

NEW SPECIES OF SCALE-WORMS
(POLYCHAETA: POLYNOIDAE) FROM THE
HYDROTHERMAL RIFT-AREA OF THE
MARIANA BACK-ARC BASIN IN THE
WESTERN CENTRAL PACIFIC

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Abstract.—Polynoid polychaetes collected by the Mariana Back-Arc Basin Expedition in the western Central Pacific in 1987 are described. They include four new species belonging to three subfamilies and four genera of Polynoidae: Macellicephalinae: *Levensteiniella raisae*; Lepidonotopodiinae: *Lepidonotopodium minutum*; and Branchinotogluminae: *Branchinotogluma burkensis* and *Opisthotrochopodus marianus*. Included also is a brief summary of the subfamilies, genera, and species associated with deep-sea hydrothermal vents, deep seep-sites, trenches, abyssal basins, experimental deep wood panels, and caves.

In her revision of the genera and species that had been grouped in Macellicephalinae Hartmann-Schröder, 1971, containing mostly abyssal species, Pettibone (1976) separated Macellicephalinae and five additional subfamilies: Macellicephaloidinae (four species), Macelloidinae, Bathyedithinae, Polaruschakovinae (two species), and Bathymacellinae. In the remaining Macellicephalinae, in addition to *Macellicephalina* (seven species), six new genera were added: *Bathykermadeca*, *Bathyeliasona* (three species), *Bathyvitiazia*, *Bathyfauvelia*, *Bathycatalina*, and *Bathykurila*.

Subsequently, additional new subfamilies, genera, and species have been added. Pettibone (1979) emended and added to Macellicephalinae *Bruunilla natalensis* (Hartman, 1971). Levenstein (1975) added two new species of *Macellicephalina* from the deep-sea trenches in the Antarctic: *M. tricornis* and *M. grandelytris*. The latter species was later transferred to *Bathyfauvelia* by Levenstein (1978a:77). Levenstein (1975) also added the new species *Macellicephaloides sandwichensis*. Levenstein (1978b) added the new species *Macellicephalina alia* from the Palau trench and the new genus

Bathymariana for *B. zebra* from the Ryuku trench. The latter genus was placed in Bathyedithinae by Levenstein (1984).

From the deep Canadian basin in the Arctic Ocean, Levenstein (1981) added the new genus *Bathypolaria* for *B. carinata* in Macellicephalinae; the new species *Bathyedithia tuberculata* in Bathyedithinae; and the new genera *Bathymiranda* for *B. microcephala* and *Bathycanadia* for *B. diaphana* in Polaruschakovinae. In the same subfamily, Loshamn (1981) added the new genus *Diplaconotum* for *D. paucidentatum* (Eliason, 1962) from the Skagerrak.

From the Japanese trench, Levenstein (1982a) added a new species of *Macellicephaloides*, *M. villosa*. From the Tasman trench, Levenstein (1982b) included a key to the genera of Macellicephalinae and added two new genera: *Bathytasmania* for *B. insolita*, and *Bathynotalia* for *B. perplexa*. The latter genus and species were referred to Harmothoinae by Pettibone (1985a:130), based on the figure of the prostomium showing long lateral antennae (not mentioned in the text): the prostomium is harmothoid, with cephalic peaks; prostomial lateral antennae are lacking in Macelli-

cephalinae. From the Kurile-Kamchatka trench, Levenstein (1983) added a new species of *Macellicephaloides*, *M. improvisa*, and included a key to the seven species of the genus.

Levenstein (1984) summarized the distributional patterns for the 19 genera and 38 species of polynoid polychaetes belonging to the six deep-sea subfamilies covered in Pettibone (1976), along with the additional genera and species indicated above. They were widely distributed on the abyssal plains and in the deep-sea trenches. The Macellicephalinae had the greatest number of genera (10) and species (21). Three subfamilies were represented by fewer genera and species: Macellicephaloidinae (one genus, seven species), Bathyedithinae (two genera, three species), and Polaruschakovinae (four genera, five species). Two subfamilies were monotypic: Macelloidinae and Bathymacellinae. These groups were defined as ancient or primary abyssal because all the representatives lived only in abyssal depths except for a few that ascended secondarily. Members of the Macellicephalinae showed the greatest vertical range and panoceanic distributions, mostly in the Northern Hemisphere. This group appeared to be the most ancient of the abyssal polynoids.

Since the summary of the group by Levenstein (1984), additional new subfamilies, genera, and species have been added, chiefly in connections with studies on the hydrothermal vents in the northeastern Pacific, deep seep-sites in the Gulf of Mexico, and deep wood panel and cave studies in the northwestern Atlantic.

From the hydrothermal rift-area off western Mexico at 21°N, Pettibone (1983) added the new subfamily Lepidonotopodiinae for *Lepidonotopodium fimbriatum*. From the Galapagos vent, the new subfamily Branchipolynoinae for *Branchipolynoe symmytilida*, commensal with the deep-sea mussel, was added by Pettibone (1984a). Also from the vents, Pettibone (1984b) added two new

species of *Lepidonotopodium*: *L. riftense* and *L. williamsae* and included a key to the species of the genus.

From the North Atlantic, Pettibone (1985a) added to Macellicephalinae two new genera: *Pelagomacellicephala* for *P. iliffei*, from a cave in the Bahamas, and *Bathybahamas* for *B. charleneae* from off the Bahamas, associated with experimental wood panels, and a new species of *Bathykerma-deca*, *B. turnerae*, from off the Virgin Islands, also associated with wood panels.

Pettibone (1985b) added the new subfamily Branchiplicatinae for *Branchiplicatus cupreus* from the vents off western Mexico at 21°N. From the vents off the Galapagos and western Mexico, Pettibone (1985c) added the third new subfamily having arborescent branchiae, Branchinotogluminae for two new genera: *Branchinotogluma*, with three new species: *B. hessleri*, *B. sandersi*, and *B. grasslei*; and *Opisthotrochopodus* for *O. alvinus*. A key to the three branchiate subfamilies was included.

Pettibone (1985d) added to Macellicephalinae the new genus *Levensteiniella* for *L. kincaidi*, and the new species *Macellicephala galapagensis* from the Galapagos, and from the Santa Catalina Channel, the new genus *Natopolynoe* for *N. kensmithi*. Included also was a summary of the polynoid polychaetes collected by DSRV *Alvin* in the Galapagos Rift in 1979 and East Pacific Rise at 21°N in 1982, along with a key to the subfamilies, genera, and species.

From the deep seep-sites at the Florida escarpment in the Gulf of Mexico, Pettibone (1986) added a new species of *Branchipolynoe*, *B. seepensis*, commensal in the mantle cavities of the Gulf of Mexico mussels, along with a key to the two species of the genus.

From the hydrothermal vents in the Northeast Pacific Explorer and Juan de Fuca Ridges, Pettibone (1988) added two new species: *Lepidonotopodium piscisae* in the Lepidonotopodiinae, and *Opisthotrochopodus tunnicliffae* in Branchinotogluminae.

A new species of *Macellicephala* from the Antarctic, *M. australis*, was added by Wu and Wang (1987).

Thus to the summary by Levenstein (1984), four new subfamilies have been added (total 10), nine new genera (total 28), and 20 new species (total 58). Four of the new genera were added to Macellicephalinae (total 14) and seven new species (total 28). Two of the new species were referred to *Macellicephala*, one to *Bathykermadeca*.

Additional polynoids were collected by the Mariana Back-Arc Basin Expedition during April and May 1987, where active hydrothermal vents were found in the western Pacific off the Mariana Islands about 18°N and 144°E. The polynoid polychaetes were collected during dives of DSRV *Alvin* and sent to me for study by Robert Hessler, along with information on the collecting sites. Four species of polynoids were collected on two *Alvin* dives: dive 1836, referred to as Snail Pits in Burke Field (1 species), and dive 1843, designated as Alice Springs (3 species). The polynoids agree with some of the subfamilies and genera that were previously described from the hydrothermal vents in the eastern Pacific.

Burke Field (*Alvin* dive 1836, 27 Apr, 18°10.9'N, 144°43.2'E, 3660 m) was an extensive area of low temperature vents at the southern end of an active spreading zone and dominated by pillow basalts. The Snail Pits vent had a water temperature of 15°C, with small, dense aggregations of "hairy" snails that clogged the vent openings. The hot vent water was crystal clear. The single polynoid collected is described below under Branchinotogluminae: *Branchinotogluma burkensis*, new species.

Alice Springs (*Alvin* dive 1843, 4 May, 18°12.6'N, 144°42.4'E, 3640 m) was an extensive area dominated by pillow basalts with sharp cliffs up to 40 m high. Some low temperature vent sites (10–25°C) were characterized by cloudy, particle-filled water and dense concentrations of white anemones. Some high temperature vents (up to 250°C)

had dense aggregations of "hairy" snails, crabs, and shrimps, with emerging crystal clear water. The three species of polynoids collected are described below under three subfamilies: Macellicephalinae: *Levensteiniella raisae*, new species (1 specimen); Lepidonotopodinae: *Lepidonotopodium minutum*, new species (9 specimens); and Branchinotogluminae: *Opisthotrochopodus marianus*, new species (12 specimens).

The types are deposited in the National Museum of Natural History, Smithsonian Institution (USNM).

Subfamily Macellicephalinae
Hartmann-Schröder, 1971
emended Pettibone, 1976
Levensteiniella Pettibone, 1985

Levensteiniella was erected for the single species *L. kincaidi* from off western Mexico at 21°N and the Galapagos Rift (Pettibone 1985d:741). An additional species is added from the Mariana Back-Arc Basin.

Levensteiniella raisae, new species
Figs. 1, 2

Material examined.—Western Central Pacific in Mariana Back-Arc Basin, *Alvin* dive 1843, 4 May 1987, Alice Springs, 18°12.6'N, 144°42.4'E, 3640 m, R. Hessler, collector, holotype (USNM 118362).

Description.—Length of holotype 21 mm, width 11 mm with setae, segments 27, last one very small (Fig. 1D). Body flattened, tapering anteriorly and more so posteriorly, with parapodia about as long as body width. Elytra 11 pairs, on segments 2, 4, 5, 7, continuing on alternate segments to 21, large, covering dorsum, oval to subreniform; most of surface covered with unusual type of macro- and micro-tubercle-papillae, with chitinous bases and bulbous papillar tips, larger ones on posterior border; bases covered with brownish foreign material and bacterial "hairs" (Fig. 1G). Elytrophores large and prominent (Figs. 1A, C, 2A, D). Dorsal cirri on segments lacking elytra, with cylindrical cirrophores on posterodorsal

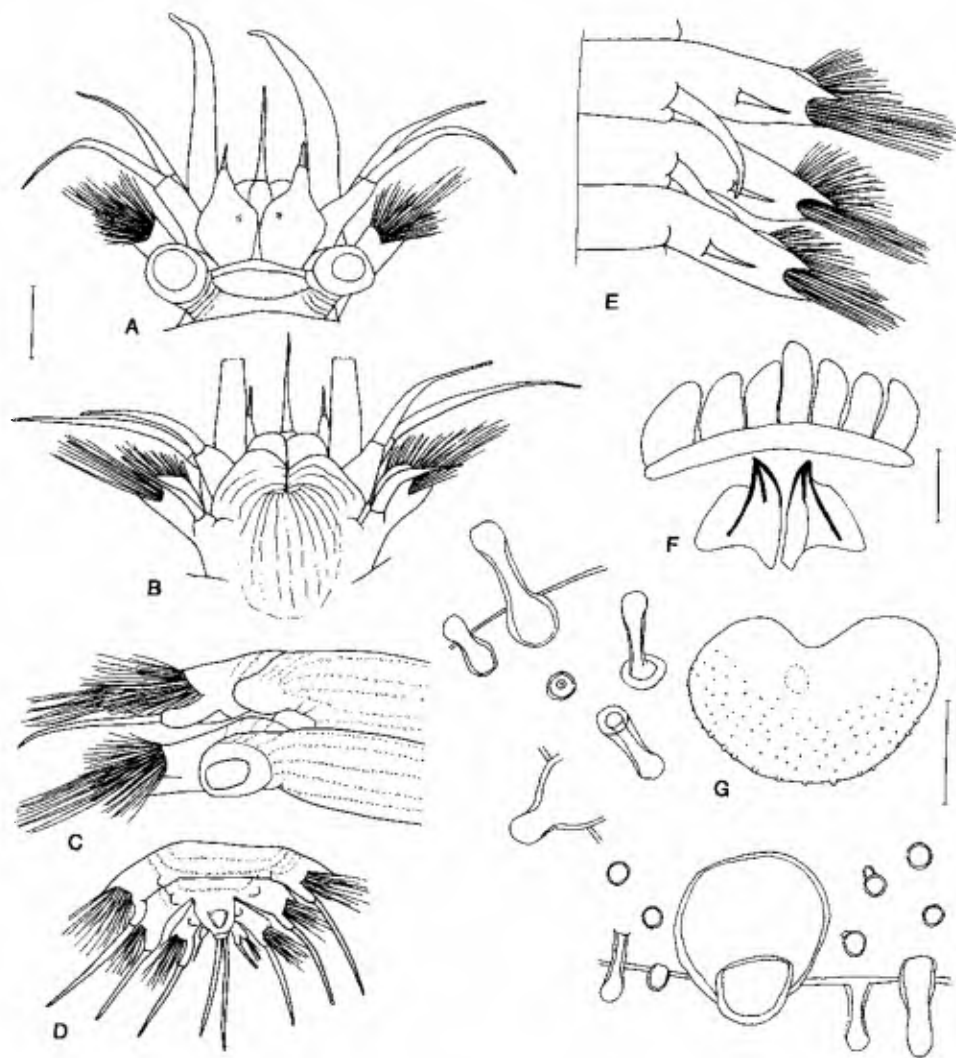


Fig. 1. *Levensteiniella raisae*, holotype, USNM 118362: A, Dorsal view of anterior end; B, Ventral view of anterior end, bases of palps only shown; C, Dorsal view of left half of segments 8 (cirrigerous) and 9 (elytragerous); D, Dorsal view of posterior end, including parapodia of segments 24-27, last one very small; E, Ventral view of left side of segments 11-13 showing ventral papillae on segments 11 and 12, tip of long papilla on segment 12 hidden from view; F, Dorsal row of border papillae and jaws of pharynx (cut open), inner view; G, Left elytron, with detail of macro- and micro-tubercle-papillae (not to scale). Scales = 1.0 mm for A-E; 0.5 mm for F; 2.0 mm for G.

faces of notopodia; long styles extending beyond neurosetae, with filamentous tips; dorsal tubercles prominent, nodular to truncate (Figs. 1C, D, 2B, C). Dorsal transverse ciliated ridges, up to five per segment, continuing onto bases of elytraphores and dorsal tubercles (Fig. 1A, C, D).

Prostomium oval, deeply bilobed: lobes projecting anteriorly, with frontal filaments; ceratophore of median antenna short, oval, inserted in anterior notch, with style short, tapered, shorter than palps; palps stout, long, tapered; lateral antennae and eyes lacking (pair of tannish spots resembling "eyes")

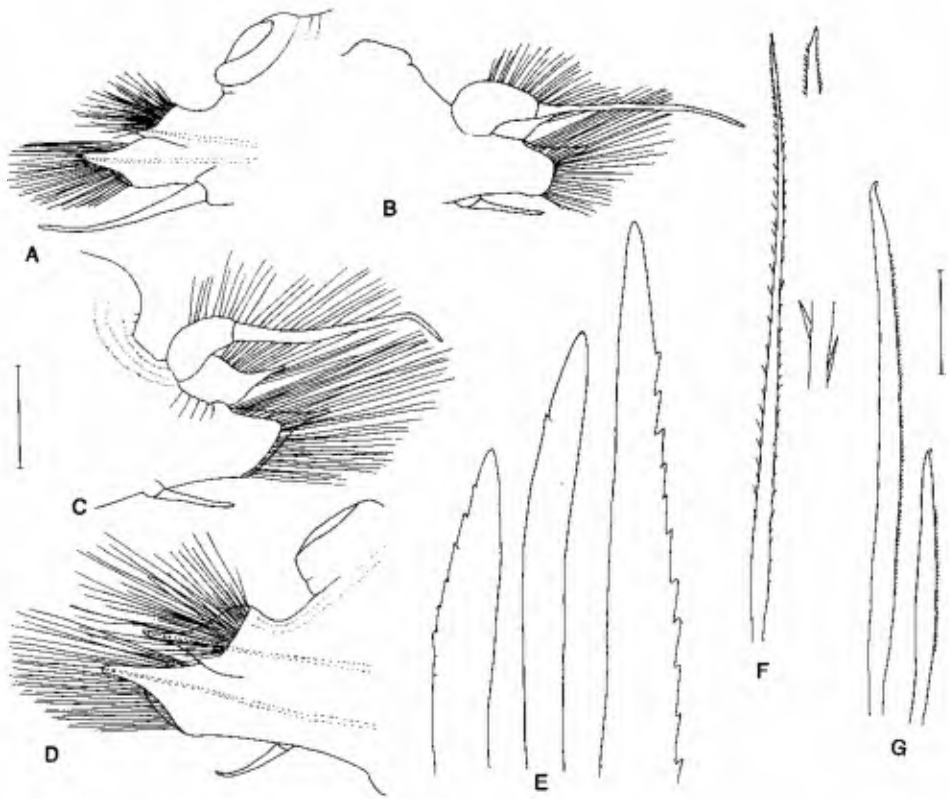


Fig. 2. *Levensteiniella raisae*, holotype, USNM 118362: A, Right elytragerous parapodium of segment 2, anterior view, acicula dotted; B, Right cirriferous parapodium of segment 3, posterior view; C, Same, from segment 8; D, Right elytragerous parapodium of segment 9, anterior view, acicula dotted; E, Notosetae; F, Supraacicular neuroseta, with detail of parts; G, Subacicular neurosetae. Scales = 1.0 mm for A–D; 0.1 mm for E–G.

(Fig. 1A). Tentacular segment not distinct dorsally; tentaculophores lateral to prostomium, lacking setae; each with pair of tentacular cirri, dorsal one about as long as palps, ventral one shorter, both with long slender tips; large bilobed facial tubercle medial to palps (Fig. 1A, B).

Second or buccal segment bearing first pair of elytraphores, biramous parapodia, with notopodium shorter than neuropodium; ventral buccal cirri similar to tentacular cirri, longer than following ventral cirri (Figs. 1A, B, 2A). Pharynx not extended (cut open); seven pairs of border papillae, none elongated; two pairs of light amber-colored, entire jaws (not denticled) (Fig. 1F).

Both rami of biramous parapodia well de-

veloped, notopodium on dorsoposterior side of larger neuropodium, rounded basally with projecting acicular process on lower side; neuropodium with conical presetal lobe with projecting acicular process, postsetal lobe shorter, rounded, deeply cut on dorsal side (Fig. 2B–D). Notosetae very numerous, forming radiating bundle, short to longer, much stouter than neurosetae, straight to slightly curved, tapering to bare blunt tips, with widely spaced spines along one side, variable in number (1–18) (Fig. 2E); tips often covered with reddish-brown foreign material and bacterial “hairs.” Neurosetae slender, numerous, forming fan-shaped bundle; supraacicular neurosetae very slender, with longer spinous regions, consisting

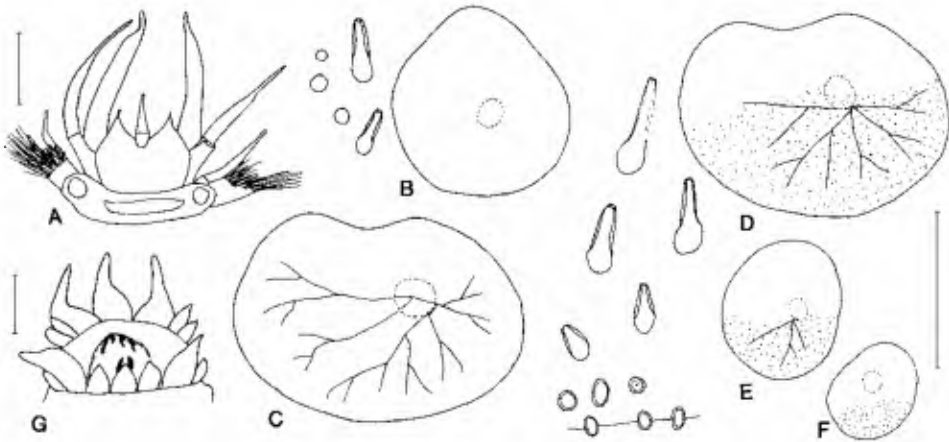


Fig. 3. *Lepidonotopodium minutum*, A–F, holotype, USNM 118363; G, paratype, USNM 118364: A, Dorsal view of anterior end, right dorsal and left ventral tentacular cirri missing; B, Right 1st elytron from segment 2, with detail of micropapillae; C, Right 2nd elytron from segment 4; D, Right 6th elytron from segment 11, with detail of micropapillae; E, Right 10th elytron from segment 19; F, Right 11th elytron from segment 21; G, Ventral view of extended pharynx. Scales = 0.5 mm for A; 1.0 mm for B–F; 0.2 mm for G.

of two rows of long, widely spaced spines along borders, and with shorter spines near tapered tips (Fig. 2F); subacicular neurosetae with shorter spinous regions, stouter, with minute, close-set spines along one border, and with slightly hooked bare tips (Fig. 2G). Ventral cirri short, tapered, attached on middle of neuropodia (Fig. 2C, D).

Anus dorsal, medial to parapodia of last two segments (26, 27); pygidium small, rectangular, with pair of long anal cirri (Fig. 1E). Two pairs of long ventral papillae on segments 11 and 12, their tips sometimes extending dorsally between parapodia (Fig. 1E).

Etymology.—The species, as well as the genus, is named for Raisa J. Levenstein in recognition of her numerous contributions to the study of the deep-sea polychaetes.

Remarks.—*Levensteiniella raisae* differs from *L. kincaidi* in the form of the elytra, where the surfaces are nearly covered with unusual macro- and micro-tubercle-papillae; in *L. kincaidi* the elytra are more delicate with only scattered micropapillae. The notosetae differ in having more distinct and fewer spines along the border, rather than more numerous spinous rows in *L. kincaidi*.

Subfamily Lepidonotopodiinae

Pettibone, 1983

Lepidonotopodium Pettibone, 1983

Lepidonotopodium was erected for *L. fimbriatum* Pettibone, 1983 from the East Pacific Rise at 21°N. Two additional species were added by Pettibone (1984b) from the Galapagos Rift, as well as 21°N: *L. williamsae* and *L. riflense*, and a fourth species from the North East Pacific Explorer and Juan de Fuca Ridges by Pettibone (1988), *L. piscesae*. An additional species is added from the Mariana Back-Arc Basin.

Lepidonotopodium minutum, new species

Figs. 3, 4

Material.—Western Central Pacific in Mariana Back-Arc Basin, *Alvin* dive 1843, 4 May 1987, Alice Springs, 18°12.6'N, 144°42.4'E, 3640 m, R. Hessler, collector, holotype (USNM 118363) and 8 paratypes (USNM 118364, 118365).

Description.—Holotype 7.5 mm long, 3.5 mm wide with setae, with 23 segments; slightly smaller paratypes 6–6.5 mm long, 3–4 mm wide, with 22–23 segments; smallest paratype 5.2–5.5 mm long, 3–3.2 mm wide, with 21–22 segments. Body short,

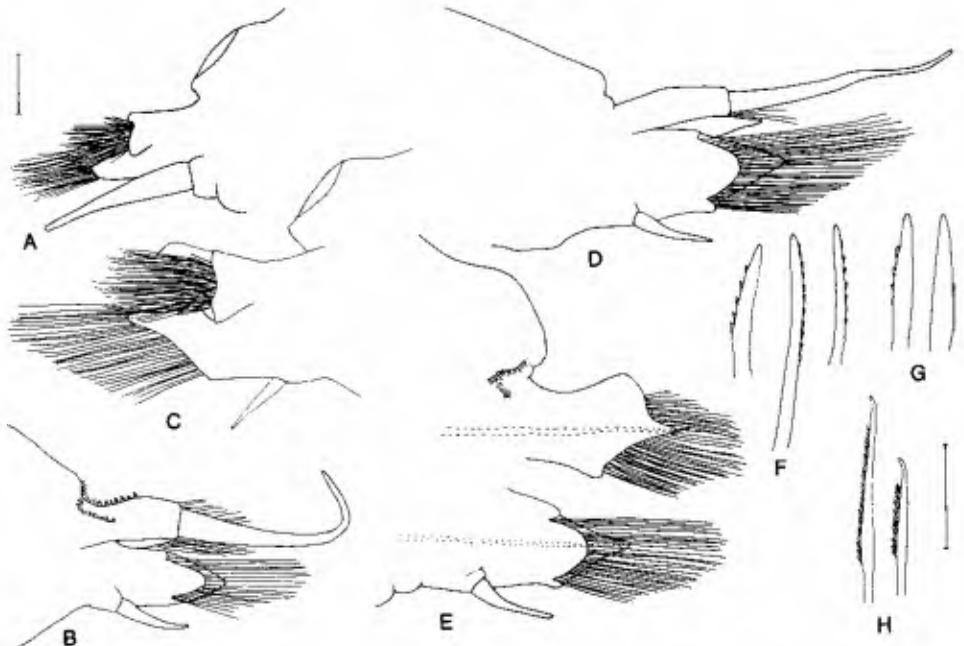


Fig. 4. *Lepidonotopodium minutum*, holotype, USNM 118363: A, Right elytragerous parapodium from segment 2, anterior view; B, Right cirriferous parapodium from segment 3, posterior view; C, Right elytragerous parapodium from segment 9, anterior view; D, Right cirriferous parapodium from segment 10, posterior view; E, Right elytragerous parapodium from segment 11, posterior view, notopodium and neuropodium separated, acicula dotted; F, Upper, middle and lower notosetae; G, Short anterior notosetae; H, Upper and lower neurosetae. Scales = 0.2 mm for A–E; 0.1 mm for F–H.

suboval in outline, flattened dorsoventrally and slightly tapered anteriorly and posteriorly. Elytra 11 pairs, on segments 2, 4, 5, 7, continuing on alternate segments to 21, attached eccentrically on prominent elytraphores (Figs. 3A, 4A, C, E). Elytra oval to subreniform, imbricated, covering dorsum, variable in size, last pair very small, opaque, smooth, with branching “veins” emanating from place of attachment to elytraphores. Surface of first pair of elytra and posterior half on rest of elytra covered with scattered micropapillae, globular with short to longer tapered or cylindrical bases (Fig. 3B–F). Elytral surface and borders covered with foreign material and bacterial “hairs.” Dorsal cirri with cylindrical cirrophores attached on dorsoposterior sides of notopodia; styles tapered, extending beyond tips of neurosetae; dorsal tubercles elongated, inflated (Fig. 4B, D).

Prostomium deeply bilobed, anterior lobes subtriangular with small frontal filaments; ceratophore of median antenna in anterior notch, short, bulbous, with short, subulate style; palps cylindrical, with tapered tips, nearly two times longer than prostomium; lateral antennae and eyes lacking (Fig. 3A). Tentacular segment not visible dorsally; tentaculophores lateral to prostomium, achaetous, each with pair of tentacular cirri, dorsal ones nearly as long as palps, ventral ones slightly shorter, both with long tapering tips (Fig. 3A). Without distinct facial tubercle.

Second or buccal segment with first pair of elytraphores, biramous parapodia, and ventral or buccal cirri attached basally on prominent cirrophores lateral to ventral mouth, with styles similar to tentacular cirri, longer than following ventral cirri (Figs. 3A, 4A). Opening of extended pharynx en-

Table 1.—Comparison of *Lepidonotopodium riftense* and *L. minutum*.

	<i>L. riftense</i>	<i>L. minutum</i>
Borders of notopodial bracts	with short papillae	lack papillae
Papillae of pharynx	7–9 pairs, none elongated	7 pairs, unequal, some elongated
Jaws of pharynx	with numerous teeth	smooth, without teeth
Long ventral papillae	2 pairs on segments 11 & 12 (on some specimens)	not present

circled with seven pairs of unequal-sized papillae; dorsal with three medial ones long, tapered, and two short lateral pairs; ventral with three middle ones and lateral pair short, next to lateral pair long, tapered; two pairs of hooked jaws, without teeth or serrations (Fig. 3G).

Biramous parapodia with shorter notopodia on anterodorsal sides of longer neuropodia (Fig. 4A–D). Notopodia subconical, with projecting acicular lobe, hidden anteriorly by very numerous notosetae; well-developed flaring bracts enclosing bases of notosetae; ventro-anterior and dorso-posterior bracts attached basally to acicular lobe (Fig. 4A, C, E). Neuropodia with conical presetal acicular lobe and shorter, rounded postsetal lobe (Fig. 4B–E); distal borders with bacterial “hairs.” Notosetae very numerous, forming thick radiating bundle, stouter than neurosetae, with widely spaced spines along one side; notosetae arranged in four groups: upper (about 8), middle (11), lower (8) (Fig. 4F), and short anterior group (Fig. 4G). Notosetae covered with foreign material and bacterial “hairs.” Neurosetae numerous, forming fan-shaped bundle; neurosetae with two rows of numerous spines along one side and slightly hooked bare tips; upper neurosetae longer, with longer spinous regions (Fig. 4H). Ventral cirri attached on middle of posterior face of neuropoda, short, tapered (Fig. 4B–E).

Segmental or nephridial papillae not obvious. Without elongated ventral papillae on segments 11 and 12. Pygidium small, rectangular, between posterior parapodia, with pair of long anal cirri.

Etymology.—The specific name *minutum* refers to the relatively small size of the species.

Remarks.—*Lepidonotopodium minutum* is closest to *L. riftense*. Both are of small size with relatively few segments (up to 7 mm in length and 23 segments). The elytra lack macrotubercles and micro-tubercles but have clavate micropapillae, differing from the other species of *Lepidonotopodium*. The notosetae have widely spaced spines along one side (also found in *L. fimbriatum*). The two species may be separated by the characters indicated in Table 1.

Subfamily Branchinotogluminae
Pettibone, 1985

Branchinotogluma Pettibone, 1985

Branchinotogluma was established by Pettibone (1985c) for three species from the hydrothermal vents off western Mexico at 21°N and the Galapagos: *B. hessleri*, *B. sandersi*, and *B. grasslei*, with *B. hessleri* as the type species. *B. grasslei* and *B. sandersi* were also reported from the North Pacific Explorer and Juan de Fuca Ridges by Pettibone (1988). An additional species is added from the Mariana Back-Arc Basin.

Branchinotogluma burkensis, new species
Figs. 5, 6

Material.—Western Central Pacific in Mariana Back-Arc Basin, *Alvin* dive 1836, 27 Apr 1987, Burke Field, Snail Pits, 18°10.9'N, 144°43.2'E, 3660 m, R. Hessler, collector, holotype (USNM 118366).

Description.—Length of holotype 30 mm, width with setae 16 mm, segments 21, with additional small parapodium on right side (Fig. 5B). Body flattened, tapering anteriorly and posteriorly, with parapodia longer than body width. No color except for golden-colored setae. Dorsum with transverse ciliated

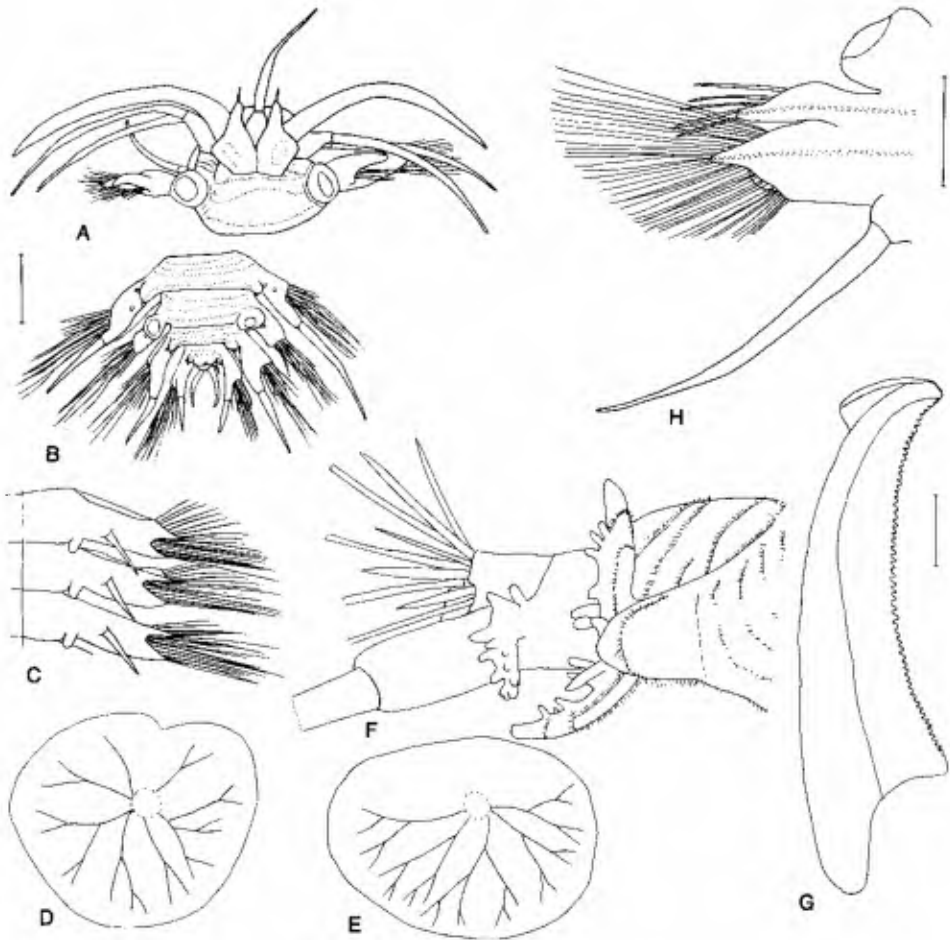


Fig. 5. *Branchinotoghluma burkensis*, holotype, USNM 118366: A, Dorsal view of anterior end; B, Dorsal view of posterior end including segments 18–21; C, Ventral view of left side of segments 11–13, showing small segmental ventral papillae; D, Right 1st elytron from segment 2; E, Right 7th elytron from segment 13; F, Dorsal view of left side of cirriferous segment 14, only base of style of dorsal cirrus shown; G, One of jaws removed from body; H, Right elytriferous parapodium from segment 2, anterior view, acicula dotted. Scales = 2.0 mm for A–E; 0.5 mm for F, G; 1.0 mm for H.

bands, 2–4 per segment, extending onto elythrofores, dorsal tubercles, and branchial bases (Fig. 5A, B, F).

Elytra 10 pairs, attached on large bulbous elythrofores on segments 2, 4, 5, 7, continuing on alternate segments to 19 (Figs. 5A, B, H, 6B). Elytra large, overlapping, covering dorsum, round to oval, delicate, with branched “veins,” without tubercles or papillae (Fig. 5D, E). Dorsal cirri on non-elytriferous segments, with cylindrical cirrofores on posterodorsal sides of noto-

podia, and long smooth styles with slender tips extending beyond tips of neurosetae; dorsal tubercles nodular, projecting (Figs. 5B, F, 6A, C). Branchiae arborescent, in two groups: on dorsal bases of notopodia and on lateral sides of elythrofores and dorsal tubercles (Figs. 5F, 6B). Branchiae beginning on segment 3 as two small groups (Fig. 6A), becoming larger (Figs. 5F, 6B, C), continuing to posterior end and becoming very small (Fig. 5B).

Bilobed prostomium with prominent cy-

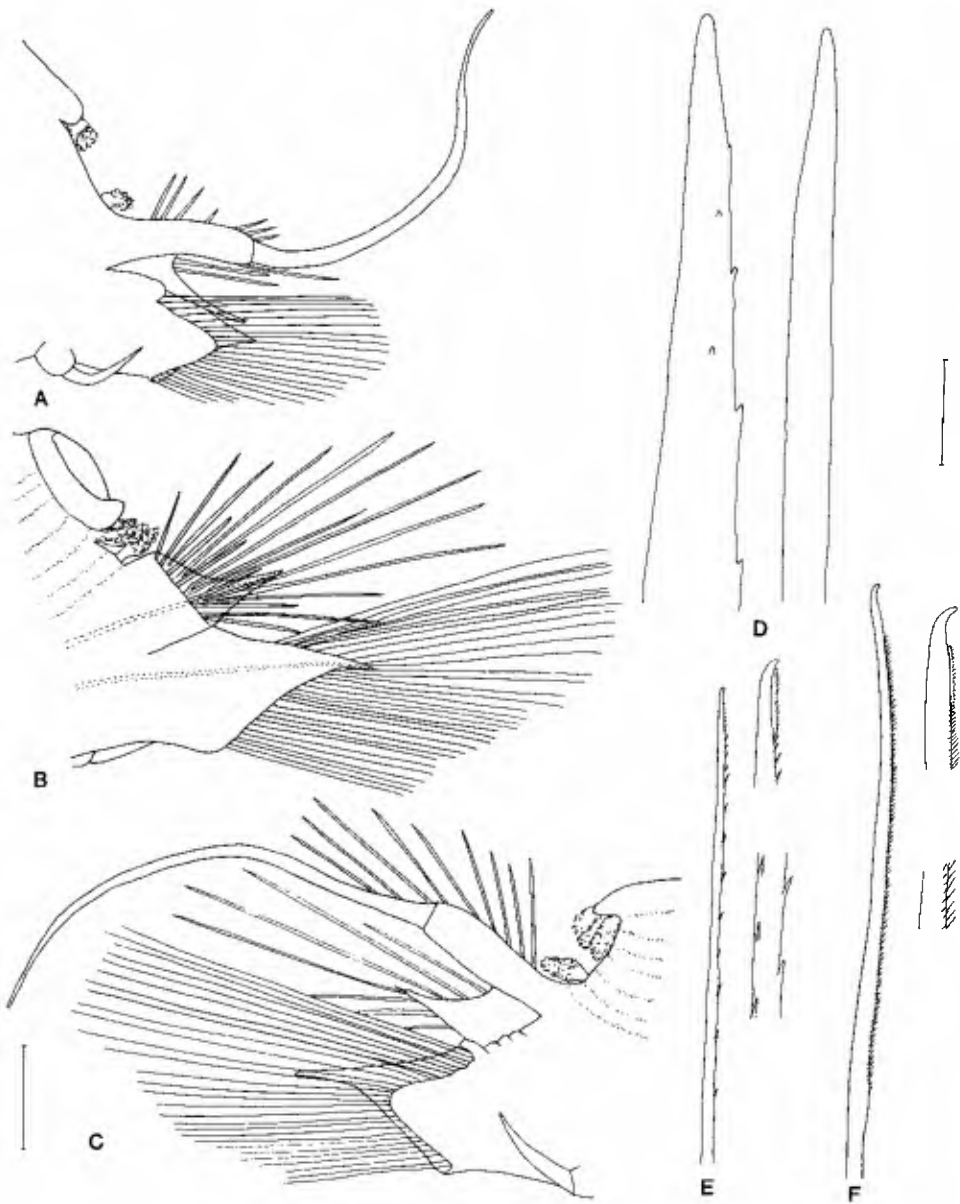


Fig. 6. *Branchinotogluma burkensis*, holotype, USNM 118366: A, Right cirriferous parapodium from segment 3, posterior view; B, Right clytragerous parapodium from segment 9, anterior view, acicula dotted; C, Right cirriferous parapodium from segment 10, posterior view; D, notosetae; E, Tip of long supraacicular neuroseta, with detail of parts; F, Subacicular neuroseta, with detail of parts. Scales = 1.0 mm for A-C; 0.1 mm for D-F.

lindrical anterior lobes with terminal filaments; median antenna with bulbous ceratophore in anterior notch and short style tapered to slender tip; palps long, tapered,

smooth, about three times length of prostomium; without eyes, but non-ocular paired oval shaded areas present (Fig. 5A). Tentacular segment not distinct dorsally; ten-

taculophores lateral to prostomium, achaetous, each with pair of dorsal and ventral tentacular cirri about as long as palps, dorsal tentacular cirri slightly longer than ventral ones (Fig. 5A). Second or buccal segment with first pair of large elytophores, biramous parapodia, and long, slender buccal cirri similar to tentacular cirri, longer than following ventral cirri; notopodium with prominent bract fused with acicular lobe (not distinct, as usual in genus) and small bundle of stout notosetae; neuropodium similar to following (Fig. 5A, H). Pharynx not everted (cut out), with five border papillae around opening: three dorsal and two ventral; two pairs of prominent dark reddish amber-colored jaws, minutely denticled on inner border (about 50) (Fig. 5G).

Biramous parapodia with notopodia shorter than neuropodia, both rami with golden-colored setae (Figs. 5H, 6A–C). Notopodia conical, with prominent projecting acicular processes, without notopodial bracts except on segment 2 with bract fused to acicular process. Notosetae numerous, forming radiating bundles, not as long as but much stouter than neurosetae, straight, tapered, acicular, shorter ones smooth, longer ones with some spines near distal tips (Fig. 6D). Larger and longer neuropodium with subconical presetal acicular lobe with projecting acicular process and shorter rounded postsetal lobe, lobes deeply separated dorsally and ventrally. Neurosetae very numerous, forming fan-shaped bundles, slender, with slightly hooked tips. Supraacicular neurosetae with two rows of widely spaced prominent spines and finely spinous hood on slightly hooked tip (Fig. 6E). Subacicular neurosetae finely spinous along border, with slightly hooked tip (Fig. 6F). Ventral cirri short, tapering, attached on middle of neuropodia (Fig. 6A–C).

Posterior end not modified or compressed. Pygidium small lobe between parapodia of last segment (21), with dorsal anus and pair of anal cirri (Fig. 5B). Segmental ventral papillae seven pairs, small squarish,

on ventral bases of parapodia of segments 11–17, none elongated (Fig. 5C).

Etymology.—The species is named *burkensis* for the collecting area, Burke Field on the Mariana Back-Arc Basin.

Remarks.—*B. burkensis* is closest to *B. grasslei* Pettibone (1985c). Both species have a pair of anal cirri and posterior segments that are not compressed or modified; branchiae are present on all segments from 3 on; and both lack elongated ventral papillae. *B. burkensis* has seven pairs of small segmental ventral papillae on segments 11–17, compared to five pairs on segments 11–15 in *B. grasslei*. In *B. burkensis*, the notopodial bract on segment 2 is fused with the acicular lobe and not distinct, as in *B. grasslei*, where the notopodial bract encloses the acicular lobe and notosetae (Pettibone 1985c, fig. 6A). The long notosetae in *B. burkensis* have distal spines, whereas they are smooth in *B. grasslei*.

Opisthotrochopodus Pettibone, 1985,
emended

Opisthotrochopodus was established by Pettibone (1985c) for *O. alvius* from the hydrothermal vents off western Mexico at 21°N and the Galapagos. *O. tunnicliffeae*, from the hydrothermal vents of the Explorer and Juan de Fuca Ridges, was added by Pettibone (1988). A third species is added from the Mariana Back-Arc Basin and the genus is emended.

Diagnosis.—Body short, with 21 segments, first achaetous. Elytra 10 pairs, on segments 2, 4, 5, continuing on alternate segments to 19. Dorsal cirri with short cirrophores and long style, and dorsal tubercles, in line with elytophores, on segments 3, 6, continuing on alternate segments to 20 and 21. Arborescent branchiae two pairs per segment, attached to lateral sides of elytophores, dorsal tubercles, and dorsal side of notopodia, beginning on segment 3 and continuing to segment 15–18. Prostomium bilobed, with triangular anterior lobes bear-

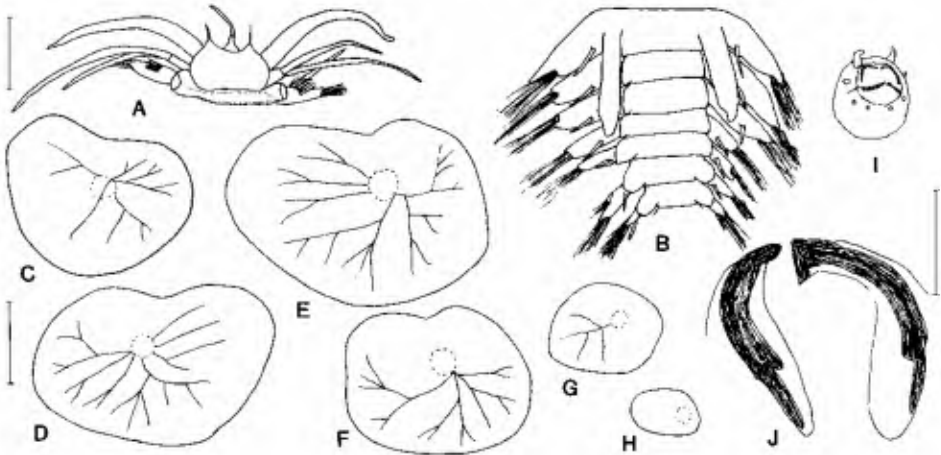


Fig. 7. *Opisthotrochopodus marianus*, A-I, paratype, USNM 118369; J, holotype, USNM 118367: A, Dorsal view of anterior end; B, Ventral view of segments 12-18; C, Right 1st elytron from segment 2; D, Right 2nd elytron from segment 4; E, Right 4th elytron from segment 7; F, Right 6th elytron from segment 11; G, Right 9th elytron from segment 17; H, Right 10th elytron from segment 19; I, Ventral view of extended pharynx; J, Dorsal jaws, inner view. Scales = 0.5 mm for A, B, I; 0.5 mm for C-H; 0.1 mm for J.

ing frontal filaments, with ceratophore of median antenna in anterior notch, with paired ventral palps, without lateral antennae or eyes. First or tentacular segment not visible dorsally; tentaculophores lateral to prostomium, achaetous, each with dorsal and ventral tentacular cirri. Second or buccal segment with first pair of elytra, biramous parapodia, and ventral or buccal cirri attached to basal parts of parapodia lateral to mouth; styles longer than following ventral cirri. Parapodia biramous, with notopodia shorter than neuropodia. Notopodia of elytragerous segments 2-17 with prominent rounded bracts enclosing conical acicular lobes and notosetae, only on segment 2 or lacking. Neuropodia with longer conical presetal and shorter rounded postsetal lobes. Notosetae stouter than neurosetae, straight, acicular, smooth or with spines. Neurosetae long, slender, finely spinous, with slightly hooked tips. Ventral cirri short, tapered. Posterior 3 to 6 segments modified, including wheel organs on segment 20 or lateral lamellae on segment 21. Pharynx with 5 to 8 border papillae; 2 pairs of dorsal and ventral hooked jaws, with or without den-

ticles. Elongated ventral papillae on segment 12 and rounded ventral lamellae on some following segments. Pygidium with or without pair of anal cirri.

Opisthotrochopodus marianus, new species
Figs. 7-9

Material.—West Central Pacific, Mariana Back-Arc Basin, *Alvin* dive 1843, 4 May 1987, Alice Springs, 18°12.6'N, 144°22.4'E, 3640 m, holotype (USNM 118367), paratype (USNM 118369), paratype (USNM 118368), 9 paratypes (3 small, USNM 118370).

Description.—Holotype 6 mm long, 3 mm wide, with 21 segments. Two adult paratypes 5-5.5 mm long, 3 mm wide, with 21 segments. Two young paratypes 2.5-3 mm long, 2-3 mm wide, with 13-14 segments plus small growing zone. Body flattened, tapering slightly anteriorly, anterior parapodia (segments 2-13) longer, tapering gradually (segments 14-18), narrowing and projecting posteriorly with extra long setae (segments 19-21) (Figs. 7B, 9H, I). Dorsum with transverse ciliated bands, 1-2 per seg-

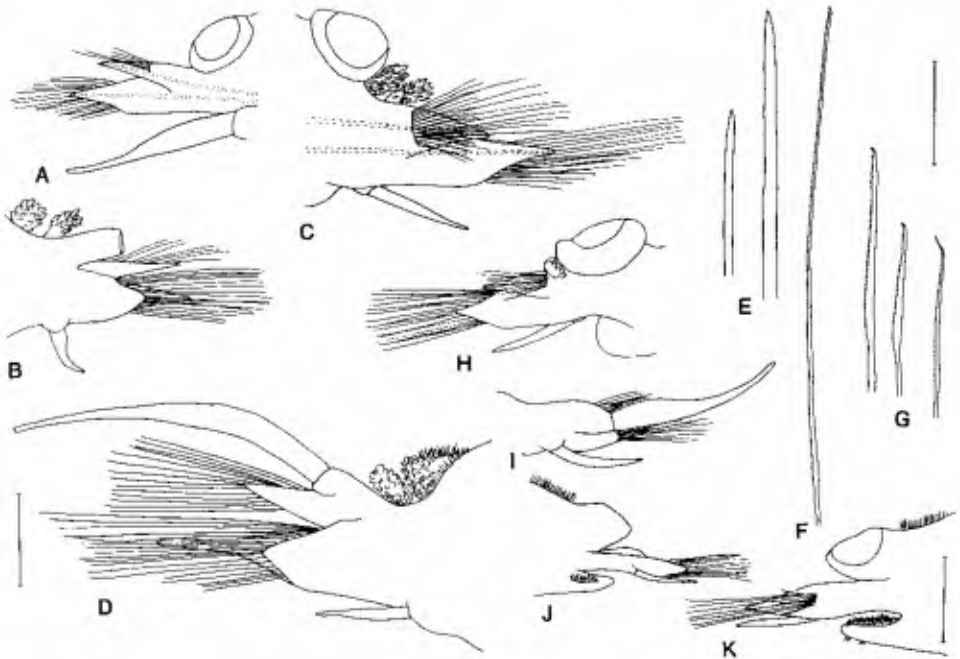


Fig. 8. *Opisthotrochopodus marianus*, paratype, USNM 118369: A, Right elytragerous parapodium from segment 2, anterior view, acicula dotted; B, Right cirriferous parapodium from segment 3, posterior view, style of dorsal cirrus broken off; C, Left elytragerous parapodium from segment 9, anterior view, acicula dotted; D, Left cirriferous parapodium from segment 10, posterior view; E, Short and long notosetae; F, Supraacicular neuroseta; G, Subacicular neurosetae; H, Right elytragerous parapodium from segment 15, anterior view; I, Right cirriferous parapodium from segment 16, posterior view; J, Right elytragerous parapodium from segment 17, posterior view; K, same, anterior view. Scales = 0.3 mm for A–D, H–J; 0.1 mm for E–G; 0.2 mm for K.

ment, extending onto elytophores and dorsal tubercles (Figs. 7A, 9H).

Elytra and prominent bulbous elytophores 10 pairs (Figs. 7A, 8A, C, H, J, K, 9H). Elytra large, overlapping, covering dorsum, except for posterior modified parapodia, round to oval, larger on middle elytra, very small on segments 17 and 19, delicate, showing branched “veins” emanating from scars of attachment to elytophores, without tubercles or papillae (Figs. 7C–H, 9H). Dorsal cirri with cylindrical cirrophores on posterodorsal sides of notopodia, long smooth styles with slender tips extending beyond setae; dorsal tubercles elongate, tapered, with long cilia (Fig. 8B, D, I). Branchiae delicate, arborescent, on lateral bases of elytophores and dorsal tubercles and dorsal bases of notopodia, beginning on

segment 3 as two small groups (Fig. 8B), becoming larger (Fig. 8C, D), and continuing to segment 15 as single small group (Fig. 8H).

Prostomium bilobed, anterior lobes triangular with slender frontal filaments; median antenna with bulbous ceratophore in anterior notch, with slender short style; palps stout, tapered, about two times longer than prostomium; without eyes (Fig. 7A). Tentaculophores lateral to prostomium, achaetous, with 2 pairs of tentacular cirri, dorsal pair longer than palps, ventral pair shorter (Fig. 7A). Second or buccal segment with first pair of prominent elytophores, biramous parapodia, similar to but smaller than following; ventral buccal cirri similar to tentacular cirri, longer than following ventral cirri; notopodium without notopodial bract

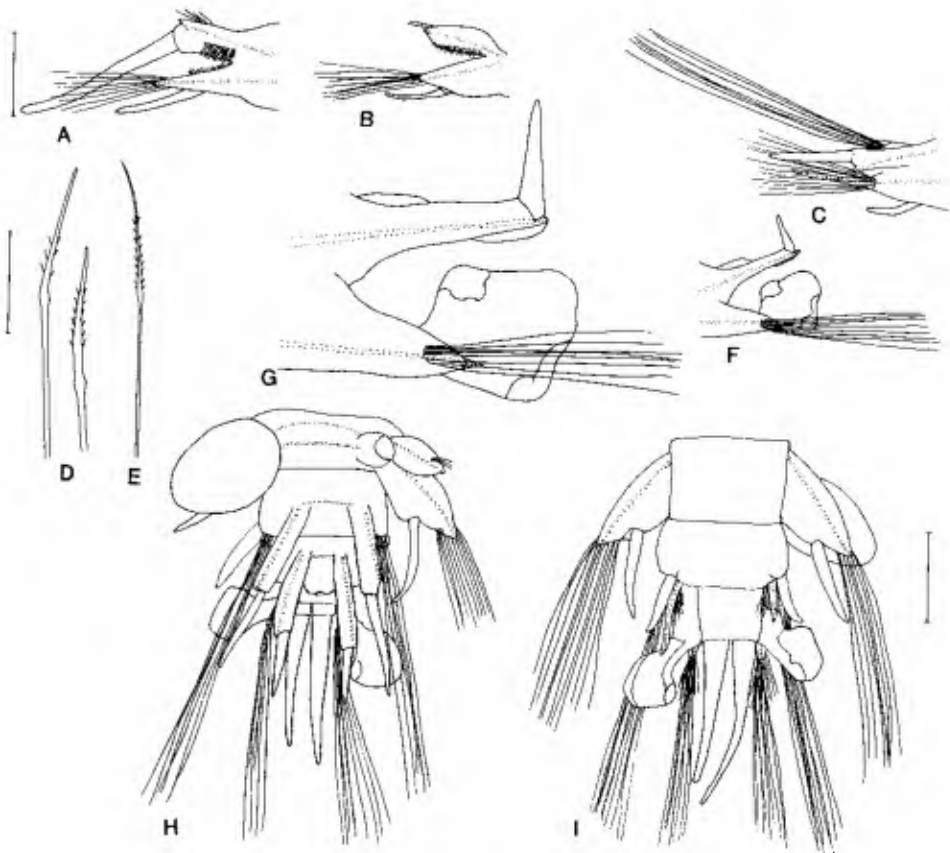


Fig. 9. *Opisthotrochopodus marianus*. A-G, paratype, USNM 118369; H-I, paratype, USNM 118368: A, Right cirriferous parapodium from segment 18, anterior view, acicula dotted; B, Right elytragerous parapodium from segment 19, anterior view, acicula dotted, elytraphore not shown; C, Right cirriferous parapodium from segment 20, anterior view, acicula dotted; D, Tips of long notosetae from same; E, Neuroseta from same; F, Left cirriferous parapodium from segment 21, anterior view, acicula dotted; G, Same, cirriferous parapodium from segment 21, anterior view, acicula dotted; H, Dorsal view of posterior end including segments 19-21, acicula dotted; I, same, ventral view. Scales = 0.3 mm for A-C, F; 0.1 mm for D, E, G; 0.2 mm for H, I.

(Figs. 7A, 8A). Notoetae stout, similar to those of following segments; lower neurosetae with capillary tips, rest similar to upper neurosetae of following segments. Extended pharynx encircled with four pairs of papillae, dorsal with two medial ones larger and lateral ones smaller; ventral with four small papillae; two pairs of curved reddish jaws occupying most of opening, without denticles on inner border (Fig. 7I, J).

Parapodia of segments 2-16 biramous, with notopodia shorter than neuropodia, both rami with light yellow amber-colored

setae (Fig. 8A-D, H, I). Notopodia rather long, conical, without notopodial bracts enclosing acicular lobe and notosetae (as in *O. alvinus*). Notoetae numerous, stouter than neurosetae, short, smooth and longer, smooth or with faint spinous rows, tapered to blunt tips (Fig. 8E). Larger neuropodia with presetal lobe long, subconical, with projecting acicular process, postsetal lobe shorter, rounded. Neurosetae numerous, long, slender, wider basally, with slightly hooked tips. Supraacicular neurosetae more slender, with longer spinous regions (Fig.

Table 2.—Comparison of three species of *Opisthotrochopodus*.

	<i>O. alvinus</i> Pettibone, 1985c (Figs. 7–9)	<i>O. tunnicliffae</i> Pettibone, 1988 (Figs. 6–9)	<i>O. marinus</i> n. sp. (Figs. 7–9)
Notopodial bracts on elytragerous parapodia	segments 2–17 (Figs. 7A, G)	segment 2 only (Fig. 6A, C)	without
Branchiae on segments	3–17	3–18	3–15
Pharynx:			
Papillae	5 small: 3 dorsal, 2 ventral	same	8: 4 dorsal, 2 medial larger; 4 ventral small
Jaws	with minute denticles (Fig. 8H, I)	same	without denticles (Fig. 7I, J)
Segment 20:			
Notopodia	achaetous (Fig. 9B, F–L)	short notosetae (Figs. 8B, C, 9A–F)	long notosetae (Fig. 9C–E)
Neuropodia	with “wheel” organ, incl. stout, acicular & slender spinous neurosetae	with “balloon” organ including stout harpoon & slender spinous neurosetae	long, slender, acicular lobe & short capillary neurosetae
Ventral cirrus	without	present	without
Segment 21:			
Lamellae	small notopodial & neuropodial (Fig. 9M, N)	without (Fig. 9C)	large lateral neuropodia (Fig. 9G–I)
Neurosetae	few, short	same	long capillary
Ventral cirrus	without	present	without

8F). Subacicular neurosetae decreasing in length ventrally, finely spinous more basally, with longer spines distally; few shorter lower ones with capillary tips (Fig. 8G). Ventral cirri short, tapered, attached on middle of neuropodia (Fig. 8B–D, H, I).

Elongated ventral papillae on segment 12, extending posteriorly to segment 15 (Fig. 7B); 6 pairs of short, flat ventral lamellae on segments 13–18, ciliated on upper side (Figs. 7B, 8H, J, K).

Parapodia from segment 15 on more or less modified. Parapodium 15 with only small branchia on lateral side of elytophore; notopodium almost as long as neuropodium; supraacicular neurosetae with capillary tips (Fig. 8H). Parapodium 16, and following parapodia, without branchiae; all neurosetae with capillary tips (Fig. 8I). Parapodium 17 with small neuropodium shorter than ventral cirrus, with bundle of long

slender capillary neurosetae; notopodium small, with three shorter and seven longer stout notosetae extending to tip of neuropodium (Fig. 8J, K).

Parapodium 18 with small notopodial acicular lobe fused to cirrophore of dorsal cirrus, ciliated on lower side, with few (4) short stout notosetae on upper side; conical neuropodium shorter than ventral cirrus, ciliated on upper side, with small bundle of long capillary neurosetae (Fig. 9A).

Parapodium 19 with elytophore and small elytron, inflated oval notopodium with short acicular lobe and few (3–4) short stout notosetae near tip, ciliated on underside; neuropodium similar to preceding parapodium, with small bundle of long capillary neurosetae (Fig. 9B, H, I).

Parapodium 20 directed posteriorly, with small notopodial acicular lobe fused to cirrophore of dorsal cirrus; neuropodium with

long slender acicular lobe nearly as long as dorsal cirrus, with short ventral cirrus (Fig. 9C, H, I). Long notosetae wider subdistally, spinous, tapering to slender tips (Fig. 9D). Shorter neurosetae slender, wider subdistally, spinous, tapering to capillary tips (Fig. 9E).

Parapodium 21 directed posteriorly, with notopodial acicular lobe fused to cirrophore of dorsal cirrus, without notosetae; neuro-podial conical acicular lobe with slender capillary neurosetae and large, oval, delicate lateral lamella; without ventral cirrus (Fig. 9F-I). Pygidium small rounded lobe with dorsal anus medial to parapodia of segment 21, and pair of long anal cirri (Fig. 9H, I).

Etymology.—The specific name *marianus* is based on the collecting site of the Mariana Back-Arc Basin.

Remarks.—*O. marianus* can be separated from the other two species of *Opisthotrochopodus* according to Table 2.

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