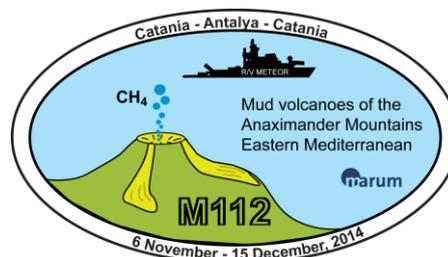


# Expedition METEOR 112

5th Weekly Report: 1 – 7 December 2014



RV METEOR's fifth week of the 112nd expedition was dominated by dives using the MARUM remotely operated vehicle QUEST 4000m. We conducted dives almost daily, during which the scientific payload that included push cores, a temperature probe, gas bubble samplers, bubble catcher, nets and a shovel was routinely utilized on the seafloor, representing the main program of this cruise. Therefore our eight ROV-pilots were always busy: early in the morning with the 2-hours pre-dive check, during the dive that lasted most of the day and also after the ROV dive in the evening (Fig. 1). Some repair work - luckily only very few – was executed in the evening hours.

On Monday, Wednesday and Thursday we performed dives at Venere mud volcano, which is well-known to us from the AUV-map, while on Friday and Saturday the dives were conducted at Cetus and Nicolas mud volcanoes. On Wednesday we placed our autonomous Sonar called ASSMO together with a temperature lance at the gas emission site "Flare 5" on the seafloor (Fig. 2). It detected the bubble escape from the seafloor every 10 minutes for 24 hours. After recovery of the device during the following ROV dive the ASSMO recordings showed the variety of bubble release emissions on the seafloor during an entire day.



**Fig. 1:** Almost daily dives of MARUM ROV QUEST 4000m mostly ended after sun-down (Photo Christian Rohleder).



**Fig. 2:** Gas emission site „Flare 5“ with the mobile sonar „ASSMO“ in the background and the temperature lance beneath Marker 2 in the foreground.

The 344th QUEST dive on Monday guided us to quite fresh looking mud flows coming down from the summit of Venere mud volcano. Under optical control of ROV-video cameras we picked the freshest looking one and followed it upslope to the summit. It is hard to describe our fascination when we were looking flows, at the emission location right from the chimney. Although there was no visible movement of the flow, we could see from its fractures, furrows and other fabrics that it must have been flowing lately. This was confirmed by the temperature lance measurements, which recorded 22°C in 50 cm depth at the emission location, which corresponds to an increase of 8°C from bottom water temperature. This very high heat flow is caused by the ascent of mud within the conduit of the mud volcano from greater depth, and certainly made the ROV-based sampling of sediments and bottom water direct from the chimney very exciting. After that dive, and during a further processing of the sediments, we found that the pore water of the mud has a drastically reduced salinity, which reach values of 10 ‰. Such fluids are quite rare in the Mediterranean because of the omnipresent Messinian salts. Furthermore the gas composition of the mud clearly showed a thermogenic source. This finding

was surprising to us because the gas composition of Flares 1-5 in the surrounding regions of the mud volcano revealed of a mixture of biogenic and thermogenic sources. We could successfully sample and quantify the gas in the sediments by means of our autoclave piston corer (Fig. 3), because this device encases the sediment with its pore water and gas content in an autoclave under the *in situ*-pressure, and therefore the sample comes to the surface without any loss of gas. The quantification under atmospheric pressure documented a more than threefold volume of gas to sediment, and explained why the mud deposits in the cores have a bubble-like appearance throughout. This phenomenon reminding us of „Mousse au Chocolat“ is well known to sedimentologists describing its appearance as “moussy texture”. This is an unmistakable indicator for strong degassing of the sediments.



**Fig. 3:** Both autoclave piston corers waiting on METEOR's hatch for their deployment.



**Fig. 4:** Since 1<sup>st</sup> Advent the first page on METEOR's intranet reminds of the forthcoming Christmas time.

In contrast to Venere mud volcano Cetus and Nicolas MVs show only little evidence of any current activity. In the central caldera of Cetus MV, we measured a slight increased heat flow, however, a bottom water sample collected near the seafloor in the volcanic cone of Nicolas MV shows a clear increase in methane concentration. Both facts are very typical for mud volcanoes; however, the low values indicate a calmer phase in mud volcanism currently.

Nicolas mud volcano was discovered just two days ago, during a night geophysical survey and we named it Nicolas because the ROV-dive at this newly discovered mud volcano was conducted on St. Nicolas' day, 6 December.

Besides all the diving activities also numerous gravity cores from single mud flows had been taken, as well as CTD-stations with sampling of water column in order to follow more in detail the near-bottom methane spreading and the methane plume formation of seeps.

METEOR's Intranet gives information on the daily station schedule, as well as any data about the vessel, personnel, weather, life on board and much more - possible because of the network which is accessible across the entire vessel. All information is very well integrated, and the first page currently shows a Christmas-like motif, which has been there since beginning December (Fig. 4). All passengers on board METEOR are healthy and sprightly.

Best regards on behalf of all cruise participants,  
Gerhard Bohrmann

RV METEOR, Sunday, 7 December 2014