# Press Release

GEOMAR
Helmholtz Centre for Ocean Research Kiel

future ocean
KIEL MARINE SCIENCES

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## Deep-Sea Organisms – Rare Life at GEOMAR
### First-time cultivation of mussels from hydrothermal vents by Kiel marine biologists

***12 February 2014/Kiel.*** **There are still many puzzles in the deep-water ecosystems that scientists are trying to solve. These systems are extremely difficult to investigate, and it takes a lot of effort to cultivate deep-sea animals under controlled conditions. Now, for the first time in Germany, Kiel marine researchers have succeeded in maintaining deep-sea mussels of the species *Bathymodiolus azoricus* in aquariums. The aim of the project is to find out how the animals propagate in the deep sea.**

Their natural habitat is dark and extremely uncomfortable, at least in human terms. Mussels of the genus *Bathymodiolus*, deep sea relatives of the *Mytilus* mussels, live in water depths of 500 to over 3000 meters near “cold seeps” or hydrothermal vents, also known as ”black smokers”. Here up to 400° Celsius hot water shoots from the seabed. At these locations, the water is enriched not only with minerals but also with gases such as methane and hydrogen sulfide. Highly-specialized bacteria use these substances for energy, which in turn benefits the mussels: They get their nutrients mostly by living in symbiosis with the bacteria, so they take advantage of the carbon produced by the microorganisms themselves. However, very little is known about the exact circumstances of the deep-sea organisms, their reproduction and propagation. “Long-term and large-scale studies in the natural habitat of the mussels are virtually impossible due to the water depths and the high technical effort required for deepwater work,” says biologist Corinna Breusing from GEOMAR Helmholtz Centre for Ocean Research Kiel.

Now Breusing, in cooperation with the Kiel Marine Organism Culture Center (KIMOCC), a joint project of GEOMAR and the Cluster of Excellence “The Future Ocean”, has been able to cultivate deep sea mussels of the species *Bathymodiolus azoricus* in culture chambers at GEOMAR. “This is really special. Worldwide, aside from the Oregon Institute of Marine Biology and the University of the Azores, we are the only institution that has ever managed to maintain *Bathymodiolus* bivalves successfully in culture,” Breusing says. As part of the German - Canadian graduate school HOSST at GEOMAR, she is working on her doctoral thesis about how different species of the genus *Bathymodiolus* have emerged in the deep sea and how the genetic exchange between different populations takes place. “Without the opportunity to observe the mussels under controlled conditions, this would hardly be possible,” Breusing adds.

The mussels were collected during a voyage of the French research vessel POURQOI PAS? in the summer of 2013 by the ROV VICTOR 6000 from an 850-meter deep hydrothermal vent located near the Azores in the Atlantic. Keeping the mussels alive provided a major challenge for the scientists: In order to provide these light-shy animals and their symbionts with vital amounts of hydrogen sulfide and methane, the researchers installed a continuous “feeding” with sodium sulfide and an air/methane mixture - not an easy task. ”Since both hydrogen sulfide and methane are toxic and flammable in their respective concentrations, some safety aspects had to be considered. But to tackle those kind of challenges in the culture of marine animals in a research environment is our goal,” explains Dr. Claas Hiebenthal, the head of KIMOCC.

Unlike many other animals of comparable deep-sea habitats *Bathymodiolus azoricus* also have their own digestive system in addition to the symbiosis with the bacteria. Therefore, they will also receive single-cell marine algae as food. ”The mussels are active, visibly filter the water and climb around the aquariums - so it seems that they are doing well,” Dr. Hiebenthal continues. Fortunately, another environmental factor of the deep sea did not have to be simulated by the scientists: *Bathymodiolus* mussels are surprisingly adaptable to atmospheric pressure, so no use of pressure chambers was necessary.

A first major success story was already realized by the GEOMAR scientists: Recently, some individual mussels had spawned through the use of hormone injections. "Nobody else had been able to do this with this species," Breusing reports. Her project task is now to raise the larvae of these animals in order to determine their swimming behavior and temperature tolerances. “These data are important to understand and more accurately predict the movements of drifting larvae using computer models of the ocean current flows.”

Until then, there is a lot of work to be done. “The reproduction of *Bathymodiolus azoricus* in the laboratory and studies on their larvae are completely uncharted territory,” says Prof. Dr. Thorsten Reusch, head of the Department of Marine Ecology at GEOMAR, who also supervises the doctoral thesis of Corinna Breusing. ”We are excited to see how it goes.”

**Links:**
www.geomar.de GEOMAR Helmholtz Centre for Ocean Research Kiel
www.futureocean.org/en/kimocc/index.php Kiel Marine Organism Culture Centre “KIMOCC”
www.hosst.org German-Canadian graduate school HOSST

**Images:**
Images are available for download at www.geomar.de/n1742-e

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