

**ANT-XXIX/4 - Weekly Report No. 4**

**08. – 16. April, 2013**

**Last measurements, lab cleaning, packing and preparations for Port Stanley**

This last expedition week was marked by station work in the area of the northern South Sandwich Islands as well as at South Georgia. Last week we found a suspected underwater cold spring system, which is expelling a permanent plume signal 45 m high from the seafloor, but, unfortunately, we were unable to investigate this with the scientific equipment we had on board, so its detailed exploration will have to wait for the future when we hope to return with other scientific equipment, including remotely operated vehicles (ROVs). Our recent Polarstern expedition was planned as an exploratory cruise to find dive targets for future investigation by ROV. This week we found more intriguing features on three submarine volcanoes (QUEST Caldera, Protector Shoal and one unnamed), where sea floor temperatures were raised locally by 2°C, and in one area to 3.5°C above the ambient temperature. These thermal anomalies are clear indicators for hydrothermal activity. Unfortunately, the fibre optic cable was unavailable for the dives at these volcanos so we had to use an older, back-up video-sled via the coax cable. Although the video images on the ship-board monitors were black and white and in poorer quality compared to OFOS, we were able to get an impression of the hydrothermal areas. These included some small chimneys formed of white minerals, surrounded by microbial mats, and confirm the presence, for the first time, of hydrothermal activity at the submarine volcanoes of the northern South Sandwich Arc. These are dive targets which we would like to investigate in a future expedition with our QUEST ROV. Then we will be able to investigate whether chemosynthetic organisms (vent microbes and animals) exist at these vents and also sample in detail the fluids and gasses.

Based on satellite data, the region north of the South Sandwich Islands is known to have an extremely high phytoplankton productivity. In light of this we used plankton nets to sample the radiolarian element of the phytoplankton for a study of the silicon isotopes in their opaline silica skeletons. We also took multicore samples from the sea floor, which will be used for in-vivo experiments on benthic foraminiferans.

On Wednesday, 10 April, we left the South Sandwich Islands and steamed westwards towards South Georgia, where we sampled sediments in one of the glacial shelf troughs using gravity and multi corers. Arriving in Cumberland Bay we started a CTD profile from the entrance of the bay to the centre of Cumberland Bay East and sampled sediment cores at the strongest gas flare site, which we named the „Cumberland Bay Flare“. In the bright sunshine early next morning we had the southernmost CTD station on the profile in front of the Nordenskjöld Glacier (Fig. 1). Then RV Polarstern steamed towards Jason Lagoon in Cumberland Bay West, where our terrestrial field party had already



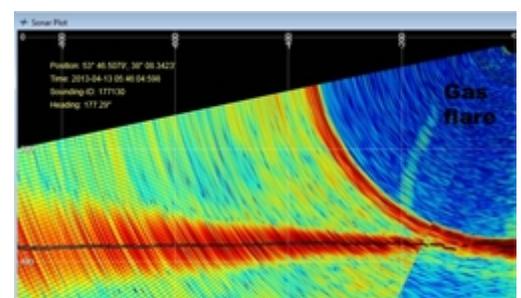
Fig. 1: CTD sampling in Cumberland Bay East.



Fig. 2: Polarstern mooring off King Edward Point during her visit to Grytviken.



Fig. 3: View of the old Grytviken whaling station.



packed their cargo on their sampling platform and sailed slowly towards us powered by an outboard engine. The pick-up by RV Polarstern of the team, counting 6 persons, ended their 15 days field work in the Jason Lagoon area. They had lots to tell us about: scientific work, life in the tents between Fur Seals and King Penguins, and of the impressive panorama of mountains and glaciers in the western Cumberland Bay, including the majestic Neumayer Glacier. After this interruption, the scientific sampling programme in Cumberland Bay continued until Friday morning 8 am (Fig. 2), and we were able to visit Grytviken, the former whaling station, and the British Antarctic Survey (BAS) station at King Edward Point (KEP) (Fig. 3). This trip gave scientists and crew the opportunity to visit the British research vessel RRS James Clarke Ross and to talk about science and technical subjects with British colleagues.

In the meantime we gained a pretty good understanding of the distribution of the young sediments and gas flares in Cumberland Bay, through multiple Parasound and Hydrosweep profiles, and we used this information to target the last samples. Based on the presence of gas flares (Figs. 4 and 5) we expected sediments with high methane concentrations, which were confirmed by our ship-based GC-measurements. Whether this gas has a microbially generated biogenic origin, or possibly a thermogenic origin will be tested in the labs at home based on isotopic analysis of carbon and hydrogen molecules of the methane. The composition of the gas fractions indicates a biogenic gas origin, probably in the uppermost layers of the marine sediments. In the night of Saturday 13 to Sunday 14 April we left South Georgia westwards with the knowledge that we had collected a great deal of data and samples for later analyses in the home institutes.

Today is Sunday 14 April and we are on our westerly transit back to port. We want to take one last piston core on the Falkland Plateau, 8 hours before we arrive in Port Stanley. A previous sediment core from the target position was 7 m long and documented the last 70,000 years of time. Analysis of this core showed how the Sub-Antarctic Front changed between cold and warm phases during this period of time. In collaboration with our colleagues from BAS, we want to core deeper into the sediment using a 20 m long piston corer, in order to investigate the oceanographic properties of this region even further back in time. Although this station work is still ahead of us, the expedition is now winding down. Today we have to finish lab analyses, so that we can pack tomorrow (Monday) and clean the labs. With that, a short, but very successful, cruise comes to an end. Over 26 days we measured many parameters, discovered and sampled new things, and gained new ideas, all of which we will publish in future scientific publications and present in lectures. The success of our scientific work is based on the excellent and welcoming support of the RV Polarstern crew, the Laeisz Company and the AWI logistics group. Therefore, we thank Capitan Schwarze and his entire crew with full heart.

On Tuesday, 16 April, we will leave the ship in Port Stanley and on Saturday we will take the weekly plane via Punta Arenas, Santiago and Madrid to come back to Germany. Everybody on board is well and happy (Fig. 6).

Best wishes for a last time in the name of all crew and scientists  
 Gerhard Bohrmann  
 FS Polarstern, Sunday, 14th April 2013

Further information on the expedition:  
<http://www.nationalgeographic.de/polarstern>

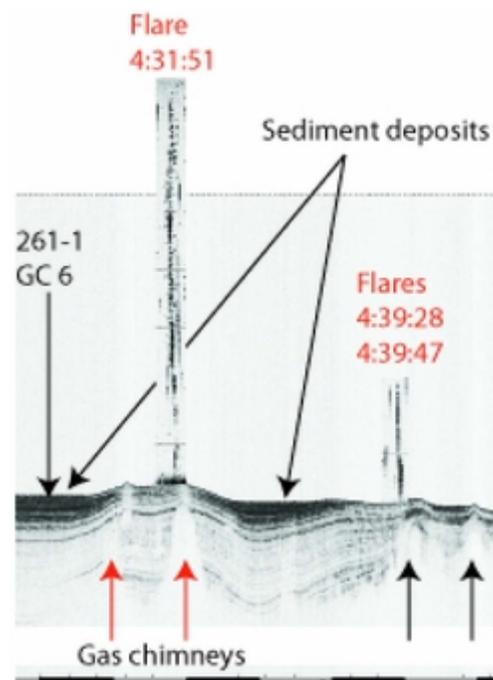


Fig.5: Combination of sediment- and water column display of gas flares in Cumberland Bay provided by Parasound.



Fig.6: Science party of the 4th leg of the 29th Antarctic expedition of the RV Polarstern.