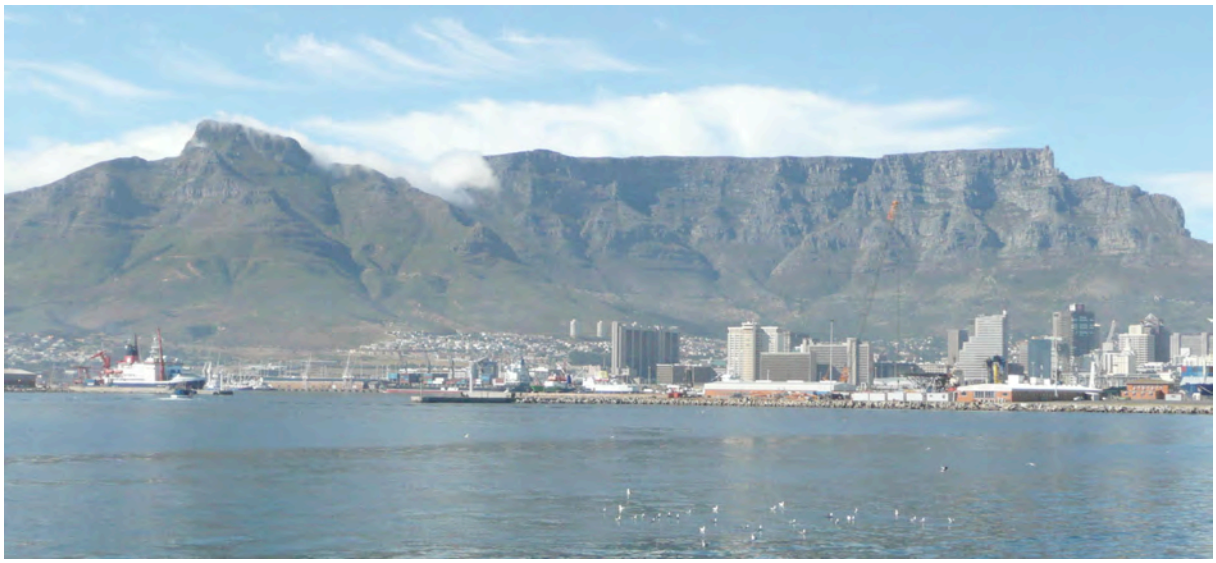
MSM19/3

AGULHAS

Weekly Report No. 1
(01.12. – 07.12.2012)

R/V MARIA S. MERIAN
42°21,7´ S / 11°21,7´ E

The starting point of the R/V MARIA S. MERIAN expedition MSM19/3 was the port of Cape Town in South Africa. By coincidence the German research icebreaker POLARSTERN called in Cape Town at the same time on its way from Bremerhaven (Germany) to Antarctica. Although it was a busy day in port, the MARIA S. MERIAN crew hosted a tour of the ship for crew members and scientists of POLARSTERN, which elicited great interest. On the morning of December 1st, the sixteen MSM19/3 scientists from Germany and Chile came on board. Originally it was planned to leave the port immediately after boarding of the scientists. Strong gusty winds from the Table Mountain, however, turned out to be a disadvantage of our scenic berth directly at the busy "Water Front", as these winds caused a closure of this part of the port due to its narrow entrance. Therefore, MARIA S. MERIAN could not leave the port before the next morning. From Cape Town we sailed southwest approximately 400 nautical miles (nm) to arrive at the northeastern tip of the Agulhas Ridge in the evening of December 3rd. Despite little time we managed to prepare all laboratories and devices punctually thanks to the excellent support from the MARIA S. MERIAN crew.

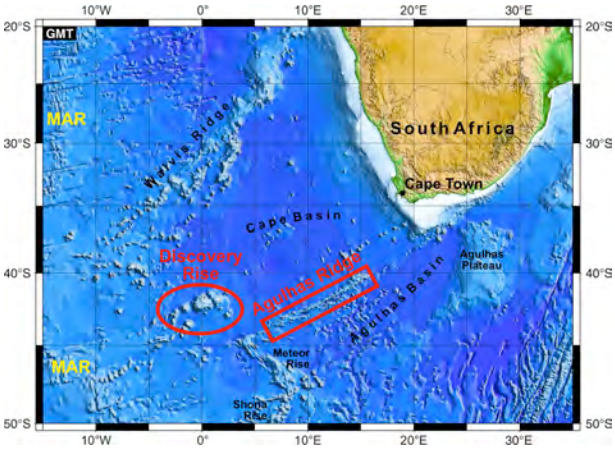


View on Cape Town, the table mountain, and R/V POLARSTERN (to the left) upon departure.

The c. 1,100 km long and more than 2,000 m high Agulhas Ridge is part of the Agulhas Falkland Fracture Zone, that initially formed during the Gondwana break-up in the early Cretaceous by the separation of South America and Africa. The Discovery Rise, located to the northwest of the Agulhas Ridge, extends over an area of c. 250 x 350 km and consists of several huge seamounts, which elevate up to > 4,000 m above the surrounding abyssal plain. Up till now too little is known about the ages and the geochemical composition of the magmatic rocks forming the Agulhas Ridge and the Discovery Rise to understand their nature and formation. Based on representative hard rock sampling of all geomorphological units of these features, MSM19/3 (and the subsequent laboratory studies on land) aims to reconstruct the age, origin, composition, and evolution of the Agulhas Ridge and the Discovery Rise. Combined with the results of the geophysical studies conducted by the Alfred Wegener Institute for Polar and Marine Research (AWI) on the previous leg MSM19/2, MSM19/3 aims to verify if the Agulhas Ridge has been tectonic-magmatically reactivated during the Cenozoic. Furthermore this approach may provide new constraints on the origin of the Dupal Anomaly in oceanic basalts of the southern hemisphere and of the enriched mantle components EM-I and EM-II as well as on the origin of intraplate volcanism („Great

Plume Debate“, http://www.mantleplumes.org/).

The northeastern tip of the Agulhas Ridge is formed by a huge plateau (Richardson Seamount) which extends over c. 180 x 80 km and elevates more than 2,000 m above the surrounding abyssal plain. Multibeam mapping carried out on leg MSM19/2 revealed abundant small volcanic cones on the eastern part of the plateau and on the seafloor directly south of Richardson Seamount. Most of these cones have a circular base up to 2 km in diameter and are up to 400 m high. We presume that they represent a late phase of volcanic activity in the area of the Agulhas Falkland Fracture Zone which may be related to a reactivation of the fracture zone. Sampling of Richardson Seamount and both cone fields, however, proved difficult due to thick manganese crusts and solidified sediments which cover the magmatic rocks. Moreover the magmatic basement often appeared heavily altered and probably reflects long-term interaction with sea water. Nevertheless we managed to get magmatic rocks from most sampled features. The dredge hauls conducted at the flanks of Richardson Seamount yielded mainly dense to slightly vesicular pillow fragments, whereas highly vesicular volcaniclastic rocks and lava fragments dominate at the small cones. The high vesicularity and strong fragmentation of the cone lavas could point to explosive volcanic activity during their formation.



The Agulhas Ridge and the Discovery Rise are the working areas of MSM19/3.

Dredge on deck...

On December 6th MARIA S. MERIAN arrived at the Agulhas Ridge itself. At noon we started with systematic sampling along the ridge which will take us approximately 600 nm further west within the upcoming week. Besides pillow lavas the first dredge hauls at the Agulhas Ridge yielded also metamorphic and pegmatitic rocks which may point to intense tectonic movements in this area.

Out of 18 dredges carried out during the first 4.5 working days of MSM19/3, 12 contained magmatic rocks, 8 Mn-Fe oxides, 11 soft sediments, and 7 biological material (macro fauna) for our biologists who study benthic animals found on the dredged rocks and the meiofauna in the sediment. Up till now they sampled among others 65 brachiopods of 5 species which largely have not been investigated genetically.

While occasionally the southern summer provided perfect conditions with nearly calm seas and sunny weather in the "roaring 40´s", on other days wind up to 8 Beaufort made the acclimatization more difficult for us. In general, however, the working conditions are good and our work on board MARIA S. MERIAN proceeds smooth so that we already could compensate almost half of the time lost in Cape Town.

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

For all cruise participants
Reinhard Werner