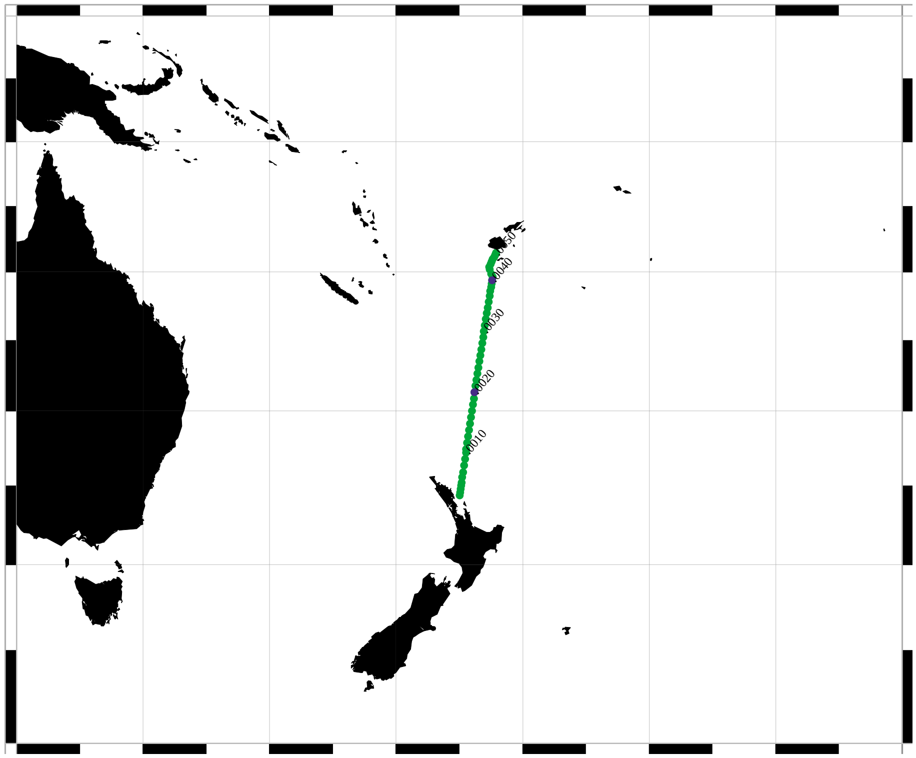
A. Cruise Narrative: P14C



A.1. Highlights

WHP Cruise Summary Information

WOCE section designation	**P14C**
Expedition designation (EXPOCODE)	**316N138_7**
Chief Scientist(s) and their affiliation	**Dean Roemmich/SIO***
Dates	1992.SEP.01 - 1992.SEP.15
Ship	R/V Knorr
Ports of call	Auckland, New Zealand to Suva, Fiji
Number of stations	52
Geographic boundaries of the stations	18° 32.3' S 175° 2.20 ' E 177° 56.10 ' E 35° 38' S
Floats and drifters deployed	Twelve floats
Moorings deployed or recovered	none
Contributing Authors	Kristin Sandborn, Mark J. Warner, Xin Bu, Marie-Claude Beaupre, Mary C. Johnson, Arnold Mantyla, David Wisegarver, Robert M. Key

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WHP Cruise and Data Information

Instructions: Click on any item to locate primary reference(s) or use navigation tools above.

Cruise Summary Information

Description of scientific program

Geographic boundaries of the survey
Cruise track (figure)
Description of stations
Description of parameters sampled

Floats and drifters deployed
Moorings deployed or recovered

Principal Investigators for all measurements
Cruise Participants

Hydrographic Measurements

CTD - general
CTD - pressure
CTD - temperature
CTD - conductivity/salinity
CTD - dissolved oxygen

Salinity
Oxygen
Nutrients
CFCs

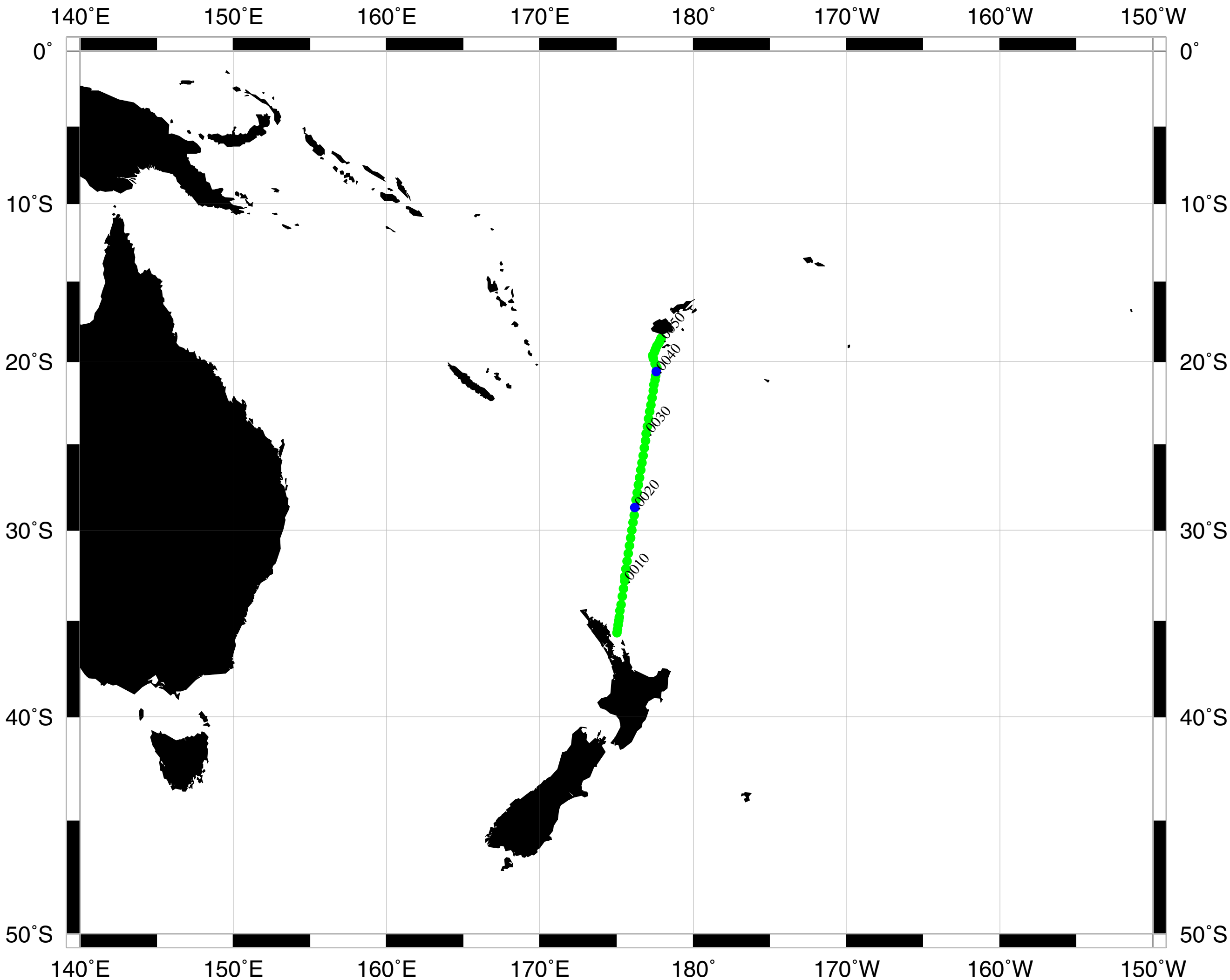
References - HYD
References - C14

DQE Reports

CTD
S/O2/nutrients
CFCs
14C

Data Processing Notes

Station locations for P14C : ROEMMICH



Produced from .sum file by WHPO-SIO

A.2. Cruise Summary

A.2.a Geographic boundaries

A.2.b Stations occupied

A total of 52 conductivity-temperature-depth (CTD) stations were made along the main track with up to 36 ten-liter water samples collected at each station. The CTD also carried an oxygen sensor and transmissometer. Stations extended from the ocean surface to within about 10 m of the bottom. All water samples were analyzed for salinity, dissolved oxygen and nutrient (nitrate, nitrite, silicate, phosphate) concentrations.

A.2.c Floats and drifters deployed

At 12 locations along the track, neutrally buoyant floats were deployed for Russ Davis(Scripps Institution for Oceanography). These were ballasted to float at 850 m depth, returning to the ocean surface to report their positions monthly via satellite.

A.2.d Moorings deployed or recovered

A.3 List of Principal Investigators

Table 1: List of Principal Investigators

Name	Responsibility	Institution
Dean Roemmich	Chief Scientist	Scripps
Bruce Cornuelle	Co-Chief Scientist	Scripps
Mark Warner	CFCs(11 & 12)	UW
William Jenkins	Tritium, Helium	WHOI
John Downing	CO2	BMSU
Robert Key	C14	Princeton University

Scripps: Scripps Institution of Oceanography
UW: University of Washington
WHOI: Woods Hole Oceanographic Institution
BMSU: Battelle Marine Science University

A.4 Scientific Programme and Methods

WOCE Leg P14C was carried out on R/V Knorr, sailing from Auckland, New Zealand on September 1 and arriving in Suva Fiji on September 15. Principal scientific objectives of WOCE are to determine the large-scale circulation of the ocean from surface to bottom including the fluxes of mass, heat and salt and to provide datasets necessary for modeling of ocean circulation and the ocean climate system. Line P14c focuses on eastward flowing waters of the subtropical gyre which carry heat away from the Australian continent into the interior of the ocean. In addition to the surface waters, the transect also sampled intermediate layers of Antarctic origin and deep layers of the nearly enclosed South Fiji Basin.

Due to favorable weather and having had no serious equipment breakdowns, the main track was completed a day ahead of schedule. In order to investigate a relatively strong current observed in the Kadavu Passage and to facilitate testing of the ship's backup winch, 16 shallow CTD stations (to 1000m depth) were carried out within the Kadavu Passage adjacent to the main track. No water samples were collected at these stations. In addition to the shipboard scientific party from U.S. institutions, participants from southwest Pacific countries included Mattias Tomczak and Cesar Villanoy from Flinders University, Australia, Leba Savu from University of the South Pacific, Fiji, and Basil Stanton from New Zealand Oceanographic Institute, New Zealand.

A.5 Major Problems and Goals not Achieved

A.6 Other Incidents of Note

A.7 List of Cruise Participants

Table 2: List of Cruise Participants

Name	Institution
Dean H. Roemmich	Scripps
James A. Wells	Scripps
Marie-Claude Beaupre	Scripps
Carl Mattson	Scripps
Leonard Lopez	Scripps
Franklin M. Delahoyde	Scripps
Barry J. Nisly	Scripps
Stanley Rosenblad	WHOI
Linda S. Bingler	Battelle
Matthias Tomczak	Flinders Institute
Cesar Villanoy	Univ. of Philippines
Bruce Cornuelle	Scripps
Sherry Gripp	Scripps
John Boaz	Scripps
Mark Warner	Univ. of Washington
Xin Bu	Univ. of Washington
Dempsey Lott	WHOI
Leba C.H. Savu	Univ. of the S. Pacific
Basil Stanton	N.Z. Oceanographic Inst.
Michael Kosro	Oregon State University
Tasha Zahn	Princeton University

B. HYDROGRAPHIC MEASUREMENT TECHNIQUES AND CALIBRATIONS (Kristin Sandborn/ODF)

B.1 DESCRIPTION OF MEASUREMENT TECHNIQUES AND CALIBRATIONS

Hydrographic casts (ODF CTD/rosette) were carried out with a NBIS (Neil Brown Instrument System) CTD and a 36 bottle rosette sampler of ODF manufacture using General Oceanics pylons. An ODF-modified NBIS Mark 3 CTD, a Benthos altimeter, a SensorMedics oxygen sensor and a SeaTech transmissometer provided by Texas A&M University (TAMU) were mounted on the rosette frame. Deep Sea Reversing Thermometers were used on this leg. Seawater samples were collected in 10-liter PVC ODF bottles mounted on the rosette frame. The frame was a 36-place dual-ring (12-bottle inner, 24-bottle outer) ODF Rosette. There were initially problems with pylons and bottles (lanyard lengths, leaks), but tripping problems mostly cleared up by Station 010. A Benthos pinger 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 three-conductor ElectroMechanical (EM) cable which provided power to the CTD and relayed the CTD signal to the laboratory.

Each CTD cast extended to within approximately 10 meters of the bottom unless the bottom returns from both the pinger and the altimeter were extremely poor. The bottles were numbered 1 through 36. When one of these 36 bottles needed servicing and repairs could not be accomplished by the next cast, the replacement bottle was given a new number. The replacement bottles were numbered 37 through 40. 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 to the Chief Scientist.

After each rosette cast was brought on board, water samples were drawn in the following order: Freon (CFC-11 and CFC-12), Helium-3, Oxygen, Total CO2, AMS 14C, and Tritium. Nutrients (silicate, phosphate, nitrate and nitrite), and Salinity are drawn next and could be sampled in arbitrary order. The identifiers of the sample containers and the numbers of the ODF samplers from which the samples were drawn were recorded on the Sample Log sheet at the time of the draw by a "bottle cop" responsible for keeping the log. Normal ODF sampling practice is to open the drain valve before opening the air vent to see if water escapes, indicating the presence of a small air leak in the sampler. This observation ("air leak"), and other comments ("lanyard caught in lid", "valve left open", etc.) which may indicate some doubt about the integrity of the water samples were also noted on the Sample Log sheets. These comments are included in this documentation with analyst and investigator comments. These include property/propery checks on data quality and sampler and analyst performance.

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 usable, though not final, state at sea. ODF data checking procedures included verification that the sample was assigned to the correct depth. 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. The oxygen and nutrient data were compared by ODF with those from adjacent stations. Any comments regarding the water samples were investigated. The raw data computer files were also checked for entry errors that could have been made on the station number, bottle number and/or flask number as would be the case for oxygens. The salinity and oxygen values were transmitted from PC's attached to either the salinometer or oxygen titration system. Nutrients were manually entered into the computer; therefore these values were double checked for data entry errors.

Investigation of data included comparison of bottle salinity and oxygen 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 analysis and sampling notes, plots, and nearby data were reviewed. If any problem was indicated, the data value was flagged. Section E, the Quality Comments, includes comments regarding missing samples and investigative remarks for comments made on the Sample Log sheets, as well as all flagged (WOCE coded) data values other than 2, an acceptable measurement.

The WOCE codes were assigned to the water data using the criteria:

code 1 = Sample for this measurement was drawn from water bottle, but results of analysis not received.

code 2 = Acceptable measurement.

code 3 = Questionable measurement. Does not fit station profile or adjoining station comparisons. No notes from analyst indicating a problem. Datum could be real, but the decision as to whether it is acceptable will be made by a scientist rather than ODF's technicians.

code 4 = Bad measurement. Does not fit station profile and/or adjoining station comparisons. There are analytical notes indicating a problem, but data values are reported. ODF recommends deletion of these data values. Analytical notes for salinity and/or oxygen may include large differences between the water sample and CTD profiles. Sampling errors are also coded 4.

code 5 = Not reported. ODF avoids using this code, all data are reported.

code 9 = Sample for this measurement not drawn. Quality flags assigned to parameter BTLNBR (bottle number) as defined in the WOCE Operations manual are further clarified as follows:

code 4 = If the bottle tripped at a different level than planned, ODF assigned it a code 4. If there is a 4 code on the bottle, and 2 codes on the salinity, oxygen and nutrients then the reassigned pressure was probably correct. If there is a 4 code on the bottle, and 4 codes on the salinity, oxygen and nutrients then the pressure assignment was probably incorrect and an appropriate pressure could not be obtained.

code 3 = An air leak large enough to produce an observable effect on a sample is identified by a 3 code on the bottle and 4 code on the oxygen. (Small air leaks may have no observable effect, or may only affect gas samples).

The following table shows the number of ODF samples drawn and the number of times each WOCE sample code was assigned.

ROSETTE SAMPLES

Stations 1-52

	Reported levels	Bottle Codes				Water Sample Codes					
		2	3	4	9	1	2	3	4	5	9
BTLNBR	1541	1455	13	48	25						
SALNTY	1516					10	1467	5	34	0	25
OXYGEN	1514					4	1471	11	28	0	27
SILCAT	1512					7	1460	0	45	0	29
NITRAT	1512					1	1488	4	19	0	29
NITRIT	1512					1	1492	0	19	0	29
PHSPHT	1512					1	1490	1	20	0	29

B.2 CTD PRESSURE, TEMPERATURE, SALINITY AND OXYGEN

All CTD pressure, temperature and salinity data reported with the bottle data are from upcasts and correspond to the CTD data being acquired at the time a bottle was tripped. The CTD pressure and temperature data have been corrected based on laboratory calibrations. The CTD salinity data are calibrated to bottle data, as described in the CTD processing section which is submitted separately. The CTD oxygen data reported in bottle files are mostly from processed downcast pressure-series data; occasionally an upcast had to be used because of problems with the downcast. The CTD oxygen data were matched to bottle stops along common isopycnals, and inserted into the bottle files. All reported CTD data are calibrated and processed with the methodology described in the documentation accompanying the CTD data submission. The CTD data and documentation are submitted separately.

The temperatures are based on the International Temperature Scale of 1990. Potential temperature is calculated using the equations of Fofonoff.

B.3 SALINITY

A single ODF-modified Guildline Autosal Model 8400A salinometer (Serial Number 57-396), located in a temperature-controlled laboratory, was used to measure salinities. The salinometer was standardized for each cast with IAPSO Standard Seawater (SSW) Batch P-120, using at least one fresh vial per cast. Analyses and data acquisition were controlled by a small computer through an interface board designed by ODF. The salinometer cell was flushed until successive readings met software criteria, then two successive measurements were made and averaged for a final result.

Salinity samples were drawn into 200 ml Kimax high alumina borosilicate bottles, after 3 rinses, and were sealed with custom-made plastic insert thimbles and Nalgene screw caps. This assembly provides very low container dissolution and sample evaporation. If loose inserts were found, they were replaced to ensure an airtight seal. Salinity was determined after sample equilibration to laboratory temperature, usually within 8-36 hours of collection. Salinity was calculated according to the equations of the Practical Salinity Scale of 1978 (UNESCO, 1981). The estimated accuracy of bottle salinities run at sea is usually better than 0.002 psu relative to the particular Standard Seawater batch used. 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. This cruise achieved an accuracy of better than 0.001 psu. Salinity samples were compared with CTD data and significant differences were investigated.

B.4 OXYGEN

Dissolved oxygen analyses were performed with an SIO-designed automated oxygen titrator using photometric end-point detection based on the absorption 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 modified-Winkler titration following the technique of Carpenter (1965) with modifications by Culberson et al. (1991), but with higher concentrations of potassium iodate standard (approximately 0.012N) and thiosulfate solution (50 gm/l). Standard solutions prepared from pre- weighed potassium iodate crystals were run at the beginning of each session of analyses, which typically included from 1 to 3 stations. Several standards were made up during the cruise 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. The auto-titrator generally performed very well.

Samples were collected for dissolved oxygen analyses soon after the rosette sampler was brought on board and after CFC and helium were drawn. Nominal 125 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 MnO(OH)2 precipitate. The samples were analyzed within 4-36 hours of collection.

Draw temperatures were very useful in detecting possible bad trips even as samples were being drawn. The data were logged by the PC control software and then transferred to the Sun (the main computer) and calculated.

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

Oxygens were converted from milliliters per liter to micromoles per kilogram using the in-situ temperature. Ideally, for whole-bottle titrations, the conversion temperature should be the temperature of the water issuing from the Niskin bottle spigot. The sample temperatures were measured at the time the samples were drawn from the bottle, but were not used in the conversion from milliliters per liter to micromoles per kilogram because the software is not available. Aberrant drawing temperatures provided an additional flag indicating that a bottle may not have tripped properly. Measured sample temperatures from mid-deep water samples were about 4-7 degree C warmer than in-situ temperature. Had the conversion with the measured sample temperature been made, converted oxygen values, would be about 0.08% higher for a 6 degree C warming (or about 0.2umol/kg for a 250umol/kg sample).

Oxygen flasks were calibrated gravimetrically with degassed deionized water (DIW) to determine flask volumes at ODF's chemistry laboratory. This is done once before using flasks for the first time and periodically thereafter when a suspect bottle volume is detected. All volumetric glassware used in preparing standards is calibrated as well as the 10ml Dosimat buret used to dispense standard Iodate solution.

Iodate standards are pre-weighed in ODF's chemistry laboratory to a nominal weight of 0.44xx grams and exact normality calculated at sea. Potassium Iodate (KIO_3) is obtained from Johnson Matthey Chemical Co. and is reported by the suppliers to be > 99.4% pure. All other reagents are "reagent grade" and are tested for levels of oxidizing and reducing impurities prior to use.

B.5 NUTRIENTS

Nutrient analyses (phosphate, silicate, nitrate and nitrite) were performed on an ODF-modified AutoAnalyzer II, generally within one hour of the cast, although some samples may have been refrigerated at 2 to 6 degree C for a maximum of 4 hours. The procedures used are described in Gordon et al. (1992) except as noted below. The AA generally performed well, with minor pump and sampler problems. A new PC/Sun-based data acquisition system was used to acquire data and detect peaks. All peaks were logged through ODF's nutrient acquisition system, and all the runs were manually re-read to check for possible computer reading errors.

Silicate is analyzed using the basic method of Armstrong et al. (1967). Ammonium molybdate is added to a seawater sample to produce silicomolybdic acid which is then reduced to silicomolybdous acid (a blue compound) following the addition of stannous chloride. The sample is passed through a 15mm flowcell and measured at 820nm. ODF's methodology is known to be non-linear at high silicate concentrations >120uM; consideration of this non-linearity is included in ODF's software.

A modification of the Armstrong et al. (1967) procedure is used for the analysis of nitrate and nitrite. For nitrate analysis, a seawater sample is passed through a cadmium column where the nitrate is reduced to nitrite. This nitrite is then reacted with sulfanilamide and coupled with N-(1-naphthyl)-ethylenediamine to form a red azo dye. The sample is then passed through a 15mm flowcell and measured at 540nm. The procedure is the same for the nitrite analysis less the cadmium column. A 50mm flowcell is required for nitrite (NO2).

Phosphate is analyzed using a modification of the Bernhardt and Wilhelms (1967) method. Ammonium molybdate is added to a seawater sample to produce phosphomolybdic acid, which is then reduced to phosphomolybdous acid (a blue compound) following the addition of dihydrazine sulfate. The sample is passed through a 50mm flowcell and measured at 820nm.

Nutrient samples were drawn into 45 ml high density polypropylene, narrow mouth, screw-capped centrifuge tubes which were rinsed three times before filling. Standardizations were performed at the beginning and end of each group of analyses (one cast, usually 36 samples) with a set of an intermediate concentration standard prepared for each run from secondary standards. These secondary standards were in turn prepared aboard ship by dilution from dry, pre-weighed primary standards. Sets of 5-6 different concentrations of shipboard standards were analyzed periodically to determine the deviation from linearity as a function of concentration for each nutrient.

Nutrients, reported in micromoles per kilogram, were converted from micromoles per liter by dividing by sample density calculated at zero pressure, in-situ salinity, and an assumed laboratory temperature of 25 degree C.

Silicate primary, Na2SiF6, standard is obtained from Fluka Chemical Company and Fischer Scientific and is reported by the suppliers to be >98% pure. Nitrate, KNO3, nitrite, NaNO2, and phosphate, KH2PO4, primary standards are obtained from Johnson Matthey Chemical Co. and the supplier reports a purity of 99.999%, 97%, and 99.999%, respectively.

B.6 *CFC-11 and CFC-12 Measurements* - WOCE P14C

(Mark J. Warner, Xin Bu)

B.6.a Sample Collection and Analysis

Samples for CFC analysis were drawn from the 10-liter Niskins into 100-cc ground glass syringes fitted with plastic stopcocks. These samples were the first aliquots drawn from the particular Niskins. There is no evidence of high contamination levels of the CFC samples resulting from the Niskin bottles.

The samples were analyzed using the CFC extraction and analysis system of Dr. Ray Weiss of Scripps Institution of Oceanography. The analytical procedure and data analysis are described by Bullister and Weiss (1988). This analytical system had been used during WHP section P6, and had remained set up in the main laboratory of the RV Knorr with carrier gas flushing the system during the month-long break between WOCE legs. The CFC concentrations in air were measured approximately twice per day during this expedition. Air was pumped to the main laboratory from the bow through Dekabon tubing.

Calibration working standard, calibrated on the SIO1986 scale, was used to calibrate the response of the electron capture detector of the Shimadzu Mini-2 GC to the CFCs. This standard, Airco cylinder CC70135, contained gas with CFC-11 and CFC-12 concentrations of 271.9 parts per trillion (ppt) and 502.2 ppt, respectively. To convert these results to the SIO1993 scale, CFC-11 concentrations need to be multiplied by 0.9755 and CFC-12 concentrations need to be multiplied by 1.0128.

B.6.b Sampling Blanks

There is always a small amount of contamination of the CFCs in the sampling and analysis of water samples. We have attempted to estimate this level of contamination by taking the mode of measured CFC concentration in samples which should be CFC-free. In this region, measurements of other transient tracers such as carbon-14 indicate that the deep waters are much older than the CFC transient. We have used all samples deeper than than 2000 meters to determine the blanks of 0.0055 picomoles per kilogram (pmol/kg) for CFC-11 and 0.0035 pmol/kg for CFC-12. These concentrations have been subtracted from all the reported dissolved CFC concentrations.

B.6.c Data

In addition to the CFC concentrations which have merged with the .SEA file, the following three tables have been included to complete the data set. The first two are tables of the duplicate samples. The third is a table of the atmospheric CFC concentrations interpolated to each station.

Table 1: CFC-11 Concentrations in Replicate Samples

Station	Sample	CFC-11
3	124	2.622
3	124	2.651
7	214	2.609
7	214	2.620
9	136	-0.002
9	136	-0.004
13	123	0.036
13	123	0.035
27	141	2.151
27	141	2.125
33	103	2.011
33	103	2.043
39	114	1.886
39	114	1.841

Table 2: CFC-12 Concentrations in Replicate Samples

Station	Sample	CFC-11
3	124	1.310
3	124	1.339
7	214	1.323
7	214	1.338
9	136	-0.002
9	136	0.002
13	123	0.024

Station	Sample	CFC-11
13	123	0.027
27	141	1.083
27	141	1.075
33	103	1.021
33	103	1.020
39	114	0.955
39	114	0.930

Table 3: Atmospheric CFC Concentrations

STATION NUMBER	F11 PPT	F12 PPT
1	266.5	494.3
2	266.5	494.3
3	266.5	494.3
4	266.4	495.6
5	266.5	494.3
6	266.5	494.3
7	266.5	494.3
8	266.5	494.3
9	266.5	494.3
10	266.5	494.3
11	266.5	494.3
12	266.5	494.3
13	266.4	495.6
14	266.4	495.6
15	266.3	496.1
16	266.3	496.1
17	266.2	494.9
18	266.2	495.0
19	266.2	495.0
20	265.9	495.0
21	265.9	495.0
22	266.1	493.7
23	266.1	491.7
24	266.1	491.7
25	265.4	491.5
26	265.2	491.0

STATION NUMBER	F11 PPT	F12 PPT
27	265.2	491.0
28	265.3	492.9
29	264.7	494.0
30	264.7	494.0
31	264.9	493.5
32	265.5	494.6
33	265.2	494.2
34	265.0	492.8
35	265.5	493.2
36	265.7	493.8
37	265.7	493.8
38	266.2	494.1
39	266.2	494.1
40	266.1	493.6
41	266.0	493.5
42	266.0	493.5
43	266.0	494.1
44	266.0	494.1
45	265.8	494.2
46	265.8	494.2
47	265.8	494.2
48	265.8	494.2
49	265.8	494.2
50	265.8	494.2
51	265.8	494.2
52	265.8	494.2

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B.8 QUALITY COMMENTS

Remarks for deleted samples, missing samples, and WOCE codes other than 2 from WOCE P14C. Investigation of data may include comparison of bottle salinity and oxygen data with CTD data, review of data plots of the station profile and adjoining stations, and rereading of charts (i.e., nutrients). Comments from the Sample Logs and the results of ODF's investigations are included in this report.

Station 003

134 @ 580db	Salinity drawn, not analyzed. Salinometer log: "Salt bottle cracked." Footnote salinity sample lost.

Station 005

117 @ 2db	Salinity was not listed on Sample Log Sheet, but sample was analyzed.

Station 006

116 @ 103db	Sample log: "leaking from bottom lid." Samples appear to be okay.
121 @ 337db	Sample log: "Lids not closed properly." PI: "open Niskin lid, O2 certainly too high, S probably too high. O2 should be deleted." Delta-S at 338db is 0.1417, salinity is 35.183. Footnote bottle leaking, samples bad. ODF recommends deletion of water samples.
127 @ 905db	Sample log: "Lids lost, no samples drawn."
130 @1209db	Delta-S at 1209db is 0.0092, salinity is 34.511. Salinometer took many tries to get two comparable readings. Sample must have been contaminated, maybe a salt crystal. Footnote salinity bad. ODF recommends the deletion of salinity. Other samples appear to be okay. Salinity agrees with Stations 008 and 009.
136 @1826db	Sample log: "O2 redrawn." Oxygen appears to be okay.

Station 007

214 @ 16db	Sample log: "leaking valve." Delta-S at 16db of 2nd run is 0.0309, salinity is 35.490. Used original run value. Delta-S is now .0187. Salinity acceptable for shallow water. Oxygen and other samples appear to be okay.
217 @ 150db	Sample log: "leaking bottle." Samples appear to be okay.
221 @ 343db	Sample log: "leaking valve." Samples appear to be okay.
222 @ 386db	Sample log: "leaking bottle."

223 @ 473db Delta-S at 474db is 0.0778, salinity is 34.984. Suspect salinity value effected by salinometer problems. Footnote salinity bad. ODF recommends the deletion of salinity.

227 @ 840db Sample log: "valve drips." Samples appear to be okay.

Station 008

117 @ 154db Sample log: "Leaks." Samples appear to be okay.

118 @ 203db PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis." NO2 low compared to adjoining stations and station profile. Re-reread chart and peak good just very low. NO3 agrees with adjoining stations. Footnote no2 uncertain.

119 @ 254db PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis." nuts -- suspicious n:p ratio Oxygen and no2 appears high, no3, po4, and sil low compared with adjoining station plots. Salinity and oxygen slightly high compared with CTD. Based on comments by PI and comparison of data, footnote samples bad which in turn would indicate a bottle problem, so footnote bottle leaking. However, one confusing factor is the no2, there is not a data value as high in the upper water column. ODF recommends the deletion of water samples.

121 @ 404db Sample log: "Leak at vent." Samples appear to be okay.

122 @ 504db Sample log: "Leaks." Samples appear to be okay.

125 @ 802db Delta-S at 804db is 0.013, salinity is 34.480. Oxygen: "poor peak." Oxygen appears to be okay.

135 @2203db Sample log: "Leaks barely at lower end." Samples appear to be okay.

Station 009

105 (No Pressure) Sample log does not indicate there was water in the bottles, and the bottles are lined through. No water samples drawn, level not reported in data set.

106 (No Pressure) See 105 comment.

107 @ 2db Sample log indicates that bottles tripped incorrectly, (7 tripped at the surface). But console ops indicates that there were 32 confirmations and that 7 tripped at 50db and not at the surface as the sample log indicates. Console ops has a note: 11 & 12 (250 & 300) not tripped. Appears that bottles did not trip as scheduled, data tripping sequence has been corrected to 107-112

108 @ 15db See 107 bottle tripping comment. Footnote bottle did not trip as scheduled.

109 @ 55db	See 107 bottle tripping comment. Footnote bottle did not trip as scheduled.
110 @ 105db	Delta-S at 205db is 0.057, salinity is 35.492. Delta-S at 105db is -.009, data looks good with this pressure. See 107 bottle tripping comment. Footnote bottle did not trip as scheduled.
111 @ 155db	Delta-S at 254db is 0.1142, salinity is 35.478. Delta-S at 154db is .005, data looks good with this pressure. See 107 bottle tripping comment. Footnote bottle did not trip as scheduled.
112 @ 205db	Sample log: "bottle hung-up (Not closed), no samples." See 107 bottle tripping comment. Footnote bottle did not trip as scheduled.
117 @ 706db	Sample log: "leaking from end cap." Samples appear to be okay.
119 @ 908db	Sample log: "bottle hung-up (Not closed), no samples."
120 @1008db	Sample log: "bottle hung-up (Not closed), no samples."

Station 010

104 @ 2db	Sample log: "bottles not closed, no samples drawn."
105 @ 16db	See 104 bottle comment.
106 @ 55db	See 104 bottle comment.
107 @ 104db	See 104 bottle comment.
108 @ 156db	See 104 bottle comment.
109 @ 206db	See 104 bottle comment.
110 @ 255db	See 104 bottle comment.
111 @ 307db	See 104 bottle comment.
112 @ 356db	See 104 bottle comment.
116 @ 707db	Delta-S at 706db is 0.021, salinity is 34.615. Salinity run indicates 4 tries were taken to get an agreement, indicating a problem with salinity. Footnote salinity bad, other samples appear to be okay. ODF recommends the deletion of salinity.
117 @ 807db	Sample log: "Top vent open." Oxygen appears high compared with adjoining stations and CTDO. Other samples appear to be okay. Footnote oxygen bad, footnote bottle leaking. ODF recommends the deletion of oxygen.
131 @2833db	Sample log: "leaking bottom lid." Leak appears to have effected oxygen and nutrients. Oxygen high and nutrients low as compared with CTDO and adjoining stations. Footnote bottle leaking, samples bad except salinity, it is reasonable at this level. ODF recommends the deletion of oxy, sil, no3, no2, and po4.

134 @3436db Delta-S at 3437db is 0.0139, salinity is 34.696. Automated salinity output indicates 5 readings made to get an average. This indicates there was contamination in the salinity sample. Footnote salinity bad. ODF recommends the deletion of salinity. Other samples look good when plotted and compared with adjoining stations.

Station 011

Cast 1 Sample log: "as per J. Wells ramp shaft off." PI: "NO3/PO4 correlation indicates ok."

106 @ 56db Sample log: "bottle open, no samples drawn."

107 @ 105db PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis." Sample log: "bottle has loose valve." Delta-S at 105db is -0.2111, salinity is 35.275. Although very strange, suspect that 7 & 8 tripped between 200 & 250 db and 9 tripped between 60-100 db. Salinity is low, oxygen low compared with Station 009 and 012 and both salinity and oxygen low compared with CTD, no3 and po4 high compared with station profile and adjoining stations, no2 overlays Station 015 perfectly, sil looks okay. Footnote bottle did not trip as scheduled, footnote samples bad.

108 @ 157db PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis." Delta-S at 157db is -0.2025, salinity is 35.269. See 107 tripping comment and PI comment. Footnote bottle did not trip as scheduled, footnote samples bad.

109 @ 206db PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis." O2 high, no3 and po4 slightly low, salinity sil and no2 appear to be okay. Could have tripped between 60-100 db. See 107 tripping comment and PI comment. Footnote bottle did not trip as scheduled, footnote samples bad.

112 @ 356db Sample log: "Lid open." No samples drawn.

121 @1213db Sample log: "valve leaking." Samples appear to be okay.

122 @1312db Sample log: "valve and lower lid leaking." Samples appear to be okay.

129 @2430db Delta-S at 2431db is 0.0051, salinity is 34.668. Automated salinity system indicated that 3 tries were taken to get good agreement. Footnote salinity bad. ODF recemmends the deletion of salinity. There was some kind of problem with the sample. Other samples appear to be okay.

Station 012

112 (No Pressure) Sample log: "Line drawn through." Appears from Console log that this bottle was not planned to trip.

102 @ 2db PI: "Bad O2 value, should be deleted. Oxygen: "sample no good, began titration without stir bar." Footnote oxygen lost.

104 @ 57db Sample log: "Redrew O2 sample." Oxygen and other samples appear to be okay.

111 @ 408db Sample log: "didn't close properly." No samples.

116 @ 810db Sample log: "Bubble in O2 flask." Oxygen and other samples appear to be okay.

136 @3970db Salinity drawn, not analyzed. No notes telling what the problem was, test analysis done and samples run out of order, footnote salinity sample lost.

Station 013

105 @ 105db Sample log: "possible pre-trip (colder than adjacent)." Bottle tripped incorrectly, footnote bottle did not trip as scheduled, footnote samples bad. ODF recommends deletion of all water samples.

106 @ 156db Sample log: "possible pre-trip ." Bottle tripped incorrectly, footnote bottle did not trip as scheduled, footnote samples bad. ODF recommends deletion of all water samples.

107 @ 207db Sample log: "bottle leaking." Oxygen and other samples appear to be okay.

111 @ 408db Sample log: "bottle not closed." No samples drawn.

117 @ 911db PI: "Oxygen OK." PI: "NO3/PO4 correlation indicates ok." Sample log: "O2 temp measured with manual thermometer." Sample log: "O2 temp measured after sampling."

123 @1517db PI: "Oxygen OK." PI: "NO3/PO4 correlation indicates ok." Nutrients: "Looks like sil gets small bubble stuck in f/c at sample 23. From reruns get that most samples have drifted from 105-119 chart units. That doesn't make sense with std's though so I don't know.-mcb" Added .105 to all samples and stds, data fits station profile and adjoining stations.

135 @3857db PI: "Oxygen OK." PI: "NO3/PO4 correlation indicates ok." See 102 comment. Sample log: "bottle not closed (lanyard hung)." No samples drawn.

Station 014

101 @ 2db Sample log: "O2 temps measured w/bucket therm."

104 @ 110db Sample log: "O2 temps measured w/bucket therm." Sample log: "tap broken." Oxygen appears slightly low compared to CTDO and adjoining stations, other samples appear to be okay. No other gas samples taken per sample log. CTD Processor: "noted point @ 110 db fits CTD oxy

okay." Oxygen agrees with adjoining stations @potemp. Bottle oxygen is acceptable.

110 @ 411db Sample log: "O2 temps measured w/bucket therm." Salinities appeared to be off by one bottle. Shipboard analyst corrected data, salinity for bottle 23 not drawn, duplicates were drawn from bottle 9.

123 @1620db See 110 comment. Footnote salinity lost.

125 @2026db Sample log: "O2 temps measured w/bucket therm." Nutrients: "No sample in tube." Footnote nutrients lost, sample log indicates sample should have been taken. Station profile looks reasonable, so this appears to be the only sampling error.

137 @4146db Sample log: "therm hung-up." Oxygen low, other samples appear to be okay. Within WOCE standards so leave as is, no other gas samples taken per sample log.

Station 015

106 @ 205db PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis." Delta-S at 205db is -0.108, salinity is 35.384. Sil low, no2 high, no3 low, o2 high, but these agree with Station 011. Station 011 also had a high no2. Salinity appears to have been sampled from bottle 7. Footnote salinity bad. Leave other samples as is. ODF recommends deletion of salinity.

108 @ 306db Delta-S at 306db is -0.1132, salinity is 35.113. Salinity appears to have been sampled from bottle 9. Footnote salinity bad. Other samples appear to be okay. ODF recommends deletion of salinity.

122 @1501db Sample log: "Still leaking from bottom lid." Samples appear to be okay.

124 @1812db Oxygen: "intercept late." Oxygen and other samples appear to be okay.

Station 016

105 @ 156db PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis, but S looks funny." See 106 comment. PI: "NO3/PO4 correlation indicates nitrate appears slightly low." Footnote no3 uncertain.

106 @ 207db PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis, but S looks funny." Delta-S at 206db is -0.3333, salinity is 35.076. Bottle appears to have pretripped and did not close properly. Footnote bottle did not trip correctly and samples bad. ODF recommends deletion of all water samples. CTD Processor: "noted point @ 207 db fits CTD oxy okay."

111 @ 407db Oxygen low compared with CTDO, okay compared with adjoining stations, other samples appear to be okay, data acceptable.

112 @ 507db	Delta-S at 507db is 0.0126, salinity is 34.819. Automated salinity analysis indicates a problem, 4 tries to get agreement. Footnote salinity bad. ODF recommends the deletion of salinity. Other samples acceptable.
138 @1517db	Sample log: "22 replaced with 38." Salinity: "Aborted 22 out of water before acceptable values." Footnote salinity lost.
124 @1820db	Salinity drawn, not analyzed. No notes telling what the problem was, footnote salinity sample lost Other samples acceptable.
132 @3448db	Salinity: "Aborted out of water before acceptable values." Footnote salinity lost.
133 @3653db	Delta-S at 3654db is -0.004, salinity is 34.678. Other samples acceptable.
134 @3857db	Delta-S at 3858db is -0.0039, salinity is 34.678. Oxygen high compared with adjoining stations. Footnote oxygen uncertain, there are no supporting notes which indicate a problem with this sample. Other samples acceptable.
135 @4061db	Delta-S at 4062db is -0.0047, salinity is 34.678. Other samples acceptable.
137 @4287db	Delta-S at 4288db is -0.0051, salinity is 34.678. Other samples acceptable.

Station 017

104 @ 106db	Salinity: "Ran out of water before acceptable values." Footnote salinity lost.
105 @ 155db	CTD Processor: "Oxygen @ 155 db did not seem to fit CTD Oxygen." Oxygen appears to have been drawn in error from 04. Footnote oxygen bad.
107 @ 256db	CTD Processor: "Oxygen @ 256 db did not seem to fit CTD Oxygen." Oxygen is .3 higher than adjoining stations. Footnote oxygen questionable.
111 @ 507db	Sample log: "bottle leaking."
137 @ 706db	See 113 comments. PI: "NO3/PO4 correlation indicates high nitrate." Footnote no3 uncertain.
113 @ 805db	Sample log: "Pylon possibly off by 1 position on outer rosette." Trip assignments corrected accordingly. Footnote bottle did not trip as scheduled.
114 @ 855db	See 113 comment.
115 @ 904db	See 113 comment.
116 @1003db	See 113 comment.

117 @1103db See 113 comment.

118 @1206db See 113 comment.

119 @1308db See 113 comment. Salinity drawn, not analyzed. No notes telling what the problem was, footnote salinity sample lost.

120 @1410db See 113 comment.

121 @1512db See 113 comment.

138 @1615db See 113 comment.

123 @1819db See 113 comment.

124 @2017db See 113 comment.

125 @2221db See 113 comment.

126 @2425db See 113 comment.

127 @2631db See 113 comment. Sample log: "bottle leaking."

128 @2834db See 113 comment.

129 @3039db See 113 comment.

130 @3243db See 113 comment.

131 @3447db See 113 comment. Delta-S at 3447db is .0041. No analytical problems noted, some tripping problems, but should not have effected this bottle. Footnote salinity uncertain.

132 @3651db See 113 comment. Delta-S at 3650db is .0029. No analytical problems noted, some tripping problems, but should not have effected this bottle.

133 @3855db See 113 comment.

134 @4057db See 113 comment. Delta-S at 4057db is .0029. No analytical problems noted, some tripping problems, but should not have effected this bottle.

135 @4331db See 113 comment.

Station 018

103 @ 57db Delta-S at 58db is -0.2818, salinity is 35.376. Salinity high, oxygen low, nutrients high. Appears that bottle tripped early and then may have leaked footnote bottle did not trip as scheduled and all samples bad. PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis."

139 @ 464db Sample log: "bottle leaking." Oxygen and other samples appear to be okay. Feature in all properties (except O2) do not match adjoining stations (450-721db), seem to be real.

115 @ 812db	CTD Processor: "Oxygen @ 812 db did not seem to fit CTD Oxygen." Oxygen agrees with Station 017, but not Station 019 (O2 vs. potemp). Footnote oxygen questionable.
117 @ 997db	Sample log: "bottle vent not closed." Samples appear to be okay.
130 @3060db	Oxygen: "intercept late." Oxygen and other samples appear to be okay.
132 @3461db	Sample log: "bottle not closed (lanyard caught)." No samples drawn.

Station 019

107 @ 55db	Sample log: "bottle leaking." Samples appear to be okay.
131 @2429db	CTD Processor: "Oxygen @ 2429 db did not seem to fit CTD Oxygen." Oxygen high compared with adjoining stations. No analytical problems noted. Footnote oxygen uncertain.

Station 020

102	(No Pressure) Sample log: "bottle open."
103 @ 2db	Salinity: "Inner cap came off with lid." See 101 comment.
104 @ 17db	See 101 comment.
105 @ 57db	See 101 comment.
106 @ 105db	See 101 comment.
107 @ 155db	See 101 comment.
108 @ 205db	See 101 comment.
109 @ 255db	See 101 comment.
110 @ 304db	See 101 comment.
111 @ 353db	See 101 comment.
112 @ 403db	See 101 comment.
101 @ 502db	Sample log: "Bottle trip is out of sequence." Trip assignments corrected accordingly. Footnote bottle did not trip as scheduled.
114 @ 699db	Sample log: "Leaks, tap area." Samples appear to be okay.
120 @1295db	Sample log: "bottle leaking." Samples appear to be okay.
123 @1592db	Salinity: "Cap off with lid." Salinity and other samples appear to be okay.
127 @2396db	Sample log: "bottle leaking." Samples appear to be okay.
135 @4032db	Delta-S at 4033db is 0.0151, salinity is 34.698. Salinity: "Contaminate sample." Footnote salinity bad. ODF recommends the deletion of salinity.

Station 021

101 @ 1db Salinity: "Loose cap." Salinity appears to be okay. Oxygen: "magnetic stirrer added after start of titration." Oxygen appears to be okay. Salinity was not listed on Sample Log Sheet, but sample was analyzed. Delta-S look noisy but reasonable.

102 @ 17db Salinity was not listed on Sample Log Sheet, but sample was analyzed. Delta-S look noisy but reasonable. Nutrients: "Sil NOTE _ Sure looks like something happened in middle of first sample-jumps +.085 and from peak shapes looks like something wrong for at least 10 or 11 samples- Ending std's look ok and no significant drift-can't see anyplace obvious where bubble pulled through or anything." Data unrecoverable, footnote sil bad. ODF recommends deletion of silicate.

103 @ 57db Salinity: "Cap off with lid." Salinity appears to be okay. See 102 nutrient comment.

104 @ 107db See 102 nutrient comment.

105 @ 156db See 102 nutrient comment.

106 @ 206db See 102 nutrient comment.

107 @ 257db See 102 nutrient comment.

108 @ 307db See 102 nutrient comment.

109 @ 356db See 102 nutrient comment.

110 @ 406db See 102 nutrient comment.

111 @ 506db See 102 nutrient comment.

112 @ 605db See 102 nutrient comment.

113 @ 705db See 102 nutrient comment.

114 @ 803db Nutrients: "Sil NOTE _ Sure looks like something happened in middle of first sample-jumps +.085 and from peak shapes looks like something wrong for at least 10 or 11 samples- Ending std's look ok and no significant drift-can't see anyplace obvious where bubble pulled through or anything." Data unrecoverable, footnote sil bad. ODF recommends deletion of silicate.

115 @ 906db See 114 comment.

116 @1008db See 114 comment.

117 @1109db See 114 comment.

118 @1211db See 114 comment.

119 @1314db See 114 comment.

120 @1415db See 114 comment.

121 @1518db See 114 comment.

122 @1619db See 114 comment.

123 @1820db See 114 comment.

124 @2019db See 114 comment.

125 @2217db See 114 comment.

126 @2414db See 114 comment.

127 @2618db See 114 comment.

132 @3647db Salinity was not listed on Sample Log Sheet, but sample was analyzed. Delta-S looks reasonable.

Station 022

110 @ 402db PI: "O2 too low as result of titration, should be deleted." Oxygen: "Delay between acidification and titration." Footnote oxygen bad. ODF recommends the deletion of oxygen. Other samples appear to be okay. CTD Processor: "noted point @ 401 db as bad but seems to fit CTD oxy." Oxygen agrees with adjoining stations.

111 @ 502db All properties deleted (bottle leaking). PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis." ODF recommends deletion of samples, footnote samples bad. Footnote bottle leaking.

Station 023

115 @ 808db Delta-S at 808db is -0.016, salinity is 34.399. Appears 15 was drawn from 16 in error and 15 not drawn. Did not correct data with this assumption, footnote salinity bad. ODF recommends the deletion of salinity. Other samples appear to be okay.

116 @ 909db Salinity lost, sample was drawn, but not analyzed. No explanation, footnote salinity lost.

124 @1814db Oxygen: "Had to break away, flushed thio prior to sample 25." Oxygen may be slightly low compared to CTDO, but this sample should not have been involved. Leave as is.

Station 024

107 @ 254db Sample log: "bottle leaking." Oxygen may be slightly low compared with previous stations, but it agrees with next set of stations, other samples appear reasonable. Leave as is.

127 @2614db NO3 and PO4 appear a little low on the station profile. They agree with previous station while the rest of the doesn’t. Other samples appear to be okay, leave as is.

129 @3018db Sample log: "Redraw O2, broke flask." Oxygen is okay, other samples appear to be okay.

134 @4031db Oxygen: "retitrated." Oxygen as well as other samples appear to be okay.

137 @4440db Delta-S at 4441db is 0.005, salinity is 34.689. Salinity: "?first 8385." Not sure what happened this is the conductivity ratio for the previous sample. Some kind of analytical problem here footnote salinity bad. ODF recommends the deletion of salinity. Other samples appear to be okay.

Station 025

106 @ 189db PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis." No analytical problems noted, leave as is. CTD Processor: "Oxygen @ 189 db did not seem to fit CTD Oxygen." Footnote oxygen questionable.

Station 026

101 @ 3db Bottle uncertain; properties don't fit. PI: "Oxygen funny titration result, O2 should be deleted." Delta-S at 3db is -0.0938, salinity is 35.581. Oxygen: "Very funny titration." Nutrients high, oxygen and salinity low. Bottle appears to have closed early, but perhaps between trips. Footnote bottle did not trip as scheduled and all samples bad.

102 @ 18db Salinity was not listed on Sample Log Sheet, but sample was analyzed. Delta-S look reasonable.

106 @ 203db Sample log: "bottle leaking." Oxygen appears high, po4 and no3 appear low compared with adjoining stations. Footnote bottle leaking and samples bad. ODF recommends the deletion of water samples. CTD Processor: "Oxygen @ 202 db point seems to fit CTD oxy okay, even if don't use them for fitting purposes." Leave oxygen coded 4.

107 @ 250db Sample log: "Water flows from tap w/o opening valve." Oxygen and salinity slightly high, po4 and no3 low, would not have questioned acceptability if note from Sample Log were not made. Footnote bottle leaking, samples bad. ODF recommends the deletion of water samples. CTD Processor: "Oxygen @ 250 db point seems to fit CTD oxy okay, even if don't use them for fitting purposes." Leave oxygen coded 4.

112 @ 587db Sample Log Sheet shows salt bottle as 22, Salinity Sheet shows 12 which is probably correct. Delta-S appears reasonable.

129 @2935db Oxygen appears high, no analytical problems found. Footnote oxygen uncertain. Other samples appear acceptable.

Station 027

102 @ 21db Sample log: "Leaking from bottom lid." Samples appear to be acceptable.

Station 028

101 @ 2db Sample log: "bottle not closed." No samples drawn.

102 @ 18db Sample log: "bottle leaking." Samples are acceptable, leave as is.

104 @ 107db Oxygen and salinity appear low, nutrients appear high. Salinity does agree with CTD. This combination does not indicate a leaky bottle. Leave is is.

Station 029

Cast 1 Sample log: "3 cases O2 replicates drawn from this cast." PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis." PI: "NO3/PO4 correlation indicates ok."

107 @ 252db Sample log: "bottle leaking (valve)," ODF recommends deletion of all samples, footnote samples bad. Footnote bottle leaking. CTD Processor: "noted point @ 252 db fits CTD oxy pretty closely." Leave oxygen coded 4.

111 @ 492db Sample log: "bottle leaking (valve)." Salinity: " Stopped to deploy rosette." Salinity low compared with CTD, suspect salinity analysis, rather than bottle, other samples acceptable. Footnote salinity uncertain.

125 @2241db NO3 appears .2 high. No analytical problems found. Footnote no3 uncertain.

126 @2434db Sample log: "leaking at bottom." Samples are acceptable.

Station 030

111 @ 514db Sample log: "bottle leaking." Samples are acceptable.

113 @ 690db Sample log: "bottle not closed." No samples drawn.

124 @2009db Delta-S at 2009db is -0.0075, salinity is 34.624. No analytical problems found, other samples are acceptable.

129 @2994db CTD Processor: "Oxygen @ 2994 db did not seem to fit CTD Oxygen." Oxygen .04 high compared with adjoining stations. Footnote oxygen questionable.

130 @3185db Oxygen: "PC hungup-rebooted, sample lost." Footnote oxygen lost.

Station 031

102 @ 16db	PI: "O2 value low, should be deleted." Oxygen: "fstartmlow." O2 analyst indicated some kind of problem, footnote oxygen bad. ODF recommends the deletion of oxygen. Other samples are acceptable.
105 @ 156db	Oxygen appears low, no analytical problem noted, footnote o2 uncertain.
106 @ 206db	Oxygen: "fstart." O2 analyst indicated some kind of problem, oxygen appears low. Footnote oxygen bad. ODF recommends the deletion of oxygen. CTD Processor: "noted point @ 206 db doesn't seem too far off from CTD oxy." Based on CTD processor's comment, removed the 4 code, accept oxygen as is. Oxygen did not agree with adjoining stations, but did agree with Station 033.
129 @3019db	Sample log: "bottle leaking." Sil slightly low, but acceptable as are other samples.
131 @3419db	No nuts sampled, no notes indicating a problem. Footnote nutrients not drawn.
132 @3630db	Oxygen appears .02 high, no analytical problem noted. Footnote oxygen uncertain, other samples acceptable. CTD Processor: "Oxygen @ 3630 db did not seem to fit CTD Oxygen."

Station 032

122 @1515db	Sample log: "bottle leaking." Samples appear to be okay.
137 @4180db	Sample log: "O2 redrawn." Samples appear to be okay.

Station 033

105 @ 106db	Delta-S at 105db is 0.0404, salinity is 35.667. Comparison with adjoining stations shows that 104 would fit better at this level and 105 would fit better at 104. Leave 104 as it is, footnote salinity uncertain.
112 @ 507db	PI: "Oxygen probably suspect. S seems odd, O2 less so but no particular reason to reject O2 value from the analysis." ODF recommends all properties deleted (bottle leaking). Footnote samples bad analysis, bottle leaking.
115 @ 809db	Sample log: "O2 flask had to be reseated." Samples appear to be okay.
121 @1413db	Sample log: "Air vent open." Delta-S at 1413db is 0.0124, salinity is 34.551. Compared with adjoining stations, salinity high, oxygen and nutrients low. Footnote bottle leaking, samples bad. ODF recommends the deletion of water samples.
122 @1515db	Salinity: "Loose thimble." Salinity and other samples appear to be okay.
125 @2022db	Oxygen high, no analytical problems noted. Footnote oxygen bad. ODF recommends the deletion of oxygen.

134 @3854db Sample log: "bottle leaking badly at bottom." Samples appear to be okay.

Station 034

101 @ 2db Oxygen: "Sample was messed up." Footnote oxygen lost.

111 @ 507db Delta-S at 507db is 0.0251, salinity is 34.674. Automated salinity analysis shows that two readings were necessary for second conductivity ratio. Footnote salinity uncertain. Oxygen appears slightly high, footnote oxygen uncertain. Other samples appear to be okay. CTD Processor: "noted point @ 507 db fits just fine." Removed oxygen code 3 per CTD Processor’s comments, adjoining stations did not have sampling at this potemp.

112 @ 607db Sample log: "bottle not closed." No samples drawn.

134 @3854db Oxygen: "Possibly some volatilization cause by delay." Oxygen and other samples appear to be okay.

Station 035

118 @1107db PI: "NO3/PO4 correlation indicates phosphate low." Entry error on po4, after correction samples appear to be okay. Delta-S at 1107db is 0.0339, salinity is 34.467. Salinity appears to be a duplicate draw with 119. Footnote salinity bad. ODF recommends the deletion of salinity.

131 @3237db Oxygen sample number entry incorrect, corrected from 34 to 31. Oxygen and other samples appear to be okay.

Station 036

202 (No Pressure) Sample log: "Open." No samples drawn.

214 @ 608db Delta-S at 607db is -0.0174, salinity is 34.593. No salinity analytical problems noted, other samples appear to be okay. Large gradient, salinity acceptable.

216 @ 809db Oxygen: "Intercept late." Oxygen and other samples appear to be okay.

219 @1112db Oxygen: "Very small bubble in flask." Oxygen and other samples appear to be okay.

222 @1415db Oxygen: "Small bubble." Oxygen and other samples appear to be okay.

224 @1618db Delta-S at 1617db is 0.0455, salinity is 34.639. Salinity could be drawing error with 226, other samples appear to be acceptable. Footnote salinity bad. ODF recommends the deletion of salinity.

233 @3449db Sample log: "bottle leaking." PI: "O2 looks very doubtful on S/O2 plot, but S/O2 curve looks unusual but no particular reason to suspect validity

of the O2 value(s) from the O2 sampling or analysis." Based on comment from sample log and oxygen too high compared with adjoining stations and CTDO, footnote bottle leaking, oxygen bad. PO4 slightly high, but leave as is, other nutrients and salinity acceptable. ODF recommends the deletion of oxygen.

Station 037

107 @ 105db	Sample log: "Leaks." Samples appear to be okay.
114 @ 496db	Sample log: "Leaks at valve." Samples appear to be okay.
128 @2211db	Sample log: "Valve leaks." NO3 high, re-checked nutrient charts, no analytical problems found. However, 125-128 appear to be high as compared with adjoining stations. Footnote no3 uncertain. Other samples appear to be okay.
133 @3233db	Sample log: "Leaks at bottom." Samples appear to be okay.

Station 038

105 @ 3db	Sample log: "No water." No samples drawn.
107 @ 55db	Salt duplicate draw of 106. Console ops: "Multiple trips (6)." Will leave this level as is as per shipboard analysis, however suspect that 6 and 7 may have tripped at 5's level. Footnote salinity bad. ODF recommends the deletion of salinity.

Station 039

111 @ 155db	Sample log: "bottle leaking." Oxygen low compared with adjoining stations, but so is 10. Other samples appear to be okay, accept data as is.
123 @1112db	Sample log: "Bottom lid leaking." Samples appear to be okay.

Station 040

107 @ 2db	Sample log: "Valve leaking." Samples all appear to be okay. Nutrient analyst had problems with sil line. Lost first 5 samples.
108 @ 15db	See 107 silicate comment.
109 @ 55db	See 107 silicate comment.
110 @ 105db	See 107 silicate comment.
111 @ 155db	See 107 silicate comment.
112 @ 205db	See 107 silicate comment.

113 @ 255db Oxygen appears ~.08 low compared with station profile and adjoining stations. Footnote oxygen uncertain. No notes indicating a problem, all other samples okay. CTD Processor: "noted point @ 254 db fits CTD oxy." Based on CTD Processor's comments, oxygen is acceptable.

114 @ 304db Sample log: "Valve leaking." Samples all appear to be okay.

115 @ 353db Oxygen: "Intercept late." Oxygen and other samples appear to be okay.

117 @ 498db Sample log: "leaking." Oxygen appear low, other samples appear to be okay. CTD Processor: "noted point @ 498 db not that far off." Based on CTD Processor's comments, oxygen and bottle are acceptable.

127 @1487db Oxygen low, no comments noted to indicate analysis problem. Other samples appear to be okay. Footnote oxygen bad, ODF recommends deletion of oxygen. Salinity: "bottle found broken in case." Footnote salinity lost.

131 @2197db Oxygen: "Flushed thio." Oxygen appears a little high, but acceptable, other samples okay.

Station 041

130 @1820db Sample log: "O2 redrawn." Oxygen and other samples appear to be okay.

133 @2429db Sample log: "bottle leaking." Samples appear to be okay.

Station 042

105 @ 2db Sample number assignment console ops vs sample log do not agree. Console ops shows 4-6, sample log indicates 5-7. Use sample log number assignment. All files appear to be numbered correctly, 5-7.

Station 043

107 @ 3db Sample log: "bottle leaking." Samples appear to be okay.

111 @ 154db Sample log: "bottle open." No samples drawn.

128 @1608db Sample log: "lanyard caught in bottom lid." ODF recommends deletion of samples, footnote samples bad. Footnote bottle leaking.

130 @2011db ODF recommends deletion of samples, footnote samples bad. Footnote bottle leaking. CTD Processor: "noted point @ 2010 db fits CTD oxy pretty closely. Leave coding as is.

Station 044

110 @ 15db	Oxygen: "O2 rig failed, sample missed." Footnote oxygen lost.
113 @ 154db	Sample log: "Leaker bottom." Samples appear to be okay.
114 @ 205db	Sample log: "Leaker." Samples appear to be okay.
140 @1313db	Sample log: "Replaced bottle 28 with 40."
129 @1414db	Oxygen: "JW ran last 7 samples while SG sampled cast." Samples appear to be okay.

Station 045

106 @ 2db	Sample log indicates salinity samples were drawn, however these salts are too low. Suppression switch set incorrectly, corrected values and salinities agree with CTD and adjoining stations. Salinity good agreement after change.
128 @1617db	Sample log: "bottle leaking." Sample Log indicates bottle 28 replaced 40. Samples appear to be okay.

Station 046

103 @ 15db	Sample log: "Salinity had to be collected opening the bottom lid." Salinity agreement poor with duplicate trip bottle 2 and CTD. TCO2 only other sample drawn. Leave as is.
105 @ 105db	Sample log: "Failed to trip."
113 @ 206db	Sample log: "Leaks badly at bottom." Samples appear to be okay.
114 @ 255db	nutrients show same water as sample 113; possible sample drawing error. Delta-S at 255db is 0.1443, salinity is 35.687. Suspect bottle tripped with bottle 13, all properties except salinity and po4 indicate that water could be from 205db (bottle 13) or 255db (bottle 14). No other non-ODF samples taken. Footnote salinity bad, po4 bad. ODF recommends the deletion of salinity, po4.
117 @ 406db	Sample log: "Leaks badly at bottom." Samples appear to be okay.

Station 047

113 @ 105db	PI: "NO3/PO4 correlation indicates all samples from 13 to 23 have either high NO3 or low PO4 (appears like high NO3)." NO3 and PO4 appear to be okay, perhaps some error was corrected shipboard and the comment not deleted.
133 @2016db	PI: "Delete oxygen, Titration problem." oxygen deleted; PC hung up during titration. WOCE requires that samples not be deleted, put oxygen back in and footnote bad.

Station 048

125 @ 801db oxygen deleted; sunlight coming thru porthole screwing up U/V detector. PI: "Delete oxygen, titration problem." WOCE requires that samples not be deleted, put oxygen back in and footnote bad.

Station 049

113 @ 4db Sample log: "A little leak around end cap." Samples appear to be okay.

119 @ 252db Delta-S at 252db is 0.1244, salinity is 35.764. Salinity appears to have been drawn from bottle 18. Footnote salinity bad. ODF recommends the deletion of salinity. Other samples appear to be okay.

129 @1110db Delta-S at 1110db is -0.0066, salinity is 34.495. No analytical problems found, other samples appear to be okay. Footnote salinity uncertain.

130 @1212db Nutrients: "No water in tube." Footnote nutrients not drawn.

Station 050

120 @ 15db Shipboard sample numbers assigned incorrectly. This was entered as sample 19, corrected entry. Sample were not suppose to be drawn from this bottle. However, salinity was drawn.

121 @ 55db Oxygen: "large bubble." Oxygen and other samples appear to be okay.

122 @ 104db Oxygen: "medium bubble." Oxygen and other samples appear to be okay.

123 @ 154db Oxygen: "large bubble." Oxygen and other samples appear to be okay. PI: "NO3/PO4 correlation indicates all samples from 23 to 31 have either high NO3 or low PO4 (appears like high NO3)." Shorebased plot shows data looks good, perhaps a data entry error was corrected after PI's comment.

124 @ 205db Oxygen: "no bubble." Oxygen and other samples appear to be okay. See 123 comment.

137 @1126db Sample log: "Small leak at end cap." Samples appear to be okay.

Station 051

121 @ 2db Oxygen: "large bubble." Oxygen appears ~.2 ml/l high compared with adjoining stations. Other samples appear to be okay. Not sure if this is real or not, footnote oxygen uncertain and have PI double check.

122 @ 13db See 121 oxygen comment. Oxygen: "large bubble, late intercept."

123 @ 53db See 121 oxygen comment.

131 @ 456db	PI: "S/O2 curve looks unusual but no particular reason to suspect validity of the O2 value(s) from the O2 sampling or analysis." Evidently, on the ship the salinity was changed to reflect that salt bottle 31 was sampled from bottle 30 and salt bottle 30 was sampled from 31. Data agrees very well in this sampling scenario.

Station 052

140 @ 102db	Sample log: "End cap leaking." Samples appear to be okay.
130 @ 201db	Oxygen: "small bubble." Oxygen and other samples appear to be okay.
132 @ 297db	Sample log: "End cap leaking." Samples appear to be okay.
137 @ 547db	PI: "NO3/PO4 correlation indicates deepest sample has high PO4." Footnote po4 uncertain.

C. CALIBRATED PRESSURE-SERIES CTD DATA PROCESSING SUMMARY AND COMMENTS

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C.1 INTRODUCTION

This document describes the CTDO data acquisition, calibration, and other processing techniques used on WOCE92-P14C, also known as Knorr 138/7. This WOCE leg was done on the R/V Knorr from September 1 - 15, 1992.

C.2 CTD ACQUISITION AND PROCESSING SUMMARY

52 CTD casts and several aborted or test casts were done during P14C. An additional 16 CTD casts with no bottle data were done after the P14C work was completed; these were only processed shipboard and are not part of this data release. The rosette used was an ODF-designed 36-bottle system with a ring of twelve 10-liter bottles and 12- and 24-place General Oceanics pylons nested inside a ring of twenty-four 10-liter bottles. A CTD,

altimeter, pinger and transmissometer were mounted on the bottom of the frame. ODF CTD #1, a modified NBIS Mark III-B instrument, was used during the leg.

The ODF CTD acquired data at a rate of 25 Hz. The data consisted of pressure, temperature, conductivity, dissolved oxygen, second temperature, four CTD voltages, trip confirmation, transmissometer, altimeter and elapsed time.

An ODF-designed deck unit demodulated the FSK CTD signal to an RS-232 interface. The raw CTD data signal was split into three paths: to be logged in raw digitized form, to be monitored in real time as raw data, and to be processed and plotted. During the P14C expedition, a Sun SPARCstation 2 computer served as the real-time data acquisition processor. Various Sun SPARC computers were used during post-cruise processing as well.

The analog CTD audio signal was recorded on VHS videotape, and all digital binary data were logged on a hard disk and then backed up to cartridge tape. In addition, all intermediate versions of processed data were backed up to cartridge tape.

CTD data processing consists of a sequence of steps; some steps are optional and used only when necessary. Data can be re-processed from any point in this sequence after the data have been acquired and stored. Each CTD cast is assigned a correction file, and while the corrections are usually determined for groups of stations, it is possible to fine tune the parameters for even a single station. The acquisition and processing steps are as follows:

- Data are acquired from the CTD sea cable and assembled into consecutive .04-second frames containing all data channels. The data are converted to engineering units.

- The raw pressure, temperature and conductivity data are passed through broad absolute value and gradient filters to eliminate noisy data. The entire frame of raw data is omitted, as opposed to interpolating bad points, if any one of the filters is exceeded. The filters may be adjusted as needed for each cast.

TYPICAL P14C RAW DATA FILTERS

Raw Data Channel	Minimum	Maximum	**Frame-to-Frame** Gradient
Pressure	-40	6400	2 decibars
Temperature	-8	32.7	.2 deg. C
Conductivity	0	64.355	.3 mmho
Oxygen	(no filter was used)		

- Pressure and conductivity are phase-adjusted to match the temperature response, since the temperature sensor responds more slowly to change. Conductivity data are corrected for ceramic compressibility in accordance with the NBIS Mark III-B Reference Manual.

- The data are averaged into 0.5-second blocks. During this step, data falling outside four standard deviations from the mean are rejected and the average is recalculated. Then data falling outside two standard deviations from the new mean are rejected, and the data are re-averaged. The resulting averages, minus second temperature and CTD voltages, are reported as the 0.5-second time series. Secondary temperature data are used to verify the stability of the primary temperature channel calibration. Secondary temperature data are only filtered, averaged and reported with the time-series data when they are used in place of the primary temperature data due to a sensor malfunction.

- Corrections are applied to the data. The pressure data are corrected using laboratory calibration data. Temperature corrections, typically a quadratic correction as a function of temperature, are based on laboratory calibrations. Conductivity and oxygen corrections are derived from water sample data. Conductivity corrections are typically a linear fit as a function of conductivity. Oxygen data are corrected on an individual cast basis. Uncorrected time-series transmissometer data are forwarded to TAMU for final processing and reporting.

The averaged data are recorded on hard disk and sent to the real-time display system, where the data can be reported and plotted during a cast. The averaging system also communicates with the CTD acquisition computer for detection of bottle trips, almost always occurring during the up casts. A 3- to 4-second average of the CTD data is stored for each detected bottle trip.

A down-cast pressure-series data set is created from the time series by applying a ship-roll filter to the down-cast time-series data, then averaging the data within 2-dbar pressure intervals centered on the reported pressure. The first few seconds of data for each cast are generally excluded from the averages due to sensor adjustment or bubbles during the in-water transition. Pressure intervals with no time-series data can optionally be filled by double-parabolic interpolation. When the down-cast CTD data have excessive noise, gaps or offsets, the up-cast data are used instead. CTD data from down and up casts are not mixed together in the pressure-series data because they do not represent identical water columns (due to ship movement, internal waves, wire angles, etc.).

The CTD time series is always the primary CTD data record for the pressure, conductivity and temperature channels. The final corrections to the CTD oxygen data are made by correcting pressure-series CTD oxygen data to match the up-cast oxygen water samples at common isopycnals. The final CTDO pressure-series data are the data reported to the principal investigator and to the WHPO.

Subsequent sections of this document discuss the laboratory calibrations, data processing and corrections for the CTD used during P14C.

C.3 CTD LABORATORY CALIBRATIONS

C.3.a Pressure Transducer Calibration

The CTD #1 pressure transducer was calibrated in a temperature- controlled bath to the ODF Ruska deadweight-tester (DWT) pressure standards. The mechanical hysteresis loading and unloading curves were measured both pre- and post-cruise at cold temperature (-2.0 to -1.4 degrees C bath) to a maximum of 8830 psi, and at warm temperature (29.1 to 30.0 degrees C bath) to a maximum of 2030/4030 psi pre-/post-cruise. The CTD #1 post-cruise testing included an additional calibration to 4030 psi in a 10.3 degrees C bath.

In addition to testing the CTD pressure response to increases in pressure at stable temperatures (mechanical hysteresis), CTD pressure sensor sensitivity to temperature change was checked by thermal shock tests. The CTD was subjected to a step change in temperature from warm air to cold water bath at stable pressure in the laboratory, then the CTD pressure and temperature were measured over a period of at least 1 hour. The thermal shock response was also checked in the opposite direction, cold bath to warm bath; that response was roughly mirror-image to the warm-to- cold response.

Thermal shock tests for CTD #1 were done from warm air to cold water bath, and later from cold bath to warm air, during the post-cruise calibration. Further testing was done in Oct.93 to get a better cold-to- warm response check by going from cold bath to warm bath; the air was too unstable to get a proper check in the May 93 attempt.

CTD #1 pre- and post-cruise pressure calibrations are summarized in Figures 1 and 2.

C.3.b PRT Temperature Calibration

Both CTD #1 PRT temperature transducers were calibrated in a temperature-controlled bath. CTD temperatures were compared with temperatures calculated from the resistance of a standard platinum resistance thermometer (SPRT) as measured by a NBIS ATB-1250 resistance bridge. The ultimate temperature standards at ODF are water and diphenyl ether triple-point cells and a gallium cell. Six or more calibration temperatures, spaced across the range of -2.0 to 30.1 degrees C, were measured both pre- and post-cruise.

CTD #1 pre- and post-cruise temperature calibrations, referenced to the ITS-90 standard, are summarized in Figure 3. Calibration coefficients are converted to the IPTS-68 standard: CTD temperature data are corrected to the IPTS-68 standard because calculated parameters, including salinity and density, are currently defined in terms of that standard only. After all data are finalized, IPTS-68 data are converted back to the ITS-90 standard as desired via multiplication by a constant factor.

C.4 CTD DATA PROCESSING

C.4.a Pressure, Temperature and Conductivity/Salinity Corrections

A maximum of 36 salinity and oxygen check samples were collected during each CTD cast. Thermometric pressure and temperature data were also measured at 1 level during 26 casts on P14C.

A 3- to 4-second average of the CTD time-series data was calculated for each sample. The resulting data were then used to verify the pre- and post-cruise temperature calibrations, and to derive CTD conductivity/salinity and oxygen corrections.

The following chart clarifies which sensors/winches were used for each cast:

P14C CTD/WINCH CONFIGURATION SUMMARY

Station(s)	CTD@ ID#	TAMU	Oxygen Sensor	Winch
1 - 19				
28 - 45	1a			
52 - 64				
21 - 27	1b	X	A	A. Johnson
65 - 68				
20	1c			
46 - 51				
@ ODF CTD #1sensor serial numbers appear below:				

		Temperature		
CTD ID#	Pressure	PRT-1	PRT-2	Conductivity
1a			FSI - T1319	
1b	131910	14304	FSI - T1320	5902-F117
1c			FSI - Press@	
@ NOTE: Occasionally, an FSI pressure sensor was tested in the second-temperature slot				

C.4.a.1 CTD #1 Pressure Corrections

CTD #1 pre- and post-cruise pressure calibrations, Figures 1a and 1b, were compared. The warm/shallow and cold/deep calibration curves both shifted at the surface by about 2.5 to 3 decibars from pre- to post-cruise. The cold/deep pressure calibration curves had similar slopes in the top 2400 decibars, then diverged an additional 2 decibars between 2400 and 6100 decibars. The post-cruise cold/upcast curve was 1 decibar closer to the downcast than pre-cruise. The warm/shallow slope was less steep post- cruise, and the surface points were .5 decibar further from the cold curve than they were during the pre-cruise calibration. The post-cruise downcast pressure calibrations had similar slopes at all 3 temperatures, whereas the pre-cruise warm calibration curve was steeper than the cold.

Because of the pre- and post-cruise slope inconsistencies, laboratory calibrations from Dec.91, May 92 and Oct.93 were also examined for trends over time. The cold/deep correction curve slopes have gone more more negative and the warm/cold surface offsets have drifted apart with time. Only the Aug.92/pre-cruise calibration contradicts these trends; the May 93/post-cruise pressure calibrations are much more consistent with the history of the instrument. The post-cruise pressure calibrations were used to correct the CTD #1 station data, with an additional offset applied to account for the shift in the calibration curves over time. No slope change was applied to the May 93 data, since there was less than a 1 decibar in 6000 decibars slope change between May 92 and May 93 laboratory calibrations.

The additional offset to the pressure calibration was determined by examining raw CTD pressure vs temperature data from the laboratory temperature calibrations and comparable shipboard data. Raw CTD pressure vs temperature data from just before the CTD entered the water on each cast were tabulated. The CTD readings were fairly stable, with atmospheric pressures and stable ambient temperatures around the CTD for 30 or more minutes prior to each cast, similar to conditions during the laboratory calibrations. The post-cruise/May 93 pressure calibration curves were shifted by the +3.0-decibar average difference between the laboratory and cast data; the resulting data, Figure 1c, were used to correct P14C CTD #1 pressure data.

Post-cruise warm-to-cold thermal shock data, Figure 2a, were fit to determine the time constants and temperature coefficients which model the pressure response to rapid temperature change. May 91 and May 93/post- cruise data were compared: the results were similar in magnitude and response time. A thermal shock test from cold to warm water baths was done in Oct.93, Figure 2b. The results were similar in magnitude but mirror- image to the warm-to-cold shock tests from May 93. The May 93 time constants and temperature coefficients, listed in the table at the end of this section, were used to correct the P14C CTD #1 pressure data. The thermal response pressure correction applied to upcasts used a modification of the downcast correction to achieve the mirror-image effect seen in the laboratory.

Thermometric pressures were measured at 1 deep point on each of 26 casts. The only shift observed in thermometric/CTD pressure differences could be attributed to a change in the DSRTs used to measure the thermometric values.

The shifted May 93/post-cruise calibration curve, Figure 1c, was used in conjunction with the May 93 thermal shock results, Figure 2a, to correct the pressure for all P14C CTD #1 casts. Any residual offset was compensated for automatically at each station: as the CTD entered the water, the corrected pressure was adjusted to 0.

THERMAL RESPONSE COEFFICIENTS FOR CTD PRESSURE@

CTD	Short Time Constant (secs)	Temp. Coeff. for Tau1	Long Time Constant (secs)	Temp. Coeff. for Tau2
ID#	Tau1	k1	Tau2	k2
1	82.1826	+0.306253	384.176	-0.26423

C.4.a.2 CTD #1 Temperature Corrections

CTD #1 had two temperature sensors: PRT-1, a Rosemount sensor, was calibrated pre- and post-cruise; PRT-2 was an interchangeable FSI sensor. Different FSI sensors were installed in CTD #1 during the pre- and post- cruise calibrations; both FSI sensors underwent repairs between the calibrations.

PRT-2 was used to monitor any PRT-1 drift during the cruise. Data from either PRT-2 sensor, when working properly, gave consistent differences when compared to PRT-1 data. Thermometric temperatures were measured during 26 casts to further check for shifts in PRT-1. No changes were noted during the leg.

A comparison of the pre- and post-cruise laboratory CTD #1 PRT-1 temperature transducer calibrations, Figures 3a and 3b, showed two curves with nearly identical slopes and a +.001 deg.C shift in the temperature correction over the range of 0 to 32 deg.C. An average of the two laboratory calibrations was calculated by averaging the coefficients of the pre- and post-cruise temperature correction curve fits. The corrections were converted to the IPTS-68 standard and then applied to the CTD #1 temperature data.

C.4.a.3 CTD Conductivity Corrections

In order to calibrate CTD conductivity, check-sample conductivities were calculated from the bottle salinities using CTD pressures and temperatures. For each cast, the differences between sample and CTD conductivities at all pressures were fit to CTD conductivity using a linear least-squares fit. Values greater than 2 standard deviations from the fits were rejected. The resulting conductivity correction slopes were plotted as a function of station number. The conductivity slopes were grouped by stations, based on common PRT and conductivity sensor combinations, and then fit as a function of station number to generate smoothed slopes for each group. These smoothed slopes were either averages of the slopes in the station group (0-order) or changing by a fixed amount from station to station (1st-order as a function of station number).

Conductivity differences were then calculated for each cast after applying the preliminary conductivity slope corrections. Residual conductivity offsets were computed for each cast and fit to station number. Smoothed offsets were determined by groups as above, based on common PRT and conductivity sensor combinations. The resulting smoothed offsets were then applied to the data. Conductivity slope as a function of conductivity was re-checked to ensure that no residual slope remained.

CTD #1

CTD #1 conductivity slopes were stable throughout P14C, dropping gradually from the first to the last station. A smoothly shifting conductivity slope as a function of station number was applied to the P14C casts, changing a total of -.00033 between stations 1 and 52.

Residual CTD #1 conductivity offset values were calculated after applying the conductivity slopes. Conductivity offsets were fit as a function of station number, then the smoothed 1st-order offsets were applied to CTD conductivities for stations 1 to 44. The conductivity sensor was cleaned after station 44, causing a shift in the offset beginning station 45. An average of the conductivity offsets for the deeper stations 45-49 was applied through station 52.

Some offsets were manually adjusted to account for discontinuous shifts in the conductivity transducer response, or to insure a consistent deep T-S relationship from station to station.

Plots of the final/adjusted P14C conductivity slopes and offsets for CTD #1 can be found in Figures 4a and 4b.

C.4.c Bottle vs. CTD Conductivity Statistical Summary

The P14C calibrated bottle-minus-CTD conductivity statistics include salinity values with quality 3 or 4. There is approximately a 1:1 correspondence between conductivity and salinity residual differences. Plots of the differences at all pressures and at pressures below 1500 decibars are shown in Figures 5a and 5b.

The following statistical results were generated from the final bottle data set and the corrected up-cast CTD data:

P14C FINAL BOTTLE-CTD CONDUCTIVITY STATISTICS

Pressure range (decibars)	Mean conductivity difference (bottle-CTD mmho)	Standard deviation (mmho)	#values in mean
all pressures	-0.000450 @@	0.036867	1506
allp (4,2rej)@	0.000241	0.003340	1467
press <1 500	-0.000887	0.045669	980
p < 1500 (4,2rej) @	0.000283	0.004775	957
press > 1500	0.000363 @@	0.002462	526
p > 1500 (4,2rej) @	0.000133	0.000719	496
@ "4,2rej" means a 4,2 standard-deviation rejection filter was applied to the differences before generating the results.			
@@ Plots of these differences can be found in Figures 5a and 5b.			

C.4.d CTD Dissolved Oxygen Data

C.4.d.1 CTD Oxygen Corrections

Dissolved oxygen data were acquired using a single Sensormedics dissolved oxygen sensor for the entire leg.

CTD oxygen data are corrected after pressure, temperature and conductivity corrections have been determined. CTD raw oxygen currents were extracted from the pressure-series data at isopycnals corresponding to the up-cast check samples. All the pressure-series data were from the down casts, where oxygen data are usually smoother than up-cast data because of the more constant lowering rate, avoiding the flow-dependence problems occurring at up-cast bottle stops. However, the P14C CTD oxygen data were affected with flow-dependence problems, down or up cast, each time a cast was stopped. There can also be flow-dependence problems if a cast is slowed down, as often happens during bottom approaches.

The CTD oxygen correction coefficients were determined by applying a modified Levenberg-Marquardt nonlinear least squares fitting procedure to residual differences between CTD and bottle oxygen values. Bottle oxygen values were weighted as required to optimize the fitting of CTD oxygen to discrete bottle samples. Some bottle levels were omitted from a fit because of large pressure differences between down- and up-cast CTD data at isopycnals. Deep data points were often weighted more heavily than shallower data due to the higher density of shallow sampling on a typical 36-bottle sampling scheme.

The P14C surface oxygen data fitting was adversely affected by the typical going-in-water bubbles/noise, making it difficult to fit CTD oxygens to the bottle data in the surface mixed layer of many casts. The value of data above the second check sample should be very carefully considered.

C.4.d.2 Bottle vs. CTD Oxygen Statistical Summary

CTD oxygens were generated by fitting up cast oxygen bottle data to down cast CTD raw oxygen current measurements along isopycnals. Residual oxygen differences from these fits (up cast bottle oxygens vs corrected down cast CTD oxygens), including oxygen values with quality code 3 or 4, are shown in the table below:

P14C FINAL BOTTLE-CTD OXYGEN STATISTICS

Pressure range (decibars)	Mean oxygen Difference (bottle-CTD ml/l)	standard deviation (ml/l)	#values in mean
all pressures	0.00558 @@	0.10238	1508
allp (4,2rej) @	0.00565	0.03677	1412
aress < 1500	0.00789	0.12637	979
p < 1500(4,2rej) @	0.00837	0.05171	919
press > 1500	0.00131 @@	0.01768	529
p > 1500(4,2rej) @	0.00077	0.01456	503
@ "4,2rej" means a 4,2 standard-deviation rejection filter was applied to the differences before generating the results.			
@@ Plots of these differences can be found in Figures 6a and 6b.			

C.4.e Additional Processing

A software filter was used on 16 casts to remove conductivity and/or temperature spiking problems in about 0.078% of the time-series data frames. Pressure did not require filtering.

Oxygen spikes were filtered out of 50 casts. The filtered oxygen levels affected approximately .965% of the time-series data frames. 33.75% of the filtered oxygen data were shallower than 100 dbars and could possibly be directly related to bubbles trapped during the going-in-water transition.

The remaining density inversions in high-gradient regions cannot be accounted for by a mis-match of pressure, temperature and conductivity sensor response. Detailed examination of the raw data shows significant mixing occurring in these areas because of ship roll. The ship-roll filter resulted in a reduction in the amount and size of density inversions.

After filtering, the down cast portion of each time-series was pressure-sequenced into 2-decibar pressure intervals. A ship-roll filter was applied to each cast during pressure sequencing to disallow pressure reversals.

C.4.f GENERAL COMMENTS/PROBLEMS

There is one pressure-sequenced CTD data set, to near the ocean floor, for each of 52 casts at 52 station locations. There was one additional equipment test cast, plus two casts aborted because of winch and/or CTD problems; these were neither processed nor reported. Another CTD cast was done immediately after any aborted cast at the same location. After the WOCE92-P14C work was completed, there were an additional 16 casts done for CTD data only and with no water samples collected (stations 53-68). These casts are not reported in this distribution as they are not part of the WOCE line.

The data reported are all from down casts.

The 0-2 decibar level(s) of some casts were extrapolated using a quadratic fit through the next three deeper levels. Recorded surface values were rejected only when it appeared that the drift was caused by sensors adjusting to the in-water transition; if there was any question that the surface values might be real, the original data was reported. Extrapolated surface levels are identified by a count of "1" in the "Number of Raw Frames in Average" reported with each data record on the tapes.

Four time-series data sets had areas of missing data. Data for the 2-decibar pressure levels which would have had missing data were interpolated. The pressures for these interpolated data frames as well as other cast-by-cast shipboard or processing comments are listed in the "CTD Shipboard and Processing Comments" in Appendix D. All interpolated data levels have a count of "1" in the "Number of Raw Frames in Average" column in the data files.

The CTD oxygen sensor often requires several seconds in the water before being wet enough to respond properly; this is manifested as low or high CTD oxygen values at the start of some casts. Flow-dependence problems occur when the lowering rate varies, or when the CTD is stopped and/or slowed, as during bottom approaches, at the cast bottom, or at bottle trips, where depletion of oxygen at the sensor causes lower oxygen readings. Significant delays and yoyos during the casts are documented in Appendix D.

D. Data Quality Evaluation

D.1 DQ Evaluation of WOCE P14C hydrographic data

(Arnold Mantyla)
1999 SEP 14

WOCE line P14C ran from New Zealand’s North Island northward through the South Fiji Basin to Suva, Fiji. The deeper waters of the basin are quite uniform in characteristics and provided a good test on the station to station analytical consistency, which overall was quite good. The shallower parts of the station profiles should be more interesting, with intermediate depth waters crossing the section westward and the surface layers crossing eastward as part of the subtropical gyre.

A 36 place rosette was used, although the full complement of bottles was not always needed because all of the casts were shallower than 4500m. There were a number of mis-fires, leakers and other trip problems that presaged the more frequent trip problems on later legs of this Knorr voyage; but all of the planned stations had reasonably complete profiles on this leg. The only other WOCE line to cross this one was WOCE P06. The crossing comparisons were fairly good, but the P06 deep salinities looked a little smoother than the P14C station, while the oxygen profiles were smoother on P14C. Deep silicates differed by about 3um, as has been true of other cruise crossings analyzed separately by SIO and OSU, with OSU being the lower one due to differences in the way the standardization calibrations are handled. WOCE silicate data could be improved if the data were recalculated in a consistent manner. The P06 crossing was at P14C station 17, the latter station deep salinities were somewhat noisier than most of the rest of the cruise, so the P06/P14C salinity comparison may not be representative of the rest of the cruise.

Standard Seawater Batch P120, used on this cruise was only about 4 months old. From other data on P120 changes with age, the salinity data on this cruise should be correct to less than .001 in salinity bias from the use of this SSW standard. The near surface CTD oxygen values assigned to the bottle trip data are often quite poor. They are from the down cast, and the initial start down CTD O2’s frequently are not very reliable, so I have flagged the poorer ones as "uncertain".

This cruise has been checked over very carefully by the originators, and I did not find it necessary to change very many of the data quality flags. However, I believe two codes were often misused: the "bad" code for data that was merely suspicious and should have been flagged only as "uncertain"; and the contradictory codes "did not trip correctly" on the bottle numbers with "data ok" on the water sample. For the most part, the "bad" codes were left as is. In the other case, the problem usually starts with an initial bottle hang-up or late trip on one bottle, causing the remaining trips to be offset from their initial planned trip depths. However, those bottles do trip correctly, and once the CTD info has been unscrambled, there should not be any codes left to cast doubt on the quality of the data. I recommend the "4" codes on the bottles on stations 9, 17, and 20 be changed to "2" to be compatible with the water sample quality code. Otherwise, a data user that sees a code that means the bottle did not trip correctly is apt to conclude that the water samples must be doubtful also.

The deep nitrates on station 11, 12, 18, and 20 appear to be systematically low compared to adjacent stations and the rest of the cruise profiles. I suggest the data originators take another look at the standard factors to see if the data can be improved. These sorts of offsets often happen when a new cadmium reduction column is used. If no error can be found, I recommend that the nitrates be flagged "uncertain" below 1500m for those 4 stations.

The following are some additional problems that should be looked into:

Station 9 - The top 5 bottles are flagged "did not trip correctly", and there are no data listed at all at the probable planned depths of 250 and 300db. The water samples are ok as listed, so the bottle codes should be changed to ok also. Also, it would be useful to list the original CTD trip information at 250 and 300db, with an artificial bottle number.

Station 16 - All of the salinities are low compared to the CTD and adjacent stations. The original salinometer values should be re-examined, standard dial settings consistent with other stations, or excessive apparent (wrong) drift? If no problem found, I would tend to let it go as is.

Station 21 - Most of the silicates have been flagged bad due to an analytical problem. The analyst noted an absorbance jump of .085 between the first and second sample. I would try to salvage the data by adding .085 to the first sample absorbance and the beginning baseline and re-calculate the data. If the recalculated data agree well with the adjacent stations, they can then be accepted as ok.

Station 23 - A clear sampling error has occurred at 808 and 909db. Only one salinity was collected, it is listed at 808db, but is clearly from 909db. Since the CTD verifies the correct position, I see no reason why the sampling error can't be corrected.

Station 29 - The deep silicates appear to be a few units higher than the adjacent stations. I suggest the calculations be re-checked. The phosphates appear to be a little high also, they should be re-checked.

D.2 CTD Data Consistency Evaluation

(WHPO Staff)
2002 FEB 21

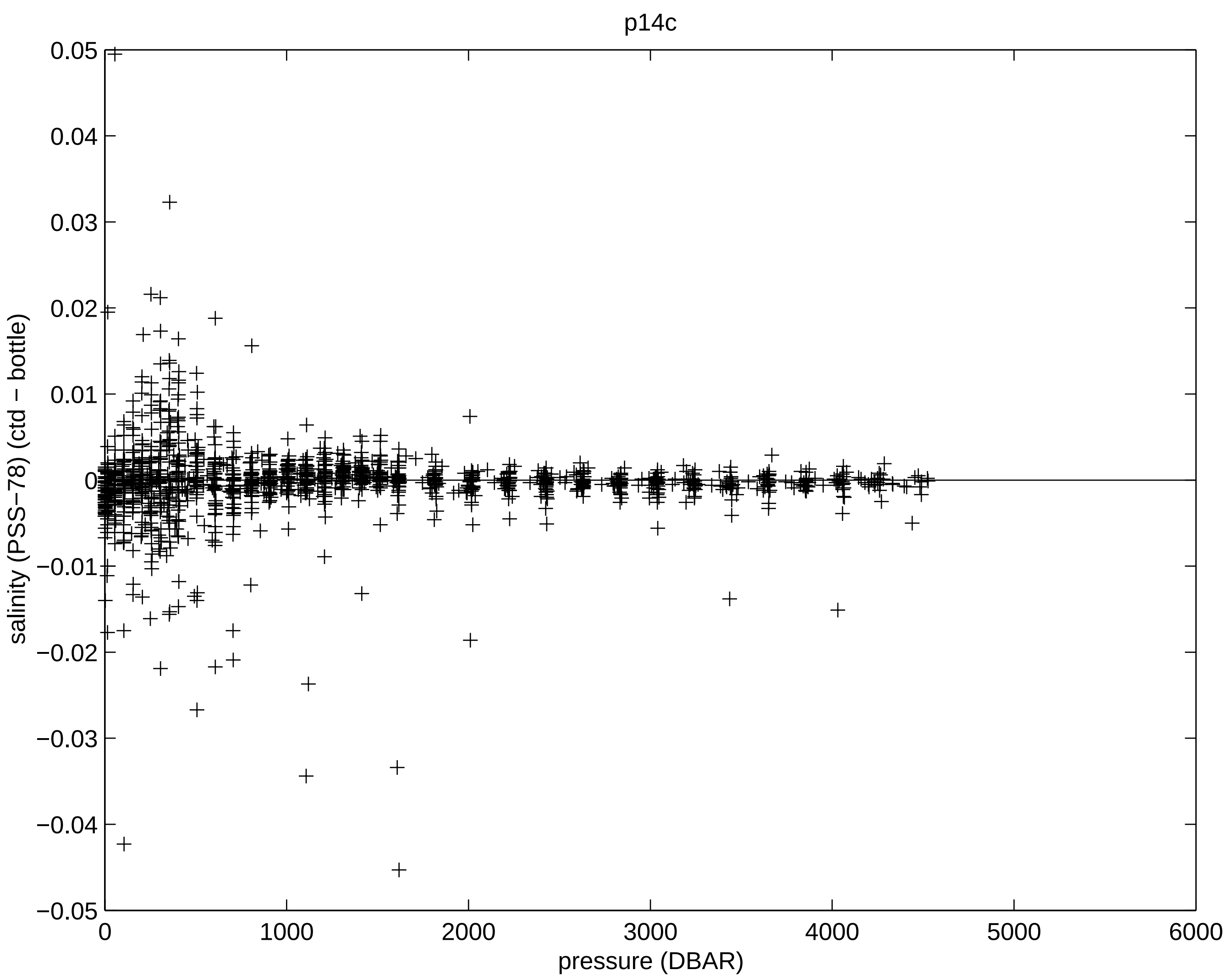
The WHP-Exchange format bottle and/or CTD data from this cruise have been examined by a computer application for contents and consistency. The parameters found for the files are listed, a check is made to see if all CTD files for this cruise contain the same CTD parameters, a check is made to see if there is a one-to-one correspondence between bottle station numbers and CTD station numbers, a check is made to see that pressures increase through each file for each station, and a check is made to locate multiple casts for the same station number in the bottle data. Results of those checks are reported in this '_check.txt' file.

When both bottle and CTD data are available, the CTD salinity data (and, if available, CTD oxygen data) reported in the bottle data file are subtracted from the corresponding bottle data and the differences are plotted for the entire cruise. Those plots are the' _sal.ps' and '_oxy.ps' files.

Following parameters found for bottle file:

EXPOCODE	OXYGEN_FLAG_W
SECT_ID	SILCAT
STNNBR	SILCAT_FLAG_W
CASTNO	NITRAT
SAMPNO	NITRAT_FLAG_W
BTLNBR	NITRIT
BTLNBR_FLAG_W	NITRIT_FLAG_W
DATE	PHSPHT
TIME	PHSPHT_FLAG_W
LATITUDE	CFC-11
LONGITUDE	CFC-11_FLAG_W
DEPTH	CFC-12
CTDPRS	CFC-12_FLAG_W
CTDTMP	TRITUM
CTDSAL	TRITUM_FLAG_W
CTDSAL_FLAG_W	DELC14
SALNTY	DELC14_FLAG_W
SALNTY_FLAG_W	DELC13
CTDOXY	DELC13_FLAG_W
CTDOXY_FLAG_W	C14ERR
OXYGEN	THETA

- All ctd parameters match the parameters in the reference station.
- All stations correspond among all given files.
- No bottle pressure inversions found.
- Bottle file pressures are increasing.
- No multiple casts found in bottle data.


p14c
salinity (PSS−78) (ctd − bottle)
pressure (DBAR)
0.05
0.04
0.03
0.02
0.01
0
−0.01
−0.02
−0.03
−0.04
−0.05
0
1000
2000
3000
4000
5000
6000

D.3 Final CFC Data Quality Evaluation (DQE) Comments on P14C.

(David Wisegarver)
Dec 2000

During the initial DQE review of the CFC data, a small number of samples were given QUALT2 flags which differed from the initial QUALT1 flags assigned by the PI. After discussion, the PI concurred with the DQE assigned flags and updated the QUAL1 flags for these samples.

The CFC concentrations have been adjusted to the SIO98 calibration Scale (Prinn et al. 2000) so that all of the Pacific WOCE CFC data will be on a common calibration scale.

For further information, comments or questions, please, contact the CFC PI for this section (mwarner@ocean.washington.edu) or David Wisegarver (wise@pmel.noaa.gov).

Additional information on WOCE CFC synthesis may be available at:

http://www.pmel.noaa.gov/cfc.

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Prinn, R. G., R. F. Weiss, P. J. Fraser, P. G. Simmonds, D. M. Cunnold, F. N. Alyea, S. O'Doherty, P. Salameh, B. R. Miller, J. Huang, R. H. J. Wang, D. E. Hartley, C. Harth, L. P. Steele, G. Sturrock, P. M. Midgley, and A. McCulloch, "A history of chemically and radiatively important gases in air deduced from ALE/GAGE/AGAGE." Journal of Geophysical Research, 105, 17,751-17,792, 2000.

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D.4 Final Report for AMS 14C Samples

(Robert M. Key)

November 10, 1997

D.4.1.0 General Information

WOCE cruise P14C was s carried out aboard the R/V Knorr in the southwestern Pacific Ocean. The WHPO designation for this cruise was 316N138/7. Dean Roemmich was the chief scientist. The cruise departed Auckland, New Zealand on September 1, 1992 and ended on September 15, 1992 at Suva, Fiji. The cruise made a meridional section along 175°E from approximately 36°S to 18°S. The reader is referred to cruise documentation provided by the chief scientists as the primary source for cruise information. This report covers details of the small volume radiocarbon samples. The AMS station locations are summarized in Table 1 and shown in Figure 1. A total of 273 $\Delta^{14}C$ samples were collected at 12 stations.

Table 1: AMS Station Locations

Station	Date	Latitude	Longitude	Bottom Depth (m)
5	9/1/92	-34.825	175.187	1430
8	9/2/92	-33.702	175.382	2363
12	9/3/92	-32.180	175.638	3916
15	9/3/92	-30.882	175.858	4139
18	9/4/92	-29.572	176.082	4277
21	9/5/92	-28.277	176.300	4473
24	9/6/92	-26.973	176.522	4401
27	9/6/92	-25.670	176.740	4448
30	9/7/92	-24.365	176.955	4447
33	9/8/92	-23.065	177.183	4334
37	9/9/92	-21.422	177.463	3793
47	9/11/92	-19.050	177.643	2570

D.4.2.0 Personnel

^{14}C sampling for this cruise was carried out by T. Zahn from the Ocean Tracer Lab at Princeton University. ^{14}C analyses were performed at the National Ocean Sciences AMS Facility (NOSAMS) at Woods Hole Oceanographic Institution. Salinity, oxygen and nutrients were analyzed by Scripps ODF. R. Key collected the data from the originators, merged the files, assigned quality control flags to the ^{14}C results and submitted the data files to the WOCE office (11/97). R. Key is P.I. for the ^{14}C data.

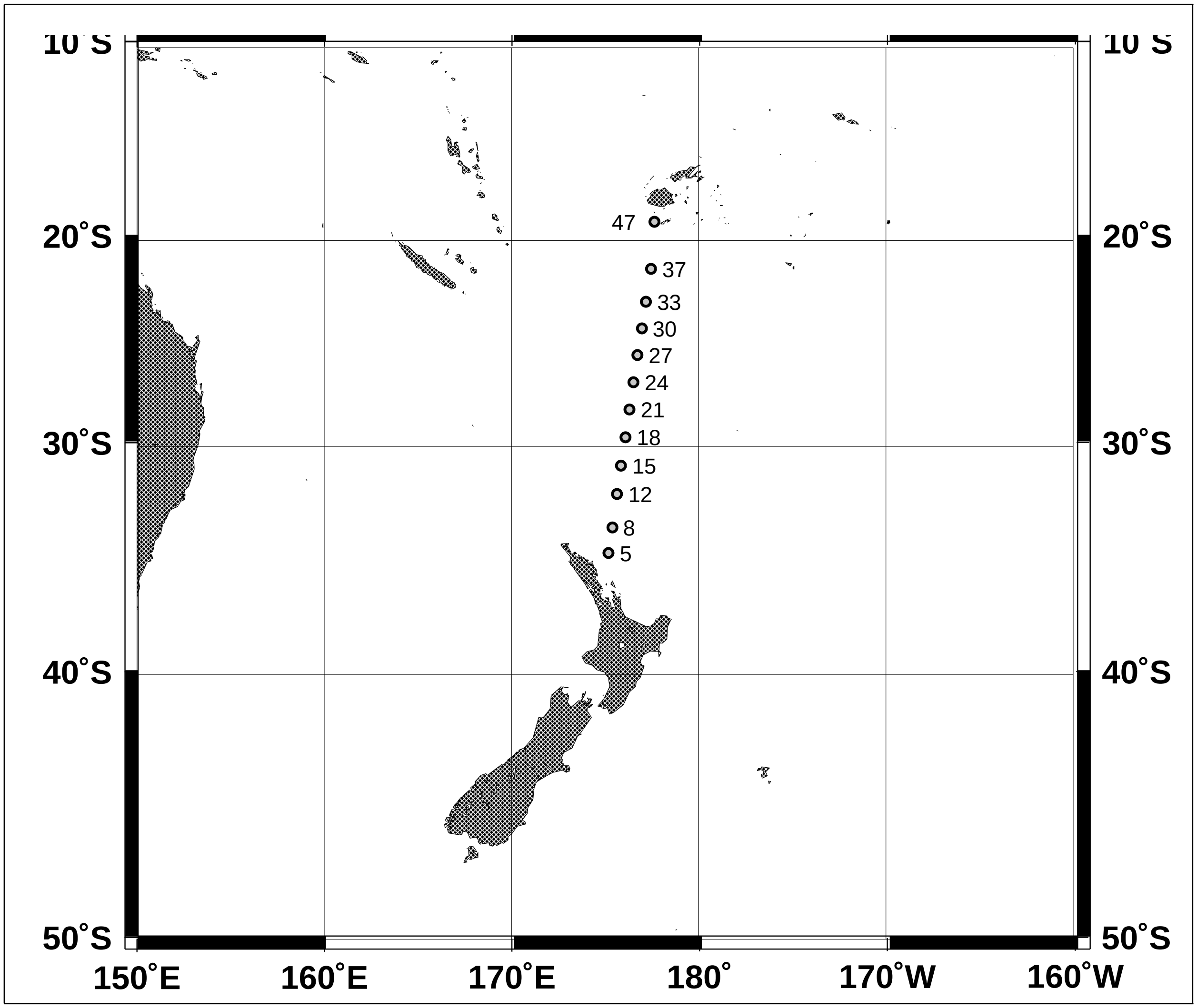

Figure 1: AMS ^{14}C station locations for WOCE P14C (map by GMT).

D.4.3.0 Results

This ^{14}C data set and any changes or additions supersedes any prior release.

D.4.3.1 Hydrography

Hydrography from this leg has been submitted to the WOCE office by the chief scientist and described in the hydrographic report.

D.4.3.2 14C

The Δ^{14}C values reported here were originally distributed in a data reports (NOSAMS, July 28, 1997). That report included preliminary results which had not been through the WOCE quality control procedures.

All of the AMS samples from this cruise have been measured. Replicate measurements were made on 9 water samples. These replicate analyses are tabulated in Table 2. The table shows

Table 2: Summary of Replicate Analyses

Sta-Cast-Bottle	$\Delta^{14}C$	Err	E.W.Mean[a]	Uncertainty[b]
8-1-28	-106.1	2.7	106.7	1.9
	-107.1	2.6		
18-1-16	-79.3	3.1	-77.1	3.7
	-74.1	3.6		
18-1-33	-212.4	2.7	-215.4	4.4
	-218.7	2.8		
21-1-1	113.6	4.2	113.8	2.4
	113.9	2.9		
24-1-11	13.3	3.1	11.4	3.3
	8.6	3.8		
24-1-16	-105.1	4.3	-111.7	6.4
	-114.2	2.6		
24-1-20	-162.8	2.7	-161.3	3.8
	-157.5	4.3		
33-1-34	-195.5	1.9	-197.4	5.8
	-203.7	3.6		
47-1-21	-36.9	3.1	-40.2	4.4
	-43.1	2.9		

a. Error weighted mean reported with data set

b. Larger of the standard deviation and the error weighted standard deviation of the mean.

the error weighted mean and uncertainty for each set of replicates. Uncertainty is defined here as the larger of the standard deviation and the error weighted standard deviation of the mean. For these replicates, the simple average of the normal standard deviations for the replicates is 3.6‰ (equal weighting for each replicate set). This precision is typical for the time frame over which these samples were measured (Dec. 1996 - Mar. 1997). Note that the errors given for individual measurements in the final data report (with the exception of the replicates) include only counting errors, and errors due to blanks and backgrounds. The uncertainty obtained for replicate analyses is an estimate of the true error which includes errors due to sample collection, sample degassing, *etc*. For a detailed discussion of this see Key (1996). Note that for stations 33 and 37 the reported errors were tripled by the PI to account for a problem with the sample collection (see next section).

D.4.4.0 Quality Control Flag Assignment

Quality flag values were assigned to all $\Delta^{14}C$ measurements using the code defined in Table 0.2 of WHP Office Report WHPO 91-1 Rev. 2 section 4.5.2. (Joyce, *et al.*, 1994). Measurement flags values of 2, 3, 4, 5 and 6 have been assigned. The choice between values 2 (good), 3 (questionable) or 4 (bad) involves some interpretation. There is no overlap between this data set and any existing ^{14}C data, so that type of comparison was not possible. In general the lack of other data for comparison led to a more lenient grading on the ^{14}C data.

When using this data set for scientific application, any ^{14}C datum which is flagged with a "3" should be carefully considered. My subjective opinion is that any datum flagged "4" should be disregarded. When flagging ^{14}C data, the measurement error was taken into consideration. That is, approximately one-third of the ^{14}C measurements are expected to deviate from the true value by more than the measurement precision (~3.6‰). No measured values have been removed from this data set, therefore a flag value of 5 implies that the sample was totally lost somewhere between collection and analysis. Table 3 summarizes the quality control flags assigned to this data set. For a detailed description of the flagging procedure see Key, *et al*. (1996).

Table 3: Summary of Assigned Quality Control Flags

Flag	Number
2	234
3	22
4	3
5	5
6	9

NOSAMS personnel noted that the quality of the results from stations 33 and 37 was significantly lower than normal. The problem was not analytical, therefore the scatter was assumed to be due to a problem with either collection or poisoning. Mercury concentration for most of the samples from these stations was found to be low. Rather than omit these results or simply flag them all as bad, the results were carefully checked, with several being marked "questionable" then the reported errors were tripled. While these data are clearly not up to normal WOCE standards, I felt that the data were "better than nothing". By substantially increasing the reported errors, the weight of these data relative to other measurements can be decreased - *caveat emptor.*

D.4.5.0 Data Summary

Figures 2-5 summarize the $\Delta^{14}C$ data collected on this leg. Only $\Delta^{14}C$ measurements with a quality flag value of 2 ("good") or 6 ("replicate") are included in each figure. Figure 2 shows the $\Delta^{14}C$ values with 2σ error bars plotted as a function of pressure. The mid depth $\Delta^{14}C$ minimum which normally occurs around 2200 to 2400 meters in the Pacific is totally absent in this data set. Figure 3 shows the $\Delta^{14}C$ values plotted against silicate.The straight line shown in the figure is the least squares regression relationship derived by Broecker *et al.* (1995) based on the GEOSECS global data set. According to their analysis, this line ($\Delta^{14}C = -70 - Si$) represents the relationship between naturally occurring radiocarbon and silicate for most of the ocean. They interpret deviations in $\Delta^{14}C$ above this line to be due to input of bomb-produced radiocarbon, however, they note that the interpretation can be problematic at high latitudes. Samples collected from shallower depths at these stations show an upward curving trend with decreasing silicate values reflecting the addition of bomb produced ^{14}C. The $\Delta^{14}C$ values for the silicate concentration range 50-120 μmol/kg generally fall somewhat below Broecker's global trend. With most of the Pacific data sets, the silicate - $\Delta^{14}C$ trend doubles back on itself with the deep and bottom water values having a somewhat steeper slope than the waters from the thermocline (down to approximately 2500m).

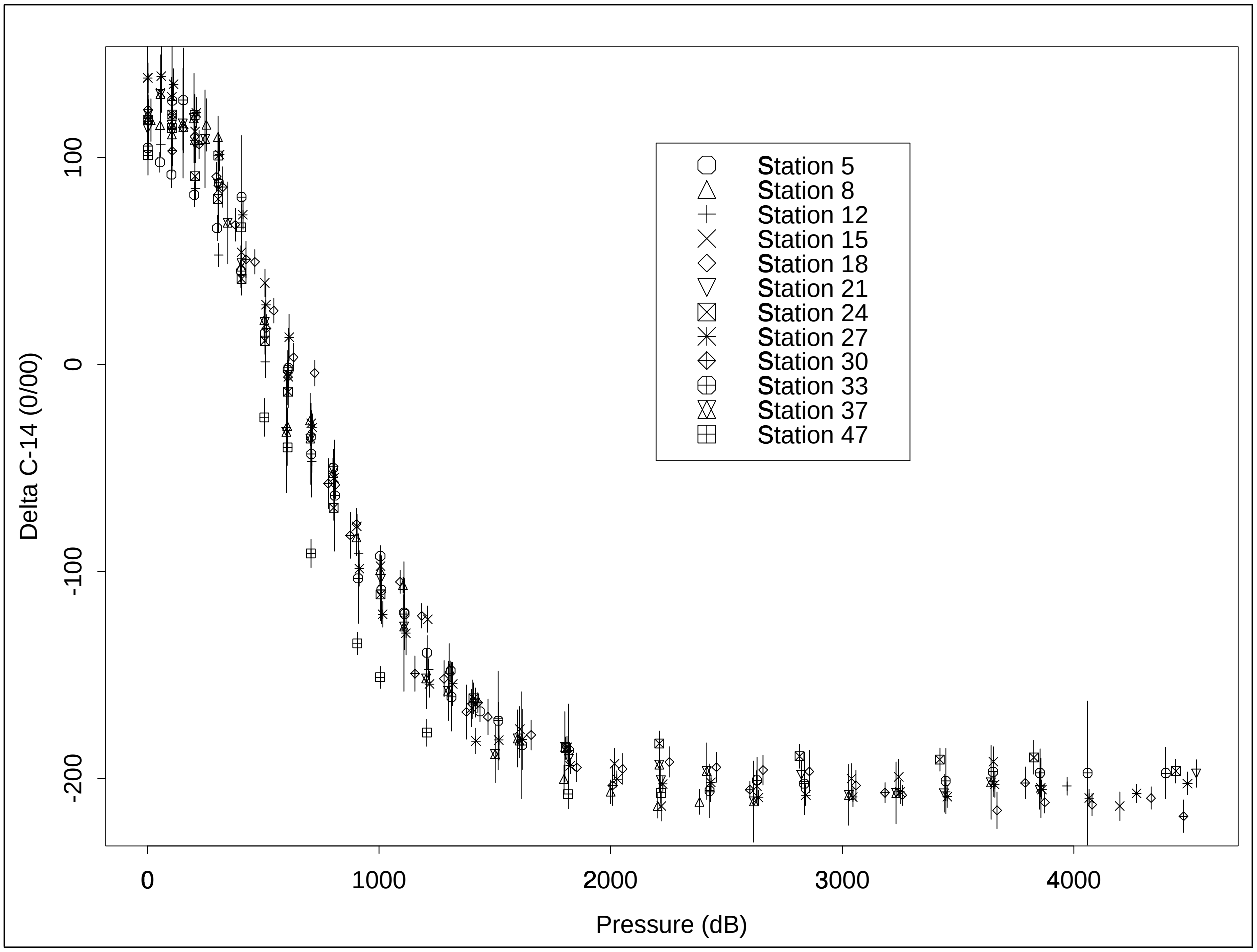

Figure 2: $\Delta^{14}C$ results for P14C stations shown with 2σ error bars.Only those measurements having a quality control flag value of 2 or 6 are plotted.

This doubling back is totally absent from the P14C data primarily because the deep and bottom waters sampled on this cruise are from a basin which is topographically isolated from open Pacific bottom waters.

Another way to visualize the ^{14}C - silicate correlation is as a section. Figure 4 shows $\Delta^{14}C$ as contour lines in silicate - latitude space for samples collected at depths between 500 and 2500 meters. In this space, shallow waters are toward the bottom of the figure. The 500 meter cutoff was selected to eliminate those samples having a very large bomb produced ^{14}C component. The 2500 meter cutoff was selected because this is the approximate topographic sill for the basin. For reference the 1000 meter depth contour is also shown (heavy line). For this data set, Broecker's hypothesis works reasonably well. The $\Delta^{14}C$ isolines are approximately horizontal and the spacing of the isolines for contours which fall below the depth of bomb-radiocarbon contamination are more or less equal. Some of the non linearity in the isolines is due to the data quality for stations 33 and 37. The presence of bomb produced radiocarbon in the shallower waters is indicated by the close spacing of the isolines for these waters.

Figure 5 compares the surface $\Delta^{14}C$ values for P14C to those from the Pacific GEOSECS data set in the same general area. throughout this latitude range, the WOCE measurements are lower than GEOSECS, but the difference is not nearly so great as is seen for the North Pacific. The hemispheric difference is due to the fact that most of the atmospheric nuclear tests were in the

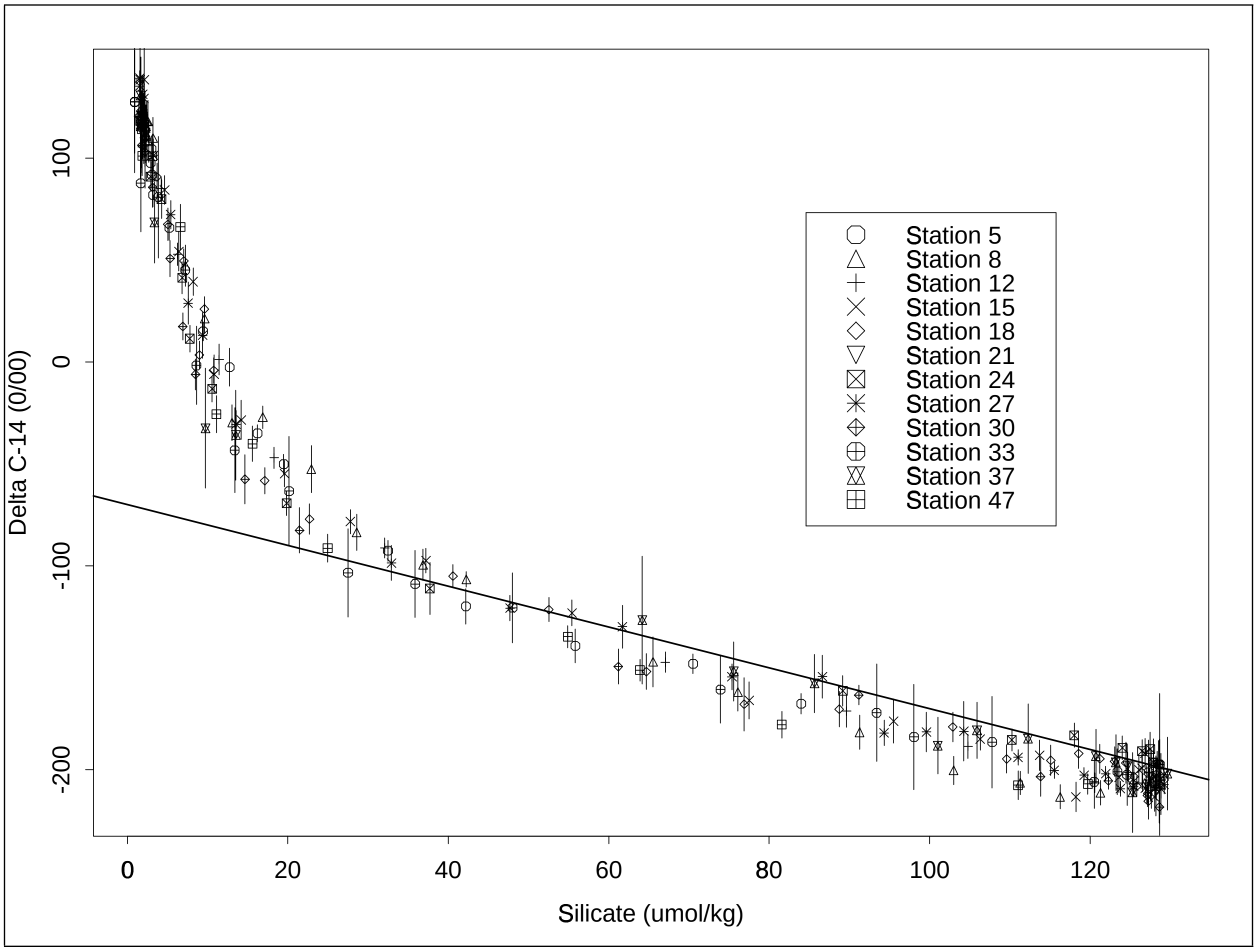

Figure 3: $\Delta^{14}C$ as a function of silicate for P14C AMS samples. The straight line shows the relationship proposed by Broecker, *et al.*, 1995 ($\Delta^{14}C$ = -70 - Si with radiocarbon in ‰ and silicate in μmol/kg).

northern hemisphere.

Figure 6 shows contoured sections of the $\Delta^{14}C$ distribution along the cruise track. The “A” portion shows the upper kilometer of the section and “B” the remainder of the water column. The data were gridded using the “loess” methods described in Chambers *et al.* (1983), Chambers and Hastie (1991), Cleveland (1979) and Cleveland and Devlin (1988). Figure 7 shows the same data as Figure 6A except the section is plotted in potential density (σ_θ) - latitude space. For this section, the maximum $\Delta^{14}C$ concentration was found at or very near the surface. The most interesting feature is the wedge of relatively young water in the deep center portion of Figure 6B. The same sort of structure is present in silicate and is assumed to be due to leakage through topography.

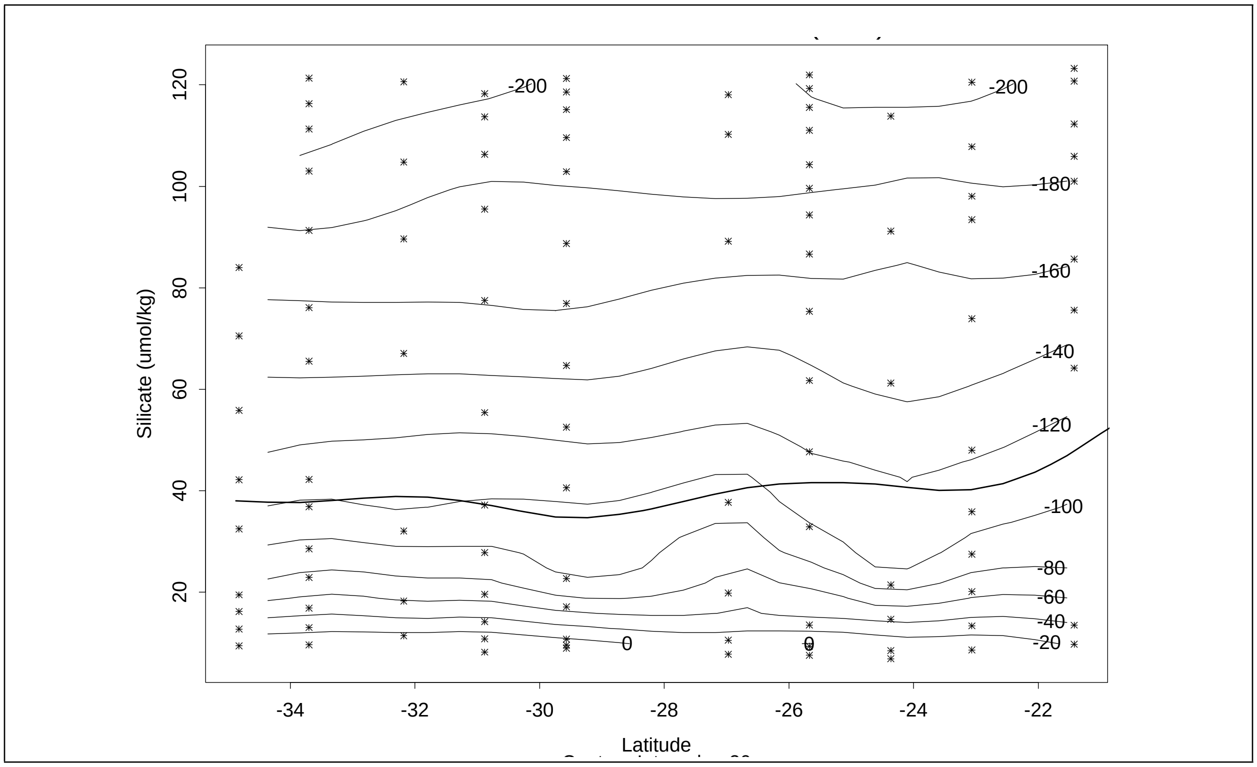

Figure 4: Section of ^{14}C contours along latitude in silicate space for the 500-2500m depth range. Note that for this section, “shallow” is toward the bottom. The 1000m depth contour is added for orientation (heavy line).

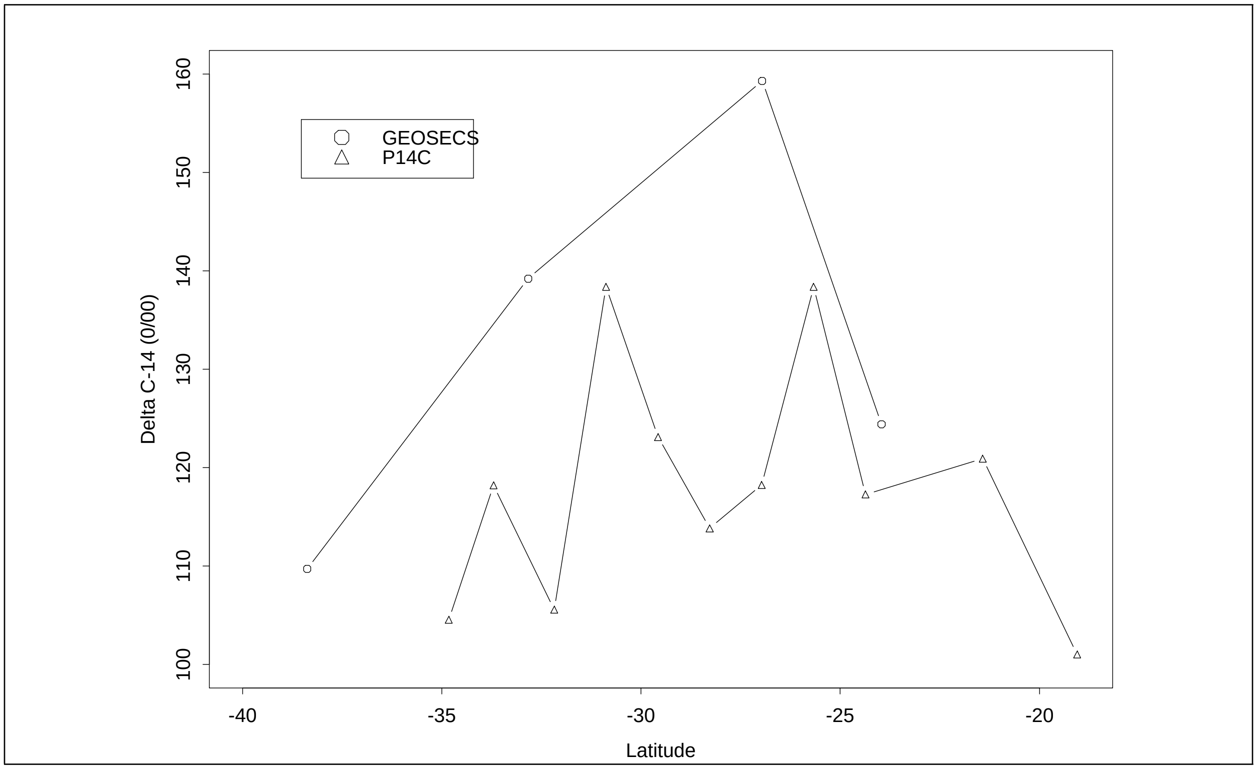

Figure 5: Surface distribution of $\Delta^{14}C$ along WOCE section P14C. For comparison the GEOSECS data from the southwestern Pacific are also plotted.

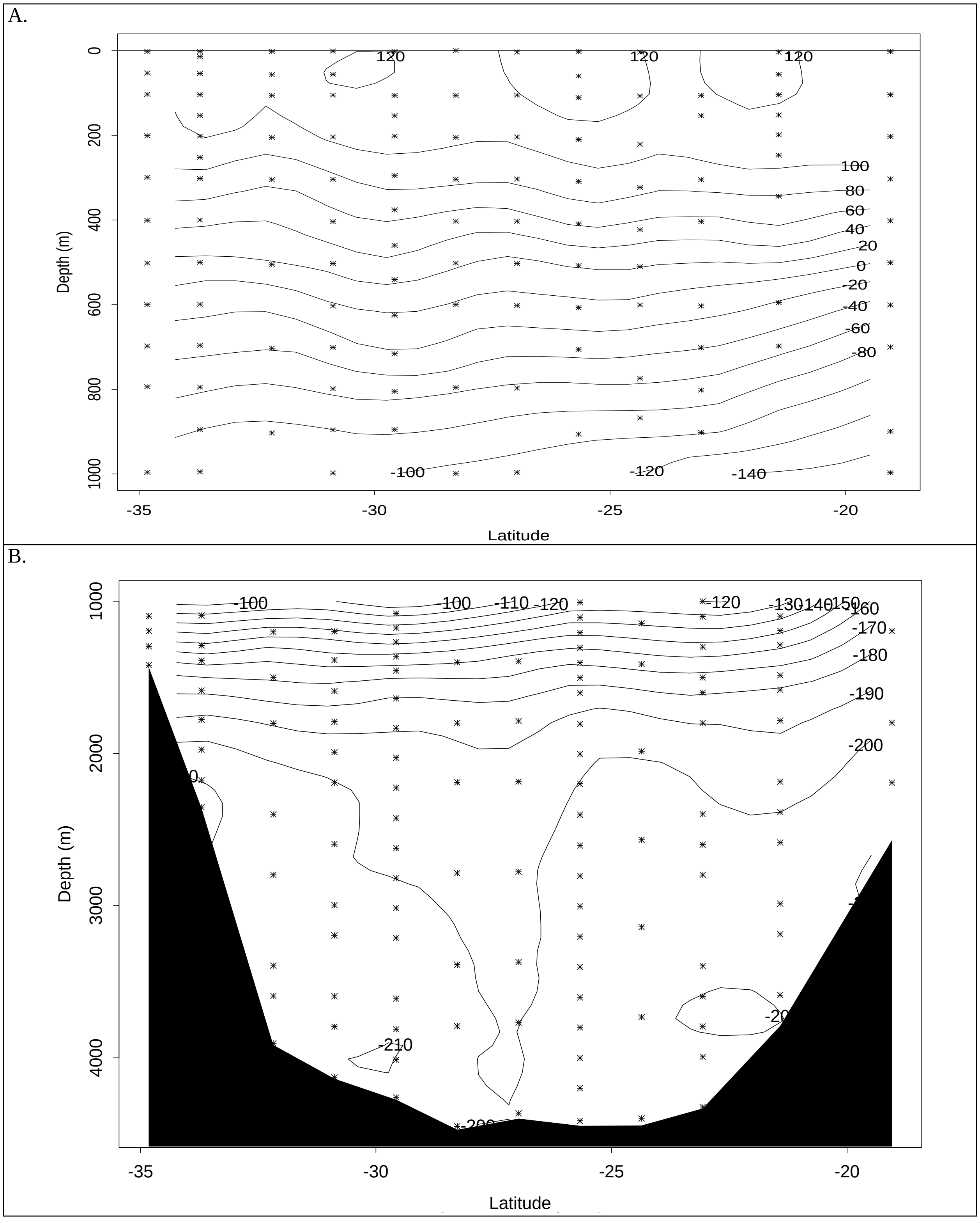

Figure 6: $\Delta^{14}C$ sections for WOCE P14C along 176°E. The section in shown in two parts to allow more detail. See text for gridding method. The bottom topography in B is taken from cruise data, but only using those stations on which $\Delta^{14}C$ was measured.

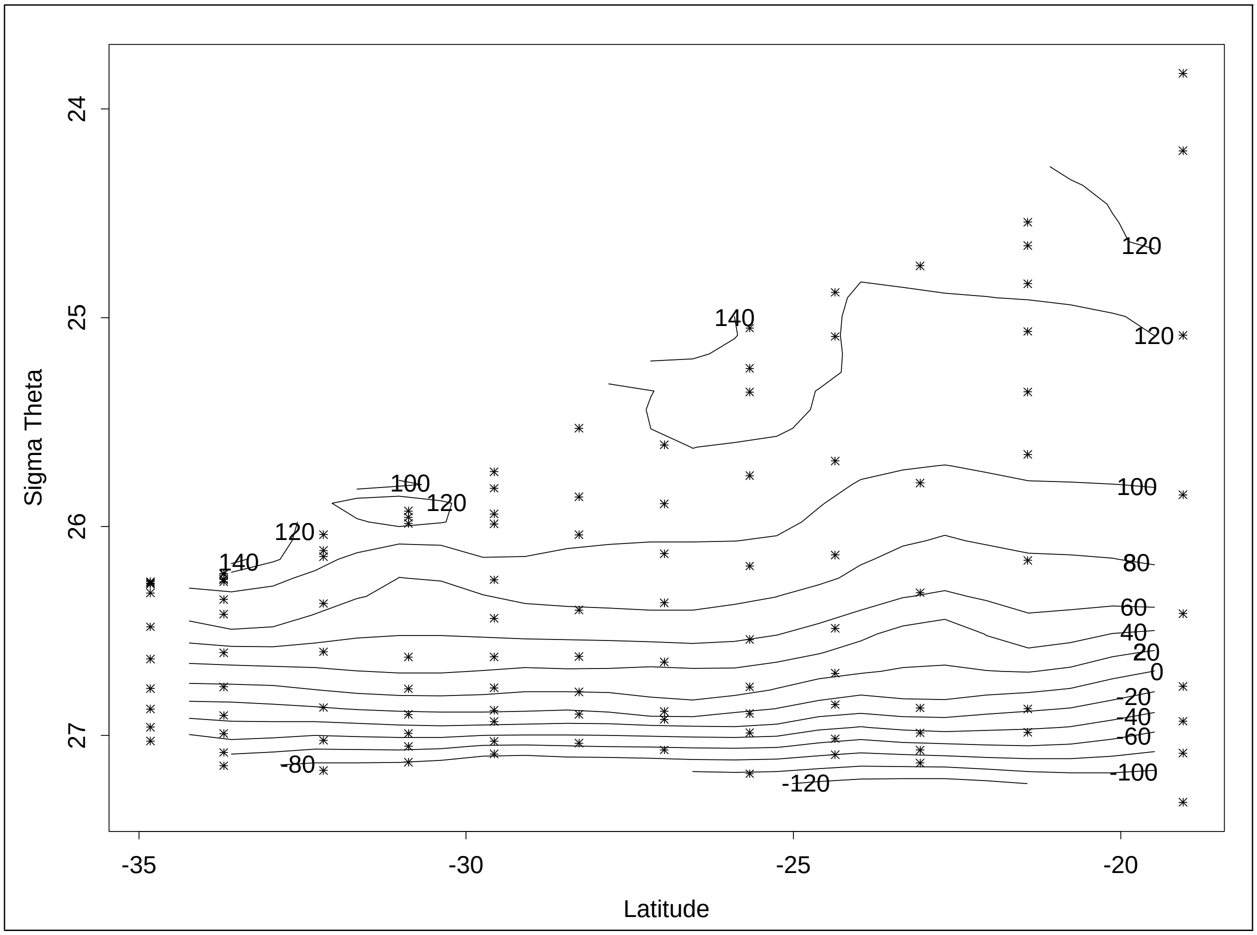

Figure 7: $\Delta^{14}C$ along WOCE section P14C plotted in potential density (σ_θ) - latitude space.

D.4.5.1 References and Supporting Documentation

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Key, R.M., WOCE Pacific Ocean radiocarbon program, *Radiocarbon, 38(3)*, 415-423, 1996.

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NOSAMS, National Ocean Sciences AMS Facility Data Report #97-082, Woods Hole Oceanographic Institution, Woods Hole, MA, 02543, 1997.

Appendix C:
WOCE92-P14C CALIBRATION FIGURES
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NOTE: All figures can be seen in the PDF version of this cruise report. Some differences fall outside of the plotted limits. Please refer to the bottle data quality codes.

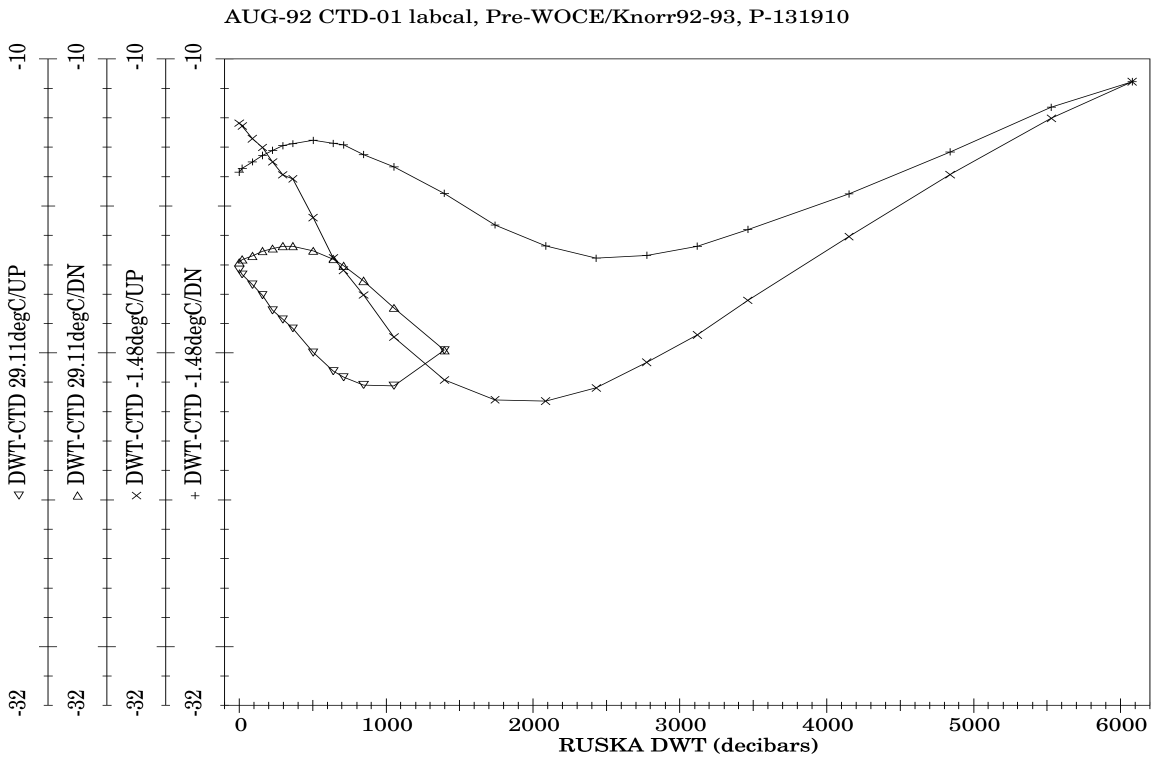

Figure 1a: CTD #1 Pre-cruise Pressure Calibration

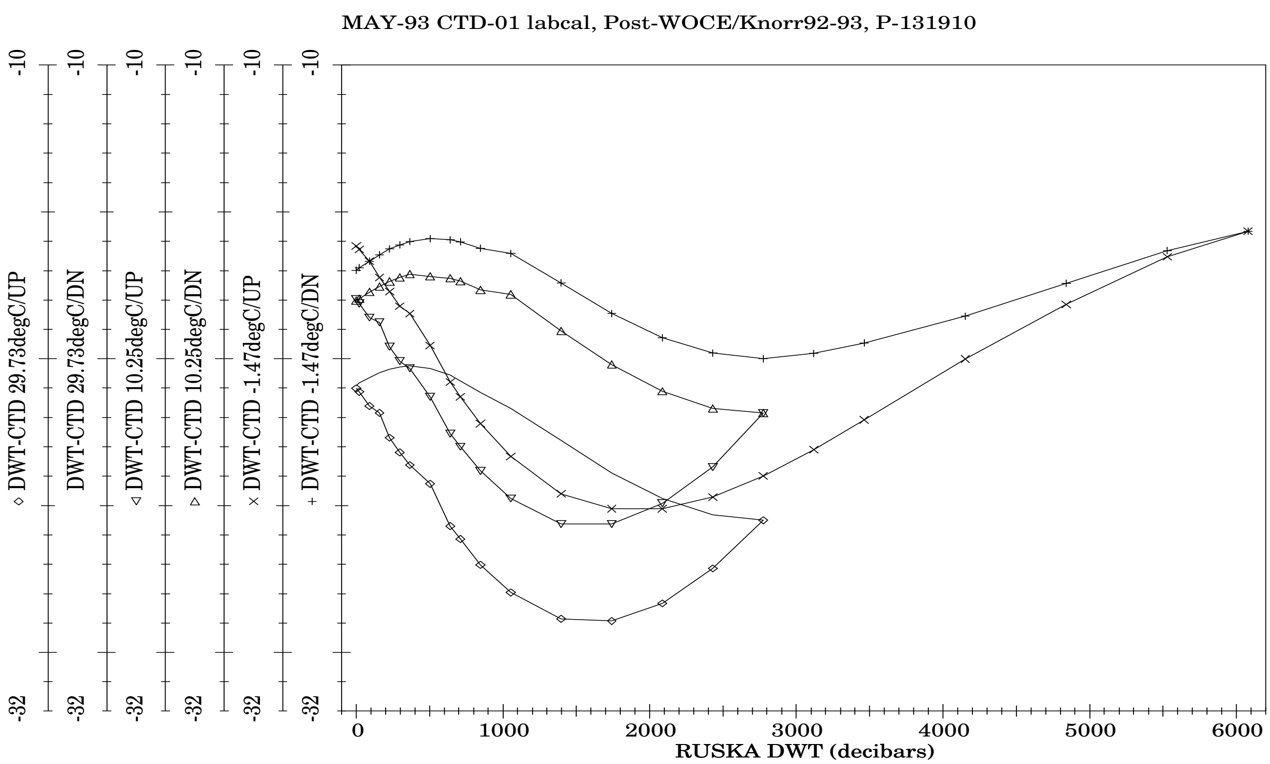

Figure 1b: CTD #1 Post-cruise Pressure Calibration

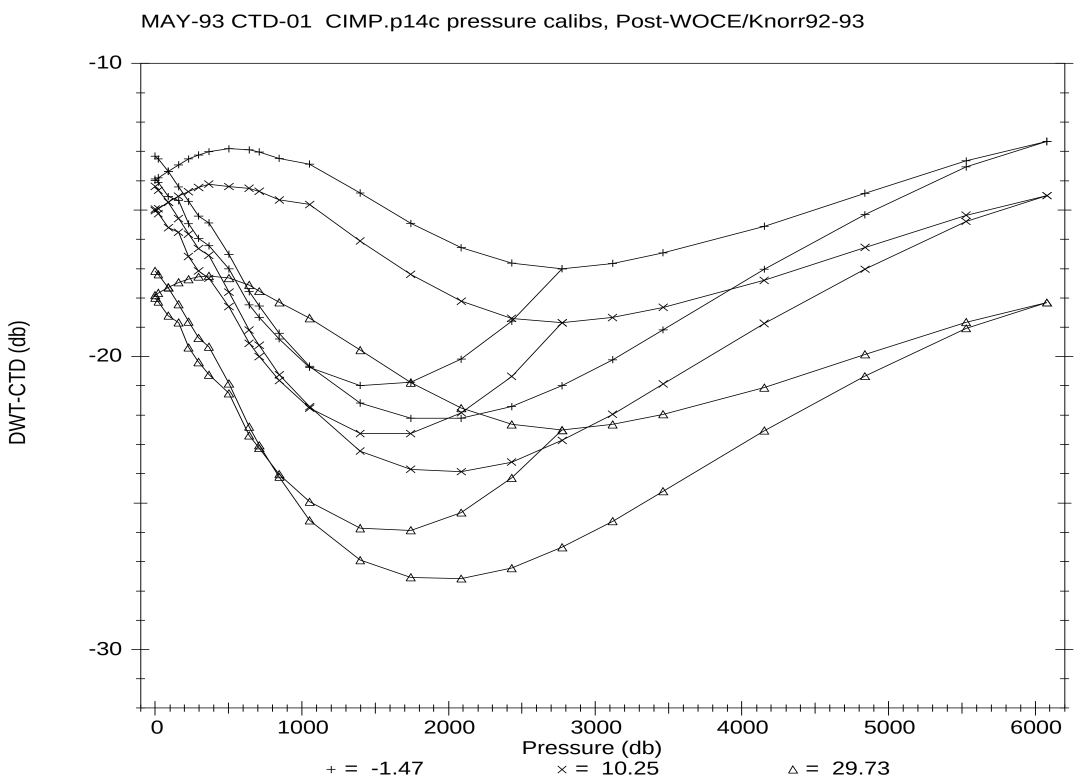

Figure 1c: CTD #1 Post-cruise Pressure Calibration plus Offset used for P14C

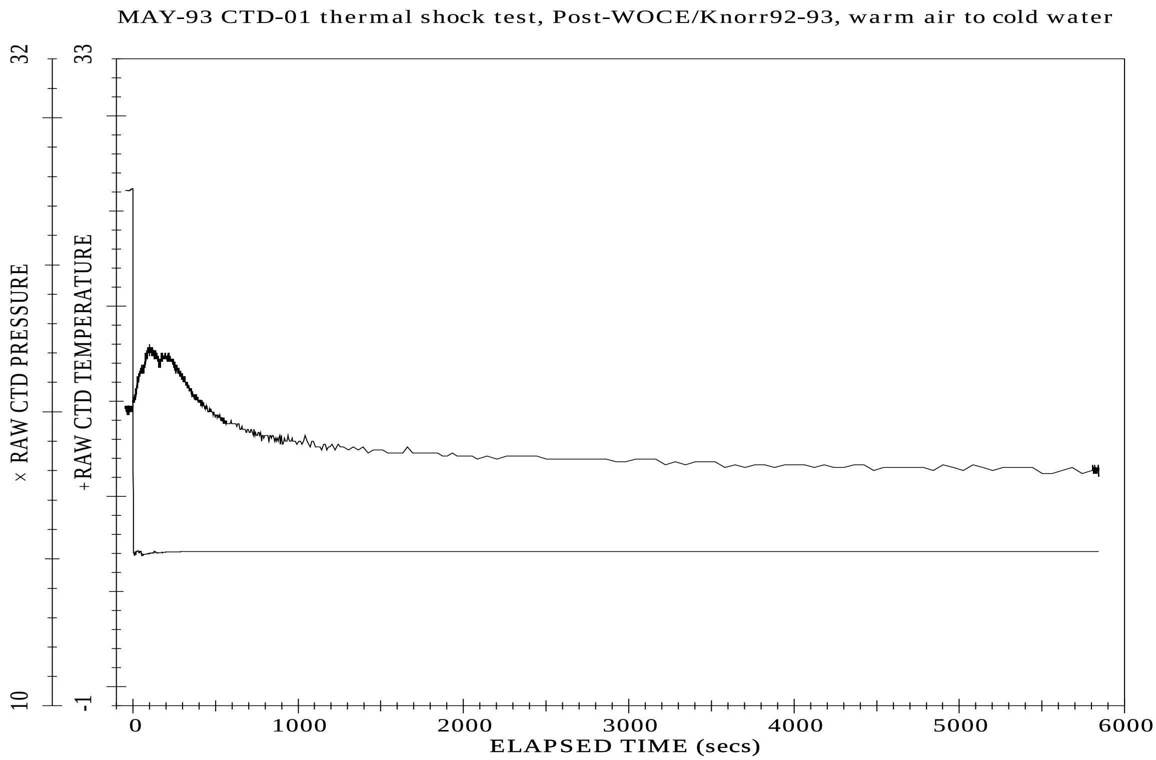

Figure 2a: CTD #1 Warm-to-Cold Thermal Shock Data

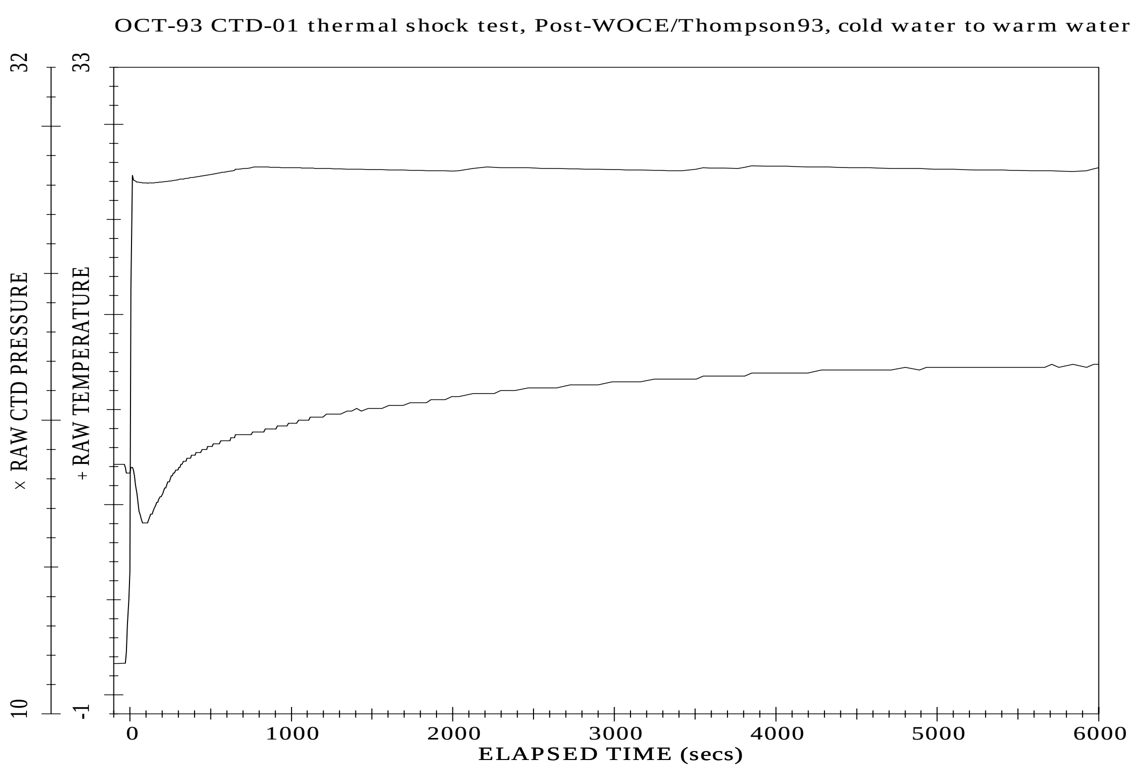

Figure 2b: CTD #1 Cold-to-Warm Thermal Shock Data

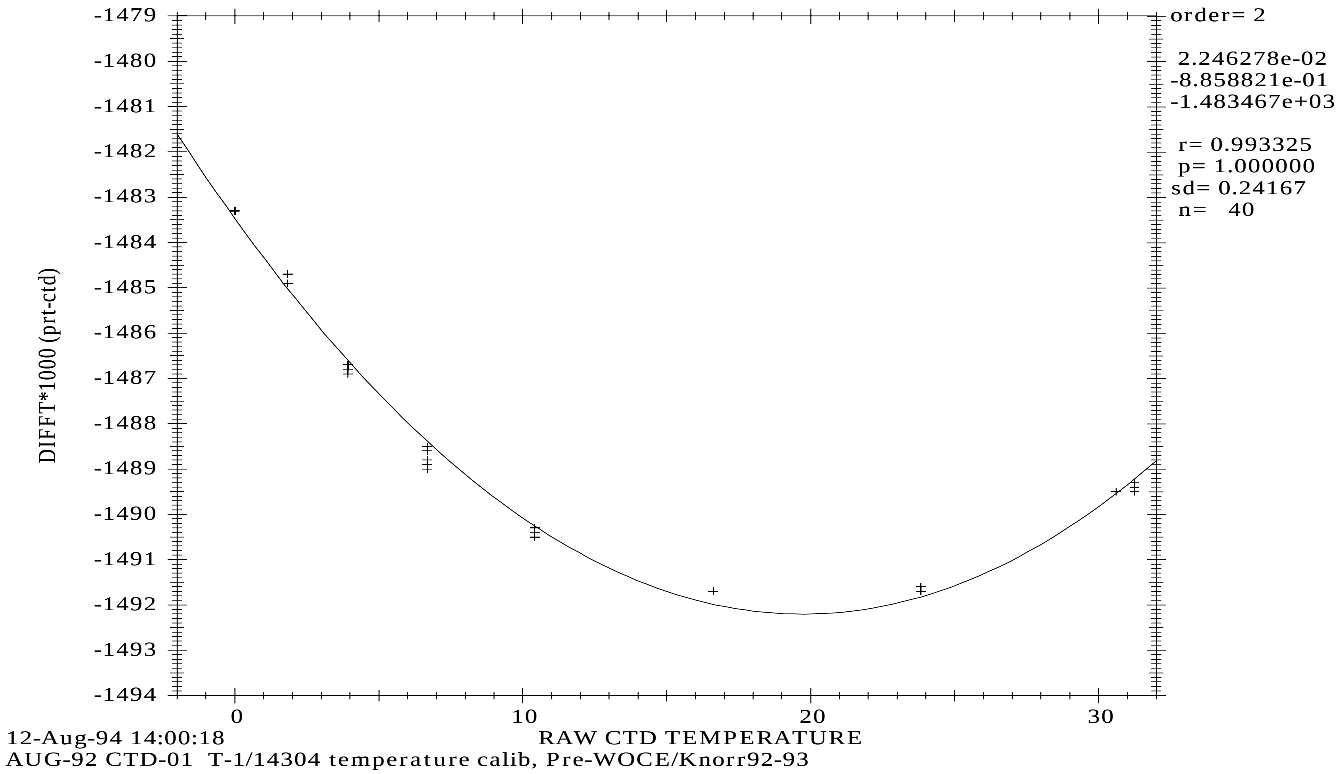

Figure 3a: CTD #1 Pre-cruise PRT-1 Temperature Calibration (ITS-90)

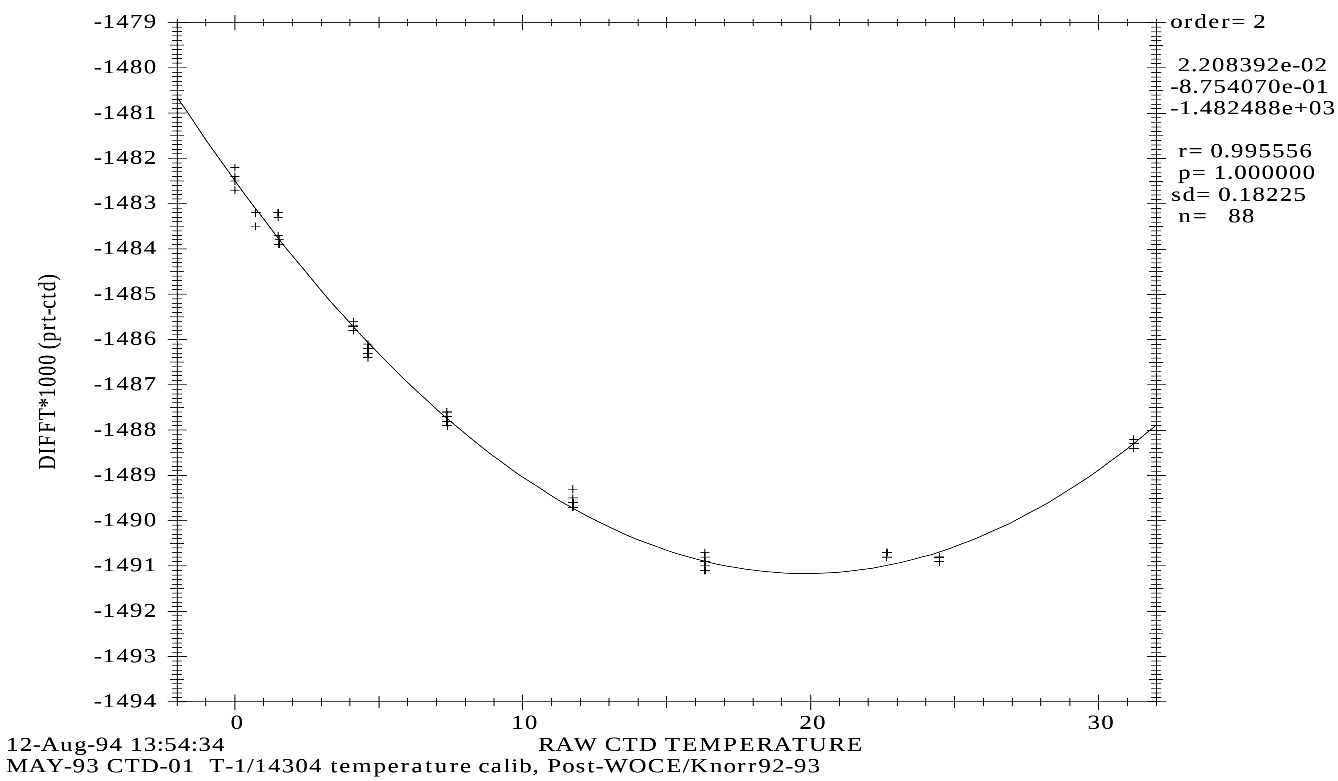

Figure 3b: CTD #1 Post-cruise PRT-1 Temperature Calibration (ITS-90)

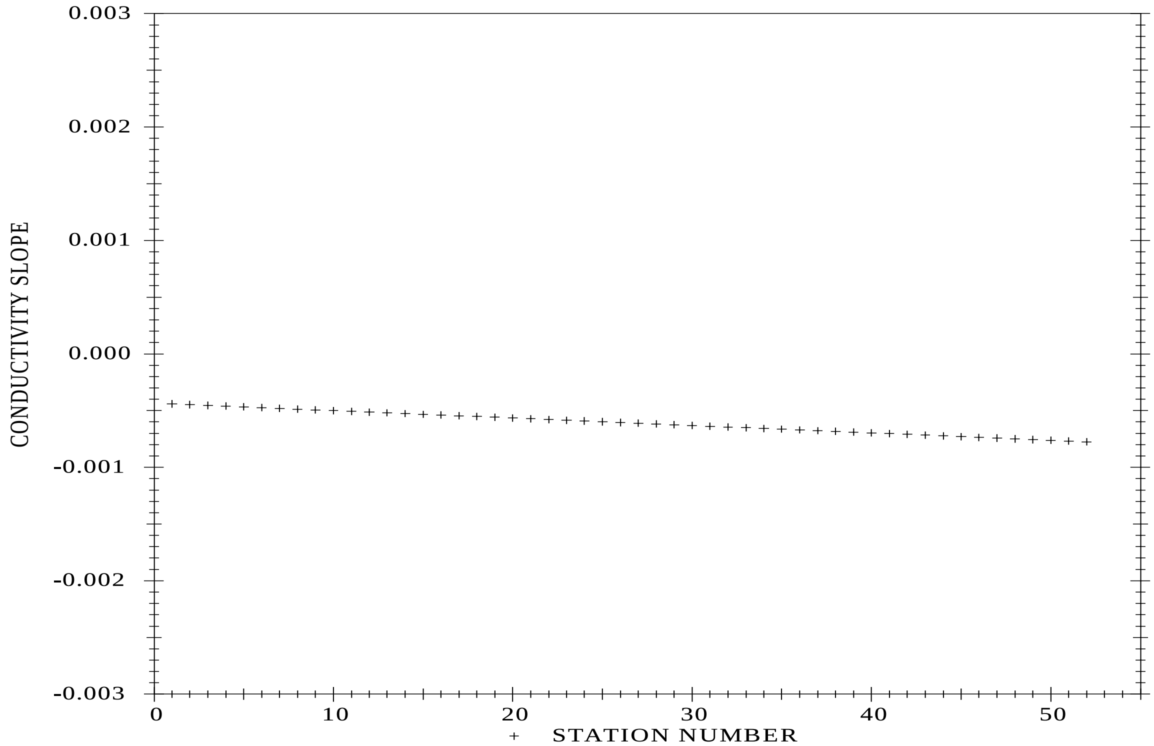

Figure 4a: P14C Conductivity Slopes, Both CTDs

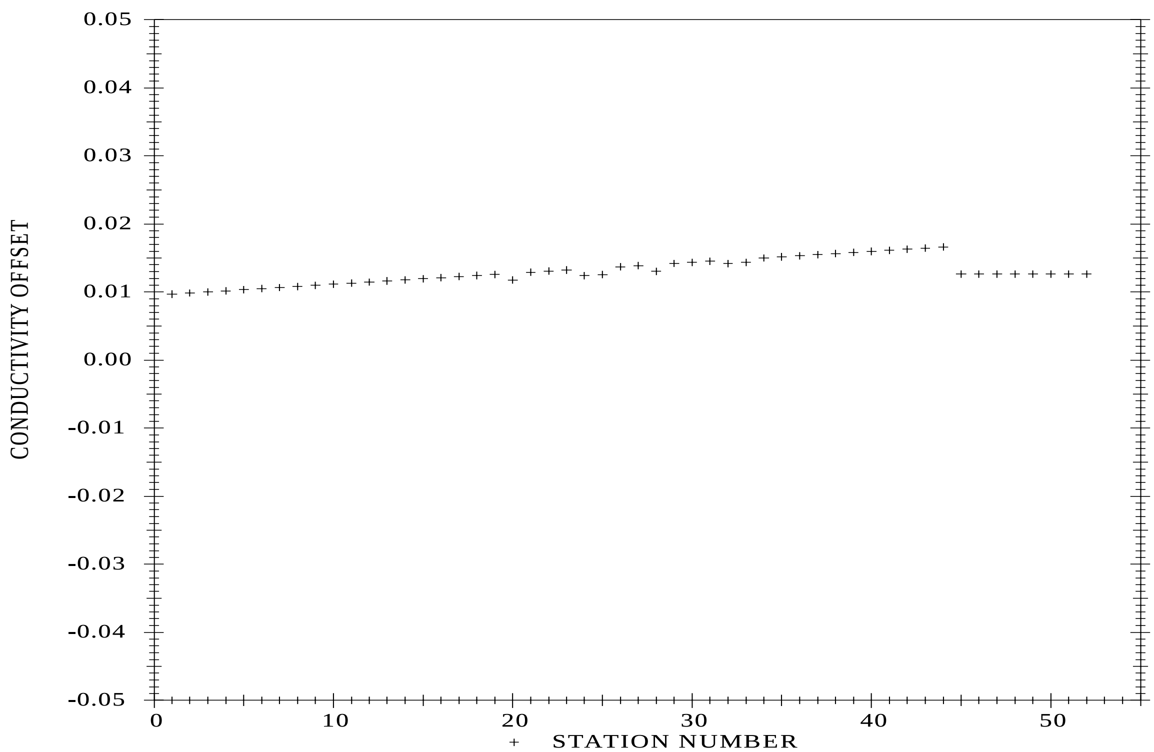

Figure 4b: P14C Conductivity Offsets, Both CTDs

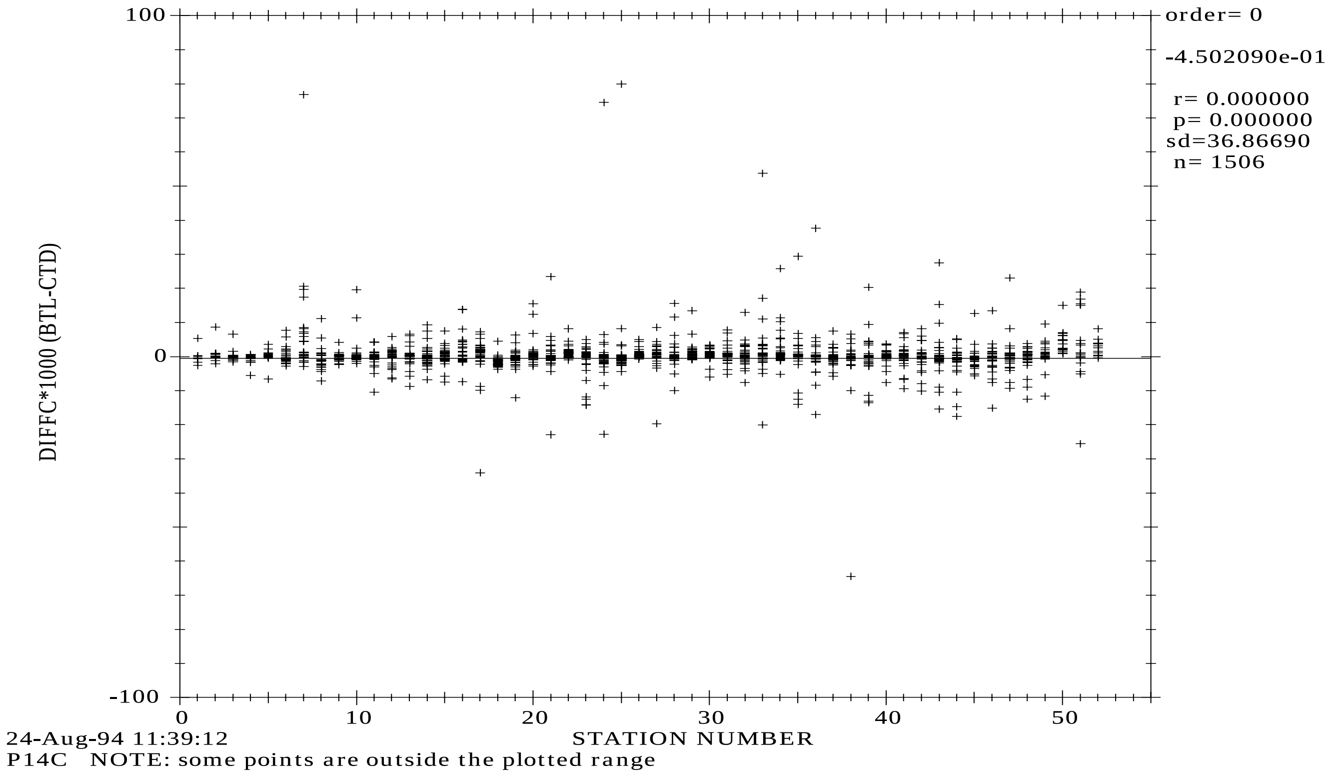

Figure 5a: P14C Residual Conductivity Bottle-CTD Differences - All Pressures

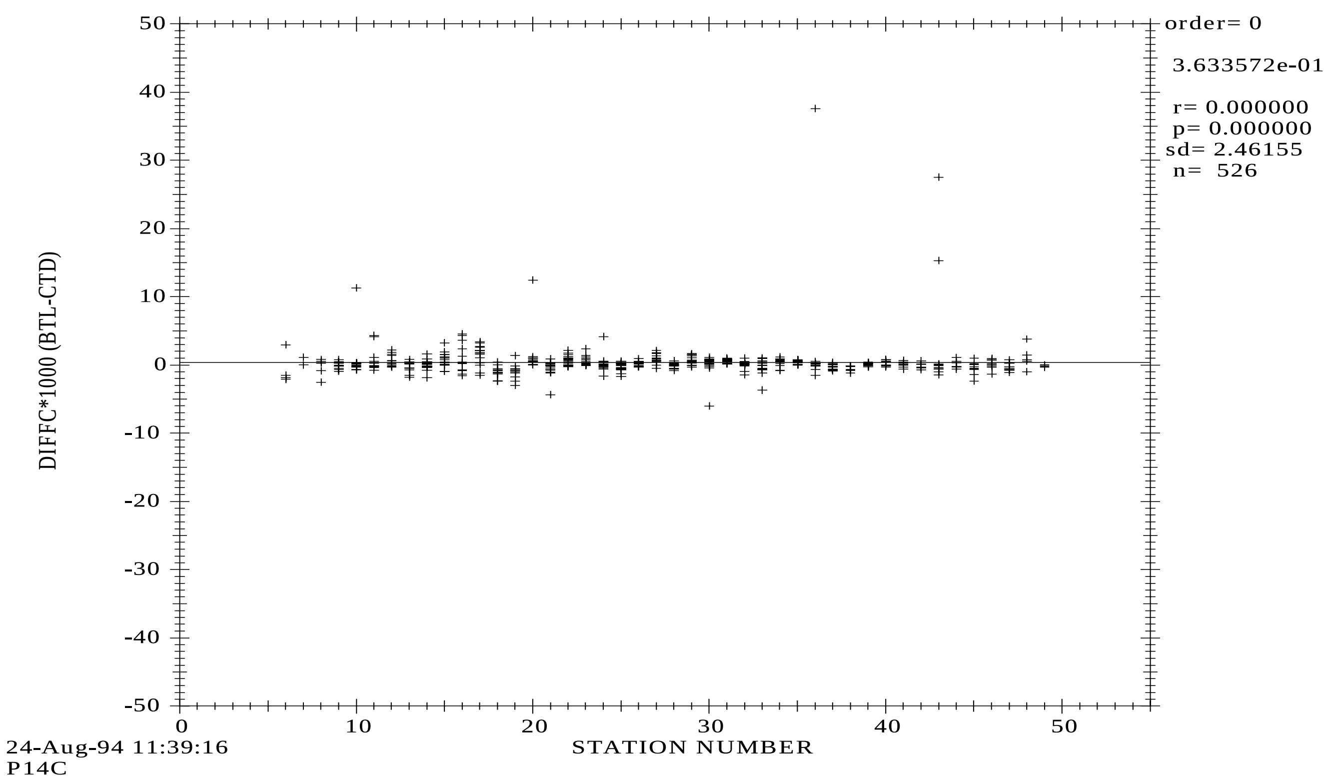

Figure 5b: P14C Residual Conductivity Bottle-CTD Differences - Prs>1500dbar

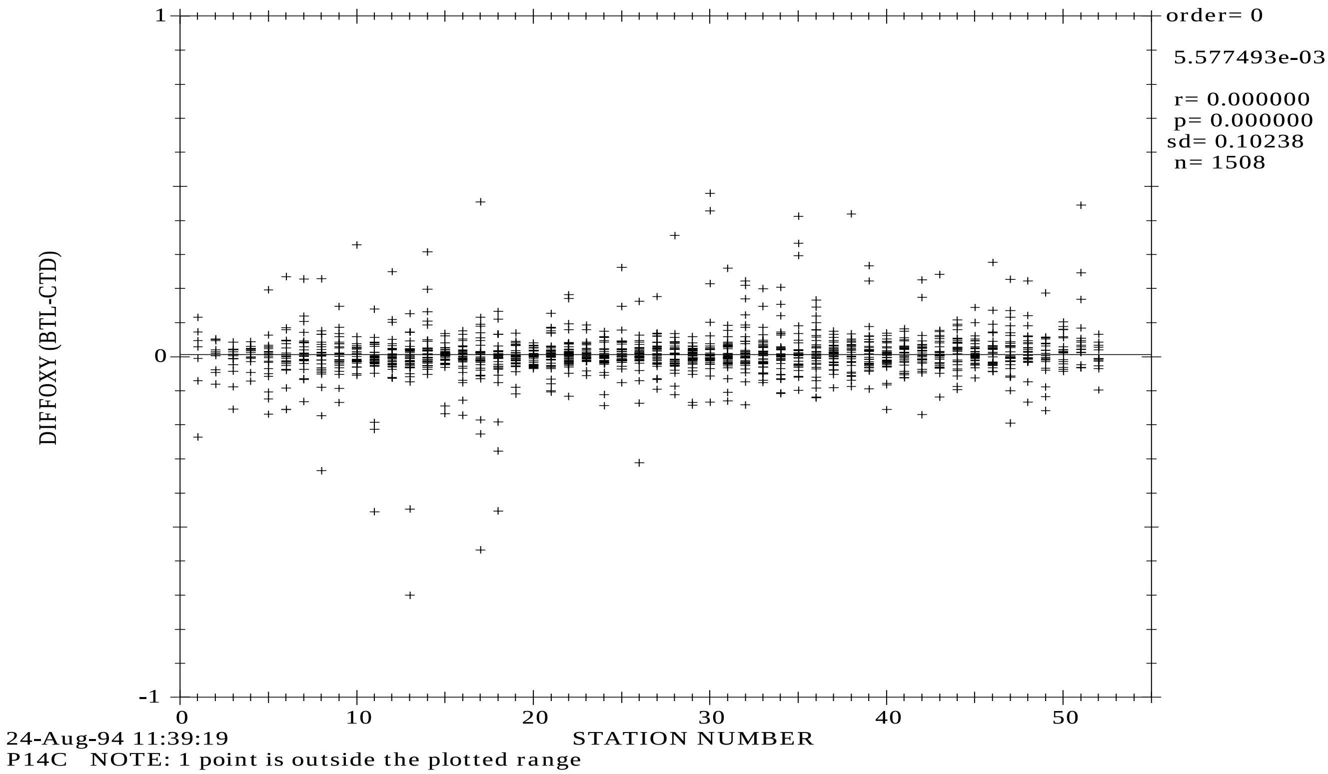

Figure 6a: P14C Residual Diss.Oxygen UpBottle-DownCTD Differences - All Pressures

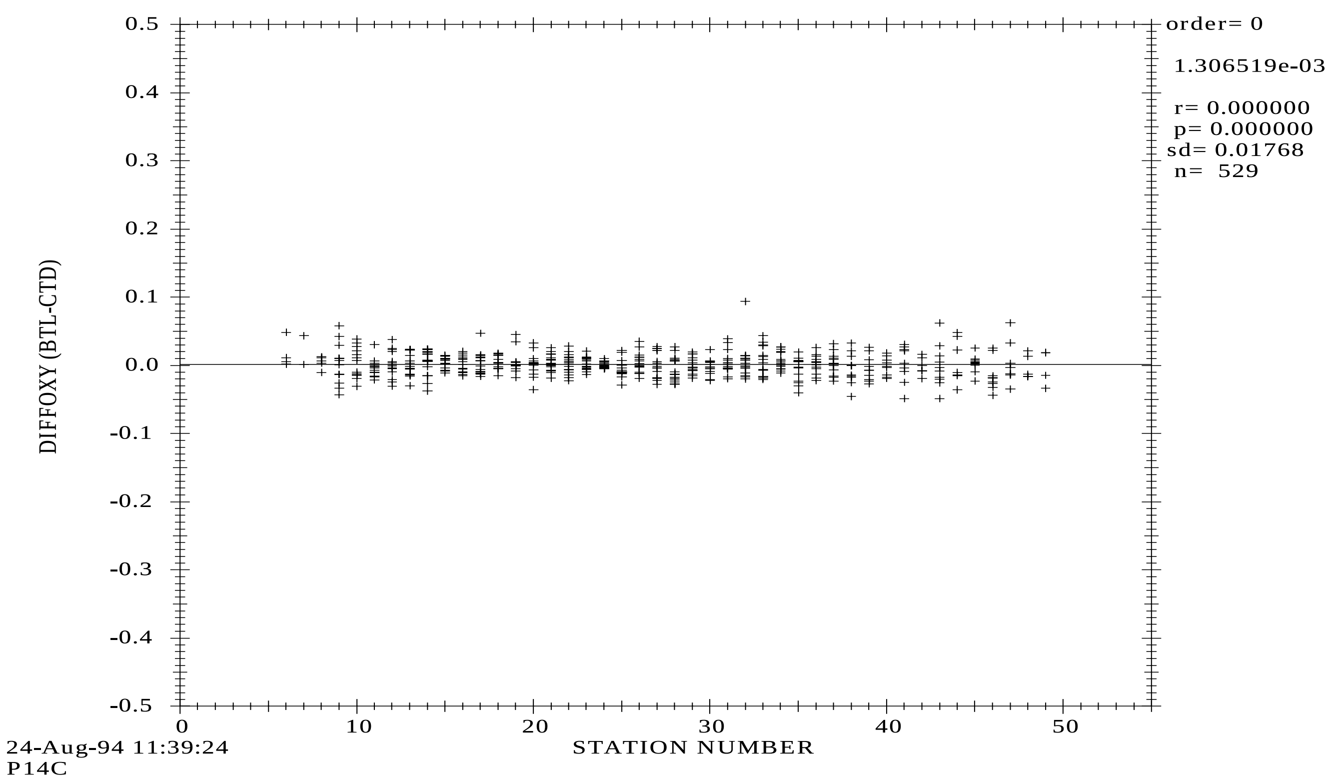

Figure 6b: P14C Residual Diss.Oxygen UpBottle-DownCTD Differences - Prs>1500dbar

Appendix D:
WOCE92-P14C PROCESSING NOTES
TABLE OF CONTENTS

WOCE92-P14C CTD SHIPBOARD AND PROCESSING COMMENTS

sta/cast	Comments
001/01	CTD oxygen fit based on that of sta 2-1 as only 7 discrete levels
002/01	bad data starting at 300 m: dropouts; no water in connector - termination?; 0 db level extrapolated; 318 db and 322-328 db levels interpolated
003/01	lost signal intermittently from 325 m, lost signal at 400-350 m up; 318-324 db and 334 db levels interpolated
004/01	
005/01	0 db level extrapolated
006/01	
007/01	ABORTED - stop at 710 m down due to winch problems - waited 35 mins before recovering; THIS CAST NOT INCLUDED IN CTD DATA DISTRIBUTION
007/02	first cast aborted due to winch problems; 0 db level extrapolated
008/01	
009/01	0 db level extrapolated
010/01	used top 7 discrete oxygens from sta 9-1 in CTD oxygen fitting as no discrete oxygen samples shallower than 400 db; 0 db level extrapolated
011/01	0 db level extrapolated
012/01	
013/01	0 db level extrapolated
014/01	606 db and 610 db levels interpolated
015/01	0 db level extrapolated
016/01	
017/01	0 db level extrapolated
018/01	large wire angle
019/01	
020/01	0 db level extrapolated
021/01	
022/01	stop CTD at 312 db for 35 sec for brake check; 0 db level extrapolated
023/01	
024/01	0 db level extrapolated
025/01	0 db level extrapolated
026/01	stop at 1316 db for brake maintenance; 0 db level extrapolated

sta/cast	**Comments** (continued)
027/01	0 db level extrapolated
028/01	
029/01	0 db level extrapolated
030/01	0 db level extrapolated
031/01	52 db level interpolated
032/01	0 db level extrapolated; salinity feature 1020-1120 db down and up casts
033/01	0 db level extrapolated; +.003 psu salinity area 1700-1714 db down - some instability in upcast in same vicinity
034/01	conductivity cell soaked in fresh water after cast; +.003 psu salinity area 2156-2176 db down
035/01	0 db level extrapolated
036/01	ABORTED from less than 1000 m due to suspected sensor problems; CTD 6v power supply being drawn down - problem was cable to PRT2, replaced;
036/02	all systems ok again
037/01	
038/01	0 db level extrapolated
039/01	0 db level extrapolated
040/01	0 db level extrapolated
041/01	
042/01	0 db level extrapolated
043/01	0 db level extrapolated
044/01	
045/01	cleaned conductivity cell w/RBS prior to cast
046/01	0 db level extrapolated
047/01	
048/01	0 db level extrapolated
049/01	0 db level extrapolated
050/01	
051/01	used top 3 discrete oxygens from sta 50-1 in CTD oxygen fitting as those discrete oxygens for this station were flagged as being bad points
052/01	0 db level extrapolated

WOCE92-P14C: CAST STOPS LONGER THAN 1-MINUTE

station/cast	down/up	#minutes stopped	avg. pressure (decibars)	Pressure range
002/01	DOWN	3.1	333	(330 - 336)
003/01	DOWN	1.0	604	(602 - 606)
		1.6	668	(664 - 672)
005/01	DOWN	1.1	2	(0 - 4)
006/01	DOWN	1.4	2	(0 - 4)
009/01	DOWN	4.5	3004	(3002 - 3006)
018/01	DOWN	1.3	4310	(4308 - 4312)
019/01	DOWN	5.0	3330	(3324 - 3336)
		5.7	3441	(3438 - 3444)
020/01	DOWN	1.6	4129	(4126 - 4132)
022/01	DOWN	1.2	4234	(4232 - 4236)
024/01	DOWN	1.3	2	(0 - 4)
025/01	DOWN	1.2	2	(0 - 4)
026/01	DOWN	1.4	1317	(1316 - 1318)
029/01	DOWN	1.3	2	(0 - 4)
030/01	DOWN	1.2	4	(2 - 6)
034/01	DOWN	1.8	2	(0 - 4)
041/01	DOWN	1.4	2906	(2904 - 2908)
042/01	DOWN	2.0	2	(0 - 4)
048/01	DOWN	1.1	3	(0 - 6)
051/01	DOWN	1.3	3	(2 - 4)

WOCE92-P14C: CTD TEMPERATURE AND CONDUCTIVITY CORRECTIONS SUMMARY

Sta/ Cast	PRT Response Time (secs)	Temperature Coefficients corT = t2*T2 + t1*T + t0			Conductivity Coefficients corC = c1*C + c0	
		t2	t1	t0	c1	c0
001/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-4.40993e-04	0.00969
002/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-4.47547e-04	0.00985
003/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-4.54101e-04	0.01001
004/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-4.60656e-04	0.01018
005/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-4.67210e-04	0.01034
006/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-4.73764e-04	0.01050
007/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-4.80318e-04	0.01066
008/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-4.86872e-04	0.01082
009/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-4.93426e-04	0.01098
010/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-4.99980e-04	0.01114
011/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06535e-04	0.01130
012/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.13089e-04	0.01146
013/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.19643e-04	0.01162
014/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.26197e-04	0.01179
015/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.32751e-04	0.01195
016/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.39305e-04	0.01211
017/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.45859e-04	0.01227
018/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.52414e-04	0.01243
019/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.58968e-04	0.01259
020/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.65522e-04	0.01175
021/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.72076e-04	0.01291
022/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.78630e-04	0.01307
023/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.85184e-04	0.01323
024/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.91738e-04	0.01240
025/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.98293e-04	0.01256
026/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.04847e-04	0.01372
027/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.11401e-04	0.01388
028/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.17955e-04	0.01304
029/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.24509e-04	0.01420
030/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.31063e-04	0.01436
031/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.37617e-04	0.01452
032/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.44171e-04	0.01418
033/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.50726e-04	0.01434
034/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.57280e-04	0.01501
035/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.63834e-04	0.01517
036/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.70388e-04	0.01533
037/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.76942e-04	0.01549
038/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.83496e-04	0.01565
039/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.90050e-04	0.01581

Sta/ Cast	PRT Response Time (secs)	Temperature Coefficients corT = t2*T2 + t1*T + t0			Conductivity Coefficients corC = c1*C + c0	
		t2	t1	t0	c1	c0
040/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.96605e-04	0.01597
041/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-7.03159e-04	0.01613
042/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-7.09713e-04	0.01629
043/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-7.16267e-04	0.01645
044/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-7.22821e-04	0.01662
045/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-7.29375e-04	0.01262
046/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-7.35929e-04	0.01262
047/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-7.42484e-04	0.01262
048/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-7.49038e-04	0.01262
049/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-7.55592e-04	0.01262
050/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-7.62146e-04	0.01262
051/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-7.68700e-04	0.01262
052/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-7.75254e-04	0.01262

SUMMARY OF WOCE92-P14C CTD OXYGEN TIME CONSTANTS

Temperature		**Press.**	**O2Grad.**
Fast (tauTF)	Slow (tauTS)	(tauP)	(tauOG)
30.0	400.0	20.0	16.0

WOCE92-P14C CTD OXYGEN:
Levenberg-Marquardt Non-linear Least-Squares-Fit Coefficients

Sta/ Cast	Slope (c1)	Offset (c2)	Pcoeff (c3)	TFcoeff (c4/fast)	TScoeff (c5/slow)	OGcoeff (c6)
001/01	8.06884e-04	2.60818e-01	2.73259e-05	3.33397e-02	-5.44250e-02	-1.01460e-05
002/01	8.06884e-04	2.60818e-01	2.73259e-05	3.33397e-02	-5.44250e-02	-1.01460e-05
003/01	2.17676e-03	5.98927e-01	-5.71561e-04	-3.20806e-02	-5.46378e-02	-1.12143e-05
004/01	1.45225e-03	-1.81581e-02	1.05677e-05	-1.97841e-02	-2.93342e-02	1.06530e-05
005/01	1.38503e-03	1.15644e-01	-6.00202e-05	-2.23830e-02	-2.72432e-02	-1.73731e-04
006/01	1.17922e-03	-8.14158e-02	2.68046e-04	-7.79251e-03	-2.62181e-02	-6.14857e-05
007/02	1.34489e-03	-4.02083e-03	9.11414e-05	-1.78353e-02	-2.55025e-02	-2.56283e-05
008/01	1.37503e-03	-1.16724e-01	2.27319e-04	-1.30975e-02	-2.91430e-02	-8.42314e-07
009/01	1.13014e-03	2.36744e-02	1.34872e-04	-5.17684e-03	-2.51890e-02	6.98500e-05
010/01	1.13180e-03	3.14323e-02	1.29840e-04	-7.19176e-03	-2.26703e-02	7.28577e-06
011/01	1.17042e-03	1.04215e-02	1.44088e-04	-2.08721e-02	-1.71948e-02	1.11503e-05
012/01	1.22582e-03	-2.40484e-02	1.63609e-04	-1.97675e-02	-1.70823e-02	-8.12037e-05
013/01	1.12257e-03	2.94386e-02	1.35894e-04	-2.90427e-02	-7.61433e-03	-9.67719e-06
014/01	1.42916e-03	-1.06695e-01	2.04102e-04	2.99322e-03	-4.29906e-02	-1.52298e-04
015/01	1.23109e-03	-1.41013e-02	1.53152e-04	-1.16770e-02	-2.57885e-02	-1.92080e-05
016/01	1.12567e-03	3.36177e-02	1.31701e-04	-2.01516e-02	-1.35697e-02	-1.22919e-05
017/01	1.21750e-03	-1.35220e-03	1.43876e-04	-1.92242e-02	-1.79192e-02	-4.06282e-05
018/01	1.34102e-03	-5.88229e-02	1.75111e-04	-4.39603e-03	-3.21663e-02	2.00733e-05
019/01	1.08059e-03	3.87322e-02	1.41218e-04	-1.88695e-02	-1.40770e-02	-2.04580e-03
020/01	1.21305e-03	1.02925e-03	1.45020e-04	-1.55113e-02	-2.01158e-02	2.09008e-04
021/01	1.44820e-03	-9.26431e-02	1.87367e-04	-5.58526e-03	-3.38417e-02	1.16620e-06
022/01	1.23650e-03	-7.40700e-03	1.47845e-04	2.00918e-03	-3.43388e-02	6.26153e-05
023/01	1.21955e-03	4.61205e-03	1.40379e-04	-8.51330e-03	-2.71229e-02	-2.64856e-04
024/01	1.22373e-03	4.73925e-03	1.39212e-04	-1.81787e-02	-1.85431e-02	-4.95149e-04
025/01	1.26587e-03	-1.47566e-02	1.48494e-04	-1.16523e-02	-2.33489e-02	2.33888e-03
026/01	1.25102e-03	-1.30540e-02	1.52029e-04	-3.00410e-03	-3.16781e-02	3.81137e-04
027/01	1.38944e-03	-5.53209e-02	1.59337e-04	2.97590e-03	-3.85136e-02	1.02540e-05
028/01	1.26447e-03	-1.45843e-02	1.47256e-04	-1.07867e-02	-2.47712e-02	-5.57667e-04
029/01	1.39968e-03	-8.09994e-02	1.83911e-04	-9.06324e-03	-2.90569e-02	1.87026e-03
030/01	1.34564e-03	-4.76091e-02	1.62534e-04	-2.27674e-03	-3.25087e-02	5.59494e-03
031/01	1.26427e-03	-9.15625e-03	1.43209e-04	-2.63839e-03	-2.98238e-02	1.43284e-05
032/01	1.49573e-03	-1.08579e-01	1.87816e-04	-7.73983e-03	-3.24086e-02	1.07246e-04
033/01	1.38634e-03	-6.72507e-02	1.70049e-04	-5.47603e-03	-3.04071e-02	5.13117e-05
034/01	1.34465e-03	-5.96095e-02	1.72402e-04	-2.05946e-04	-3.40344e-02	1.06100e-03
035/01	1.32151e-03	-3.58628e-02	1.53245e-04	3.62745e-03	-3.58575e-02	1.83092e-04
036/02	1.29304e-03	-3.30691e-02	1.54943e-04	-1.07757e-02	-2.38614e-02	4.36999e-05
037/01	1.32249e-03	-3.67577e-02	1.52722e-04	-1.03383e-02	-2.55409e-02	1.40581e-05
038/01	1.37909e-03	-6.08819e-02	1.65681e-04	5.06790e-04	-3.50490e-02	6.74447e-04
039/01	1.52093e-03	-1.03101e-01	1.72629e-04	3.39200e-03	-4.13269e-02	1.00370e-03
040/01	1.24670e-03	-5.05698e-03	1.40924e-04	-5.97541e-03	-2.74250e-02	-3.38552e-05

Sta/ Cast	Slope (c1)	Offset (c2)	Pcoeff (c3)	TFcoeff (c4/fast)	TScoeff (c5/slow)	OGcoeff (c6)
041/01	1.77481e-03	-1.96207e-01	1.97164e-04	-3.72159e-03	-4.10188e-02	-3.45028e-04
042/01	1.37431e-03	-4.09218e-02	1.39929e-04	-9.28540e-03	-2.66939e-02	3.16100e-05
043/01	1.41852e-03	-6.58746e-02	1.60533e-04	-9.06489e-05	-3.56835e-02	9.07926e-06
044/01	1.40813e-03	-5.09140e-02	1.41597e-04	2.54728e-04	-3.60582e-02	1.34171e-05
045/01	1.46001e-03	-9.15967e-02	1.74343e-04	-1.41720e-03	-3.50655e-02	1.32040e-03
046/01	1.56575e-03	-1.19456e-01	1.72254e-04	-7.55708e-03	-3.25536e-02	3.49852e-05
047/01	1.30814e-03	4.88388e-03	1.08740e-04	-4.01343e-03	-2.95757e-02	1.76368e-05
048/01	1.45697e-03	-2.37269e-02	8.75430e-05	5.88766e-04	-3.74642e-02	1.03337e-04
049/01	1.40909e-03	2.85585e-04	6.95564e-05	9.95727e-05	-3.53687e-02	1.03733e-06
050/01	1.58776e-03	-2.43796e-02	2.58693e-05	-5.29623e-04	-3.95747e-02	4.66512e-05
051/01	1.54778e-03	-9.59620e-02	1.20296e-04	-6.91372e-03	-3.23902e-02	3.66700e-05
052/01	2.20508e-03	-8.44322e-02	-3.64263e-04	-2.21049e-02	-3.09774e-02	7.93722e-05

WHPO Data Processing Notes

Date	Contact	Data Type	Data Status Summary
04/24/97	Warner	CFCs	Data are Public
08/15/97	Uribe	DOC	Submitted 1997 August 15th

2000.12.11 KJU

File contained here is a CRUISE SUMMARY and NOT sumfile. Documentation is online.

2000.10.11 KJU

Files were found in incoming directory under whp_reports. This directory was zipped, files were separated and placed under proper cruise. All of them are sum files.

Date	Contact	Data Type	Data Status Summary
10/15/97	Roemmich	CTD/BTL/SUM	Data are Public
11/10/97	Key	DELC14	Final Data Rcvd @ WHPO

Today I uploaded C-14 data and the final C-14 data report for WOCE Pacific leg P14C. The report was sent in 3 different formats: FrameMaker document file, MIF, and a postscript version. If you can not use any of these formats, I can translate to wordperfect with some minor losses. The data was sent as comma separated, flat ascii and includes only station, cast, bottle, c14, c14error and c14flag. This leg is now "final" with respect to C-14. The preliminary data report for these numbers was issued 7/28/97, so the official release data for these values will be 7/28/99 unless published prior to that date.

Date	Contact	Data Type	Data Status Summary
03/10/98	Key	DELC14	Data are NonPublic; Release 7/99
04/29/99	Quay	DELC13	Data and/or Status info Requested by dmb
07/22/99	Mantyla	NUTs/S/O	DQE Begun
09/14/99	Mantyla	NUTs/S/O	DQE Report rcvd @ WHPO

I'm finished with P14C, just have to proof read the write up and then should get it to you today.

Date	Contact	Data Type	Data Status Summary
02/24/00	Warner	CFCs	Submitted
03/08/00	Bartolacci	CFCs	Data Merged/OnLine

2000.03.08 DMB

- Merged CFC11/12 sent by Mark Warner (email below) into current p14c bottle file.
- Obtained bottle file from WHPO website.
- Used SDiggs' "driver.pl and warner.pl" code to reformat cfc values.
- Used DNewton's code "mrgsea" to add cfc columns and data into existing bottle file.
- Ran wocecvt to check format. No errors.
- Ran maskhyd to add date/name stamp.
- Replaced original bottle file on website with new file filename is p14chy.txt, and moved old file to 'original' subdirectory with filename containing date replaced.

Date	Contact	Data Type	Data Status Summary
04/14/00	Key	DELC14	Data are Public

As of 3/2000 the 2 year clock expired on the last of the Pacific Ocean C14 data (P10). All Pacific Ocean WOCE C-14 data should be made public.

Date	Contact	Data Type	Data Status Summary
04/19/00	Bartolacci	DELC14	Website Updated

P14C Changed to indicate data are at WHPO but not in WOCE format (RAW) and there-fore not yet merged.

06/16/00 Kozyr TCARBN Submitted

No other carbon measurements available. The P14C Section was a problematic Section for CO2 measurements. Only surface measurements were made on 51 stations and only one parameter (TCO2). I am not considering to publish NDP for this cruise, but you can use the final TCO2 data (attached) that are public and final.

06/20/00 Bartolacci PCO2 Submitted; not merged into hyd file

values are surface values and may not correspond to any station/cast/bottle combination.

07/06/00 Bartolacci DELC14 Data Merged into BTL file

2000.07.06 DMB

Notes on merging C14 into p14c bottle file.

files in this directory:

p14c.c14.data.txt file sent (by Key?) on 1997.11.10 no documenation found.
Contains only stations with valid values. Moved to subdirectory 'old'.

P14C.C14.txt file sent (by Key) on 1998.03.08. contains stations missing value.

P14C.C14.hqx binhex'd version of above

As per S. Diggs P14C.C14.txt was used to merge c14, c14er and associated flag.

- Used current bottle file p14chy.txt to merge values into.
- Used perl script conv_key.pl to convert comma separated values to something mrgsea can ingest
- Used D. Newton's mrgsea to merge DelC14, C14ERR, and flag.
- Ran wocecvt on output file p14chy_delc14_c14er.txt, with no errors.
- renamed file and replaced current bottle file with new merged file.
- moved old p14chy.txt to original and renamed to indicate it was replaced.

07/12/00 Bartolacci DELC14 Website Updated; files merged/online

Bottle: (delc14, c14err, qualt1, qualt2)

C14 and C14er was merged into P14C bottle file. Current bottle file was replaced with newly merged file and all table references were edited to reflect this change.

10/17/00 Jenkins TRITUM Submitted/Preliminary

WOCE Indian Ocean = WITrit.dat (Contains all legs)
WOCE Pacific P10 = WP10Trit.dat
WOCE Pacific P13 = WP13Trit.dat
WOCE Pacific P14c = WP14cTrit.dat
WOCE Pacific P18 = WP18Trit.dat
WOCE Pacific P19 = WP19Trit.dat
WOCE Pacific P21 = WP21Trit.dat
SAVE South Atlnt = SAVETrit.dat

- Column Layout as follows: Station, Cast, Bottle, Pressure, Tritium, ErrTritium
- Units as follows: Tritium and ErrTritium in T.U.
- All data are unfortunately still preliminary until we have completed the laboratory intercomparision and intercalibration that is still underway.

11/13/00 Anderson TRITUM Reformatted by WHPO

I have put the Jenkins tritium data into WOCE format. There were no quality codes so I set the TRITUM to 2.

01/30/01 Stuart DELC13 Submitted

Enclosed are three text files (and data) for the Pacific. The headers are:

Lab ID WHPID Station Cast Niskin Del-C13 C13 flag

The files are for P10, P14C, P17E, and P17E/P19S

02/26/01	Jenkins	TRITUM	Data are Public; may require minor revisions

It was brought to my attention that the WOCE Pacific/Indian He-Tr data was not as yet made public. After submitting it to you last year, I had intended on going through it one more time to ensure there were no problems with it. Unfortunately, I have not had the time to do this. Is it possible, therefore, to release it as public data, and if there are any subsequent minor revisions, to make changes? I suspect there might be a few samples in the set that might have got through our initial quality control.

06/19/01	Swift	CTDTMP	Update Needed

An oceanographically-insignificant error in CTDTMP data for this cruise has been found (ca. -0.00024*T - 0.00036 degC). A data update is forthcoming. In the interim the corrected data files can be obtained from: ftp://odf.ucsd.edu/pub/HydroData/woce/crs

06/20/01	Johnson	CTD	Data Update; Processing error corrected

revised data available by ftp 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

06/22/01 Uribe CTD/BTL Website Updated; CSV File Added

CTD and Bottle files in exchange format have been put online.

08/27/01	Swift	He/Tr	Data Status changed to Public

Please make the following changes from non-public to public. All Jenkins Pacific/Indian data are public according to an email he sent 2/26/2001, hence P14C 316N138_7 The He/Tr data were cleaned up by S. Anderson. So when you merge them, please make them public.

09/28/01	Muus	CFCs	Data Merged into BTL file

CSV file updated

Notes on P14C CFC merging Sept 28, 2001. D. Muus

1. New CFC-11 and CFC-12 from:
   /usr/export/html-public/data/onetime/pacific/p14/p14c/original/20010709_CFC_UPDT_WISEGARVER_P14C/20010709.172810_WISEGARVER_P14C/20010709.172810_ WISEGARVER_P14C_p14c_CFC_DQE.dat merged into SEA file taken from web Sept 25, 2001 (20000712WHPOSIODMB)
   · All "1"s in QUALT1 changed to "9"s and QUALT2 replaced by new QUALT1 prior to merging.
2. Exchange file checked using Java Ocean Atlas.

11/19/01	Anderson	DELC13/TR	Data merged into online file

· Merged DELC13 that was received from Key in May, 2001 into .sea file.
· Merged TRITUM received from Jenkins Oct, 2000 into .sea file.
· Set QUALT2 flags for both DELC13 and TRITUM to be the same as the QUALT1 flags.
· Put new merged file online.

11/30/01	Diggs	BTL	Website Updated; New CSV File Added

Exchange file updated and placed online. new files now has c14/c13 data from Key (Sarilee merged them).

02/04/02	Uribe	CTD	Website Updated; CSV File Added

CTD was converted to exchange and put online.

02/21/02	Hajrasuliha	CTD/BTL	Internal DQE completed

Created *.ps files for the cruise. Created *check.txt file for the cruise.

03/06/02	Kappa	DOC	Updated text and pdf cruise reports

Added ODF ctd report, cfc report, ctd data consistency check report, Final C14 report, cfc dqe report, WHPO data processing notes, and all related figures in the PDF cruise report.