

2. Weekly report (30.10.-05.11.06)

The second week of the expedition BIONIL (leg M70/2a) was dedicated to the study of seeps in the central area of the Nile fan, and to the exploration of the Western Delta. The central area of the deep Nile Fan investigated by us is relatively flat and hosts numerous pockmarks. The results from two previous MEDIFLUX cruises indicate considerable geological and biological activity, hence we selected two sites at 1700 and 2100 m to explore them with the AUV, with alternating use of the multibeam and the echosounder for gas detection, and also study them in detail by ROV-based operations. Unfortunately, Neptune turned against us, and wind speeds and waves rose to the operational limit of both robots, forcing us to be very flexible with the planning of station work. Furthermore, an accident during one deployment kept the ROV team busy with repairs for two days. Nevertheless we managed a total of 3 ROV dives and 3 AUV dives in the central area during leg M70/2a.

In contrast to most known seeps, which are actively emitting gas to the hydrosphere, the area we investigated at the 1700 m site shows no distinct topographic feature but a striking backscatter signal. In the eastern part that is a bit more elevated than the rest of the central area we found vast carbonate pavements and highly porous crusts outcropping from the seafloor (called “soufflé” by our French colleagues).



Deployment of colonization trays and measurement of sulfide emission on carbonate-covered seeps of the central zone.

The carbonates rest on an active fluid-flow impacted area of the seafloor, as shown by the dark patches of sediment between carbonate plates, an abundance of bacterial mats and detectable hydrogen sulfide concentrations in the bottom water. The carbonates appear to be a barn for bivalves and snails as well as for a variety of polychaetes and tubeworms. However, all large shells found on the seafloor were empty, suggesting fluctuations in the activity of the seeps.



In situ Profiler measuring oxygen, sulfide, pH and temperature with microelectrodes in seep sediments of the central area

For the friends of sulfide-oxidizing bacteria we found a large zone of about 60x100 m of exposed, very flat sediments, which are blackish and highly gassy. This area of the seafloor is partially covered by sulfur precipitates. Looking at them under the microscope we recognized the typical morphology of sulfur filaments produced by *Arcobacter*, a tiny bacterial cell, which produces enormous masses of sulfur by oxidation of the sulfide, which seeps from the gassy sediments. Another area with high backscatter further west was not active, but displayed numerous pockmarks of 1-5 m diameter, often showing outcropping carbonate crusts at their bottom (unfortunately also very often plastic debris and other signs of human traffic).

Finally, we used one dive to explore the western region of the Nile delta, namely one of the highly active mud volcanoes of a huge caldera of more than 8 km diameter. The so-called Chefren mud volcano hosts a large and very deep brine pool in its center, which leaks sulfidic brines laterally at the rim of the mud volcano at 3030 m water depth and forms interesting and highly colourful microbial mats at the surface of the seafloor. We were surprised to see major changes in the morphology of the brine pool within the 3 years between the last visit with RV L'Atalante and the French submersible Nautil. Unfortunately, pushcore sampling with the ROV was impossible due to the very fluidic muds and the association of our target sites with very steep slopes.

Meanwhile we are steaming back to Heraklion (Crete) against wind and waves, to exchange part of the scientific crew. The second leg of BIONIL will be dedicated to geological and biological sampling, hence we will say good-bye to our AUV team. We are very proud of the excellent results obtained with Aster^x, which had completed its deepest dive at 2100 m almost flawlessly (if there had not been this moment of accelerated heart beats when the acoustic contact stopped for 30 min).

Looking forward to a day and night in the old port of Heraklion, with best greetings to all colleagues, friends and families on land

– the BIONIL team

