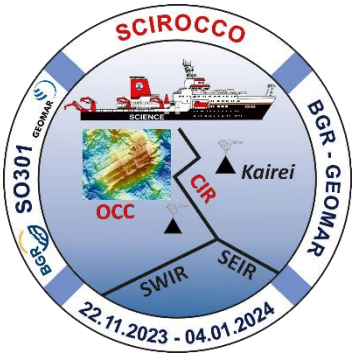
FS SONNE cruise SO301

SCIROCCO & KABA

22 November, 2023 – 4 January, 2024

Port Louis (Mauritius) – Port Louis

At sea 25° 20.20‘ S, 70° 1.94‘ E



Weekly Report Nb. 6 (25/12 – 31/12)

After the bathymetric survey, the towed magnetometer, the acoustic whale detection system and the airgun array were deployed on the afternoon of 25 December to survey another refraction profile. This profile extended 54 nautical miles from the Antarctic to the Somalia Plate (SE-NW) along the ocean bottom seismometers (OBS) deployed the previous day. After retrieving the outboard systems on the morning of 27 December, all 42 OBSs were released by acoustic command and successfully recovered on deck by the evening of 28 December. This was followed by bathymetric mapping with the EM122 multibeam echo sounder, which completed two areas on the western edge of the working area. A further CTD-survey by the KABA secondary user project lasting one and a half days began on 30 December. Three "Tow-Yo" profiles with the ship's own CTD rosette and two hydrocast deployments with the Titan rosette were carried out at the Kairei hydrothermal field and, among other things, water samples of the plume were taken. The return transit began on the afternoon of 31 December, during which bathymetry (EM122), shipboard magnetics and gravity will be recorded until the exclusive economic zone of Mauritius on the night of 2 January. We will arrive in Port Louis on 4 January, demobilise the cargo with 12 containers and disembark on 5 January.

We can look back with satisfaction on 37 working days in the survey area, in which weather and technology enabled a gap-free measurement programme with extensive data acquisition:

Refraction seismics counted 81 deployments and 86 recoveries of a total of 50 ocean bottom seismometers of GEOMAR and BGR, which were actively shot by refraction profiles and in curves between reflection profiles at one minute intervals. Several refracted phases can be recognised up to a distance of approx. 40 km, including shear waves and Moho reflections. A first model derived from the data depicts the oceanic core complex (OCC) as a high velocity body.

The reflection seismic survey operated for the first time with an 8 km hydrophone cable and was able to acquire a dense rectangular network of 29 profiles across the OCC and all three mid-ocean ridges around the Rodriguez triple point (approx. 44,000 shot points). The topography and sediment-free lithology require complex subsequent processing with e.g. 3D migration and methodological approaches such as field continuation. Near-surface structures and faults can already be recognised in the area of the OCC. The hoped-for refracted phases also occur in the last two kilometres of the long streamer.

The potential field methods magnetics and gravity recorded a dense data grid on all profiles, which allows a new detailed view of anomalies in the working area and the OCC in particular - in addition to a comparison with data sets from earlier surveys in the near-ridge area, which show inaccuracies in the IGRF reference model.

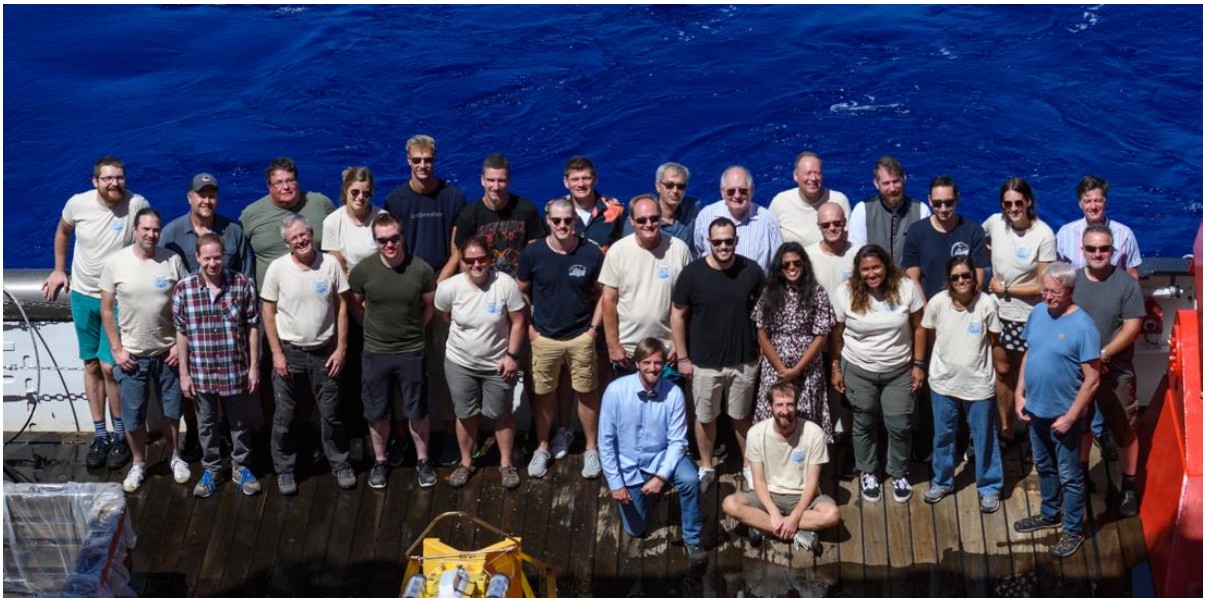
The high data quality of the bathymetric dataset, which is recorded by the numerous profiles, demonstrates the advantages of multiple coverage from different azimuths. It becomes the starting point for the seismic 3D migration to eliminate the diffractions with water velocities.

In 28 CTD deployments, the KABA project recorded the intensity and spread of the hydrothermal plume in the Kairei vent field using temperature, reduction potential and turbidity measurements and sampled it with the water samplers. On board we measured the concentration of hydrogen and methane, and carried out experiments on the microbial degradation of hydrogen, metals and sulphur compounds. More than 200 samples were collected for counting microorganisms and for gene and genome sequencing with the water samplers. A total of over 1000 samples were taken to quantify the trace metal input and its dispersion in the water column. We will analyse these samples in our laboratories at the University of Bremen, the Constructor University, and the Max Planck Institute for Marine Microbiology and thus be able to resolve geochemical and microbial processes in hydrothermal plumes with an unprecedented level of detail.

All this work was only possible thanks to the excellent facilities of the RV SONNE and the good co-operation between the scientific groups and the professional crew of SONNE. We would like to thank Captain Tilo Birnbaum and his crew for their continuous support during all manoeuvres, the smooth realisation of the work programme and the excellent service on board. Thanks to the consistently good teamwork in a calm working atmosphere, we return to our institutes and laboratories highly satisfied with a wealth of data.

All cruise participants wish you a happy and successful new year 2024!

Martin Engels, Federal Institute for Geosciences and Natural Resources (BGR), Chief Scientist



Scientific crew of SO301