4. Weekly Report FS Sonne So261
Expedition „HADES“
19.03. – 25.03.2018

Week four was mostly dedicated to our work at the references sites at 4000 and 5500m water depth. We use these shallow sites for comparison to our hadal sites. On March 19 we started our usual station program with the Riever camera system to get a first picture of the seafloor, subsequently the other instruments followed. After retrieving all instruments back on deck and checking the first data a clear difference between hadal and abyssal sites could be observed. This was most obvious when looking at the in situ oxygen microprofiles. Here an oxygen penetration depth of > 20 cm could be observed at the 4000m site which is 4-times deeper than at the hadales sites. So, this is the first evidence that sediments at the bottom of the Atacama Trench show elevated rates of organic matter mineralization. Also the sediment sampling using the multicorer and gravity corer was so far very successful even at these great water depth. The Sediment-Geochemistry group from Marum was able to collect 166 surface sediment cores of at least 30 cm from 14 deployments at our 7 stations (Fig. 1). Only two cores got lost so far. Many groups on board use these sediments cores for their sampling, for example for benthic community structure or geochemical pore water analyses. Gravity corer sampling worked also well and in total 30m of sediment could be collected. These cores will provide valuable information on the deposition history and reveal if there were changes in the composition of the settling material. We hope to identify and distinguish between periods of slow constant settling from mass vesting events.

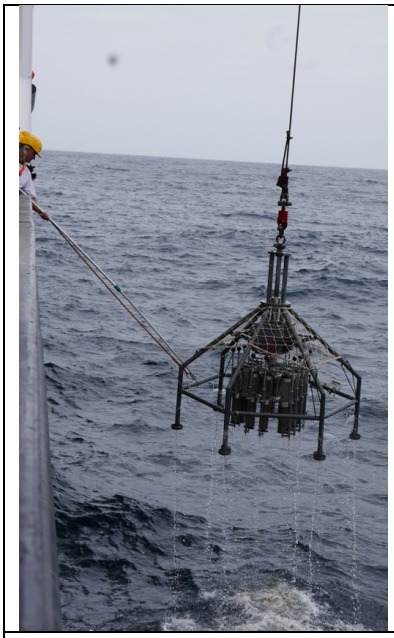

Fig. 1 MUC recovery from 7940 m wáter depth (Foto: M. Schlösser)

Fig. 2: Sediment layers with different colors can be seen (Foto: M. Schlösser)

One of our main interests during this cruise is to investigate how the Atacama Trench follows the trend in elevated mineralization activities as seen from other trench systems in the Pacific. Pore water profiles, retrieved on board from sediment cores, will hereby help to investigate biogeochemical and microbial processes. Results from on board measurements, so far support our hypothesis. Despite the great water depth biogeochemical process rates are higher in trench axis sediments as compared to abyssal sediments. Geochemical pore water gradients also reveal interesting patterns, which together with changes in sediment color (Fig. 2) and differences in grain sizes, indicate that mass vesting events influence the sediment deposition.

Fig. 3: Sampling for „Environmental-DNA“ from bottom wáter and sediment (Foto: M. Schlösser)

On our expedition along the Atacamca Trench we continued the work with the fifth hadal station further north at 21° 46.86’ S with our entire sampling program. From the collected sediments, the French team from Ifremer analyses samples for morphological identification of meiofauna organisms, with the hope to find species new for science. Other samples are taken to later extract what we now call “environmental DNA” (DNA extracted from air, water or sediment/soil) (Fig. 3). This environmental DNA is a comprehensive archive of the living organisms presents down there. The small ones are captured with the sediment, whereas the larger ones often leave remains when passing by (skin, scale, mucus, all pretty much encompass the DNA that can be revealed in a similar way as now famous forensics analysis do). Their main interest is to investigate all living creatures, from very tiny ones called microbes including prokaryotes (micro-organisms including both Archaea and Bacteria), and meiofauna (microscopic animals smaller than 1 mm) to larger animals we can’t capture entirely but can grasp DNA signature. The world of these

organisms is populated by animals of amazing shapes and adaptations, capable of withstanding extreme conditions. Often forgotten due to their small size, meiofauna and microbes are essential to the proper functioning of the ecosystem, playing an important role in benthic food webs and nutrient cycling, and they are characterized by high sensitivity to environmental changes. Microbes and meiofauna can modify their environments and promote the degradation of organic matter and bioturbation of the sediment. Indeed, these living things are extremely abundant in the hadal trench ecosystems.

We are finishing now our sampling activities at the fifths hadal site with the third MOCCNESS net haul, sampling zooplankton at different water depth. During the last days of our station work we will investigate another hadal site further north to finish our transect of sampling sites along the trench axis. This should help us to identify variations of biogeochemical and microbial process rates within the Atacama Trench.

All the best from the SONNE crew and the scientific party of So261,
Frank Wenzhöfer

(with support of Matthias Zabel and Daniela Zeppilli)

You can also follow our cruise at https://www.mpi-bremen.de/en/Blogpost-3-SO261.html