

RV SONNE

SO289 - South Pacific GEOTRACES

18th February - 8th April 2022

Valparaiso (Chile) - Noumea (New Caledonia)

1st Weekly Report

Reporting Period: 17th - 27th February 2022

The cruise SO289 is part of the International GEOTRACES Programme as a section cruise. The research cruise will cross the South Pacific Ocean (SPO) along 32.5°S from Valparaiso (Chile) to Noumea (New Caledonia), 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

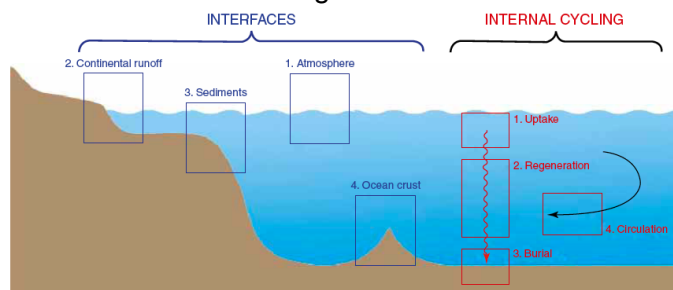


Fig. 1: A schematic representation of the four major boundaries at which micronutrients enter/leave the ocean, and the internal cycling that they undergo in the ocean.

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 SPO from ocean boundaries (Fig. 1) including the atmosphere (Australian dust), continents (e.g. Maipo River), 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 SPO. The TEI transport assessment along the cruise track will also allow a more reliable use of some TEIs as paleo circulation proxies. The work on board will use GEOTRACES trace metal clean sampling and analysis approaches.

The cruise involves a range of national and international research groups and we have many different nationalities on board which creates a wonderful multi-cultural environment. The cruise is led by GEOMAR, and we have scientists involved from Jacobs University, the Universities of Kiel, Marseille, Lausanne, Xiamen, Minnesota, South Florida and Vienna, the Alfred Wegener Institute, NIOZ, ETH Zürich, Memorial University and a Chilean observer from the University of Chile.

Our travel from the home laboratories to Chile was undertaken with great caution in order to prevent infection with COVID. We all had booster vaccinations and have had 2 PCR tests (with negative results) before we could board the Sonne in Valparaiso on February 17. The daily routine by the science team and crew is still strongly affected by the COVID pandemic, with great care paid to hygiene and distancing on board, and daily antigen COVID tests and 2

further PCR tests during the cruise. The 33 SO289 scientists on the cruise have a cabin to themselves, again to minimise risk of infection. All the precautions have functioned so far, with no Corona cases since we sailed 5 days ago.

The Corona pandemic has major consequences for global shipping, with delays in container transport. In addition, many ports are fully booked with commercial vessels. We suffered from this issue in Valparaiso, where the planned mobilisation of SO289 would be conducted in the period February 16-18. Instead, we boarded the Sonne whilst she was for anchor in the bay of Valparaiso, with the boat to boat transfer being undertaken by the local pilot boats (Fig. 3). We departed Valparaiso without our equipment on February 17 and sailed to the only available



port (actually a shipyard) for us in Chile (Talcahuano near Concepcion); all other Chilean ports were fully booked for periods of between 2-8 weeks. Our containers arrived gradually on board in the period February 18 to 22 whilst we were berthed in Talcahuano, and our equipment and the trace metal clean winch could be installed in this period. The prolonged waiting time also allowed us to send the frozen samples from cruises SO287 and SO288 to Germany.

After a delay of 4.5 days, we were able to leave port on February 22 at 1930 h, and commence cruise SO289. A transit back to the region of Valparaiso was necessary, where we then conducted a first CTD station in the mouth of the river Maipo on February 23 before continuing to sail to the 32.5°S section and conducting sampling.

We are now 5 days into the cruise, and we are sampling station 9. We are still in Chilean EEZ waters, just north of the Robinson Crusoe Islands, in the Marine Park of Juan Fernandez. Tomorrow night we will have reached international waters and will keep sailing west along 32.5°S towards New Zealand and New Caledonia.

The weather is very kind to us with low winds and pleasant temperatures. The Sonne is very stable, and we hardly notice the swell.

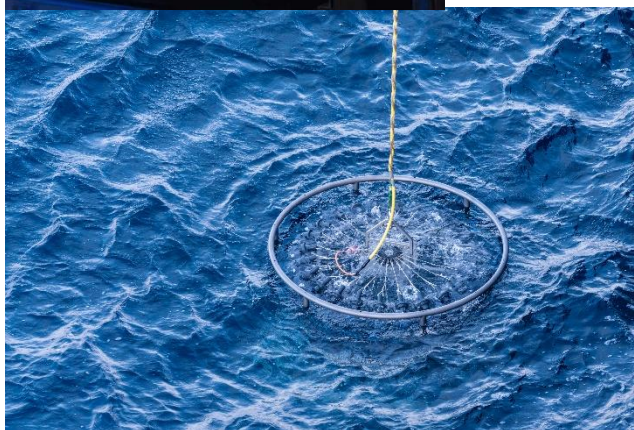


Fig. 2: Top: Winch with Kevlar conducting wire. Below: Deployment of titanium CTD frame. Photo E Achterberg (top) and C. Rohleder (below).

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. 2), 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 organisation was challenging due to COVID issues, container transport problems and port cancellations. We have overcome the challenges and are now sampling and



Fig. 3: Pilot boat and Sonne in Valparaiso. Photo N. Fröhberg.

conducting exciting research. All this is greatly benefitting the early career researchers on board, who will collect crucial samples and data for their PhD and Postdoc projects. Getting this cruise to depart from Talcahuano has been an outstanding team effort. All the members of the South Pacific GEOTRACES team are therefore very grateful to the German Research Fleet Coordination Centre at the Universität Hamburg, the captain and doctor of the Sonne, the shipping company BRIESE RESEARCH, the Agent ULTRAMAR, 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 32.5°S/79°W

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