A new species of scale-worm (Polychaeta: Polynoidae), *Lepidonotopodium jouinae* sp. nov., from the Azores Triple Junction on the Mid-Atlantic Ridge

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**Abstract:** A new species of scale-worm, *Lepidonotopodium jouinae*, belonging to the sub-family Lepidonotopodinae (Polychaeta: Polynoidae) has been found in samples collected on deep-sea hydrothermal vent fields at the Azores Triple Junction on the Mid-Atlantic Ridge. It is the first species of Polynoidae described from the Mid-Atlantic Ridge hydrothermal vents. Other species of the same genus have been described from hydrothermal vents of the Pacific Ocean.


**Keywords:** Annelida, Polychaeta, Polynoidae, deep-sea, hydrothermal vent, Mid-Atlantic Ridge.

**Introduction**

Since the discovery of deep-sea hydrothermal vent communities in 1977 (Lonsdale, 1979), about 40 species of Polynoidae have been described as living in these areas. Pettibone described the first hydrothermal vent species of Polynoidae in 1983, *Lepidonotopodium fimbriatum*, from the hydrothermal area off Western Mexico at 21°N and she erected a new subfamily, Lepidonotopodinae, for this unusual species. Five other Lepidonotopodinae, belonging to two genera, have then been described: *Lepidonotopodium williamsae* and *L. rifitense* Pettibone, 1984 from the Galápagos Rift, *L. piscisae* Pettibone, 1988 (Pettibone, 1990) from the Explorer Ridge, *L. minutum* Pettibone, 1989 from the Mariana Back Arc Basin, the branchiate *Thermopolynoe branchiata* Miura, 1994 from the Lau Back Arc and North Fiji Basins and finally *L. atalantae* Desbruyéres & Hourdez, 2000 from 9°50’ and 13°N on the East Pacific Rise. In 1985, the first hydrothermal vents on the Mid-Atlantic Ridge were discovered (Rona et al., 1986) in the TAG (Trans-Atlantic Geotraverse) area. Other vent sites have later been discovered: Lucky Strike, Snake Pit, Broken Spur, Fifteen Twenty, Menez Gwen, Rainbow (see Van Dover et al., 1996 and Desbruyéres et al., in press). Although these latter report some species of Polynoidae, no taxonomic work on this family has been published to date.
Only the very abundant species *Amathys lutzi* Desbruyères & Laubier, 1996 (Ampharetidae) has been described.

In this paper we describe *Lepidonotopodium jouinae*, a new species of Lepidonotopodinae from the Azores Triple Junction area on the Mid-Atlantic Ridge, which has been found among *Bathydiadophorus azoricus* Von Cosel, Comtet & Krylova, 1999, washings.

**Material and methods**

Type locality: Mid-Atlantic Ridge, 37°17'18"N, 32°16'29"W, 1690 meters depth ("Tour Eiffel" site on the Lucky Strike vent field). Animals found in *Bathydiadophorus azoricus* washings.


Other 176 specimens of *Lepidonotopodium jouinae* sp. nov. have been found on the Lucky Strike vent field (sites "Tour Eiffel", "Nuno", "Sintra", "Isabel", "L'Aiguille", "Bairro Alto" and "PP24") and the Menez Gwen vent field (37°51'40"N, 31°31'10"N, site "Annabelle"). They have been collected during 26 dives during the cruises DIVA1 (1994), DIVA2 (1994), MARVEL (1997) and PICO (1998).

Specimens, fixed with 10% formalin in sea water and preserved in ethanol, were prepared for SEM. The specimens were critical point dried with carbon dioxide, sputtered with gold-palladium and examined with a Philips scanning electron microscope (XL30).

**Description of Lepidonotopodium jouinae** sp. nov.

The holotype is 8 mm long for 24 segments, and 5 mm wide including chaetae. The largest paratype has a length of 14 mm for 23 segments, the smallest has a length of 4.8 mm for 19 segments. The body is short, suboval in outline, flattened dorsoventrally, slightly tapered and rounded anteriorly and posteriorly. Specimens appear light brown after preservation. Notopodial chaetae are straw coloured, often covered by mineral deposits. Neuropodial chaetae are gold coloured.

The eleven pairs of elytra are located on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19 and 21 (Fig. 1a). They cover the dorsum and are attached eccentrically on prominent elyphorophores, with dorsal cirri on the posterior segments. The elytra are opaque, oval to subreniform, imbricate, appearing smooth to the naked eye. Under the scanning electron microscope (Fig. 2a, c, d), the elytral surface in the non-overlapping area, appears covered with numerous globular (10 μm in diameter) or clavate (up to 27 μm long) microcapsules (Fig. 2c). The dorsal cirri on segments lacking elytra have cylindrical cirrophores, attached dorsoexternally on the notopodia (Figs 2b, 3b), and are slightly bulbous with tapering tips. They extend well beyond the tip of the neurochaetae. The dorsal tubercles on the elyphorophorous segments are large and inflated (Fig. 2b). The surface of both the elyphorophorous and cirrigenous segments have some bands or tufts of cilia (Fig. 2b). There are two transversal ciliated ridges per segment on the first 12 segments and only one per segment on the remaining posterior segments.

The prostomium is bilobed, the anterior lobes subtriangular, each with a small frontal filament; lateral antennae are absent (Fig. 1b, c). The median antenna is inserted in the anterior notch, having a short cylindrical ceratophore and a short subulate style. The palps are slightly subulate, about one and a half times the length of the prostomium. Eyes are lacking. The first or tentacular segment is not visible dorsally (Fig. 1b). The tentaculophores of the tentacular segment are lateral to the prostomium (Fig. 1c) and lack chaetae. The styles are smooth and tapered. The styles of the dorsal tentacular cirri are 1.5 times longer than that of the ventral ones and they are longer than the palps, while the ventral ones are subequal in length to the palps. The facial tubercle is lacking.

The second or buccal segment bears the first pair of large elytralophes, and biramous parapodia (Fig. 1b, c). The two ventral or buccal cirri are attached basally on prominent cirrophores lateral to the ventral mouth; they are similar in shape to the tentacular cirri and are longer than the following ventral cirri. The mouth is enclosed in upper, lateral and posterior lips between segments 1 and 2. Six pairs of unequal pear-shaped papillae and two median papillae encircle the opening of the extended pharynx. The two median papillae are shorter than the six other pairs (Fig. 1d). The two pairs of dorsal and ventral hooked jaws are minutely serrated with numerous teeth (Fig. 1e).

The biramous parapodia have shorter notopodia located on the anterodorsal sides of the longer neuropodia (Fig. 3a-d). The notopodium is subconical, with aciculiform lobe, and is enclosed by a flaring bract, more developed posteriorly due to the presence of the aciculum. The neuropodium is deeply cleft in the upper and lower part, with a long conical prechaetal aciculiform lobe and a shorter rounded postchaetal lobe. Tufts of bacteria-like filaments are located on the margin of neuropodia and notopodia, and on the chaetae (Fig. 3a-d). The nothochaetae are numerous, forming thick...
Figure 1. *Lepidonotopodium jouinae* sp. nov. a. Light and b-e. SEM views. a. Formalin prevered specimen in dorsal view. b. Dorsal view of the prostomium (pharynx everted) and first segments. c. Fronto-dorsal view of the prostomium with palps and buccal cirri. (p) palps, (vc) ventral buccal cirrus, (dc) dorsal buccal cirrus. d. Frontal view of the everted pharynx with the two pairs of jaws and six pairs of buccal papillae plus one mediodorsal and one medioventral papillae. e. Detail of the ventral pair of jaws.

Figure 1. *Lepidonotopodium jouinae* sp. nov. a. Vue en microscopie optique et b-e, vues en microscopie électronique à balayage (MEB). a. Habitus d’un spécimen fixé au formol en vue dorsale. b. Vue dorsale du prostomium et des premiers segments. c. Vue fronto-dorsale du prostomium avec ses palpes et cirres buccaux. (p) palps, (vc) cirre buccal ventral, (dc) cirre buccal dorsal. d. Vue frontale du pharynx dévaginé montrant les deux paires de mâchoires et les six paires de papilles buccales plus une papille medioventrale et une médiodorsale. e. Détail de la paire de mâchoires ventrale.
A NEW SPECIES OF POLYNOIDAE FROM THE MID-ATLANTIC RIDGE

Figure 2. Lepidonotopodium jouinae sp. nov. SEM views. a. Elytron removed from segment 9. b. Dorsal view of segments 9-11 showing the inflated dorsal tubercles (large arrow) on an elytraphorous segment and bands of cilia (small arrows). c. View of the elytral surface in a clean area showing micropapillae. d. View of the elytral surface in an area covered by filamentous and mineral material. e. Ventral view of segments 11-15 of a specimen with elongated ventral papillae. f. Ventral view of posterior segments and the pygidium with two anal cirri.

Figure 3. *Lepidonotopodium jouinae* sp. nov. SEM views. 

- **a.** Anterior view of a cirrigerous parapodium (segment 8).
- **b.** Posterior view of a cirrigerous parapodium (segment 8). The arrow indicates the cirrophore.
- **c.** Anterior view of an elytrophorous parapodium (segment 9).
- **d.** Posterior view of an elytrophorous parapodium (segment 9).
- **e.** Notochaetae.
- **f.** Ventral neurochaetae.
- **g.** Dorsal neurochaeta.
- **h.** Tips of ventral neurochaetae.

*Figure 3. Lepidonotopodium jouinae* sp. nov. Vues en MEB. 

- **a.** Vue antérieure d’un parapode cirrophore (segment 8).
- **b.** Vue postérieure d’un parapode cirrophore (segment 8). La flèche indique le cirrophore.
- **c.** Vue antérieure d’un parapode élytrophore (segment 9).
- **d.** Vue postérieure d’un parapode élytrophore (segment 9).
- **e.** Soies notopodiales.
- **f.** Soie neuropodiale ventrale.
- **g.** Soie neuropodiale dorsale.
- **h.** Extrémités de soies neuropodiales ventrales.
radiating bundles. They are stouter than the neurochaetae (Fig. 3a-d). The superior notochaetae are shorter than those from the middle of the notopodium. The notochaetae have two rows of alternating teeth, appearing as scales, partially pealed off the body on the chaetae (Fig. 3e). The tips of the notochaetae are blunt. The neurochaetae are numerous, forming fan-shaped bundles (Fig. 3a-d). The dorsal ones have one row of spines and straight tips (Fig. 3g). The ventral neurochaetae have two rows of numerous spines along one side, with bare slightly hooked tips (Fig. 3f, h). The ventral cirri are very short, tapered, attached on the base of the neuropodia (Fig. 3a-d).

On about one half of the specimens, there are five pairs of large elongated papillae at the base of the neuropodia of segments 11 to 15 (Fig. 2e). In some of these specimens, sperm can be seen through the wall of the papillae. Any kind of segmental or nephridial papillae are absent on other segments. The elongated papillae are attached ventrally on the neuropodia and are similar in size, extending to the base of the neurochaetae. The three first pairs are attached basally whereas the two posteriormost pairs are attached more distally (Fig. 2e).

The pygidium is not visible dorsally (Fig. 2f). There is one pair of ventral anal cirri, as long as the dorsal cirri of the preceding segments.

Etymology. The species with the epithet jouinae is named in the honor of Dr. Claude Jouin-Toulmond for her kindness and enthusiasm at communicating her passion of Zoology. She was our teacher for our first contacts with Biology and Taxonomy at the “Université Pierre-et-Marie-Curie in Paris, France” and is still working with us on hydrothermal ventannelids.

Discussion

Lepidonotopodium was erected by Pettibone (1983) for L. fimbriatum from hydrothermal rift-area off western Mexico at 21°N. It is the type species of the subfamily Lepidonotopodinae, polywails without lateral antennae, with a bilobed prostomum and with well developed notopodial bracts. They have 11 pairs of elytra, located on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19 and 21. Since this first description, five other species of Lepidonotopodium have been described (L. riftense, L. williamsae, L. minutum, L. piscesae and L. atalantae). Miura (1994) erected a second genus, Thermopolyne, in this subfamily, with the species T. branchiata. This genus differs from Lepidonotopodium in having arborescent branchiae.

Lepidonotopodium jouinae is a small species of Lepidonotopodium as are L. riftense, L. minutum and L. atalantae. L. jouinae resembles L. piscesae in having five pairs of elongate ventral papillae but differs in the location of these papillae on the neuropodia. In L. piscesae, the papillae are all inserted at the base of the neuropodia whereas in L. jouinae, the two last pairs are inserted more distally on the neuropodia. In addition, L. jouinae has 24 segments and L. piscesae has 28 segments. About 250 specimens have been observed, most of which were sexually mature (presence of sperm in the elongated papillae). We are therefore confident that the adults do not have more than 24 segments, this number being very stable as in other hydrothermal vent polynoid species. The prostomium has triangular cephalic peaks in L. riftense, L. minutum, L. atalantae and L. jouinae whereas L. fimbriatum, L. piscesae and particularly L. williamsae have more prominent cylindrical lobes. The jaws are also distinctive: they have numerous small teeth in L. jouinae as in L. riftense and L. atalantae. Other species have either smooth teeth (L. minutum) or a small number of big teeth as in L. fimbriatum, L. williamsae and L. piscesae (see Tables 1-3 in Desbruyères and Hourdez, 2000). The papillae on the proboscis of L. jouinae are different in position and shape from the other species.

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References


