FS Meteor | Expedition M205 “RUBBLE”

Las Palmas de Gran Canaria – Fortaleza

23.10.2024 – 28.11.2024

1. Weekly Report (23.10.2024 — 27.10.2024)

Figure 1. Expedition participants of the 205th voyage of the research vessel METEOR *(ship's crew not complete). Photo: Dr Torben Riehl, chief scientist M205.*

The general aim of this research cruise is to better understand the relationship between habitat heterogeneity and biodiversity in the deep abyssal zone. Based on a still widespread marine biology textbook opinion that the abyssal zone is largely structurally poor and homogeneous, RUBBLE builds on the findings of the FS Sonne cruise SO237 ("VEMA-Transit"). Using extensive echo sounder mapping, these revealed an unexpectedly high degree of structure in the seabed topography and composition and led to the conclusion that, in addition to sedimentary soft bottoms, rock formations ("reefs") are also widespread in this depth zone (Devey et al. 2018b, 2018a, Riehl et al. 2020).

RUBBLE is particularly interested in how soft substrates (sedimentary bottoms), which cover most of the abyssal seabed, vary in their composition, how this variation is influenced by bathymetric habitat heterogeneity and to what extent biodiversity is affected.

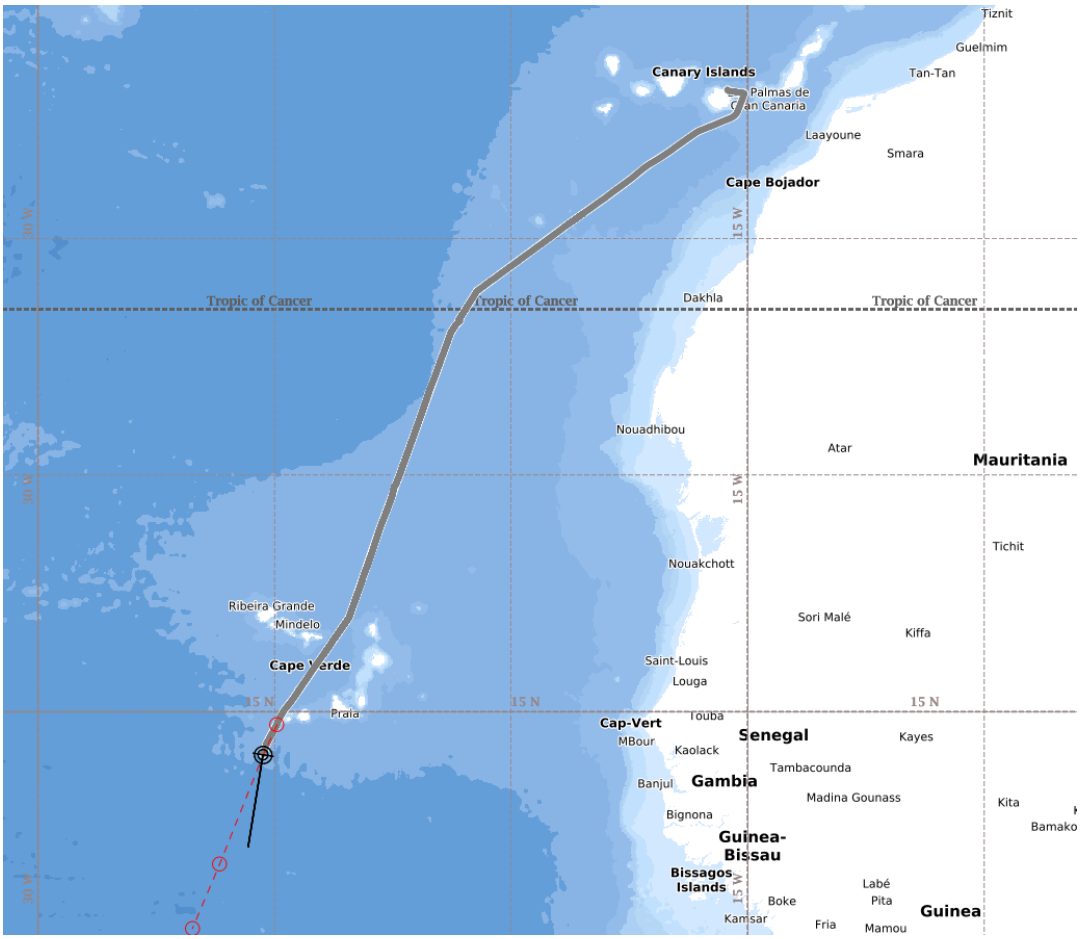

Figure 2. Cruise track of voyage M205 of the research vessel METEOR until 27 October 2024, exported from D-SHIP. The yellow star marks the approximate position of the METEOR towards the end of 27 October 2024.

The first week of our M205 expedition was largely characterised by a period of waiting. The cargo ship that was transporting the containers with our equipment to Gran Canaria, among other things, was stuck in England for several days with an engine failure, meaning that it was unable to reach Las Palmas on time despite the time buffer we had planned. As a result of being dependent on these containers full of sampling devices, electronics, fixatives and other essential equipment, we were unable to set sail in the morning hours of 23 October as originally planned, but used the time as best we could to prepare for the upcoming campaign. In addition to getting to know each other within and between the two groups of crew and scientists, this primarily meant familiarising ourselves with the ship's operation and life on board, coordination between the ship's crew and equipment operations leaders and meticulous planning of the research data collection, taking into account all conceivable eventualities as far as possible. In particular, the delay in the start of the expedition led to an extensive revision of the ambitious station plan for the seabed mapping and sampling in order not to jeopardise the achievement of the set goals.

Figure 3. The long-awaited loading of the containers with the research equipment *for the 205th research cruise of the research vessel METEOR in the harbour of Las Palmas de Gran Canaria. Photo: Dr Torben Riehl, cruise leader M205.*

Departure from Las Palmas finally took place on the evening of 24 October 2024, after the containers were delivered piece by piece from midday on the same day and loaded immediately afterwards. Due to the delay, the speed limit of 10 knots was lifted by the control centre for German research vessels.

On the morning of 25 October 2024, the containers were opened to unload the scientific equipment. By the evening, all the sampling equipment had been lashed on deck, all the laboratory equipment had been distributed and the remaining material had been safely stowed back in the containers together with the empty expedition boxes. The following days of 26 and 27 October were taken up with setting up the laboratories, planning and preparing for the mission.

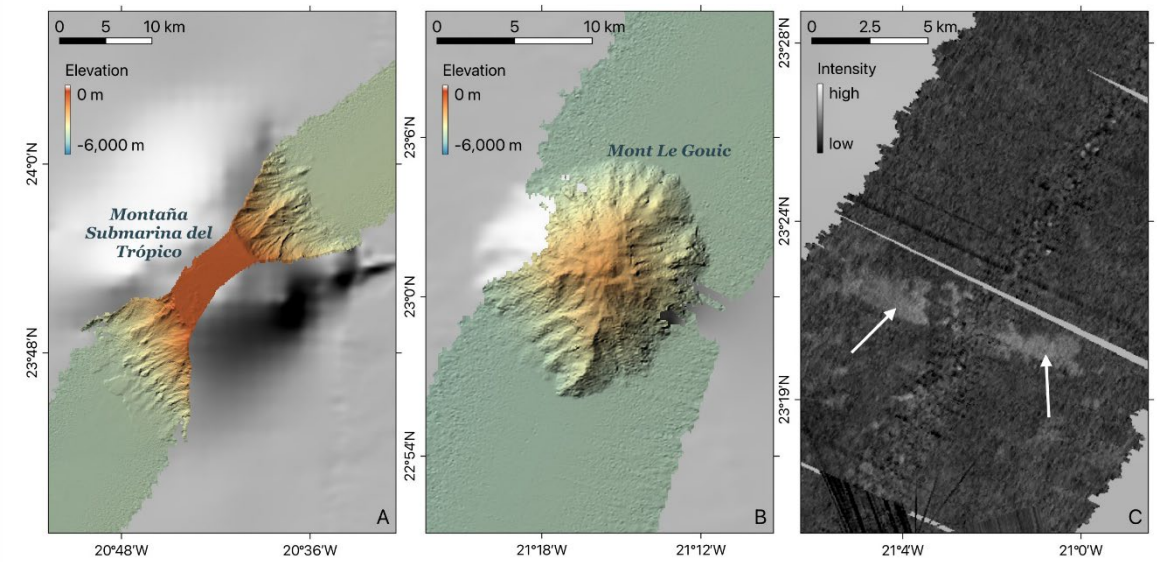

Figure 4. Details of the EM122 deep water echosounder transit bathymetry during the 205th voyage of the research vessel METEOR: *(A, B) Profiles over the large seamount Montaña Submarina del Trópico and the smaller Mont Le Gouic. Both seamounts are marked in the nautical charts, but only the Mont Le Gouic was partially mapped. With our data, Mont Le Gouic is now completely mapped. (B) The multibeam backscatter image shows variations in the seafloor reflectivity. Brighter areas with higher reflectivity (arrows) could indicate areas with Mn-nodules or other harder, rougher substrates at the seafloor, even if the general topography is rather flat and visually unspectacular. The M205 transit bathymetry data will be available for the Seabed 2030 campaign and added to the GEBCO map (General Bathymetric Chart of the Oceans), which is shown as shaded relief in the background. Map: Dr. Nico Augustin, responsible for bathymetric mapping.*

The research work began immediately after leaving the Spanish Exclusive Economic Zone on 25 October 2024 at 21:40 UTC. Since then, the EM122 multibeam echo sounder has been used at full ship speed to map the seabed. This underway bathymetry (Figure 4) will be incorporated into the international efforts of the Seabed 2030 project, which aims to map the entire seabed with a resolution of at least 100 metres by 2030 (Mayer et al. 2018).

At the same time, a start was made on collecting Saharan dust using sticky traps attached to the top platform of the mast (Figure 5). The aim here is to investigate the role of Saharan dust in fertilising the Central Atlantic deep-sea region. It is also planned to equip one of the drones brought along for public relations purposes with similar sticky traps. Test flights to collect Saharan dust will be carried out as soon as station work begins, the ship is in position and weather conditions permit.

At around 02:00 shipboard time on 27 October 2024, the exclusive economic zone of Cape Verde was reached, which is why the data recording described above had to be temporarily interrupted.

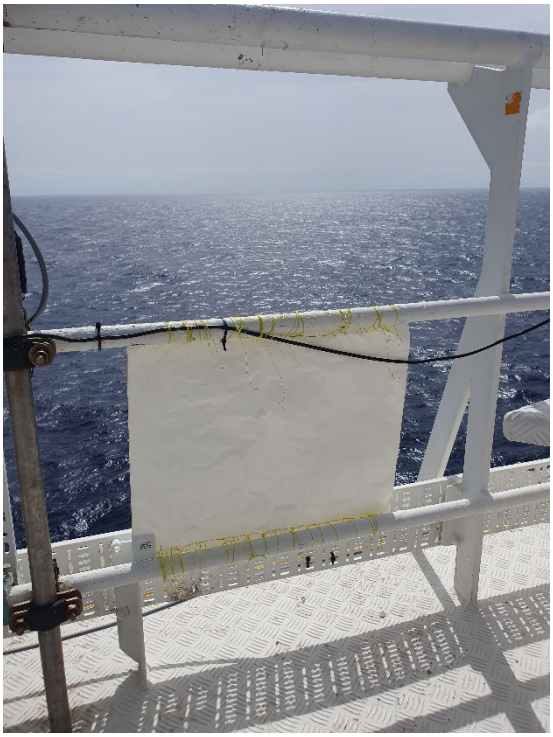

Figure 5. Dust particle collector *on the main mast of the research vessel METEOR installed by Dr. Mandy Zieger-Hofmann and Dr. Andreas Gaertner. Photo: Dr Mandy Zieger-Hofmann.*

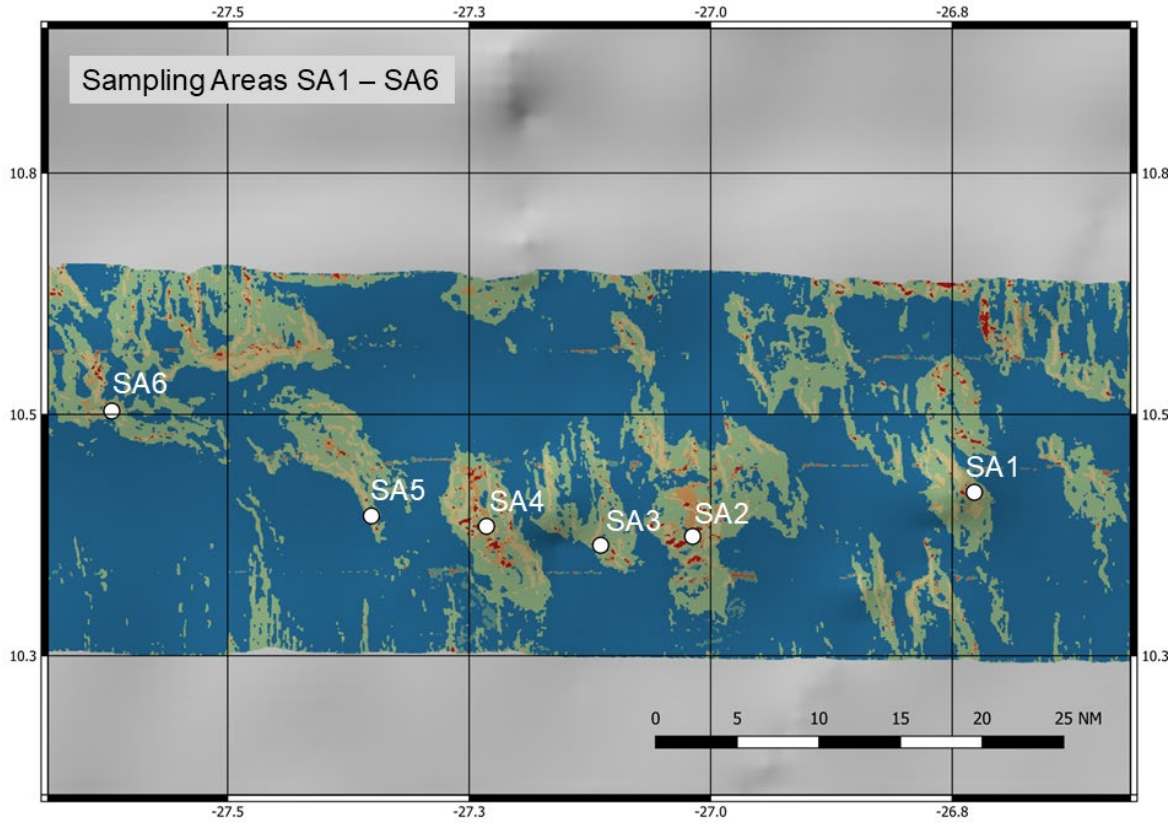

Figure 6. Sampling area of the 205th voyage of the research vessel METEOR. *The coloured seabed shows the distribution of different habitats (modified after Riehl et al., 2020). The sampling areas SA1-SA6 represent individual hummocks that have a high potential for rock habitats due to their surface roughness and hardness. They are more or less surrounded by shallow sediment plains and separated from each other. The background topography shown in grey is based on GEBCO. Map: Dr Torben Riehl, cruise leader M205.*

The targeted sampling area (Figure 6) is located in the eastern Vema Fracture Zone. A fracture zone is an elongate tectonic feature on the seafloor associated with a transform fault. It is caused by the lateral displacement of parts of the oceanic crust along plate margins. These zones often occur along mid-ocean ridges, in this case the Mid-Atlantic Ridge, and consist of a sequence of offset and staggered fractures. They mark boundaries between oceanic plates that move differently. As usual for fracture zones, the Vema Fracture Zone is characterised by mountain ranges and deep valleys and thus by a high potential for habitat heterogeneity. It extends far to the east and west on both sides of the Mid-Atlantic Ridge, with depths of well over 5,000 metres in some places, especially in the valleys.

Quellen

Devey CW, Augustin N, Yeo IA (2018a) Raw multibeam EM122 data and data products: SONNE cruise SO237 (North Atlantic). Available from: https://doi.org/10.1594/PANGAEA.893352.

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Mayer L, Jakobsson M, Allen G, Dorschel B, Falconer R, Ferrini V, Lamarche G, Snaith H, Weatherall P (2018) The Nippon Foundation—GEBCO seabed 2030 project: The quest to see the world's oceans completely mapped by 2030. Geosciences 8: 63.

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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