RV Sonne

Cruise SO308 South Indian Ocean GEOTRACES GI07

31st October – 22nd December 2024

Durban (South Africa) – Fremantle (Australia)

8. Weekly Report

Reporting Period: 15th December - 22nd December – 2024

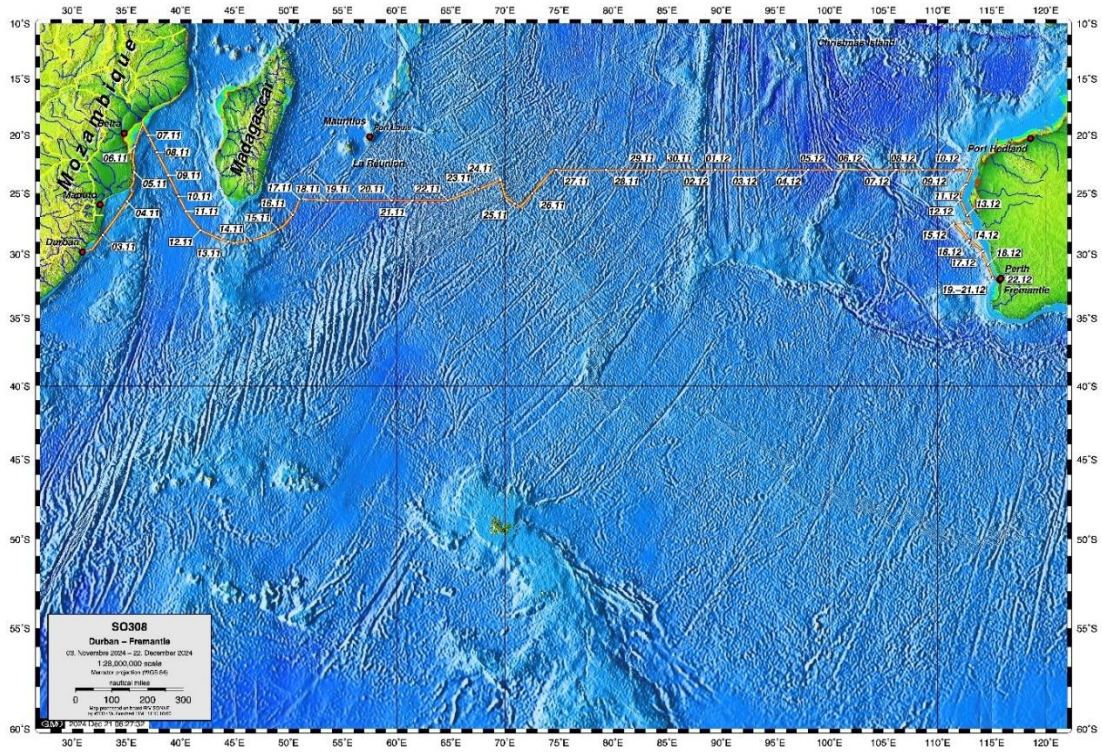

Figure 1: Track with 51 stations

The final week of the GEOTRACES research cruise SO308 was completed this morning as we sailed into the port of Fremantle. The off loading of containers was conducted swiftly. Getting the biosecurity permissions organized for the airfreight, seafreight and frozen goods transport was a little more challenging and took some negotiating. In the end all was solved and the frozen goods are now on their way to the various labs around the world.

Over the last seven days we have sampled 5 stations whilst moving southwards with the flow of the Leeuwin Current. All the sampling went smooth, and we were also able to pack all our equipment and samples before sailing into Fremantle. We have in total sampled 51 stations along our transect of about 11500 km. A total of 16 stations were superstations with an additional CTD deployment with in situ pumps. We had planned 51 stations, and we also completed them, with the locations of most stations as initially planned. This is rather unique in my experience as typically there are a range of changes to the station programme on my

expeditions. We sailed somewhat further south in the region south of Reunion and Mauritius, in order to avoid the strongest impacts of an westwards moving hurricane.
We efficiently finalised our SO308 cruise and dropped off cruise participants in Fremantle to fly back to their home countries. The Sonne cruise SO308 was very successful, and we achieved the majority of our objectives. Plenty of samples to be analysed in the coming months, and manuscripts to be written. The success of the cruise was due to the great team effort from all involved, both on land and on the vessel. In particular I would like to mention the captain and crew, who contributed greatly to the success of the cruise.

Figure 2: Scientists of SO308. Photo by Eric Achterberg.

Tuning in to phytoplankton rhythms

The daily lives of phytoplankton in the ocean are usually regular. Since they are dependent on sunlight, their daily activities, such as DNA replication and cell division, often follow a diel pattern. By taking measurements all throughout the day-night cycle, we can learn about their growth rates. Growth rates are important, as the speed at which phytoplankton cells divide has a big impact on their abundance, which in turn is a critical consideration for photosynthetic rates and food web interactions.

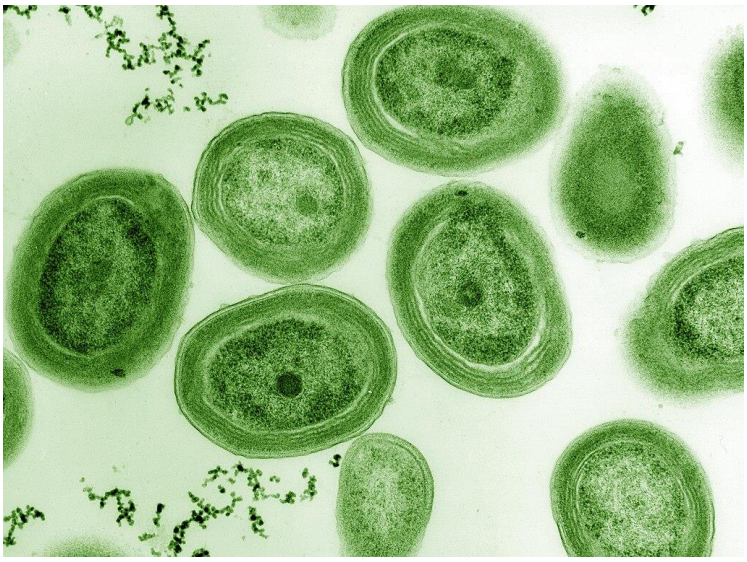

Figure 3: Prochlorococcus marinus microscope image by Luke Thompson and Nikki Watson (Creative Commons licence).

Postdoctoral scientists Nicole Dames and Charlotte Eckmann, from the Marine Biological Laboratory in Woods Hole, Massachusetts USA, are particularly interested in the growth rates of *Prochlorococcus* (Fig. 3), a ubiquitous phytoplankton genus that is especially important in low nutrient open ocean waters. Previous work in the Indian Ocean's Bay of Bengal has shown that *Prochlorococcus* cells divide up to three times a day—among the highest reported growth rates for this group across all oceans. Nicole and Charlotte want to see if the same high growth rates are seen in the southern part of the Indian Ocean as well, or if the *Prochlorococcus* there follow a more laidback schedule.

To do this, they took samples of surface water every 1-2 hours across a three-day period (Fig. 4). These samples included filtering water (Fig. 5) for DNA extraction, which will allow them to pinpoint the exact *Prochlorococcus* ecotype(s) (a sub-species level of classification) present in the water. They also added a fixative to seawater samples for flow cytometry analysis, which will allow for an accurate count of the *Prochlorococcus* cells and an indication of which growth phase the cells are in—this data will allow them to calculate growth rates.

Figure 4: Nicole and Charlotte collect seawater from the CTD. Photo by Tabea von Keitz.

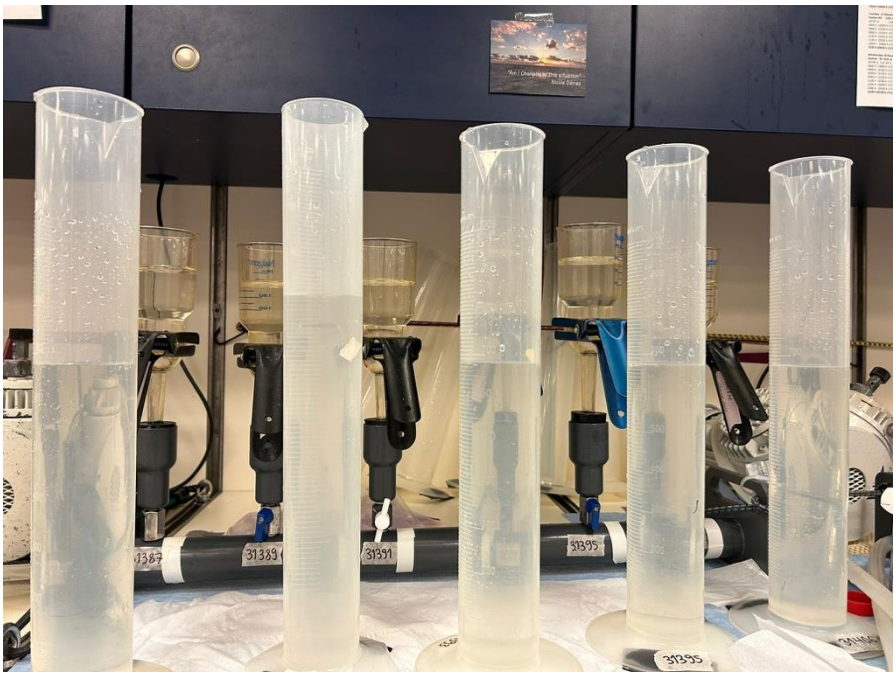

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Figure 5: DNA filtration manifold. Photo by Nicole Dames.

Prochlorococcus cells are less than a micrometre long, but as they are likely the most abundant photosynthetic organism on Earth, they have an outsized impact on carbon cycling and ocean food webs. Learning more about their growth, especially in under sampled regions such as the South Indian Ocean, is important for understanding these global processes. The daily lives of tiny phytoplankton can have huge implications!

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