METEOR Cruise M157

Mindelo (Cape Verde Islands) – Walvis Bay (Namibia); 04. August – 16. September 2019

5. Weekly report; 08. September 2019

Central work in the northernmost part of this expedition focused on possible adaptation mechanisms of macrozoobenthic organisms to the margins of the oxygen minimum zone. A total of 7 stations were sampled, with the three most westerly and deepest (500 to 1500 m) serving mainly to record biodiversity Fig. 1). The newly collected samples will later be evaluated in the laboratory using a microscope. The species, their abundance and biomass will be determined. In addition, living individuals of the target species *Lembulus bicuspidatus* (Bivalvia) were collected (Fig. 1) and incubated already on board. On the one hand, respiration rates were measured. On the other hand, the animals were kept for different periods in oxygen-free water and later dissected. Both the gills and the labium were fixed separately in RNAlater (Fig. 1). Later, in our laboratories, we will find out which metabolic strategy (aerobic or anaerobic) was pursued and which enzymes are responsible for this. It will also be shown which endosymbiontic bacteria with which functions contribute to the species being able to tolerate the strong fluctuations in oxygen availability. As already assumed in the 4th weekly report, the work along the border between the Angolan and Namibian territorial waters was completed on the evening of September 1st with many new findings and samples.

Fig. 1 left: Use of the large box corer from water depths of more than 500 m;
right: about 100 living *Lembulus bicuspidatus* could be collected from the sediments, inlay: after incubation experiments the gills and the labium were fixed in RNAlater for later investigations.

The transit time to the southernmost profile section at 25°S could be used to repair the pump CTD damaged in the second week. This allowed us to measure high-resolution gas and nutrient profiles with the Pump-CTD of the IOW for the fourth time during the night from Thursday to Friday last week (Fig. 2). Since oxygen is measured at both the inlet and outlet of the Pump-CTD, and both profiles fit exactly on top of each other, we can be sure that the pumping process will not result in any major mixing of the water bodies. In the pumped water, nitrate, nitrite, ammonium and phosphate concentrations are measured at intervals of 33 seconds with an auto-analyzer. In this way it is possible to obtain a vertical resolution of well under one meter for these nutrients. Details in the distribution of the nutrients become visible, which can never be recorded with a conventional sampling with a rosette sampler. At the same time as the Pump-CTD, the oceanographic microstructure profiler was also used, with which even the smallest turbulences in the water column can be measured. This allows a later interpretation of the profiles in order to decide which changes in concentrations were caused by mixing processes and which by the activity of organisms.

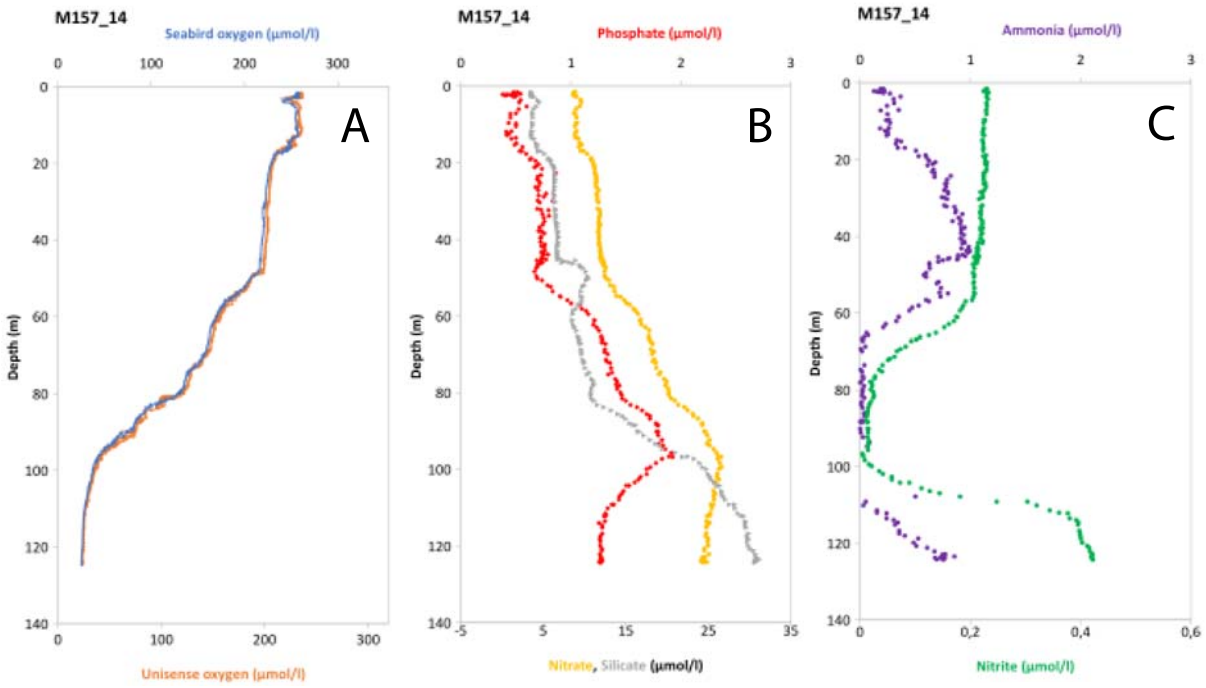

Fig. 2 High resolution profiles of oxygen and nutrients in the water column as measured with the Pump-CTD.

Also on the 25°S transect important populations of the "Namibian sulfur pearl" *Thiomargarita namibiensis* were found in the sediment and examined more closely. These giant bacteria are typical for the sulphide-rich muds off the Namibian coast. Thanks to the benthologists and their sieves, however, we now know that there is apparently another population of large sulphur bacteria in the north of our study area, which otherwise lives in large quantities in the sediments of the upwelling areas along the South American west coast. These filamentous bacteria called *thioploca* live in bundles in common mucus sheaths that extend from the surface to several centimetres into the sediment. These bundles can

Fig. 3
A clew of *thioploca* sheaths from the sediment sieves of benthologists.

be up to one mm thick and up to 20 cm long. DNA samples were taken to characterize this newly discovered population, so that we can later clarify the genetic similarity of these bacteria to their relatives in the Pacific.

Until next Thursday, we will continue our work on 25°S. Then a relatively short stop for final investigations in the working area at 23°S before the big packing of the equipment begins.

All on board are still doing very well.

Matthias Zabel and the M157 Team