

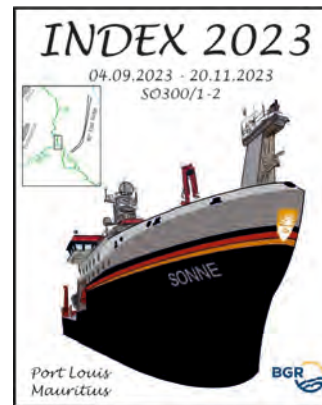
## RV SONNE cruise SO300/2

### INDEX 2023

30 October – 05 November 2023

At sea 27° 38' S, 73° 54' E

### Weekly report No. 5 (30/10 – 05/11)



During the night from 29 – 30 October, FS SONNE was in transit from cluster 09 to cluster 11, where only one ROPOS dive was carried out in the NEW SONNE field. This dive had several objectives: (1) mapping and sampling the stockwork zone exposed there at a normal fault beneath the massive sulfide bodies, (2) sampling the hydrothermal fluids at the various sites, and (3) completing the biological samples from this field. All objectives were achieved on this spectacular and scientifically highly interesting dive. After the ROV ROPOS was back on deck, RV SONNE set course for cluster 12. In this southernmost cluster in the BGR license area, we recovered a long mooring, completed four ROPOS dives, took three gravity cores, deployed the baited fish camera twice for 24 hours each, operated six HOMESIDE stations and deployed the video sled STROMER once.

The ROPOS dives were initially carried out in the already known HUNA and PENUMBRA fields. In the PENUMBRA field, the focus was on recovering recolonization experiments, completing the biological sample inventory and taking fluid samples. Fluid samples were also collected in the HUNA field, and structures that have only been found here in the BGR license area were also investigated. These include so-called "shelves", structures up to several tens of meters high, which consist of laterally extending, partly overhanging, plate-like layers. These layers consist of a mixture of silica, iron and manganese oxides and are extremely fragile. In addition, a mound was sampled which is entirely composed of hydrothermal silica and from which clear fluids of up to 315°C emanated from small chimneys. At approx. 10 psu, these fluids have the lowest salinity measured in the license area to date and clearly indicate a phase separation below the HUNA field.

The remaining two ROPOS dives, the gravity cores, the STROMER station and part of the HOMESIDE mapping were dedicated to the investigation of a plateau-like area of approx. 17 km<sup>2</sup> east of PENUMBRA. Station 108HMS detected a strong self-potential anomaly which, after examination on the sea floor with ROPOS, turned out to be an enormous, singular, extinct chimney complex which is around 35 meters high and has a width of around 15 meters at its base (Figure 1). In its immediate vicinity numerous small topographic mounds were identified on the bathymetric map created with HOMESIDE data. Most of these mounds could be characterized as hydrothermal using ROPOS dives. On the entire plateau between the known hydrothermal fields PENUMBRA and UMBRA there are more than one hundred obviously inactive hydrothermal mounds. Massive sulfides are outcropping on some of them, others are covered by iron-manganese crusts with hydrothermal sediment underneath. At some mounds self-potential anomalies were measured using the SP array of the video sled STROMER which may indicate massive sulfides beneath the hydrothermal sediments. Further investigations will

find out if there is wide-spread mineralization at depth between the mounds. We have named this new field AURORA.

In addition to this positive exploration results our environmental program also continued. On Tuesday, the last long-term mooring was recovered at the southernmost edge of the INDEX license area. With a total length of over 3100 m and a mooring depth of almost 4000 m, the complex system was a scientific and technical challenge. For over a year, data and samples were collected at various water depths in order to obtain information about the oceanographic, biogeochemical and sedimentological conditions in this part of the INDEX area. But before all the data could be saved, the system first had to be recovered. In a five-hour retrieval operation and with the combined efforts of the scientists and the crew, instrument after instrument and wire rope after wire rope were brought back on deck. In the end, the efforts and the decision to choose this location in general had more than paid off: a complete year worth of samples from three sediment traps were in the laboratory and are now awaiting in-depth analysis in the home laboratories, which will take several months. In addition, the current meters have recorded more than 54,000 data sets and, together with the BGR's passive samplers, are providing valuable insights for the INDEX program.

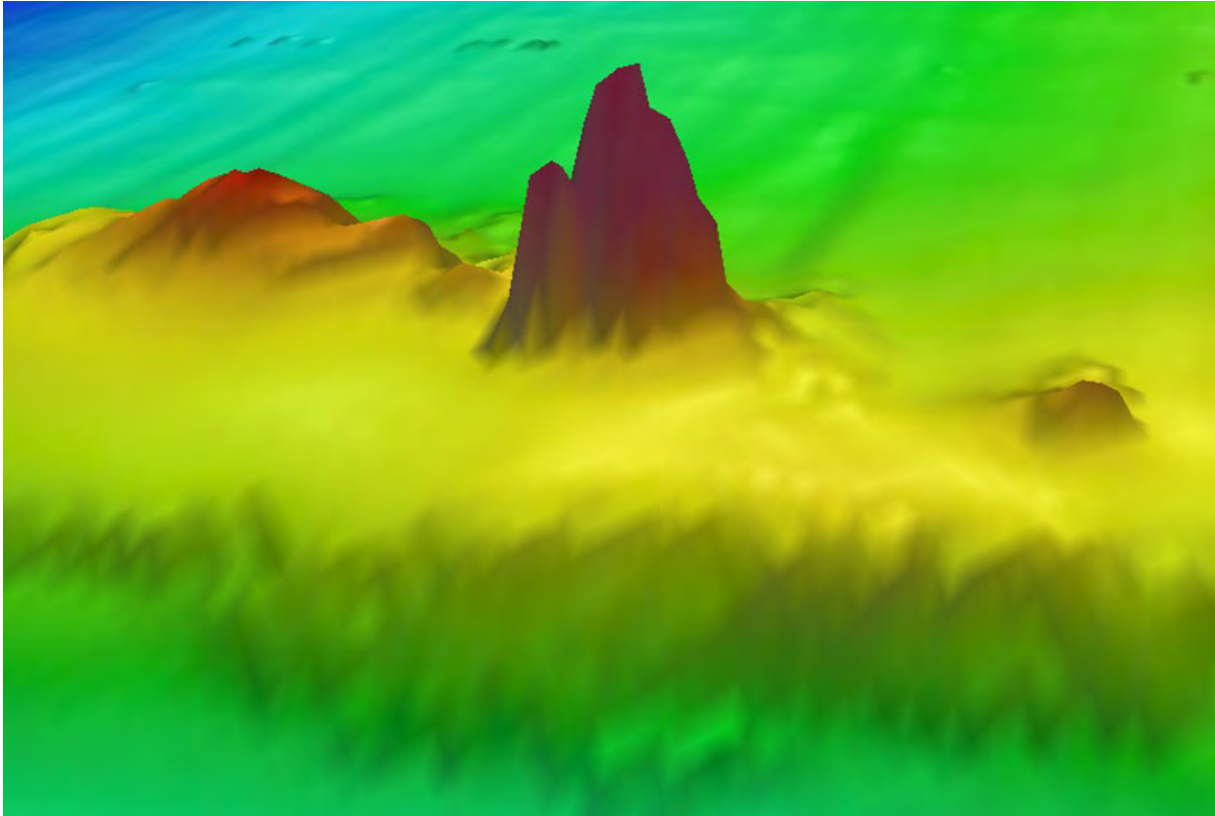
During the course of the cruise, the SAMS baited camera lander has been deployed eight times with four deployments located near to the vent sites (near field) and four deployments positioned far from the vent sites (far field) along our 1000-km long transect. We are doing these deployments to assess if there is any difference in the seafloor scavenger community near to versus far from the vent sites to estimate what the impact of deep-sea mining may be on the deep-sea scavenger community. We have found similar species richness (the number of species) at the near field and far field sites, but further analysis is pointing to different biodiversity and community structure between the two habitat types indicating that while species richness may remain unchanged following mining, the scavenger biodiversity may be affected. These conclusions will be important to consider when deep-sea mining strategies are developed so the environmental damage is kept to a minimum. For most of the deployments, we have observed abundant shrimp communities with three to four *Cerataspis monstrosus* shrimp being observed at the bait during each image. On the last near field site, we were surprised to find the abundance of *C. monstrosus* increased by an order of magnitude at the bait (Figure 2), forcing us to rename the camera station "Shrimp City".

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: 3-D image of the large chimney from HOMESIDE data of station 23\_108HMS. The chimney is about 35 m high and there are small sulfide mounds on both sides which are typical for the entire AURORA field.*



*Figure 2: Large aggregations of *C. monstrosus* shrimp at the bait at 3000m depth.*