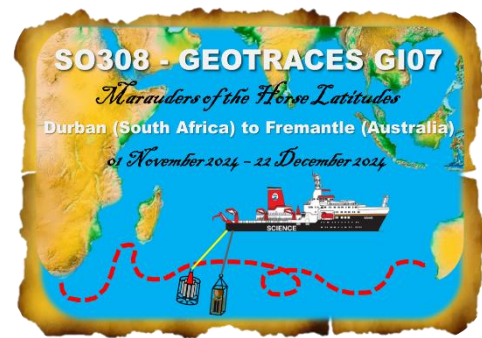


RV SONNE

Cruise SO308 South Indian Ocean GEOTRACES GI07

31st October – 22nd December 2024

Durban (South Africa) – Fremantle (Australia)



1. Weekly Report

Reporting Period: 31st October - 3rd November 2024

The research cruise SO308 is part of the International GEOTRACES Programme as a section cruise. The cruise will cross the South Indian Ocean (SIO) along 23°S from Mozambique to Fremantle (Australia), with a focus on trace element biogeochemistry and chemical oceanography but also including physical and biological oceanographic components. The research topic of the cruise is to determine in detail the distributions, sources and sinks of trace elements and their isotopes (TEIs) in the water column along a zonal section in one of the least studied ocean regions on earth. We

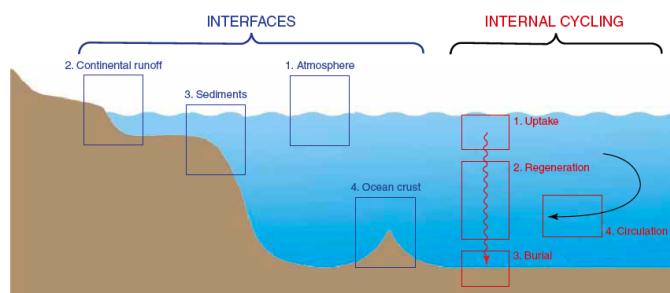


Fig. 1: A schematic representation of the four major boundaries at which micronutrients enter/leave the ocean, and the internal cycling that they undergo in the ocean.

aim to investigate the biogeochemical cycling of TEIs, and their interactions with surface ocean productivity and the carbon and nitrogen cycles (incl. N₂ fixation) given that some TEIs act as micronutrients. The findings will have global significance for understanding the chemical environment in which ecosystems operate. The supply pathways of TEIs to the SIO from ocean boundaries (Fig. 1) including the atmosphere (east African and northwest Australian dust),

continents (Zambezi river), sediments (on continental shelves/slopes and deep seafloor), and ocean crust (hydrothermalism) will be investigated. The TEI transport within water masses will be determined with a focus on the southward flow of hydrothermally derived TEIs towards the Southern Ocean but also the deep inflow of Southern Ocean waters into the SIO. The TEI transport assessment along the cruise track (Fig. 2) will also allow a more reliable use of some TEIs as paleo circulation proxies. We will deploy 19 ARGO floats, which will also include Biogeochemical floats) from German and US organisations along our cruise track. The cruise is officially part of the international GEOTRACES program.

The cruise involves a range of national and international research groups and we have many different nationalities on board which creates an excellent multi-cultural environment. The cruise is led by GEOMAR, and we have scientists involved from Constructor University, ZMT, the Universities of Tasmania, Xiamen, Zhejiang, Minnesota, South Florida, Chicago, Stanford, University College London, the Alfred Wegener Institute, Woods Hole, Max Planck Institute for Marine Microbiology (Bremen), IAEA Monaco, Helmholtz-Zentrum Hereon.

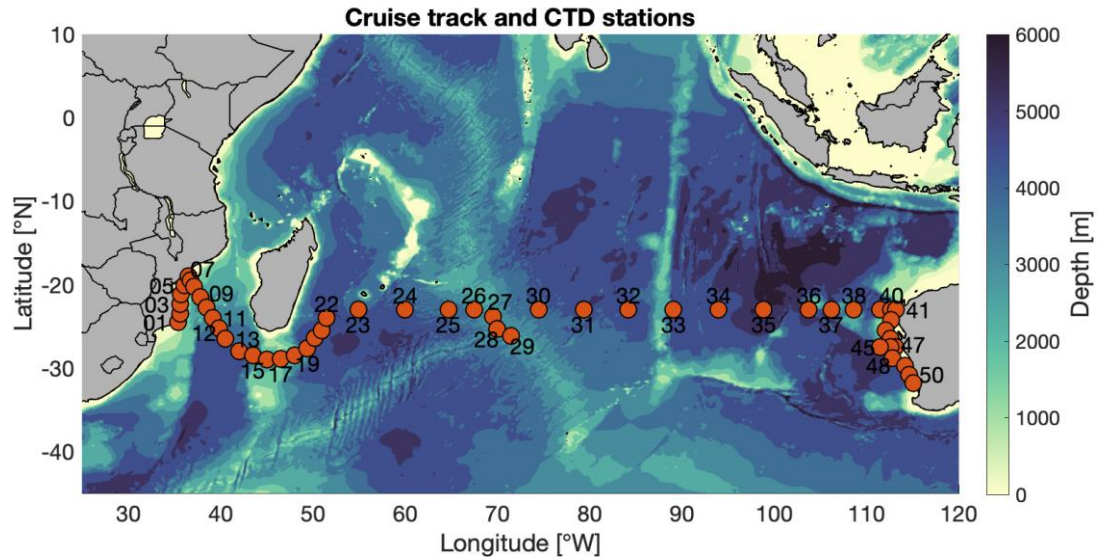


Fig. 2 The planned cruise track with 51 stations (red dots) along the section.

The journey from the home labs to Durban (South Africa) went smoothly and all participants embarked on 30 October. Since the arrival of the SONNE in Durban on October 28, the crew of the SONNE, together with outside contractors, have been working hard to repair technical problems with a winch and an engine. The repairs were finalized on November 2 and we departed 2.5 days delayed in the evening of November 2.

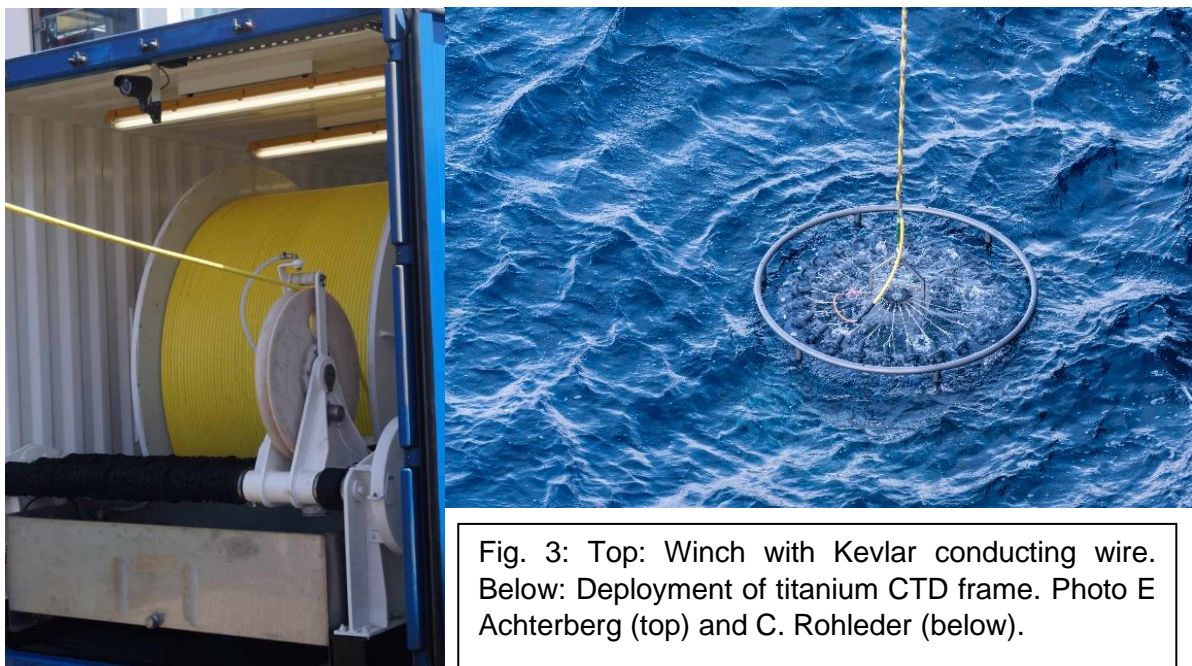


Fig. 3: Top: Winch with Kevlar conducting wire. Below: Deployment of titanium CTD frame. Photo E. Achterberg (top) and C. Rohleder (below).

We are currently steaming towards the EEZ of Mozambique and reach our first CTD station in the evening of November 4. On a daily basis we will sample in detail the water column until the seafloor using the trace metal clean titanium CTD and also the stainless steel SONNE CTD. The titanium CTD is operated by a dedicated winch system with a Kevlar cable (Fig. 3), thereby preventing contamination of the samples during the sample collection. Once on deck Niskin bottles are removed from the frame and taken to our trace metal clean container where the water is filtered through various different filter pore sizes into a large number of different bottles.

for analysis at sea and in the home laboratories. We are also collecting particles from the water column using in situ pumps for elemental and synchrotron analysis. We are deploying daily a second CTD (stainless steel) to assess controls on surface ocean primary productivity and dinitrogen fixation. In addition, we will deploy a mini multicorer at every station to collect shallow sediment cores. We will assess sediment-water exchange from pore water analysis of the cores.

The cruise will sail through a range of EEZs of various countries. Obtaining diplomatic clearances for the 3 states has been a challenge, and the clearance to work in waters of Mozambique only arrived 2 weeks before we sailed, and today we received the clearance to work in Australian waters.

All the members of the Equatorial Pacific GEOTRACES team are very grateful to the German Research Fleet Coordination Centre at the Universität Hamburg, the captain and crew of the SONNE, the shipping company BRIESE RESEARCH, the Agent Meihuizen in South Africa, and LPL Projects + Logistics GmbH for providing their outstanding support to science and ship logistics which made this cruise possible. We are grateful for the financial support for this cruise by the BMBF.

RV SONNE at sea 27°40 S/33°30 E

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