Research vessel
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MSM131: 18.08. – 28.09.2024
Reykjavik - Emden

Fifth weekly report: 9 - 15 Sept. 2024

The 5th week of our research cruise was generally characterized by worse weather conditions than before, so that we were only able to dive to the sea floor on two days. Although the daily forecasts did not predict bad weather, the actual wind speeds were at least one Beaufort force higher, but often even two Beaufort force higher. We used these times to complete our sea floor surveys with the multibeam echo sounder and the sediment echo sounder. We were able to survey a longer distance on Monday, 9 September, on the way to the Molloy Ridge, where we carried out station work with a gravity corer the following day and then steamed back to the area of the Jøtul hydrothermal field. On Wednesday and Thursday of this week, the station work was mainly carried out to investigate the hydrothermal plume above the Jøtul field. During the day, this was mainly operations with the mini-corer (Fig. 1) to obtain further surface samples to map the hydrothermal input of metallic components to the sea floor. At night, these were mainly CTD stations and profiles to document and sample the hydrothermal plume in the water column. In addition to the temperature, the redox potential (Fig. 2) was also measured using online sensors and corresponding water samples were taken to measure the methane and hydrogen contents as well as the helium isotopes later in the home lab.

Figure 1: The Mini-Corer is our lightest device with which, when used successfully, we obtain four very good core segments of the exact surface of the seabed as well as the bottom water above it (© Gerhard Bohrmann).

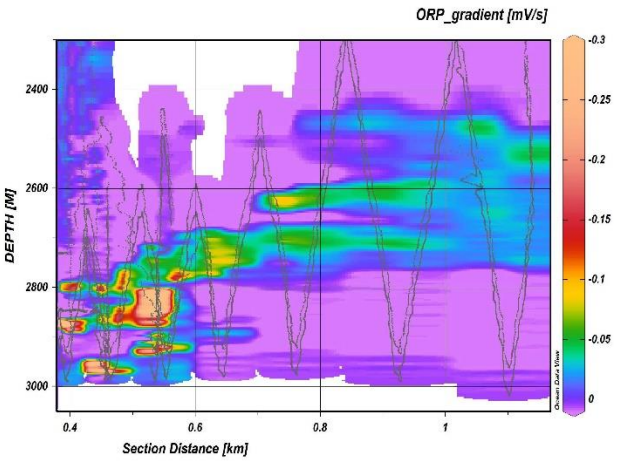

Figure 2: The ORP gradient compilation of the Tow-Yo CTD shows clear anomalies in the water column above the seafloor smokers on the left side of the diagram, while towards the north the hydrothermal plume rises higher on the right side (© Miriam Römer).

On Friday, 13 September, the weather had calmed down and ROV QUEST4000 was finally able to dive again. The dive plan was accordingly ambitious, as we still have some open questions that we would like to have clarified at a water depth of 3000 m in the Jøtul field. The 386th dive of QUEST4000 began at the Nidhogg hydrothermal mound. We planned to take a fluid sample from the active area there, as the temperature during the previous sampling fluctuated greatly, so we had to expect varying degrees of dilution by seawater. The new sampling with KIPS and IGT sampler was carried out precisely at a constant temperature of 214°C (Fig. 3). This meant that the fluid was 60°C hotter than the previous measurement at Nidhogg, which should also have an effect on the chemical composition. ROV QUEST then moved 300 m north along the 3020 m isobath to the Black Smoker. This is the fourth time on this expedition that we have visited the smoker and each time we notice small or large changes in its appearance. It is the first black smoker discovered in the Jøtul field in 2022 and we therefore name it by the Norwegian name Fenris, which stands for the famous

strong wolf in Norse mythology. Sampling with IGT and KIPS samplers was easily carried out in the vent opening of Fenris at maximum temperatures of 314°C. We then moved with ROV QUEST4000 about 100 m west towards a west/east facing narrow ridge of hydrothermal rocks and reached a second active black smoker, which we named Gyme, another figure from Norse mythology. We had already visited Gyme during the previous dive and since two new chimneys have grown by several decimetres since then, we were not sure whether we had found the right smoker or whether it was an undiscovered black smoker. Since we were at the end of the dive, we could not search the area any further to clarify this question. However, it was quickly decided after the dive that it was Gyme when we compared the high-resolution images.
On Friday we had a larger audience because, like on the previous Sunday to the German Maritime Museum in Bremerhaven and on Wednesday to the Universum in Bremen (Fig. 4), on Friday we had a live broadcast to school class 12a in the district school in Wilhelmsburg. During the video conference, the pupils asked numerous questions about our research in the Jøtul hydrothermal field and generally about life and research on research vessels and we gave explanations.

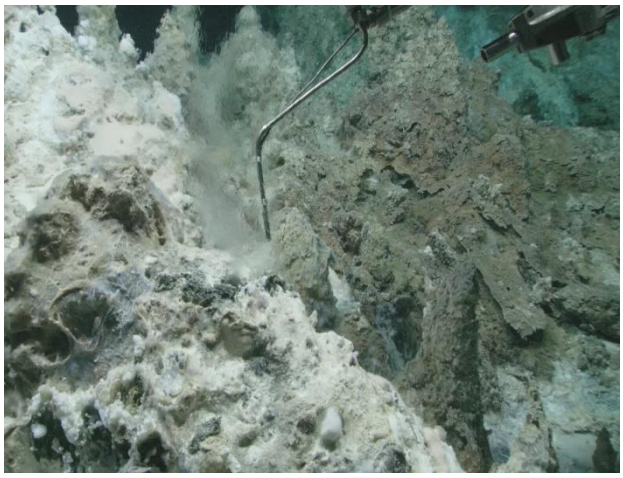

Figure 3: Sampling with a gas-tight IGT sampler at a fluid vent (shimmering spot) at the Nidhogg hydrothermal mound. The surrounding hydrothermal rocks are intensively covered with white microbial mats (© MARUM).

Figure 4: Visitors to the Bremen Universum in the research studio watch the live stream in fascination. The images from the deep-sea robot MARUM QUEST are shown on a large screen and the expedition leader answers questions from the audience (© Ulrike Prange).

To round off the week, we made our 487th dive today in relatively calm weather, which took us back to the two smokers Gyme and Fenris, where we recorded extensive video mosaics of the structures and their surroundings. We will use these to create high-resolution, three-dimensional models in our home laboratory after the trip, which will help us better understand the detailed structure of the smoker systems. And again we were surprised that one of the Gyme's chimneys grew by about two decimetres in two days, and another fell over at the slightest touch of the ROV due to its top-heavy nature. Chimneys can grow quickly and collapse again under their own weight. This shows that such smokers are very dynamic, which ultimately led to the formation of the hydrothermal hills in the Jøtul field.

All participants are healthy!
Greetings on behalf of all,

Gerhard Bohrmann RV MARIA S. MERIAN, Sunday 15 September, 2024

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