

Chemosymbiotic species from cold seeps around NE Atlantic



Clara F. Rodrigues^{1,2}, Sébastien Duperron², Ana Hilário¹ and Marina R. Cunha¹

¹ Centro de Estudos Ambientais e do Mar, Departamento de Biologia, Universidade de Aveiro, 3810-193 Aveiro, Portugal
² Université Pierre et Marie Curie, UMR7138 (UPMC CNRS IRD MNHN), Systématique Adaptation, Evolution, 75052 Paris, France

✉ clara.rodrigues@ua.pt

Gulf of Cadiz

13 Bivalvia (see map for distribution):

- *Acharax* nov. sp. (1)
- *Solemya* (*Petrasma*) nov sp. (2)
- *Lucinoma* nov sp. (3)
- *Thyasira vulcolutre* (4)
- *Spinaxus sentosus* (5)
- *Isorropodon* nov. sp. (6)
- *Isorropodon* sp. indet (7)
- *Calyptogena cf. regab* (8)
- *Bathymodiolus mauritanicus* (9)
- *Idas* sp. (10)
- *Laubericoncha chuni* (11)
- *Callogonia cyrili* (12)
- *Pliocardia* sp. (13)

15 Siboglinidae:

- *Siboglinum* spp. (6 species)
- *Siboglinum cf. poseidoni*
- *Cyclobrachia* sp.
- *Bobmarleya gadensis*
- *Spirobrachia tripeira*
- *Lamellisabela denticulata*
- *Lamellisabela* sp.
- *Polybrachia* spp.

High diversity of frenulate (Thyasira, Siboglinidae) in the Gulf of Cadiz near volcanoes. A DNA taxonomy analysis is necessary to assess the extent of the symbiosis.

Microbial diversity in Frenulate, Siboglinidae, Polybrachia, Cyclobrachia and other bivalves recovered from the Gulf of Cadiz (N. Adachi).

Mud volcanoes (MV) with chemosymbiotic species. Bon, Bonjardim MV; CA: Captain Arutyunov MV; CR: Carlos Ribeiro MV; Dar, Darwin MV; Gem, Gemini MV; Gin, Ginsburg MV; JB, Jesus Baraza MV; Kid, Kidd MV; Mek, Meknes MV; Mer, Mercator MV; PDE, Pen Duick Escarpment; Por, Porto MV; Sag, Sagres MV; Yum, Yuma MV.

Bacteria associated:

► Phylogenetic analysis of bacterial 16S rRNA gene sequences demonstrated that most bacteria were related to known sulfide-oxidizing endosymbionts found in other deep-sea chemosymbiotic;

► *Thyasira vulcolutre*: symbiont sequence clusters with vesicomyid symbionts;

► *Bathymodiolus mauritanicus*: was shown to possess a dual symbiosis with thio- and methanotrophic symbionts;

► *Other bivalves*: under study.

(a) Phylogenetic tree of bacterial 16S rRNA gene sequences associated with the gills of two bivalve species from the Gulf of Cadiz. Minimum evolution trees derived from LogDet distance analysis.

(b) FISH hybridization on *T. vulcolutre* gill filaments with the ThyCo193 probe. No signal was observed from the ciliated zone, whereas all bacterioytes from the lateral zone were fully hybridized (in green), indicating bacterioytes filled with bacteria. Nuclei of thiasirid cells, which are counterstained with DAPI, appear blue.

(c) Phylogenetic tree showing the relationship of the Gammaproteobacteria 16S rRNA gene sequences recovered from several species of frenulates from the Gulf of Cadiz. The tree was obtained using Minimum Evolution and LogDet.

► Siboglinidae: Phylogenetic analyses indicate that the primary symbiont in most cases belongs to the Gammaproteobacteria and were related to thiotrophic and methanotrophic symbionts from other marine invertebrates, whereas members of the microflora were related to multiple bacterial phyla.

► This is the first molecular evidence of methanotrophic bacteria in at least one frenulate species.

► No selection for specific symbionts - environmental acquisition as previously proposed for this group of siboglinids

Western Mediterranean - Alboran Sea

2 Bivalvia:

- *Lucinoma* sp.
- *Myrtea* sp.

2 Siboglinidae:

- *Lamellibrachia* sp. (a)
- *Siboglinum* sp.

Bacteria associated:

► Not yet studied

First record of a Vesicomyid (Thyasira, Siboglinidae) from the Alboran Sea. The Alboran tubeworm is essentially identical to *Lamellibrachia* sp. found in the eastern Mediterranean.



Eastern Mediterranean

8 Bivalvia:

- Solemyidae NID
- *Lucinoma kazani*
- *Myrtea* sp.(a)
- *Myrtea amorpha*
- *Thyasira striata*
- *Idas modiolaeformis*
- *Idas* sp. EM
- *Thyasira* sp. EM (b)

1 Siboglinidae:

- *Lamellibrachia* sp.

Bacteria associated:

- *Lamellibrachia* sp.: gammaproteobacterium closely related to other sulfide-oxidizing tubeworm symbionts.
- *Myrtea* sp. and *Thyasira* sp.EM: gammaproteobacterial endosymbionts; the Myrtea-associated bacterium is closely related to lucinid symbionts from both deep-sea and coastal species, whereas the *Thyasira*-associated bacterium is closely related to the symbiont of a *T. flexuosa* from coastal waters off the U.K.
- Solemyidae: no bacteria found, but it was a small single specimen

First documented record of a living solemyid bivalve in a peckmark of the Nile Deep-sea Fan (eastern Mediterranean Sea).

Gulf of Guinea

14 Bivalvia:

- *Acharax* sp.
- *Lucinoma myriamae*
- *Graecina karinae*
- *Joellina dosiniiformis*
- *Thyasira* sp. nov sp.
- *Isorropodon bigoti*
- *Isorropodon striatum*
- *Isorropodon atalvae*
- *Calyptogena valdiviae*
- *Calyptogena regab*

Bivalvia (cont.):

- *Wareniconcha guinensis*
- *Elenaconcha guiness*
- *Laubericoncha chuni*
- *Bathymodiolus aff. boomerang*

2 Siboglinidae:

- *Lamellibrachia* spp.

Bacteria associated:

- *Thyasira* nov sp.: gammaproteobacterium related to *Maoritithys hadalis* symbiont II, but both are related to environmental sequences and branch far from any other known symbionts;
- *Calyptogena regab* and *Laubericoncha chuni*: see Decker *et al.* (Poster BG66 EGU2011-11570);
- Other taxa: under study.

After Krylova & Sahling 2010; Oliver *et al.* submitted

ACKNOWLEDGMENTS

• Thanks are due to Dr. Graham Oliver (National Museum of Wales, Cardiff), Dr. Gordon Webster and Prof. Andrew J. Weightman (Cardiff University), with whom some of the work has been done.

* We also thank Carole Decker (IFREMER) for carry this poster.

* CFR is supported by the FCT grant (SFRH/BPD/64154/2009) and AH is supported by the FCT grant SFRH/BPD/22383/2005