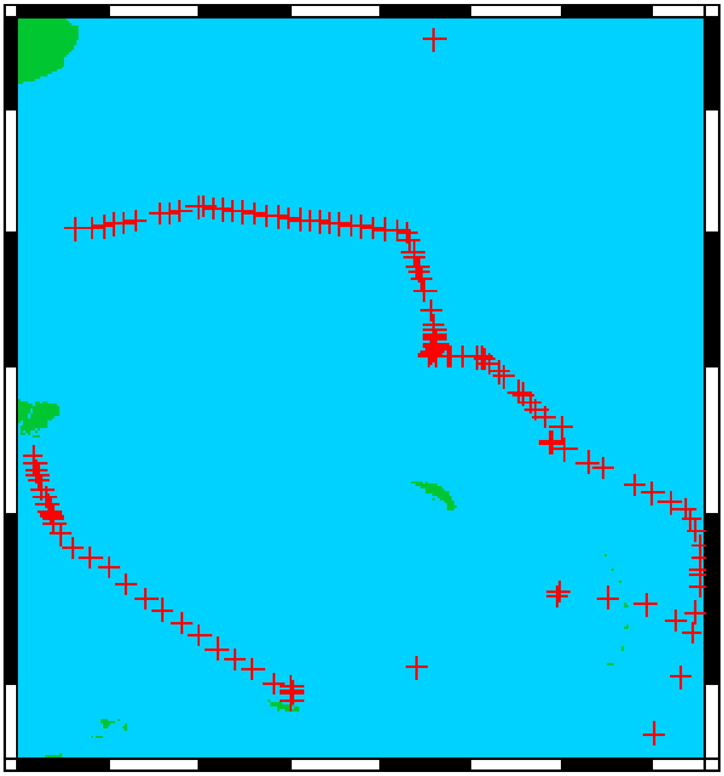
A. Cruise Narrative: SR01



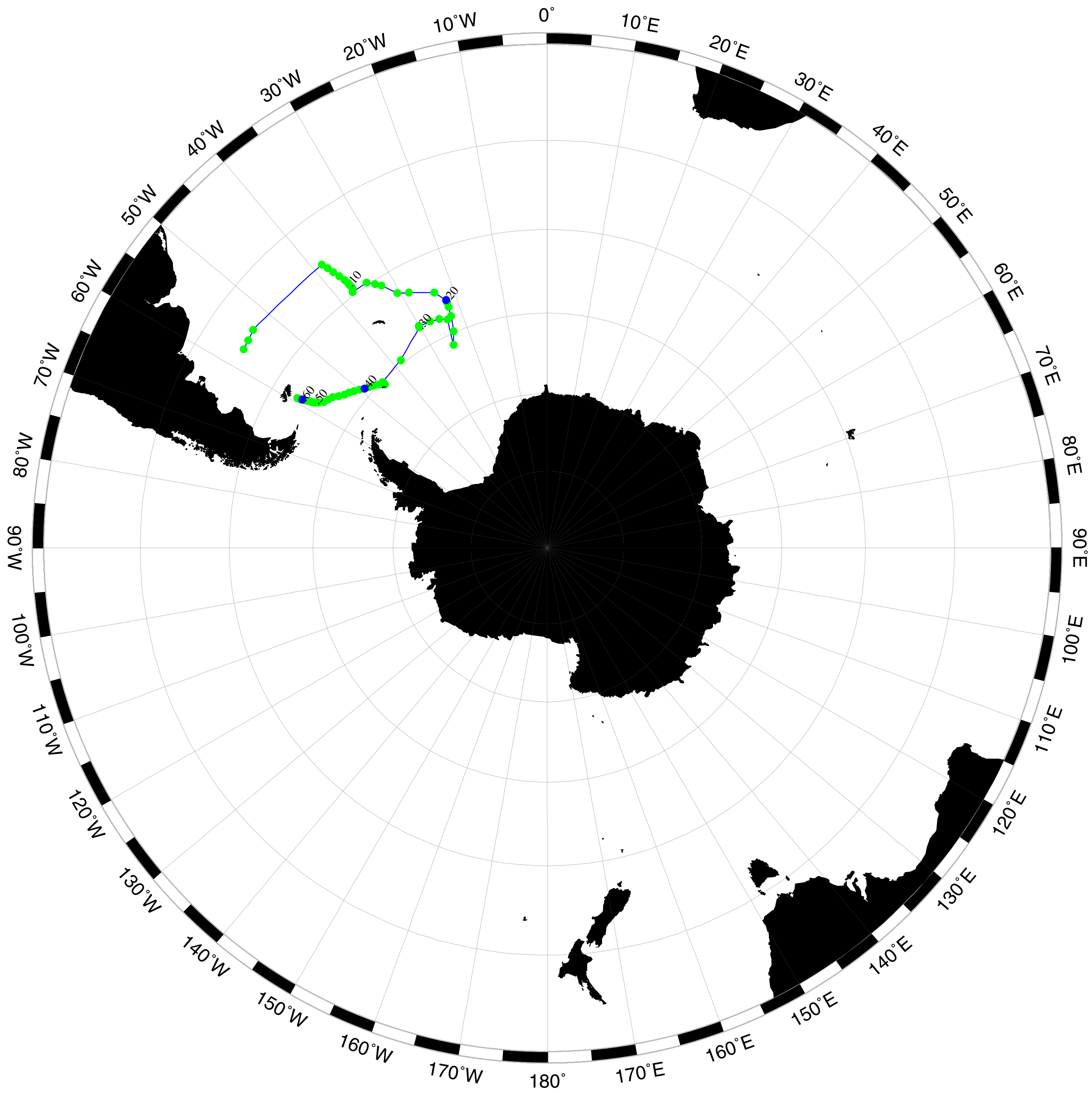
WOCE Line	**SR01**
ExpoCode	**06AQANTX_5**
Chief Scientist	**R. Gersonde/AWI**
DOD-Ref.No.	19930208
Polarstern Cruise-No.	ANT X/5
Dates	08.08.1992 - 26.09.1992
Region	Argentine Basin Inner Seas off the West Coast of Scotland SW Atlantic (Limit 20W) Weddell Sea
Port of departure	Puerto Madryn Argt.
Port of return	Punta Arenas Chile

Cruise Participants:

Name/Inst.	No./Unit	Type of measurements
Gersonde, R./AWI	53 stations	B08 Phytoplankton
Gersonde, R./AWI	18 stations	B09 Zooplankton
Gersonde, R./AWI	3 stations	G01 Dredge
Gersonde, R./AWI	40 stations	G04 Core-soft bottom (no. of cores) Sediment corer
Gersonde, R./AWI	68 stations	G04 Core-soft bottom (no. of cores) Surface sediment
Gersonde, R./AWI	5500 n miles	G90 Other geological or geophysical measurements Parasound echosounding
Schenke, H.W./AWI	5500 n miles	G74 Multi-beam echosounding
Witte, H./AWI	65 stations	H13 Bathythermograph drops
Passelaigue, F./COM	24 stations	B09 Zooplankton
Schlüter, M./GEOMAR	12 stations	H73 Geochemical tracers (e.g. freons) Helium
Peterson, R./SIO	1 station	D71 Current profiler (e.g. ADCP) Krauss-drifter, deployment 22.9.92
Peterson, R./SIO	1 station	D71 Current profiler (e.g. ADCP) Krauss-drifter, deployment 23.9.92
Peterson, R./SIO	5 stations	D71 Current profiler (e.g. ADCP) Krauss-drifter, deployment 9.8.92
Peterson, R./SIO	63 stations	H09 Water bottle stations
Peterson, R./SIO	63 stations	H10 CTD-Stations
Christie, D./UOREG	7 stations	G03 Core-rock (no. of cores)

aktualisiert am: 25.06.2001

Station locations for SR01 :PETERSON



Produced from .sum file by WHPO-SIO

The Expedition ANTARKTIS X/5 of RV "Polarstern" in 1992
Die Expedition ANTARKTIS X/5 mit FS ‚Polarstern" 1992

Herausgegeben von Rainer Gersonde mit Beiträgen der Fahrtteilnehmer
Ber. Polarforsch. 131 (1993) ISSN 0176 - 5027

B. Itinerary

(R. Gersonde)

RV "Polarstern" left the Argentine harbor Puerto Madryn on August 8, 1992 at 8:00 h local time heading towards the southern part of the Argentine Basin. On board were 44 crew members (see 9. 5) and a scientific party of 31 (see 9.3). The largest scientific group were geoscientists, including a guest each from the US, Great Britain and Spain. In addition a hydrographic working group of five from the US, a biologist from France and a microbiologist from Italy attended expedition ANT-X/5.

The scientific program was planned to start at the border of the Argentine shelf to conduct a hydrographic survey of the Falkland Current on a W-E transect on 45•S. However, an unexpected deterioration in the weather with gale-force winds (8 - 9 Bft) and rough seas prevented this survey. It was only possible to launch satellite-tracked drifting buoys at five positions between 59°53.9'W and 58°14.6'W. A hydrographic survey of the northward loop of the Subantarctic and Subtropical Front in the western part of the Argentine Basin was cancelled after only three CTD stations to save time for following hydrographic surveys. Thus, most of the hydrographic information at Transect A (Figs, 1, 2) was gathered by XBT deployments.

The geoscientific sampling program was also disturbed by the weather conditions during the first days at sea. Nevertheless, it was possible to collect the first sediment core of the cruise, containing late Quaternary sequences, at the relatively steep Argentine continental rise (Fig. 2). Heading east on Transect A, the area of the Argentine Basin characterized by sediment waves ("mud waves") was reached between 51°W and 50°W. The sediment waves were sampled with gravity corer and multicorer at several stations. In addition, the water column was sampled with plankton- and multi-nets.

ANTARKTIS X/5

R/V POLARSTERN
08 August 1992 − 26 September 1992
Puerto Madryn, Argentina to Punta Arenas, Chile

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C. BOTTLE DATA COLLECTION, ANALYSES, AND PROCESSING

ODF CTD/rosette casts were carried out with a 24-bottle rosette sampler of ODF manufacture using General Oceanics pylons. An ODF-modified Neil Brown (NBIS) Mark 3 CTD #4 and a Benthos altimeter were mounted on the rosette frame. The CTD consisted of 2 PRT (Platinum Resistance Thermometer) channels and 1 each, pressure and conductivity channels. Data were acquired in-situ using a single conductor cable. A Benthos pinger with a self-contained battery pack was mounted separately on the rosette frame; its signal was displayed on the precision depth recorder (PDR) in the ship's laboratory. The rosette/CTD was suspended from a one conductor wire which provided power to the CTD and relayed the CTD signal to the laboratory. Seawater samples were collected in 2.1-liter PVC Niskin and ODF bottles.

Each CTD cast extended to within approximately 10 meters of the bottom. The bottles were numbered 1 through 24. Normally, if one of these 24 bottles needed servicing, and repairs could not be accomplished by the next cast, the replacement bottle was given a new number. This was done for the first few stations of this leg. At Station 002, bottle 11 was replaced and the new bottle was numbered 25. At Station 003, bottle 11 was put back in service. At Station 004, bottle 10 was replaced with bottle 25 and used until Station 008. Subsets of CTD data taken at the time of water sample collection were transmitted to the bottle data files immediately after each cast to provide pressure and temperature at the sampling depth, and to facilitate the examination and quality control of the bottle data as the laboratory analyses were completed. The CTD data and documentation are submitted separately.

After each rosette cast was brought on board, water samples were drawn in the following order: Helium-3, Oxygen, Nutrients (silicate, phosphate, and nitrate), Salinity, Carbon 13, Oxygen 18 and Barium. The samples and the Niskin sampler they were drawn from were recorded on the Sample Log sheet. Comments regarding validity of the water sample (valve open, lanyard caught in lid, etc.) were also noted on the Sample Log sheets. There were a few stations that the water froze during sampling. These levels were investigated and if there was a problem with the data were deleted.

The discrete hydrographic data were entered into the shipboard data system and processed as the analyses were completed. The bottle data were brought to a useable, though not final, state at sea. ODF data checking procedures included verification that the sample was assigned to the correct level. This was accomplished by checking the raw data sheets, which included the raw data value and the water sample bottle, versus the sample log sheets. Any comments regarding the water samples were investigated. The salinity raw data computer files were also checked for entry errors, but many errors were found during shorebased data checking. Investigation of data included comparison of bottle salinity with CTD data, and review of data plots of the station profile alone and compared to nearby stations.

If a data value did not either agree satisfactorily with the CTD or with other nearby data, then analyst and sampling notes, plots, and nearby data were reviewed. If any problem was indicated, the data value was flagged or deleted. (However, ODF preserves in its archives all bottle data values). Section 6, the Bottle Data Processing Notes, includes comments regarding deletion of samples. When it was determined that a particular 2.1 liter water sample was contaminated because of leakage or other bottle or rosette malfunction, that level was reported using just the CTD data (pressure, temperature and salinity).

Pressure and Temperatures

All pressures and temperatures for the Niskin bottle data tabulations on the rosette casts were obtained by averaging CTD data for a brief interval before the bottle was closed on the rosette. The actual methods are included in the CTD data submission.

Salinity

Salinity samples were drawn into 200ml Kimax high-alumina borisilicate bottles with custom-made plastic insert thimbles and Nalgene screw caps. This assembly provides very low container dissolution and sample evaporation. Salinity bottles were rinsed three times before filling. Salinity was determined after sample equilibration to laboratory temperature, usually within about 8-36 hours of collection. Salinity has been calculated according to the equations of the Practical Salinity Scale of 1978 (UNESCO, 1981). This calculation uses the conductivity ratio determined from bottle samples analyzed (minimum of two recorded analyses per sample bottle after flushing) with a Guildline Autosal Model 8400A salinometer. The salinometer was standardized against Wormley P-120 standard seawater, with at least one fresh vial opened per cast. This salinometer belonged to AWI. ODF took two Autosals which never worked well enough to use for samples. Probably a problem with 220 V/ 50 cycle ships power. ODF salt PC interface not used, samples run manually.

Accuracy estimates of bottle salinities run at sea are usually better than 0.002 psu relative to the specified batch of standard. Although laboratory precision of the Autosal can be as small as 0.0002 psu when running replicate samples under ideal conditions, at sea the expected precision is about 0.001 psu under normal conditions, with a stable lab temperature.

Oxygen

Samples were collected for dissolved oxygen analyses soon after the rosette sampler was brought on board and after helium was drawn. Nominal 100 ml volume-calibrated iodine flasks were rinsed twice with minimal agitation, then filled via a drawing tube, and allowed to overflow for at least 3 flask volumes. The sample temperature was measured with a small platinum resistance thermometer embedded in the drawing tube. Reagents were added to fix the oxygen before stoppering. The flasks were shaken twice; immediately after drawing, and then again after 20 minutes, to assure thorough dispersion of the $Mn(OH)_2$ precipitate. The samples were analyzed within 4-36 hours of collection.

Dissolved oxygen analyses were performed with an SIO-designed automated oxygen titrator using photometric end-point detection based on the absorbtion of 365 nm wavelength ultra-violet light. Thiosulfate was dispensed by a Dosimat 665 buret driver fitted with a 1.0 ml buret. ODF uses a whole-bottle Winkler titration following the technique of Carpenter (1965) with modifications by Culberson *et al.* (1991), but with higher concentrations of potassium iodate standard (approximately 0.010N) and thiosulfate solution (50 gm/l). Standard solutions prepared from pre-weighed potassium iodate crystals, and were run at the beginning of each session of analyses, which typically included from 1 to 3 stations. Several standards were made up and compared to assure that the results were reproducible, and to preclude the possibility of a weighing error. Reagent/distilled water blanks were determined to account for oxidizing or reducing materials in the reagents.

Blanks, and thiosulfate normalities corrected to 20 degrees C, calculated from each standardization, were plotted versus time, and were reviewed for possible problems. New thiosulfate normalities were recalculated from the standards and blanks, after the blanks had been smoothed. These normalities were then smoothed, and the oxygen data was recalculated.

Nutrients

Nutrients (phosphate, silicate, nitrate and nitrite) analyses were performed on a Technicon AutoAnalyzer®, computer peak reading system by Mark Spears (TAMU). The procedures used are described in Hager *et al.* (1972) and Atlas *et al.* (1971). Standardizations were performed with solutions prepared aboard ship from preweighed standards; these solutions were used as working standards before and after each cast (approximately 36 samples) to correct for instrumental drift during analyses. Sets of 4-6 different concentrations of shipboard standards were analyzed periodically to determine the linearity of colorimeter response and the resulting correction factors. Phosphate was analyzed using hydrazine reduction of phosphomolybdic acid as described by Bernhardt & Wilhelms (1967). Silicate was analyzed using stannous chloride reduction of silicomolybdic acid. Nitrite was analyzed using diazotization and coupling to form dye; nitrate was reduced by copperized cadmium and then analyzed as nitrite. These three analyses use the methods of Armstrong *et al.* (1967).

Sampling for nutrients followed that for Helium and dissolved oxygen. Samples were drawn into ~45 cc high density polyethylene, narrow mouth, screw-capped bottles which were rinsed twice before filling. The samples may have been refrigerated at 2 to 6°C for a maximum of 15 hours.

DATA COMPARISONS AND COMMENTS

The oxygen and nutrient data were compared by ODF with those from the adjacent station. ODF did comparisons with SAVE data set.

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D. Quality Comments

Remarks for deleted samples, missing samples, and WOCE codes other than 2 from ANTARKTIS X/5. Investigation data may include comparison of bottle salinity with CTD data, review of data plots of the station profile and adjoining stations. ODF did not analyze the nutrient samples, but the data was used to assist in sorting out any problems with salinity or oxygen. Comments from the Sample Logs and the results of ODF's investigations are included in this report.

Station 001

101 @ 5db Oxygen: "Not enough acid." Delete oxygen (4.36).

111 @1607db Sample Log: "Block broken - no samples." CTD salinity reasonable, so will leave in station profile.

113 @2005db Sample Log: "Short sample on salts." Salinity could be .008 to .012 high, but report as is. Agreement with CTD is reasonable, agreement with adjoining stations is good.

118 @3430db Delta-S at 3430db is 0.0344, salinity is 34.709. Conductivity spikes on up-cast caused by flapping paint chip on sensor guards. Suspect CTD data, bottle salinity agrees with adjoining station.

122 @4671db Sample Log: "Vent not closed tightly - leak when vented." Salinity and oxygen appear to be okay.

Station 002

103 @ 137db Sample Log: "Cap off center." Bottle data (salinity and oxygen) appears to be okay.

106 @ 510db Sample Log: "Air bubble - O2." Bottle data (salinity and oxygen) appears to be okay.

107 @ 709db Sample Log: "Cap leaked." Bottle data (salinity and oxygen) appears to be okay.

112 @2020db Salinity: "Erratic readings." Delta-S at 2020db is 0.0736, salinity is 34.905. Deleted bottle salinity, did not agree with adjoining stations.

115 @2931db Delta-S at 2931db is 0.0682, salinity is 34.836. Deleted bottle salinity, did not agree with adjoining stations.

116 @3234db Delta-S at 3234db is 0.0709, salinity is 34.817. Deleted bottle salinity, did not agree with adjoining stations.

117 @3541db Delta-S at 3541db is 0.0721, salinity is 34.790. Deleted bottle salinity, did not agree with adjoining stations.

118 @3845db Delta-S at 3845db is 0.0663, salinity is 34.773. Deleted bottle salinity, did not agree with adjoining stations.

120 @4451db Bottle data (salinity) appears to be okay. Sample Log: "Broke bottle." Oxygen not drawn, comment must refer to oxygen.

125 @1716db (1.7 liter) in place of 11. Delta-S at 1716db is 0.0696, salinity is 34.768. Bottle salinity is too high. Oxygen appears to be okay. Delete salinity.

Station 003

111 @1661db Sample Log: "Spigot open." Oxygen: "Good"

115 @2949db Sample Log: "Bottles 15-22 and 24, these vents were left wide open! Leaked when spigot open." Salinity agrees with CTD. Oxygen and nutrients, except no3 slightly high, appear to be okay.

116 @3253db See 115 comment.

117 @3568db See 115 comment.

118 @3872db See 115 comment.

119 @4174db See 115 comment. Delta-S at 4174db is 0.0042, salinity is 34.697.

120 @4530db See 115 comment. Delta-S at 4530db is 0.0048, salinity is 34.685.

121 @4833db See 115 comment. Delta-S at 4833db is 0.012, salinity is 34.688.

122 @5186db See 115 comment. Delta-S at 5186db is 0.0092, salinity is 34.682.

123 @5498db See 115 comment. Sample Log: "Vent loose." Delta-S at 5498db is 0.0053, salinity is 34.675.

124 @5905db Delta-S at 5905db is 0.0073, salinity is 34.676. See 115-122 comment.

Station 004

113 @1719db Salinity: "Not enough sample for one rinse." Salinity appears to be okay.

118 @3142db Salinity: "No sample."

123 @4764db Delta-S at 4764db is 0.0073, salinity is 34.678. Not sure what happened to the salinity. Oxygen also appears low. Nutrients low. Suspect that bottle leaked, delete salini-

ty and oxygen (5.06). PI to make decision on nutrients.

Station 006

113 @1807db Oxygen: "No sample." No reason noted for no oxygen, sample log indicates it was drawn. Difficult to decide from the data whether the samples drawn before or after 13 are correct, so leave as is. This comment is being made to indicate that the entire water column was check for an oxygen drawing error. Salinity data entry error, incorrect value was 34.732. Salinity good with correction.

Station 007

112 (No Pressure) Delta-S at 2050db is -0.0123, salinity is 34.750. This bottle was tripped on the fly. Trying to recreate the sequence of events from the CTD times, it appears that at bottle 13 the winch was stopped for over 2 minutes. Then the console operator tripped the bottle as the winch started up again. The bottle could have tripped anywhere in the 14 db above bottle 13. Delete all water samples. Delete entire level, not sure where bottle tripped.

113 @2050db Delta-S at 2050db is -0.0062, salinity is 34.746. Oxygen: "No sample." No reason noted on the sample log sheet, and sample log indicates a sample was drawn.

115 @2632db Salt on btl 15 ?? Delta-S at 2632db is 0.0177, salinity is 34.803. CTD profile appears a little noisy, this is a salinity maximum. Bottle salinity agrees with adjoining stations. Other samples appear to be okay.

120 @4597db Oxygen: "No sample." No reason noted on the sample log sheet, and sample log indicates a sample was drawn.

Station 008

111 @1463db Sample Log: "No H20 for o2." Salinity and nutrients have the line drawn down the column indicating all samples were taken, however, we do not have salinity data but we do have nutrient data.

123 @5817db Nutrients do not agree as a duplicate trip with 24. See 124 comments.

124 @5823db Sample Log: "Slight air leak." 23 and 24 were scheduled to trip together. Salinity and oxygen for these samples are the same, but nutrients are not the same. The air leak would have affected oxygen. Have PI decide which is correct.

Station 009

110 @ 914db salt ? Delta-S at 914db is -0.0812, salinity is 34.258. Bottle salinity is bad, too low. Delete bottle salinity. Oxygen and nutrients appear to be okay.

115 @2185db Oxygen: "Bad restarted." Lost oxygen sample.

119 @3854db Oxygen: "No sample." Sample was drawn according to sample log.

Station 010

118 @3206db salt ? Delta-S at 3206db is -0.0108, salinity is 34.706. Salinity too low, appears to have been misdrawn from 19. Oxygen and nutrients appear to be okay. Bad salt creates an incorrect density inversion. Delete salinity.

Station 011

113 @2092db Delta-S at 2092db is 0.0044, salinity is 34.787. CTD has a lot of noise in the trace, water samples appear to be okay.

Station 012

113 @1775db Delta-S at 1775db is -0.0065, salinity is 34.756. Samples appear to be okay.

122 @4583db Sample Log: "Air leak, vent not closed." Samples appear to be okay.

Station 014

102 @ 81db Oxygen: "Air bubble." Oxygen raw data indicates past end point. Value is very uncertain, very likely much too high. Comment made by RTW, however, data agrees with adjoining stations. Leave as is.

Station 015

101 @ 3db Delta-S at 3db is 0.0557, salinity is 33.839. Samples appear to be okay.

103 @ 213db Sample Log: "Bottle bottom did not close."

Station 016

105 @ 459db Oxygen: "Odd endpoint." This was overshoot - should have been overtitration. We don’t know if it is close to correct or not. Delete oxygen (4.19).

Station 017

103 @ 140db Shipboard comment: "Bottle salt ??" Salinity and other samples appear to be okay.

116 @1917db	Delta-S at 1917db is 0.0072, salinity is 34.691. Bottle salinity slightly high compared with adjoining stations, other samples appear to be okay. Could be a salinity drawing error. Delete bottle salinity.
119 @2525db	Delta-S at 2525db is -0.0059, salinity is 34.675. Salinity and other samples appear to be okay compared with adjoining stations.
Station 018	
101 @ 6db	Sample Log: "Air bubble - O2." Data appears to be okay.
103 @ 211db	Delta-S at 211db is -0.0394, salinity is 34.440. Gradient area, other samples appear to be okay, too.
106 @ 663db	Sample Log: "Valve leaked." Data appears to be okay.
Station 019	
101 @ 6db	Sample Log: "Bottom leaked." Samples appear to be okay.
103 @ 107db	Sample Log: "Bottom leaked." in high gradient ? Samples appear to be okay.
106 @ 307db	Sample log: "Air bubble in NAI?" Oxygen samples appear to be okay.
120 @3527db	Sample log: "Tube fell off in sample (NAI)." Oxygen samples appear to be okay.
Station 020	
106 @ 279db	Sample Log: "Valve leak." Samples appear to be okay.
Station 021	
111 @ 5db	Surface salinity in high gradient. Samples appear to be okay.
112 @ 46db	Surface salinity in high gradient. Sample Log: "NAI tube fell off while sampling." Samples appear to be okay.
113 @ 93db	Surface salinity in high gradient. Samples appear to be okay.
Station 022	
111 @ 3db	Silicate appears high compared by pressure with adjoining stations. PI's should decide if all okay. In high salinity gradient. Samples appear to be okay.
112 @ 77db	Silicate appears high compared by pressure with adjoining stations. PI's should decide if all okay. In high salinity gradient. Samples appear to be okay.
Station 023	
109 @ 3db	Btls have odd salts. Delta-S at 3db is 0.0502, salinity is 33.756. Samples agree with pressure comparison of adjoining stations.
110 @ 32db	Btls have odd salts. Sample Log: "Sample froze before rinse was possible (O2)." Delta-S at 32db is 0.0384, salinity is 33.745. Samples agree with pressure comparison of adjoining stations.
111 @ 61db	Btls have odd salts. Delta-S at 61db is 0.0322, salinity is 33.749. Samples agree with pressure comparison of adjoining stations.
113 @ 80db	No nutrient sample, no reason noted on sample log.
124 (No Pressure)	Bottle tripped on the the way down, do not report.
Station 024	
Entire cast	Console ops: "Ramp shaft was at 24, one too far?" Bottle 24 tripped at the surface, all trip pressures corrected accordingly. Ramp shaft was advanced one too far at the end of the cast. Double tripping bottles lead to problems with ctdtrips. Problems with water freezing during sampling. Possible problem with salt sampling order ?
101 @ 137db	Sample Log: "Water frozen in spigots - used bucket of fresh hot water to warm and start flow." Sampled after helium. No salinity." Samples appear to be okay.
104 @ 511db	Sample Log: "No salinity, oxygen or nutrients."
107 @1008db	Delta-S at 1008db is -0.0061, salinity is 34.686. Leave salinity as reported, agrees with adjoining stations as plotted vs. pressure and potential temperature.
108 @1019db	Sample Log: "No salinity, oxygen or nutrients."
111 @1516db	Sample Log: "No salinity, oxygen or nutrients."
115 @2525db	Sample Log: "No salinity, oxygen or nutrients."
117 @3136db	Delta-S at 3136db is 0.0121, salinity is 34.674. Salinity is high compared with adjoining stations, other samples appear to be okay. Delete salinity.
118 @3541db	Delta-S at 3541db is -0.0159, salinity is 34.642. Salinity is low compared with adjoining stations, other samples appear to be okay. Appears to be effected by the water freezing during sampling, delete salinity.

120 @3852db	Sample Log: "Water frozen in spigots - used bucket of fresh hot water to warm and start flow." Delta-S at 3852db is 0.0036, salinity is 34.659. Leave salinity as reported, precision is .0006 off.
121 @4469db	Sample Log: "Water frozen in spigots - used bucket of fresh hot water to warm and start flow." Delta-S at 4469db is 0.0069, salinity is 34.660. Leave salinity as reported, precision is .003 off, considering the conditions is okay.
122 @4873db	Sample Log: "Water frozen in spigots - used bucket of fresh hot water to warm and start flow." Delta-S at 4873db is -0.0308, salinity is 34.628. Salinity is low compared with adjoining stations, other samples appear to be okay. Appears to be effected by the water freezing during sampling, delete salinity.
123 @4869db	Sample Log: "No salinity, oxygen or nutrients."
Station 026	
101 @ 5db	Sample Log: "No salinity or nutrients sampled, not enough water after He & CH."
103 @ 113db	Sample Log: "No oxygen, salinity or nutrients sampled, not enough water after He & CH."
109 @ 960db	Sample Log: "No oxygen or salinity sampled, not enough water after He & CH."
113 @1676db	No salinity, no reason noted on sample log. Oxygen and nutrients appear to be okay, He & CH were not sampled according to sample log.
117 @2779db	Sample Log: "No salinity or nutrients sampled, not enough water after He & CH." Oxygen appears to be high (5.465), o2 draw temperature also high. Delete oxygen.
118 @3064db	No salinity, no reason noted on sample log. Oxygen and nutrients appear to be okay, He & CH were not sampled according to sample log.
121 @4240db	Sample Log: "No salinity sampled, not enough water after He & CH."
122 @4740db	Sample Log: "No oxygen or salinity sampled, not enough water after He & CH."
123 @5250db	Sample Log: "No oxygen, salinity or nutrients sampled, not enough water after He & CH."
124 @6355db	Sample Log: "No oxygen or salinity sampled, not enough water after He & CH."
Station 027	
101 @ 3db	No indication on sample log sheet that salinity and nutrients were not suppose to be sampled, however, missing samples are at levels that He & CH were sampled. Data compares okay with adjoining stations, so all okay. Sample Log: "No oxygen sampled."
103 @ 111db	No indication on sample log sheet that salinity and nutrients were not suppose to be sampled, however, missing samples are at levels that He & CH were sampled. Data compares okay with adjoining stations, so all okay. Sample Log: "No oxygen sampled."
110 @1008db	No indication on sample log sheet that salinity and nutrients were not suppose to be sampled, however, missing samples are at levels that He & CH were sampled. Data compares okay with adjoining stations, so all okay. Sample Log: "No oxygen sampled."
113 @1714db	No indication on sample log sheet that salinity and nutrients were not suppose to be sampled, however, missing samples are at levels that He & CH were sampled. Data compares okay with adjoining stations, so all okay. Sample Log: "No oxygen sampled."
116 @2296db	No indication on sample log sheet that salinity and nutrients were not suppose to be sampled, however, missing samples are at levels that He & CH were sampled. Data compares okay with adjoining stations, so all okay. Sample Log: "No oxygen sampled."
118 @2623db	No indication on sample log sheet that salinity and nutrients were not suppose to be sampled, however, missing samples are at levels that He & CH were sampled. Data compares okay with adjoining stations, so all okay. Sample Log: "No oxygen sampled."
120 @2926db	No indication on sample log sheet that salinity and nutrients were not suppose to be sampled, however, missing samples are at levels that He & CH were sampled. Data compares okay with adjoining stations, so all okay. Sample Log: "No oxygen sampled."
121 @3230db	No indication on sample log sheet that salinity and nutrients were not suppose to be sampled, however, missing samples are at levels that He & CH were sampled. Data compares okay with adjoining stations, so all okay. Sample Log: "No oxygen sampled."

123 @3545db	No indication on sample log sheet that salinity and nutrients were not suppose to be sampled, however, missing samples are at levels that He & CH were sampled. Data compares okay with adjoining stations, so all okay. Sample Log: "No oxygen sampled."
124 @3975db	No indication on sample log sheet that salinity and nutrients were not suppose to be sampled, however, missing samples are at levels that He & CH were sampled. Data compares okay with adjoining stations, so all okay. Sample Log: "No oxygen sampled."
Station 028	
101 @ 3db	Sample Log: "No oxygen, salinity or nutrients sampled."
104 @ 116db	Sample Log: "No oxygen, salinity or nutrients sampled."
109 @ 960db	Sample Log: "No oxygen, salinity or nutrients sampled."
113 @1505db	Sample Log: "No oxygen, salinity or nutrients sampled."
116 @2092db	Sample Log: "No oxygen, salinity or nutrients sampled."
118 @2407db	Sample Log: "No oxygen, salinity or nutrients sampled."
120 @2621db	Sample Log: "No oxygen, salinity or nutrients sampled."
122 @2990db	Sample Log: "No oxygen, salinity or nutrients sampled."
123 @3173db	Sample Log: "No oxygen, salinity or nutrients sampled."
Station 029	
101 @ 3db	Sample Log: "No oxygen, salinity or nutrients sampled." Nutrients were drawn and appear to be okay.
103 @ 101db	Sample Log: "No oxygen, salinity or nutrients sampled."
107 @ 687db	PO4 is ˜.2 too high. PI to make a decision what to do with this sample.
108 @ 993db	Sample Log: "No oxygen, salinity or nutrients sampled."
111 @1501db	Sample Log: "No water, lanyard hang-up."
112 @1806db	Sample Log: "No oxygen, salinity or nutrients sampled."
115 @2416db	Sample Log: "No oxygen, salinity or nutrients sampled."
118 @3028db	Sample Log: "No oxygen, salinity or nutrients sampled."
121 @3640db	Sample Log: "No oxygen, salinity or nutrients sampled."
123 @3957db	Sample Log: "No oxygen, salinity or nutrients sampled."
Station 030	
101 @ 3db	Sample Log: "No oxygen, salinity or nutrients sampled."
107 @ 435db	Sample Log: "No oxygen, salinity or nutrients sampled."
109 @ 597db	Sample Log: "O2 - Air bubble." Oxygen appears a little low compared with previous stations, but the air bubble does not seem to have effected the sample, so report as is.
113 @1363db	Sample Log: "No oxygen, salinity or nutrients sampled."
117 @2155db	Sample Log: "No oxygen, salinity or nutrients sampled."
120 @2809db	Sample Log: "No oxygen, salinity or nutrients sampled."
123 @3558db	Sample Log: "No oxygen, salinity or nutrients sampled."
Station 031	
101 @ 6db	Sample Log: "Leaks at bottom." Appear to be okay for surface samples.
Station 032	
101 @ 5db	Sample Log: "Leaks at bottom." Samples appear to be okay for shallow samples.
Station 033	
108 @ 706db	Sample Log: "NaOH tube popped off - resampled (O2)." Oxygen as well as other samples appear to be okay.
114 @1802db	Delta-S at 1802db is -0.5258, salinity is 34.145. Salinity may be a transcription error, erasures on raw data sheet, and not any way to tell what the values were. Delete salinity.
Station 037	
116 @3550db	Sample Log: "Leaks, drew it first." Samples appear to be okay.
Station 038	
101 @ 9db	Sample Log: "Bottle leaked." Samples appear to be okay, plotted vs pressure.

107 @ 409db	Sample Log: "Bottle leaked." Samples appear to be okay, plotted vs pressure.
112 @1225db	Loosened lid spring, before cast. Samples appear to be okay, plotted vs pressure.
117 @2228db	Sample Log: "Bottle leaked." Samples appear to be okay, plotted vs pressure.
Station 039	
124 @4124db	Oxygen: "Very odd endpoint." This is overshoot. All we can say is oxygen is less than this, but can't say how much less. It could be quite a bit high. Delete oxygen (5.77).
Station 042	
119 @2927db	Sample Log: "Tube came off in bottle (O2)." Oxygen appears to be okay.
Station 044	
101 @ 10db	Sample Log: "Sea snot all over bottles." Samples appear to be okay.
102 @ 74db	Sample Log: "Sea snot all over bottles." Samples appear to be okay.
103 @ 118db	Sample Log: "Sea snot all over bottles." Samples appear to be okay.
104 @ 223db	Sample Log: "Sea snot all over bottles." Samples appear to be okay.
123 @4128db	Sample Log: "Bottom did not close - no samples."
124 @4342db	Salinity data entry error, station number entered incorrectly. Corrected and updated both stations 44 and 45. Salinity was missing before the correction was made.
Station 046	
101 @ 4db	Samples appear to be okay.
102 @ 52db	Samples appear to be okay.
103 @ 96db	Samples appear to be okay.
104 @ 141db	Samples appear to be okay.
Station 047	
112 @2028db	Oxygen slightly high, appears to be drawing error with 13. Delete oxygen (4.37).
116 @3041db	Sample Log: "Air bubble (O2)." Oxygen appears to be okay, large change between adjoining stations but, not only for this sample.
117 @3296db	Sample Log: "Air bubble (O2)." Oxygen appears to be okay, large change between adjoining stations but, not only for this sample.
119 @3750db	Delta-S at 3750db is -0.0227, salinity is 34.690. Oxygen and nutrients appear to be okay. Delete salinity.
Station 048	
101 @ 3db	Oxygen: "Mess up." Analytical error, delete oxygen (6.79).
111 @1627db	Delta-S at 1627db is -0.1954, salinity is 34.409. Oxygen and nutrients appear to be okay. Delete salinity.
Station 049	
106 @ 765db	Sample Log: "Air bubble (O2)." Oxygen appears low, other samples okay. Leave o2 as is.
116 @2624db	Delta-S at 2624db is -0.0065, salinity is 34.715. Salinity appears to be misdrawn from 15. Delete salinity. Other samples are okay.
Station 051	
117 @1905db	Oxygen ˜.2 low compared to adjoining stations, analytical problem, delete oxygen (3.63).
1 (No Pressure)	Sample Log: "21 bottles."
Station 052	
110 @ 3db	Sample Log: "O2 was not drawn." Salinity and nutrients look okay.
Station 059	
120 @ 150db	Oxygen: "Mess up." Analytical problem, delete oxygen (6.85). Actually looks like a sampling error with 21, but analysts noted a problem during analysis.

E. Calibration and Processing Summary; Pressure-Series CTD Data - Antarktis X/5

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Introduction

ODF CTD #4, a modified NBIS Mark IIIB CTD, was used exclusively for the entire cruise. This instrument included the standard pressure, temperature and conductivity channels. Pressure and temperature calibrations were performed in July and October of 1992 on the instrument at the ODF Calibration Facility.

Laboratory Calibration Procedures

The CTD pressure transducer was calibrated to a Ruska Model 2400 Piston Gage pressure reference in a temperature-controlled water bath. Pre-cruise calibration curves were measured at two different temperatures (0.24 and 23.42°C) to two different maximum loading pressures (1398 and 6080 dbar). Post-cruise calibrations curves were measured at three different temperatures (−0.01, 23.33 and 31.66°C) and three maximum loading pressures (372, 1406 and 6080 dbar). CTD PRT temperatures were calibrated to a NBIS ATB-1250 resistance bridge and Rosemount standard PRT.

Shipboard Calibration Procedures

CTD conductivity was calibrated to *in-situ* check samples collected during each rosette cast. DSRT racks were occasionally used as independent temperature and pressure calibration checks.

Pressure and Temperature

There were no significant shifts in the pressure or temperature calibrations throughout the cruise.

Conductivity

Bottle salinities were measured with an AWI Guildline Autosal™ salinometer (50-569). IAPSO Standard Sea water batch P120 was used exclusively. CTD rosette trip pressure and temperature were used with the bottle salinity to calculate a bottle conductivity. This conductivity was then used to correct the CTD conductivity. The correction consists of a slope and offset as a function of conductivity. Two slopes were used:

Station	Conductivity slope
001-024	0.0
025-063	−0.000762972

Figure 1 summarizes the offset corrections; the residual salinity differences after applying the corrections are summarized in Figure 2.

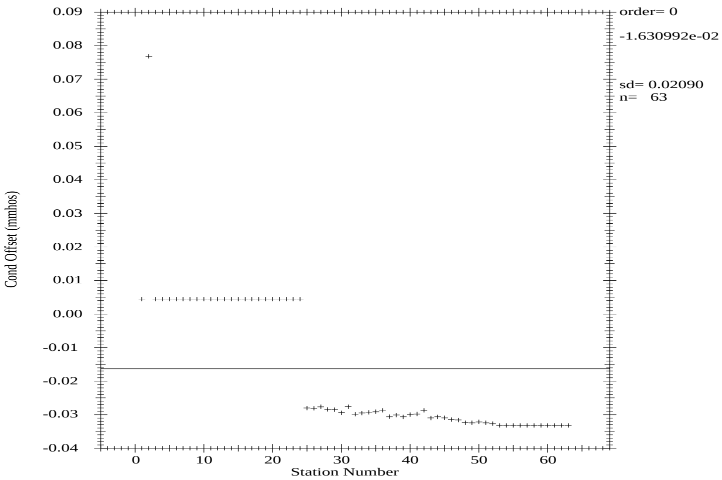

Figure 1: Conductivity offset corrections.

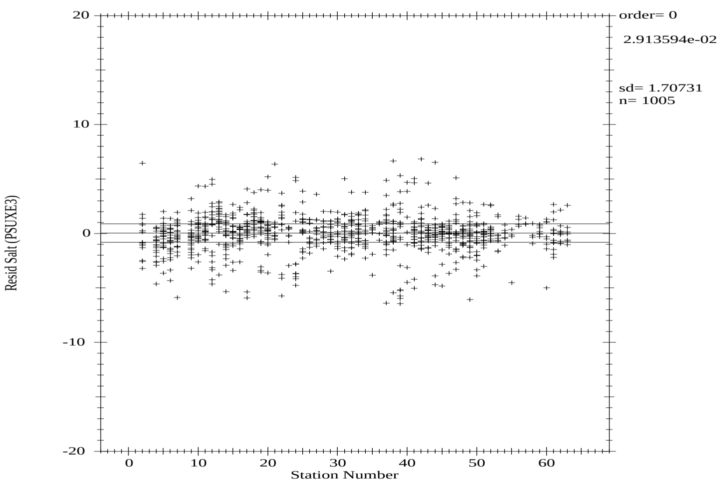

Figure 2: Salinity residual differences after correction.

There was considerable noise in the conductivity channel on stations 1 and 2. This was due to a paint chip that had delaminated from the conductivity sensor guard and interfered with the sensor. This was removed prior to station 3. The shift in the conductivity slope occurred prior to station 25 when the conductivity sensor was cleaned. A constant conductivity offset was used for stations 1 and 3-24. Station 2 required an abnormally large offset because of a conductivity shift due to the above noted problem with the sensor. For stations 25-53, conductivity offset corrections were derived for each cast. A constant conductivity offset was also used for stations 54-63.

CTD Data Acquisition and Processing

CTD data were acquired and processed in real-time on an Integrated Solutions, Inc. Optimum V workstation. The 25 Hz data from the CTD were filtered, response-corrected and averaged to a 2 Hz (0.5 second average) time-series. Sensor models for pressure, temperature and conductivity were applied. Rosette trip data were extracted from the time-series. At the end of the cast, various consistency and calibration checks were performed, and a 2.0 dbar pressure-series of the down-cast was generated and subsequently used for reports and plots.

For the final processing, the 25 Hz data were once again filtered, response-corrected and averaged to a 2 Hz time-series on a Sun SPARCstation 10 using post-cruise calibration data. Rosette trip data were re-extracted from these time-series data. The down-cast data were then pressure-sequenced in 2.0 dbar intervals. This data distribution consists of the 2.0 dbar down-cast pressure-series.

A few casts displayed conductivity offsets due to biological or particulate artifacts, or frozen sensors. In these cases the data were additionally filtered after the cast. The upper 138 dbar of station 32 were not reported in the down-cast data because of frozen sensors. Up-cast data were only reported for stations 23, 24, and 27 due to frozen sensors.

CTD and Rosette System

The ODF-modified Neil Brown MK IIIB CTD was deployed on a 24-place, 2.1 L rosette frame. An Ocean Instruments pinger was attached to the base of the frame. A Benthos altimeter provided height above the bottom in the CTD data stream. A General Oceanics 24-place Pylon was used to close bottles.

Standard CTD maintenance procedures included soaking the conductivity sensor in distilled water between casts (to maintain sensor stability) and insuring the CTD was not exposed to direct sunlight or wind (to maintain an internal equilibrated temperature).

June 2001

ODF has discovered a small error in the algorithm used to convert ITS90 temperature calibration data to IPTS68. This error affects reported Mark III CTD temperature data for most cruises that occurred in 1992-1999. A complete list of affected data sets appears below.

ODF temperature calibrations are reported on the ITS90 temperature scale. ODF internally maintains these calibrations for CTD data processing on the IPTS68 scale. The error involved converting ITS90 calibrations to IPTS68. The amount of error is close to linear with temperature: approximately -0.00024 degC/degC, with a -0.00036 degC offset at 0 degC. Previously reported data were low by 0.00756 degC at 30 degC, decreasing to 0.00036 degC low at 0 degC. Data reported as ITS90 were also affected by a similar amount. CTD conductivity calibrations have been recalculated to account for the temperature change. Reported CTD salinity and oxygen data were not significantly affected.

Revised final data sets have been prepared and will be available soon from ODF (ftp://odf.ucsd.edu/pub/HydroData). The data will eventually be updated on the whpo.ucsd.edu website as well.

IPTS68 temperatures are reported for PCM11 and Antarktis X/5, as originally submitted to their chief scientists. ITS90 temperatures are reported for all other cruises.

Changes in the final data vs. previous release (other than temperature and negligible differences in salinity/oxygen):

S04P: 694/03 CTD data were not reported, but CTD values were reported with the bottle data. No conductivity correction was applied to these values in the original .sea file. This release uses the same conductivity correction as the two nearest casts to correct salinity.

AO94: Eight CTD casts were fit for ctdoxy (previously uncalibrated) and resubmitted to the P.I. since the original release. The WHP-format bottle file was not regenerated. The CTDOXY for the following stations should be significantly different than the original .sea file values: 009/01 013/02 017/01 018/01 026/04 033/01 036/01 036/02

I09N: The 243/01 original CTD data file was not rewritten after updating the ctdoxy fit. This release uses the correct ctdoxy data for the .ctd file. The original .sea file was written after the update occurred, so the ctdoxy values reported with bottle data should be minimally different.

DATA SETS AFFECTED:

WOCE Final Data - NEW RELEASE AVAILABLE:

WOCE Section ID	P.I.	Cruise Dates
S04P	(Koshlyakov/Richman)	Feb.-Apr. 1992
P14C	(Roemmich)	Sept. 1992
PCM11	(Rudnick)	Sept. 1992
P16A/P17A (JUNO1)	(Reid)	Oct.-Nov. 1992
P17E/P19S (JUNO2)	(Swift)	Dec. 1992 - Jan. 1993
P19C	(Talley)	Feb.-Apr. 1993
P17N	(Musgrave)	May-June 1993
P14N	(Roden)	July-Aug. 1993
P31	(Roemmich)	Jan.-Feb. 1994
A15/AR15	(Smethie)	Apr.-May 1994
I09N	(Gordon)	Jan.-Mar. 1995
I08N/I05E	(Talley)	Mar.-Apr. 1995
I03	(Nowlin)	Apr.-June 1995
I04/I05W/I07C	(Toole)	June-July 1995
I07N	(Olson)	July-Aug. 1995
I10	(Bray/Sprintall)	Nov. 1995
ICM03	(Whitworth)	Jan.-Feb. 1997

non-WOCE Final Data - NEW RELEASE AVAILABLE:

Cruise Name	P.I.	Cruise Dates
Antarktis X/5	(Peterson)	Aug.-Sept. 1992
Arctic Ocean 94	(Swift)	July-Sept. 1994

Preliminary Data - WILL BE CORRECTED FOR FINAL RELEASE ONLY NOT YET AVAILABLE:

Cruise Name	P.I.	Cruise Dates
WOCE-S04I	(Whitworth)	May-July 1996
Arctic Ocean 97	(Swift)	Sept.-Oct. 1997
HNRO7	(Talley)	June-July 1999
KH36	(Talley)	July-Sept. 1999

"Final" Data from cruise dates prior to 1992, or cruises which did not use NBIS CTDs, are NOT AFFECTED.

post-1991 Preliminary Data NOT AFFECTED:

Cruise Name	P.I.	Cruise Dates
Arctic Ocean 96	(Swift)	July-Sept. 1996
WOCE-A24 (ACCE)	(Talley)	May-July 1997
XP99	(Talley)	Aug.-Sept. 1999
KH38	(Talley)	Feb.-Mar. 2000
XP00	(Talley)	June-July 2000

F. Summary and first results

(R. Gersonde)

Expedition ANT-X/5 was the first geoscientific and hydrographic oriented expedition with RV "Polarstern" to the Scotia Sea and adjacent areas. The cruise was carried out during southern winter (8.8.92 - 26.9.92) and thus about 2000 nm of the ca. 6000 nm long cruise track from Puerto Madryn to Punta Arenas was in dense pack ice at temporarily extremely low air temperatures (Fig. 1). Despite this, a large amount of data and samples were collected (Tab. 1). Indeed work was possible within the sea ice even in high winds, which would have prevented works in the open water. On the other hand the sea ice conditions occasionally dictated the cruise track, A transect originally planned from the Georgia Basin to the Islas Orcadas Rise was cancelled to save time for crossing the pack ice. Also the planned circuit of the southern inlet of the South Sandwich Trench was prevented by dense pack ice.

Expedition ANT-X/5 was focused on a marine geologic survey. Sampling programs (see 6.0) were carried out on five transects (Transect A - E, Figs. 2 - 6) in the southern Argentine Basin, the East Georgia Basin, east of the South Sandwich Trench, in the Scotia Sea, and the eastern Drake Passage (Fig. 1). This region of the Southern Ocean is characterized by complex bottom topography with deep sea channels and trenches, and ridge systems. Similarly, the hydrographic pattern, which at least in some regions is controlled by the sea floor topography, is also rather complex. The western section of the Atlantic Southern Ocean is known as the major outflow region of cold Antarctic bottom waters and the oceanic frontal systems show distinct loops and merge together in some areas (Fig. 1).

During the marine geological program at a total of 68 positions surface sediment samples were collected (Tab. 1, see 6.1 Fig. 33). The rather large number of samples is due to the fact that beside geoscientific stations with multicorer sampling (MUC) surface sediment samples were also recovered at many hydrographic stations with an instrument (Minicorer, MIC) which was installed below the CTD. Together with the sample sets collected during expeditions ANT-VIII/3 (GERSONDE & HEMPEL 1990) and ANT-IX/4 (HUBBERTEN in BATHMANN et al. 1992) there is now a surface sediment sample set, that covers large parts of the region underlying the Antarctic Circumpolar Current (ACC) in the Atlantic sector. This sample set is being studied with sedimentological methods, to map the distribution pattern of different sediment components such as clay minerals, organic carbon, quartz, biogenic opal, and barium in the Southern Ocean. Micropaleontological and isotopic studies are being carried out to document the distribution pattern of living (benthic foraminifera) and dead (diatoms, radiolarians, foraminifer) microorganisms and to compare them with the present hydrographic situation. The obtained results are also combined with results from studies in the water column (s. 3.0). Altogether these data are needed as a base for paleoceanographic reconstructions carried out on sediment cores. Surface sediment samples were also studied for geochemical investigation of early diagenetic processes at the sediment/water interface which have a strong influence on the preservation of paleoenvironmental signals in the sediment record and the compound budgets of the ocean (see 6.7).

Besides surface samples, sediment cores were recovered successfully at 40 stations with the gravity corer (SL) or the piston corer (KOL) to a total length of almost 400 m (Tab. 1, see 6.1 Fig. 33). The high average of core recovery - total length of the individual cores is in average 10 to 12 m (Fig. 35) - was possible by a precise selection of coring localities, which relied on the continuously conducted bathymetric survey with the Hydrosweep system and high resolution sediment-echosounding profiling with the Parasound system (see 4.1, 4.2). For this reason it was also possible for the first time to recover relatively long sediment cores in the Scotia Sea area.

The documentation of the bathymetry with isolines and three-dimensional maps based on Hydrosweep data also gives important morphological information on the area surrounding sample stations which then can be considered during interpretation of sedimentological data. The digital recorded Parasound signals will be compared with sedimentological and geophysical data obtained from the sediment cores (see 6.3). The aim of this study is to correlate the reflectors recorded by Parasound with sediment layers in the cores. It will thus be possible to date the reflectors and the events related to them, and subsequently to chart them over larger distances.

Paleoceanographic reconstructions carried out on sediment cores provide information on the development of the ACC (paleotemperature estimations, reconstruction of frontal systems), the variability of sea ice coverage and paleoproductivity, and the history of deep and bottom water masses in the Atlantic sector of the Southern Ocean during the late Quaternary time interval (ca. last 1 Mio. years). One objective of these studies is the understanding of feedback mechanisms influencing the rapid climatic changes during the late Pleistocene. These topics are worked up in detail within the frame of the Sonderforschungsbereich 261, concentrating on paleoenvironmental reconstructions of the last 300.000 years. The sediment core materials obtained during ANT-X/5 contain late Quaternary sections with high temporal resolution (s. 6.5), With such material it will be possible to complement on-going paleoceanographic reconstructions in the eastern sector of the Southern Ocean.

In the course of Transects A and B (southern Argentina Basin) on a total length of more than 500 km wavy sediment structures (mud waves) were recorded. These reached heights of 120 m and were up to 3 - 4 km long (see 4.2, Figs. 24, 25). Such structures, are widespread in the Argentine Basin and can be related to bottom water currents (e.g., LEDBETTER & KLAUS 1987). First results from sediment cores recovered from mud waves show that these sediments are finely grained and may contain well preserved siliceous microfossil assemblages. Preliminary dating of the cores results in sedimentation rates around 1 cm/1000 years (see 6.5).

At the flanks of the Northeast Georgia Rise (Transact C, Fig. 4) and the Bruce Bank (Transect D, Fig. 5) surface sediments and sediment cores were taken on depths transects of several 1000 meters in order to obtain information on the sedimentation pattern in different water depth and water masses. From this, signals can be obtained, which allow the reconstruction of the variability in the activity and thickness of the outflowing cold Antarctic bottom water during late Pleistocene climatic cycles.

First sedimentological, geochemical and micropaleontological data obtained on cores, which have been recovered on Transects C and D, indicate that the sedimentation pattern of late Quaternary deposits in the western sector of the southernmost Atlantic differs from that in the eastern sector recorded by earlier expeditions (e.g. GERSONDE & HEMPEL 1990, HUSBERTEN in BATHMANN et al. 1992). The zone of high late Quaternary sedimentation rates was found well south of the Polar Front and extends into the area seasonally covered by sea ice. First estimations of sedimentation rates (see 6.5) show that the results of DEMASTER (1981) indicating no accumulation of biogenic opal during the Holocene must be revised. High post-glacial sedimentation rates of diatomaceous muds and oozes ranging up to 70 cm per 1000 years have been found in cores from Transect D. In fact, high biogenic sedimentations rates are also supported by the strong oxygen consumption rates measured in surface sediments of the Scotia Sea (see 6.7, Fig. 43).

On the Transect E which crosses the eastern part of the Drake Passage only two relatively short sediment cores could be gathered, Only rarely the Parasound-echosounding system indicated some minor penetration (Fig. 6), which can be interpreted to indicate an environment affected by strong bottom water velocities. Nevertheless, a large number of surface sediments was collected using the MIC at most of the hydrographic stations. On the transect, Parasound indicated higher penetration depths only in one area, located southwest of the Falkland Islands. Unfortunately bad weather conditions prevented geologic sampling in this area underlying the Falkland Current.

Besides the collection of sediment materials an actuopaleontological sampling program was carried out to collect calcareous and siliceous microorganisms in the water column (see 3.4). Sampling used multinets at 23 sites, plankton nets at 26 sites (Tab. 1) and a ship's pumping system (368 samples). The samples are used for the delineation of species distribution patterns in the Southern Ocean in relation to hydrography and environmental conditions, such as nutrient availability and sea ice. Such data are fundamental for the definition of paleoenvironmental marker species and assemblages.

Another geological program dedicated to study geodynamic processes in the collision zone of converging plates was carded out in the eastern part of the Scotia Sea (see 5-0). It was a pre-investigation for a larger expedition program planned for 1995 with the aim of studying the petrological and geochemical evolution of the Scotia Arc and associated back-arc magmatism, and the submarine fluid venting at the collision zone and the backarc area. Three dredge hauls were carried out in the fore-arc region (western flank of the South Sandwich Trench). They recovered mostly lithified sediments. The Miocene age Of the sediments (see 6.5) gathered from a fore-arc hill suggests that older sediment was "scraped off" during subduction of the South American Plate. A so-called "wax corer' was used at eight sites in the area of one segment of the South Sandwich spreading center (back-arc area) in order to study its small scale geochemical variability. For the documentation of the spreading center morphology and for the selection of sampling sites ca. 2000 km2 were mapped with the Hydrosweep system (see 4.1, Figs. 22, 23). In addition gravimetric measurements were carried out to enable three-dimensional gravity modeling of the spreading center (see 4.3, Fig. 28). For the study of processes related with fluid venting water samples were taken. in the areas of tectonic activity for helium and methane measurements (see 5.2).

Besides geology a comprehensive hydrographic program with a total of 63 hydrographic stations using CTD and rosette (Tab. 1), and the deployment of 70 XBTs was accomplished successfully (see 3.1). The survey was focused at selected sections of the Transects B, C, D and E in order to obtain fulldepth measurements of temperature, salinity, dissolved oxygen and nutrients (N, P, Si) for charting the oceanic frontal systems of the ACC and investigation of upper-level mixing. Thereby the first comprehensive oceanographic data set could be established recording the hydrographic conditions during austral winter in the area of the Scotia Sea and adjacent seas, In addition, five satellite-tracked drifting-buoys were released shortly after leaving Puerto Madryn, and three more were launched south of the Falkland Islands, in order to obtain direct measurements of the upper-level velocity of the Falkland Current (see 3.1.2).

The preliminary results of the hydrographic survey in the southern Argentine Basin indicate that a hypothesized deep winter overturning of Subantarctic waters in that area cannot be supported by the measurements obtained during ANT-X/5. The observation of PETERSON & WHITWORTH (1989) of the mergence of the Subantarctic and Polar Front at the southern boundary of the Argentine Basin and their loop southward into the Georgia Basin through a gap in the Falkland Ridge system were however supported by the survey on Transect B. The data also suggest, that this area may be an important key area controlling the northward flow of cold Antarctic Bottom Water and the poleward transport in heat and salt. It was also found, that during austral winter especially the southern boundary of the ACC is located quite far north of its position measured during summer (PETERSON & STRAMMA 1991, Fig. 10), suggesting a northward shift on the ACC circulation pattern during winter.

Water samples were also collected for the study of stable oxygen and carbon isotopes using the rosette bottles and the supernatant in MUC and MIC tubes. This program which complements studies carried out during former expeditions with RV "Polarstern" to the Southern Ocean is in close connection to marine geologic studies (see 3.2).

Smaller programs were dedicated to biological and microbiological studies. The photodependence and chronodependence to the diel vertical migrations of zooplankton in southern high-latitudes was studied during on-board experiments (see 3.5). For the study of microscopic investigations of biofilms on sediment surfaces and the experimental fossilization of deep-sea microbes surface sediments were collected with the multi- and the minicorer (see 7.0).