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Volcanoes and strom around Sandwich Island

After we left the northernmost submarine volcano area of the South Sandwich Island chain last Sunday evening we mapped an unknown ridge on the southbound journey with the ship's acoustic survey systems PARASOUND and HYDROSWEEP. To the east of the South Sandwich volcanic arc, this ridge comes up to 1000 m depth in the forearc basin. The near-surface structures indicate that this ridge might be an uplifted plate in a tectonic convergence, but its position and tectonic origin cannot be interpreted without a seismic survey. Our next target was the forearc basin of the northern South Sandwich Arc, the seafloor topography of which in the vicinity of Visokoi, Candlemas and Saunders Islands (Fig. 1) was explored during a detailed survey of the British Antarctic Survey 18 years ago. At that time the deep-towed HAWAII MR1 system was used to collect bathymetry and backscatter images of the seafloor. In preparation for this expedition we studied these data in detail and looked for locations which showed increased backscatter reflections on a relatively flat seafloor. Our experience from other regions indicated that such areas can be the locations where fluid or gas emissions strongly alter the physical properties of the seafloor. The most pronounced backscatter anomaly we identified is in the vicinity of Saunders Island in 3700m depth and we surveyed this area with OFOS (OFOS = Ocean Floor Observation System), our deep-sea camera system. Unfortunately, just after seeing the seafloor on the onboard screens we had to bring the OFOS back on deck, as a mechanical winch problem occurred. We then used the winch repair time for a planned further survey in the forearc basin. After 14 h of acoustic seafloor surveys OFOS was ready to go again and high quality colour HD images of the seafloor at 3700 m water depth were obtained for an hour. After these errors in the image transfer along the 6880 m of fibre-optic cable increased and consequently we had to abort the OFOS dive. Fortunately, OFOS's bottom time and the collected images were enough to characterize the nature of the different backscatter reflections of the seafloor and the main aim of the OFOS dive was achieved. With OFOS back on deck the trouble shooting team found that one fiber of the fiber-optic cable had a fault 40 m before the termination, and they then changed the OFOS data communication to the other fiber cable. While this work was being undertaken, the acoustic seafloor survey continued on a plateau-like area of the upper slope in 2000 m depth, which is mostly formed by igneous rocks from the active volcanoes of the South Sandwich Islands. We then decided to continue our southbound voyage with RV Polarstern to the southern part of the arc as our on-board meteorologists forecasted a storm with 9-10 Beaufort scale winds and wave heights of 6 m with higher wind speeds in the northern island arc. On Wednesday, 3 April we steamed to the South while continuously gathering PARASOUND and HYDROSWEEP data. Unfortunately, the forecast was correct and in the late evening we heaved-to in

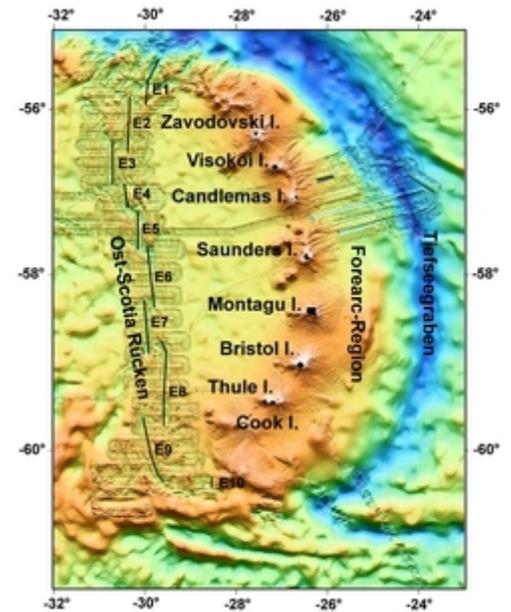


Fig. 1: South Sandwich Island volcanic chain, with the 8000 m deep South Sandwich Trench to the East and the East Scotia Ridge to the West.



Fig. 2: Iceberg watch at night using spotlights.



Fig. 3: Drifting iceberg with Chinstrap Penguins as passengers.

the sheltered side of Montagu Island as heavy gusts surrounded us. The shelter by the island offered protection from the storm and helped those affected by sea-sickness. Due to the high seas station work was impossible and even the multi-beam data were almost unusable. After sunrise on Thursday morning we saw how near the ship was to the coastline of Montagu Island, being only 2 nautical miles away, and this allowed us to see Mount Oceanite and a wide glacier front ending in sharp ice-edge at the sea (Fig. 6). After the wind speeds decreased slightly we decided later in the morning to continue the acoustic survey lines towards the south of the forearc basin.

That night we reached the southernmost position of our expedition at the latitude of 59° S and then turned to the East to continue the survey across the South Sandwich Trench onto the South American Plate. While the South Sandwich Trench is over 8000 m deep in its northern part, the southern sector is less deep - about 6000 m. Interestingly, our depth measurements showed that some areas of the trench are actually 500 m deeper than marked on the charts! So we have collected some important new hydrographic data.

From the trench we steamed further 30 nautical miles to the east for a comprehensive coring position where an earlier study found very pure biogenic opal and diatom ooze, which we wanted to study further. Our short mapping survey showed a very localized basin filled with nicely layered sediments. On Friday, 5 April we sampled the basin with the CTD and water sampler, multi corer, gravity corer and the 20 m-long piston corer; all of which performed admirably and kept the geologists and geochemists very busy. The piston corer collected a 18.5 m long sequence of very pure biogenic opal ooze, a lithology which is restricted to the areas south of the Polar Front. After travelling back to the southern forearc area we had a further sediment coring station between Bristol and Thule Islands, but recovered only a small amount (14 cm) of dark colored sediments covered with gravel of volcanic components.

This Sunday we were back at the latitude of Candlemas Island where we are currently surveying a very interesting phenomenon in 3800 m water depth. PARASOUND data show a plume structure that is raising 40 m above the seafloor, but is clearly distinct from the seafloor signal. This structure appears not to be a typical gas flare as these usually rise higher in the water column, so we are speculating wildly about its origin. The sampling on the way will hopefully allow us a more detailed interpretation.

We will report next week about this and much more. Everybody on board is well and happy.

Best wishes in the name of all crew and scientists
Gerhard Bohrmann

FS Polarstern Sunday, 7th April 2013

Further information on the expedition:

<http://www.nationalgeographic.de/polarstern>



Fig. 4: A Southern Right Whale that joined us one morning around the ship.



Fig. 5: During the storm on Wednesday, 3th April, entering the working deck was prohibited, for safety reasons. Occasionally large waves broke over the side and flooded the aft area of the ship.



Fig. 6: RV POLARSTERN sheltering in the lee of Montagu Island from storm force winds.