RV SONNE

SO289 - South Pacific GEOTRACES

18th February - 8th April 2022

Valparaiso (Chile) - Nouméa (New Caledonia)

4. Weekly Report

14th March - 20th March 2022

**Observations of plastic litter, underwater images with video camera and seafloor bathymetry**

***Progress:*** We have had a successful week, and until Friday night (March 18) were able to conduct daily station occupations with CTD casts and in situ pump deployments. We have made steady progress west towards Noumea along our 31.5°S latitude cruise track. Surface waters from the tow-fish were sampled to assess trace element and nutrient concentrations and the functioning of surface ocean microbial communities. The weather has been variable with winds up to force 6-7 Beaufort, but this has not prevented us to work at the stations. Due to a medical emergency we are currently heading for Tahiti before returning to our station work.

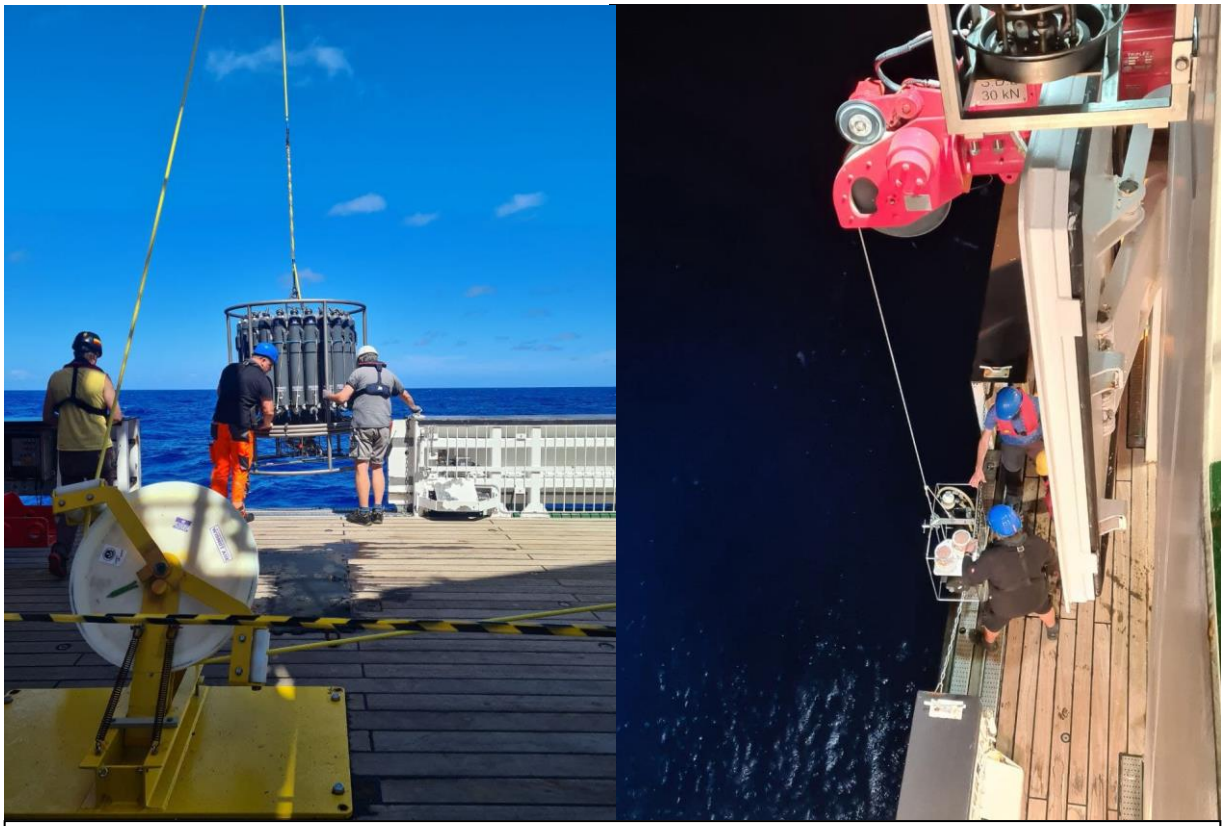


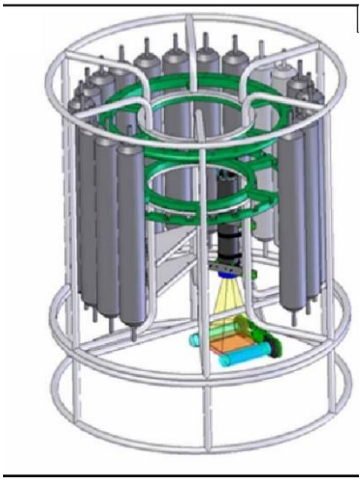
Figure 1: CTD and in situ pump deployments on SONNE. Photos by Juliane Tammen

Figure 2: Plastic litter in the middle of the South Pacific

Figure 3: Wildlife on macro-litter. Small crab uses lid as a raft and place to hide. Plastic litter as a vector for species transfer in the ocean. Photo Stephan Hamisch.

***Microplastic observations:*** Our Chilean observer Maria Amenabar happened to work on microplastics at the University of Chile in Santiago. Aaron Beck at GEOMAR therefore prepared sampling equipment at the last moment before our flights to Chile. A metal filter has been installed on the underway surface ocean water supply system of the Sonne, and plastic materials with a size larger than 10 µm are collected continuously, and then removed from the filter on a daily basis. The collected samples will be transferred to GEOMAR and analysed for microplastic particles using our automated hyperspectral camera system. In addition, Maria conducts litter spotting surveys each day (Figs. 2 and 3), whereby she notes all plastic debris that can be spotted from the upper deck of the vessel. Maria has already observed important gradients in plastic litter abundances, with highest numbers on the edge of the South Pacific gyre system. The obtained data will be used for the validation of the GEOMAR plastic litter distribution models.

***Underwater Vision Profiler:*** We are deploying an underwater vision profiler (UVP) on our stainless steel CTD frame (Fig. 4). The UVP 5 is provided by Rainer Kiko (Observatoire Oceanologique de Villefranche), The UVP provides high performance images using a camera that takes rapid pictures of an illuminated parcel of water under the CTD frame. The camera can observe zooplankton and macroscopic particles with a size > 100 µm. A section along our SO289 transect of the UVP data is shown in Figure 5, with enhanced particle (>125 µm) concentrations in the surface ocean and at the depth of the oxygen minimum zone. The enhanced particle abundance in the surface ocean is related to primary production in the euphotic zone with also increased numbers of zooplankton. The oxygen minimum zone off the Chilean shelf also contains enhanced concentrations of particles that have sunk from the surface ocean. Two further interesting features can be noted along the section. Firstly, there is a gradual decline in particle abundance in the deep ocean away from the shelf and into the remote South Pacific



Ocean. This is related to the decrease in nutrient supply to surface ocean communities with a consequent reduction in primary productivity and the number of sinking particles that make their way to the deep ocean. Secondly, the hydrothermal inputs at 112°W are visible in the UVP data, and also a near bottom nepheloid layer of resuspended particles .

Algorithms exist to convert the UVP observations into a sinking particle flux. Our cruise provides the exciting opportunity to combine the UVP data (and calculated sinking flux) with 234 Thorium-238 Uranium disequilibrium based particulate carbon export. This will facilitate the validation of the UVP sinking flux algorithms.

**Figure 4.** The UVP system in use on SO289. View of the UVP lamps that illuminate a volume of seawater to allow camera to image particles and zooplankton (modified from Picheral et al., 2010, modified by Chris Galley).

***Multibeam Data Collection*** We are running the EM122 multibeam system and processing the data to obtain bathymetric information. This work is done by Chris Galley, and supports our cruise but also the Underway Bathymetry Project that is hosted at GEOMAR. We have obtained some excellent bathymetry data for extinct underwater volcanoes along our transect in the region between 131-134°W. (Figure 6). The figure shows the enhanced bathymetry data quality of the multibeam system over satellite derived bathymetry data.

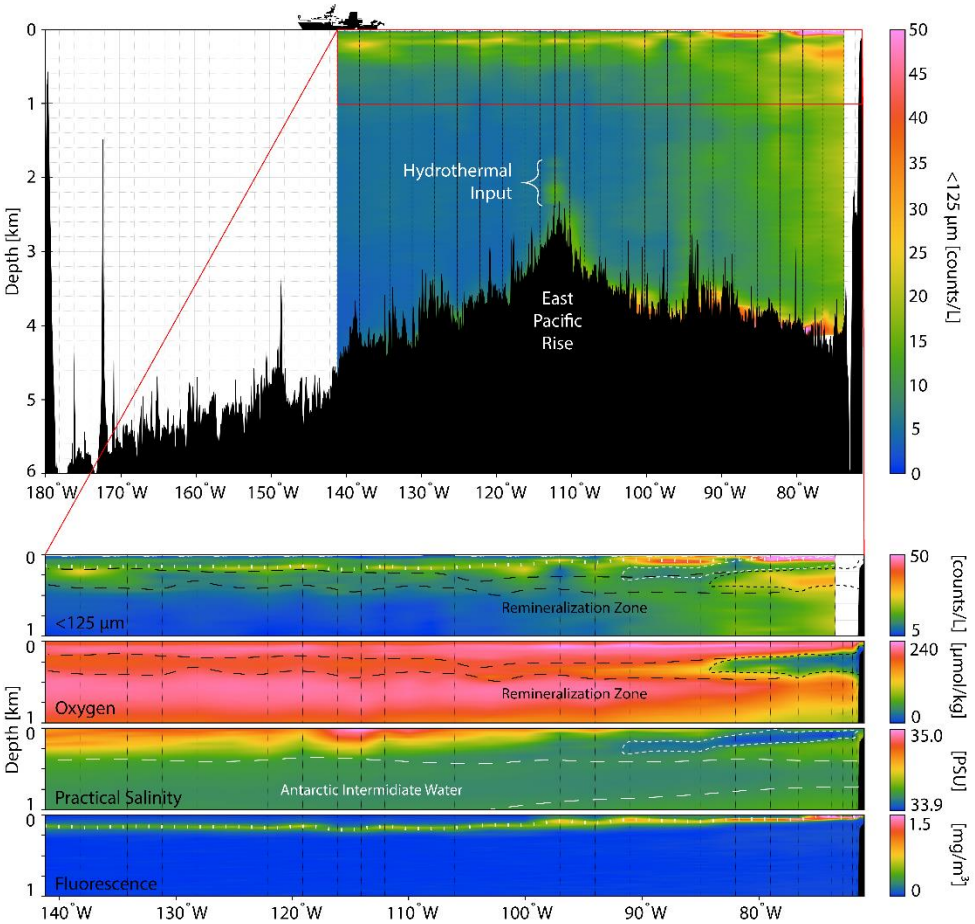



**Figure 5.** UVP 5 obtained particle abundance for full depth along SO289 section. Bottom: sections of particle abundance (<125 µm), oxygen, salinity and fluorescence for top 1000 m. Graph by Chris Galley.

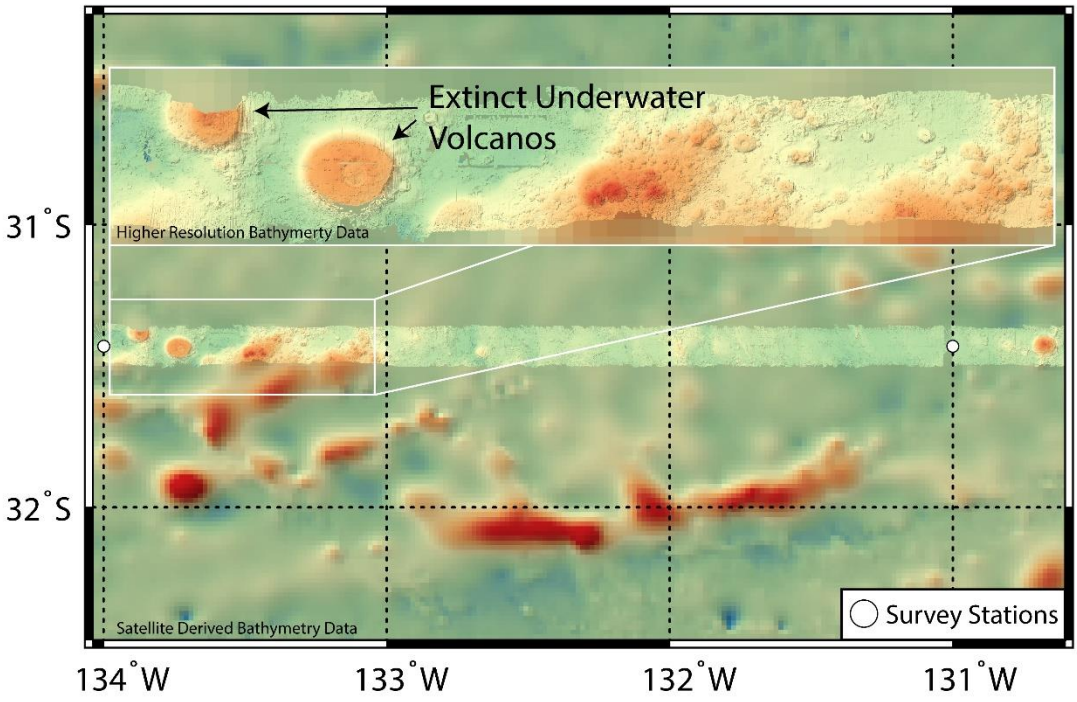



**Figure 6.** High resolution multibeam bathymetry data, and low resolution satellite bathymetry data for part of our transect. Graph by Chris Galley.

RV SONNE at sea 21.0°S/147.3°W

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