RV METEOR - M183
13.07. - 09.08.2022, Ponta Delgada - St. John´s

1st Weekly Report (13. - 17.07.2022)

On the morning of July 13, the research vessel Meteor left the port of Ponta Delgada (Fig. 1) on Sao Miguel as scheduled and began its journey north through the Azores archipelago. Our destination is over 2000 km north of the Azores at the southern tip of the Reykjanes Ridge, which is part of the Mid-Atlantic Ridge (Fig. 2).

A few hours after sending this first weekly report, we will have completed the transit and will initiate the first activities in the working area. In this first weekly report of the cruise, we will report about our research project and its background.

Fig. 1:
A night view of the METEOR in Ponta Delgada.
Photo: Aaron Röhler

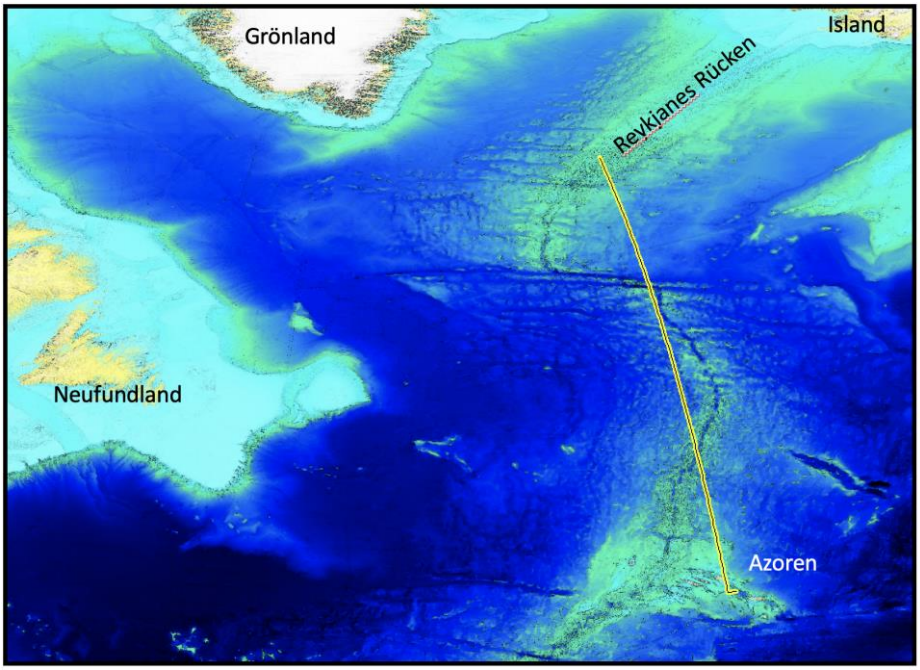

Fig. 2: The map shows the transit route from Sao Miguel, Azores, to the working area on the eastern flank of the southern Reykjanes Ridge.

Why is our working area in the middle of the North Atlantic scientifically interesting at all? The ridges mentioned at the beginning form a 60,000 km long band that runs through all oceans. These mid-ocean ridges have deeply furrowed flanks, in whose valleys sediments accumulate. The M183 cruise of the research vessel METEOR focuses on the exploration of these sediment troughs in the area of the eastern flank of the Reykjanes Ridge.

But what is it about these ridge flanks? Previous research has shown that about 2% of the water mass in the oceans is below the seafloor. There, the water does not just sit around, but it flows through the rocky, volcanically formed rocks in the flanks of the oceanic ridges. Along these ridges, new seafloor is continually being formed as the Earth's major tectonic plates drift apart. Melts from the Earth's upper mantle penetrate into this "gap" and form basalt - the volcanic substrate of the seafloor. Although this basaltic crust is hard, it is also brittle and full of holes. The fractures and cavities are filled with seawater, which slowly warms up there and rises as a result. Cold seawater then inevitably flows in and a circulation system (Fig. 3) develops that represents the largest heat pump on the planet.

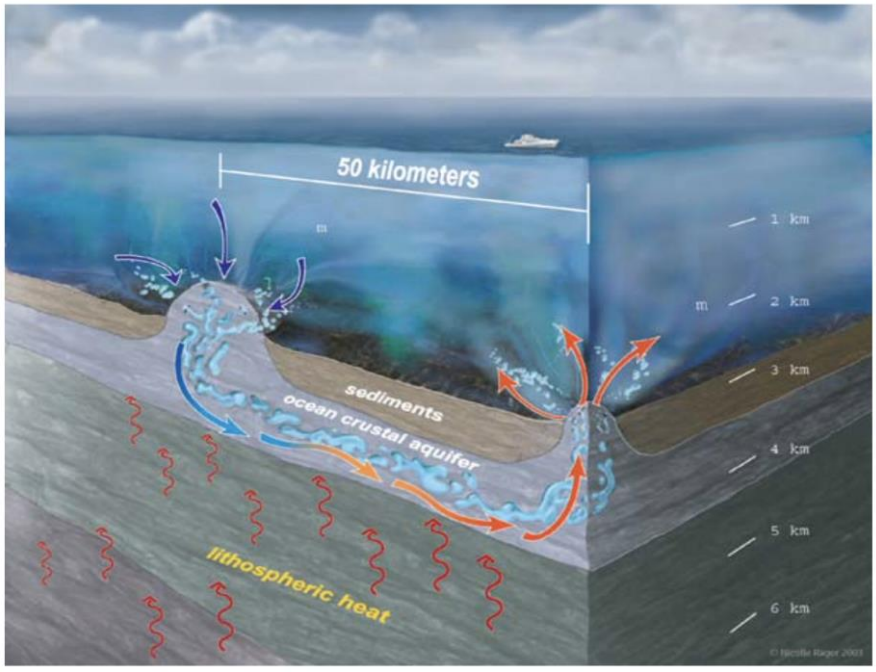

Fig. 3: Illustration of the circulation of seawater through the basaltic crust. Beneath the sediments, water flows laterally in crustal aquifers from one rocky outcrop to the next. From Fisher (2005) DOI 10.1007/s10040-004-0400-y

The global importance of these circulation systems for the exchange of heat and materials between the crust and the oceans has become a focus of marine geological research in recent years. These systems host little-known microbial ecosystems whose role in the carbon cycle is being explored. It is also known that the ridge flank circulation systems are important natural CO_2 reservoirs. We would like to find out if the ridge flanks are also suitable as reservoirs for anthropogenically released CO_2.

To pursue these ambitious goals, we need specially designed observatories that will be installed by drilling into the seafloor. This will be implemented during a subsequent research cruise in summer 2023 using the seabed drill rig MeBo of MARUM - Center for Marine Environmental Research at the University of Bremen. The observatories will be installed in the sedimentary basins, because we know that water flows horizontally through the basaltic crust there (Fig. 3). If we now know in which direction the water flows, we can plan the observatories in such a way that we can use different measuring stations in the downstream of the water.

The central goal of Expedition M183 is to identify and initially characterize sites suitable for MeBo drilling and installation of a seafloor observatory. To do this, we need to measure sediment thickness and heat flow densities, and determine the distribution of rocky outcrops without any sediment cover. Determination of sediment thickness, e.g., for deployment of the gravity corer and heat flow probe, will be accomplished by METEOR's PARASOUND system and at higher resolution by an ROV-based sediment echosounder. Initial sampling of sediments with the gravity corer is planned, as pore water profiles provide very useful information on conditions and processes in the underlying basalt crust.

These diverse tasks require a broad-based team with expertise from disciplines such as geophysics, geology, oceanography, geochemistry, microbiology and - most importantly - deep-sea technology. Our scientific and technical team consists of 21 people (including 8 students) from MARUM in Bremen (15) and GEOMAR in Kiel (4) as well as AWI and the University of Oldenburg (1 each). In the coming weeks, I will report on the different working methods and the first results in a highlight-like manner.

So what happened during the first week? With good weather and favorable currents, we were able to make good time and arrive at the work area on schedule. The laboratories are set up and the working procedures are discussed. There was even time for a short test dive with the MARUM ROV SQUID and a test sampling of sediments with the gravity corer. Everyone is well and enjoying the excellent hospitality and pleasant atmosphere on board. Now we are looking forward to the start of the research activities on Monday, July 18.

With best regards, also on behalf of all cruise participants,

Wolfgang Bach
(University of Bremen)

At sea, 58°N, 32°W