathopods of other genera and species within their respective taxonomic groups.

Members of the genus *Rotomelita* co-occur with *Carnarimelita* in at least one anchialine pool in western Hawaii (see below). Members of *Rotomelita* differ greatly, however, in having weak, typically dissimilar gnathopods; short, truncate telson lobes; and in their much smaller size.

### ***Carnarimelita janstocki*, new species (Fig. 1)**

#### Material examined:

Anchialine pool, off King's Landing Rd., near Hilo, Hawaii, January 13, 1987, coll. student of Dr. J. Chan - 1 female ovig. 11.0 mm. (HOLOTYPE) and slide mount, NMNS cat. No. IZ-1987-121. Ibid., May 23, 1987, J.

Maciolek coll. - 3 female ov. (9.0-11.5 mm), (PARATYPES) IZ-1987-125; Ibid. - 3 female ov. (9.5-11.0 mm), (PARATYPES), USNM (Washington) collection; Ibid. - 1 female (ov.) (PARATYPE) ZMA (Amsterdam) collection Anchialine pool, Kokio, N. Kohala, 1/VI/82, J. Maciolek coll. - 1 female ov. IZ-1987-125.

Kohanaiki Pond, A3, AREA A, North Kona coast, Hawaii, J. Maciolek and David Chai, coll., Mar. 5, 1987 - 2 males (8.2-8.8 mm), 5 females (br. II - ov., 9.2-10.0 mm), Bishop Museum collection; Ibid., March 7/87 - 2 females (ov., 9.6-10.0 mm), Bishop Mus. collection; Ibid., March 8, 1987 - 1 male (9.4 mm) ALLOTYPE, NMNS collection, slide mount; Ibid. - 1 male (8.5 mm), 3 females (br. II - ov., 9.2-11.2 mm), NMNS collection.

Diagnosis (female ov., 11.0 mm): With the characters of the genus. Antenna 1, peduncular segments 1 & 2 elongate, each more than twice length of head. Accessory flagellum 2-segmented. Antenna 2, peduncular segments 4 & 5 elongate, setose, each as long as multi-segmented flagellum.

Mandibular palp, terminal segment slender, shorter than 2, posterior margin lined throughout with long "D" setae. Maxilla 1 inner plate with 4-5 apical setae. Maxilliped, inner plate with 3 apical conical spines; outer plate not broadly expanded.

Gnathopod 1, palmar margin evenly convex, lined with numerous (>20) small notched spines on each side, and one offset heavy spine at posterior angle; dactyl with distinct unguis; carpus, hind margin about half length of anterior margin, bearing 4-5 clusters of setae; merus short, shallow, with posterior marginal pilosity or tumescence. Gnathopod 2, lower margin of coxa slightly excavate or sinuous; basis elongate (50% longer than basis of gnathopod 1), hind margin with median cluster of long setae; segment 3 longer than deep; carpus deep, shorter than in GN1; propod, palmar margin strongly convex, with numerous (>30) small notched spines on each side, and 2 (occasionally 3) strong to medium, postero-distal spines; hind margin short, less than half anterior margin, with 4-6 clusters of setae.

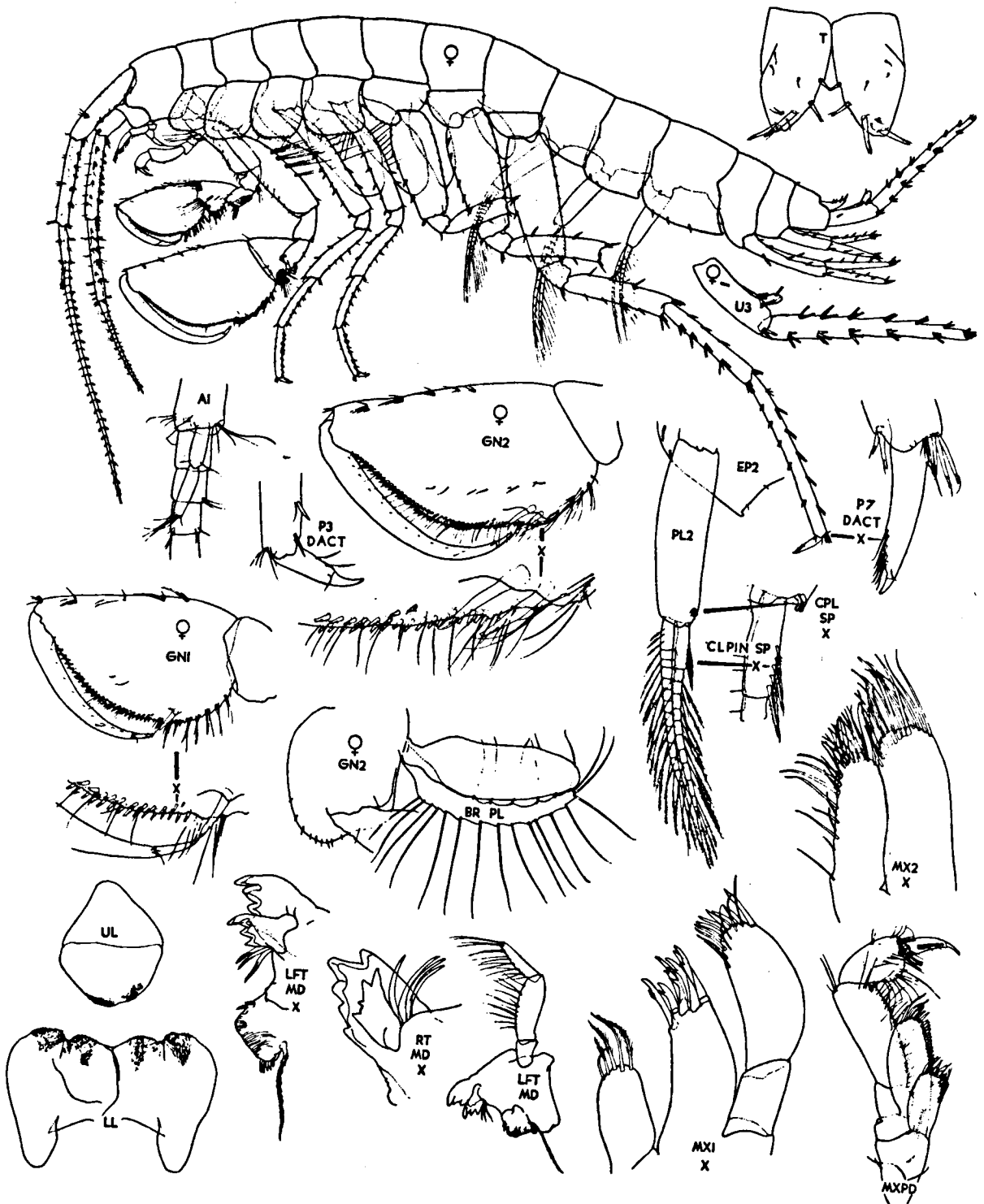


Fig. 1. *Carnarimelita janstocki*, new genus, new species. Female ov. (11.0 mm). Anchialine pool near Hilo, Hawaii. A1, Antenna 1; BR. PL., Brood Plate; CLPIN SP., Clothespin spine; CPL. SP., coupling spine; DACT., Dactyl; EP 2, epimeral plate 2; GN1, Gnathopod 1; GN2, Gnathopod 2; LFT, Left; LL, Lower Lip; MD, Mandible; MX1, Maxilla 1; MX2, Maxilla 2; MXPD, Maxilliped; P3, Peraeopod 3; P5, Peraeopod 5; P6, Peraeopod 6; P7, Peraeopod 7; PL2, Pleopod 2; RT, Right; T, Telson; U3, Uropod 3; UL, Upper Lip; X, magnified; ♀, Female.

Peraeopods 3 & 4, bases weakly long-setose behind; segments 5 & 6 subequal, shorter than 4; dactyls with 1-2 postero-distal setae. Peraeopods 5-7, basis linear, hind margin straight, nearly bare; dactyls with short unguis and 5-7 tightly spaced antero-distal setae.

Pleon side plates 1-3, hind corners acuminate, that of pleon 3 slightly produced. Pleopods 1-3, inner ramus basally with 4-5 regular "clothespin" spines. Uropod 1, peduncle with single baso-facial spine and single disto-lateral spine. Uropod 3, outer ramus more than twice length of peduncle, margins with 5-6 clusters of short spines.

Telson, inner distal margin of each lobe with 4-5 spines. Coxal gills on P4 & 5 usually much larger than the others.

Color: white, unpigmented.

Male (9.8 mm): Very similar to, but smaller than, female. Gnathopod 1, carpal lobe relatively shallow. Peraeopods 3-7, dactyls less setose (only 1-4 distal setae on each). Coxal gills relatively small.

Taxonomic commentary: *Carnarimelita janstocki* has many morphological features in common with other tropical Pacific anchialine genera such as *Anchialella vulcanella* Barnard, 1979, and *Galapsiellus lelouporum* (Monod, 1970) (Galapagos and Gulf of California), and *Tegano seticornis* (Bousfield, 1970) (Rennell I.). However, these latter three species have gnathopods of a more typically melitid form (gnathopod 1 small, non-raptorial, usually with sensory pilosity on carpus and merus, in both sexes), short peraeopods with simple dactyls, 2-segmented outer ramus of uropod 3, and are much smaller in size. *Rotomelita lokoa* Barnard, 1977, and *R. ana* Barnard, 1977, previously recorded from Hawaiian anchialine pools, and the closely similar *Nainola latimerus* (Bousfield, 1971) (Bismarck Archipelago) are also strikingly different from *Carnarimelita* in the form of the gnathopods, uropod 3 and telson, and are much smaller in size, as noted above.

Distributional-Ecological commentary: *Carnarimelita janstocki* has to date been obtained only from anchialine pools and only from the "big" island of Hawaii. However, the genus (and

possibly other species) would not be unexpected in similar habitats of Maui and other islands northwestward in the Hawaiian archipelago.

The pools of the Kohanaiki region have been described in detail by Maciolek (1987). All occur in prehistoric pahoehoe lava flow. Observed mean bottom salinity of pools in area A was 14.4‰. Temperatures of pools in areas A to E ranged from 20.8°C to 29.9°C. The diversity of invertebrates and fishes in pools of Area A was relatively high, presumably because of average higher salinities than in the adjacent study areas. At least four other amphipod species were noted in pool samples including *Rotomelita lokoa* Barnard 1977, and three species of *Paramoera*, including *P. paaki* Barnard, 1977.

There seems little doubt that *C. janstocki* is a predatory amphipod. Dr. Chan's student observed that it was "attempting to catch *Halocaridina*", a decapod shrimp that is common in anchialine pools near Hilo. The shrimp is as large as, or larger than, the amphipod! A predaceous life style has been noted in other hadziids, even in those without strongly developed gnathopod 1. Thus Stock (1983) believes that the nearly mutually exclusive distributions of hadziid amphipods and smaller crustaceans such as thermosbaenaceans and ostracods in the Caribbean region is attributable mainly to predation by the former on the latter.

## REFERENCES

- BARNARD, J. L., 1977. The Cavernicolous Fauna of Hawaiian Lava Tubes. 9. Amphipoda (Crustacea) from brackish lava ponds on Hawaii and Maui. *Pacific Insects*, 17(2-3): 267-299.
- , 1979. Littoral Gammaridean Amphipoda from the Gulf of California and the Galapagos Islands. *Smiths. Contr. Zool.*, 271: 1-149.
- & C. M. BARNARD, 1983. *Freshwater Amphipoda of the World*. Vols. I & II: 1-830 (Hayfield Assoc., Mt. Vernon, VA).
- BOUSFIELD, E. L., 1970. Terrestrial and Aquatic Amphipod Crustacea from Rennell Island. *Nat. Hist. Rennell Ids. Copenhagen*, 6(71): 155-168.
- , 1973. *Shallow-water Gammaridean Amphipoda of New England*: 1-312 (Comstock/Cornell Univ. Press, Ithaca, N.Y.).
- , 1977. *A New Look at the Systematics of Gamma-*

- roidean Amphipods of the World. Crustaceana, Suppl., 4: 282-316.
- , 1982. Amphipoda. Gammaridea. in: Synopsis and Classification of Living Organisms. Vol. II. ed. S. B. Parker: 254-285 (McGraw-Hill, N.Y.).
- BOUTIN, C. & M. MESSOULI, 1988. *Metacrangonyx gineti*, n. sp. d'un surce du haut-Atlas Marocain et la famille des Metacrangonyctidae n. fam. (Crustacea Amphipodes stygobies). Vie Milieu, 38(1): 67-84.
- HOLSINGER, J. R., 1982. Amphipoda. in: Aquatic Biota of Mexico, Central America, and the West Indies. ed. S. Hurlbert and A. Villalobus-Figuerosa: 209-214 (San Diego State Univ., Cal.).
- HOLSINGER, J. R. & J. YAGER, 1985. A new genus and two new species of subterranean amphipod crustaceans (Hadziidae) from the Bahamas and Turks and Caicos Islands. Bijdr. Dierk., 55(2): 283-294.
- HURLEY, D. E., 1954. Studies on the New Zealand Amphipodan Fauna. No. 4. The Family Gammaridae, Including a Revision of the Freshwater Genus *Phreatogammarus* Stebbing. Trans. Roy. Soc. New Zealand, 81(4): 601-618.
- LEDOYER, M., 1982. Crustaces Amphipodes Gammariens. (C.N.R.S., Paris), 59(1): 1-598. Faune de Madagascar.
- LOWRY, J. K. & G. D. FENWICK, 1983. The shallow-water gammaridean Amphipoda of the subantarctic islands of New Zealand and Australia: Melitidae, Hadziidae. J. roy. Soc. New Zealand, 13(4): 201-260.
- MACIOLEK, J., 1986. Environmental Features and Biota of Anchialine Pools on Cape Kinau, Maui, Hawaii. Stygologia, 2(1/2): 119-129.
- , 1987. Evaluation of anchialine pools in the Awakee, Kohanaiki, and Makalawena Land Divisions, North Kona, Hawaii. Report Consult. Serv. Contract, No. 87-132, County of Hawaii, June, 1987, pp. 1-12.
- NOTENBOOM, J., 1988. Phylogenetic relationships and biogeography of the groundwater-dwelling amphipod genus *Pseudoniphargus* (Crustacea), with emphasis on the Iberian species. Bijdr. Dierk., 58(2): 159-204.
- SCHRAM, F. R., 1986. Crustacea: 1-606 (Oxford Univ. Press, New York, Oxford).
- STOCK, J. H., 1977. The Taxonomy and Zoogeography of the Hadziid Amphipoda. Stud. Fauna Curaçao and other Caribbean Islands, 55: 1-130.
- , 1983. Predation as a factor influencing the occurrence and distribution of small Crustacea in West Indian groundwaters. Bijdr. Dierk., 53(2): 233-243.
- , 1985. Stygobiont amphipod crustaceans of the hadzioid group from Haiti. Bijdr. Dierk., 55(2): 331-426.

Received: December 28, 1989