

RV MARIA S. MERIAN

Cruise MSM105

11.01. - 23.02.2022

Walvis Bay - Mindelo

BUSUC II

The Benguela System
under climate change –

Effects of variability in physical forcing
on carbon and oxygen budgets

5. Weekly Report

07. - 13.02.2022



The last days in our study area are now already over. Before our second port call in Walvis Bay on February 10, we revisited our main stations on the 25°S and 23°S transects. The repeated measurements enable to record the temporal variability of the environmental conditions in the oxygen minimum zone. At these stations, our focus is on high-resolution measurements of nutrients and gases in the water column using our pump CTD. In contrast to our previous cruise (M157) in September 2019, we now had a situation where oxygen in the water column towards the bottom was not only low but partially depleted due to strong coastal upwelling. At the 25° line, we also encountered toxic sulfide in the bottom water already. One of these stations showed particularly exciting profiles with respect to the nitrogen compounds nitrate, nitrite and ammonium, so we decided to sample it a third time. In this way we were able to get an impression of the variability even in shorter periods of time. We found strong fluctuations in the nutrient distribution, which are certainly the driver for the unusual activity patterns of bacteria in this sea area. Especially remarkable was this last sampling, where extreme high nitrite concentrations were measured (up to 18 μM).

Accompanying the pump CTD, the AFIS ("automatic flow ingestion sampler") was used. This is an in situ methodology developed at IOW. Immediately after closing the sample bottles bacteria and the genes they have just activated are preserved. After these operations, the preserved bacteria are filtered off and deep-frozen. With further processing in the laboratory and subsequent sequencing of the genes, we can then see which bacteria and which of their genes were active in the water column. In addition to this, for the various nitrogen compounds incubations with so-called tracers (^{15}N -labeled) were carried out, in order to record the turnover rates in the water column as accurately as possible.

The presence of sulfide in bottom waters gave us the opportunity to study in more detail the activity of bacteria that degrade this toxic end product in water and sediment. A key organism in the sediment for the degradation of sulfide is the giant bacterium *Thiomargarita namibiensis*, which was first discovered here on the shelf off Namibia in 1997. These bacteria seem to be particularly adapted to the changing environmental conditions in this sea area, as

their size (one cell is 1-3 times as thick as a human hair) allows them to absorb and store particularly large amounts of nutrients and thus also survive unfavorable times well.



Preparation of a use of the AFIS by Christian Meeske, with the filled fixation syringes on the AFIS bottles (Photo: M.Schmidt).

At both the 23° line and the 25° line, we encountered a healthy population of Thiomargarita in the sulfidic shelf sediments, which were incubated under different conditions. Among other things, this showed that these bacteria can oxidize sulfide at a tremendously high rate. Sub-samples from different depths of the water column were also incubated to measure the rate of sulfide oxidation. Overall, these studies are intended to answer the question of how effectively sulfide oxidizing bacteria can oxidize and thus detoxify sulfide under different environmental conditions. All of this information is an important piece of knowledge towards a better understanding of the variability of this upwelling region and a necessary prerequisite for the development of robust models.

Then, on Wednesday, our work on the Namibian Shelf ended with a port call in Walvis Bay. Here we replenished our fuel supplies. In the meantime we are back at sea and on our way to our destination port Mindelo. We use the transit time for underway measurements, processing of samples and laboratory experiments on board. The mood is good and after the demanding station work we are looking forward to a few more relaxed days with a regular daily schedule.

Best regards on behalf of all participants,

Heide Schulz-Vogt, Klaus Jürgens and Volker Mohrholz
(Leibniz-Institute for Baltic Sea Research Warnemuende)