3. Weekly Report
FS Pelagia Expedition 64PE-445, SaltAx

Week three of our expedition was also used for seafloor mapping but this week we focussed mainly on seismic profiling. In addition, we took a few sediment cores with a so-called gravity corer at selected positions.
At the beginning of this week we moved northwards to investigate the seafloor and sub-bottom in this part of our working area. Since we already have some good seafloor maps of this area we mapped less there. Nevertheless, we could add some new data and a little highlight was the discovery of several volcanic craters in and around the so-called Discovery Deep. These craters are not necessarily new but may have been overseen during earlier mapping surveys in 2011 and 2013 when the weather was quite stormy and thus the data quality was not as good as today.

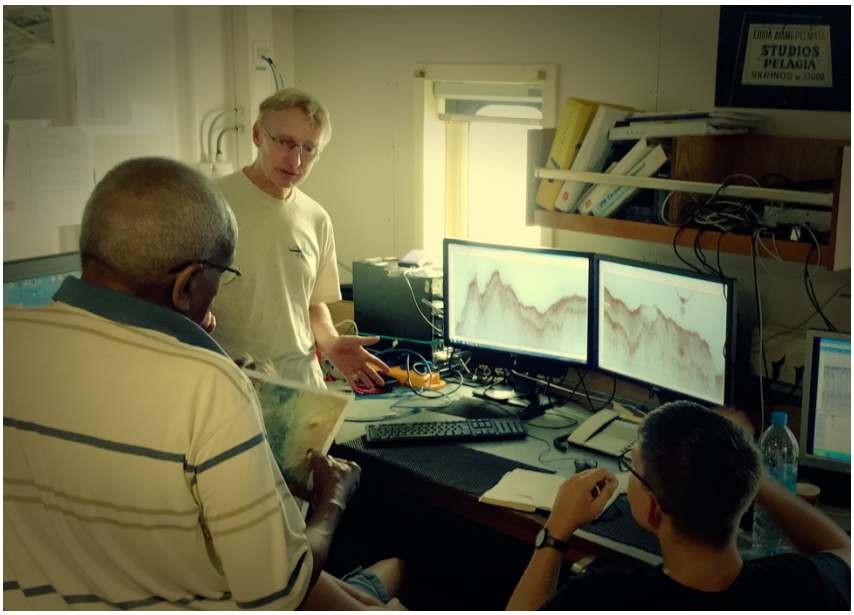
Our sound waves for the seismic surveys comes from electrical sparks. The sparker candles become electrically charged and discharge abruptly into a towed metal frame visible by a bright spark. By this some seawater gets vaporized and a deep sound wave is generated.
Picture: N. Augustin, GEOMAR

After completing in the north, we spent the last days again in the southern working area to do two more, longer seismic lines.
But what is „seismic“? Together with the seafloor mapping it is our most important tool during this expedition. The seismic method is a powerful tool to investigate structures in the subsurface of the earth, in our case below the seafloor. It works similar to medical ultrasonic examinations used to investigate structures underneath our skin: sound waves are generated artificially and their reflections at inhomogeneities (the borders of sediment and/or rock layers) are received on board and recorded. For marine seismic experiments, the sources of the soundwaves are often airguns or sparkers that are towed behind the ship. The reflected sound waves are recorded by several hydrophones which are organized in a long flotation tube that is also towed by the vessel. After acquisition, the recorded signals become organized by computers into common midpoint gathers and stacked, so that we can read the data. The resulting image is a good approximation of the structures underneath the seabed. Seismic profiles can be many nautical miles long and can acquire penetration depths up to several kilometres into Earth’s crust. However, during this expedition we use a sparker system that generates comparable low energies and reaches penetration depths of a few hundreds of meters only. The benefit of this system is that we achieve a higher resolution in the uppermost layers, which we need to answer our questions on past salt and sediment movements in the Red Sea. During the last weeks

we were able to see different sediments layers, the underlying salt and even some volcanoes and a glimpse of oceanic crust. A great result! In the meantime, we collected seismic data along profiles of 425 nautical miles in total (almost 800 km). The detailed studies of this data will keep us and our colleagues at home busy for many more months, but we will figure out step-by-step the image about the state of the subsurface in our working area – just like the doctor can make a diagnose about your well-being with the ultrasonic-check.

In addition to the seismic and bathymetric surveys, we also took some sediment samples with our colleagues from the Red Sea University in Port Sudan. The main interest was in the brine filled deeps in the axis of the Red Sea rift that contain metalliferous muds. These are a few basins that contain undersea “salt lakes” made of very salty water that is denser than the ambient seawater, the brines. A brine occurs when the rock-salt, that is normally laying beneath the pelagic sediments of the Red Sea, reaches shallower under the sediment or even crops out at the seafloor. Seawater can dissolve this salt, becomes denser, sinks and become trapped in basins at the seafloor. Hydrothermal activity discharges hot, metal-containing fluids into some of these brine-filled deeps – a sign of the volcanic activity under the rift basin. When the fluids venting into the colder brine, they lose the metal freight in the form of tiny, mostly black metal-sulphide-grains which – over millennia – may form thick metal-rich sediments. Our Sudanese and German colleagues look forward to joint studies on five cores from these deeps with an overall length of more than 20 meters.

At the end of week three we almost finished the scientific work. Tonight, we will go back to Port Sudan where we will say good bye to our guests from the Red Sea University and to bunker some fuel and proviant.



The seismic data are the topic of many scientific discussions between all researchers on board. We got expected but also quite unexpected results and we do not always have the same opinion about that – but that is what makes science so interesting. Picture: N.Augustin (GEOMAR)

Some sediments from brine filled deeps in the Red Sea also have been recovered during this expedition. Even though the focus was mainly on seismic and bathymetric surveys, the sediments have been awaited with excitement too and encouraged dialogs between colleagues.
Top picture: F.v.d.Zwan (GEOMAR)
Bottom picture: J.Preine (Uni Hamburg)

In the coming days we clean up the labs, pack our equipment and work on the cruise report.
All on board are well and the mood is still great.
With best regards,
Nico Augustin