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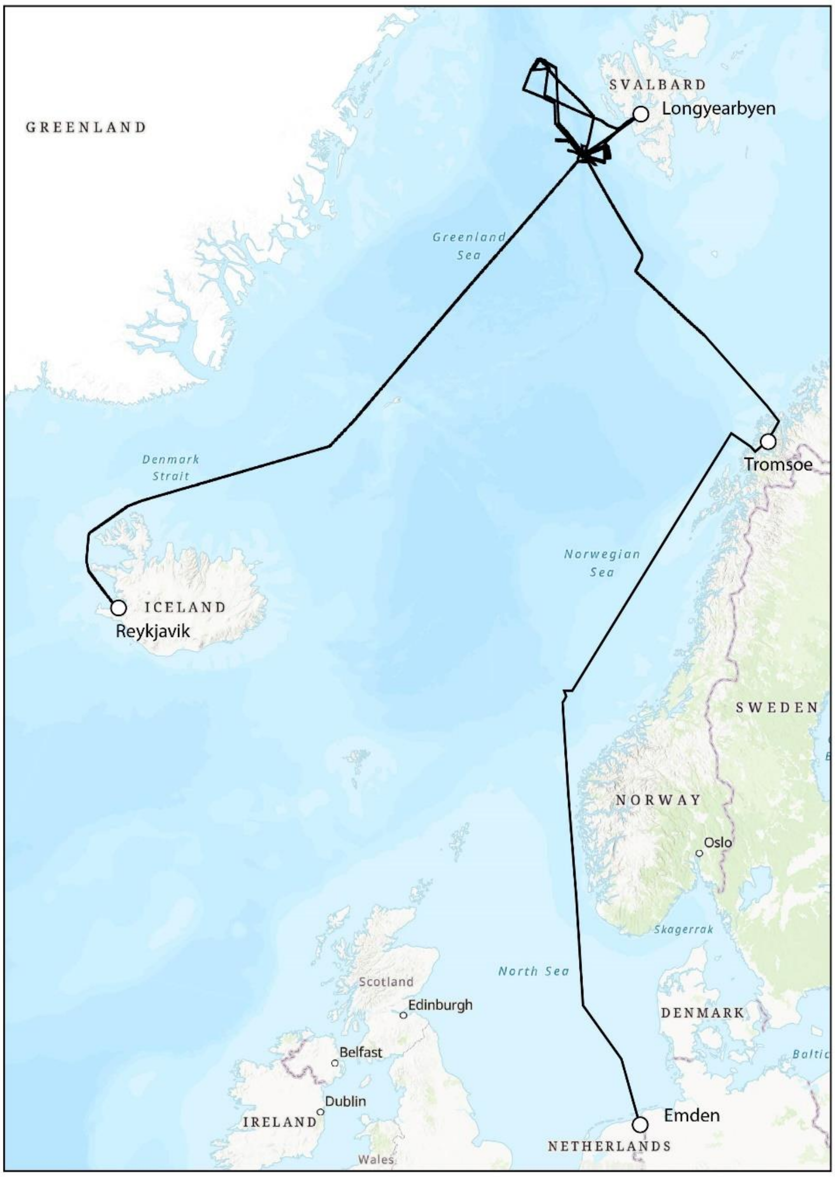
Short Cruise Report
R/V MARIA S. MERIAN Cruise MSM131
Reykjavik – Longyearbyen - Emden
18 August – 28 September 2024
Chief Scientist: Gerhard Bohrmann
Captain: Björn Maass



Objectives

As part of the research unit "The Ocean Floor as Reactor" of the Bremen Cluster of Excellence "The Ocean Floor – Earth's Uncharted Interface" we used RV MARIA S. MERIAN cruise MSM131 to investigate fluid circulation at hydrothermal fields at the Knipovich Ridge and Molloy Ridge in the Norwegian Greenland Sea west of Svalbard. In contrast to other spreading ridges in the European Northern Sea and the Arctic, these more than 500 km long segments of ultraslow oceanic spreading have hardly been investigated and active hydrothermal fields on the seabed are not very well known. We have been mainly concentrated to the Jøtul hydrothermal field which was discovered during R/V MARIA S. MERIAN cruise MSM109 two years ago. A detailed micro-bathymetric map was used to investigate several structures, mainly hydrothermal mounds, for their fluid activity using ROV QUEST4000. Due to the high methane content in the plume above the Jøtul field, high methane emission rates were predicted, which were to be determined using gas-tight sampling devices. Further objectivs of the expedition were to investigate individual hydrothermal vents and to investigate the hydrothermal plume, which generally drifts northward in the direction of the current. The relationship of the oceanic core complex (OCC) on the east side of the Jøtul hydrothermal field to the hydrothermal circulation was also to be investigated.

Cruise Narrative

On **Sunday, 18 August**, 2024, RV MARIA S. MERIAN left the "Grandabryggja" pier in the Old Port of Reykjavik at 08:36 local time to set off for the Norwegian Sea. Investigations on the so-called Knipovich Ridge to determine the distribution of hydrothermal vents on the seabed are the main objective of the research mission MSM131. The departure on Sunday was preceded by 4 days of intensive unloading and loading work in the port of Reykjavik. After the ship arrived in Reykjavik around noon on Wednesday, the 3 packed containers from the previous cruise MSM130 were unloaded and the ship's crew began loading 3 Bremen containers of the "Remotely Operated Vehicles". The start of the assembly of MARUM ROV QUEST 4000 on the ship was a top priority, as an additional port day is required to integrate the ROV into the ship's operations. Thanks to the good port logistics in All 8 containers from Germany, 6 from MARUM in Bremen and 2 from AWI Bremerhaven, were delivered to Reykjavik on time and on Thursday the remaining 5 containers were placed on the MERIAN. Most of the scientists also came to board on Friday, while the ROV team was already busy installing the various ROV components from the first day in port. Saturday was the day for setting up the ship's laboratories, for which the ship's crew had already emptied the two containers with the laboratory equipment packed in transport boxes and the consumables.

The port work was completed on Saturday evening and the ship was ready to set sail on Sunday morning. The ship sailed north through the Denmark Strait on the west side of Iceland and then, after the passage, almost directly for the Jøtul hydrothermal field on the northern Knipovich Ridge west of Svalbard. 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.

Our working area was 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 wanted to pursue these questions with additional investigations during MSM131.

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. 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. 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 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.

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 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.

Last **Monday, 26 August** 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.

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.

The dive on **Sunday, 1 September** (Dive 483) was already mentioned in the last weekly report but not its results, because these, together with the dive on **Tuesday, 3 September** (Dive 484), were spectacular for us. We investigated 2 hydrothermal hills whose characteristic appearance led us to name them Yggdrasil and Nidhogg two years ago. These terms, like the word Jøtul, come from Nordic mythology and since these are important objects of investigation for us, we like to use their names and not just numbers. The summit area of Yggdrasil is a very complicated rock structure made up of channels and overhanging roofs, so-called flanges, under which the hydrothermal fluid collects. Since the fluids are hotter and have a lower density than sea water, they flow upwards over the edge, enlarging the edge of the rock roof in a horizontal direction by precipitating metal-rich minerals. We were able to suck in one such hydrothermal fluid, which had a temperature of at least 289°C, under a flange with our intake nozzle and sample it in the KIPS container. A second fluid sample was obtained with one of the two pressure-tight IGT samplers. While these flange samples come from mid-height of the structure, a second location, namely an outlet channel at the summit of Yggdrasil, was visited. This escaping fluid also had a temperature of 282°C, so it can be assumed that the escaping fluids come from the same source. Two years ago, we also measured a temperature of 272°C at Yggdrasil.

The second part of the dive took us to the Nidhogg hydrothermal mound, about 120 m further west. Here, too, there is a hill structure with a diameter of about 35-40 m, which towers about 10 m above the surrounding area and has a summit area with chimney structures of metal-mineral precipitation. Only a small part of the structure is characterized by active fluid outlets, where the hot liquid appears as intensely shimmering water. We were able to successfully sample such an outlet point here on Nidhogg with KIPS and IGT fluid samplers, measuring temperatures of up to 152°C. Compared to 2 years ago, when we only measured temperatures of up to 33°C, the values this time are significantly higher. In the wider area around the active fluid vents of the Nidhogg, white bacterial mats indicate diffuse fluid flow and whenever we zoom into certain areas with the high-resolution cameras of QUEST4000, we see numerous, often very small animals, such as snails, worms and various crustaceans. Amphipods can often be seen, which have a chemosynthetic lifestyle in symbiosis with bacteria.

In addition to the ROV dives, the fourth week of the expedition was also characterized by an intensive sampling program of the hydrothermal plume in the water column and its effect on the sea floor. So-called Tow-Yo CTD profiles were carried out mainly at night, with the CTD and its water samplers being hoisted and lowered in a zigzag manner along one stretch while the ship was traveling very slowly in the depth range occupied by the hydrothermal cloud. This made it possible to record the area of the hydrothermal plume along the profile and even to track plumes from individual exit points on the sea floor. The temperature and redox potential sensors and the methane, carbon dioxide and hydrogen measurements on water samples from the rosette water were particularly helpful in this. Water samples were taken for later analysis of the helium isotopes in the Bremen laboratory and will inform us about the input of components from the Earth's mantle.

The input of metals from the hydrothermal sources and the distribution via the hydrothermal plume in the Jøtul hydrothermal field will be determined using chemical measurements on surface sediments. To this end, we have set up a large network of 22 mini-corer stations on several days this week, which will be expanded in the coming days. The surface sediments of the mini-corer are of high quality and these stations can also be operated in bad weather when work on the seabed with the ROV is not possible. The programs on the ship complement each other very well depending on the weather. The use of simple sampling devices is sometimes necessary because we unfortunately often have technical problems with the ROV that have to be solved on board by the ROV crew. For example, on Tuesday evening when ROV-QUEST was brought in, the latch system was damaged, which unfortunately could not be repaired on board. It is thanks to several colleagues, and in particular one colleague who arrived by plane, that a spare part was brought from Bremen to Longyearbyen by **Friday, 6 September** which we were able to bring on board in Longyearbyen in front of the harbor entrance using the ship's speedboat, and so we were able to dive with ROV QUEST again on Sunday. The visitors to the German Maritime Museum in Bremerhaven were present with a moderator from the MARUM public relations office and with a teleconference from the ship and, like many others, were able to follow part of the live stream on the YouTube channel.

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 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 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.

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. 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, 13 September** 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, 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. 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.

Despite its shortness, the sixth week was the most successful for our science. It was only 4 days long for our work, because on Thursday evening we stopped station work and set off on the return journey to Germany. Due to significantly better weather conditions than in the previous week, we were able to dive on 3 out of 4 days. Only **Tuesday, 17 September**, did we not have the opportunity to use our diving robot due to the high swell and a strong wind of Beaufort 6-7. During that day, the surface sampling program in the Jøtul hydrothermal field and the area of the hydrothermal plume to the north was completed with 3 mini-corer stations. With a total of 35 stations, a great set of samples was obtained on our cruise, the analysis of which will show an image of the drift of hydrothermal particles through the plume.

The three dives of the week mainly worked on profiles that began in the west at a water depth of more than 3000 m and examined the sea floor up the slope to the east. The almost daily growth changes on the two smokers of the Jøtul main field Gyme and Feneris were usually at the beginning of the investigation programs. During the two dives 488 and 490 we examined a sea area at a water depth of 2935 m that contained numerous indications of cold seep outlets. Using a new camera system that is aligned vertically to the bottom and records high-resolution digital images below the ROV every half second, we mapped an area of around 600 square meters. The ROV flew over 25 lines at a distance of 1 meter so that a high degree of coverage of the image series was achieved and an overall mosaic of all images could be calculated on board. Without having carried out a precise habitat characterization, we were able to identify certain patterns. The most striking were areas with yellowish-brown crumbly crusts, which contained significantly more faunal components than other surfaces. Other areas were covered by gray bacterial mats, while the largest areas were covered by clay-brown seafloor with the occasional visible of tubeworms.

To characterize these surface areas, we took two push cores each and carried out a measurement in the respective habitat with the temperature lance. The temperature lance has 8 temperature sensors that are lined up at a distance of 8 cm. The temperature profile or temperature gradient is then determined using the 8 measurements, which last for about 12-15 minutes. Under visual control of the cameras, the ROV pilots place the push cores and the T-lance, thus ensuring that samples and measurements are taken in the same habitat (Fig. 4). After the dive, the push cores were immediately sampled on board for pore water and gas composition and partially analyzed. High methane contents with a characteristic distribution in the cores showed that methane dissolved in the pore water is involved in different microbiological processes that depend on the habitat. In addition to anaerobic methane oxidation, other processes such as fluid flow from the subsurface and biological activity of benthic macro-organisms play a role. For a more precise interpretation, however, the pore water profiles of inorganic components are important, but these can only be determined in the laboratory in Bremen. The big question we ask ourselves when interpreting this seep area is the question of the driving process. Is the hydrothermal circulation of the Jøtul field the driving mechanism and are we dealing with a cold end of a circulation cell, or do other mechanisms such as dewatering of marine sediments play a role that have no direct connection to the hydrothermal circulation? The origin of the methane is very important to determine, which we want to clarify with the isotope analyses of carbon and hydrogen in the home laboratory.

We investigated a completely different question on the penultimate dive 489 on Wednesday 18 September by examining and sampling an oceanic core complex (OCC) that is located immediately east of the Jøtul hydrothermal field and whose relationship to the hydrothermal field is completely unclear. Rock complexes of an OCC consist largely of ultra-basic mantle rocks that are serpentinized and rise up through intensive interaction with seawater at deep faults. Such faults in the rock structure are often recognized on the surface of OCCs by a striped pattern in the detailed morphology. A detailed survey with an autonomous underwater vehicle (AUV) two years ago discovered such a micro-bathymetric striped pattern, so we can assume that an oceanic core complex is present here. During dive 489 we selectively collected 14 different rock samples from the sea floor along a 600 m long profile and the petrographic analyses in the Bremen laboratories will give us information about the rock diversity and its relationship to the OCC.

After finishing the station work in the Jøtul hydrothermal field, the MARIA S. MERIAN headed for our next port of call, Tromsø. It left the shelf of the Barents Sea on the night of **Sunday, 22 September**, to enter the fjord landscape of Flugløysundet and, after about 25 km, the wide passage of Grøtsundet, so that we could berth in the port of Breivika/Tromsø on time at 8:00 a.m. In addition to our Norwegian scientists, several other scientist also left the ship and 3 employees from the Kula company came on board to prepare for the shipyard period that would follow this cruise on the way to Emden. After 2 hours, we set off again at 10:00 a.m. and the MERIAN circumnavigated the island of Tromsøya in the north and sailed on the west side of the island across the southern fjord systems to the open sea of the European North Sea.

From there we went past the Lofoten Islands on the passage route south over the Vøring Plateau and the break-off niche of the famous Storegga slide on the continental margin to the Norwegian Trough, through Danish areas into the German Entenschnabel, where our cruise ended on **Friday, 27 September**, a day earlier than planned after passage over the Ems in Emden.

Acknowledgement

We are returning to Germany with new scientific findings from the Jøtul hydrothermal field with many new measurement results, data, samples and observations. We scientists are very happy about the goals we have achieved and are returning home with very good results. We owe the success of the scientific work to the excellent and friendly support of the ship's crew in all areas (nautical, WTD, deck crew, engine and service area, etc.), the shipping company and the employees of the German Research Fleet Coordination Centre as well as the colleagues from MARUM logistics. We would especially like to thank Captain Björn Maass and his entire crew, who were always friendly and helpful in all matters. The ship time was provided by the Deutsche Forschungsgemeinschaft within the METEOR/MERIAN core program. Funding of the cruise was performed by the Bremen Cluster of Excellence "The Ocean Floor – Earth's Uncharted Interface".

Cruise participants

Name	**Leg**	**Discipline**	**Affiliation**
Anagnostou, Eirini	2	KIPS, fluid chemisty	CoUB
Asatrian, Kristina	1	OBS recovery	AWI
Barrenechea Angeles, Inés	2	Foraminifers	UiT
Bergenthal, Markus	1	ROV	MARUM
Berger, Frederik	1 + 2	Hydroacoustics	MARUM
Bohrmann, Gerhard, Prof.	1 + 2	ROV / Chief Scientist	MARUM, GeoB
Büttner, Hauke	1 + 2	ROV	MARUM
De Azevedo Ribeiro, Pedro	2	ROV dives	UiB
Diehl, Alexander	2	IGT, ROV dives	MARUM
Feddersen, Greta	1 + 2	ICOS, hydroacoustics	MARUM
Franke, Rosalia	2	Media	GeoB
Jain, Apoorvi	2	Hydroacoustics	MARUM
Kienatz, Tim	1 + 2	ROV	MARUM
Knutsen, Stig Morten	1 + 2	ROV dives	NOD
Kopiske, Eberhard	1	CTD, Mini-corer	MARUM
Malnati, Janice	2	ICOS, GC, CTD	GeoB

Marcon, Yann	1	ROV dives, mosaicks	MARUM, GeoB
Meckel, Eva-Maria	2	KIPS, fluid chemistry	CoUB
Meyer, Maximilian	1 + 2	Hydroacoustics	GeoB
Reuter, Christian	1 + 2	ROV	MARUM
Pape, Thomas	2	CTD, GC, ROV dives	GeoB
Pilot, Matthias	1	OBS recovery	AWI
Rehage, Ralf	1 + 2	ROV	MARUM
Reuter, Christian	1 + 2	ROV	MARUM
Röhler, Aaron	1	ROV dives	MARUM
Römer, Miriam	1 + 2	MAPR, ROV dives	GeoB, MARUM
Schillai, Sophia	1 + 2	ROV	MARUM
Schlindwein, Vera	1	OBS recovery	AWI
Schröder, Marcel	1 + 2	ROV	MARUM
Spiesecke, Ulli	1 + 2	ROV	MARUM
Streuff, Katharina, Dr.	1	MBES, PARASOUND	GeoB
Strmic-Palinkasn Sabina	1	ROV dives	UiT
Von Wahl, Till	2	ROV	MARUM

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GeoB Fachbereich Geowissenschaften der Universität Bremen, Klagenfurter Straße 2-4, D-28359 Bremen, Germany, https://www.geo.uni-bremen.de

AWI Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung, Postfach 12 01 61, 27515 Bremerhaven, Germany, https://www.awi.de

UiT The Arctic University of Norway, PO Box 6050 Stakkevollan N-9037 Tromsø, Norway, https://en.uit.no/startsida

UiB University of Bergen, Institutt for geovitenskap, Postboks 7803, N-5020 Bergen, Norway, https://www.uib.no/en/deepsea

CoUB Constructor University, Bremen gGmbH, Campus Ring 1, 28759 Bremen, Germany, https://constructor.university/

NOD Norwegian Offshore Directorate, Professor Olav Hanssens vei 10, 4021 Stavanger, Norway, https://www.npd.no/en/

Date 2024	St. MSM131/	Instrument	Begin	Latitude N	Longitude E	Water depth (m)
23.08.2024	**1**	**CTD-01**	06:17	77° 26.426'	07° 42.402'	3059
	2	**OBS JOT03**	10:28	77° 25.800'	08°03.530'	2312
	3	**OBS JOT13**	13:07	77° 30.397'	08° 11.048'	2351
	4	**OBS JOT02**	14:36	77° 30.201'	07° 51.036'	3055
	5	**OBS JOT14**	17:43	77° 37.819'	08° 02.600'	2641
	6	**OBS JOT15**	19:32	77° 39.999'	07° 30.020'	3464
	7	**OBS JOT01**	21:44	77° 33.013'	07° 32.704'	3477

	8	**OBS JOT11**	23:36	77° 27.466'	07° 39.058'	2830
24.08.2024	**9-1**	**ROV-481**	12:18	77° 26.411'	07° 42.506'	3016
	10	**OBS JOT04**	19:04	77° 21.621'	07° 50.448'	2663
	11	**OBS JOT12**	20:40	77° 22.746'	08° 07.313'	2136
	12	**OBS JOT09**	22:43	77° 14.940'	07° 54.390'	2682
25.08.2024	**13**	**OBS JOT08**	01:19	77° 16.955'	06° 52.894'	2601
	14	**OBS JOT07**	03:11	77° 23.014'	06° 59.366'	2662
	15	**OBS JOT06**	04:56	77° 28.373'	07° 10.174'	2759
	16	**CTD-02**	07:06	77° 26.101'	07° 42.525'	2933
	17	**OBS JOT05**	15:03	77° 23.249'	07° 33.633'	3620
	18	**OBS JOT10**	18:07	77° 32.990'	06° 25.111'	1993
26.08.2024	**19**	**CTD-03**	08:20	77° 26.390'	07° 42.542'	2993
27.08.2024	**20**	**CTD-04**	18:19	79° 36.828'	03° 39.716'	3566
28.08.2024	**21**	**CTD-05**	00:54	79° 48.125'	03° 10.706'	3778
	22-1	**ROV-482**	08:14	79° 36.847'	03° 39.695'	3554
	23	**CTD-06**	20:51	79° 36.873'	03° 39.632'	3570
31.08.2024	**24**	**CTD-07**	07:03	77° 26.396'	07° 42.682'	2999
	25	**MIC-01**	10:15	77° 26.399'	07° 42.506'	3005
	26	**MIC-02**	13:27	77° 26.428'	07° 42.501'	3009
	27	**MIC-03**	15:41	77° 26.431'	07° 42.482'	3015
01.09.2024	**28-1**	**ROV-483**	06:21	77° 26.201’	07° 42.460’	2965
	29	**CTD-08**	18:45	77° 26.398'	07° 42.635'	2898
02.09.2024	**30**	**MIC-04**	06:19	77° 26.457'	07° 42.504'	3002
	31	**MIC-05**	08:45	77° 26.462'	07° 42.332'	3037
	32	**MIC-06**	13:22	77° 26.458'	07° 42.146'	3067
	33	**MIC-07**	15:47	77° 26.463'	07° 42.894'	3113
	34	**CTD-09**	18:54	77° 26.468'	07° 42.647'	2788
03.09.2024	**35-1**	**ROV-484**	06:21	77° 26.217’	07° 42.484’	2973
04.09.2024	**36**	**MIC-08**	06:34	77° 26.496'	07° 42.539'	3016
	37	**MIC-09**	09:14	77° 26.495'	07° 42.340'	3049
	38	**MIC-10**	11:48	77° 26.496'	07° 42.150'	3080
	39	**MIC-11**	14:01	77° 26.501'	07° 42.951'	3099
	40	**MIC-12**	16:27	77° 26.569'	07° 42.792'	3111
	41	**CTD-10**	19:18	77° 26.316'	07° 44.004'	2714
05.09.2024	**42**	**MIC-13**	07:36	77° 26.564'	07° 42.191'	3087
	43	**MIC-14**	10:16	77° 26.570'	07° 42.455'	3055
	44	**MIC-15**	13:06	77° 26.567'	07° 42.700'	3015
	45	**MIC-16**	15:48	77° 26.579'	07° 42.045'	2980
	46	**CTD-11**	18:57	77° 26.236'	07° 42.783'	2796
07.09.2024	**47**	**MIC-17**	07:16	77° 26.493'	07° 42.673'	2997
	48	**MIC-18**	11:45	77° 26.530'	07° 43.021'	2963
	49	**MIC-19**	13:48	77° 26.507'	07° 43.059'	2957
	50	**MIC-20**	15:56	77° 26.430'	07° 42.991'	2962
	51	**CTD-12**	18:19	77° 26.131'	07° 43.252'	3004
08.09.2024	**52-1**	**ROV-485**	04:17	77° 26.414’	07° 42.265’	3000
	53	**CTD-13**	18:32	77° 26.252'	07° 42.124'	3035
09.09.2024	**54**	**MIC-21**	06:03	77° 26.415'	07° 42.999'	2960

	55	**MIC-22**	08:21	77° 26.459'	07° 43.046'	2960
	56	**MIC-23**	10:27	77° 26.460'	07° 43.215'	2950
10.09.2024	**57-1**	**GC-1**	07:26	79° 36.857'	03° 39.440'	3567
	57-2	**GC-2**	11:28	79° 36.854'	03° 39.479'	3567
	57-3	**GC-3**	14:29	79° 36.850'	03° 39.446'	3566
11.09.2024	**58-1**	**MIC-24**	10:29	77° 26.574'	07° 43.238'	2961
	59-1	**MIC-25**	12:41	77° 26.543'	07° 43.590'	2936
	60-1	**MIC-26**	14:52	77° 26.605'	07° 43.897'	2965
	61-1	**MIC-27**	17:06	77° 26.609'	07° 43.581'	2979
	62-1	**CTD-14_1**	19:40	77° 26.152'	07° 41.960'	2578
	62-2	**CTD-14_2**	21:37	77° 26.187'	07° 42.131'	3071
12.09.2024	**63**	**MIC-28**	08:35	77° 26.619'	07° 43.190'	2983
	64	**MIC-29**	10:58	77° 26.635'	07° 42.851'	3021
	65	**MIC-30**	13:09	77° 26.648'	07° 42.517'	3052
	66	**MIC-31**	15:23	77° 26.655'	07° 42.186'	3068
	67	**CTD-15**	18:02	77° 27.156'	07° 44.328'	3078
13.09.2024	**68**	**MIC-32**	08:20	77° 26.342'	07° 42.720'	2993
	69-1	**ROV-486**	11:01	77° 26.197'	07° 42.193'	2989
	70	**CTD-16**	21:16	77° 27.062'	07° 44.636'	3025
14.09.2024	**71**	**CTD-17**	17:05	77° 26.488'	07° 43.218'	2942
15.09.2024	**72**	**ROV-487**	09:14	77° 26.389'	07° 42.515'	2976
	73	**CTD-18**	19:50	77° 26.779'	07° 42.636'	3031
16.09.2024	**74-1**	**ROV-488**	06:46	77° 26.351'	07° 42.379'	2993
	75	**CTD-19**	19:27	77° 26.408'	07° 41.940'	3086
17.09.2024	**76**	**MIC-33**	11:16	77° 26.355'	07° 42.536'	3005
	77	**MIC-34**	13:53	77° 26.295'	07° 42.619'	3001
	78	**MIC-35**	15:49	77° 26.324'	07° 42.653'	3001
	79	**CTD-20**	18:23	77° 26.507'	07° 41.441'	3145
18.09.2024	**80-1**	**ROV-489**	07:42	77° 26.197'	07° 42.490'	2950
	81	**CTD-21**	20:04	77° 26.878'	07° 41.460'	3083
19.09.2024	**82-1**	**ROV-490**	06:17	77° 26.414'	07° 42.274'	3002
	83	**CTD-22**	17:12	77° 26.486'	07° 42.750'	2989

Scientific work/station work during MSM 131:

CTD stations: 22

OBS recoveries: 15

Gravity Corer stations: 3

MIC stations: 35

ROV QUEST dives: 10