Research vessel
MARIA S. MERIAN

MSM131: 18.08. – 28.09.2024
Reykjavik - Emden

2nd weekly report: 19.08.-25.08.24

After R/V MARIA S. MERIAN left the coast of Iceland and the wind increased significantly on the way north (Fig. 1), some of us scientists on board noticed that we had not yet fully acclimated to the sea. Fortunately, this leveled off after 1 to 2 days and nights and the pale faces returned to their original color. On Tuesday, 20 August, we reached the Norwegian EEZ at 12:16 p.m. and were able to start recording the hydroacoustic devices. With instructions and dry tests on the multibeam echo sounders and the PARASOUND sediment echo sounder, our hydroacoustic watch keeper were well prepared and were very excited about the first recordings. Further preparations for the expedition's scientific work program took place during the daily science meetings in the afternoon on the transit route to the work area.

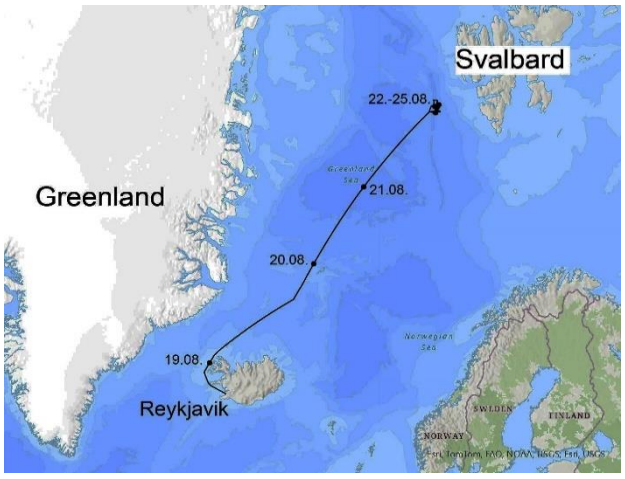

Figure 1: Map of the European Nordic Seas between Iceland, Greenland, Svalbard and Norway showing the route of the MARIA S. MERIAN MSM131 since Sunday, 18 August, from the port of Reykjavik.

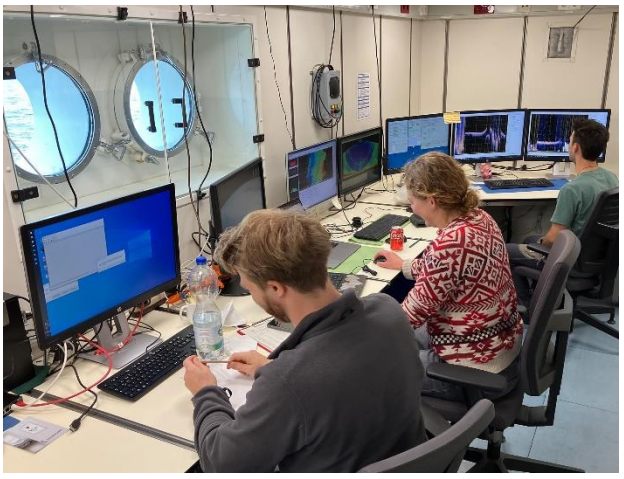

Figure 2: View into the hydroacoustic laboratory of the MARIA S. MERIAN, where the ship's various sonar systems are used 24 hours a day. (© Gerhard Bohrmann).

Our working area is the Knipovich Ridge at 77° 27’ North, where we discovered the first hydrothermal field of the 500 km long Knipovich Ridge two years ago with this ship. The Knipovich Ridge is part of the global mid-ocean ridge and separates the European from the North American tectonic plate with very slow spreading rates of around 1.4 cm per year by forming new oceanic crust. The central graben runs along the ridge axis, which in our area lowers the two graben shoulders, which are separated by around 20 km from each other, from a water depth of 2000 m to around 3000 m. In the middle of the graben there is a narrow ridge made of volcanic pillow lava basalts. The hydrothermal field we found, which we named Jøtul Field after a giant in Norse mythology, is not tied to this volcanic ridge as originally expected, but is located 5 km east of the ridge at the foot of the eastern rift shoulder at a water depth of 3000 m. The Jøtul hydrothermal field is characterized by numerous fluid vents of varying temperatures, metallic precipitates and chemosynthetic organisms adapted to the hot springs and mound structures. Temperatures of over 300° C were measured at one of the black smokers. Building on our new discovery 2 years ago, at least 3 international expeditions have now visited the Jøtul field and carried out further sampling. Important questions, such as the geological distribution of the different fluid outflows and their relationship to the nearby mantle rocks, sediments and volcanic crustal rocks, are unclear, as are the initial concentrations of the various gas phases in the fluids that we have detected in the ambient water of the Jøtul field. We want to pursue these questions with additional investigations during MSM131.

Figure 3: The AWI's first ocean bottom seismometer comes on deck, which was deployed in July 2023 during R/V POLARSTERN cruise PS137 in the area of the Jøtul hydrothermal field (© Gerhard Bohrmann).

Figure 4: MARUM ROV QUEST is lifted up ready to enter the water and begin the first dive to the Jøtul hydrothermal field (© Gerhard Bohrmann).

After reaching the working area on Thursday evening, 22 August, we started with an acoustic survey of the water column on the eastern shoulder of the Knipovich Ridge (Fig. 2). On Friday morning we started with the first CTD station, whose changes in temperature and Eh data showed very clear hydrothermal signals near the bottom and at a higher level. The rest of the day and the first half of the night were used to record 7 ocean bottom seismometers (OBS; Fig. 3). In total, Vera Schlindwein and her working group at the AWI, Bremerhaven, placed 15 OBS on the sea floor in the area of the Jøtul field and its surroundings. Last year, 7 OBS were deployed during the R/V POLARSTERN cruise PS137 and 8 further short-term OBS were deployed by a Norwegian research vessel about 2 months before our cruise. They register micro-seismic earthquakes, the analysis of which allows us to identify structures in the subsurface and may give us clues about the structure of the Jøtul fluid system within the earth's crust.

On Saturday morning, 24 August, the time had come for MARUM ROV QUEST to make its first dive. In the last few days, numerous repairs had to be carried out on the deep-sea robotic system, as the vehicle had suffered a number of injuries during transport in the container from Bremen to Reykjavik. We had initially noticed this on the transport container, which had suffered relatively major transport damage. However, as the vehicle was being upgraded on deck of the MERIAN, injuries were gradually noticed, which we attempted to repair using on-board equipment. Unfortunately, the 481st dive of the ROV QUEST 4000 (Fig. 4) was also delayed due to further technical problems, and it was not until around 5:00 p.m. local time that the seabed at a depth of 3000 m could be reached. Thanks to our previous knowledge and very good maps, we were able to find a black smoker immediately and a beacon was placed on the sea floor for quick retrieval. A short survey of the sea floor about 120 m to the west showed that there was plenty of hydrothermal activity due to the numerous bacterial mats distributed in patches. Unfortunately, a rapid loss in one of the four oil circuits forced us to abort the dive and ascend after a relatively short time. During the night of Sunday, 25 August, the OBS group was able to collect another 6 OBS from the sea floor. The CTD is currently in the water and after further successful repairs to the ROV, we can continue the program with the next dive tomorrow, if the weather permits.

Greetings on behalf of all participants,

Gerhard Bohrmann

RV MARIA S. MERIAN, Sunday 25 August, 2024