R/V MARIA S. MERIAN

MSM100 “GeoBaSIS-3D”

Emden - Emden, 12.05. - 09.06.2021

2nd Weekly Report

17.05. - 23.05.2021

In the second week of our cruise, we continued the 3D seismic measurements we had started in very good weather, i.e. low wind and calm seas. The outside temperatures were quite fresh with 8 - 9 °C and also the sun was rarely visible. Good weather conditions are very important for 3D seismics, as stronger winds and high waves would exert too much force on the measurement equipment. Therefore we followed the weather forecasts carefully and on 20.05.21 the time had come. A low pressure area with high wind speeds and swell announced itself. From 13:00 we began with retrieval of the equipment and approx. 6 hours later everything was again on board, exactly in time before the worsening weather. For the phases when 3D seismic cannot be recorded due to weather conditions, we planned 2D seismic measurements, which are not that sensible to bad weather as 3D. After taking a crew member ashore for medical reasons during the night, we arrived back at the survey area in the morning and deployed our 2D seismic equipment. Despite intermittent high wind speeds of up to 8 Beaufort and high swells, we have been able to measure 2D seismic profiles since May 21st, complementing our 3D seismic data in the "Entenschnabel" area.

Several factors can influence sediments and their properties, these include, for example, crestal faults, compaction faults, but also subglacial channels (tunnel valleys). Our measurement area in the "Entenschnabel" (Fig. 1) is interesting because several of these factors come together here in a small area (Fig. 2). Crestal faults occur over salt diapirs when the buoyancy of salt uplifts the sediments above the salt diapir, causing cracks. Compaction faults form when water-saturated mudstones drain due to surcharge, causing some contraction, and subglacial valleys formed during ice ages due to runoff meltwater from glaciers beneath the ice sheet. Each of these factors can actually affect impermeable barrier formations, such as mudstones, and cause fluids such as natural gas, CO_2, or even nitrogen to migrate from the subsurface to the seafloor. We are now interested in whether these faults can work together to form a common fault system (called a seal-bypass system) that can allow fluids from the deep subsurface to escape through the barrier formation and reach the seafloor.

Everyone on board is well and sends greetings home.

Best regards on behalf of all cruise participants

Axel Ehrhardt

(BGR - Federal Institute for Geosciences and Natural Resources)

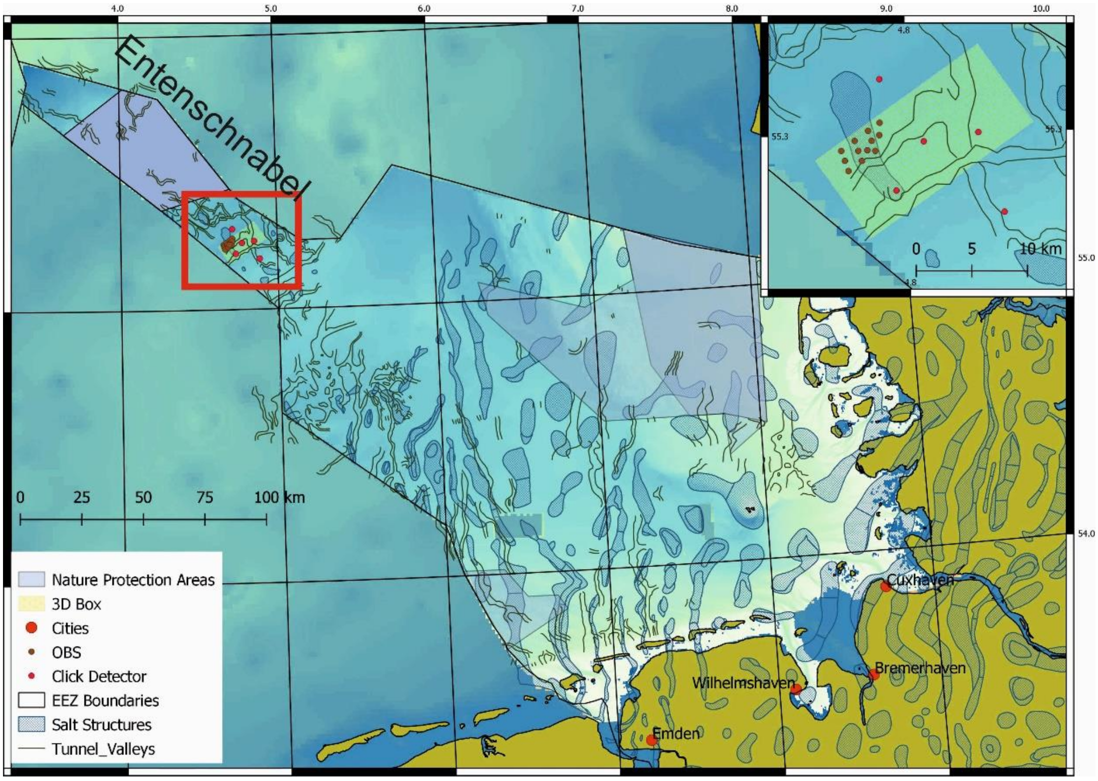

Fig. 1: In the figure is the German Exclusive Economic Zone (EEZ). In the area of the red box is our measurement area, see also small map above right. Here we investigate the disturbances in the sediments around the Belinda salt diapir, as well as in the area of the subglacial channels (tunnel valleys).

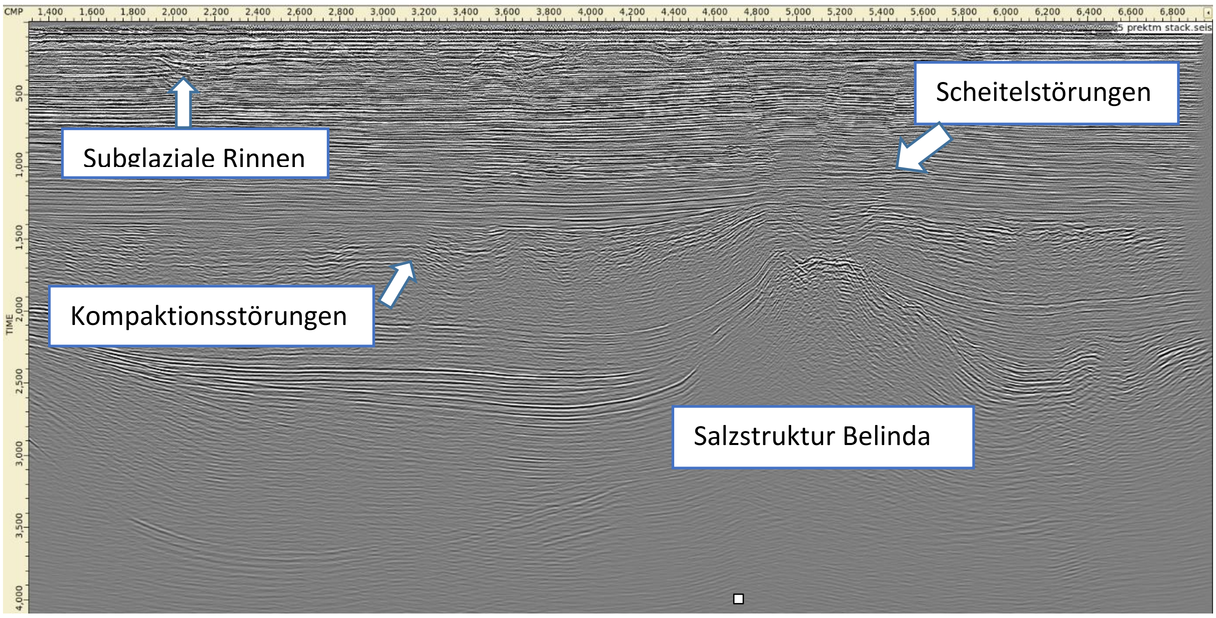

Fig. 2: Preliminary processed 2D seismic profile over the Belinda salt diapir. Crestal faults are seen over Belinda and subglacial valleys are seen to the side of Belinda. Compaction faults are abundant over large areas of the North Sea.

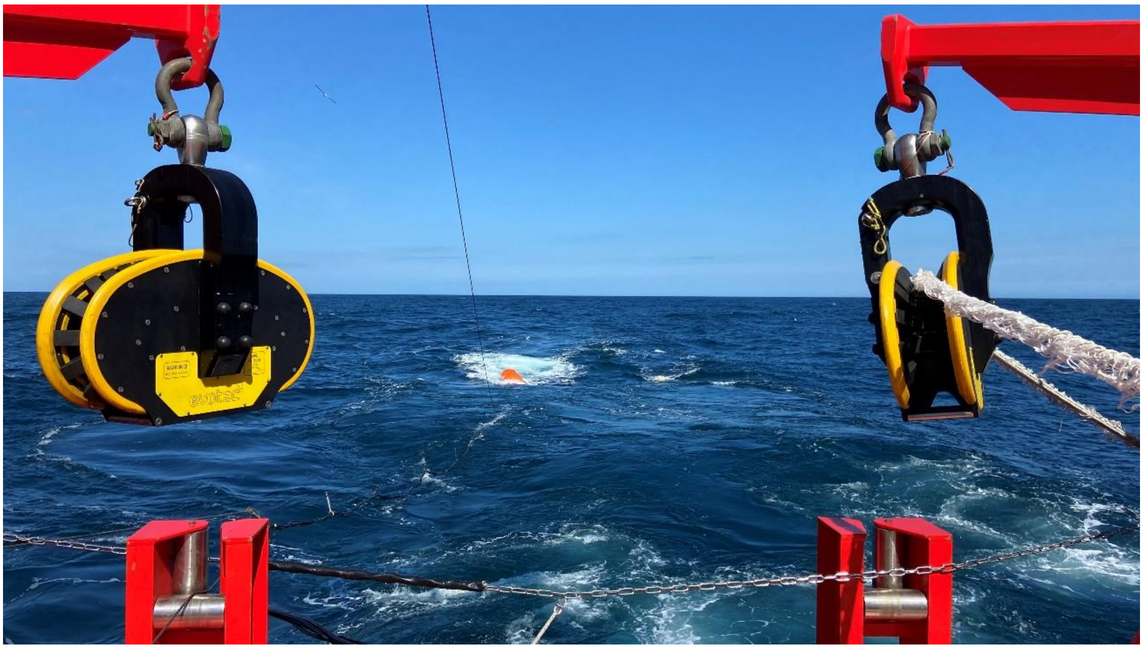

Fig. 3: View of the 2D seismic measurement equipment, which consists of one seismic source and one seismic measurement cable.