FS SONNE

Expedition SO307: MADAGASCAR, MADAGASCAR-BIO & INDICOM

12.09. – 28.10.2024, Durban – Durban

3. Weekly Report (23.09 – 29.09.2024)

Our plan for this week was to sample the main body of the Madagascar Ridge along its deep eastern flank, which worked out well. Several dredge hauls returned suitable volcanic rocks (sometimes in large quantities) from different stratigraphic levels along the slope. One dredge haul that was pulled over the uppermost part of the slope (near its transition to the summit plateau) yielded well-preserved volcanic rocks but also carbonate containing fragments of Inoceramus shells (Fig. 1). Because this genus went extinct at the end of the Cretaceous (together with the dinosaurs), all volcanic layers beneath must be more than 65 million years old, consistent with the postulated Late Cretaceous age (c. 80 Ma) for the main phase of the northern Madagascar Ridge volcanism. In addition, we have successfully sampled isolated seamounts and other structures during this week that are located on the deep abyssal plain to the east of the Madagascar Ridge.

Fig. 1: Calcareous Sediment with fossil shell fragments (white rectangles) of the extinct bivalve genus Inoceramus.

In addition to the geological sampling with the chain bag dredge, the multi-corer (MUC) has already been used six times on this cruise so far to sample the upper sediment layers of the ocean floor and the CTD probe 17 times (Fig. 2a). The CTD probe measures electrical **c**onductivity and **t**emperature as a function of water **d**epth and is connected to a water sampler that can take water samples from any depth. For this, the device has 24 circularly arranged containers, each holding 10 liters, so-called “Niskin bottles”, through which the ocean water can flow freely when open. Based on the data from the probe received live on deck during each deployment, it is possible to decide immediately from which depth water samples are to be taken by triggering an electrical impulse that closes one bottle at a time. Back on board, the water is drained from the individual Niskin bottles (Fig. 2b) and distributed to the various biological oceanography teams for further chemical and biological analyses (Fig. 2c). One of the research objectives of the GEOMAR biological oceanographers on board is the investigation of biological and biogeochemical processes that control the transport and microbial turnover of organic carbon in the deep sea. Plant plankton, i.e., photosynthetic algae, convert carbon dioxide into organic carbon within the light-exposed, shallow water layers. Only a small proportion of this sinks into the deep sea. Nevertheless, this amount of carbon is comparable to the annual increase in atmospheric CO_2 caused by fossil fuel burning. Gel-like particles containing carbohydrates and proteins play an important role in this transport, bridging the gap between carbon dissolved in the water and particulate carbon (Fig. 2c)

Fig.2a: The CTD probe with ROSETTE water sampler returns to the deck. The ship's crew (left) and scientists (right) work hand in hand (all photos taken by J.G.).

Fig.2b: Emptying the water samples from the different depths from the respective Niskin bottles.

Fig. 3c: Staining experiments carried out directly on board to examine gel particles, which presumably play a major role in the turnover of organic material in the deep sea.

At the end of this week, the ship set course south a little earlier than planned to investigate the fracture zones (large tectonic faults in the ocean crust) in the vicinity of the slowly spreading Southwest Indian Ridge. This area, around longitude forty degrees south, is known for its strong storms ("Roaring Forties") and so we want to take advantage of the good working conditions forecasted over the next week for this area.

Everyone on board is well and sends their regards to those at home,

Jörg Geldmacher
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