

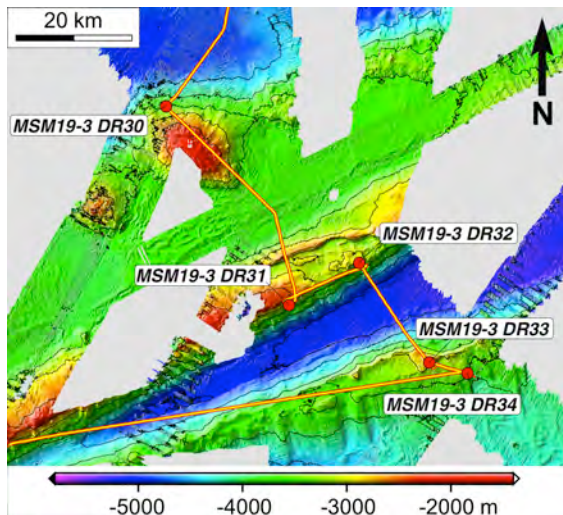


MSM19/3 AGULHAS

**Weekly Report No. 2
(08.12. – 14.12.2012)**



Our studies during the second week of MARIA S. MERIAN cruise MSM19/3 focused on sampling in the area of the Agulhas Ridge, which is formed by two prominent, parallel striking ridge structures. In-between these ridges narrow troughs are up to 6,000 m deep, whereas the abyssal plain north and the south of the Agulhas Ridge is situated in "only" 4,000 to 5,000 m water depth. The foremost feature of the ridges are their steep flanks towards the troughs and more gentle slopes facing away from the troughs. This morphology indicates that the ridges represent fractured and tilted ocean crust; a perfect setup to systematically sample the ocean crust in this area. Therefore we aimed to sample the steep flanks of the ridges in more or less regular intervals of approximately 100 km in order to identify temporal geochemical variations (i.e. with increasing distance from the Mid Atlantic Ridge). Overall we sampled 10 sites at the flanks. At eight of these sites the dredge hauls recovered volcanic rocks which mainly comprise fragments of aphyric pillow lava. Minor lithologies in the dredges were highly vesicular lavas, sedimentary rocks, and volcanoclastic rocks.



Map section of the Agulhas Ridge incl. dredge stations (bathymetry from MSM19/2, 3, and previous cruises).



The rock laboratory onboard MARIA S. MERIAN after a successful dredge haul.

Another feature of the Agulhas Ridge has been revealed by bathymetric mapping and geophysical studies conducted by the Alfred Wegener Institute for Polar and Marine Research (AWI) on the previous leg MSM19/2. Seamounts and small ridges are situated directly on the Agulhas Ridge and appear of volcanic origin. These structures may have formed after the formation of the Agulhas Falkland fracture zones and may be related to a reactivation of this fracture zone. To test this hypothesis, MSM19/3 aimed to sample some of these volcanoes. The dredge hauls at these structures yielded moderate to highly vesicular pillow and sheet lava fragments, which resemble the vesicular lavas dredged at the flanks of the Agulhas Ridges. Therefore the vesicular lavas of the flanks may also represent a younger (?) phase of volcanic activity.

Leg MSM19/2 and a previous AWI cruise also revealed, that the ocean floor to the north and the south of the Agulhas Ridge is characterized by a unusual rough morphology which clearly differs from normal deep sea plain. Among others, seismic profiles show that the magmatic basement frequently penetrates the sediments in this area and forms basement highs which rise up to c. 1,000 m above the ocean floor. That also points to a younger (Cenozoic?) phase of volcanic activity in the area of the Agulhas Ridge and therefore may

indicate reactivation of the fracture zone. To verify this observation, we made the attempt to sample some of the seamounts north of the ridge. Dredging at these features, however, proved to be a very difficult task most likely due to thick manganese crusts covering the magmatic rocks and most dredges returned empty or contained only manganese. Finally we managed to sample successfully one of the seamounts. This dredge haul yielded among dense, aphyric lavas also metamorphic rocks which suggest intense tectonic movements in this area.



A rock sample prepared for further analyses on land.



Pilot whales visiting MARIA S. MERIAN

After finishing our work at the Agulhas Ridge on December 12th, R/V MARIA S. MERIAN sailed to the northern end of the Meteor Rise, adjacent to the southwestern tip of the Agulhas Ridge. Bathymetric maps based on satellite altimetry ("predicted bathymetry") reveal some large, up to 3,000 m high seamounts in this area which are situated on a huge ridge-like structure. Our bathymetric mapping, however, showed, that these seamounts are large plateaus with steep flanks. Several dredge hauls at the flanks of these plateaus yielded again metamorphic rocks besides lavas, volcanoclastics, sediments and manganese. Furthermore the dredges contained a broad variety of plutonic, metamorphic, and sedimentary rocks which we consider as dropstones. Two varieties dominate among the *in situ* lavas: a vesicular, olivine-feldspar porphyritic lava and a dense, almost aphyric lava. In the early morning of December 14th, we finished our work at the Meteor Rise and R/V MARIA S. MERIAN headed 140 m in northern direction towards the final working area of leg MSM19/3, the Discovery Ridge.

Complementing mapping of the ocean floor and sediment echo sounding, a total of 43 dredges have been carried out during the first two weeks of cruise MSM19/3. Of these, 27 dredges recovered magmatic rocks (without dropstones), 20 Mn-Fe oxides, 34 soft sediments, and 15 biological material (macro fauna).

This week the weather was on our side for most of the time. Apart from two small deeps which caused wind up to 9 Beaufort and high swell for a short time, the sea was relatively calm and did not hinder our studies. At some days it was even possible to enjoy the sun on deck R/V MARIA S. MERIAN. We could frequently observe albatrosses and a particular highlight was the appearance of c. 15 pilot whales which followed the vessel for almost one hour.

All participants are doing well and send greetings to everyone at home.

For all cruise participants
Reinhard Werner