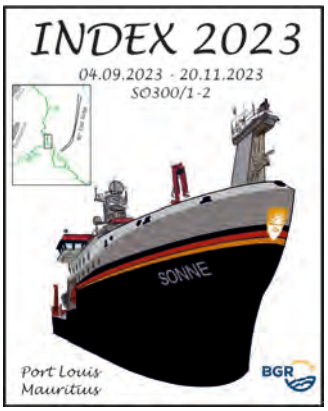
RV SONNE cruise SO300/2

INDEX 2023

09 - 15 October 2023

At sea 23° 52‘ S, 69° 36’ E



Weekly report No. 2 (08/10 – 15/10)

The second week of expedition SO300/2 focused on Cluster 04 of the BGR license area for the exploration of massive sulfides in the Indian Ocean. In total 27 stations have been realized during this week including six ROPOS dives, recovery and re-deployment of a long mooring consisting of three sediment traps, three current meters, and 27 passive samplers. Two CTD/rosette stations to sample and record the water column, and two gravity corers. Additionally, we deployed twice a baited trap equipped with a still camera, once on-axis and once off-axis. Finally, six HOMESIDE stations mapped 110 km² of seafloor in high resolution.

Two hydrothermal systems were already known in Cluster 04 at the beginning of this cruise: ALPHA and EDMOND-GAUSS-SCORE (EGS). Both contain active and inactive sites. Two new sites were now detected in the ALPHA field and 10.5°C, diffuse hydrothermal fluid emanates at the slope of a basalt mound in one of these new sites. Hydrothermal fluids with maximum temperatures of 344°C were sampled in the ALPHA field using the KIPS system. The fluid, which almost has endmember quality, has a salinity of 1.5 times seawater salinity indicating a brine phase which results from boiling and phase separation of the hydrothermal fluid at depth beneath the ALPHA field. Apart from fluid samples numerous sulfide samples were taken. A 15 m tall inactive chimney complex in the inactive part of the EGS field was of special interest. The absence of vent fauna as well as a thin sediment cover indicate that this field has been inactive for a while. Still, the chimneys are intact and apart from a thin layer of Fe oxides they consist of rather fresh massive sulfides. We suspect that a combination of Zn sulfides and silica may stabilize these structures longer than typical Fe sulfides would do. The mentioned chimney complex was also mapped with 4875 images to produce a 3-dimensional photogrammetric model of it.

During the ROV dives in Cluster 04 a large number of biological samples of all faunal size classes were taken for biodiversity and connectivity studies. Push cores and water samples from CTD stations will be used for eDNA and metabarcoding. Another highlight of last week was the recovery of three incubators which were deposited close to a high-temperature vent, an inactive vent and in a non-vent area in the EGS field four years ago. The incubators contained different substrates such as sulfides and rocks onto which bacteria and archaea should attach to and grow. All recovered substrates from the different sites seem to contain organic growth but the one close to the high-temperature vent showed the most obvious traces of growth. The valuable samples will be investigated on board as well as prepared for the transport to the home laboratory at Geomar in Kiel.

The baited fish camera was deployed twice for 24 hours each and the main objective is to study biodiversity and functionality of the near-bottom megafauna. First results indicate a significant difference between on-axis and off-axis areas but more deployments during this cruise are necessary for a good statistical basis of any statement.

As mentioned above, in Clusters 01 and 04 of the INDEX area, a total of five current meters, two in Cluster 01 and three in Cluster 04, were also recovered with the retrieval of the sediment trap moorings. These provide information on current regimes (direction and intensity), water temperature and pressure at different depths from 800 m water depth to the seafloor. Initial results are in line with the data sets collected since 2015. Currents at about 800 m water depth are partly influenced by near-surface processes, whereas at 2500 m the orientation of the central water masses plays a more important role. At the seafloor, currents are mostly strongly directional and seem to be related to the bathymetry of the Central Indian Ridge. These obtained data allow an estimation of how particulate material is transported in the deep sea.

The seafloor area covered by high-resolution bathymetric data of Cluster 04 has been increased during the last week by 110 km². Because of the heave compensation of RV SONNE the resulting bathymetric maps are of excellent quality. Additionally, numerous anomalies, mainly with respect to turbidity, were detected in the water column along a ridge structure southwest of the EGS field but the source of these anomalies could not be found so far. This objective remains for future expeditions.

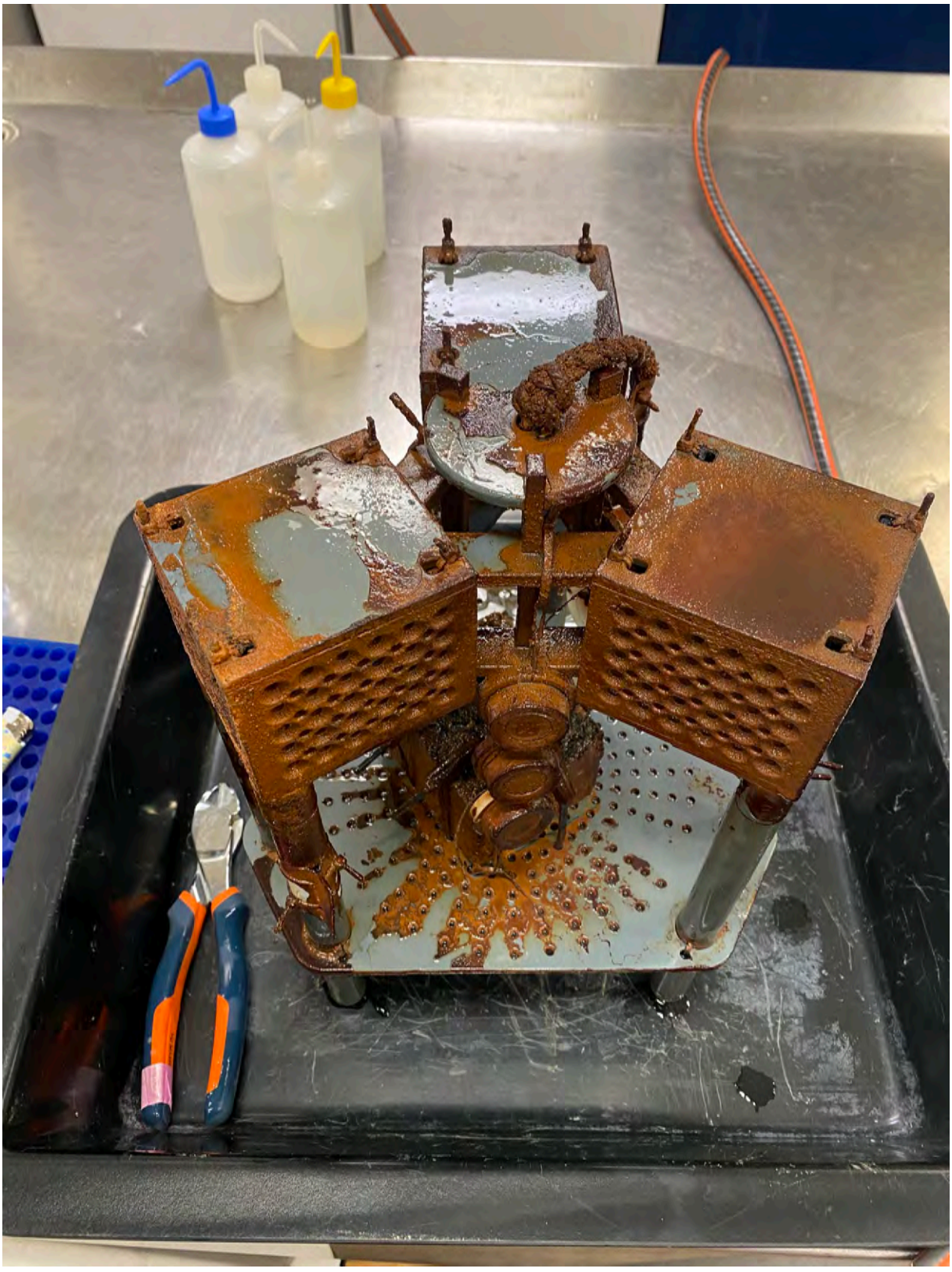
After finishing the scientific work in Cluster 04 RV SONNE is now on her transit to Cluster 05 and she is planned to arrive there on Monday, 16 October at 07:00 local time.

All participants of cruise SO300/2 are well.

Best regards on behalf of the entire crew,

Thomas Kuhn, Federal Institute for Geosciences and Natural Resources (BGR)

Chief Scientist



The incubator after four years deployment close to a high temperature vent. Photo: R. Baaske.