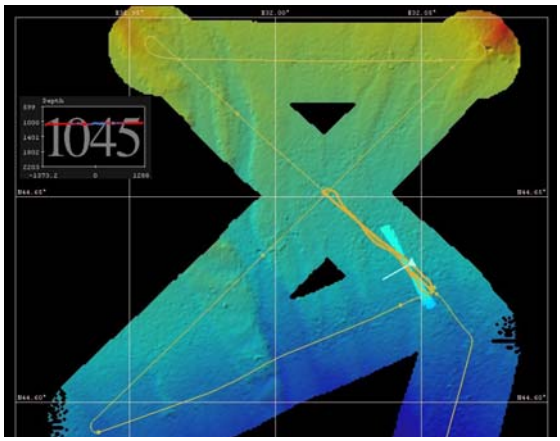
Meteor cruise M 72/5
Second Weekly Report, period 22nd – 28th May

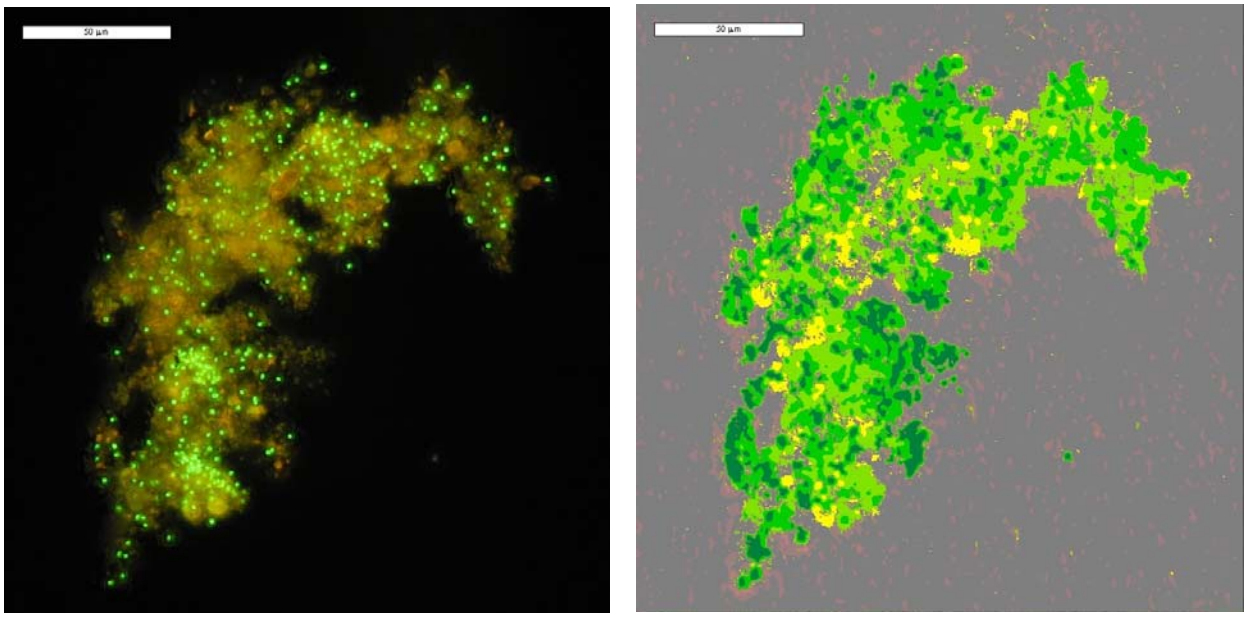
At the end of week one we had reached the upper slope of the paleo-Dnepr area where we continued with sampling sediments and the water column in the anoxic zone and around the chemocline. Here the chemocline meets the seabed in 160 m depth and we had the opportunity to sample sediments from adjacent anoxic and oxic areas. In the evening of the 22nd May we left this region and moved to our third working area on the eastern side of Crimea, where we followed the same strategy as before: We searched for coring locations by surveying the seabed with Parasound and swath bathymetry starting in the deep basin and going upslope into shallow shelf areas. Similar to the previous working area we found major proportions of the seabed furrowed by erosion channels and the Parasound survey suggested disturbed stratification over large areas, in particular in the deep basin and upper slope regions. This sometimes made it difficult to find suitable locations for sediment station work. We therefore decided to stay off the very central part of the basin and selected a number of coring locations along the depth gradient on the slope between 2000 and 70 m water depth.



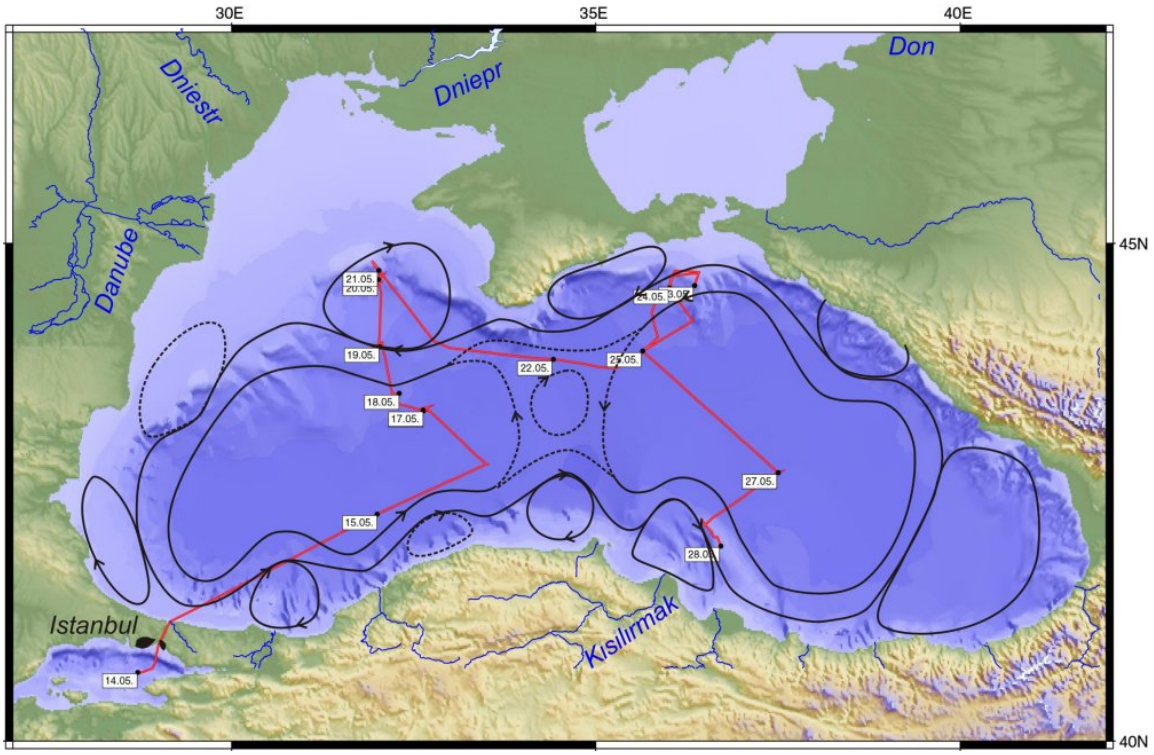
Snapshot of a bathymetric survey showing erosion channels in intermediate slope depths.

Three days of sediment coring and water column work followed. For the sediment work we use a 10-m long gravity corer and a Multi Corer (MUC). The two instruments complement each other very well because the gravity cores with average lengths of 7-8 m reach deep into lacustrine sediments but they usually lack the upper 20-30 cm of the very soft surface sediments, while the MUC recovers undisturbed sediment surfaces and serves excellently for sampling the fluffy top layer. Major objectives of the biogeochemical sediment investigations focus on the turnover processes of the Fe-S system and other metals and the various coupled biogeochemical processes. Other aspects concentrate e.g. on the fluxes of diluted porewater compounds such as hydrogen sulphide across the fluffy sediment-water interface.

Microorganisms are responsible for the biogeochemical processes in the oxygen-free parts of the water column and within the sediments. The microbiologists on board trace the occurrence of different microbial groups in the water column and sediments. Modern molecular biological and staining techniques are used to detect prokaryotes (Bacteria and Archaea). While in the water column there are already up to 1 million cells per cm^3 of water, their numbers even increase in the sediment. However, the distribution of cells is patchy, and they are not easy to separate from sediment particles. The pictures below show a sediment particle (from a sapropel layer) densely colonised by Bacteria or Archaea. The sample was stained with a specific dye for nucleic acids and photographed under UV light at different focus levels of the microscope. The bar length corresponds to 50 µm (about the thickness of a human hair). The cells appear as green dots. The second picture shows the three-dimensional structure of the particle indicated by a depth-colour scale.



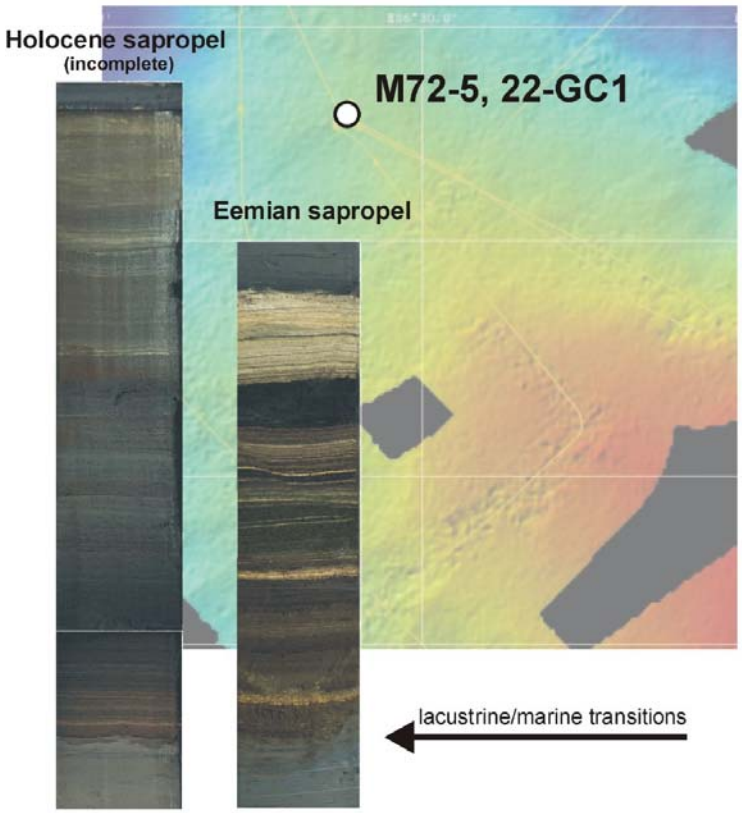
Sediment particle form a sapropel layer colonised by Bacteria or Archaea. On the right, a colour map representing the three-dimensional structure of the particle.



M72/5 cruise track until 28th May. The black loops indicate the major surface water circulation patterns.

We left working area 3 in the evening of 25th May and moved to a station in the central area of the eastern Black Sea circulation where we performed an extensive water column program including various CTD and pump-CTD casts, in situ pump casts and light measurements. This station represents an important counterpart to

the previous more peripheral stations because the chemocline is here relatively shallow (see weekly report 1) and also because the centres of the gyres are suggested to be unaffected by rim currents waters which transport the intrusions from the big rivers joining the Back Sea.



Holocene and Eemian marine sapropel units from sediment core 22-GC1. The back-ground shows a multibeam screen-shot of the investigated ridge structure.

On the 27th May, after two days of water column work, RV Meteor headed toward the fourth working area in the southeastern Black Sea, where a depth transect of multi and gravity coring was planned along a tectonically formed ridge that extends far into the eastern Black Sea basin. During the night from the 27th to 28th, parts of the ridge were mapped by multibeam and Parasound echography in order to identify suitable coring locations. Next day, gravity cores were taken from around 850 m water depth. Surprisingly, the split sediment core provided a first view into a most probably complete section of the last glacial period. Coring efforts during the last years rather suggested an extensive glacial sediment cover on most of the Black Sea slope areas not reachable with conventional gravity and piston coring devices. To our all surprise, we could also identify at the base of the core the complete marine unit deposited during the last sea level highstand in Marine Isotope Stage 5. The intercalation of dark organic rich intervals and light layers of presumably coccolith ooze in this unit demonstrates that the last marine stage of the Black Sea must have had a more complex history than we know from the Holocene. Despite the fact that the exact dating of this sequence will be challenging, the „Eemian“ sapropel will provide the opportunity not only for a comparative study to the Holocene, but will also allow to understand how the marine Black Sea returned to a glacial freshwater lake.

The weather is continuously warm and calm, the forecasts are still promising and the mood is still excellent. We are therefore looking forward to another opportunity for coring the “2nd sapropel station” again in the next week.

We are all in good health and send our best wishes.
Christian Borowski and the M 72/5 shipboard party.
28. May 2007