

# Research Vessel SONNE

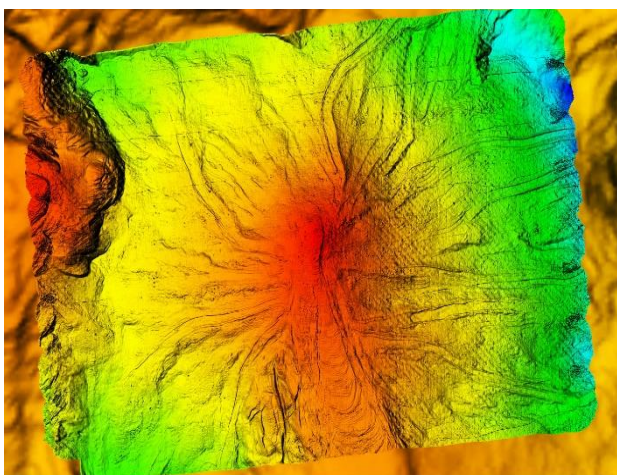
SO278: 12.10. – 01.12.2020

Emden – Emden

## 5th Weekly Report: 09.– 15.11.2020



After we left our work area south of Crete to the northwest on Saturday evening, 14 November, we reached our smaller work area southwest of the Peloponnese on Sunday, 15 November, after 20 hours of steaming. This area, located on the western Mediterranean ridge, is also very close to the border between the accretionary wedge and the tectonic backstop and is officially referred to as the “cobblestone region” due to its morphological phenomena. Here, too, we want to examine 1-2 mud volcanoes, in order to be able to compare them with mud volcanoes of the Olimpi region and the United Nation ridge. It is particularly important for us to sample the pore water at the outflow area, to be able to classify the mud volcanoes according to the source depth and the surrounding environment.



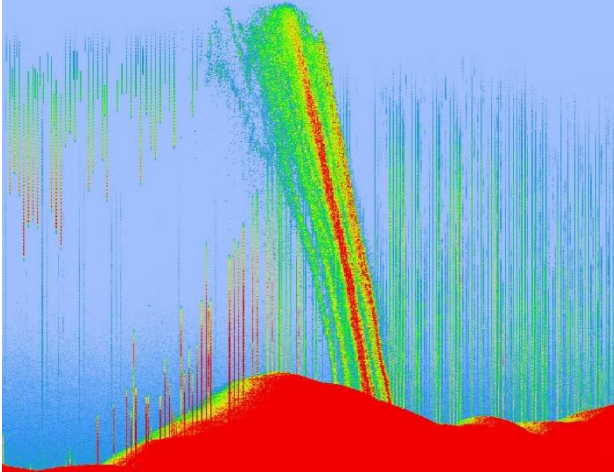
**Figure 1:** The AUV SEAL has mapped the central mud outlet on the Nice mud volcano. The survey area of 4 x 3 km shows mud flow deposits in all directions, building a flat dome around the center.



**Figure 2:** After the multicorer brought up several tubes from the sea floor, their distribution is discussed in the group of scientists (© Frauke Ahrlich).

Before arriving at our new working area tonight, we spent a week of exciting investigations in the Olimpi mud volcanic field south of Crete. One of the objects of investigation on the seabed was the Nice mud volcano, whose central mud outlet area we mapped with the AUV during the night from Sunday, 8, to Monday, 9 November (Fig. 1). While most of the mud volcanoes investigated so far have more dome-like structures, the Nice mud volcano forms a flat elevation. Its mud flow deposits appear to be significantly more water-bearing and have flown in all directions from the central ascent channel (Fig. 1). The AUV map also showed that the youngest mud flows mainly flowed towards the south, which prompted us to expand the map with an additional AUV dive carried out in the night from Friday, 13, to Saturday, 14 November. It was MARUM AUV-SEAL's 100th dive. Like in other cases, the detailed bathymetry acquired with the AUV allows us to pursue our scientific goals with further, more targeted sampling. On the Nice mud volcano, for instance, measurements of two heat flow profiles can be assigned to distinct mud flow units stacked on top of each other. Moreover, we acoustically detected and further examined a gas plume located in a fault zone to the north of the Nice mud volcano. The water samples that we collected at this location on Monday, 9

November, as part of a CTD station, showed up to 90 times higher methane levels directly above the sea floor and up to 150 m above it. An AUV survey on Thursday, 12 November, was able to specify several gas seeps that were close together (Fig. 3). Finally, an observation profile with the OFOS on Friday, 13 November, showed us how the corresponding sources with chemosynthetic living organisms and authigenic carbonates are built up on the sea floor.



**Figure 3:** Several gas plumes were detected by the AUV SEAL at an important investigation location in 1850 m water depth, which, according to the OFOS investigation on the sea floor, is a typical seep region.



**Figure 4:** As soon as a gravity corer has been hoisted from the seabed to the ship and is moored in the SONNE's landing gear, the scientists need many hands for the following work (© Heike Duggen).

Another highlight of the week were the findings of circular depressions on the sea floor with a diameter of 50 - 400 m, which are reminiscent of sinkholes and which were observed in various places on the AUV maps. Although their origin is unclear, their genesis seems to be related to the subsidence of the Messinian salts in the subsurface. We found many indications that they were once filled with brine. We examined such a pit, still filled with brine, on Wednesday, 11 November, with a gravity corer equipped with temperature sensors. The brine was characterized by a clearly defined halocline, below which the salt content jumped to 270 ‰ in the gravity corer and the temperature rose from 13.8° C to a constant value of 14.5° C. With increasing depth, we measured a second sharp transition to likely brine-rich waters, that caused a further temperature increase of more than 1° C. The initial methane and H<sub>2</sub>S concentrations were correspondingly high, hence we carried out the analyses of this gas-rich sediment core with great caution, working in fresh air on the open deck as far as possible. Further sediment samples were taken this week on the Nice, Milano, Monza, Gelendzhik and Heraklion mud volcanoes (Fig. 2 and 4), the processing of which often kept us busy until late at night.

The weather conditions this week were again very summery and the very good sea conditions made all station work possible. All participants are healthy!

Best regards also on behalf of the cruise participants,

Gerhard Bohrmann (Marum, University of Bremen) R/V SONNE, Sunday 15 November 2020