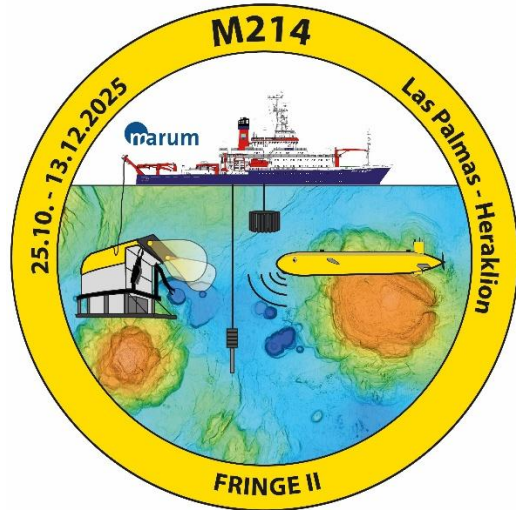


Research Vessel METEOR

M214: 25.10. – 13.12.2025

Las Palmas – Malaga - Iraklion - Iraklion

Fifth Weekly Report: 17 – 23 Nov 2025



The fifth week, like the previous week, brought us ideal weather conditions with light winds, mostly between Beaufort 3 and 4, only rarely reaching Beaufort 5. We frequently had clear, sunny skies with good visibility and calm seas with a swell of around 1 meter, usually less and only rarely somewhat higher. This was due to a ridge of high pressure extending over Crete and eastern Turkey, while several constantly developing low-pressure systems formed in the western Mediterranean, causing some heavy showers, including in Italy, but these did not reach our area (Fig. 1). Therefore, there were no weather-related obstacles to night dives or daytime sampling with heavy equipment.

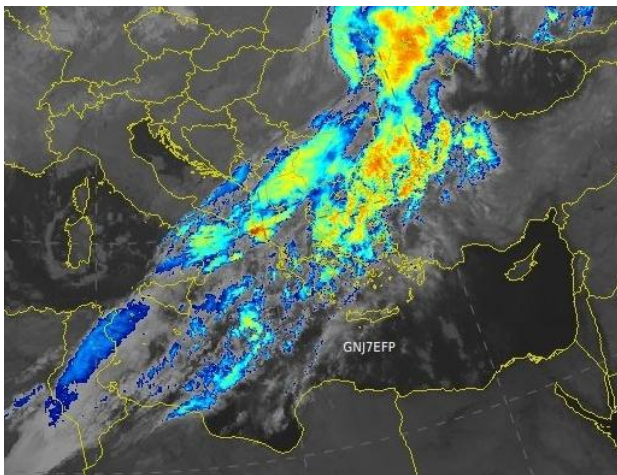


Figure 1: The satellite image from Wednesday, November 19, shows a band of rain northwest of Crete, associated with the low-pressure area over the western Mediterranean. The METEOR, on the other hand, was located within a stable ridge of high pressure.



Figure 2: Sample processing in the METEOR chemistry laboratory. After each CTD station, the samples from the 24 water samplers are analyzed for their methane content. (© Elmar Schreiber).

During the 117th dive of AUV SEAL 5000 on Sunday, 16 November, the summit and northwestern slope of the Heraklion mud volcano were surveyed. The mud volcano lies within an elliptical caldera, the rim of which is approximately 5 km east-west and 2.5 km north-south. Compared to the surrounding area, the caldera has sunk over 100 m due to mud eruption from the depths of the Heraklion volcano and the corresponding mass deficit in the subsurface. The micro-bathymetric map illustrated that mud flows in earlier times were predominantly directed southward, but that more recently, mud transport has clearly been directed northward, with some mud flows already reaching the caldera rim. During a second dive on Monday night, we mapped the eastern part of the volcano with the AUV, so that the structure is now completely recorded microbathymetrically. During the day, we conducted sampling with the gravity corer and multicorer. When sampling the relatively fresh mud that had erupted from the vent, we found the highest salinity levels in the pore water. With a salinity of up to 30‰, we are well above the solubility limit of sodium chlorite, so it is no surprise that we can see precipitates of individual small halite crystals in the mud. In addition, there are a

number of different clasts, the most striking being a boulder of pure halite with an average diameter of almost 10 cm (Fig. 3). This clast has distinctly cubic halite crystal faces and certainly originates from the Messinian evaporite sequence of the Upper Miocene; it is therefore approximately 5-6 million years old. The transport of mud has penetrated this subsurface formation, carrying various rock fragments from the formation to the seabed surface. A comprehensive analysis of the clasts will reveal which other formations have also been breached.



Figure 3: Fist-sized salt pebbles of relatively pure halite cored from a mud breccia at the summit of the Heraklion mud volcano (© Gerhard Bohrmann).



Figure 4: Group photo of the scientists who participated in the second leg of the M214 cruise in the eastern Mediterranean. (© Elmar Schreiber).

A night-time program of heat flow measurements on Tuesday, 18 November, was dedicated to the northern volcanic vent of the Gelendzhig volcanic field. This vent was successfully sampled the following day using a gravity corer, and the analysis of the pore water salinity yielded further surprises. A sediment core taken directly from the vent's upwelling channel showed a salinity of 1%, a clear indication of freshwater compared to the 4% salinity of seawater. As has been observed in other mud volcanoes, this freshening of the pore water most likely results from the release of water molecules from minerals undergoing transformation in deeper sediment layers. One known transformation of clay minerals is the change of smectite to illite, which leads to this water release. Just a few dozen meters away from this mud containing freshened pore water, another mud with elevated salinity levels of 10-27% is found, which can only be explained by the influence of the Messinian salinar sequence. A core sample taken further north along the mudflow draining from the summit yielded the same high dissolved salt concentrations, but only at a greater depth. Sampling a sediment core between the summit and the location mentioned before was not possible, as we had to leave the position that day due to an urgent military alert. We used the night of Wednesday, 19 November, to survey a basin at a depth of 3500 meters using Parasound, with the aim of collecting a sediment core for seismic event analysis. The survey during the night was very promising but had to be aborted at 2:18 a.m. due to an emergency call from the Greek authorities requesting the rescue of refugees in a boat very close to us. The boat was spotted in the searchlight, and all 35 refugees were rescued and cared for aboard the METEOR. They were safely handed over to the coast guard in the port of Kali Limenes at approximately 10:00 AM ship's time on November 20th. We were able to conduct a CTD measurement and a heat flow analysis until the next distress call came in at 11:00 AM on 21 November, and we were ordered to search for another boat. We were finally released at 11:00 PM that night and set sail for our next port of call in Heraklion, where we arrived today, Sunday, 23 November, a day earlier than planned.

All participants are healthy!

Best regards also on behalf of the cruise participants,
Gerhard Bohrmann

R/V METEOR, Sunday 23 November, 2025

We are reporting on our expedition M214 in a weblog: <https://www.marum.de/Fringell.html>