

RV SONNE

SO298 “Equatorial Pacific GEOTRACES GP11”

April 14 - June 2, 2023

Guayaquil (Ecuador) - Townsville (Australia)



1st Weekly Report

(April 14 - 16, 2023)

The research cruise SO298 is part of the International GEOTRACES Programme as a section cruise. The cruise will cross the equatorial Pacific Ocean (EPO) along 0°S from Guayaquil (Ecuador) to Townsville (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 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.

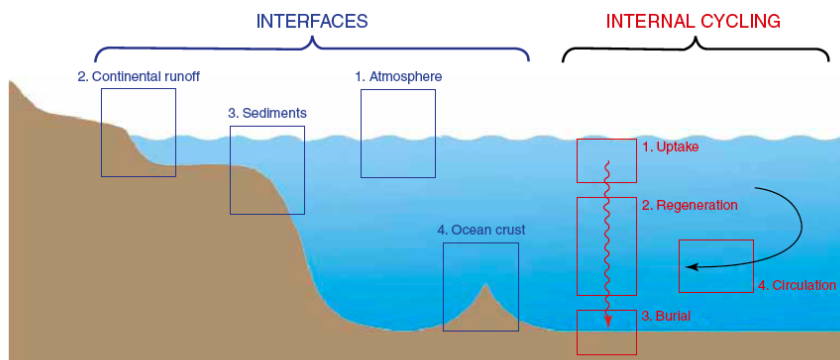


Fig. 1: A schematic representation of the four major boundaries at which micronutrients enter/leave the ocean and the internal cycling that they undergo in the ocean.

The findings will have global significance for understanding the chemical environment in which ecosystems operate. The supply pathways of TEIs to the EPO from ocean boundaries (Fig. 1) including the atmosphere (east Asian dust), continents (rivers on east and west side of transect), sediments (on continental shelves/slopes), 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 in the western EPO. The TEI transport assessment along the cruise track (Fig. 2) will also allow a more reliable use of some TEIs as paleo circulation proxies. 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, the Universities of Kiel, Xiamen, Southampton, Minnesota, South Florida, Shanghai Jiao Tong and Zhejiang, the Alfred Wegener Institute, Max Planck Institute for Chemistry (MPIC), Helmholtz-Zentrum Hereon.

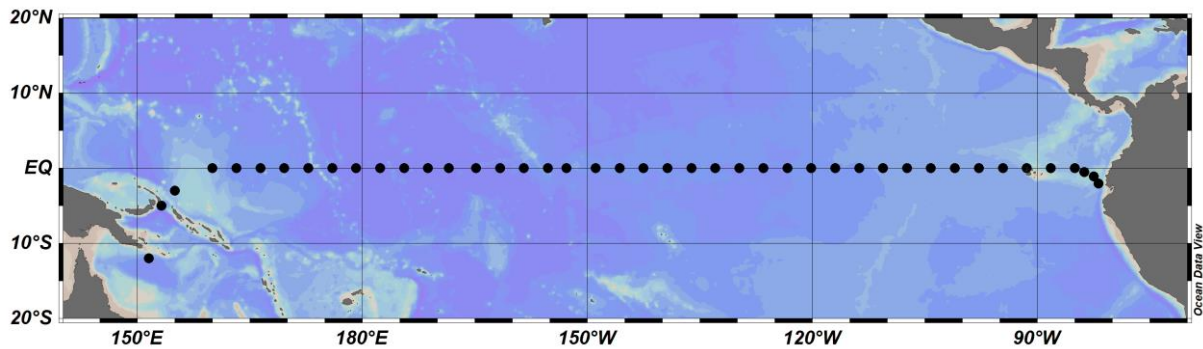


Fig. 2: The planned cruise track with 42 stations (dots) along the equator.

The journey from the home labs to Guayaquil went reasonably smoothly and all participants embarked on April 13. The containers and the rest of the equipment also arrived on April 13 (2 days late) and we all worked hard to organise the labs and prepare for the first station.

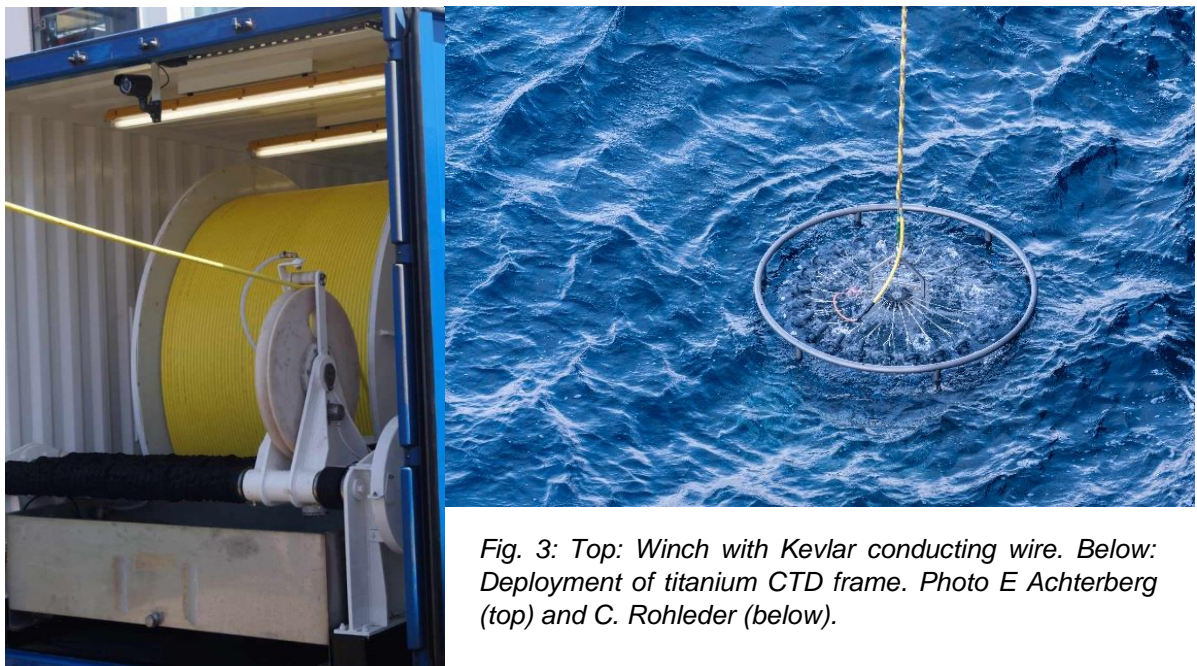


Fig. 3: Top: Winch with Kevlar conducting wire. Below: Deployment of titanium CTD frame. Photo E Achterberg (top) and C. Rohleder (below).

Our first CTD station was conducted on April 15 immediately outside Guayaquil, in waters with a depth of 110 m. From there we continued towards the Galapagos Islands. We are now 2 days into the cruise and have nearly finalised station 4. The weather is very kind to us with low winds, regular rain and high temperatures. The Sonne is very stable, and we hardly notice the sea.

On a daily basis, we will sample in detail the water column until the seafloor using the trace metal clean titanium CTD and 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 titanium CTD (stainless steel) to assess controls on surface ocean primary productivity and di-nitrogen fixation.

The cruise will sail through a range of EEZs of various countries. Obtaining diplomatic clearances for the 5 states has been a challenge. 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 REMAR in Ecuador, 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 Federal Ministry for Education and Research (BMBF).

RV SONNE at sea 00°34.2S/83°44W

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