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At the beginning of the week we completed the first of our four planned meridional sections running between 60 and 70 °S. The sections are made up of hydrographic stations with a regular spacing of 30 nautical miles. At each of these stations we carry out a multiplicity of physical, chemical and biological sampling.

On approach to the station the RMT net (Rectangular Midwater Trawl), which was mentioned in the first Weekly Report, is towed for about 45 minutes. The purpose of these trawls is now not to catch deep-sea plankton, but instead zooplankton from the upper 200 metres of the water. Indeed the RMT actually consists of two nets, one with an opening of eight square metres and a mesh size of 4.5 mm and a smaller net with an opening of one square metre and a mesh size of 0.33 mm. While the net with larger mesh size only catches larger creatures, the smaller one can catch krill larvae and smaller zooplankton. In practice the smaller net rarely captures larger creatures, as they are sufficiently mobile to get out of its way; they have less chance of escaping the larger net. If the RMT catch contains krill then the net is redeployed for a second trawl for a shorter time at shallower depth to enable live creatures to be brought aboard.

Another instrument which is used at every station and lowered in some cases to the sea floor – so far during our cruise as much as 5400 m depth – is the so-called CTD (Conductivity, Temperature, Depth Sonde). The CTD is lowered on a conducting-core cable which allows the transmission of data on board in real time. The measurements from the CTD allow the state variables temperature, salinity and density to be determined. From differences in the vertical distribution of density between the stations it is possible to calculate the current flowing between them at right angles to the section. Attached to the CTD there is also an oxygen sensor and a transmissometer; this latter device measures the clarity of the water. This enables the concentration of phytoplankton to be determined, usually represented as either chlorophyll concentration or the concentration of POC (Particulate Organic Carbon).

The CTD is mounted in a cylindrical frame which supports 24 water bottles each of 12-litre capacity. These bottles can be closed at any chosen depth by a signal sent from the deck unit. From the water samples taken a whole series of constituents will be determined, some on board, some back in the laboratory at the home institutions of the participating scientists. These include dissolved oxygen, dissolved nutrients, particulate organic carbon, nitrogen and phosphor, and also chlorophyll and salinity. These point measurements will also, where appropriate, be used to calibrate instruments attached to the CTD.

At every other station a multinet (MN) is used for vertical hauls. The multinet only has an opening of one quarter of a square metre but consists of five separate nets which can be opened and closed remotely at chosen depths. The catches from the multinet are primarily used to compare with the zooplankton echosounder's vertical profiles of the intensity of acoustic scattering and ultimately for their conversion to a species-dependent zooplankton concentration.

Every second day another net with the name of WP-2 is lowered to a depth of 100 m and hauled back to the surface. The WP-2 has at its end a particularly large plexiglass vessel, so that very sensitive creatures, such as arrow worms, can be caught without injury and kept for experiments.

In addition other net hauls are made to catch living organisms which serve as fodder for creatures already being kept on board. Since all net deployments are sensitive to the wind and are varyingly suited to use in ice conditions deviations from the scheme described above are sometimes necessary.

The early Antarctic summer is making itself apparent by a rapid disappearance of the sea ice. Satellite images show that the area of ice-free water has expanded from about 150 000 square km at the beginning of December to about 630 000 by this time; this corresponds to an area the size of the North Sea. This year, as in almost every Antarctic spring, the opening in the sea ice began over Maud Rise. Staring from there it spread, and is still spreading, in all directions. Like a mountain on the sea floor Maud Rise reaches from the over 4000 m deep abyssal plain surrounding it to within 1500 m of the surface.

To gain further insight into the mechanism generating the Polynya over Maud Rise we placed our most eastern section along the 3°E meridian, which almost exactly cuts across the top of the Rise. Our CTD data confirm that there is a broad influx of relatively warm water here. With a temperature of up to 0.9 °C it is more than 2.5 °C above the freezing point of seawater at the salinity of the water present. The core of this so-called Warm Deep Water lies at about 200 m depth, which is relatively shallow, but it is separated from the surface layer by a stable thermocline, a layer with strong vertical temperature and density gradients. Directly over Maud Rise, however, this thermocline is weaker. The temperature in the surface layer is slightly higher and reduced in the layer below. Apparently in the region of Maud Rise vertical mixing is stronger and the Deep Water can surrender its warmth to the surface layer. Which of the various possible mixing processes is responsible for this has not yet finally been determined. The influence of the circulation of water masses and mixing on the sea ice cover had consequences on the stocks of Antarctic krill, as the krill populations seem to be linked to the presence of sea ice during the winter months.

Having completed our section along 3°E from south to north we are now working along the Greenwich Meridian from north to south. Along this section we are recovering moored instruments deployed by colleagues from the Alfred Wegener Institute in February of this year. They are being replaced by new instruments or by those recovered once their internally recorded data have been downloaded and they have had new batteries installed for a further two-year deployment. Thus we hope to complement the spatial survey which we are carrying out at present with time series at the mooring positions covering a total period of three years. The moored instruments include mechanical current meters, temperature and salinity recorders, ice echosounders and, especially for our krill studies, acoustically calibrated ADCPs which record not only profiles of the current but also the vertical distribution of acoustic backscatter. From these data, as from the zoo-plankton echosounder data, the vertical distribution of zooplankton can be estimated, though less specifically, as the instrument only works with one frequency. The moored instruments are connected together by a line. At various depths buoyancy elements hold the mooring upright in the water. At the top at a depth of about 140 m is the upward pointing ice echosounder. At the bottom the mooring line is connected by a release to a heavy anchor weight. To recover the mooring a coded acoustic signal is transmitted to the release which then breaks the connection to the anchor weight so that the buoyancy elements together with the instruments rise to the surface.

After we reached the first mooring position we began to search the vicinity of the ship for whales supported by two professional whale observers from the International Whaling Commission (IWC) here on board. After more than an hour without any sign of whales we activated the release located in over 4500 m via the ship’s hydrophone array. Just at the moment that we wanted to transmit the release signal there appeared next to the ship an approximately 9-metre long mink whale. We immediately stopped transmitting acoustic signals. As after almost an hour the whale was still near the ship we withdrew from the mooring position to make other measurements. Then the whale disappeared, so we steamed slowly back to the mooring. On approaching the mooring we transmitted the release signal from a range of about one nautical mile as no whale had been seen for half an hour. About ten minutes later – the first buoyancy elements of the mooring had already appeared at the surface – we saw the whale again directly at the mooring position. As the evaluation of the photos made by the observers showed it was clearly the same individual as we had seen earlier at the mooring position. Apparently the whale was more interested in the mooring with its yellow and orange buoyancy elements than the ship. For about another hour even after we had begun to take the mooring on board the whale stayed close by. Then it disappeared. He had presumably seen enough. The appearance of the whale had cost us two valuable hours of ship time but presented us with a natural spectacle not met every day. Since then we have recovered and redeployed the second mooring; this time without being visited by whales.

The atmosphere on board remains good. All are well, but the heavy workload means that they are not all too cheerful.

On behalf of all the cruise participants I should like to wish the readers of the Weekly Report a peaceful and happy Christmas, Volker Strass