Research vessel SONNE

SO318: 22.02. – 26.03.2026
San Diego – Ensenada – San Diego

Fourth weekly report: 16. – 22.03.2026

We used the fourth week to thoroughly investigate and extensively sample the barite seeps in the Mexican section of the San Clemente Fault. In addition, Sunday was marked by an important achievement by our hydro-acoustics team: they successfully calibrated the EK60/80 fish finder. This fish finder has different transducers operating at different frequencies, and the 18 kHz transducer can detect gas bubbles in the water column, and quantification of the gas stream can be achieved once the instrument is calibrated. Since we had already investigated two gas seeps—the newly discovered Kinkipar Seep and the DeMar Seep, both with distinct gas emissions on the seafloor—our acoustics group had expressed a desire to calibrate the EK60/80. To calibrate the 18 kHz signal, they had to lower a metal sphere with a diameter of 6.3 cm into the sound cone of the 18 kHz transducer beneath the ship. Calibration software and hardware provided by the manufacturer are on board, including three fishing rods used to lower the calibration sphere from the bow to the transducer's position on the ship's hull. The weather on Sunday morning was perfect, and so the highly dedicated group began the calibration (Fig. 1). Thanks to the precisely balanced lengths of the fishing lines and sophisticated command logistics, our expedition members were able to use the fishing rods to position the designated sphere within a 6-meter-diameter acoustic circle at a depth of 30 meters. Once all four quadrants of the circle had received sufficient signals from the precisely defined sphere, the calibration was successfully completed. This not only enables us to quantify gas emissions during the upcoming measurement of gas emissions, but also allows us to retrospectively quantify the gas emissions that have already been measured.

Figure 1: Using three fishing rods and precisely calculated line lengths, the members of the hydro-acoustics group manage to position the calibration sphere beneath the ship, exactly within the sound cone of the 18 kHz transducer. (@ Gerhard Bohrmann)

Figure 2: The MARUM ROV-QUEST 5000 returning at night to the stern of the research vessel, where it is retrieved using the docking head—installed for the first time on this cruise—on the ship's A-frame. (© Tom Leymann)

On Sunday afternoon, the two MBARI Mapper AUVs were sent out on another mission to survey the seafloor topography. With their 1-meter resolution range, they are very well suited for mapping the barite deposits associated with seeps on the seafloor, a phenomenon previously documented in the area of Pull-Apart Basin 2. The AUV surveys conducted during SO318 aimed to cover the entire 50-km-long area of the San Clemente strike-slip fault. This was achieved using the two AUVs in five survey campaigns, each covering 10 km. Thus, during our first week in Mexico, we had already surveyed two 10-km sections in Pull-Apart Basin 3.

On Sunday March 15 the AUV survey mapped the southeasternmost Pull-Apart Basin 1. On Wednesday, March 18, the northwesternmost 10 km were mapped, so that by the middle of last week we already had the micro-bathymetry of the entire 50-km-long fault zone. From Monday, March 16, through today, Sunday, March 22, we were able to conduct QUEST dives 17 through 23 which were planned and ran based on the AUV maps (Fig. 2).

Figure 3: The porewater geochemists aboard the FS SONNE have a lot on their plate during our cruise. They process all the porewater samples from the push, multicorer, and gravity corer samplings. They titrate the alkalinity on board, while the samples are split for many other measurements to be conducted on land. (© Tina Treude)

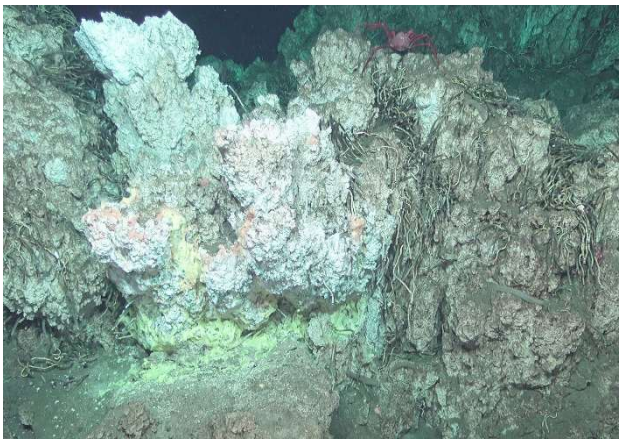

Figure 4: Massive barite rock formations containing barite with tube worms in the northwestern extension of Pull-Apart Basin 2, above the slope of the strike-slip fault. Yellowish microbial mats indicate active fluid seepage zones. (© MARUM)

The dives revealed a wide variety of barite deposits precipitated from the fluids. For example, there are small barite chimneys—usually associated with tube worms—protruding from the seafloor, as well as large barite blocks in various shades of dark color, which likely represent older precipitates. Young barite precipitates have light colors, with various white, yellow, and other-colored microbial mats that correspond to locations of active fluid seepage (Fig. 4). In a few cases, we were able to identify fluid seeps by the observation of shimmering fluid during the dive, a portion of which was collected using an evacuated sampler. Shipboard methane measurements confirmed our observations, and detailed chemical analyses of the collected fluid in our home laboratories will provide clues as to the origin of the fluids.

Sampling for barite analyses and associated microbes is an important part of the program, as is sampling the ambient water to determine its methane content with ROV-based Niskin bottles and several hydrocasts. The monomineralic barite rocks are highly porous and poorly consolidated, making them difficult to sample. Sulfide-oxidizing bacteria covering the younger barites indicate that anaerobic methane oxidation is taking place within the barite rocks, so that only a small fraction of dissolved methane enters the seawater. This methane release appears to vary greatly, as our methane measurements in seawater show highly fluctuating levels of dissolved methane. The hydrogen sulfide produced by anaerobic methane oxidation serves as a nutrient for the most commonly associated tube worms (Fig. 4), which perform chemosynthesis with their microbial symbionts.

In addition to the dives, we collect sediment cores from the vicinity of the San Clemente Fault using a gravity corer and a multicorer. These cores are then analyzed for their geochemical and sedimentological characteristics. Porewater is collected on board, partially measured, and divided into several subsamples. Since push cores are also taken on every dive—and their pore water must be processed the very evening after the dive—our small geochemistry team in the chemistry lab is more than swamped but very excited to have these valuable samples (Fig. 3).

All expedition members (crew and scientists) are in good spirits!
Wishing you a great weekend on behalf of all expedition members,

Gerhard Bohrmann FS SONNE, Sunday, March 22, 2026

You can watch the ROV QUEST dives live on MARUM's YouTube channel:
https://www.youtube.com/@marumTV