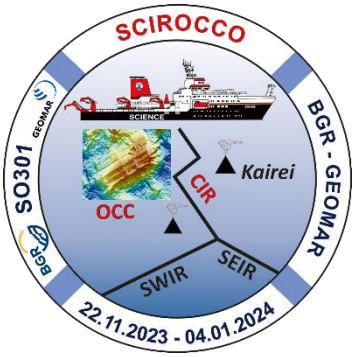
FS SONNE cruise SO301

SCIROCCO & KABA

22 November, 2023 – 4 January, 2024

Port Louis (Mauritius) – Port Louis

At sea 25° 25.8‘ S, 70° 39.4‘ E



Weekly Report Nb. 4 (11/12 – 17/12)

Over the course of this week, we were able to complete the multichannel seismic (MCS) profile network with the 8 km streamer and the towed magnetometer and acoustic whale detection systems. When we finish the profiling tomorrow morning, 14 out of 16 planned regional profiles plus all 10 additional profiles for densification around the Oceanic Core Complex (OCC) and the Kairei Hydrothermal Field (KHF) will have been surveyed. Three lines with limited data quality were sailed twice and two additional lines were surveyed, bringing the total number of acquired profile lines to 29.

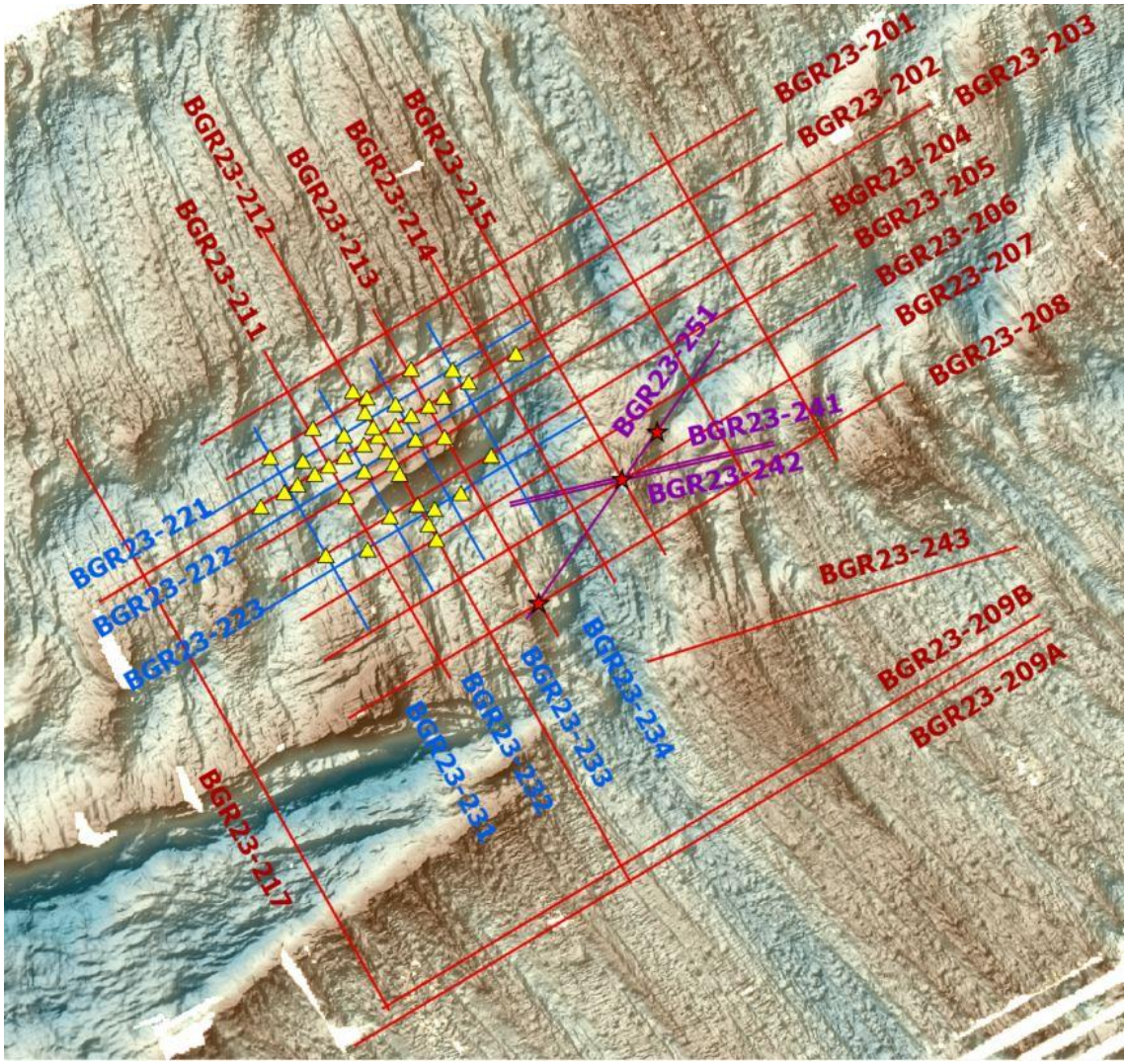
This second week of continuous operation was not without its challenges. With the rougher weather at the beginning of the week, swells of 3.5 metres, and wind speeds of around 5 Bf, parts of the streamer began to float up and could no longer be kept at the target depth with the depth control units (birds). This caused considerable noise in the data. We reacted by extending the first heavy streamer section (lead in) and changing the profile direction against the swell. We also realised that those depth control units coupled with the recovery system floated conspicuously often at the surface. These units can rotate freely around the streamer and were occasionally turned into upside-down position due to the strong wave movement from the side, so that the wing position displayed on the monitor caused rising instead of diving. These actions combined with a calming of the weather, enabled the streamer to be kept at a target depth of 12 metres again.

From Tuesday onwards, the airguns showed the expected first signs of wear from the constant stress. One of two airgun arrays was taken on board a total of four times during profile changes to replace damaged sensor cables, pressure hoses, or O-rings in the airguns. Three buoyancy bodies (balls), whose shackles had broken in a chain reaction, also had to be replaced. However, the airgun array was always able to work with at least 14 of 16 airguns along the profiles (90% of the energy according to the modelling). The redesign of the airgun array by our technicians before the cruise has proved its worth in view of these below-average signs of wear.

The data quality of the towed streamer is excellent. However, the very mountainous bathymetry and the sonic hard basalt crust without sediment cover at the mid-ocean ridge pose a major challenge for seismic subsurface imaging. The data show strong diffractions and 3D effects. We expect that post-cruise data processing will be successful in combination with

the velocity models of refraction seismics (OBS). The evaluation of refracted phases occurring in the streamer, methods such as downward field continuation, FWI (full waveform inversion), and/or quasi 3D migration will further support data quality enhancement.

In the coming week, the third part of the cruise will begin, in which the plume of the Kairei hydrothermal vent field will be surveyed again with CTD deployments, refraction profiles will be shot, and the recovery of all OBS will be on the programme.



Working area around the Rodriguez Triple Junction: Regional profiles (red), additional profiles at the OCC (blue) and at the Kairei hydrothermal field (KHF) (purple). Measured profiles are annotated with profile names. During the two-week profiling, 41 ocean bottom seismometers (OBS) at the OCC (yellow triangles) and 5 broadband OBS at the KHF recorded all airgun shots while the shot spacing was increased to 60 seconds during turns for profile change.

With best wishes from the 3rd Advent on behalf of all cruise participants

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

Chief Scientist