Expedition M70/2b

3. Weekly report (06.11.-12.11.06)

After a day and night in Heraklion, Crete, for the exchange of scientific crew and equipment, we started the second leg of the BIONIL expedition with 14 new scientists on board, including biologists of Ifremer and the University of Paris 6, geochemists of the University Utrecht and NIOZ, and geologists of Ifremer and the National Institute of Oceanography and Fisheries of Egypt. It was quite sad to say goodbye to the fabulous AUV team and our colleagues from Ifremer, GeoAzur, MARUM and MPI. But we have a new goal, to visit the same sites as on the first leg again, this time focusing on biological and geological sampling and in situ geochemical and subsurface temperature measurements. First we had to go around the island of Crete to fuel up, luckily with excellent weather allowing spectacular views on the coastline. The new equipment was installed within a day, and we started the first dive of the second leg on the 9 November at the mud volcano Amon. Everyone agreed to go back to the "sulfur river" at the bottom of the mud volcano to get in situ measurements of sulfide and oxygen fluxes as well as temperature and pH. The second dive was dedicated to deployment of colonizers as well as blade core sampling next to bivalve accumulations and retrieval of carbonate crusts from the western rim of Amon.

Fig. 1 Animals and crusts of the Amon seeps

At first sight, the deep sea of the Eastern Mediterranean looks quite poor in life, even at its cold seep systems, but the diversity is in the detail. The carbonate crusts surrounding the sulfidic sediments of Amon are populated by many different animals: gastropods, anemones, polychaetes, sipunculians, small sponges, and also by chemosynthetic bivalves. Sampling of a few crusts provided 24 small mussels (*Idas* sp) (Fig. 1a) and 6 lucinids (*Lucinoma* aff. *kazani*), both most likely hosting sulfide-dependent symbionts. Interestingly, half of the mussels and one lucinid harboured small white worms (up to 2 cm long, very thin), most likely a parasite. We also collected a beautiful sea urchin (Fig. 1b) named "Benedicte" after an excellent new HERMES student working day and night with smelly muds and crumbly crusts. Furthermore, our biologists were very pleased when a giant shrimp was recovered alive from one of the gravity cores taken at Amon. We suspect that this critter is the cause of zillions of biogenic mounds covering hundreds of square meters around the active center of Amon, but we certainly have to test this hypothesis with further box core sampling.

But also the geologists got lucky with the first two dives and the gravity coring in between: A spectacular carbonate tower (Fig. 2) was discovered in the southwestern part of Amon mud volcano, in connection with the NW-SE fault visualized with the AUV multibeam dive at

Amon. This massive carbonate deposit could be nicknamed ‘pillow carbonate’, because it exhibits very dark and rounded shapes, which resemble pillow lavas. During the dive, we first thought for a moment that it might correspond to an asphalt deposit, similar to those observed in the Gulf of Mexico. But the analysis of the retrieved sample showed that the entire structure corresponds to numerous small nodule-shaped aragonite chimneys coated by manganese-rich oxides. At Amon we are looking at an enormous variety of shapes and colors of carbonate crusts. Our first results from in situ measurements indicate that part of the area may be influenced by brine and sulfide seepage.

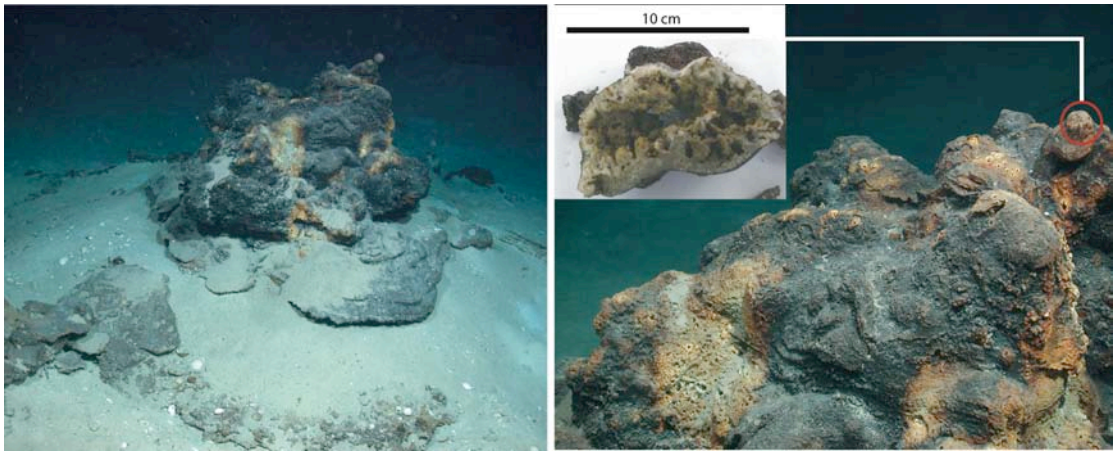

Fig. 2 Carbonate towers on Amon mud volcano

And finally we are proud to report the subsurface temperature record for the Nile delta mud volcanoes of over 70° C at 6 m depth below seafloor in the center of Amon mud volcano. Fig. 3 shows the sampling party of this very hot core. But even more interesting than records are observations helping to understand temporal changes at such deep-water seeps. A gravity core equipped with T-probes taken at the same position as 3 years ago during the NAUTINIL cruise showed a doubling of temperatures from 33° to over 65°, showing that these geo-systems undergo extreme fluctuations. Now, as I write, we are in the middle of the third dive at the Amon sulfur band and have just discovered large patches of giant tubeworms and mytilids associated with a thin, highly sulfidic mud-flow above flat carbonate crusts. This gives a perspective on the time it may take to get a good overview of these highly fractured ecosystems – three 15-hour ROV dives on an area of 100 x 100 m, and we still find new habitats.

Fig. 3 Sampling gravity cores of Amon mud volcano

Looking forward to the next dives and more discoveries – the BIONIL team