

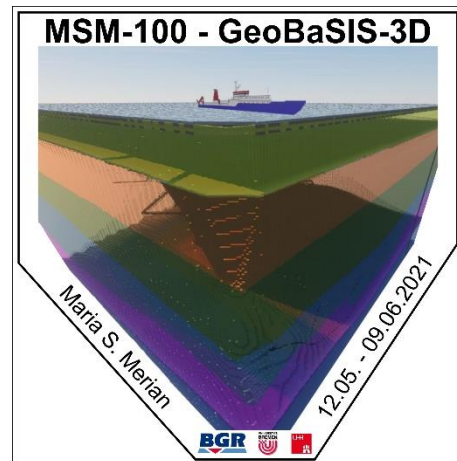
R/V MARIA S. MERIAN

MSM100 "GeoBaSIS-3D"

Emden - Emden, 12.05. - 09.06.2021

3rd Weekly Report

24. - 30.05.2021



Our third week at sea started with good weather prospects, so we planned to resume 3D seismic measurements on Tuesday, 25.05.21. On Monday afternoon we retrieved our 2D seismic instruments and prepared it for the 3D deployment. This measurement break was also used to test the recovery of the initially deployed seafloor seismometers (OBS) and their anchor weights. For this purpose, two OBS were retrieved back on board (Figure 2). The remaining 10 stayed on the seafloor until the end of the survey. During the night the sediment echo sounder data were completed and in the morning at 06:00 we started deploying the 3D seismic instruments. 6 hours later, around noon, everything was in place and ready for the measurement. At this point I would also like to emphasize the excellent cooperation with the crew of the MARIA S. MERIAN, without whom the handling of this complex equipment would not be possible at all, and I would like to thank them for their commitment. In the following days we continued our profile measurements to slowly but surely fill our 3D volume. In order to be able to carry out the measurements continuously over such a long period of time, the equipment and the measurement electronics are watched around the clock. For this, the technicians and scientists of the project take turns in a watch rhythm. The team for the GeoBasis-3D project on board the MARIA S. MERIAN consists of 11 technicians and scientists from the BGR, 2 students from the University of Bremen, two students from the University of Hamburg, a field service engineer from the UK and a marine mammal observer from Braunschweig. As a team, we ensure that measurements are possible around the clock.

The slow but continuous progress of the measurements ensures that the area we can image three-dimensionally is getting larger and larger. A first impression of the three-dimensional data can be seen in Figure 1. It shows preliminarily processed data that depict a first narrow strip in 3D. The advantage of the 3D data is evident here in that one can see the horizontal continuation of sediment layers and structures. One can show not only vertical cross-sections of the subsurface, but also horizontal slices, called time slices. The time slices show areas of equal reflection travel times. A conversion of the travel times of the seismic signals into depths has not yet been done. The reason is that for the conversion an exact knowledge of the sound propagation velocities in the subsurface is necessary. However, this has yet to be analyzed. This analysis of the velocities is one of the most time-consuming processing steps. Figure 1 shows the horizontal plane in the area of a mudstone formation with compaction faults. These faults are thought to have resulted from spontaneous drainage of the mudstones. We want to reconstruct the exact course of events more precisely with the help of the obtained data. The time slice already indicates that this drainage created circular fault structures. The full 3D volume will reveal if and where more of these circular structures occur and how they behave in three-dimensional space. In addition, we will investigate whether there is evidence that these faults may still be permeable to fluids and thus affect the tightness of this possible barrier formation.

With weather conditions still good, we are entering our fourth week at sea to measure the remaining approximately 30% of our 3D volume.

Everyone on board is well and sending greetings home.

Best regards on behalf of all cruise participants

Axel Ehrhardt

(Federal Institute for Geosciences and Natural Resources (BGR))

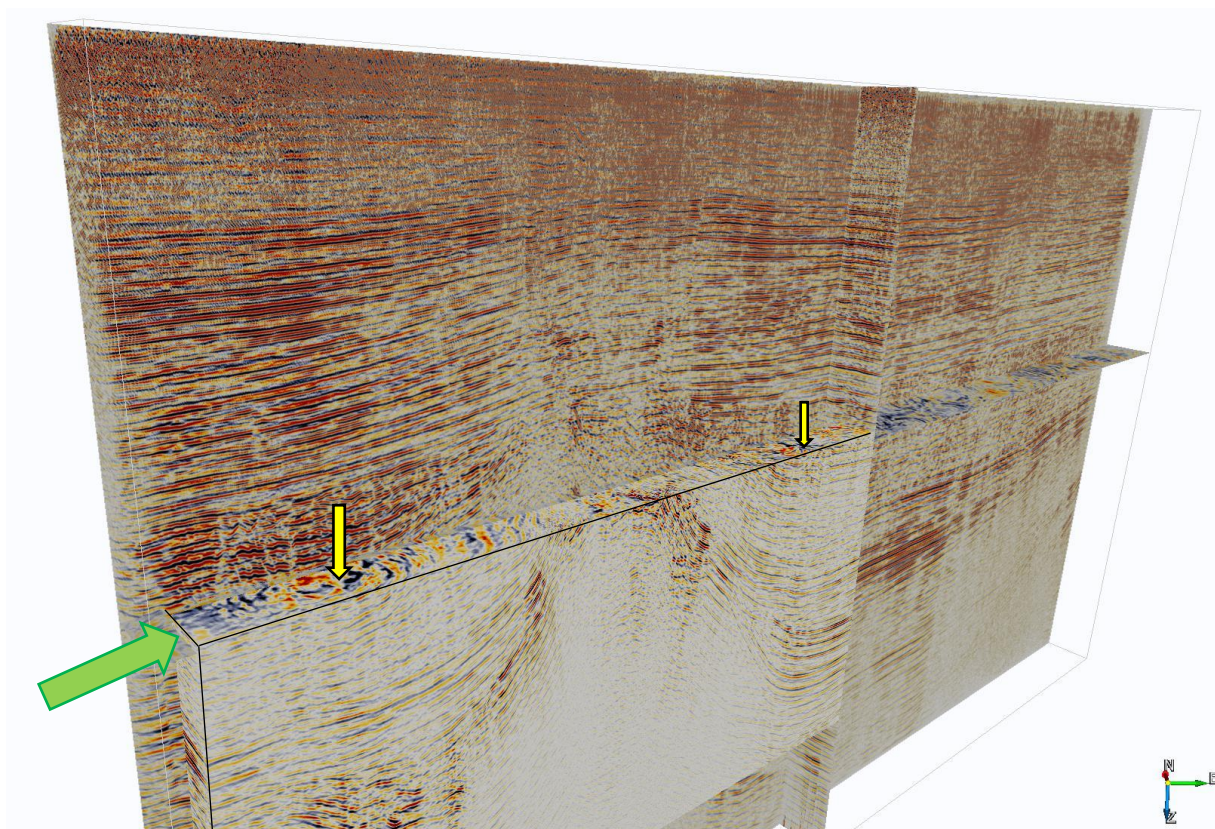


Fig. 1: Preliminary processed section of the 3D volume. The Belinda salt dome can be seen in the front area. The time slice (green arrow) is in the range of 1550 ms. The yellow arrows point to the circular compaction structures in the area of the mudstone formation mentioned in the text.



Fig. 2: Recovery of an ocean bottom seismometer (OBS). The devices are connected to the anchor weight with a coil and a rope (visible in the foreground of the OBS), which is subsequently recovered as well (photo S. Steuer).



Fig. 3: Early morning on the North Sea, the weather is calm but also here it is very cool with 8 - 10°C air temperature (photo B. Hankers).