

Weekly report RV MERIAN MSM13-3
Expedition "HOMER"
25.10.09-30.10.09



This expedition started with a very nice reception on board RV Maria S. Merian, which for the first time berthed at the New Lemesos Port of Cyprus. Representatives of the German Embassy in Nikosia, Cypriot researchers, port authorities, and representatives of a number of maritime institutions met on board the MERIAN to inform each other of the goals of the research expedition MSM13 and of the role of Cyprus in EU oceanography programs. After two days of installing the ROV QUEST for the first time on board MERIAN, and after unpacking 8 containers, we left Limassol in the morning of Sunday 25 October, with beautiful Southern Mediterranean weather and steamed towards our first target area.

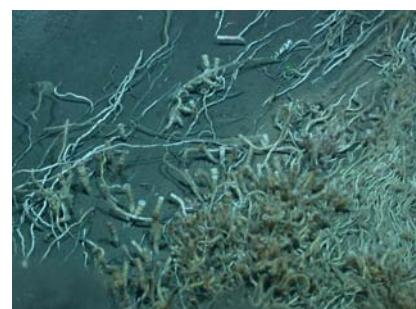


Reception on board RV Maria S. Merian in Limassol, 22 Oct. 09 (Source: A. Unterbirker)

The cruise legs MSM13/3 and 4 will investigate chemosynthetic ecosystems of the deep Eastern Mediterranean. At fluid escape structures in water depths of 1000- 2000 m energy rich chemical substances such as sulfur and hydrocarbon compounds are available to fuel chemosynthetic ecosystems. These are inhabited by a variety of free living and symbiotic microorganisms and their host animals, which exploit the chemical energy from subsurface sediment strata. Chemosynthesis refers to a special ability to use chemical energy to fix CO₂ just as plants do with the help of sunlight. This is an intriguing phenomenon in the deep sea which normally resembles a food impoverished desert -except for the spectacular oases of life associated with hydrothermal vents, cold seeps, whale and wood falls.

Giant chemosynthetic worms on sulfidic mud (Source MARUM)

The expedition contributes to the EC's 7th FP HERMIONE, the GDRE DIWOOD and ESF EUROCORES project CHEMECO, as well as to the goals of the research center MARUM (Geosphere- Biosphere Research). The main objectives of the two subsequent legs MSM13/3 and 4 are to obtain a quantitative



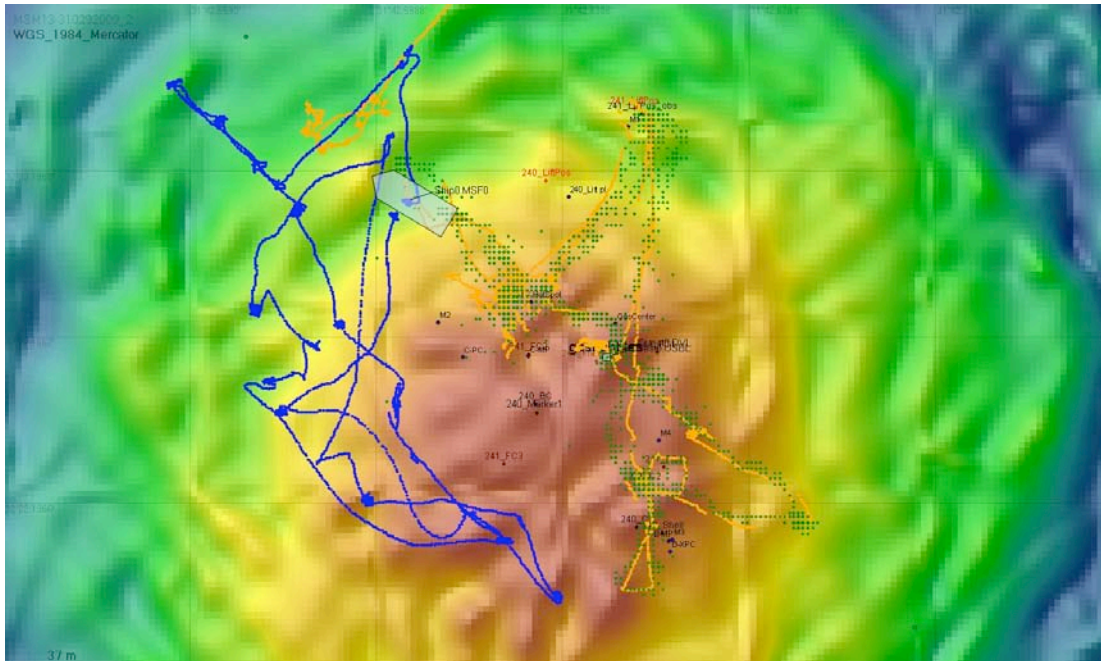
insight in element cycling and export at different types of fluid seeps in the Eastern Mediterranean and to understand the relation and interaction between energy availability, biodiversity and habitat structure.

Deployment of ROV QUEST and the Heat flux corer (Source: Miriam Römer)



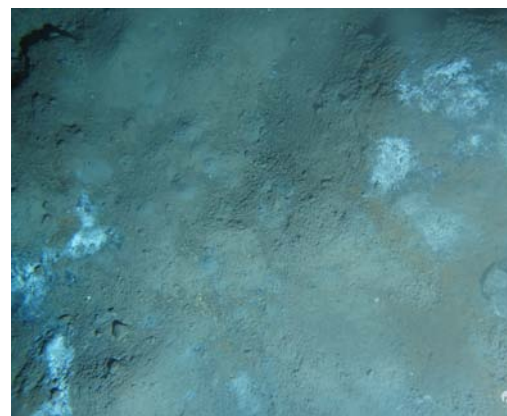
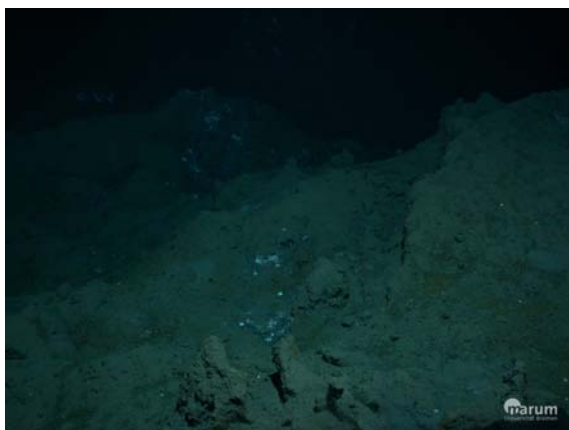
The main tools of this leg are the ROV QUEST4000 (MARUM, University Bremen) and its diverse payloads operated by the MPI Bremen, as well as the online heat flux corer of IFM Geomar. We use these tools in a combination to quantify physical, biogeochemical and ecological processes in chemosynthetic ecosystems, and to study the link between the deep-water geosphere and biosphere in the Eastern Mediterranean. We work on the deep central delta of the Nile fan province where we return to well-known chemosynthetic ecosystems, which have been studied regularly since 2003, to get a better understanding of spatial and temporal scales of chemosynthetic ecosystems. Using high-resolution bathymetry maps of our target areas, we can couple videographic, geochemical as well as ecological investigations in a quantitative manner. Our main target sites are characterized by extensive carbonate pavements and sulfidic muds, and by an astonishing diversity of life. After 6 years of work in this area, we have finally returned to recover a number of long-term deployments and experiments, which aim at a better understanding at the dispersal and interconnection of deep-water chemosynthetic organisms.

We reached the first study site in the morning of the 26 October and immediately began our work with the calibration of the Posidonia navigation system. For our studies aiming at small scale habitat structures, it is essential that we can deploy and relocate instruments and experiments with a precision of less than 10 m at the seafloor in a depth of > 1000 m, which is still a technological and methodological challenge. This time we can profit from MERIAN's excellent positioning system, and – using MERIAN for the first time as research platform – we were pleasantly surprised by the precision of the ship's station keeping and positioning.



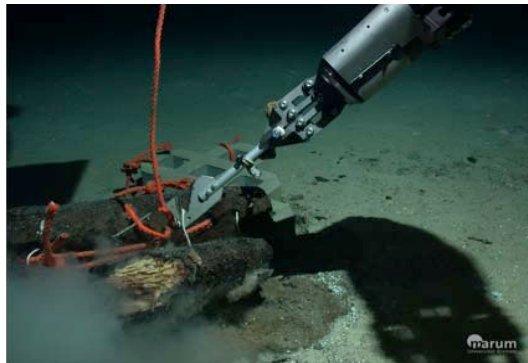
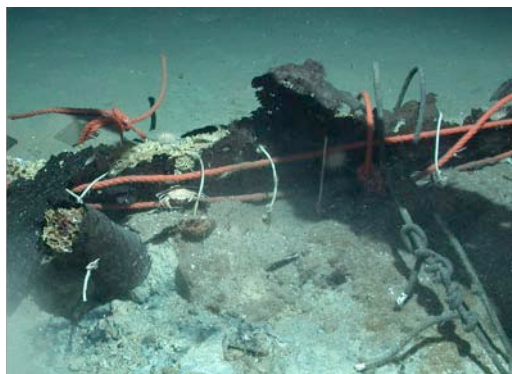
The ship and the ROV are moving on an area of 100x100m between the different instruments and experiments marked on the dive map. As the visibility is <10 m, it is essential that the positioning is as precise. (Source: P. Wintersteller)

Another challenge was getting all instruments ready for a first deployment 24 hours after leaving port. But we were lucky. A first test dive was started in the afternoon of the 26 October. This was the 236th dive of the ROV QUEST, which we can now use after a full overhaul in Bremen during the summer. During the test dive we were able to deploy our deep-sea elevator and to unpack it with the ROV at the seafloor, we placed a larval colonization experiment of our colleagues of the University Pierre et Marie Curie in Paris, and we relocated some of the markers of the METEOR M70 expedition. During the night, further installations took place at the ROV and in the labs, and we immediately went down again with the ROV midday on the 27 October. During this cruise leg, we dive during the day, work on our samples during the night, while our colleagues run mapping surveys and heat flux measurements.



Mud flows on the deep sea floor, covered by bacterial mats composed of giant sulfur-oxidizing bacteria (Source: MARUM, University Bremen)

The first short three dives between the 27 and 30 October were dedicated to the sampling of three biological colonization experiments at a water depth of 1700 m. In different distances from the local chemosynthetic ecosystem, we had deployed large wood logs in 2006, which are now almost completely degraded by specialized wood boring animals. It is an old theory, that chemosynthetic organisms can use sunken woods as stepping stones for their dispersal, and our experiments clearly show that some mussels use this strange habitat to get their energy from sulfur, even at > 100m distance from the next seep in a normal pelagic setting. Coming back now for the third time to these experiments has allowed us to record a fascinating succession of the diverse life forms settling on the wood, and also different biogeochemical phases in the life of the chemosynthetic ecosystem and our sunken wood experiments.



*Sunken wood sampled at the seafloor (left), showing that the wood degrading bacteria have reduced the sedimentary environment (upper right), and that the wood boring bivalve *Xylophaga* has almost grazed all of the log (below) (Source MARUM; C. Bienhold)*

While each dive and the first few days on board have helped to find and remove a few more errors and technical problems with our high tech tools on board, including solving a major power failure and installing new cameras and online sensors on the ROV, hard work by our system operators on the new multipurpose plug of the fiber cable of MERIAN and with the settings and performance of the positioning system, we have planned carefully the next week, which will take us to our second target site on the deep Central Nile delta.

As to the weather conditions, they are currently dominated by rain and thunderstorms, so underwater it is better than above. That is why we keep diving.



The multicorer sampling crew working under unexpectedly harsh weather conditions. (Source: M. Römer)

Please find more information on this expedition on our weblog
[http://www.mpi-bremen.de/
European_scientists_at_sea_A_scientific_weblog.html](http://www.mpi-bremen.de/European_scientists_at_sea_A_scientific_weblog.html)

With warm greetings from all participants of the expedition HOMER MSM13-3

Antje Boetius
Chief scientist