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VENT ASSOCIATED *MUNIDOPSIS* (DECAPODA: ANOMURA: GALATHEIDAE) FROM BROTHERS SEAMOUNT, KERMADEC ARC, SOUTHWEST PACIFIC, WITH DESCRIPTION OF ONE NEW SPECIES

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ABSTRACT

A species of squat lobster, *Munidopsis kermadec* new to science is described and illustrated from a hydrothermal vent area in Brothers Seamount, Kermadec Volcanic Arc, Southwest Pacific Ocean. It is distinguished from the allied *Munidopsis lauensis*, by the shape of rostrum, the erectness of eye spines, structure of the sixth abdominal segment and dactyl morphology of P2-4. This new record increases the number of species of *Munidopsis* reported from Southwest Pacific vent fields to five. A key is provided to distinguish the vent associated *Munidopsis*. New records of *M. lauensis* and *M. sonne* from Brothers Seamount are also reported here and this extends their distribution further south to the western Pacific. The habitat of the new species is briefly described. A note on the *Munidopsis* diversity in West Pacific vent fields is also provided.

INTRODUCTION

The first research cruise of the manned submersible, *Shinkai 6500* and R/V *Yokosuka* (Japan Agency for Marine-Earth Science and Technology) was organized by researchers of Japan and New Zealand to explore hydrothermalism and vent associated communities in Kermadec Volcanic Arc, Southwest Pacific (Fig. 1, 34°51.7′S, 179°03.5′E) during 24 October to 10 November 2004. The Kermadec Ridge complex is an active subduction zone extending in a northeastern direction for 2000 km off East Cape, North Island of New Zealand (Wright et al., 1998; de Ronde et al., 1999; Stoffers et al., 1999). This is the first exploration on the Kermadec volcanoes by manned submersible systems. In previous surveys of the Kermadec volcanoes, vent associated fauna such as deep-sea mussels, *Gigantidas gladius* Cosel and Marshall, 2003, deep-sea vent barnacles, *Vulcanolepas osheai*, Buckeridge, 2000, alvinocaridid shrimps, *Alvinocaris niwa*, Webber, 2004 and *Alvinocaris longirostris*, Kikuchi and Ohta, 1995 were collected by dredging. The expedition discovered that the Brothers Seamount supports unique biological communities predominated by tubeworms, barnacles, brachyuran crabs, shrimps, and a few galatheids.

Species of the genus *Munidopsis* Whiteaves, 1874 are found in a variety of habitats, from shallow to deep water throughout the Atlantic, Indian and Pacific Oceans (Ambler, 1980; Baba, 2005; Macpherson and Segonzac, 2005; Macpherson, 2007) where they form an important scavenging macrofauna. The majority of species of *Munidopsis* occur in the deep-sea, deeper than 800 m. More than 200 species are known in the world oceans with nine species reported only from active hydrothermal vent systems (Williams, 1988; Williams and Baba, 1989; Khodkina, 1991; Baba and de Saint Laurent, 1992; Baba, 1995; Baba, 2005; Martin and Haney, 2005; Macpherson and Segonzac, 2005; Macpherson, 2007; Schnabel and Bruce, 2006; Osawa et al., 2006). With the increase in deep-sea research in the last two decades, particularly around hydrothermal vent sites, the number of species of *Munidopsis* described has continued to increase (Chevaldonne and Olu, 1996). Four species of the genus are reported from West Pacific hydrothermal vent fields such as Mariana Back Arc Basin (*M. marianica* Williams and Baba, 1989), Lau and North Fiji Back Arc Basins (*M. lauensis* Baba and Saint Laurent, 1992; *M. starmer* Baba and Saint Laurent, 1992; *M. sonne* Baba, 1995). Three species are reported from East Pacific vent fields *M. alvisca* Williams, 1988; *M. lentigo* Williams and Van Dover, 1983; and *M. subsquamosa* Henderson, 1885. The true identity of *M. subsquamosa* as vent endemic needs to be confirmed on molecular level (Chevaldonne and Olu, 1996). Two species, *M. acutispina* and *M. exuta* Macpherson and Segonzac, 2005, are reported from Atlantic hydrothermal vents.

The present paper describes a new species of *Munidopsis* collected from the Brothers Seamount, Kermadec Volcanic Arc, Southwest Pacific. We also report *M. sonne*, collected from the same field, recognizable by its variant rostral pattern. Finally we give a short note on *M. lauensis* with regard to the unique morphology of left P3.

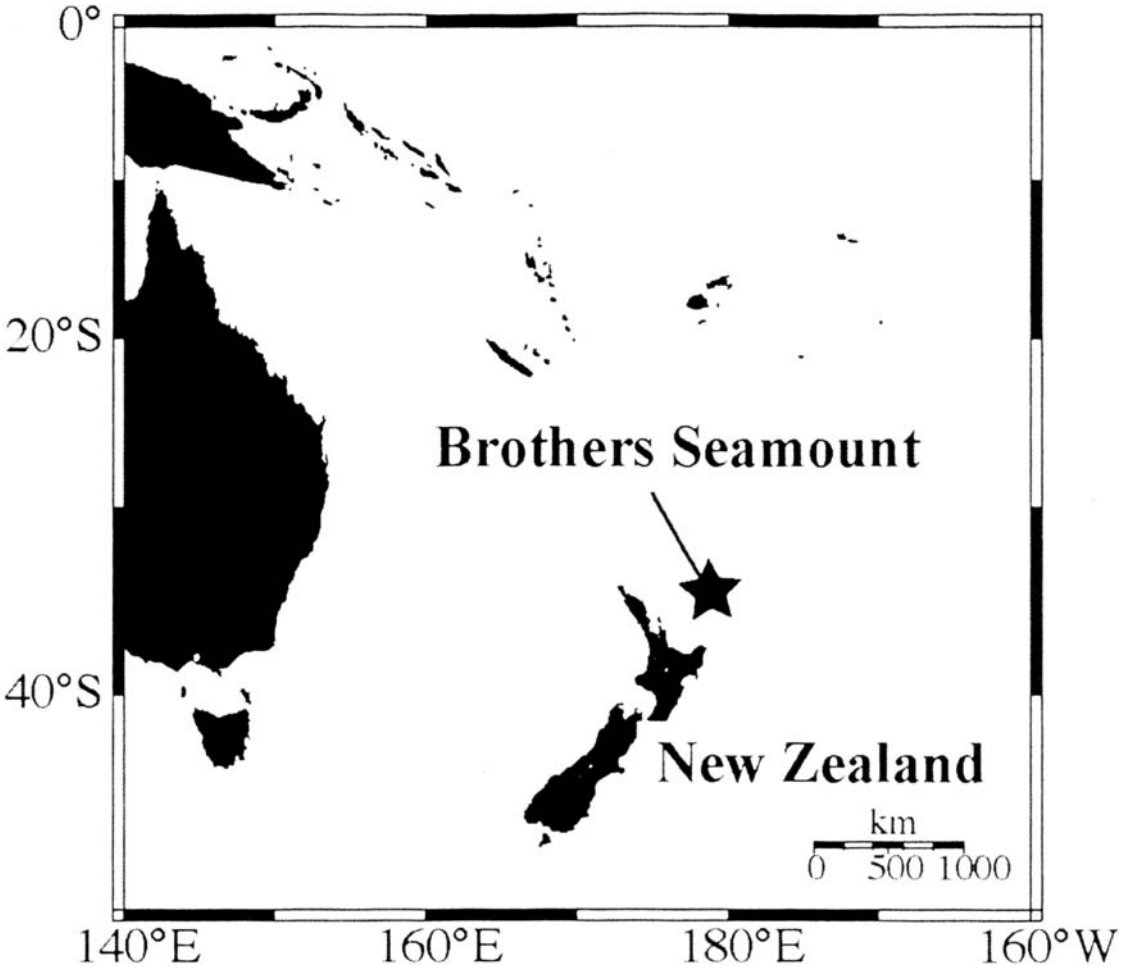

Fig. 1. Locality of the collection site (star) of *Munidopsis kermadec* n. sp. along with *M. lauensis* and *M. sonne* from the Kermadec Volcanic Arc, Southwest Pacific Ocean.

Systematics

Order Decapoda
Galatheidae Samouelle, 1819
Munidopsis Whiteaves, 1874
Munidopsis kermadec n. sp. (Fig. 2)

Material Examined.—Holotype female (NIWA, 25862) with a carapace length of 24.5 mm and a carapace width of 15.9 mm, collected from Brothers Seamount, 34°51.756′S, 179°03.476′E by the submersible *Shinkai 6500,* Dive #852, at a depth of 1649 m on 27 October 2004.

Diagnosis.—Carapace with interrupted transverse ridges, more distinct on posterior half. Cervical grooves not deep but distinct. Rostrum relatively broad triangular, weakly carinate. Sternal plastron broad posteriorly. Pleon unarmed, posteromedian margin of sixth segment slightly raised, bilobed medially. Telson composed of 10 plates, posterolateral margin strongly convergent, with fringe of coarse setae. Smooth rounded cornea cupped within broad based ocular peduncle, eyespine acute, directed laterally. Dactyli of pereiopods 2-4 stocky distally, ventral margin almost straight, acute corneous tip strongly curved. Epipods absent from pereiopods.

Description of Holotype.—Carapace exclusive of rostrum distinctly longer than broader, anterior and posterior cervical grooves distinct. Rostrum almost straight in lateral view, relatively broad triangular, with weak dorsal carina merging into gastric region. Frontal margin oblique with small antennal spine. Anterolateral spine small. Lateral margin with strong, laterally directed spine at the end of anterior cervical groove (Fig. 2A, B). Gastric region strongly inflated with concavity at either side, with 2 long transverse ridges on epigastric region, followed by 2 or 3 short transverse ridges. Posterior cervical grooves dividing the carapace almost equally into anterior and posterior halves. Anterior branchial region bearing less prominent rugosites, posterior branchial region with moderately developed rugosites with tendency being most elongate across anterior and posterior parts of cardiac region.

Pterygostomian flap with oblique ridges more distinct posteriorly, produced anteriorly, ending in somewhat rounded margin below antennal peduncle (Fig. 2B).

Pleon unarmed, transverse ridge of segments 2 and 3 smooth, divided into narrow anterior and broader posterior parts by concave trough, segments 4, 5 and 6 smooth. Segment 6 slightly raised, posteromedian margin bilobed

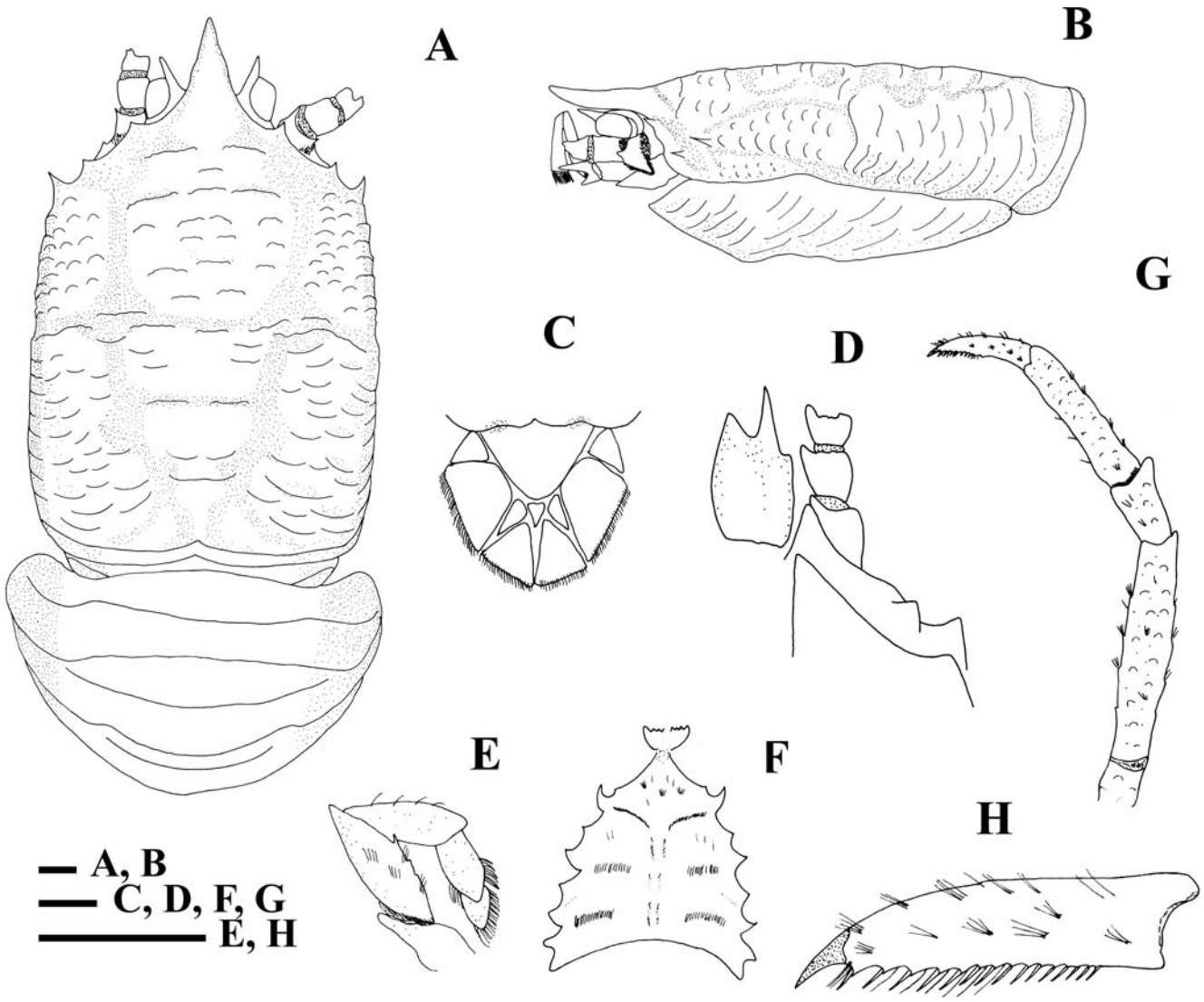

Fig. 2. *Munidopsis kermadec* n. sp. holotype. A, carapace and pleon 2-4 in folded position, dorsal view; B, parts of anterior cephalothorax, lateral view; C, telson plates and distal margin of 6th pleomere; D, anterior part of cephalothorax, showing antennular and antennal peduncles, ventral view; E, endopod of right third maxilliped, lateral view; F, sternal plastron, ventral view; G, right P2, lateral view; H, dactylus of same, lateral view. Scales: A, B = 2 mm; C, D, F, G = 2 mm; E, H = 1 mm.

medially (Fig. 2C). Telson composed of 10 plates, length-width ratio 0.92, posterolateral margin strongly convergent with fringe of coarse setae.

Eyes large in size, well exposed, smooth rounded cornea cupped within broad based ocular peduncle extended anteriorly into acute spine directed laterally, accompanied by a very small mesioventral spine.

Basal article of antennular peduncle with distal margin irregularly crenulate, slender dorsolateral carina continued into anterior spine, below it broader anterior spine directed obliquely laterad, flanked by inflated surface, mesiodorsal spine much smaller. Antennal peduncle with fixed basal article extended into stout, short flat ventral spine with subdivided mesial margin and shorter lateral spine, second with small distolateral spine, third and fourth segment with scalloped margins (Fig. 2D).

Third maxilliped with relatively broad endopod. Basis with few corneous spines. Ischium shorter than merus, bearing mesial crest armed with fine 23 corneous tipped spines somewhat diminishing in size distally. Merus with irregular sized teeth on flexor margin and very small spine at distoextensor margin, carpus, propodus and dactyl not reaching proximal end of ischium when folded (Fig. 2E).

Sternite 3 relatively broad, width slightly more than one third that of following sternite, broader posteriorly than anteriorly, divided by median longitudinal groove into left and right parts; anterior margin bearing 2 lobes distinctly tuberculate, anterior angle ending in blunt but distinct process on each side (Fig. 2F).

Pereiopod 1 (P-1) was missing.

Pereiopods 2-4 relatively long, corresponding segments of respective legs nearly equal in size except for meri successively decreasing posteriorly (Fig. 2G). Merus

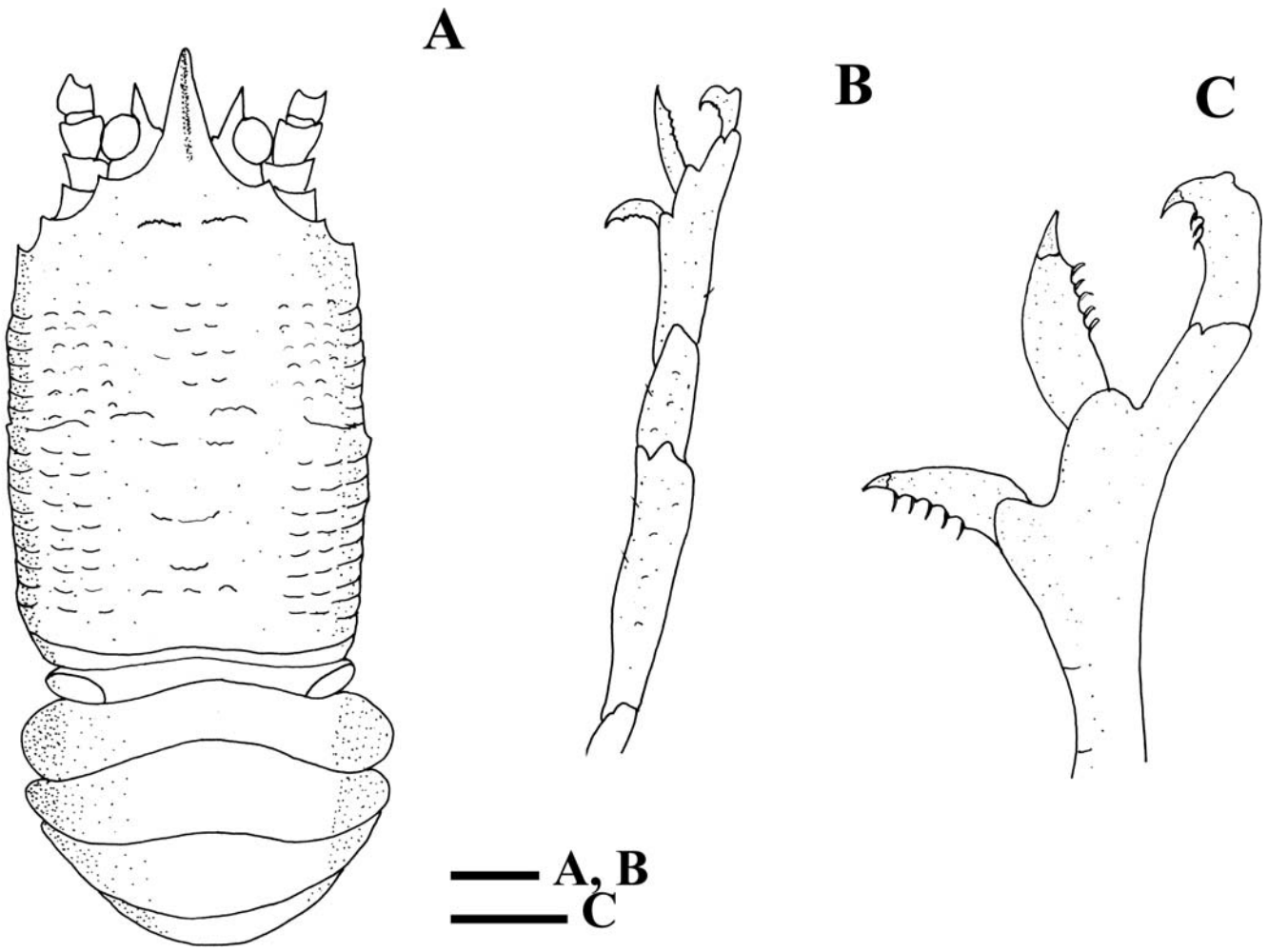

Fig. 3. *Munidopsis lauensis*. A, carapace and pleon 2-4 in folded position, dorsal view; B, left P3, lateral view; C, same enlarged, propodus and dactylus, lateral view. Scales: A, B = 2 mm; C = 1 mm.

relatively smooth, with setae; dorsal spines small or often tuberculate, ventral margin with obsolescent tubercles. Carpus with blunt spine on dorsodistal corner, dorsolateral surface feebly tuberculate. Propodus slender, about 1.5 times as long as dactylus, obliquely rounded longitudinal ridge on lateral surface bearing row of scale-like tubercles, dorsodistally and ventrally with sparse setae. Dactylus stocky distally, ventral margin almost straight, acute corneous claw strongly curved, preceded by row of 15 movable spines on ventral margin (Fig. 2H).

Epipods absent from all pereiopods.

Etymology.—The specific name is derived from the locality, Kermadec Volcanic Arc from where the new species was collected. The name is used as a noun in apposition.

Remarks.—The present new species, *Munidopsis kermadec* resembles *M. lauensis*. However, the shape of rostrum, erectness of eye spines, structure of sixth abdominal segment and dactyl morphology of P2-4 make it readily distinguishable. *M. kermadec* features a relatively broad triangular rostrum, whereas the rostrum of *M. lauensis* is narrowly triangular. The eyespine of *M. kermadec* is directed laterally whereas it is almost straight in *M. lauensis*. The first lateral spine at the end of the anterior cervical groove is stronger in the new species than *M. lauensis*. The posterior margin of 6th pleomere of *M. kermadec* is bilobed in the midline whereas it is almost transverse in *M. lauensis*. In *M. lauensis*, the dactyli of the P2-4 is gradually narrowed distally and the terminal corneous claw is gently curved, whereas in the new species it is greatly stocky distally and the terminal corneous claw is strongly curved. This last character links the new species to *M. alvisca*, but differs from it in having no perceptible scale like rugae in the rostrum. Also, *M. alvisca* possesses both mesiodorsal eyespine, directed obliquely upward and a mesioventral eyespine, whereas in new species eyespine is directed laterally and accompanied by a very small mesioventral spine.

Munidopsis lauensis
Baba and de Saint Laurent, 1992
(Fig. 3)

Munidopsis lauensis Baba and de Saint Laurent, 1992: 326, fig. 3.

Type Locality.—Hine Hina, Lau Basin, 22°32′S, 176°43′W, 1750 m

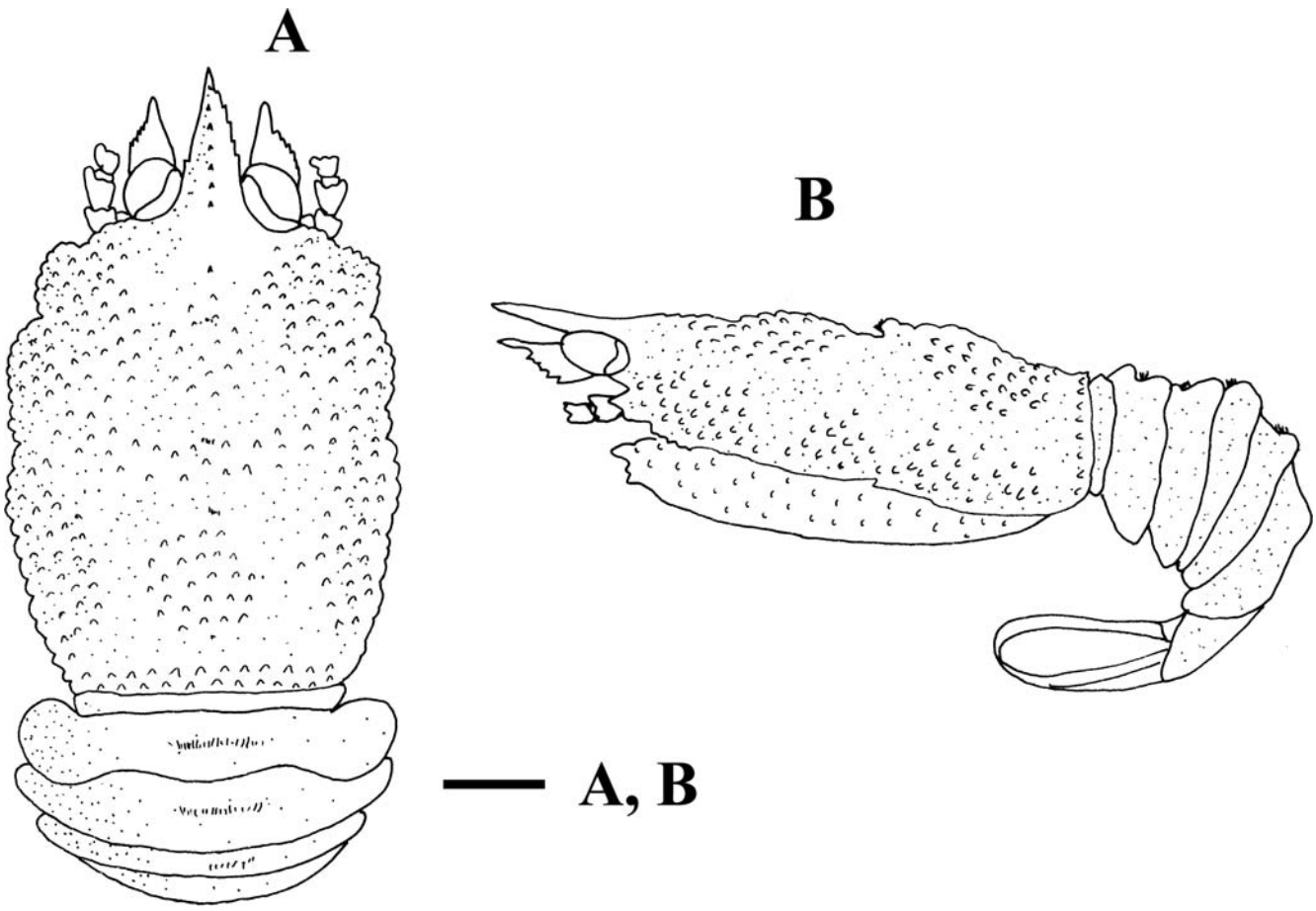

Fig. 4. *Munidopsis sonne*. A, carapace and pleon 2-4 in folded position, dorsal view; B, parts of anterior cephalothorax, lateral view. Scale indicates 2 mm.

Material Examined.—Female (JAMSTEC 056421) with a carapace length 19.1 mm, carapace width 11.9 mm, and cheliped length 29.9 mm, collected from Brothers Seamount, 34°51.756′S, 179°03.476′E by the submersible *Shinkai 6500* Dive #852, at a depth of 1649 m on 27 October 2004.

Remarks.—The specimen can be confidently identified from the description and illustrations given by Baba and de Saint Laurent, 1992. However, there is a variation in the morphology of the left P3. It is found to be very different from the type material. The dactylus is branched into three, each with 4 or 5 movable spines on the ventral margin ending in a corneous claw (Fig. 3B, C). All the other legs are found to be normal. This could be considered as a possible abnormal growth of the left dactylus of P3. The shape of rostrum of Brothers material is slightly broader than illustrated by Baba and de Saint Laurent, 1992 (Fig. 3A).

Distribution.—Endemic to vent habitats and known only from N. Fiji Back Arc Basin: White Lady vent field; Lau Back Arc Basin: Valu Fa Ridge, Hine hina vent fields and Manus Back Arc Basin. The distribution is now extended geographically to the Southern West Pacific.

Munidopsis sonne Baba, 1995
(Fig. 4)

Munidopsis sonne Baba, 1995: 188, figs. 1 and 2.

Type Locality.—North Fiji Basin, 16°59.49′S, 173°54.83′E, 1992 m.

Material Examined.—Female (JAMSTEC 056420) with a carapace length 13.1 mm, carapace width 9.0 mm, and cheliped length 16.6 mm, collected from Brothers Seamount, 34°51.756′S, 179°03.476′E by the submersible *Shinkai 6500* Dive #852, at a depth of 1649 m on 27 October 2004.

Remarks.—In the specimen examined, the rostrum is almost triangular, length nearly 1/4 of remaining carapace, dorsal surface is ridged on midline, lateral margins somewhat convex with a row of small spines only on right side, left side almost spineless and smooth (Fig. 4A, B). This can be considered as a morphological variation and the remaining characters are consistent with the original description.

Distribution.—Endemic to hydrothermal vents and known only from the type locality N. Fiji Back Arc Basin. The present record extends its distribution to the southern West Pacific.

Table 1. Diversity of *Munidopsis* in West Pacific vent fields.

Vent field	Mariana (18°11′N, 144°45′E)	Manus (03°41′S,151°40′E)	Lau (20°03′S, 176°34′W)	N. Fiji (16°59′S, 173°55′E)	Brothers Seamount (34°52′S, 179°03′E)
	M. marianica	*M. lauensis*	*M. lauensis*	*M. lauensis* *M. starmer* *M. sonne*	*M. lauensis* *M. sonne* *M. kermadec* n. sp.

Habitat Description

On Brothers Seamount, two sites of active hydrothermal vent fields were located. Chimneys of one to three meters in height, emitting vigorous transparent and black hydrothermal fluids at 353°C were found. Animal communities associated with hydrothermal discharges were generally located around the chimneys. They were dominated by tubeworms, stalked barnacles, alvinocaridid shrimps, bythograeid crabs, and a few galatheid crabs.

The video showed abundant shrimps, of more than one species, swimming in the vicinity of chimneys or crawling on the naked substratum. Scale-worm (polycheate) were seen attached to the chimneys. Dense beds of stalked barnacles and tubeworms were found. Reptant decapod crustaceans were diverse, represented by the bythograeid crabs, *Austinograea* sp., lithodid crabs, *Paralomis* sp., and galatheid crabs, *Munidopsis* sp. At least 6-8 individuals of *Munidopsis* were seen in the video image swimming swiftly or crawling in the vicinity of the chimneys. Most of them were seen among the stalked barnacles and tubeworms. The new species, *M. kermadec* were seldom seen in the video record, but the collected *M. lauensis* could easily be seen in the video image. There were thick mats of bacterial colony on the substratum, which appeared to be white in color. Some zoarid fish were observed swimming in the vicinity, apparently attracted by the food particles.

Key to Vent Associated Species of *Munidopsis*

1. a. Carapace with a pair of epigastric spines 2
   b. Carapace without a pair of epigastric spines 6
2. a. Epipod on P1 3
   b. No epipod on P1 5
3. a. Lateral eye spine present, ventral margin of P2-4 dactyli straight, posteromedian margin of 6th pleomere markedly produced . . . . . *M. marianica* Williams and Baba, 1990.
   b. Lateral eye spine absent, ventral margin of P2-4 dactyli not straight, posteromedian margin of 6th pleomere slightly convex, not produced 4
4. a. Rostrum broad at base, distally narrowed and upturned, absence of antennal spine, P2-4 dactyli ventral margin slightly curving . . . . . *M. exuta* Macpherson and Segonzac, 2005
   b. Rostrum subtriangular in proximal half, slightly upturned, antennal spine present, P2-4 dactyli ventral margin strongly curving . . . . . *M. subsquamosa* Henderson, 1885
5. a. Protruded rounded posterolateral flap of 6th pleomere distinctly over reaching posteromedian margin . . . . . *M. starmer* Baba and de Saint Laurent, 1992
   b. Posterolateral flap of 6th pleomere in transverse with posteromedian margin, ... *M. acutispina* Benedict, 1902.
6. a. Carapace with tubercles-like setiferous processes, serrate rostral margin, epipod present on P1-4 . . . . . *M. sonne* Baba, 1995
   b. Carapace smooth with transverse rugae running longitudinally, absence of lateral serrations on rostrum, epipods absent from P1-4 . . . . . 7.
7. a. Cornea depressed, shielded by flat dorsal spine and ventral plate . . . . . *M. lentigo* Williams and Van Dover, 1983
   b. Cornea not depressed, eyespine strongly produced beyond cornea 8
8. a. Rostrum broad triangular, posteromedian margin of 6th pleomere bilobed in midline, P2-4 dactyli with terminal claw strongly curved . . *M. kermadec* n. sp.
   b. Rostrum narrowly triangular, posteromedian margin of 6th pleomere transverse 9
9. a. Eyespine long relative to cornea, distinct carina on rostrum bearing almost imperceptible scale like rugae, P2-4 dactyli terminal claw strongly curving . . . . . *M. alvisca* Williams, 1998
   b. Eyespine small relative to cornea, distinct dorsal carina on rostrum ending into gastric region, P2-4 dactyli terminal claw gently curving . . . . . *M. lauensis* Baba and de Saint Laurent, 1992

Discussion

Species of *Munidopsis* are distributed in all deep sea habitats and they comprise an important element of macrofauna of hydrothermal vent and cold seep environments, along the Pacific and Atlantic Oceans as well as in other reducing habitats such as whale carcasses or decomposing woods in the deep-sea (Williams and Van Dover, 1983; Van Dover et al., 1985; Williams, 1988; Williams and Baba, 1989; Baba, 2005; Martin and Haney, 2005; Macpherson and Segonzac, 2005; Macpherson, 2007). *Munidopsis kermadec*, n. sp., from Brothers Seamount, is the tenth species of *Munidopsis* associated with active hydrothermal vents.

Munidopsis kermadec was found to occur with the other two congeners, *M. sonne* and *M. lauensis*. There are few reports on co-existence of more than one species of *Munidopsis* in a vent field. In the West Pacific, the first report of co-existence (*M. starmer* and *M. lauensis*) was from North Fiji Basin (Baba and de Saint Laurent, 1992). Baba (1995) also later reported *M. sonne* from the same North Fiji Basin. Since then, this is the second report of three species of *Munidopsis* co- inhabiting the same vent field. Other vent fields like Lau and Manus Basins in Southwest Pacific are inhabited by only one species of

galatheid crab, *M. lauensis* (Baba and de Saint Laurent, 1992). Similarly, in Mariana Back Arc Basin, only one species of galatheid crab (*M. marianica*) is found (Williams and Baba, 1989). Table 1 presents the current *Munidopsis* diversity in the West Pacific vent fields and shows that they are one of the typical species found there.

The distribution of *M. lauensis* is restricted to the Southwest Pacific at deep-sea vents. In the Lau Basin, it occurs at a depth of 1750 m, while it is found at 2000 m deep in hydrothermal sites of North Fiji Basin (Baba and de Saint Laurent, 1992) and Manus Basin (Tunnicliffe, 1991). This is the first report of *M. lauensis* from Brothers Seamount. The wide distribution of this species in the Southwest Pacific vent fields probably reflects its dispersal potential, which is yet to be fully understood. Baba (1995) described *M. sonne* based on a specimen from the North Fiji Basin at a depth of 1992 m, but it has not been reported in any other vent fields until this study. The occurrence of these two species in Brothers Seamount extends their distribution further south in the West Pacific.

The study of gene flow through populations may provide important evidence for dispersability and isolation mechanisms. The distributional pattern, speciation and biogeography of *Munidopsis* are still unknown and ongoing studies on genetic diversity could clarify these problems and help to elucidate its evolution.

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