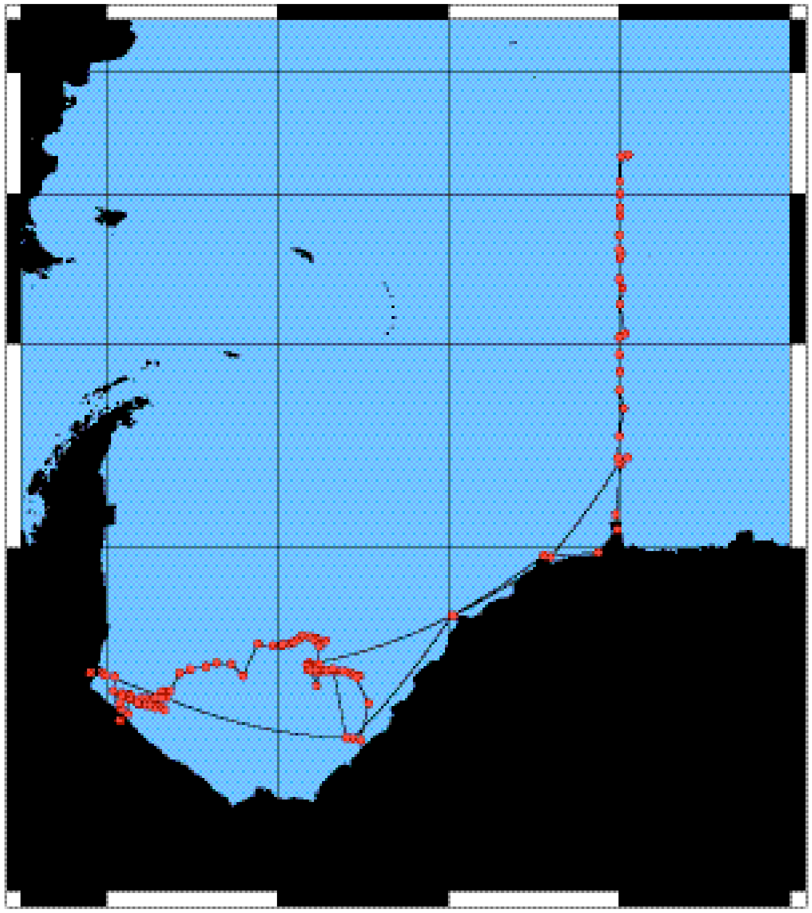
A. CRUISE REPORT: A12

(Updated JUL 2008)



A.1. HIGHLIGHTS

Cruise Summary Information

WOCE section designation	**A12**
Expedition designation (EXPOCODE)	**06AQ199901_2**
Chief Scientist & affiliation	**Dr. Eberhard Fahrbach/AWI***
Dates	1999 JAN 09 - 1999 MAR 16
Ship	*R/V Polarstern*
Ports of call	Cape Town
Number of stations	133
Geographic boundaries of the stations	46º 9.41'S 61°08.89'W 01°00.55'E 76°43.02'S
Floats and drifters deployed	10 Floats, 00 Drifters
Moorings deployed or recovered	07 Deployed, 07 recovered

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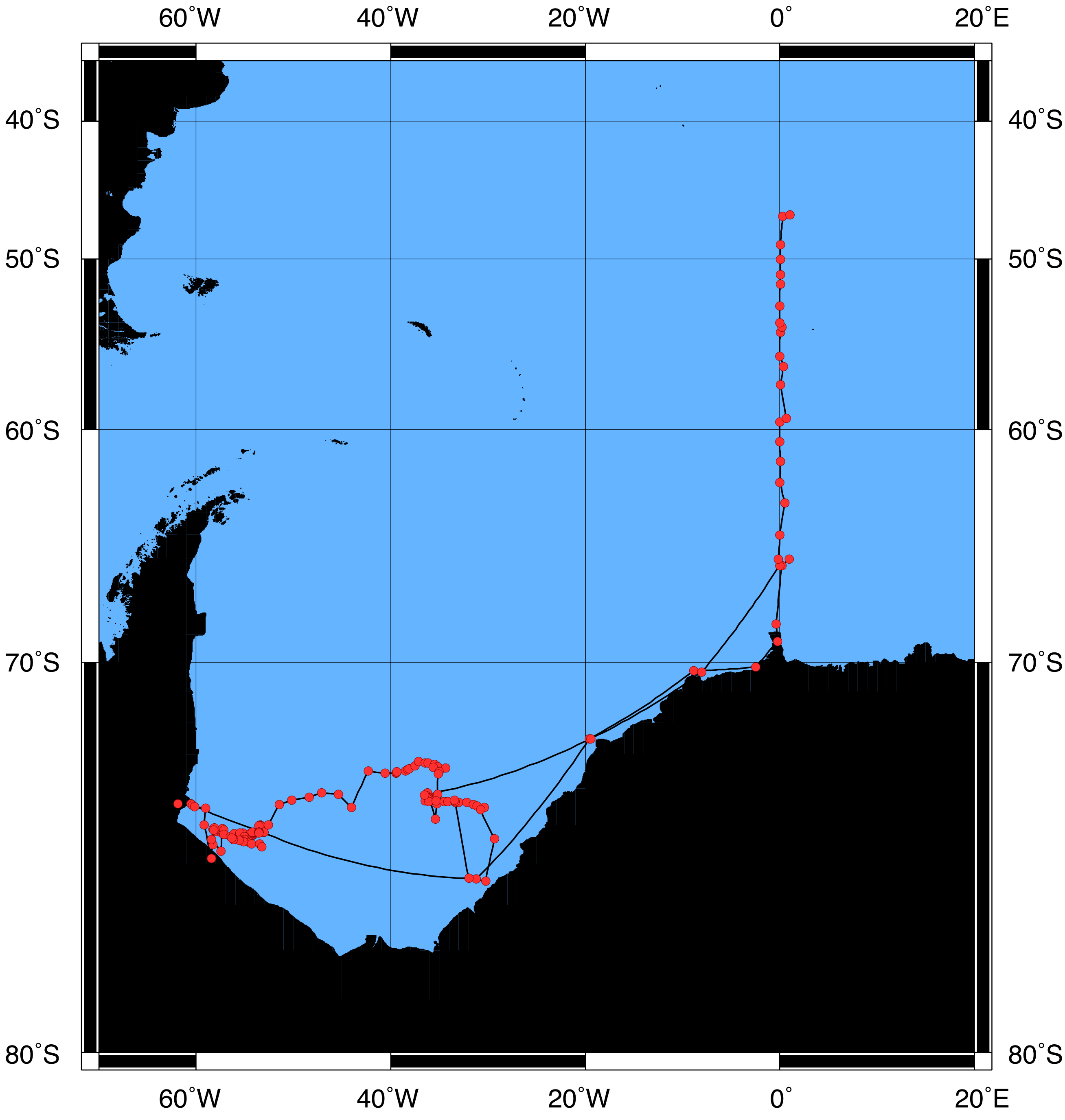
CRUISE AND DATA INFORMATION

Links to text locations. Shaded sections are not relevant to this cruise or were not available when this report was compiled

Cruise Summary Information	**Hydrographic Measurements**
Description of Scientific Program	**CTD Data:**
Geographic Boundaries	Acquisition
Cruise Track (Figure): PI CCHDO	Processing
Description of Stations	Calibration
Description of Parameters Sampled	Salinities **Temperature** **Pressure**
Bottle Depth Distributions (Figure)	Oxygens
Floats and Drifters Deployed	**Bottle Data**
Moorings Deployed or Recovered	Oxygen
	Nutrients
Principal Investigators	Carbon System Parameters
Cruise Participants	Helium / Tritium
	Radiocarbon
Problems and Goals Not Achieved	
Other Incidents of Note	
Underway Data Information	**References**
Navigation Bathymetry	
Acoustic Doppler Current Profiler (ADCP)	
Thermosalinograph	
XBT and/or XCTD	
Meteorological Observations	**Acknowledgments**
Atmospheric Chemistry Data	
Data Processing Notes	

Station Locations • A12_1999 • Fahrbach • *R/V Polarstern*



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1 LEG ANT XVI/1 Bremerhaven-Cape Town (15 December 1998 – 6 January 1999)

1.1 SUMMARY AND ITINERARY

S. El Naggar (AWI)

POLARSTERN left Bremerhaven on 15 December 1998 at 21:00 after two months in the shipyard Lloyd-Werft. The leg ANT XVI/1 had two parts: from Bremerhaven to Las Palmas (15 December 1998 – 23 December 1998) and from Las Palmas to Cape Town (23 December 1998 – 6 January 1999). During the first part the new installations on POLARSTERN, implemented by the Lloyd-Werft from 15 October 1998 – 15 December 1998, were tested and certified and the operation of the French ROV VICTOR 6000 (**r**emotely **o**perated **v**ehicle) from POLARSTERN was prepared. Atmospheric chemistry investigations were carried out between Bremerhaven and Cape Town.

1.2 TESTING OF THE NEW INSTALLATIONS

1.2.1 Work in the context of the midlife conversion

N. Compagnot, S. El Naggar, G. Guermeur, W. Manthei, U. Neuhäuser, M. Nokin, F. Parthiot, J.-P. Peyronnet, F. Rybicki, B. Sablotny, E. Wagner (AWI, GENAVIR, IFREMER, LAEISZ, TM, UHH)

During the first part of the cruise from Bremerhaven to Las Palmas, all new installations and reconstructions made in the Lloyd-Werft, Bremerhaven, were tested under operational conditions and certified.

The conversion of POLARSTERN focussed on:

1. Installation of a new crane on the ship's foredeck with a maximum load capacity of 25 tons. The jib's maximum length is 28 m. The deployment of the new crane will significantly simplify the supply of the Neumayer Station and the support of land expeditions.
2. Rebuilding of the ship's foredeck to take up 10 additional laboratory containers.
3. Installation of a panel covering the aft trawl ramp to hinder waves reaching the working deck and to ease the deployment and recovery of large ROVs.
4. Rebuilding of the lower part of the moon pool to enable and secure the operation of the new underwater navigation system.
5. Modernization of the weather station and installation of a new data acquisition system.
6. Installation of two INMARSAT-B units (digital system) used for satellite communication (telephone, fax and data 64 kbits).
7. Installation of an underwater navigation system (Ultra Short Base Line) used to localize and communicate with ROVs.

8. Installation of two UPS units to ensure a stabilized and buffered power supply (220 V AC, 120 kVA/unit, 10 minutes) in all laboratories and computer rooms.
9. Installation of two laser-ring platforms (MINS) to determine roll, pitch and heading of the ship. The system provides digital as well as analogous data for the ship's navigation and for scientific use.

Among others, the data communication with a newly installed INMARSAT-B system and the new data acquisition system of the weather station on board were tested under operational conditions. Data communication to AWI is now operating with a data transfer rate of 6 kbyte/s. The digital system is now working properly and satisfactoriely. The SUN workstation based data acquisition system of the weather station has replaced the old one and is running well under operational conditions. It provides data to all users. Some software modules will be modified after the cruise.
The ultrafiltration plant was tested and certified. POLARSTERN has now a complete water treatment system. The modifications necessary for the deployment of a ROV in summer 1999 during ARK XV/1 were tested and experiments concerning the dynamical behaviour of the ship were carried out.

1.2.2 The Underwater Navigation System POSIDONIA 6000

S. El Naggar, G. Guermeur, J.P. Peyronnet, F. Rybicki, und B. Sablotny (AWI, IFREMER, TM)

The underwater navigation system POSIDONIA 6000, **U**ltra **S**hort **B**ase **L**ine (UBSL), from Thomson Marconi Sonar was installed for the first time on board and tested in water depth of 5,000 m. Transponders were deployed to test the functionality, reproducibility, and accuracy of the system. Since the acoustic array was installed within the moon pool, the accuracy and reproducibility of the positioning of the new instrument platform in the moon pool were examined. Measurements of ships noise were made using a spectrum analyser and the POSIDONIA acoustic array as receiver under different dynamical and operational conditions of the ship. The test of the complete system was carried out from 19 to 20 December 1998 at 42°15.7' N, 12°43.7' W in a water depth of 5,150 m. The test results are summarized below:

1. Noise measurements: The noise spectrum shows two significant maxima of approximately same intensity. The first one is between 3 and 4 kHz with a half bandwidth of 3 kHz. The second one is at 16 kHz and with a half bandwidth of 8 kHz. The noise intensity is on average about 30 times higher than comparable ships of the same category.
2. Accuracy: The transponder position was determined within ± 50 m in 5,000 m water depth. 5% of the positioning data were erroneous.
3. Range: The horizontal detection range of the transponder was determined to 7,000 m in 5,000 m water depth. The range limit was defined by 30% positioning errors.
4. Reproducibility: Due to the missing software and a defect in the second transponder the reproducibility could not be determined.
5. System acceptance: The system was accepted for board installation and will be used for the ROV operation of VICTOR 6000 on ARK XV/1, July 1999.

1.3 ATMOSPHERIC CHEMISTRY

1.3.1 Sampling in the air and surface water of the North- and South Atlantic Ocean for the determination of organohalogen compounds and alkyl nitrates

R. Fischer, R. Looser and B. Mittermaier (UUI)

Within the scope of the work of the Department of Analytical and Environmental Chemistry of the University of Ulm (Germany) on global environmental chemistry including the atmospheric chemistry of organic compounds, we took samples in the lower troposphere and in the surface water of the Atlantic Ocean.

Persistent substances of environmental concern occur not only in the areas of production and application, but are widespread over the entire globe. The understanding of the processes of transport, distribution and reactions, of these compounds in the environment which influence their global distribution is of special importance. The determination of the contents of man-made chemicals (xenobiotics) and further indicator molecules in representative areas of the environment as a function of place and time and the interpretation of the results with consideration of the geophysical processes such as air and water currents, allow general conclusions on the global distribution behaviour of xenobiotics.

The north-south-north transfers of POLARSTERN offer unique sampling possibilities for the characterization of the differences between both hemispheres. The results are indispensable to explain sources and sinks of organic trace compounds. The exchange of substances between atmosphere and water surface is of special interest.

During ANT XVI/1 large volume air samples (250–750 m^3), small volume air samples (up to 100 l) and small volume water samples (20 ml) were taken. These will be examined at the University of Ulm for organohalogen compounds (halogenated benzenes, anisoles, benzonitriles and benzaldehydes, halogenated C_1 and C_2-compounds) as well as short- and long-chain mono alkyl nitrates and multi-functional alkyl nitrates.

1.3.2 North/south profile of semi-volatile halogen hydrocarbons

B. Mittermaier (UUI)

Results of previous expeditions of POLARSTERN concerning the global distribution of halogenated methylphenylethers (anisoles), which are partially biogenic, are to be completed by halogenated benzonitriles and benzaldehydes. A special target of this cruise was to use a custom-synthesized carbon-covered titania as sorbent and to compare it in parallel sampling with the conventional adsorbent silica under the special conditions of the tropical regions.

Air sampling was performed by large-volume samplers. By means of a turbine, air with a flow rate of approx. 30 m^3/h is sucked through a sampling layer and a break-through layer of an adsorption material, separated by a filter from each other. The duration of the individual samplings ranged between 8 and 24 hours with collected volumes between 250 and 750 m^3. 43 large-volume samples were taken, mostly two samples in parallel.

Due to its character of an extreme trace analysis of organic compounds, particular attention was paid to contamination-free sampling points aboard. Sampling normally took place on the uppermost deck; in some cases parallel on the uppermost deck and on the helicopter deck in order to determine influences from the ship. The blank of both adsorption materials was also investigated. No samples were taken during the stations, at the working hours of the incineration plant of the ship and while the deck was painted.

In the laboratories of the University of Ulm the adsorption materials are first solvent-extracted in order to solve the adsorbed analytes. After several clean-up and group separation steps the qualitative and quantitative gas chromatographic analysis is performed by HRGC-ECD and HRGC-MSD.

1.3.3 Global distribution of alkyl nitrates in the marine boundary layer of the Atlantic Ocean

R. Fischer (UUI)

Organic nitrates as complex mixtures of homologues and isomers are important reactive atmospheric trace substances. The main source of organic nitrates in the atmosphere is the conversion of hydrocarbons in a reaction chain involving $OH/H_2O/O_2/NO$. Both the repetitions of these side reactions and the reaction of alkenes with OH or NO_3 result in formation of keto alkyl nitrates or alkyl dinitrates. Photolysis of ketones and aldehydes leads to alkyl radicals that may also react to alkyl nitrates. Alkyl nitrates are part of the NO_y pool with a contribution of up to 15 %. Their lifetime is in the range of several days to weeks, so long-range transport from highly polluted areas to remote areas is possible. In regions with very low NO concentration, like marine troposphere, no significant new alkyl nitrate formation is expected. Otherwise degradation of alkyl nitrates by photo dissociation or by OH radicals leads to formation of NO_x. Therefore alkyl nitrates can influence the ozone formation in unpolluted regions, particularly in the marine boundary layer or during the arctic springtime by release of NO_x.

The large scale distribution of alkyl nitrates is measured and the results were compared with those of earlier field studies (Albatross campaign 1996). Therefore 51 air samples were collected. 31 with volumes between 20 and 100 l and 16 air samples with volumes of 1 to 2 l. All samples were collected from a platform or railing at the bow or at the uppermost deck of POLARSTERN. The air samples were enriched on Tenax TA. Two tubes (connected in series) were used to control the sampling efficiency. After sampling the tubes remained in flame sealed glass ampoules and were kept refrigerated until analysis. The tubes were desorbed thermally, trapped prior to injection at –170°C and separated by high resolution gas chromatography. The meridional distribution of alkyl nitrates will give us information on possible sources and sinks in the troposphere. We continue the discussion of earlier results obtained on POLARSTERN cruises across the Atlantic Ocean in 1985, 1993, 1994, 1996, and 1998.

1.3.4 North/south profile of biogenic and man-made volatile organohalogen compounds

R. Looser (UUI)

The aim of the study was the investigation of the contamination pattern of biogenic volatile organohalogen compounds with a possible input from the continents. Furthermore the equilibrium partitioning of these chemical substances between the surface water and the atmosphere was examined. Emphasis was laid on regions with a high primary production. The occurrence of short chain (C_1 – C_3) halogenated aldehydes and nitriles which have been proofed to be products of enzyme reactions under laboratory conditions was investigated. A north/south profile of the concentrations of trihalomethanes, tetrachloroethene, hexachloroethane, and hexachlorobutadiene could be recorded at the same time.

Air sampling was done using small-volume air sampler with adsorption tubes. Highly volatile organohalogen compounds which are very abundant in air (e.g. tetrachloromethane, CFCs, chloromethane) were sampled on adsorbents on a carbon molecular sieve basis with a high adsorptivity. During the cruise 19 air samples with sampling volumes of 4 – 5 l were collected. The sampling efficiency was controlled by serial coupling of two adsorption tubes.

Volatile organohalogen compounds in water were sampled using the purge and trap technique. 0.5 l of sea water was purged with cleaned nitrogen and the purged compounds were sampled on three adsorption tubes in succession. 15 water samples were collected during the cruise.

All samples were taken to the laboratory at the University of Ulm and will be analysed by gas chromatography with electron capture detection (HRGC-ECD) after thermal desorption and cold trapping.

2 LEG ANT XVI/2 Cape Town - Cape Town (9 January 1999 – 16 March 1999)

2.1 SUMMARY AND ITINERARY

E. Fahrbach (AWI)

On 9 January 1999 at 20:00 POLARSTERN put to sea from Cape Town with 43 crew members and 43 scientists on board. The cruise track is reproduced in Fig. 2. At the border of the South African 200-nautical-mile zone, the oceanographic measurements began, with the dropping of XBTs (e**x**pendable **B**athy**t**hermographs), used to measure the temperature of the seawater down to a depth of 700 m. Hydrosweep and **A**coustic **D**oppler **C**urrent **P**rofiler (ADCP) data were logged.

The first iceberg crossed the path of POLARSTERN at 50°S. At 55°S we reached the Greenwich Meridian and deployed floats at intervals of 30 or 60 nautical miles up to 61°S. These so-called ALACE (**A**utonomous **L**agrangian **C**irculation **E**xplorers) sink to a depth of approximately 700 m and will indicate the currents at this depth over the next one to two years. The deployments were carried out in the southern part of the Antarctic Circumpolar Current and the northern Weddell Gyre. In order to trace the inflow, the drifters come up to the surface at weekly intervals, where they can be located by satellites, before sinking again to their nominated depth. As they rise to the surface they record a temperature profile that is transmitted via the satellites.

In order to measure the convection and the longer-term changes in the water mass properties that are dependent on the ice coverage, 7 moored instrument strings, equipped with temperature and salinity sensors, current meters and upward looking sonars, have been maintained on the Greenwich Meridian since 1996. These measurements are a contribution to the "**Cli**mate **Var**iability and Predictability Programme" (CLIVAR) of the "**W**orld **C**limate **R**esearch **P**rogramme" (WCRP). On the outward journey, three moorings were recovered south of Maud Rise and four new ones deployed. With winds of force 7 to 8 and the consequent sea state, the weather conditions were not very favourable, and the new fill-in section over the stern ramp proved to be advantageous.

In the northern part of the Weddell Gyre we began the deployment of positioning buoys on icebergs, which are then tracked by satellites. Throughout the cruise 11 iceberg buoys were deployed. These will record the drift tracks of the icebergs, in order to ascertain where the freshwater originating on the continent feeds into the ocean.

After reaching the Antarctic coast, we steamed to the South African Sanae Station in order to deliver a generator. It was transferred with a South African Oryx helicopter from the POLARSTERN to the ice shelf, from where it was transported further on a sledge. Our helicopter took two South African colleagues to the coastal station, from where they were taken to the main station, which lies further inland.

The journey along the coast to Neumayer Station passed quickly, because the sustained easterly wind, having an offshore component, drove the ice to the west into the open ocean. When we arrived in Atka Bay, on 21 January, it was filled from the east with a thick ice cover, that consisted in part of large, old floes. An attempt to carry out the unloading at the northern ice front had to be suspended, because a strong swell arose and an iceberg strayed towards the landing site. Further into the Bay the unloading could commence late on the Thursday afternoon.

On the Friday evening around 10 o'clock the equipment and fuel for the Station had been delivered and the tools for the salvage of Filchner Station had been taken on board. The station had been located on the Ronne Ice Shelf and went adrift into the Weddell Sea when the giant iceberg A-38 broke off the ice shelf in October 1998. The iceberg A-38 fell into several pieces, the largest ones were A-38A and A-38B. The Filchner Station was located on top of the latter. It was our task to dismantle the station on the floating iceberg in the southern Weddell Sea before it would drift in the perennial ice out of reach. Seventeen wintering personnel and summer visitors stayed at the station and four members of the salvage team came on board. After midnight, with some trouble, we broke out of Atka Bay, and steamed to the south-west.

On 24 January we reached Drescher Inlet, a bay cut deeply into the front of Riiser-Larsen Ice Shelf. There we established a fuel depot for our aircraft and replaced an automatic weather station that has been operating since 1992. In the afternoon the aeroplane POLAR4 landed with the last two members of the salvage team. They had been on a traverse 1,300 km south of Neumayer Station and had been unable to return sooner on account of bad weather. In the meantime the weather had improved, so that POLAR4 was able to fly from Neumayer Station to the traverse and transport the two men from there to Drescher Inlet. With the team complete, we steamed further south, in order to drop off a group of Norwegians at "Blåenga", a summer station established by Monica Kristensen. The station has been taken over by the Norwegian Polar Institute and served as a base for the project of the four Norwegians.

During the passage we made a visit by helicopter to the British Halley Station, while POLARSTERN steamed on in the broad coastal polynya. On 25 January, we met at 76°37´S, 31°19´W a barrier of icebergs. South of this, a solid cover of fast ice had developed that extended over the Filchner Depression and formed for us an insurmountable obstacle. As a result the disembarkation of the Norwegians and their equipment had to take place over a distance of 65 nautical miles. This was a time-consuming operation because the fuel had to be transported underslung beneath the helicopters. We were unable to retrieve a sea level recorder of our English colleagues, because it lay seaward of the polynya in a band of thick ice.

We had to cross this ice field, which appeared very difficult to navigate, in order to proceed westward. Therefore, we sailed back to the north, as far as 74° 30´ S, where the ice cover was looser and we were able to make westerly progress. Once we had turned west-southwest in the direction of Filchner Station, the ice cover became ever more compact. Nevertheless, a wide area of open water over the

Filchner Depression, to the west of the fast ice barrier, was visible in the satellite pictures. We wanted to reach the front of Ronne Ice Shelf in this polynya, and from there make further westerly progress in the coastal polynya. However, we then noticed in the satellite pictures a line of fractures in the ice that extended about 90 nautical miles east from the northeastern corner of the Filchner iceberg (Fig. 7).

On 28 January an advance party landed on the iceberg with the helicopter. The mighty iceberg could be seen from a distance of 70 nautical miles and filled the horizon. At the northeastern corner we came to the calving edge, which towered more than 50 m above the sea ice pressed against its base. We flew along the northern edge to the station, which lay about 3 km south of the ice cliffs. A quick inspection revealed that the station was in good condition. We continued the exploration along the iceberg's northern edge, which was about 36 m high. At many points there were impressive scars, formed through collisions with other icebergs. On the western side we found ice cliffs of around 26 m height.

For POLARSTERN the route to A-38B proved to be troublesome. About 20 nautical miles distant from the sought-after channel, we were stuck fast in the ice for the first time. Only the turning of the tide during the course of the night reduced the pressure of the ice, so that we were able, using all our power, to break free. We sailed round the shear zone and reached the sought-after channel. Because it consisted of a succession of leads that lay oblique to our course, time and again we had to break through the intervening pressure ridges, so that we only arrived at iceberg A-38B on 30 January.

On 31 January the equipment needed for the dismantling and removal of Filchner Station was unloaded on the western side of the iceberg A-38B (Fig. 8). Just 30 km away from the station, we had found a section of the former ice front with 18 m high cliffs. Sunny weather and light winds made the work easier. At midday the equipment was unloaded and the salvage team set out for the station with three trains of sledges towed by Pisten-Bullys. At the station an advance party was already busy getting the heating, the melt water tank, the kitchen and the radio-room in working order. Once the operation of the station had been checked, the dismantling could begin. The equipment that was distributed around the station platform, and had been buried by the previous years' snowfall, was uncovered. A generator, a number of depots with both full and empty fuel drums, which lay under 1 to 2 m of snow, a further Pisten-Bully and a tanker sledge, which had to be recovered from 4 m of snow, were dug out. The freed drums and other miscellaneous items were loaded onto sledges. At the same time work on the station was proceeding. The station consisted of a platform supported by 14 legs at a height of about 4 m above the current snow surface, so as to prevent the accumulation of snow around it. Containers for living, dining and storage were secured to the platform. The storage container was cleared out and loose items on the platform were packed ready for transport. The storage container was then dismantled and the other containers were unfastened from the platform. The work proceeded well, so that on 7 February the first 20 tonnes of material were taken on board POLARSTERN. This first load comprised miscellaneous cargo, including the dangerous goods such as fuel drums, gas bottles and old batteries and was transported to the ship with Pisten-Bullys and sledges. An anti-cyclone brought weak northerly winds and comparatively warm temperatures (between -1 and –2°C). Linked with the warm air masses was a constant covering of low cloud and occasional snow showers, which greatly hindered the pilots and permitted only short helicopter flights.

On 10 February the dismantling of the station was completed. A snow ramp had been pushed up around the station platform, and the station containers were pulled down this and placed on sledges or simple runners. The overnight transportation of everything to the ship had already begun. While the Pisten-Bullys were still in use during the day for dismantling the last of the station and loading the sledges, the first two loads were removed overnight. On 11 February at 20:00, all 120 tonnes of material from the station and 50 tonnes of equipment used for its transport (Pisten-Bullys, sledges, containers, etc) had been brought to the POLARSTERN and loaded on board. All that remained of the station was the steel support structure, buried in the snow. Despite the hard conditions and the speed at which the work was undertaken, no serious incident occurred.

The ice conditions were difficult and allowed only a restricted set of measurements. The ice islands, surrounded by numerous icebergs, formed a barrier, against which a band of pack ice built up according to wind direction and tide. The sea ice hardly broke out at all this summer, so that the floes and pressure ridges of last winter were still present. During the outward journey the south wind opened up the ice cover a little, but the temperatures dropped to –15°C and new ice formed immediately between the floes. The water was almost everywhere close to the freezing point, so that even with milder temperatures new ice was forming. The change of the wind from southerly to northerly led to new ice pressure. Because of the low wind speeds, of less than force 6, the ice pressure increased only in moderation, but, under the influence of tidal currents, it was time and again sufficient to hold POLARSTERN fast for several hours, until the tide had turned.

The south wind had opened the coastal polynya in front of Ronne Ice Shelf (**Fig. 8**), so we were able to carry out a hydrographic section from A-38B, west along the ice front to within a few miles of the Lassiter Coast. In an inlet, on 2.5 m thick fast ice, we deployed a buoy that is equipped with a 486 m long wire with 3 current meters and 10 temperature and salinity sensors. The measurements from these sensors were transmitted via satellite. After a few days the data transmission ended due to a unknown reason.

The hydrographic section running along the ice front from the Antarctic Peninsula had to be terminated south of the iceberg A-38B, because the iceberg had in the meantime changed its direction of motion and was drifting southwest with a velocity of about one kilometre per day. As a result, the distance between the ice shelf and the iceberg was decreasing, so that the polynya, which had been created on the southern side of the iceberg by the continual northerly winds, was gradually shrinking. In the southeast, between the ice shelf and the iceberg, an insurmountable barrier of ice had built up, so we turned and headed northeast along the western side of the iceberg. A polynya had developed in the lee of the northern part of the iceberg, but the sea ice was being packed up against the Ronne Ice Front and a collection of smaller icebergs. As a result much power, patience and fuel were required to reach this polynya from the south. Once we had made it, we were able to reach our old landing site.

The continual (if also weak) northerly wind drove the ice from the north against the iceberg, and a broad belt of pack ice developed, consisting partly of ground up floes and partly of floes that had been heaped up into impressive ridges. It was obvious that this ice field could only be penetrated with great difficulty, and that a return to the iceberg would be equally difficult. We therefore gave up our plan to head around east of the iceberg and continue our hydrographic section along the new calving front of the ice shelf, and instead waited in the polynya until the dismantling of Filchner Station had been finished. We occupied the time with taking biological samples, using Bongo nets, Agassiz trawls and fish traps, and with measuring a sequence of oceanographic profiles, that is a yo-yo CTD.

Under these conditions we were unable to retrieve either of the bottom pressure recorders that had been deployed last year in front of Filchner-Ronne Ice Shelf. We did however set up further marker buoys on icebergs and three meteorological buoys on ice floes. The buoys are a contribution towards the maintenance of a network, for which the "International **P**rogramme for **A**ntarctic **B**uoys" (IPAB) of the WCRP is responsible. A buoy with oceanographic sensors (SUSI) was deployed close to the iceberg A-38B, in order to investigate delivery and effects of melt water from the iceberg over a longer time. This buoy however had to be retrieved on account of a malfunction.

The continual northerly wind had driven the sea ice into the southern Weddell Sea, so after our departure from A-38B, we were often held fast by the ice, because our four engines were incapable of overcoming the combined forces of wind and tide. With the turning of the wind, cracks opened up that, nevertheless, ran from south to north and therefore oblique to our direction of travel. Therefore, and with difficulty, we had to break through the high pressure ridges between the cracks, in order to progress to the northeast. Our course out of the region of ice pressure to the north of the pieces of iceberg A-38 was thus determined more by the ice than by the scientific objectives. When the wind finally turned and blew with increasing strength towards the north, it created sufficient room between the floes that we could once again follow a course aimed at making specific measurements.

Following the departure from A-38B, work related to the biological and oceanographic research programmes became the top priority. Biologists from the University of Oldenburg collected samples to investigate and evaluate the concentrations of heavy metals in Antarctic crustaceans. Elevated levels of cadmium were of particular interest. The aim is to develop a conceptual model of the uptake and transmission of heavy metals within the Antarctic food chain. In order to judge the levels of pollution in the water, the heavy metal concentrations are determined not only in the water but also in the creatures that live in the water, which effectively integrate the conditions of their surroundings over a long period of time. As a result there are higher concentrations in their tissues, that are more easily measured, and the short-term fluctuations that occur in the water cannot distort the picture. From the water samples taken on earlier expeditions it is known that no detectable increase in the heavy metal content of the south polar seas is attributable to the impact of mankind. Therefore, Antarctic crustaceans can be taken as examples of an unpolluted state and serve as a standard against which to judge the degree to which other waters are polluted. Now it appears that the heavy metal concentrations found in different types of animal can vary significantly. For instance, there are crustaceans in the Antarctic, like *Notocrangon antarcticus*, that, with a cadmium content of over 10 mg/kg, would be regarded as polluted if they were caught in the North Sea. They were caught together with amphipods of the type *Glyptonotus antarcticus* that, with a tenfold lower concentration, would be classified as unpolluted. Now the biologists would like to know the cause of the differing up-takes, and how, for example, *Notocrangon antarcticus* can live with such high concentrations of heavy metals, which would have to be classified as poisoning. In order to find answers to these questions, the biologists catch organisms for investigation using a variety of nets. In free water, the catches are made with a Bongo net that is either hauled vertically or towed alongside, while for the layers of water near the seabed, an Agassiz trawl that is dragged along the bottom or a fish trap is used. Some of the creatures are frozen, because the heavy metal concentrations cannot be measured on board. With the others the up-take rates are determined through experiments, in which the animals live for various periods of time in water containing heavy metals, before being likewise frozen for later measurement. The results of these investigations will be available once the measurements have been carried out in Oldenburg.

At the northern threshold of the Filchner Depression, the so-called Ice Shelf Water drains into the deep sea. This water mass forms because water of high salinity flows in beneath the ice shelf. Its outflow contributes to the formation of Weddell Sea Bottom Water, which feeds into the circumpolar ocean to the north, from where it flows further into the three ocean basins as Antarctic Bottom Water. It is the objective of our work to quantify the transport of Ice Shelf Water into the deep sea, reckoned at about 1 million cubic metres per second, using direct measurements of the currents made with moored instruments. These investigations are taking place as a cooperation between the AWI, the British Antarctic Survey, the Geophysical Institute of the University Bergen, Norway and Earth and Space Research, Seattle, USA in the framework of the "**F**ilchner **R**onne **I**ce **S**helf **P**rogramme" (FRISP) of "**S**cientific **C**ommitee on **A**ntarctic **R**esearch" (SCAR).

The recovery of the moorings called for much patience. The mooring F3, belonging to a group of four moorings on the continental slope to the northwest of the Filchner Depression, was lying, at the time of the first attempt at recovery, under D11, a giant iceberg 8 nautical miles in width and 30 nautical miles in length. With the other three moorings and the Bottom Pressure Recorder C2 we had more luck. F4 lay just to the north of the iceberg in a polynya. Nevertheless, thick fog had developed over the open water, turning the recovery into an exciting game of hide and seek. The moorings F1 and F2 were situated in the thick band of ice to the south of the iceberg, but with some patience and the use of acoustic position finding during the ascent, we were able to locate both moorings amongst the ice.

Over the night leading up to 21 February we left our work area to the north of the Filchner Depression and steamed south in a wide coastal polynya (Fig. 9) to pick up the Blåenga group. The sea smoke that, with air temperatures down to –20°C, was forming over the polynya, had thickened into a bank of fog that compelled us to reduce our speed. At the fast ice edge, at 76°44´S, 30°26´W, the sun broke through, so the four Norwegians with their skidoos and sledges were quickly brought on board with the helicopters.

Afterwards we went to the bottom pressure recorder M2 of the Proudman Oceanographic Laboratory. On our journey south M2 had been lying under thick ice, but now it had to surface within of a broad expanse of new ice. The southerly wind was constantly creating open water, but because of the low temperatures a compact covering of new ice was rapidly forming. Under these conditions M2 put our patience to the test, because it first only rose to the sea surface after repeated attempts at release, then was practically invisible between the compacted floes of new ice. Meanwhile, D11 shifted sufficiently to leave F3 clear. The route back there led through such strong ice pressure that we were often held fast, and the detour required more than two days. Our efforts were rewarded with the successful retrieval of F3.

On 26 February, on the way to Neumayer Station we cleared away the fuel depot from Drescher Inlet that we had established for the planes at the start of the cruise. The loading work lasted longer than expected, because the ferrying of empty drums to the ship could not be done by helicopter, on account of the bad weather, but had to be completed with a Pisten-Bully and two sledges.

During the night of 26 to 27 February we arrived at Neumayer Station, accompanied by winds of force 8. We had to wait until the following afternoon, until the wind abated enough for us to be able to move alongside the ice shelf edge and begin the relief work. The pieces of the former Filchner Station, the Pisten-Bullys and the sledges had been stowed on the forward hatch covers and in the hold, and these first had to be unloaded before the final loading for the homeward journey could begin. Atka Bay was covered with several layers of rafted pancake ice, which was forming quickly in temperatures of –15°C and being pushed together at the ice shelf edge by the wind. The ice cover dampened the oncoming swell, which was, however, still sufficient to keep the ship in motion. On the Sunday morning we had to get out the ice anchors, before we were able to continue the unloading operation. These were needed to hold the ship steady enough to safeguard the pipeline used to fill the fuel tanks of the station.

Meanwhile the wind had almost completely died down. Therefore, everyone who was not busy with the loading work could use the Sunday afternoon, with its glorious weather and bright sunshine, to enjoy a game of football or a walk on the ice shelf. It was also possible to visit the station.

In addition to the routine work in the meteorological, geophysical and chemical observatories of Neumayer station, comprehensive reconstruction of the station was carried out. The main construction work was the set up of a ground radio station providing a permanent data connection at 64 kbits/s between Neumayer Station and the AWI, via the INTELSAT satellites. The connection is made to a radio station at Raisting. This project has been designed and realised by Deutsche Telekom and its subsidiary company DeTeSat in collaboration with AWI. The permanent connection makes it possible to transmit new data directly to the AWI. The data can then be used more efficiently and maintenance of the systems becomes easier. With the permanent connection the station can be reached via telephone or fax in the same way as any subsection of AWI.

The atmospheric chemistry work at Neumayer Station was aimed at the extraction of fundamental information about the climate and composition of the palaeo-atmosphere from profiles of trace materials deposited in the firn and ice. This requires a detailed knowledge of the chemical processes in the atmosphere and the physical and chemical interactions of the trace materials with the firn layer. Investigations into the photochemistry of the Antarctic troposphere and the special role of the firn layer as a temporary store for reactive trace gases have been the work of the PEAN'99 campaign (**P**hotochemical **E**xperiment **at** **N**eumayer), which has been carried out by the AWI in collaboration with the British Antarctic Survey. These investigations concentrated on nitric oxides, ozone, peroxides, formaldehyde and carbon monoxide and were in addition to the routine measurements made at the tracer observatory. The investigations verify the complex influence of meteorological and photochemical conditions and the firn layer on the observed concentrations of trace gases in the atmosphere. For example, there seems to be a no clear relationship between nitrate profiles in the firn and atmospheric concentrations of nitric oxide.

Both the aeroplanes POLAR2 and POLAR4 took part in two campaigns of geophysical measurements during the flight programme based out of Neumayer Station from the 18 December 1998 to the 14 February 1999. These campaigns involved a total of 235 hours of flying. In addition POLAR4 was involved in an emergency medical evacuation. The Indian patient was brought to Neumayer Station by South African colleagues and was flown out via the British Halley Station to the American Amundson-Scott Station at the south pole.

During the first part of the flight programme, which was a contribution to the EPICA (**E**uropean **P**roject for **I**ce **C**oring In **A**ntarctica) preliminary survey of Dronning Maud Land (southeast of Neumayer Station), the existing grid of ice thickness measurements was supplemented by new profiles covering a total distance of 18,500 km. Among them was a flight along the ice divide in the direction of Dome Fuji. This flight opens up the possibility of a tie up with the ice core that has been drilled there and already dated, by tracing the internal layering of the ice between the two sites. This is possible, because the technique of radio-echo sounding reveals not only the sub-glacial relief but also the internal structure of the ice.

The concluding part of the airborne campaign involved flights for EMAGE (**E**astern Antarctic **Ma**rgins **G**eophysical **E**xperiment). The objective of this geophysical project, which has been planned over a number years, is to explore the earliest geological and tectonic structures left by the opening of the Weddell Sea in the area between the Antarctic stations of Halley in the west and Novolazarevskaya in the east. This is achieved through the use of airborne magnetic and gravimetric measurements. The area already covered by measurements, to the north of Neumayer Station, was extended westward along the coast of Riiser-Larsen Ice Shelf by approximately 50,000 km^2. The profiles obtained during this part of the programme reach a total length of 17,500 km.

On 1 March the wind slowly picked up again, but it remained sunny, so conditions remained favourable during the loading of the material for the return journey. In the evening the loading work was finished. We were able to take our leave from the 2 women and 7 men of the 19th overwintering party and to celebrate the end of the season on the ice and the completion of the relief with a barbeque on board. Because the wind had reached again force 8, we could not stay at the ice shelf edge, but went into the open water of Atka Bay. During the night we returned to the ice edge and, to the accompaniment of fireworks and atmospheric music, set the winterers onto the ice shelf with the crane. They drove back to the station in Pisten-Bullys. The next morning POLARSTERN was made ready for sea. We took another lap of honour past the waving winterers, who had come to the ice shelf edge for the final farewell, and steamed away to the northeast. The wind had again abated and the sun shone from a bright blue sky. After the completion of the relief, there were 49 scientists on board, including the former wintering party and the summer visitors.

By the afternoon we were already passing through a loose field of ice, consisting of either newly-formed pancakes or heavily-melted older floes. Therefore, we began the XBT section that extended to the South African continental slope. On Wednesday morning we reached the Greenwich Meridian at 66°30´S, where the station work continued with a CTD and a haul of the Bongo net. Southerly winds of force 4 gave rise to a moderate swell. From there we headed north along the Greenwich Meridian to 48°S, where we turned to the northeast. On this northerly journey we were able to carry out a CTD section, with 22 stations, extending to 46°10´S, 01°02´E. Along this section we recovered and redeployed three moorings.

On 6 March we crossed the 60th parallel and left the Antarctic. Following our departure from Atka Bay, southerly winds of force 6 assisted our journey to the north. Then a ridge of high pressure, lying between two depressions situated in the western and eastern Weddell Sea, swung over us, so that we came into a region of northwesterly winds, which brought us temperatures above the freezing point and poor visibility. After that the wind varied between force 6 and 8 and maintained a northwesterly direction. When we arrived on 10 March at the planned position for the deployment of a bottom pressure recorder, at 48°S, the wind was gusting to force 10. We had to discontinue all work and steam onwards to 47°03´S, 00°30´E, where we recommenced the CTD and XBT work. Because of the continuing heavy seas, we could only deploy the bottom pressure ecorder at 46°S, 1°E, where the last CTD station was also completed. The XBT section was finished at the continental slope of South Africa. On 16 March 1999, as planned, POLARSTERN entered Cape Town.

2.2 WEATHER CONDITIONS

H. Weiland und H. Köhler (DWD)

2.2.1. From Cape Town to Neumayer Station

On 9 January 1999 POLARSTERN started from Cape Town to its 16th research-cruise into the Antarctic. At first the heading was to the 55°S on the Greenwich Meridian and from there on to the south. At the beginning of the cruise there was a low south of the Cape, on its rear side the ship had southerly winds between 5 and 7 Bft. At about 11 January there was developing a large storm-depression which stayed until 15 January. The wind force was Bft 6 to 8, Bft 9 at times, coming from north to northwest. On the following days the Westwind Drift became prevailing, with strong easterly wind on the coasts of the Antarctic continent. On 20 January POLARSTERN reached the South African Sanae Station. On the next day she arrived at the ice shelf edge near Neumayer Station. For one day the easterly wind decreased and turned to the southeast, the conditions increased due to dry air from the ice. Helicopter flights became possible. But on the next day the wind increased again und snowfall began, that flights were no more possible and loading work more difficult.

2.2.2 From Neumayer Station to Filchner Station

On 23 January POLARSTERN started towards the Weddell Sea. We reached Drescher Inlet on 24 January and passed the British Halley Station on 25 January. As low pressure still remained north of Neumayer Station, high pressure influence was prevailing over the Weddell Sea with weak southerly winds. On 26 January POLARSTERN continued towards Filchner Station through the ice. Northeasterly winds, induced by a low pressure system east of the Antarctic Peninsula built up ice ridges which reduced the ship's speed. Later on, the wind turned from northeast to east and then to the south providing more favourable ice conditions. On 30 January we reached the iceberg A-38B.

2.2.3 In the southern Weddell Sea

On 31 January the dismantling of the Filchner Station began. On 1 February POLARSTERN went along the shelf-ice coast to the west through a polynya and reached the most westerly point of the trip on the eastern shore of the Antarctic Peninsula. A strong katabatic wind from southwest came from the ice shelf. On 2 February a low approached from the north and went into the eastern Weddell Sea with increasing southerly winds. Two days later another low arrived at the Antarctic Peninsula causing a northeasterly wind and severe ice conditions again. On 5 February POLARSTERN returned to the loading area. On 11 February the dismantling of the station was finished. Since the beginning of the month there had been a continuous cover of low clouds over the whole area. Due to these conditions helicopter-flights were only possible near the ship and along the ice shelf front.

2.2.4 From Filchner Station to Neumayer Station

On 12 February POLARSTERN started its way back, suffering severely under the ice conditions. As the wind turned to southeast on the following days due to a developing low over the Weddell Sea, the ice began to move to the northwest and the conditions improved. Later, a high pressure ridge built up with light southerly winds. On 21 February we arrived at "Blåenga" where southerly katabatic wind blow with temperatures to –21°C and intensive sea smoke. On 22 February the weather situation changed again, a low from the Antarctic Peninsula was responsible for northeasterly winds, providing difficult ice conditions. But on 24 February POLARSTERN reached open water. With strong northeasterly winds we arrived at Drescher Inlet on the 25 February. The helicopter flights were difficult further on, especially over the ice shelf due to white out-conditions. Over open water and over loose ice floes however, flights were possible for the most time. On 27 February we reached Neumayer Station. The strong northeast winds changed to a light south, which remained during the next days. Due to the katabatic winds, the temperatures decreased to –11°C.

2.2.5 From Neumayer Station to Cape Town

On 2 March POLARSTERN left Neumayer Station and went along the Greenwich Meridian to the north with moderate southerly winds due to a large low extending from South Africa to the Antarctic. Later on the Westwind Drift developed again and POLARSTERN arrived on the northern flanks of the lows after crossing 60°S with strong winds coming prevailingly from westerly directions. During the last days, the subtropical high was dominating. The westerly winds decreased, later on we had a moderate wind from southeast. On the 16 March POLARSTERN arrived at Cape Town.

The frequency distributions of wind direction and force are displayed for the time periods during which POLARSTERN operated between 45° and 66°S (Fig. 3), 66° and 72°S (Fig. 4) and south of 72°S in Fig. 5. Two examples for typical surface air pressure distributions which determined by southerly (top) or northerly winds (bottom) the ice situation are shown in Fig. 6.

2.3 SEA ICE CONDITIONS

G. Birnbaum, H. Brix, D. Dommenget, R. Gladstone, S. Harms and A. Jenkins (AWI, BAS)

POLARSTERN is equipped with a satellite data receiver (SeaSpace-TeraScan). It provides a means of producing sea ice charts on the basis of two types of satellites: NOAA (**N**ational **O**ceanic and **A**tmospheric **A**dministration) and DMSP (**D**efense **M**eteorological **S**atellite **P**rogram). During ANT XVI/2 data were received from NOAA-12, NOAA-14, NOAA-15 and DMSP F-12, F-13, F-14 (Figs. 7 to 9).

On NOAA satellites a AVHRR (**A**dvanced **V**ery **H**igh **R**esolution **R**adiometer) system is operated. It uses five channels in the visible and infrared spectrum with a resolution of approx. 1 km (depending on the earth's curvature). DMSP's SSM/I (**S**pecial **S**ensor **M**icrowave / **I**mager) offers a seven-channel, four frequency, linearly-polarized, passive microwave radiometric system. Its resolution is in the range between 13 and 69 km. In addition data is supplied from the OLS (**O**perational **L**inescan **S**ystem) sensor including a visible and an infrared channel with approx. 0.5 km resolution.

Satellite data analysis on board POLARSTERN consisted of choosing appropriate satellite passes for data transmission. The received data was transformed onto suitable map projections (mainly Mercator and polar stereographic) applying the TeraScan and TeraVision software packages. Coastlines and the ship's track were added. Because microwave data are not influenced by clouds, they show the sea ice distribution directly. Combining the different channels allows conclusions on the ice types (first year or multi-year ice), however only with coarse resolution.

The high resolution visible and infrared data allow detailed presentations of the ice cover given favourable weather conditions. Limitations arise from the availability of the visible channels (daylight only) and from the cloud cover. Appropriate combination of several channels may well minimize the optical filtering properties of some clouds (especially cirriform types). Nevertheless massive cloud cover reduces those channels to meteorological use.

In-situ sea ice observations were conducted hourly from the bridge of POLARSTERN as part of the **A**ntarctic **S**ea Ice **P**roc**e**sses and **C**lima**t**e (ASPeCt) Program, a multi-disciplinary initiative of Antarctic sea ice zone research within SCAR's **Glo**bal **Chan**ge (GLOCHANT) Program. The overall aim of ASPeCt is to understand and model the role of Antarctic sea ice in a coupled atmosphere-ocean system. One of the major projects of SCAR is to develop a seasonal and regional climatology of sea ice thickness and characteristics around Antarctica. The obtained data were submitted to the ASPeCt after the cruise for further analyses.

Pack ice conditions in the immediate vicinity of the ship (about 1 km radius) were observed. For each observation, the time (GMT), latitude and longitude, and meteorological parameters (e.g. air and water temperature, wind speed and direction, cloud coverage, visibility, etc.) were recorded together with the sea ice information. The following sea ice parameters were documented:

- total ice concentration, to the nearest 10% (Fig 10)
- concentration of the three dominant ice types present in the pack (thickest = primary ice type; thinnest = tertiary ice type)
- ice types (e.g. frazil, shuga, grease, nilas, pancakes, young grey ice, young white ice, first year ice, multiyear ice, brash, fast ice)
- ice thickness in cm (Fig. 10)
- floe size in m
- ice topography (level ice, rafted pancakes, cemented pancakes, ridged ice, Fig. 11)
- snow type and thickness in cm.

POLARSTERN entered the pack ice zone on 22 January 1999 15:00 at 69 37'S, 00 00'. In the eastern Weddell Sea near the ice shelf the total sea ice concentration remained below 40%, both for the southbound and the northbound track, and the ice thickness rarely exceeded 40 cm. In the southern Weddell Sea, north of the Filchner-Ronne Ice Shelf, POLARSTERN encountered mainly first year pack ice which was strongly ridged. The sea ice concentration frequently exceeded 90%. Average ice thickness of 1 m and more was observed frequently. The ridge height often exceeded 1 m. Some multi-year ice floes were sighted in the southeastern and the southwestern regions of the southern Weddell Sea. POLARSTERN left the pack ice zone on 2 March 1999 14:00 at 69 45'S, 07 01'W.

2.4 RESEARCH, SUPPLY AND CONSTRUCTION OPERATIONS AT THE NEUMAYER STATION

2.4.1 Supply operations

S. El Naggar (AWI)

Material and fuel were supplied to the Neumayer Station via POLARSTERN in the time period from 21 to 22 January 1999. The offloading took place at the northern ice shelf edge about 15 km away from the station. The height of the ice edge was about 11 m.

The 19th overwintering team (2 women and 7 men) replaced the former one (9 men). They partly arrived on board of the South African RV AGULHAS on 15 December 1998 and partly on POLARSTERN. Besides routine maintenance work of the meteorological, geophysical and chemical observatories, major constructions on the building facilities were carried out. Three men from the company of J. Kramer in Bremerhaven participated at the work.

The participants of the Dronning-Maud-Land-Travers arrived with AGULHAS. The travers was prepared at the Neumayer Station and supplied with vehicles, material and personal (see 2.5). The flight programme occurred with POLAR2 and POLAR4

The weather conditions were rather unfavourable. Strong winds and drift prevailed. During the five weeks duration of the summer field season only two weeks had weather conditions which permitted work outside the station.

On 17 February AGULHAS visited the station for a second time and took 9 persons and some containers on board. On 27 February the station was handed over to the 19th overwintering team. The field season ended on 3 March 1999.

2.4.2 General Logistics

A. Brehme, D. Dzubil, S. El Naggar, W. Förster, J. Janneck, F. Kallweit, W. Kaiser, E. Kohlberg, W. Krüger, W. Mack, J. Meyer, M. Prozinski, M. Reise, R. Witt, H. Wohltmann, A. Ziffer (AWI, GL, KR, LAEISZ)

The main operations were:

The safety system of the Neumayer Station was tested and certified by the Germanische Lloyd (GL).

The roof of the vehicle hangar was lifted by about 80 cm.

The main generator was replaced.

A new antenna (3.7 m in diameter) was installed, to allow for a continuous data and voice link between the Neumayer Station and the AWI by INTELSAT satellites. This project was realized by the German Telecom and its subsidiary company DeTeSat together with the AWI. This permanent link allows a continuous data transfer from the observatories to the AWI. This will increase the efficiency of data application and facilitate the maintenance of the systems. By this link, the Neumayer Station is also directly connected by phone or fax to the AWI.

2.4.3 Research programme and observatories

2.4.3.1 Geophysical observatory

T. Büßelberg, S. Krull, U. Neumann, C. Sacker (AWI)

One part of the geophysical observations of Neumayer Station is a seismological network of 22 stations (28 channels). 16 of these stations are configured to a detection array, which is installed on the Halvfar Ridge (Watzmann), 50 km southeast of Neumayer Station. Additionally, there is a station on the Sörasen Ridge, 80 km southwest of Neumayer Station.

On the Ekström Ice Shelf 5 stations ("West", "Süd", "GvN", "DI5", "Obs") are located in a radius up to 14 km around the Neumayer Station, in the past this stations are used to detect and locate local seismicity like ice quakes. All the seismological data are transferred to the Neumayer Station by telemetry and stored on hard disk for further data processing.

The detected events were analysed to locate their hypocenter. Monthly, the picked times of the phases were send to the **U**nited **S**tates **G**eological **S**urvey (USGS). The ability of the array to detect events could be seen by the detection of earthquakes with small magnitudes of 3 and a epicentral distance of 300 km. These events could be detected by the new broadband station (also AWI) at Sanae Station, too. They show, that there is still a seismic activity on the Antarctic continent.

Another part of the geophysical observations is the investigation of the magnetic field. For this, there are two proton magnetometers for the measurement of the total intensity of the magnetic field and two fluxgates to determine the components of the magnetic field. In certain times the inclination and declination of the earth magnetic field (the difference of the field from the north and vertical direction) were measured. Changes in the gravity field and the tides were observed by an Askania gravimeter. All the seismological, magnetic and gravimeter data were observed continually and digital stored on tape or disk.

The overwinterers Udo Neumann and Stefan Krull were instructed to continue the observations.

Various maintenance operations were carried out on geophysical stations as done every year. The ice shelf stations "West" and "GvN" were built up for the next season. Additionally, at "GvN" some old "Saft" batteries were installed for the winter. It was planed, that the other ice shelf stations obtain "Saft" batteries after the field party to Olymp and Watzmann, too. Due to the bad weather conditions the field party was stopped and came back to Neumayer Station after 6 days. The service work for the Watzmann and Olymp stations has to be done later.

On 28 February a transceiver at the Watzmann could be exchanged with a helicopter flight. Consequently the new overwinterers received the seismological network in good conditions. Both magnetometers were lifted. At this occasion the DC-supply of one instrument was exchanged which improved the data quality. The magnetic data of Neumayer Station are needed for further interpretation of the EPICA and EMAGE programmes.

The PRARE ground station to observe the ERS-2 satellite passes was repaired and is now fully active. Due to a defect motor the station was passive since May 1998. The **D**ronning **M**aud **L**and (DML) field party was supported by geophysical personal and instruments of the Neumayer Station. For this purpose C. Sacker joined the field party in the Kottas hills.

2.4.3.2 Meteorological observatory

S. El Naggar, A. Köhnlein, J. Lieser, B. Loose, H. Schmid and A. Wille (AWI)

The meteorological observatory was successfully operated during the last year, and a complete data set was delivered. The new overwintering team was introduced to the routine work and took over after a few weeks. Major maintenance was done of all instruments, sensors, data acquisition systems and the radio sonde system.

The following work was done in addition to the routine maintenance.

A new humidity sensor (HMP 233-VÄISÄLÄ) was installed in addition to validate the present hair based one.

The pyranometer array of the BSRN (**B**aseline **S**urface **R**adiation **N**etwork), the meteorological mast and the platform of the solar tracker were lifted to compensate the new snow accumulation.

A test pyranometer array was installed and parallel measurements were made to validate the present instruments.

A new data recording system based on a PC was installed for the radio sonde system (DIGI-CORA) to avoid data loss.

The spectral photometer (SPM1A) was mounted on the solar tracker to provide continuous measurements.

A new decoding and encoding system (HAMCOMM) based on a simple PC interface for weather information was installed and tested in the radio room. The system could receive and transmit via HF weather data and charts. It is planned to distribute weather information from Neumayer Station via HF to other Antarctic stations.

2.4.3.3 Air Chemistry Observatory

U. Frieß, A. Jones und R. Weller (AWI, BAS, IUP)

A comprehensive technical and scientific programme was performed at the Neumayer Air Chemistry Observatory during this summer season. The routine work included servicing of the scientific equipment, calibration of all measuring devices and finally training of the new overwintering crew. The scientific programme includes mainly accompanying measurements for the nitrogen oxide and peroxide project. Basically, the snow and firn analyses and the low volume aerosol sampling measurements have been intensified and immediate ion chromatographic analyses of the filter and snow samples were performed during the campaign. Finally, the NO_y apparatus was installed in the Air Chemistry Observatory at the end of the summer season and will continuously measure NO_y during this overwintering period.

2.4.3.4 Computersystem and network

T. Büßelberg, S. Krull, U. Neumann, and C. Sacker (AWI)

Apart from training the new overwinterers in the computers and network, new equipment was installed.

10 Mbit hubs were changed against 10/100 Mbit switches. Therefore a new fiber-optics cable was installed between the two tubes. The old RG58 cabling was totally deactivated.

The new media converter, dedicated for the glass fiber line to the obs, does not work with the old optical repeater. Therefore the old equipment was installed in the rack in the east tube.

In the west tube rack a router was installed. It connects the Neumayer Station network to the AWI network in Bremerhaven over a new permanent link. The full bandwidth of 6-11 kbytes/s is not reached yet. At present the bandwidth amounts to 1.5-3.0 kbyte/s. The new link is used for email exchange and data transfer.

Two new PCs were installed, the operating system is Windows NT Workstation respectively Server.

The SUN workstations (gvns11, gvns7), working with large amounts of data, obtained an upgrade with memory and 100 Mbit network cards. The TeraScan satellite data acquisition SUN gvns6 did not work as expected with an additional S-bus card, so the upgrade with a 100 Mbit network card was not successful.

Two DLT tape drives with 40 Gbyte capacity are now used for data storage in seismology and satellite data acquisition.

The old SUN workstation (gvns9, SUN IPX) from the station office and the old radio operator PC (Compaq Prolinea 486/33) were removed and sent back to Bremerhaven. A SUN memory was sent directly to Sanae Station, where an old equivalent SUN is used for seismology data acquisition.

2.4.3.5 UV-B-Dosimetry

S. El Naggar (AWI)

The UV-B personal dosimetry programme will be continued and extended with a new biological dosimeter (VIOSPOR). It is planned, to determine the UV-B dose per person during the year by means of the different systems. Due to the bad weather conditions, a part of the summer programme had to be cancelled. The AWI-UV-B spectrometer Land 5, which continuously records the solar UV-B radiations, was replaced by a newly calibrated one, Land 3.

2.4.4 PEAN'99 C: Nitrogen oxides, hydroperoxides, and formaldehyde in the Antarctic troposphere and their interaction with the firn layer

H.W. Jacobi, A. Jones, K. Riedel und R. Weller (AWI, BAS)

2.4.4.1 Introduction

The aim of the PEAN'99 campaign (**P**hotochemical **E**xperiment **a**t **N**eumayer) was to study the photo-chemistry of the Antarctic troposphere and the special role of the firn layer as a reservoir and reactive surface for photochemically active trace gases. The measuring programme comprised reactive nitrogen oxides (NO_y = NO, NO_2, HNO_3, PAN (**p**eroxy**a**cetyl**n**itrate), alkyl nitrates,...), photo-oxidants (ozone and hydroperoxides), formaldehyde, and CO.

Nitrate is one of the dominant ions to be found in firn- and ice cores. It is believed that deposition of particulate nitrate and HNO_3 are the main sources for nitrate in the snow pack. Intrusions of nitrogen oxide rich stratospheric air masses and long range transport of nitrogen oxides formed by lightning and biomass burning can be advanced as potential nitrate sources. Thus, nitrate profiles in ice cores might be expected to provide information about the strengths of the above mentioned sources in the palaeo-atmosphere. An understanding of the NO_y budget at high latitudes is desirable from the point of view of ice core interpretation. While there is an abundance of data on concentrations of nitrate in ice cores, it is not a simple step to translate this into an understanding of past atmospheric composition, partly due to the lack of knowledge of present day nitrogen chemistry at high latitudes, and partly because the physical and chemical interactions of these compounds with the firn layer is not yet clarified.

For this reason the main part of the PEAN'99 activities was dedicated to assess the budget of reactive nitrogen oxides and to study their interactions with the snow layer. For this purpose $NO/NO_2/NO_y$, PAN, organic nitrates, gaseous HNO_3, and particulate nitrate were determined during the campaign from 28 January to 28 February. To study the interaction of these species with the snow layer, we performed gradient measurements of NO, NO_2, and PAN at 5 cm and 250 cm height above the snow surface and studied the interaction of ambient air drawn through a 0.015 m^3 snow block.

Another goal was to elucidate the photochemistry of peroxides (H_2O_2/ROOH) and formaldehyde in the polar troposphere. Atmospheric peroxides, hydrogen peroxide

(H_2O_2) and organic peroxides (ROOH) are important photo-oxidants and reservoirs for hydroxyl radicals that initiate the decomposition of many different trace gases. Formaldehyde (HCHO), an intermediate of the photooxidation of miscellaneous hydrocarbons, also plays an important role as a free radical source in the polluted and unpolluted atmosphere. Previous HCHO and peroxide measurements revealed distinct differences between observed concentrations and model predictions. From HCHO and H_2O_2 profiles in firn and ice-core samples it might be possible to derive information on the oxidation potential of the palaeo-atmosphere. Due to technical problems the H_2O_2 and HCHO measurements during the summer campaign 1997 were limited. Therefore, investigation of the seasonality of tropospheric H_2O_2 and HCHO mixing ratios were continued during the '99 summer season and the determination of H_2O_2 and HCHO concentrations in firn and snow was intensified.

2.4.4.2 NO, NO_2 and NO_y measurements

We measured NO/NO_2/NO_y using two chemiluminescence detectors coupled with a photolytical NO_2 and a Au/CO catalysed NO_y convertor, respectively. The basic technique of the chemiluminescence method is the gas phase reaction of NO with O_3 and the subsequent detection of the resulting electronically excited NO_2^* by fluorescence. In order to measure NO_2 and NO_y by this method, these compounds have to be reduced to NO, which was done by selective photolysis of NO_2, and by passing the ambient air stream, in presence of CO over a solid gold catalyst thermostated at 300°C, respectively. This apparatus worked continuously and the NO/NO_2/NO_y data are available as 20-minutes averages for the whole campaign. However, some technical problems with the NO_y convertor (impurities in the CO reactant gas) caused significant gaps in the NO_y time series (approximately for 50% of the campaign). A preliminary evaluation of the raw data set revealed that the back ground NO_y mixing ratios were well below 100 pptv (**p**arts **p**er **t**rillion by **v**olume), typically between 20-40 pptv, while the NO/NO_2 mixing ratios remained below 10 pptv. While the gradient measurements did not show a significant net NO flux into or out of the snow layer, the snow block experiment indicated a distinct NO_x production from within the snow layer most pronounced during sunlight.

2.4.4.3 PAN, O_3 and CO measurements

Peroxyacetylnitrate (PAN) is a nitrogen containing compound, which is generated in continental regions during the oxidation of higher organic compounds in the presence of NO_2. The most important sink is thermal decomposition. Because this decay is strongly temperature dependent, PAN has a life time of several weeks in cold, polar regions. Results of several field experiments show that PAN can constitute a major contribution to the sum of reactive nitrogen compounds (NO_y) in the Arctic troposphere. Up to now no PAN measurements in Antarctica have been published. Therefore, within the frame of the PEAN'99 campaign, continuous *in situ* measurements of PAN were performed by electron capture gas chromatography combined with a cryogenic pre-concentration technique. The time resolution of the measurements was 10 min and a detection limit around 5 pptv was achieved. The mixing ratios of PAN showed maxima of 60 pptv, but most of the time the values were less than 20 pptv. In addition, carbon monoxide was measured, because again long-range transport of continental air masses is the dominant CO source for Antarctica. PAN measurements were also continued during the cruise of POLARSTERN from Neumayer Station to Cape Town.

Because one main focus of PEAN'99 was to investigate interactions between the atmosphere and the snow surface, PAN and O_3 measurements were performed at two different heights (0.05 m and 2.5 m above the snow surface). The results were used to determine gradients, from which deposition or emission rates can be derived. A detailed evaluation of the results, considering the meteorological data of the Neumayer Station will be done after the campaign.

2.4.4.4 Alkyl nitrates and inorganic nitrate measurements

The alkyl nitrates ($RONO_2$) are a relatively stable component of NO_y, with known sources from combustion and from the atmospheric photo oxidation of organic compounds in the presence of NO_x. Evidence is also emerging of an oceanic source for these compounds, with measurements in equatorial regions showing latitudinal profiles similar to compounds with a known marine origin. The southern ocean is a highly productive region during the polar summer and autumn, and measurements made from Neumayer Station two years ago indicated high concentrations of methyl and ethyl nitrates in the ambient air. Their role in nitrogen chemistry at these southern polar latitudes thus becomes of interest. Our previous campaign also revealed significant diurnal variability in NO_y concentration, which raised the question, which component of NO_y was responsible for this signal. Studies in Greenland have suggested that deposition of ambient inorganic nitrate (HNO_3 and particulate nitrate) cannot be the sole route whereby nitrate enters the snow/firn, and this probably affects the ice core signal.

In order to address these issues, whole air samples were collected every 3 hours on a number of days and under various weather conditions in order to look for a diurnal variation in $RONO_2$ and to compare concentrations with NO_y measurements. When wind speeds were suitably low, sampling was carried out at two heights simultaneously, in order to detect gradients. The samples will be analysed in the UK using gas chromatography with electron capture detection.

The filter programme to sample inorganic nitrate was continued this summer, using the permanent pump system at the air chemistry observatory. A 3-stage filter pack of teflon/nylon/nylon was used to sample particulate nitrate and HNO_3. The data from this will be used to assess the budget of NO_y. Furthermore, on days when diurnal sampling for $RONO_2$ was carried out, filter changes were made at higher frequency in an attempt to detect a diurnal variation in HNO_3/p-NO_3-concentrations. Surface snow samples were also taken coincidentally. The aim of these diurnal variation studies is to investigate the exchange processes between NO_y compounds in the ambient air and in the snow/firn. Ultimately such knowledge is necessary in order to correctly interpret nitrate data from ice cores.

2.4.4.5 Peroxide and formaldehyde measurements

During the summer campaign "98/99, peroxides (H_2O_2/ROOH) and formaldehyde (HCHO) were continuously monitored at Neumayer Station. These observations were part of the PEAN-Project and continue on from time series measurements made during the overwintering season of 1997.

The planned measuring programme was performed successfully. A preliminary evaluation of the data shows atmospheric hydrogen peroxide mixing ratios between 100 and 400 pptv, and for methyl hydroperoxide, the most common organic peroxide, of approximately 200 pptv, while the formaldehyde mixing ratios ranged between 50 and 400 pptv. In addition, snow samples were analysed during the summer campaign in order to compare concentrations of these reactive trace gases in the air and snow. An understanding of the exchange processes of these oxidants between the atmosphere and the snow/firn holds the potential for reconstructing the oxidation potential of palaeo-atmospheres.

2.4.5 Installation of a ground- based DOAS instrument at the Neumayer Station air chemistry observatory

U. Frieß (IUPH)

A dual channel DOAS (**D**ifferential **O**ptical **A**bsorption **S**pectroscopy) spectrograph has been installed at the Neumayer air chemistry observatory. The instrument was developed at the Institut für Umweltphysik, Heidelberg. It measures zenith scattered sunlight, covering the wavelength ranges 320-435 nm (UV) and 400-650 nm (visible). The light is spectrally dispersed by two holographic gratings and detected with cooled photo diode arrays. Using the absorption structure of several atmospheric constituents (Ozone, NO_2, OClO and BrO), the instrument is able to detect the column amount of those trace gases. These species are involved into the ozone depleting mechanisms in the Antarctic stratosphere.

To examine chemical and physical processes in the stratosphere, the DOAS measurements will be compared with photochemical model calculations. The data will also be used to validate satellite borne measurements, e.g. GOME (**G**lobal **O**zone **M**onitoring **E**xperiment) and TOMS (**T**otal **O**zone **M**apping **S**pectrometer), and the ozone soundings regularly performed at Neumayer Station.

Chlorine and bromine compounds are the major cause for the ozone depletion in the Antarctic polar stratosphere. Another halogen compound, iodine oxide, can contribute to the ozone depletion even when present in small amounts. A further goal of the DOAS measurements is the possible detection of iodine oxide or at least the estimate of an upper limit for the concentration of this trace gas. Continuous DOAS measurements were performed at Neumayer Station since 1994. It is planned to operate the new instrument for several years. Beside the study of the diurnal and seasonal variation of the various trace gases, those measurements supply information about long- term trends of the stratospheric trace gas budget.

2.5 LANDOPERATIONS AND FLIGHT PROGRAMMES

2.5.1 Airborne programme

D. Steinhage, M. Schürmann, F. Thiel, T. Büßelberg (AERODATA, AWI, DLR)

The airborne programme of the austral summer 1998/99 consists of three different projects (EPICA, EMAGE, APIS) carried out between 15 December 1998 and 14 February 1999. During that time some of logistic flights have been done which are related to a distinct project, e.g. the participation in the evacuation of an Indian patient from RV POLAR BIRD with POLAR4 via the Neumayer-Halley-Amundsen Scott stations as well as the maintenance of three automatic weather stations of the University of Utrecht. A fourth project, airborne RES with Filchner Station as base, had to be cancelled due to the fact that the station did no longer exist. The station had to be removed after the calving of iceberg A-38 from Filchner-Ronne Ice Shelf.

All three projects started in the past. Therefore, see for a detailed description the report of ANT XIV/3 (W.Jokat and H. Oerter (ed.), 1998: Die Expedition ANTARKTIS-XIV mit FS POLARSTERN 1997, Bericht vom Fahrtabschnitt ANT XIV/3, Berichte zur Polarforschung, Nr. 267). The following section will only describe the work of the season 1998/99.

As the ferry flights of POLAR2 and POLAR4 have become routine and just minor changes of the flight tracks have been applied compared to those in the past, as well as the fact that no scientific measurements have been carried out on them, a detailed description will not be given. They lasted 260 hours for both airplanes.

Within the geophysical programmes of EPICA and EMAGE several GPS and magnetic reference stations have been deployed by POLAR4 The data collected by these stations completed by data of the geophysical observatory at Neumayer Station. The ground based RES traverse also maintained from time to time some reference stations or put them up at Kottas Camp and B32 (DML05).

The total measuring equipment which is not integrated in POLAR2 has been shipped on board of the RV AGULHAS from Cape Town to Neumayer Station and with POLARSTERN back to Cape Town.

EPICA (**E**uropean **P**roject for **I**ce **C**oring in **A**ntarctica)

Within the EPICA pre-side survey another 18,500 km of airborne RES (**r**adio **e**cho **s**ounding) have been measured in the fourth season in a row in **D**ronning **M**aud **L**and (DML) for the determination of ice thickness and magnetic properties. The flights of this austral summer, with the DML ground traverse as logistic base, enlarged the investigated area further to the southeast. In total 25 flights with together 96 hours of flight time, including logistic flights, have been carried out. Fig. 12 shows a map of all measuring flights, the dotted lines mark the ice divides in DML.

A flight towards Dome Fuji will most likely allow to connect the obtained profiles to the dated ice core drilled there, because the RES system also reveals the internal structures of the ice in addition to the ice thickness. For this flight POLAR4 had to deploy a fuel depot at B33 (DML17) and to collect the empty drums afterwards.

Due to unfavourable snow conditions and later in the season general bad weather conditions four flights from the Kottas Camp had to be cancelled. Additionally technical problems led to some problems with the schedule. But all problems could be solved with the available spare parts for the planes and the measuring system.

The maintenance of three weather stations of the University of Utrecht, at Camp Victoria, at B32 as well as at Svea Cross south-west of Kottas Camp, could be combined with logistic flights.

EMAGE (**E**astern Antarctic **M**argin **A**ero**g**eophysical **E**xperiment)

The aim of this long term geophysical project is to detect first geological-tectonical structures of the opening of the Weddell Sea in the region between the Antarctic stations Halley in the West and Novolazarevskaja in the East. The area of investigation could be enlarged by 50,000 km^2 in this austral summer with 18 flights. Included are two flights for static and dynamic compensation. All compensations as well as those of the last seasons have been carried out at 71°S, 9°30'W. To extend the investigated area in front of the Rijser-Larsenisen POLARSTERN deployed a fuel depot at the edge of the Drescher inlet. Fig. 13 shows a map with all flown profiles.

Nearly all flights above the sea could be flown with 130 kts in 600 feet barometric altitude. During all flights the measuring system consists of two Trimble GPS receiver, a modified LaCoste-Romberg gravimeter, a laser altimeter and an airborne Geometrics magnetic system with ^4He sensors. The line spacing was 5 nm, the total length of all profiles 17,500 km.

To achieve the necessary precision of the positioning for the evaluation of the gravity data post differential GPS processing will be used. The necessary GPS reference stations are the Neumayer Station and a GPS station set up at Halvfarryggen, close to the central point of there installed seismological array "Watzmann". To allow the correction of the airborne gravity data for the tides, the continuous registration of the gravimeter of the geophysical laboratory at Neumayer Station is available. To eliminate the daily variations of the magnetic data also registrations of the geophysical laboratory are available. Parallel to the registrations at Neumayer Station also a magnetic reference station on base of a Geometrics G856, had been installed on Skjoldet, an ice rumple in the Rijser-Larsenisen.

APIS (**A**ntarctic **P**ack **I**ce **S**eals)

As in the past, for the APIS programme a digital video camera had been installed on all EMAGE flights, but this time just in the vicinity of sea ice recordings have been done. The map in Fig. 14 shows all sections with video monitoring. Gaps are due to clouds and missing sea ice coverage. On 14 flights 17 hours of video in total have been collected, covering 4,000 km of profiles. The video camera has been handled by the operator on board (M. Schürmann, F. Thiel (both AERODATA), D. Steinhage (AWI)). Responsible for the APIS project at AWI is Dr. Jochen Plötz. For further information see report ANT XIV/3.

2.5.2 Glaciology

F. Wilhelms, C. Drücker, G. Stoof, H. Wohltmann, J. Wehrbach, A. Schmid, J. Pogorzalek, C. Sacker, F. Kallweit, D. Steinhage (AWI)

In this season glaciological studies have been carried out afresh, for the pre-reconnaissance of a deep drilling site within EPICA. In the period from 15 December 1998 to 16 February 1999 several EMR-profiles (EMR: **e**lectro**m**agnetic **r**eflection method), were recorded connecting the sites of the 100-m- to 150-m-long ice cores drilled last year. The aim is to enable a correlation between the different ice cores and to extend the information gathered at points to the EMR-sections.

The EMR-measurements are part of a DFG funded project managed by Dr. Uwe Nixdorf. For the first time, two standard EMR-systems from the company Mala Geoscience, Sweden, have been put in use. The 1,000-km-long section with the measured profiles (Fig. 15) is the same route along which three 100-m- to 150-m-long ice cores and numerous firn cores have been drilled last season. Another 1,000 km have to be added for the roundtrip Neumayer-Kottas Camp-Neumayer.

Arrival and departure of the traverse participants, as long as they were not participants of the overwintering team, were organized with the South African RV AGULHAS. The ship also transported the scientific equipment and provisions. The logistic equipment, three Kässbohrer Pisten-Bullys, six sleds with diverse superstructures, two skidoos and several Nansen sleds could be taken over from the Neumayer Station. The span was put together such that it was possible to work in the container during the trip. This enabled the use of the Ramac-apparatus from the Pisten-Bully span.

Several antennae in the frequency range between 50 MHz and 800 MHz were used. With a shielded 500-MHz aerial some uppermost 20 m of firn coverage and using a 100-MHz antenna the range to a depth of 100 m to 150 m were mapped. Thus, the data basis for the correlation between the ice core drill sites as well as between firn core drill sites are available. In addition several **C**ommon **M**id **P**oint (CMP) measurements were carried out using different aerials to determine the velocity-depth-function at different drill sites. Especially at DML05 two satellite drillings were connected by several profiles using different aerials. At the same time, the GPS measurements of stakes were repeated in order to determine the surface flow velocity of ice, a firn core was drilled and a snow pit was dug.

Besides the main scientific questions numerous other tasks could be performed. Thus the traverse served as a temporal base for aero-EMR-measurements and therefore provided, in addition to a tank container of kerosene, further material for airplane support. Besides that, it also installed and maintained GPS and magnetic reference stations at Kottas Camp and other locations along the track for some periods of time.

2.5.3 The Norwegian Antarctic Research Expedition 98/99, NARE 98/99

H. Eggenfellner, K. Pedersen, O. Skog und E. Vike (NPI)

The goals for the expedition were to bring home four automatically recording weather stations (and the data) from the area, to remeasure the movement and snow accumulation of 36 aluminium stakes placed in a glaciological monitoring network on the Bailey Ice Stream and across the Filchner Ice Shelf to the Berkner Island (two stake lines), and finally – to bring home any environmental harmful products and equipment remaining at the summer-base Blåenga.

The same group had participated on the NARE 96/97 to do the same work, but unfortunately the ice conditions at that season where too heavy and made it impossible to reach the summer base. Because of very good international co-operation in the Antarctic the group could join POLARSTERN from Cape Town to the most southern part of the Weddell Sea.

After 16 days of sailing the group was put ashore at the summer base (77°30'43"S, 34°12'37"W) the 25 January 1999. All the huts where under the snow-surface and only bamboos showed that there was something under the snow.

After two days of digging and 10 days with very bad weather the group started off towards the Theron Mountains 220 km inland (79°00'00"S, 27°55'44"W). They used four snow-mobiles as transportation. Here the group divided in two. In the Theron Mountains Pedersen and Skog established a communication base (HF radio and Inmarsat C) to communicate with the field party and the "outer world" (POLARSTERN and Norway). They also mounted a GPS receiver on a nunatak as reference station for the measuring of the glaciological monitoring network.

On 7 February Vike and Skog drove to the weather station "Delta", 170 km north-east of Theron base (at 78°00'00"S, 22°31'43"W). The weather station is four meter high but only two meter of it were visible over the snow. They demounted the station (after three hours of digging) and brought it back to the Theron base. They also found some old gasoline which they brought back.

At the same time the weather station in the Theron Mountains was demounted by Eggenfellner and Pedersen.

On 9 February Vike and Eggenfellner started out on the "stake round". During the season 91/92 36 stakes where accurate positioned with the help of differential GPS. One line followed the 80th parallel and one line followed the 79°15'-parallel across the Filchner Ice Shelf, plus four lines across the Bailey Ice Stream. The network was again measured during the 92/93 season, so the movement of the stakes during one year was already known. The total driving distance on this round is 800 km, but because of good conditions and no serious problems the "stake-round" this season took only a short week. However, not all the stakes where measured because they where covered by snow. On each stake the snow accumulation during the period was also measured.

Close to Berkner Island (80°06'02"S, 41°52'55"W), the third weather station was de-mounted.

On 16 February the Norwegians left the Theron Mountains. Because of very good driving conditions and nice weather, the trip out to the summer base (220 km) took only 7 hours.

All environmental harmful goods (oil, batteries etc.) were removed from the base. Most of the material was still in good condition and was handed over to the Argentineans at the Belgrano base. Also the left-over gasoline, oil and food from this seasons work was given to Belgrano.

To make the pick-up operation as less time consuming for POLARSTERN as possible, the Norwegians drove with all their equipment 150 km northeast of the summer base to the ice-edge. On 21 February 1999, they where picked up after a very successful season.

2.6 DISMANTLING OF THE FILCHNER STATION

J. Ams, A. Brehme, J. Janneck, W. Kaiser, N. Lensch, J. Porgarzalek, R. Witt, A. Ziffer (AWI, KG, LAEISZ)

In October 1998 the large tabular iceberg A-38 calved from the Filchner-Ronne Ice Shelf and broke into several pieces. Filchner Station (Figs. 17 and 18) was situated on one of them A-38B with an area of 2980 km^2 (Fig. 16). It became necessary to dismantle and remove the station, and for this reason a salvage team of nine people sailed on board POLARSTERN. On 31 January 1999 the salvage team was disembarked and the equipment needed for the work on the station unloaded on the western side of the iceberg A-38B, where the ice cliffs were 18 m high (Figs. 19 and 20). The landing site was just 30 km away from the station. An advance party got the heating, the melt water tank, the kitchen and the radio room up and running. The salvage work began on 1 February. First, the covering of snow was removed from the equipment that was distributed around the station platform. A generator, a number of depots with both full and empty fuel drums, which lay under 1 to 2 m of snow, a further Pisten-Bully and a tanker sledge, which had to be recovered from 4 m of snow, were dug out (Fig. 21). The freed drums and other miscellaneous items were loaded onto sledges. At the same time work on the station was proceeding. The station consisted of a platform supported by 14 legs at a height of about 4 m above the current snow surface, so as to prevent the accumulation of snow around it. Containers for living, dining and storage were secured to the platform. The storage container was cleared out and loose items on the platform were packed ready for transport. The storage container was then dismantled and the other containers were unfastened from the platform. On 7 February the first 20 tonnes of material were taken on board POLARSTERN. This first load comprised miscellaneous cargo, including the dangerous goods such as fuel drums, gas bottles and old batteries and was transported to the ship with Pisten-Bullys and sledges.

On 10 February the dismantling of the station was completed. A snow ramp had been pushed up around the station platform, and the station containers were pulled down this and placed on sledges or simple runners. The overnight transportation of everything to the ship had already begun. While the Pisten-Bullys were still in use during the day for dismantling the last of the station and loading the sledges, the first two loads were removed overnight. On 11 February at 20:00, all 119.8 tonnes of material from the station and 48 tonnes of equipment used for its transport (Pisten-Bullys, sledges, containers, etc) had been brought to the POLARSTERN and loaded on board (Fig. 22, Tab. 1 and 2). The cargo included 30,200 l of fuel, comprising 8,000 l of kerosene, 9,800 l of Arctic diesel and 12,400 l of petrol. During the salvage operation 5,200 l of fuel were consumed. The kerosene and Arctic diesel were used for fuel on POLARSTERN and the petrol was unloaded at Neumayer Station. All that remained of the station is the steel support structure, buried in the snow (Fig. 23). Despite the hard conditions and the speed at which the work was undertaken, no serious incident occurred.

Order of Work

31 January 1999

06:00 Start of unloading.
06:15 First flight of members of the salvage team to the station, in order to get the motor, snow-melt tank and crane up and running. The engine heater was switched on and the main switch of the crane was closed. The water level in the melt-tank was raised with 150 l of water brought from POLARSTERN.
10:00 Return flight to the ship to unload the remaining equipment.
12:00 End of unloading.
12:30 Departure for the station. Everything except the separate runners was taken to the station. A cold store was set up and the provisions were stowed away. The station was established. The radio equipment (VHF and short wave) was set up in working order.

1 February 1999

The satellite communications were started up. It was necessary to repair a plug. Test calls to AWI and Neumayer Station followed. The skidoos and starter unit were taken from the platform and set down on the ice. Snow was bulldozed away from the reserve diesel generator (90 KVA). Work started to clear snow from the Pisten-Bully garage. Snow was bulldozed away from the petrol depot and the drums were put on sledges. Clearing out of kitchen, mess, radio room and scrap store started. The winches and the uppermost stage of the platform supports were dismantled. Further dismantling of the supports proved not to be possible, because the last extension pieces had been cut down to size and the crank handles were resting against the grating. Therefore, snow later had to be pushed up to the level of the platform, so that the containers could be pulled off.

2 February 1999

The last piece of the Pisten-Bully garage was freed with a chainsaw. The Bully was completely iced up, but the motor started without problems after preheating. Because the roof of the garage had slumped, it was lifted with a Bully crane and propped up with beams. After this the vehicle could be driven from the garage without problem. The Bully was made in good working order.
14:00 The Bully was set to work. From this time three Pisten-Bullys with snow shovels were available. The snow was bulldozed away from the depot of Arctic diesel and the drums were put on sledges. Clearing of snow from the sledges and tank container began. The steel parts used for raising the station were dismantled and stowed in a container. The store was cleared out and the shelves were taken down. The antenna mast was disassembled.

3 February 1999

The 10 foot tank container and the bivouac huts were cleared of snow. The wooden boards between the kitchen and dormitory containers, which formed the store, were removed. Clearing of the container rooves started. The fastenings and stays of the workshop container were detached. Assorted pieces of steel were packed up. The batteries of the reserve generator were installed. The test run was successful.

4 February 1999

Snow was bulldozed from around the freight sledges and the 900-kg sledge. The sledges were shovelled free of snow. The winches and heavy duty shackle were removed from the station and stowed in containers. The wooden boxes with bolts, nuts, washers and shackles were taken from the station and placed in containers. Clearing of snow from the 20 foot tank container started. Clearing of the container roofs was completed. Removal of the planks and beams from the support structure of the platform. Loading of the empty drums, which had contained kerosene belonging to BAS, on the sledges with the petrol drums. The bivouac huts were prepared for occupation.

5 February 1999

Snow was cleared from the 20-foot tank-container. Steel items were stowed in container 202. Zarges boxes and miscellaneous items were stowed in container 246. Boxes that were no longer required were transferred from the supply container 204 to container 246. Zarges boxes that were not yet needed were placed on the platform. A freight sledge was loaded with rubbish, special waste, dangerous items and loose cargo for Neumayer Station. Fixing brackets of the former store between the kitchen and dormitory containers were dismantled. Container bridge fittings were dismantled. All the container fastenings that were welded onto the longitudinal girders were cut off. The cable fastenings on the container roofs were dismantled. On the south side of the station snow was bulldozed up to the level of the platform.

6 February 1999

Old sanitary material was packed away. Tools from the workshop container that were no longer required were packed away. Spare parts for the 90-KVA generator and melt tank were packed away. Freight containers 202 and 246 were loaded with return freight. Remaining freight (Bully spares, etc) in the supply container 204 were transferred to container 246. On the west and east sides of the station snow was bulldozed up to the level of the platform. Construction of the new camp, consisting of folding container W 209, container 204 for provisions and two bivouac huts.

7 February 1999

Remaining provisions were removed from folding container W 209 and stowed in empty container 204. Transport of petrol drums, freight sledges with miscellaneous items (skidoos, starter unit, empty drums) and sledges with waste to the loading site at the edge of the iceberg. Loading of POLARSTERN. Empty sledges were taken back to the station. The transport and loading operation lasted all day. The camp power supply was connected up to the reserve diesel generator. The kitchen fittings were removed from the station and arranged in the folding container W 209. The radio equipment was dismantled and installed in the folding container W 209. The interior fittings of the container from the kitchen, mess and radio room were removed. On the north side of the station snow was bulldozed up to the level of the platform.

8 February 1999

The mess fittings were placed in the folding container W 209. The first members of the salvage team moved into a bivouac hut. The crane was disassembled. The top shute of the melt tank was dismantled. The extensions to the exhaust pipes of the burner and 90-KVA generator were dismantled. The radio container, the mess container and the kitchen container were lifted from the platform and placed on runners.
17:30 The main motor was taken out of service. The remaining station containers were connected up to the power supply of the reserve diesel generator. The container fittings were stowed in the radio room and the container was closed with wooden boards.

9 February 1999

The water supply to the toilet container was shut off. The water and waste water pipes in the dormitory containers were disassembled. The dormitory containers were lifted from the platform, placed on runners and reconnected to the power supply in the camp. The workshop container was packed up and placed on a sledge. The provisions that were no longer required were stowed in a heated bivouac hut. Because both hut and provisions were going to Neumayer Station, repacking was unnecessary. Because of the ice situation, speed was important, and the first transport of material to POLARSTERN took place during the night.

10 February 1999

The melt-water container was drained and placed on a sledge. The toilet container was drained, dismantled water pipes were stored inside it, and the container was placed on a sledge. The remaining material (tools, strops, shackles, etc) were packed away in the return freight container. The folding container W 209 was cleared out and folded up.
12:30 The diesel unit was taken out of service, and all cables were removed and packed away.
13:00 The chilled provisions were taken to the ship by helicopter.
15:00 An attempt to tow container 202, which was full of pieces of steel and wood, with three Bullys failed, because the container was too heavy. Some of the wood was reloaded onto a sledge. The container could then be pulled with two Bullys.
15:30 Three members of the group flew back to POLARSTERN in the helicopter.
17:30 The remainder of the group drove to POLARSTERN with four Pisten-Bullys and freight. A further load was transported to the ship during the night.

11 February 99

08:00 The last load, comprising two bivouac huts towed by two Pisten-Bullys, was brought to ship. At the site of the former Filchner Station, only the central supports, anchored in the ice and the platform, consisting of longitudinal and transverse girders and the welded-on grating, which had served as a walkway, remained.
20:00 The last sledge was loaded and POLARSTERN cast off from the loading site on iceberg A-38B.

Tab. 1: Load taken on board on 7 February 1999

26	empty drums (kerosene)	Dangerous cargo
20	empty drums (Arctic diesel)	Dangerous cargo
1	tank container 10 foot T101 with leftover kerosene	Dangerous cargo
1	drum used oil (half full)	
14	batteries	Dangerous cargo
	power unit	
1	heating unit	
2	skidoos	
62	drums filled with 12,400 l petrol	Dangerous cargo
9	Zarges boxes for Neumayer Station	
6	Pisten-Bully wheels for Neumayer Station	
2	Pisten-Bully cog wheels for Neumayer Station	
1	rope winch for Neumayer Station	
2	oxygen gas bottles	Dangerous cargo
2	acetylene gas bottles	Dangerous cargo
17	propane gas bottles	Dangerous cargo
8	fire extinguishers	Dangerous cargo
misc. cleaning material		
1x net of various rubbish (kitchen waste, plastic, paper, etc.)		
	Total weight: 20.3 t	

Tab. 2: Load taken on board on 10 and 12 February 1999

	Weight
90 KVA generator	2.2 t
2x Nansen sledges	0.1 t
Cont. AWI 202	12.1 t
Cont. AWI 204	4.0 t
Stat. cont. toilet	3.0 t
Cont. AWI 246	7.0 t
Stat. cont. kitchen	4.0 t
Pisten-Bully No. 15	7.5 t
Pisten-Bully No. 16	7.5 t
Cont. AWI W 209	4.0 t
Pisten-Bully No. 11	7.5 t
Pisten-Bully No. 14	7.5 t
Cont. motor 10 foot	3.8 t
Cont. melt tank 10 foot	2.1 t
Cont. AWI T 210 with 8,000 l kerosene	11.5 t
Stat. cont. dormitory	3.0 t
Stat. cont. dormitory	3.0 t
Workshop cont.	1.0 t
Stat. cont. radio	3.0 t
Stat. cont. mess	2.0 t
Bivouac hut	4.3 t
Bivouac hut	3.0 t
Stat. cont. mess	2.0 t
10x cont. sledges	28.0 t
1x small sledge	1.5 t
6x pairs of runners	3.6 t
Brace for 10 foot container	1.0 t
65 drums of Arctic diesel (of which 49 drums filled with 9,800 l)	7.8 t
Empty weight of drums	1.3 t
Total weight	148.3 t
Load of 7.2.99	+20.3 t
Total weight taken on board	168.6 t
Salvage equipment	-48.0 t
Station material taken on board	119.8 t

Tab. 3: ALACE-Driftkörper, die während ANT XVIII/2 ausgelegt wurden.
ALACE deployed during ANT XVIII/2.

	Auslegung			1. Auftauchen		
Argos-Id#	Datum	Breite	Länge	Datum	Breite	Länge
3311	15.01.99	54.998° S	0.002° W	---	nicht	aufgetaucht
8058	15.01.99	55.497° S	0.002° E	22.01.99	55.219° S	1.460° E
8067	15.01.99	56.000° S	0.000° E	22.01.99	55.999° S	1.189° E
8064	16.01.99	57.000° S	0.000° E	22.01.99	57.067° S	0.508° E
9353	16.01.99	58.002° S	0.000° E	23.01.99	58.506° S	0.875° E
9356	16.01.99	59.000° S	0.000° E	23.01.99	58.643° S	0.932° E
9355	16.01.99	59.500° S	0.003° W	23.01.99	59.592° S	0.423° E
9354	16.01.99	60.000° S	0.000° E	23.01.99	60.124° S	0.168° E
8063	17.01.99	60.500° S	0.003° W	23.01.99	60.667° S	0.258° E
8060	17.01.99	60.998° S	0.003° W	23.01.99	61.064° S	0.209° W

Tab. 4: Eisberg-Markierungsbojen, die während ANT XVIII/2 ausgelegt wurden.
Satellite transmitters on icebergs deployed during ANT XVIII/2.

				Beschreibung des Eisbergs			
ARGOS Id#	Auslegung Datum/ Zeit	Breite	Länge	Länge (m)	Breite (m)	Höhe (m)	
9803	15.01.99 14:39	54.75223° S	0.35270° E	250	250	40	wenige Spalten, Oberfläche stark angeschmolzen
9802	15.01.99 19:03	55.61683° S	0.92667° W	1830	530	50	wenige Spalten, Oberfläche stark angeschmolzen
9835	16.01.99 14:24	58.64333° S	0.00333° E	740	560	30-40	wenige Spalten, Oberfläche stark angeschmolzen
9665	20.01.99 13:04	70.37517° S	9.48200° W	600	300	30	viele Spalten, harte Oberfläche
9782	23.01.99 09:19	70.26333° S	11.24343° W	650	280	30-40	sehr viele Spalten, harte Oberfläche
9834	23.01.99 09:39	70.49983° S	11.49250° W	740	280	25-35	sehr viele Spalten, harte Oberfläche
9667	29.01.99 18:50	75.12040° S	47.16150° W	370	100	15-25	einige Spalten am Rand
9831	30.01.99 12:15	75.26635° S	51.59023° W	520	220	30-50	keine Spalten, Schneeoberfläche
9781	31.01.99 09:10	75.21400° S	53.65200° W	750	350	20-35	keine Spalten, Schneeoberfläche
8069	01.02.99 16:47	75.44583° S	55.15300° W	1200	280	45-60	keine Spalten, Schneeoberfläche, liegt sehr schief
9832	05.02.99 12:33	75.32450° S	52.83183° W	7000	4000	9-65	A-38B (Filchner Station)
8057	01.03.99 17:07	70.36350° S	10.22600° W	650	370	45	viele Spalten, harte Oberfläche

Tab.5: Verankerungen, auf dem Nullmeridian aufgenommen wurden.
Moorings recovered on the Greenwich Meridian.

Mooring	Latitude Longitude	Date Time(UTC) (1. Record)	Water Depth (m)	Type	SN	Depth (m)	Record length (days)
AWI233-3	69° 23.9´S	29.04.98	2000	ULS	36	155	(1)
	00° 00.7´W	22:00		AVTP	9763	248	265
				AVTPC	9783	749	265
				ACM-CTD	1453A	1954	264
AWI232-3	68° 59.7´S	30.04.98	3360	ULS	39	50	(1)
	00° 03.7´W	20:00		AVTPC	9201	140	263
				ACTPC	10492	655	263
				AVTPC	9214	1802	263
				ACM-CTD	1385A	3304	263(2)
AWI231-2	66° 30.0´S	02.05.98	4535	ULS	42	186	260
	00° 01.1´W	20:00		AVTPC	9200	212	260
				SM37	211	215	260
				SM37	212	265	260(2)
				SM37	213	315	260(2)
				SM37	214	365	260
				SM37	215	415	260(2)
				SM37	216	465	260
				SM37	217	515	260
				SM37	218	565	260
				SM37	231	615	260
				SM37	220	665	260
				ACM-CTD	1386A	719	260
				AVT	9391	1830	260
				ACM-CTD	1443A	4490	260
AWI229-2	63° 58.7´S	05.05.98	5180	ULS	43	150	302
	00° 02.3´E	22:00		AVTP	10002	196	302
				SM37	221	202	302
				SM37	222	252	302
				Micro-J	1325F	302	302
				SM37-P	243	302	302(2)
				Micro-J	1324F	302	302
				SM37	224	352	302
				SM37	225	402	302
				SM37	226	452	302
				SM37	227	502	302
				SM37	228	552	302
				SM37	229	602	302
				SM37	230	652	302(2)
				ACM-CTD	1391A	707	302(2)
				AVT	9186	2003	302
				ACM-CTD	1392A	5134	302
AWI227-5	59° 04.2´S	08.05.98	4616	ULS	40	160	(3)
	00° 04.9´E	18:00		AVTP	10451	270	301
				AVTPC	9211	708	301
				SM37-P	244	709	301
				AVT	9190	2014	(3)
				ACM-CTD	1388A	4561	301
AWI228-2	56° 58.6´S	13.05.98	3746	AVTPC	8418	277	297
	00° 01.3´E	18:00		AVTP	8417	483	297
				AVT	9179	839	297
				SM37-P	245	840	297
				AVT	9180	2041	297
				ACM-CTD	1404A	3691	(4)

Tab. 6: Verankerungen, die auf dem Nullmeridian ausgelegt wurden.
Moorings deployed on the Greenwich Meridian.

Mooring	Latitude Longitude	Date Time(UTC)	Water Depth(m)	Type	SN	Depth (m)
AWI233-4	69° 23.9'S	20.01.99	2026	ULS	41	240
	00° 01.1'W	12:18		ACM-CTD	1504A	329
				AVTPC	9212	826
				ACM-CTD	1400A	1982
AWI232-4	68° 59.7'S	19.01.99	3413	ULS	38	212
	00° 01.9'W	23:33		ACM-CTD	1505A	300
				AVTP	9997	807
				AVT	10495	1853
				ACM-CTD	1402A	3356
AWI231-3	66° 29.9'S	18.01.99	4560	ULS	07	214
	00° 00.9'W	23:15		ACM-CTD	1506A	242
				CT500		300-650
				ACM-CTD	1454A	749
				AVT	10530	1855
				ACM-CTD	1403A	4516
AWI230-2	66° 00.3'S	18.01.99	3450	ULS	26	161
	00° 10.6'E	11:51		ACM-CTD	1507A	190
				MJ	1321F	290
				SC	1974	392
				SC	2413	493
				SM37	449	593
				ACM-CTD	1452A	699
				AVT	10531	1595
				ACM-CTD	1409A	3406
AWI229-3	63° 57.8'S	04.03.99	5180	ULS	13	180
	00° 02.3'E	15:25		ACM-CTD	1448A	218
				CT500		250-650
				ACM-CTD	1449A	725
				AVT	10532	2021
				ACM-CTD	1411A	5172
AWI227-6	59° 04.2'S	06.03.99	4700	ULS	43	202
	00° 04.4'E	19:50		AVTPC	9206	311
				AVTPC	9213	738
				SC	2418	739
				AVTPC	7727	2045
				ACM-CTD	1455A	4656
AWI228-3	56° 57.9'S	07.03.99	3780	ACM-CTD	1389A	306
	00° 01.4'E	15:19		AVTPC	8048	513
				AVTPC	9219	869
				SC	2419	870
				AVTPC	8037	2076
				ACM-CTD	1317A	3727
				SBE26	226	3780
AWI238-1	54° 30.2'S	08.03.99	1794	ACM-CTD	1390A	1741
	00° 01.7'E	11:13		SBE26	227	1794
AWI237-1	46° 09.9'S	11.03.99	3763	ACM-CTD	1387A	3710
	01° 01.1'E	15:03		SBE26	228	3763

Tab.7: Verankerungen, die am Kontinentalhang nordwestlich des Filchnergrabens aufgenommen wurden.
Moorings recovered on the continental slope northwest of the Filchner Depression.

Mooring	Latitude Longitude	Date Time(UTC) (1. Record)	Water Depth (m)	Type	SN	Depth (m)	Record length (days)
F1	74° 30.9'S	22.01.98	647	AVTPC	9192	440	393
	36° 36.3'W	13:00		TL	0001	547	362(8)
				AVTC	7717	591	(5)
				AVTC	10909	637	327(8)
				SM37	137	638	393
F2	74° 25.6'S	23.01.98	1180	AVTC	4040	767	348(8)
	36° 22.5'W	19:00		TL	0002	880	(4)
				AVTC	5294	978	(5)
				TL	0003	1030	(4)
				TL	0004	1080	(4)
				AVTC	9193	1124	390
				AVTC	10907	1170	309(8)
				SM37	138	1171	390
F3	74° 18.0'S	23.01.98	1637	AVTPC	7066	1224	(5)
	36° 04.5'W	21:45		TL	0005	1337	(4)
				AVTC	4132	1435	(6)
				TL	0006	1487	(4)
				TL	0007	1537	(4)
				AVTC	9403	1581	395
				AVTC	6798	1627	(7)
				SM37	139	1628	395
F4	74° 09.3'S	24.01.98	1984	AVTC	9708	1777	332(8)
	35° 42.2'W	03:00		TL	0009	1884	133(8)
				AVTC	9194	1928	390
				AVTC	9195	1974	376(8)
				SM37	140	1975	390

Abkürzungen/ Abbreviations:

- ACM-CTD: Falmouth Scientific 3-dimension acoustic current meter with CTD sensor head (CTD= Conductivity, Temperature, Depth)
- AVTPC: Aanderaa current meter with temperature, pressure, and conductivity sensor
- AVTP: Aanderaa current meter with temperature and pressure sensor
- AVT: Aanderaa current meter with temperature sensor
- SC: SeaBird Electronics self contained CTD, type: SeaCat SBE16
- SM37: SeaBird Electronics MicroCat CT Recorder
- SM37P: SeaBird Electronics MicroCat CT Recorder with 3000 psi pressure sensor
- ULS: Upward looking sonar Christian Michelsen Research Inc.
- TL: Oregon Environmental Instruments 9311 Temperature Logger
- CT500: 500m sensor string of 9 ea. SeaBird Electronics MicroCat CT Recorder
- SBE26: SeaBird Electronics Tidegauge SBE26, 10.000 psi

Anmerkungen/Remarks

1: data retrieved with failures, which may be fixed by the manufacturer
2: some parameters were not measured correctly
3: instrument flooded, all data lost
4: battery failed, all data lost
5: data stored on magnetic tape, instrument was recording before switching power off.
6: all data lost, tape didn't spool correctly
7: instrument did not start recording
8: instrument did not recording the complete period

2.7 CIRCULATION AND WATER MASS FORMATION IN THE ATLANTIC SECTION OF THE SOUTHERN OCEAN

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Objectives

The field work aimed to measure circulation and water mass properties in the Atlantic sector of the Southern Ocean, to investigate the contribution of the Weddell Sea to the ocean's role in climate. In this respect water mass modification plays an important role, because it leads to the formation of Antarctic Bottom Water which is an essential part of the global thermohaline circulation. With the aim to determine the spatial and temporal variability of the water masses and the ocean currents, vertical temperature and salinity profiles were measured from the ship, moored instruments were recovered and deployed and drifting platforms were launched.

At the northern threshold of the Filchner Depression, the so-called Ice Shelf Water drains into the deep sea. This water mass forms because water of high salinity flows in beneath the ice shelf. At a depth of 1,000 m, the freezing point of seawater is lowered to -2.5°C. As a result the inflowing water, even if it has already reached the freezing temperature at the sea surface, can be further cooled at the base of the ice shelf through melting. In this manner, the coldest water found anywhere in the ocean is formed. Part of this supercooled water freezes at the underside of the ice shelf on its way back out, so forming marine ice. Another part comes out at the front of the ice shelf as supercooled water. In the Filchner Depression it flows to the north, where with a temperature of -2.1°C it crosses a low saddle at the edge of the continental shelf, and as a result of its high density, caused by its low temperature, drains into the deep sea. This outflow contributes to the formation of Weddell Sea Bottom Water, which feeds into the circumpolar ocean to the north, from where it flows further into the three ocean basins as Antarctic Bottom Water.

It is the objective of our work to quantify the transport of Ice Shelf Water into the deep sea, reckoned at about 1 million cubic metres per second, using direct measurements of the currents made with moored instruments. The mixing of the Ice Shelf Water with the lighter surrounding water determines the depth to which the outflow can sink. This can be derived from the temporal fluctuations of the Ice Shelf Water flow, that are measured with the moored instruments, and the spatial distribution, that can be learnt from CTD (**C**onductivity, **T**emperature, **D**epth) sections. For this reason, four moorings were placed in the outflow last year by HMS ENDURANCE. In order to record the distribution of water masses, we carried out a CTD section from the iceberg A-38B, extending onto the continental slope, a second section in the region of the descending flow of Ice Shelf Water and a third along the northern threshold of the Filchner Depression. These investigations are taking place as a cooperation between the AWI, the British Antarctic Survey, the Geophysical Institute of the University Bergen, Norway and Earth and Space Research, Seattle, USA in the framework of the "**F**ilchner **R**onne **I**ce **S**helf **P**rogramme" (FRISP) of "**S**cientific **C**ommitee on **A**ntarctic **R**esearch" (SCAR).

The objective of the investigations in the eastern Weddell Sea and the Antarctic Circumpolar Current is to detect, if there are correlations between the fluctuations of the Antarctic Circumpolar Current and the properties of the Weddell Sea Bottom Water. Furthermore it should be shown, if the variations in the deep and bottom water of the Weddell Sea affect the Antarctic Bottom Water in the South Atlantic. To determine the origin of the variations, it is planned to measure the fluctuations of the Antarctic Circumpolar Current south of South Africa, in particular the intensity and location of the southernmost current bands and the transition to the northern part of the Weddell gyre. In case of the formation of a large Weddell Polynya west of Maud Rise, the measurements should allow to determine, if an increased inflow of Circumpolar Deep Water contributes to the polynya development or, if the local atmospheric forcing dominates. Furthermore the occurrence of deep convection and the change of water mass properties as a consequence of the polynya will be detected.

The measurements continue the time series in the Weddell Sea covering the past decade. They will allow to determine the dominant time scales and the spatial distribution of observed changes of the water mass properties. It is planned to identify a minimum set of measurements which is sufficient to determine the state of the water mass formation in the Weddell Sea, which can be applied as a long term monitoring system with an as small as possible logistical effort. These measurements are a contribution to the "**Cli**mate **Var**iability and Predictability Programme" (CLIVAR) of the "**W**orld **C**limate **R**esearch **P**rogramme" (WCRP).

To investigate the contribution of icebergs to the fresh water cycle in the Weddell Sea, 11 of them were tagged with satellite transmitters (Fig. 31, Tab. 4). The icebergs originate at the Antarctic coast or ice shelf edge, when the ice masses from the inland reach the ocean and break off. With a typical velocity of 15 km per day they might drift for several years in the Weddell Sea until they finally break into small pieces and supply continental fresh water to the ocean. If they encounter shallow water during their drift they can stay at a fixed location for years until they melted enough or broke to smaller bergs which can drift freely. By iceberg melt the Weddell Sea receives about 410 Gt of fresh water per year.

Large icebergs can be followed on satellite images. However, a large part of the icebergs is too small to be detected by satellites, but they might contribute significantly to the fresh water input. Therefore, the tracks of relatively small bergs should be measured. The results will be used to determine the appropriate parameters in a numerical model of the iceberg drift which is run in AWI. This model includes atmospheric driving forces, ocean currents and sea ice. It takes into account that iceberg motion can be determined by surrounding sea ice, if the sea ice cover is ridged enough. The observed and the model trajectories will be compared to optimize the model parameters. In a final state it will be possible to determine with the validated models the variations in the iceberg drift and consequently of the regional fresh water input due to climate changes, because iceberg motion determines where the fresh water from the Antarctic continent is supplied to the ocean. Together with the other components of the fresh water budget, as precipitation minus evaporation and differential freezing and melting of sea ice, the fate of the icebergs can locally affect the stability of the water column and consequently the formation of deep and bottom water.

Work at Sea

On the way towards the Neumayer Station and back to Cape Town expendable Bathythermographs (XBTs) were launched to measure the ocean temperature to a depth of 700 m. The data were directly inserted in the GTS. However the tracklines did no correspond completely on the way south and north (Figs. 24, 25 and 26, Annex 1). Measurements with the Acoustic Doppler Current Profiler (ADCP) and the thermosalinograph were carried through the complete cruise. The thermosalinograph records are presented in Figs. 25 and 26.

To determine the water mass properties 257 vertical profiles were measured with a CTD sonde along the Greenwich Meridian and in the southern Weddell Sea (Fig. 27, Annex 2). In the southern Weddell Sea a CTD section was done from iceberg A-38B over the continental slope (Fig. 27) and a detailed survey was carried out between the Ronne Ice Shelf up to Lassiter Coast and the iceberg A-38B (Figs. 27 and 28 top). The distribution of the water masses sinking along the continental slope and at the northern threshold of the Filchner Depression was measured (Figs. 27 and 28 bottom).

In the vicinity of the Southwest Indian Ridge between 55°S and 61°S, in the transition zone from the Antarctic Circumpolar Current to the Weddell Gyre, a set of 10 ALACEs (Autonomous Lagrangian Circulation Explorer) were launched in a distance of 30 or 60 nm (Fig. 29, Tab. 3). These floats sink to a depth of approximately 700 m and return every 7 days to the surface, where they transmit their position and a temperature profile via Service Argos. During the drift the floats supply information about the injection of Circumpolar Deep Water into the Weddell Gyre. This warm and salty water mass represents the major heat and salt source which limits the ice thickness and permits the formation of deep and bottom waters. In addition to the ALACEs, a meteorological buoy (ODAS) with a drogue at 200 m was deployed.

To measure the low period variability of the water mass properties and the sea ice thickness, seven moorings were recovered and deployed along the Greenwich Meridian with temperature and salinity sensors, current meters and upward looking sonars (ULS) (Fig. 30, Tabs. 5 and 6). On the way south, three moorings were recovered and four redeployed south of Maud Rise. On the way north, three moorings were exchanged in the northern part of the Weddell gyre. Additionally two sea level recorders were deployed in the Antarctic Circumpolar Current.

A set of four moorings and two sea level recorders of the Proudman Oceanographic laboratory, which were deployed in 1998, were recovered on the continental slope northwest of the Filchner Depression (Tab. 7). The mooring F3 was lying, at the time of the first attempt at recovery, under D11, a giant iceberg 8 nautical miles in width and 30 nautical miles in length (Fig. 28 bottom). With the other three moorings and the bottom pressure recorder C2 we had more luck. F4 lay just to the north of the iceberg in a polynya. Nevertheless, thick fog had developed over the open water, turning the recovery into an exciting game of hide and seek. The moorings F1 and F2 were situated in the thick band of ice to the south of the iceberg, but with some patience and the use of acoustic position finding during the ascent, we were able to locate both moorings amongst the ice. The bottom pressure recorder M2 was recovered on the way back because on our journey south, M2 had been lying under thick ice. The southerly wind was constantly creating open water, but because of the low temperatures a compact covering of new ice was rapidly forming. The Bottom Pressure Recorder was held on the sea floor by an anchor weight, from which it could be detached by means of a release that would be activated on receipt of an acoustic signal. However, M2 put our patience to the test, because it first only rose to the sea surface after repeated attempts at release, then was practically invisible between the compacted floes of new ice. Meanwhile, D11 shifted sufficiently to leave F3 clear. The route back there led through such strong ice pressure that we were often held fast, and the detour required more than two days. Our efforts were rewarded with the successful retrieval of F3.

Three buoys were deployed on ice floes for the "**I**nternational **P**rogramme for **A**ntarctic **B**uoys" (IPAB) in the framework of the WCRP, to observe meteorological parameters and sea ice drift. A buoy with oceanographic instruments was deployed in an inlet, on 2.5 m thick fast ice at the Ronne ice front within a few miles of the Lassiter Coast. It was equipped with a 486 m long wire with 3 current meters and 10 temperature and salinity sensors. The measurements from these sensors were transmitted via satellite. After a few days no more data were transmitted.

CTD Data Processing

Hydrographic observations were made with a Falmouth Scientific Triton Integrated CTD (FSI-ICTD) combined with a 24 bottles water sampler. The CTD contained three temperature channels: Fast Response (FT), Platinum with 100 ms time constant (PT1) and Platinum with 400 ms time constant (PT2). The sample rate was 21 Hz. Connected to the CTD was a Benthos Altimeter Mod. 2110. A FSI data terminal DT 1050WS was used as deck unit. The water sampler consisted of a frame from General Oceanics and a Falmouth Scientific Sure Fire water sampler release unit. The water sampler was equipped with 12 liter bottles from Ocean Test Equipment with stainless steel springs.

CTD SN 1360 was used for the first 151 casts. Then, we switched to instrument SN 1347 because frequent spikes occurred in the pressure record. However, it appeared that the perturbations were not due to the CTD and consequently we switched back after 25 casts to the initial CTD. Altogether 257 profiles were taken (Annex 2)

The pre-cruise calibration had demonstrated the perfect status of the system. However, the comparison of the final data with those of previous cruises which were measured with a Neil Brown Mark IIIB evidenced that the 100 ms temperature probe (PT1) did not work properly in both instruments. Further investigation indicated that both PT1 were subject to a systematic error. The data set was reprocessed by use of the records from the 400 ms sensor (PT2).

CTD-Calibration

Temperature and Pressure

The pre- and post-calibrations were made at the Scripps Institute of Oceanography (SIO). No significant time drift occurred between the two calibrations. Thus the correction based on the SIO calibration from August 1998 was applied to all data. The corrections were determined by use of all calibration points as:

Correction = $A + B*N + C*N^2 + D*N^3 + E*N^4$ (N = instruments reading).

The coefficients for the two CTDs are presented in the table below.

Coefficients for ICTD SN 1347

Kanal	A	B	C	D	E
PT1	0.00179275	0.000367769	5.98102E-006	-1.73705E-006	3.92021E-008
PT2	-0.00296646	0.000105862	1.00638E-005	-1.1248E-006	2.2004E-008
Press loading	1.6215	0.000766727	-2.36597E-007	-5.02071E-011	8.88206E-015
Press unloading	1.22939	0.000835985	-5.34279E-007	4.4177E-011	1.33783E-015

Coefficients for ICTD SN 1360

Kanal	A	B	C	D	E
PT1	0.00448876	-4.55829E-005	3.83954E-005	-2.4525E-006	4.40105E-008
PT2	-0.00332538	-0.000208227	3.21668E-005	-1.67948E-006	2.77787E-00
Press loading	-0.641264	-0.000848878	3.51877E-007	-7.04156E-011	4.47779E-015
Press unloading	-0.706127	-0.000846957	2.60004E-007	-3.95838E-011	1.89705E-015

The accuracy of the data was estimated as the mean difference between the correction and the calibration points. The pressure data are better than ±0.2 dbar for loading pressure and ±1dbar for unloading pressure. The temperature is better than ±0.001K. T68 temperature scale is used to maintain a consistent basis for later salinity and density calculations.

Salinity/Conductivity:

Water samples were taken from the bottles for salinity/conductivity correction. The samples were measured with a Guildline Autosal 8400B using IAPSO Standard Seawater from Ocean Scientific International; Batch No. P134. The Autosal measurements were controlled and logged by PC and software (SIS Softsal Package). The conductivity differences between CTD and Autosal measurements did neither show a pressure or nor a time dependence. Thus the ICTD conductivity was corrected by a constant offset of:

$C_{corrected} = C_{ICTD} + COR.$

While ICTD SN 1347 was used, 89 salinity samples were taken and measured. The conductivity correction was determined from 61 samples taken deeper as 100 m and resulted in: COR = 0.0053 mS/cm with a standard deviation of 0.001 mS/cm. 1278 salinity samples were taken and measured while ICTD SN 1360 was used. The conductivity correction was determined from 952 samples. Here 966 samples were taken from depth below 100 m, 14 samples of them were rejected because they were off by up to 0.03 mS/cm. The correction resulted in COR = 0.0154 mS/cm with a standard deviation of 0.001 mS/cm.

Data Acquisition and Processing

The raw data from the CTD down- and up-casts were recorded using a PC and FSI's acquisition software (W95-ICTD, Version 1.5). The binary formatted raw data were transferred to a SUN UNIX Workstation for post-processing. These software routines are written in FORTRAN and are essentially based on the formerly used PC-based post-processing package from EG&G (Oceansoft) which was used since 1989 for the processing of the Neil Brown CTD Mark IIIB data.

The post-processing procedures for the down-cast:

Editing spikes using a graphical editor:
All parameters are plotted versus scan number on the screen. Questionable parts of the profiles were enlarged. Spikes were removed with a minimum/maximum filter, a difference filter or manually by setting markers with the mouse pointer. Removed values were replaced by linear interpolation.

Pressure averaging:
The output of this program is an ASCII formatted file containing the cast header and the CTD record on 2dbar steps with pressure, temperature, conductivity, and computed parameters like salinity, potential temperature, and density. The program executes the following tasks:

a. Apply corrections for PT1, PT2 and the loading pressure based on the SIO-calibration
b. Combine Fast Response and Platinum temperatures; select one of the two channels (PT1 or PT2)
c. Apply time lag correction for the conductivity
d. Eject pressure reversals (keep monotonely increasing pressure)
e. Average conductivity and temperature for 2-dbar-intervall
f. Apply conductivity cell correction (consider temperature- and pressure effect on the cell ceramic)
g. Compute salinity
h. Interpolate pressure, temperature, and salinity on the center of the pressure interval
i. Compute conductivity from pressure, temperature, and salinity.

Details are documented in the EG&G software manual Oceansoft from 1989 as well as in Falmouth Scientific ICTD Operation Manual.

The post-processing procedures for the up-cast: Create a bottle file

Check bottle firing:
The up-cast data were acquired in the same way as the down-cast data. While taking a water sample (bottle firing), the acquisition software changes a specific bit ("marker") within an additional byte which is added to the standard CTD record. Thus it is possible to identify water sample records in the up-cast and create a bottle file. In this first step, the taken number of samples is compared with the "markers" in the up-cast with a program similar to the graphical spike editing program. It allows to erase or insert "markers".

Reduce number of records:
To accelerate further processing superfluous records were ejected. Thus, 200 records before and after the "marker" were kept.

Editing spikes using a graphical editor:
The same routine as described in the down-cast processing was applied.

Create the bottle file:
The average of pressure, PT1 or PT2, and the conductivity was calculated from 50 records before and after the "marker". Temperatures FT & PT1 or FT & PT2 were not combined. The cell correction (see pressure averaging) was applied to the conductivity values, and the SIO corrections to PT1/PT2 and the unloading pressure. The standard deviation of PT1/PT2 (STDDEV) was added to each bottle record as a control value to identify by small values samples which were taken in layers homogenous enough to be used for the conductivity correction on the basis of the comparison between CTD-conductivity and Autosal measurements.

Summary of data processing:

Due to the SIO pre- and post-calibration and Autosal measurements on board the instruments accuracy is much better than the manufacturers specification:

	Accuracy	
Parameter	ANT XVI/2	manufacturers specifications
Pressure (dbar)	±0.2 loading, +/- 1.0 unloading	±0.03 % of full scale (±2.0dbar at 6.500 dbar)
Temperature (°C)	±0.001	±0.003
Conductivity (mS/cm)	±0.001	±0.003
Salinity	±0.001	

Preliminary results

A hydrographic section was carried out in the coastal polynya in front of the Ronne Ice Shelf from iceberg A-38B to the west up the Lassiter Coast (Figs. 28 top and 32). An outflow of Ice shelf Water was observed at the eastern boundary of the Ronne Depression, which formed a strip along the ice shelf front of more than 100 km length with temperatures in the water column below the surface freezing point. The coldest temperatures of –2.12°C were observed at station 29 and even at the sea surface temperatures around –2°C were encountered indicating upwelling of supercooled water. The outflow of Ice Shelf Water was surveyed on a three-dimensional grid. The temperature minimum at the eastern slope of the depression decreases clearly to the north (Fig. 33). It remains to explain, why the northward directed outflow of Ice Shelf Water follows the eastern slope whereas due to the effect of Coriolis force it is expected at the western slope.

To the southwest of iceberg A-38B another iceberg laid at the ice shelf front (Fig. 28 top) which prohibited measurements along the ice front. The section had to be finished at the southeast corner of A-38B, because of the heavy sea ice. Two sections were obtained perpendicular to the ice shelf front towards iceberg A-38B. They show by increasing temperature and salinity with increasing distance from the ice shelf front, the decreasing influence of the Ice Shelf Water (Fig. 34). At the loading site of A-38B two series of CTD yoyos were achieved (Figs. 35 and 36).

The descending plume of former Ice Shelf Water, now transformed to Weddell Sea Bottom Water, was surveyed at three transects. (Figs. 28 bottom and 37). The core of cold water with low salinity is located at the northern threshold of the Filchner Depression in 400 m to 500 m depth (Fig. 39). After crossing the sill, the plume turns under the influence of the Coriolis force to the left and sinks between the eastern (Fig. 37b) and the western (Fig. 37a) section from 1,500 m to 2,500 m depth. On this path the temperature increases significantly due to mixing with ambient water masses. However, the core can still be clearly identified. On a section along the 2,800 m depth contour (Fig. 38) higher temperatures are found as in shallower parts of the slope, suggesting that the cold core did not exit seaward between the eastern and western sections (Figs. 37a and b). The evaluation of the current meter data (Tab. 7), which can occur only after the return, will allow to estimate the volume transport of the cold plume.

The vertical distributions of temperature and salinity along the Greenwich Meridian display the typical structure of a cold dome with low salinity which is centred at approximately 61°S (Fig. 40) and is formed by the cyclonic circulation of the large scale Weddell gyre. At the southern side over the slope of Maud Rise Warm Deep Water is carried to the west and creates temperature and salinity maxima of 1.2°C and 34.69. In the northern part of the gyre significantly cooler Warm Deep Water and Weddell Sea Bottom Water is carried to the east. In the past years a gradual warming and increase of salinity was observed in the Warm Deep Water and the Weddell Sea Bottom Water. The preliminary data suggest that the warming and salinity increase continues in the Warm Deep Water. However, conclusions can only be drawn of the final processing of the data set.

2.8 INVESTIGATIONS ON THE METAL METABOLISM IN POLAR AMPHIPODS AND DECAPODS

J. Ritterhoff and J. Kahle (ICBM)

Objectives

In recent years high metal concentrations (especially regarding Cadmium) were reported in marine amphipods and decapods from polar regions. In particular, hyperiid amphipods from the Arctic and Antarctic showed extremely high cadmium levels up to 100 mg kg^{-1} d.w., deep sea amphipods *Eurythenes gryllus* from the Canada Basin levels up to 360 mg kg^{-1}. Decapod crustaceans from polar oceans also display elevated cadmium levels. The observed metal accumulation is in contrast to the low soluble metal concentration normally found in Antarctic sea water. Without efficient mechanisms of storage and detoxification, the metal ions taken up by the organisms would be toxic. Thus, uptake and detoxification strategies as well as mechanisms of the metal metabolism are essential issues for those organisms accumulating high amounts of metals. The corresponding physiological and biochemical mechanisms are not yet fully understood.

The main goal of the current project is to develop and improve a conceptual model of the metal metabolism in marine amphipods and decapods from polar waters, based on investigations on the accumulation strategies and related storage and detoxification mechanisms. This would be a precondition to assess the importance of trophic transfer of metals, for example, to seabirds and marine mammals. To achieve this goal integrated field studies and toxicokinetic and bioaccumulation experiments on board ship are necessary.

Methods

Mesozooplankton for determination of metals was mainly sampled at 12 stations by vertical bongo hauls (200 - 0 m), mesh sizes 500 μm and 700 μm, hauling at 0.4 m s^{-1} and by towed bongo hauls (0 - 200 - 0 m), trawled with 1 knot. Macrozoobenthos was collected at 5 stations using a trap (400 m) with fish pieces as a bait to get a selective catch of necrophorous organisms. Although 5 times the Agassiz trawl (200 - 400 m) was trawled for 10 min to get a broader variety of taxa. Organisms were identified to species level (if possible), sexed and sorted according to developmental stage and body size. The samples were shortly rinsed with double-distilled water, dried on good quality filter paper and immediately frozen at -27°C. Special care was taken to avoid contamination, e.g. by maintaining animals always in water or closed containers. Occurrence of paint particles or other materials was excluded by close visual inspection of each specimen collected using a binocular microscope. More than 1,000 field samples of 44 Antarctic crustaceans and some other taxa were collected during the cruise. Sampled material included 2 decapod species, 23 amphipod, 6 isopod, 4 copepod, 4 euphausiid, 1 cumacea, 2 pteropod and 5 fish species. Thus this field studies will give a first overview on the metal levels in Antarctic marine organisms from different trophic levels.

Furthermore 13 toxicokinetic experiments were done as a tool for calibration of monitor organisms to follow the time course of uptake (8 to 20 d) and depuration (8 to 14 d) of water born cadmium, lead, nickel, cobalt, chrome, copper and zinc in the decapod species *Notocrangon antarcticus*, the amphipods *Waldeckia obesa*, *Orchomene plebs* (adult and juveniles), *Orchomene spec.*, *Ampelisca bouvieri*, and the copepods *Metridia gerlachei* and *Calanoides acutus*. Nominal exposure concentrations were 5 μg Cd l^{-1}, 5 μg Co l^{-1}, 20 μg Pb l^{-1}, 20 μg Ni l^{-1}, 20 μg Cr l^{-1}, 30 μg Cu l^{-1} and 60 μg Zn l^{-1}. Furthermore toxicokinetics experiments were done to follow the uptake (20 d) and depuration (10 d) of metals via the food path in *O. plebs* using artificial contaminated fish and naturally polluted snails.

Finally, three uptake experiments were performed using a wide range of 6 exposure levels to investigate accumulation strategies of *O. plebs*, *A. bouvieri* and *C. acutus* and to validate model predictions based on the compartment models which will be developed from the results of the toxicokinetic experiments.

During all experiments no elevated mortality due to metal exposure were noted.

Potential results

Since the metal analysis and the statistical evaluation will be done in our laboratories at the Institute for Chemistry and Biology of the marine environment (ICBM) in Oldenburg, the results of our project could not presented here.

However the experiments and field work will result in a set of data about the (i) water borne uptake and depuration of metals, (ii) uptake of metals via the food path (iii) their binding to specific, soluble, ligands, (metallothioneins and hemocyanin), (iv) the formation and sequestration of insoluble precipitates in concretions or granules and probably (v) their compartmentalisation within membrane-limited vesicles (lysosomes) and (vi) the influence of life-history and abiotic factors. These results will be the basis for the modelling of a conceptual model at the end of the project.

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2. Las Palmas - Cape Town

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2. Neumayer Station to Filchner Station and back to Neumayer Station
3. Neumayer Station to Cape Town

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Hargreaves, Geoffrey William	(POL)
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Jacobi, Hans Werner	(AWI)
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Riedel, Katja	(AWI)
Ritterhof, Jürgen	(ICBM)
Rohardt, Gerd	(AWI)
Sacker, Karsten	(AWI)
Sellmann, Lutz	(AWI)
Skog, Ottar	(NPI)
Steinhage, Daniel	(AWI)
Vike, Erik	(NPI)
Weiland, Hans	(DWD)
Weller, Rolf	(AWI)
Werbach, Johann	(KG)
Witt, Ralf	(AWI)
Wöste, Hans-Christian	(DPA)
Wohltmann, Holger	(AWI)
Ziffer, Albert	(AWI)

6 SCHIFFSPERSONAL / SHIP´S CREW

	ANT XVI/1	ANT XVI/2
Master	Keil, Jürgen	Keil, Jürgen
1. Offc.	Grundmann, Uwe	Grundmann, Uwe
1. Offc.	Rodewald, Martin	Rodewald, Martin
Ch. Eng.	Schulz, Volker	Schulz, Volker
2. Offc.	Spielke, Stefan	Fallei, Holger
2. Offc.		Peine, Lutz
Doctor	Dehof, Stefan	Dehof, Stefan
R. Offc.	Hecht, Andreas	Hecht, Andreas
2. Eng.	Delff, Wolfgang	Delff, Wolfgang
2. Eng.	Folta, Henryk	Folta, Henryk
2. Eng.	Simon, Wolfgang	Simon, Wolfgang
Electron.	Baier, Ulrich	Baier, Ulrich
Electron.	Bretfeld, Holger	
Electron.	Dimmler, Werner f. L.P.	Dimmler, Werner
Electron.	Fröb, Martin	Fröb, Martin
Electron.	Holtz, Hartmut	Holtz, Hartmut
Electron.	Piskorzynski , Andreas	Piskorzynski, Andreas
Boatsw.	Loidl Reiner	Loidl, Reiner
Carpenter	Neisner, Winfried	Neisner, Winfried
A.B.	Bäcker, Andreas	Bäcker, Andreas
A.B.	Bindernagel , Knuth	Bindernagel, Knuth
A.B.		Bohne, Jens
A. B.	Hagemann, Manfred	Hagemann, Manfred
A.B.		Hartwig, Andreas
A.B.	Moser , Siegfried	Moser, Siegfried
A.B.	Schmidt, Uwe	Schmidt, Uwe
A.B.	Winkler, Michael	Winkler, Michael
Storekeeper	Beth, Detlef	Beth, Detlef
Mot-man	Arias Iglesias, Enr.	Arias Iglesias, Enr.
Mot-man	Dinse, Horst	Dinse, Horst
Mot-man	Fritz, Günter	Fritz, Günter
Mot-man	Giermann, Frank	Giermann, Frank
Mot-man	Krösche, Eckhard	Krösche, Eckhard
Cook	Silinski, Frank	Silinski, Frank
Cooksmate	Fischer, Matthias	Fischer, Matthias
Cooksmate	Tupy, Mario	Tupy, Mario
1. Stwdess	Dinse, Petra	Dinse, Petra
Stwdess/KS	Kampfhenkel, Ute	Kampfhenkel, Ute
2. Stwdess	Schmidt, Maria	Schmidt, Maria
2. Stwdess	Silinski, Carmen	Silinski, Carmen
2. Stwdess	Streit, Christina	Streit, Christina
2. Steward	Tu, Jian-Min	Tu, Jian-Min
2. Steward	Wu, Chi Lung	Wu, Chi Lung
Laundrym.	Yu, Chu Leung	Yu, Chu Leung

f. L. P. = from Las Palmas

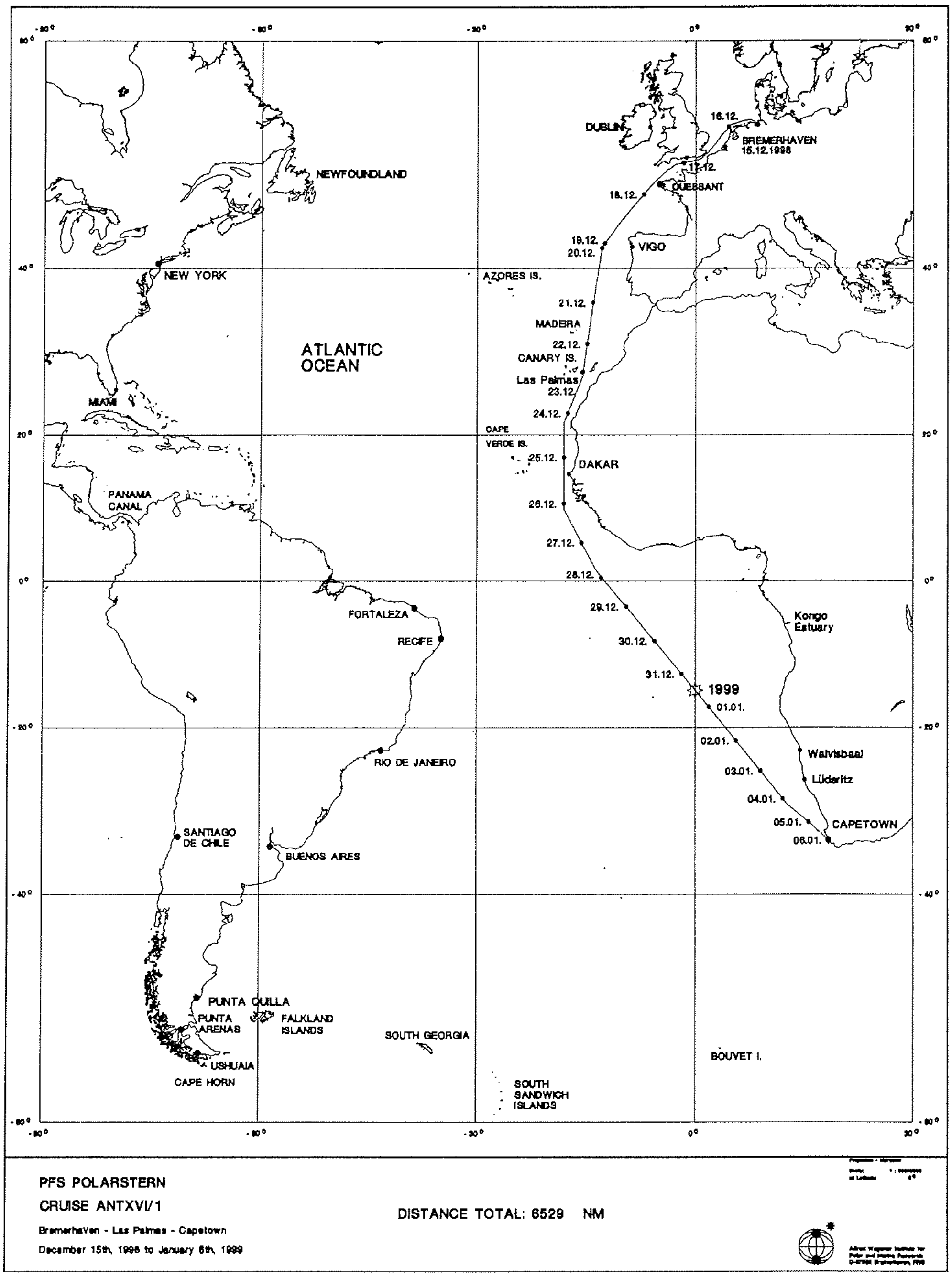


Abb. 1: Fahrtroute der POLARSTERN während ANT XVI/1.
Fig. 1: Cruise track of POLARSTERN during ANT XVI/1.

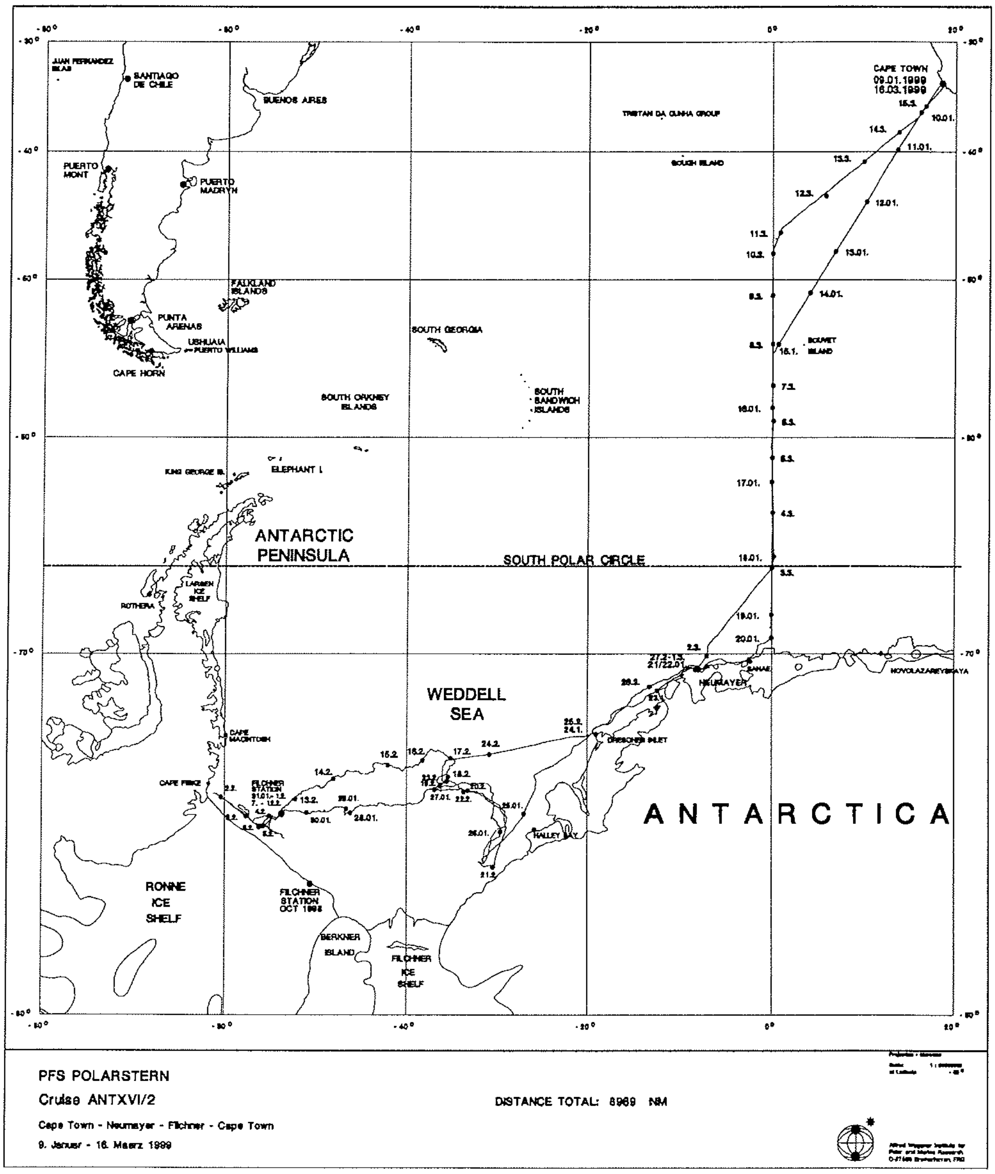
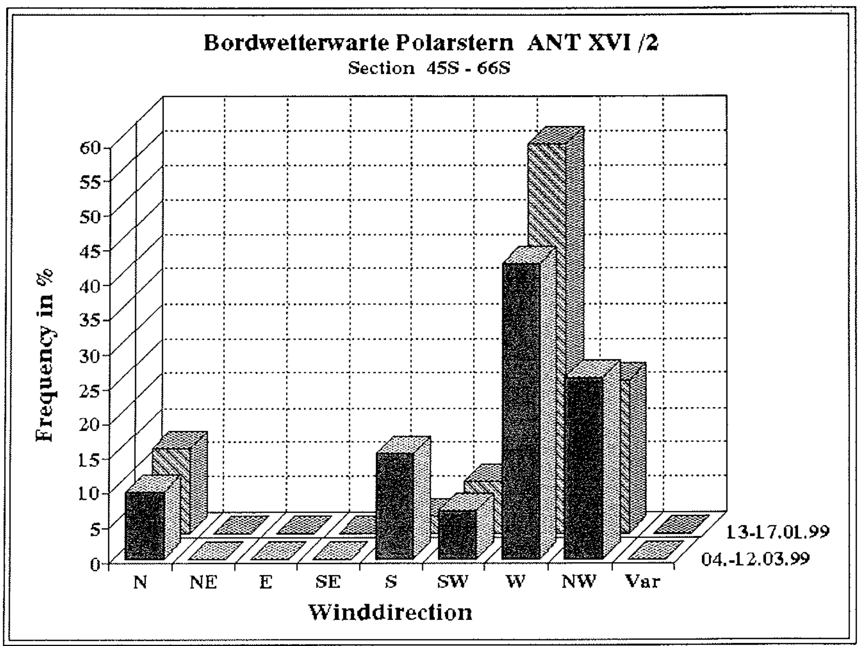


Abb. 2: Die Fahrtroute der POLARSTERN während ANT XVI/2.
Fig. 2: Cruise track during POLARSTERN cruise ANT XVI/2.



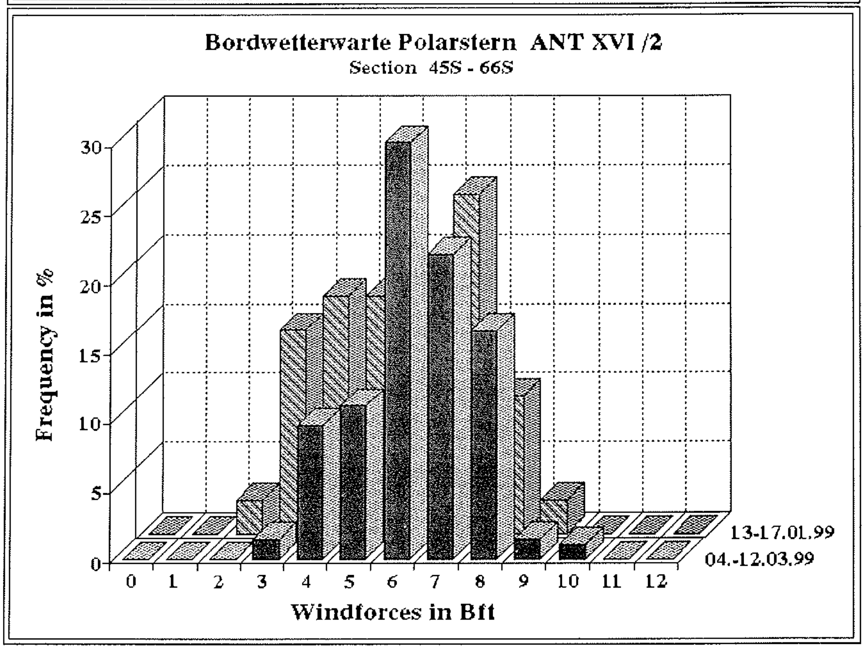
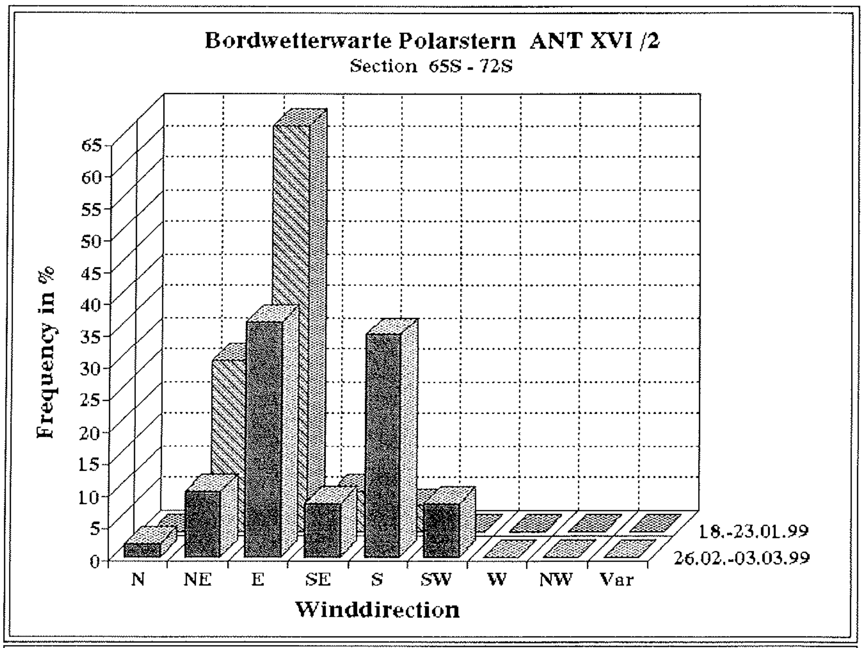


Abb. 3: Häufigkeitsverteilung der Windstärke und Windrichtung im Bereich der Westwinddrift.

Fig. 3: Frequency distribution of wind force and direction in the westerlies.



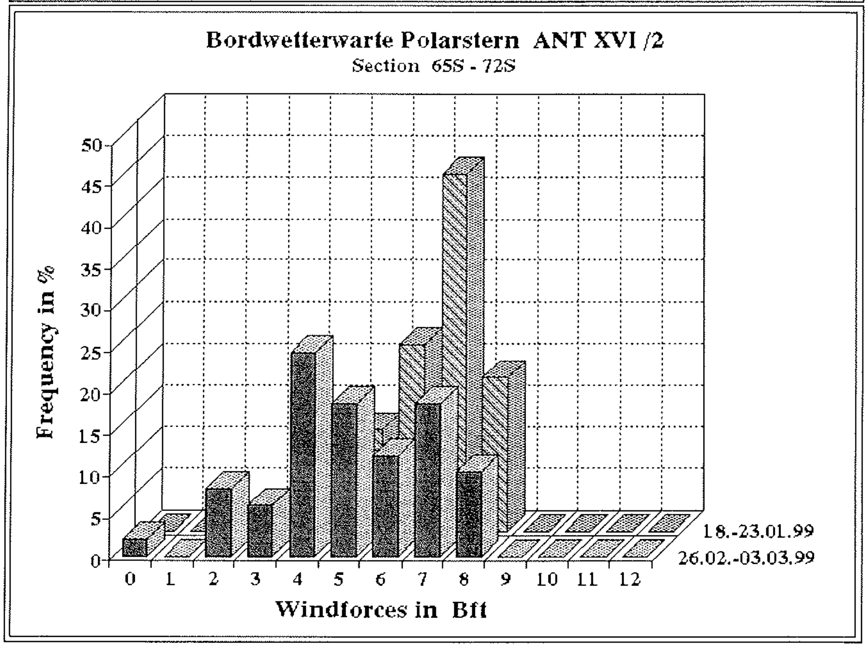
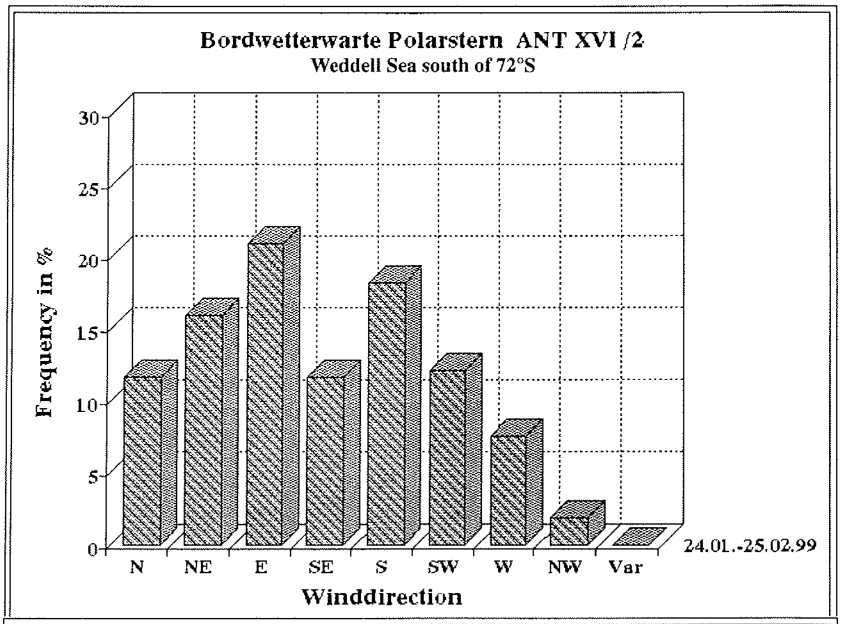


Abb. 4: Häufigkeitsverteilung der Windstärke und Windrichtung im Bereich der Ostwinddrift.

Fig. 4: Frequency distribution of wind force and direction in the easterlies.



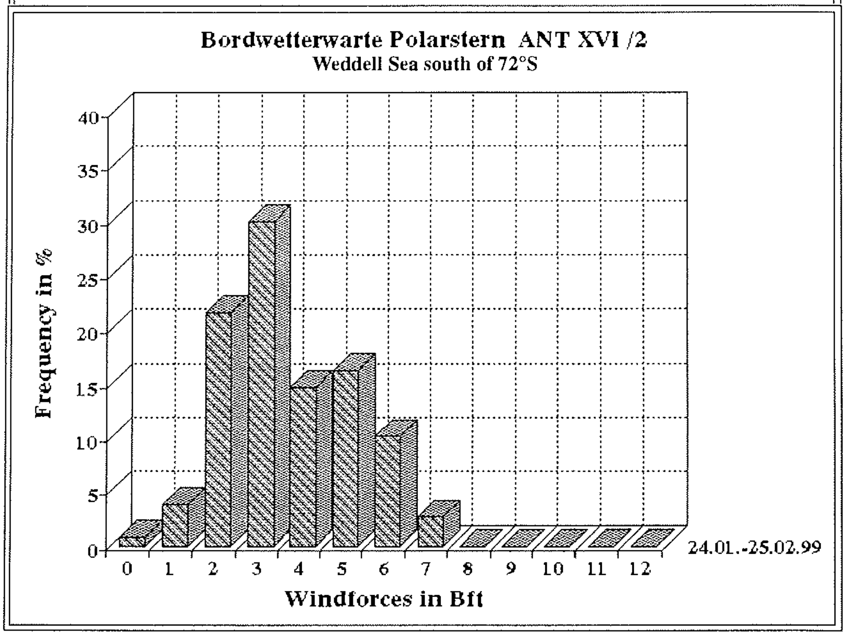


Abb. 5: Häufigkeitsverteilung der Windstärke und Windrichtung im südlichen Weddellmeer.

Fig. 5: Frequency distribution of wind force and direction in the southern Weddell Sea.

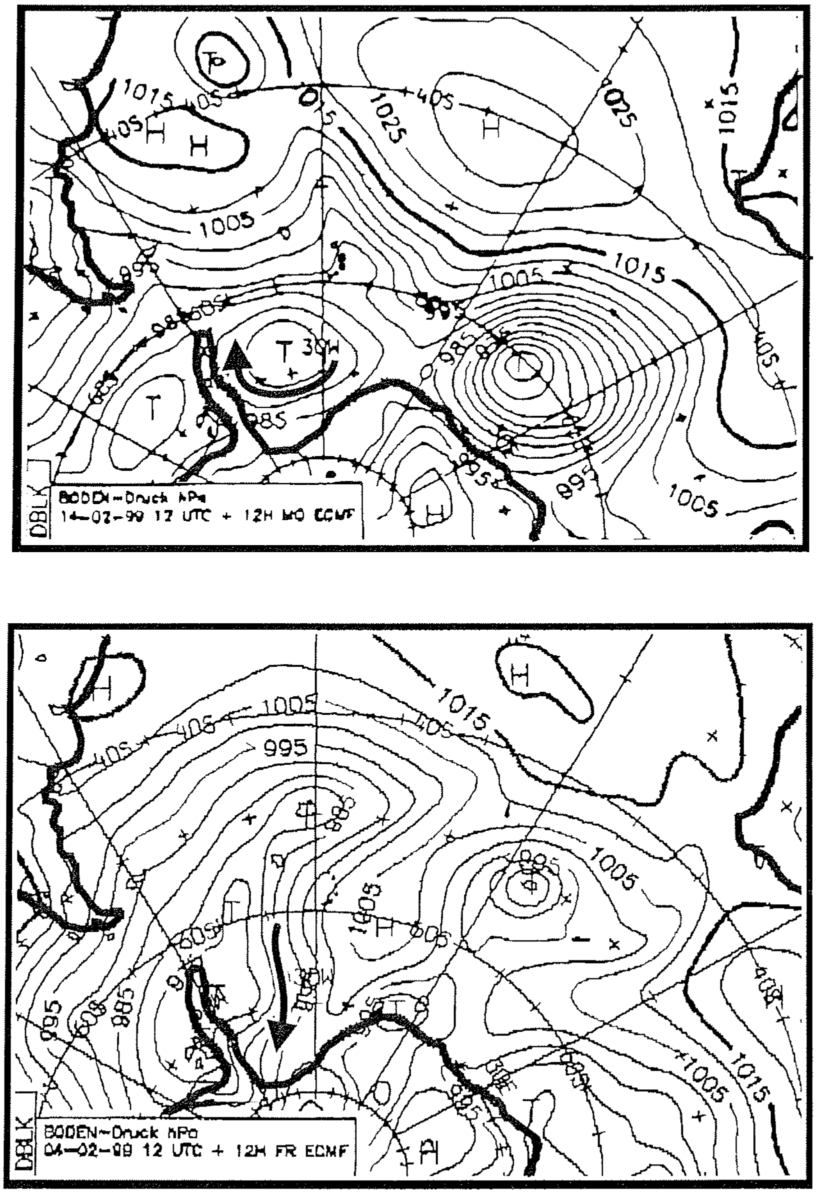


Abb. 6: Luftdruckverteilung über dem südlichen Weddellmeer bei südlichen (oben) und nördlichen Winden(unten).
Fig. 6: Air pressure distribution above the southern Weddell Sea during southerly (top) and northerly winds (bottom).

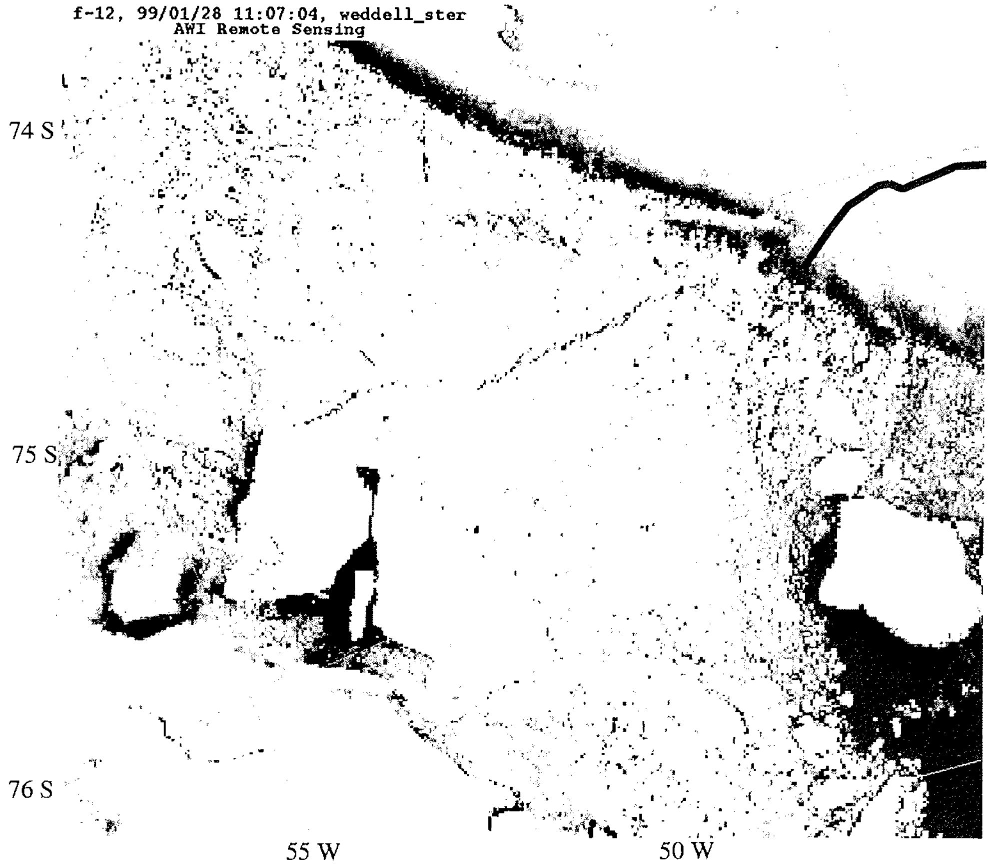


Abb. 7: Die Eisverhältnisse im südlichen Weddellmeer am 28.01.99, aufgenommen mit dem DSMP-Satelliten F-12. Die Fahrtroute der POLARSTERN ist als dicke schwarze Linie eingezeichnet.
Fig. 7: Ice conditions in the southern Weddell Sea on 28 January 1999 from the DSMP satellite F-12. The track of POLARSTERN is indicated by a black line.

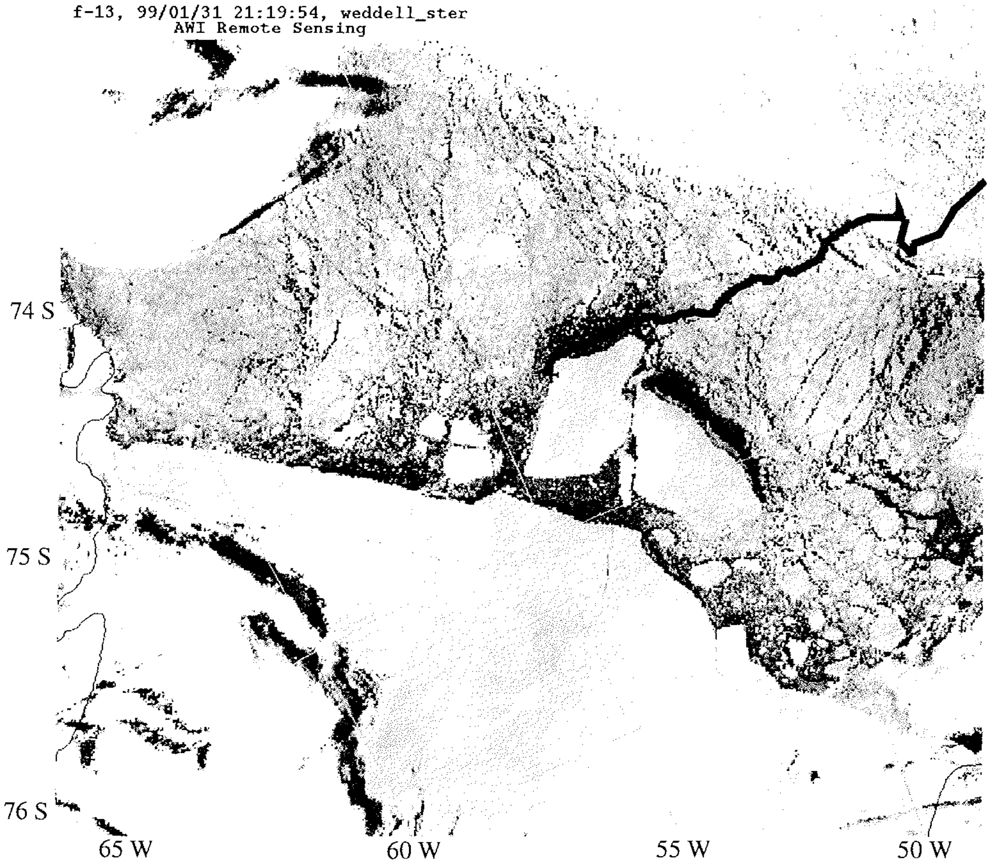


Abb. 8: Die Eisverhältnisse im südlichen Weddellmeer am 31.01.99, aufgenommen mit dem DSMP-Satelliten F-13. Die Fahrtroute der POLARSTERN ist als dicke schwarze Linie eingezeichnet.
Fig. 8: Ice conditions in the southern Weddell Sea on 31 January 1999 from the DSMP satellite F-13. The track of POLARSTERN is indicated by a black line.

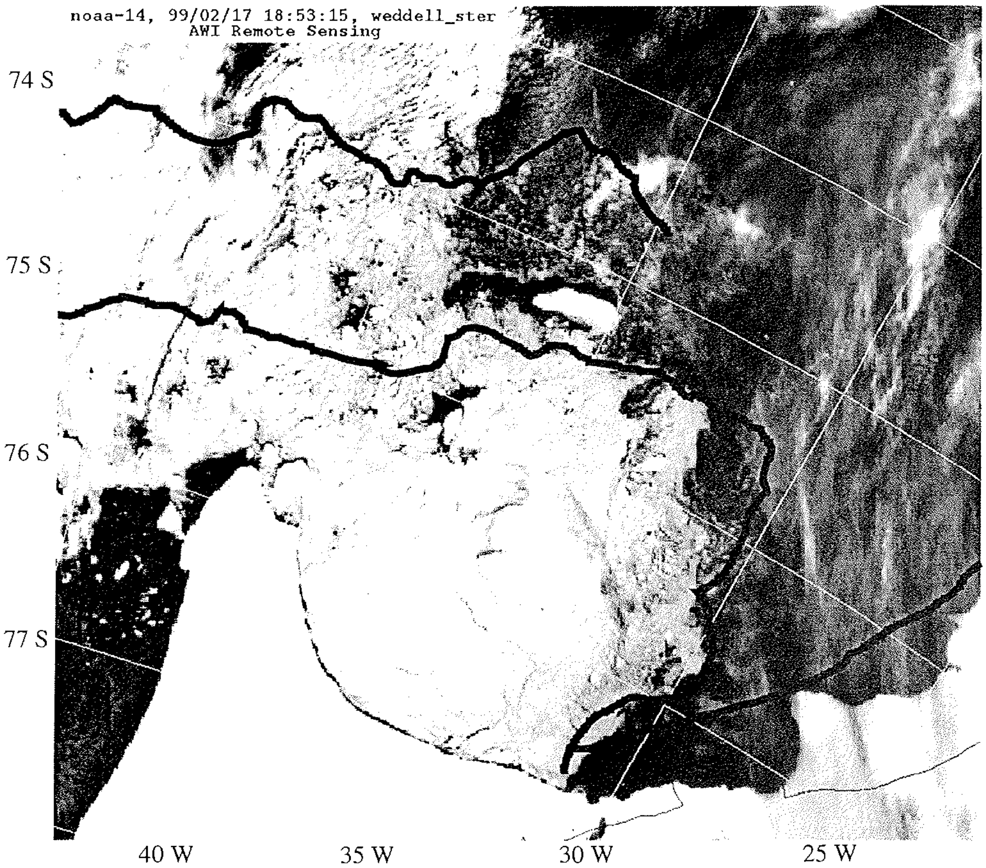
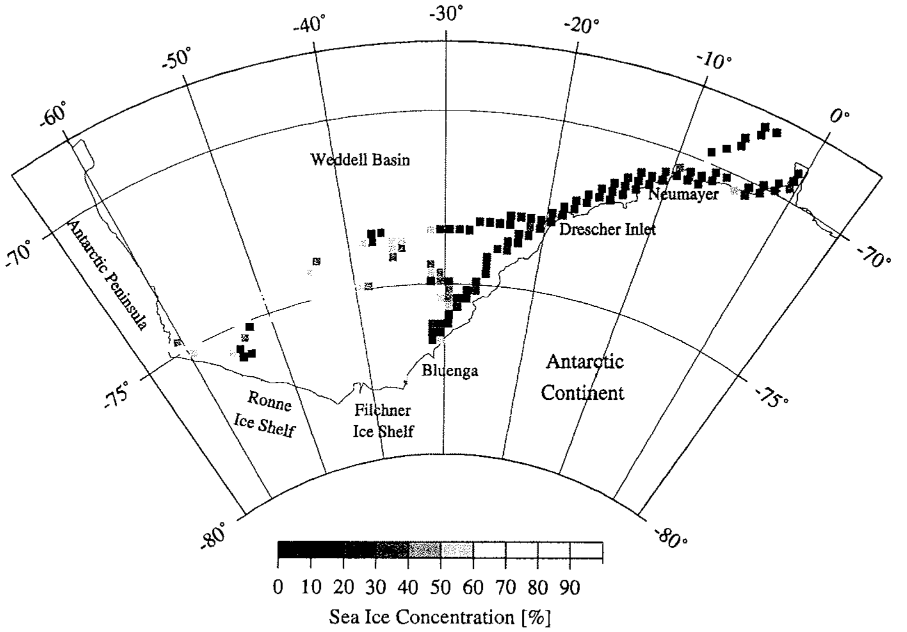


Abb. 9: Die Eisverhältnisse im südlichen Weddellmeer am 17.02.99, aufgenommen mit dem NOAA-14 Satelliten. Die Fahrtroute der POLARSTERN ist als dicke schwarze Linie eingezeichnet.
Fig. 9: Ice conditions in the southern Weddell Sea on 17 February 1999 from the NOAA-14 satellite. The track of POLARSTERN is indicated by a black line.



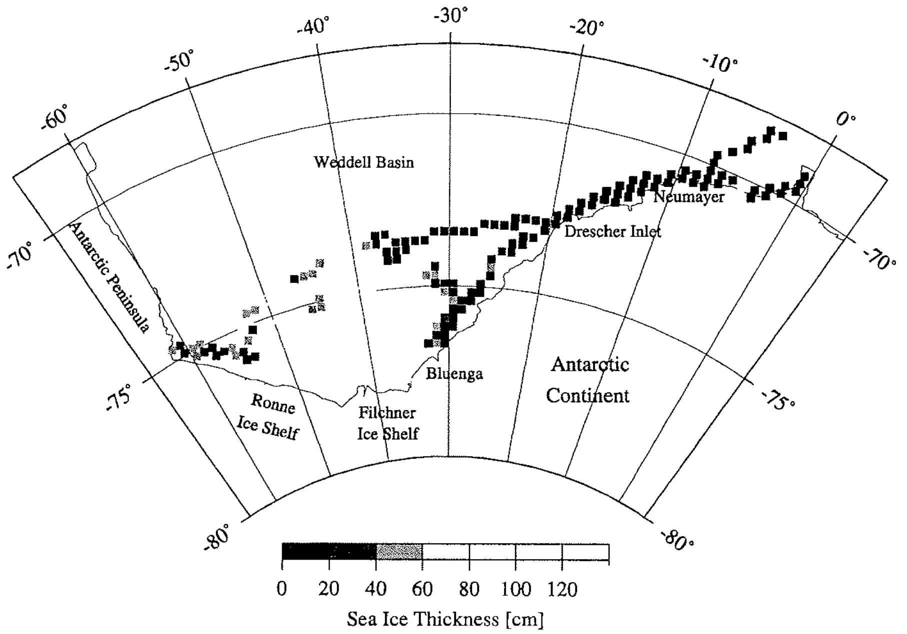


Abb. 10: Meereiskonzentration (oben) und -dicke (unten) während ANT XVI/2.
Fig.10: Sea ice concentration (top) and thickness (bottom) during ANT XVI/2.

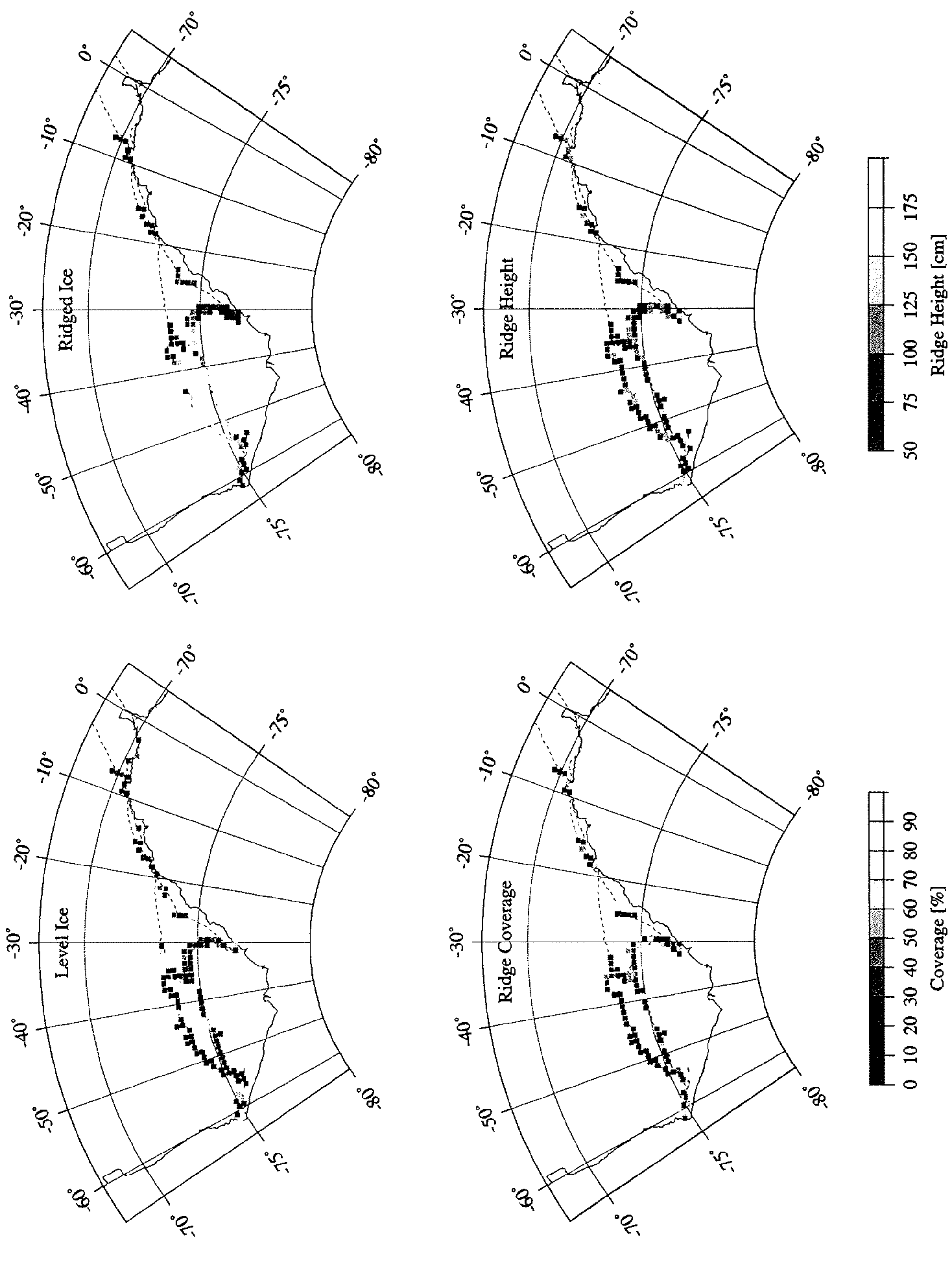


Abb. 11: Pressrückenhäufigkeit und -höhe während ANT XVI/2.
Fig. 11: Ridge coverage and height during ANT XVI/2.

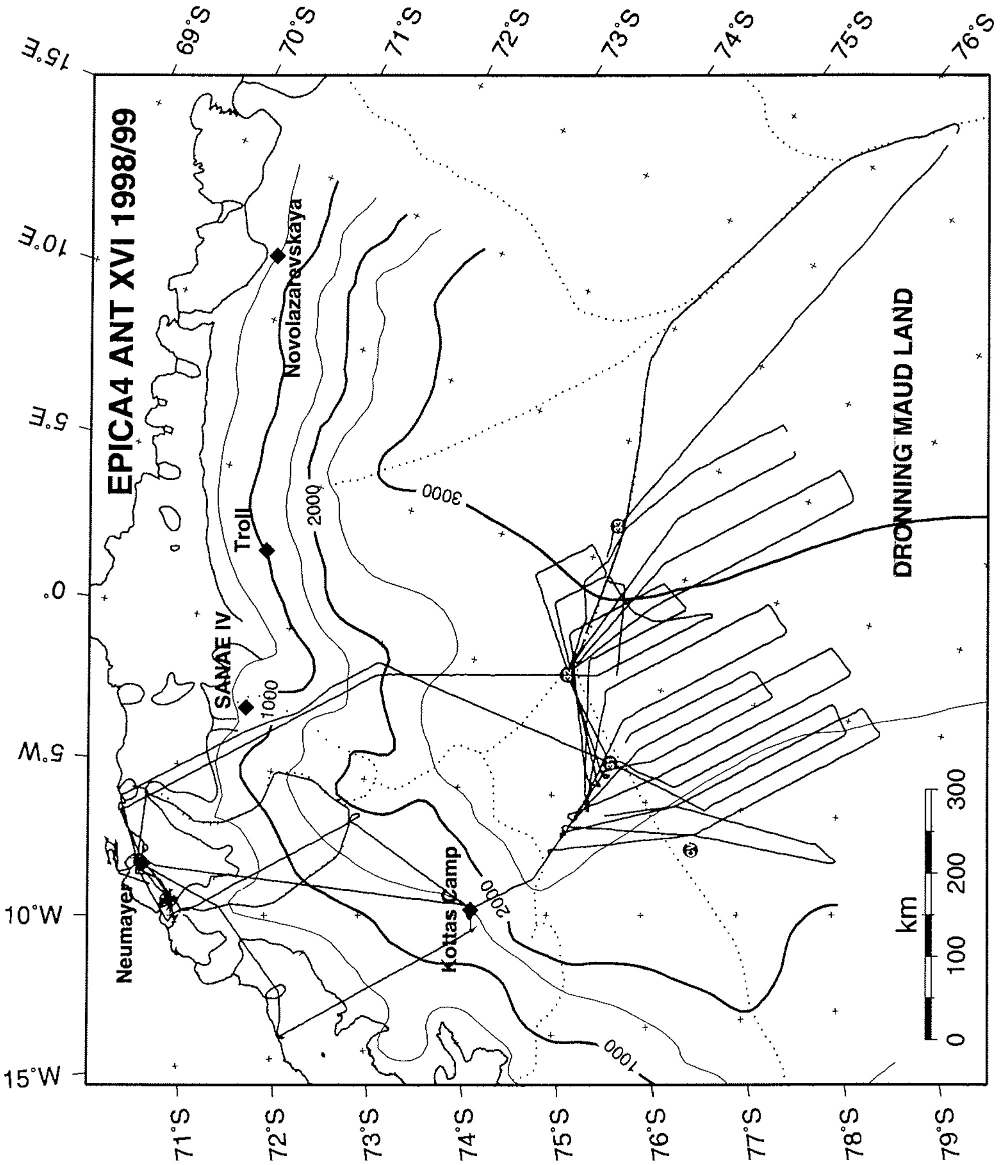


Abb. 12: Die EMR-Messflüge der Saison 1998/99. Eisscheiden sind als punktierte Linien eingetragen.
Fig. 12: EMR flights during the season 1998/99. Ice divides are indicated in stippled lines.

Ein Flug in Richtung Dome Fuji ermöglicht die Anbindung der Daten an den dort gebohrten und bereits datierten Eiskern. Denn neben dem Untergrundrelief wird bei

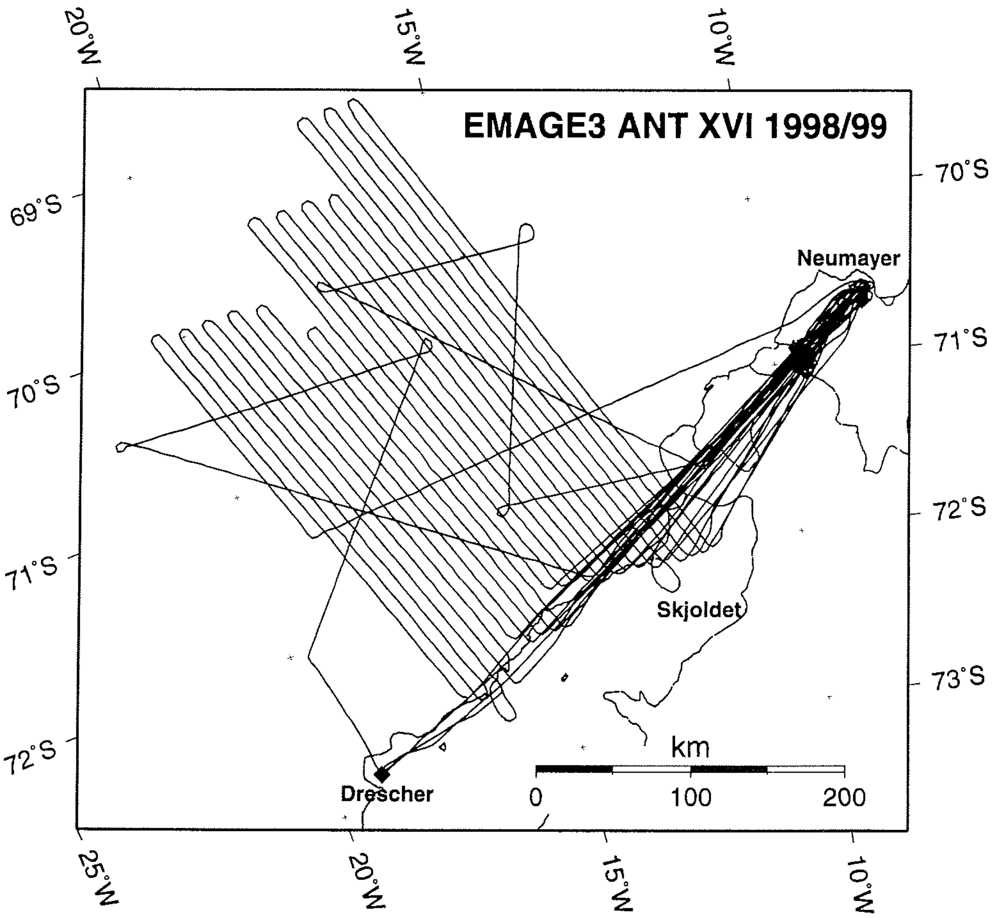


Abb. 13: Die während der Saison 98/99 im Rahmen von EMAGE 3 erflogene Profile.
Fig. 13: Flights carried out during the season 1998/99 for EMAGE 3.

APIS (**A**ntarctic **P**ack **I**ce **S**eals)

Für das APIS-Programm wurde wie in der Vergangenheit auf den Flügen für EMAGE eine Digitalvideokamera betrieben. Während dieser Saison wurden jedoch nur über dem Meereis Aufnahmen gemacht. Die in Abb.14 dargestellte Karte zeigt die Abschnitte mit Videoaufnahmen. Lücken sind aufgrund von Bewölkung oder fehlender Meereisbedeckung entstanden. Auf 14 Flügen wurden insgesamt 17 Stunden Video über eine Strecke von mehr als 4.000 km aufgezeichnet. Die Kamera wurde vom jeweiligen Operateur an Bord bedient (M. Schürmann, F. Thiel (beide AERODATA), D. Steinhage (AWI)). Ansprechpartner für APIS am AWI ist Dr. Jochen Plötz, für weitere Informationen sind dem Fahrtbericht ANT XIV/3 zu entnehmen.

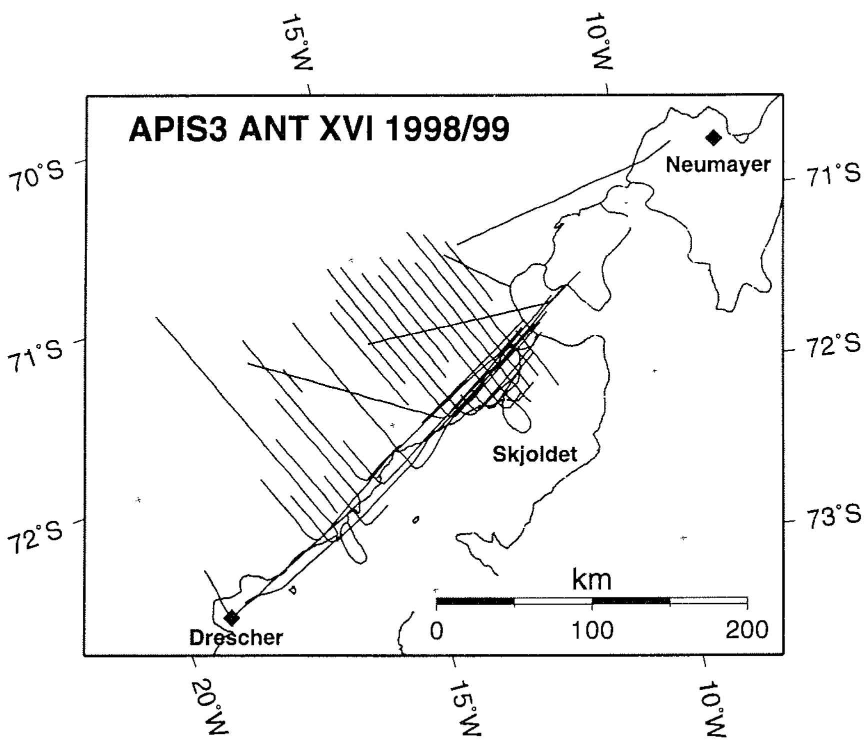


Abb.14: APIS Zählstreifenabschnitte der Saison 1998/99 vor dem Rijser-Larsenisen.
Fig. 14: APIS tracks in front of the Rijser-Larsenisen during the 1998/99 season.

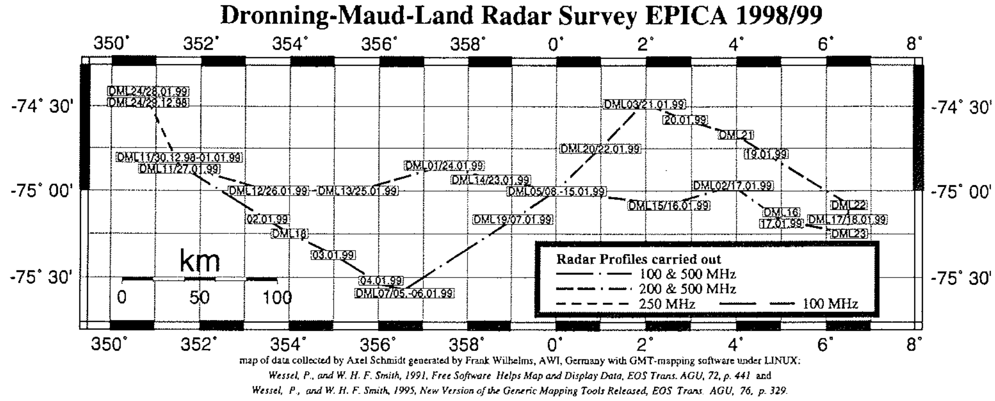


Abb. 15: Fahrtroute der DML-Boden-EMR-Traverse ex-Kottas-Camp.
Fig. 15: Trackline of the DML ground EMR travers ex Kottas Camp.

2.5.3 The Norwegian Antarctic Research Expedition 98/99, NARE 98/99

H. Eggenfellner, K. Pedersen, O. Skog und E. Vike (NPI)

Die Expedition NARE 98/99 hatte folgende Ziele:

1. Vier automatische Wetterstationen mit den gespeicherten Daten zu bergen.
2. Erneut die Bewegung und die Schneeakkumulation an 36 Aluminium-Balisen zu messen. Sie gehören zu einem glaziologischen Beobachtungsnetz mit zwei Balisen-Reihen auf dem Bailey Ice Stream und über das Filchner-Schelfeis bis auf Berkner Island.
3. Die umweltbelastenden Stoffe und das Material, das bei der Blåenga-Sommerstation lagerte, zu bergen.

Die Arbeitsgruppe war schon an NARE 96/97 beteiligt gewesen, aber auf Grund der ungünstigen Eisbedingungen war es damals nicht möglich, die Station zu erreichen.

Nach einer Anfahrt von 16 Tagen wurde die Gruppe am 25.1.99 an der Sommerstation bei 77°00'43"S, 34°12'37"W abgesetzt. Die Station war vollständig mit Schnee bedeckt, und nur Bambusrohre wiesen darauf hin, dass sie sich unter der Schneedecke befand. Nach zwei Tagen Schneeräumen und zehn Tagen mit sehr schlechtem Wetter startete die Gruppe mit Snow-Mobilen zu den Theron Mountains, die 220 km im Inland liegen. Dort teilte sich die Gruppe. Pedersen und Skog bauten in den Theron Mountains bei 79°00'00"S, 27°55'44"W das Kommunikationszentrum mit einer Funkverbindung auf Kurz- und Grenzwelle und Inmarsat-C auf, um die Verständigung mit der zweiten Gruppe und nach außen (POLARSTERN und Norwegen) sicherzustellen. Ferner installierten sie einen GPS-Empfänger auf einem Nunatak als Referenzstation zur Vermessung des glaziologischen Netzes.

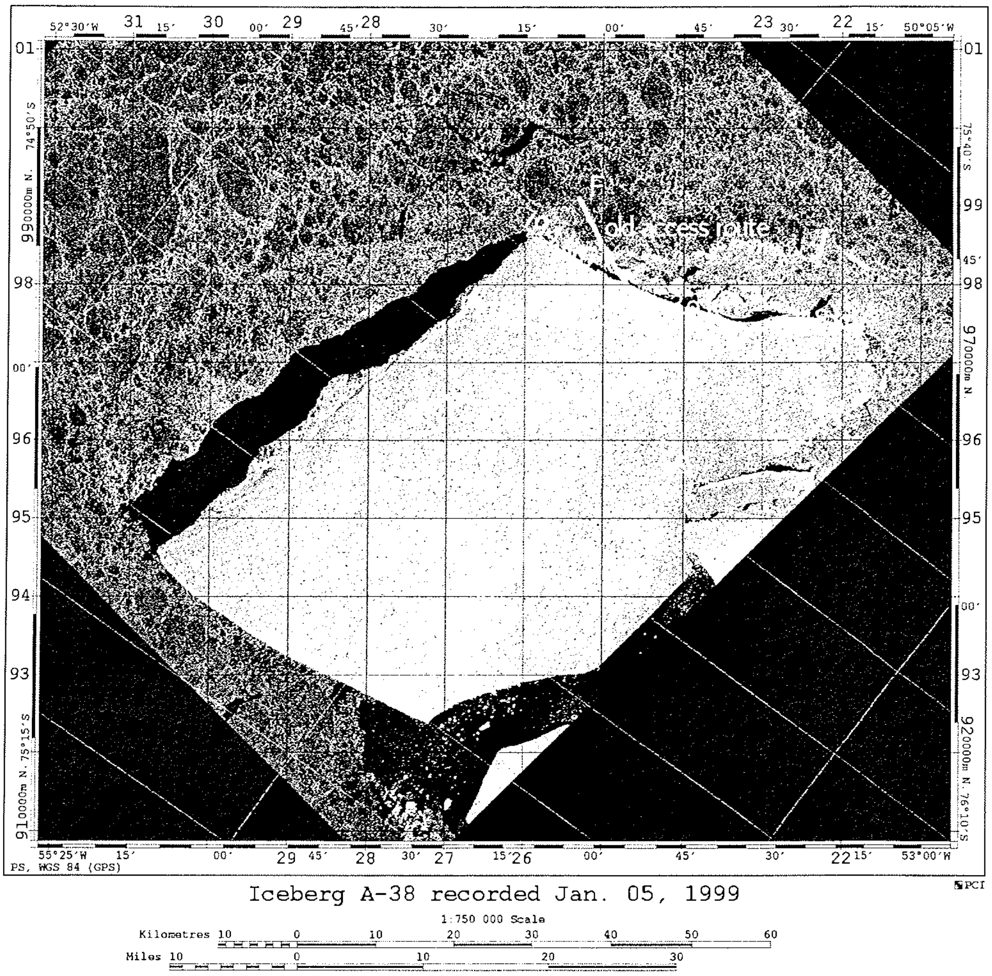


Abb.16: RADARSAT-Aufnahme des Eisbergs A-38B im südlichen Weddellmeer, auf dem die Filchner-Station seit Oktober 1998 trieb.
Fig. 16: RADARSAT image of the iceberg A-38B in the southern Weddell Sea. Filchner Station has been adrift on the iceberg since October 1998.

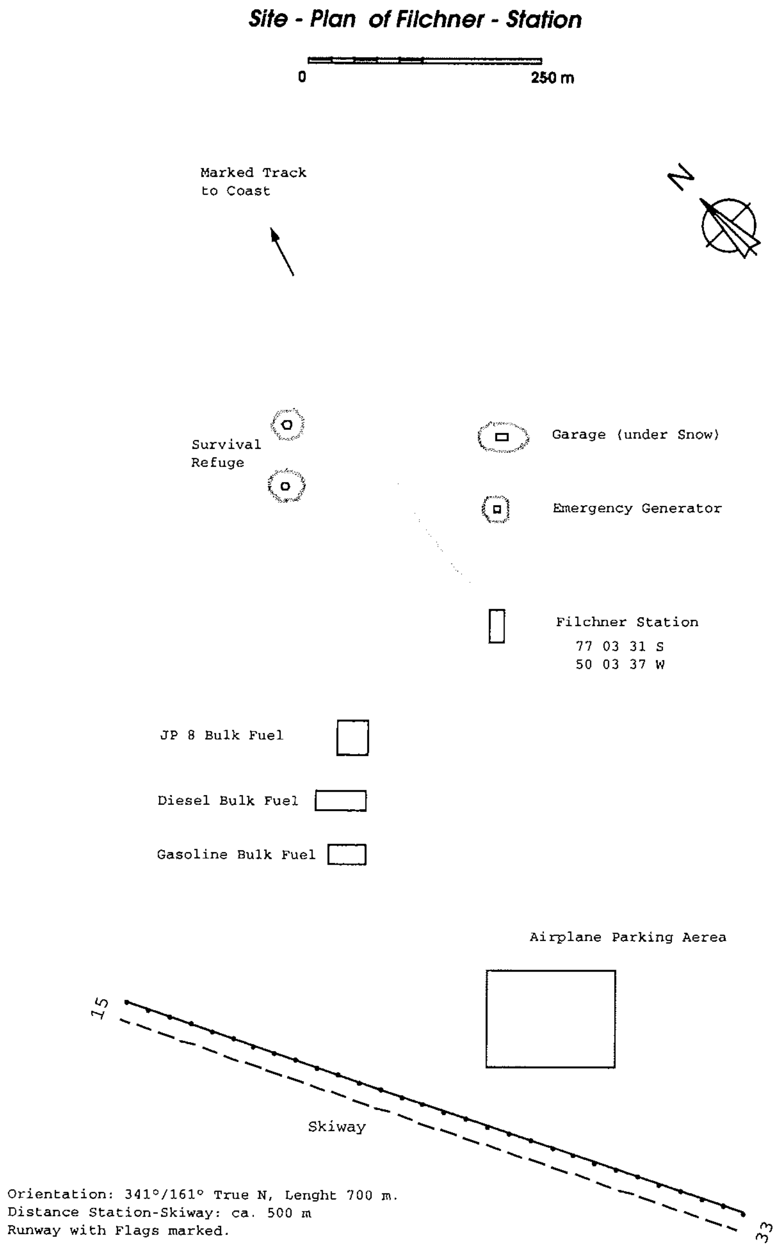


Abb.17: Lageplan der Filchner-Station 1997 vor dem Eisbergabbruch.
Fig. 17: Plan of Filchner Station in 1997 before the iceberg calved.

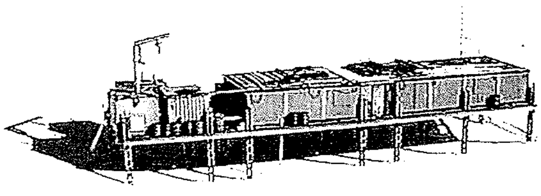


Abb.18: Ansicht der Filchner-Station am 28. Januar 1999 (Foto: Fahrbach).
Fig. 18: View of Filchner Station on 28 January 1999 (Photo: Fahrbach).

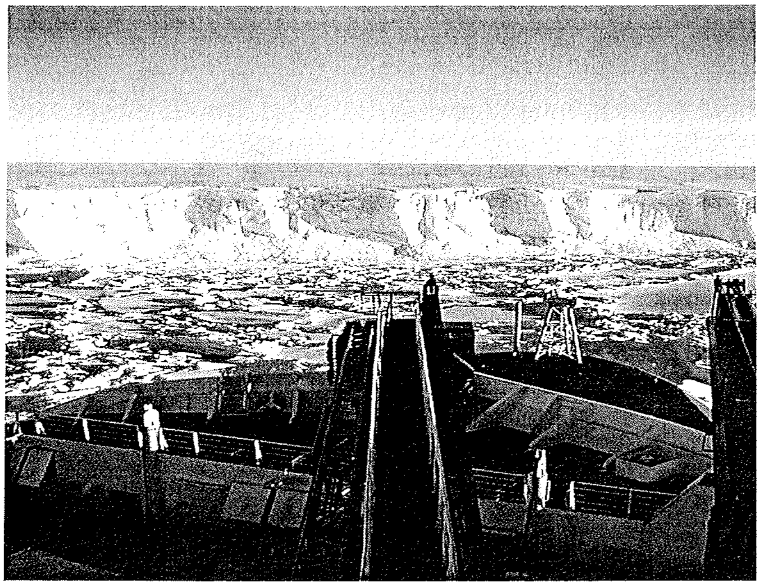


Abb.19: Die Landestelle der POLARSTERN an der Abbruchkante des Eisbergs A-38B am 30. Januar 1999 (Foto: Wöste).
Fig. 19: The landing site used by POLARSTERN at the calving edge of iceberg A-38B on 30 January 1999 (Photo: Wöste).

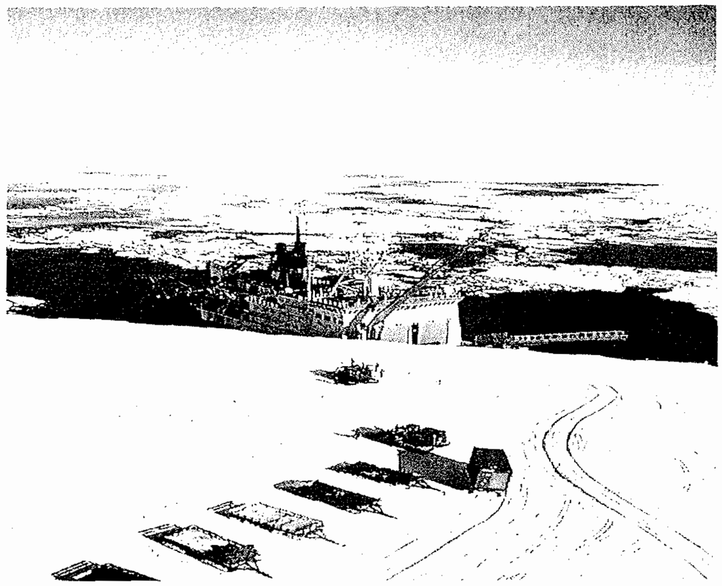


Abb.20: Die Entladung des Bergungs-Materials von der POLARSTERN an der Eisbergkante am 31. Januar 1999 (Foto: Wöste).
Fig. 20: The unloading of the salvage equipment from POLARSTERN at the iceberg edge on 31 January 1999 (Photo: Wöste).

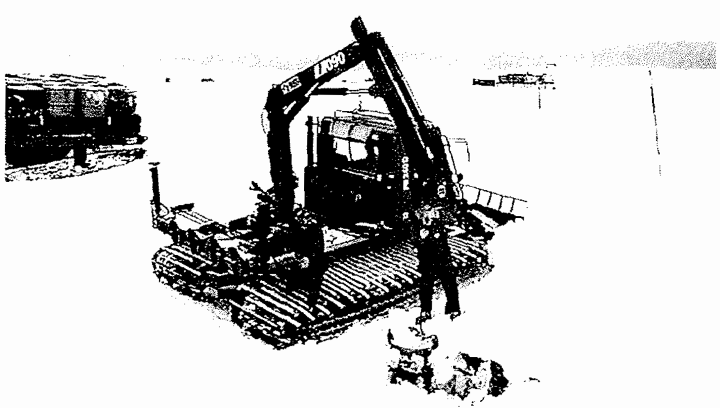


Abb.21: Die Bergungsgruppe beim Ausgraben und Verladen von Leerfässern am 1. Februar 1999 (Foto: Wöste).
Fig. 21: The salvage team on 1 February 1999, digging out fuel drums and loading them on sledges (Photo: Wöste).

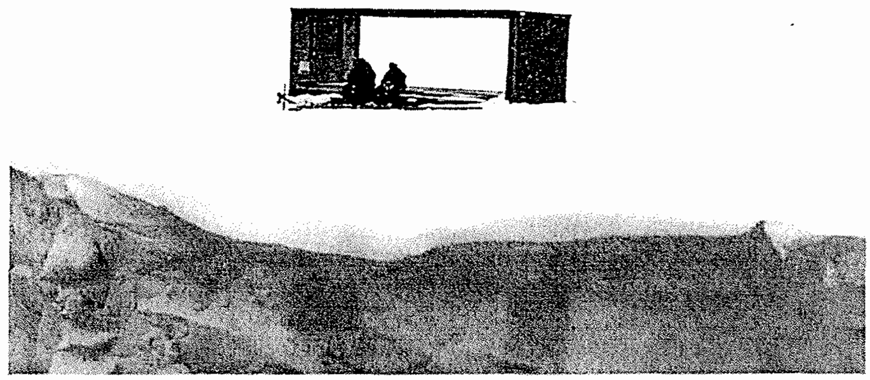


Abb.22: Pause an der Verladekante des Eisbergs A-38B im ehemaligen Messecontainer der Filchner-Station (Foto: Fahrbach).
Fig.22: A break in loading at the iceberg edge, taken in the former mess container of Filchner Station (Photo: Fahrbach).

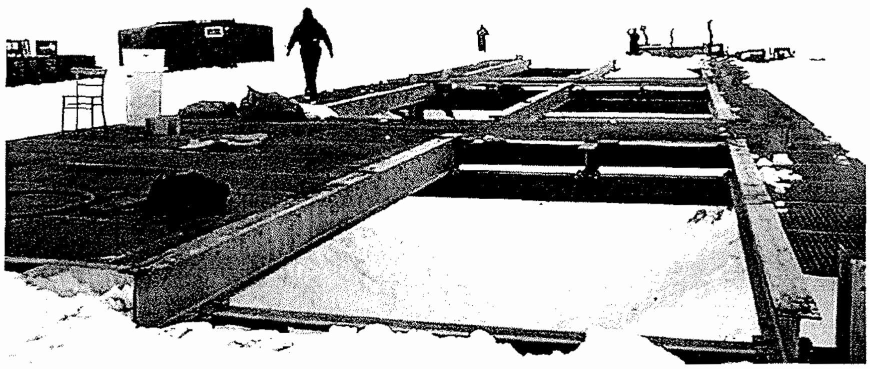


Abb.23: Die verbliebenen Stahlteile der Unterkonstruktion der Filchner-Station am 11. Februar 1999 (Foto: Wöste).
Fig.23: The steel support structure of the former Filchner Station remaining on iceberg A-38B on 11 February 1999 (Photo: Wöste).

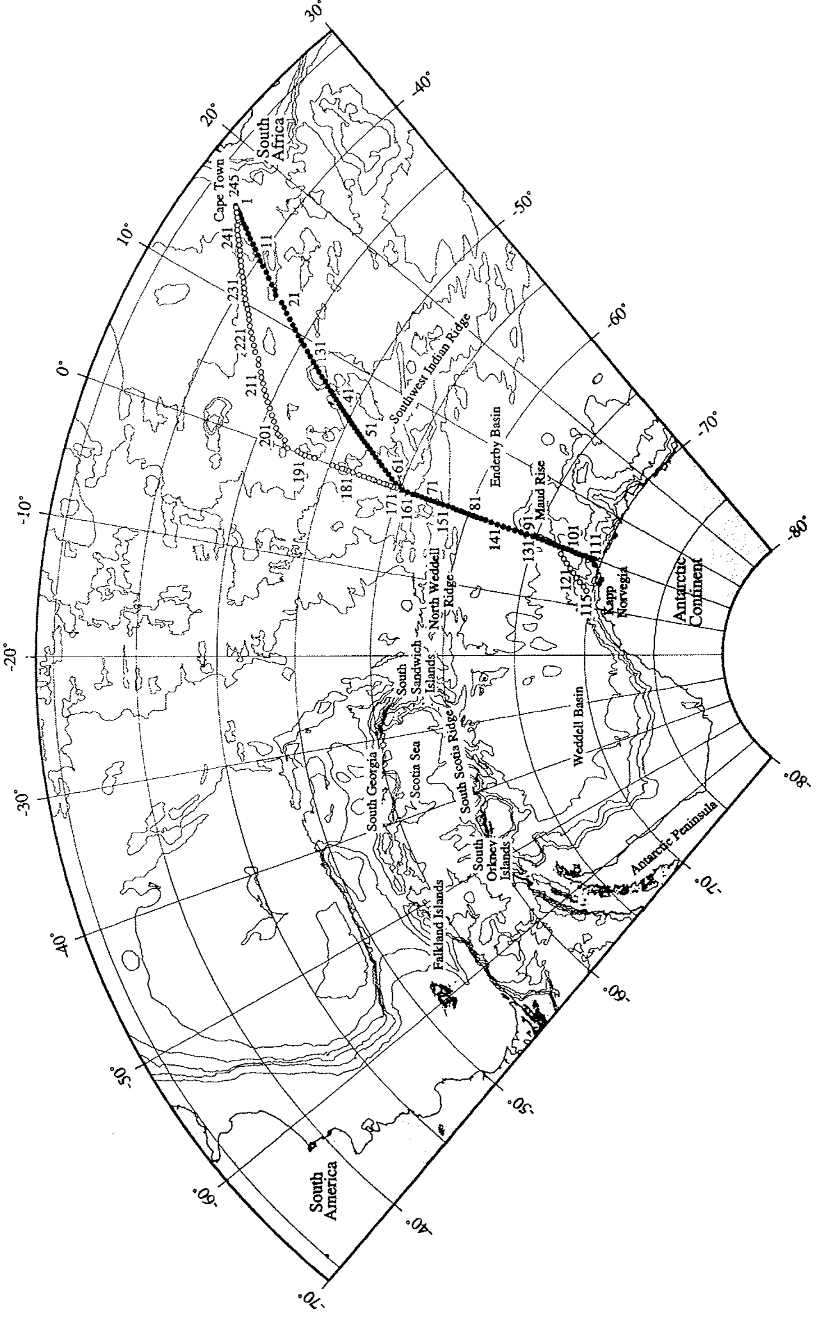


Abb. 24: Lage der XBT-Messungen auf der An- und Abreise während ANT XVI/2.
Fig. 24: XBT deployments during ANT XVI/2.

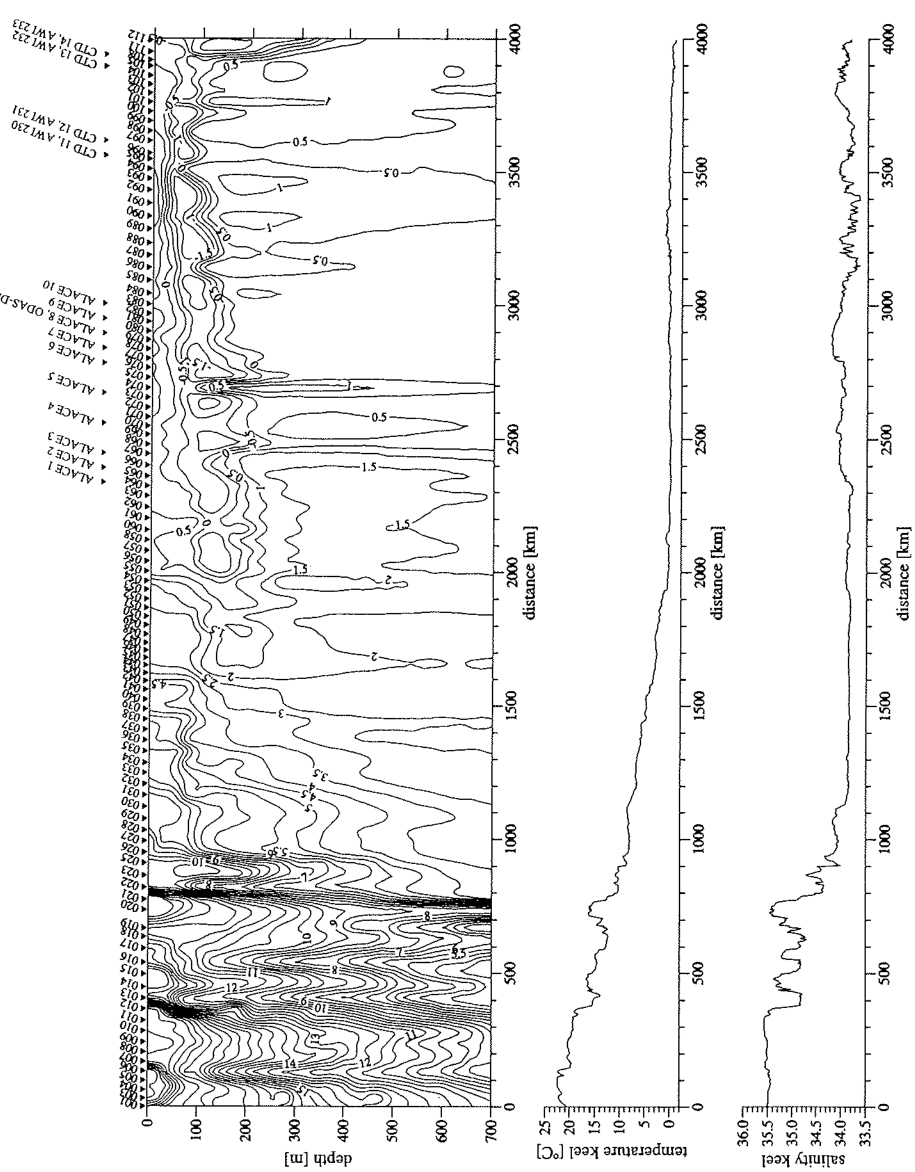


Abb. 25: XBT-Schnitt (oben) auf der Anreise von Kapstadt (links) in die Antarktis (rechts) und die Temperatur- (Mitte) und Salzgehaltsverteilung (unten) am Kiel in etwa 10 m Tiefe. Die Positionen der Auslegung der 10 ALACE und der ODAS-Driftboje, sowie der Verankerungen AWI230-233 sind ebenfalls angegeben.

Fig. 25: XBT section (top) from Cape Town (left) to Antarctica (right) and the temperature (centre) and salinity distribution (bottom) at the keel in 10 m depth. The positions of the deployment of 10 ALACE and a ODAS buoy as well as of moorings AWI230-233 are also indicated.

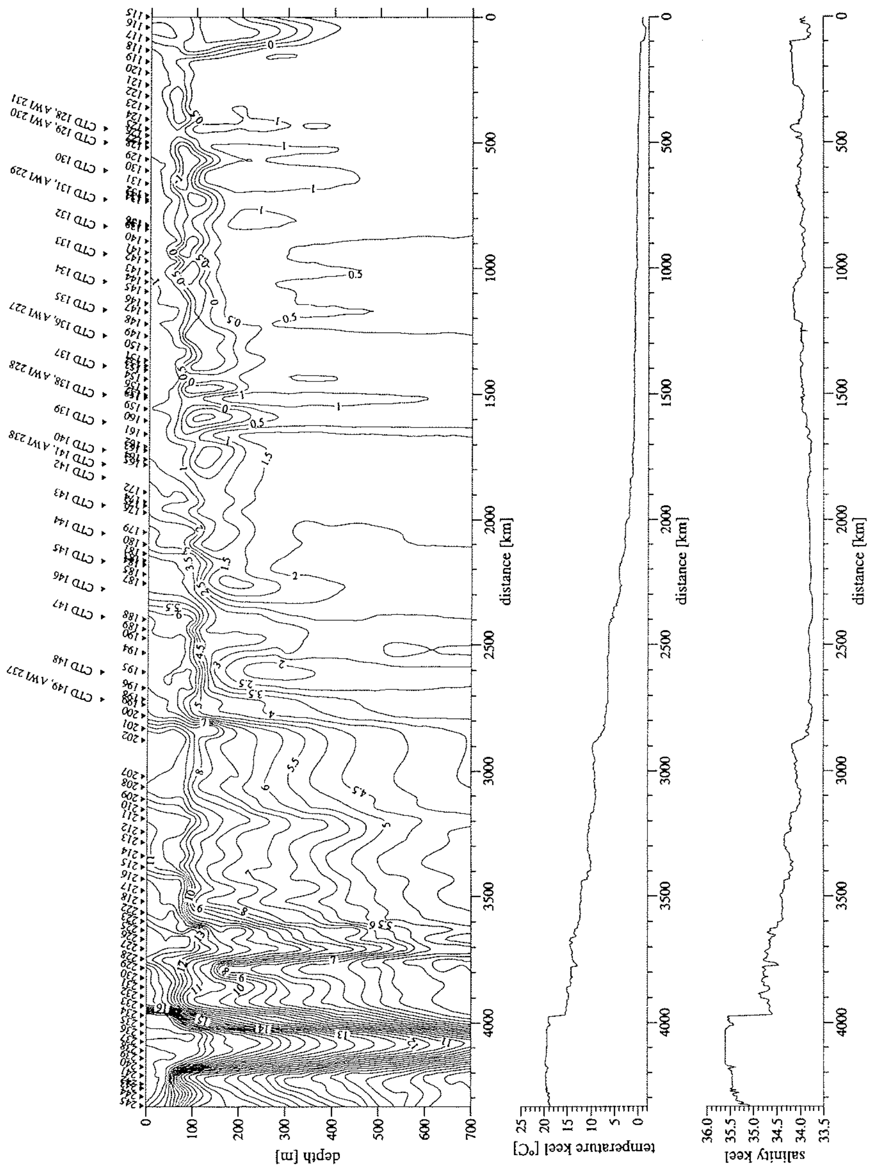


Abb. 26: XBT-Schnitt (oben) auf der Rückreise von der Antarktis (rechts) nach Kapstadt (links) und die Temperatur- (Mitte) und Salzgehaltsverteilung (unten) am Kiel in etwa 10 m Tiefe. Die Positionen der Verankerungen AWI227-231, 238 und 239, sowie der CTD-Stationen sind ebenfalls angegeben.
Fig. 26: XBT section (top) from Antarctica (right) to Cape Town (left) and the temperature (centre) and salinity distribution (bottom) at the keel in 10 m depth. The positions of the deployment moorings AWI227-231, 238 and 239 and the CTD stations are also indicated.

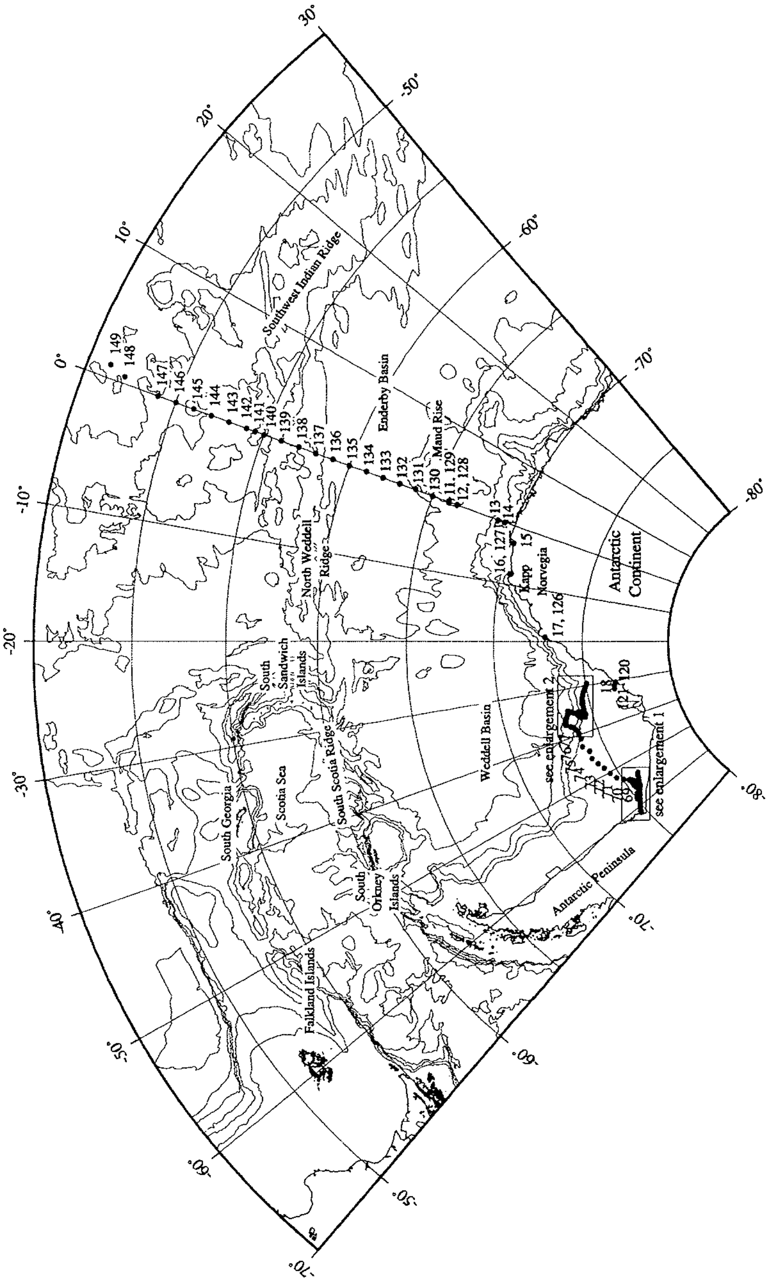


Abb. 27: Lage der CTD-Stationen während ANT XVI/2. Enlargement 1 und 2 sind in Abb. 28 vergrößert dargestellt.
Fig. 27: Locations of the CTD stations during ANT XVI/2. Enlargement 1 and 2 are displayed in Fig. 28.

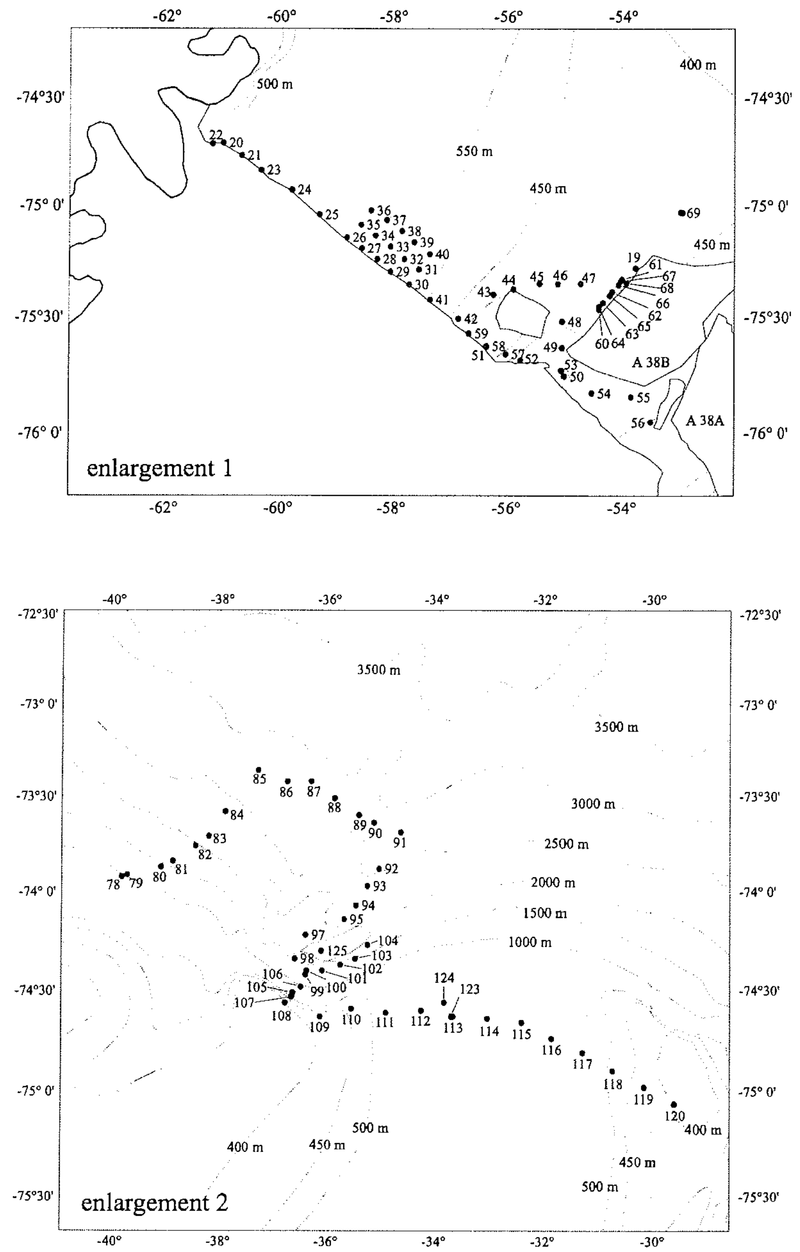


Abb. 28: Lage der CTD-Stationen im südlichen Weddellmeer. Die Lage von Enlargement 1 (oben) und 2 (unten) ist in Abb. 27 angegeben.
Fig. 28: Locations of the CTD stations in the southern Weddell Sea. The positions of enlargement 1 (top) and 2 (bottom) are displayed in Fig. 27.

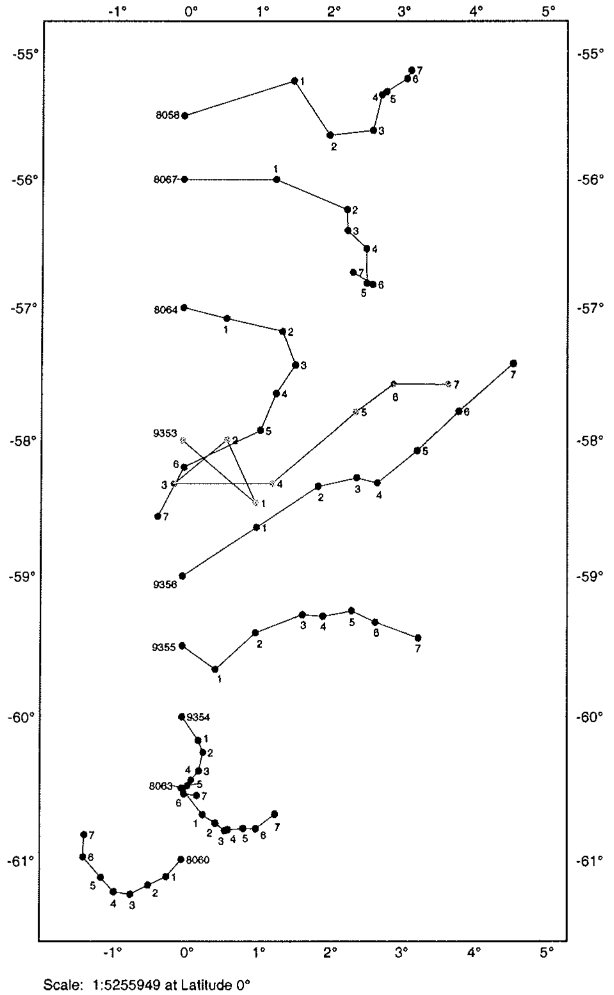


Abb. 29: Die Driften während der ersten 7 Wochen der 10 ALACE, die während ANT XVI/2 ausgebracht wurden.
Fig. 29: The drift tracks of 10 ALACE which were deployed during ANT XVI/2 during the first 7 weeks.

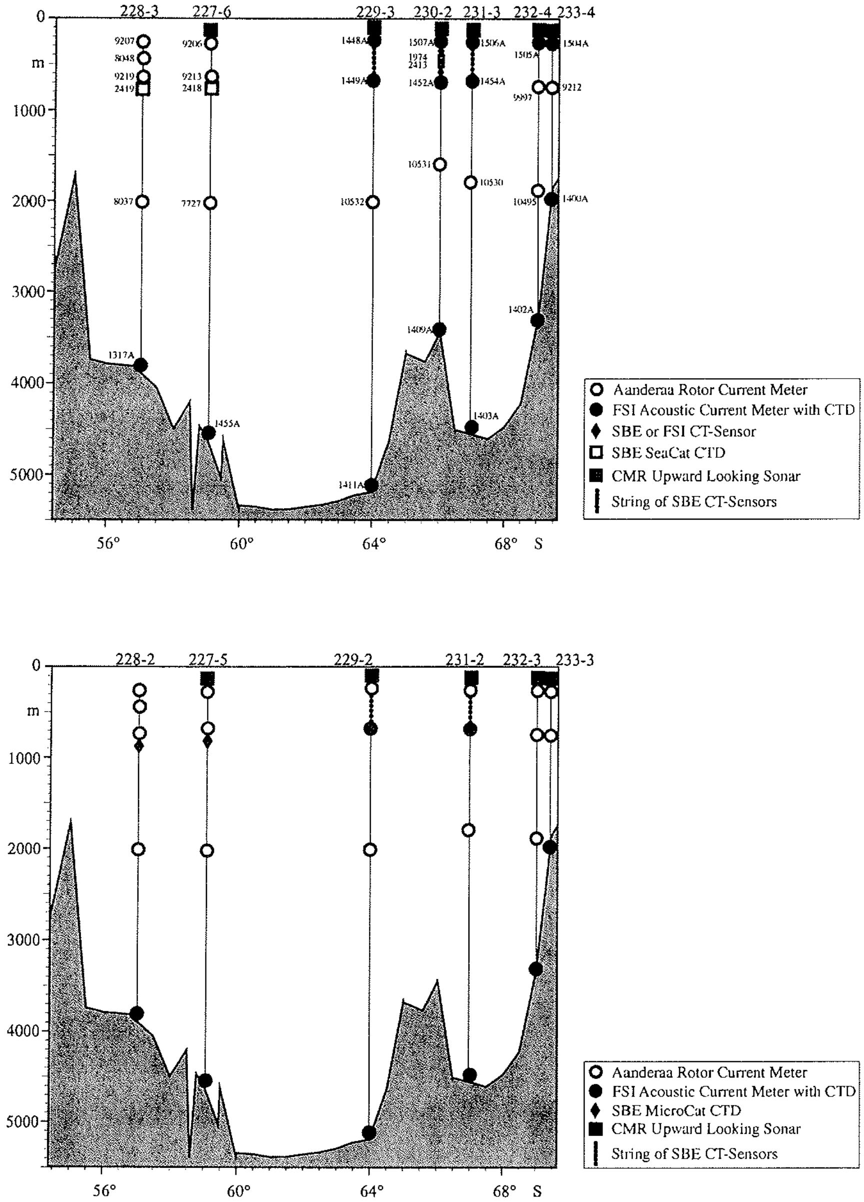


Abb. 30: Die Verankerungen, die während ANT XVI/2 im Weddellmeer am Meridian von Greenwich ausgelegt (oben) und aufgenommen (unten) wurden.

Fig. 30: The moorings, which were deployed (top) and recovered (bottom) during ANT XVI/2 in the Weddell gyre at the Meridian of Greenwich.

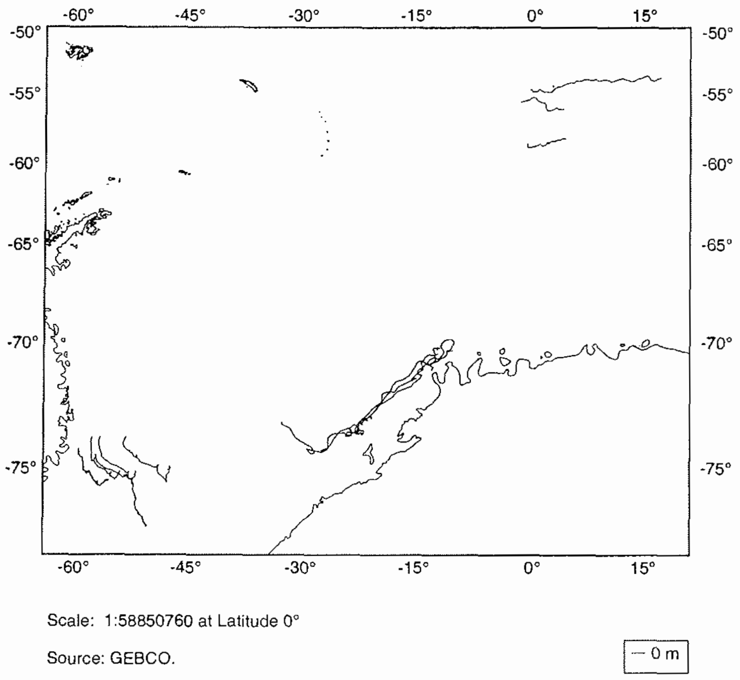


Abb. 31: Driftbahnen der Eisberge, die während ANT XVI/2 im nördlichen Weddellmeer, im Antarktischen Küstenstrom und vor dem Ronne-Schelfeis markiert wurden.

Fig. 31: Drift of icebergs on which satellite transmitters were deployed during ANT XVI/2 in the northern Weddell Sea, the Antarctic Coastal Current and in front of the Ronne Ice Shelf.

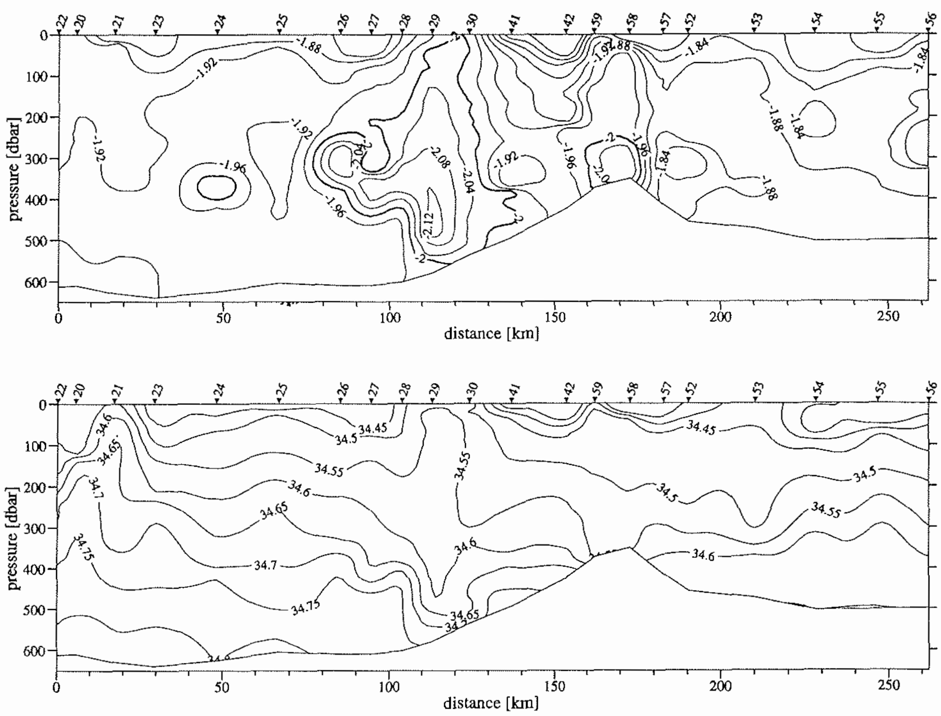


Abb. 32: Vertikalverteilung der potentiellen Temperatur und des Salzgehalts auf einem CTD-Schnitt, der während ANT XVI/2 entlang der Kante des Ronne-Schelfeis südlich des Eisbergs A-38B (rechts) bis zur Lassiter-Küste an der Antarktischen Halbinsel (links) ausgeführt wurde. Die Lage der Stationen ist in Abb. 28 (oben) angegeben.

Fig 32: Vertical distribution of potential temperature and salinity on a CTD section which was measured during ANT XVI/2 along the Ronne Ice Shelf south of the iceberg A-38B (right) to the Lassiter Coast at the Antarctic Peninsula (left). The location of the stations is indicated in Fig. 28 (top).

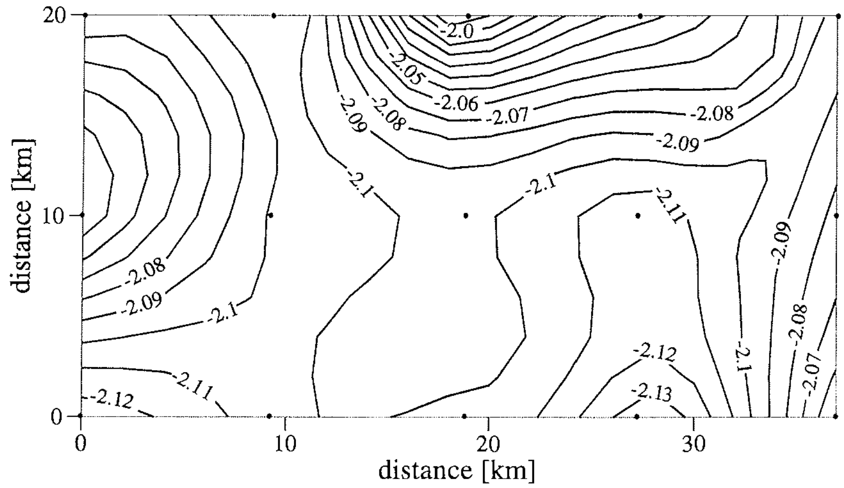


Abb. 33: Die horizontale Verteilung des Temperaturminimums im Eisschelfwasser-Ausstrom vor dem Ronne-Schelfeis. Die dargestellte Fläche wird durch die Stationen 26, 36, 40 und 30 (Abb. 28 oben) aufgespannt.

Fig 33: The horizontal distribution of the temperature minimum in the outflow of Ice Shelf Water from the Ronne Ice Shelf. The displayed area is limited by the stations 26, 36, 40 and 30 (Fig. 28 top).

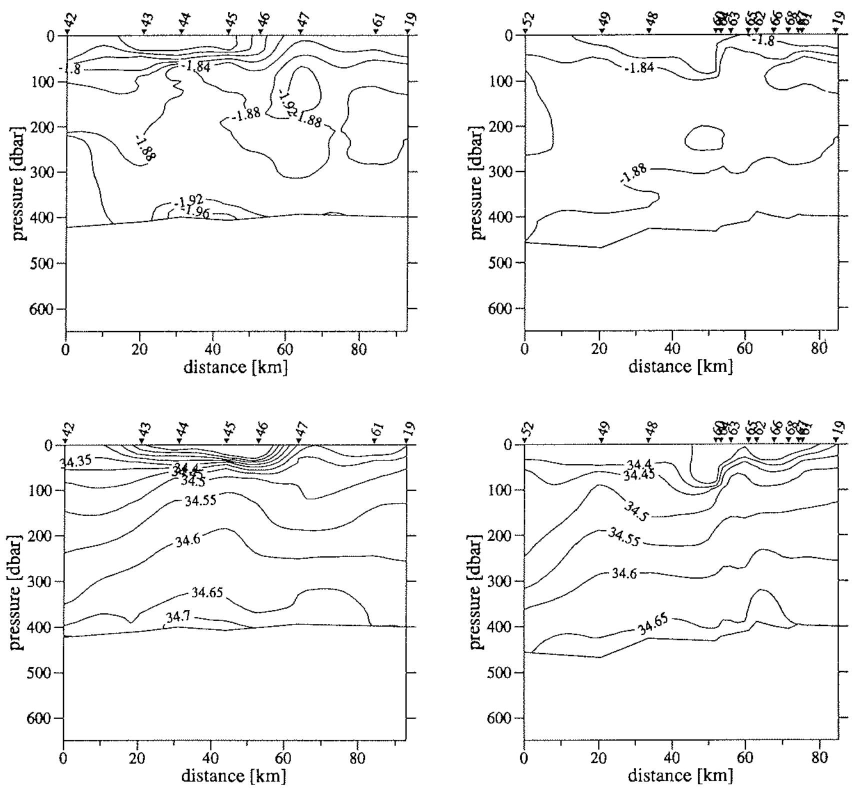


Abb. 34: Vertikalverteilung der potentiellen Temperatur und des Salzgehalts auf CTD-Schnitten, die während ANT XVI/2 von der Kante des Ronne-Schelfeis (links) bis zur Anlegestelle bei der Filchner-Station an der Nordwestecke des Eisbergs A-38B (rechts) ausgeführt wurden. Die Lage der Stationen ist in Abb. 28 (oben) angegeben.

Fig 34: Vertical distribution of potential temperature and salinity on CTD sections which were measured during ANT XVI/2 from the Ronne Ice Shelf (left) to the north-western corner of iceberg A-38B (right). The location of the stations is indicated in Fig. 28 (top).

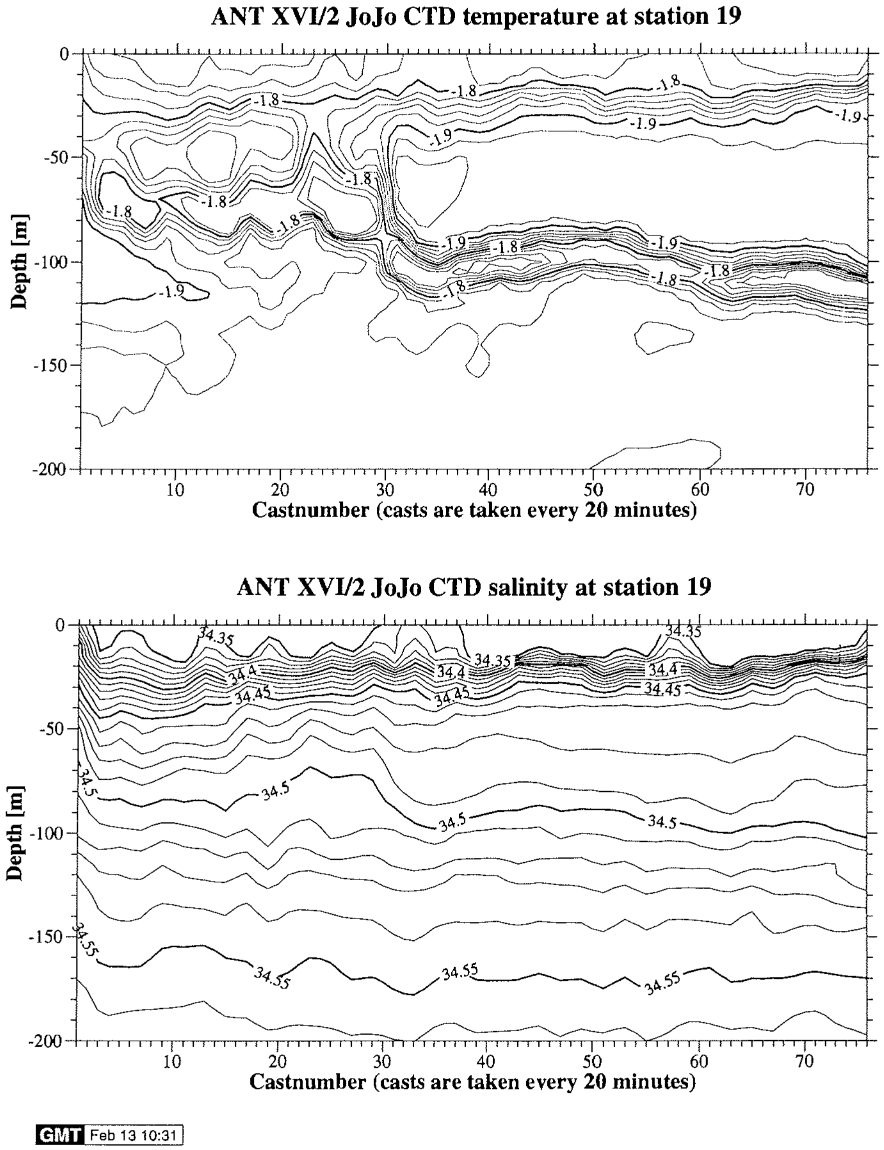


Abb. 35: Die zeitliche Temperatur- und Salzgehaltsverteilung, die während ANT XVI/2 an Station 19 an der Anlegestelle bei der Filchner-Station an der Nordwestecke des Eisbergs A-38B vom 31.01.99 16.11 bis zum 1.2.99 16.38 mit 78 CTD-Profilen aufgenommen wurde. Die Lage der Station ist in Abb. 28 (oben) angegeben.

Fig 35: The temperature and salinity which was measured during ANT XVI/2 at station 19 at the northwestern corner of iceberg A-38B with 78 CTD profiles obtained from 31 January 1999 16:11 to 1 February 1999 16:38. The location of the station is indicated in Fig. 28 (top).

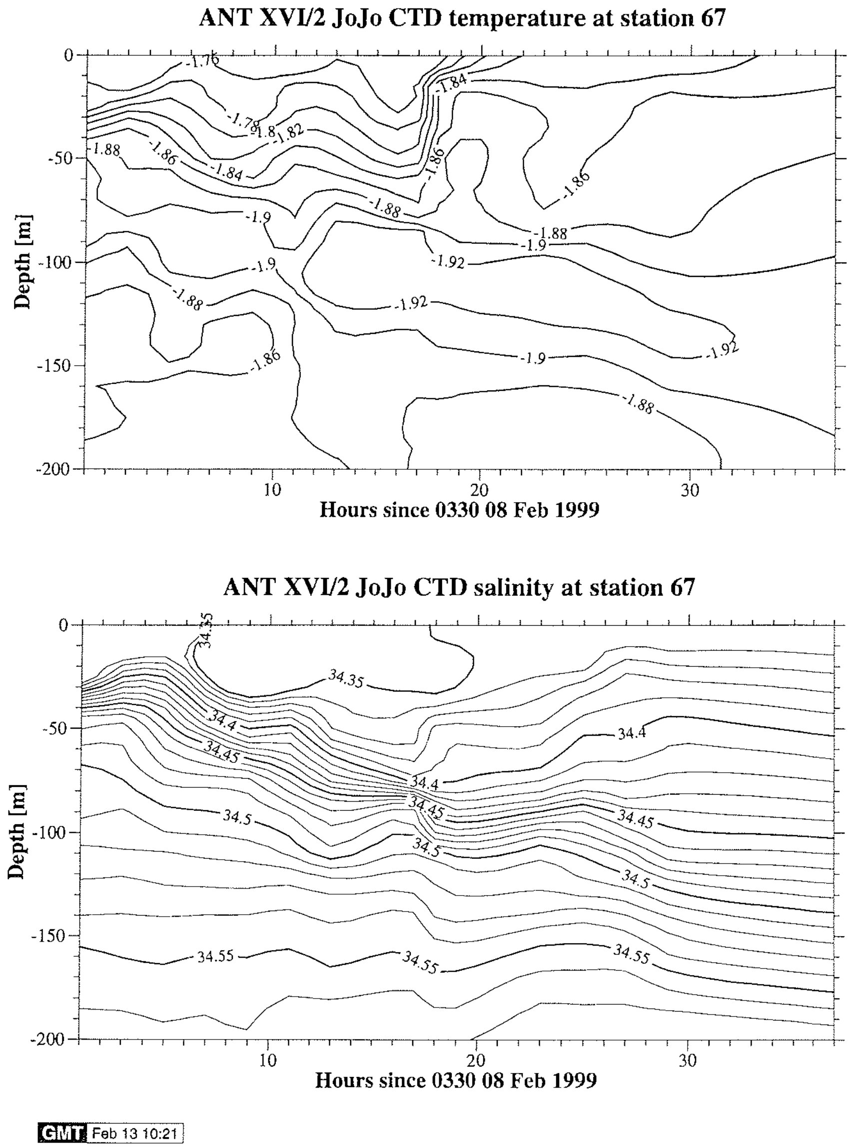


Abb. 36: Die zeitliche Temperatur- und Salzgehaltsverteilung, die während ANT XVI/2 an Station 67 an der Anlegestelle bei der Filchner-Station an der Nordwestecke des Eisbergs A-38B vom 08.02.99 03.24h bis zum 10.02.99 16.27 mit 40 CTD-Profilen aufgenommen wurde. Die Lage der Station ist in Abb. 28 (oben) angegeben.

Fig 36: Temperature and salinity which was measured during ANT XVI/2 at station 67 at the northwestern corner of iceberg A-38B with 40 CTD profiles obtained from 8 February 1999 03:24 to 10 February 1999 16:27. The location of the station is indicated in Fig. 28 (top).

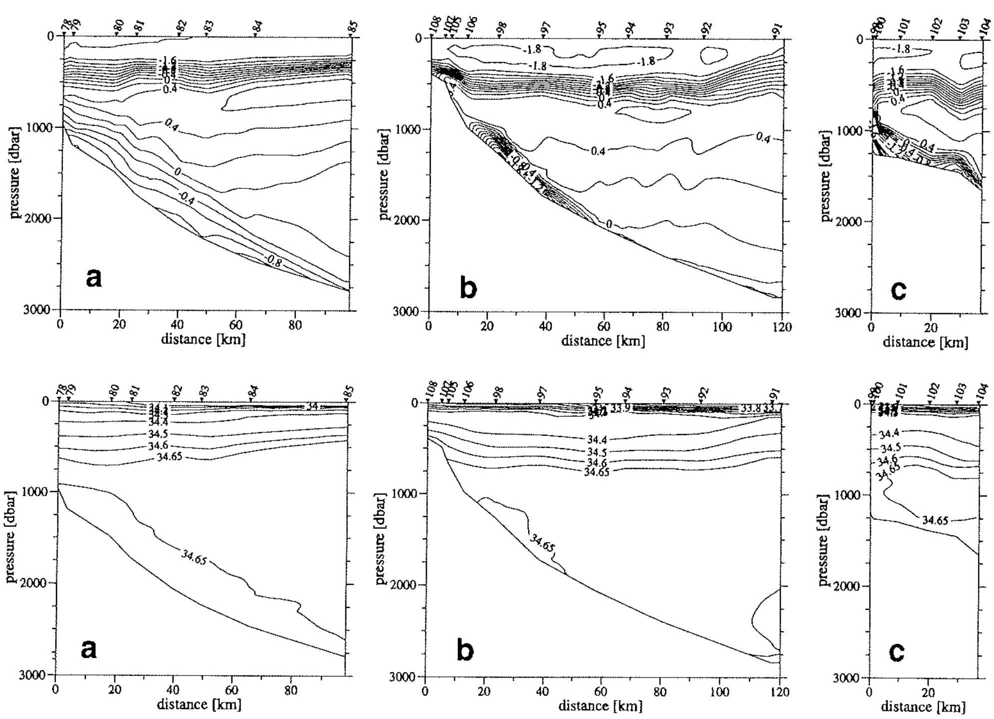


Abb. 37: Vertikalverteilung der potentiellen Temperatur und des Salzgehalts auf CTD-Schnitten, die während ANT XVI/2 von der Schelfkante über den Kontinentalabhang von Westen (a, Stationen 79-85) nach Osten (b, Stationen 108-91) und um den Eisberg D11 (c, Stationen 99-104) ausgeführt wurden. Die Lage der Stationen ist in Abb. 28 (unten) angegeben.

Fig 37: Vertical distribution of potential temperature and salinity on CTD sections which were measured during ANT XVI/2 from the shelf edge over the continental slope from west (a, stations 79-85) to the east (b, stations 108-91) and around iceberg D11 (c, stations 99-104). The location of the stations is indicated in Fig. 28 (bottom).

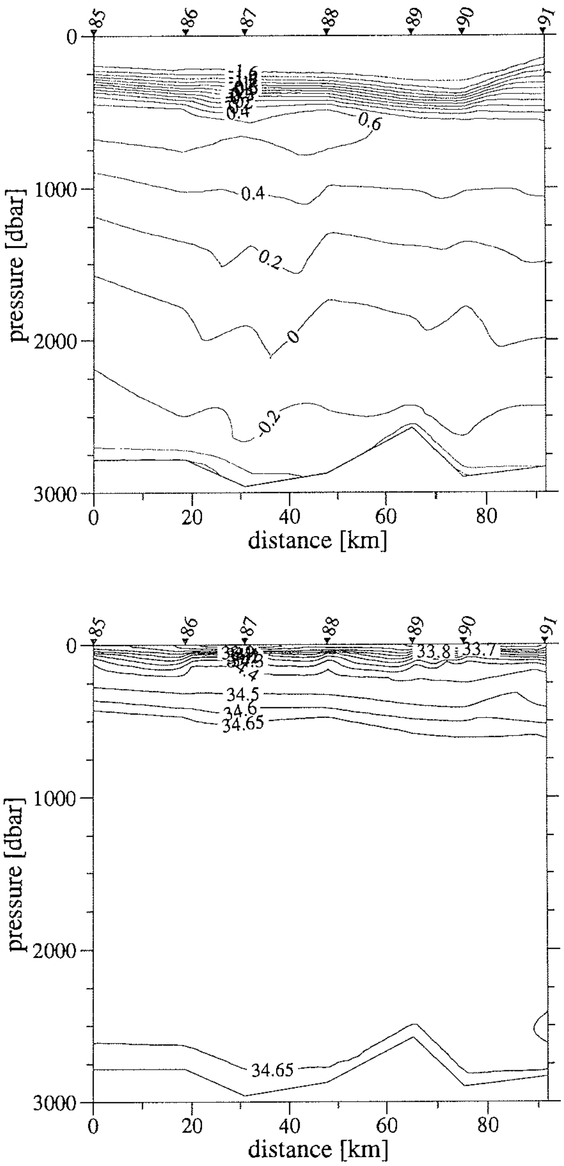


Abb. 38: Vertikalverteilung der potentiellen Temperatur und des Salzgehalts auf einem CTD-Schnitt, der während ANT XVI/2 über dem Kontinentalabhang bei etwa 2.800 m Wassertiefe von Westen (links) nach Osten (rechts) ausgeführt wurde. Die Lage der Stationen ist in Abb. 28 (unten) angegeben.

Fig 38: Vertical distribution of potential temperature and salinity on a CTD section which was measured during ANT XVI/2 over the continental slope at about 2,800 m water depth from west (left) to the east (right). The location of the stations is indicated in Fig. 28 (bottom).

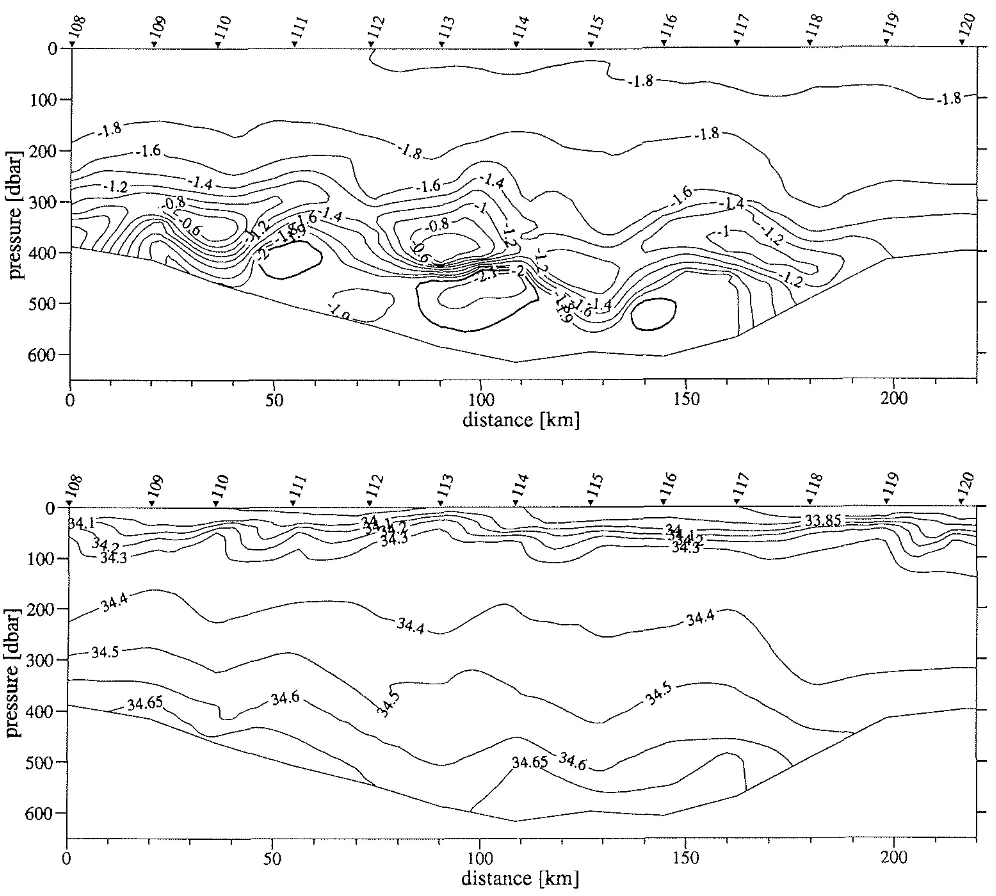


Abb. 39: Vertikalverteilung der potentiellen Temperatur und des Salzgehalts auf einem CTD-Schnitt, der während ANT XVI/2 entlang der nördlichen Schwelle des Filchnergrabens von Westen (links) nach Osten (rechts) ausgeführt wurde. Die Lage der Stationen ist in Abb. 28 (unten) angegeben.

Fig 39: Vertical distribution of potential temperature and salinity on a CTD section which was measured during ANT XVI/2 along the northern sill of the Filchner Depression from west (left) to the east (right). The location of the stations is indicated in Fig. 28 (bottom).

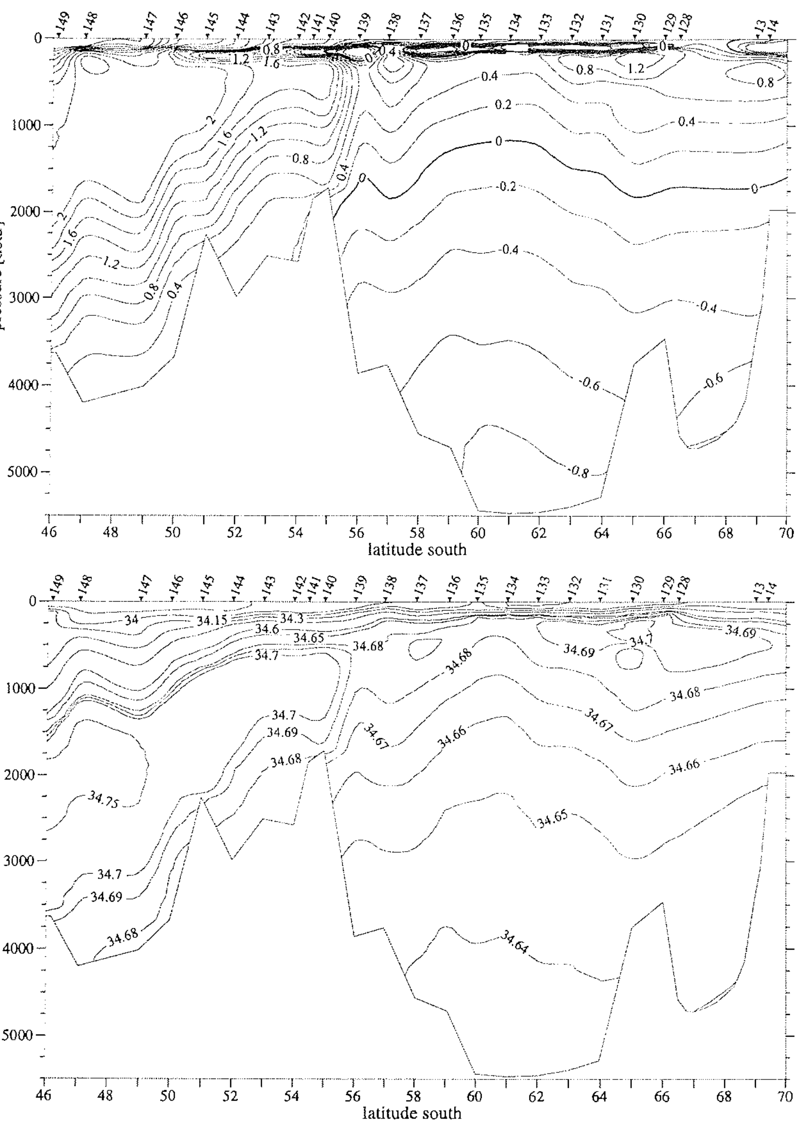


Abb. 40: Vertikalverteilung der potentiellen Temperatur und des Salzgehalts auf einem CTD-Schnitt, der während ANT XVI/2 entlang dem Meridian von Greenwich von der Antarktis (rechts) nach Norden ausgeführt wurde. Die Lage der Stationen ist in Abb. 27 angegeben.

Fig 40: Vertical distribution of potential temperature and salinity on a CTD section which was measured during ANT XVI/2 along the Greenwich Meridian from Antarctica (right) to the north. The location of the stations is indicated in Fig. 27.

7 ANNEXES

ANNEX 1 XBTs

Table 1. ANT XVI/2 XBT Stations

Station	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
1	10/01/99	15:15	S37°00'	E16°00'	4675	DBLK001	wrong latitude in file
2	10/01/99	17:00	S37°14'	E15°50'	4715	DBLK002	T rise at 300 m
3	10/01/99	17:03	S37°14'	E15°49'	4743	DBLK003	T rise at 250 m
4	10/01/99	19:02	S37°29'	E15°38'	4790	DBLK004	T rise at 350 m
5	10/01/99	21:02	S37°45'	E15°25'	4854	DBLK005	ok
6	10/01/99	23:00	S38°01'	E15°12'	4459	DBLK006	ok
7	11/01/99	01:00	S38°18'	E15°00'	4208	DBLK007	ok
8	11/01/99	03:00	S38°35'	E14°47'	3960	DBLK008	ok
9	11/01/99	05:00	S38°52'	E14°33'	4821	DBLK009	ok
10	11/01/99	07:00	S39°11'	E14°19'	4830	DBLK010	ok
11	11/01/99	09:01	S39°30'	E14°04'	4883	DBLK011	ok
12	11/01/99	11:01	S39°49'	E13°48'	4839	DBLK012	T rise at 150 m
13	11/01/99	12:57	S40°08'	E13°33'	4844	DBLK013	ok
14	11/01/99	14:57	S40°26'	E13°17'	4897	DBLK014	ok
15	11/01/99	16:59	S40°49'	E13°01'	4868	DBLK015	ok
16	11/01/99	18:59	S41°09'	E12°44'	4682	DBLK016	ok
17	11/01/99	21:08	S41°33'	E12°25'	3144	DBLK017	ok
18	11/01/99	23:00	S41°53'	E12°09'	4966	DBLK018	ok
19	12/01/99	01:00	S42°04'	E11°51'	4167	DBLK019	ok
20	12/01/99	02:59	S42°39'	E11°34'	4362	DBLK020	ok
21	12/01/99	04:59	S42°56'	E11°18'	4521	DBLK021	ok
22	12/01/99	07:00	S43°16'	E11°00'	4524	DBLK022	ok
23	12/01/99	08:58	S43°37'	E10°43'	4416	DBLK023	ok
24	12/01/99	10:59	S43°58'	E10°25'	4602	DBLK024	first 20 m missing
25	12/01/99	11:03	S43°58'	E10°25'	4602	DBLK025	ok
26	12/01/99	13:00	S44°16'	E10°08'	4536	DBLK026	ok
27	12/01/99	15:00	S44°36'	E09°52'	4810	DBLK027	wrong expedition name in file
28	12/01/99	17:00	S44°55'	E09°36'	4592	DBLK028	ok
29	12/01/99	19:00	S45°15'	E09°19'	4588	DBLK029	ok
30	12/01/99	21:00	S45°36'	E09°02'	4533	DBLK030	ok
31	12/01/99	23:00	S45°56'	E08°44'	4462	DBLK031	ok
32	13/01/99	01:00	S46°15'	E08°26'	4313	DBLK032	ok
33	13/01/99	03:00	S46°34'	E08°10'	1536	DBLK033	ok
34	13/01/99	05:00	S46°52'	E07°53'	1997	DBLK034	ok
35	13/01/99	07:00	S47°12'	E07°36'	2233	DBLK035	ok
36	13/01/99	09:00	S47°31'	E07°19'	1806	DBLK036	ok
37	13/01/99	11:00	S47°49'	E07°02'	4320	DBLK037	ok
38	13/01/99	12:58	S48°07'	E06°46'	4217	DBLK038	ok
39	13/01/99	14:59	S48°25'	E06°30'	3754	DBLK039	ok
40	13/01/99	16:59	S48°41'	E06°14'	3819	DBLK040	ok
41	13/01/99	19:00	S48°58'	E05°59'	3869	DBLK041	ok
42	13/01/99	20:59	S49°13'	E05°45'	3810	DBLK042	ok
43	13/01/99	23:00	S49°27'	E05°32'	3739	DBLK043	ok
44	14/01/99	00:58	S49°40'	E05°20'	3369	DBLK044	ok
45	14/01/99	02:59	S49°53'	E05°08'	3486	DBLK045	high Ts at depth
46	14/01/99	05:00	S50°06'	E04°55'	839	DBLK046	ok
47	14/01/99	07:00	S50°19'	E04°43'	3249	DBLK047	ok
48	14/01/99	09:00	S50°34'	E04°29'	3402	DBLK048	ok
49	14/01/99	11:00	S50°49'	E04°14'	3198	DBLK049	ok
50	14/01/99	13:00	S51°04'	E04°00'	3651	DBLK050	ok

Table 1. (continued)

Station	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
51	14/01/99	15:00	S51°19'	E03°45'	3504	DBLK051	ok
52	14/01/99	17:01	S51°34'	E03°30'	2788	DBLK052	ok
53	14/01/99	19:00	S51°50'	E03°15'	3144	DBLK053	ok
54	14/01/99	21:00	S52°05'	E03°00'	3036	DBLK054	ok
55	14/01/99	23:00	S52°22'	E02°43'	2569	DBLK055	ok
56	15/01/99	01:00	S52°39'	E02°25'	2791	DBLK056	ok
57	15/01/99	03:00	S52°58'	E02°07'	2825	DBLK057	ok
58	15/01/99	05:00	S53°16'	E01°48'	2594	DBLK058	ok
59	15/01/99	07:00	S53°34'	E01°29'	2756	DBLK059	ok
60	15/01/99	07:02	S53°34'	E01°29'	2756	DBLK060	ok
61	15/01/99	09:00	S53°54'	E01°09'	2580	DBLK061	ok
62	15/01/99	11:00	S54°13'	E00°49'	2970	DBLK062	ok
63	15/01/99	12:59	S54°33'	E00°28'	2375	DBLK063	ok
64	15/01/99	15:00	S54°51'	E00°13'	1330	DBLK064	ok; ALACE 1 deployed at 16:00
65	15/01/99	17:00	S55°09'	E00°00'	3358	DBLK065	ok; ALACE 2 deployed at 18:45
66	15/01/99	19:00	S55°32'	E00°00'	3867	DBLK066	ok
67	15/01/99	20:59	S55°55'	E00°00'	3380	DBLK067	ok; ALACE 3 deployed at 21:25
68	15/01/99	23:00	S56°14'	E00°00'	3881	DBLK068	ok
69	16/01/99	01:00	S56°33'	E00°00'	4351	DBLK069	ok
70	16/01/99	03:00	S56°51'	E00°00'	3894	DBLK070	ok; ALACE 4 deployed at 04:00
71	16/01/99	05:00	S57°09'	E00°00'	4245	DBLK071	ok
72	16/01/99	07:00	S57°28'	E00°00'	3874	DBLK072	ok
73	16/01/99	08:59	S57°48'	E00°00'	4340	DBLK073	ok; ALACE 5 deployed at 10:15
74	16/01/99	11:00	S58°07'	E00°00'	4470	DBLK074	ok
75	16/01/99	13:00	S58°28'	E00°03'	4015	DBLK075	ok
76	16/01/99	15:00	S58°48'	E00°05'	4695	DBLK076	ok; ALACE 6 deployed at 16:15
77	16/01/99	17:00	S59°06'	E00°00'	4751	DBLK077	ok
78	16/01/99	19:00	S59°25'	E00°00'	4898	DBLK078	ok; ALACE 7 deployed at 19:30
79	16/01/99	21:00	S59°43'	E00°00'	5406	DBLK079	ok; ALACE 8 deployed at 22:45
80	16/01/99	23:00	S60°01'	E00°00'	5378	DBLK080	ok
81	17/01/99	01:00	S60°20'	E00°00'	5371	DBLK081	ok; ALACE 9 deployed at 02:10
82	17/01/99	03:00	S60°37'	E00°00'	5417	DBLK082	ok
83	17/01/99	05:00	S60°56'	E00°00'	5412	DBLK083	ok; ALACE 10 deployed at 05:25
84	17/01/99	07:00	S61°17'	E00°00'	5416	DBLK084	ok
85	17/01/99	09:00	S61°44'	E00°00'	5375	DBLK085	wrong latitude in file
86	17/01/99	11:00	S62°10'	E00°00'	5378	DBLK086	ok
87	17/01/99	13:00	S62°35'	E00°00'	5354	DBLK087	ok
88	17/01/99	15:00	S63°01'	E00°00'	5321	DBLK088	ok
89	17/01/99	17:00	S63°28'	E00°03'	5267	DBLK089	ok
90	17/01/99	19:00	S63°54'	E00°05'	5224	DBLK090	ok
91	17/01/99	21:00	S64°20'	E00°06'	4891	DBLK091	ok
92	17/01/99	23:00	S64°47'	E00°07'	3957	DBLK092	ok
93	18/01/99	01:00	S65°10'	E00°08'	3874	DBLK093	ok
94	18/01/99	03:00	S65°30'	E00°08'	3596	DBLK094	ok
95	18/01/99	05:00	S65°50'	E00°09'	3599	DBLK095	ok; CTD at 06:00; 230-2 at 09:30
96	18/01/99	12:40	S66°02'	E00°13'	3411	DBLK096	ok
97	18/01/99	14:39	S66°26'	E00°01'	4415	DBLK097	ok; 231-3 at 15:00; CTD at 20:30

Table 1. (continued)

Station	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
98	19/01/99	01:00	S66°46'	W00°01'	4718	DBLK098	ok
99	19/01/99	03:00	S67°06'	W00°02'	4717	DBLK099	ok
100	19/01/99	05:00	S67°25'	W00°03'	4667	DBLK100	ok
101	19/01/99	07:00	S67°44'	W00°02'	4610	DBLK101	ok
102	19/01/99	09:00	S68°03'	W00°03'	4511	DBLK102	ok
103	19/01/99	11:03	S68°20'	W00°03'	4412	DBLK103	ok
104	19/01/99	13:00	S68°38'	W00°03'	4153	DBLK104	ok
105	19/01/99	15:00	S68°57'	W00°02'	3497	DBLK105	ok; 232-3 at 16:00; CTD at 19:15
106	20/01/99	01:00	S69°09'	W00°02'	3091	DBLK106	died at 60 m
107	20/01/99	01:03	S69°09'	W00°02'	3091	DBLK107	peaks to 14°C
108	20/01/99	01:06	S69°09'	W00°02'	3091	DBLK108	ok
109	20/01/99	03:00	S69°21'	W00°01'	2241	DBLK109	peaks to 30°C
110	20/01/99	03:03	S69°21'	W00°01'	2241	DBLK110	peaks; CTD at 04:00; 233-3 at 06:00
111	20/01/99	13:00	S69°26'	W00°01'	1679	DBLK111	ok
112	20/01/99	15:00	S69°37'	W00°59'	2404	DBLK112	ok
113	21/01/99	01:00	S70°24'	W03°38'	482	DBLK113	ok
114	21/01/99	03:05	S70°20'	W04°31'	462	DBLK114	ok
115	02/03/99	15:00	S69°35'	W06°42'	2982	DBLK115	ok
116	02/03/99	17:00	S69°18'	W05°57'	2261	DBLK116	ok
117	02/03/99	19:00	S68°58'	W05°16'	2771	DBLK117	ok
118	02/03/99	21:00	S68°39'	W04°37'	3589	DBLK118	ok
119	02/03/99	23:00	S68°22'	W03°53'	3897	DBLK119	ok
120	03/03/99	01:00	S68°02'	W03°11'	4183	DBLK120	ok
121	03/03/99	03:00	S67°42'	W02°30'	4232	DBLK121	ok
122	03/03/99	05:00	S67°23'	W01°52'	4610	DBLK122	ok
123	03/03/99	07:00	S67°04'	W01°11'	4717	DBLK123	ok
124	03/03/99	09:00	S66°45'	W00°31'	4749	DBLK124	ok
125	03/03/99	13:50	S66°29'	W00°00'	4517	DBLK125	ok
126	03/03/99	15:00	S66°15'	W00°01'	3726	DBLK126	ok
127	03/03/99	18:10	S66°00'	E00°00'	3444	DBLK127	ok
128	03/03/99	19:01	S65°49'	W00°02'	3738	DBLK128	ok
129	03/03/99	21:00	S65°23'	W00°02'	4043	DBLK129	ok
130	04/03/99	00:45	S65°59'	W00°01'	3727	DBLK130	ok
131	04/03/99	03:01	S64°32'	E00°00'	4676	DBLK131	ok
132	04/03/99	05:01	S64°07'	E00°04'	5163	DBLK132	ok
133	04/03/99	16:35	S63°58'	E00°02'	5217	DBLK133	ok
134	04/03/99	17:01	S63°54'	E00°01'	5229	DBLK134	ok
135	04/03/99	19:00	S63°28'	W00°01'	5264	DBLK135	spiky at 350 m
136	04/03/99	21:00	S63°03'	E00°00'	5228	DBLK136	ok
137	05/03/99	00:27	S63°00'	E00°00'	5322	DBLK137	ok
138	05/03/99	01:00	S62°54'	E00°00'	5331	DBLK138	ok
139	05/03/99	03:00	S62°28'	E00°00'	5363	DBLK139	cast aborted
140	05/03/99	03:03	S62°28'	E00°00'	5363	DBLK140	ok
141	05/03/99	04:55	S62°03'	E00°00'	5384	DBLK141	ok
142	05/03/99	09:00	S61°46'	E00°00'	5372	DBLK142	ok
143	05/03/99	11:00	S61°20'	E00°00'	5418	DBLK143	ok
144	05/03/99	15:18	S61°00'	W00°01'	5415	DBLK144	ok

Table 1. (continued)

Station	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
145	05/03/99	17:00	S60°39'	W00°01'	5422	DBLK145	ok
146	05/03/99	19:00	S60°13'	E00°00'	5377	DBLK146	ok
147	05/03/99	23:00	S59°55'	E00°00'	5422	DBLK147	ok
148	06/03/99	00:59	S59°29'	E00°04'	4649	DBLK148	ok
149	06/03/99	21:05	S59°03'	E00°04'	4665	DBLK149	ok
150	06/03/99	23:00	S58°38'	E00°03'	4777	DBLK150	ok
151	07/03/99	01:05	S58°12'	E00°01'	4382	DBLK151	ok
152	07/03/99	04:18	S58°00'	E00°00'	4533	DBLK152	ok
153	07/03/99	05:00	S57°51'	E00°00'	4215	DBLK153	ok
154	07/03/99	07:00	S57°32'	E00°01'	4095	DBLK154	ok
155	07/03/99	09:00	S57°12'	E00°01'	4214	DBLK155	error
156	07/03/99	09:02	S57°12'	E00°01'	4214	DBLK156	ok
157	07/03/99	16:31	S56°57'	E00°02'	3760	DBLK157	ok
158	07/03/99	17:00	S56°52'	E00°02'	3613	DBLK158	ok
159	07/03/99	19:00	S56°28'	E00°02'	3837	DBLK159	ok
160	07/03/99	20:56	S56°03'	E00°00'	3402	DBLK160	ok
161	08/03/99	01:02	S55°34'	E00°00'	3801	DBLK161	ok
162	08/03/99	03:01	S55°07'	E00°00'	3351	DBLK162	ok
163	08/03/99	05:00	S54°59'	E00°00'	1681	DBLK163	ok
164	08/03/99	07:00	S54°40'	E00°00'	1000	DBLK164	ok
165	08/03/99	11:14	S54°28'	E00°02'	1935	DBLK165	ok
166	08/03/99	13:00	S54°15'	E00°01'	2668	DBLK166	bad data (strong winds, big swell)
167	08/03/99	16:28	S53°58'	E00°00'	2525	DBLK167	bad data (strong winds, big swell)
168	08/03/99	17:00	S53°52'	E00°00'	2594	DBLK168	bad data (strong winds, big swell)
169	08/03/99	17:04	S53°52'	E00°00'	2594	DBLK169	bad data (strong winds, big swell)
170	08/03/99	17:11	S53°52'	E00°00'	2594	DBLK170	bad data (strong winds, big swell)
171	08/03/99	17:26	S53°47'	W00°01'	2770	DBLK171	bad data (strong winds, big swell)
172	08/03/99	19:00	S53°29'	E00°00'	2670	DBLK172	ok
173	08/03/99	21:00	S53°08'	E00°00'	2663	DBLK173	bad data (strong winds, big swell)
174	08/03/99	21:04	S53°08'	E00°00'	2663	DBLK174	ok
175	08/03/99	23:20	S53°00'	E00°00'	2488	DBLK175	ok
176	09/03/99	01:00	S52°45'	E00°00'	2714	DBLK176	cut at 570 m
177	09/03/99	03:00	S52°24'	E00°02'	2620	DBLK177	bad data (strong winds, big swell)
178	09/03/99	04:55	S52°03'	E00°03'	3017	DBLK178	bad data (strong winds, big swell)
179	09/03/99	05:00	S52°03'	E00°03'	3017	DBLK179	ok
180	09/03/99	09:00	S51°36'	E00°00'	2791	DBLK180	ok
181	09/03/99	11:00	S51°16'	E00°00'	2547	DBLK181	ok
182	09/03/99	14:11	S51°01'	E00°01'	2283	DBLK182	bad data (strong winds, big swell)
183	09/03/99	14:14	S51°01'	E00°01'	2283	DBLK183	ok
184	09/03/99	15:03	S50°53'	W00°01'	2573	DBLK184	ok
185	09/03/99	17:00	S50°32'	W00°02'	3377	DBLK185	spiky below 300 m
186	09/03/99	17:01	S50°32'	W00°02'	3377	DBLK186	spiky below 200 m
187	09/03/99	19:00	S50°12'	W00°01'	3621	DBLK187	ok; no XBT for 12 hours
188	10/03/99	07:00	S48°55'	E00°02'	3904	DBLK188	ok
189	10/03/99	09:04	S48°34'	E00°00'	3765	DBLK189	ok
190	10/03/99	11:00	S48°15'	E00°00'	3481	DBLK190	ok
191	10/03/99	13:25	S47°59'	E00°01'	3951	DBLK191	bad data (strong winds, big swell)

Table 1. (continued)

Station	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
192	10/03/99	13:28	S47°59'	E00°01'	3951	DBLK192	bad data (strong winds, big swell)
193	10/03/99	13:30	S47°59'	E00°01'	3951	DBLK193	ok
194	10/03/99	14:58	S47°44'	E00°07'	3895	DBLK194	ok; no XBT for 10 hours
195	11/03/99	09:05	S47°03'	E00°03'	4211	DBLK195	ok
196	11/03/99	11:00	S46°42'	E00°43'	4104	DBLK196	ok
197	11/03/99	13:00	S46°20'	E00°55'	4470	DBLK197	bad data (strong winds, big swell)
198	11/03/99	13:04	S46°20'	E00°55'	4470	DBLK198	ok
199	11/03/99	17:08	S46°09'	E01°02'	4075	DBLK199	ok
200	11/03/99	19:00	S45°55'	E01°28'	4019	DBLK200	ok
201	11/03/99	21:00	S45°38'	E01°59'	4474	DBLK201	ok
202	11/03/99	22:59	S45°21'	E02°26'	4271	DBLK202	ok
203	12/03/99	01:03	S45°03'	E02°55'	4909	DBLK203	ok
204	12/03/99	03:02	S44°47'	E03°23'	4151	DBLK204	peaks
205	12/03/99	03:06	S44°47'	E03°23'	4151	DBLK205	ok
206	12/03/99	05:00	S44°31'	E03°50'	5181	DBLK206	peak at 100 m; combine with 207
207	12/03/99	05:02	S44°31'	E03°50'	5181	DBLK207	peaks below 200 m
208	12/03/99	06:58	S44°16'	E04°15'	4794	DBLK208	ok
209	12/03/99	09:00	S44°01'	E04°44'	4693	DBLK209	ok
210	12/03/99	11:00	S43°46'	E05°08'	4479	DBLK210	ok
211	12/03/99	13:00	S43°36'	E05°32'	4545	DBLK211	ok
212	12/03/99	15:00	S43°17'	E06°00'	4665	DBLK212	ok
213	12/03/99	17:01	S43°06'	E06°27'	4658	DBLK213	ok
214	12/03/99	19:00	S42°43'	E06°52'	4665	DBLK214	ok
215	12/03/99	21:00	S42°28'	E07°18'	4755	DBLK215	ok
216	12/03/99	23:00	S42°11'	E07°44'	4894	DBLK216	ok
217	13/03/99	01:00	S41°56'	E08°10'	4701	DBLK217	ok
218	13/03/99	03:00	S41°41'	E08°35'	4634	DBLK218	cut at 600 m
219	13/03/99	03:02	S41°41'	E08°35'	4634	DBLK219	peaks
220	13/03/99	03:04	S41°41'	E08°35'	4634	DBLK220	peaks
221	13/03/99	03:06	S41°41'	E08°35'	4634	DBLK221	ok
222	13/03/99	05:00	S41°27'	E09°00'	4722	DBLK222	ok
223	13/03/99	07:00	S41°16'	E09°20'	4573	DBLK223	ok
224	13/03/99	09:00	S41°03'	E09°39'	4707	DBLK224	peaks
225	13/03/99	09:03	S41°03'	E09°39'	4707	DBLK225	ok
226	13/03/99	11:00	S40°50'	E09°58'	4477	DBLK226	ok
227	13/03/99	13:00	S40°37'	E10°18'	4624	DBLK227	ok
228	13/03/99	15:00	S40°23'	E10°40'	4681	DBLK228	ok
229	13/03/99	17:00	S40°12'	E11°01'	4632	DBLK229	ok
230	13/03/99	19:01	S39°58'	E11°22'	4873	DBLK230	ok
231	13/03/99	21:00	S39°46'	E11°42'	5032	DBLK231	ok
232	13/03/99	22:59	S39°33'	E12°01'	4827	DBLK232	ok
233	14/03/99	01:01	S39°20'	E12°22'	4981	DBLK233	ok
234	14/03/99	03:00	S39°08'	E12°43'	4943	DBLK234	ok
235	14/03/99	05:00	S38°55'	E13°02'	4929	DBLK235	ok
236	14/03/99	07.00	S38°44'	E13°21'	4289	DBLK236	ok
237	14/03/99	09:00	S38°31'	E13°39'	4960	DBLK237	ok
238	14/03/99	10:59	S38°19'	E13°57'	4965	DBLK238	ok

Table 1. (continued)

Station	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
239	14/03/99	13:00	S38°08'	E14°13'	4962	DBLK239	ok
240	14/03/99	15:00	S37°56'	E14°31'	4959	DBLK240	ok
241	14/03/99	17:00	S37°45'	E14°51'	4949	DBLK241	ok
242	14/03/99	19:00	S37°37'	E15°12'	4900	DBLK242	ok
243	14/03/99	21:08	S37°30'	E15°19'	4881	DBLK243	ok
244	14/03/99	23:00	S37°17'	E15°34'	4809	DBLK244	ok
245	15/03/99	01:00	S37°04'	E15°53'	4727	DBLK245	ok

ANNEX 2 CTD

Table 2. ANT XVI/2 CTD Stations

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
1	011	01	18/01/99	06:09	S66°00.22'	E00°09.80'	3451	1101D(U).raw	upcast profile spiky when bottles were closed; bottle #7 didn't close despite of BAF message; triple samples for practice; position near mooring AWI 230
2	012	03	18/01/99	20:32	S66°30.29'	E00°01.86'	4503	1203D(U).raw	upcast profile spiky when bottles were closed; double samples for practice; position near mooring AWI 231
3	013†	02	19/01/99	19:16	S68°59.76'	W00°03.91'	3320	1302D(U).raw	discontinuity in T and C at bottle #20; BAF at bottle #14; reset; bottle file starts at bottle #14; double samples for practice; position near mooring AWI 232
4	014	01	20/01/99	04:05	S69°24.06'	W00°02.45'	1950	1401D(U).raw	double samples for practice; position near mooring AWI 233
5	015†	02	20/01/99	22:55	S70°15.95'	W02°47.33'	268	1502D(U).raw	double samples for practice
6	016	01	23/01/99	01:21	S70°29.41'	W08°08.98'	275	1601D(U).raw	hydrosweep wasn't working; lids of sample bottles were not rinsed
7	017	02	24/01/99	06:46	S72°52.22'	W19°05.67'	409	1702D(U).raw	hydrosweep wasn't working; altimeter problems; bottles #3 and 4 didn't close;
8	018	01	26/01/99	00:17	S76°36.65'	W31°18.84'	378	1801D(U).raw	
9	019	01	31/01/99	16:11	S75°16.95'	W53°44.76'	402	1901D(U).raw	first cast of 24h JoJo CTD; bottle #6 leaked slightly
10	019	02	31/01/99	17:06	S75°16.79'	W53°43.97'	403	1902D(U).raw	JoJo CTD near SUSI; no bottles
11	019	03	31/01/99	17:26	S75°16.79'	W53°43.84'	404	1903D(U).raw	JoJo CTD near SUSI; no bottles
12	019	04	31/01/99	17:41	S75°16.76'	W53°43.72'	404	1904D(U).raw	JoJo CTD near SUSI; no bottles
13	019	05	31/01/99	17:58	S75°16.73'	W53°43.56'	405	1905D(U).raw	JoJo CTD near SUSI; no bottles; stopped at 17.5 m during upcast due to ice
14	019	06	31/01/99	18:18	S75°16.73'	W53°43.40'	407	1906D(U).raw	JoJo CTD near SUSI; no bottles
15	019	07	31/01/99	18:38	S75°16.69'	W53°42.95'	405	1907D(U).raw	JoJo CTD near SUSI; no bottles CTD lifted out of water after upcast for correction of position
16	019	08	31/01/99	19:02	S75°16.71'	W53°42.96'	405	1908D(U).raw	JoJo CTD near SUSI; no bottles
17	019	09	31/01/99	19:21	S75°16.75'	W53°43.22'	406	1909D(U).raw	JoJo CTD near SUSI; no bottles

Table 2. (continued)

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
18	019	10	31/01/99	19:41	S75°16.71'	W53°43.05'	406	1910D(U).raw	JoJo CTD near SUSI; no bottles
19	019	11	31/01/99	20:00	S75°16.71'	W53°42.52'	409	1911D(U).raw	JoJo CTD near SUSI; no bottles
20	019	12	31/01/99	20:28	S75°16.90'	W53°42.72'	404	1912D(U).raw	JoJo CTD near SUSI; no bottles; downcast file corrupted
21	019	13	31/01/99	20:48	S75°16.93'	W53°42.55'	405	1913D(U).raw	JoJo CTD near SUSI; no bottles
22	019	14	31/01/99	21:15	S75°17.01'	W53°42.36'	408	1914D(U).raw	JoJo CTD near SUSI; no bottles
23	019	15	31/01/99	21:34	S75°17.07'	W53°42.45'	408	1915D(U).raw	JoJo CTD near SUSI; no bottles
24	019	16	31/01/99	21:54	S75°17.18'	W53°42.75'	406	1916D(U).raw	JoJo CTD near SUSI; no bottles; computer reboot at the end of downcast; no downcast file
25	019	17	31/01/99	22:22	S75°17.37'	W53°42.90'	409	1917D(U).raw	JoJo CTD near SUSI; no bottles
26	019	18	31/01/99	22:44	S75°17.47'	W53°43.12'	410	1918D(U).raw	JoJo CTD near SUSI; no bottles
27	019	19	31/01/99	23:07	S75°17.57'	W53°43.47'	412	1919D(U).raw	JoJo CTD near SUSI; no bottles
28	019	20	31/01/99	23:27	S75°17.69'	W53°43.62'	413	1920D(U).raw	JoJo CTD near SUSI; no bottles
29	019	21	31/01/99	23:46	S75°17.77'	W53°43.78'	412	1921D(U).raw	JoJo CTD near SUSI; no bottles
30	019	22	01/02/99	00:01	S75°17.87'	W53°43.92'	411	1922D(U).raw	JoJo CTD near SUSI; no bottles
31	019	23	01/02/99	00:22	S75°17.91'	W53°44.22'	411	1923D(U).raw	JoJo CTD near SUSI; no bottles
32	019	24	01/02/99	00:40	S75°17.87'	W53°44.57'	407	1924D(U).raw	JoJo CTD near SUSI; no bottles
33	019	25	01/02/99	00:57	S75°17.96'	W53°44.58'	411	1925D(U).raw	JoJo CTD near SUSI; no bottles
34	019	26	01/02/99	01:15	S75°18.02'	W53°44.61'	410	1926D(U).raw	JoJo CTD near SUSI; no bottles; discontinuity in upcast data at 100 dbar
35	019	27	01/02/99	01:33	S75°18.00'	W53°44.74'	414	1927D(U).raw	JoJo CTD near SUSI; no bottles
36	019	28	01/02/99	01:50	S75°18.04'	W53°44.74'	412	1928D(U).raw	JoJo CTD near SUSI; no bottles
37	019	29	01/02/99	02:10	S75°18.06'	W53°44.78'	412	1929D(U).raw	JoJo CTD near SUSI; no bottles
38	019	30	01/02/99	02:26	S75°18.08'	W53°44.86'	411	1930D(U).raw	JoJo CTD near SUSI; no bottles
39	019	31	01/02/99	02:46	S75°18.07'	W53°44.87'	410	1931D(U).raw	JoJo CTD near SUSI; no bottles
40	019	32	01/02/99	03:11	S75°17.90'	W53°44.33'	408	1932D(U).raw	JoJo CTD near SUSI; no bottles; downcast spiky; CTD lifted out of water after upcast due to ice
41	019	33	01/02/99	03:28	S75°17.83'	W53°44.14'	408	1933D(U).raw	JoJo CTD near SUSI; no bottles

Table 2. (continued)

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
42	019	34	01/02/99	03:44	S75°17.77'	W53°43.98'	409	1934D(U).raw	JoJo CTD near SUSI; no bottles
43	019	35	01/02/99	04:01	S75°17.70'	W53°43.76'	412	1935D(U).raw	JoJo CTD near SUSI; no bottles
44	019	36	01/02/99	04:17	S75°17.64'	W53°43.67'	412	1936D(U).raw	JoJo CTD near SUSI; no bottles
45	019	37	01/02/99	04:34	S75°17.56'	W53°43.51'	412	1937D(U).raw	JoJo CTD near SUSI; no bottles
46	019	38	01/02/99	04:51	S75°17.49'	W53°43.31'	414	1938D(U).raw	JoJo CTD near SUSI; no bottles
47	019	39	01/02/99	05:07	S75°17.41'	W53°43.18'	411	1939D(U).raw	JoJo CTD near SUSI; no bottles
48	019	40	01/02/99	05:25	S75°17.32'	W53°42.93'	408	1940D(U).raw	JoJo CTD near SUSI; no bottles
49	019	41	01/02/99	05:39	S75°17.27'	W53°42.79'	414	1941D(U).raw	JoJo CTD near SUSI; no bottles
50	019	42	01/02/99	05:55	S75°17.20'	W53°42.62'	410	1942D(U).raw	JoJo CTD near SUSI; no bottles
51	019	43	01/02/99	06:12	S75°17.13'	W53°42.44'	409	1943D(U).raw	JoJo CTD near SUSI; no bottles
52	019	44	01/02/99	06:29	S75°17.07'	W53°42.26'	408	1944D(U).raw	JoJo CTD near SUSI; no bottles
53	019	45	01/02/99	06:45	S75°17.01'	W53°42.10'	410	1945D(U).raw	JoJo CTD near SUSI; no bottles
54	019	46	01/02/99	07:02	S75°16.95'	W53°41.94'	409	1946D(U).raw	JoJo CTD near SUSI; no bottles; strange peak in T and conductivity at 90 dbar
55	019	47	01/02/99	07:19	S75°16.91'	W53°41.82'	415	1947D(U).raw	JoJo CTD near SUSI; no bottles
56	019	48	01/02/99	07:35	S75°16.87'	W53°41.63'	410	1948D(U).raw	JoJo CTD near SUSI; no bottles
57	019	49	01/02/99	07:53	S75°16.83'	W53°41.46'	416	1949D(U).raw	JoJo CTD near SUSI; no bottles
58	019	50	01/02/99	08:08	S75°16.81'	W53°41.42'	412	1950D(U).raw	JoJo CTD near SUSI; no bottles
59	019	51	01/02/99	08:28	S75°16.79'	W53°41.37'	412	1951D(U).raw	JoJo CTD near SUSI; no bottles
60	019	52	01/02/99	08:47	S75°16.78'	W53°41.32'	412	1952D(U).raw	JoJo CTD near SUSI; no bottles
61	019	53	01/02/99	09:05	S75°16.78'	W53°41.20'	412	1953D(U).raw	JoJo CTD near SUSI; no bottles
62	019	54	01/02/99	09:23	S75°16.79'	W53°41.18'	412	1954D(U).raw	JoJo CTD near SUSI; no bottles
63	019	55	01/02/99	09:43	S75°16.80'	W53°41.23'	411	1955D(U).raw	JoJo CTD near SUSI; no bottles
64	019	56	01/02/99	10:07	S75°16.84'	W53°41.48'	411	1956D(U).raw	JoJo CTD near SUSI; no bottles
65	019	57	01/02/99	10:28	S75°16.88'	W53°41.59'	409	1957D(U).raw	JoJo CTD near SUSI; no bottles
66	019	58	01/02/99	10:47	S75°16.91'	W53°41.69'	410	1958D(U).raw	JoJo CTD near SUSI; no bottles
67	019	59	01/02/99	11:05	S75°16.96'	W53°41.60'	410	1959D(U).raw	JoJo CTD near SUSI; no bottles; big spike at start of upcast data
68	019	60	01/02/99	11:23	S75°17.00'	W53°42.03'	410	1960D(U).raw	JoJo CTD near SUSI; no bottles
69	019	61	01/02/99	11:42	S75°17.04'	W53°42.26'	411	1961D(U).raw	JoJo CTD near SUSI; no bottles

Table 2. (continued)

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
70	019	62	01/02/99	12:02	S75°17.08'	W53°42.48'	408	1962D(U).raw	JoJo CTD near SUSI; no bottles
71	019	63	01/02/99	12:20	S75°17.10'	W53°42.61'	410	1963D(U).raw	JoJo CTD near SUSI; no bottles
72	019	64	01/02/99	12:38	S75°17.12'	W53°42.75'	410	1964D(U).raw	JoJo CTD near SUSI; no bottles
73	019	65	01/02/99	12:55	S75°17.16'	W53°42.95'	407	1965D(U).raw	JoJo CTD near SUSI; no bottles
74	019	66	01/02/99	13:12	S75°17.16'	W53°43.06'	410	1966D(U).raw	JoJo CTD near SUSI; no bottles
75	019	67	01/02/99	13:30	S75°17.19'	W53°43.33'	405	1967D(U).raw	JoJo CTD near SUSI; no bottles; discontinuity at start of upcast data
76	019	68	01/02/99	13:47	S75°17.18'	W53°43.40'	406	1968D(U).raw	JoJo CTD near SUSI; no bottles
77	019	69	01/02/99	14:05	S75°17.19'	W53°43.53'	407	1969D(U).raw	JoJo CTD near SUSI; no bottles
78	019	70	01/02/99	14:21	S75°17.17'	W53°43.52'	408	1970D(U).raw	JoJo CTD near SUSI; no bottles
79	019	71	01/02/99	14:37	S75°17.16'	W53°43.65'	407	1971D(U).raw	JoJo CTD near SUSI; no bottles; spiky upcast data
80	019	72	01/02/99	14:55	S75°17.13'	W53°43.63'	408	1972D(U).raw	JoJo CTD near SUSI; no bottles
81	019	73	01/02/99	15:10	S75°17.10'	W53°43.57'	408	1973D(U).raw	JoJo CTD near SUSI; no bottles
82	019	74	01/02/99	15:27	S75°17.08'	W53°43.69'	406	1974D(U).raw	JoJo CTD near SUSI; no bottles
83	019	75	01/02/99	15:44	S75°17.03'	W53°43.63'	405	1975D(U).raw	JoJo CTD near SUSI; no bottles
84	019	76	01/02/99	15:59	S75°16.98'	W53°43.51'	404	1976D(U).raw	JoJo CTD near SUSI; no bottles
85	019	77	01/02/99	16:18	S75°16.93'	W53°43.49'	409	1977D(U).raw	JoJo CTD near SUSI; no bottles
86	019	78	01/02/99	16:38	S75°16.87'	W53°43.43'	409	1978D(U).raw	last cast of 24h JoJo CTD near SUSI
87	020†	01	02/02/99	14:43	S74°42.59'	W60°57.58'	610	2001D(U).raw	stopped at 10 m during upcast due to ice; all bottles were closed but only the first 9 were sampled
88	021	01	02/02/99	18:23	S74°46.16'	W60°38.09'	628	2101D(U).raw	
89	022†	01	02/02/99	21:43	S74°42.86'	W61°08.89'	611	2201D(U).raw	deck reading in the protocol was taken at the surface; bottle #1 not closed; skipped on purpose; position near ACSYS-buoy
90	023†	01	03/02/99	00:24	S74°50.07'	W60°17.76'	638	2301D(U).raw	bottles were frozen
91	024†	01	03/02/99	02:13	S74°55.72'	W59°45.60'	625	2401D(U).raw	bottles were frozen
92	025	01	03/02/99	04:17	S74°02.40'	W59°16.45'	604	2501D(U).raw	bottles were frozen; hosed off with warm water; problems with sample bottle #1 at salinometer: bottle empty before measurement was completed

Table 2. (continued)

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
93	026†	01	03/02/99	06:12	S75°08.66'	W58°46.62'	609	2601D(U).raw	bottles were frozen; hosed off with warm water
94	027†	01	03/02/99	07:32	S75°11.58'	W58°30.67'	602	2701D(U).raw	bottles were frozen; hosed off with warm water
95	028	01	03/02/99	08:54	S75°14.49'	W58°14.32'	586	2801D(U).raw	bottles were frozen; hosed off with warm water
96	029	01	03/02/99	10:06	S75°17.90'	W58°00.13'	578	2901D(U).raw	conductivity spiky in upper 100 m due to ice platelets; no bottles
97	030	01	03/02/99	11:51	S75°21.29'	W57°40.22'	536	3001D(U).raw	conductivity spiky in upper 100 m due to ice platelets; no bottles
98	031	01	03/02/99	13:05	S75°17.28'	W57°29.87'	533	3101D(U).raw	conductivity spiky in upper 20 m due to ice platelets; no bottles
99	032	01	03/02/99	14:10	S75°14.52'	W57°45.72'	558	3201D(U).raw	conductivity spiky in upper 20 m due to ice platelets; no bottles
100	033	01	03/02/99	15:18	S75°11.16'	W58°00.41'	571	3301D(U).raw	no bottles
101	034	01	03/02/99	16:39	S75°08.10'	W58°16.27'	588	3401D(U).raw	no bottles
102	035	01	03/02/99	18:02	S75°05.13'	W58°31.51'	590	3501D(U).raw	no bottles
103	036	01	03/02/99	19:14	S75°01.29'	W58°20.97'	577	3601D(U).raw	no bottles
104	037	01	03/02/99	20:36	S75°03.83'	W58°04.29'	573	3701D(U).raw	no bottles
105	038	01	03/02/99	21:48	S75°06.88'	W57°47.95'	558	3801D(U).raw	no bottles
106	039	01	03/02/99	23:25	S75°09.90'	W57°34.84'	552	3901D(U).raw	no bottles; computer reboot after downcast
107	040	01	04/02/99	00:54	S75°13.22'	W57°18.80'	528	4001D(U).raw	no bottles
108	041	01	04/02/99	02:51	S75°29.33'	W57°18.30'	493	4101D(U).raw	no bottles
109	042	01	04/02/99	04:30	S75°30.41'	W56°48.88'	423	4201D(U).raw	no bottles
110	043†	01	04/02/99	06:43	S75°23.97'	W56°12.29'	413	4301D(U).raw	2 bottles were closed at each depth; bottle #5 didn't close
111	044	01	04/02/99	08:00	S75°22.55'	W55°51.35'	402	4401D(U).raw	2 bottles were closed at each depth
112	045†	01	04/02/99	10:53	S75°21.09'	W55°24.11'	409	4501D(U).raw	2 bottles were closed at each depth
113	046	01	04/02/99	12:06	S75°21.19'	W55°05.06'	404	4601D(U).raw	2 bottles were closed at each depth
114	047	01	04/02/99	18:49	S75°21.14'	W54°41.75'	395	4701D(U).raw	2 bottles were closed at each depth; winch stopped for a few minutes at 240 dbar
115	048†	01	05/02/99	06:26	S75°31.11'	W55°00.69'	426	4801D(U).raw	2 bottles were closed at each depth;

Table 2. (continued)

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
116	049	01	05/02/99	07:58	S75°38.05'	W55°00.74'	468	4901D(U).raw	winch stopped for a few minutes at 3 m; bottle #4 said it closed but didn't close; bottle #14 said BAF on first click but closed 2 bottles were closed at each depth; bottles #1 and 2 were closed at bottom before start of upcast file;
117	050†	01	05/02/99	09:36	S75°45.40'	W54°58.53'	473	5001D(U).raw	upcast file started late at 430-440 m 2 bottles were closed at each depth; bottle #14 said it closed but didn't close; bottle #16 was never fired but closed
118	051	01	05/02/99	13:03	S75°37.75'	W56°19.64'	350	5101D(U).raw	no bottles
119	052	01	05/02/99	14:51	S75°41.20'	W55°43.82'	456	5201D(U).raw	2 bottles were closed at each depth
120	053	01	05/02/99	17:02	S75°43.94'	W55°01.45'	472	5301D(U).raw	2 bottles were closed at each depth; bottle #3 didn't close
121	054	01	05/02/99	19:14	S75°49.74'	W54°29.95'	503	5401D(U).raw	2 bottles were closed at each depth
122	055†	01	05/02/99	21:05	S75°50.73'	W53°48.98'	492	5501D(U).raw	2 bottles were closed at each depth
123	056†	01	05/02/99	22:45	S75°57.16'	W53°28.31'	497	5601D(U).raw	2 bottles were closed at each depth
124	057†	01	06/02/99	06:54	S75°39.65'	W55°59.16'	415	5701D(U).raw	P,T gauge at bottle #2 turned before CTD went into the water
125	058†	01	06/02/99	08:38	S75°37.56'	W56°19.61'	350	5801D(U).raw	
126	059†	01	06/02/99	10:03	S75°34.26'	W56°38.08'	373	5901D(U).raw	conductivity spiky in upper 20 m due to ice platelets
127	060	01	07/02/99	08:02	S75°28.06'	W54°22.94'	431	6001D(U).raw	downcast information lost due to computer problems; couldn't close bottles during upcast; cast was repeated
128	060†	02	07/02/99	08:30	S75°27.99'	W54°22.62'	433	6002D(U).raw	
129	061	01	07/02/99	11:33	S75°20.16'	W53°58.32'	400	6101D(U).raw	first cast of JoJo CTD; no bottles
130	061	02	07/02/99	11:54	S75°20.05'	W53°58.45'	400	6102D(U).raw	JoJo CTD; no bottles
131	061	03	07/02/99	12:10	S75°19.98'	W53°58.70'	398	6103D(U).raw	last cast of JoJo CTD; no bottles
132	062	01	07/02/99	21:55	S75°23.28'	W54°09.00'	392	6201D(U).raw	
133	063	01	07/02/99	23:52	S75°26.23'	W54°18.33'	420	6301D(U).raw	

Table 2. (continued)

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
134	064†	01	07/02/99	23:33	S75°27.25'	W54°22.63'	423	6401D(U).raw	T,P gauge at bottle #2 turned before CTD went into the water
135	065†	01	08/02/99	00:35	S75°24.32'	W54°11.45'	412	6501D(U).raw	
136	066	01	08/02/99	02:15	S75°21.48'	W54°02.33'	401	6601D(U).raw	
137	067†	01	08/02/99	03:24	S75°20.48'	W54°00.13'	398	6701D(U).raw	first cast of JoJo CTD at Filchner iceberg
138	067	02	08/02/99	04:30	S75°20.50'	W54°00.34'	397	6702D(U).raw	JoJo CTD at Filchner iceberg; no bottles
139	067	03	08/02/99	05:30	S75°20.79'	W54°00.58'	393	6703D(U).raw	JoJo CTD at Filchner iceberg; no bottles
140	067	04	08/02/99	06:30	S75°20.70'	W54°01.98'	395	6704D(U).raw	JoJo CTD at Filchner iceberg; no bottles
141	067	05	08/02/99	07:29	S75°20.45'	W54°01.85'	395	6705D(U).raw	JoJo CTD at Filchner iceberg; no bottles
142	067	06	08/02/99	08:32	S75°20.44'	W54°01.89'	396	6706D(U).raw	JoJo CTD at Filchner iceberg; no bottles
143	067	07	08/02/99	09:32	S75°20.26'	W54°01.53'	394	6707D(U).raw	JoJo CTD at Filchner iceberg; no bottles
144	067	08	08/02/99	10:31	S75°20.16'	W54°00.74'	395	6708D(U).raw	JoJo CTD at Filchner iceberg; no bottles
145	067	09	08/02/99	11:29	S75°20.23'	W54°00.85'	392	6709D(U).raw	JoJo CTD at Filchner iceberg; no bottles
146	067	10	08/02/99	12:31	S75°19.62'	W54°02.19'	391	6710D(U).raw	JoJo CTD at Filchner iceberg; no bottles
147	067	11	08/02/99	13:33	S75°19.31'	W53°57.46'	392	6711D(U).raw	JoJo CTD at Filchner iceberg; no bottles
148	067	12	08/02/99	14:32	S75°19.52'	W53°58.02'	391	6712D(U).raw	JoJo CTD at Filchner iceberg; no bottles; error COM1 port; wrong port setup for water sampler
149	067	13	08/02/99	15:29	S75°19.64'	W53°57.93'	393	6713D(U).raw	JoJo CTD at Filchner iceberg; no bottles; error COM1 port; wrong port setup for water sampler
150	067	14	08/02/99	19:35	S75°19.55'	W53°58.38'	385	6714D(U).raw	JoJo CTD at Filchner iceberg; no bottles; first cast after 4 hours; new altimeter; problems with water sampler; many pressure jumps in up- and downcast
151	067	15	08/02/99	20:35	S75°19.48'	W53°56.40'	397	6715D(U).raw	JoJo CTD at Filchner iceberg; no bottles; problems with water sampler; many pressure jumps in up- and downcast
152	067†	16	09/02/99	00:41	S75°19.23'	W53°55.68'	386	6716D(U).raw	JoJo CTD at Filchner iceberg; with bottles; first cast after 4 hours; new CTD, serial number 1347; new water sampler, original altimeter;

Table 2. *(continued)*

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
153	067	17	09/02/99	01:34	S75°19.26'	W53°55.54'	390	6717D(U).raw	still many pressure jumps in up- and downcast JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347;
154	067	18	09/02/99	02:31	S75°19.29'	W53°55.36'	389	6718D(U).raw	many pressure jumps in up- and downcast JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347;
155	067	19	09/02/99	03:31	S75°19.31'	W53°55.17'	395	6719D(U).raw	many pressure jumps in up- and downcast JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347;
156	067	20	09/02/99	04:30	S75°19.37'	W53°55.29'	387	6720D(U).raw	many pressure jumps in up- and downcast JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347;
157	067	21	09/02/99	05:28	S75°19.35'	W53°55.20'	390	6721D(U).raw	many pressure jumps in up- and downcast JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347;
158	067	22	09/02/99	06:30	S75°19.31'	W53°55.12'	393	6722D(U).raw	many pressure jumps in up- and downcast JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347;
159	067	23	09/02/99	07:28	S75°19.25'	W53°54.94'	396	6723D(U).raw	many pressure jumps in up- and downcast JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347;
160	067	24	09/02/99	09:30	S75°19.13'	W53°55.12'	389	6724D(U).raw	many pressure jumps in up- and downcast JoJo CTD at Filchner iceberg; no bottles; 08:30 CTD skipped; CTD serial number 1347;
161	067	25	09/02/99	11:55	S75°19.20'	W53°55.14'	394	6725D(U).raw	many pressure jumps in up- and downcast; problems closing bottles JoJo CTD at Filchner iceberg; no bottles; 09:30 and 10:30 CTDs skipped; CTD serial number 1347;

Table 2. (continued)

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
									tried a different wire (winch EL31); no more pressure jumps; still problems closing bottles
162	067	26	09/02/99	12:36	S75°19.31'	W53°55.52'	393	6726D(U).raw	JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347; winch EL31; problems closing bottles
163	067	27	09/02/99	13:33	S75°19.44'	W53°56.20'	393	6727D(U).raw	JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347; winch EL31; problems closing bottles
164	067	28	09/02/99	14:30	S75°19.56'	W53°55.96'	396	6728D(U).raw	JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347; winch EL31; problems closing bottles
165	067	29	09/02/99	15:30	S75°19.69'	W53°55.66'	393	6729D(U).raw	JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347; winch EL31; problems closing bottles
166	067	30	09/02/99	16:30	S75°19.82'	W53°55.36'	395	6730D(U).raw	JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347; winch EL31; problems closing bottles
167	067	31	09/02/99	17:28	S75°19.93'	W53°55.13'	395	6731D(U).raw	JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347; winch EL31; problems closing bottles
168	067	32	10/02/99	08:30	S75°19.86'	W53°53.84'	400	6732D(U).raw	JoJo CTD at Filchner iceberg; no bottles; first CTD after 16 hours; CTD serial number 1347; winch EL31; problems closing bottles
169	067	33	10/02/99	09:42	S75°19.81'	W53°54.17'	398	6733D(U).raw	JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347; winch EL31; problems closing bottles
170	067[†]	34	10/02/99	10:30	S75°19.86'	W53°54.47'	397	6734D(U).raw	JoJo CTD at Filchner iceberg; with bottles; CTD serial number 1347; winch EL31; problems closing bottles;

Table 2. (continued)

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
171	067	35	10/02/99	11:30	S75°19.85'	W53°54.42'	398	6735D(U).raw	no P,T readings at bottles JoJo CTD at Filchner iceberg; with bottles; CTD serial number 1347; winch EL31; problems closing bottles; once again pressure jumps in up- and downcast
172	067	36	10/02/99	12:37	S75°19.85'	W53°54.26'	391	6736D(U).raw	JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347; winch EL31; pressure jumps; problems closing bottles
173	067	37	10/02/99	13:30	S75°19.84'	W53°55.42'	395	6737D(U).raw	JoJo CTD at Filchner iceberg; no bottles; CTD serial number 1347; winch EL31; pressure jumps; problems closing bottles
174	067	38	10/02/99	14:29	S75°19.93'	W53°55.30'	395	6738D(U).raw	JoJo CTD at Filchner iceberg; with bottles; CTD serial number 1347; winch EL31; pressure jumps; problems closing bottles
175	067	39	10/02/99	15:30	S75°20.04'	W53°55.09'	405	6739D(U).raw	JoJo CTD at Filchner iceberg; with bottles; CTD serial number 1347; winch EL31; pressure jumps; problems closing bottles; bottles # 5, 7, 8, 10, 12, 13, 18, 22, 23 didn't close
176	067	40	10/02/99	16:27	S75°20.18'	W53°54.87'	402	6740D(U).raw	JoJo CTD at Filchner iceberg; with bottles; CTD serial number 1347; winch EL31; pressure jumps; problems closing bottles; bottles # 3, 4, 6, 14, 15, 22 didn't close; P,T gauge at bottle #2 turned before CTD went into the water
177	068	01	11/02/99	20:36	S75°20.83'	W53°54.23'	407	6801D(U).raw	back to the original setup: CTD serial number 1360; winch EL32; original water sampler and altimeter; no more pressure jumps; water sampler ok
178	069†	01	12/02/99	22:45	S75°01.80'	W52°57.40'	365	6901D(U).raw	bottle #9 closed instead of #1
179	070	01	13/02/99	14:07	S74°44.55'	W51°48.15'	386	7001D(U).raw	bottles #10 to 24 closed for biologists;

Table 2. (continued)

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
180	071	01	13/02/99	20:53	S74°33.46'	W50°18.94'	425	7101D(U).raw	no samples taken from #10 to 24; no bottle #2
181	072	01	14/02/99	06:48	S74°24.14'	W48°41.57'	521	7201D(U).raw	
182	073†	01	14/02/99	14:33	S74°13.33'	W47°11.71'	548	7301D(U).raw	
183	074†	01	14/02/99	20:35	S74°01.67'	W45°44.31'	513	7401D(U).raw	
184	075	01	15/02/99	01:05	S75°05.21'	W44°00.69'	554	7501D(U).raw	bottles #9 and 13 were closed at same depths as bottles #2 and 3 to sort out bottle #2 problem; bottle #2 did close correctly
185	076	01	15/02/99	07:25	S73°49.54'	W42°33.29'	530	7601D(U).raw	
186	077†	01	15/02/99	17:05	S73°55.96'	W40°57.17'	816	7701D(U).raw	no P,T reading at bottle #2
187	078†	01	15/02/99	22:48	S73°55.48'	W39°47.53'	952	7801D(U).raw	
188	079	01	16/02/99	00:25	S73°54.55'	W39°41.54'	1173	7901D(U).raw	
189	080†	01	16/02/99	03:21	S73°52.31'	W39°04.00'	1480	8001D(U).raw	
190	081	01	16/02/99	04:59	S73°50.19'	W38°50.93'	1704	8101D(U).raw	
191	082†	01	16/02/99	08:12	S73°45.48'	W38°25.99'	2027	8201D(U).raw	
192	083†	01	16/02/99	10:43	S73°42.33'	W38°11.09'	2193	8301D(U).raw	
193	084†	01	16/02/99	13:15	S73°34.98'	W37°53.09'	2433	8401D(U).raw	
194	085†	01	16/02/99	17:01	S73°21.38'	W37°16.07'	2741	8501D(U).raw	
195	086†	01	16/02/99	20:02	S73°25.45'	W36°43.96'	2743	8601D(U).raw	
196	087†	01	16/02/99	23:20	S73°24.91'	W36°17.60'	2913	8701D(U).raw	
197	088†	01	17/02/99	03:21	S73°30.39'	W35°51.04'	2827	8801D(U).raw	
198	089†	01	17/02/99	07:02	S73°35.91'	W35°23.24'	2536	8901D(U).raw	bottle #10 was released but not closed; bottle #14 was closed but not released
199	090†	01	17/02/99	09:50	S73°38.62'	W35°06.37'	2857	9001D(U).raw	
200	091†	01	17/02/99	13:37	S73°41.48'	W34°36.50'	2795	9101D(U).raw	bottles #1 to 5 were not sampled since the upper valves were not closed
201	092†	01	17/02/99	21:12	S73°52.54'	W35°00.32'	2507	9201D(U).raw	
202	093†	01	17/02/99	23:47	S73°58.27'	W35°13.59'	2362	9301D(U).raw	
203	094†	01	18/02/99	02:20	S74°04.35'	W35°26.37'	2171	9401D(U).raw	wrong P,T reading at bottle #5

Table 2. (continued)

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
204	095†	01	18/02/99	04:46	S74°08.47'	W35°39.58'	2025	9501D(U).raw	
205	097†	01	18/02/99	12:00	S74°12.90'	W36°22.50'	1704	9701D(U).raw	
206	098†	01	18/02/99	14:11	S74°20.55'	W36°34.65'	1250	9801D(U).raw	
207	099†	02	18/02/99	19:06	S74°25.08'	W36°22.54'	1199	9901D(U).raw	wrong P,T readings at bottles #2 and 5; bottle #3 said BAF, but wasn't closed
208	100	01	18/02/99	20:22	S74°24.04'	W36°21.83'	1249	10001D(U).raw	
209	101†	01	18/02/99	22:37	S74°24.07'	W36°04.27'	1282	10101D(U).raw	
210	102	01	19/02/99	01:24	S74°22.44'	W35°43.75'	1377	10201D(U).raw	
211	103†	01	19/02/99	03:38	S74°20.39'	W35°26.71'	1435	10201D(U).raw	
212	104	01	19/02/99	06:50	S74°16.38'	W35°16.36'	1624	10401D(U).raw	
213	105	02	19/02/99	14:00	S74°30.76'	W36°36.95'	658	10502D(U).raw	
214	106	01	19/02/99	16:05	S74°28.88'	W36°27.95'	968	10601D(U).raw	bottles #7 and 8 didn't close; bottle #1 was fired for test purposes at 965 m; bottle #1 closed ok; not sampled
215	107	01	19/02/99	17:31	S74°31.96'	W36°38.48'	481	10701D(U).raw	bottle #3 was fired for test purposes at 477 m; bottle #3 closed ok; not sampled
216	108	01	19/02/99	18:42	S74°33.89'	W36°45.34'	391	10801D(U).raw	bottle #2 was fired for test purposes at 390 m; bottle #2 didn't close
217	109	01	19/02/99	22:30	S74°37.76'	W36°06.78'	416	10901D(U).raw	bottle #1 was fired for test purposes at 416 m; bottle #1 closed ok; not sampled
218	110	01	20/02/99	01:10	S74°35.36'	W35°31.28'	462	11001D(U).raw	
219	111	01	20/02/99	03:20	S74°36.33'	W34°52.75'	505	11101D(U).raw	
220	112	01	20/02/99	06:28	S74°36.04'	W34°13.58'	541	11201D(U).raw	bottle #7 said BAF on first release; closed; bottle #1 was fired for test purposes at 538 m; bottle #1 didn't close
221	113	01	20/02/99	09:47	S74°37.85'	W33°58.69'	585	11301D(U).raw	
222	114	01	20/02/99	12:25	S74°38.63'	W33°00.42'	617	11401D(U).raw	
223	115	01	20/02/99	14:05	S74°39.42'	W32°22.04'	595	11501D(U).raw	
224	116	01	20/02/99	15:55	S74°44.21'	W31°48.91'	605	11601D(U).raw	bottle #2 was fired for test purposes at 608 dbar; bottle #2 closed at 567 dbar; not sampled

Table 2. (continued)

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
225	117	01	20/02/99	17:40	S74°48.79'	W31°15.49'	567	11701D(U).raw	bottle #2 was fired for test purposes at 570 dbar; bottle #2 closed at 420 dbar; not sampled
226	118	01	20/02/99	19:29	S74°53.82'	W30°42.85'	491	11801D(U).raw	bottle #2 was fired for test purposes at 489 dbar; bottle #2 closed at 420 dbar; not sampled
227	119	01	20/02/99	21:20	S74°58.71'	W30°08.00'	416	11901D(U).raw	bottle #2 was fired for test purposes at 417 dbar; bottle #2 closed at 15 dbar; sampled; bottle #9 closed at wrong depth (400 dbar)
228	120	01	20/02/99	22:58	S75°03.63'	W29°34.14'	398	12001D(U).raw	
229	121	01	21/02/99	10:39	S76°43.02'	W30°26.01'	359	12101D(U).raw	
230	122	02	21/02/99	17:39	S76°34.87'	W32°00.09'	386	12202D(U).raw	
									3 bottles closed at each depth for biologists; only 1 bottle/depth sampled; samples may be corrupted due to ice
231	123	01	22/02/99	12:06	S74°37.58'	W33°40.12'	584	12301D(U).raw	
232	124	01	22/02/99	13:25	S74°33.39'	W33°47.71'	592	12401D(U).raw	
233	125	01	23/02/99	17:26	S74°17.80'	W36°05.18'	1636	12501D(U).raw	
234	126	01	25/02/99	13:13	S72°52.24'	W19°04.54'	410	12601D(U).raw	
235	127	01	27/02/99	08:59	S70°34.12'	W08°00.49'	157	12701D(U).raw	
236	128	01	03/03/99	10:52	S66°29.42'	E00°00.04'	4488	12801D(U).raw	position near mooring AWI 231; P,T gauge at bottle #9 shows wrong depth
237	129	01	03/03/99	16:27	S66°00.10'	W00°01.47'	3409	12901D(U).raw	position near mooring AWI 230; P,T gauge at bottle #9 shows wrong depth
238	130	01	03/03/99	22:53	S65°00.09'	E00°00.09'	3687	13001D(U).raw	
239	131	01	04/03/99	05:51	S63°57.74'	E00°05.20'	5175	13101D(U).raw	position near mooring AWI 229; P,T gauges at bottles #5 and 13 show wrong depth; bottle #13 was fired but didn't close; bottle #17 wasn't fired but closed
240	132	01	04/03/99	21:22	S62°59.95'	E00°00.09'	5286	13201D(U).raw	P,T gauge at bottle #5 shows wrong depth; several spikes in upcast
241	133	01	05/03/99	05:21	S61°59.93'	E00°00.43'	5344	13301D(U).raw	P,T gauge at bottle #9 shows wrong depth

Table 2. (continued)

No.	Station	Cast	Date (dd/mm/yy)	Time (GMT)	Latitude	Longitude	Depth (m)	Filename	Comments
242	134	01	05/03/99	12:42	S60°59.90'	W00°00.19'	5362	13401D(U).raw	
243	135	01	05/03/99	20:05	S59°59.85'	W00°00.30'	5333	13501D(U).raw	
244	136	01	06/03/99	03:05	S59°04.12'	E00°06.34'	4615	13601D(U).raw	P,T gauges at bottles #5 and 9 show wrong depth
245	137	01	07/03/99	02:07	S57°59.90'	E00°00.46'	4469	13701D(U).raw	
246	138	02	07/03/99	11:47	S56°58.28'	E00°03.70'	3696	13802D(U).raw	P,T gauge at bottle #13 shows wrong depth
247	139	01	07/03/99	21:16	S56°00.09'	W00°00.19'	3795	13901D(U).raw	bottle #10 didn't close
248	140	01	08/03/99	03:44	S54°59.98'	E00°00.20'	1699	14001D(U).raw	
249	141	02	08/03/99	10:06	S54°29.18'	E00°01.90'	1823	14102D(U).raw	
250	142	01	08/03/99	14:49	S54°00.18'	E00°00.09'	2539	14201D(U).raw	
251	143	01	08/03/99	22:00	S53°00.18'	W00°00.27'	2473	14301D(U).raw	P,T gauge at bottle #9 shows wrong depth
252	144	01	09/03/99	05:19	S51°59.98'	E00°00.21'	2944	14401D(U).raw	P,T gauges at bottles #5 and 9 show wrong depth; last station with EL 32; very high seas and big swell
253	145	01	09/03/99	12:46	S51°00.15'	E00°00.24'	2230	14501D(U).raw	P,T gauge at bottle #9 shows wrong depth; first station with EL 31; very high seas and big swell
254	146	01	09/03/99	20:17	S50°00.02'	E00°00.23'	3610	14601D(U).raw	P,T gauge at bottle #9 shows wrong depth; high seas; big swell; EL 31
255	147	01	10/03/99	03:54	S49°00.12'	E00°00.30'	3944	14701D(U).raw	P,T gauges at bottles #5, 9, and 13 show wrong depth; high seas; big swell; EL 31
256	148	01	11/03/99	06:39	S47°03.36'	E00°30.00'	4123	14801D(U).raw	bottles #5-8 didn't close; P,T gauges at bottles #9 and 13 show wrong depth; high seas; big swell; EL 31
257	149	02	11/03/99	15:21	S46°09.41'	E01°00.55'	3571	14902D(U).raw	P,T gauge at bottle #9 shows wrong depth; high seas; big swell; EL 31; last CTD station ANT XVI/2

Unless otherwise noted: CTD serial number 1360.
Unless otherwise noted: winch EL32.
During the later part of the cruise, on the Greenwich Meridian, the P,T racks at the bottles tipped over at wrong depths due to high seas and strong swell.
†Recurring problem: According to the pressure gauge, bottle #2 closed at the same depth as bottle #3. Starting at station 105/02 the first 4 bottles were skipped on purpose.

ANNEX 3 Stationsliste/Station list

Date	Station No.	Time (UTC)	Latitude	Longitude	Depth (m)	Operation
15.01.99	53/001	16:08	54°59.9'S	00°00.1'W	1732	ALACE
	53/002	18:45	55°29.8'S	00°00.1'E	3831	ALACE
	53/003	21:28	56°00.0'S	00°00.0'E	3821	ALACE
16.01.99	53/004	04:00	57°00.0'S	00°00.0'E	3804	ALACE
	53/005	10:13	58°00.1'S	00°00.0'E	4554	ALACE
	53/006	16:16	59°00.0'S	00°00.0'E	4621	ALACE
	53/007	19:33	59°30.0'S	00°00.2'W	4666	ALACE
	53/008	22:48	60°00.0'S	00°00.0'E	5378	ALACE,ODAS
		22:53	60°00.2'S	00°00.1'W	5378	
17.01.99	53/009	02:10	60°30.0'S	00°00.2'W	5384	ALACE
	53/010	05:24	60°59.9'S	00°00.2'W	5419	ALACE
18.01.99	53/011	06:10	66°00.2'S	00°09.8'E	3521	CTD,BO,BO,DPL 230-2
		11:51	65°59.8'S	00°11.4'E	3448	
	53/012	15:04	66°30.1'S	00°01.3'E	4545	REC 231-2,DPL 231-3,
		23:15	66°30.0'S	00°01.0'E	4556	CTD
19.01.99	53/013	16:00	68°59.9'S	00°04.5'W	3384	REC 232-3,CTD,
		23:33	68°59.6'S	00°00.3'W	3413	DPL 232-4
20.01.99	53/014	04:05	69°24.0'S	00°02.5'W	1995	CTD,REC 233-3,
		12:18	69°23.8'S	00°00.1'W	2026	DPL 233-4
	53/015	21:48	70°15.8'S	02°47.2'W	222	AGT,CTD
		23:23	70°15.1'S	02°45.9'W	276	
23.01.99	53/016	01:20	70°29.4'S	08°08.9'W	272	CTD
		01:53	70°29.4'S	08°08.9'W	272	
24.01.99	53/017	06:15	72°52.7'S	19°05.2'W	413	FT,CTD,BO,BO
		13:19	72°52.3'S	19°05.2'W	425	
26.01.99	53/018	00:26	76°36.4'S	31°18.9'W	318	CTD,BO,BO
		01:53	76°36.4'S	31°19.5'W	364	
30.01.99	53/019	21:06	75°16.3'S	53°43.5'W	410	FT,YOYO-CTD,
01.02.99		19:32	75°18.1'S	53°47.3'W	419	BO,BO,AGT
02.02.99	53/020	14.44	74°42.6'S	60°57.8'W	634	CTD
		15.52	74°42.4'S	60°59.0'W	636	
	53/021	18:25	74°46.1'S	60°38.0'W	650	CTD,BO,BO
		20:25	74°46.1'S	60°38.3'W	639	
	53/022	21:43	74°42.9'S	61°08.9'W	636	CTD
		22:16	74°42.9'S	61°08.8'W	635	
03.02.99	53/023	00:25	74°50.1'S	60°17.8'W	663	CTD
		00:54	74°50.3'S	60°17.4'W	664	
	53/024	02:12	74°55.7'S	59°45.6'W	646	CTD
		02:41	74°55.5'S	59°45.8'W	648	
	53/025	04:20	75°02.3'S	59°16.4'W	628	CTD
		04:51	75°02.2'S	59°16.9'W	628	

	53/026	06:13	75°08.7'S	58°46.6'W	622	CTD
		06:44	75°08.5'S	58°46.0'W	633	
	53/027	07:33	75°11.6'S	58°30.6'W	626	CTD
		08:06	75°11.5'S	58°29.9'W	614	
	53/028	08:54	75°14.5'S	58°14.3'W	598	CTD
		09:29	75°14.6'S	58°13.5'W	598	
	53/029	10:10	75°18.0'S	58°00.2'W	590	CTD
		11:02	75°18.1'S	58°00.1'W	599	
	53/030	11:53	75°21.3'S	57°40.2'W	556	CTD
		12:06	75°21.2'S	57°40.3'W	558	
	53/031	13:05	75°17.3'S	57°29.9'W	555	CTD
		13:25	75°17.4'S	57°29.1'W	555	
	53/032	14:10	75°14.5'S	57°45.7'W	580	CTD
		14:32	75°14.6'S	57°45.8'W	580	
	53/033	15:18	75°11.2'S	58°00.4'W	593	CTD
		15:43	75°11.1'S	58°00.5'W	593	
	53/034	16:41	75°08.1'S	58°16.3'W	612	CTD
		17:02	75°08.0'S	58°16.3'W	611	
	53/035	18:00	75°05.1'S	58°31.5'W	612	CTD
		18:23	75°05.0'S	58°31.4'W	612	
	53/036	19:14	75°01.3'S	58°21.0'W	600	CTD
		19:37	75°01.2'S	58°20.8'W	600	
	53/037	20:39	75°03.9'S	58°04.2'W	598	CTD
		21:02	75°03.8'S	58°04.1'W	597	
	53/038	21:50	75°06.9'S	57°48.0'W	579	CTD
		22:13	75°06.9'S	57°47.0'W	580	
	53/039	23:26	75°09.9'S	57°34.8'W	577	CTD
		23:56	75°10.1'S	57°35.4'W	575	
04.02.99	53/040	00:54	75°13.2'S	57°18.8'W	551	CTD
		01:16	75°13.5'S	57°19.2'W	551	
	53/041	02:52	75°25.3'S	57°18.3'W	513	CTD
		03:11	75°25.4'S	57°18.4'W	514	
	53/042	04:30	75°30.4'S	56°48.9'W	435	CTD
		04:49	75°30.1'S	56°49.2'W	440	
	53/043	06:45	75°24.0'S	56°12.2'W	431	CTD
		07:05	75°23.8'S	56°11.9'W	431	
	53/044	08:01	75°22.5'S	55°51.3'W	420	CTD,AGT
		09:41	75°22.5'S	55°47.3'W	418	
	53/045	10:55	75°21.1'S	55°24.1'W	426	CTD
		11:20	75°21.2'S	55°24.2'W	425	
	53/046	12:05	75°21.2'S	55°05.1'W	420	CTD
		12:29	75°21.3'S	55°05.4'W	420	
	53/047	18:50	75°21.0'S	55°41.8'W	412	CTD
		19:18	75°21.2'S	54°42.0'W	412	
05.02.99	53/048	06:28	75°31.1'S	55°00.6'W	441	CTD
		06:53	75°31.1'S	55°00.4'W	445	
	53/049	08:00	75°38.1'S	55°00.8'W	489	CTD
		08:31	75°38.0'S	55°00.5'W	487	

	53/050	09:39	75°45.4'S	54°58.6'W	495	CTD
		10:05	75°45.4'S	54°58.3'W	496	
	53/051	13:04	75°37.8'S	56°19.5'W	363	CTD
		13:20	75°37.7'S	56°19.9'W	362	
	53/052	14:51	75°41.2'S	55°43.8'W	474	CTD
		15:13	75°41.2'S	55°44.0'W	475	
	53/053	17:00	75°43.9'S	55°01.4'W	479	CTD
		17:27	75°43.9'S	55°01.4'W	478	
	53/054	19:14	75°49.7'S	54°30.0'W	510	CTD
		19:40	75°49.7'S	54°29.4'W	511	
	53/055	21:05	75°50.7'S	53°49.0'W	511	CTD
		21:33	75°50.7'S	53°48.6'W	509	
	53/056	22:47	75°57.2'S	53°28.3'W	516	CTD
		23:14	75°57.1'S	53°28.9'W	515	
06.02.99	53/057	06:55	75°39.6'S	55°59.1'W	422	CTD
		07:16	75°39.6'S	55°59.2'W	433	
	53/058	08:40	75°37.6'S	56°19.6'W	363	CTD
		09:04	75°37.6'S	56°19.8'W	363	
	53/059	10:05	75°34.2'S	56°38.1'W	387	CTD
		10:30	75°34.2'S	56°38.3'W	387	
07.02.99	53/060	08:04	75°28.1'S	54°23.0'W	438	CTD,AGT
		10:08	75°26.9'S	54°18.9'W	444	
	53/061	11:11	75°20.5'S	53°58.4'W	414	FT,YOYO-CTD
		18:39	75°20.2'S	53°58.0'W	418	
	53/062	21:57	75°23.3'S	54°09.0'W	408	CTD
		22:20	75°23.2'S	54°08.4'W	409	
	53/063	22:55	75°26.2'S	54°18.3'W	439	CTD
		23:15	75°26.2'S	54°18.5'W	439	
	53/064	23:35	75°27.3'S	54°22.6'W	438	CTD
		23:59	75°27.2'S	54°22.6'W	438	
08.02.99	53/065	00:35	75°24.3'S	54°11.5'W	428	CTD
		00:57	75°24.2'S	54°11.1'W	424	
	53/066	02:46	75°21.5'S	54°02.3'W	414	CTD
		03:05	75°21.4'S	54°02.3'W	411	
	53/067	03:23	75°20.5'S	54°00.1'W	413	YOYO-CTD
		15:44	75°19.7'S	53°58.0'W	409	
		19:34	75°19.5'S	53°58.3'W	407	YOYO-CTD
		20:49	75°19.6'S	53°56.4'W	412	
09.02.99		00:41	75°19.2'S	53°55.7'W	403	YOYO-CTD
		07:44	75°19.2'S	53°55.1'W	413	
		09:45	75°19.1'S	53°55.1'W	409	CTD,BO,BO,CTD
		12:13	75°19.2'S	53°55.1'W	412	
		12:37	75°19.3'S	53°55.5'W	408	YOYO-CTD
		17:44	75°44.2'S	53°55.1'W	413	
10.02.99		08:37	75°19.9'S	53°53.9'W	418	FT,YOYO-CTD
		16:55	75°20.2'S	53°54.8'W	420	
11.02.99	53/068	20:37	75°20.8'S	53°54.7'W	422	CTD
		20:58	75°20.9'S	53°54.3'W	422	

12.02.99	53/069	22:46	75°01.8'S	52°57.4'W	382	CTD
		23:07	75°01.9'S	52°57.6'W	381	
13.02.99	53/070	14:05	74°44.6'S	51°48.2'W	403	CTD
		14:25	74°44.6'S	51°48.9'W	406	
	53/071	20:54	74°33.5'S	50°18.9'W	490	CTD
		21:13	74°33.5'S	50°19.6'W	422	
14.02.99	53/072	06:50	74°24.1'S	48°41.6'W	533	CTD
		07:15	74°24.0'S	48°42.2'W	531	
	53/073	14:32	74°13.3'S	47°11.7'W	570	CTD,BO,BO
		15:45	74°13.2'S	47°12.9'W	568	
	53/074	20:36	74°01.7'S	45°40.2'W	541	CTD
		21:03	74°01.8'S	45°40.9'W	536	
15.02.99	53/075	01:03	74°05.2'S	44°00.7'W	576	CTD
		01:32	74°05.2'S	44°00.5'W	575	
	53/076	07:26	73°49.5'S	42°33.3'W	548	CTD
		07:51	73°49.5'S	42°33.6'W	544	
	53/077	17:05	73°56.0'S	40°57.2'W	834	CTD
		17:44	73°55.9'S	40°57.9'W	845	
	53/078	22:51	73°55.5'S	39°47.5'W	988	CTD
		23:34	73°55.4'S	39°48.2'W	985	
16.02.99	53/079	00:23	73°54.6'S	39°41.6'W	1222	CTD
		01:11	73°54.4'S	39°42.4'W	1165	
	53/080	03:21	73°52.3'S	39°04.0'W	1522	CTD
		04:16	73°52.2'S	39°04.1'W	1516	
	53/081	04:59	73°50.2'S	38°50.9'W	1751	CTD
		06:01	73°49.9'S	38°50.6'W	1756	
	53/082	08:14	73°45.5'S	38°26.0'W	2046	CTD
		09:32	73°45.3'S	38°28.2'W	2087	
	53/083	10:44	73°42.3'S	38°11.1'W	2249	CTD
		12:00	73°42.4'S	38°13.4'W	2235	
	53/084	13:15	73°35.0'S	37°53.1'W	2488	CTD
		14:49	73°34.7'S	37°54.5'W	2492	
	53/085	17:01	73°21.4'S	37°16.1'W	2805	CTD
		18:40	73°21.6'S	37°17.8'W	2800	
	53/086	20:04	73°25.4'S	36°43.9'W	2807	CTD
		21:42	73°25.3'S	36°44.6'W	2808	
	53/087	23:21	73°24.9'S	36°17.5'W	2979	CTD
17.02.99		01:00	73°25.1'S	36°18.9'W	2974	
	53/088	03:18	73°30.4'S	35°51.1'W	2901	CTD
		04:55	73°30.6'S	35°52.0'W	2890	
	53/089	07:02	73°35.9'S	35°23.2'W	2599	CTD
		08:33	73°36.0'S	35°23.9'W	2594	
	53/090	09:50	73°38.6'S	35°06.4'W	2916	CTD
		11:34	73°38.5'S	35°07.0'W	2918	
	53/091	13:33	73°41.5'S	34°36.5'W	2846	CTD,BO,REC C2
		18:56	73°41.4'S	34°36.8'W	2851	
	53/092	21:13	73°52.5'S	35°00.3'W	2564	CTD
		22:40	73°52.3'S	35°01.4'W	2574	

	53/093	23:48	73°58.3'S	35°13.6'W	2420	CTD
18.02.99		01:09	73°58.5'S	35°13.9'W	2415	
	53/094	02:19	74°04.4'S	35°26.4'W	2229	CTD
		03:35	74°04.3'S	35°26.5'W	2230	
	53/095	04:47	74°08.5'S	35°39.6'W	2078	CTD
		06:00	74°08.3'S	35°40.0'W	2082	
	53/096	09:32	74°09.2'S	35°43.0'W	2038	REC F4
		10:33	74°09.2'S	35°42.9'W	2039	
	53/097	11:56	74°12.9'S	36°22.5'W	1758	CTD
		13:03	74°12.8'S	36°22.8'W	1752	
	53/098	14:10	74°20.5'S	36°34.7'W	1278	CTD
		15:07	74°20.2'S	36°33.4'W	1335	
	53/099	17:15	74°25.3'S	36°22.6'W	1229	REC F2,CTD
		19:52	74°25.0'S	36°22.6'W	1245	
	53/100	20:23	74°24.0'S	36°21.8'W	1294	CTD
		21:11	74°24.2'S	36°21.9'W	1287	
	53/101	22:38	74°24.1'S	36°04.3'W	1329	CTD
		23:31	74°24.3'S	36°04.8'W	1311	
19.02.99	53/102	01:24	74°22.4'S	35°43.8'W	1415	CTD
		02:22	74°22.2'S	35°43.6'W	1427	
	53/103	03:41	74°20.4'S	35°26.6'W	1474	CTD
		04:37	74°20.3'S	35°25.8'W	1474	
	53/104	06:50	74°16.4'S	35°16.4'W	1670	CTD
		07:50	74°16.2'S	35°16.6'W	1680	
	53/105	12:55	74°30.9'S	36°36.0'W	666	REC F1,CTD,BO,BO
		15:14	74°30.1'S	36°36.6'W	781	
	53/106	16:03	74°28.8'S	36°27.9'W	992	CTD
		16:45	74°28.4'S	36°29.4'W	1014	
	53/107	17:39	74°32.0'S	36°38.5'W	487	CTD
		18:02	74°31.6'S	36°39.1'W	515	
	53/108	18:43	74°33.8'S	36°45.3'W	403	CTD
		19:00	74°33.7'S	36°45.9'W	403	
	53/109	22:33	74°37.8'S	36°06.7'W	433	CTD
		22:52	74°37.8'S	36°06.5'W	432	
20.02.99	53/110	01:09	74°35.4'S	35°31.3'W	476	CTD
		01:28	74°35.3'S	35°31.1'W	479	
	53/111	03:17	74°36.3'S	34°52.7'W	523	CTD
		03:42	74°36.2'S	34°52.5'W	523	
	53/112	06:29	74°36.0'S	34°13.6'W	557	CTD
		06:54	74°35.9'S	34°13.8'W	563	
	53/113	09:49	74°37.9'S	33°38.7'W	606	CTD
		10:19	74°37.7'S	33°39.4'W	609	
	53/114	12:23	74°38.6'S	33°00.4'W	638	CTD
		12:50	74°38.4'S	33°00.0'W	642	
	53/115	14:06	74°39.4'S	32°22.0'W	616	CTD
		14:36	74°39.3'S	32°21.4'W	617	
	53/116	15:55	74°44.2'S	31°48.9'W	628	CTD
		16:23	74°44.1'S	31°48.8'W	628	

	53/117	17:40	74°48.8'S	31°15.4'W	591	CTD
		18:10	74°48.5'S	31°14.1'W	587	
	53/118	19:28	74°53.8'S	30°42.9'W	507	CTD
		19:53	74°53.7'S	30°42.7'W	508	
	53/119	21:20	74°58.7'S	30°07.9'W	432	CTD
		21:44	74°58.7'S	30°07.9'W	431	
	53/120	22:58	75°03.6'S	29°34.2'W	412	CTD
		23:20	75°03.7'S	29°33.6'W	412	
21.02.99	53/121	10:40	76°43.0'S	30°26.0'W	347	CTD
		11:02	76°43.0'S	30°26.0'W	369	
	53/122	15:21	76°34.9'S	32°00.9'W	393	REC M2,CTD
		17:59	76°34.8'S	31°59.9'W	402	
22.02.99	53/123	12:03	74°37.6'S	33°40.1'W	605	CTD
		12:32	74°37.4'S	33°40.7'W	603	
	53/124	13:23	74°33.3'S	33°47.7'W	611	CTD
		13:50	74°33.4'S	33°47.6'W	613	
23.02.99	53/125	17:28	74°17.8'S	36°05.2'W	1689	CTD,REC F3
		21:45	74°18.8'S	36°03.8'W	1636	
25.02.99	53/126	10:05	72°52.0'S	19°05.6'W	427	FT,CTD
		14:32	72°52.0'S	19°05.6'W	431	
27.02.99	53/127	06:15	70°33.6'S	08°04.0'W	148	AGT,CTD
		09:16	70°34.1'S	08°00.5'W	152	
03.03.99	53/128	10:52	66°29.4'S	00°00.0'E	4279	CTD,BO
		13:35	66°29.9'S	00°00.7'W	4519	
	53/129	16:30	66°00.0'S	00°01.5'W	3482	CTD
		18:01	66°00.1'S	00°01.0'W	3430	
	53/130	22:53	65°00.0'S	00°00.0'E	3753	CTD
04.03.99		00:37	65°00.0'S	00°00.7'E	3715	
	53/131	05:50	63°57.7'S	00°05.2'E	5221	CTD,REC 229-2,
		16:10	63°58.5'S	00°02.2'E	5217	DPL 229-3,BO,BO
	53/132	21:18	63°00.0'S	00°00.1'E	5322	CTD
05.03.99		00:15	62°59.9'S	00°00.7'E	5325	
	53/133	05:19	61°59.9'S	00°00.4'E	5387	CTD
		07:43	62°00.1'S	00°00.3'E	5390	
	53/134	12:41	60°59.9'S	00°00.2'W	5423	CTD
		15:10	61°00.1'S	00°00.4'W	5418	
	53/135	20::06	59°59.9'S	00°00.3'W	5376	CTD
		2227	60°00.0'S	00°00.2'W	5377	
06.03.99	53/136	03:02	59°04.1'S	00°06.3'E	4685	CTD,REC 227-5,
		20:25	59°04.3'S	00°04.2'E	4700	DPL 227-6,BO,BO,
						REC 227-6,DPL 227-6
07.03.99	53/137	02:06	57°59.9'S	00°00.5'E	4537	CTD
		04:06	58°00.1'S	00°00.5'E	4538	
	53/138	10:08	56°58.6'S	00°01.1'E	3742	REC 228-2,CTD,
		16:00	56°57.1'S	00°01.6'E	3766	DPL 228-3,BO,BO
	53/139	21:17	56°00.1'S	00°00.1'W	3858	CTD
		22:55	56°00.0'S	00°00.1'W	3833	

08.03.99	53/140	03:42	55°00.0'S	00°00.2'W	1750	CTD
		04:40	55°00.0'S	00°00.0'E	1734	
	53/141	08:37	54°31.9'S	00°00.9'E	1608	DPL 238-1,CTD
		11:05	54°29.0'S	00°02.2'E	1897	
	53/142	14:49	54°00.1'S	00°00.1'E	2585	CTD
		16:03	54°00.6'S	00°00.2'W	2543	
	53/143	22:00	53°00.2'S	00°00.2'W	2546	CTD
		23:15	53°00.7'S	00°00.3'W	2483	
09.03.99	53/144	05:20	51°59.9'S	00°00.2'W	2998	CTD
		06:47	51°59.8'S	00°00.0'E	2971	
	53/145	12:46	51°00.1'S	00°00.2'E	2270	CTD
		14:01	51°00.9'S	00°00.9'E	2300	
	53/146	20:19	50°00.0'S	00°00.4'E	3617	CTD
		22:08	50°00.3'S	00°01.5'E	3616	
10.03.99	53/147	03:53	49°00.1'S	00°00.3'E	3968	CTD
		06:13	49°01.3'S	00°01.4'E	4008	
11.03.99	53/148	06:40	47°03.3'S	00°30.0'E	4154	CTD
		08:56	47°03.3'S	00°30.1'E	4178	
	53/149	14:40	46°09.9'S	01°01.4'E	3666	DPL 237-1,CTD
		17:06	46°09.4'S	01°02.4'E	4027	

AGT=Agassiz trawl
ALACE=Alace float
BO=Bongo net
CTD=Conductivity, temperature, depth-sonde
DPL=Mooring deployement
FT=Fish trap
ODAS=ODAS buoy
REC=Mooring or sea level recorder recovery

CCHDO Data Processing Notes

Date	Contact	Data Type	Summary
2004-04-20	Bartolacci, Danie	CTD/SUM	

Detailed Notes

- Added quality bytes for all values (2 if valid value was present, -999. if value was missing) and associated comment lines in header.
- Added CTDOXY and flag column with missing values and missing value flag. This was done in order to convert files into netcdf (our in-house code requires all columns be present).
- Renamed all station files to CCHDO format.
- Converted files to netcdf with no apparent errors.

Date	Contact	Data Type	Summary
2004-04-15	Bartolacci, Danie	CTD/SUM	EXCHANGE Format, No Qual Values

Detailed Notes

CTD files are in .csv format, but at present have no quality bytes associated with values and therefore cannot be converted to netCDF at this time.

A directory and web page files have been created for this cruise. All station track and data files link. This cruise will not link to the website until web-generating code is working and run.

Notes on sumfile reformatting:

2004.04.13 DMB

I have reformatted the A12_1999a sumfile:

- Changed expocode from 06ANTXVI_2 to 06AQ199901_2
- Changed date format from yyyymmdd to mmddyy
- Added event code as UN
- Changed position format from DD.dd to DD MM.mm
- Added hemisphere alphabetic
- Added NAV as UNK
- Realigned all columns to conform with WOCE standards
- Added name/date stamp
- ran sumchk with no errors

file was renamed a12_1999asu.txt and put online.

Date	Contact	Data Type	Summary
2004-04-13	Bartolacci, Danie	SUM	Data Reformatted/OnLine

Detailed Notes

Notes on sumfile reformatting:

2004.04.13 DMB

I have reformatted the A12_1999a sumfile:

- Changed expocode from 06ANTXVI_2 to 06AQ199901_2
- Changed date format from yyyymmdd to mmddyy
- Added event code as UN
- Changed position format from DD.dd to DD MM.mm
- Added hemisphere alphabetic
- Added NAV as UNK
- Realigned all columns to conform with WOCE standards
- Added name/date stamp
- ran sumchk with no errors

CCHDO Data Processing Notes

Date	Contact	Data Type	Summary
2004-02-17	Witte, Hannelore	CTD/SUM	1999a, 2000a, 2002a Data Submitted Together

Detailed Notes

This is information regarding line: A12

ExpoCode:	06ANTXVI_2,†ANTXVIII_3,†ANTXX_2
Cruise Date:	1999/01/18 - 2003/01/15
From:	WITTE, HANNELORE
Email address:	hwitte@awi-bremerhaven.de
Institution:	AWI
Country:	GERMANY
The file:	AWICTD.tar - 4248576 bytes
has been saved as:	20040217.052429_WITTE_A12_AWICTD.tar
in the directory:	20040217.052429_WITTE_A12
The data disposition is:	Public
The file format is:	WHP Exchange
The archive type is:	Other: Tar/Zip/Tar
The data type(s) is:	Summary (navigation)

CTD File(s)

The file contains these water sample identifiers:

- Cast Number (CASTNO)
- Station Number (STATNO)

WITTE, HANNELORE would like the following action(s) taken on the data:

- Merge Data