Research vessel METEOR

M134:
Port Stanley – Punta Arenas
Third weekly report: 30 Jan – 05 Feb. 2017

The exciting discovery of methane hydrates on the shelf of sub-Antarctic South Georgia on Sunday kept us very busy using all available equipment to document and quantify the solid hydrate connection of methane and water. Changes in the salinity concentration in the sediment cores, which were precisely measured by determining the chloride content, are direct responses to hydrate formation or dissolution. Similar to the formation of sea ice, hydrate formation enriches the sediments with salt. The measured chloride contents, elevated up to 45 mmol against seawater, are a good indicator for hydrate enrichment in the sediment. Methane hydrate dissolution happens during the corer extrusion and during the later work in the laboratory, methane evaporates and the hydrate water dilutes the pore water. It is this dilution that we measure via the chloride content of the pore water and can use for a quantification of methane hydrates. An alternative method to verify these pore water measurements is the quantification of methane with the autoclaved gravity corer DAPC (Fig. 1). The DAPC collects a sediment core and seals and stores it gas-tight with the *in-situ* pressure of the seafloor. Methane is unable to evaporate during recovery of the equipment in the water column and is released on deck via a quantitative pressure valve. Despite the total volume of the DAPC being only 15 l, more than 50 l of methane were released during the dissolution of the gas hydrates, which is indicative of a methane concentration of about 10%. As this concentration is in line with the estimates based on the chloride measurements, we will be able to contribute excellent new analyses from the South Georgian Church Trough to the world map of gas hydrate distribution.

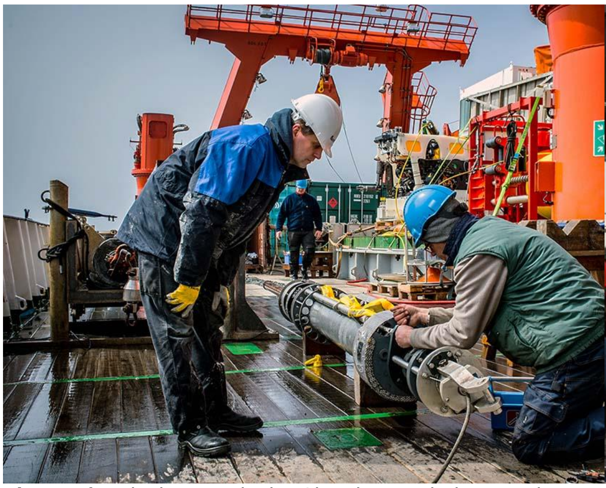

Fig. 1: After deployment in the Church Trough the autoclave gravity core DAPC is checked for sealage on deck of RV METEOR.

Fig 2: Close to glacier sampling with the water rosette. The calving Nordenskjöld glacier in the background is feed by several mountain glaciers.

On Monday, 30 January, we finished the station work in the Church Trough with further deployments of gravity core, multicore, CTD and bottom water samples. On Monday night several shelf troughs were mapped by cross profiling in an eastward direction until on Tuesday morning arriving in a selected area of the Royal Trough, where sediment cores sampling was planned. Only a few miles before reaching the coring location however, we discovered an iceberg was slowly drifting on to our core location, blocking our way. We decided therefore to start the survey mapping of the Royal Bay, the landwards end of the Royal Trough, that we had planned for the early evening. When reaching the entrance of the bay we had to stop for a short while as very strong winds came down the Ross

Glacier into the bay. Gusts of 11 Beaufort was too strong for us and therefore METEOR turned back to the gravity core location, which was now freed from the eastward drifting iceberg. Two gravity cores for microbiology and biochemistry, a CTD station, followed by a fine-scale mapping survey finished the day. The mapping of the seafloor overnight turned out to be difficult as we had to reduce the vessels speed to help retain the quality of data collected by the multibeam system in wind conditions of 9-10 Beaufort. As a result of the bad weather in the night we had a delayed arrival at Cumberland Bay delayed on Wednesday 1 February. On entering into Cumberland Bay East, progress was slowed by several icebergs and growlers, and the weather changed rapidly. Wind- and wave actions decreased remarkably and the clouds moved away in favour of blue sky. Multiple water sampling (Fig. 2) and sediment core collections as well as an ROV dive followed. At around 19:00 we had to abort the dive due to rising sea fog and an increasing row of growlers blocking the entrance to Cumberland Bay.

Following the over-night mapping of the Cumberland Trough to the shelf edge and back, Thursday, 2 February, was perfect for land-based sampling with beautiful sunny weather conditions. In order to follow the iron intake into the ocean, which leads to phytoplankton blooms in the nutrient-rich waters of South Georgia, we took ground water spring samples and melt water samples in King Edward Cove. In parallel all scientists and crew had the possibility to visit the former whaling station at Grytviken which had been in used from 1904-1964. Grytviken, known as the staring point of several famous Antarctic expeditions, with its fur seals, elephant seals, penguins and seabirds as well as with its building remaining from the whaling industry past, was a big event for most of us. The museum and post office were open and the friendly chats with the few inhabitants in glowing sunshine were the perfect disruption to the daily work at sea.

Fig. 3: Northward view over the moulting elephant seals at Susa Point showing RV METEOR at her anchorage in Cumberland Bay East bewteen Thatcher and Barff Peninsula.

Fig. 4: A plaque in the libary of Grytviken church in memory of the visits of the 1st METEOR in 1926 and of the 2nd METEOR in 1981. It took 36 years for the 3rd METEOR to visit Grytviken.

The brilliant weather was also used on Friday, 3 February, for the final sampling of Cumberland Bay, and a dive with ROV SQUID at the Grytviken gas flare brought us satisfactory sediment, gas and water samples of the cold seep on the seafloor. We used the next night and Saturday for seafloor mapping surveys which brought us first to the east and later to the south of the island. Here the sun is also shining and a calm sea gives favourably conditions for our research tasks.

Best wishes on behalf of everyone on board,

Gerhard Bohrmann FS METEOR Sunday, 5 February 2017