Expedition METEOR 112

2nd Weekly Report: 10 – 16 November 2014

After a preliminary mapping of our target area at the foot of Venere Mud Volcano, on 9 November we deployed ROV QUEST 4000 for the first time during the cruise, in the darkness of night until sunrise at 06:00 a.m. (Fig. 1). When the ROV reached the seafloor we saw numerous, dark stained patches of different sizes, their centers mostly covered by white bacterial mats, characteristic of cold seeps. The recognition of direct indicators of fluid seepage right at the beginning of the dive was only possible due to our preliminary investigations based on thorough analyses of hydro-acoustic data. Most scientists of this cruise watched the dive on the large projection screen in the lab which showed the most important camera images from the ROV. The dive is controlled by two scientists together with the two pilots in the ROV's control container, and communication with them was considerably facilitated by the new intercom facility. For the first time, more scientists could be actively involved in the dive, leading to a dynamic exchange between lab and container. When gas bubble emissions from the seafloor were observed, at several locations, there was great enthusiasm. Based on the broad signal of the ship's echosounder we had already concluded that there should be more than one location of gas emission. Unfortunately we could not take samples of the gas, of organisms or of other seafloor manifestations of seepage because the ROV's manipulator arm developed a technical fault after a short period of operation.

Fig. 1: Deployment of MARUM ROV QUEST 4000 in the Mediterranean by night (Photo: Christian Rohleder).

Fig. 2: Surface of gravity core No. 4 with clasts and shells of vesicomyid clams (Photo: Flore Mary).

Therefore we used the dive time for careful documentation of the seep area, and in the second half we traversed upslope towards the western peak of Venere mud volcano. This peak is characterized by high values in the backscatter intensity in our maps which made us suspect a near-surface exposure of clast-rich mud breccia. The entire seafloor upslope was observed to be characterized by fine-grained pelagic sediments highly bioturbated by benthic organisms such as crabs, sea urchins and shrimp. Clast-rich mud breccia was not directly exposed on the seafloor, but the occurrence of mud breccia only a few centimeters below the surface was proven by sediment cores we took on Monday 11 Nov using our gravity corer. Downslope in the seep area, the sediments contained a high proportion of vesicomyid clams (Fig. 2) whose chemosynthetic lifestyle is linked to environments of methane escape. During a second ROV dive we were able to make use the high-resolution micro-bathymetry map acquired during the first dive using the AUV SEAL 500. In particular, the AUV map showed an area of about 100 x 100 m with high seafloor backscatter intensities, characteristic of fluid

and/or gas emissions. By observations along four profiles across the area we could prove that backscatter intensity correlated to the appearance at seabed of carbonate crusts (Fig. 3). The seep carbonates were further associated with acterial mats and chemosynthetic organisms such as clams and sporadic tubeworms.

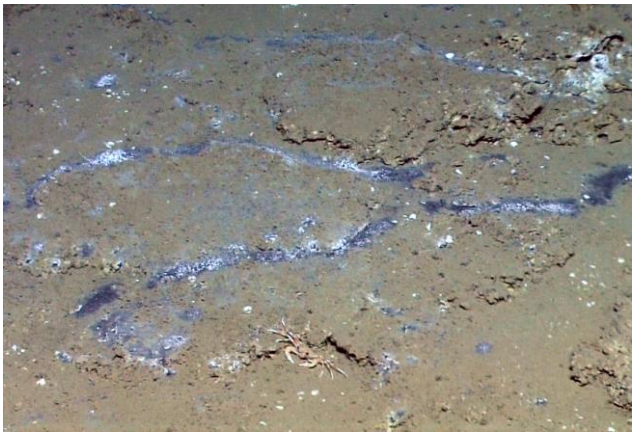

Fig 3: Patchy calcareous layers at the seafloor of Venere mud volcano; partly colonized by bacterial mats and seep organisms in intermediate layers.

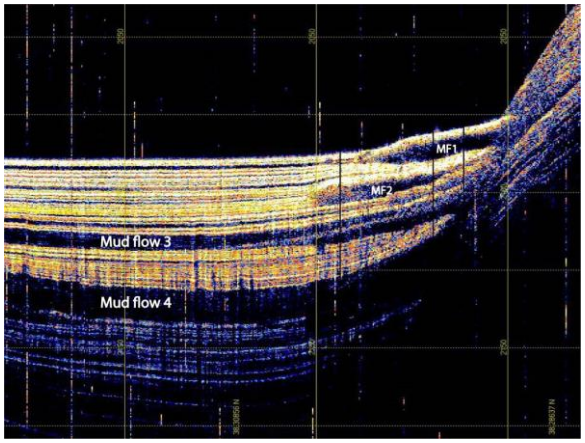

Fig 4: PARASOUND – record showing distinct mud flows at the edge of a mud volcano.

During the past week we had two days of bad weather, which were used for mapping the very interesting morphology of the seafloor of the over 5 million year old pre-Messinian accretionary wedge of the Calabrian Arc. Backscatter intensity maps showed, in addition to the numerous mud volcanoes with their impressive mud flows, a number of tectonic elements, including strike-slip faults, thrust-fold ridges and intervening basins. Additionally PARASOUND subbottom profiles show the third dimension, and we could trace mud flows from the volcanic structures into the basins (Fig. 4).

On Thursday we received news saying that, unfortunately, we will not obtain the research permit for the Turkish Anaximander Mountains, where we had originally planned to do our work during METEOR cruise M112. Despite the strong efforts during the past week of the German Federal Foreign Office (AA), the German Embassy in Ankara, the Control Station German Research Vessels in Hamburg and many others, trying to obtain the research permit for our work in Turkish waters, this could not be achieved. A kind of paralyzing shock soon disappeared, and we started to adapt to the new situation. After long discussions among the scientific team we are sure that we will be able to successfully continue our expedition using the available equipment on the Calabrian Arc until 15 December. All participants are well and could also enjoy the Mediterranean sun during a few free minutes last week.

Best regards on behalf of all cruise participants,
Gerhard Bohrmann RV METEOR, Sunday, 16 Nov 2014

For further information:
www.nationalgeographic.de/meteor oder unter
www.marum.de/Logbuch_Meteor_112.html