



## ***Mesonerilla neridae* sp. nov. (Nerillidae): First meiofaunal annelid from deep-sea hydrothermal vents**

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### **Abstract**

Though most common in coastal sandy bottoms, nerillid annelids have been found in a broad variety of habitats around the world and two genera have previously been reported from the deep sea. During a cruise to the southern East Pacific Rise and northern Pacific Antarctic Ridge (near Easter Island) in 2005, six specimens of a new species of *Mesonerilla* were collected at depths of 2234–2649 m. Samples were taken via DSV *Alvin* with a slurp gun collecting fine silt and volcanic glass shards in cracks, fissures, and mussel beds from 5–20 m away from active venting areas. As well as being the first deep-sea hydrothermal vent associated nerillid, this is the first record of an adult meiofaunal annelid from deep-sea hydrothermal vent areas and the first record of *Mesonerilla* from the deep sea. Based on the new material we here describe a new species of *Mesonerilla*, *M. neridae* sp. nov., with nine chaetigerous segments, three antennae, long chaetae, and almost no ciliation. It resembles the subtidal, interstitial *M. roscovita* in the shared presence of a short median antenna and *M. fagei* and *M. lüderitzi* by presence of chaetae in segment one and relatively short parapodial cirri.

**Key words:** deep sea, hydrothermal vent, meiofauna, Polychaeta, Annelida

### **Introduction**

No meiofaunal annelid adults have been described from hydrothermal vent areas and in general only relatively few records exist from the deep sea (Giere 2008; Desbruyères et al. 2006). Most meiofaunal annelids, such as protodrilids, psammodrilids, and dinophilids, are known from the interstitial environment of intertidal and subtidal coastal areas, which also accounts for the majority of Nerillidae (Worsaae 2005). However, many nerillids have also been found in mud or silty sediments, suggesting a more flexible range of habitat than other meiofaunal annelid taxa. Three nerillids are known from the deep sea: *Paranerilla cilioscutata* Worsaae & Kristensen, 2003 and *Paranerilla* sp. from Atlantic muddy sediment and globigerina sand and *Meganerilla bactericola* Müller, Bernhard & Jouin-Toulmond, 2001 from sulphur bacterial mats in the Pacific Ocean (Müller et al. 2001; Worsaae & Kristensen 2003). None of the 49 previously described species of Nerillidae have ever been reported from near deep hydrothermal vents, though an unidentified species referred to as *Nerilla* sp. was reported from a shallow hydrothermal vent at 100 m depth in the sub-polar Mid-Atlantic ridge (Fricke et al. 1989). The few records may be explained by the challenge of collecting meiofauna living in the flocculent surface detritus layer of mud bottom or from cracks in hard

substrates with common deep-sea sampling gear. The present study resulted from examination of sediments from hard-bottom substrates near hydrothermal vents at the Pacific Antarctic Ridge gathered via the deep submergence vehicle (DSV) *Alvin*. Specimens of a new species of *Mesonerilla* (Nerillidae) were discovered representing the first deep-sea hydrothermal vent nerillid, which is formally described here.

## Materials and methods

Material was collected on the PAR05 cruise on RV *Atlantis* during two dives from DSV *Alvin* SW of Easter Island at the beginning of the Pacific Antarctic Ridge (Dive 4093) and NW of Easter Island at the southern end of the East Pacific Rise (Dive 4097). Sediment samples were collected from cracks and fissures and also sometimes amongst mussel clumps 5–20 m away from active venting areas with a slurp gun. The exact position is unknown since the slurp gun was used multiple times during a dive into the same canister. The amount of sediment (mainly fine silt and volcanic glass shards) was small, less than 250 ml, and was suspended and decantation sieved using a 250- $\mu$ m mesh and quickly sorted while still cold. One specimen from Dive 4097 (holotype) was photographed alive and fixed in 3% glutaraldehyde in sodium cacodylate buffer with 0.3 M sucrose, post-fixed in 1% osmium tetroxide, rinsed, and then dehydrated through an ethanol series. The specimen was then critical point dried, mounted, and coated with platinum. Five specimens were collected further south on Dive 4093; four of these were preserved in 2% formalin (in seawater) and transferred to 70% ethanol (paratypes) and one specimen was preserved in 95% ETOH (paratype). All material is deposited in the Benthic Invertebrate Collection, Scripps Institute of Oceanography.

## Results

### *Mesonerilla neridae* sp. nov.

Figures 1–2, Table 1

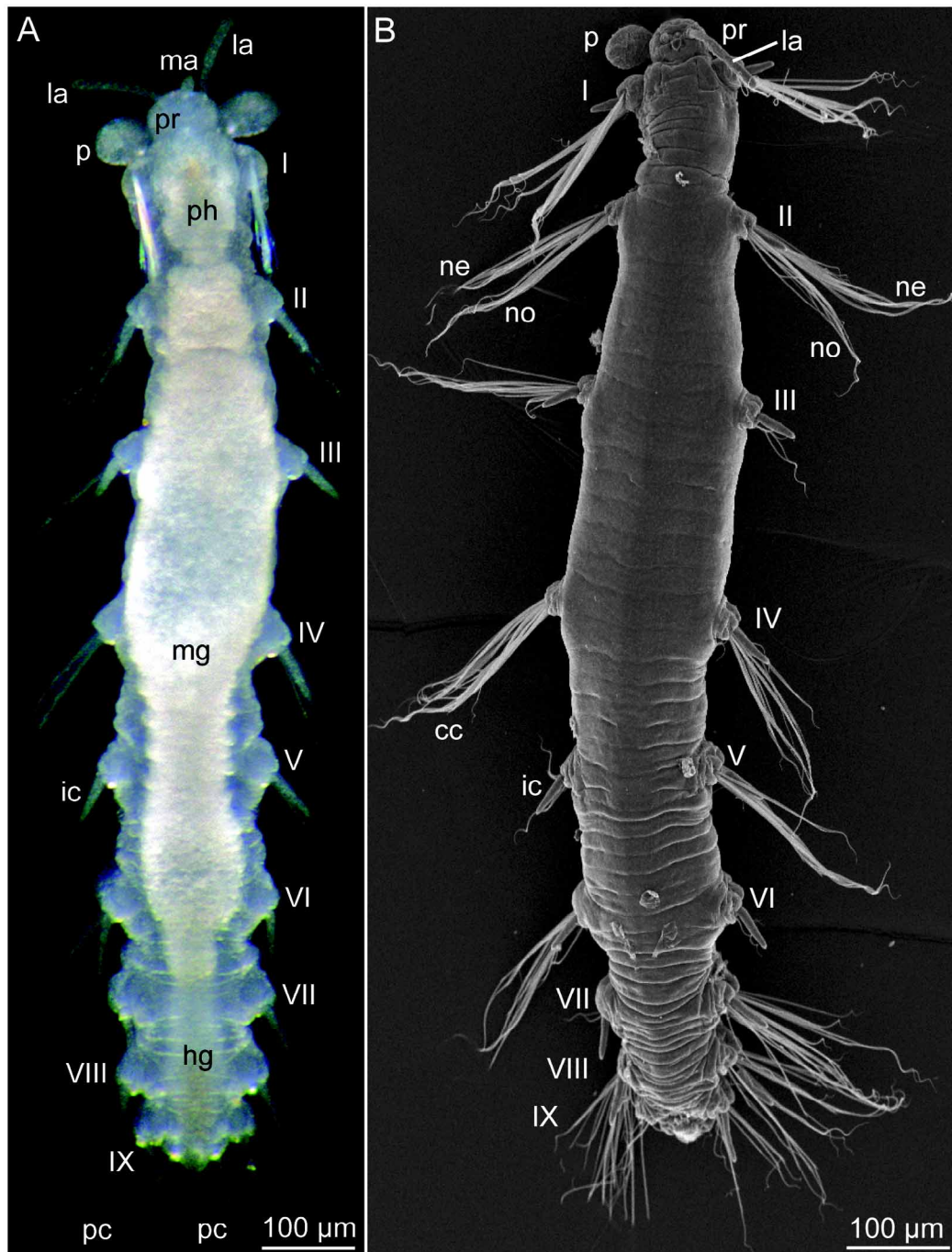
**Holotype.** SEM specimen mounted on stub (measured and photographed alive) (SIO-BIC A1291), DSV *Alvin*, dive 4097, April 2, 2005, 23°49.396'S, 115°27.348'W, 2649 m.

**Diagnosis.** A species of *Mesonerilla* (Nerillidae) with nine chaetigerous segments and three prostomial antennae. Prostomium with two club-shaped palps, two filiform lateral antennae, one short median antenna, and no eyes. Long compound chaetae with single distal extension on shaft; first segment with straight chaetae, following segments with blade at oblique angle to shaft. Cylindrical and distally pointed parapodial cirri present in all chaetigers; interramal cirri in segment 2–9 of similar size, less than half maximum body width and half minimum chaetal length; parapodial cirri in first segment ca. half length. Two filiform pygidial cirri, shorter than chaetae of last segment.

**Etymology.** Named for Nerida Wilson, who was assisting the second author with the sorting and discovered the first specimens.

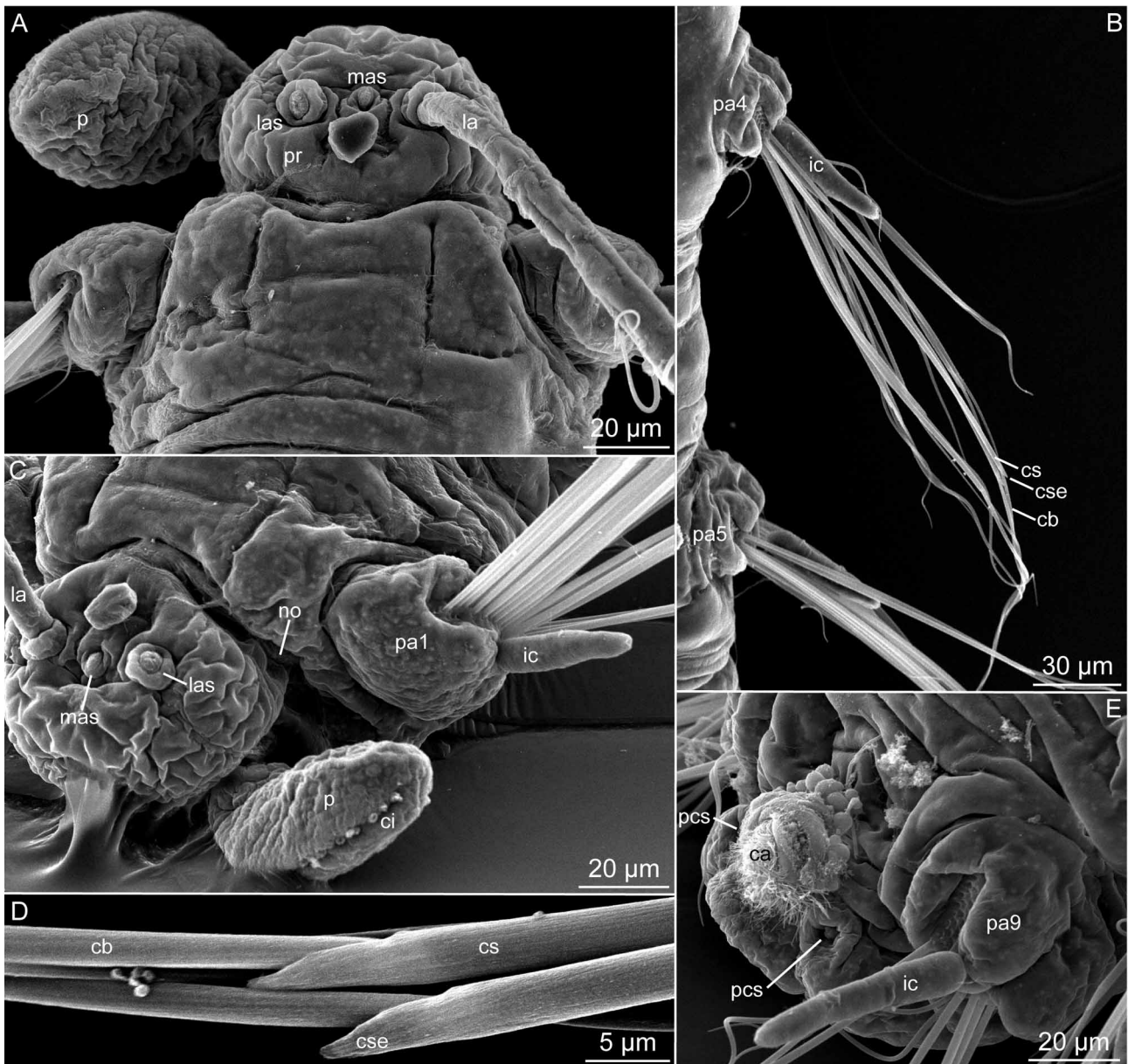
**Description (based on holotype).** A hyaline 1200  $\mu$ m long (without appendages) and 170  $\mu$ m wide (not including parapodia) species of *Mesonerilla* with no obvious eyes (Fig. 1A). Prostomium 60  $\mu$ m long, 80  $\mu$ m wide with two club-shaped palps (70, 80  $\mu$ m long) with row of ciliary tufts, two lateral antennae (110, 130  $\mu$ m) and one short median antenna (30  $\mu$ m) (Figs. 1, 2A–C, E). Few cilia in two areas anterior and posterior to median antenna, respectively. Few barely distinguishable cilia possibly present between lateral antennae and palps. Nuchal organs between palps and buccal segment (first segment) (Fig. 2C). Nine segments, increasing in length from segments 1 to 4 (120,

130, 170, 190  $\mu\text{m}$  long), and then decreasing from segments 5 to 9 (140, 140, 90, 80, 50), pygidium even shorter (30  $\mu\text{m}$  long) (Fig. 1). First segment containing ventral mouth opening of buccal organ with muscular pharynx and lateral posteriorly extending esophageal glands (Fig. 1A). Midgut extending from esophagus border between first and second segment to segment six (Fig. 1A). Intestinal wall lined by numerous small glandular cells, giving whitish opaque appearance of midgut in darkfield photo by reflecting the light (Fig. 1A). Hindgut, less opaque extending from segment 7 to ciliated terminal anus at pygidium (Fig. 1A).



**FIGURE 1.** *Mesonerilla neridae* sp. nov. (SIO-BIC A1291). A, light micrograph of live animal, dorsal view (dark field); B, scanning electron micrograph of same specimen with two antennae and pygidial cirri lost, dorsal view. Abbreviations: I-IX, segments 1-9; cc, compound chaetae; hg, hindgut; ic, interramal cirrus; la, lateral antenna; ma, median antenna; mg, midgut; ne, neurochaetae; no, notochaetae; p, palp; pc, pygidial cirrus; ph, pharynx; pr, prostomium.

Long compound chaetae present in all segments, chaetal shafts with single 5–7  $\mu\text{m}$  long distal extension (Fig. 2D). Small differences in chaetal size throughout chaetigers, though longest at middle segments (Fig. 1B). First uniramous segment with up to 19 straight chaetae, maximum 240  $\mu\text{m}$  long (shaft: 130  $\mu\text{m}$ , blade: 110  $\mu\text{m}$ ) in one chaetal fascicle of parapodium (50  $\mu\text{m}$  long); following segments biramous with chaetae having blades at oblique angle to shaft. Total chaetal length up to 260  $\mu\text{m}$  long at middle segments (shaft: 150  $\mu\text{m}$ ; blade: 110  $\mu\text{m}$ ), grouped in dorsal (with 5–11 notochoetae) and ventral fascicles (with 6–9 neurochaetae) of parapodium (30–40  $\mu\text{m}$  long).



**FIGURE 2.** *Mesonerilla neridae* sp. nov. (SIO-BIC A1291). A–E, scanning electron micrographs. A, prostomium and first segment, dorsal view; B, parapodia, cirri, and chaetae of segments 4 and 5, right side in dorsal view; C, prostomium and first segment, frontal view; D, compound chaetae of middle chaetigers; E, segment nine and pygidium, dorsolateral view. Additional abbreviations: ca, ciliated anus, ci, ciliary tufts (curled or lost); cb, chaetal blade; cs, chaetal shaft; cse, distal extension of chaetal shaft; las, lateral antenna scar; mas, median antenna scar; no, nuchal organ; pa1–9, parapodium of segments 1–9; pcs, scar of pygidial cirrus.

**TABLE 1.** Unless otherwise indicated, the information is provided in the original descriptions. Taxon names with lightest shade = closest resemblance; shaded cells indicate deviation from characteristics of *Mesonerilla neridae* sp. nov.

<i>Mesonerilla</i> Remane, 1949	max L without append. (µm)	max W parapo- segm. (µm)	Present	30	130	80	40	70	Equal size	para. cirri, relative lengths	para. cirri, shape	pyg. cirri, max L (µm)	pyg. cirri, shape	chaetae in buccal segm. (µm)	chaetae around segm. IV, max L (µm)	
<i>Mesonerilla neridae</i> sp. nov. (holotype)	1200	170	Present	30	130	80	40	70	Equal size	Cylindrical pointed tip	Filiform	110	Filiform	c. 19	240	260
<i>M. armoricana</i> Swedmark, 1959	1100	150	Absent	100	180	80	50	50	Equal size	Cylindrical	225	Bottle- shaped (neck 40 µm)	None	none	c. 90**	
<i>M. biantennata</i> <i>biantennata</i> Jouin, 1963	650	70	Present	Absent	112	60	26*	35*	Slightly incr. in L posteriorly, 7 & 8 longer	Cylindrical	200	Filiform	1	50	88	
<i>M. biantennata</i> <i>pacifica</i> Jouin, 1970b	580	c. 70*	Present	Absent	75	60	27*	35*	Slightly incr. in L posteriorly, 7 & 8 not longer	Cylindrical	?	?	1 or 2	Similar to <i>M.</i> <i>biantennata</i>	Similar to <i>M.</i> <i>biantennata</i>	
<i>M. equadoriensis</i> Schmidt & Westheide, 1977	810	130	Present	175	220	70	50	190	Incr. in L posteriorly	Cylindrical	380	Filiform	10	85	195	
<i>M. fagei</i> Swedmark, 1959	c. 1000	130	Present	130	300	130	20	80	Equal size	Cylindrical pointed tip	c. 200*	Filiform	c. 8**	c. 120**	c. 130**	
<i>M. intermedia</i> Wilke, 1953	1200	150	Present	355	450	?	40	250	Incr. in L posteriorly	Slightly bottle- shaped	330	Filiform	6**	40 (c. 115**)	c. 220**	
<i>M. lüderitzi</i> Remane, 1949	600 (frag- ment)	c. 130*	Present	135	200	45	48	60	Slightly incr. in L posteriorly	Slightly bottle- shaped	?	?	4 to 5	<100*	<100*	
<i>M. roscovita</i> Lévi, 1953	800	150	Absent	c. 40**	300	100	c. 40**	c. 80**	Equal size 2 to 8; longer 9	Cylindrical	150	Filiform	None	None	c. 180**	

\*Estimated from original description, \*\*Measurements on material collected near type localities by the first author. Abbreviations: ant=antenna, append= appendages, L=length, max=maximum, para=parapodial, pyg=pygidial, segm=segment W=width.

Equal-sized, short, cylindrical, distally pointed interramal cirri in segments 2–9 (60–70  $\mu\text{m}$ ); parapodial cirri of first segment shorter (40  $\mu\text{m}$ ) (Figs. 1, 2). Two relatively short, filiform pygidial cirri (100, 110  $\mu\text{m}$ ) (Figs. 1A, 2E). Ventral ciliation around mouth opening continuing in narrow midventral band to pygidium. Very few dorsal cilia on trunk, with no obvious dorsal ciliary tufts in transverse bands and no short transverse ciliary bands on anterior dorsal margin of parapodia. No reproductive or nephridial organs observed.

**Paratypes.** Four specimens fixed in formalin (SIO-BIC A1292), DSV *Alvin*, dive 4093, March 28, 2005, 31°51.869'S, 112°02.638'W, 2235 m. Specimens 700–930  $\mu\text{m}$  long, but strongly contracted and in bad condition. Few lateral antennae (up to 150  $\mu\text{m}$  long) and parapodial cirri present (up to 80  $\mu\text{m}$  long). Compound chaetae in all segments with distal extension on shaft (6–8  $\mu\text{m}$  long). Buccal chaetae in one bundle, straight, up to 260  $\mu\text{m}$  long (shaft/blade: 150/110); other chaetae with blade at oblique angle to shaft. Up to 10 notopodial and 9 neuropodial chaetae in segments 2–9 with maximum length 260–350  $\mu\text{m}$  (shaft/blade: 170/90 and 220/120) around segment four.

**Associated fauna.** The sediment samples that contained the nerillids also contained dorvilleids, hesionids, an undescribed scalibregmatid (*Axiokebuita*), and the recently described sphaerodorid *Sphaerodoropsis annae* Aguado & Rouse, 2006.

**Remarks.** The new species is the first record of *Mesonerilla* from the deep sea, as well as the first nerillid from a deep hydrothermal vent area. *Mesonerilla neridae* sp. nov. has a characteristic short median antenna similar to that of *M. roscovita* Lévi, 1953, from which it otherwise differs by its presence of chaetae in segment one, larger body size, and longer chaetae. *Mesonerilla neridae* sp. nov. also has shorter lateral and median antennae and short pygidial cirri compared to *M. roscovita*. Due to the presence of chaetae in segment one and presence of short parapodial cirri (relative to body and chaetal lengths), it may most closely resemble *M. fagei* and *M. lüderitzi* (see Table 1). However, *M. neridae* sp. nov. differs from the latter two species by the larger number and length of chaetae, short median antenna, and larger size. It furthermore has longer buccal cirri and shorter pygidial cirri than *M. fagei*. With the sparse description of *M. lüderitzi* based on a fragment or a juvenile no more characters could be compared here.

## Discussion

Studies of meiofauna have largely been neglected at deep hydrothermal vent environments (Bright 2006), though some recent studies are starting to focus on this group (e.g., Copley et al. 2007; Zekelya et al. 2006). These studies have not concentrated on annelids and have mainly documented other groups such as copepods, ostracodes, and nematodes. Given this fairly recent focus on deep-sea vent meiofauna it is perhaps not so surprising that *Mesonerilla neridae* sp. nov. is the first meiofaunal annelid to be described from this habitat. *Mesonerilla* (and *Leptonerilla*) have been found in fine silty sediments of Atlantic caves (Worsaae et al. 2004), with some habitat resemblance in sediment type and food sources. Even so, the presence of *M. neridae* sp. nov. near hydrothermal vents in deep-sea fine silty sediment and volcanic glass of the Pacific again demonstrates the habitat flexibility of nerillids, not found among other meiofaunal annelids usually restricted to the interstitial habitat.

A range of other annelids have been described from deep-sea hydrothermal vents including leeches and larger-bodied polychaetes from families such as Alvinellidae, Ampharetidae, Amphinomidae, Dorvilleidae, Eunicidae, Glyceridae, Hesionidae, Maldanidae, Nautiliniellidae, Neredidae, Orbiniidae, Phyllodocidae, Polynoidae, Serpulidae, Siboglinidae, Spionidae, and

Syllidae (see Desbruyères et al. 2006), and most recently Chaetopteridae (Nishi & Rouse 2007) and Sphaerodoridae (Aguado & Rouse 2006). No doubt there remain other smaller-bodied annelids to be described from the sediments near deep-sea hydrothermal vents if they are sampled properly.

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