# Expedition METEOR 84/2

5th Weekly Report: 21.03. – 27.03.2011

During week 5 of our cruise we completed the work in the Turkish working area Samsun. This work was first limited to the Ordu Ridge but could be expanded to two parallel running ridges by using multi beam echosounder and Parasound mappings. Furthermore, by registration of very clear backscatter signals, active gas seeps at the hilltops and plateau-like ridges could be mapped. A large part of the seep areas showed both, active gas emissions in the water column and gas hydrate occurrence in the sediments. After a final measurement up to the edge of the Turkish area we started the transit to Ukraine. The transit to that working area was very exhausting as under strong wind around 8 Beaufort the METEOR could proceed only very slowly. With just 4-5 knots METEOR fought through the waves of up to 4m, and this was especially for the scientist who had embarked in Trabzon a first practical test at sea. After passing the Ukrainian border we switched on again the acoustic systems on board the METEOR in order to obtain sufficient geophysical data during our trip to the Kerch deep sea fan. Unfortunately the quality of data also suffered due to the strong swell so that we had to be a bit patient with our mapping until the sea calmed down. But this is easy in the Black Sea because of its limited water volume and if the wind ceases a bit.

*Fig. 1: Tatyana and Dima, our guests from Ukraine and Russia marking their samples (left), the new much smaller autoclave corer before its application (mid), discussion of the previous data base at Kerch Flare in the Geolab (right; photos: V. Diekamp, MARUM, Bremen).*

In Ukraine our first destination was a strong gas emission site in a water depth of 900m which is well-known by the name Kerch Flare. South of Kerch Strait, in the exit of the Sea of Azov, in the prolongation the Kerch Peninsula the Kerch deep sea fan is developed, which is an area of considerable high sediment accumulation with a high potential of methane-production. This situation is similar to the Danube and Dnieper deep sea fan. At water depth shallower than 700m above the gas hydrate stability zone hundreds of gas emissions are found whereas below this zone gas flares in the form of acoustic anomalies in the water column occur only infrequently. Nevertheless these gas emissions are of a certain importance – a good portion of gas is bound in gas hydrates – but the emission of free gas

also means that there is a spill-over of gas that cannot be bound in hydrates any more. Kerch Fan is such highly active system, and we had been able to quantify the gas emissions during several ROV dives by means of optical methods. We did not succeed with a gas hydrate sampling then, although gas quantities had been quantified from two autoclave piston corer samplings which clearly gave hint of the presence of hydrates. This time at once the sampling of a sediment core rich in gas hydrate succeeded as we could locate the emissions more exactly. An extensive sampling program was executed until Thursday evening. The night as well as the entire Friday we used for mapping on the continental slopes of Kerch deep sea fan, development of the mountains as well as the Crimean Peninsula. These showed how dependant on the landward side the continental ridge shows completely different morphologies. For instance we found very much and closely lying canyon systems below the Crimean mountains which considerably furrowed the slope by downward transport of rocky material. On the slope of the delta, however, we can see single sliding bodies, especially in the high resolution bathymetry of EM710 multibeam echosounder, which give a completely different structure to the continental slope.

*Fig. 2: Photo of the group on the sunny working deck (left); porous gas hydrate from Helgoland mud volcano (right, photos M. Schneider & A. Bahr).*

A further peak waited for us at the weekend when we visited a bit more in the West at Sorokin Trough the closely related mud volcanoes Dvurechenskii and Helgoland. Both were fed with mud from the underground by the same diapir structure whereas Dvurechenskii is filled up to the edge with mud, and Helgoland shows a caldera-like depression whose mud filling is just in the beginning. During our last year's expedition both were active and showed strong gas emissions whereas this time only Helgoland mud volcano showed activity. Also here we could sample gas hydrates for the first time in the closer edge of Helgoland whereas the direct emission point is too warm for the hydrate generation according to our temperature measurements in the sediment. The gas hydrate pieces we recovered showed a pervasive structure (Fig. 2) which during closer examination turned out a typical bubble structure.

All participants are healthy and fine, on their behalf,

Gerhard Bohrmann RV METEOR Sunday, 27th March 2011

Further information on the cruise (in German): http://www.marum.de/Logbuch_Meteor_84/2