R/V METEOR
Cruise M168 (GPF 20-3_080)
08.11.2020 – 08.12.2020
Emden – Emden

4. Weekly report, 23. – 29.11.2020

At the beginning of the fourth week of our expedition, we left King's Trough for a short time and reached the Gnitsevich Seamounts, a group of seamounts northwest of the trough. They are located together with other seamounts on a section of the seafloor, which is elevated relative to the surrounding, up to 5,000 m deep, seafloor. This plateau-like seafloor has an average depth of about 3,000 m and transitions to the Mid-Atlantic Ridge about 300 km to the west. The seamounts have never been sampled before and our goal is to investigate how they were formed, why this section of the ocean floor forms a plateau and whether their formation is related to the formation of King's Trough and its flanking ridge structures. The cause could be an underlying mantle plume, which could be identical to the assumed mantle plume beneath King's Trough.
In contrast to Palmer Ridge and King's Trough, which we sampled at great depths of more than 5,000 m in some places, the seamounts lie at much lower depths and rise to about 700 m below sea level. It is possible that they once were almost at sea level or even above, so that some of them might have been ocean islands millions of years ago. As the ocean crust beneath these islands cooled, they eventually subsided below sea level and to greater depths. We

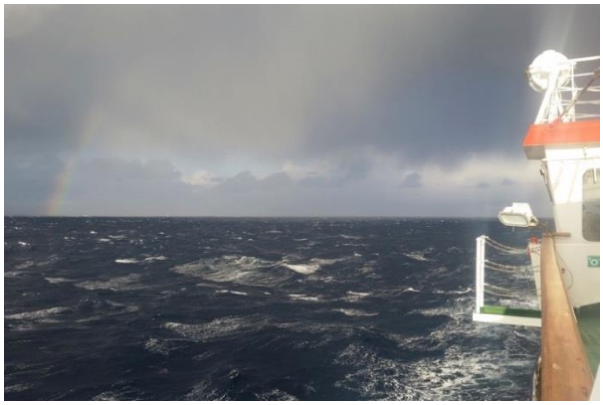
Left: Half full dredge from a dredge haul at the seamounts west of King's Trough. Some rocks are so large that it was a challenge to get them out of the chain bag. Top: Volcanic rock from one of the seamounts showing a mixture of two different magmas: a felsic (bright area) and a mafic (dark area) (pictures: Antje Dürkefälden, Fabian Hampel).

conducted several dredge hauls and recovered a variety of rocks. Besides obvious dropstones, we sampled many slightly rounded volcanic rocks, which in contrast to the dropstones are "in situ", which means that they originate from this area. It is possible that they represent former beach cobbles and would thus support the assumption that the seamounts were once ocean islands. Interestingly, some of the rocks show very dark areas embedded in a bright groundmass. This can be explained by magma mixing, when evolved, so-called felsic, magma was mixed with primitive, so-called mafic, magma (see picture above).

After sampling of the Gnitsevich Seamounts, we returned to King's Trough, but this time to the southwest flank. We recovered volcanic and plutonic rock samples at the large Antialtair Seamount as well as on the steep flank of the trough.

The weather is still changeable and good days with relatively calm seas, where we can dredge without problems, are followed by stormy days with very rough seas so that we can only do mapping but sampling is impossible. Therefore, the work program has to be rescheduled frequently and adapted to the changing weather conditions. Fortunately, we are supported by a meteorologist and a weather technician from the National Meteorological Service (Deutscher Wetterdienst, DWD). Although the meteorologist cannot be directly on board as is the case on some other research cruises, she works closely with the weather technician here on board and provides us with a daily weather briefing. With this detailed weather forecast for our working area we are able to estimate much better whether wind and sea state will make it possible to take samples at the planned locations, since it is essential to be able to keep the ship stable on one position during dredging.

In the middle of the week it became clear that we would have to avoid a strong storm front developing in our working area. On Thursday night, we therefore canceled our planned dredge program at King's Trough and started a transit of nearly 400 nm towards the east-northeast to get out of the influence of the storm front as much as possible. Unfortunately, this means that we will not be able to return to our working area, as we then would not have enough time to start the return transit to Emden in time next week. Although this means that we will not have the opportunity to sample the southern Azores-Biscay Rise as originally planned, we are fortunate that we have instead reached the northernmost part of this ridge outside of our original working area. So we quickly worked out a short alternative program, and now we are mapping the seamounts in this area and will start dredging as soon as the weather conditions allow it.



Great atmosphere in the North Atlantic - but unfortunately, the sea is too rough to take samples (picture: Antje Dürkefälden).

All cruise participants are doing well and send their best greetings to everybody at home!

Antje Dürkefälden and the scientific party of M168
(GEOMAR Helmholtz Centre for Ocean Research Kiel)