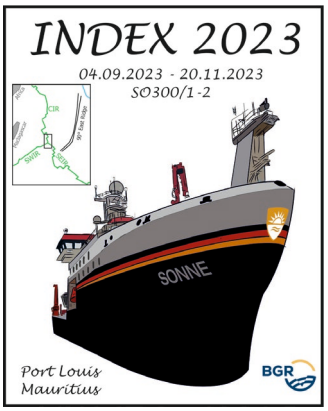
RV SONNE cruise SO300/2

INDEX 2023



06-12 November 2023

At sea 69°56'E / 25°28'S

Weekly report No. 6 (06/11 – 12/11)

In the sixth week of cruise SO300/2 (INDEX2023/2) we continued our work in the southernmost BGR license Cluster 12. We carried out four CTD/water sampling stations for biological and biogeochemical studies, took two gravity corers, and deployed a long mooring. Furthermore we started our drilling campaign with the BGR-owned Remotely Operated Coring System (ROCS) which has been mounted to ROV ROPOS. At the evening of 08 November we had to leave Cluster 12, earlier than planned, because of bad weather with strong winds and high swell. We wanted to continue the drilling stations in the JIM hydrothermal field in Cluster 09. However, bad weather was chasing us and it was not possible to deploy the ROV. We carried out a gravity corer program in the northern part of the JIM field with six stations and then continued to Cluster 05. In the KAIMANA field in Cluster 05 we could resume the ROV work on 11 November with drilling at sites 4 and 9. HOMESIDE stations were realized during the nights if RV SONNE was not in transit from Cluster 12 to 05.

The first dive using the ROV-based drilling system ROCS took place in the newly discovered AURORA hydrothermal field. In this inactive area, mineralization is suspected underneath numerous mound structures, but indicative sulfide outcrops at the surface have only been observed at eight sites so far. In order to obtain more information about possible mineralization below the seafloor, a total of four drill cores with a maximum possible length of 1 meter each were drilled within the scope of one dive. Figure 1 shows an approximately 80 centimeter long drill core of fresh (unaltered) sulfide. The compact core mainly consists of fine-grained, iron-rich pyrite with traces of sphalerite and silica. Larger cavities as well as alternating veins that presumably served as pathways for the hot, metal-bearing, ascending hydrothermal fluids during the active phase of the deposit are filled with chalcopyrite. This finding may indicate copper-rich sulfide mineralization at greater depths in the AURORA field.

The JIM hydrothermal field in Cluster 09 stretches over two basins which are separated by an E-W striking ridge. In the northern basin a certain number of mound structures occur similar to the AURORA field. From ROPOS tracks we know that some of these mounds have a surface covered with Fe-Mn oxide crusts. Thus, we investigated these mounds using gravity cores to get samples from their shallow subsurface. All six gravity cores were successful but only two of them contained hydrothermal material in the form of silica and massive sulfides. We conclude so far, that most of the hydrothermal mounds in the northern JIM field are bound to obvious tectonic structures and they may be not as numerous as in the AURORA field.

The last CTD stations which were successfully conducted during the sixth week of this expedition completed the oceanographic investigations of the water column. The water samples and data were collected from the northernmost to the southernmost cluster of the INDEX region and thus provide a comprehensive picture of the water mass composition in the

southern subtropical Indian Ocean. Preliminary results show small differences in the CTD profiles compared to previous years, but these reflect normal variability and do not imply large-scale changes.

In addition a further deep-sea mooring of more than 1.6 km in length was successfully deployed in Cluster 12 with three sediment traps, three current meters and three passive samplers (for dissolved trace elements). Although the weather conditions posed a particular challenge, the system was able to be deployed in the deep sea for another year thanks to the excellent teamwork of the scientists and crew. This means that the particle flux study in the southernmost cluster of the INDEX area can be continued for the sixth year in a row.

With one CTD station the biology group finished their collection of environmental DNA (eDNA) samples. This next generation sequencing (NGS) technique allows us to analyse genetic material in environmental samples rather than directly from an organism. To complement traditional methods of surveying biodiversity, a total of 223 eDNA samples from deep sea sediment (111) and water column (112) from 4 different vent fields were filtered and processed onboard to expand diversity coverage and increase taxonomic resolution.

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

Figure 1: ROV ROPOS with the drill tool ROCS mounted at the front side (left; photo: T. Kuhn) and a drill core from the AURORA field in Cluster 12 (photo: S. Sturm).