Expedition M210 "Dive@MAR 2"

5. Weekly Report, 27.05.2025

The weather forecast for the last three working days was very good: winds of no more than 4-5 Bft and wave heights of 2 m or less gave hope for three more dives before the research work was completed. Unfortunately, during the night from Sunday to Monday, it became apparent that the shaft bearing on propulsion motor No. 2 was defective and had to be replaced. The two CTD stations that night could therefore only be operated using the bow thruster, and ROV diving was also impossible without a working propulsion motor. Replacing the bearing in the propulsion motor with a spare bearing took the entire following day. So, another day without diving, which hit us hard after the many weather-related and technical setbacks of the past few weeks. We had actually planned to continue our work with another dive at the Rainbow Pits, then head to the Lucky Strike area to dive at the Capelinhos vent and finally at Menez Gwen. So, we had to make a decision, and we chose Capelinhos and Menez Gwen over the Rainbow Pits.

However, we used the day without diving to calibrate the Posidonia underwater navigation system in order to correct deviations between the displayed and actual position on the seabed. We had already started this the previous week and carried out a few outstanding tests before setting off for Capelinhos. Arriving there early on Tuesday morning, we encountered the US research vessel RV NEIL ARMSTRONG, which was conducting research with the ROV JASON II in the Lucky Strike hydrothermal field, about half a nautical mile away. Both diving projects were limited to locally confined hydrothermal structures in the Capelinhos and Lucky Strike vent fields, so we confirmed via radio that simultaneous diving at both sites would be safe for both parties.

Figure 1: The US research vessel RV NEIL ARMSTRONG, which was working simultaneously with the ROV JASON II at the Lucky Strike hydrothermal field, approximately 0.5 nautical miles away from us.

Capelinhos is a solitary hydrothermal vent located east of Lucky Strike at a depth of 2000 m, with a 10 m high sulphide complex at its summit with concentrated hot fluid emissions. Due to its proximity to Lucky Strike, Capelinhos is an important component of our research program on the diversity of hydrothermal fluids and the microorganisms they contain, the genetic connectivity between the hydrothermal vents of the Azores, and the population genetics of symbiotic microorganisms. Our sampling of symbiotic mussels, hot and diffuse fluids, and solid samples from the smoker structure has provided us with valuable material for our subsequent investigations in our home laboratories.

On Tuesday night, we continued on to Menez Gwen, where we began our last dive in the morning. Our primary focus here was to collect symbiotic *Bathymodilus azoricus* mussels, which we wanted to send alive to GEOMAR in Kiel to keep them in the aquarium for further research. We had deliberately scheduled this part of the program for the end of our research trip because the Menez Gwen hydrothermal field is only a 15-hour transit from Horta on the Azores island of Fayal, providing a good opportunity to deliver the

mussels for air freight to Germany shortly after collection during a stopover on the return travel.

Figure 2: Scientists from the M210 in the FS METEOR's universal laboratory watching the live video stream of a dive. From here, they communicate with the ROV control station, which can only accommodate the two pilots and two scientists. Interactive participation from the universal laboratory allows the entire group of scientists to plan a dive together.

First, however, a final extensive collection program of hot and diffuse fluids, hydrothermal sediments, and chimney pieces took place during the dive. We ended the dive with photo/video mapping of deep-water corals located a few dozen meters away from the Menez Gwen vents in an area known as the Coral Garden, which we had already dived during the M190 expedition.

At around 10 p.m. on Wednesday evening, we finished our work at Menez Gwen by deploying an Argo float. The Bundesamt für Seeschifffahrt und Hydrographie (BSH) had asked us to do this in support of the international Argo program. Argo floats are drifting devices consisting of a battery-powered, autonomous CTD that collect oceanographic data over several years. They sink in regular cycles from the sea surface to a depth of

2000 m, recording vertical profiles of the water column. After surfacing, the data is sent via satellite communication to national and international data centers and made freely available worldwide. There are currently around 4,000 Argo floats in the world's oceans.

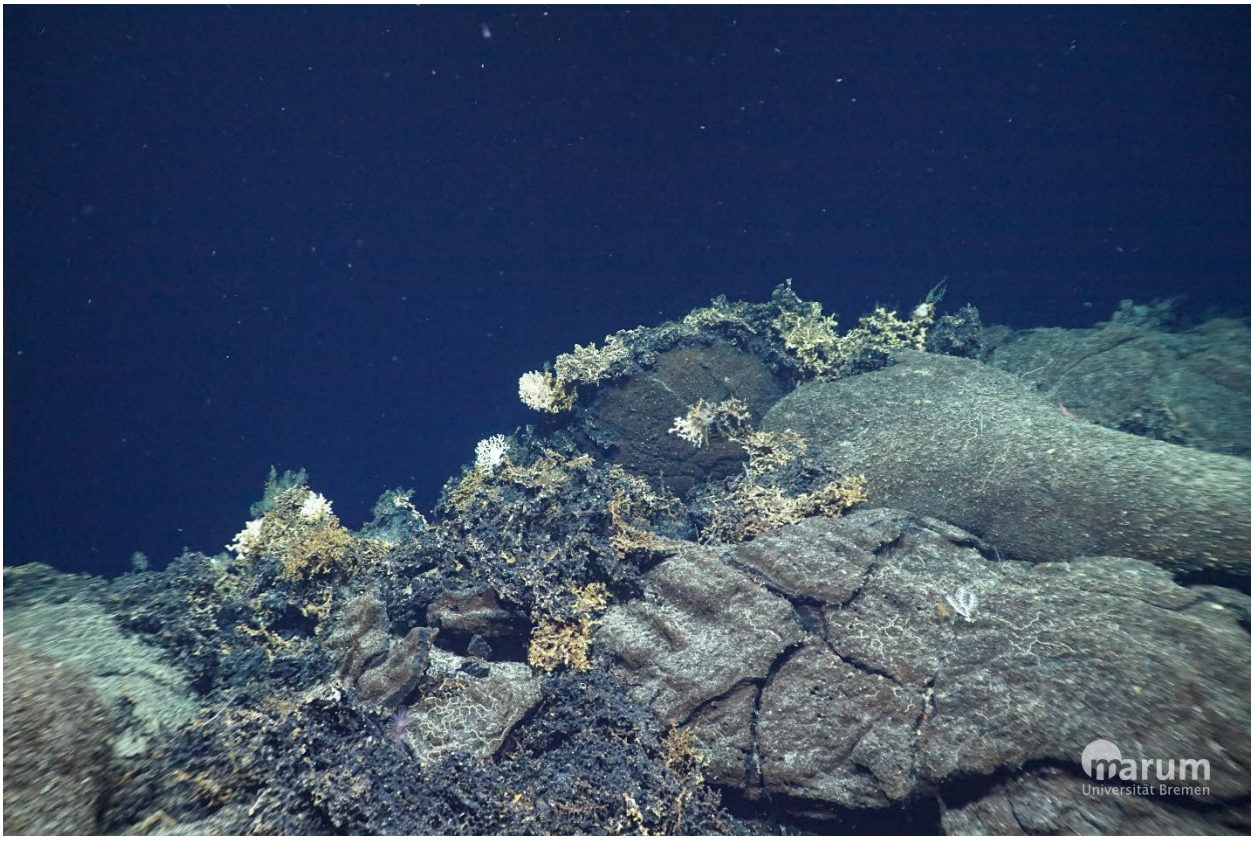

Figure 3: Deep-water corals in the Coral Garden on the Menez Gwen seamount at a depth of 830 m.

After deploying the float, we finally headed for Horta, where we arrived on Thursday at around 1:00 p.m. and were met by the pilot boat, which brought the shells ashore for air freight. We then finally set off on our return transit and have been sailing at cruising speed towards Las Palmas on Gran Canaria ever since, slowing down only twice briefly to about 2 knots to deploy two more Argo floats. Tomorrow, Monday, we are expected to arrive in Las Palmas at around 3:00 p.m.

We have had an eventful and challenging few weeks. We had the privilege of witnessing the maiden voyage of the new ROV MARUM QUEST 5000, which has a higher payload capacity and more powerful data transmission and hydraulic systems than its predecessor, QUEST 4000. These have proven to be a real asset for German marine

research during the voyage. However, a particular challenge for the M210 was that QUEST 5000 was being used on a ship for the first time without having undergone a test run. This was noticeable at the beginning of the voyage in the form of research downtime. In addition, we repeatedly had to contend with unusually strong winds and waves for the time of year, which resulted in several days of diving and even work downtime. All in all, however, we had a relatively successful voyage with 61 stations, including 7 ROV dives, considering the circumstances.

We would like to thank Captain Rainer Hammacher and his crew for their fantastic support in all situations. The mood on board was always very good, and we are very impressed by the extremely friendly atmosphere on board and the helpfulness of all crew members. We would like to thank everyone very much for this.

Greetings from aboard on behalf of all participants

Christian Borowski