

Chemosymbiotic species from cold seeps around NE Atlantic

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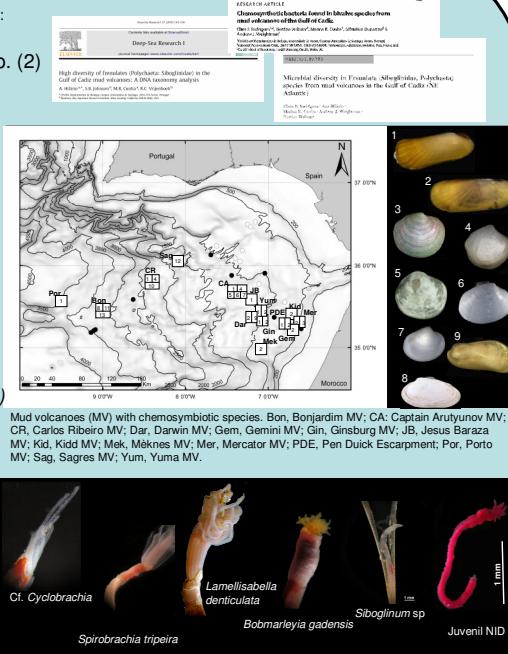
Gulf of Cadiz

13 Bivalvia (see map for distribution):

- Acharax nov. sp. (1)
- Solemya (*Petrasma*) nov sp. (2)
- *Lucinoma* nov sp. (3)
- *Thyasira vulcolute* (4)
- *Spinaxis 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)

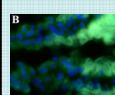
15 Siboglinidae:

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



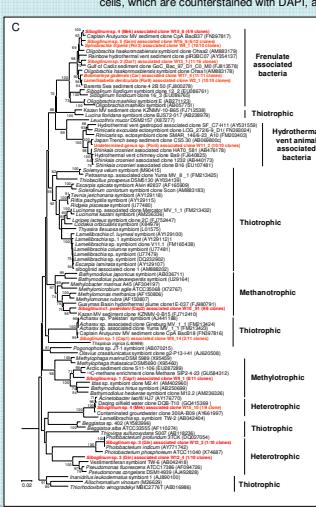
Bacteria associated:

- Phylogenetic analysis of bacterial 16S rRNA gene sequences demonstrated that most bacteria were related to known sulfide-oxidizing endosymbionts found in other deep-sea chemosynthetic; *Thyasira vulcolute*: symbiont sequence clusters with vesicomyids 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 some bivalve species from the Gulf of Cadiz. Minimum evolution trees derived using Log-D distance analysis.

(b) FISH hybridization of surface gill filaments with the ThyGoC193 probe. No signal was observed from the ciliated zone, whereas all bacteriocytes from the lateral zone were fully hybridized (in green), indicating bacteriocytes filled with bacteria. Nuclei of thyridial cells, which are counterstained with DAPI, appear blue



► 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 microbiota were related to multiple bacterial phyla.

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

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

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

Western Mediterranean - Alboran Sea

2 Bivalvia:

- *Lucinoma* sp.
- *Myrtle* sp.

2 Siboglinidae:

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

The Alboran tubeworm is essentially identical to *Lamellibrachia* sp. found in the eastern Mediterranean

Bacteria associated:

► Not yet studied

1 bivalve
Others?



Eastern Mediterranean

8 Bivalvia:

- Solemyidae NID
- *Lucinoma kazani*
- *Myrtle* sp.(a)
- *Myrtle amorphora*
- *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.
- *Myrtle* sp. and *Thyasira* sp. EM: gammaproteobacterial endosymbionts; the *Myrtle*-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. flexosa* from coastal waters off the UK.
- *Solemyidae*: no bacteria found, but it was a small single specimen

Gulf of Guinea

14 Bivalvia:

- *Acharax* sp.
 - *Wareniconcha guinensis*
 - *Elenaconcha guiness*
 - *Laubericoncha chuni*
 - *Bathymodiolus aff. boomerang*
- 2 Siboglinidae:
- *Lamellibrachia* spp.

After Krylova & Sahling 2010; Oliver et al. submitted

Bacteria associated:

- *Thyasira* nov. sp.: gammaproteobacterium related to *Maorithyas 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.

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 as 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