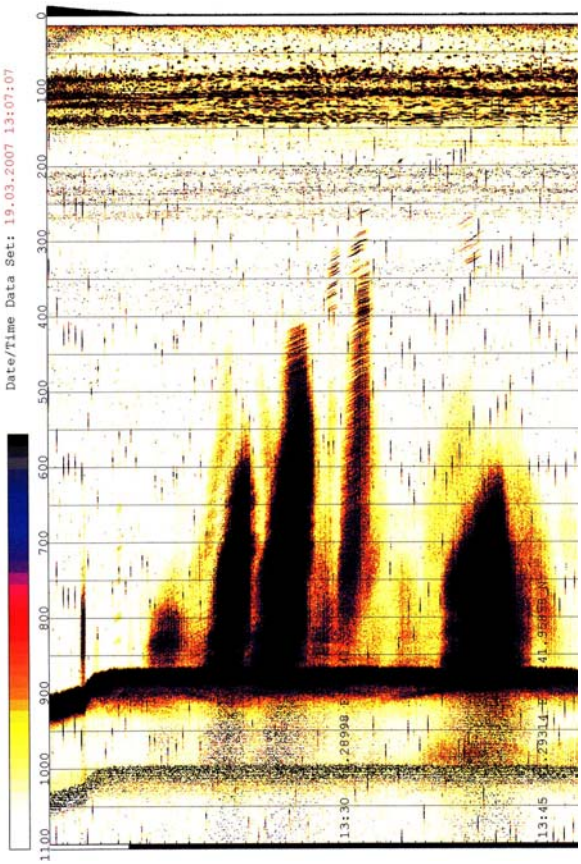
M72/3 – second weekly report 23 – 29 March 2007

After finishing the diving program with ROV QUEST and the geological work at the Georgian continental margin of the first week, RV METEOR sailed north on a 28-hour-long transit to Ukrainian waters. We took advantage of the transit to overcome a period of bad weather. An area of low pressure over the Balkan States together with high pressures over western Russia leads to strong winds of Beaufort 8 and 9. We reached our area in the Ukrainian waters on Friday March 23 and started with a survey south of Kerch Strait. Kerch Strait connects the Black Sea with the Sea of Azov between the Kerch (Ukraine) and Taman (Russian) peninsulas. The area is characterised by a large submarine fan (Don-Kuban fan), which is together with the Dnjeper and Danube Fans one of the larges submarine fans in the Black Sea. Large sediment thickness and accumulations of organic carbon transported to this area have a high potential for methane formation. Free methane forms methane hydrate in water depths greater than 750 m (i.e. within the gas hydrate stability field) or the gas is escaping to the water column in areas shallower than 750 m. Therefore many sites, where gas escapes from the seafloor like in the Batumi area, have been detected by the 18 kHz signal of the Parasound system (Fig. 1).



Once the weather calmed down a dive was performed on the so-called Egorov Seep site, where our Ukrainian colleagues found a 1000-m-high acoustic anomaly in 1800-m water depth back in 2003. The investigation of RV METEOR showed however, that this gas seep is presently not active. The dive on Sunday March 25 was on Dvurechenskii mud volcano in the central Sorokin Trough. The Dvurechenskii volcano is a mud pie type of mud volcano. Its caldera of approximately 1-km in diameter is filled with mud originating from the Oligocene to Miocene Maikop formation. The mud is forming an outflow on the southwestern flank of the volcano.

Figure 1: *The gas emission sites detected by ROV QUEST are characterised by acoustic anomalies in the water column (so-called flares). Pattern of flares are strongly variable depending on the ship's course. At the continental margin of Georgia cluster of flares of 300 to 600 m height above the seafloor develop in 900 m water depth.*

Previous studies during the MARGASCH cruise M52/1 in 2001 had shown an active mud rise in the central part of the mud volcano, where a temperature anomaly of more than 7°C was measured. These results lead to a temperature recording program carried out in conjunction with the previous leg M72/2. This program includes a long-term experiment with a mooring on the seafloor in order to measure temperature changes. The mooring was deployed on March 7, and during our re-visit three weeks later we recovered one of the temperature data loggers (Fig. 2). The second data logger is planned to measure temperature changes of the mud volcano over 3-4 years, in order to understand long-term variations in the mud flow activities of the Dvurechenskii mud volcano. The temperature data measured during the last 3

weeks already revealed temperature changes of the mud volcano and let us forecast interesting results on temperature variations of the mud volcano for the future.

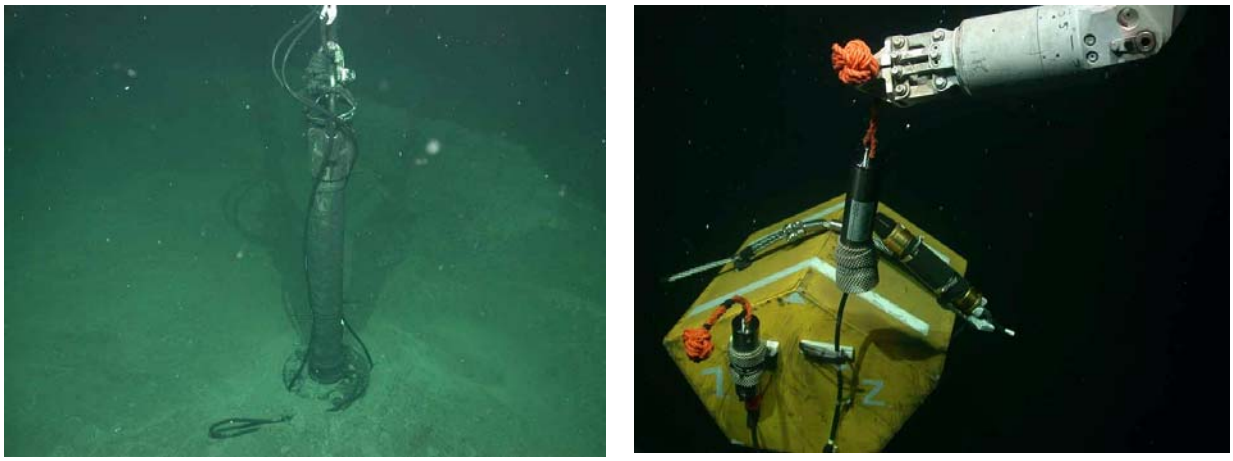


Figure 2: *Part of the temperature mooring on the sea floor (left). The tube of the of the mooring is connected by a chain to a float which keeps its body 5 m above the seafloor due to is buoyancy (right). Both data logger mounted on the float are connected by cables to the temperature sensors. The mooring was deployed during cruise M72/2 on Dvurechenskii mud volcano in more than 2000 m water depth. The right image shows the situation when the ROV arm of QUEST is taking one of the data loggers away*. Images taken by ROV QUEST (MARUM).

Besides the recovery of the date logger, push cores and temperature measurements with the T-stick were taken along profiles over the mud volcano. In order to establish a geological map we performed video documentation continuously and searched for gas emission sites, which have not been found. In addition to the ROV work the sediments of the mud volcano were sampled by the autoclave piston corer. This tool takes a sediment core of up to 2.5 m length and keeps the gas and gas hydrate inside the sediments under in-situ pressure conditions. Conventional sampling by gravity and piston coring leads to a huge pressure release during the heave through the water column, which leads to the escape of most of the gas and decomposition of parts of the gas hydrates. The autoclave tools keep those components still in the chamber and a controlled degassing of the cores allows quantifying the amounts of gas and gas hydrate in the sediments. The results from three autoclave piston core deployments indicate that the sediments from Dvurechenskii mud volcano contain more than 10% gas hydrates.

A gravity corer on the Vodyanitskii mud volcano, which is located close to Dvurechenskii mud volcano, recovered the first gas hydrate specimen, and we decided to perform a one-day dive program on this structure on Wednesday March 28. This dive was exciting in many aspects. Among others the first images from bubble release in 2000 m water depth of the Black Sea have been taken. After long search we have only observed two sites where single bubble streams rise from the seafloor and have been impressed that there is a large acoustic plume in water column above the mud volcano just produced by a relatively small seepage. We quantified the bubble amount by the gas catcher, the gas was sampled by the gas bubble sampler and finished this successful dive.

All participants are well and in good spirits.

In the name of all cruise participants

Gerhard Bohrmann FS METEOR, 29 March 2007