RV Meteor | Expedition M205 "RUBBLE"

Las Palmas de Gran Canaria – Fortaleza

23.10.2024 – 28.11.2024

2nd Weekly Report (28.10.2024 - 03.11.2024)

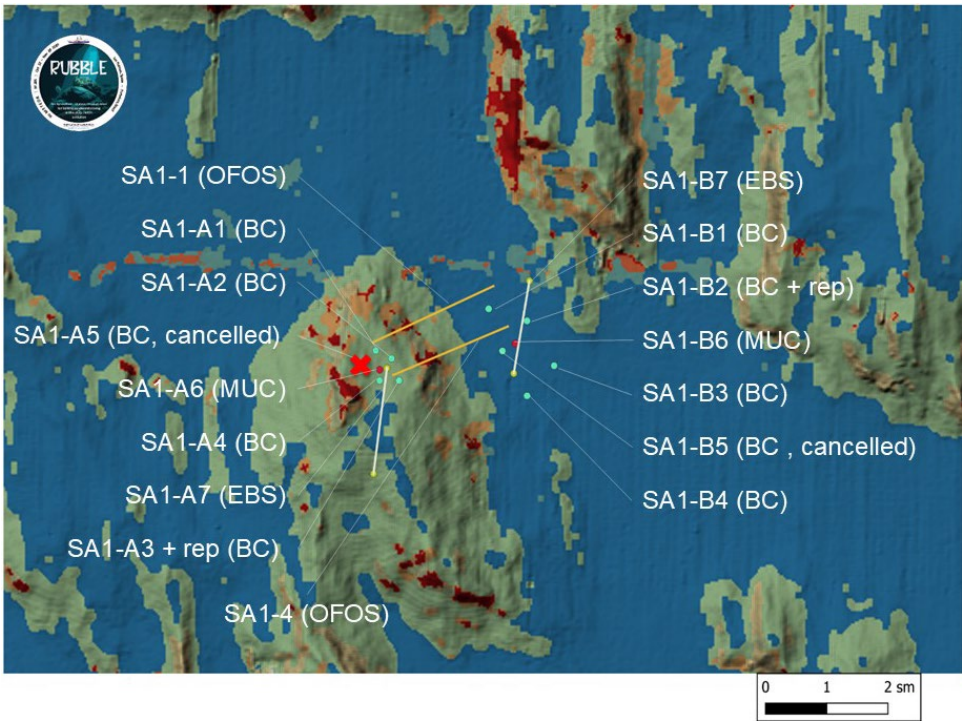

Figure 1. Sampling area SA1 of the 205th voyage of the research vessel METEOR. *The coloured seabed shows the distribution of different habitats (modified after Riehl et al., 2020). Sampling Area SA1 is characterised by a small seamount, part of an oceanic microplate in a network of fracture zones embedded in a abyssal-hill landscape. Due to their surface rugosity and their hardness, represented by yellow-red colours, such seamounts have a high potential for rock habitats. They are more or less surrounded and separated by level sediment plains. BC = box corer; EBS = epibenthic sled; MUC = multicorer; OFOS = Ocean Floor Observation System. Map: Dr Torben Riehl, SENCKENBERG, chief scientist M205.*

Summary Sampling Area SA1

By the time this report was submitted, work on Sampling Area SA1 (**Figure 1**) had been completed and work had begun on the second Sampling Area (10° 22.5886' N, 27° 11.4078' W; 4790-5922 m depth). SA1 included 2 successful OFOS deployments, multiple sampling of pelagic *Sargassum*, several plankton samples collected, 8(+1) successful large box corer (BC) deployments, two successful multicorer (MUC) deployments, 2 successful epibenthic sled (EBS) deployments, 7 successful drone flights (1 of which with experimental dust particle collector), estimated 150 GB of image and video data for scientific and public outreach purposes. Work on SA1 was completed on 1 November 2024 at around 2 pm. During the second BC deployment, a weld seam of the box broke, which is why the sample lost sediment and can no longer be quantitatively analysed. The third BC deployment was not triggered due to difficulties with the guiding cable and was therefore empty. The third BC was repeated and the fifth planned deployment was cancelled in order to stay on schedule.

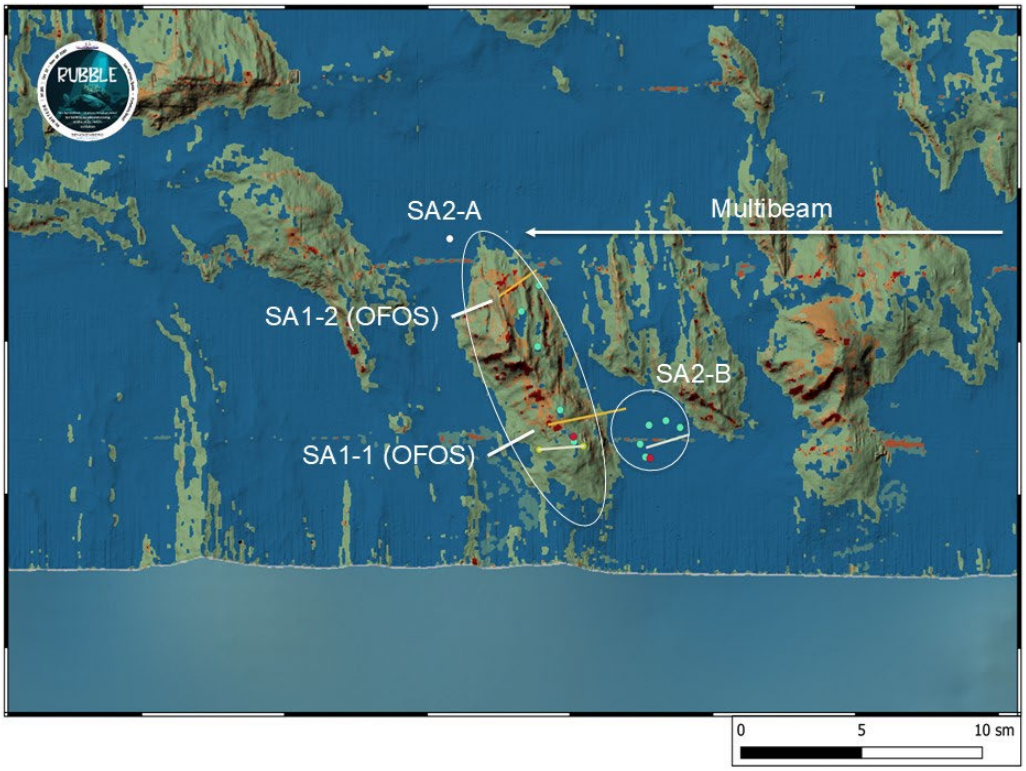

Figure 2. Station planning for Sampling Area SA2 of the 205th voyage of the research vessel METEOR. *The coloured seabed shows the distribution of different habitats (modified after Riehl et al., 2020). Sampling Area SA2 is structured similarly to SA1. OFOS = Ocean Floor Observation System. Map: Dr Torben Riehl, SENCKENBERG, chief scientist M205.*

The Ocean Floor Observation System

The OFOS is to be used first in each sampling area of this expedition. It plays a crucial role in the subsequent sampling of the seabed. The Ocean-Floor Observation System (OFOS) serves three important purposes on RUBBLE: Firstly, the OFOS serves to guide the detection of the predicted habitat type distribution. Secondly, the OFOS deployments serve to map the megafauna (animals > 1 cm) and their Lebensspuren - traces that the megafauna have left behind in the sediment and which represent indirect evidence of the diversity and activity of the megafauna. In addition, the OFOS is used to assess the suitability of the underwater landscapes for sampling the seabed with the three different types of equipment used in RUBBLE.

The first OFOS mission was carried out on 29 October 2024 from 08:17 board time. The mission was successful. At around 11:40 we had our first visual contact with hard substrates, whose presence had been predicted at this exact position (Riehl et al. 2020).

Evidence of sessile anemones, polychaetes (**Figure 5**) and sponges from OFOS video surveys and EBS and BC samples shows the importance of hard substrates for a specialised fauna. Following the expedition, comparisons of the different habitats will show the extent to which hard substrates contribute to benthic biodiversity.

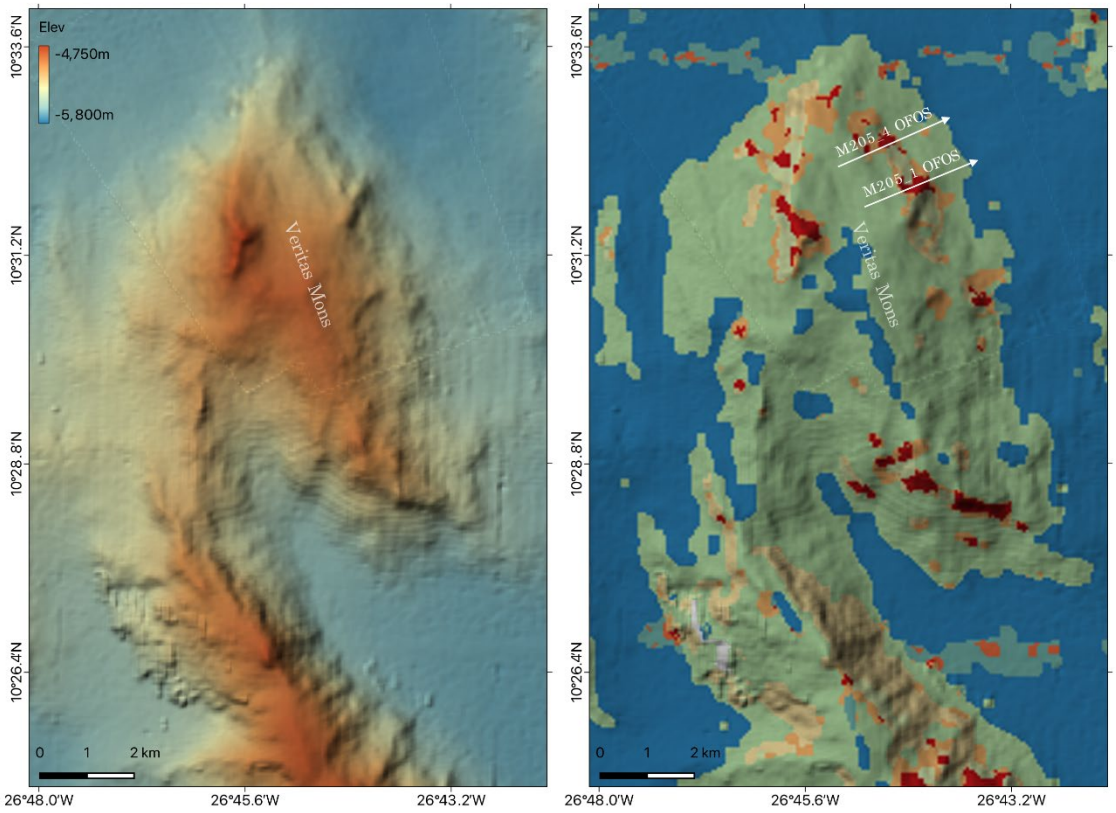

***Figure 3. The Veritas Mons seamount**: Bathymetric relief map (left) and choropleth map of the habitat distribution (hard substrate potential according to Riehl et al. (2020); right). The Seeberg is a basaltic abyssal hill with an extension of 11.6 km in a north-south direction and 7.7 km in an east-west direction. Its axis is orientated approx. 21° (NNW). The highest elevation is in the north-western part of the massif at 10° 31' 25" N, 26° 45' 38" W and with a sea depth of 4760 m approx. 881.5 m above the deepest surrounding seabed at 5641.5 m. Maps: Dr. Nico Augustin, GEOMAR.*

As proving the existence of unsedimented hard substrates is one of the main objectives of this expedition, we can already speak of a scientific success at this early stage. The subsequent OFOS deployment along a parallel track shifted 0.7 nm to the north was also successful, with similar results. In both cases, hardgrounds were predicted and found on slopes with relatively steep gradients, where sediment accumulation is not possible due to the slope position. The prediction model was also validated in area SA2. In the case of station SA2-1, in addition to basaltic rocks on steep slopes, we also encountered manganese crusts on the plateau near the summit of the seamount there.

Ongoing station work

Station work in the second Sampling Area SA2 (**Figure 2**), located approx. 34 nm WSW, began on the evening of 01.11.2024. The time of the transit was used to record bathymetry data in order to correct artefacts in the existing data set from cruise SO237. The sequence of equipment deployments on SA2 should correspond to the sequence of the previous SA1 if everything runs smoothly.

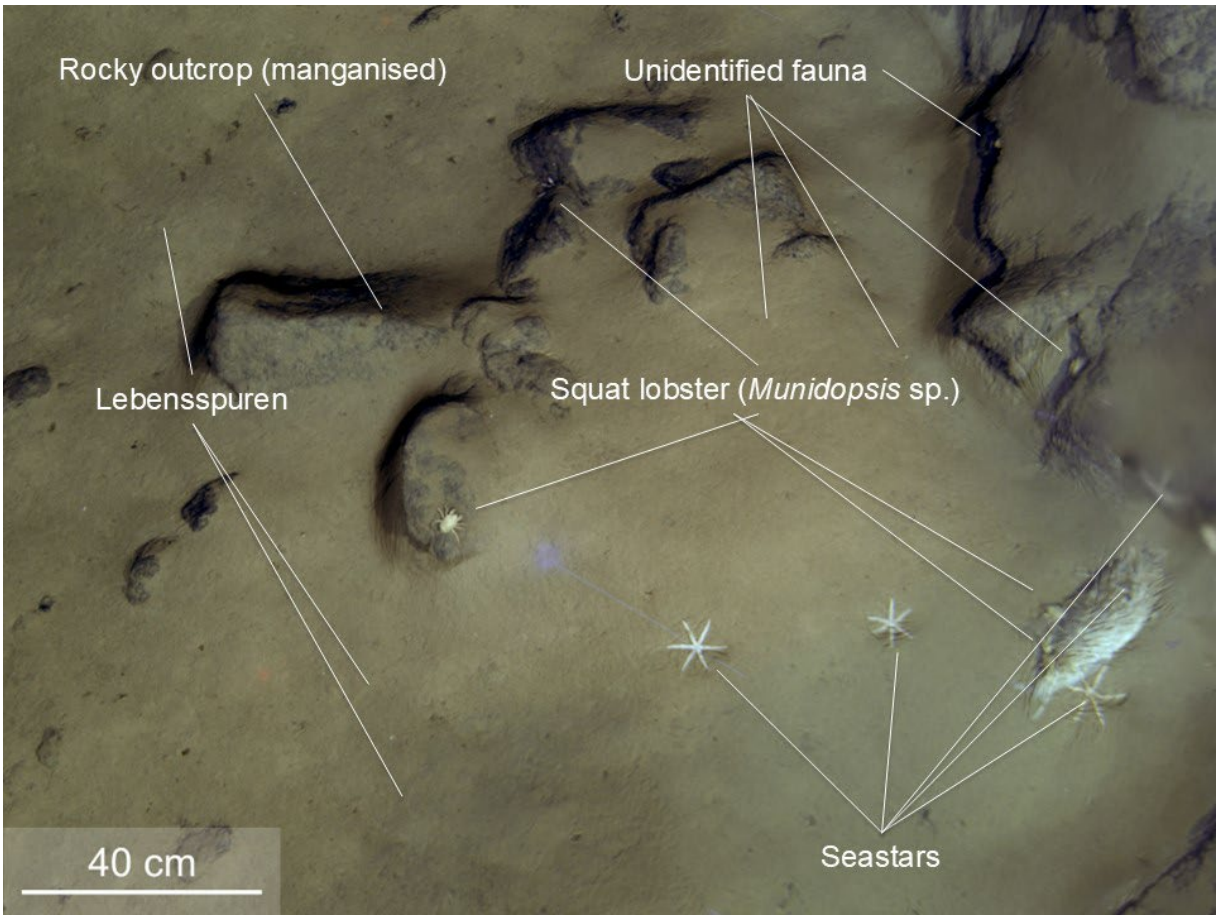

Figure 4. 3D reconstructed image of the seabed on the Veritas Mons seamount from the SA1-1 OFOS mission. *This was the first time that abyssal rock habitats were detected. Abyssal rock, probably manganese-coated basalt, occurred on steeper slopes in steps and flat areas as well as in the form of loose rocks. Growth, for example with anemones and sponges (not seen here), but also colonisation with vagile fauna, such as decapod crustaceans and starfish, could be detected. This picture also shows an "organic case" in the form of a dead fish being consumed by scavengers - starfish and brittle crabs. Figure: Linus Budke, SENCKENBERG.*

Sampling of benthic biology and sedimentology immediately followed the OFOS deployments. To compare heterogeneous and homogeneous habitats, each sampling area was divided into two sampling sites. This was done using the habitat maps based on multibeam and backscatter data (Riehl et al. 2020), the accuracy of which was confirmed by the previous OFOS surveys (**Figure 4**). The first sampling site, consisting of five large BC stations, one MUC station and one EBS station, was accordingly placed in the area of the crest of a seamount, the second identically composed sampling site in the neighbouring shallow and sedimented abyssal plain.

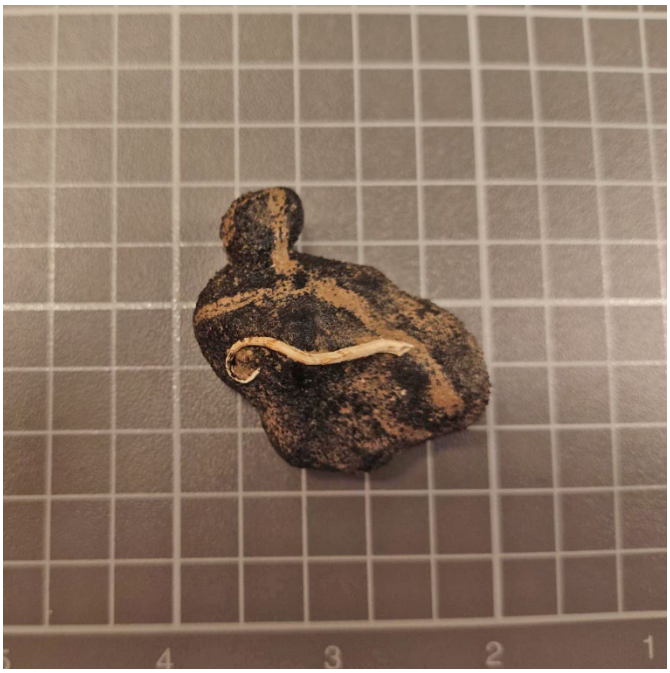

***Figure 5. Manganese crust with polychaete tube**, collected by large box crab at station SA2-2 of the 205th expedition of the research vessel METEOR. Photo: Julia Jacoby.*

By the time this report was submitted, 5 BC deployments (3 of which were successful), 1 successful MUC deployment and 1 EBS deployment in heterogeneous terrain had been completed at the second sampling area in addition to the successful OFOS deployment.

Acknowledgements

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Reference

Riehl T, Wölfl A-C, Augustin N, Brandt A, Devey CW (2020) Discovery of widely available abyssal rock patches prompts rethinking origins of deep-sea biodiversity. Proceedings of the National Academy of Science 117: 15450–15459. https://doi.org/10.1073/pnas.1920706117

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