

Research vessel MARIA S. MERIAN

MSM109: 06.07. – 03.08.2022

Tromsø – Reykjavik

4th and last weekly report

25.07. – 03.08.2022



After the 3rd week of our expedition was quite successful, the 4th week was associated with even more scientific highlights. We were able to dive during all days, further examining the region of seafloor hydrothermal activity that we had mapped from the methane and Eh anomalies in the CTD profiles of the water column. On Monday we discovered a black smoker whose fluid at a temperature of over 300°C shot out of an almost 20 cm opening (Fig. 1). Since the opening was not directed upwards but to the side and the chimney area sat relatively short on a mound of older hydrothermal deposits, it was a great challenge for the ROV pilots to carry out the necessary sampling on the smoker. In addition to the fluid samples at three different points of the outflow, a piece of the sulphide precipitates could also be obtained from the edge of the smoker. The methane levels, which are in the range of mmol/L, surprised us, but explain why we measured quite high levels of methane in the water of our CTD-casts and profiles. During Tuesday's dive we revisited the smoker for temperature and further fluid sampling and mapped the northward distribution of bottom hydrothermal features. During the night our AUV Seal 5000 surveyed the area with a higher resolution than before by conducting a dive just 60 m above the sea floor. This map gives us more details that we were able to use during the ROV dive the following day. Wednesday's ROV dive explored the southward extension of the hydrothermal field and amazed us with more findings of active fluid vents.



Figure 1: The temperature measurement in the outflow opening of the black smoker showed that the fluids are more than 300°C hot. In addition to this active smoker, we found and sampled numerous inactive and extinct smokers (MARUM ROV dive 463).

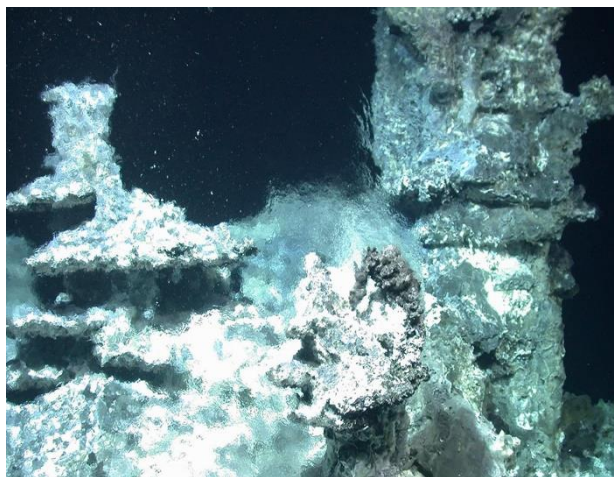


Figure 2: The most beautiful hydrothermal vent on our expedition consisted of several chimneys and flanges and the outflowing fluid shimmered everywhere. We named the complex structure Yggdrasil hydrothermal vent (MARUM ROV dive 465).

A complex hydrothermal edifice with numerous chimneys and flanges was found (Fig. 2). The hot fluid escaped everywhere, so that the entire structure was completely surrounded by shimmering water and photo documentation was extremely difficult. Here, too, the outlet temperature was over 250°C and the methane content was several mmol/L. We were so fascinated by this hydrothermal vent that we gave it the name Yggdrasil, the term for the tree of life in Norse mythology. With these results of the expedition we can define a new hydrothermal field, namely the first of the 500-km-long Knipovich Ridge. The field has an extension of about 1 km in north/south direction and with a width of 150-250 m it follows the eastern

marginal fault at a water depth of 3,000 m. We call it the Jøtul hydrothermal field, a name for a being that in Norse mythology corresponds to a giant that dwells in a mountain or range. The last two ROV dives, on Thursday and Friday, we dived 50 km to the south in what is probably the youngest volcanic area in 3,200 m water depth. There, too, we had already found hydrothermal relics on an earlier dive, but they were very difficult to find in a 10 m deep and very narrow canyon of mainly piled up pillow lavas. In fact, more hydrothermal relicts were found on Thursday with possible sulphide deposits. Friday's short ROV dive captured an abundance of existing lava structures and morphologies. We were also able to welcome viewers from Germany to this dive at short notice via telepresence, who followed the internet link of the MARUM YouTube channel.



Figure 3: After 28 days on an expedition in the Norwegian Greenland Sea with great scientific success, the scientific participants of the MSM109 are looking forward to returning home.

On Friday, 29 July at 5:00 p.m., we had to stop station work and set off for Reykjavik. On the transit route to the port, the ship only travels 10 knots through the water for reasons of energy saving and cost. We use the southbound path in the East Greenland Current, which brings us further advantages in these austerity measures, and will thus arrive in the port of Reykjavik punctually on Wednesday, 3 August, where the cruise officially ends and the scientists and some crew members start their journey home.

With 13 ROV and 8 AUV dives, 15 CTD stations, 6 of which are yoyo profiles, we have been very successful in sampling and measuring, discovering and investigating the Jøtul hydrothermal field and mapping the seafloor over 2,829 nautical miles. We scientists are very happy about the goals achieved (Fig. 3) and return on land with great results. We also owe the success of the scientific work to the excellent and friendly support from the ship's crew in all areas (nautical, WTD, deck crew, engine and service area, etc.) of the shipping company and the employees of the control center in Hamburg and at MARUM as well as the colleagues from the Norwegian Petroleum Directorate. We would especially like to thank Captain Björn Maass and his entire team, who supported us in all matters.

All participants on the ship are healthy.

Greetings on behalf of all on board

Gerhard Bohrmann,

FS MARIA S. MERIAN, 31 Sunday July 2022