

Crustacea, Brachyura

Very few representatives of brachyuran crabs have colonized the deep oceans: the families Geryonidae (maximal depth 1500 m) and Ethusidae GUINOT, 1977 (maximal depth 5500 m). Therefore it was surprising to find a brachyuran group living in high density at the hydrothermal vents of the mid-oceanic ridges and back-arc basins between 2500 and 4000 m depths.

Twelve species of hydrothermal brachyuran crabs are presently described. All species restricted to hydrothermal vents belong to a single family, the Bythograeidae, including four genera: *Bythograea* (five species from the East Pacific Rise), *Allograea* (one species from the East Pacific Rise), *Cyanograea* (one species from the East Pacific Rise), *Austinograea* (four species, three from back-arc basins, and one from the Central Indian Ridge), and *Segonzacia* (one species from the Mid-Atlantic Ridge). A possibly new species of *Austinograea* from the Lau Back-Arc Basin is currently under description. In addition, some opportunistic species such as *Chaceon affinis* (Geryonidae) from Menez Gwen, Mid-Atlantic Ridge and *Xenograpsus testudinatus* (Varunidae) from the shallow waters of the Okinawa Arc are also present in active vent sites.

A joint work between morphologists and molecular taxonomists allowed for the confirmation of new species of *Bythograea* (with the sister species *Bythograea thermydron*/*B. galapagensis*; and *B. laubieri*/*B. vrijenhoeki*). The phylogeny of all bythograeid genera, joining morphological and molecular data, is in preparation (HURTADO et al., pers. comm.). Based on spermatozoal ultrastructure of three bythograeid species *Bythograea thermydron*, *Austinograea alayseae* and *Segonzacia mesatlantica*, TUDGE et al. (1998) suggest that the bythograeids derive from the Xanthidae MACLEAY, 1838 sensu lato, and in particular of an ancestor of *Calocarcinus* CALMAN, 1909 (Trapeziidae MIERS, 1886), a crab of deep-sea coral reefs, which colonized the hydrothermal systems in or after the Eocene. Preliminary molecular studies (unpublished) support affinities of several vent crab families of Xanthoidea; nevertheless other studies are still necessary to corroborate this hypothesis.

The bythograeids are widely distributed on the western Pacific back-arc basins, the mid-oceanic ridges of the Pacific with

clear northern limit at 21°N, and the North Atlantic and Central Indian Oceans. It is noted that in spite of the distance, which separates these populations, the Central Indian Ridge populations are more closely related to those of the back-arc basins than those from the North Atlantic. Southern Mid-Atlantic Ridge and Indian Ridge, however, have not been visited often and are insufficiently explored.

Only a few studies were made on vent crab fecundity. *B. thermydron* produces a considerable quantity of eggs (up to 30 000, VAN DOVER 1985), which develop to zoea larvae. These larvae are rarely found in vent areas, but the larger megalope stage, especially of *B. thermydron* and *B. microps*, is often found in large quantities in tubeworm and mussel aggregations. Megalopes of *Cyanograea praedator* were collected, but juvenile and sub-adult stages have yet to be found.

It is important to note that several bythograeid species have reduced eyestalks and are even blind when adult. In other species (*C. praedator*), the eyes and their peduncles are unmovable and covered by vent mineral deposits.

Crabs have a relatively hard carapace and special care should be taken of the legs. For descriptions, the specimens must be as intact as possible; damaged specimens may be too easily misidentified. In general, males with their sexual gonopods are necessary to identify the species with certainty. Crabs have to be first fixed in 10% buffered formaldehyde, but then preserved in 75% ethyl or isopropyl alcohol. Prior to fixation, a leg (P3 or P4) has to be preserved in 80% ethanol for molecular analyses.

References:

- MARTIN J.W. & T. HANEY (2005) Zool. J. Linn. Soc. **145**: 445-522.
 TUDGE C.C., JAMIESON B.G.M., SEGONZAC M. & D. GUINOT (1998) Invertebr. Reprod. Dev. **34**: 13-23.
 VAN DOVER C.L., FACTOR J.R., WILLIAMS A.B. & C.J. JR BERG (1985) Biol. Soc. Wash. Bull. **6**: 223-227.

Macroregonia macrochira SAKAI, 1978

Size: Up to 122 mm carapace length.

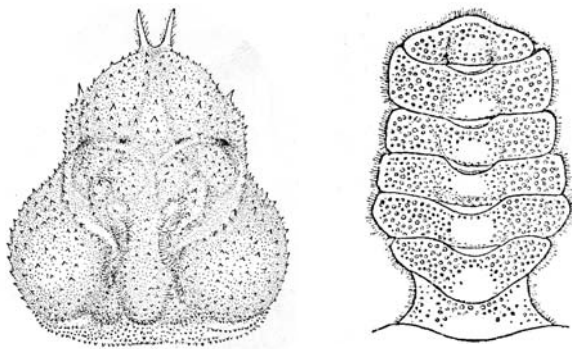
Morphology: Carapace ovate, anteriorly broadened; dorsal surface tuberculated, convex, with deep grooves delimiting regions. Two short rostral spines. Abdomen with seven segments in both sexes. Chelipeds and walking legs very long and cylindrical, covered with tubercles; cheliped fingers compressed; merus of walking legs with row of small spines along flexor and extensor margins. The species is one of the largest spider crabs known, resembling the Japanese giant crab *Macrocheira*. The species is the unique representative of the genus, belonging to

the subfamily Oregoniinae, which is characterized by the abdomen of the male: broad, with the terminal tergum transversely oval and invaginated to the preceding one.

Biology: The species is found in high concentrations on and around vent sites. Mature males tend to be widely dispersed, whereas females and juveniles are more concentrated near vents. It preys on different vent organisms.

Distribution: Juan de Fuca and Explorer Ridges.

Fig. 1-4: from SAKAI (1978).



1: Male holotype, carapace, dorsal view, without legs; enlargement x0.5.

2: Male holotype, abdomen; enlargement x0.9.



3: Three specimens in situ on dead vesicomid bed and among tubeworms (*Ridgeia piscesae*) © NOAA.



4: Ovigerous female in situ among tubeworms (*Ridgeia piscesae*) © NOAA.

References:

- SAKAI T. (1978) Res. Crust. **8**, Suppl.: 1-42.
TUNNICLIFFE V. & R.G. JENSEN (1987) Can. J. Zool. **65**: 2443-2449.

Arthropoda, Crustacea, Decapoda, Portunoidea, Portunidae

Bathynectes maravigna (PRESTANDREA, 1839)

Size: Up to at least 50 mm carapace length.

Color: Bright orange, with tips of spines and dactylus white. Legs with several white bands.

Morphology: Carapace smooth, wider than long, hexagonal in shape. Frontal margin of the carapace with four conspicuous lobes. Antero-lateral sides of the carapace bearing five acute teeth, the posterior one extremely elongated. Chelipeds strong and with spines on the carpus and propodus. First three pairs of walking legs long and slender. Fifth pair of legs much shorter than the others and with a lanceolate dactylus.

Biology: Benthic on hard and soft substrates, on the upper continental slope. Next to Menez Gwen one specimen was observed amongst the branches of white corals, off active sites. Two specimens (one caught) have been observed at Lost City on azoic carbonate chimney with percolating fluid. Probably necrophagous. Ovigerous females usually found in spring and summer.

Distribution: General: Eastern Atlantic Ocean, from Norway and Faeroes southward to North Western Morocco, including Madeira and Canary Islands; Mediterranean. Mid-Atlantic Ridge: next to Menez Gwen and Lost City. Depth range: 100-1455 m.



1: Specimen in vivo, habitus; by M. Biscoito © MMF.



2: Specimen in situ, from Lost City; cruise Exomar © Ifremer.



3: Two juvenile specimens in situ from Lost City; cruise Exomar © Ifremer.

Reference:

MANNING R.B. & L.B. HOLTHUIS (1981) *Smithson. Contrib. Zool.* **306**: 1-379.

M. BISCOITO & P. BRIAND

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Arthropoda, Crustacea, Decapoda, Brachyura, Geryonidae

Chaceon affinis (MILNE-EDWARDS & BOUVIER, 1894) “deep-sea red crab”

Size: Up to 145 mm carapace length.

Color: Dark red to light brown.

Morphology: Carapace smooth, wider than long, hexagonal in shape with rounded anterior part. Five lateral spines along the antero-lateral margin of the carapace. Chelipeds strong, with propodus longer than high. Walking legs long and slender, the dactylus of the fifth pair being antero-posteriorly flattened.

Biology: Benthic on hard and soft substrates, on the upper continental slope. At Menez Gwen several specimens were observed over pillow lava, near the active sites, as well as at the

border of *Bathymodiolus azoricus* mussel beds. They were observed eating mussel tissue. Ovigerous females usually found in spring and summer.

Distribution: North-eastern Atlantic Ocean, from Iceland to Cape Verde, including the Azores, Madeira and Canary Islands, 130-2047 m (most common between 600 and 1000 m); Mid-Atlantic Ridge: Menez Gwen, Lost-City.



1: Specimen in vivo; by M. Biscoito © Museu Funchal.



2: In situ at Menez Gwen, showing two specimens on mussel bed of *Bathymodiolus azoricus*; cruise Marvel © Ifremer.



3: In situ at Lost City; cruise Exomar © Ifremer.

Reference:

BISCOITO M. & L. SALDANHA (2000) J. Crustac. Biol. **20**(1): 128-131.

Allograea tomentosa GUINOT, HURTADO & VRIJENHOEK, 2002

Size: Female: 16 x 25 mm (male unknown).

Color: Brown.

Morphology: Body and legs completely covered by brown, dense tomentum, consisting of very short plumose setae, with sparse, longer simple setae; only white extremities of eyestalks, second antennular article and antennal flagellum (may be reddish-coloured) not covered by tomentum. Carapace: surface entirely smooth, densely setose, without transverse granulous rows. Anterolateral margin marked by rounded edge, not joining exorbital angle, and divided into three parts by two small notches. Front broad, not deflexed, not protruded from general outline of carapace, nearly truncated and nearly straight in outline, with small but marked external angles. Suborbital plate absent. Orbits present, complete and closed, showing as clearly defined pockets, entirely visible; orbital borders slightly thickened, smooth, without teeth or notches; external angle smooth, not marked. Eyestalks short, cylindrical throughout length; cornea present, whitish, unafaceted. Eyes and two first pairs of cephalic appendages exposed, not recessed under front. Mxp3 endognath with antero-external angle of merus strongly pro-

duced, very close to epistome; internal border of merus with marked mesial lobe; palp very short, small, tip only reaching proximal mesial margin of ischium; symmetrical in ventral view; dactylus extremely reduced, inserted at tip of propodus. Chelipeds short, somewhat asymmetrical; fingers dimorphic; both chelae covered on both sides by dense tomentum, and surfaces smooth when denuded; fingers grooved; occluding edge of dactylus on large chela (at right) with three blunt teeth, occluding edge of fixed finger with four marked teeth; tips of fingers on small chela pointed and crossing; occluding edge of dactylus with very low, somewhat indistinct teeth, occluding edge of fixed finger with four acute teeth; dactyli dark-coloured on 3/4 length on both chelae, fixed fingers only in half distal part. Walking legs elongated and slender, meri and propodi narrow, dactyli thin, all articles entirely covered with dense tomentum.

Biology: Live on the mussel beds and in lava pillar near vent chimneys, associated with sea anemones and buccinid gastropods *Eosipho auzendei*.

Distribution: Pacific-Antarctic Ridge: 31°S.



1: Holotype female (right side denuded); scale bar 1 cm; by D. Guinot © MNHN.



2: Holotype female, ventral view (right side denuded); scale bar 1 cm; by D. Guinot © MNHN.



3: Paratype female, frontal view; scale bar 1 cm; by D. Guinot © MNHN.

Reference:

GUINOT D., HURTADO L.A. & R. VRIJENHOEK (2002) C. R. Biol., Paris **325**(11): 1143-1152.

Arthropoda, Crustacea, Decapoda, Brachyura, Bythograeidae

Austinograea alayseae GUINOT, 1990

Size: Male 35 x 55 mm, female 38 x 63 mm.

Color: Whitish, unless cheliped fingers brown.

Morphology: Carapace: dorsal surface without transverse granulose rows. Suborbital plate absent. No orbit, no ocular structures; only a plate fused to the surrounding region, corresponding to a remnant eye-stalk; no cornea, only a very minute (sometimes dark) spot; hence completely blind. Internal border of merus of Mxp3 straight, not produced. Chelipeds with chelae not always dimorphic, but often with one side crusher, the other cutter. Setose fields not present on the chelae. Walking legs short. Second pleopod G2 clearly shorter than G1.

Remarks: *A. yunohana* is closer to *A. alayseae* than to *A. williamsi*. *A. yunohana* and *A. alayseae* have a similar proportional ratio of length and width of the carapace, and differ by several characters: the posterolateral margin of the carapace more strongly convergent toward the posterior margin in *A. yunohana*; the shape of the abdominal segment six (one and

half as long as the fifth in *A. alayseae*; equal in length to fifth segment in *A. yunohana*); the G1 (unarmed in *A. yunohana*, strongly armed with spiniform setae along the margins for whole length in *A. alayseae*); the G2 (filiform and nearly as long as G1 in *A. yunohana*; nearly half the length of G1 in *A. alayseae*).

Two samples found in Vai Lili (7 specimens) and Hine Hina (4 specimens) sites, distinct from *A. alayseae* by the remnant eye's shape, and from *A. williamsi* by the chelae and G1, have been designated as "*Austinograea* sp. (aff. *williamsi*)" by GUINOT (1990) and need further investigations.

Biology: Actively moving on mussel beds, in shimmering water at ca. 15°C maximum, around black smokers.

Distribution: Lau Back-Arc Basin: Valu Fa Ridge, sites Vai Lili and Hine Hina; North Fiji Back-Arc Basin: site White Lady; Manus Back-Arc Basin.

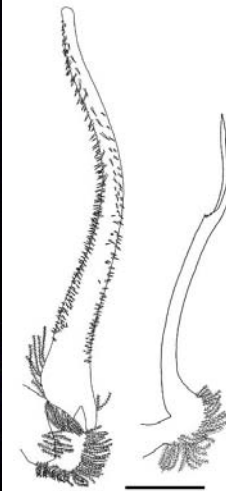


2: Specimen on mytilid bed of *Bathymodiolus brevior*, with two shrimps: *Lebbeus* sp., front the crab, and *Nautilocaris saintlaurentae* on the right; Lau Basin, cruise TU-IM07; by courtesy of C.R. Fisher.

1: In situ photograph of a specimen on gastropod bed of *Ifremeria nautilei*; Lau Basin, cruise TUIM07; by courtesy of C.R. Fisher.

References:

- DESBRUYÈRES D., HASHIMOTO J. & M.-C. FABRI (in press) Geophys. Monogr.
GALKIN S.V. (1992) Oceanology **32**(6): 768-774.
GUINOT D. (1990) Bull. Mus. Natl. Hist. Nat., Paris **11**(4): 879-903.
TAKEDA M., HASHIMOTO J. & S. OTHA (2000) Bull. Natl. Sci. Mus, Tokyo, Ser. A **26**(4): 159-172.
TSUCHIDA S. & J. HASHIMOTO (2002) J. Crustac. Biol. **22**(3): 642-650.
TUDGE C.C., JAMIESON B.G.M., SEGONZAC M. & D. GUINOT (1998) Invert. Reprod. Dev. **34**(1): 13-23.



6: Pleopods G1 (left) and G2 (right); scale bar 2 mm; by S. Tsuchida.

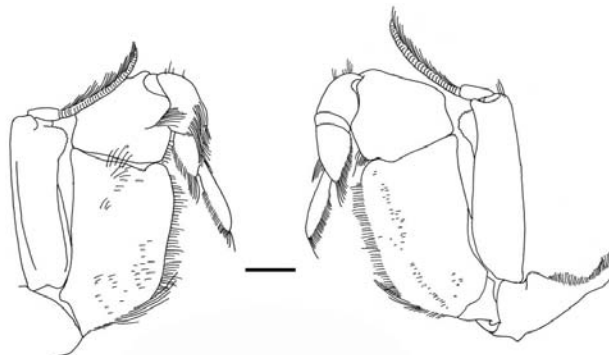
3: Dorsal view; by P. Briand © Ifremer.



4: Frontal view; by P. Briand © Ifremer.



5: Male, ventral view showing the two pleopods in situ; cruise Biolau © Ifremer.



7: Third maxillipeds; scale bar 2 mm; by S. Tsuchida.

Arthropoda, Crustacea, Decapoda, Brachyura, Bythograeidae

Austinograea rodriguezensis TSUCHIDA & HASHIMOTO, 2002

Size: More than 44 mm carapace width and 26 mm carapace length.

Morphology: Carapace transversely long, like an ellipse and almost flat, but slightly curving downward to front orbital and lateral margins. Front orbital margin elongate, bluntly pointed medially. Dense patch of short setae covering anterior third to half of subhepatic region. Male first gonopod slender and nearly straight, thick proximally and sharpened distally with several small stout spines arranged along dorsal surface. Second gonopod more slender and about half length of first, with slight curve on proximal portion.

Biology: This crab is found near black smoker complexes (T 360°C, pH 3.4) with *Rimicaris kairei* shrimp swarms.

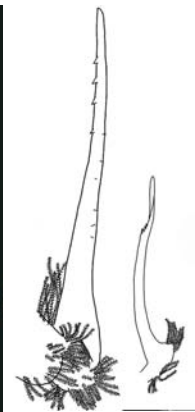
Distribution: Central Indian Ridge: Kairei and Edmond Vent Fields.



1: Dorsal view, scale bar 5 mm; by S. Tsuchida.



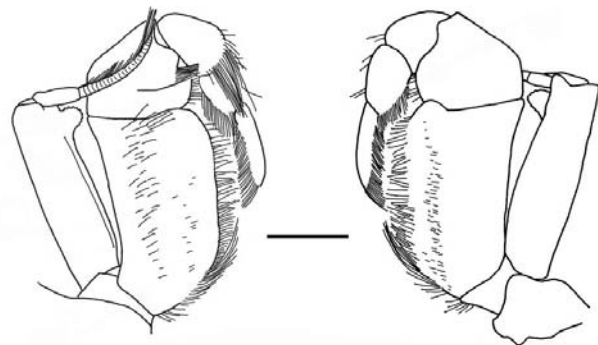
2: Ventral view, scale bar 5 mm; by S. Tsuchida.



3: First (left) and second gonopods (right) of male; scale bar 0.5 mm; by S. Tsuchida.



5: In situ view of numerous specimens near black smoker complexes at the Kairei Vent Field, among sea anemones *Mariactis* cf. *bythios*, and shrimps *Rimicaris kairei* (top left) © JAMSTEC.



3: Third maxillipeds, ventral views; scale bar 2 mm; by S. Tsuchida.

References:

TSUCHIDA S. & J. HASHIMOTO (2002) *J. Crustac. Biol.* **22**(3): 642-650.

VAN DOVER C.L. HUMPHRIS S.E., FORNARI D., CAVANAUGH C.M., COLLIER R., GOFFREDI S.K., HASHIMOTO J., LILLEY M.D., REYSENBACH A.L., SHANK T.M., VON DAMM K.L., BANTA A., GALLANT R.M., GOTZ D., GREEN D., HALL J., HARMER T.L., HURTADO L.A., JOHNSON P., MCKINNESS Z.P., MEREDITH C., OLSON E., PAN I.L., TURNIPSEED M. & Y. WON (2001) *Science* **294**: 818-822.

Arthropoda, Crustacea, Decapoda, Brachyura, Bythograeidae

Austinograea williamsi HESSLER & MARTIN, 1989

Size: Female carapace length 25.8 mm and carapace width 39.7 mm; male 24.5 x 37.8 mm.

Morphology: Carapace slightly granulate to completely smooth; subhepatic area with densely setose patch. Eyes absent; potential eyestalk vestige is fused to the surrounding orbital region of the carapace and bear no cornea or pigment. Third maxilliped, in inner view of distal end of exopodal peduncle medial cristate to distally located; coxa nearly covered by the juxtaposition of the margin of the carapace with the sternum and chelipedal coxa (in other genera, the maxillipedal posterolateral coxal process is easily seen in ventral view); dactylus broadest near midpoint, not curved; insertion on propodus not visible in outer view; merus, medial lobe only half length of medial margin; distal end acutely produced. Chelipeds equal in size, slightly or strongly dimorphic; setose fields on the ventral dactylar surface in both sexes; densely setose ventral margins on the merus and basi-ischium of all walking legs, chelipeds with fingers. Crusher nearly always on right; cutter, inner occluding margins of dactylus and propodus not gaping, meeting along entire length. Pleopods, G1 nearly twice

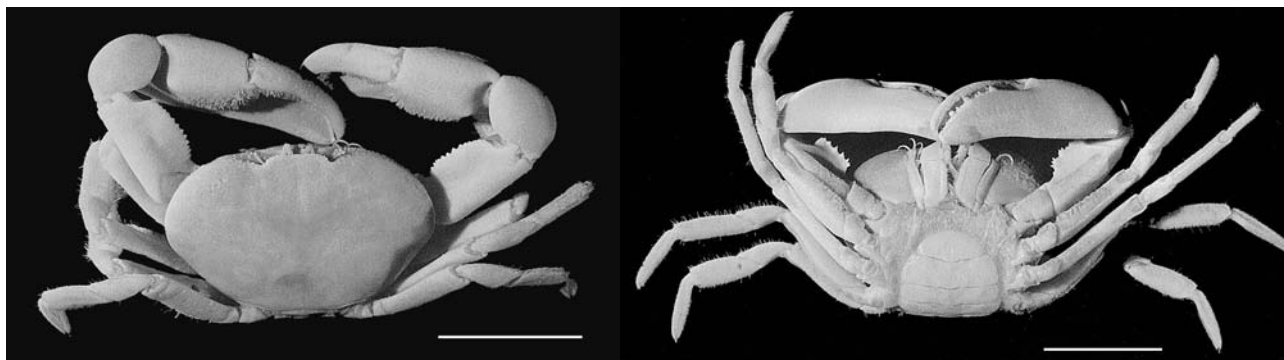
length of G2, narrow, more or less straight and no twisted, grooved posteriorly and anteriorly, with mesial double row of short stout sclerotized spines; G2 with bend about two-thirds length at level of small oval area fringed with short setae, distally curved.

Remarks: Some characters of this species resemble those of *Segonzacia mesatlantica* (Mid-Atlantic Ridge) more than those to of the East Pacific Rise species *Bythograea therymydron*. The orbital region is not as clearly demarcated in either species as it is in *B. therymydron*. The last three segments of the walking legs are similarly setose. In the same way, the pleopods of *A. williamsi* are most similar to those of *S. mesatlantica* than to those of *B. therymydron*.

Biology: Living in abundance on the *Alviniconcha hessleri* snail beds that frequently were found to fill vent openings; also occurs more sparsely within the surrounding vent field. It is a scavenger and probably carnivorous. No ovigerous females in April.

Distribution: Mariana Back-Arc Basin.

1-4: from HESSLER & MARTIN (1989).



1: Male holotype, ventral view; scale bar 2 cm.

2: Female allotype, ventral view; scale bar 2 cm.



3: Third maxillipeds, ventral views; scale bar 2 mm.

4: First (left) and second (right) pleopods of male; scale bar 2 mm.

References:

HESSLER R.R. & J.W. MARTIN (1989) *J. Crustac. Biol.* **9**(4): 645-661.
 HESSLER R.R., LONSDALE P. & J. HAWKINS (1988) *New Sci.* **24**: 47-51.

Arthropoda, Crustacea, Decapoda, Brachyura, Bythograeidae

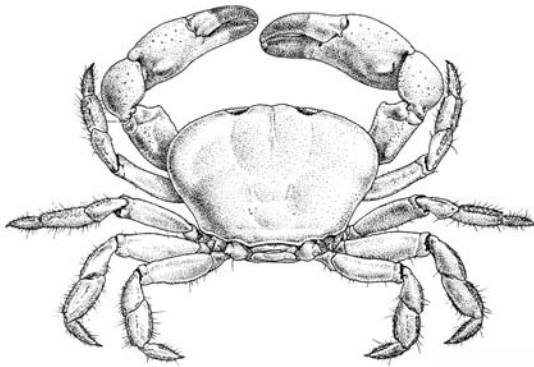
Austinograea yunohana TAKEDA, HASHIMOTO & OHTA, 2000

Size: Up to 50.5 mm carapace breadth and 32.5 mm carapace length .

Morphology: Carapace whitish and elliptical, dorsal surface smooth and shining to naked eye, without hairs or setae. Orbit shallow, widely open, with small eyestalk fixed at its bottom. Eyestalks somewhat variable in size, immovable, thickened distally, with distal part truncated together with unpigmented cornea. Both chelipeds heavy, long, slightly different in size and shape, with the right being larger. The male second pleopod is as long as, or longer than half the length of, at most nearly equal to, the first.

Biology: Living in high densities close to active smokers and/or in and around diffuse vent fluids.

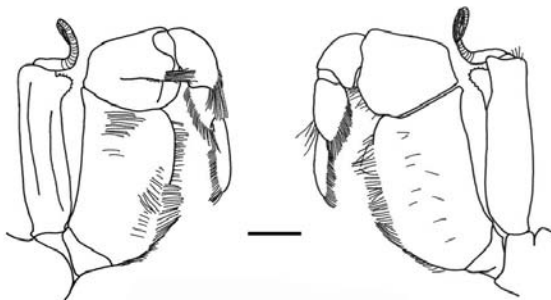
Distribution: West Pacific, Izu Ogasawara Arc.



1: Paratype (31.5 x 20.5 mm) from Kaikata Seamount, by Y. Okata © JAMSTEC.



2: Front view © JAMSTEC.



3: Third maxillipeds, scale bar 2 mm; by S. Tsuchida.



4: First (left) and second (right) pleopods, scale bar 2 mm; by S. Tsuchida.



5: A hydrothermal vent on Kaikata Seamount; by M. Takeda © JAMSTEC.

Reference:

TAKEDA M., HASHIMOTO J. & S. OHTA (2000) Bull. Natl. Sci. Mus., Tokyo, Ser. A 26(4): 159-172.

Arthropoda, Crustacea, Decapoda, Brachyura, Bythograeidae

Bythograea galapagensis GUINOT & HURTADO, 2003

Size: Male 29.6 x 52.3 mm; female 24.8 x 44.6 mm.

Color: Body and legs white.

Morphology: Carapace glabrous; granular transverse row. Front broad, obscurely bilobed, median depression shallow, no external angles. Eyes, antennules and antennae recessed under front. Suborbital plate elongated, narrow, smooth. Orbits almost non-existent. Eyestalks narrow, depressed, only very slightly broadened distally; cornea fringed with soft hairs laterally, sexually dimorphic (more fusiform tip in adult female); juvenile females with cylindrical eyestalks and pigmented cornea. Setae only at bases of chelipeds and walking legs. Mxp3 filling mouth field except for very large gap between anteroexternal part of merus of endognath and epistome; merus granular, produced with marked mesial lobe; palp reaching 2/3 length mesial margin of ischium. Male small cheliped (cutter) inflated, rugose in superior half; fingers not gaping, with pointed tips. Female chelipeds dimorphic, both inflated; superior half of propodus rugose. Male small chela and both female chelae with developed pilose patches covering most of internal surface of palm; no setae visible on external surface and between fingers.

Remarks: It was appropriate to erect *B. galapagensis* as a new species, despite the fact that it should be perhaps the not well-known *B. intermedia* DE SAINT LAURENT, 1988, from the same vent at the Galapagos Rift. The distinction between *B. galapagensis* and *B. therydron* is clear, particularly in males. *B.*

therydron principally differs by the more developed suborbital plate, slightly thicker eyestalks, and the broadened cornea in both sexes (versus fusiform tip in *B. galapagensis*); male G1 short, markedly twisted, round-tipped and glabrous in *B. therydron* (versus longer, less twisted, acute-tipped and subdistally setose in *B. galapagensis*); G2 longer and crossed in *B. therydron* (versus almost straight, not crossed in *B. galapagensis*); male telson longer and forming a more pointed triangle in *B. therydron*, and the proportions of articles the walking legs in both sexes (meri and propodi) much more elongated and slender in *B. therydron*. *B. galapagensis* shares with *B. laubieri* narrow eyestalks, small cornea and short, thick walking legs. But *B. laubieri* differs by the suborbital plate being granular at least on the inferior portion, the red-tipped granules of the carapace, chelae with colored areas, regularly setose walking legs and a thick, glabrous, non-twisted G1. *B. galapagensis* shares with *B. vrijenhoeki* narrow eyestalks, narrow and smooth suborbital plate (but narrower in *B. vrijenhoeki*), and short, thick walking legs. *B. vrijenhoeki* differs from *B. galapagensis* by the more fusiform cornea, shorter male telson, more regular setation of walking legs, and the non-twisted, regularly tapering, and glabrous G1.

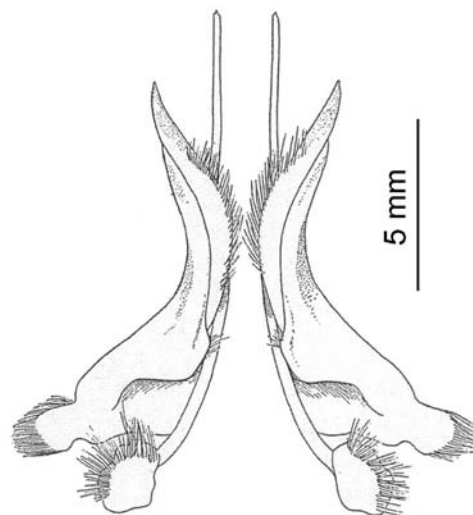
Biology: Collected among tubeworms *Riftia pachyptila*, mussel beds, and observed on pillow lava.

Distribution: Galapagos Spreading Center.

1: Dorsal view,
scale bar 1 cm;
by D. Guinot.



2: Frontal view; by
D. Guinot.



3: In situ pleopods G1 and G2; by D. Guinot.

References:

- GUINOT D. & L.A. HURTADO (2003) C. R. Biol., Paris **326**: 423- 439.
SAINT LAURENT M. DE (1988) Oceanol. Acta, n° spec. **8**: 99-107.

Arthropoda, Crustacea, Decapoda, Brachyura, Bythograeidae

Bythograea laubieri GUINOT & SEGONZAC, 1997

Size: Up to 60 mm wide.

Color: White to more or less purplish-blue.

Morphology: Carapace convex, glabrous; dorsal surface with many flat granules and only a transversal granular row. Suborbital plate present, but reduced and granulous. Eye-stalks moveable, long, very narrow, deeply recessed and with cornea not broadened. Internal border of merus of Mxp3 produced with a strong lobe. Male telson ovate. Female telson subovate. Chelipeds dimorphic in both sexes. Large cheliped with propodus heavy and globulous, granular on the internal and external surfaces, granules may be coloured at tip; fingers short; dactylus very thick. Pilose patches along proximal border between the fingers and/or near their base, especially on the internal distal surface of palm. Both sexes with purplish areas along fixed fingers and sometimes largely on the palm. Walking legs very short and broadened, with short regular setation; meri dorsally inflated; propodi almost as long as wide; dactyli relatively short and thick. G1 stout, not much curved, with a thick subdistal part and pointed apex; G2 clearly longer than G1.

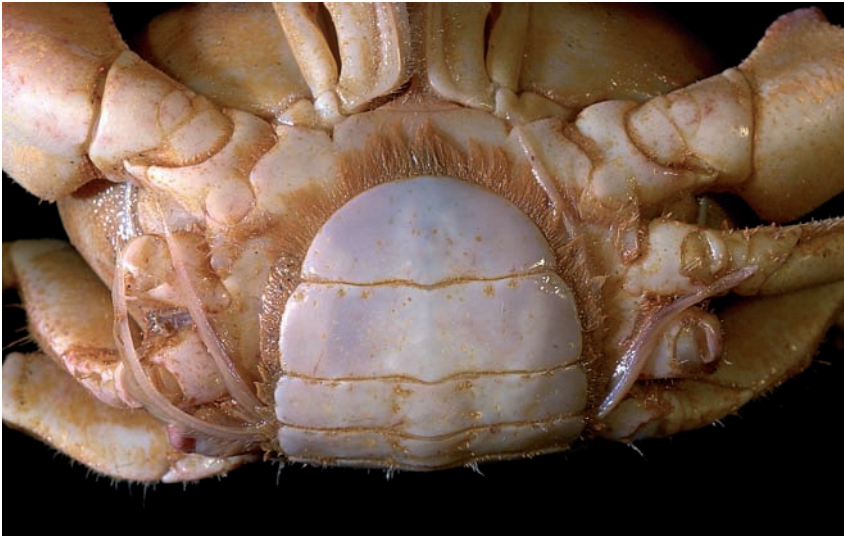
Remarks: *B. laubieri* and *B. vrijenhoeki* are sister species. They form the *laubieri* group [versus *thermydron* group (consisting of *B. thermydron* and *B. galapagensis*) with non-twisted G1 (versus twisted and S-shaped G1 in the *thermydron* group), short and regular setation (versus scattered tufts of stiff setae in *thermydron* group), with short and stout pereopods, the shortest legs being in male *B. laubieri* (versus longer and more slender in the *thermydron* group; proportionately the longest and more slender in *B. thermydron*)].

Biology: Near black smokers, among siboglinid or alvinellid tubeworms, *Chorocaris* and *Nematocarcinus burukovskyi* shrimps, or on pillow lava. Usual density 20-30 ind.m². On the site Pillar de Neige (2.5 km south Rehu site), ca. 120 ind.m² were observed in shimmering water. But may be confused in situ with co-occurring *B. thermydron*.

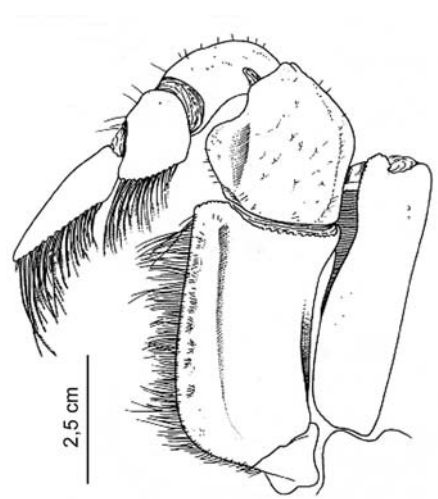
Distribution: South East Pacific Rise: 17°S and 38°S. Never observed at localities north of 17°S. May be co-occurring with *B. thermydron* at 17°S. Very abundant and co-occurring with *B. vrijenhoeki* at 38°S.



1: Male from 38°S, width 41.7 mm, dorsal view; by P. Briand © Ifremer.



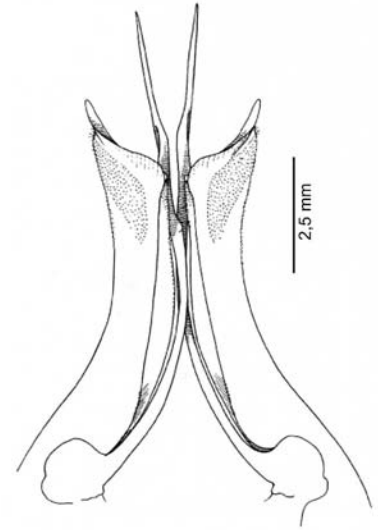
2: Female from 38°S, width 44 mm, ventral view; by P. Briand © Ifremer.



4: Third maxilliped; by D. Guinot.



3: Male, ventral view; by P. Briand © Ifremer.



5: Pleopods G1 & G2; by D. Guinot.

References:

- GEISTDOERFER P., AUZENDE J.-M., BATIZA R., BIDEAU D., CORMIER M.-H., FOUQUET Y., LAGABRIELLE Y., SINTON J. & P. SPADEA (1995) C. R. Acad. Sci., Paris **320**(2a): 47-54.
- GUINOT D. & L.A. HURTADO (2003) C. R. Biol., Paris **326**: 423- 439.
- GUINOT D. & M. SEGONZAC (1997) Zoosystema **19**(1): 117-145.

Arthropoda, Crustacea, Decapoda, Brachyura, Bythograeidae

Bythograea microps DE SAINT LAURENT, 1984

Size: Maximal 24 x 40 mm.

Morphology: Carapace transversely elliptical, flat. Dorsal surface setose, ornamented with flat granules on the frontal and antero-lateral regions and marked by two transverse granular rows, the posterior one slight and interrupted. A characteristic suborbital plate present, demarcated by dorsal and ventral row of large granules. Eye-stalks moveable, long, very narrow, deeply recessed; cornea present but not broadened. Internal border of merus of Mxp3 produced, with a marked lobe. Male telson very short. Chelipeds homomorphic in the female: propodus thin and elongated, with large granules on the internal and external surfaces, and with stiff setae; near the base of the fixed finger of both chelipeds a characteristic oval smooth and glabrous area, sometimes violaceous. Chelipeds heteromorphic in the male: smaller cheliped as in the female, slender, hairy and with a violaceous "spot" at the base of the palm; large cheliped heavier, smooth (only rugose near the superior mar-

gin) and glabrous, with short fingers. Walking legs elongated, with narrow meri and propodi and with thin dactyli. G1 not twisted, pointed; G2 long and crossed.

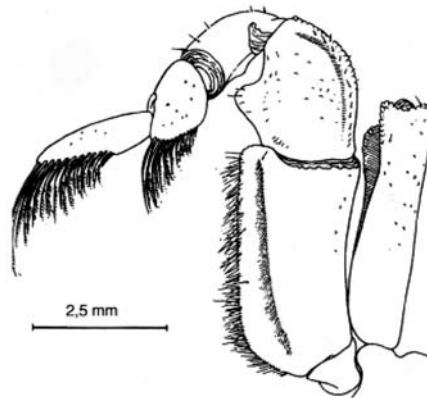
Remarks: *B. microps* is unique among the species of *Bythograea*. It is the smallest species (maximum width 40 mm) of and it shows the most drastic reduction of eyestalks. It is setose (on carapace, and especially on chelae) and more granular on carapace and pereopods, in particular on merus and carpus. The male telson is comparatively the shortest in the genus *Bythograea*. *B. microps* resembles *B. thermydron* by the long and crossed G2 but differs by the non-twisted and pointed G1.

Biology: Living among tubeworms *Riftia pachyptila* and alvinellid clusters, and on mussel beds.

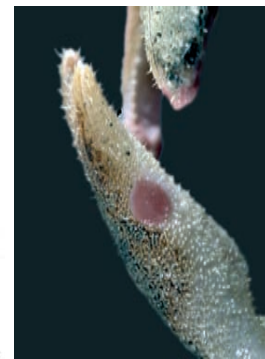
Distribution: Galapagos Spreading Center; East Pacific Rise: 21°N to 21°S; not observed at 38°S.



1: Specimen from East Pacific Rise: 13°N; dorsal view; by P. Briand © Ifremer.



3: Third maxilliped; from DE SAINT LAURENT (1988).



5: Right cheliped showing the violaceous "spot" at the base of the palm; by P. Briand © Ifremer.



2: Frontal view; by P. Briand © Ifremer.



4: Specimen in situ, among *Riftia pachyptila*; cruise Phare © Ifremer.

References:

- GUINOT D. & L.A. HURTADO (2003) C. R. Biol., Paris **326**: 423- 439.
 GUINOT D., HURTADO, L.A. & R. VRIJENHOEK (2002) C. R. Biol., Paris **325**(11): 1143-1152.
 SAINT LAURENT M. DE (1984) C. R. Acad. Sci., Paris **299**(9): 355-360.
 SAINT LAURENT M. DE (1988) Oceanol. Acta, n° spéc. **8**: 99-107.

Arthropoda, Crustacea, Decapoda, Brachyura, Bythograeidae

Bythograea thermydron WILLIAMS, 1980

Size: Width, up to 59 mm.

Color: Body and legs white.

Morphology: Adult carapace transversely elliptical, depressed, nearly smooth except for granular anterior margins and tract above orbital region, front bilobed; orbits incomplete, triangular suborbital plate nearly horizontal, visible dorsally; eyestalks slender, reduced, movable, directed obliquely lateral, cornea unpigmented; mat of plumose setae below lateral margin in male, restricted in female; chelipeds heavy, unequal, fixed finger spooned at tip, inner surface of male palm smooth, bearing mat of plumose setae in female; male pl 1 stout, twisted, S-curved, slender pl 2 elongate, crossed.

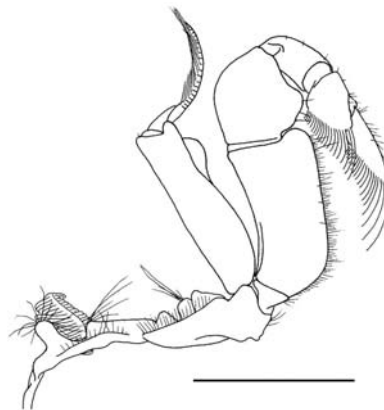
Biology: Living among the tubeworms *Riftia pachyptila* and on mussel beds of *Bathymodiolus thermophilus*, abundant in temperature range between 1.8 and 12°C, but also among chimneys colonized by tubeworms Alvinellidae, therefore in warmer water. Co-occurring with *Bythograea laubieri* at 18°C. Some specimens are observed isolated at tens of meters away the active sites, on pillow lava. This species is a predator and scavenger.

Distribution: Galapagos Spreading Center, East Pacific Rise: between 21°N and 18°S.

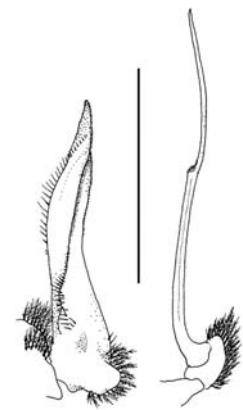


1: Dorsal view; by P. Briand © Ifremer.

1-5: Specimens from East Pacific Rise: 13°N.



2: Third maxilliped; by J. Martin.



3: Pleopods G1 and G2; by J. Martin.



4: In situ specimen among *Riftia pachyptila*; cruise Phare © Ifremer.



5: Frontal view; by P. Briand © Ifremer.

References:

- FUSTEC A., DESBRUYÈRES D. & S.K. JUNIPER (1987) *Biol. Oceanogr.* **4**(2): 121-164.
GUINOT D. (1989) *Bull. Mus. Natl. Hist. Nat, Paris*, 4è sér. **11A**(1): 203-231.
GUINOT D. & L.A. HURTADO (2003) *C. R. Biol., Paris* **326**: 423- 439.
GUINOT D. & M. SEGONZAC (1996) *Zoosystema* **19**(1): 117-145.
WILLIAMS A.B. (1980) *Proc. Biol. Soc. Wash.* **93**: 443-472.

Bythograea vrijenhoeki GUINOT & HURTADO, 2003

Size: Male 42.4 mm; female 47 mm width.

Morphology: Carapace dorsal surface with regions indistinct, glabrous, smooth, except on anterolateral regions ornamented with flat granules; granular transverse row. Anterolateral, frontal margins of carapace, margins of suborbital plate beaded with granules that are practically never red- or brown-tipped. Eyes, antennules, antennae deeply recessed under front. Suborbital plate very narrow, markedly elongated, smooth, subdivided by uncalcified fissure in two parts. Orbits almost non-existent. Eystalks narrow, hardly broadened distally; cornea unpigmented or with a small dark remnant, sexually dimorphic, tip more or less fusiform, laterally fringed with soft hairs. Mxp3 with merus produced in a marked mesial lobe; palp reaching 2/3 length mesial margin of ischium; propodus asymmetrically ovate in ventral view. Male telson triangular. Female telson short, wide and flattened distally. Chelipeds dimorphic in both sexes; heterochely and heterodonty in males. Both sexes with dactyl of cheliped brown-coloured or completely white; brown-coloured, elongated area at bases of palm and fixed finger, that may be partly depressed; in large chela, another coloured zone (sometimes only traces or absent) oblique along proximal part of palm, bordering fixed finger. Walking legs elongated, slender; meri cylindrical; dactyli relatively elongated. G1 rather long, narrow, curved but non-twisted, regularly tapering, without setae; G2 markedly longer than G1.

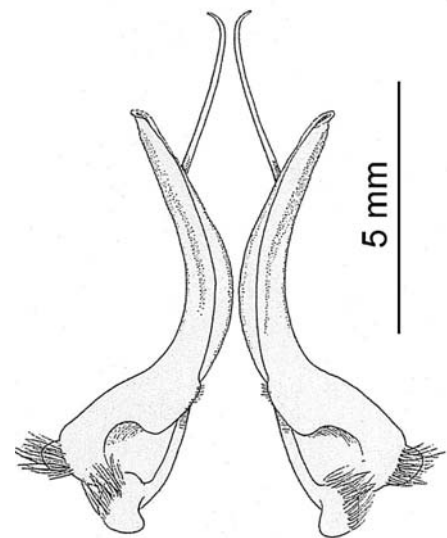
Remarks: *Bythograea vrijenhoeki* is sister species of *B. laubieri*, co-occurring on the Southern East Pacific Rise (31° and 38°S), south of the Easter Microplate. They share similar carapaces, ocular regions, mouthparts, sternal plates, chelipeds, as well as the presence of setose patches and colored areas on the chelae. *B. vrijenhoeki* shows pale brown-colored areas on the chelae, but several individuals are entirely white, while a violaceous area may persist along the inferior border of the palm in the most discoloured individuals of *B. laubieri*. The granules on the carapace are practically always white in *B. vrijenhoeki*, while in *B. laubieri* they are red- or brown-tipped, often resembling crescent spots. *B. vrijenhoeki* differs from *B. laubieri* by: G1 narrow, regularly curved, tapering (versus stout, not much curved, with a thick subdistal part and a long and pointed apex in *B. laubieri*); suborbital plate smooth, versus granulous in *B. laubieri*; ornamentation weakly granulous on the carapace and chelipeds (versus more marked in *B. laubieri*); male telson triangular, versus ovate in *B. laubieri*; female telson short, wide, and flattened distally (see ventral view below) versus subovate in *B. laubieri*; shape of chelae (palm stouter in *B. laubieri*); walking legs (shorter and thicker in *B. laubieri*, in particular thicker dactyli).

Biology: Lives in great density around the active edifices, co-occurring sympatrically with *B. laubieri* at 38°S, and with *Allograea tomentosa* at 31°S (although it was not observed during the American cruise PAR 5 in April 2005).

Distribution: Pacific-Antarctic Ridge: 31° to 38°S.



1: Male, width 42.3 mm, from 38°S, dorsal view; by P. Briand © Ifremer.



2: Pleopods G1 and G2 in situ; by D. Guinot.



3: Male, ventral view; by P. Briand © Ifremer.



4: Female, width 43.5 mm, from 38°S, ventral view; by P. Briand © Ifremer.

Reference:

GUINOT D. & L.A. HURTADO (2003) C. R. Biol., Paris **326**: 423- 439.

Arthropoda, Crustacea, Decapoda, Brachyura, Bythograeidae

Cyanagraea praedator DE SAINT LAURENT, 1984

Size: Female maximal 70 x 121 mm.

Morphology: Carapace dorsal surface glabrous (at least in large specimens) smooth, without transverse granulous rows. Only some coarse granules ventrally, under the orbit, and smaller ones along the proximal antero-lateral border. Suborbital plate absent. Eye-stalks mobile, short, located in clearly defined pockets and easily visible; cornea enlarged, brown colored. Internal border of merus of Mxp3 straight, without a lobe. Chelipeds very heavy, dimorphic; in the major chela, propodus strongly inflated; both chelae with surface smooth, without patches of hairs or setae. Fingers black. Walking legs with a short, soft tomentum along superior and inferior borders of meri

and propodi and on the whole surface of dactyli. G2 long, about the same length as G1.

Biology: Populations generally of low density, on the walls of black smokers. Frequently associated with Alvinellidae, which form part of their diet (stomach with numerous fragments of alvinellids and other polychaetes, and parts of young *Bythograea*). Megalopes collected and observed at the base of small chimney at 17°25'S (Oasis).

Distribution: East Pacific Rise: 21°N, 13°N, 14°S, 18°S; absent from Galapagos Spreading Center. The species is not recorded between 23°S and 38°S.



1: Female, dorsal view; by P. Briand © Ifremer.



2: Frontal view; by P. Briand © Ifremer.



3: Third maxilliped, scale bar 5 mm; from HESSLER & MARTIN (1989).

4: First and second pleopod, scale bar 1 mm; from HESSLER & MARTIN (1989).



5: Specimen in situ on an alvinellid colony; cruise Phare © Ifremer.



6: Specimen in situ on an alvinellid colony; cruise Phare © Ifremer.

References:

- HESSLER R.R. & J.W. MARTIN (1989) J. Crustac. Biol. **9**(4): 645-661.
GUINOT D. & M. SEGONZAC (1997) Zoosystema **19**(1): 117-145.
GUINOT D., HURTADO L.A. & R.C. VRIJENHOEK (2002) C. R. Biol. Paris **325**(11): 1143-1152.
SAINT LAURENT M. DE (1984) C. R. Acad. Sci., Paris **299**(9): 355-360.
SECRETAN S. & D. GUINOT (1988) Oceanol. Acta, n° sp. **8**: 119-124.

Arthropoda, Crustacea Decapoda Brachyura, Bythograeidae

Segonzacia mesatlantica (WILLIAMS, 1988)

Size: Male 22 x 39 mm, female 21 x 35 mm.

Morphology: Carapace depressed, without transverse granular rows; dorsal surface finely granulate anteriorly and laterally. Suborbital plate absent, but presence of a distinct area located ventrolateral to orbit, more or less developed, sometimes depressed, with special texture, generally purplish [“oval tan colored spot” of WILLIAMS (1988)]. Eye-stalks mobile, well visible but short, cylindrical, without enlargement of cornea. Internal border of merus of Mxp3 straight, without a strong lobe. Chelipeds subequal, short; sexual dimorphism not very pronounced;

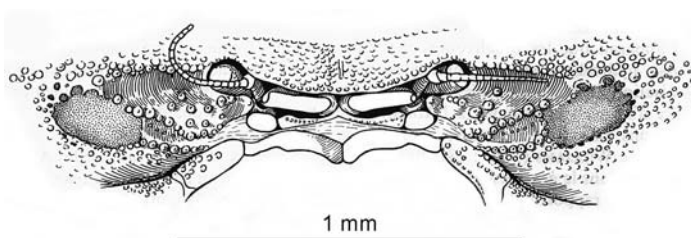
propodus glabrous in the male, with a pubescence along the inferior border in female. Walking legs rather long, each with dense patches of short setae on extensor surface of carpus and propodus and, more extensively, on dactyl. G2 long, with flagellum twisted in a tight spiral.

Biology: Populations of low density, on walls of black smokers. Necrophagous, feeding on mussels, dead shrimps and exuviae.

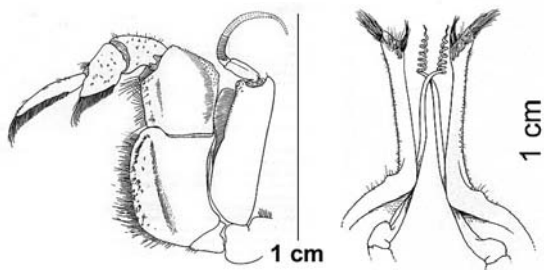
Distribution: Mid-Atlantic Ridge: TAG, Snake Pit, Logatchev, Rainbow, Lucky Strike and Menez Gwen.



1: Dorsal view; by P. Briand © Ifremer.



2: Frontal view; by D. Guinot.



3: Third maxilliped; by D. Guinot.

4: Pleopods in situ; by D. Guinot.



5: Specimen on a mussel bed of *Bathymodiolus puteoserpentis* at Snake Pit. Note the “oval tan colored spots” visible on the sides of the carapace are not eyes; by courtesy of C.L. Van Dover (cruise DiversExpedition).



6: Specimen at Menez Gwen mussel bed; cruise Atos © Ifremer.

References:

GUINOT D. (1989) Bull. Mus. Natl. Hist. Nat., Paris **11**(1): 203-231.
 GUINOT D. (1990) Bull. Mus. Natl. Hist. Nat., Paris **11**(4) [1989]: 879-903.
 HESSLER R.R. & J.M. MARTIN (1989) J. Crustac. Biol. **9**(4): 645-661.
 SEGONZAC M. (1992) C. R. Acad. Sci., Paris **314**: 593-600.
 WILLIAMS A.B. (1988) Fish. Bull. **86**(2): 263-286.

Arthropoda, Crustacea, Decapoda, Brachyura, Varunidae

Xenograpsus testudinatus NG, HUANG & HO, 2000 “varunine crab”

Size: 21.7 x 20.1 mm.

Color: Fresh specimens reddish to greyish-brown.

Morphology: Carapace quadrate, convex, glabrous. Eyes well-developed, base broad, cornea small, pigmented; peduncle short, stout. Third maxilliped broad, closing without gape, but not covering entire buccal cavity. Chelipeds short, stout, equal, similar to each other, outer surface of palm covered with thick granules, in addition to longitudinal rows of granules; inner surface of fingers deeply excavated; distal part with tufts of stiff setae. Ambulatory legs short, stout, with depressed granulated margins. Male abdomen triangular; telson triangular, widely elongated with rounded tip. Female abdomen rounded, large

covering most of sternum when mature. Male G1 stout, heavily calcified, bearing a subdistal outgrowth, distal pectinated marginal fringe covered with setae. G2 short, with rounded tip.

Biology: Common in high densities around shallow water hydrothermal vents, where it apparently is the only brachuran crab. *X. testudinatus*, is the first representative of the family Varunidae to be known from this environment. Opportunist feeder nourishing zooplankton (copepods) killed by sulphurous and highly acidic discharges of active chimneys (65-116°C).

Distribution: Okinawa Arc: Northeastern Taiwan, Tashi fishing grounds, 15 m depth.



1: In vivo specimen; by N.K. Ng.

References:

- JENG, M.-S., CLARK P.F. & P.K.L. NG (2004) Journal of Crustacean Biology **24**(1): 188-212.
JENG M.-S., NG N.K. & P.K.L. NG (2004) Nature **432**: 969.
NG N.K., HUANG J.F. & P.H. HO (2000) Nat. Taiwan Mus. Spec. Publ. Ser. **10**: 191-199.

Echinodermata, Crinozoa, Crinoidea, Cyrtocrinida, Hyocrinidae

Hyocrinus biscoitoi ROUX, 2004

Size: Stalk length reaching one meter, proximalmost stalk diameter 6.2 mm, arm length 25 cm, length of genital pinnules up to 45 mm.

Color: Bright yellow.

Morphology: Five arms with first pinnule on sixth brachial (Br6), after Br6 usually brachial pairs (sometimes three brachials) united by non muscular articulations; genital pinnules with a rigid proximal part of 14 ossicles and a gracile distal one tending to be rolled up; cover plates narrow; tegmen moderately inflated with numerous elongated plates and a small

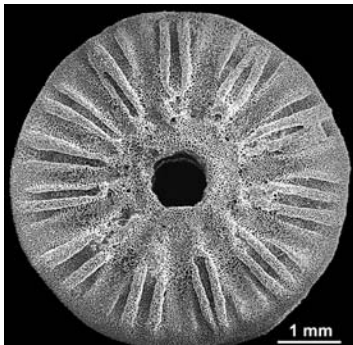
oral cone; anal cone relatively low in external position; radials wider than primibrachials, basals fused; proximal stalk with polygonal cross section and symplexial articulations showing 10 or 11 crenular units usually with two crenulae united in a tuning fork shape.

Biology: Suspension feeder nourishing zooplankton and filtering seawater without mineral particles off thermal vent area.

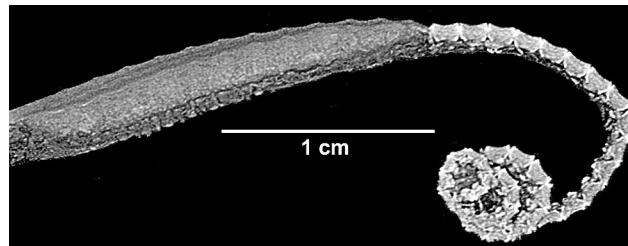
Distribution: East Pacific Rise: Southeastern Seamount, 12°42'N, 103°52'W, 2410 m; off vent sites.



1: Lateral view of theca; by courtesy of M. Roux.



3: Proximal stalk complex; by courtesy of M. Roux.



2: Genital pinnule; by courtesy of M. Roux.



4: Holotype in situ; cruise Hope 99 © Ifremer.

Reference:

Roux M. (2004) Pac. Sci. **58**(4): 597-613.

M. ROUX

Denisia 18 (2006): 475

Echinodermata, Crinozoa, Crinoidea, Cyrtocrinida, Hyocrinidae

Laubiericrinus pentagonalis ROUX, 2004

Size: Stalk length 70 cm, proximalmost stalk diameter 1.8 mm, arm length 10.5 cm, length of genital pinnules up to 37 mm.

Color: Bright yellow.

Morphology: Five arms with first pinnule on fifth brachial (Br5); genital pinnules with a rigid proximal part of eight ossicles; all pinnules tending to be rolled up in their flexible end; brachial pairs or isolated brachials constricted midway between their muscular joints; well-developed cylindrical anal tube and oral cone; oral cone higher than anal tube; each oral with one

finger-like projection; basal ring with three irregular sutures; proximal stalk with pentalobate to pentagonal cross section and symplexial articulations showing five crenular units of two to three crenulae; tallest columnals with deep irregular pits in areolar lobes.

Biology: Suspension feeder nourishing zooplankton and filtering water without mineral particles; off thermal vent area.

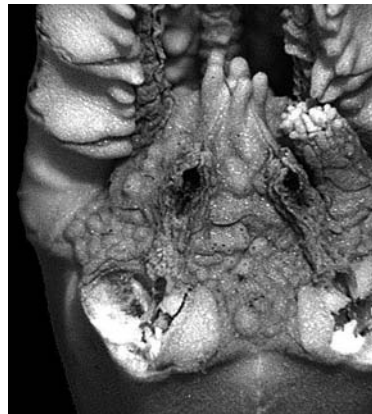
Distribution: South-western Pacific: North Fiji Back-Arc Basin; off vent sites.



1: Lateral view; by courtesy of M. Roux.



2: Aboral cup and proximal arms; by courtesy of M. Roux.



3: View of tegmen with two arms removed; by courtesy of M. Roux.



4: Imbricated cover plates of a genital pinnule; by courtesy of M. Roux.

Reference:

Roux M. (2004) Pac. Sci. **58**(4): 597-613.

M. ROUX

Denisia 18 (2006): 476

Echinodermata, Asteroidea, Neoasteroidea, Brisingida, Brisingidae

Brisinga endecacnemos ASBJØRNSSEN, 1856

Size: Diameter in the 2.8-3.0 cm range. Arm length \geq 33.0 cm in length.

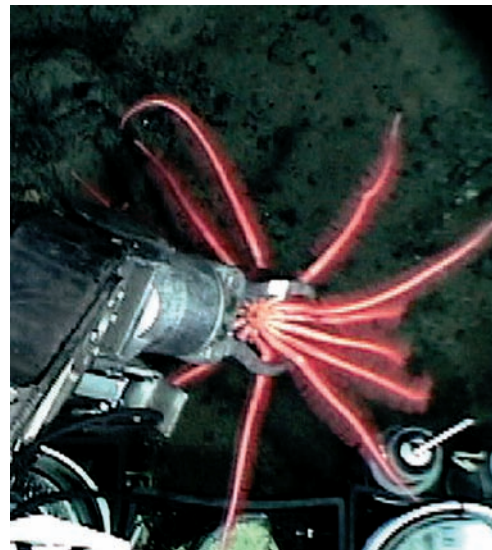
Color: "Splendid red".

Morphology: Arm number 9-12, but 10 on average. As with all members of the Brisingidae, arms with distinct reticulate ridges/costae on proximal gonad regions of arm. Papulae absent. Proximal adambulacral syzygies directly fused in adults. Gonads serial. Separated from other *Brisinga* spp. on the basis of having two oral and lateral mouth spines, a single suboral spine, spinelets in a single row on costal plate, single furrow spine, single subambulacral spine and "higher" (wider) than long adambulacral plates.

Remarks: This species was the first representative of the Brisingida discovered and was originally postulated to have been the evolutionary "link" between ophiuroids and asteroids (SARS 1875).

Biology: Suspension feeder, with its arms in extended posture. It produces eggs in clusters compared to others which produce eggs continuously.

Distribution: Norway, United Kingdom (Rockall Trough, Ireland), Portugal (Cape Verde area) to Mid-Atlantic Ridge: Logatchev.



1: In situ specimen collected at some meters of the active area of Logatchev; cruise DiversExpedition, 2001; by courtesy of C. Van Dover.

References:

- CLARK A.M. & C. MAH (2001) *Echinoderm Studies* **6**: 229-347.
CLARK A.M. & M.E. DOWNEY (1992) *Starfishes of the Atlantic*. Chapman and Hall, London: 1-794.
DOWNEY M.E. (1986) *Smithson. Contrib. Zool.* **435**: 1-57.
EMSON R.H. & C.M. YOUNG (1994) *Marine Biology* **118**: 433-442.
GAGE J.D., PEARSON M., CLARK A.M., PATERSON G.L.J. & P.A. TYLER (1983) *Bull. Br. Mus. Nat. Hist. (Zool.)* **45**(5): 263-308.
HOWELL K.L., POND D.W., BILLET D.S.M. & P.A. TYLER (2003) *Marine Ecology Progress Series* **255**: 193-206.
MAH C.L. (1998) in MOOI R., & M. TELFORD (Eds.) *Proc. 9th Intern. Echinoderm Conf.*, San Francisco, CA. A.A. Balkema, Rotterdam: 273-277.

Echinodermata, Asteroidea, Neoasteroidea, Brisingida, Freyellidae

Freyella PERRIER, 1885

Size: General range: Disk diameter in adults: 1-3.2 cm, arms in adults up to >20.0 cm.

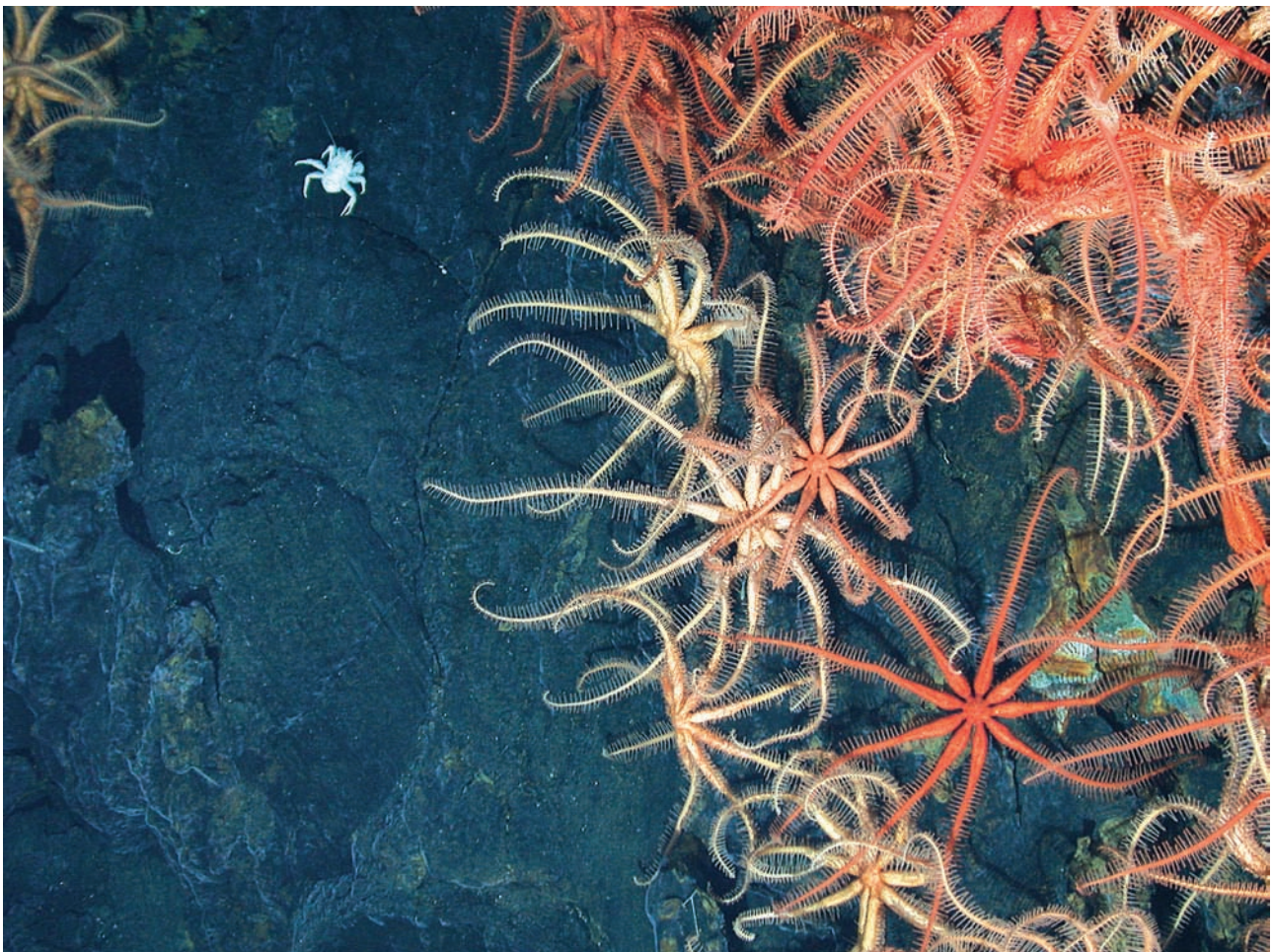
Color: Orange red or white (*F. elegans* from Atlantic).

Morphology: Brisingidans with tesellate plates over abactinal arm surface, continuous with disk plates. Proximal syzygies (basal adambulacrals) articulated with tissue and not directly fused. Papulae absent. Arms number varies from six to 15. Interradial arcs gently curved.

Biology: Suspension feeding is the observed feeding mode in all brisingidans, but there are likely taxon-specific adjustments to

flow regime and local feeding environment for different brisingidan taxa. Specimens generally isolated in abyssal environment, but often in large density on dead chimneys mainly in vent areas of Pacific mid-oceanic ridges; fewer at the Mid-Atlantic Ridge. Although observed on dead vent chimneys, most species of *Freyella* have been collected from abyssal soft-bottom sediments.

Distribution: East Pacific Rise: 13°N; Pacific-Antarctic Rise; Western Pacific: Lau and N-Fiji Back-Arc Basins. Distribution of this genus is worldwide, 1200-6860 m.



1: Numerous *Freyella* sp. specimens with a galatheid crab; from Lau Basin, site Tui Malila, 1887 m, cruise TUIM07; by courtesy of C. Fisher.

References:

CLARK A.M. & MAH C. (2001) Echinoderm Studies **6**: 229-347.

DOWNEY M.E. (1986) Smithson. Contrib. Zool. **435**: 1-57.

MAH C.L. (1998) in MOOI R. & M. TELFORD (Eds.) Proc. 9th Intern. Echinoderm Conf., San Francisco, CA. A.A. Balkema, Rotterdam: 273-277.

NAAR D.F., HEKINIEN R., SEGONZAC M., FRANCHETEAU J. & the Pito Dive Team (2004) Am. Geophys. Union, Geophys. Monogr. Series **148**: 305-318.

Echinus alexandri DANIELSSEN & KOREN, 1883

Size: Diameter, 65 mm; height, 32 mm; primary spines until 50 mm.

Morphology: Regular sea urchin. The shape of the test is flattened on both sides, but more at the oral side. The mouth is provided with five strong teeth, the so called "Aristotle's Lantern", whose epiphyses are particularly large in the specimen observed. The primary tubercles of the interambulacral plates are conspicuous and form 10 regular vertical rows. Near the peristome the tubercles and spines are smaller. The long slender spines are striated and of smaller size at the oral side. Small globispherous pedicellariae are found mainly near the mouth. Large tridentate pedicellariae are numerous with very broad leaf shaped valves more or less indented at the extremity.

Remarks: Specimens of an *Echinus* species were discovered for the first time in the eastern Pacific, on basalt seafloor at some

tens of meters off vent sites (Southern East Pacific Rise: 38°S, 2200 m depth), during the Easter Microplate Expedition (PAR 5) in April 2005 (<http://www.mbari.org/expeditions/eastermicroplate/>). Four pale pink urchins around 3 cm in diameter were collected. First examinations of these individuals indicate that they belong to the genus *Echinus* (E. Ramirez-Llodra & P. Tyler, unpublished data).

Biology: The presence of mud in the mouth indicates deposit feeding behavior. Development seems to be through a pelagic larval stage.

Distribution: Northeast Atlantic from depths ranging from 230-3150 m; Mid-Atlantic Ridge: Lucky Strike. Not endemic; a small population has been observed in Lucky Strike in 1997 but never since this time.



1: Living specimen from Lucky Strike; by P. Briand © Ifremer.



2: Valve of ophiocephalous pedicellaria (SEM) © Ifremer.



3: Various kind of pedicellariae (SEM) © Ifremer.



4: Various kind of pedicellariae (SEM) © Ifremer.

References:

- MORTENSEN T. (1903) The Danish Ingolf-Expedition 4(1): 100, 146, Pl. V, XV, XVI, XVIII-XXI.
MORTENSEN T. (1943) A Monograph of the Echinoidea III(3): Camarodonta II. C.A. Reitzel, Copenhagen: 65-68.

Chiridota hydrothermica SMIRNOV & GEBRUK, 2000

Size: Slender, worm-like holothurians, reaching 26 cm in length when alive.

Diagnosis: Circumoral tentacles 12, large, lobe-like, formed by fused processes exceeding 20 in number (up to 30). Pieces of calcareous ring have deep posterior depression, except for interradial mediodorsal one. Dorsal, ventral and apparently medioventral radial pieces without perforations. The only type of spicules in the body integument are wheels, from 66-202 μm diameter, aggregated into numerous papillae of various size spread over the body in the interradials. Tentacle spicules are rods, from 140-250 μm long, branching at the ends. Polian vesicles slender, exceeding 20 in number. Ciliated funnels rare. Intestine looped.

Biology: The species is restricted to hot vent habitats. Holothurians often occur on rocks, with the posterior end hid-

den in a crack, and the body stretched into the water and tentacles open, implying suspension feeding. On the South EPR, holothurians frequently occur among mussel clumps near the base of chimneys, where venting fluids are leaky, as well as among 'old' barnacle fields and clumps of barnacles on chimney edifices with little to no venting. *C. hydrothermica* is apparently opportunistic, able to switch between suspension and deposit feeding.

Distribution: Manus and North Fiji Back-Arc Basins, also Southern East Pacific Rise: 17-21°S. In the Manus Basin *C. hydrothermica* is most abundant at the periphery of active vent zones, among aggregations of dead gastropods, *Alviniconcha* and *Ifremeria*, and barnacles *Eochionelasmus ohtai*. Holothurian density on average is 2-3 m^{-2} , but it may reach 30 m^{-2} , and holothurians often form clusters of up to 6-8 individuals.



1: Specimens among a *Calyptogena magnifica* clump at East Pacific Rise: 17°S; cruise Biospeedo © Ifremer.



2: Specimen on a sulphide edifice in the Lau Back-Arc Basin by courtesy of C.R. Fisher, TU-IM07.



3: Wheel shaped spicules (SEM) © Ifremer.



4: Wheel shaped spicules (SEM) © Ifremer.

References:

- DESBRUYÈRES D: ALAYSE-DANET A.M., OHTA S. & the Scientific Parties of Biolau and Starmer Cruises (1994) Mar. Geol. **116**: 227-242.
GALKIN S.V. (1997) Mar. Geol. **142**: 197-206.
SMIRNOV A.V., GEBRUK A.V., GALKIN S.V. & T. SHANK (2000) J. Mar. Biol. Ass. U.K. **80**: 321-328.

Echinodermata, Ophiuroidea

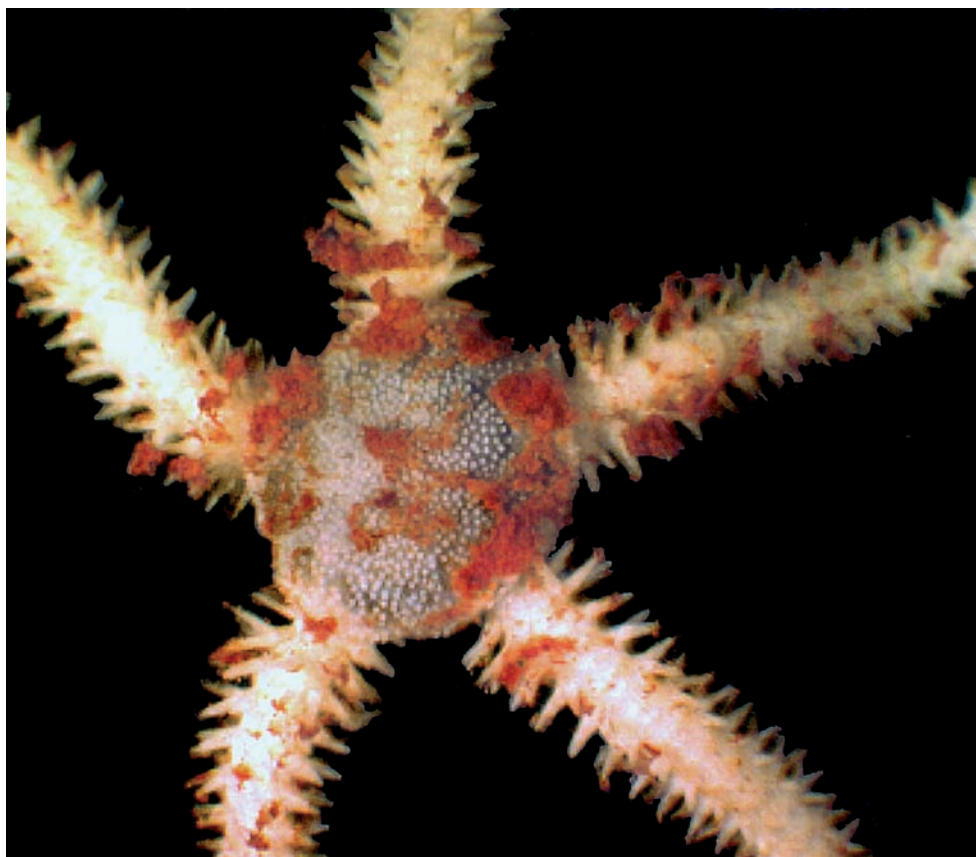
Currently, six genera and species of ophiuroids have been recognized in hydrothermal communities, two in the Pacific and the remaining in the Atlantic Ocean. This makes the ophiuroids one of the smallest groups of vent animals, but the most species-rich group of echinoderms. The first ophiuroid species was described only 10 years ago and recent work suggests that the group is more common and species-rich than previously thought. Two of the presently recorded species are considered “endemic” to the deep-sea hydrothermal vent environment, one is shared with methane cold seeps, one is only known from a depleted vent environment and may not be “endemic”, while the remaining two are “regular” deep-sea species.

It is important to bear in mind that the ophiuroid deep-sea fauna is only incompletely known and many species are only reported from a single or a few individuals. For the identification of ophiuroids the ontogenetic stage is of great importance, since morphological identification is based almost exclusively on skeletal characters, which change greatly in number and shape during growth. Therefore, whenever possible, size series from the smallest juveniles to the largest adults should be collected.

In contrast to better studied groups such as molluscs and polychaetes, reproduction and dispersal mechanisms of ophiuroids are largely unknown. The geographical distribution of most species of vent ophiuroids is unknown. Sibling species may be present in morphologically identical species with wide distribution, but have not yet been identified. New records of previously described species from new locations are important for answering these questions.

Many ophiuroids have a cryptic life-style and may be difficult to collect with standard sampling methods. Most of the currently recognized species live on mussel beds or colonies of tubeworms, some probably hiding in crevices among shells and tubes. They may wedge themselves into small cracks, are then difficult to detect and often impossible to extract in situ. Techniques collecting whole blocks of bottom substrate or mussel beds may need to be employed. Ophiuroids tend to shed their arms when stressed and should be handled with care. Small specimens may be placed directly in ethanol, but larger specimens are ideally killed by placing them in brackish water (50:50 fresh- and saltwater) or freshwater, until all movement

has stopped. This usually takes only a few minutes. The animals then need to be transferred to ethanol immediately to prevent osmotic swelling of the epidermis. Samples should preferably be preserved in 80-96% ethanol to allow molecular analysis. For morphological work ethanol preserved material can be used, but ophiuroids may also be preserved in 4% formalin, which needs to be buffered e.g. with a teaspoon of borax per liter to protect the calcareous skeleton. After no more than 24 hours the animals should be transferred to 80% ethanol for long term storage. As with any work where species identification is involved, voucher specimens should be deposited in a recognized natural history museum collection.



1: *Ophiolamina eprae* from East Pacific Rise: 13°N; by P. Briand © Ifremer.

Ophiactis tyleri STÖHR & SEGONZAC, 2005

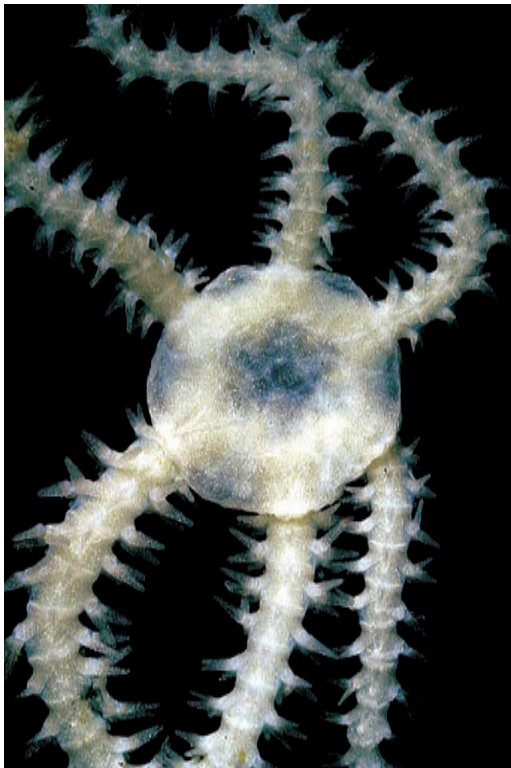
Size: Only two specimens known, disk diameter 2.1 mm and 1.4 mm. Maximum size probably larger.

Color: In alcohol cream-white.

Morphology: Round spineless disk, covered with overlapping scales; length of radial shields about 1/4 of disk diameter. Six arms, bearing three spines near disk, two further out, ventral distal spine slightly hook-shaped. Dorsal arm plates triangular; single oval mouth papilla similar to single tentacle scale. Tricuspid teeth.

Biology: Little known. Occurs in both non-hydrothermal and hydrothermal conditions at the shallowest Mid-Atlantic vent site. Has not been found elsewhere. Asexual reproduction through fission.

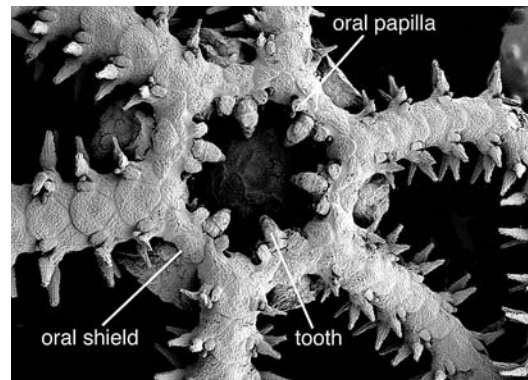
Distribution: Mid-Atlantic Ridge: segment 38°N and at Menez Gwen hydrothermal vent.



1: Dorsal view.



2: Ventral view.



3: Ventral aspect (SEM). 1-3: by courtesy of S. Stöhr.

Reference:

STÖHR S. & M. SEGONZAC (2005) J. Mar. Biol. Ass. UK **85**: 383-402.

Ophioctenella acies TYLER et al., 1995

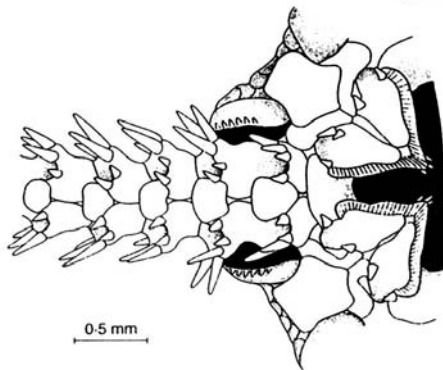
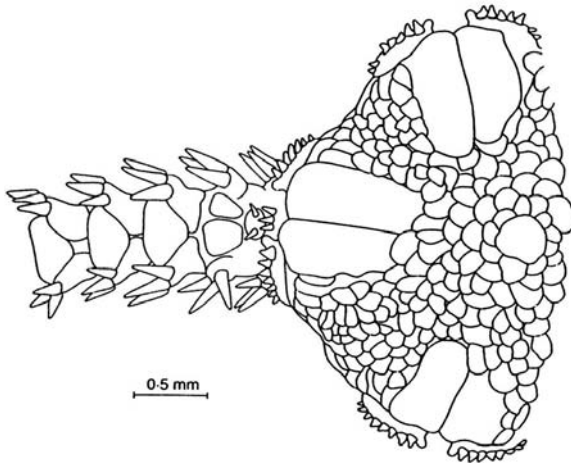
Size: Disk diameter up to 5 mm.

Color: Pinkish to light orange on disk, cream to light orange on arms.

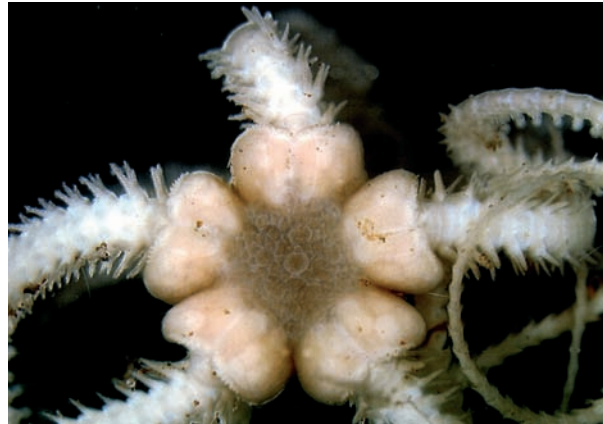
Morphology: Disk strongly indented interradially; length of radial shields about 1/4 disk diameter, contiguous for most of length; 3-4 arm spines. Jaws lined with long plate-like structure with a sharp outer edge giving the jaw an arrow-head appearance. Teeth long, sharply pointed structures with two or three on each jaw; dorsal arm plate with a distinctive proximal notch.

Biology: Occurs within several meters of active black smokers and diffusers mainly on blocks of sulphide from collapsed chimneys; abundant on beds of mytilid bivalves *Bathymodiolus* spp. Appears restricted to depths below 1600 m, most abundant below 3000 m. Also abundant on Northwest Atlantic cold seeps with similar depth preference. Post-larval structures suggest planktonic development. Affinity to *Bathymodiolus* suggests that these ophiuroids may utilize the rich organic food source provided by the mussel pseudofeces.

Distribution: MAR, at all hydrothermal vent sites except Menez Gwen; 1626-3650 m. Occurs also at Northwest Atlantic methane cold seeps (South Barbados).



1: Drawings of an adult (top, dorsal; bottom ventral) by courtesy of P. Tyler © NOC-UoS.



2: In vivo by P. Briand © Ifremer.



3: Ventral view (preserved specimen) by courtesy of S. Stöhr.

References:

- STÖHR S. & M. SEGONZAC (2005) *J. Mar. Biol. Ass. UK* **85**: 383-402.
TURNIPSEED M., JENKINS C.D. & C.L. DOVER (2004) *Mar. Biol.* **145**: 121-132.
TYLER P.A., PATERSON G.J.L., SIBUET M., GUILLE A., MURTON B.J. & M. SEGONZAC (1995) *J. Mar. Biol. Ass. UK* **75**: 977-986.

Spinophiura jolliveti STÖHR & SEGONZAC, 2006

Size: Disk diameter up to 10 mm, arm length up to 50 mm.

Color: Beige to cream.

Morphology: Rapidly tapering, whip-like, curled arms. Dorsal disk spineless, covered with round, overlapping scales; length of radial shields about 1/6 of disk diameter, separated almost entirely by a wedge-like plate; arm comb continuous across arm base. 5 arm spines, longer than an arm joint, rough on proximal joints, thorny on distal joints. Spine-like mouth papillae, 10-14 to each side of a jaw; first tentacle pore bears 1-3 spines. Up to seven spine-like tentacle scales. Length of oral shield 1/3 of ventral disk length; madreporite larger with lateral pore.

Biology: Occurs in hydrothermal conditions, associated with mytilid bivalves *Bathymodiolus thermophilus* and siboglinid tube-worm *Riftia pachyptila*, rarely with vesicomid clams *Calyptogena magnifica*; sometimes sympatric with *Ophiolamina eprae* (East Pacific Rise: 17°S, sites Rehu, Animal Farm). Has been found on dead and dying mussel and worm communities, which suggests that this ophiuroid may be necrophagous. Post-larval structures suggest planktotrophic development.

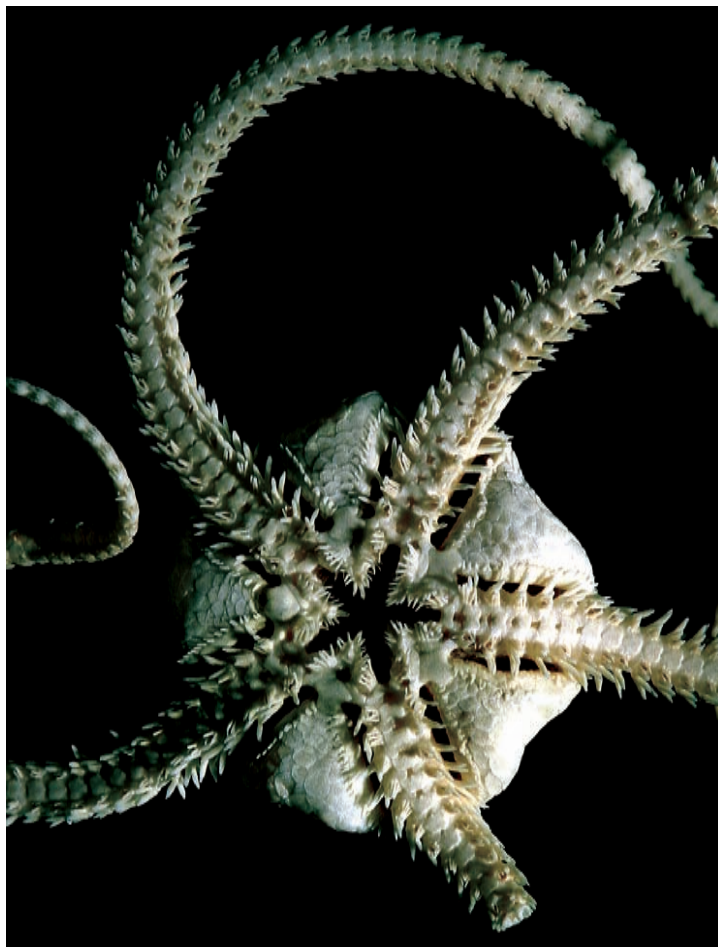
Distribution: East Pacific Rise: 13-9°N, 17-18°S, and 38°S.



1: Holotype ventral (dried); by courtesy of S. Stöhr.



2: Specimens in vivo on mytilid bed of *Bathymodiolus thermophilus*; cruise Phare © Ifremer.



3: Holotype dorsal (dried); by courtesy of S. Stöhr.

Reference:

STÖHR S. & M. SEGONZAC (2006) Species Diversity **11**: 7-32.

Echinodermata, Ophiuroidea, Ophiurida, Ophiacanthidae

Ophiolamina eprae STÖHR & SEGONZAC, 2006

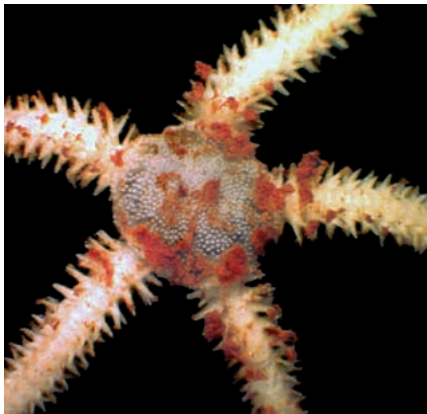
Size: Disk diameter up to 3.7 mm, arms about 15 mm long.

Color: Light pinkish orange to cream, often covered with orange particles.

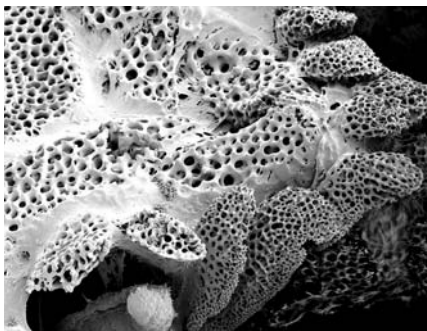
Morphology: Dorsal disk covered with low thorny granules, which obscure the disk scales; round radial shields, about 1/5 of disk diameter long, covered with granules. five lateral mouth papillae, the proximal three lamella-like, slanting vertically, the distal two flat, oval. Oral shield wider than long, its distal edge bears granules; madreporite larger, with lateral pore. Up to five conical, erect arm spines, as long as an arm joint; single large, oval tentacle scale.

Biology: Occurs in hydrothermal sediment and warm fluid emissions, associated with mytilid mussels *Bathymodiolus thermophilus* and siboglinid tubeworm *Riftia pachyptila*; sometimes sympatric with *Spinophiura jolliveti* (East Pacific Rise: 17°S, sites Rehu, Animal Farm). Collecting results suggest a cryptic life-style. Most abundant in a dying mussel community, suggesting a necrophagous habit.

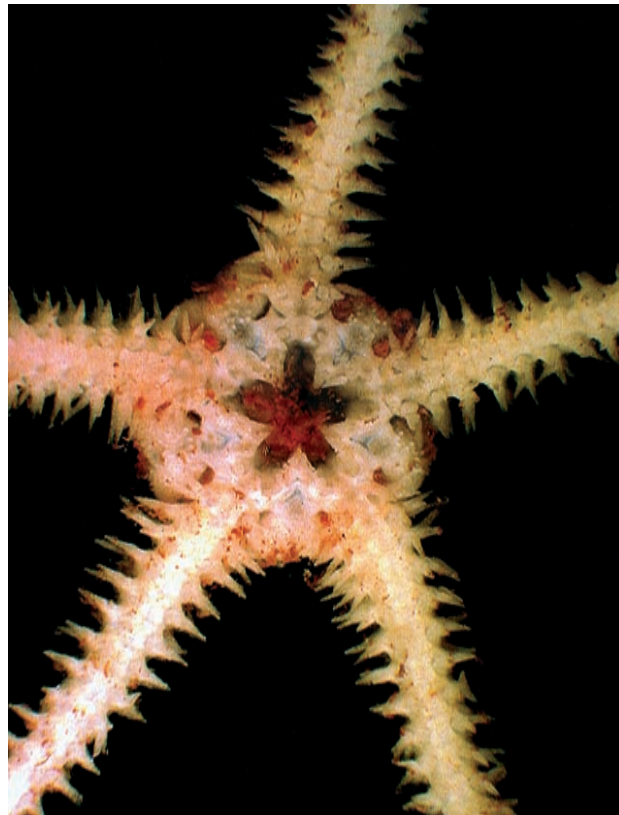
Distribution: East Pacific Rise: 9°N, East Wall; 13°N, 17-18°S, Oasis, Animal Farm, Rehu.



1: Specimen in vivo, dorsal view; by P. Briand © Ifremer.



2: Mouth papillae (SEM); by courtesy of S. Stöhr.



3: Specimen in vivo, ventral view; by P. Briand © Ifremer.

Reference:

STÖHR S. & M. SEGONZAC (2006) *Species Diversity* **11**: 7-32.

S. STÖHR & M. SEGONZAC

Denisia 18 (2006): 485

Calispadella alata CASANOVA & MOREAU, 2005

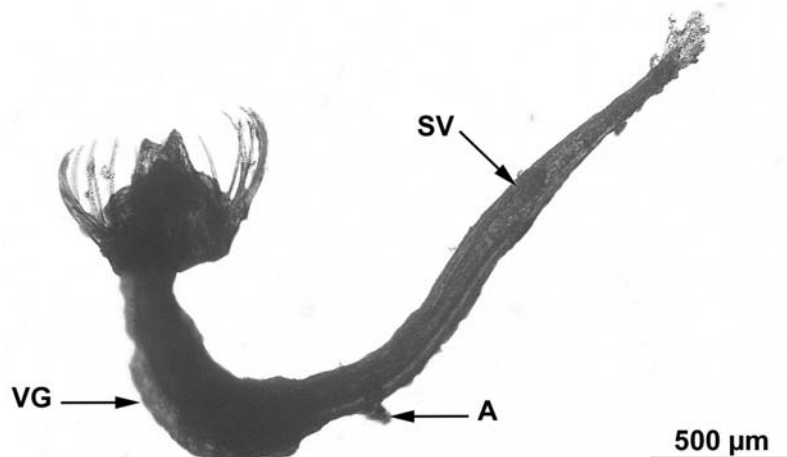
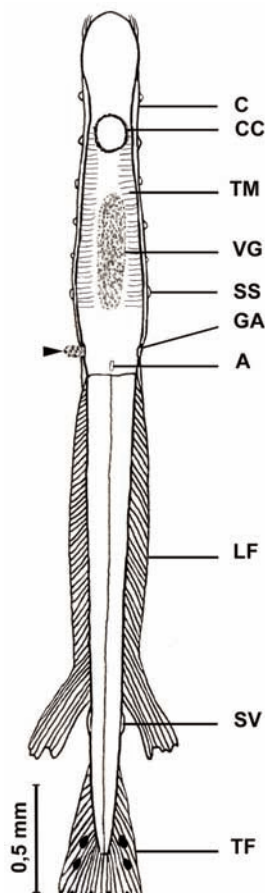
Size: 3.95 mm.

Morphology: Body very elongated and rigid. Tail segment 57% of the total body length. Head rather elongated. Hooks, 12/13, gently curved and clear amber colored. Anterior teeth, 2/1, long and thin. Posterior teeth absent. Vestibular organs rounded, scattered with prominent blunt spines. Eyes absent. Corona ciliata located on the neck, small and perfectly rounded. Collarette thin on the whole body, but more marked in the neck region, with many sensory spots. Ventral ganglion well developed, prominent, representing ~ 43% of the trunk length. One pair of lateral fins, beginning at the level of the trunk-tail trans-

verse septum, ending as two free wing-like extensions, themselves ending abruptly into festoons provided with some patches of adhesive cells on their edges. Caudal fin spatulate. All fins rayed throughout and scattered with sensory spots. Transverse musculature in trunk, reaching the level of the posterior edge of the ventral ganglion. Seminal vesicles well apart from the lateral fins and perhaps in contact with tail fin when mature.

Biology: Probably attached to rocks or other solid objects.

Distribution: Mid-Atlantic Ridge: Lucky Strike, site Sintra.



2: Paratype (juvenile). A – anus; SV – seminal vesicle; VG – ventral ganglion; from CASANOVA & MOREAU (2005).

1: Habitus, dorsal view. TM – transverse musculature; VG – ventral ganglion; A – anus, supposed to be seen by transparency; note the mass of spermatozoa (arrow-head) plugging the left female genital aperture (GA). C – collarette; CC – corona ciliata; LF – lateral fins; SS – sensory spots; SV – seminal vesicles; TF – tail fin; from CASANOVA & MOREAU (2005).

Reference:

CASANOVA J.-P. & X. MOREAU (2005) J. Plankton Res. **27**(2): 221-225.

Hemichordata, Enteropneusta, Saxipendiidae

Saxipendium coronatum WOODWICK & SENSENBAUGH, 1985 “spaghetti worm”

Size: None of the specimens was complete. The preserved specimens are in tortuous coils wrapped upon themselves.

Color: Yellow-white. The proboscis is the lightest shade and the anterior part of the collaris the darkest. The posterior raised ring of the collaris very light.

Morphology: The proboscis is softly pointed anteriorly and enlarges posteriorly to produce an arrow shape. A narrow peduncle joins the proboscis to the collar. The cuff-like collar is as wide as the proboscis but it is very short. It has a definite raised ring just anterior to the juncture of the trunk. Anteriorly the trunk is the same width as the collar but is reduced slightly in overall dimensions in succeeding regions. The branchial region is more rounded in cross section than the posterior regions which are slightly flattened and have a median longitudinal de-

pression with raised lateral ridges. These ridges have undulations produced by the varied size of the individual gonads in the two longitudinal rows. The gill pores are not readily visible but the raised gonopores are.

Biology: According to CAMERON (2002), *Saxipendium*, which lives on rocky outcrops and extend its proboscis in the water columns, seems to be a good candidate for filter feeding. The sperm of *Saxipendium* and the small eggs found in the female suggest non-specialized external fertilization and embryology leading to a planktotrophic larva.

Distribution: This worm is found inside the graben out of active vents. It was described from Galapagos Spreading Center but was also observed on the East Pacific Rise from 21°N to 17°S and the Pacific-Antarctic Ridge: 38°S.



1: Population in situ;
by courtesy of R. Lutz.



2: Close up of the anterior part of the worm; by courtesy of R. Lutz.



3: Close up of the anterior part of the worm, ventral view.
Cruise PAR 5 (Easter Microplate);
by courtesy of R. Vrijenhoek.

References:

- CAMERON C.B. (2002) Biol. Bull. **202**: 192-200.
FRANZÉN A., WOODWICK K.H. & T. SENSENBAUGH (1985) Zoomorphology **105**(5): 302-307.
WOODWICK K.H. & T. SENSENBAUGH (1985) Proc. Biol. Soc. Wash. **98**(2): 351-365.

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