



RV SONNE expedition SO288

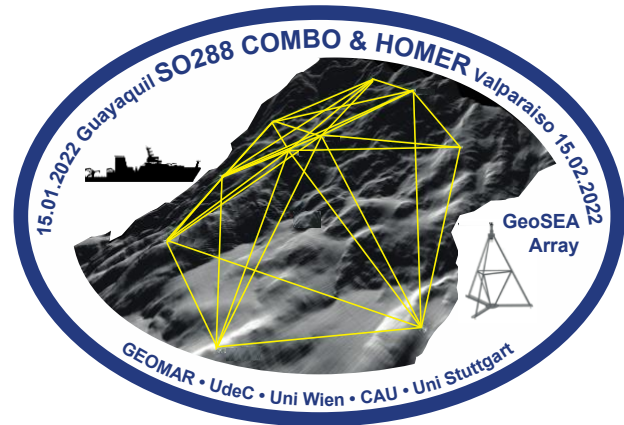
COMBO & HOMER

15.01.2022 – 15.02.2022

Guayaquil (Ecuador) – Valparaiso (Chile)

Weekly report No. 1

11.-16.01.2022



At Sea, 08°30'S/80°34'W

The expedition SO288 COMBO & HOMER covers geoscientific research activities (COMBO), as well as biogeochemical studies (HOMER), though the greater goal of the cruise is the recovery of the GeoSEA array. The Geosea array is a geodetic measuring system, which was installed during the expedition SO244 at the end of 2015. Because the system's purpose is to quantify the build-up of tectonic stress, which accumulated in the underlying oceanic crust over the span of several years, it was placed on to the active plate boundary offshore Chile. This active plate boundary is expressed as a deep-sea trench in the seafloor morphology and is where the oceanic Nazca plate is shoved under the continental South American plate and subducted into the lower mantle. Due to the static friction of the two plates, strong tectonic stress can accumulate which, when released abruptly, can cause earthquakes and thus increase the risk of tsunamis. Therefore, in order to improve the assessment of geohazards connected to geological and tectonic processes, the GeoSEA Array records the local seafloor deformation along three marine geodetic networks ([BMBF Projekt GeoSEA](#)). Now that the batteries of the autonomous seafloor transponders are exhausted and thus ongoing deformation can no longer be recorded, a speedy recovery of the stations is intended. This recovery requires the use of a remotely operated vehicle ([ROV](#)). The data that was recorded by the GeoSEA array is stored locally in the seafloor transponders and comprises acoustic distance measurements, inclination measurements as well as pressure change measurements. All measurements are made with high accuracy and both



the distance and inclination measurements have a sub-centimetre resolution (Fig. 1).

Fig. 1: Multiple stations of the GeoSEA-Arrays shown on the deck of RV SONNE during cruise SO244, shortly before their deployment in 2015. The transponders are attached to approximately 4 m tall steel tripods, which were installed on the seafloor at water depths between 2600 m - 5400 m and are now going to be recovered with the help of a ROV.



Foto: J. Steffen, GEOMAR

While extensive seafloor mapping was carried during the expedition SO244 with both the RV SONNE's multibeam sonar and an autonomous underwater vehicle (AUV), very little is known of structures under the seafloor. This knowledge gap will hopefully be bridged by a combination of high-resolution seismic methods (e.g., [Ocean Bottom Seismometers](#)) and visual studies of the seafloor (ROV camera), which will enable a qualified assessment of the measured geodetic signals and their place of origin.

The Humboldt Current System is one of the most productive ocean areas in the world. Upwelling of nutrient-rich deep water supports high net primary production, a key process in the global carbon cycle. In general these areas are highly significant for carbon export via the biological carbon pump, which is an important removal process of CO₂ from the atmosphere. However, key aspects involved in the cycling of organic carbon (DOC) in the deep ocean remains largely unknown and how the fate of the organic carbon will change in the future ocean is uncertain. Thus, the goal of Humboldt Organic Matter Remineralization (HOMER) is the detailed biochemical characterization and turnover of particulate and dissolved organic matter in the water column and in particular in deep, meso- and bathypelagic, waters. In the framework of HOMER, we will collect water samples for *state-of-the art* biochemical analyses and microbial process rates, and will conduct onboard incubation experiments under predicted climate change conditions. Thus, HOMER is great societal and socio-economic value by shedding light on the largely unknown processes regulating the fate of organic carbon in the deep ocean and with this Earth's climate. The preparations of our sampling campaign are progressing smoothly and according to plan. We have unpacked our equipment and the biogeochemical laboratories are set up (Fig. 2). We are currently preparing the incubation experiments and we are excited to collect our first samples soon.



Fig. 2: Installation of the biochemical lab.

Foto: K. Becker GEOMAR

The COVID-19 pandemic demands special safety- and health requirements that must be abided by even before the port is reached. Since all participants adhered to said pandemic related requirements, nothing thwarted our safe departure. The few days in the port of Guayaquil were used to prepare and assemble the scientific equipment and to perform ROV tests, which were completed successfully (Fig. 3).



On Saturday the 15. of January 2022 at around 13:00h, the RV SONNE left the CONTECTON-Terminal of Guayaquil port in Ecuador (02°16'S/79°54'W). The port was left after the result of an extensive PCR-screening, which took place the previous day, came back all negative. Further PCR screening is scheduled to take place after a few days at sea. The incipient journey follows the south American coastline down to our study area offshore northern Chile. A first safety briefing was already carried out during the passage of the Rio Guayas.



Fig. 3: Test dive of the remotely operated vehicle ROV Kiel 6000 carried out in the port of Guayaquil (CONTECTON-terminal, mooring 6). The ROV will be used to recover the GeoSEA Array during cruise SO288.

Foto: S. Kontradowitz, GEOMAR

Aside from the 21 scientists and technicians from GEOMAR and the team of the ROV Kiel 6000, multiple guest researchers, two from the university of Santiago de Chile, two from the university of Vienna and one from the university of Stuttgart have joined the expedition. After the RV SONNE's pandemic related operation in the Mediterranean and Atlantic, we are extremely happy to lead the RV SONNE out of a southern American port and back into the Pacific Ocean. We are all in good spirits and the Pacific Ocean has lived up to its name and welcomed us with calm seas. The mood on board is accordingly excellent and the collaboration of ship crew and scientific crew as immaculate as anticipated.

With best regards on behalf of all participants on board of the RV SONNE,

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