

ANT XXIII/4 Weekly Report No. 4 (to the Amundsen Sea, West Antarctica)
6 March - 12 March 2006

This week again has been full of events so that this weekly letter is prepared with a small delay. The week started with a detailed swath-bathymetric survey of the glacial troughs off the central Getz ice-shelf. As a surprise, the survey revealed extremely deep erosional features reaching down to 1600 m below sea-level. According to our information, this may be the deepest glacial trough ever recorded so far from the inner continental shelves of Antarctica. These great water depths, which are also observed to about 1300 m in other troughs in front of West Antarctic ice-shelves, are probably the result of the lower land-surface of West Antarctica (without the ice-sheet) compared to that of East Antarctica. During glacial times, the surface was even deeper due to the larger ice-sheet load. The mighty glaciers carved these troughs in the same way as they formed, for instance, the Norwegian fjords. The question is, however, why these troughs are hardly filled with sediments or rock material transported from glaciers? Strong bottom-water currents might be a reason. Our marine geologists identified small sediment fills at some locations of these troughs with a sub-bottom profiler which can penetrate down to 200 m beneath the sea-floor. Using a gravity corer, they took sediment samples. This device has a heavy weight on top of a pipe which is pressed into the sea-floor and returns with a sediment core.

As one of our research aims in this region is to determine how far the ice-sheet of Antarctica advanced and retreated during the alternating glacial and inter-glacial times, we crossed the continental shelf of the Amundsen Sea with seismic survey lines. This is an international project in which data of this expedition and that of the previous cruise of the HRS James C. Ross are combined. Every 12 seconds, seismic sources, called airguns, generate seismic pulses which travel into the earth and are reflected from geological formations under the sea-floor. The reflected signals are recorded with a towed hydrophone cable and are processed resulting in a section across the sedimentary layers and the kilometre deep rock basement beneath. The seismic sections across the sediments show, for instance, where the ice-sheet eroded and transported sediments. Seismic images of the basement tell us about the development of geological structure of the deeper continental shelf which may reveal transport paths of former ice-streams. Studies of the tectonic history and the structure of the earth's crust in this region are, therefore, also aims of this expedition. Nine ocean-bottom seismometers were deployed at the sea-floor along a 200 km long line last week. In this experiment, airguns are also used to generate seismic signals which travel down to 20-30 km deep through the earth's crust and uppermost earth's mantle. The seismometers record these signals and provide data to be analysed for the architecture and thickness of the earth's crust. After completion of the profile, we recovered the seismometers which is always a nervous undertaking, because every one of these expensive instruments must be released from its anchor via a short acoustic pulse in order to float to the surface. The geophysicists watched the

nearby ice-floes and were quite relieved and happy when the last seismic event came on board.

Saturday was the day of decision! Will we reach eastern Pine Island Bay? Early in the morning, the captain and chief-scientist boarded a helicopter to undertake a reconnaissance flight during perfect weather in order to check out the possibility for Polarstern to break through in eastward direction. The satellite images of the last days appeared promising and kept their promise! A passage is possible. Days of southeasterly winds opened a polynya. But before we could leave, we needed to recover the GPS instruments from Mt. Murphy and other locations in the coastal zone and on ice-shelves, because we do not plan to return to this part of the Amundsen Sea embayment. The geologists took the opportunity to join the helicopter flight and collected more basement, volcanic and surface exposure samples. At the end of this day's flight program, an important part of our expedition program is completed, and we are ready to start a new chapter. It is a tradition to celebrate mid-term with a Bergfest. The ship's crew installed barbecues on the sun-drenched working deck, and the cook and his team were exceptional again with preparing BBQ delicatesses and side-dishes. While the party on deck E continued into the late night, Polarstern made its way along the polynya between a large ice-shelf tongue and gigantic icebergs into the eastern Pine Island Bay. On Sunday morning we reached the bay and our main destination of this expedition. Next week, you will hear more of our work in this rarely visited but scientifically extremely exciting bay.

All expeditioners are well and send their regards.

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(Chief Scientist)