Research vessel
MARIA S. MERIAN

MSM131: 18.08. – 28.09.2024
Reykjavik - Emden

Third weekly report: 26.08.-01.09.24

The third week unfortunately began with slightly worse weather than before, so that we could not dive in the Jøtul hydrothermal field, which is located at 77°26' north latitude, on Monday 26 August. A look at the various weather forecasts told us that wind and sea conditions further north would allow more favorable conditions for station work, and so we steamed to our northern study area at almost 80° north. This was mainly possible because our three colleagues from the Alfred Wegener Institute had already recovered their 15 ocean bottom seismometers during three night shifts, so that this work, which was tied to the region, could be successfully completed during the first leg of the cruise. After the valuable seismic data had been saved from the individual devices, the OBSs were stacked on pallets in the large laboratory (Fig. 1) and then stowed in an AWI container together with the ship's crew.

After all, a short dive in the Jøtul field had previously visited the black smoker, which gave us the first indication on the expedition in 2022 that a larger, active hydrothermal field could be found here. At that time, the smoker showed only a short stump and the 316°C hot fluid shot out as a black liquid like from a wide stovepipe that was slightly inclined upwards but not vertically. Since then, the structure, consisting of metallic minerals, has grown significantly in height, with the original exit channel breaking down into several individual exits and the overall structure becoming significantly wider towards the top (Fig. 2).

Figure 1: In the large laboratory of the MARIA S. MERIAN, the so-called hangar, the recovered ocean floor seismometers were stacked before they were stowed away in one of the two containers of the Alfred Wegener Institute in Bremerhaven (© Gerhard Bohrmann)

Figure 2: The black smoker, which had only one exit channel when it was discovered two years ago, has not only grown considerably but has also thickened upwards like a bouquet of flowers by forming several exit channels (© MARUM).

Last Monday we steamed north to the so-called Molloy Ridge, which is a relatively short spreading segment connected by fracture zones both to the north with the Lena Trough and to the south with the Knipovich Ridge. At the northern end of the ridge and north of the Spitsbergen Fracture Zone, two gas flares in the water column are described in the literature, which are confirmed by our hydroacoustic measurements. During our measurements with the ship's hydroacoustic systems, we were able to identify the two flares and carried out a CTD station at both exit points with sampling of the water column and examined for methane concentrations. We were able to detect higher methane concentrations in the area of the gas flare of the northern Molloy Ridge. This finding and information from colleagues in Tromsø prompted us to conduct a

dive to the seabed there on Wednesday 28 August. Similar to what we know from other regions of the world's oceans, at this depth of 3500 m on the sea floor, massive gas hydrates are formed from the methane bubbles bubbling out of the sea floor, which form hill-like structures due to their increased buoyancy. When methane bubbles escape in contact with water, white methane hydrate forms, which looks like ice, but in contrast to frozen water, has a completely different structure that is only stable at higher pressures and cold temperatures. Due to the strong undersaturation of the sea water with methane, the gas hydrates on the bottom are dissolved over time or mechanically decouple from the sea floor and rise independently due to their higher buoyancy. Both lead to strange cavity structures on the sea floor that change significantly over longer periods of time. We were able to investigate this excellently and persistently during the 482nd dive of ROV QUEST, so that this dive war a major highlight of the expedition so far.

Figure 3: Seafloor raised by gas hydrate formation (white and yellowish substance) in the area of a methane gas emission at the northern Molloy Ridge (© MARUM).

Figure 4: Group photo of the first leg from Reykjavik to Longyearbyen in front of the MARUM ROV QUEST 4000 on the aft deck of RV MARIA S. MERIAN (© Gerhard Bohrmann).

We combined a survey with the ship's own multibeam and sediment echo sounder on the following Thursday 29 August, with the transit to Longyearbyen, where we were able to dock at the coal port pier on Friday at 9:00 a.m. sharp for about 8 hours. This short port stay was planned for a partial change of scientists. Nine scientists disembarked, such as our OBS scientists from the Alfred Wegener Institute, and nine new scientists who landed around midday by plane from Oslo or Tromsø were re-embarked. Some of the ship's crew and scientists used the few hours to look around the polar city of Longyearbyen and do a few purchases.

For everyone, the views of the mountains and glaciers around the Isfjord were a welcome change from the rest of the sea, and many of us enjoyed the evening transit of the ship out of the fjord. In 12 hours we were back in the Jøtul hydrothermal field, where we were unable to dive on Saturday due to the weather, but used the day to take sediment samples in the area around the hydrothermal vents. This Sunday we were able to complete an extended dive with great samples and data from two hydrothermally active hills, thus ending the week. We will write about the exciting results in the next weekly report.

Greetings on behalf of all participants,

Gerhard Bohrmann RV MARIA S. MERIAN, Sunday 1 September, 2024

Attention: in the coming days we will broadcast some of the dives live via telepresence

https://www.youtube.com/watch?v=BeFz4y_f6pA