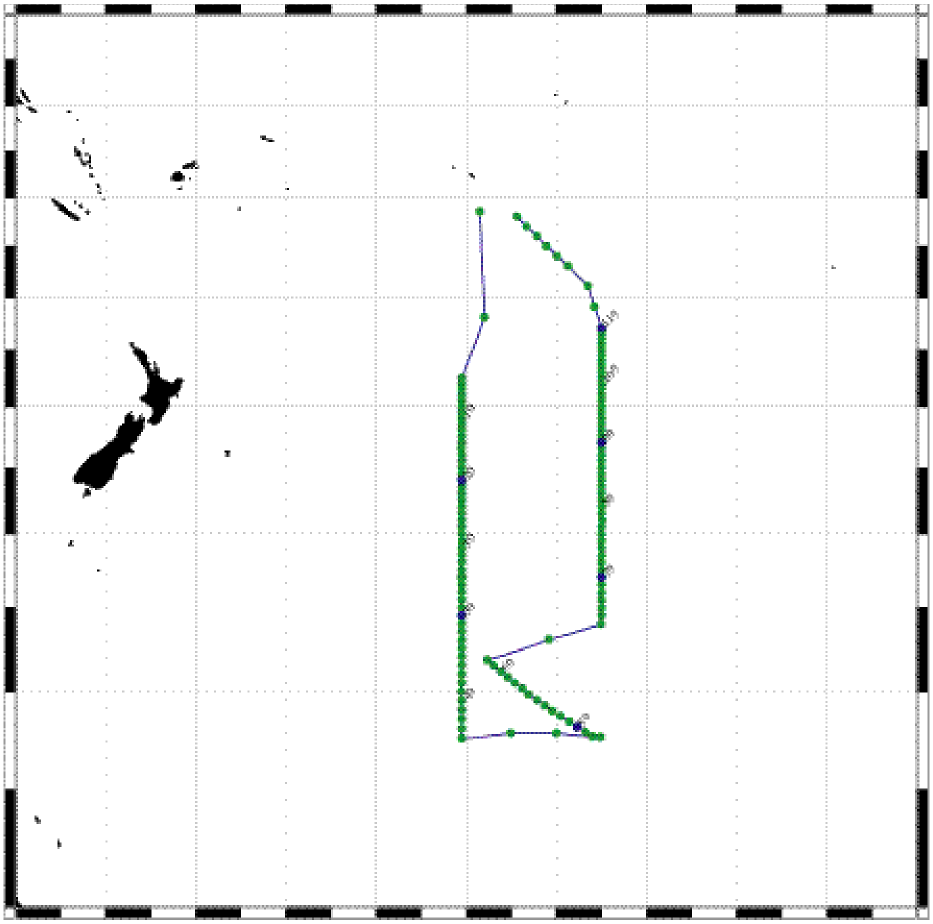
A. Cruise Narrative: P16A, P17A



A.1 Highlights

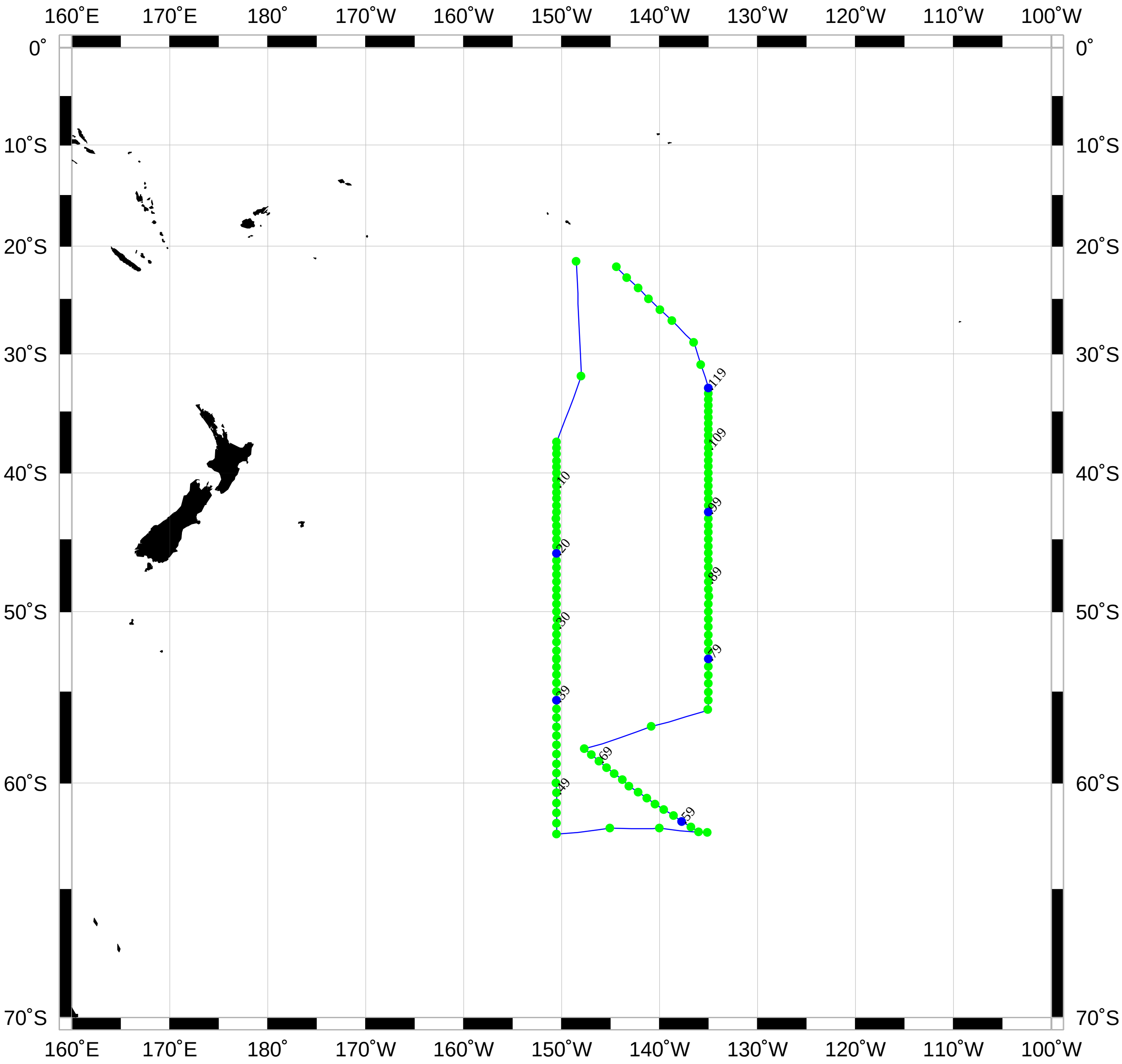
WOCE Line	**P16A and P17A**
WOCE EXPOCODE	**316N138/9**
Chief Scientist	**Joseph L. Reid**
	Scripps Institution of Oceanography
	University of California San Diego
	307 Nierenberg Hall
	La Jolla CA 92093-0230
	phone: 619-534-2055
	fax: 619-534-7452/0704
	email: jreid@ucsd.edu
Ship	R/V Knorr
Ports of call	Papette, Tahiti, round trip
	21° 29'S
Geographic boundaries	134° 51'W 150° 30'W
	62° 30'S
Cruise dates	1992.OCT.06 - 1992.NOV.25

WHP Cruise and Data Information

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

Cruise Summary Information	Hydrographic Measurements
Description of scientific program	CTD - general
	CTD - pressure
Geographic boundaries of the survey	CTD - temperature
Cruise track (figure)	CTD - conductivity/salinity
Description of stations	CTD - dissolved oxygen
Description of parameters sampled	**Discrete**
Bottle depth distributions (figure)	Salinity
Floats and drifters deployed	Oxygen
	Nutrients
Principal Investigators for all measurements	
Cruise Participants	
Problems and goals not achieved	
	DQE Reports
	CTD
	S/O2/nutrients
	CFCs
	14C
References **HYD** **LV 14C** **AMS 14C**	**Data Processing Notes**

Station locations for P16A_P17A; Reid (1992)



Produced from .sum file by WHPO-SIO

A.2 Cruise Summary Information

A.2.a Cruise Track (Fig. 1)

A.2.b Stations occupied

There were 127 CTD/rosette stations, all close to the bottom. Large volume casts were done at 14 stations, most were single deep casts because of limited extraction reagents due to a misplaced replacement shipment.

A.2.c Floats and drifters deployed (Fig. 2)

Eighteen ALACE floats were deployed, 9 along P16 at 150W, 8 along P17 at 135W, and one above the Udintsev Fracture Zone.

A.2.d Moorings deployed or recovered

A.3 List of Principal Investigators

Table 1: List of Prinicpal Investigators

NAME	MEASUREMENT RESPONSIBILITY	AFFILIATION
J. Reid/J. Swift	CTD/O2/Nutrients	SIO
J. Bullister	CFCs	PMEL
R. Davis	ALACE floats	SIO
E. Firing	ADCP	U Miami
W. Gardner	Transmissometer	TAMU
L. Gordon	Nutrient support	OSU
W. Jenkins	Helium/Tritium	WHOI
C. Keeling	CO2 (shore)	SIO
R. Key	C14	Princeton
J. Lupton	Helium (deep)	UCSB
S. Smith	Bathymetry	SIO
T. Takahashi/D. Chipman	CO2 (shipboard)	LDGO
R. Weiss	CFCs, u/w CO2	SIO
W. Smethie	CFCs	LDGO

Table 2: List of Institutions

Abbreviation	Address
LDGO	Lamont-Doherty Earth Observatory Columbia University Palisades NY 10964 U.S.A.
Princeton	Princeton University Princeton NJ 08544-1003 U.S.A.
WHOI	Woods Hole Oceanographic Insitution Woods Hole MA 02543 U.S.A
U Miami	Rosentiel School of Marine and Atmospheric Science University Of Miami 46200 Rickenbacker Causeway Miami FL 33149-1098
U Hawaii	University of Hawaii 1000 Pope Road Honolulu HI 96822
NOAA PMEL	NOAA Pacific Marine Environmental Laboratory 7600 Sand Point Way NE Seattle WA 98115-0700
SIO	Scripps Institution of Oceanography University of California of San Diego 9500 Gilman Drive La Jolla CA 92093
TAMU	Texas A&M University Department of Oceanography College Station TX 77843
OSU	Oregon State University Corvallis OR 97331

A.4 Scientific Programme and Methods

RV Knorr departed Papeete, Tahiti on 6 October, 1992 to extend southward the WOCE Pacific sections P16 and P17 completed by the RV Washington TUNES expedition during August, 1991. Two equipment shakedown stations were done enroute to the first scheduled station at 37.5 S, 150.5 W, a reoccupation of TUNES station 180. Both shakedown stations were 36-place 10-liter rosette/CTD casts to the bottom with duplicate sampling of the standard hydrographic water samples. A summary of the duplicate analyses is given in Table 3. Station 2 was at 32 S, near the WOCE P6 line completed in

June 1992 as part of this same Knorr voyage. Data from the P6 line was not yet available for comparison with this cruise data.

Table 3: JUNO1 Duplicate Sample Mean Differences and Standard Deviations.

	SALINITY		OXYGEN(ml/l)		NITRATE		PHOSPHATE		SILICATE	
	Mean	sigma	Mean	sigma	Mean	sigma	Mean	sigma	Mean	sigma
Duplicate trips=52	.0004	.0004	.006	.006	.04	.04	.005	.006	.15	.16
Mixed layer n=38	.0007	.0006	.012	.013	.03	.03	.005	.006	.10	.11
Duplicate Draws n=69	.0010	.0009	.004	.003	.23	.24	.012	.008	.46	.42
Average Diff	.0007%		.007ml/l		.10um/l		.007um/l		.24um/l	
% of full scale			0.09%		0.3%		0.3%		0.2%	

From station 3 the cruise track ran south taking stations at 30 minutes of latitude (~55 km) intervals along 150.5 W, intending to reach the vicinity of WOCE line S4 at 67°S completed by the Soviet vessel Ioffe in March 1992. However, the ice pack was still near its maximum seasonal extent during the Austral early spring. Large icebergs were first seen at about 58S, and streamers of pancake sea ice 4 miles south of station 53 at 62.5°S forced the Captain to turn around for safety reasons. The ship hove to during the short nights while it was in the vicinity of ice and bergs for the next week. From sta. 53, the ship steamed eastward, taking two small volume stations on the dead-heading run to the corner stations at 62.5 S, 135 W in the Amundsen Basin. The gerard and rosette casts were unusually far apart on stations 56 because the ship had to move to avoid a rampaging iceberg; the iceberg was 5 miles away at the start of the deep deep gerard cast and had closed to within 2 miles by the end of the cast. From station 56, an arc of station positions was laid out roughly normal to the trend of the Pacific Antarctic Ridge. Station 71 was at the crest of the ridge. The rational for this line of stations was two-fold: to examine any possible Ross Sea bottom water flow along the flanks of the rise upstream of the Udintsev and Eltanin Fracture Zone systems; and to have a line of stations underneath the 10-day repeat satellite track to compare geostrophic sea-surface elevation and satellite altimetry. Earlier satellite tracked drifter tracks and sea level elevations from satellite altimetry have indicated the presence of recurrent eddies near the ridge. From station 71, a single station was done to the bottom of the Udintsev Fracture Zone on the long deadheading run to start at 56S the northward run of the WOCE P17 line along 135°W. Station spacing of 30 minute latitude intervals was resumed until the TUNES 179 repeat station was reached at 33°S (sta.119). During the northward run, the ship discovered it had a 50% greater speed capability than it had on the southward run, with the result the planned WOCE work was completed 3 days ahead of schedule. The extra available ship time was used to flesh out the historical deep station array by taking a few deep stations in the data sparse regions in the deep trough between the Austral Islands and the Tuamotu Archipelago, avoiding areas covered by P6, SCORPIO, TUNES, GEOSECS, and PHOENIX expeditions. Having completed 127 stations, the number originally planned prior to the cruise, we arrived ahead of schedule in Papeete on the afternoon of 25 November, 1992 local time.

Preliminary results:

The major features observed were the salinity minimum of the Intermediate Water, the deep oxygen minimum and nutrientmaxima extending southward, the salinity maximum and the colder bottom water extending northward.

There was a cold and thick surface layer (less than -1 C) south of about 55°S on the 150°W section but a few days later there was a warm cap at the surface at 56°S on the 135°W section.

The minimum salinity was at the surface south of 55°S on both sections and extended down to about 800-1000m morth of there North of about 44 S there was a layer of maximim oxygen just above it.

The great oxygen minimum from the North Pacific was at about 1900-2400 m morth of 50°S and rose to about 500m at 62°S. The nitrate and phosphate maxima were at about the same depth but the silica maximum was a little deeper. The nitrate and phosphate maxima rose to abut 300m near 60°S.

The layer of salinity maximum which extends northward is relatively high in oxygen and low in nutrients. It lies near 500-600 m at 62°S and slopes downward to 4000m along 150°W. Along 135°W it intersects the bottom near 45°S. It appears as a minimum above the bottom in all three nutrients below their maxima between 60°S and 50°S and extends as a minimum above the bottom past 33°S in silica.

Along 135°W water denser than 45.92 in sigma-sub-4 and and below 0.9° in potential temperature is not found north of the East Pacific Rise, but along 150°W values as high as 45.97 and below 0.8°C extend beyone 37°S.

Bottle depth distributions

The depth distributions for small volume samples along 150°W are shown in Fig. 3, and along 135°W in Fig. 4.

A.5 Major Problems and Goals not Achieved

As is common to most CTD/rosette cruises, a great deal of water sample data was lost due to a variety of rosette malfunctions; on only about one third of the stations did the rosette successfully get a good sample from every intended depth. About 200 planned sampling depths were lost. It was a continual challenge to identify mis-trips quickly in order to get the bottle/lanyard/pylon problem repaired before too many stations were done with the same malfunction and data loss. Aside from problems easily spotted visually upon the cast retrieval such as one or both lids open, fouled lanyards, or non-trips; other bottle malfunctions were identified by comparison of the bottle water sample salinity with the CTD salinity recorded at the time of the bottle trip; by outlyers seen on the autoanalyzer analog trace peak heights as the samples were being run; and by unusual rosette bottle water temperatures recorded as the oxygen samples were being drawn. The "oxy draw temp" proved to be an invaluable aid in quickly spotting pre-tripped rosette bottles: where the rosette water sample was much colder than the in- situ temperature, the bottle must have tripped deeper in the water column than intended. Later availability of nutrient and salinity data confirmed suspicions initially aroused by the oxy draw temps. Pretrips appeared to be a result of lanyard rigging problems, allowing the lower bottle end cap to slip closed prematurely and the upper cap closing when triggered by the pylon rotor. Pretrips diminished over the course of the cruise as lanyards were adjusted. As the cruise progressed, the frequency of unplanned double trips increased. The pylon tripping problem was traced late in the cruise to some bent shafts in the spring loaded release pins causing temporary hangups until the pylon rotor triggered the next sample. The double trips were verified by comparison of both the water sample salinity and oxygen with the CTD salinity and oxygen traces.

The CTD winch slip-rings failed a couple of times and excessive electrical line noise forced a switch to the backup hydrographic winch for most of the cruise. The CTD signal was clean from that winch.

Moderately rough weather made recovery of the CTD/rosette difficult at times. The package swung so wildly in the air that the CTD cable was bent where it swung against the sheave guards. Frequent cable end reterminations were done, severely depleting stocks of spare parts. Station 7 lost the CTD signal on the up cast after only 7 bottles were tripped. Because the ship seemed to be behind schedule and the down CTD trace was OK, it was decided to not repeat the cast for the rest of the water samples. A freak wave on the 20th of October damaged the starboard garage door on the aft hangar. Another one on the next day completely demolished the door. The area was boarded up for the remainder of the cruise. The hangar contained the LVS extraction barrels, which were not damaged. Operations continued by using the aft door.

The major goal not achieved on the cruise was the inability to extend the P16 line closer to Antarctica It was early in the season, February would have been better. Many in the scientific party had worked farther into thin sea ice on other expeditions, so it was disappointing to turn around so far north.

A.6 Other Incidents of Note

A.7 List of Cruise Participants

Table 4: List of Cruise Participants

NAME	RESPONSIBILITY ON CRUISE	AFFILIATION
Reid, Joseph L.	Chief Scientist	SIO/MLRG
Mantyla, Arnold W.	Co-chief Scientist	SIO/MLRG
Beaupre,Marie-Claude	Nutrients/data	SIO/ODF
Boaz, John T	Salts/deck/ALACE	SIO/STS
Birdwhistell, Scot P.	Helium Irritium	WHOI
Esmay, Rebecca	C02	LDGO
Fair, Christina F.	Oxyoens/data	SIO/ODF
Gille, SarahT.	CTD watch/ADCP	MIT/WHOI
Goddard, John G.	C02	LDGO
Gorman, Eugene P.	CFCs	LDGO
Handley, William H.	Ship's resident tech.	WHOI
Hellman, Sidney B.	Helium/tritium	LDGO
Hiller, Scott M.	Electronics tech./CTD/deck	SIO/ODF
Jennings, Joe C. Jr.	Nutrients	SIO/ODF
Johnson, Mary C.	CTD data/computer systems	SIO/ODF
Key, Robert M.	LVS extractions/AMS C14	Princeton
Lopez, LeonardT.	Salts/deck	SIO/ODF
Newton, David M.	CTD watch/deck/ALACE	SIO/MLRG
Nisly, Barry J.	Oxygens/deck/data	SIO/ODF
Sabine,Christopher	C02	U Hawaii
Van Woy, Fredrick A.	CFCs	SIO
Wells, James A.	Salts/deck	SIO/ODF

B. Underway Measurements

B.1 Navigation and bathymetry

B.2 Acoustic Doppler Current Profiler (ADCP)

B.3 Thermosalinograph and underway dissolved oxygen, etc

B.4 XBT and XCTD

B.5 Meteorological observations

B.6 Atmospheric chemistry

Figure 1

WOCE P16A / P17A JUNO RV KNORR 6 October - 25 November 1992

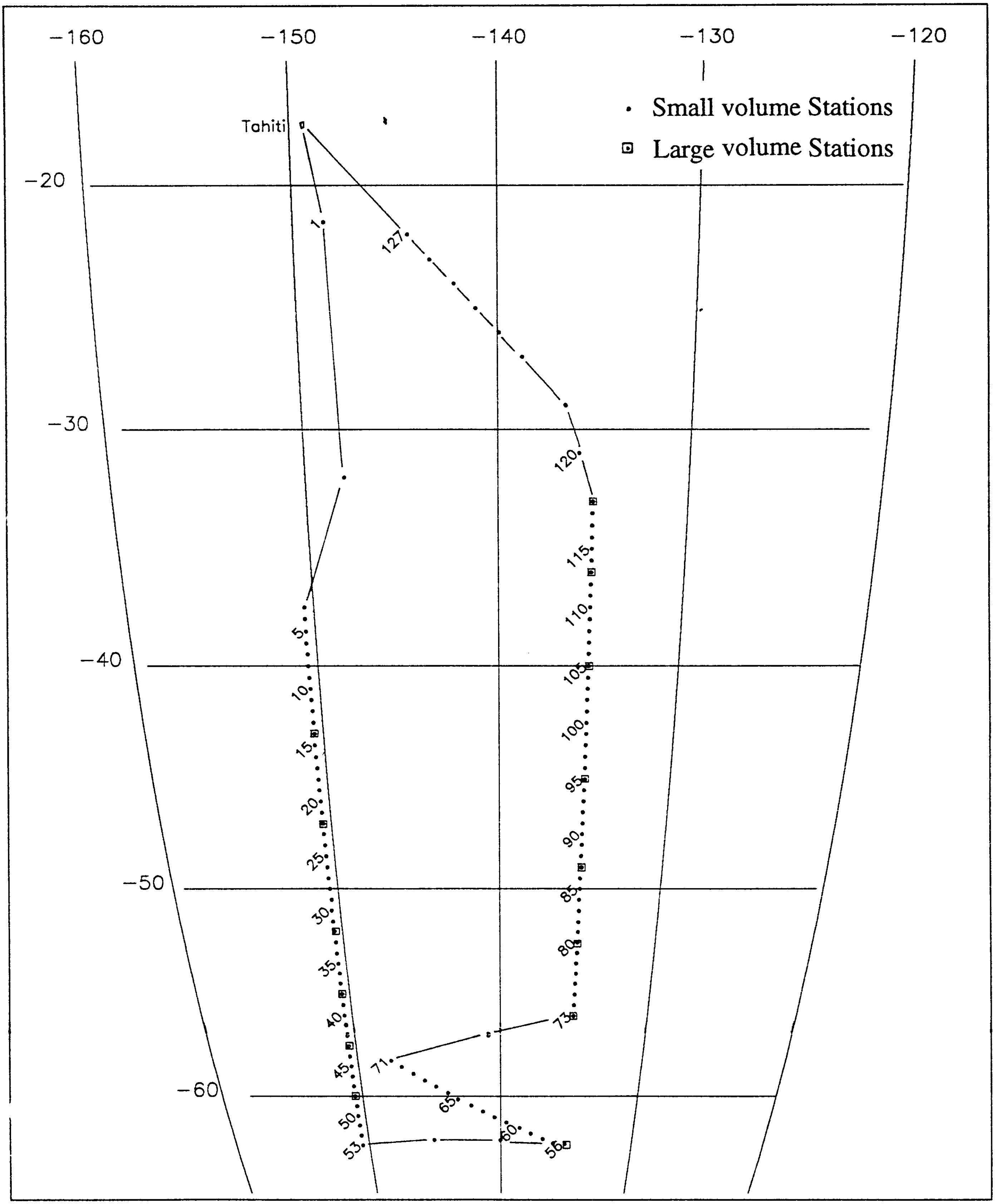
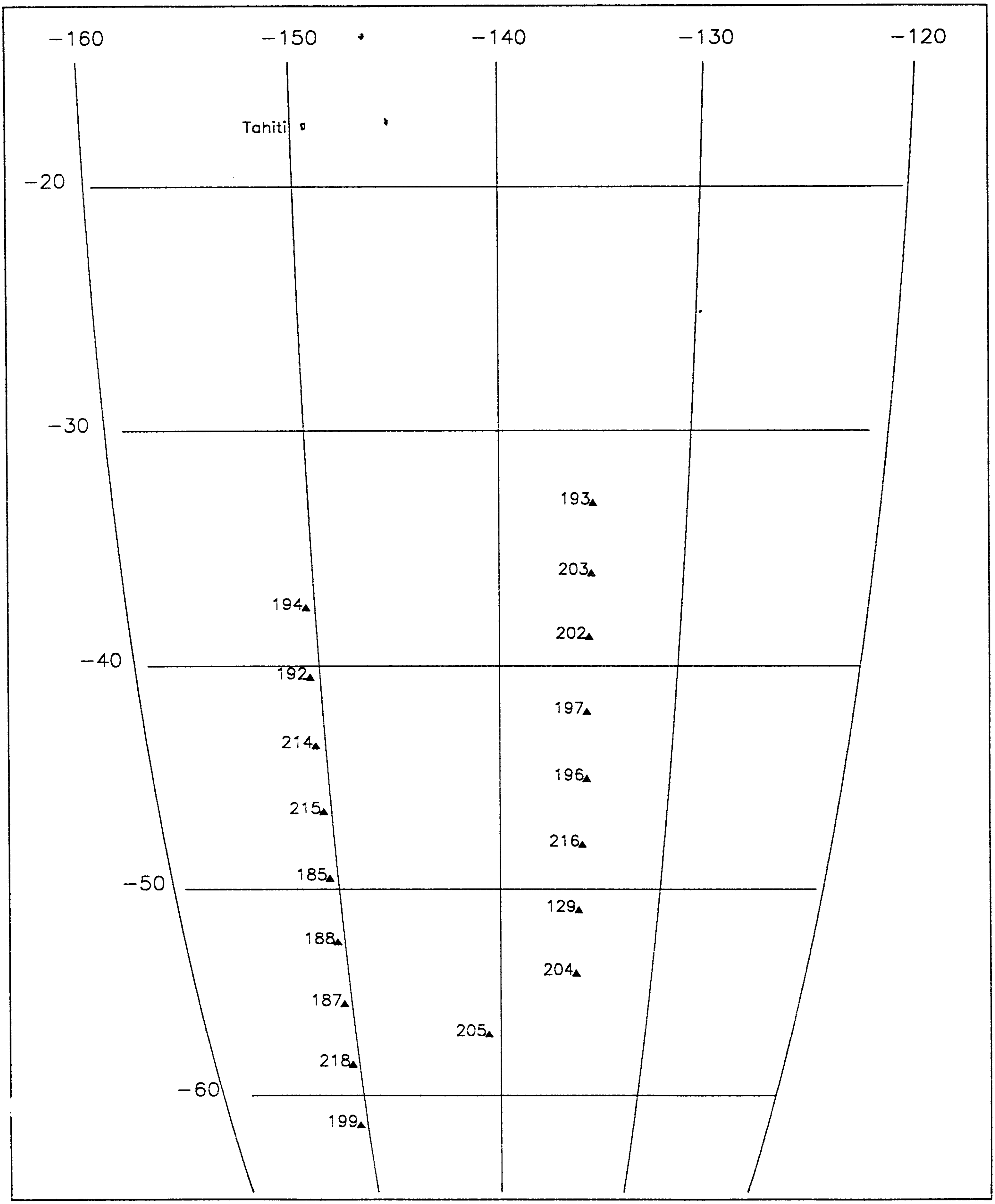
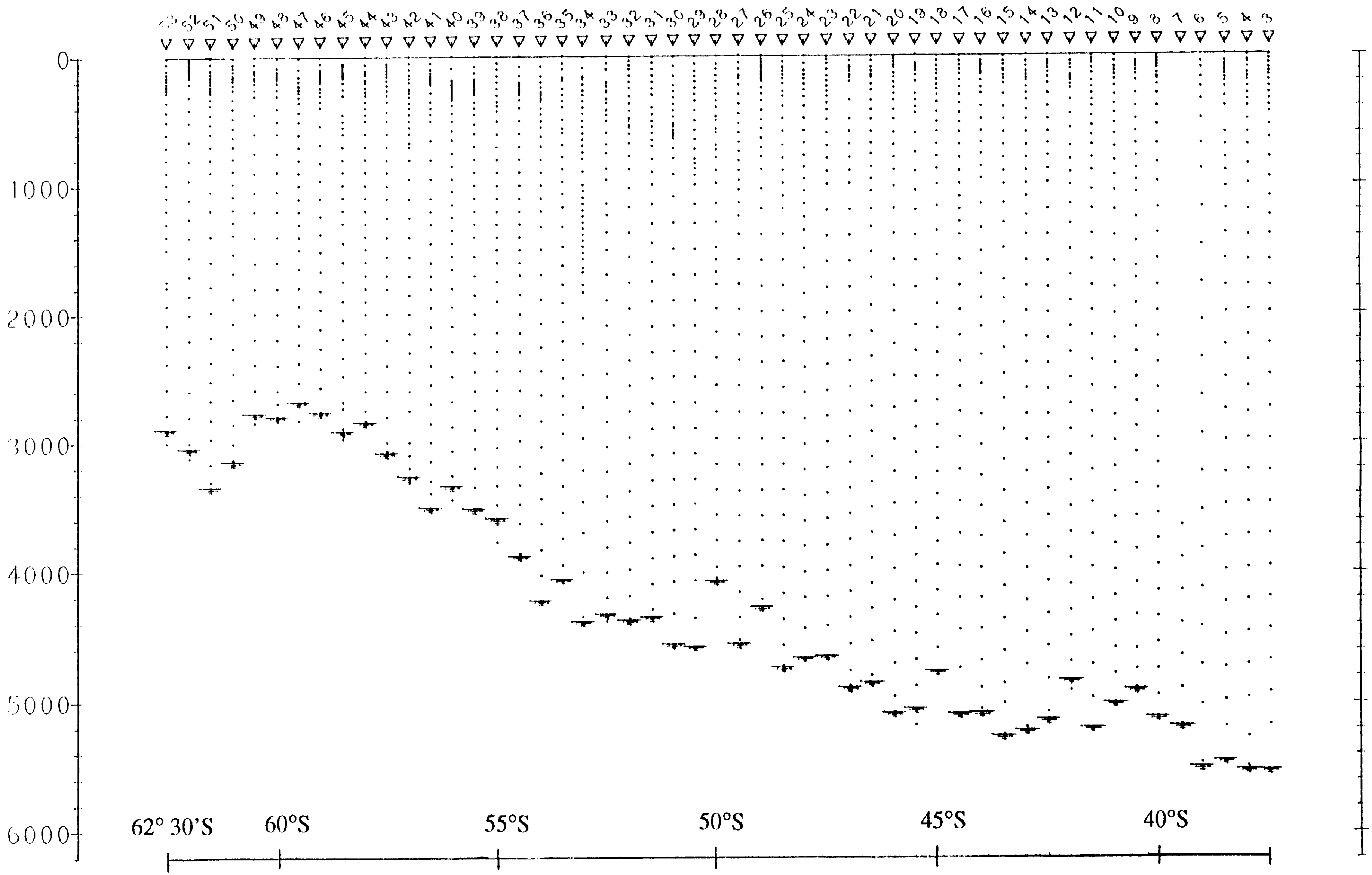


Figure 2

ALACE FLOAT NUMBERS AND LAUNCH POSITIONS

WOCE P16A / P17A JUNO RV KNORR 6 October - 25 November 1992

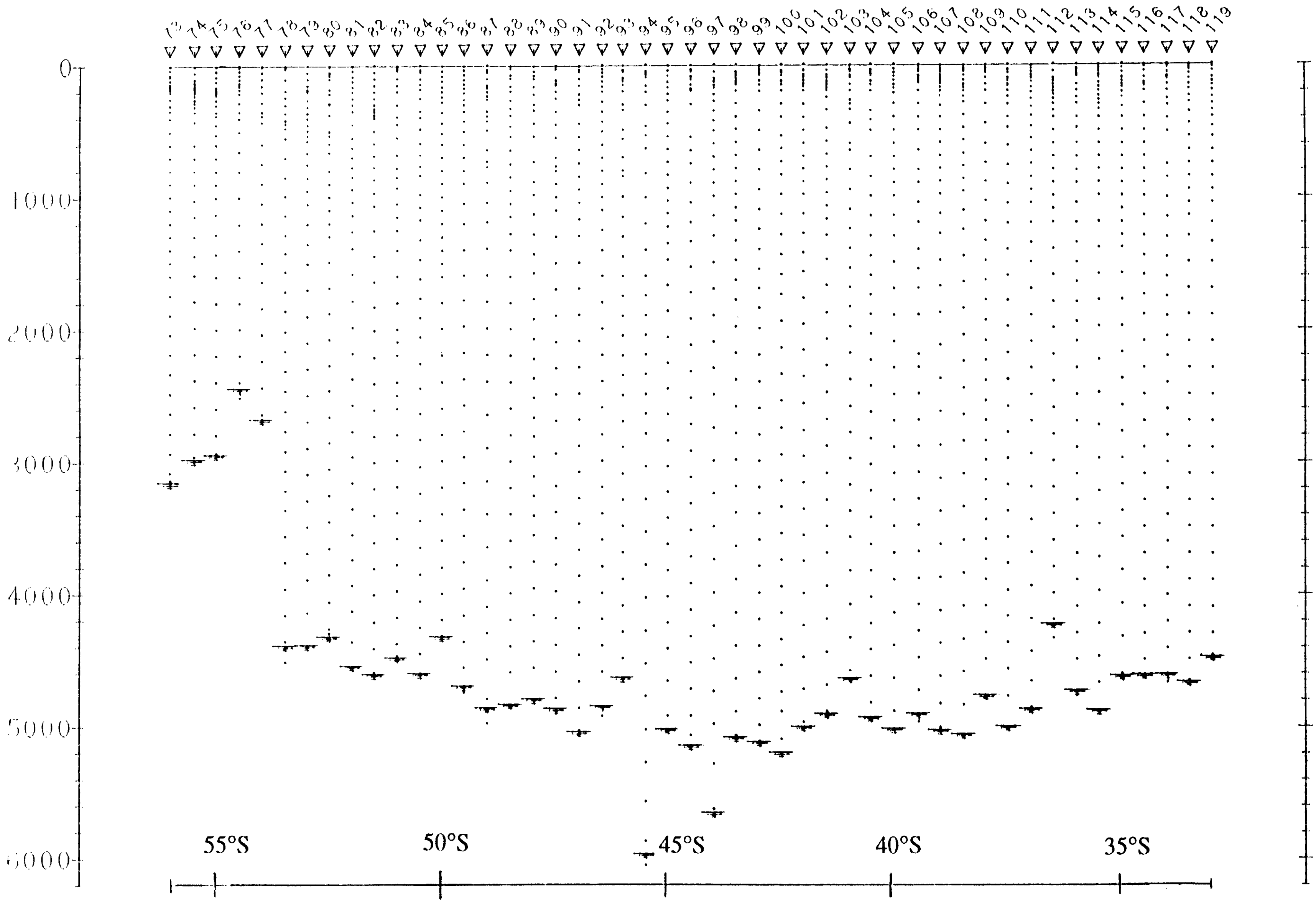




WOCE P16A (150°W) RV KNORR October 12-28, 1992

Small volume (10 liter) water sample depths

Figure 3



WOCE P17A (135°W) RV KNORR November 7-20, 1992

Small volume (10 liter) water sample depths

Figure 4

WOCE92-P16A/P17A

(JUNO1 EXPOCODE 316N138/9)

Calibrated Pressure-Series CTD Data Processing Summary and Comments

October 10, 1994

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1. Introduction

This document describes the CTDO data acquisition, calibration, and other processing techniques used on WOCE92-P16A/P17A, also known as JUNO1 and Knorr 138/9. This WOCE leg was done on the R/V Knorr from October 6 - November 25, 1992.

2. CTD Acquisition and Processing Summary

128 CTD casts and several test casts were done during JUNO1. 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 CTDs #1 and #2, modified NBIS Mark III-B instruments, were both used during the leg.

Each 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 JUNO1 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. Oxygen data may also be filtered for noise. 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 JUNO1 RAW DATA FILTERS

Raw Data Channel	Minimum	Maximum	Frame-to-Frame Gradient
Pressure	-40	6400	1-2 decibars
Temperature	-8/-2.5	32.7	.1-.2 °C
Conductivity	0	64.355	.1-.3 mmho
Oxygen†	0	25000	100 μamp

† oxygen was filtered for 15 casts only due to winch-induced noise problems.

- 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 derivedfrom 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-decibar 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 each CTD used during JUNO1.

3. CTD Laboratory Calibrations

3.1. Pressure Transducer Calibration

Each CTD 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 is checked by a thermal shock test. A CTD is subjected to a step change in temperature (usually from warm air to cold water bath) at stable pressure in the laboratory, then the CTD pressure and temperature are measured over a period of at least 1 hour. The thermal shock response has been checked in the opposite direction, cold bath to warm bath, for several CTDs. The response is roughly a mirror-image to the warm-to-cold response. The thermal response of the CTD pressure sensor is typically checked when the sensor is first installed, then every few years.

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 #2 has not been tested since 1987, when the current pressure sensor was first installed.

CTD #1 pre- and post-cruise pressure calibrations are summarized in Figures 1 and 2; CTD #2 pressure calibrations are shown in figures 3 and 4.

3.2. PRT Temperature Calibration

All CTD 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 pre- and post-cruise temperature calibrations, referenced to the ITS-90 standard, are summarized in Figures 5 and 6. Calibration coefficients are then 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.

4. CTD Data Processing

4.1. 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 or 2 levels for 99 casts during JUNO1.

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.

There were numerous problems with dropouts/noise in all CTD channels for the first 34 stations of JUNO1. The problems continued despite reterminating the wire several times, switching CTDs for 8 casts and removing various combinations of sensors or peripheral instruments. It was finally determined that the noise/dropouts were winch-induced: the backup winch was used from the second CTD cast for station 34 until the end of the cruise, except for one cast at station 46 to test attempted repairs on the primary winch.

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

JUNO1 CTD/WINCH CONFIGURATION SUMMARY

<table>
<tr><th>Station(s)</th><th>CTD†
ID#</th><th>TAMU</th><th>Oxygen
Sensor</th><th>Winch</th></tr>
<tr><td>1-5</td><td>1b</td><td rowspan="2">N152D</td><td rowspan="5">A</td><td rowspan="11">A.Johnson</td></tr>
<tr><td>6</td><td rowspan="2">1a</td></tr>
<tr><td>7</td><td rowspan="2">N152D (dead)</td></tr>
<tr><td>8</td><td rowspan="2">2</td></tr>
<tr><td>9-15</td><td>N173D</td></tr>
<tr><td>16-24</td><td rowspan="3">1b</td><td>none</td><td rowspan="3">B</td></tr>
<tr><td>25,26</td><td>N173D</td></tr>
<tr><td>27,28</td><td rowspan="5">none</td></tr>
<tr><td>29</td><td rowspan="2">1b (PRT2 dead)</td><td>none</td></tr>
<tr><td>30</td><td rowspan="6">B</td></tr>
<tr><td>31-34/1</td><td rowspan="8">1c</td></tr>
<tr><td>34/4-37</td><td rowspan="2">Markey</td></tr>
<tr><td>38-45</td><td rowspan="4">N173D</td></tr>
<tr><td>46</td><td>A.Johnson</td></tr>
<tr><td>47-60</td><td rowspan="4">Markey</td></tr>
<tr><td>61-87</td><td rowspan="3">A</td></tr>
<tr><td>88-95</td><td>none</td></tr>
<tr><td>96-127</td><td>N173D</td></tr>
</table>

† ODF CTD sensor serial numbers appear below:

<table>
<tr><th rowspan="2">CTD
ID#</th><th rowspan="2">Pressure</th><th colspan="2">Temperature</th><th rowspan="2">Conductivity</th></tr>
<tr><th>PRT-1</th><th>PRT-2</th></tr>
<tr><td>1a</td><td rowspan="3">131910</td><td rowspan="3">14304</td><td>FSI1319</td><td rowspan="3">5902-F117</td></tr>
<tr><td>1b</td><td>FSI1320</td></tr>
<tr><td>1c</td><td>none</td></tr>
<tr><td>2</td><td>110188</td><td>15766</td><td>10680</td><td>2172-G147</td></tr>
</table>

4.1.1. CTD Pressure Corrections

4.1.1.1. CTD #1

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 +2.5-decibar average difference between the laboratory and cast data; the resulting data, Figure 1c, were used to correct JUNO1 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 JUNO1 CTD #1 pressure data. The thermal response pressure correction applied to upcasts used a the downcast correction, modified to achieve the mirror-image effect seen in the laboratory.

Thermometric pressures were measured at 1 deep point on each of 99 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 JUNO1 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.

4.1.1.2. CTD #2

CTD #2 pre- and post-cruise pressure calibrations, Figures 3a and 3b, were compared. The warm/shallow calibration curves shifted by 3 decibars from pre- to post-cruise; the cold/deep calibration curves shifted by 2 decibars in the same direction. The slopes of the pressure calibration curves shifted by less than half a decibar over 6000 decibars. The CTD #2 shipboard pre-cast pressure vs. temperature data were only 1 decibar off from the May 93 calibration data. The shape of the upcast/shallow sections of the May 93 calibration more closely resembled the shape of historical CTD #2 calibration data. The May 93 hysteresis curve, offset by 1 decibar to match shipboard data, Figure 3c, was used to correct the CTD #2 pressure data on JUNO1.

Warm-to-cold thermal shock data from Feb.87, Figure 4, were the only available thermal shock data for the CTD #2 pressure sensor. Time constants and temperature coefficients were calculated from this data to model the pressure response to rapid temperature change. These values, listed in the table at the end of this section, were used to correct the JUNO1 CTD #2 pressure data. As with CTD #1, the thermal response pressure correction applied to upcasts used a modified version the downcast correction to achieve the mirror-image effect seen in the laboratory for other NBIS CTDs where cold-to-warm thermal shock data have been measured.

Thermometric pressure data were measured once per CTD #2 cast. The thermometric/CTD pressure differences were stable and comparable to the values obtained for post-calibration CTD #1 data vs. the same DSRT.

The shifted May 93/post-cruise calibration curve, Figure 3c, was used in conjunction with the Feb.87 thermal shock results, Figure 4, to correct the pressure for the eight JUNO1 CTD #2 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 ID#	Short Time Constant (secs) Tau1	Temp. Coeff. for Tau1 k1	Long Time Constant (secs) Tau2	Temp. Coeff. for Tau2 k2
1	82.1826	+0.306253	384.176	-0.26423
2	114.933	+0.160436	4957.67	-0.18672

4.1.2. CTD Temperature Corrections

4.1.2.1. CTD #1

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 check for PRT-1 drift during the cruise. A .003 °C shift in the PRT-1/PRT-2 difference was noted during stations 6 and 7, the last two casts before switching PRT-2 sensors. The differences returned to normal after the backup FSI sensor was installed at station 16, so PRT-1 appeared to be stable. Both PRT-2 sensors failed during JUNO1 and no PRT-2 was installed beginning station 29-3. A thermometric temperature was measured during each cast after station 30 to check for shifts in PRT-1. No shifts were noted during the leg.

A comparison of the pre- and post-cruise laboratory CTD #1 PRT-1 temperature transducer calibrations, Figures 5a and 5b, showed two curves with nearly identical slopes and a +.001 °C shift in the temperature correction over the range of 0 to 32 °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.

4.1.2.2. CTD #2

CTD #2 had two Rosemount temperature sensors, each calibrated pre- and post-cruise (Figures 6a and 6b). The correction for PRT-1, the primary sensor, shifted an average +.007 °C between calibrations with no slope change. The correction for PRT-2, the secondary sensor, shifted an average +.017 °C and had a steeper post-cruise slope.

PRT-1 and PRT-2 values during each JUNO1 CTD #2 cast were compared; the differences between the two sensors remained constant at .004 °C. Since all eight CTD #2 casts were done mid-Oct.92, only 2 months after the pre-cruise calibration and 7 months before the May 93 calibration, and the magnitude of the PRT-2 drift was more than twice the PRT-1 drift, it was decided to use the pre-cruise PRT-1 temperature calibration data, Figure 6a. The corrections were converted to the IPTS-68 standard and then applied to the CTD #2 temperature data.

Thermometric temperature data were measured once per cast as another way to validate CTD temperature data. Thermometric/CTD temperature differences for both CTDs, using the same DSRTs, were compared after applying final CTD temperature corrections. For casts where the DSRTs were properly soaked, the differences were almost all less than .0005 °C, indicating that CTD #2 temperature data are comparable to data from the more stable CTD #1, whose calibration varied only .001 °C over 9 months.

4.1.3. 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.

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.

4.1.3.1. CTD #1

CTD #1 conductivity slopes were stable throughout JUNO1, dropping off slightly in the last third of the cruise. The calculated slopes for the casts below 55 deg. S. latitude were much more scattered than the rest of the leg. This was where the surface conductivities shifted to being lower than the deep conductivity values, plus the conductivity ranges within each cast were only 2-4 mmho. Because the slopes before and after these far-south stations were consistent, it was decided to use the same (0-order) slope for the higher-latitude stations as calculated for the lower-latitude CTD #1 casts through station 84. A gradually changing conductivity slope as a function of station number was used for the last third of the casts, shifting by less than -.0002 from station 85 to station 127.

Residual CTD #1 conductivity offset values were calculated after applying the conductivity slopes. There were no differences noted between high and low latitude casts. The conductivity offsets for the first 7 stations were fit as a function of station number, and the smoothed first-order offsets were applied to stations 1 through 7. This slow drift in conductivity offsets is typical for the start of a leg, when the CTD has not been used for over a week. A constant conductivity offset value was calculated and applied to the CTD #1 casts for stations 16 through 84. A slight upward drift in the offsets was noted from the stations in the mid-80’s to the end of the leg. Conductivity offsets were fit as a function of station number, then the smoothed first-order offsets were applied to CTD conductivities for stations 85-127. The transition in offset values between station groups was smooth, with no sudden shifts between groups.

4.1.3.2. CTD #2

During JUNO1, CTD #2 was used for exactly 8 casts while CTD #1 was under repair. Conductivity sensors are usually left soaking in water between casts to minimize drifting problems. Prior to station 8, CTD #2 had not been used nor had its conductivity sensor been soaked since the CTD left San Diego two months earlier. CTD #2 conductivity drifted with time during the first four casts (stations 8-11), where down and up casts were noticeably shifting within each cast. The drift decreased in magnitude the more the CTD was used, becoming negligible by station 12.

CTD #2 conductivity slopes as a function of conductivity were calculated using data above 1000 decibars only; the effect of the drifting problems noted above was minimized by using this more limited range. The calculated slopes were consistent for all 8 casts, and an average of the slopes was applied.

Residual conductivity offsets were then calculated for each CTD #2 cast for various pressure ranges. It was decided to use the offset values calculated from data below 4000 decibars only, again to minimize the effect of the drifting noted above. Individually calculated offsets were used for stations 8-12; because the CTD drifting had stabilized after that point, an average offset was used for stations 13-15.

The problem of drifting within each cast still needed to be resolved. The apparent time- and/or pressure-dependent drift could be characterized by a first-order slope with respect to pressure. This would adequately correct upcast CTD data, which could be directly matched up to bottle trip data. Upcasts were used for the final CTD #2 pressure-series data for stations 8-13. Stations 14 and 15 may have had small conductivity offsets in the top 1000 decibars of their upcasts, so their downcast data were used.

The time-based drift that caused large differences in down and up cast data was apparently gone after station 12, but a small residual pressure slope was still apparent on the rest of the CTD #2 casts, whether down or up cast data were used. Pressure-dependent slopes to conductivity were calculated cast by cast from bottle vs CTD data, then applied to the eight CTD #2 casts. The sparse bottle data available for station 12 did not distort its calculated pressure slope, which was consistent with the trend in the 8-cast group. The calculated slope for station 14 did not fit the trend, so an average of the slopes from stations 13 and 15 was applied.

4.1.3.3. Bottle vs. CTD Conductivity Statistical Summary

Plots of the final/adjusted JUNO1 conductivity slopes and offsets for both CTDs can be found in Figures 7a and 7b. These plots include adjustments made to the conductivity offsets to ensure continuity of cast-to-cast TS relationships or to account for discontinuous shifts in the transducer response.

The JUNO1 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 8a and 8b.

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

JUNO1 Final Bottle-CTD Conductivity Statistics

pressure range (decibars)	mean conductivity difference (bottle-CTD mmho)	standard deviation (mmho)	#values in mean
all pressures	0.000444††	0.012726	4356
allp (4,2rej) †	0.000057	0.001412	4200
press < 1500	0.000935	0.016655	2404
p<1500(4,2rej)†	0.000151	0.002238	2312
press > 1500	-0.000161††	0.004378	1952
p>1500(4,2rej)†	-0.000033	0.000634	1859

† "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 8a and 8b.

4.2. CTD Dissolved Oxygen Data

4.2.1. CTD Oxygen Corrections

Dissolved oxygen data were acquired using Sensormedics dissolved oxygen sensors. Two oxygen sensors were used during JUNO1. Sensor A was used with both CTDs for stations 1-15. A new oxygen sensor B was put into service starting with station 16 and was used until it died during station 60. The original oxygen sensor A was put back on at station 61 and used for the rest of the cruise. Station 29 was done without an oxygen sensor installed in an attempt to narrow down the source of the FSK noise problem described earlier in this document.

CTD oxygen data were corrected after pressure, temperature and conductivity corrections had been applied. CTD raw oxygen currents were extracted from the pressure-series data at isopycnals corresponding to the up-cast check samples. Most 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. CTD oxygen data can be affected by flow-dependence problems in either direction any time the cast is stopped or slowed down, especially at bottle stops or bottom approaches. Casts where up-cast data were used are documented in Appendix D-1; cast stops longer than 1 minute, which may have affected the pressure-series data, are noted in Appendix D-2.

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 JUNO1 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 usefulness of

CTD oxygen data above the second check sample should be carefully considered.

There were tripping problems on several casts that resulted in large sections of missing bottle data values. Bottle data from nearby casts with similar PTCO profiles were used to fill in these missing areas so a CTD oxygen fit could be accomplished. The affected casts for this cruise were at stations 7, 12, 18 and 34-1. Details regarding which bottle data were used for these CTD oxygen fits are included in Appendix D-1.

Bottle oxygen data were recalculated with smoothed blanks and thio normalities after CTD oxygen data were fit.

4.2.2. 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 of up cast bottle oxygens, with the new blanks/normalities applied, vs corrected down cast CTD oxygens are shown in the table below. These differences include data values with quality code 3 or 4.

JUNO1 Final Bottle-CTD Oxygen Statistics

pressure range (decibars)	mean oxygen difference (bottle-CTD ml/l)	standard deviation (ml/l)	#values in mean
all pressures	-0.01405††	0.16772	4286
allp (4,2rej) †	0.00261	0.04823	4018
press < 1500	-0.02553	0.22213	2364
p<1500(4,2rej)†	0.00129	0.08038	2188
press > 1500	0.00007††	0.04109	1922
p>1500(4,2rej)†	0.00128	0.01395	1837

† "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 9a and 9b.

4.3. Additional Processing

An excessive amount of FSK signal noise was noted during the first 34 JUNO1 CTD casts, plus station 46, before the problem was isolated as the Alman Johnson winch. The noise manifested itself as random bits dropping out of the data stream, causing occasional dropouts/noise in any single channel at various frames. The pressure, temperature and conductivity absolute and gradient filters, mentioned in the "CTD Acquisition and Processing Summary" section near the beginning of this report, eliminated most of the raw data frames with dropouts. Raw oxygen data are usually not filtered, but it was necessary to add an oxygen filter and re-block-average/re-process 15 JUNO1 casts with excessive oxygen dropouts: stations 4-7, 12, 14, 15, 25-28, 30, 32, 34-1 and 46. Some small-scale noise, especially in the oxygen signal, may still remain in any cast done with the Alman Johnson winch. The transmissometer signal on the Alman Johnson casts was not filtered; those data are very noisy in comparison to casts done with the Markey winch.

A post-block-averaging software filter was used on 67 casts to remove conductivity or temperature spiking problems in about 0.055% of the time-series data frames. Pressure did not require filtering.

Post-block-averaging oxygen spikes were filtered out of 116 casts. The filtered oxygen levels affected approximately .287% of the time-series data frames. 96.0% of the filtered oxygen data were shallower than 100 decibars and could be directly related to bubbles trapped during the going-in-water transition.

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 showed 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 (or up cast - see table below) 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.

5. General Comments/Problems

There is one pressure-sequenced CTD data set, to near the ocean floor, for each of 128 casts at 127 stations. Additional test casts were neither processed nor reported.

The data reported is from down casts, excepting the 10 casts listed below:

JUNO1 UP-CAST PRESSURE-SERIES DATA

Station(s)	Problem with Down Cast Data
008-013 (all cast 1)	time-dependent conductivity drift, decreasing in magnitude each cast; up casts correlated more directly with bottle data and could be calibrated more accurately than down casts
016/01	down cast CTD oxygen data could not be fit to bottle data
034/01	noisy down cast, plus 80-minute stop near bottom of cast
046/01	-.01 psu salinity offset on down cast
052/01	conductivity sensor froze during deployment, data ok after first 100 decibars

The 0-decibar level of some casts was 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 were reported. Extrapolated surface levels are identified by a count of "1" in the "Number of Raw Frames in Average" reported with each data record; they are also noted in Appendix D-1.

One time-series data set, station 46, had a few seconds of missing data in several spots due to the FSK signal noise problems mentioned earlier. Data missing in the corresponding 2-decibar pressure-series levels 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-1. All interpolated data levels also have a count of "1" in the "Number of Raw Frames in Average" column in the data files.

In addition, missing data values, such as CTD oxygens in casts where the sensor failed or was not present on the rosette package, are represented as "-9" in the data files. There are two such casts in this data set: 029/03 and 060/01. Stations without transmissometer data will have "0" in the transmissometer data field. In this data set, stations 16-24, 27-37, and 88-95 are without transmissometer data. The transmissometer was malfunctioning during stations 7 and 8, so those data should be ignored.

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 or yoyos during the casts are also documented in Appendix D.

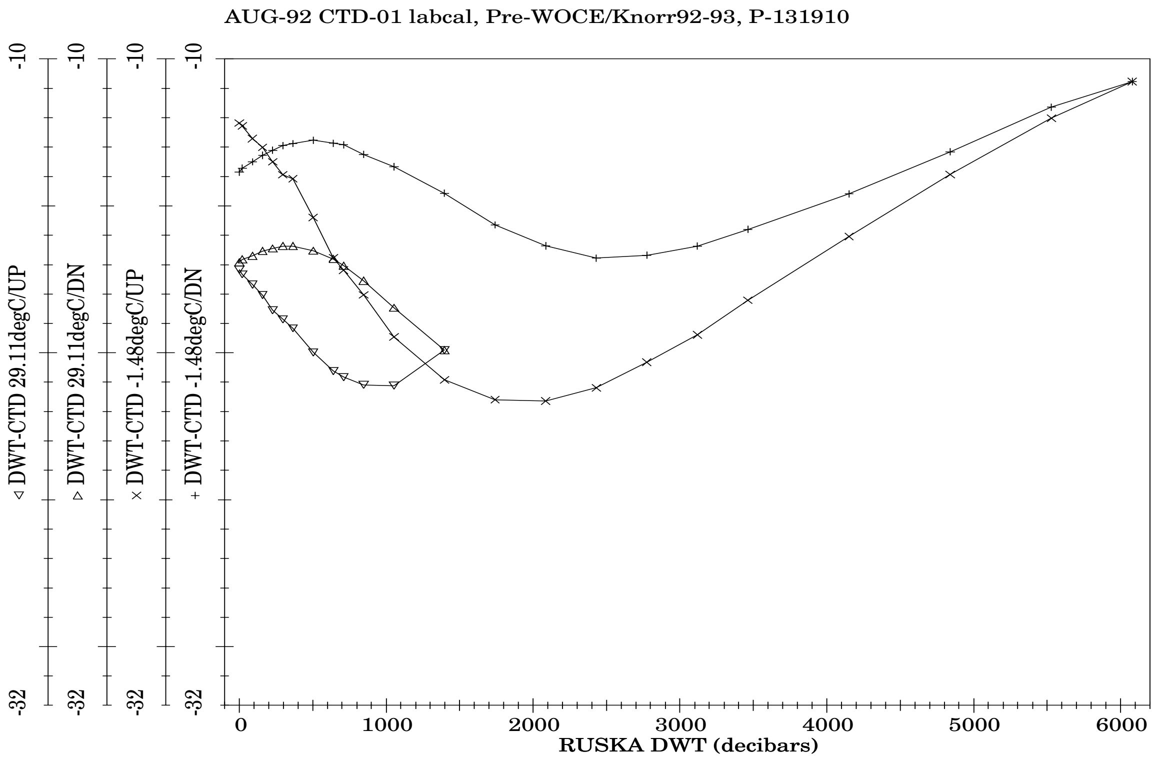

Figure 1a: CTD #1 Pre-cruise Pressure Calibration

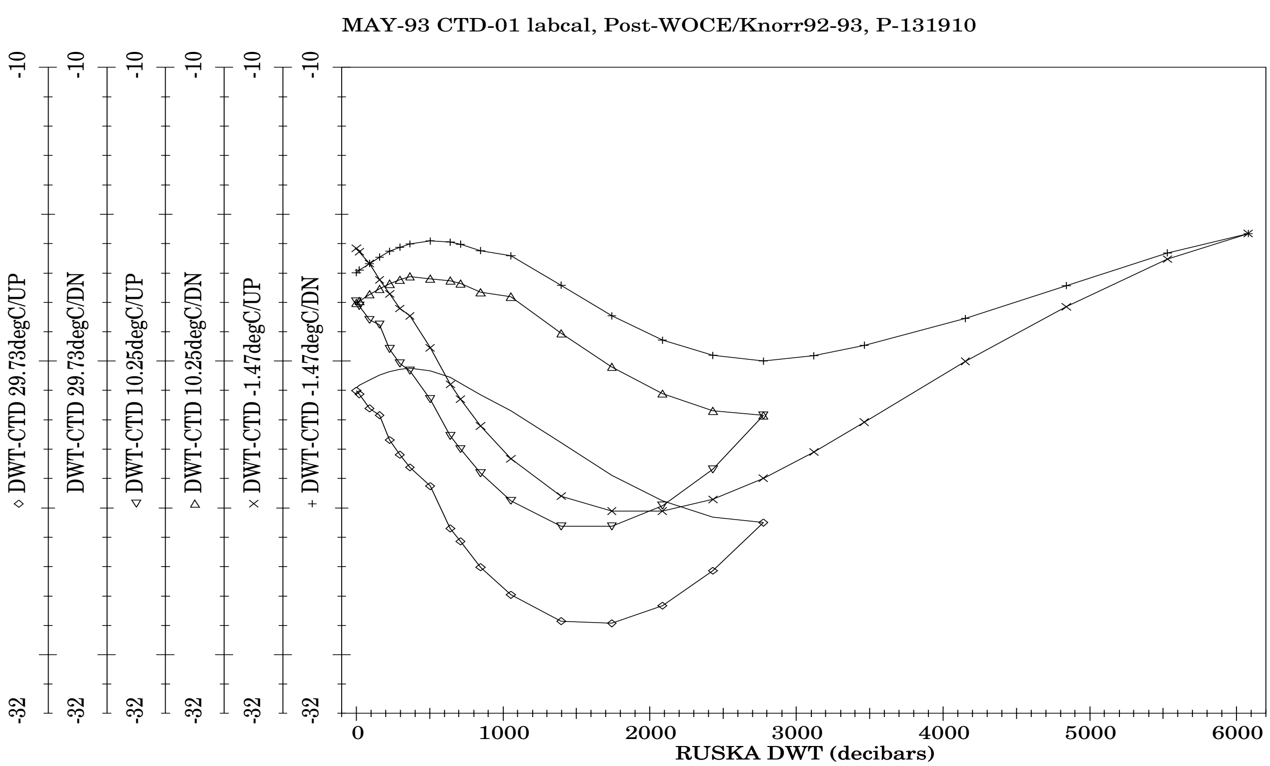

Figure 1b: CTD #1 Post-cruise Pressure Calibration

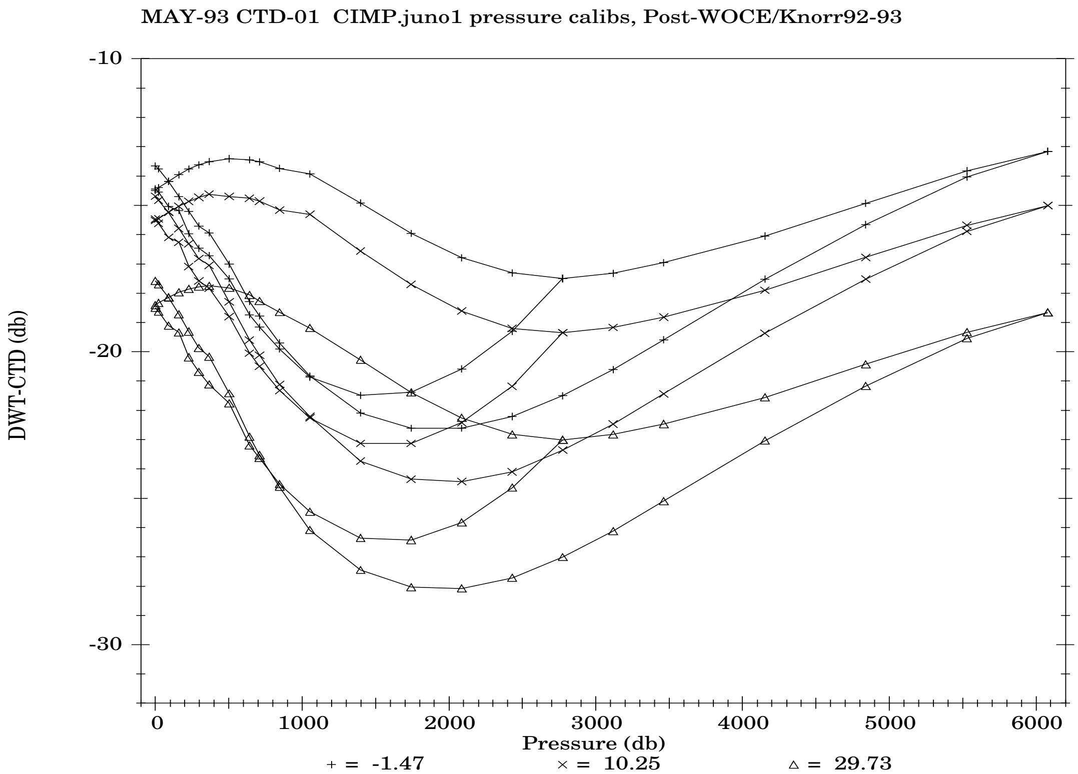

Figure 1c: CTD #1 Post-cruise Pressure Calibration plus Offset used for JUNO1

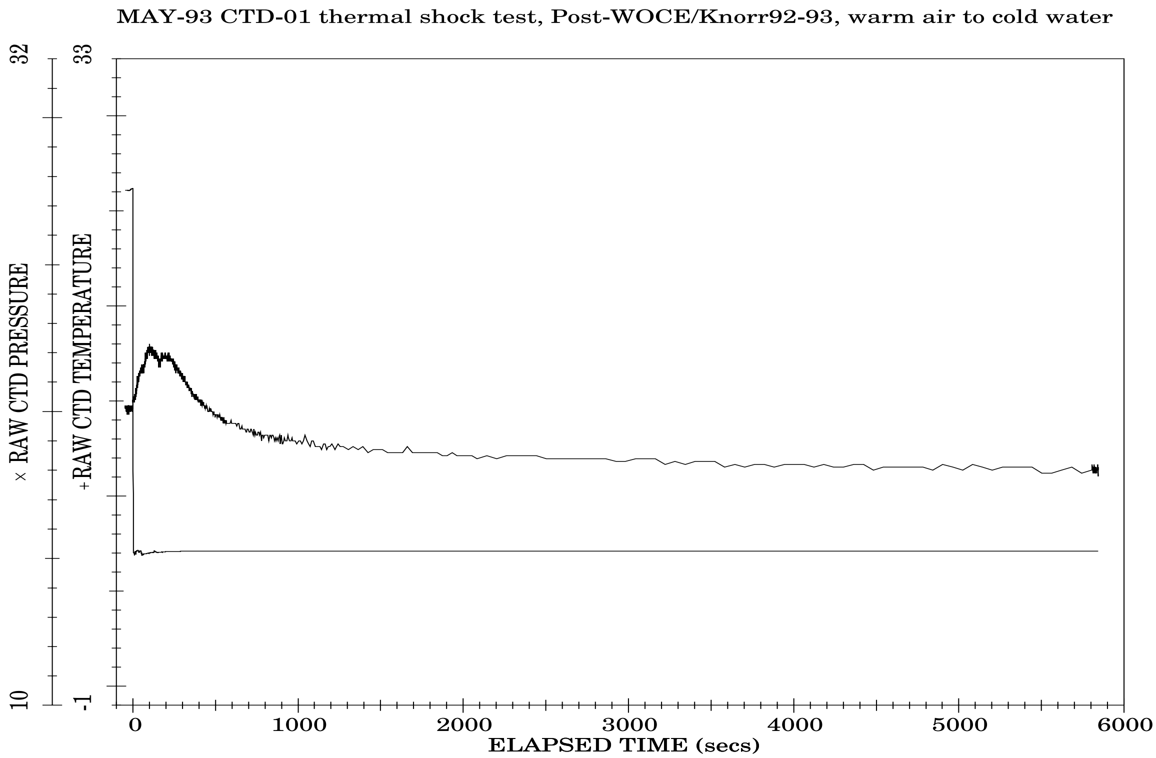

Figure 2a: CTD #1 Warm-to-Cold Thermal Shock Data

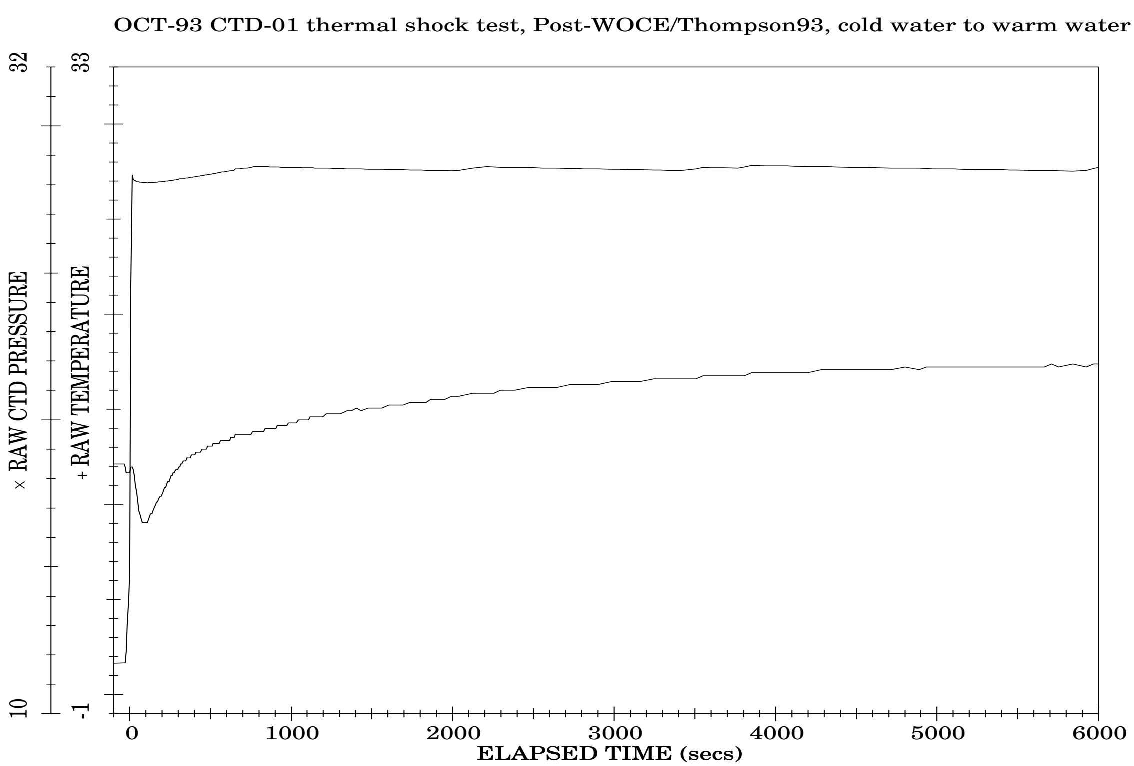

Figure 2b: CTD #1 Cold-to-Warm Thermal Shock Data

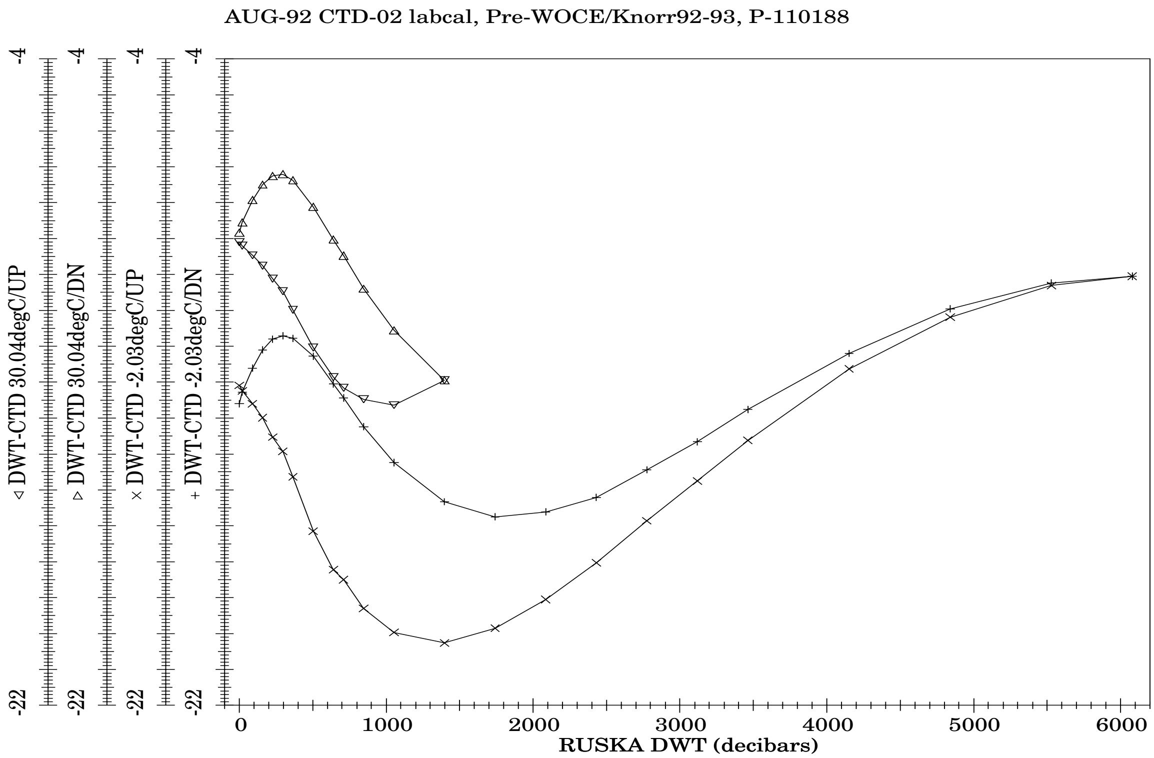

Figure 3a: CTD #2 Pre-cruise Pressure Calibration

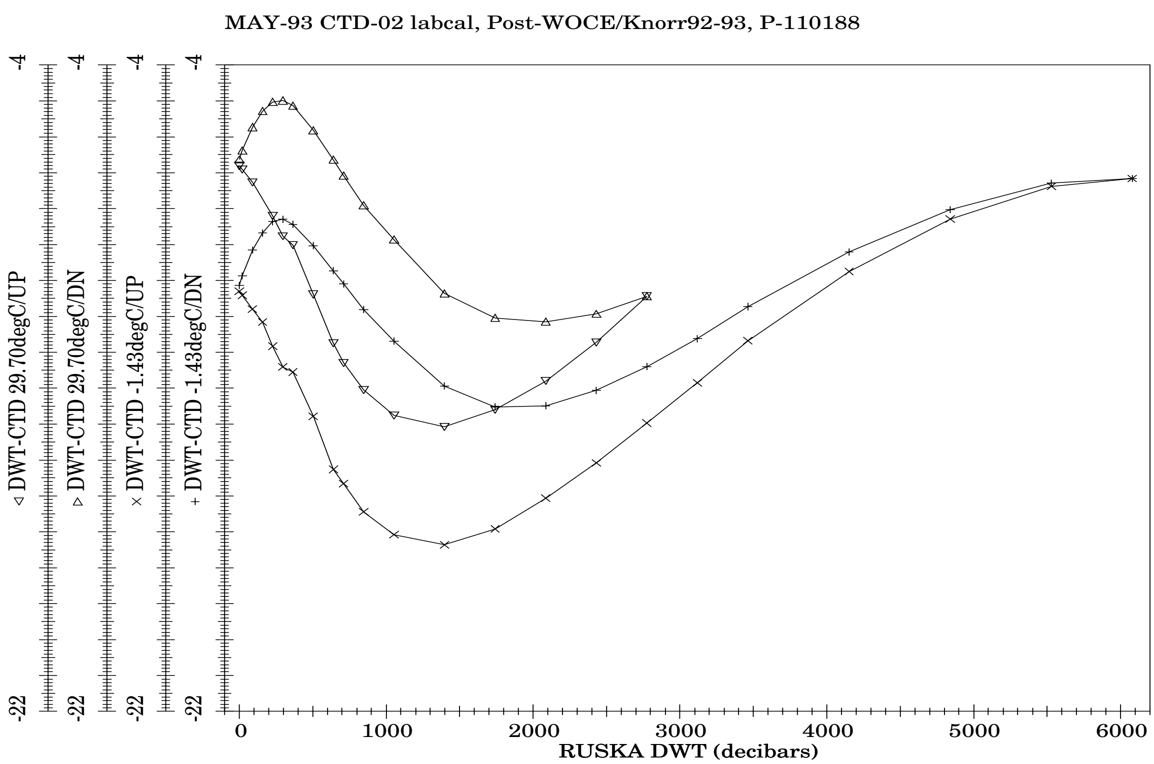

Figure 3b: CTD #2 Post-cruise Pressure Calibration

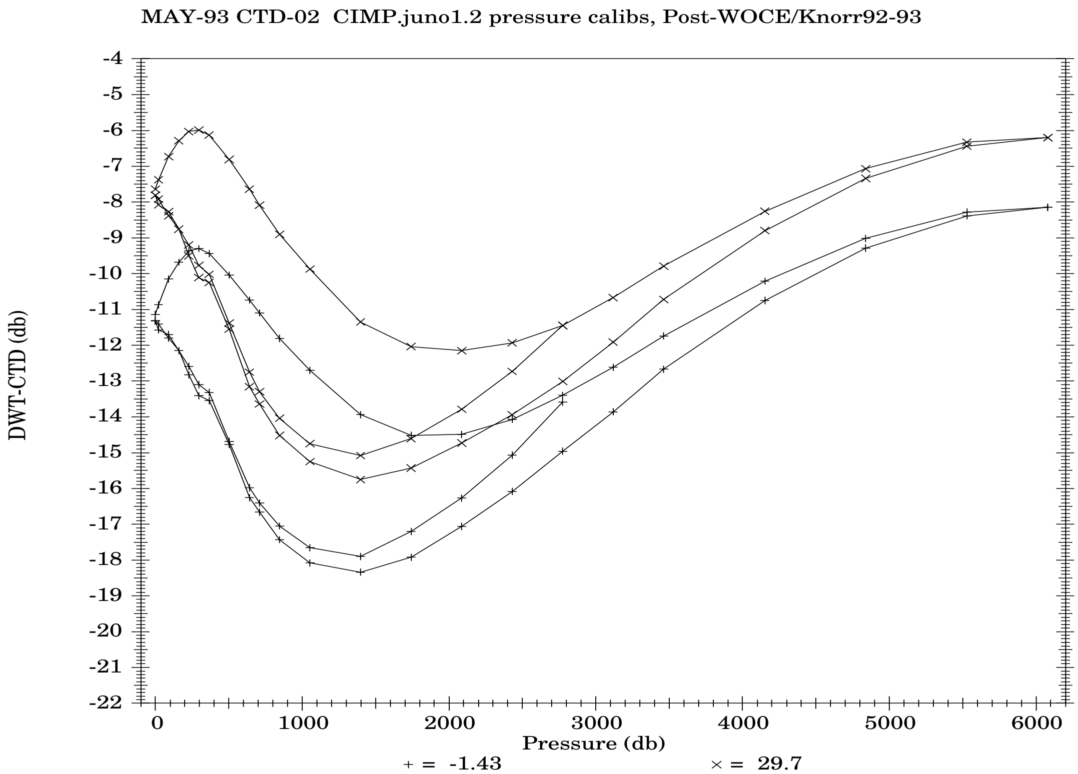

Figure 3c: CTD #2 Post-cruise Pressure Calibration plus Offset used for JUNO1

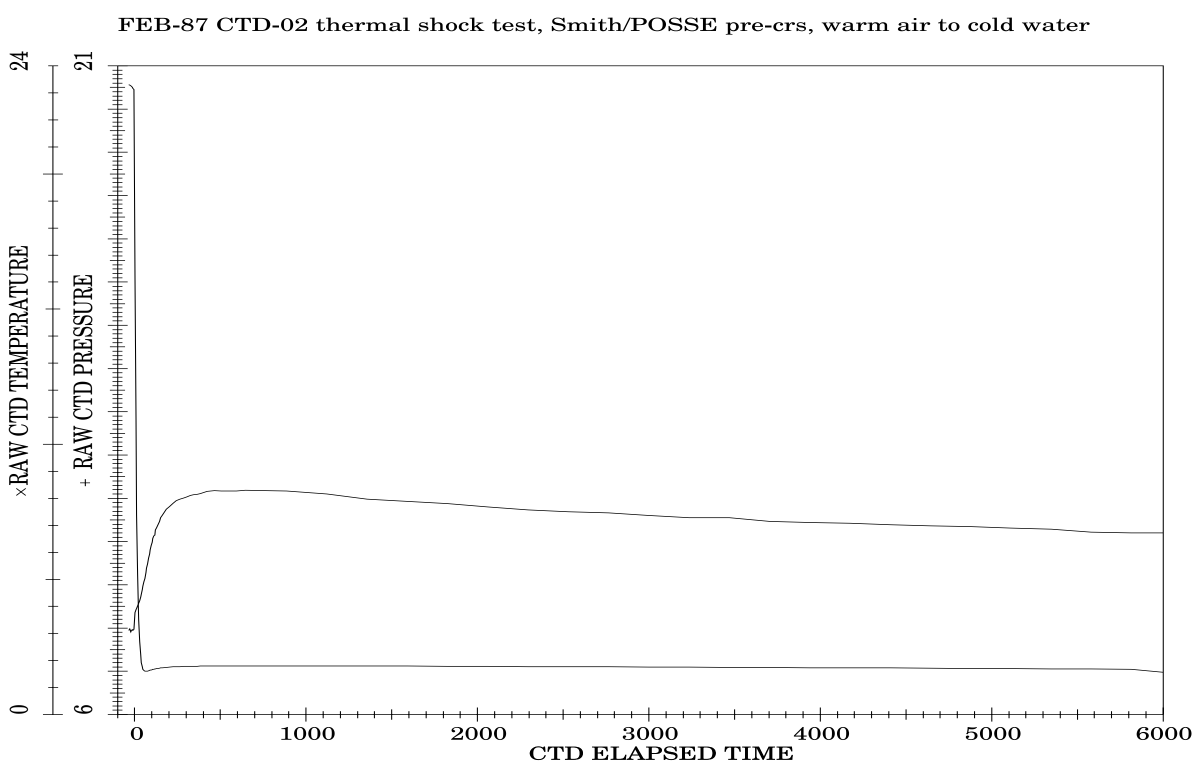

Figure 4: CTD #2 Warm-to-Cold Thermal Shock Data

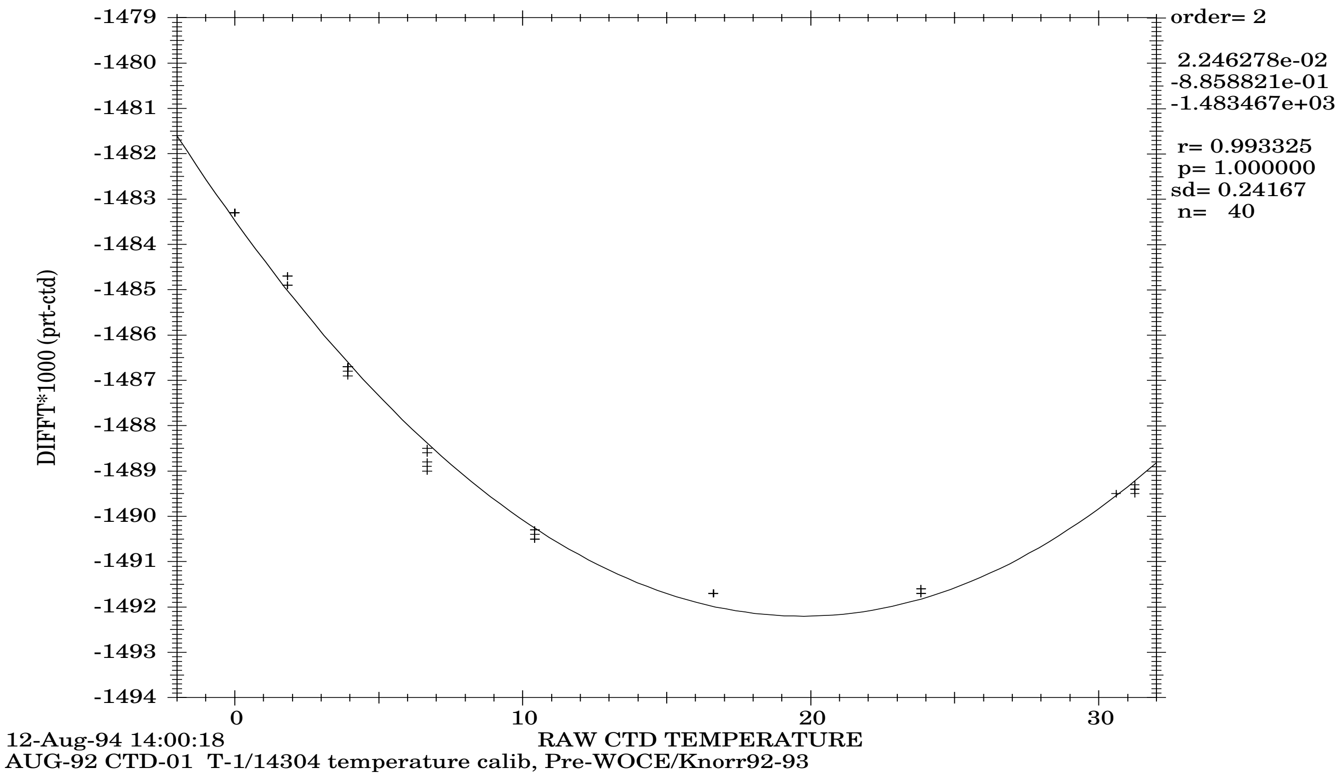

Figure 5a: CTD #1 Pre-cruise PRT-1 Temperature Calibration (ITS-90)

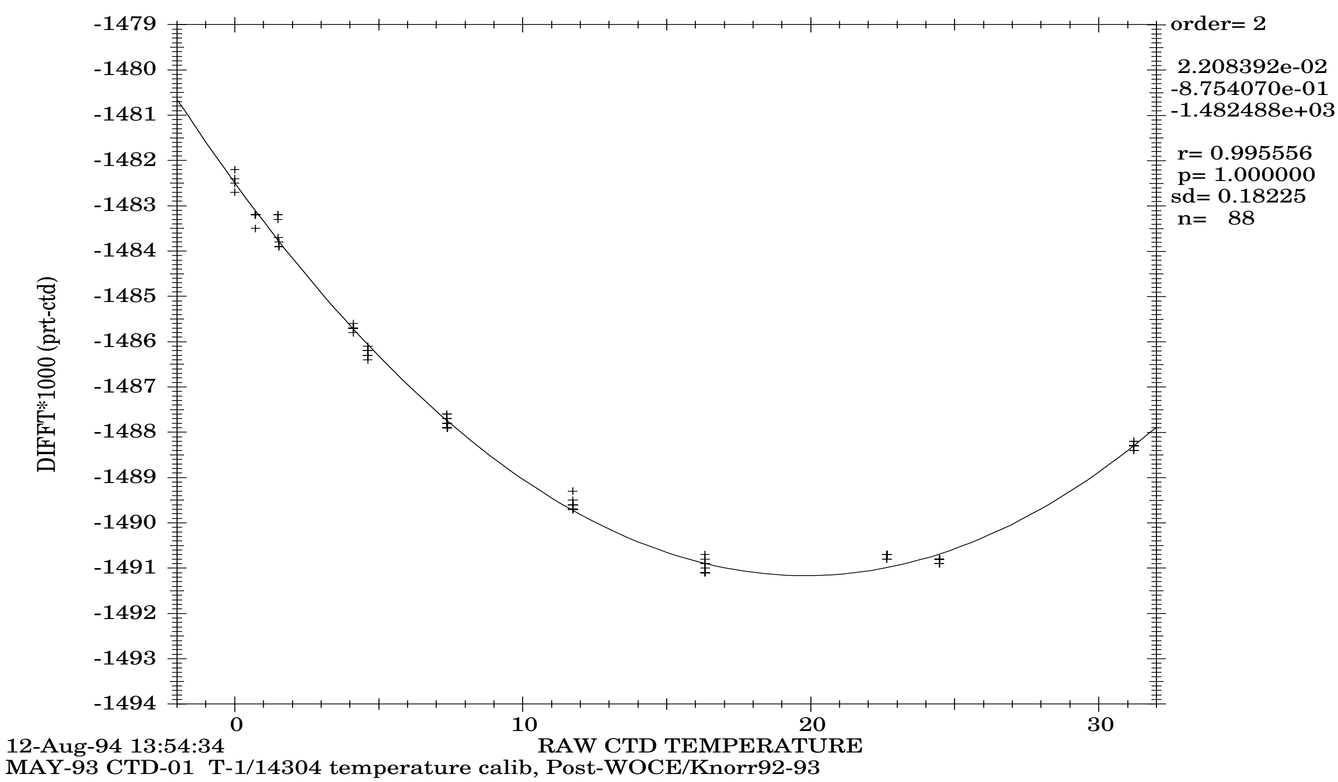

Figure 5b: CTD #1 Post-cruise PRT-1 Temperature Calibration (ITS-90)

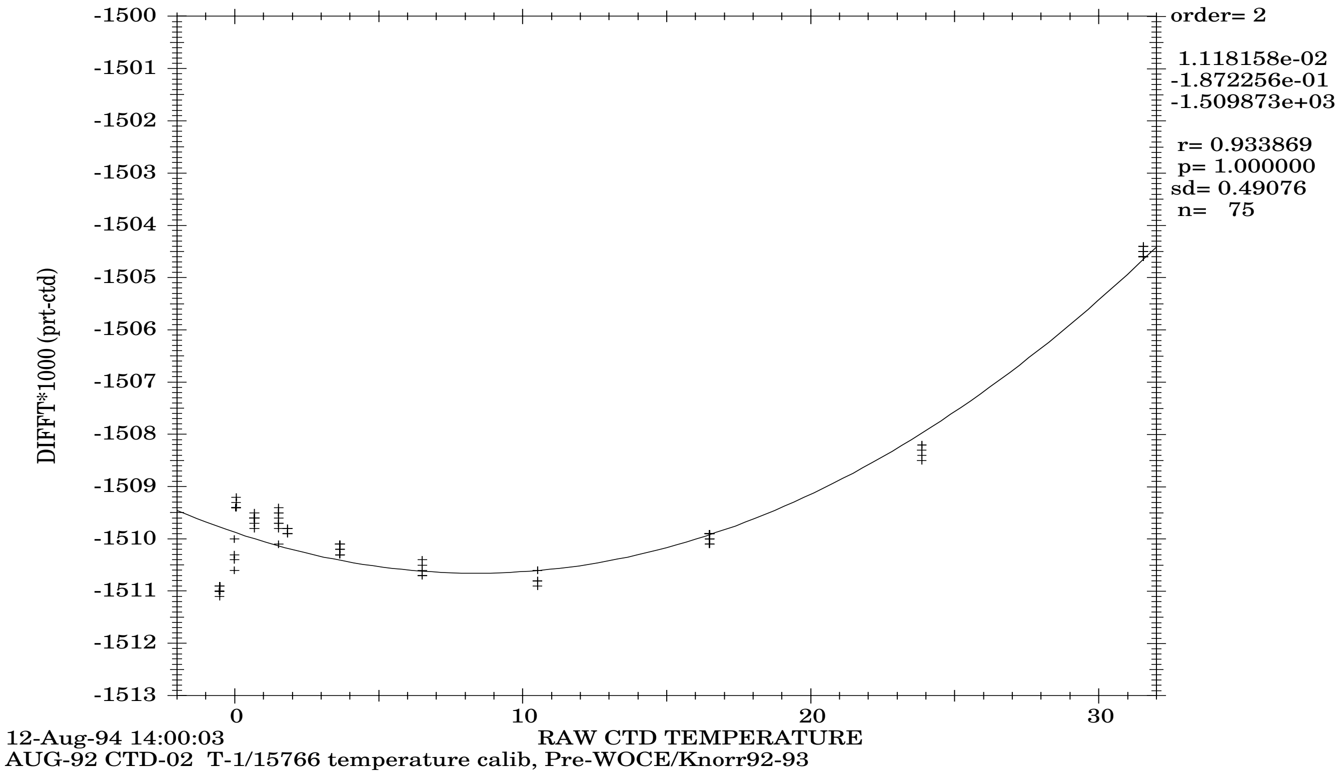

Figure 6a: CTD #2 Pre-cruise PRT-1 Temperature Calibration (ITS-90)

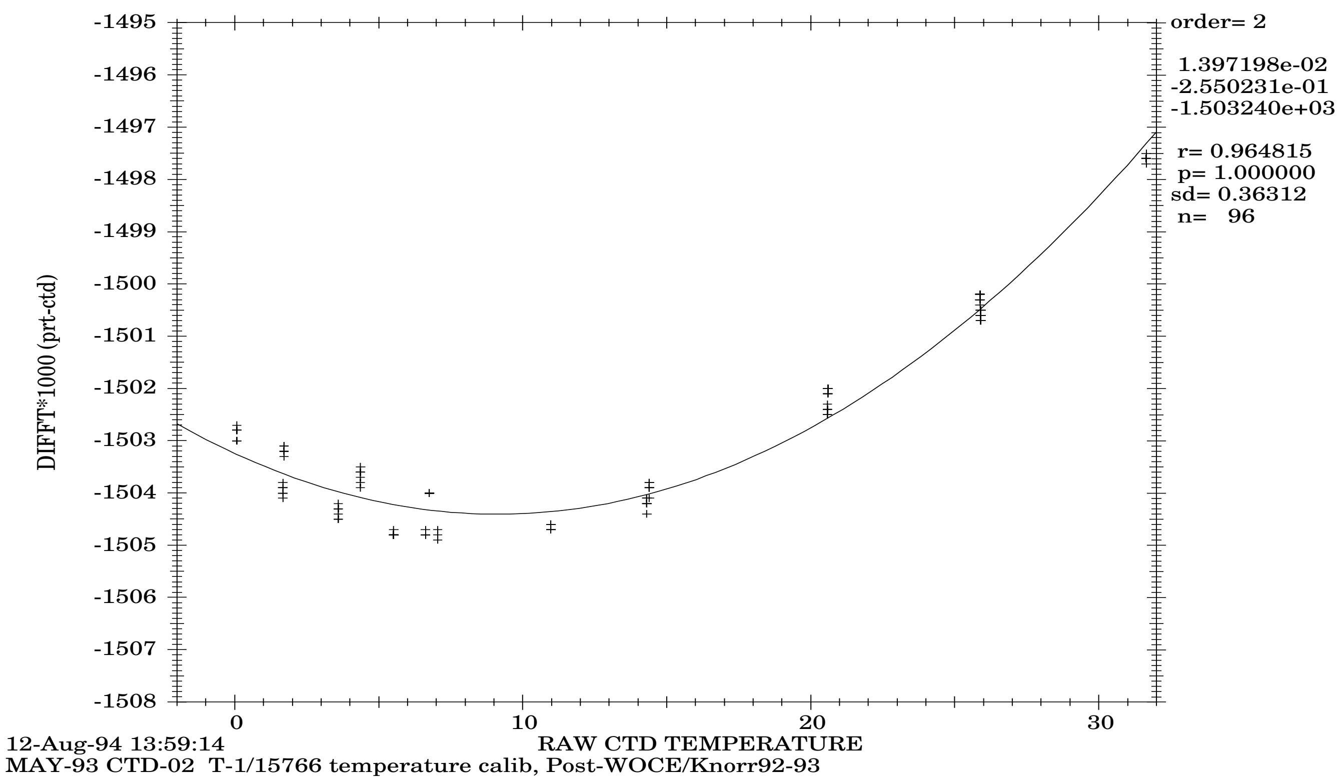

Figure 6b: CTD #2 Post-cruise PRT-1 Temperature Calibration (ITS-90)

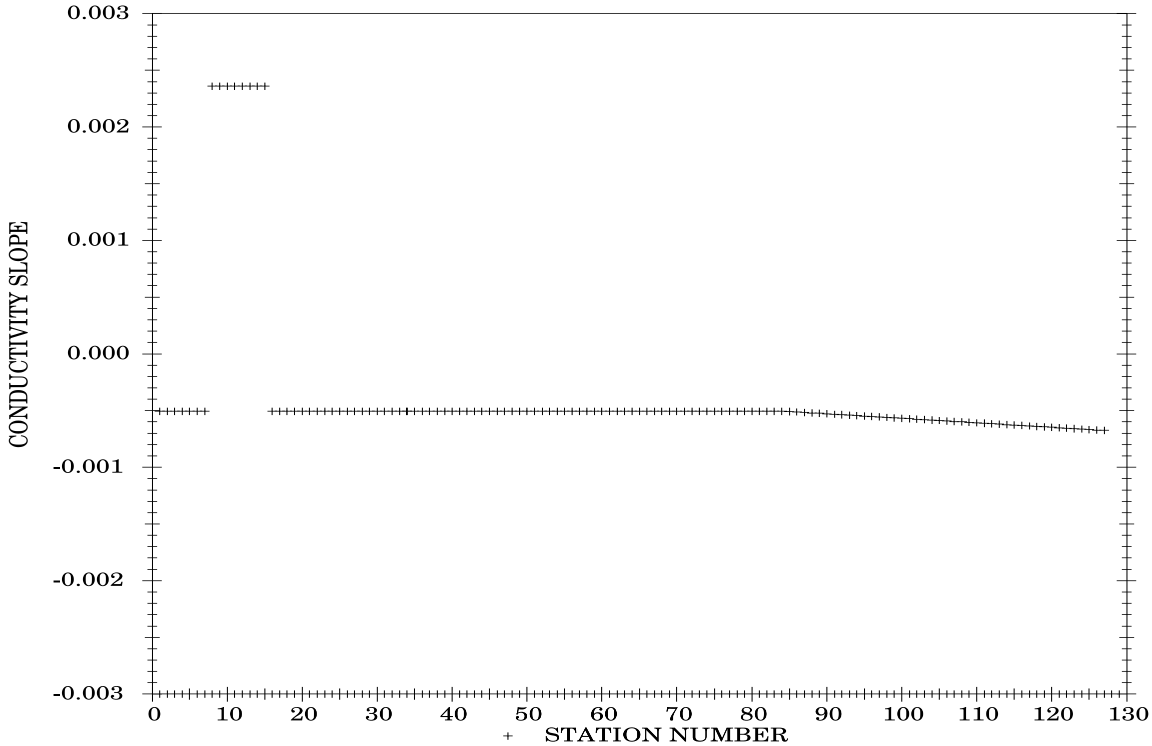

Figure 7a: JUNO1 Conductivity Slopes, Both CTDs

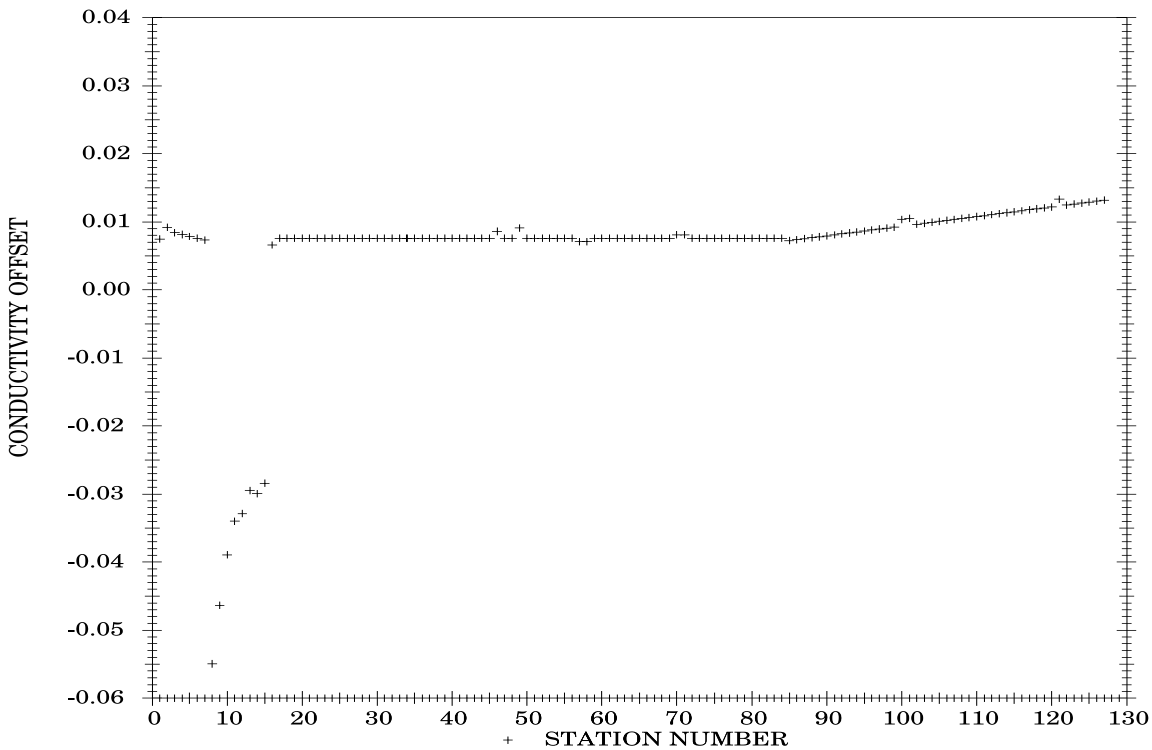

Figure 7b: JUNO1 Conductivity Offsets, Both CTDs

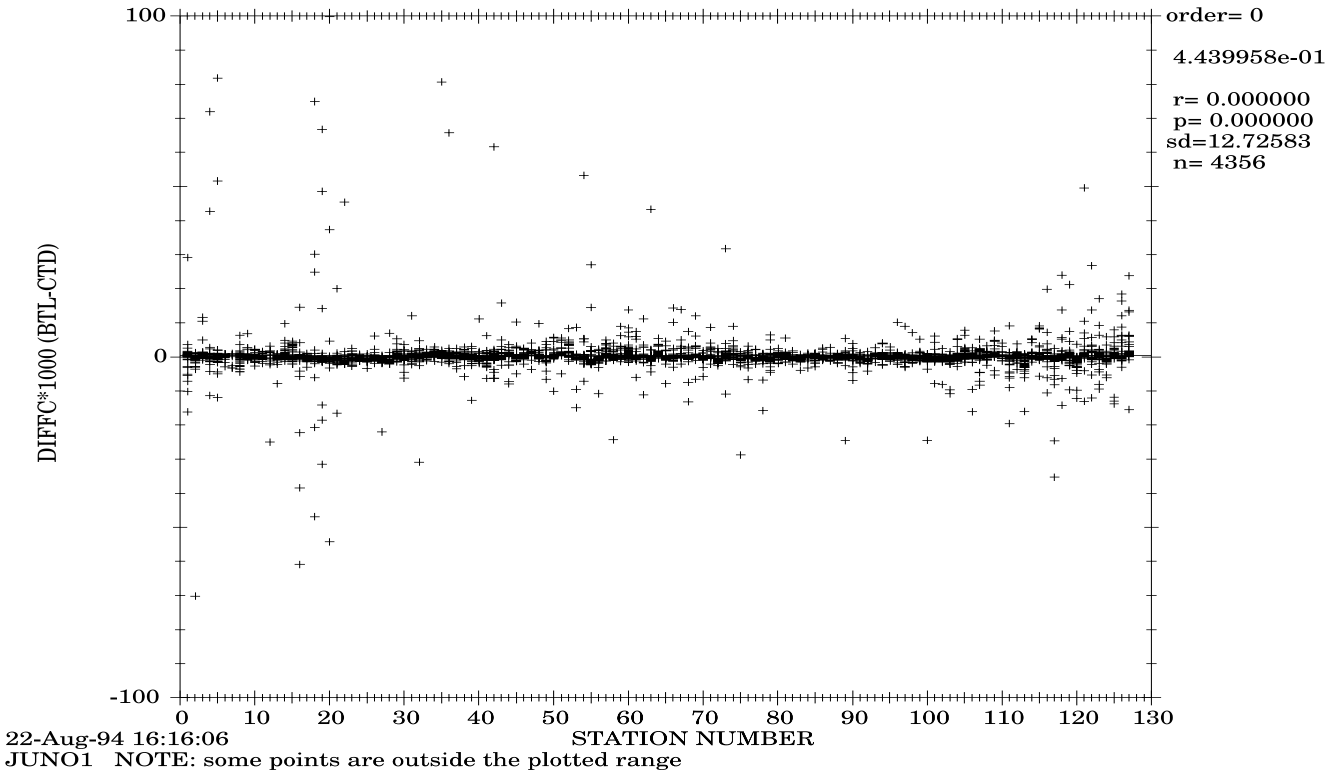

Figure 8a: JUNO1 Residual Conductivity Bottle-CTD Differences - All Pressures

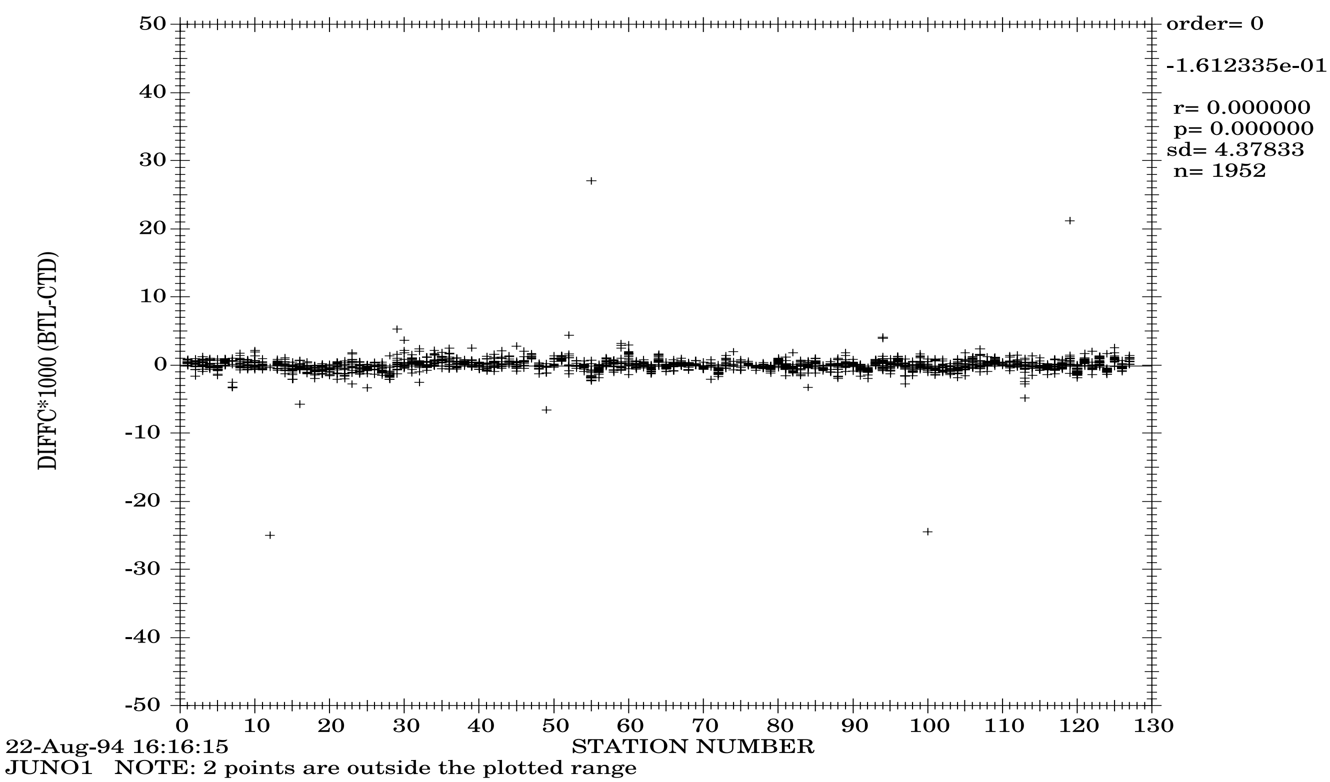

Figure 8b: JUNO1 Residual Conductivity Bottle-CTD Differences - Prs>1500dbar

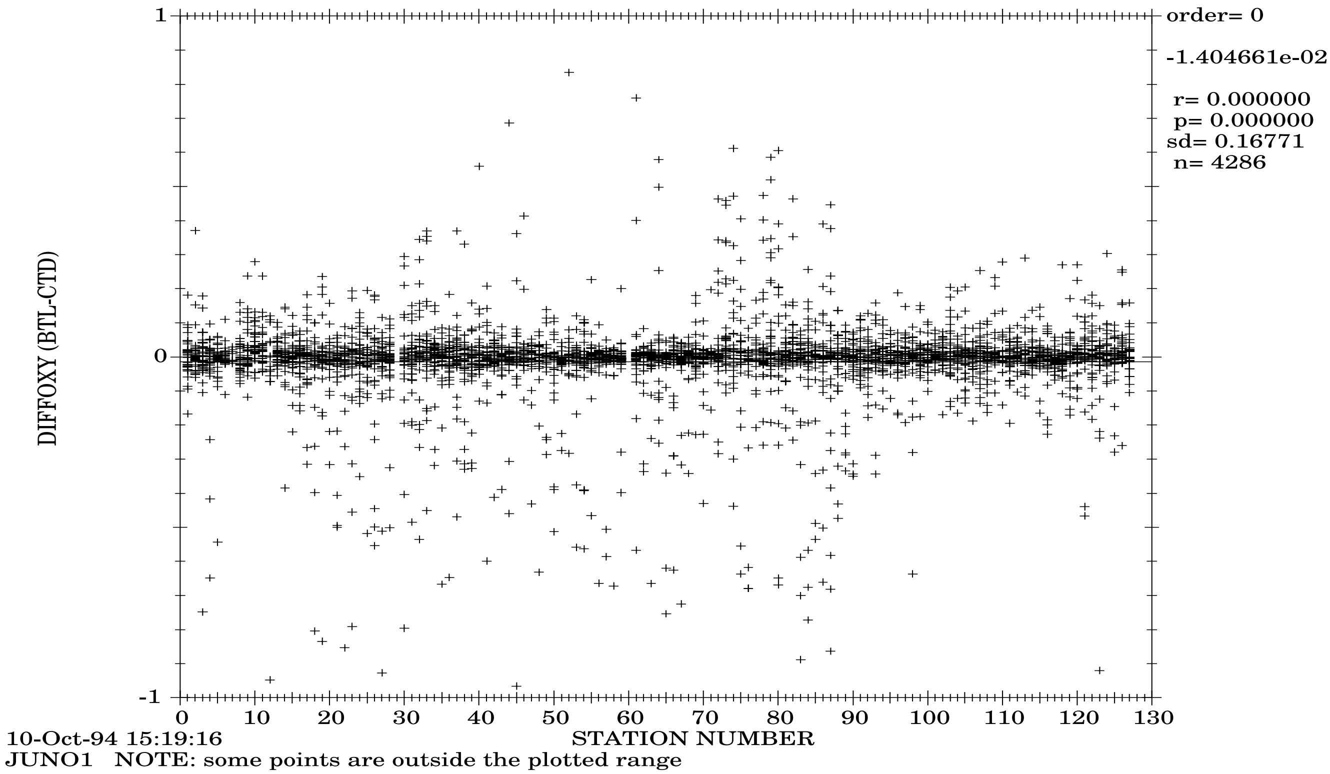

Figure 9a: JUNO1 Residual Diss.Oxygen UpBottle-DownCTD Differences - All Pressures

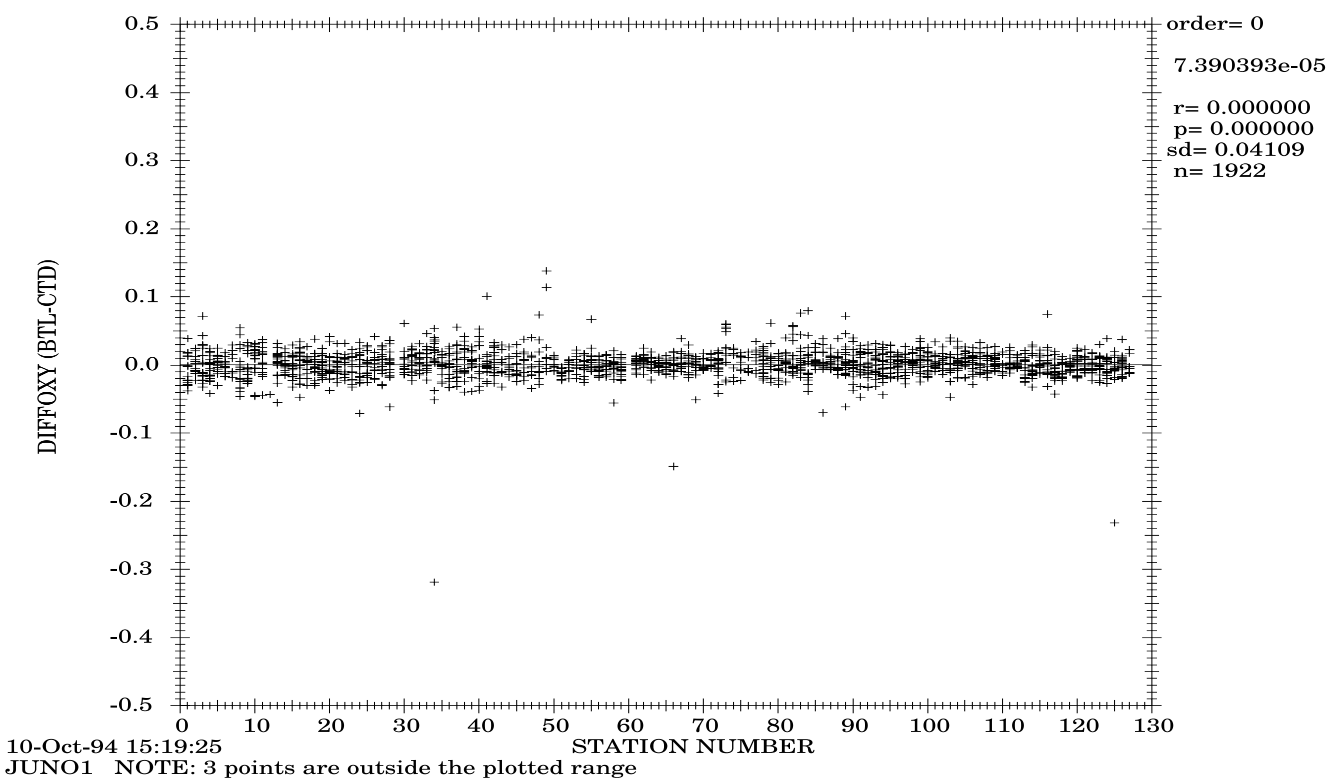

Figure 9b: JUNO1 Residual Diss.Oxygen UpBottle-DownCTD Differences - Prs>1500dbar

Appendix C:

JUNO1 - WOCE92-P16A/P17A Calibration Figures

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NOTE: some differences fall outside of the plotted limits.
Please refer to the bottle data quality codes.

Appendix D:

JUNO1 - WOCE92-P16A/P17A Processing Notes

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APPENDIX D-1:

JUNO1 - WOCE92-P16A/P17A CTD Shipboard and Processing Comments

sta/cast	Comments
001/01	xmiss TAMU #N152D; oxygen sensor A; PRT2=FSI-1320
002/01	
003/01	0 db level extrapolated
004/01	
005/01	
006/01	multiple aborted starts/noisy signal problems prior to cast; repair attempts included various combinations of xmiss/PRT2 removal, new end termination, new wire from slip rings to lab, inner or outer pylon only, try backup winch/wire, changing harness, changing trip box, bypassing sliprings; second end termination minus 50ft wire = clean signal; left inner rosette empty for cast; switched to PRT2=FSI-1319 this cast; xmiss died downtrace at 3400+ db
007/01	xmiss still dead; PRT2=FSI-1319 again; 0 db level extrapolated; CTD signal died after 3724 db trip; minimal bottle data above 3700 db: added stations 6/8 bottle oxygens above 3700 db for CTD oxygen fit
008/01	UP cast; change to CTD #2; xmiss still dead
009/01	UP cast; switch to spare TAMU xmiss #N173D
010/01	UP cast; 15-min. stop at 2007 mwo up: sliprings fell off winch axle - resecured, no apparent damage
011/01	UP cast
012/01	UP cast; no or bad bottle data 575-5000 db: added stations 11/13 bottle oxygens to fill in the hole for CTD oxygen fit
013/01	UP cast; new outer pylon, bucket shield around endcap wiring - not at sensor end - to shield cables from movement
014/02	winch stopped 5000 mwo down
015/01	0 db level extrapolated
016/01	UP cast; back to CTD #1, change back to PRT2=FSI-1320, NEW CTD oxygen sensor B, xmiss removed until station 25; endcap removed/replaced since last use
017/01	
018/01	rough seas, variable winch speed - winch stopped several times in top 300 m down; 0 db level extrapolated; mistrips/sparse bottle data: fill in top 700 db with stations 17/19 for CTD oxygen fit
019/01	new end termination after 50 ft cut off wire due to kinks from rough seas; 0 db level extrapolated; sparse oxygen bottle data top 750 db, not augmented by nearby casts for CTD oxygen fit
020/01	new inner pylon; winch stopped/reversed during bottom approach
021/01	new end termination + 150 pounds added to rosette before cast; winch stopped at 530 m down due to large wire angle
022/01	2 kinks in wire from last cast not removed
023/01	0 db level extrapolated
024/01	smooth recovery in 30kt winds
025/01	xmiss TAMU #N173D installed; 0 db level extrapolated
026/01	package touched bottom; 0 db level extrapolated
027/01	xmiss removed until station 38
028/01	0 db level extrapolated
029/03	6 aborted casts to <= 500 m before this cast: harness changed, new end termination; no PRT2 signal this cast; stripped-down CTD: oxygen sensor removed, ODF altimeter removed until station 35 - signal clear; 0 db level extrapolated
030/01	CTD oxygen sensor B back on; PRT2 signal still dead; full stop at 4590 mwo (10 m before bottom); 0 db level extrapolated
031/01	PRT2 removed for rest of leg - neither FSI sensor works; original harness with taped-up connections
032/01	noisy CTD oxygen down+up: water in CTD oxygen sensor cleared out after cast; 0 db level extrapolated

sta/cast	Comments
033/01	
034/01	UP cast; 0 db level extrapolated; signal died bottom of downcast: sliprings detached - 80-minute delay for repairs; no bottle data above 1650 db: use cast 4 data to fill in the top 1600 db for CTD oxygen fit
034/04	switch to backup/Markey winch/wire; shallow cast to re-acquire missing bottle data from deep cast
035/01	Bray altimeter installed beginning this cast
036/01	
037/01	0 db level extrapolated
038/02	TAMU xmiss #N173D back on; organic matter fouled sensors at 2730 db down; 0 db level extrapolated
039/01	
040/01	
041/01	tried to use PRT2=FSI-1320, reading 0 - removed before cast
042/01	
043/02	
044/01	0 db level extrapolated
045/01	tested repaired ODF altimeter, no good
046/01	UP cast; testing same ODF altimeter, still not working; back to primary/Alman Johnson winch: spiking problems remain; 2198 db, 2204 db and 2208 db levels interpolated
047/01	back to Bray altimeter; using backup/Markey winch this cast through end of leg
048/02	rosette fouled with organic matter on recovery; 0 db level extrapolated; no bottle oxygen data above 116 db: used average difference between ˜100 db and srfc btls for stations 47/49 to extrapolate surface value for ctd oxygen fit
049/01	xmiss messy most of downcast: organic matter apparently never cleaned off rosette
050/01	0 db level extrapolated
051/01	stop at 3356 db down
052/01	UP cast; conductivity sensor froze going in, down/up match at 100+ db; other sensors look ok; ice on wire coming in
053/01	
054/01	
055/01	0 db level extrapolated
056/02	stop at 52 db down for winch check 2-3 mins.
057/01	0 db level extrapolated
058/01	
059/01	0 db level extrapolated
060/01	CTD oxygen sensor B died near surface down - no CTD oxygen reported
061/01	original CTD oxygen sensor A re-installed prior to cast
062/01	
063/01	0 db level extrapolated
064/01	
065/01	0 db level extrapolated
066/01	stopped 3290 db down for winch check
067/01	altimeter read 6 m shallower than PDR
068/01	0 db level extrapolated
069/01	
070/01	
071/01	
072/01	xmiss: large nephels layer from 4200 db to bottom; 0 db level extrapolated
073/02	suspect bottle oxygen data off/too shallow for part of cast: shifted 1300-2100 db bottle data down one pressure level for CTD oxygen fit
074/01	0 db level extrapolated

sta/cast	Comments
075/01	0 db level extrapolated
076/01	0 db level extrapolated
077/01	xmiss dropout area 940-1000 db down
078/01	
079/01	0 db level extrapolated
080/02	0 db level extrapolated
081/01	0 db level extrapolated
082/01	0 db level extrapolated
083/01	xmiss dropouts: 100-150 units approximately 3000 db down to bottom, ok up; 0 db level extrapolated
084/01	0 db level extrapolated
085/01	xmiss dropouts from 1700 m down - noisy throughout rest of cast: frequent 100-150 unit dropouts; 0 db level extrapolated
086/01	noisy xmiss throughout cast - see 085/01
087/02	xmiss bad again beginning 300 m down
088/01	xmiss removed until station 96; 0 db level extrapolated
089/01	bad kink in wire after recovery: taped up; 0 db level extrapolated
090/01	0 db level extrapolated
091/01	0 db level extrapolated
092/01	0 db level extrapolated
093/01	50+ minute delay at start for bow thruster problem; 0 db level extrapolated
094/01	0 db level extrapolated
095/02	
096/01	xmiss #N173D back on, offset right at 483 db down; 0 db level extrapolated
097/01	winch almost stopped at 5100 mwo down; 0 db level extrapolated
098/01	xmiss jump at 770 db; winch stopped at 3580 db down; 0 db level extrapolated
099/01	0 db level extrapolated
100/01	0 db level extrapolated
101/01	0 db level extrapolated
102/01	0 db level extrapolated
103/01	0 db level extrapolated
104/01	
105/03	pylon/rampshaft adjusted prior to cast
106/01	pylon adjusted/repaired prior to cast
107/01	pylon changed prior to cast/rebuilt; 0 db level extrapolated
108/01	pylon tuning prior to cast; 0 db level extrapolated
109/01	0 db level extrapolated
110/01	0 db level extrapolated; one bottle value between 500-2800 db: added stations 109/111 bottle oxygens to fill in the gap for ctd oxygen fit
111/01	0 db level extrapolated
112/01	0 db level extrapolated
113/02	erratic xmiss profile in top 150 m down
114/01	substitute pylon before cast
115/01	xmiss drops off 540 db down, then conductivity drops at 555 db, both begin to clear 590-600, then xmiss much worse until 3100 db down: probably organic matter fouling sensor; 0 db level extrapolated
116/01	xmiss/conductivity sensors cleaned prior to cast; 0 db level extrapolated
117/01	0 db level extrapolated
118/01	
119/02	last station on 135W, same location as TUNES-2 station 179; 0 db level extrapolated
120/01	0 db level extrapolated

sta/cast	Comments
121/02	0 db level extrapolated
122/01	used position from Firing’s Ashtech GPS receiver, ship’s receiver temporarily out; 0 db level extrapolated
123/01	
124/01	0 db level extrapolated
125/01	CTD voltage drops at 430 db down - back to surface, restart out-of-water after readjustment; after gradual decrease during cast, voltage drops again around 4132 db trip, immediately readjusted; suspect corrosion on the connectors
126/01	all CTD contacts cleaned prior to cast: green patina; 0 db level extrapolated
127/01	0 db level extrapolated

APPENDIX D-2

JUNO1 - WOCE92-P16A/P17A: CAST STOPS LONGER THAN 1-MINUTE

station /cast	down /up	#minutes stopped	avg.pressure (decibars)	pressure range
002/01	DOWN	1.9	2	(0 - 4)
009/01	UP	1.3	4834	(4832 - 4836)
010/01	UP	13.6	2031	(2030 - 2032)
011/01	UP	5.8	5060	(5058 - 5062)
012/01	UP	5.8	4776	(4774 - 4778)
013/01	UP	5.1	5168	(5166 - 5170)
016/01	UP	1.8	13	(10 - 16)
		1.5	4276	(4274 - 4278)
		4.4	4990	(4986 - 4994)
018/01	DOWN	1.2	230	(228 - 232)
		1.7	330	(326 - 334)
021/01	DOWN	1.3	503	(502 - 504)
		3.9	512	(506 - 518)
025/01	DOWN	5.1	2779	(2776 - 2782)
034/01	UP	1.3	1282	(1280 - 1284)
034/04	DOWN	3.3	1801	(1798 - 1804)
040/01	DOWN	1.4	3492	(3490 - 3494)
046/01	UP	6.1	2612	(2606 - 2618)
047/01	DOWN	1.7	10	(8 - 12)
052/01	UP	5.9	3042	(3040 - 3044)
056/02	DOWN	2.8	38	(36 - 40)
061/01	DOWN	1.7	4034	(4032 - 4036)
066/01	DOWN	2.8	3275	(3272 - 3278)
088/01	DOWN	1.8	16	(14 - 18)
098/01	DOWN	1.2	3582	(3580 - 3584)
101/01	DOWN	1.1	657	(656 - 658)

APPENDIX D-3:

JUNO1 - WOCE92-P16A/P17A: CTD Temperature and Conductivity Corrections Summary

Sta/ Cast	PRT Response Time (secs)	Temperature Coefficients $corT = t2*T^2 + t1*T + t0$ t2	t1	t0	Conductivity Coefficients $corC = c1*C + c0$ c1	c0	
001/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00747	
002/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00919	
003/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00841	
004/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00814	
005/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00786	
006/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00759	
007/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00731	
008/01	.30	1.32352e-05	-2.62903e-04	-1.51031			†
009/01	.30	1.32352e-05	-2.62903e-04	-1.51031			†
010/01	.30	1.32352e-05	-2.62903e-04	-1.51031			†
011/01	.30	1.32352e-05	-2.62903e-04	-1.51031			†
012/01	.30	1.32352e-05	-2.62903e-04	-1.51031			†
013/01	.30	1.32352e-05	-2.62903e-04	-1.51031			†
014/02	.30	1.32352e-05	-2.62903e-04	-1.51031			†
015/01	.30	1.32352e-05	-2.62903e-04	-1.51031			†
016/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00660	
017/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
018/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
019/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
020/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
021/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
022/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
023/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
024/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
025/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
026/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
027/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
028/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
029/03	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
030/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
031/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
032/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
033/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
034/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
034/04	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
035/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
036/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
037/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
038/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
039/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
040/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
041/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
042/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	
043/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760	

†see next table for CTD #2 conductivity corrections summary.

Sta/ Cast	PRT Response Time (secs)	Temperature Coefficients corT = t2∗T² + t1∗T + t0 t2	t1	t0	Conductivity Coefficients corC = c1∗C + c0 c1	c0
044/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
045/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
046/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00860
047/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
048/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
049/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00910
050/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
051/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
052/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
053/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
054/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
055/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
056/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
057/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00710
058/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00710
059/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
060/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
061/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
062/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
063/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
064/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
065/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
066/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
067/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
068/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
069/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
070/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00810
071/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00810
072/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
073/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
074/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
075/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
076/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
077/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
078/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
079/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
080/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
081/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
082/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
083/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
084/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.06358e-04	0.00760
085/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.08944e-04	0.00724
086/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.12915e-04	0.00738
087/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.16887e-04	0.00752
088/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.20859e-04	0.00767
089/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.24830e-04	0.00781
090/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.28802e-04	0.00795
091/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.32774e-04	0.00809
092/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.36745e-04	0.00823

Sta/ Cast	PRT Response Time (secs)	Temperature Coefficients $corT = t2*T^2 + t1*T + t0$			Conductivity Coefficients $corC = c1*C + c0$	
		t2	t1	t0	c1	c0
093/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.40717e-04	0.00837
094/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.44689e-04	0.00851
095/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.48661e-04	0.00866
096/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.52632e-04	0.00880
097/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.56604e-04	0.00894
098/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.60576e-04	0.00908
099/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.64547e-04	0.00922
100/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.68519e-04	0.01036
101/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.72491e-04	0.01050
102/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.76462e-04	0.00965
103/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.80434e-04	0.00979
104/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.84406e-04	0.00993
105/03	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.88377e-04	0.01007
106/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.92349e-04	0.01021
107/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-5.96321e-04	0.01035
108/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.00293e-04	0.01049
109/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.04264e-04	0.01064
110/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.08236e-04	0.01078
111/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.12208e-04	0.01092
112/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.16179e-04	0.01106
113/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.20151e-04	0.01120
114/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.24123e-04	0.01134
115/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.28094e-04	0.01148
116/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.32066e-04	0.01163
117/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.36038e-04	0.01177
118/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.40010e-04	0.01191
119/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.43981e-04	0.01205
120/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.47953e-04	0.01219
121/02	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.51925e-04	0.01333
122/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.55896e-04	0.01247
123/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.59868e-04	0.01262
124/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.63840e-04	0.01276
125/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.67811e-04	0.01290
126/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.71783e-04	0.01304
127/01	.30	2.22788e-05	-8.80861e-04	-1.48332	-6.75755e-04	0.01318

APPENDIX D-4:
JUNO1 CTD #2 Conductivity Corrections

Sta/ Cast	Conductivity Coefficients corC = c2∗P + c1∗C + c0 c2	c1	c0
008/01	-2.21817e-06	0.00236	-0.0549491
009/01	-9.55860e-07	0.00236	-0.0463487
010/01	-8.29590e-07	0.00236	-0.0389324
011/01	-5.15252e-07	0.00236	-0.0339827
012/01	-3.08278e-07	0.00236	-0.0328678
013/01	-3.00128e-07	0.00236	-0.0294771
014/02	-3.14800e-07	0.00236	-0.0299458
015/01	-3.29467e-07	0.00236	-0.0284145

APPENDIX D-5:

Summary of JUNO1 - WOCE92-P16A/P17A CTD Oxygen Time Constants

Temperature		Press.	O2 Grad.
Fast(tauTF)	Slow(tauTS)	(tauP)	(tauOG)
10.0	400.0	16.0	16.0

APPENDIX D-6:

JUNO1 - WOCE92-P16A/P17A CTD Oxygen: Levenberg-Marquardt Non-linear Least-Squares-Fit Coefficients

Sta/ Cast	Slope (c1)	Ofset (c2)	Pcoeff (c3)	TFcoeff (c4/fast)	TScoeff (c5/slow)	O Gcoeff (c6)
001/01	1.37867e-03	-5.28482e-02	1.54751e-04	-1.09893e-02	-2.74422e-02	-2.32649e-04
002/01	1.25190e-03	-1.12244e-02	1.46543e-04	-1.04371e-02	-2.52274e-02	9.81624e-04
003/01	1.22290e-03	-1.13466e-02	1.52875e-04	-5.60787e-03	-2.87967e-02	7.48095e-04
004/01	1.28514e-03	-1.34882e-02	1.44241e-04	-1.41728e-03	-3.51547e-02	8.67497e-04
005/01	1.21392e-03	2.38138e-03	1.45835e-04	-2.01387e-02	-1.96296e-02	2.32583e-04
006/01	1.28566e-03	-1.31833e-02	1.46008e-04	-1.07548e-02	-3.01433e-02	-1.57973e-03
007/01	1.20925e-03	8.90095e-03	1.41217e-04	7.95973e-03	-3.88015e-02	1.13539e-03
008/01	1.31518e-03	7.73826e-03	1.32311e-04	-3.04854e-02	-3.64431e-03	-1.10589e-03
009/01	1.31264e-03	4.27776e-03	1.34590e-04	-2.81762e-02	-5.86923e-03	-8.68553e-04
010/01	1.47528e-03	-3.74110e-02	1.38007e-04	-2.19386e-02	-1.93231e-02	-2.09509e-03
011/01	1.40681e-03	-6.31935e-03	1.28464e-04	-2.43425e-02	-1.71358e-02	-1.82864e-03
012/01	1.39774e-03	2.05777e-04	1.25842e-04	-2.84719e-02	-1.24365e-02	-1.52245e-03
013/01	1.49283e-03	-3.74976e-02	1.36086e-04	-3.56247e-02	-1.16583e-02	-1.81753e-03
014/02	1.42417e-03	-3.61365e-02	1.44160e-04	-1.05189e-02	-4.22533e-02	-2.55356e-05
015/01	1.31103e-03	-1.24047e-02	1.47050e-04	-2.31436e-02	-2.42200e-02	6.30135e-04
016/01	1.84446e-03	-6.44291e-02	1.42494e-04	-3.94526e-02	-1.49317e-02	5.39376e-04
017/01	1.46802e-03	1.21780e-02	1.40013e-04	-5.34046e-02	7.13295e-03	3.93868e-03
018/01	1.40905e-03	2.80315e-02	1.35742e-04	-3.67709e-02	-2.91076e-03	-2.46474e-03
019/01	1.59740e-03	-4.11829e-03	1.33856e-04	-2.95826e-02	-2.13173e-02	-6.23073e-03
020/01	1.51248e-03	5.78273e-03	1.35707e-04	-3.66622e-02	-1.11968e-02	-6.13351e-03
021/01	1.56814e-03	-3.66733e-03	1.34335e-04	-9.84409e-03	-3.43367e-02	-1.79906e-03
022/01	1.61568e-03	-8.33214e-03	1.31127e-04	-8.50297e-03	-3.94566e-02	-5.34282e-03
023/01	1.60912e-03	-5.90283e-03	1.31829e-04	-2.76363e-02	-2.44477e-02	-1.45687e-03
024/01	1.37693e-03	3.14787e-02	1.37983e-04	-3.15237e-02	-4.82298e-03	4.51309e-03
025/01	1.61374e-03	-1.55842e-02	1.39607e-04	-1.45403e-02	-3.32626e-02	3.49286e-04
026/01	1.29312e-03	4.59587e-02	1.39943e-04	-2.67348e-02	-2.91513e-03	-7.93080e-05
027/01	1.58465e-03	-8.69712e-03	1.36510e-04	-2.49817e-02	-2.38047e-02	3.29504e-05
028/01	1.25402e-03	6.76182e-02	1.31325e-04	-1.52349e-02	-1.29002e-02	-9.70909e-04
030/01	1.30567e-03	-3.01864e-02	1.52690e-04	-9.86946e-03	-3.69767e-02	-2.69933e-04
031/01	1.18675e-03	1.13349e-02	1.46552e-04	-2.45162e-02	-1.36415e-02	-6.42537e-04
032/01	1.22050e-03	2.55057e-02	1.32275e-04	-3.79205e-03	-4.09027e-02	-3.21076e-05
033/01	1.26592e-03	1.44508e-02	1.33754e-04	9.71754e-04	-5.27057e-02	-1.34135e-04
034/01	3.23077e-03	-4.54814e-01	1.04934e-04	-1.29299e-01	-5.35389e-02	-4.94824e-03
034/04	1.47959e-03	2.59755e-02	6.71498e-05	5.34662e-02	-1.20177e-01	-2.02418e-03
035/01	1.23113e-03	1.81465e-02	1.35543e-04	1.60012e-02	-5.53131e-02	1.81362e-05
036/01	1.38019e-03	-2.50366e-02	1.42007e-04	-5.32511e-03	-5.47533e-02	1.51652e-04

Sta/ Cast	Slope (c1)	Offset (c2)	Pcoeff (c3)	TFcoeff (c4/fast)	TScoeff (c5/slow)	OGcoeff (c6)
037/01	1.63459e-03	-4.25681e-02	1.12561e-04	7.47960e-02	-1.65291e-01	1.07402e-04
038/02	1.03005e-03	5.43198e-02	1.49076e-04	-4.77229e-02	1.77845e-02	-6.63847e-03
039/01	6.40907e-04	2.99094e-02	2.49423e-04	-1.35645e-02	1.40636e-01	-2.01600e-03
040/01	1.29569e-03	6.89598e-02	1.03091e-04	-3.06358e-02	-6.21364e-02	-2.20177e-05
041/01	1.12212e-03	1.19333e-02	1.59693e-04	-6.21048e-02	3.89471e-02	-5.85216e-03
042/01	9.84976e-04	1.12095e-01	1.19657e-04	-5.84309e-02	1.71470e-02	-4.86992e-03
043/02	1.04150e-03	5.60486e-02	1.44970e-04	-5.39748e-02	2.27284e-02	-2.97549e-03
044/01	1.02986e-03	9.76537e-02	1.22048e-04	-4.35906e-02	1.21910e-03	4.92480e-06
045/01	1.05735e-03	9.31772e-02	1.19648e-04	-2.59074e-02	-1.73222e-02	2.66894e-03
046/01	7.95982e-04	2.72189e-01	5.98130e-05	-8.30119e-02	8.87245e-03	-2.04908e-04
047/01	1.12555e-03	4.91629e-02	1.38554e-04	-2.02566e-02	-2.12915e-02	3.63254e-03
048/02	3.61275e-04	4.94284e-01	1.38701e-05	-1.09029e-01	2.03599e-03	5.69608e-03
049/01	9.77944e-04	1.19579e-01	1.20466e-04	-2.85472e-02	-7.87827e-03	1.68190e-03
050/01	5.86983e-04	3.26162e-01	6.68468e-05	-7.74462e-02	5.29375e-03	2.76348e-03
051/01	7.11363e-04	2.76453e-01	7.34176e-05	-7.83046e-02	2.34902e-03	-4.69944e-03
052/01	6.44358e-04	3.34260e-01	5.27947e-05	-1.11543e-01	1.62026e-02	1.44967e-04
053/01	6.50313e-04	3.08113e-01	6.60630e-05	-9.53462e-02	1.57219e-03	6.96699e-03
054/01	5.42256e-04	3.66272e-01	5.24500e-05	-8.18531e-02	-4.20534e-03	1.23182e-02
055/01	8.34058e-04	1.96441e-01	9.39722e-05	-6.04776e-02	8.31810e-03	5.14444e-04
056/02	8.36181e-04	2.07819e-01	8.72993e-05	-7.68222e-02	1.11859e-02	1.47488e-03
057/01	9.46954e-04	1.68041e-01	9.33804e-05	-6.03839e-02	-6.91618e-03	1.07728e-03
058/01	1.08454e-03	7.88304e-02	1.21063e-04	-5.99034e-02	3.90447e-03	1.39304e-03
059/01	1.10315e-03	6.40057e-02	1.29073e-04	-3.04059e-02	-1.07933e-02	1.21435e-02
061/01	7.76400e-04	2.91776e-01	7.27054e-05	-5.39106e-02	6.70102e-03	1.01365e-03
062/01	9.22401e-04	2.12607e-01	9.61597e-05	-4.89162e-02	1.63535e-02	1.47217e-03
063/01	9.38344e-04	2.07068e-01	9.73513e-05	-4.75751e-02	1.80021e-02	2.77068e-03
064/01	9.95570e-04	1.96507e-01	9.56203e-05	-5.03000e-02	1.21268e-02	-2.96603e-05
065/01	8.38705e-04	2.83792e-01	6.91350e-05	-5.60641e-02	-5.82034e-03	4.40878e-03
066/01	7.58406e-04	3.47923e-01	4.84368e-05	-9.63006e-02	-1.89829e-02	1.16846e-02
067/01	1.02489e-03	2.07114e-01	8.64706e-05	-5.61940e-02	-2.93675e-03	8.69324e-03
068/01	1.00976e-03	2.16265e-01	8.50257e-05	-6.06803e-02	-8.87201e-03	7.75538e-03
069/01	1.10966e-03	1.76880e-01	9.21820e-05	-7.06323e-02	-7.66408e-03	3.31752e-03
070/01	1.19079e-03	8.18653e-02	1.42358e-04	3.82141e-03	9.14210e-03	3.92894e-03
071/01	9.40044e-04	2.42424e-01	7.75264e-05	-6.43554e-02	8.04517e-03	-2.30017e-03
072/01	7.56158e-04	3.35697e-01	5.42980e-05	-1.05070e-01	3.96669e-02	-4.54181e-05
073/02	9.28343e-04	2.44302e-01	8.27014e-05	-5.84462e-02	3.79895e-05	-1.71778e-05
074/01	1.18861e-03	1.56235e-01	9.41887e-05	-7.54183e-02	1.14997e-02	-2.21024e-04
075/01	1.02158e-03	3.52987e-02	2.00004e-04	1.36238e-02	3.64914e-02	-1.98024e-03
076/01	8.93133e-04	1.02228e-01	1.66819e-04	-2.41619e-02	7.01715e-02	-1.30902e-04
077/01	8.84116e-04	9.35808e-02	1.83821e-04	-7.78074e-02	9.52010e-02	-2.20801e-03
078/01	1.59906e-03	-3.03078e-02	1.50311e-04	-3.09001e-02	-1.76623e-02	1.91968e-06
079/01	1.65091e-03	-3.04479e-02	1.44738e-04	-2.87482e-02	-2.84429e-02	-6.63222e-04
080/02	1.45379e-03	4.09951e-02	1.25881e-04	-4.14504e-02	-1.04210e-02	-2.15246e-04
081/01	1.53727e-03	9.64089e-03	1.31036e-04	-7.58670e-03	-3.55270e-02	1.45088e-04
082/01	1.61977e-03	-1.26964e-02	1.35496e-04	-1.75921e-02	-3.25993e-02	-5.63100e-04

Sta/ Cast	Slope (c1)	Offset (c2)	Pcoeff (c3)	TFcoeff (c4/fast)	TScoeff (c5/slow)	OGcoeff (c6)
083/01	1.50860e-03	1.64778e-02	1.31937e-04	-2.29627e-02	-2.21334e-02	-1.42324e-04
084/01	1.67374e-03	-1.20112e-02	1.30168e-04	-1.73020e-02	-3.74075e-02	-2.09539e-03
085/01	1.55694e-03	2.70489e-04	1.36072e-04	-1.66694e-02	-2.99704e-02	-1.38208e-04
086/01	1.57398e-03	-2.63911e-03	1.35259e-04	-2.54258e-02	-2.39834e-02	-8.35575e-05
087/02	1.50126e-03	1.35895e-02	1.33740e-04	-2.57722e-02	-1.82333e-02	5.43369e-03
088/01	1.58961e-03	-1.45059e-03	1.32788e-04	-1.40384e-02	-3.38418e-02	-7.45349e-05
089/01	1.69476e-03	-2.96476e-02	1.38175e-04	-2.32823e-02	-3.32795e-02	-1.30049e-05
090/01	1.55285e-03	6.56987e-03	1.32575e-04	-1.68903e-02	-2.95382e-02	-1.53621e-03
091/01	1.51957e-03	4.59445e-03	1.37671e-04	-2.81403e-02	-1.67522e-02	2.69136e-04
092/01	1.40953e-03	2.99883e-02	1.34762e-04	-1.71954e-02	-1.88407e-02	-5.07895e-05
093/01	1.57128e-03	1.80691e-03	1.33430e-04	-1.31283e-02	-3.42618e-02	-3.37093e-05
094/01	1.59636e-03	-6.62018e-03	1.35149e-04	-2.07071e-02	-2.77985e-02	-2.00832e-04
095/02	1.40969e-03	2.55153e-02	1.36339e-04	-1.59436e-02	-1.87832e-02	-9.79720e-06
096/01	1.52455e-03	4.97896e-03	1.37144e-04	-2.69442e-02	-1.84920e-02	-2.67006e-03
097/01	1.56427e-03	-8.04511e-03	1.38984e-04	-1.28955e-02	-3.16798e-02	-3.06734e-05
098/01	1.59877e-03	-1.34005e-02	1.40145e-04	-2.75301e-02	-2.28151e-02	4.25315e-03
099/01	1.49905e-03	7.50846e-03	1.39785e-04	-3.45032e-02	-1.22387e-02	2.08219e-07
100/01	1.59205e-03	-7.40693e-03	1.37063e-04	-2.06367e-02	-2.76105e-02	-9.63636e-04
101/01	1.53616e-03	-2.49125e-03	1.39002e-04	-1.49315e-02	-2.75599e-02	1.06722e-06
102/01	1.54621e-03	-2.99682e-03	1.39576e-04	-2.37837e-02	-2.18604e-02	-2.19642e-03
103/01	1.70056e-03	-3.06896e-02	1.41546e-04	-3.13084e-02	-2.73055e-02	-6.36526e-03
104/01	1.54598e-03	-4.14654e-03	1.40055e-04	-1.78931e-02	-2.54422e-02	-9.82682e-04
105/03	1.56175e-03	-1.95192e-03	1.39462e-04	-3.83868e-02	-1.52819e-02	-1.28518e-05
106/01	1.47178e-03	6.89598e-03	1.41715e-04	-1.75307e-02	-2.15649e-02	6.54184e-04
107/01	1.51816e-03	-1.27578e-03	1.41761e-04	-2.07029e-02	-2.15594e-02	-7.60231e-06
108/01	1.60731e-03	-1.89291e-02	1.43455e-04	-1.51057e-02	-3.12528e-02	-4.05181e-03
109/01	1.62618e-03	-2.18276e-02	1.42179e-04	-1.50597e-02	-3.11842e-02	-5.60391e-03
110/01	1.57342e-03	-1.25162e-02	1.41289e-04	-1.06688e-02	-3.05827e-02	5.55291e-04
111/01	1.49342e-03	4.77842e-04	1.43431e-04	-1.48149e-02	-2.35673e-02	-3.43402e-03
112/01	1.48921e-03	6.42431e-03	1.41405e-04	-1.19511e-02	-2.62225e-02	-2.57796e-03
113/02	1.56445e-03	-6.65260e-03	1.39796e-04	-1.75054e-02	-2.62204e-02	-4.26802e-03
114/01	1.51456e-03	-2.08712e-03	1.43291e-04	-1.23373e-02	-2.56401e-02	-2.28323e-04
115/01	1.44913e-03	1.54277e-02	1.40669e-04	-1.95735e-02	-1.94190e-02	-2.73825e-03
116/01	1.47775e-03	4.50016e-03	1.44901e-04	-2.44724e-02	-1.64852e-02	-5.30855e-03
117/01	1.56409e-03	-1.64519e-02	1.46135e-04	-1.74352e-02	-2.41412e-02	-4.60503e-03
118/01	1.46545e-03	1.16641e-02	1.41093e-04	-2.45694e-02	-1.73678e-02	-1.07030e-02
119/02	1.54371e-03	-6.69314e-03	1.43498e-04	-2.53860e-02	-2.08684e-02	-6.09472e-03
120/01	1.46745e-03	1.71662e-03	1.47041e-04	-1.76752e-02	-1.98251e-02	4.25760e-05
121/02	1.45729e-03	1.08221e-02	1.42151e-04	-1.86667e-02	-2.06463e-02	-6.76126e-05
122/01	1.59356e-03	-3.06027e-02	1.51753e-04	-1.35584e-02	-2.69688e-02	-3.86248e-03
123/01	1.65550e-03	-3.61752e-02	1.47259e-04	-1.51013e-02	-2.79033e-02	-7.39572e-03
124/01	1.49688e-03	1.32129e-03	1.39904e-04	-1.08899e-02	-2.59656e-02	-3.11962e-03
125/01	1.78304e-03	-8.18502e-02	1.62185e-04	-2.97124e-03	-3.63469e-02	8.98294e-04
126/01	1.55101e-03	-9.83733e-03	1.41255e-04	-5.94416e-03	-2.95940e-02	-1.38803e-03
127/01	1.39663e-03	2.63369e-02	1.36980e-04	-4.57357e-03	-2.64061e-02	-1.02604e-03

World Ocean Circulation Experiment
Pacific Ocean P16A/P17A
R/V Knorr Voyage 138 Leg 9
6 October 1992 - 25 November 1992
Papeete, Tahiti - Papeete, Tahiti
Expocode: 316N138_9

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2 July 2001

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DESCRIPTION OF MEASUREMENT TECHNIQUES AND CALIBRATIONS

1. Water Sampling Package

ODF CTD/rosette casts were carried out with 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. Seawater samples were collected in 10-liter PVC Niskin and ODF bottles mounted on the rosette frame. 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 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 numberd 38 and 41. 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.

Large Volume Sampling (LVS) [Key91] was also performed on this expedition. These casts were carried out with ~270-liter stainless steel Gerard barrels on which were mounted 5-liter bottles with deep-sea reversing thermometers

(DSRTs). Samples for salinity, silicate and ^{14}C were obtained from the Gerard barrels; samples for salinity and silicate were drawn from piggyback Niskin-style bottles. The salinity and silicate samples from each piggyback bottle were used for comparison with the Gerard barrel salinity and silicate to verify the integrity of the Gerard sample.

2. Bottle Sampling

At the end of each rosette deployment water samples were drawn from the bottles in the following order:

- CFCs;
- ^3He;
- O_2;
- Total CO_2;
- Alkalinity;
- AMS ^{14}C;
- Tritium;
- Nutrients;
- Salinity.

Tritium, Nutrients (silicate, phosphate, nitrate and nitrite), and Salinity could be sampled in arbitrary order.
The identifiers of the sample containers and the numbers of the ODF or Niskin samplers from which the samples were drawn were recorded on the Sample Log sheet. 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 investigative comments and results.

Tripping problems were experienced at the beginning of the leg until all the lanyards were fine-tuned. There were also numerous tripping problems occurring with 24-place pylons toward the end of the leg (from about Station 100 on). Most were "double trips", with one bottle not closing at the intended level but then closing at the next level up, along with the bottle intended to trip at that level. Some of these actually sometimes tripped up 1 further level, ending up with 3 bottles tripping at the same depth. CTD data was used for the scheduled levels that had been missed. Attempts were repeatedly made to find a solution to the problems by swapping out the 2 24-place pylons. At one point some bent release pins were straightened but most of the effort was in seeking the exactly correct alignment position for each pin.

Samples for salinity, silicate and ^{14}C were obtained from the Gerard barrels; samples for salinity and silicate were drawn from the piggyback Niskin bottles. The Gerard barrels were numbered 81 through 94 and the piggyback bottles were numbered 41 through 50 and 71. The salinity and silicate samples from the piggyback bottle were used for comparison with the Gerard barrel salinities and silicates to verify the integrity of the Gerard sample.

LVS casts experienced an annoying number of pre-trips. A rogue wave hit the aft part of the deck and wiped out the aft hanger door as well as banging the bottom parts of the barrels into each other. There did not seem to be any permanent damage to the barrels after repairs were made.

3. Bottle Data Processing

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. Salinity, oxygen, and the nutrients were compared to P6 and TUNES 2 and agreed within WOCE standards. 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.

WHP water bottle quality codes were assigned as defined in the WOCE Operations Manual [Joyc94] with the following additional interpretations:

2	No problems noted.
3	Leaking. *An air leak large enough to produce an observable effect on a sample is identified by a code of 3 on the bottle and a code of 4 on the oxygen. (Small air leaks may have no observable effect, or may only affect gas samples.)*
4	Did not trip correctly. *Bottles tripped at other than the intended depth were assigned a code of 4. There may be no problems with the associated water sample data.*
5	Not reported. *No water sample data reported. This is a representative level derived from the CTD data for reporting purposes. The sample number should be in the range of 80-99.*
8	Pair did not trip correctly. Note that the Niskin bottle can trip at an unplanned depth while the Gerard trips correctly and vice versa.
9	The samples were not drawn from this bottle.

WHP water sample quality flags were assigned using the following criteria:

1	The sample for this measurement was drawn from the water bottle, but the results of the analysis were not *(yet)* received.
2	Acceptable measurement.
3	Questionable measurement. *The data did not fit the station profile or adjacent station comparisons (or possibly CTD data comparisons). No notes from the analyst indicated a problem. The data could be acceptable, but are open to interpretation.*
4	Bad measurement. *The data did not fit the station profile, adjacent stations or CTD data. There were analytical notes indicating a problem, but data values were reported. Sampling and analytical errors were also coded as 4.*
5	Not reported. *There should always be a reason associated with a code of 5, usually that the sample was lost, contaminated or rendered unusable.*
9	The sample for this measurement was not drawn.

WHP water sample quality flags were assigned to the CTDSAL (CTD salinity) parameter as follows:

2	Acceptable measurement.
3	Questionable measurement. *The data did not fit the bottle data, or there was a CTD conductivity calibration shift during the up-cast.*
4	Bad measurement. *The CTD up-cast data were determined to be unusable for calculating a salinity.*
7	Despiked. *The CTD data have been filtered to eliminate a spike or offset.*

WHP water sample quality flags were assigned to the CTDOXY (CTD O_2) parameter as follows:

1	Not calibrated. *Data are uncalibrated.*
2	Acceptable measurement.
3	Questionable measurement.
4	Bad measurement. *The CTD data were determined to be unusable for calculating a dissolved oxygen concentration.*
5	Not reported. *The CTD data could not be reported, typically when CTD salinity is coded 3 or 4.*
7	Despiked. *The CTD data have been filtered to eliminate a spike or offset.*
9	Not sampled. *No operational CTD O_2 sensor was present on this cast.*

Note that CTDOXY values were derived from the down-cast pressure-series CTD data. CTD data were matched to the up-cast bottle data along isopycnal surfaces. If the CTD salinity is footnoted as bad or questionable, the CTD O_2 is not reported.

Table 3.0 shows the number of samples drawn and the number of times each WHP sample quality flag was assigned for each basic hydrographic property from the Rosette Casts:

Rosette Samples Stations 1-127								
	Reported	WHP Quality Codes						
	levels	1	2	3	4	5	7	9
Bottle	4472	0	4211	49	102	45	0	65
CTD Salt	4472	0	4471	1	0	0	0	0
CTD Oxy	4398	0	4303	95	0	1	0	73
Salinity	4356	0	4248	14	94	4	0	112
Oxygen	4358	0	4285	15	58	2	0	112
Silicate	4361	0	4311	2	48	0	0	111
Nitrate	4361	0	4311	2	48	0	0	111
Nitrite	4255	0	4211	2	42	106	0	111
Phosphate	4361	0	4310	2	49	0	0	111

Table 3.0 Frequency of WHP quality flag assignments for P16A/P17A.

Table 3.1 shows the number of samples drawn and the number of times each WHP sample quality flag was assigned for each basic hydrographic property from the Large Volume Casts:

Large Volume Samples Stations 014, 022, 032, 034, 038, 043, 048, 056, 073, 080, 087, 095, 105, 113, 119									
	Reported	WHP Quality Codes							
	levels	1	2	3	4	5	7	8	9
Bottle	332	0	317	8	2	0	0	0	5
Salinity	327	0	315	2	10	0	0	0	5
Silicate	327	0	316	2	9	0	0	0	5
Temperature	272	0	299	0	3	10	0	0	20
Pressure	331	0	330	0	1	0	0	1	0

Table 3.1 Frequency of WHP quality flag assignments for P16A/P17A Large Volume.

Additionally, all WHP water bottle/sample quality code comments are presented in Appendix A and the Large Volume comments are in Appendix B.

3.1. Pressure and Temperature

All pressures and temperatures for the bottle data tabulations on the rosette casts were obtained by averaging CTD data for a brief interval at the time the bottle was closed on the rosette, then correcting the data based on CTD laboratory calibrations.

All reported CTD data are calibrated and processed with the methodology described in the documentation accompanying the CTD data submission.

LVS pressures and temperatures were calculated from deep-sea reversing thermometer (DSRT) readings. Each DSRT rack normally held 2 protected (temperature) thermometers and 1 unprotected (pressure) thermometer. Thermometers were read by two people, each attempting to read a precision equal to one tenth of the thermometer etching interval. Thus, a thermometer etched at 0.05 degree intervals would be read to the nearest 0.005 degrees.

Each temperature value reported on the LVS casts is calculated from the average of four readings provided both protected thermometers function normally. The pressure is verified by comparison with the calculation of pressure determined by wireout. The pressure from the thermometer is fitted by a polynomial equation which incorporates the wireout and wire angle.

Calibration of the thermometers are performed in ODF’s calibration facility depending on the age of the thermometer and not more than two years of the expedition.

The temperatures are based on the International Temperature Scale of 1990.

3.2. Salinity Analysis

Equipment and Techniques

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 salinometers were modified by ODF and contained interfaces for computer-aided measurement.

Salinity samples were analyzed for the rosette casts and the Large Volume casts from both the piggyback bottle and the Gerard barrel.

The salinity analyses were performed when samples had equilibrated to laboratory temperature, within 8-25 hours after collection. The salinometer was standardized for each group of analyses (typically one cast, usually 36 samples) using at least one fresh vial of standard seawater per group. A computer (PC) prompted the analyst for control functions such as changing sample, flushing, or switching to "read" mode. At the correct time, the computer acquired conductivity ratio measurements, and logged results. The sample conductivity was redetermined until readings met software criteria for consistency. Measurements were then averaged for a final result.

Sampling and Data Processing

Salinity samples were drawn into 200 ml Kimax high-alumina borosilicate bottles, which were rinsed three times with sample prior to filling. The bottles were sealed with custom-made plastic insert thimbles and Nalgene screw caps. This assembly provides very low container dissolution and sample evaporation. Prior to collecting each sample, inserts were inspected for proper fit and loose inserts were replaced to insure an airtight seal. The draw time and equilibration time were logged for all casts. Laboratory temperatures were logged at the beginning and end of each run.

PSS-78 salinity [UNES81] was calculated for each sample from the measured conductivity ratios. The difference (if any) between the initial vial of standard water and one run at the end as an unknown was applied linearly to the data to account for any drift. The data were added to the cruise database.

Salinity samples were compared with CTD data and significant differences were investigated.

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.

Laboratory Temperature

There were some problems with lab temperature control throughout cruise; the Autosal bath temperature was adjusted accordingly. Salinities were generally considered good for the expedition despite the lab temperature problem.

Standards

IAPSO Standard Seawater (SSW) Batch P-120 was used to standardize the salinometers.

3.3. Oxygen Analysis

Equipment and Techniques

Dissolved oxygen analyses were performed with an ODF-designed automated oxygen titrator using photometric end-point detection based on the absorption of 365nm wavelength ultra-violet light.
The titration of the samples and the data logging were controlled by PC software. Thiosulfate was dispensed by a Dosimat 665 buret driver fitted with a 1.0 ml buret. ODF uses a whole-bottle Winkler titration following the technique of Carpenter [Carp65] with modifications by Culberson *et al.* [Culb91], 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 or dilution error. Reagent/distilled water blanks were determined, to account for presence of oxidizing or reducing materials. The auto-titrator generally performed very well. A decrease in voltage output led to changing the UV source lamp during the cruise.

Sampling and Data Processing

Samples were collected for dissolved oxygen analyses soon after the rosette sampler was brought on board, and after samples for CFC and helium were drawn. Using a Tygon drawing tube, nominal 125ml volume-calibrated iodine flasks were rinsed twice with minimal agitation, then filled and allowed to overflow for at least 3 flask volumes. The sample draw 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 to assure thorough dispersion of the precipitate, once immediately after drawing, and then again after about 20 minutes. The samples were usually analyzed within a few hours of collection and and then the data were merged into the cruise database.

Thiosulfate normalities were calculated from each standardization and corrected to 20°C. The 20°C normalities and the blanks were plotted versus time and were reviewed for possible problems. New thiosulfate normalities were recalculated after the blanks had been smoothed as a function of time, if warranted. These normalities were then smoothed, and the oxygen data were 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 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 for this calculation was not available. Aberrant drawing temperatures provided an additional flag indicating that a bottle may not have tripped properly. The electronic thermometer for measuring draw temperatures ceased to function part-way through the cruise and a mercury thermometer was used for a couple of days until ODF’s Electronic Technician made up a new electronic one.

Even though laboratory and sample temperatures were recorded, these temperatures were not used in the calculation of oxygen. Therefore, these temperatures are not reported in the data submission to ensure that the data user does not use these temperatures. Measured sample temperatures from mid-deep water samples were about 4-7°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°C warming (or about 0.2μmol/kg for a 250μmol/kg sample).

Volumetric Calibration

Oxygen flask volumes were determined gravimetrically with degassed deionized water 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. The volumetric flasks used in preparing standards were volume-calibrated by the same method, as was the 10 ml Dosimat buret used to dispense standard iodate solution.

Standards

Potassium iodate standards, nominally 0.44 gram, were pre-weighed in ODF's chemistry laboratory to ±0.0001 grams. The exact normality was calculated at sea after the volumetric flask volume and dilution temperature were known.

Potassium iodate was obtained from Johnson Matthey Chemical Co. and was reported by the supplier to be >99.4% pure. All other reagents were "reagent grade" and were tested for levels of oxidizing and reducing impurities prior to use.

4. Nutrients

Nutrient analyses (phosphate, silicate, nitrate and nitrite) were performed on an ODF-modified 4-channel Technicon AutoAnalyzer II, generally within a few hours after sample collection.
Occasionally samples were refrigerated up to a maximum of 8 hours at 2-6°C. All samples were brought to room temperature prior to analysis. The methods used are described by Gordon *et al.* [Gord92].

Silicate was analyzed using the technique of Armstrong *et al.* [Arms67]. An acidic solution of ammonium molybdate was added to a seawater sample to produce silicomolybdic acid which was then reduced to silicomolybdous acid (a blue compound) following the addition of stannous chloride. The sample was passed through a 15mm flowcell and measured at 820nm. This response is known to be non-linear at high silicate concentrations; this non-linearity is included in ODF's software.

A modification of the Armstrong *et al.* [Arms67] procedure was used for the analysis of nitrate and nitrite. For the nitrate analysis, the seawater sample was passed through a cadmium reduction column where nitrate was quantitatively reduced to nitrite. This nitrite is then diazotized with sulfanilamide and coupled with N-(1-naphthyl)-ethylenediamine to form an azo dye. The sample is then passed through a 15mm flowcell and measured at 540nm. A 50mm flowcell is required for nitrite (NO2). The procedure is the same for the nitrite analysis less the cadmium column.

Phosphate was analyzed using a modification of the Bernhardt and Wilhelms [Bern67] technique. An acidic solution of ammonium molybdate was added to the sample to produce phosphomolybdic acid, then reduced to phosphomolybdous acid (a blue compound) following the addition of dihydrazine sulfate. The reaction product was heated to ~55°C to enhance color development, then passed through a 50mm flowcell and the absorbance measured at 820m.

Besides running rosette cast samples, LVS cast samples for both Gerard barrels and piggyback Niskins were analyzed for silicate as an added check (with salinity) on barrel sample integrity.

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 standards. Sets of 4-6 different concentrations of shipboard standards were analyzed periodically to determine the deviation from linearity as a function of concentration for each nutrient.

All peaks were logged manually, and all the runs were re-read to check for possible reading errors.

Temperature regulation problems in the analytical lab did not appear to significantly affect the results, which were generally very good. ODF first attempted to control the temperature in the lab during the previous leg by rigging up a ceramic heater and fan, under the control of a thermistor and in conjunction with the ship's cooling. This worked well on this leg, providing about plus or minus 0.5°C stability, except when outside temperatures were too warm in the tropics, or when it became too cold and the ship's heating system was erratically controlled. Depending on the ship's heading, the wind would sometimes blow directly into either the lab's ventilation shaft or the vent for the hood. In these extreme cold conditions, the vent covers (up on the exterior 02 level) were closed by the analysts after first checking with the ship's engineering staff.

Nutrients, reported in micromoles per kilogram, were converted from micromoles per liter by dividing by sample density calculated at 1 atm pressure (0 db), *in situ* salinity, and an assumed laboratory temperature of 25°C.

Standard

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

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Appendix A

WOCE P16A/P17A: Bottle Quality Comments

Remarks for deleted samples, missing samples, and WOCE codes other than 2 from JUNO - WOCE P16A/P17A. Comments from the Sample Logs and the results of ODF's investigations are included in this report. DQE comments may also be included. Units stated in these comments are degrees Celsius for temperature, Practical Salinity Units for salinity, and unless otherwise noted, milliliters per liter for oxygen and micromoles per liter for Silicate, Nitrate, Nitrite, and Phosphate. The first number before the comment is the cast number (CASTNO) times 100 plus the bottle number (BTLNBR).

Station 001

111 Sample log: "Bottom endcap did not close." Therefore, no samples drawn. Pressure is 385db.

125 Sample log: "Bottom endcap did not close." Therefore, no samples drawn. Pressure is 2331db.

Station 002

101 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2. Pressure is 2db.

106 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 188db.

109 Sample log: "Bottom endcap did not close." Therefore, no samples drawn. Pressure is 307db.

112 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 443db.

Station 003

101-136 Nutrients: "No no2 this run-had to use scic for no3." Footnote no2 lost.

103 Mistrip: O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, and nitrate bad, nitrite lost, and phosphate bad. Pressure is 78db.

106 None. Sample log: "Bottle leaking." Data appears to be okay. See 101-136 nutrients comments. Footnote no2 lost. Pressure is 170db.

128 Sample log: "Cap on salinity bottle loose. (thimble?)" Data appears to be okay. See 101-136 nutrients comments. Footnote no2 lost. Pressure is 3522db.

Station 004

101 Sample log: "Bottle did not close." Therefore, no samples drawn. Pressure is 15db.

102 Sample log: "O2 draw temp too low." Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, and nitrate bad, nitrite lost, and phosphate bad. Pressure is 53db.

102-136 Nutrients: "No no2 this run-had to use scic for no3." Footnote no2 lost.

103 Sample log: "O2 draw temp too low, vent open." Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, and nitrate bad, nitrite lost, and phosphate bad. Pressure is 70db.

111 Mistrip: S diff high, O2 draw temp high, nuts low. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, and nitrate bad, nitrite lost, and phosphate bad. Pressure is 411db.

Station 005

101-109	Nutrients: "No no2 this run-had to use scic for no3." Footnote no2 lost.
103	Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, and nitrate bad, nitrite lost, and phosphate bad. Pressure is 58db.
110	Sample log: "Bottom valve broke off on hard landing on deck. No sample." Pressure is 261db.
111	Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, and nitrate bad, nitrite lost, and phosphate bad. Pressure is 334db.
111-136	Nutrients: "No no2 this run-had to use scic for no3." Footnote no2 lost.
112	Sample log: "Vent open." Data appears to be okay. Footnote nitrite lost. Pressure is 411db.
132	Sample log: "Vent slightly open." Data appears to be okay. Footnote nitrite lost. Pressure is 4565db.

Station 007

Cast 1	Sample log: "Lost CTD signal on up cast." Only ˜7 good trips, few others tripped on way up and 1 at surface (bottle 26), but there is no corresponding CTD trip information.
126	Surface sample - no corresponding CTD bottle trip info as CTD had died.

Station 008

134	Sample log: "Lanyard hangup. No sample." Pressure is 4833db.

Station 010

114-129	DQE: "Pressure assignment done correctly, code bottle 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable.
113	Sample log: "Bottle not tripped. Ramp shaft pointed at 14." Left CTD data (pressure, temperature, and conductivity) in bottle data files. There are no water samples. This level is included and assigned with just CTD data to ensure no data gap for users. Footnote bottle no samples taken. Pressure is 3643db.

Station 011

108	Spigot broke off during rosette separation - no O2 sample; salt & nuts look okay. Pressure is 309db.
134	Sample log: "Lanyard hangup. No sample." Pressure is 4802db.

Station 012

103	Sample log: "Bottle leaks." Data appears to be okay. Pressure is 85db.
107	Sample log: "Bottle leaks." Data appears to be okay. Pressure is 206db.
108	Nutrient: "Odd shaped PO4 peak." PO4 ˜0.14 too high. Analyst reran samples for PO4, value similar to the first reading, but definitely too high. Footnote PO4 bad, ODF recommends deletion of PO4. Pressure is 235db.
113-134	Sample log: "Bottles did not trip." Therefore, no samples drawn.
135	Mistrip: S diff low, T diff high, P diff huge. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 4781db.

Station 013

104	Sample log: "Lid stuck open. No sample." Pressure is 79db.

107 Sample log: "Bottle leaks." Data appears to be okay. Pressure is 178db.

110 Sample log: "Lid stuck open. No sample." Pressure is 406db.

Station 014

201 Bottle tripped 1/2 out of water; no O2 sample; salt & nuts drawn. Footnote bottle didn't trip as scheduled. Helium may have been drawn, probably bad. DQE: "Code CTD salinity questionable and bottle salinity as acceptable." ODF does not dispute DQE coding. No CTDOXY is calculated because the CTD Salinity is coded questionable. Pressure is 2db.

207 Sample log: "Bottle leaks." Data appears to be okay. Pressure is 209db.

229 Salinity apparently lost during analyses. Too tight computer tolerance rejected. Salinometer values, not recorded manually. Pressure is 3280db.

Station 015

101 Sample log: "Bottle leaks." Data appears to be okay. DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2. Pressure is 14db.

102 Sample log: "Bottle leaks(?)" Data appears to be okay. Pressure is 52db.

107 Sample log: "Bottle leaks." Data appears to be okay. Pressure is 192db.

133 DQE: "Originator coded data questionable, O2 and SiO3 data are acceptable." ODF does not dispute the DQE coding of O2 and SiO3. Pressure is 4697db.

Station 016

101 Sample log: "Upper endcap leaks." Mistrip: S diff high, O2 draw temp low, O2 low, nuts look okay. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. DQE: "Change CTD O2 code to 3, nutrient codes to 2." ODF does not dispute the DQE coding of CTD O2, SiO3, NO3, NO2, and PO4. Pressure is 13db.

108 Sample log: "Bottom endcap leaks." Mistrip: S diff low, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 209db.

111 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 409db.

112 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 506db.

130 Sample log: "Vent open." S diff large suggesting slight contamination. Shipboard processors recommends deletion of all water samples. Salinity is the only parameter that indicates a problem. Will footnote salinity as bad and other samples as okay. But if DQE decides to change codes then ODF will concur. Delta-S at 3797db is -0.007, salinity is 34.709.

134 PO4 0.02 um/l high. Entire deep profile appears high when plotted vs. pressure, but agrees with adjoining stations, except 30 and 34, plotted vs. potemp. DQE: "PO4 is acceptable." ODF does not dispute the DQE coding of PO4. Pressure is 4777db.

Station 017

101 Sample log: "Upper endcap leaks. No freons drawn." Data appears to be okay. DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2. Pressure is 12db.

107 Sample log: "Upper endcap leaks. No freons drawn." Data appears to be okay. Pressure is 256db.

111 Mistrip: S diff high, O2 draw temp low, O2 low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 535db.

Station 018

101 Sample log: "Bottle leaks." Mistrip: S diff high, O2 low, NO3 high, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 14db.

102 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 50db.

103 Sample log: "Bottle may have leak." Samples appear to be okay. Pressure is 91db.

104 Mistrip: S diff high, O2 draw temp low, Sil high ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 126db.

105 Mistrip: S diff low, O2 draw temp low, Sil high ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 157db.

106 Mistrip: S diff low, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 200db.

137 Mistrip: O2 draw temp low, O2 low, ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 238db.

108 Sample log: "Spring/endcap separated. No sample." Pressure is 276db.

111 Mistrip: S diff high, O2 draw temp low. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 453db.

112 Sample log: "O2 draw temp was 5.7 at first." (7.0 now) Checked thermometer - seemed OK. Sil high, O2 low, nuts high Mistrip: O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 527db.

Station 019

101 Sample log: "1 not quite seated until punched (aboard)." Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 4db.

104 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 110db.

105 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 130db.

106 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 161db.

107 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 211db.

108 Mistrip: S diff low, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 310db.

111 Mistrip: S diff low, O2 draw temp low ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 459db.

112 Mistrip: S diff low, O2 draw temp low. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 612db.

Station 020

138 Sample log: "Bottle 38 replaces btl 1." Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 12db.

107 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 180db.

108 Sample log: "Bottle leaks." Mistrip: S diff low, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 218db.

111 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 360db.

Station 021

138 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 12db.

102 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2. Pressure is 49db.

107 Sample log: "Bottle leaks." Data appears to be okay. Pressure is 234db.

108 Sample log: "O2 draw temp started at 4.2, came up to 5.6." Mistrip: S diff low, O2 draw temp low, ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 282db.

Station 022

113 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 13db.

114 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2. Pressure is 48db.

138 Sample log: "Bottle did not trip. Bottom lanyard too short, bottom did not close." Therefore, no samples drawn. Pressure is 2802db.

108 Sample log: "Bottle did not trip." Therefore, no samples drawn. Pressure is 4226db.

112 Mistrip: S diff low, O2 draw temp high, nuts low. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 4971db.

Station 023

Cast 1 Sample log: "Tripped 12-position pylon deep, 24-position pylon shallow. Bottle position from shallow to deep is: 13-36, 1-12." Data appears to be okay.

113 Mistrip: S diff slightly low, O2 draw temp slightly low, nuts high - was in mixed layer with next 2 bottles. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with the DQE coding of CTD O2. Pressure is 12db.

114 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with the DQE coding of CTD O2. Pressure is 39db.

115 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with the DQE coding of CTD O2. Pressure is 69db.

121 DQE: "Code O2, SiO3, NO3, NO2 and PO4 questionable." O2 is high compared with CTD trace, other than NO2 cannot see why DQE coded data as questionable. ODF does not dispute the DQE coding. Pressure is 329db.

101 Sample log: "Bottle open. No sample." Pressure is 2433db.

104 Delta-S at 3044db is -0.004, salinity is 34.717. DQE: "Change salinity code to 3." ODF does not dispute DQE coding of salinity.

112 Sample log: "Bottle open. No sample." Pressure is 4759db.

Station 024

101 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with the DQE coding of CTD O2. Pressure is 11db.

107 Sample log: "Bottle leaks." Data appears to be okay. Pressure is 280db.

119 Nutrients: "Did not get sampled, missed by mistake." Pressure is 1268db.

Station 025

101 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with the DQE coding of CTD O2. Pressure is 9db.

107 Sample log: "Bottle leaks." Data appears to be okay. Pressure is 227db.

113 Sample log: "Bottle didn’t come back with rosette; lost at sea." Therefore, no samples drawn. Pressure is 706db.

114 Sample log: "Bottle came back up cracked from top to bottom." Therefore, no samples drawn. Pressure is 806db.

136 Oxygen analyst says forgot sulfuric before titration, discrete value obviously wrong. Footnote oxygen lost. Pressure is 4818db.

Station 026

101 Sample log: "Leaks from bottom endcap." Data appears to be okay. Pressure is 4db.

101-104	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with the DQE coding of CTD O2.
113	Sample log: "Vent open, leaks badly." Salt check suggests slight contamination, but within 0.005 S compared to CTD, suggest accept as is. Oxygen appears to be okay. Pressure is 433db.

Station 027

101	Mistrip: S diff low, nuts high ODF recommends deletion of all water samples. Footnote bottle leaking, CTD O2 questionable, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 3db.
101-102	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with the DQE coding of CTD O2.

Station 028

101-102	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with the DQE coding of CTD O2. Pressure is 7-69db.
107	Sample log: "Bottle leaks." Data appears to be okay. Pressure is 306db.

Station 029

Cast 3	Console Ops: "No oxygen." No CTD oxygen per schedule.
307	Sample log: "Bottle leaks." Data appears to be okay. Pressure is 309db.
325	Shipboard: S diff slightly high. Delta-S at 2329db is 0.0068, salinity is 34.715. Automated salinity system indicates that 6 readings were tried before 2 agreed, normal number is 2. Footnote salinity bad.

Station 030

101-103	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with the DQE coding of CTD O2.
107	Sample log: "Bottle leaks." Data appears to be okay. Pressure is 383db.

Station 031

101	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable. Also code bottle O2 questionable." ODF agrees with the DQE coding of CTD O2 and does dispute the coding of bottle O2. Pressure is 13db.
102	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable. ODF agrees with the DQE coding of CTD O2. Pressure is 60db.
103	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable. ODF agrees with the DQE coding of CTD O2. Pressure is 109db.

Station 032

101	Mistrip: S diff low, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 10db.
107	Sample log: "Bottle leaks." Data appears to be okay. Pressure is 258db.

132 Delta-S at 3641db is -0.0031. DQE: "Code salinity questionable." ODF agrees with DQE coding of salinity.

133 Delta-S at 3843db is 0.0029. DQE: "Code salinity questionable." ODF agrees with DQE coding of salinity.

134 Delta-S at 4055db is 0.0025. DQE: "Code salinity questionable." ODF agrees with DQE coding of salinity.

Station 033

101-102 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with the DQE coding of CTD O2.

125 O2 duplicate draw of 26. DQE: "Change bottle oxygen code from 4 to 3." ODF does not dispute DQE code change for oxygen. Pressure is 2311db.

Station 034

412 Sample log: "Upper endcap did not seat." Therefore, no samples drawn. Pressure is 558db.

101 Sample log: "Upper endcap leaks." Data appears to be okay, regarding comment from Sample Log. Pressure is 1661db.

Station 034

412 Sample log: "Upper endcap did not seat." Therefore, no samples drawn. Pressure is 558db.

101 Sample log: "Upper endcap leaks." Data appears to be okay, regarding comment from Sample Log. Pressure is 1661db.

Station 035

109 Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 404db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 695db.

128 Sample log: "Bottle leaks." Data appears to be okay. Pressure is 2679db.

113 Mistrip: S diff high, O2 draw temp low, nuts high. DQE: "Bottle would be okay with bottom pressure. Suggest using CTD data from bottle 36, as done on several other stations. Change bottle code from 3 to 4, and sample codes from 4 to 2." ODF agrees with DQE suggestion.

Station 036

101 Sample log: "Bottle leaking slowly from lower endcap." Data appears to be okay. Pressure is 9db.

109 Sample log: "Probably pre-tripped." Mistrip: S diff high, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 358db.

114 Sample log: "Bottle leaking slowly from lower endcap." Data appears to be okay. Pressure is 634db.

Station 037

101 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with DQE coding of CTD O2. Pressure is 3db.

103 Sample log: "Bottle leaks." Data appears to be okay. Pressure is 158db.

107 Sample log: "Upper endcap leaks." Data appears to be okay. Pressure is 282db.

128 Lost salinity due to cracked salt bottle - not run. Pressure is 2480db.

Station 038

201 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with DQE coding of CTD O2. Pressure is 7db.

202 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with DQE coding of CTD O2. Pressure is 57db.

Station 039

127 Delta-S at 2181db is 0.0031, salinity is 34.739. DQE: "Code salinity questionable." ODF agrees with DQE coding of salinity.

Station 041

121 O2 duplicate draw of 22. Footnote oxygen bad, ODF recommends deletion of oxygen. Pressure is 1469db.

133 O2 questionable (high) - confirmed after preliminary CTDOXY fit. Footnote oxygen bad, ODF recommends deletion of oxygen. Pressure is 3198db.

Station 042

101 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2. Pressure is 2db.

102 Oxygen: O2 value lost - thio not strong enough for higher O2 concentrations DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2. Pressure is 55db.

112 Sample log: "Vent open. Leaked." S diff high, Sil high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 457db.

118 O2 duplicate draw of 19. DQE: "Change oxy code from 4 to 3." ODF does not dispute DQE change to oxygen code. Pressure is 811db.

Station 043

212 Mistrip: S diff high, Sil high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 192db.

214 Sample log: "Bottom endcap leaks." Data appears to be okay. Pressure is 268db.

Station 044

107 Sample log: "Top did not close. No Sample." Pressure is 205db.

Station 045

107 Sample log: "Top did not close." Therefore, no samples drawn. Pressure is 146db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 307db.

130 Delta-S at 2221db is 0.0038, salinity is 34.713. DQE: "Code salinity questionable." Diagnostics from salinity analysis program indicates 4 tries before accepting a salinity value, indicating a problem with the analysis. ODF agrees with DQE coding of salinity.

113	O2 draw T, salt, nuts all indicate tripped at bottom. change CTD trip info to match bottle 36. Footnote bottle did not trip as scheduled, samples appear to be okay at corrected pressure. Pressure is 3020db.

Station 046

130	Sample log: "Bottle leaks." Data appears to be okay. Pressure is 1836db.

Station 047

107	Surface salt not analyzed - why?? No reason given. Footnote salinity lost. Pressure is 9db.
116	Sample log: "Upper endcap leaks." Data appears to be okay. Pressure is 436db.

Station 048

212	No surface bottle data as console operator did not switch pylons. Pressure is 8db.
260	This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 85db.
232	O2 appears 0.05 high. DQE: "Code O2 questionable." ODF agrees with DQE coding of oxygen. Pressure is 2225db.
213	AWM: "Bottle 13 values match bottom values from bottle 36; change CTD trip info to match 36." Footnote bottle did not trip as scheduled. Pressure is 2836db.

Station 049

130	Sample log: "Vent open." Bottle data shows leakage must have occurred. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 1821db.
133	O2 high - analyst indicated bad end point - CTDOXY confirms that no such inflection. ODF recommends deletion of oxygen. Footnote oxygen bad. Pressure is 2422db.
135	O2 0.1 high - CTDOXY confirms that no such inflection. ODF recommends deletion of oxygen. Footnote oxygen bad. Pressure is 2830db.

Station 050

120	DQE: "O2 is acceptable." ODF does not dispute DQE change of O2 code. Pressure is 796db.

Station 052

111	O2 high - analyst commented that very weird end point - sample was in mixed layer. ODF recommends deletion of oxygen. Footnote oxygen bad. Pressure is 3db.
160	This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 99db.
129	Delta-S at 1874db is 0.0057. DQE: "Code salinity questionable." Diagnostics from salinity analysis program indicates 5 tries before accepting a salinity value, indicating a problem with the analysis. ODF agrees with DQE coding of salinity.
113	O2 draw T, salt, nuts all indicate tripped at bottom. Change CTD trip info to match bottle 36. Footnote bottle did not trip as scheduled. Pressure is 3169db.

Station 053

105	DQE: "Code O2 questionable." ODF does not dispute DQE code change. Pressure is 6db.
106	DQE: " O2 is acceptable." ODF does not dispute DQE code change. Pressure is 56db.
129	Sample log: "Bottle leaks around spigot o-ring. Data appears to be okay. Pressure is 1810db.
133	Sample log: "Bottom endcap leaks." Data appears to be okay. Pressure is 2418db.

Station 054

107 Sample log: "Bottle leaks." Data appears to be okay. Pressure is 183db.

111 Sample log: "Bottle leaks." Data appears to be okay. Pressure is 410db.

113 Sample log: "Both lids open. No sample." Pressure is 606db.

119 Sample log: "Leaks from bottom." Data appears to be okay. Pressure is 1210db.

Station 055

101 Sample log: "Top did not close." Therefore, no samples drawn. Sample log: "1 & 12 switched in rosette placement. Not a rampshaft problem." Pressure is 532db.

121 Salt bad; higher than any on this or adjacent stations - CTD verifies that S bad - O2 & nuts okay though, so not rosette malfunction ODF recommends deletion of salinity. Footnote salinity bad. Pressure is 1600db.

130 O2 0.08 high. DQE: "Code O2 questionable." ODF agrees with DQE coding of O2. Pressure is 3213db.

Station 056

201-212 Bottle 12 O2 draw temp matches surface bottles; ramp shaft off by 1 on inner pylon after cast; change CTD trips file to show trip order as 11->1, then 12. Footnote bottle did not trip as scheduled. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable.

207 Sample log: "Bottle leaks." Data appears to be okay. Pressure is 353db.

Station 057

107 Sample log: "End cap leaks." Data appears to be okay. Pressure is 217db.

Station 058

103 Delta-S at 137db is -0.0317, salinity is 34.226. This is a large gradient area, there also appears to be a strange feature in the CTD up trace. Bottle salinity agrees with adjoining stations. DQE: "Originator coded CTD salinity questionable, CTD salinity is acceptable." ODF does not dispute DQE change of CTD salinity code.

107 Sample log: "End cap bad." Data appears to be okay. Pressure is 267db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 711db.

113 O2 draw T, salt, nuts all indicate tripped at bottom; change CTD trip info to match bottle 36. Footnote bottle did not trip as scheduled. Pressure is 4357db.

Station 059

122 O2 & nuts look like duplicates of 21. Delta-S at 2008db is 0.0032, salinity is 34.710. DQE: "Code salinity 3, O2 3, and SiO3 3." ODF does not dispute DQE salinity, O2, and SiO3 coding.

123 Delta-S at 2162db is 0.0037, salinity is 34.709. DQE: "Code salinity 3." Autosal diagnostics indicate 4 tries to get a good reading, indicating a problem with the samples. ODF agrees with DQE salinity coding.

124 Delta-S at 2316db is 0.004, salinity is 34.708. DQE: "Code salinity 3." ODF does not dispute DQE salinity coding.

Station 060

Cast 1	Bottle salts look high at bottom compared to adjacent stations & CTD - unusually high Autosal drift, with end standard seawater on other side of suppression dial setting (2.0,1.9 at start) - salinometer could have a decade shift error - Need end standard approximately 0.003 higher for salts to agree with CTD and adjacent stations - Salt analyst indicates had trouble during entire run as most samples took multiple readings instead of the usual 2 - he ran 2nd standard seawater at end to confirm high drift - Electronics Technician did crossover check and there is no error. No CTD oxygen per schedule.
101-136	See 1all salinity comment. ODF recommends deletion of salinity. Footnote salinity bad.
113	Sample log: "Bottle tripped at surface." Data appears to be okay. Footnote bottle did not trip as scheduled. Pressure is 2db.
160	This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 811db.

Station 061

102	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with DQE coding of CTD O2. Pressure is 65db.
122	Sample log: "Spigot leaks." Data appears to be okay. Pressure is 1771db.

Station 063

116	Sample log: "Spigot loose - not leaking." Data appears to be okay. Pressure is 812db.

Station 064

101	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with DQE coding of CTD O2. Pressure is 3db.
114	DQE: "Code O2 questionable." O2 appears low. ODF agree with DQE coding of O2. Pressure is 806db.
116	DQE: "O2 is acceptable. ODF does not dispute DQE coding of O2. Pressure is 1100db.

Station 065

101	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with DQE coding of CTD O2. Pressure is 7db.
115	DQE: "Code O2 3 (questionable)." ODF does not dispute DQE O2 coding. Pressure is 912db.

Station 066

124	Sample log: "Upper end cap did not seat properly." Mistrip: S diff high, O2 draw temp low, nuts high. S diff high, O2 draw temp high, nuts bad, O2 low. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 1904db.

Station 067

130	Sample log: "Bottle leaks from vent." Data appears to be okay. Pressure is 2536db.

Station 068

113	Sample log: "Pretrip?" No - Bottle data looks okay. Pressure is 709db.

Station 071

123	DQE: "Code salinity 3 (questionable)." ODF does not dispute DQE coding of salinity. Pressure is 1214db.
128	DQE: "Code salinity 3 (questionable)." ODF does not dispute DQE coding of salinity. Pressure is 1722db.
135	Sample log: "Salt not drawn." No reason noted as to why the sample was not drawn. Other samples appear to be okay. Pressure is 2733db.
136	Sample log: "Salt not drawn." No reason noted as to why the sample was not drawn. Other samples appear to be okay. Pressure is 2792db.

Station 072

101	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2. Pressure is 4db.
108	Sample log: "Leaks out of spout" Data appears to be okay. Pressure is 308db.

Station 073

201-203	Oxygen: "Had trouble with UV gain fluctuation, 1-4, 7 & 19." DQE: "O2 is acceptable." ODF does not dispute DQE O2 code change.
204	O2 high ˜0.1 - Analysis sheet says "weird end point". ODF recommends deletion of oxygen. See 201-203 Oxygen analyst comments, footnote oxygen bad. DQE: "Change O2 code from 4 (bad) to 3 (questionable)." ODF does not dispute DQE O2 code change. Pressure is 85db.
207	DQE: "O2 is acceptable." ODF does not dispute DQE O2 code change. Pressure is 160db.
210	S diff high - possible duplicate draw from 11. ODF recommends deletion of salinity. Footnote salinity bad. Pressure is 257db.
219	DQE: "O2 is acceptable." ODF does not dispute DQE O2 code change. Pressure is 1006db.
221	O2 duplicate draw of 222. ODF recommends deletion of oxygen. DQE: "Change O2 code from 4 (bad) to 3 (questionable)." ODF does not dispute DQE O2 code change. Pressure is 1209db.
222-228	DQE: "O2 is acceptable." ODF does not dispute DQE O2 code change.
229	DQE: "Code O2 3 (questionable)." ODF does not dispute DQE O2 coding. Pressure is 2216db.

Station 075

107-108	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with DQE coding of CTD O2.
126	S diff low - looks like duplicate draw from 25. ODF recommends deletion of salinity. Footnote salinity bad. Pressure is 1140db.
134	Sample log: "Leaks" Data appears to be okay. Pressure is 2633db.

Station 076

113-115	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF agrees with DQE coding of CTD O2.

Station 077

114	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2. Pressure is 15db.

125	Sample log: "Bottom endcap did not close." Therefore, no samples drawn. Pressure is 904db.
Station 079	
107	Sample log: "Leaks from bottom endcap." Data appears to be okay. Pressure is 269db.
Station 080	
201-203	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.
211	Sample log: "Lanyard broke on launch." No sample. Bottle stop made and CTD level so leave in and count as 36 bottle tripped. Pressure is 507db.
Station 081	
118	Oxygen: Real NaOH dispenser problems. Redrew. O2 duplicate draw of 17. ODF recommends deletion of oxygen. Footnote oxygen bad. Pressure is 1150db.
Station 082	
101-102	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.
Station 083	
101-105	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.
Station 084	
101-103	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.
107	O2 looks ˜0.25 ml/l high - analyst comment that bubble Footnote oxygen bad, ODF recommends deletion of oxygen. Pressure is 259db.
121	Sample log: "Leaking - vent loose." Data appears to be okay. Pressure is 1789db.
Station 085	
101-103	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.
110	Sample log: "Bottle empty. Both lids were closed (endcap caught on pinger, closed in air)." Therefore, no samples drawn. Pressure is 448db.
Station 086	
101-103	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.
102	Sample log: "Leaks from top endcap." Data appears to be okay. Pressure is 41db.
111	Sample log: "Leaks from bottom endcap." Data appears to be okay. Pressure is 435db.
Station 087	
201-203	DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.

Station 088

101-103 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.

135 Therm P/T match bottle 34, not 35; salt diffc could match either bottle. Either lanyard hung or bottle tripped same level as 34. After reconsidering, decided that in light of later pylon problems, 35 probably did trip with 34 as confirmed by thermometric pressure. Footnote bottle did not trip as scheduled. Pressure is 4476db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 4680db.

Station 089

101-102 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.

107 Sample log: "Leaks at bottom." Data appears to be okay. S diff slightly high - other data looks okay. Pressure is 308db.

108 Sample log: "Leaks at bottom." Data appears to be okay. Mistrip: S diff low, O2 draw temp low, nuts high. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 349db.

Station 090

101-103 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.

Station 091

125 Salt missing - evidently not drawn. Footnote salinity lost. Pressure is 2923db.

Station 093

101-102 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.

Station 094

102 Sample log: "Leaking slightly from bottom." Data appears to be okay. Pressure is 54db.

120 Mistrip: Salt/O2/Sil. match bottle 19. Use CTD values from 19. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Pressure is 2222db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 2373db.

125 Delta-S at 3338db is 0.0051, salinity is 34.702. Automated salinity system indicates 4 tries were made before an agreement was accepted. Poor agreement with adjoining stations. Footnote salinity bad.

Station 095

202 Sample log: "Leaking at bottom." Data appears to be okay. Pressure is 48db.

215 Mistrip: Salt/O2/Nuts match bottle 14. Use CTD values from 14. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Pressure is 945db.

260 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 1042db.

Station 096

101 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2. Pressure is 9db.

Station 098

101-102 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.

121 Mistrip: Salt/O2/Nuts match bottle 20. Use CTD values from 20. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Pressure is 1652db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 1804db.

124 Mistrip: Salt/O2/Nuts match bottle 23. Use CTD values from 23. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Pressure is 2215db.

161 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 2418db.

Station 100

117 Mistrip: Salt/O2/Nuts match bottle 16. Use CTD values from 16. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Pressure is 1303db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 1456db.

122 Salt matches bottle 20 salt, big delta-S. Other data (O2, nuts) okay. Footnote salinity bad, ODF recommends deletion of salinity. Pressure is 2375db.

Station 101

115 Mistrip: Salt/O2/Nuts match bottle 14. Use CTD values from 14. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Pressure is 800db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 898db.

127 Sample log: "Spigot leaks." Data appears to be okay. Pressure is 3008db.

135 Mistrip: Therm pressure matches bottle 34 CTD trip. Salt/oxy/nuts could belong either place. Use CTD values from 34. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Pressure is 4563db.

161 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 4813db.

Station 102

102 Sample log: "Upper endcap leaks." Data appears to be okay. DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2. Pressure is 47db.

115 Mistrip: Salt/O2/Nuts match bottle 14. Use CTD values from 14. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Pressure is 787db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 885db.

120 Mistrip: Salt/O2/Nuts match bottle 19. Use CTD values from 19. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Pressure is 1307db.

121 Mistrip: Salt matches bottle 20 CTD trip. Use CTD values from 20. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Pressure is 1493db.

161 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 1696db.

Station 103

Cast 1 Outer pylon off by -1 after bottom trip; no pylon confirm at bottom trip only, but computer confirmed 5 times for single button press. Therm shows 35 pressure matches bottom trip pressure; 36 is also bottom S/O2/nuts (vs. 13's level), so pylon began in right place. Note that outer pylon changed between Stations 102/103 due to double-tripping problems on several bottles per cast since Station 095. SUMMARY: Bottles 35,34,29,26,24,21,19,18,17,16,14,13 tripped one level deeper than scheduled. Pylon advancing problem.

102 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute DQE coding of CTD O2. Pressure is 18db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 610db.

113 Footnote bottle did not trip as scheduled. Scheduled trip at 630db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 660db.

114 Footnote bottle did not trip as scheduled. Scheduled trip at 680db. Pressure is 810db.

161 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 961db.

116 Footnote bottle did not trip as scheduled. Scheduled trip at 983db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 1113db.

117 Footnote bottle did not trip as scheduled. Scheduled trip at 1134db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 1261db.

118 Footnote bottle did not trip as scheduled. Scheduled trip at 1284db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 1411db.

119 Footnote bottle did not trip as scheduled. Scheduled trip at 1433db. Pressure is 1560db.

162 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 1711db.

121 Footnote bottle did not trip as scheduled. Scheduled trip at 1735db. Pressure is 1861db.

163 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 2215db.

124 Footnote bottle did not trip as scheduled. Scheduled trip at 2239db. Pressure is 2421db.

164 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 2623db.

126 Footnote bottle did not trip as scheduled. Scheduled trip at 2645db. Pressure is 2826db.

165 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 3229db.

129 Footnote bottle did not trip as scheduled. Scheduled trip at 3249db. Pressure is 3431db.

166 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 4411db.

134 Footnote bottle did not trip as scheduled. Scheduled trip at 44428db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 4671db.

135 Mistrip: tripped at bottom per therm pressure. Reassign to 36 CTD values. Pylon advancing problem. Footnote bottle did not trip as scheduled. Pressure is 4755db.

Station 104

Cast 1 Outer pylon off by -1 beginning with bottle 31 tripping at bottle 32 level; normal pylon/computer confirms throughout. Pylon began in right place, as confirmed by therm pressure for bottle 35 (where it should be). SUMMARY: 31, 30, 29, 27, 25, 24, 19, 18, 16, 14, 13 tripped one level deeper than expected. Pylon advancing problem.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 861db.

113 Footnote bottle did not trip as scheduled. See Cast 1 tripping comment. Scheduled to trip at 861db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 1011db.

114 Footnote bottle did not trip as scheduled. See Cast 1 tripping comment. Scheduled to trip @1011db. Pressure is 1162db.

161 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 1312db.

116 Footnote bottle did not trip as scheduled. See Cast 1 tripping comment. Scheduled to trip @1312db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 1465db.

118 Footnote bottle did not trip as scheduled. See Cast 1 tripping comment. Scheduled to trip @1616db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 1767db.

119 Footnote bottle did not trip as scheduled. See Cast 1 tripping comment. Scheduled to trip @1767db. Pressure is 1919db.

162 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 2669db.

124 Footnote bottle did not trip as scheduled. See Cast 1 tripping comment. Scheduled to trip @2669db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 2869db.

125 Mistrip: O2/salt/nuts match bottle 24 values. Use CTD values from 24. Footnote bottle did not trip as scheduled. See Cast 1 tripping comment. Scheduled to trip @2869db. Pressure is 3070db.

163 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 3275db.

127 Mistrip: O2/salt/nuts match bottle 26 CTD trip. Use CTD values from 26. Footnote bottle did not trip as scheduled. See Cast 1 tripping comment. Scheduled to trip @3275db. Pressure is 3481db.

164 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 3688db.

129 Footnote bottle did not trip as scheduled. See Cast 1 tripping comment. Scheduled to trip @3688db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 3892db.

130 Footnote bottle did not trip as scheduled. See Cast 1 tripping comment. Scheduled to trip @3892db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 4096db.

131 Mistrip: tripped at bottle 32 level per O2/nuts. Reassign to 32 CTD values. All other outer trips also 1 or more off beginning here. Footnote bottle did not trip as scheduled. See Cast 1 tripping comment. Scheduled to trip @4096db. Pressure is 4300db.

Station 105

Cast 3 Pylon repaired prior to cast to try to fix double/late tripping problems; still a few late trips. No change.

360 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 710db.

319 Mistrip: Salt/O2/Nuts match bottle 18. Use CTD values from 18. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled to trip @1517db. Pressure is 1315db.

361 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 1517db.

326 Mistrip: Salt/O2/Nuts match bottle 25. Use CTD values from 25. Original 26 CTD values used for bottle 27. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled to trip @2939db. Pressure is 2735db.

327 Mistrip: Salt/O2 match bottle 26 CTD trip. Use CTD values from 26. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled to trip @3142db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 2939db.

362 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 3142db.

331 Mistrip: (Salt)/O2/nuts match bottle 30 data; O2 profile looks like data belongs one level shallower. Use CTD values from 30. Probable pylon advancing problem. Salinity is 0.002 high, o2 is 0.022 high, no3 0.2 low and po4 0.01 low compared with duplicate trip bottle 30. Plots vs. potemp for adjoining stations indicate that this is a problem and that this bottle may have deeper water in it, but it did not trip with bottle 32. Footnote bottle did not trip as scheduled and salinity, oxygen, no3, no2 and po4 questionable. Using questionable comment because sil agrees with the duplicate trip and adjoining station comparison. Scheduled to trip @3960db. Pressure is 3755db.

332 Mistrip: (Salt)/O2 match bottle 31 CTD trip; O2 profile looks like data belongs one level shallower. Use CTD values from 31. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled to trip @4217db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 3960db.

363 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 4217db.

313 Mistrip: Salt/O2/Nuts match bottle 36 values. Use CTD values from 36. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled to trip @730db. Pressure is 5122db.

Station 106

101 Sample log: "Leaks badly, bottom lid did not seat well." Data appears to be okay. Pressure is 6db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 659db.

119 Mistrip: Salt/O2/Nuts match bottle 18. Use CTD values from 18. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @1566db. Pressure is 1415db.

161 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 1566db.

127 Mistrip: Salt/O2/Nuts match bottle 26. Use CTD values from 26. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @3134db. Pressure is 2932db.

162 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 3134db.

113 Mistrip: Salt/O2/Nuts match bottle 36. Use CTD values from 36. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @659db. Pressure is 5066db.

Station 107

135 Mistrip: Therm pressure matches bottle 34 CTD trip. Salt/oxy/nuts could belong either place. Use CTD values from 34. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @4920db. Pressure is 4711db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 4920db.

Station 108

102 Sample log: "Upper end cap leaks." Data appears to be okay. Pressure is 34db.

133 Mistrip: Salt/O2/Nuts match bottle 32. Use CTD values from 32. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @4932db. Pressure is 4164db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 4420db.

135 Mistrip: Therm pressure matches bottle 34 CTD trip. Salt/oxy/nuts could belong either place. Use CTD values from 34. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @4420db. Pressure is 4673db.

161 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 4932db.

Station 109

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 1048db.

116 Mistrip: Salt/O2/Nuts match bottle 15. Use CTD values from 15. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @1502db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 1350db.

115 Sample log: "Lanyard hungup." Therefore, no samples drawn. Assigned CTD data (pressure, temperature, and conductivity) from scheduled trip at ˜1500db in bottle data files. This level is assigned with CTD data as a stop of the CTD and an attempted trip level at 1500db. This was done so the Data Quality Evaluator has additional information to ensure that pressure assignments were done correctly. Footnote bottle no samples taken. Pressure is 1502db.

119 Mistrip: Salt/O2/Nuts match bottle 18. Use CTD values from 18. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @1964db. DQE: "Trip information assigned properly, leave code that bottle did not trip as scheduled." Pressure is 1808db.

161 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 1964db.

126 Mistrip: Salt/O2/Nuts match bottle 25. Use CTD values from 25. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @3038db. DQE: "Trip information assigned properly, leave code that bottle did not trip as scheduled." Pressure is 2885db.

162 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 3038db.

133 Mistrip: see 136/135 notes; off one level until double trip at 32. Bottle 33 values match 32 CTD values, Use CTD values from 32. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @4161db. DQE: "Trip information assigned properly, leave code that bottle did not trip as scheduled." Pressure is 3957db.

134 Mistrip: see 136/135 notes; off one level until double trip at 32. Bottle 34 values match 33 CTD values, Use CTD values from 33. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @4368db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 4161db.

135 Mistrip: Therm pressure matches bottle 34 CTD trip. Salt/oxy/nuts could belong either place. Use CTD values from 34. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @4575db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 4368db.

136 Mistrip: 13 tripped at bottom, 35 therm pressure shows it tripped one level higher as well. Bottle 32 values match 32, probably all bottles off 1 level until then. Use CTD values from 35. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @4852db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 4575db.

113 Mistrip: Salt/O2/Nuts match bottle 36. Use CTD values from 36. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @1048db. DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable. Pressure is 4858db.

Station 110

Cast 1 Sample log: "Bottles 13->26 did not trip." Multiple tripping problems during cast: 12 no-confirms from outer pylon, but 5x computer confirm at most levels. Pylon confirms: 34,32,30,27,20->1. Single computer confirms: 34,32,30,27,15 plus inner rosette (12->1). All other computer confirms 5x/5 secs apart per button press.

113-126 Bottles did not trip, see 1all Sample Log comment. Included CTD data (pressure, temperature, and conductivity) in bottle data files. There are no water samples. This was done on DQE request.

127 Mistrip: Bottle-CTD salt difference match up with 15 CTD trip. Use CTD values from 15. Original 27 CTD values used for bottle 29. Probable pylon advancing problem. Samples appear to be okay after pressure reassignment. Footnote bottle did not trip as scheduled. Scheduled trip @3225db. Pressure is 919db.

127-135 DQE: "Trip information assigned properly, code bottle as 2." ODF will leave bottle code as 4 to be consistent with other mistrips. Data is usable.

128 Mistrip: Bottle-CTD salt difference match up with 25 CTD trip. Use CTD values from 25. Original 28 CTD values used for bottle 30. Probable pylon advancing problem. Samples appear to be okay after pressure reassignment. Footnote bottle did not trip as scheduled. Scheduled trip

@3429db. Pressure is 2822db.

129 Mistrip: Bottle-CTD salt difference match up with 27 CTD trip. Use CTD values from 27. Probable pylon advancing problem. Samples appear to be okay after pressure reassignment. Footnote bottle did not trip as scheduled. Scheduled trip @3633db. Pressure is 3225db.

130 Mistrip: Bottle-CTD salt difference match up with 28 CTD trip. Use CTD values from 128. Original 30 CTD values used for bottle 31. Probable pylon advancing problem. Samples appear to be okay after pressure reassignment. Footnote bottle did not trip as scheduled. Scheduled trip @3833db. Pressure is 3429db.

131 Mistrip: Bottle-CTD salt difference match up with 30 CTD trip. Use CTD values from 30. Probable pylon advancing problem. Samples appear to be okay after pressure reassignment. Footnote bottle did not trip as scheduled. Scheduled trip @4040db. Footnote bottle did not trip as scheduled. Scheduled trip @4040db. Pressure is 3833db.

132 Shorebased CTD processor found that bottles 34 through 32 tripped one level shallower than originally scheduled. All data agrees with adjoining stations after the pressures were corrected. Footnote bottle did not trip as scheduled. Scheduled trip @4240db. Pressure is 4040db.

133 See 132 Shorebased CTD processor comment. Footnote bottle did not trip as scheduled. Scheduled trip @4445db. Pressure is 4240db.

134 See 132 Shorebased CTD processor comment. Footnote bottle did not trip as scheduled. Scheduled trip @4651db. Pressure is 4445db.

135 Mistrip: Therm pressure matches bottle 34 CTD trip. Salt/oxy/nuts could belong either place. Use CTD values from 34. Probable pylon advancing problem. Samples appear to be okay after pressure reassignment. Footnote bottle did not trip as scheduled. Scheduled trip @4863db. Pressure is 4651db.

Station 111

127 Mistrip: Salt/O2/Nuts match bottle 26. Use CTD values from 26. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @2734db. Pressure is 2533db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 2734db.

Station 112

108 Sample log: "Lower end cap leaks." Data appears to be okay. Pressure is 233db.

127 Mistrip: Salt/O2/Nuts match bottle 26. Use CTD values from 26. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @2633db. Pressure is 2429db.

160 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 2633db.

Station 113

206 Sample log: "Did not close. Lanyard hungup." Therefore, no samples drawn. Pressure is 157db.

218 Mistrip: Salt/O2/Nuts match bottle 17. Use CTD values from 17. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @1367db. Pressure is 1215db.

260 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 1367db.

224 Mistrip: Salt/O2/Nuts match bottle 23. Use CTD values from 23. Probable pylon advancing problem. Footnote bottle did not trip as scheduled. Scheduled trip @2331db. Pressure is 2127db.

261 This level is included to fill in the data gap caused by double tripping. The bottle is -9 and coded 5 and there are no water samples. Pressure is 2331db.

Station 114

115

Station 115

101 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2. Pressure is 3db.

Station 116

101-103 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.

121 O2 high (˜ 0.05) - no obvious problem. DQE: "Code oxygen as 3." ODF agrees with DQE coding of O2. Pressure is 1767db.

Station 117

114 Sample log: " No sample - empty." Pressure is 870db.

Station 119

202-203 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.

211 Salt diffc high; bottle salt matches bottle 10 salt. Bottle O2/Nuts look normal. Reran salts for 10/11 and definitely match. Apparent double draw for salinity. Footnote salinity bad, ODF recommends deletion of salinity. Pressure is 407db.

231 Salt diffc high; bottle salt higher than any nearby. Bottle O2/Nuts look normal. Salt sheet shows 4 reads during analysis before readings agreed. Sample bottle/cap look okay. Rerun verifies high value. Footnote salinity bad, ODF recommends deletion of salinity. Surmise that sample was from last use of this case on Station 107 & that sample not collected on this station. Pressure is 3552db.

Station 120

101-102 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.

112 Sample log: "Bottle 35 therm lanyard caught in lid of bottle 12 - had to lift lid of 12 to remove so could separate rosettes, thus exposing bottle contents to air briefly - no freon drawn." Mistrip: Salt diffc high; Salt/Nuts/O2 don’t belong here. ODF recommends deletion of all water samples. Footnote bottle leaking, salinity, oxygen, silicate, nitrate, nitrite, phosphate bad. Pressure is 658db.

Station 121

201-203 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.

Station 122

101-102 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.

Station 123

101-103 DQE: "CTD O2 data assigned to the bottle trips are often poor near the surface, as explained by ODF CTD data processors. I agree, and have flagged obvious cases as questionable." ODF does not dispute the DQE coding of CTD O2.

117 Sample log: " Leaking from bottom." Data appears to be okay. Pressure is 1366db.

124 Sample log: " Leaking from bottom." Data appears to be okay. Pressure is 2432db.

136 O2 low - flask number & run data normal - probable pickling error (also happens Sta 125 bottom sample, same analyst) - CTDO confirms that bad. Footnote oxygen bad, ODF recommends deletion of oxygen. Pressure is 4354db.

Station 124

117 Sample log: "Bottom end cap leaking - weak inner spring; pulled for repair - was also cracked around handle & leaking at joint between end cap section & main body of bottle." Data appears okay. None. Pressure is 1058db.

Station 125

124 Delta-S at 2313db is 0.0041, salinity is 34.655. Automated salinity analysis does not indicate a problem. This sample could have been misdrawn from 25. Salinity does not agree with station profile or adjoining stations. Footnote salinity bad. DQE: "Code salinity as 3." ODF does not dispute the DQE change to salinity coding.

136 O2 low - flask number & run data normal - probable pickling error (also happens Sta 123 bottom sample, same analyst) - CTDO confirms that bad. Footnote oxygen bad, ODF recommends deletion of oxygen. Pressure is 4829db.

Station 127

113 Sample log: " Leaks around spigot." Data appears to be okay. Pressure is 166db.

130 Sample log: " Bottom end cap leaking." Data appears to be okay. Pressure is 1980db.

Appendix B

WOCE P16A/P17A: Large Volume Quality Comments

Remarks for missing samples, and WOCE codes other than 2 from JUNO - WOCE P16A/P17A Large Volume Samples. Investigation of data may include comparison of bottle salinity and silicate data from piggy-back and Gerard with CTD cast 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 014

182 @3129db	Sample log: "Air vent not sealing." Salinity and silicate agree with piggy-back bottle (42) data.
143 @3433db	Sample log: "Niskin turned sideways during transport. Therm NG. Footnote temperature not drawn. Samples were taken from the piggy-back (niskin) bottle, data indicates samples are acceptable for both piggy-back and Gerard (83).
183 @3434db	See comments from Piggy-back (43). Footnote temperature not drawn.
145 @4046db	Sample log: "Trip arm did not go down far enough for Niskin. No sample. Footnote temperature not drawn. Gerard (87), samples appear to be okay.
187 @4047db	Samples appear to be okay, Piggy-back (45). Footnote temperature not drawn.
146 @4354db	Delta-S at 4354db is 0.0031, salinity is 34.716. Piggy-back salinity slightly high compared with station profile and rosette cast. Footnote piggy-back salinity uncertain. Gerard (89) silicate low, footnote Gerard silicate uncertain.
189 @4355db	Piggy-back (46) salinity high, but Gerard silicate low. No notes or problems noted with salinity and/or silicate analysis. PI will have to decide if Gerard samples are acceptable. Footnote Gerard silicate uncertain, piggy-back salinity uncertain.
148 @4974db	Sample log: "Trip arm did not go down far enough for Niskin. No sample. Gerard (92) Footnote temperature not drawn.
192 @4974db	Sample log: "Lid did not latch per RK." See comments from Piggy-back (48). Footnote temperature not drawn. Salinity and silicate appear to be acceptable.

Station 022

247 (No Pressure)	Post-tripped; samples not collected, Gerard (90).
248 (No Pressure)	Post-tripped; samples not collected, Gerard (92).
249 (No Pressure)	Post-tripped; samples not collected, Gerard (93).
290 (No Pressure)	Post-tripped; samples not collected, Gerard (47).
292 (No Pressure)	Post-tripped; samples not collected, piggy-back (48).
293 (No Pressure)	Post-tripped; samples not collected, piggy-back (49).
241 @3339db	Sample log: "41 turned." Not quite sure what the comment from Sample Log means, samples are acceptable. Gerard (81).
243 @3750db	LM Therm rdgs disagree, omit per AWM Gerard (83). Temperature not reported, it appears that just the thermometer did not reverse properly. Salinity and silicate are acceptable at scheduled pressure.
283 @3750db	See piggy-back (43) thermometer comment. Temperature not reported.
245 @4151db	Salinity and silicate low compared with Gerard and rosette cast, Gerard (87) samples appear acceptable. Footnote salinity and silicate uncertain.
287 @4151db	Gerard samples acceptable, see comments piggy-back (45).

Station 032

283 (No Pressure)	Sample log: "Gerard did not drop messenger." Niskin tripped near surface - turnbuckle had worked loose. Level not reported, no samples.
284 (No Pressure)	Sample log: "Gerard did not trip." Level not reported, no samples.
2 (No Pressure)	Messenger hangup on 83, only Gerard 81/82/93 used. No therm rdgs except on 41/42/49.
Cast 3	Double ping at 3450mwo down; cast aborted.

Station 034

Cast 2	Sample log: "Aborted cast. No samples." Messenger hung on top barrel/fork off wire.
Cast 3	Sample log: "Aborted cast. No samples." 8 remaining barrels from Cast 2 sent back down. Pretrip/double ping.

Station 038

142 @2349db	Sample log: "Therms did not trip. Shorten pin on Niskin." Footnote temperature not drawn; Gerard (82).
182 @2349db	Footnote temperature not drawn; see piggy-back (42) thermometer comment. Sample log: "Check relief valve - did not seat well." Salinity and silicate are acceptable.
143 @2550db	Sample log: "Therms did not trip. " Gerard (83)
183 @2551db	See piggy-back (43) thermometer comment. Salinity and silicate are acceptable.
149 @2962db	Sample log: "Therms did not trip. " Footnote temperature not drawn; Gerard (85).
185 @2963db	Footnote temperature not drawn; see piggy-back (49) thermometer comment. Salinity and silicate are acceptable.
189 @3368db	Sample log: "Did not latch." Piggy-back (46). Salinity and silicate are acceptable. Other Gerard samples integrity to be determined by PI.
147 @3569db	Sample log: "Leaks when vent opened." Delta-S at 3569db is -0.0031, salinity is 34.706. Salinity and silicate is low, footnote samples bad, bottle leaked. Gerard (90) samples are acceptable.
190 @3569db	Gerard samples are acceptable, note from Sample Log appears to have effected only the piggy-back (47) samples.

Station 043

145 @2473db	Sample log: "Vent not tight." Therm post-tripped: T high/P low. Delta-S at 2473db is -0.1002, salinity is 34.615. Salinity and silicate low, footnote bottle leaking, temperature not drawn, salinity and silicate bad. Gerard (85) salinity and silicate acceptable.
185 @2473db	Gerard salinity and silicate acceptable, see piggy-back (45) thermometer comment.
147 @2769db	Sample log: "Vent not tight." Salinity and silicate acceptable for both piggy-back and Gerard (89).

Station 048

145 @2230db	Sample log: ""Therms?"" Therm post-tripped: T high/P low. Salt diffs look ok. Salinity differences are within the accuracy of the measurement. However, there is a .002 difference and the water should be similar. Based on the therm post-trip suspect that the piggy-back did trip later later than scheduled, footnote bottle leaking, and salinity and silicate uncertain, temperature not reported. Salinity and silicate slightly high compared to rosette data. Gerard (85) samples appear acceptable.
185 @2230db	Salinity and silicate are acceptable, see piggy-back (45) comments, appears to have post-tripped.

189 @2531db	Sample log: "Did not latch." Salinity and silicate are acceptable, Piggy-back (47).
148 @2680db	Sample log: "Niskin problem" No samples, Gerard (90) salinity and silicate acceptable.
190 @2680db	Salinity and silicate acceptable, see Piggy-back (90) tripping problem. Footnote temperature not drawn.
Station 056	
Cast 3	Sample log: "All look ok. Pinger switch stuck."
347 @2622db	Salinity is acceptable, Gerard (89).
389 @2622db	Sample log: "Gerard barrel did not latch." Salinity and silicate agree with rosette data, Piggy-back (47). Other Gerard samples integrity to be determined by PI.
143 @3803db	Therm post-tripped: T high/P low. Salt diffs look ok. Footnote temperature not reported. Gerard (83)
183 @3803db	Footnote temperature not reported; see piggy-back (43) temperature comment. Silicate appears slightly high, but salinity agreement is very good. Other Gerard samples integrity to be determined by PI.
145 @4316db	Therm reversed in air. Not read. Footnote temperature not drawn. Gerard (85)
185 @4316db	Footnote temperature not drawn; see piggy-back (45) thermometer comment.
147 @4572db	Sample log: "Spigot open." Salinity and silicate are acceptable; Gerard (87) also okay. Problem noted on Sample Log would not effect Gerard samples.
146 @4827db	Silicate a little low, but acceptable, Gerard (89) salinity and silicate acceptable.
189 @4828db	Sample log: "Gerard barrel did not latch." Salinity and silicate agree with rosette data, Piggy-back (46) silicate a little low, but acceptable. Other Gerard samples integrity to be determined by PI.
Station 073	
145 @2409db	Delta-S at 2409db is -0.1233, salinity is 34.601. Salinity and silicate too low, footnote bottle leaking and salinity and oxygen bad. Salinity and silicate for Gerard (85) are acceptable.
185 @2410db	Salinity and silicate are acceptable. Piggy-back (45) leaked.
189 @2817db	Sample log: "Gerard did not latch" Salinity and silicate are acceptable; Piggy-back (47).
148 @3021db	Sample log: "Salt bottle needs new plug." Salinity sample is acceptable, Gerard (90).
Station 080	
384 @2057db	Sample log: "Slight leak. Check o-ring and relief valve." Salinity and silicate are acceptable, Piggy-back (44). Other Gerard samples integrity to be determined by PI.
389 @2511db	Sample log: "Gerard did not latch." Salinity and silicate are acceptable, Piggy-back (47). Other Gerard samples integrity to be determined by PI.
348 @2663db	Sample log: "Plug on salt btl still bad." Salinity is a little high, but well within the accuracy of the measurement. Gerard (90).
141 @2936db	Sample log: "Bad therm?" Not clear if full return, but looks okay. Gerard (81)
Station 087	
Cast 3	Sample log: "Msg did not release on 83; 84-93 back down as cast 4.
445 @1884db	Footnote piggyback did not trip as scheduled and salinity and silicate bad. Footnote pressure bad, this is only for the piggy-back bottle. See Gerard (85) comments. Delta-S at 1884db is -0.0374, salinity is 34.538.
485 @1884db	Sample log: "Under pressure (pre/post trip? or leak?) - Check pressure relief valve." Based on thermometer, salinity and silicate, piggyback (45) appears to have tripped ˜400 m

shallower than scheduled (2100m), and Gerard tripped ˜300 m shallower than scheduled. With corrections made to data samples appear much better, however, other Gerard samples integrity to be determined by PI. Also compared LVS data to rosette data and Gerard data "fits" very well.

141 @3054db	Sample log: "Therm rack needs stronger spring." This comment would not affect the Gerard (81) samples. Leave as is and will not code.
147 @4433db	Sample log: "Leaks" Suspect Gerard (89) okay and piggyback has a slight problem as indicated by Sample Log comment. Footnote bottle leaking, salinity and silicate bad.
189 @4433db	Sample log: "No latch." Salinity and silicate checks appear to be okay, piggyback (47). Suspect Gerard samples okay and 47 has a slight problem as indicated by Sample Log comment.
Station 095	
345 @2041db	Sample log: "Leaky." Salinity and silicate are acceptable as are Gerard (85).
347 @2339db	Sample log: "Very leaky." Delta-S(n-g) at 2340db is -0.0011 and acceptable, silicate also agrees very well with Gerard (89) and rosette cast data.
389 @2339db	Salinity and silicate are acceptable; Piggy-back (47)
390 @2488db	Sample log: "Did not release msg. Could be turnbuckle or a fluke." Salinity and silicate are acceptable; Piggy-back (48).
141 @2769db	Sample log: "Replace spring on therm rack 1." Gerard (81)
145 @3780db	Footnote salinity, silicate and temperature bad, bottle leaking. Piggy-back could have leaked, but Gerard (85) are acceptable. ODF recommends deletion of piggy-back samples. Delta-S(n-g) at 3780db is -0.0024, salinity is 34.701.
185 @3780db	Sample log: "Pretrip?" Salinity and silicate are acceptable. Appears that piggy-back (45) had problems. Footnote temperature bad. ODF recommends deletion of temperature.
189 @4279db	Sample log: "Salt btl needs new plug." Salinity agrees with Piggy-back (47) -.0013, silicate acceptable. Suspect Gerard samples okay.
Station 105	
447 @2566db	Sample log: "Only therms tripped" Gerard (89) samples are acceptable.
489 @2567db	Sample log: "Did not latch." Salinity and silicate appear to be okay. See piggy-back (47) comment. Other Gerard samples integrity to be determined by PI.
143 @3660db	Niskin Mistrip: therm pressure/temp from much nearer to surface. Delete therm readings. Footnote temperature not reported Salinity and silicate are acceptable; Gerard (83) also acceptable.
183 @3661db	Footnote temperature not reported; see Piggy-back (43) comments.
185 @4171db	Sample log: "Did not release msg." Salinity and silicate are acceptable, Piggy-back (45).
282 @4660db	Sample log: "Salt btl 16 needs new plug." Salinity appears acceptable; Piggy-back (47).
248 @4920db	Niskin Mistrip: therm pressure/temp from near-surface; delete therm rdgs. Delta-S at 4920db is -0.465, salinity is 34.246. Gerard (83) appears to have tripped okay. Footnote bottle leaking, temperature not reported, salinity and silicate bad.
283 @4921db	Footnote temperature not reported, Gerard samples acceptable; see piggy-back (48) comments.
249 @5173db	Delta-S at 5173db is 0.007, salinity is 34.718. Gerard (84) appears to be okay. Footnote salinity bad.
284 @5173db	Gerard samples acceptable; see comments piggy-back (49).

Station 113	
Cast 1	Sample log: "Nut & salt numbers "backward" draw. Sheet is correct." Data okay.
343 @1808db	Delta-S at 1808db is -0.0039, salinity is 34.599. Gradient area, salinity and silicate are acceptable; Gerard (83).
383 @1809db	Gradient area, salinity and silicate are acceptable; Piggy-back (43).
384 @1960db	Sample log: " Leaks - check o-ring and air vent." Salinity and silicate are acceptable; Piggy-back (44). Other Gerard samples integrity to be determined by PI.
347 @2415db	Sample log: " Leaks - check spring and o-rings." Salinity and silicate appear to be acceptable; Gerard (89).
389 @2415db	Salinity and silicate appear to be okay; see piggy-back (47) comments.
141 @2934db	Sample log: "Leaky." Salinity and silicate are acceptable; Gerard (81) appears to be okay.
143 @3392db	Sample log: "Did not trip." Gerard (83).
183 @3392db	Sample log: "Did not latch." Salinity and silicate appear to be okay; see piggy-back (43) temperature comment. Other Gerard samples integrity to be determined by PI.
145 @3849db	Delta-S at 3849db is -0.0381, salinity is 34.662. Salinity too low, silicate too high, footnote salinity and silicate bad, bottle leaking. Gerard (85) salinity and silicate are acceptable.
185 @3849db	Salinity and silicate are acceptable; piggy-back (45).
189 @4306db	Sample log: "Did not latch." Salinity and silicate are acceptable; Piggy-back (47). Other Gerard samples integrity to be determined by PI.
Station 119	
182 @2106db	Sample log: "Bubbles in hose when pumping." Check plumbing at barrel. Salinity and silicate are acceptable; piggy-back (42). Other Gerard samples integrity to be determined by PI.

DQ EVALUATION OF JUNO I (KNORR CR. 138/9) P16A/P17A HYDROGRAPHIC DATA

(A. Mantyla)
8 Aug. 96

In spite of the many rosette trip problems that resulted in numerous unfortunate data gaps the quality of the data is, for the most part, quite good. The use of a 36 place rosette made the loss of data less serious than it would have been if only a 24 place rosette had been used. Only 4 stations (7,12,19, and 110) out of 127 occupied were major "busts" for water sampling, but each did have complete full depth CTD data available. The data originators have done a thorough job in evaluating the data, and in resolving inadvertent shifts in rosette bottle tripping sequences that result from mis-fires, hang-ups, or double-trips. In some cases the data originators flagged bottle codes "4" to indicate that the bottle did not trip where planned, although all of the water sample data is okay and confirmed by CTD salinity and oxygen comparisons. For the most part, I have changed those codes to "2" because the data really is okay, even though the CTD operator did not initially know which bottle they were tripping. Because many data users automatically throw out any data flagged 3 or 4, it would be a shame to have data not used that is really okay. Stations 10 and 56 are good examples. I have left the "4" code at double trip levels on the extraneous trips (where bottle 13 tripped with bottle 36, adjacent rosette slots, for example).

I feel that they were a little over-zealous in the use of the "sample is bad" code. There are clear cases of leakers that are clearly wrong and should be flagged bad. But in other cases where data is only slightly questionable, I have changed the code from "bad" to "uncertain", or even to okay when the apparent error is within WOCE precision tolerances.

The CTD data processors noted that the CTD O2 data assigned to the bottle trips are actually from the down profile (taken at the same density level as the bottle data) and are often poor near the surface. I agree, and have flagged obvious cases as questionable data.

The numerous double-trips in the latter part of the cruise have been properly resolved, but the CTD data at the missed levels have not been saved. In a discrete data set archive that is usually used separate from high resolution CTD data sets, it would be valuable to leave in the trip information for better vertical resolution of at least the T and S (and the density) profile. I recommend the delete data gaps be restored with the corrected CTDO2 trip information.

I have not made detailed comparisons of this cruise with crossings of other cruises because I understand that is being done in a rigorous fashion by someone else. However, there doesn't appear to be any serious discrepancies between the duplicated stations occupied by both JUNO and TUNES, aside from surprisingly large seasonal differences in the surface waters.

On station 35, bottle 13 listed at 695db is bad there, but would be okay listed at the bottom with the CTD data from bottle 36, as done on several stations later in the cruise. I suggest that be done, changing the bottle code from 3 to 4 and the "4" sample codes to "2"; and leave the CTD information at 695db with a fake bottle number.

On station 73, there appears to be oxygen sample drawing problems, although not as severe as indicated by the originators "bad" codes between 1006 and 2216db. Comparisons of oxygen versus density plots of this and the bracketing stations indicate that most of the oxygens are okay, and only the ones from 1209db (probably drawn from 1307db) and 2216db (probably drawn from 2065db) are questionable. I have changed the quality flags accordingly and would recommend the CTDO2 fit be redone.

In spite of the problems arising from trip uncertainties, the analytical results (salinity, oxygen, and especially the nutrients) were as good as any that I've seen. It was unfortunate that the ship scheduling pushed the cruise into the wrong season, making it impossible to get closer to Antarctica.

Data Quality Evaluation Report for CTD Data: WOCE legs P16A and P17A
(Bob Millard)
December 11, 1996

WOCE hydrographic sections P16A and P17A, collected south of Tahiti along 150W and 135W to the Antarctic ice, are examined in this report. The overall potential temperature versus salinity plot of figure 1 shows the range of potential temperature variation from below -1.5 to 26 C while the salinity varies from 33.75 to 36.3 psu. The oxygens values range from 155 to 330 µmol/kg, as the potential temperature versus oxygen plots of figure 2 indicates. All of the 2 decibar CTD temperature, salinity and oxygen observations and those water sample data marked as good in the bottle file are displayed in figures 1 and 2. As a more detailed examination of the CTD data shows, these data are very well calibrated to the water samples and in general free of spurious observations. The only apparent oddity seen in these overall plots is the high surface oxygen of station 65 which is examined later.

The cruise report contains good descriptions of the instrument calibration methods in the laboratory and at sea as well as the general CTD data processing methods along with adaptions made for this data set to obtain the 2 decibar CTD profiles. These descriptions closely follow write-ups for other Scripps cruise reports. The laboratory pressure calibration description gives some standards pressure values in psi while the CTD measurements are reported in decibars. I would keep all pressures in units of decibars. I was confused by the method use to correct the station varying CTD conductivity calibrations. It is described as first applying a station dependent slope adjust (in some cases) and then following with a station dependent conductivity bias Ue. stations 85-127). I agree with correcting the conductivity drift from station to station by varying the conductivity slope as this models the conductivity cell dimensions changing. It seems redundant to then further adjusted in some cases (like stations 85-127) with a station by station conductivity bias in the deep water. Does this imply that a slight vertical calibration error remains after the best fit conductivity slope was applied which is corrected by the conductivity bias adjustment? The resultant CTD salinities appear well well behaved in the vertical as discussed next.

A check of the CTD salinity calibrations for up-profile bottle file samples is given in figure 3 a, b, and c. Figure 3a shows salinities differences (all differences are CTD-Water Sample value CWSI) for those WS data marked good in the quality word for all pressure levels. Only a few values in stations 54, 61, 64, 121 appear to be excessively large. Further checking shows all of these occur in high salt gradient regions where large differences can occur. Figure 3b shows the good salinities differences below 1000 decibars with the station average (solid line) close to the zero line. The standard deviation for all the good deep water salinity differences below 1000 dbars is low (0.001 psu). The station average line plotted on figure 3b suggested that only a few stations (28, 55, and 92) might have deep salinity calibration problems. These stations are looked at more closely using offset (waterfall) plots of salinity difference versus pressure and also potential temperature versus salinity plots. Figure 3c is a plot of salinity differences versus pressure which indicates that the CTD salinity data for these WOCE legs are very well calibrated in the vertical.

Waterfall plots of salinity differences versus pressure offset and labelled with station numbers are shown in figure 4a, b, & c, for stations groups around the stations 28, 55, and 92 questioned earlier. These plots reinforce the possibility of a salinity calibration error in the CTD but difference plots can't sort out whether the CTD or bottle salinity is in error. Figure 5 plots potential temperature versus salinity for stations around 28 and it appears that the CTD salinity is salty. The same Theta/S plot (figure 6) for stations around 55 clearly shows that most bottle salts of station 55 are fresh below 1 C and finally the theta/S for stations around 92 (figure 7) indicates that the CTD salts are high.

Overall and deep water (pressures greater than 2000 dbars) histograms of salinity and oxygen differences (CTD-WS) are given in figure 8. The salinity differences below 2000 dbars have an extremely good standard deviation (0.001 psu) and mean difference indicating careful bottle salinity quality control and CTD calibration. The oxygen differences below 2000 dbars also show a low standard deviation of 0.78 µmol/kg and mean difference of zero again indicates careful bottle oxygen quality control and CTD calibration.

A comparison of the station to station CTD oxygen calibrations to the bottle oxygens (CTD-WS µmol/kg) is shown in figures 9a and b. Oxygen differences at depths greater than 1000 decibars are extremely tight around the zero line with no stations standing out except for one observation level of station 34. The vertical calibration of the CTD oxygens appears well behaved as indicated in figure 9c. There is one large difference at about 4500 decibars which also belongs to station 34. A theta/oxygen plot (figure 10) of stations 32 to 37 shows the CTD down and up (o) deep oxygens (theta less than .8 C) to be high. Figure 11 shows the oxygen differences for these same stations plotted versus pressure with the CTD oxygen drifting progressively higher below 4100 decibars. The 2 decibar CTD data should to be flagged questionable below 4100 dbars for station 34. Station 34's 2 dbar oxygens appear noisy in the deep water compared to neighboring stations. This seems to be confirmed in the high-pass filtered noisy summary shown in figure 12.

Noise Checks for spurious salinity and oxygen values:

An evaluation of the CTD salinity and oxygen noise levels with checks for spurious data values. To check for spurious salinity and oxygen observations in the 2 decibar CTD data the standard deviation of the high-pass filtered oxygen and salinity with wavelengths between 4 and 25 decibars is summarized in the deep water depth ranges to the cast bottom. The standard deviation (scatter) is plotted versus station for several depth intervals from the bottom to the surface. Figure 12a, & b shows the standard deviation of salinity (12a) and oxygen (12b) from 3000 dbars to the bottom of the cast. The station bottom pressure is shown in figure 12c. Note some station don't go to 3000 dbars and the are left blank on plot 12 a & b. The average salinity scatter (0.00023 psu) is indicated on the plot and includes stations with higher levels of scatter (see stations 21, 36, and 84-90).

Upon further examination these anomalies were found to be real; associated with salinity finestructure in the deep waters as shown in figure 13. The salinity noise level (minimum, scatter) is approximately 0.0002 psu (see stations in 30's, upper 50's and 130's). Excessive oxygen noise in figure 12b is seen for stations 25-27, 34, and 53 which appears to be instrumental. Station 34 was observed earlier (figure 11) to exhibit some added oxygen noise over neighboring stations. Figure 14 shows a plot of oxygens versus pressure for stations 24 to 27. Bursts of oxygen noise are observed to always be towards lower oxygen for stations 25-27. This might be lowering rate induced (a slower lowering rate equals lower oxygen values) as the oxygen sensor is flow rate sensitive. The station 53 oxygen profile also shows oxygen spikes towards lower values as can be seen in figure 15. The average oxygen standard deviation is 0.22 µmol/kg which is close to the observed oxygen noise level (minimum) of slightly less than 0.2 µmol/kg. The observed CTD noise levels from other data sets examined have ranged in salinity from 0.0001 to 0.0003 psu and in oxygen from 0.08 µmol/kg to 0.35 µmol/kg. Both the salinity and oxygen deep water standard deviations for P16A and 17A are at the lower end of these previously observed noise values ranges.

The extremes values of the high-passed filtered salinities oxygens are shown in figures 16a & c with the pressure level that they occur shown in figure 16b. Only one extreme value was found to be a data problem, the low (.12 psu) surface salinity of station 10, as can be seen in figure 17. The high surface oxygen values of station 65 noted in figure 2 are plotted versus pressure in figure 18 together with neighboring stations. Station 65 is 20 µmol/kg higher than both the surface water sample oxygen and neighboring oxygens suggesting that the 2 dbar CTD oxygens from 0 to 40 dbars should be flagged as questionable.

Vertical stability checks:

A check for density inversions provides additional information about spurious salinity and/or temperature values particularly in the near surface region where this method provides a more sensitive test than looking at the high wave number salinity variability. The vertical gradient of potential density (determined by computing the first difference of density) is calculated and checked for decreases in density with depth exceeding one of two thresholds : (-0.005 and -0.0075 kg/m3). The P16A/17A CTD data has very few questionable data using the vertical stability criteria compared with other data sets reviewed. A plot of the 8 points flagged are given in figure 19. All are in the higher gradient region of the upper 250 decibars. The salinity of station 33 appears to be .025 psu to high from the surface to 4 decibars (see figure 20) and there is a temperature inversion of 0.075 C between 4 and 6 dbars that may not be real (figure 21). Table 1 are the density inversion values plotted on figure 19 together with station number and pressure.

Table 1 Density inversions in 2 dbar CTD data

Dsg/Dp < -0.005 kg/dbar		
Dsg/Dp	station	pressure dbars
-8.0205450e-003	33.	0.0
-5.1842380e-003	33.	2.0
-6.5631825e-003	73.	160.
-6.5502019e-003	73.	166.
-9.0889441e-003	105.	2.0
-5.1686410e-003	110.	222.
-5.7039556e-003	122.	100.
-5.1416392e-003	122.	196.

Dsg/Dp < -0.0075 kg/dbar		
Dsg/Dp	station	pressure dbars
-8.0205450e-003	33.	0.0
-9.0889441e-003	105.	2.0

Figure 1

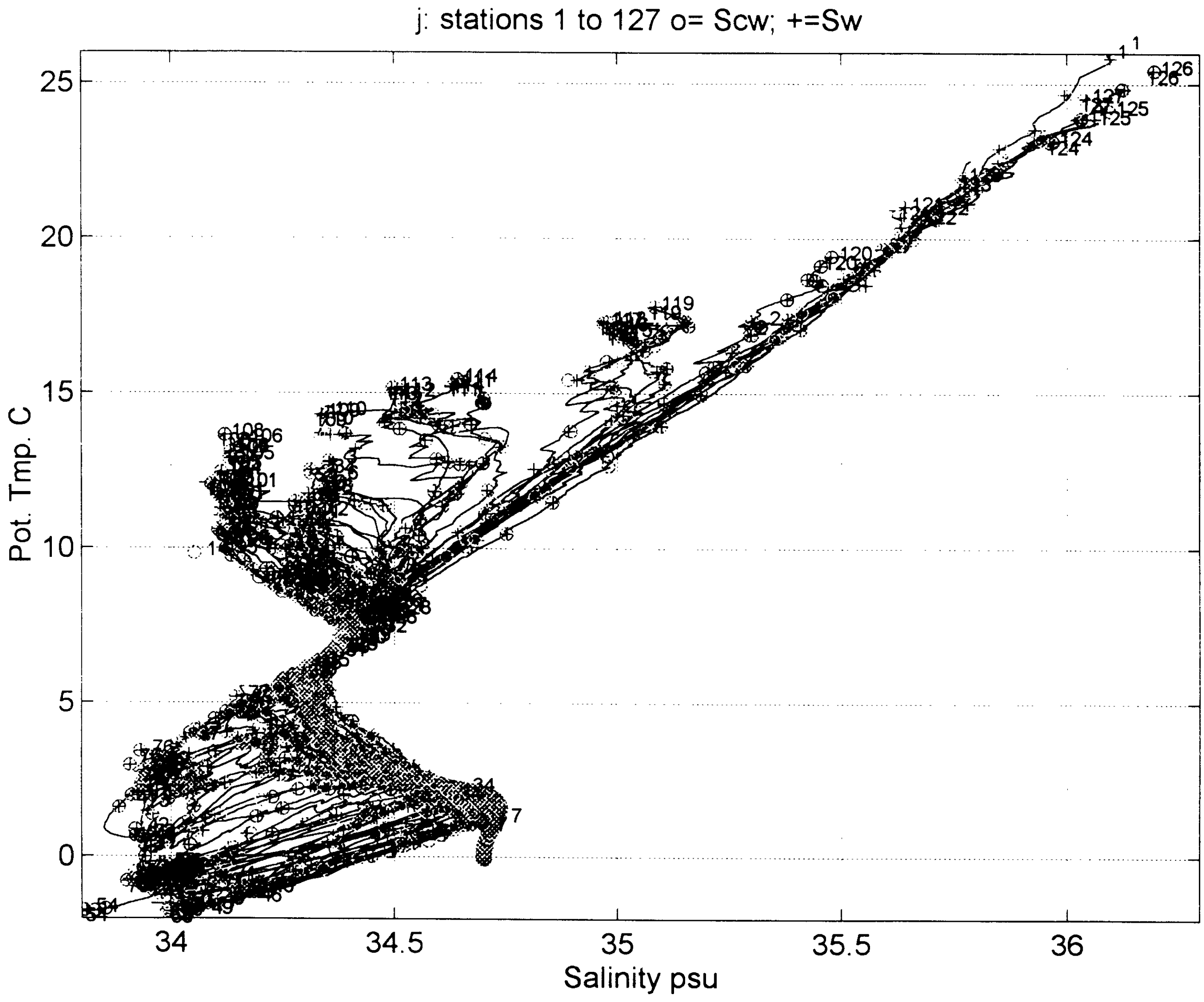


Figure 2

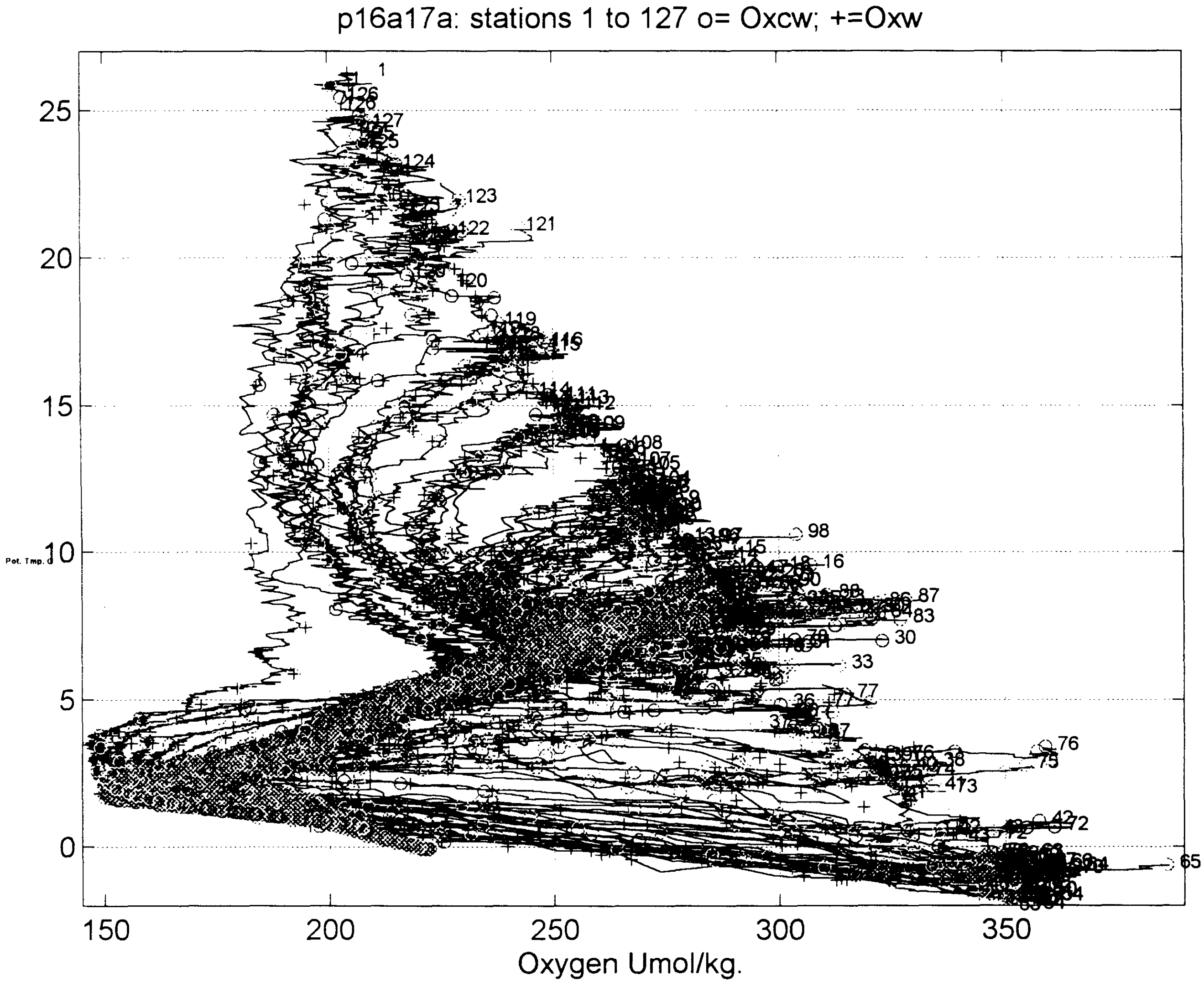


Figure 3

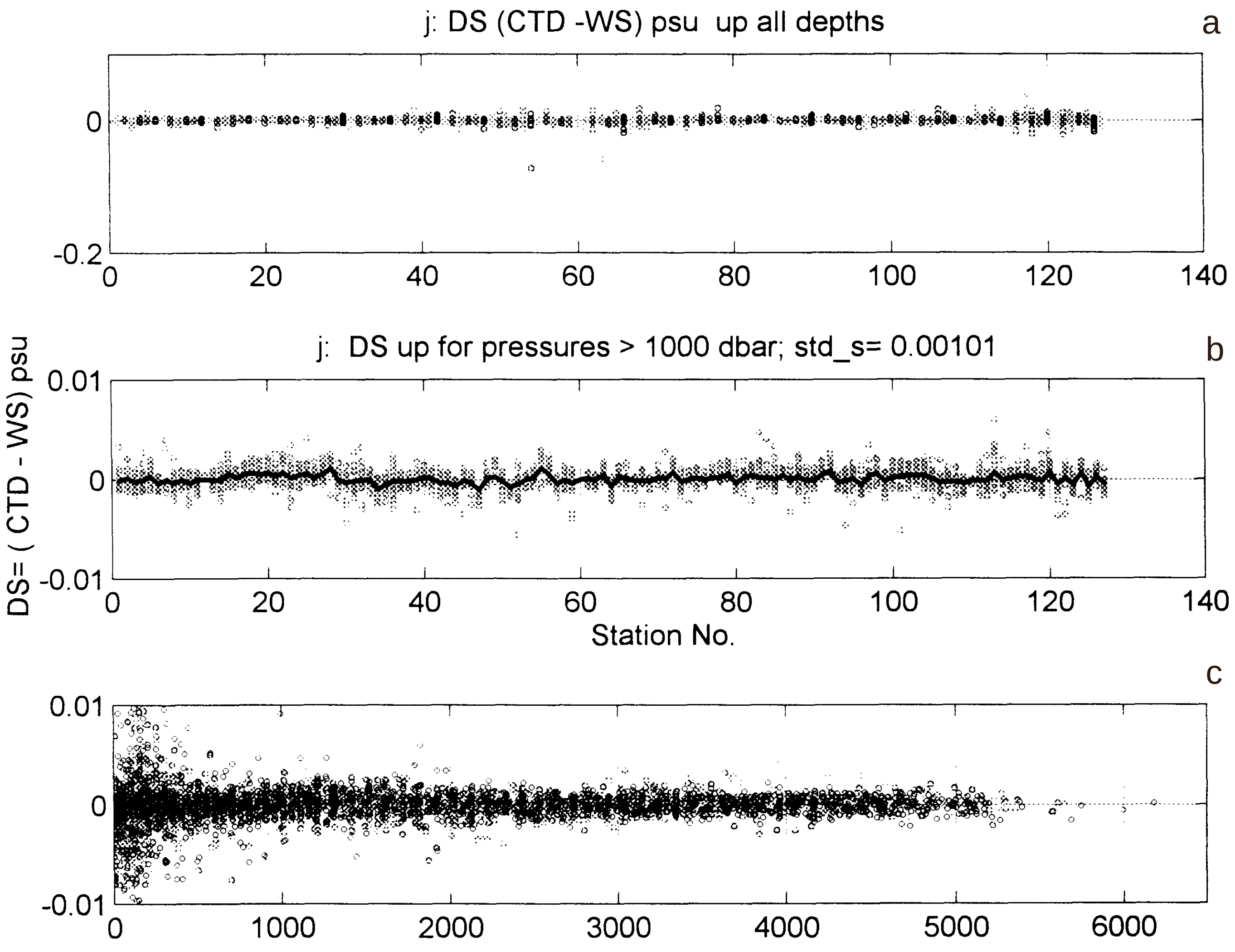
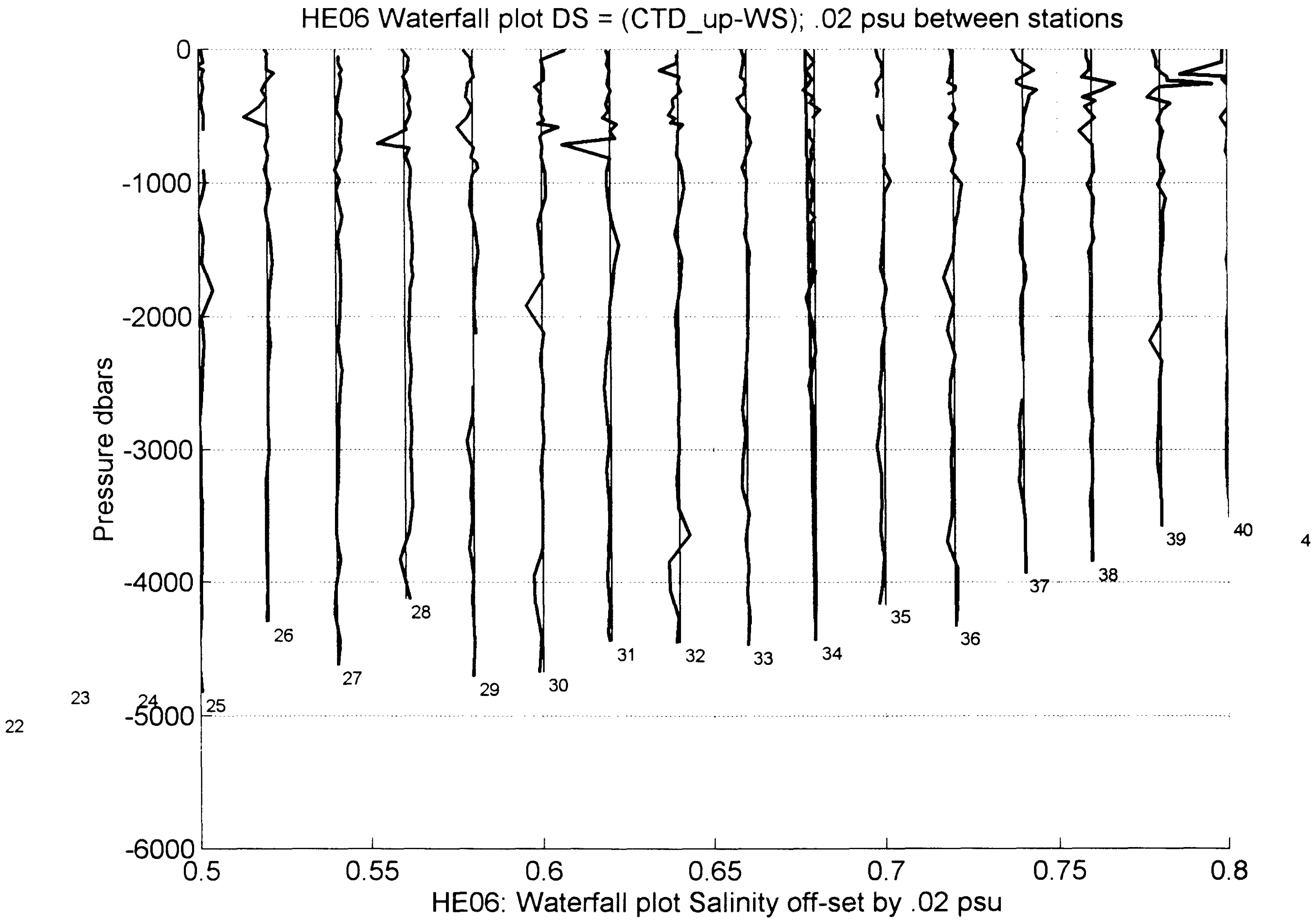

j: DS (CTD -WS) psu up all depths
a
0
-0.2
0
20
40
60
80
100
120
140
j: DS up for pressures > 1000 dbar; std_s= 0.00101
b
DS= (CTD - WS) psu
0.01
0
-0.01
Station No.
c
1000
2000
3000
4000
5000
6000

Figure 4a



HE06 Waterfall plot DS = (CTD_up-WS); .02 psu between stations
Pressure dbars
0
-1000
-2000
-3000
-4000
-5000
-6000
0.5
0.55
0.6
0.65
0.7
0.75
0.8
HE06: Waterfall plot Salinity off-set by .02 psu
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
4

Figure 4b

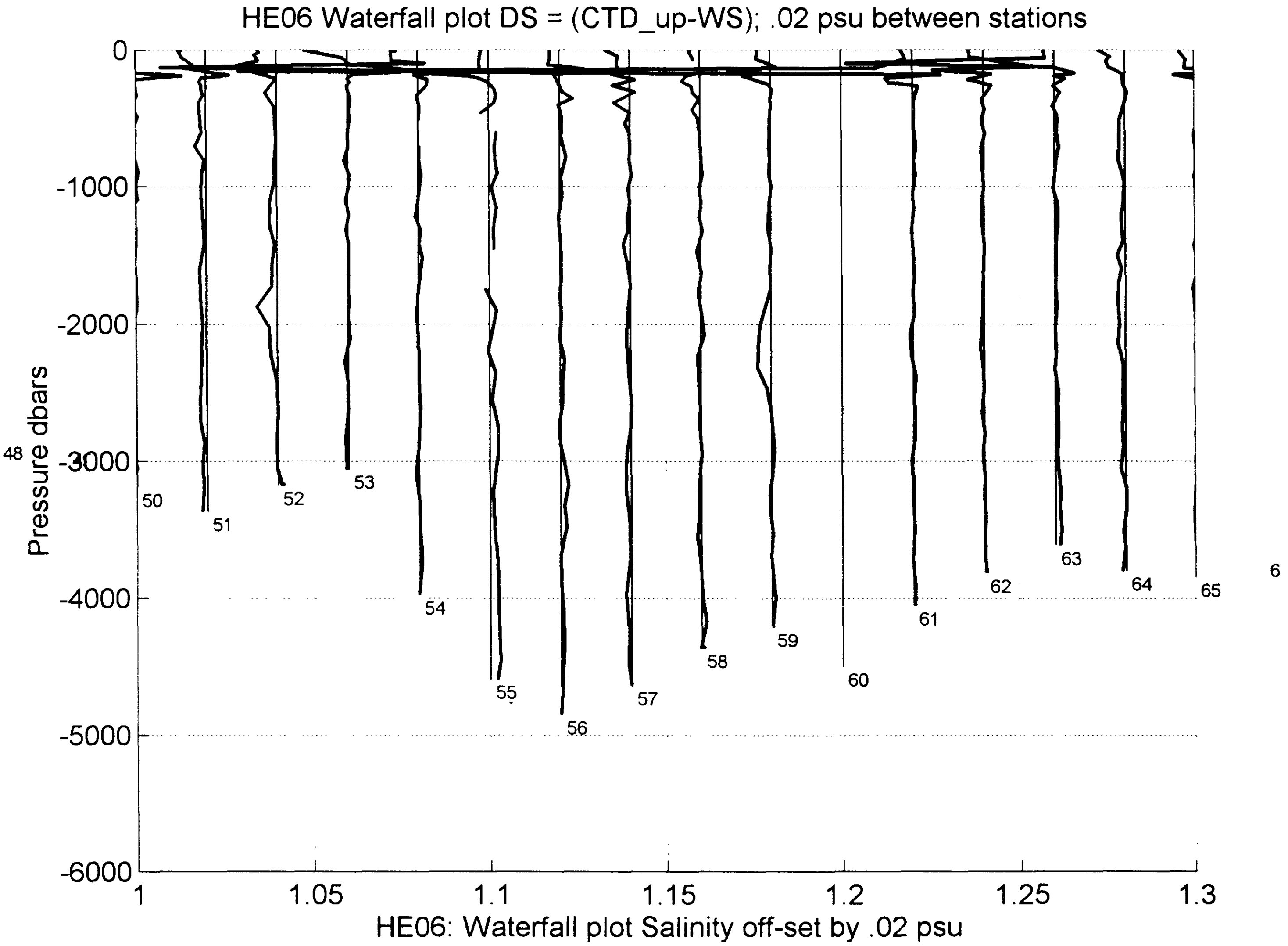
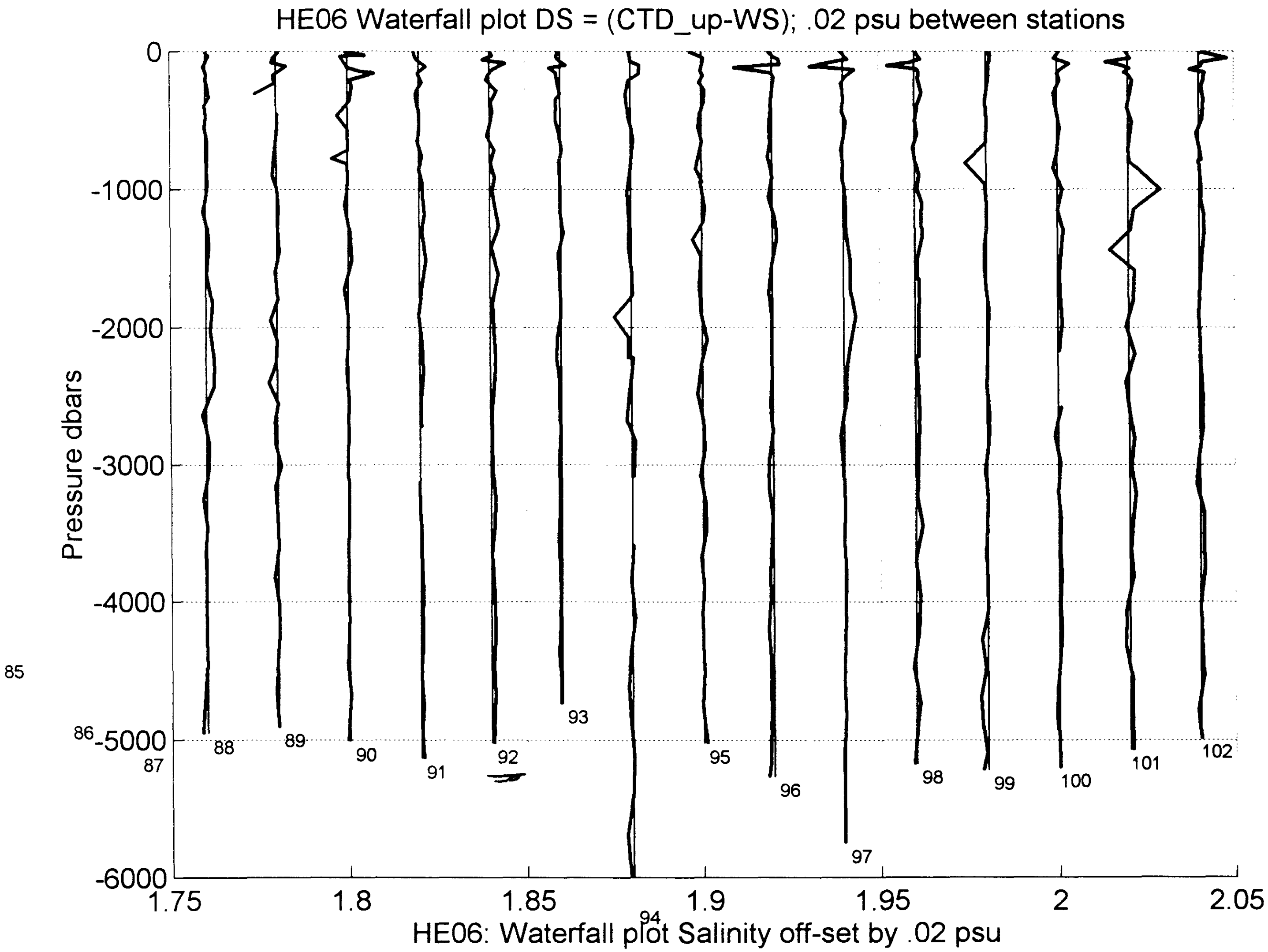
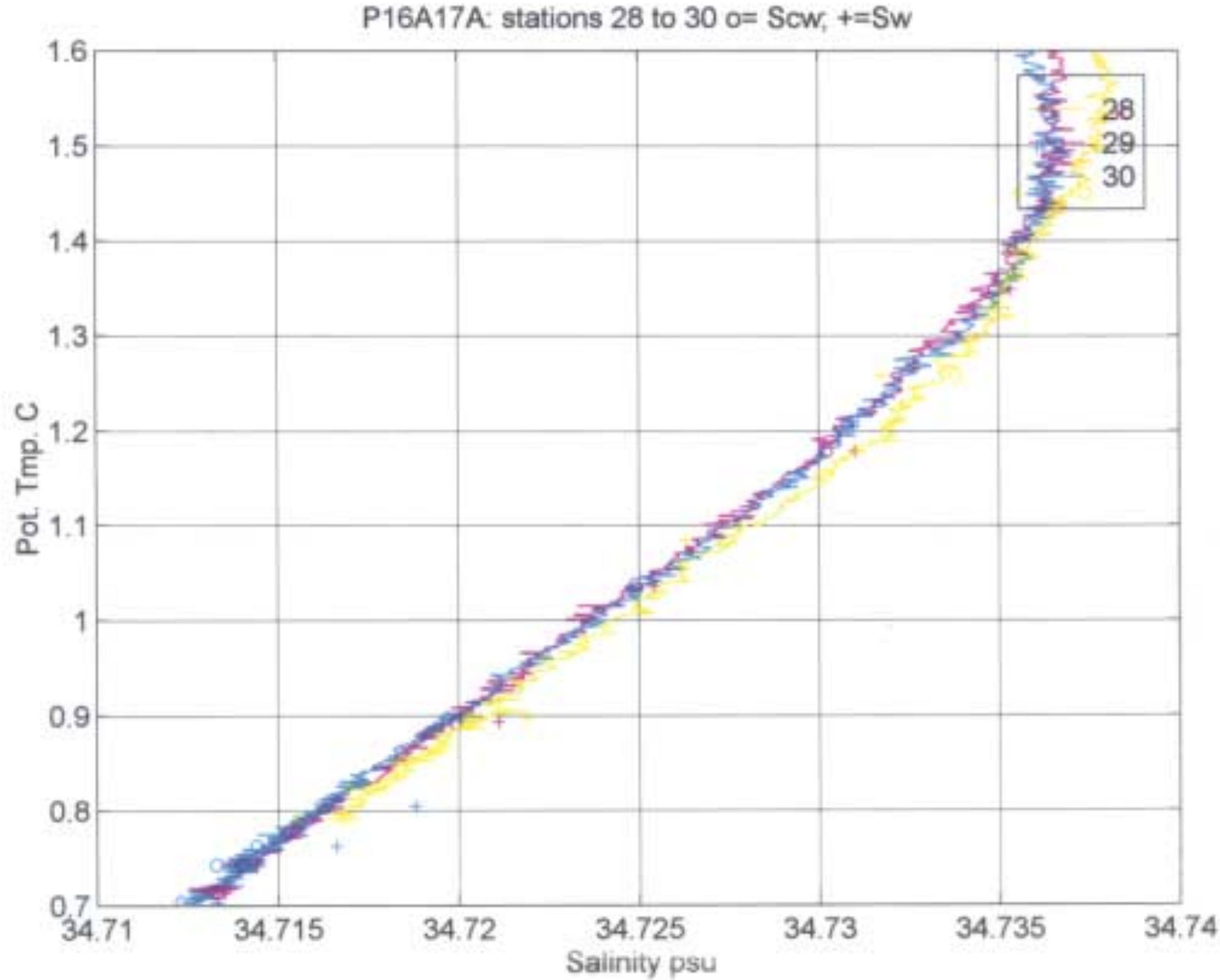

HE06 Waterfall plot DS = (CTD_up-WS); .02 psu between stations
Pressure dbars
0
-1000
-2000
-3000
-4000
-5000
-6000
1
1.05
1.1
1.15
1.2
1.25
1.3
48
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
6
HE06: Waterfall plot Salinity off-set by .02 psu

Figure 4c



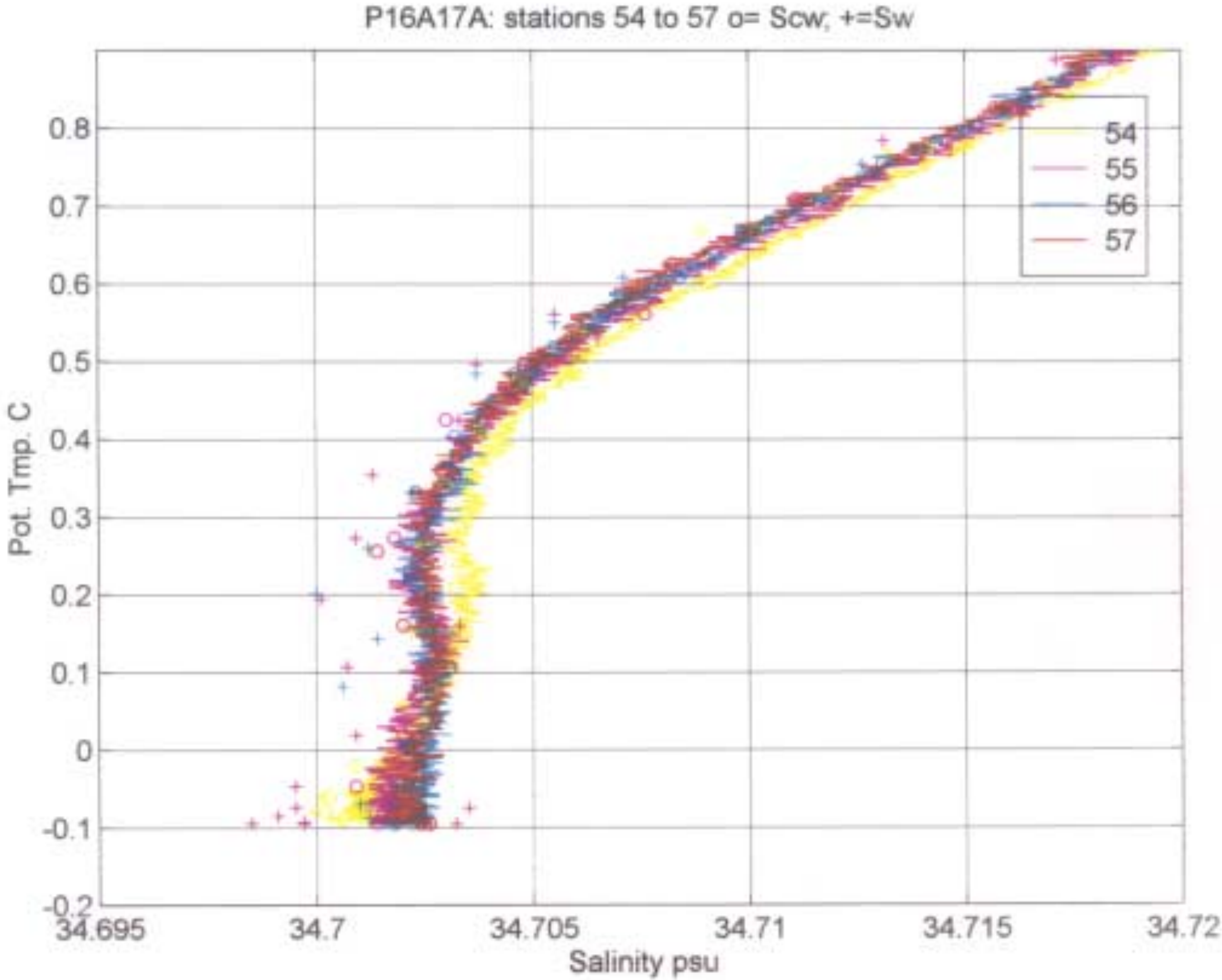
HE06 Waterfall plot DS = (CTD_up-WS); .02 psu between stations
Pressure dbars
0
-1000
-2000
-3000
-4000
-5000
-6000
1.75
1.8
1.85
1.9
1.95
2
2.05
HE06: Waterfall plot Salinity off-set by .02 psu
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103

Figure 5



P16A17A: stations 28 to 30 o= Scw; +=Sw
Pot. Tmp. C
Salinity psu
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
34.71
34.715
34.72
34.725
34.73
34.735
34.74
28
29
30

Figure 6



P16A17A: stations 54 to 57 o= Scw; +=Sw
Pot. Tmp. C
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
34.695
34.7
34.705
34.71
34.715
34.72
Salinity psu
54
55
56
57

Figure 7

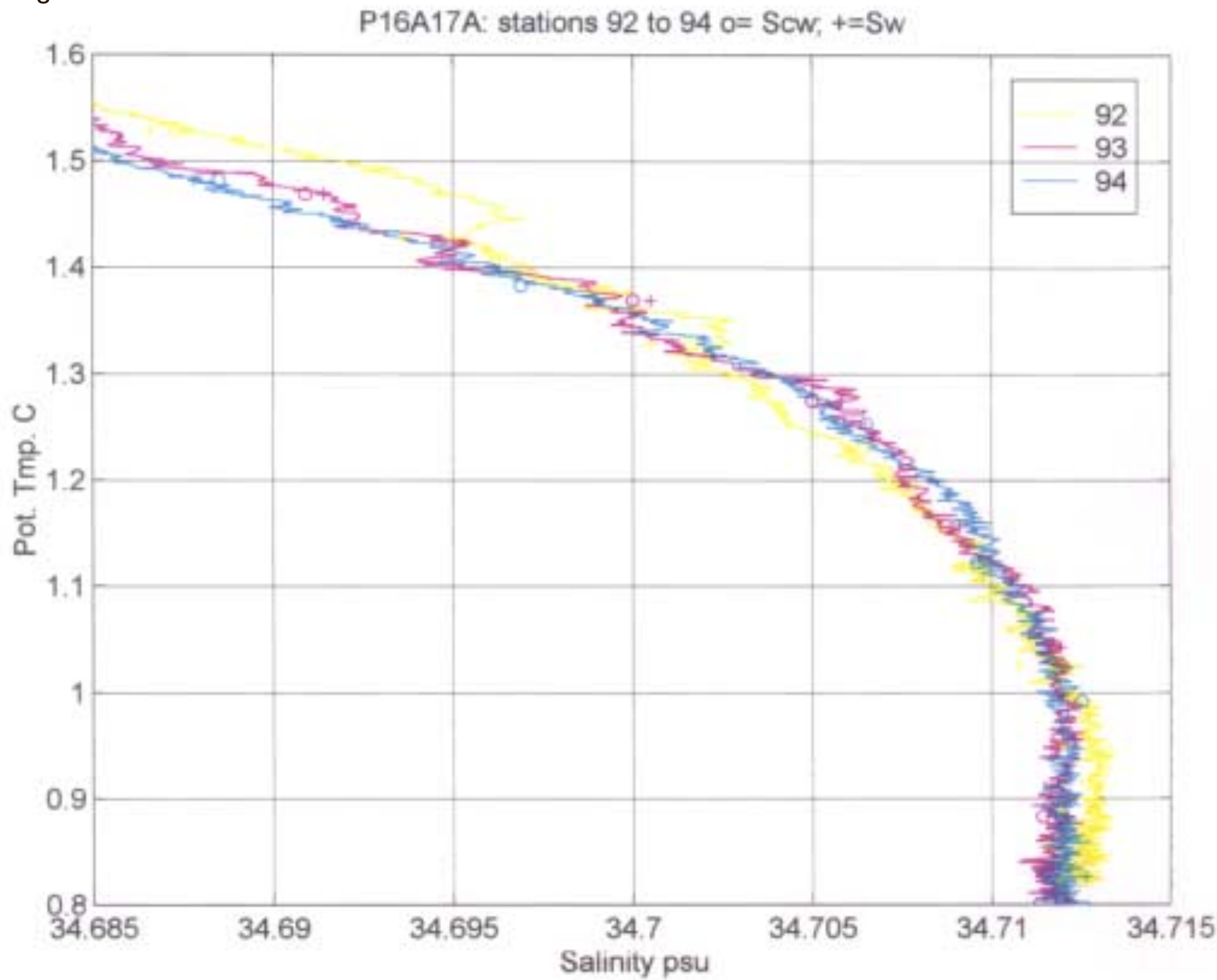
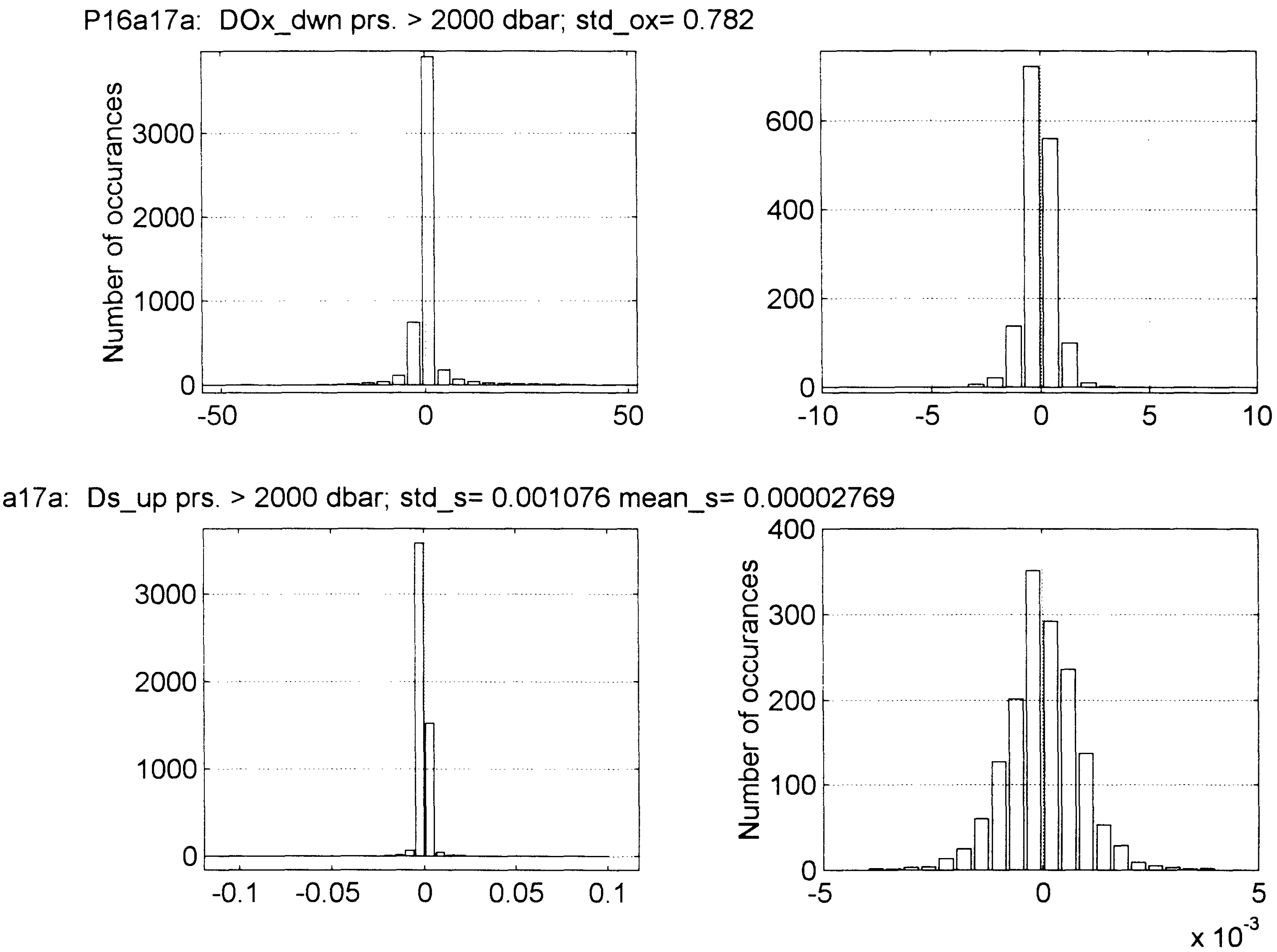
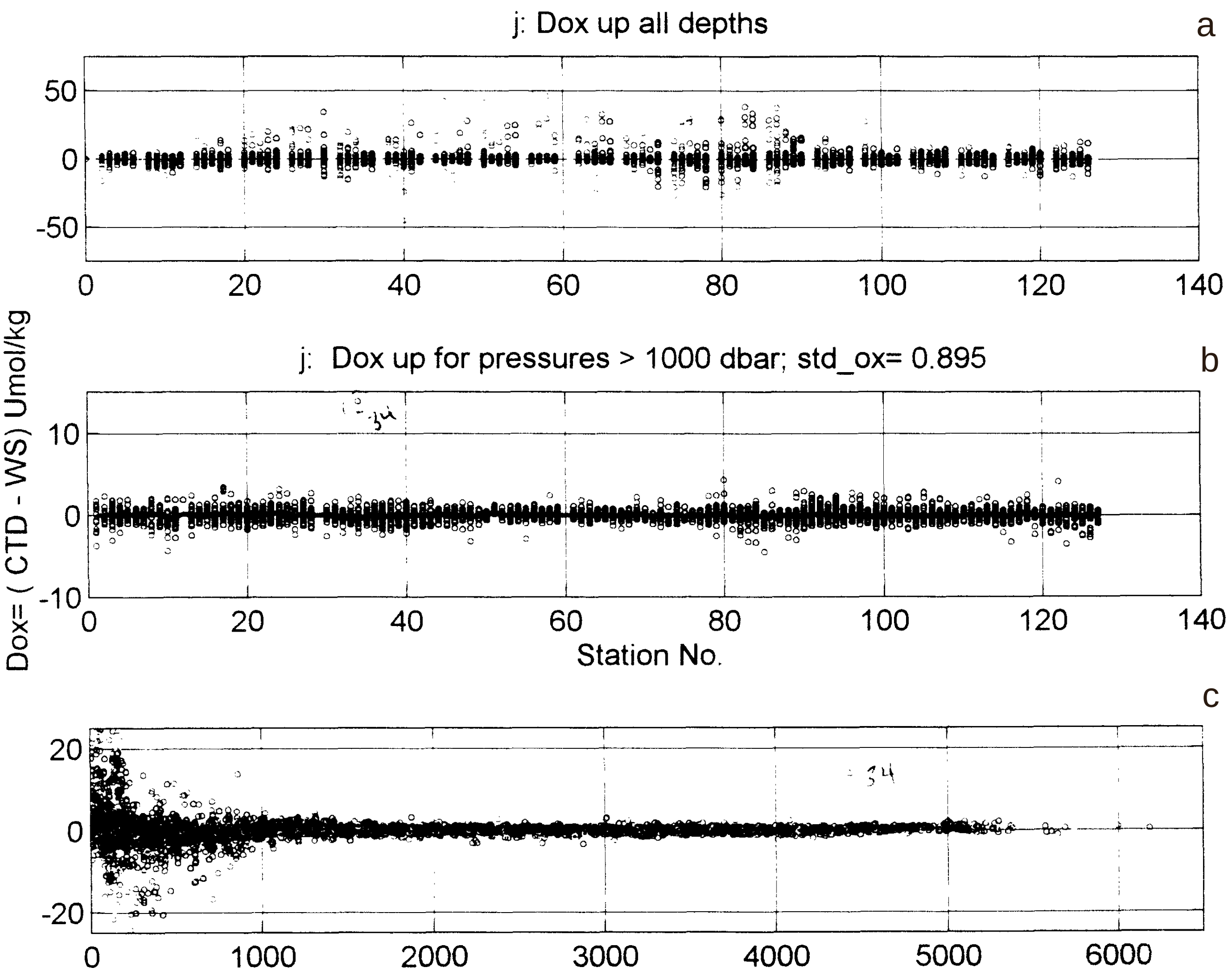

P16A17A: stations 92 to 94 o= Scw; +=Sw
Pot. Tmp. C
Salinity psu
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
34.685
34.69
34.695
34.7
34.705
34.71
34.715
92
93
94

Figure 8



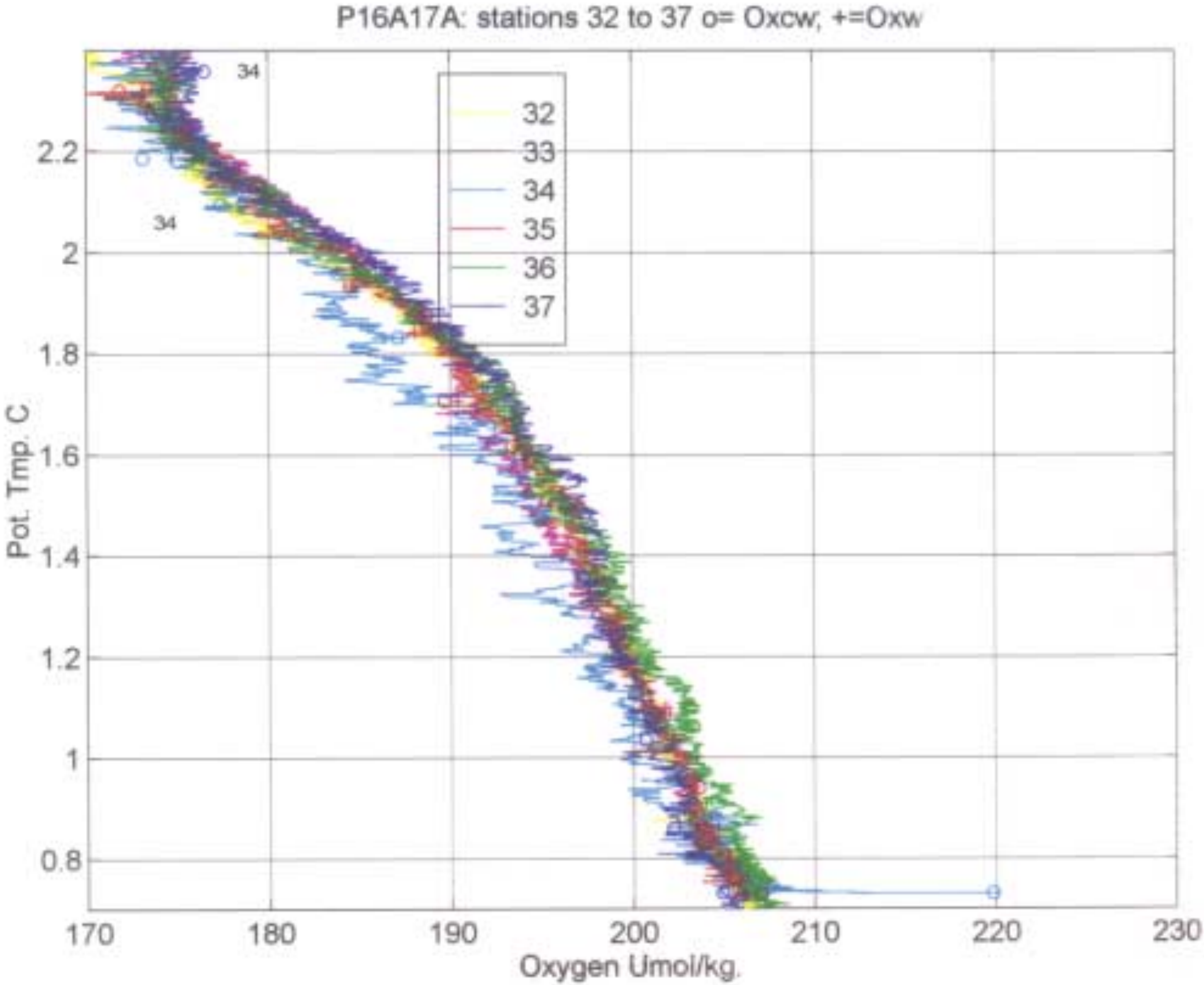
P16a17a: DOx_dwn prs. > 2000 dbar; std_ox= 0.782
Number of occurances
0
1000
2000
3000
-50
0
50
0
200
400
600
-10
-5
0
5
10
a17a: Ds_up prs. > 2000 dbar; std_s= 0.001076 mean_s= 0.00002769
0
1000
2000
3000
-0.1
-0.05
0
0.05
0.1
Number of occurances
0
100
200
300
400
-5
0
5
x 10^-3

Figure 9



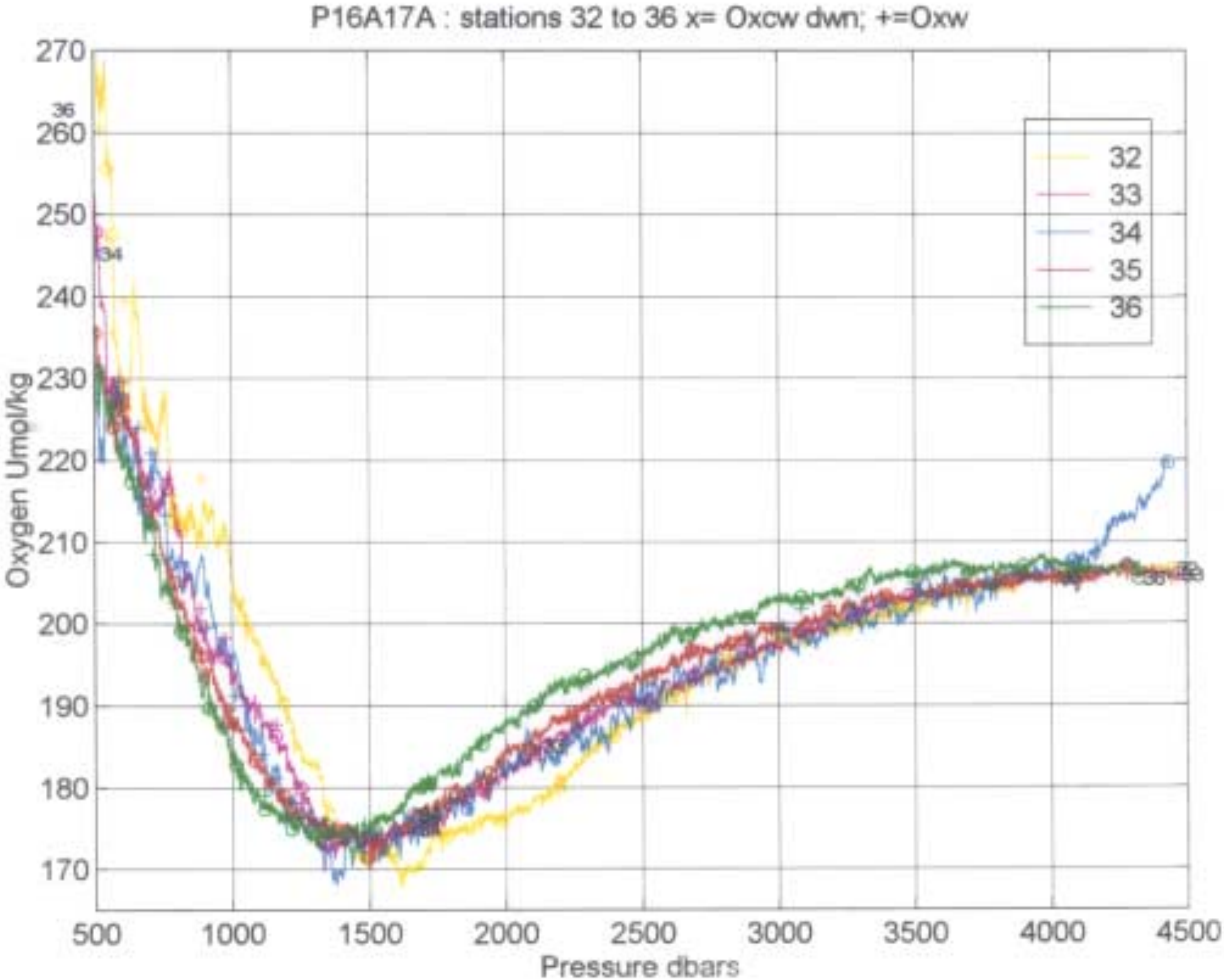
j: Dox up all depths
a
50
0
-50
0
20
40
60
80
100
120
140
j: Dox up for pressures > 1000 dbar; std_ox= 0.895
b
10
0
-10
Station No.
Dox= (CTD - WS) Umol/kg
c
20
0
-20
0
1000
2000
3000
4000
5000
6000

Figure 10



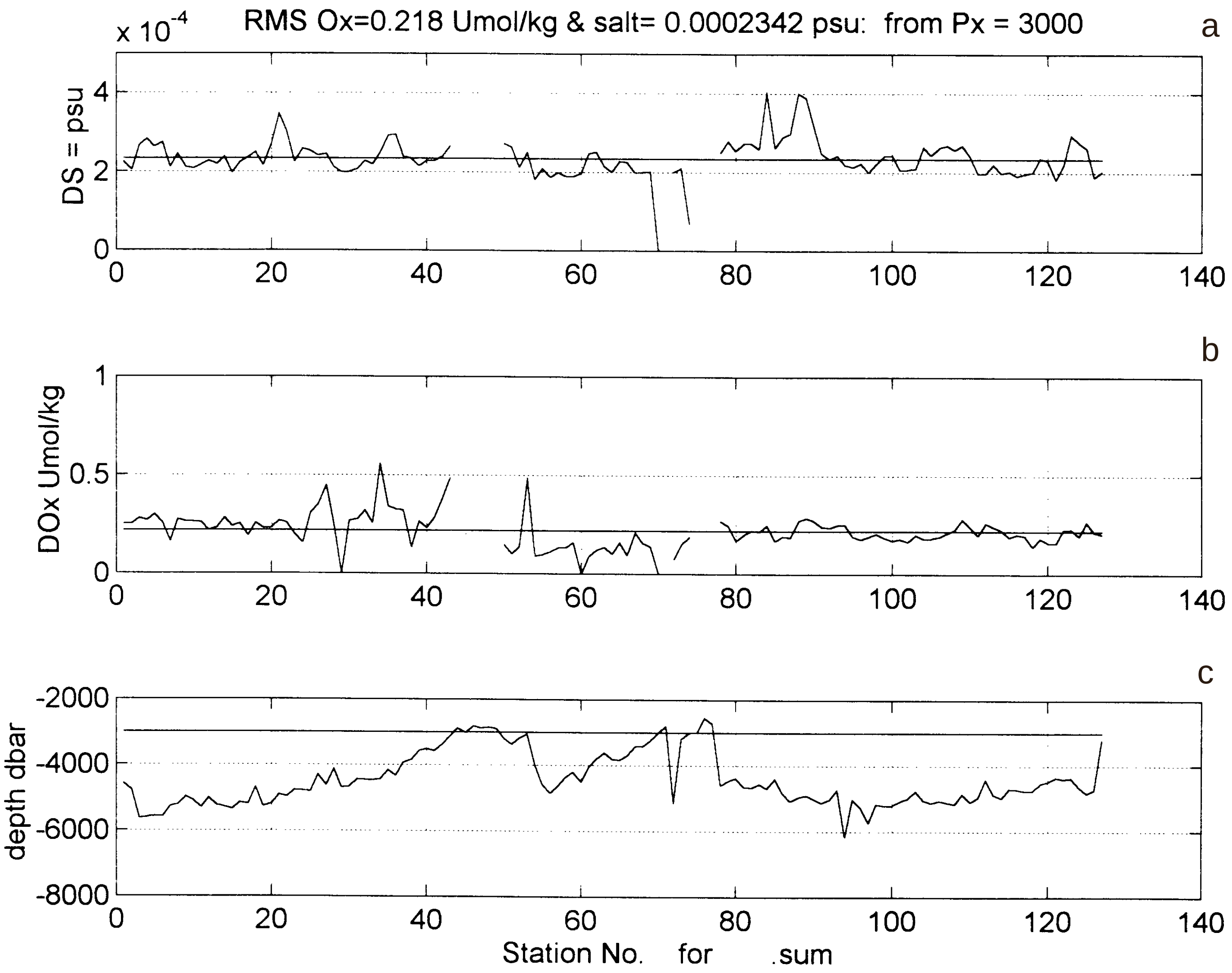
P16A17A: stations 32 to 37 o= Oxcw; +=Oxw
Pot. Tmp. C
Oxygen Umol/kg.
32
33
34
35
36
37
34
34
2.2
2
1.8
1.6
1.4
1.2
1
0.8
170
180
190
200
210
220
230

Figure 11



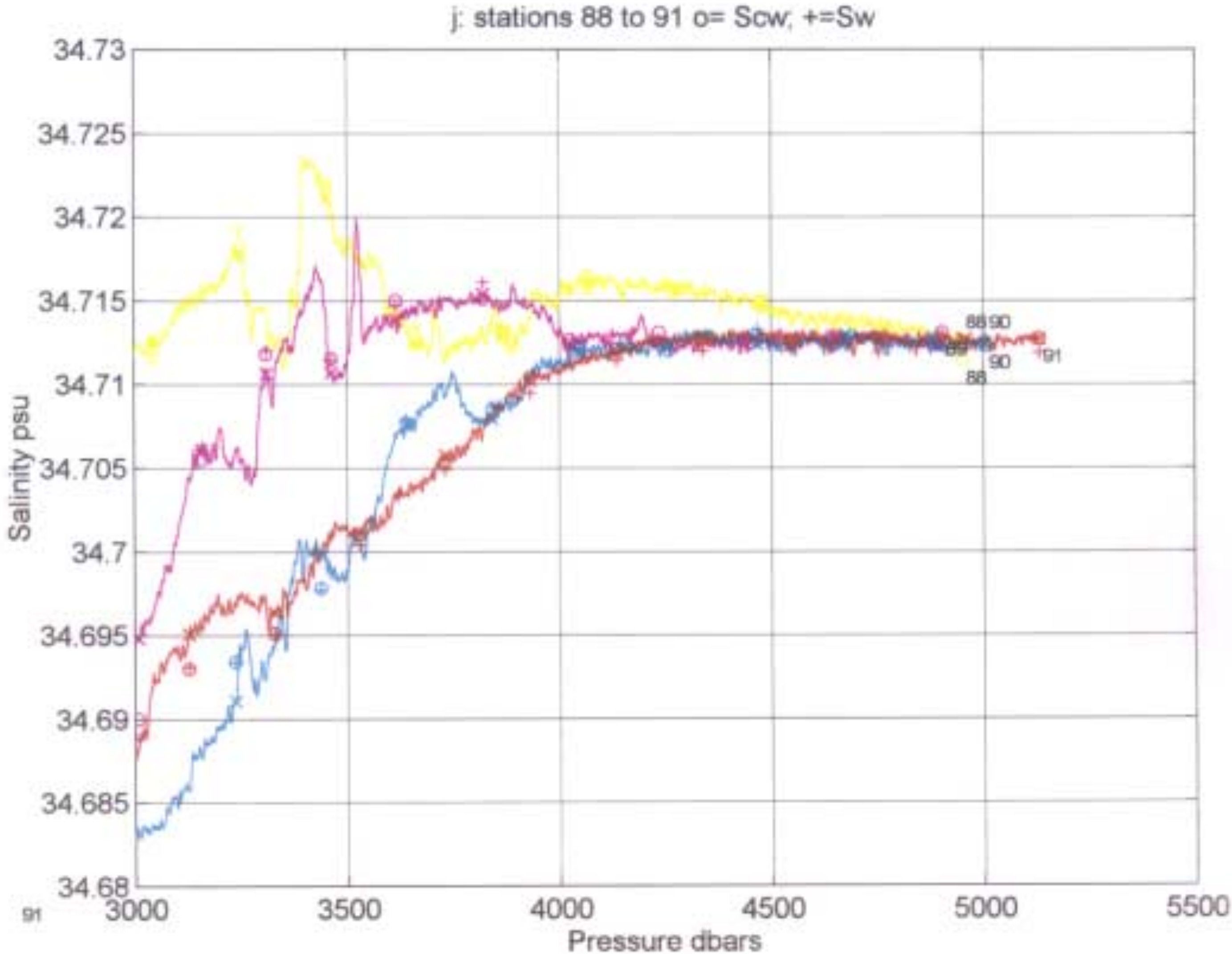
P16A17A : stations 32 to 36 x= Oxcw dwn; +=Oxw
Oxygen Umol/kg
Pressure dbars
270
260
250
240
230
220
210
200
190
180
170
500
1000
1500
2000
2500
3000
3500
4000
4500
32
33
34
35
36

Figure 12



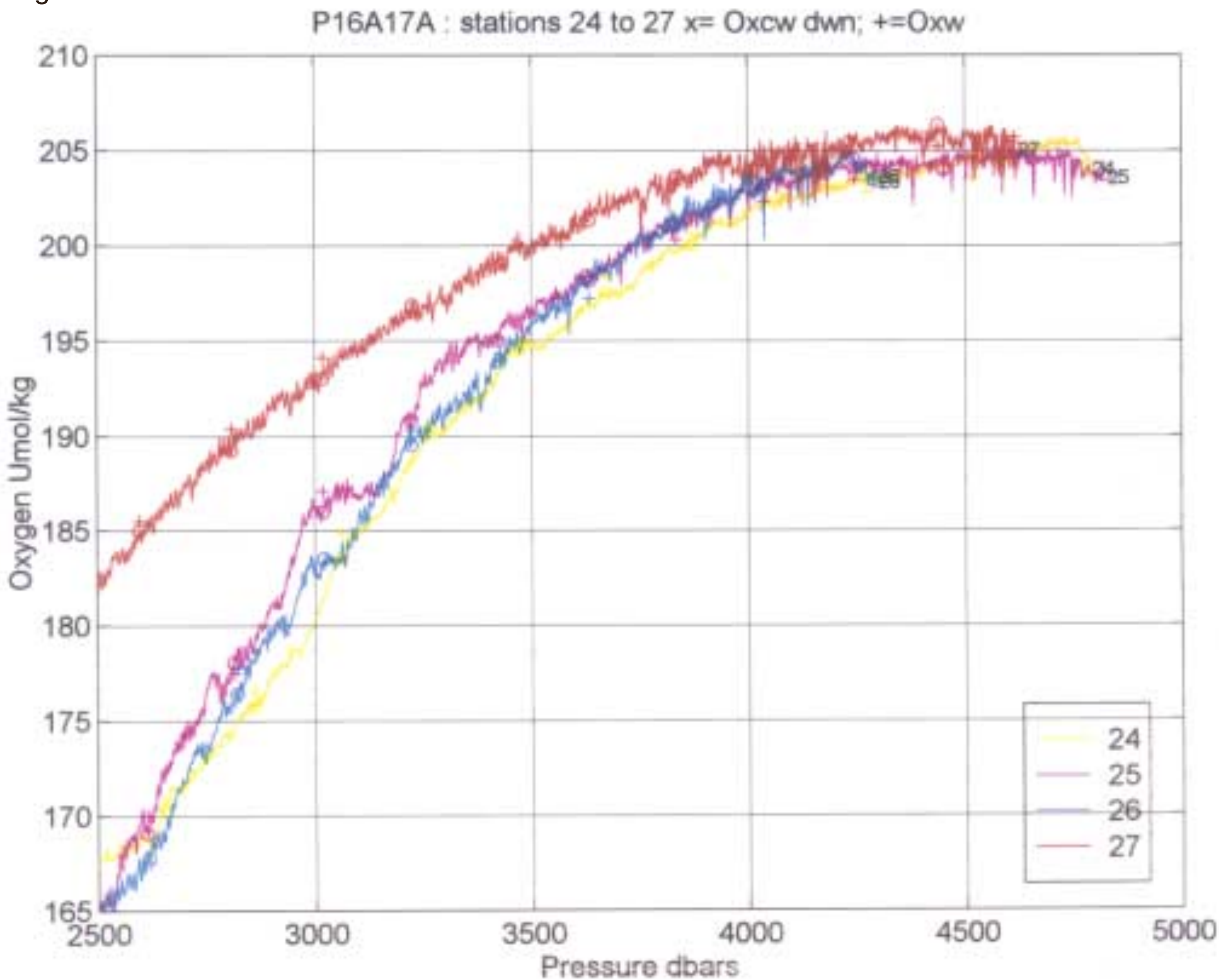
RMS Ox=0.218 Umol/kg & salt= 0.0002342 psu: from Px = 3000
a
x 10^-4
DS = psu
b
DOx Umol/kg
c
depth dbar
Station No. for .sum

Figure 13



j: stations 88 to 91 o= Scw; +=Sw
34.73
34.725
34.72
34.715
34.71
34.705
34.7
34.695
34.69
34.685
34.68
Salinity psu
3000
3500
4000
4500
5000
5500
Pressure dbars
88 90
90
91
88
91

Figure 14



P16A17A : stations 24 to 27 x= Oxcw dwn; +=Oxw
Oxygen Umol/kg
Pressure dbars
210
205
200
195
190
185
180
175
170
165
2500
3000
3500
4000
4500
5000
24
25
26
27

Figure 15

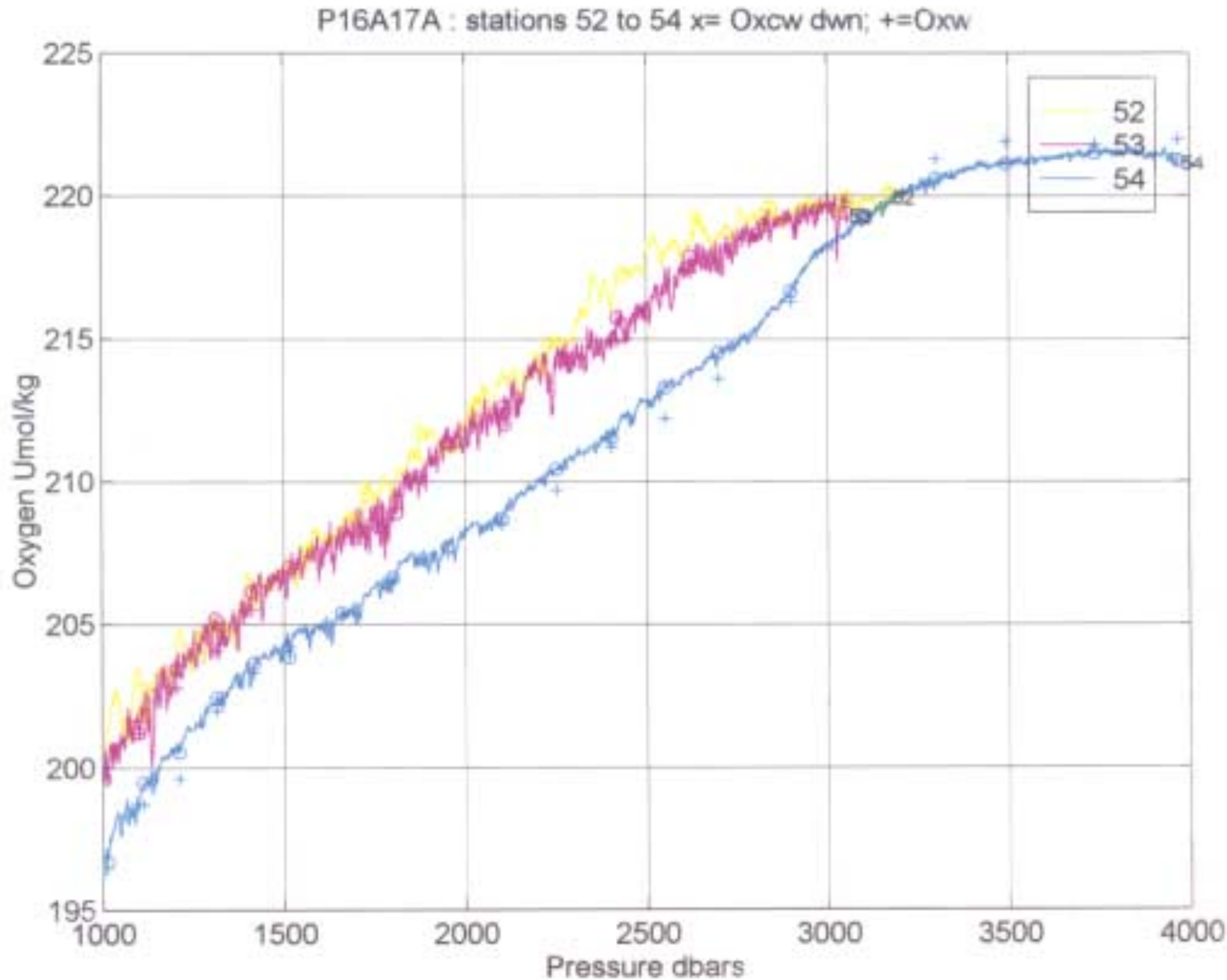
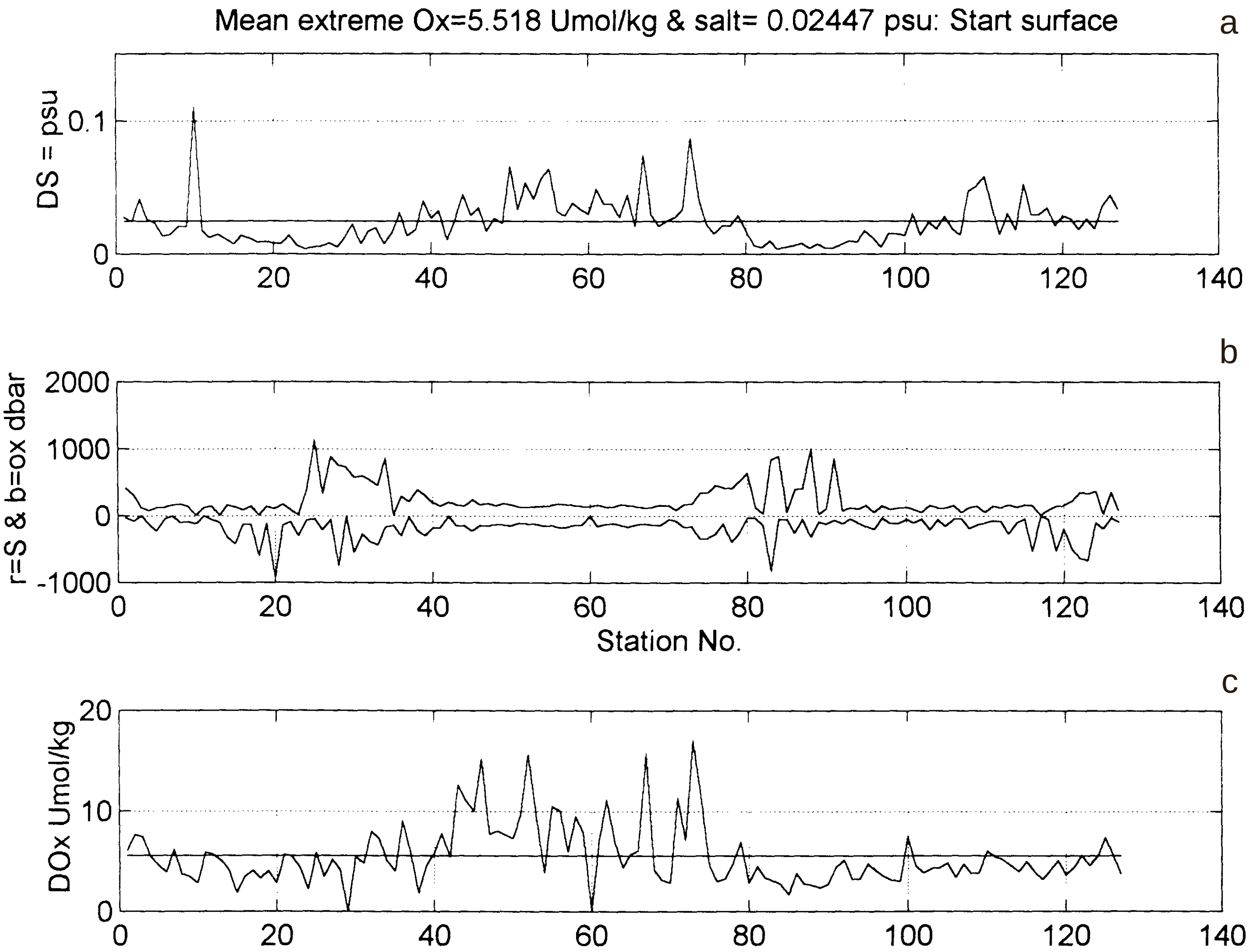
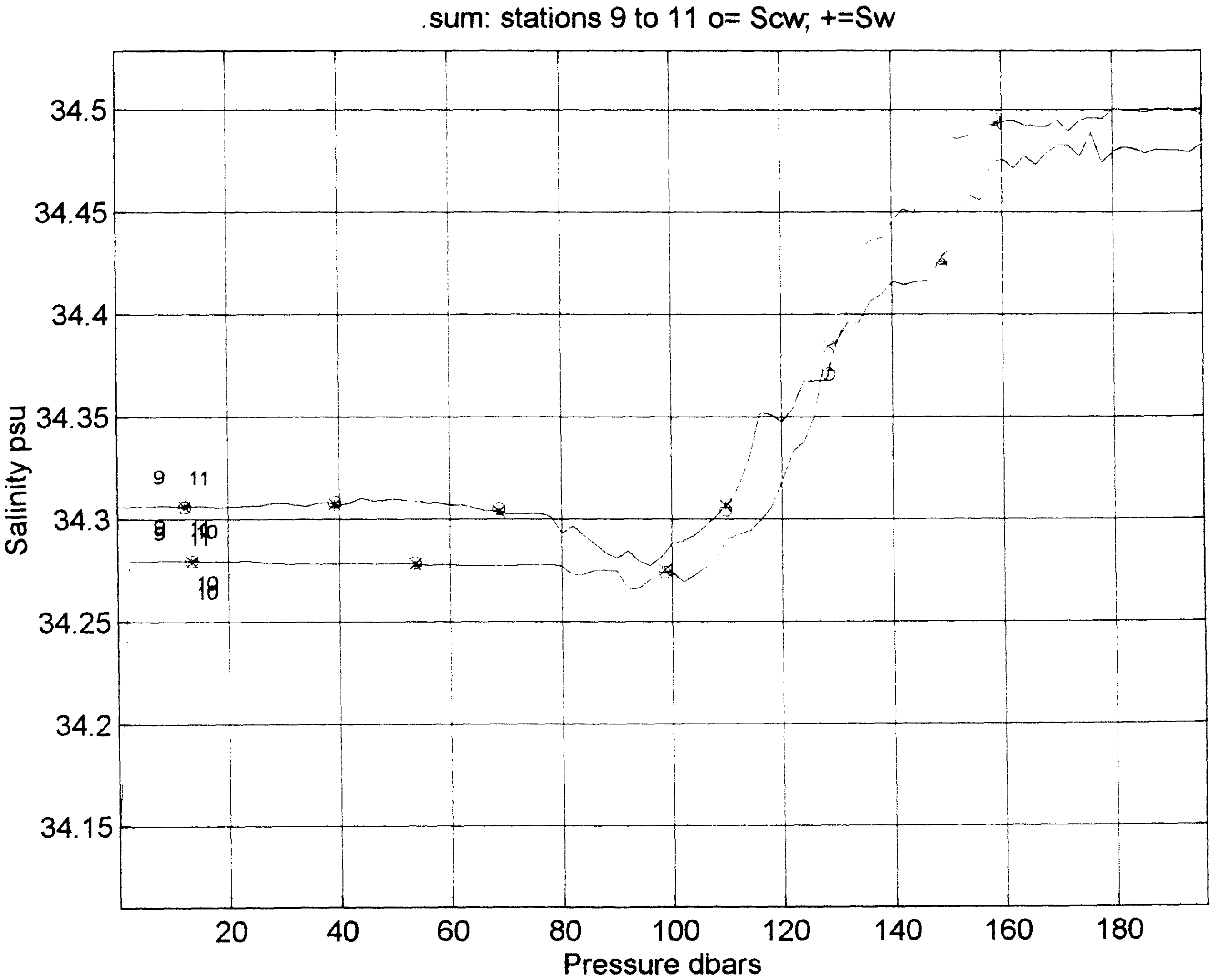

P16A17A : stations 52 to 54 x= Oxcw dwn; +=Oxw
Oxygen Umol/kg
Pressure dbars
52
53
54
225
220
215
210
205
200
195
1000
1500
2000
2500
3000
3500
4000

Figure 16



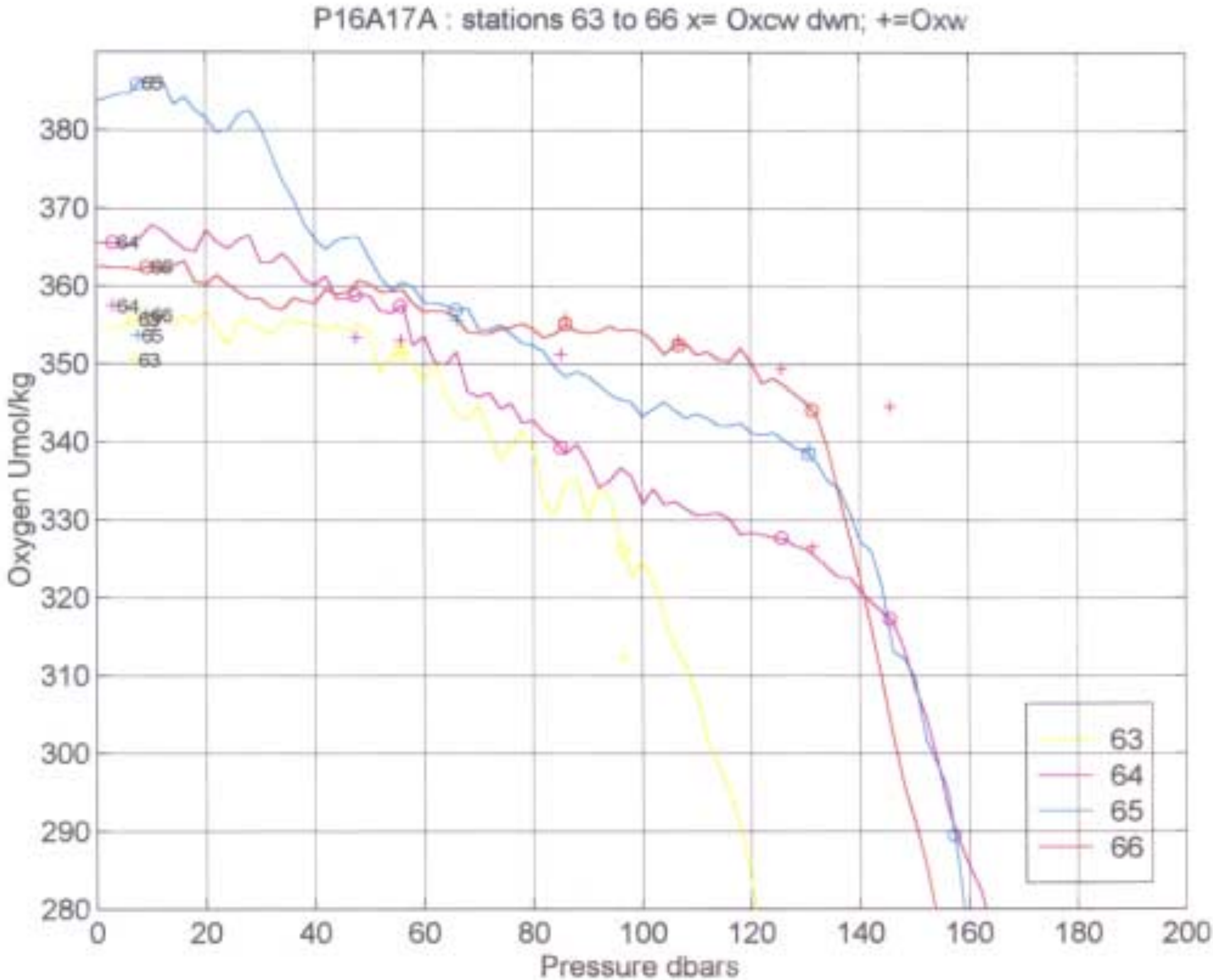
Mean extreme Ox=5.518 Umol/kg & salt= 0.02447 psu: Start surface
a
DS = psu
0.1
0
0
20
40
60
80
100
120
140
b
r=S & b=ox dbar
2000
1000
0
-1000
0
20
40
60
80
100
120
140
Station No.
c
DOx Umol/kg
20
10
0
0
20
40
60
80
100
120
140

Figure 17



.sum: stations 9 to 11 o= Scw; +=Sw
Salinity psu
34.5
34.45
34.4
34.35
34.3
34.25
34.2
34.15
Pressure dbars
20
40
60
80
100
120
140
160
180
9
11
10

Figure 18



P16A17A : stations 63 to 66 x= Oxcw dwn; +=Oxw
Oxygen Umol/kg
Pressure dbars
380
370
360
350
340
330
320
310
300
290
280
0
20
40
60
80
100
120
140
160
180
200
63
64
65
66

Figure 19

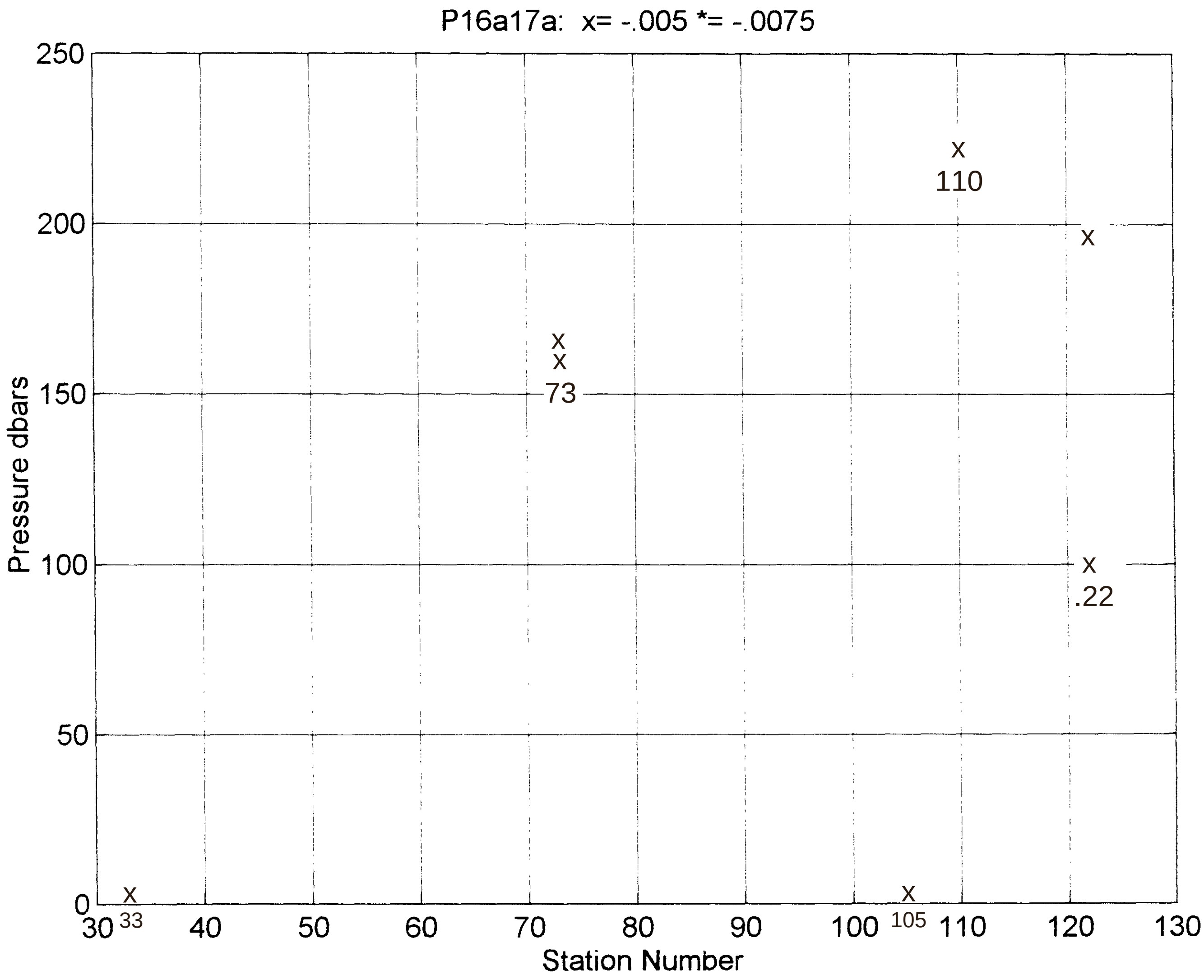

P16a17a: x= -.005 *= -.0075
250
200
150
100
50
0
Pressure dbars
30
40
50
60
70
80
90
100
110
120
130
Station Number
110
73
.22
33
105

Figure 20

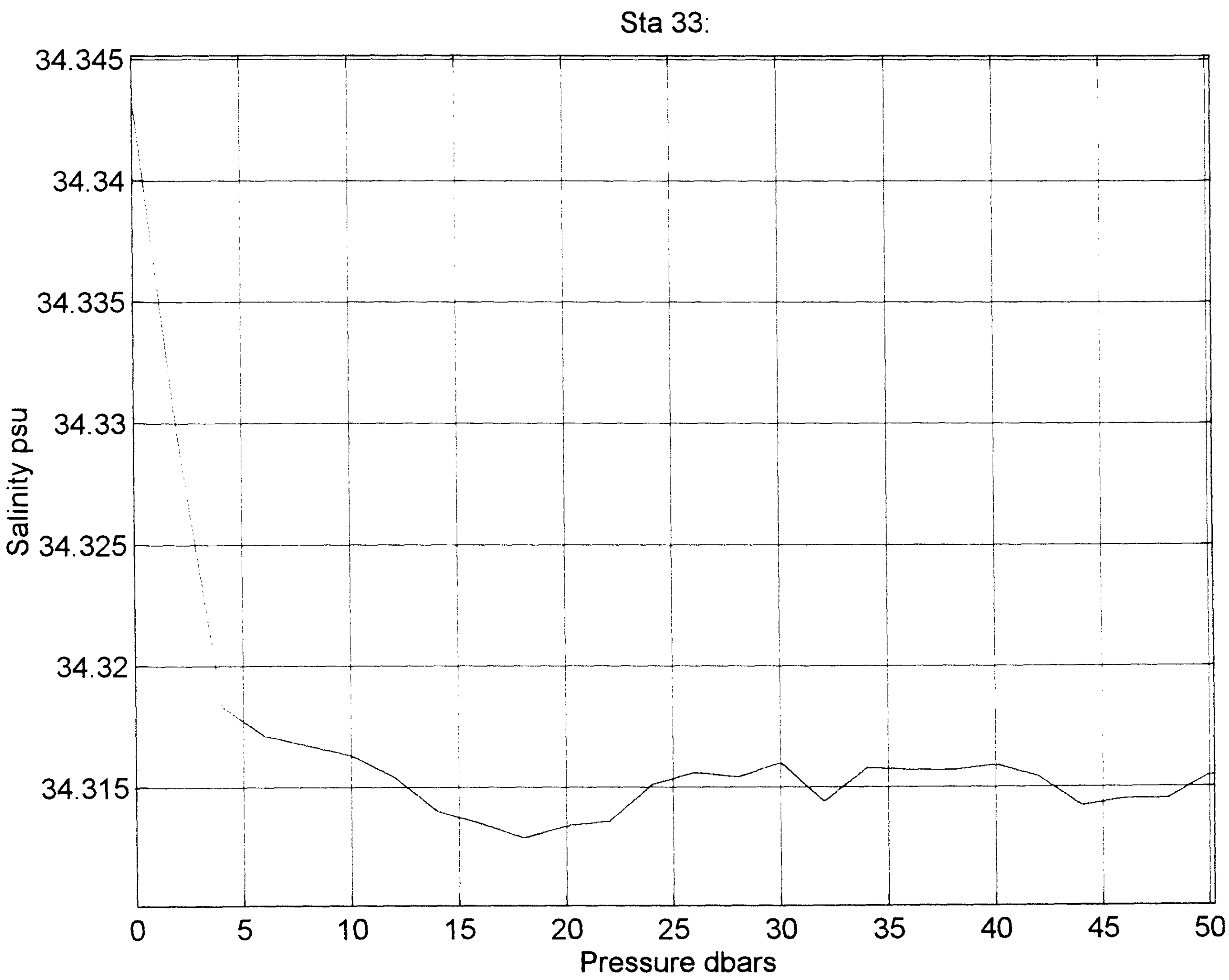
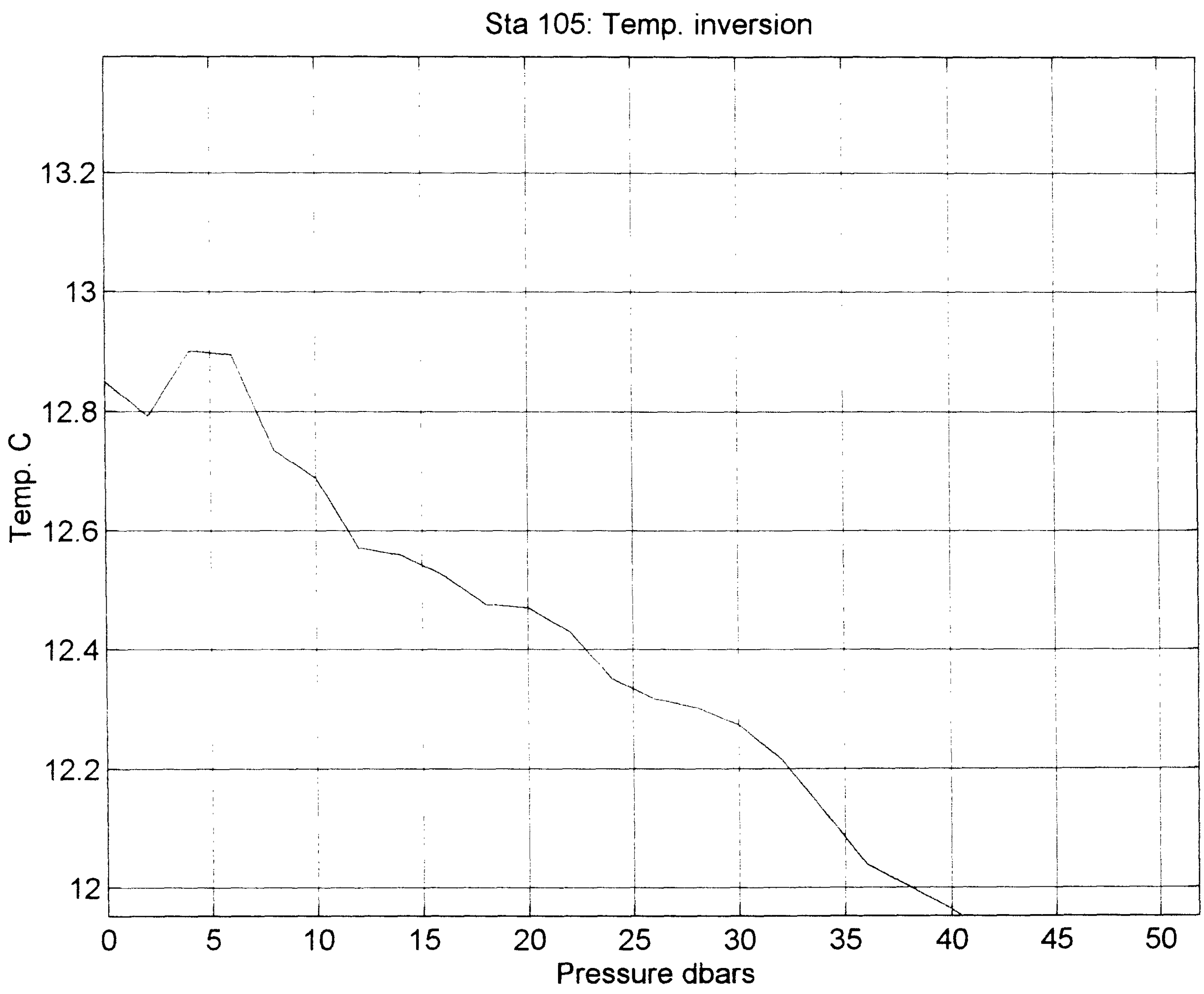

Sta 33:
Salinity psu
34.345
34.34
34.335
34.33
34.325
34.32
34.315
0
5
10
15
20
25
30
35
40
45
50
Pressure dbars

Figure 21



Sta 105: Temp. inversion
Temp. C
13.2
13
12.8
12.6
12.4
12.2
12
0
5
10
15
20
25
30
35
40
45
50
Pressure dbars

P16A17A
Final Report
for Large Volume Samples
and $\Delta^{14}C$ Measurements

Robert M. Key
July 7, 1996

1.0 General Information

WOCE cruise P16A17A was the first of three legs carried out aboard the R/V Knorr in the south central and southeastern Pacific Ocean. The WHPO designation for this leg was 316N138/9 (A.K.A. Juno-1). Joe Reid of SIO was chief scientist. This report covers details of data collection and analysis for the large volume Gerard samples. To the best of my knowledge, no final report for this cruise has been produced. The cruise departed Papeete, Tahiti on October 6, 1992 and returned to Papeete on November 25, 1993.

Fourteen large volume (LV) stations were occupied on this leg. The planned sampling density was 1 station every 5° of latitude (~300nmi). The basic WOCE plan for LV stations included one deep cast (2500db to the bottom), and one intermediate (1000db to 2500db) cast. For the southern end of the P16 section on this leg, only 1 near bottom cast was taken at each LV station to improve horizontal resolution. In the event of mistripped Gerard sampler(s), casts were repeated as time allowed in an attempt to collect the full suite of samples. All LV casts for the Juno cruises were done using the starboard-aft crane and coring cable on the R/V Knorr. The purpose of these casts was to collect samples for ^{14}C analysis. ^{14}C coverage for the upper water column was done *via* small volume AMS sampling from the Rosette. AMS sample analysis is not yet completed.

Table 1 summarizes the LV sampling and Figure 1 shows the station positions for leg P16A17A.

Table 1: Station/Cast Summary

Station	Cast	South Latitude	West Longitude	# LV Samples
14	1	42.986	150.517	9
22	2	47.026	150.476	9
32	2	51.977	150.425	3
38	1	54.983	150.497	9

Table 1: Station/Cast Summary

Station	Cast	South Latitude	West Longitude	# LV Samples
43	1	57.481	150.442	9
48	1	59.988	150.508	9
56	1	62.487	134.945	9
	3	62.481	135.203	9
73	1	56.027	135.016	9
80	1	52.582	134.995	9
	3	52.583	134.970	9
87	1	48.999	134965	9
	3	49.000	134.960	3
	4	48.986	134.953	6
95	1	44.976	134.960	9
	3	15.007	134.912	8
105	1	40.015	134.969	5
	4	40.014	134.964	9
113	1	35.992	134.987	9
	3	36.001	134.989	9
119	1	32.989	134.987	5
Total	21			165

Each Gerard barrel was equipped with a piggyback 5 liter Niskin bottle which, in turn, had a full set of high precision reversing thermometers to determine sampling pressure and temperature. Both Gerard and Niskin were sampled for salinity and silicate. Additionally, each Gerard was sampled for radiocarbon. The salinity samples from the piggyback bottle were used for comparison with the Gerard barrel salinities to verify the integrity of the Gerard sample. As each sample was collected, data were recorded on a sample log sheet. Normal sampling practice was to open the drain valve before opening the air vent to see if water escaped, indicating the presence of an 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 noted on the log sheets. The discrete hydrographic data were entered into the shipboard data system and processed as the analyses were completed. The bottle data were brought

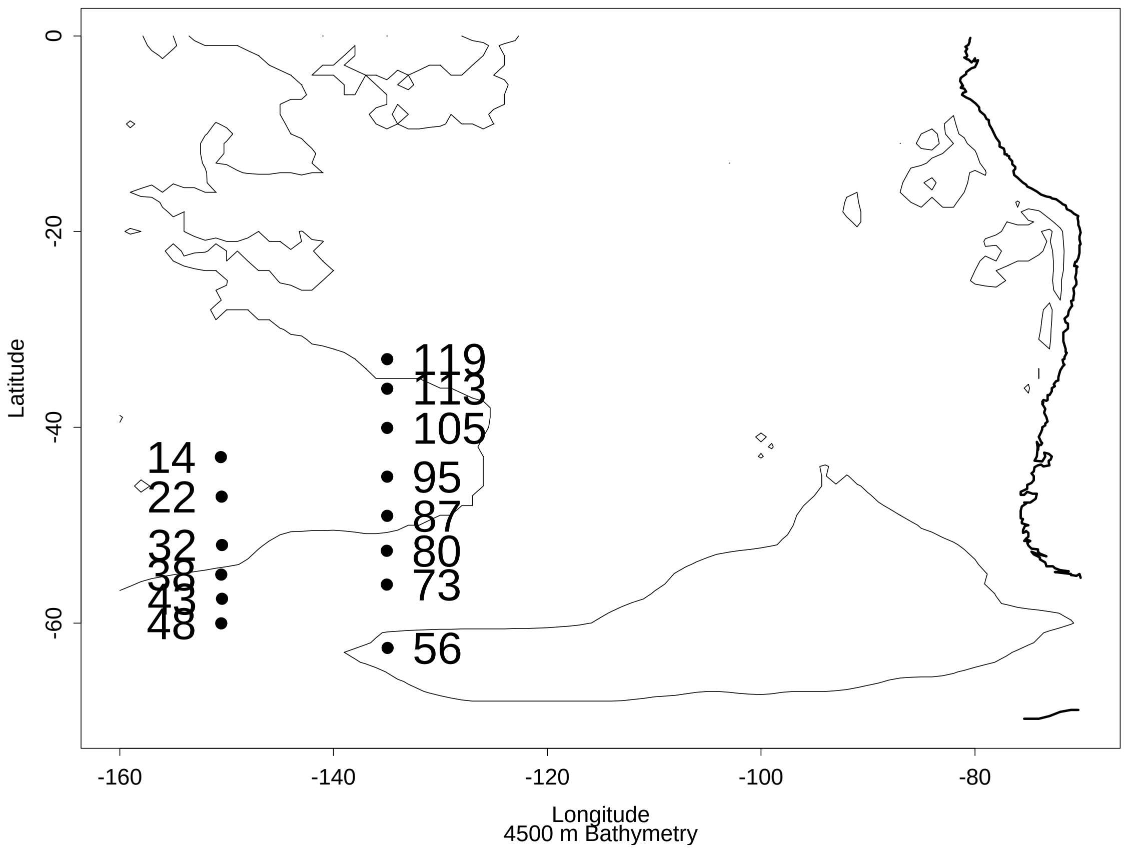


Figure 1: Large volume station locations for WOCE cruise P16A17A.

to a usable, though not final, state at sea. ODF data checking procedures included verification that the sample was assigned to the correct depth. The salinity and nutrient data were compared with those from adjacent stations and with the Rosette cast data from the same station. Any comments regarding the water samples were investigated. The raw data computer files were also checked for entry errors.

2.0 Personnel

LV sampling for this cruise was under the direction of the principal investigator, Robert M. Key (Princeton). All LV ^{14}C extractions at sea were done by Key. In addition to Key, deck work was done by the SIO CTD group (primarily John Boaz, Jim Wells and Leonard Lopez) with assistance from the scientific party. Lopez, Wells and Key were responsible for reading thermometers. Salinities and nutrients were analyzed by SIO-ODF. ^{14}C analyses were performed at Göte Östlund's laboratory (U. Miami, R.S.M.A.S.). Minze Stuiver made the ^{13}C measurements which are necessary to correct the ^{14}C values for fractionation effects. Key collected the data from the originators, merged the files, assigned quality control flags to the ^{14}C, rechecked the flags assigned by ODF and submitted the data files to the WOCE office (7/96).

3.0 Results

This data set and any changes or additions supersedes any prior release. In this data set Gerard samples can be differentiated from Niskin samples by the bottle number. Niskin bottle numbers are in the range 41-49 while Gerards are in the range 81-93.

3.1 Pressure and Temperature

Pressure and temperature for the LV casts are determined by reversing thermometers mounted on the piggyback Niskin bottle. Each bottle was equipped with the standard set of 2 protected and 1 unprotected thermometer. Each temperature value reported on the LV casts is calculated from the average of four readings, provided both protected thermometers functioned normally. The temperatures are based on the International Temperature Scale of 1990. All thermometers, calibrations and calculations were provided by SIO-ODF. Reported temperatures for samples in the thermocline are believed to be accurate to 0.01°C and for deep samples 0.005°C. Pressures were calculated using standard techniques combining wire out with unprotected thermometer data. In cases where the thermometers failed, pressures were estimated by thermometer data from adjacent bottles combined with wire out data. Because of the inherent error in pressure calculations and the finite flushing time required for the Gerard barrels, the assigned pressures have an uncertainty of approximately 10 dB. The pressures recorded in the data set for each Gerard-Niskin pair generally differ by approximately 0.5 dB with the Gerard pressure being the greater. This is because the Niskin is hung near the upper end of the Gerard. Figure 2 shows potential temperature *vs.* pressure for the LV casts. CTD values from the same stations and pressure ranges are indicated on the plot as connected, small filled squares.

3.2 Salinity

Salinity samples were collected from each Gerard barrel and each piggyback Niskin bottle. Analyses were performed by the same personnel who ran the salt samples collected from the Rosette bottles so the analytical precision should be the same for LV salts and Rosette salt samples. When both Gerard and Niskin trip properly, the difference between the two salt measurements should be within the range 0.000 - 0.003 on the PSU scale. Somewhat larger differences can occur if the sea state is very calm and the cast is not “yoyo’ed” once the terminal wire out is reached. This difference is due to the flushing time required for the Gerard barrels and the degree of difference is a function of the salinity gradient where the sample was collected. In addition to providing primary hydrographic data for the LV casts, measured salinity values help confirm that the barrels closed at the desired depth.

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 evapora-

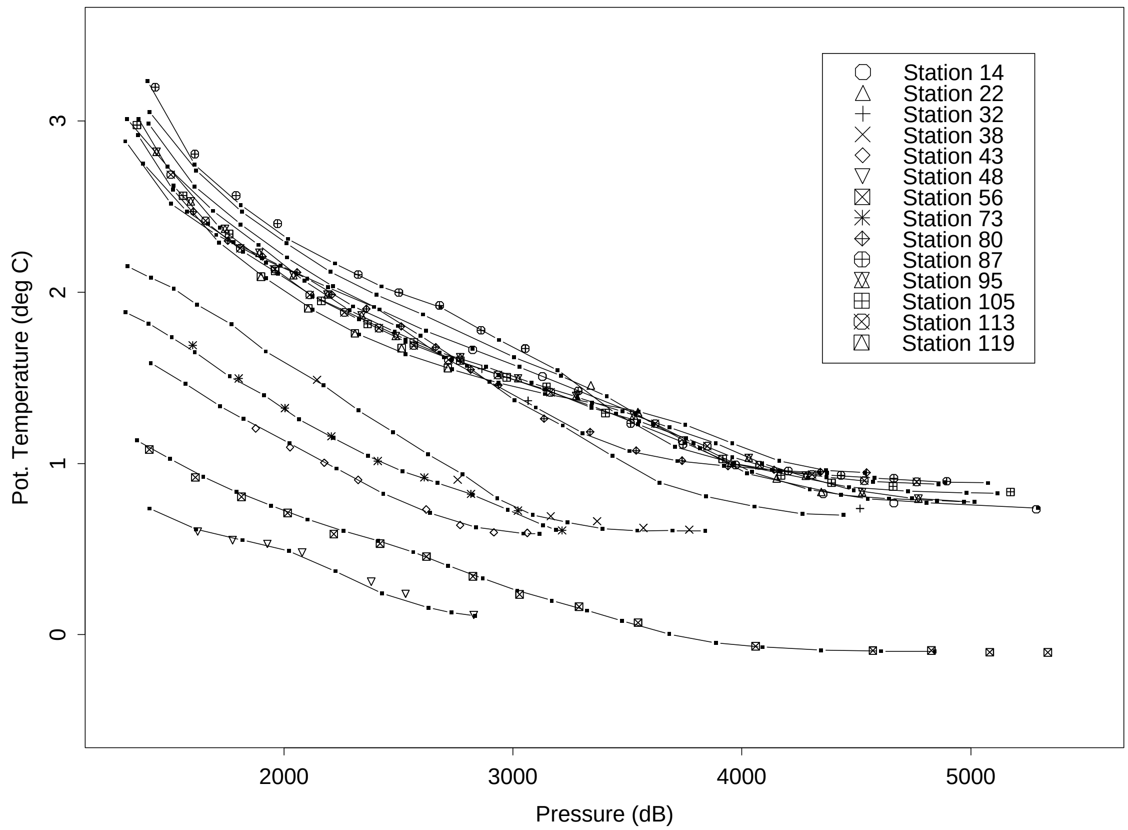


Figure 2: Potential temperature from DSRT on LV casts *vs.* pressure. CTD data from the same stations and depth ranges are indicated by connected, small filled squares.

tion. As loose inserts were found, they were replaced to ensure a continued air-tight seal. Salinity was determined after a box of samples had equilibrated to laboratory temperature, usually within 8-12 hours of collection. The draw time and equilibration time, as well as per-sample analysis time and temperature were logged.

A single Guildline Autosal Model 8400A salinometer 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. The estimated accuracy of bottle salinities run at sea is usually better than 0.002 PSU relative to the particular Standard Seawater batch used. PSS-78 salinity (UNESCO 1981) was then calculated for each sample from the measured conductivity ratios, and the results merged with the cruise database. There were some problems with lab temperature control throughout cruise; the Autosal bath temperature was adjusted accordingly. Salinities were generally considered good for the expedition despite the lab temperature problem. The quality of the temperature and salinity is demonstrated by Figure 3 which shows data from all of the large volume samples overlain by CTD/Rosette data from the same stations. Each Gerard-Niskin pair is assigned the same temperature which allows direct comparison of the paired salinity values on the figure.

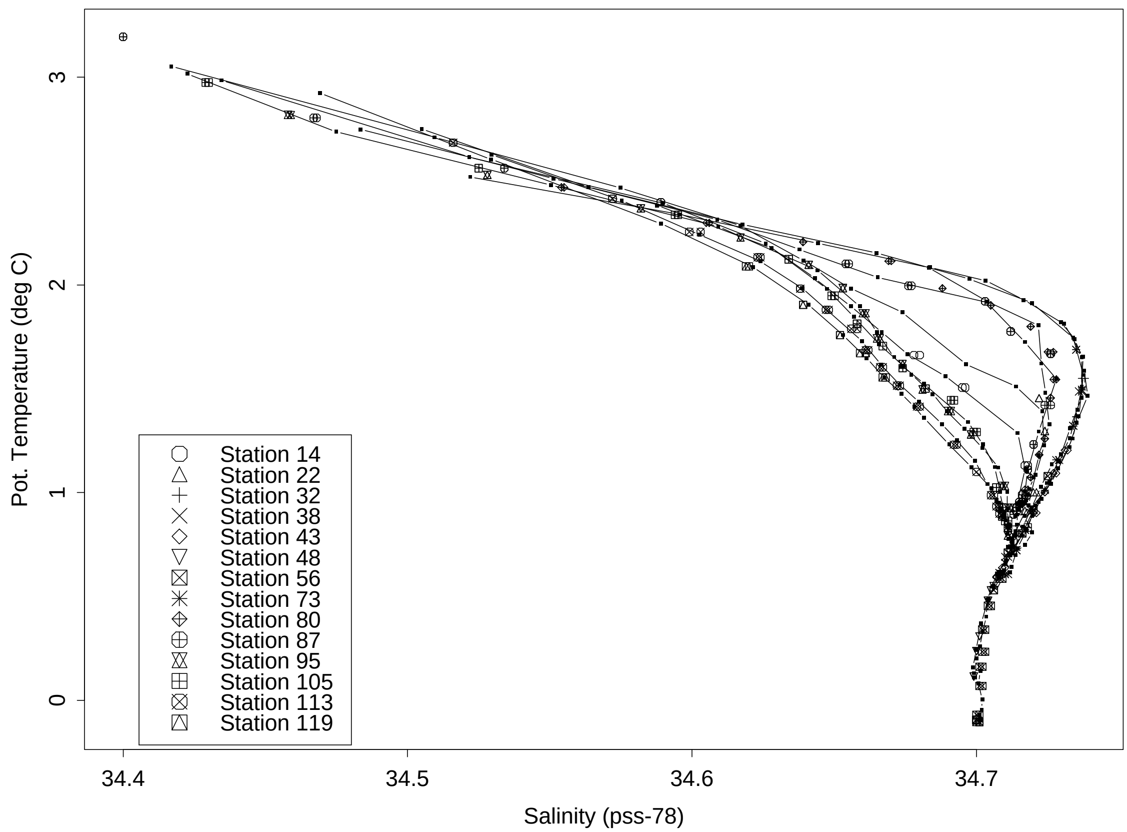


Figure 3: Theta-salinity for all of the large volume cast data with a QC flag of 2 for both temperature and salinity. CTD theta values with Rosette bottle salinities (small filled squares) are overlain for comparison.

3.3 Nutrients

Nutrient samples were collected from Gerard samples. On this leg silicate values were measured on all samples. LV nutrients were measured along with Rosette nutrients so the analytical precision for Gerard samples should be the same as Rosette samples. Nutrients collected from LV casts are frequently subject to systematic offsets from samples taken from Rosette bottles. For this reason it is recommended that these data be viewed primarily as a means of checking sample integrity (*i.e.* trip confirmation). The Rosette-Gerard discrepancy is frequently less for silicate than for other nutrients. For the area covered by this leg, deep silicate values are as useful for trip confirmation as salt measurements.

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 with solutions prepared aboard ship from preweighed chemicals; these solutions were used as working standards before and after each cast to correct for instrumental drift during analysis. Sets of 4-6 different concentrations of shipboard standards were analyzed periodically to determine the linearity of colorimeter response and the resulting correction factors.

Nutrient analyses were performed on an ODF-modified 4 channel Technicon AutoAnalyzer II, generally within one hour of the cast. Occasionally some samples were refrigerated at 2 to 6 °C for a maximum of 4 hours. The methods used are described by Gordon *et al*. (1992), Atlas *et al*. (1971), and Hager *et al*. (1972). All peaks were logged manually, and all the runs were re-read to check for possible reading errors.

Silicate was analyzed using the technique of Armstrong *et al*. (1967). ODF''s methodology is known to be non-linear at high silicate concentrations (>120 µM); a correction for this non-linearity was applied. Phosphate was analyzed using a modification of the Bernhardt and Wilhelms (1967) technique.

Na_2SiF_6, the silicate primary standard, was obtained from Fluka Chemical Company and Fischer Scientific and is reported by the suppliers to be >98% pure. Primary standards for phosphate, KH_2PO_4, were obtained from Johnson Matthey Chemical Co. and the supplier reports purity of 99.999%.

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 °C. The overall quality of the silicate data for this cruise is demonstrated in Figure 4 which shows both Gerard and piggyback Niskin silicate values as a function of potential temperature. Overlain on the plot (connected, small filled squares) are the Rosette measurements for the same stations and depth ranges.

3.4 ^{14}C

Some of the $\Delta^{14}C$ values reported here have been distributed in a data report produced by Östlund (1995). That report included preliminary hydrographic data and is superseded by this submission.

All Gerard samples deemed to be "OK" on initial inspection at sea were extracted for ^{14}C analysis using the technique described by Key (1991). The extracted $^{14}CO_2$/NaOH samples were returned to the Ocean Tracer Lab at Princeton and subsequently shipped to Östlund's lab in Miami. Both ^{13}C and ^{14}C measurements are performed on the same CO_2 gas extracted from the large volume samples. The ^{13}C analyses were done in M. Stuiver's lab at the Univ. Washington. The standard for the ^{14}C measurements is the NBS oxalic acid standard for radiocarbon dating. R-value is the ratio between the measured specific activity of the sample CO_2 to that of CO_2 prepared from the standard, the latter number corrected to a $\delta^{13}C$ value of -19‰ and age corrected from today to AD1950 all according to the international agreement. $\Delta^{14}C$ is the deviation in ‰ from unity, of the activity ratio, isotope corrected to a sample $\delta^{13}C$ value of -25‰. For further information of these calculations and procedures see Broecker and Olson (1981), Stuiver and Robinson (1974) and Stuiver (1980). Östlund's lab reports a precision of 4‰ for each measurement based on a long term average of counting statistics. Of the 165 Gerard samples collected, ^{14}C has

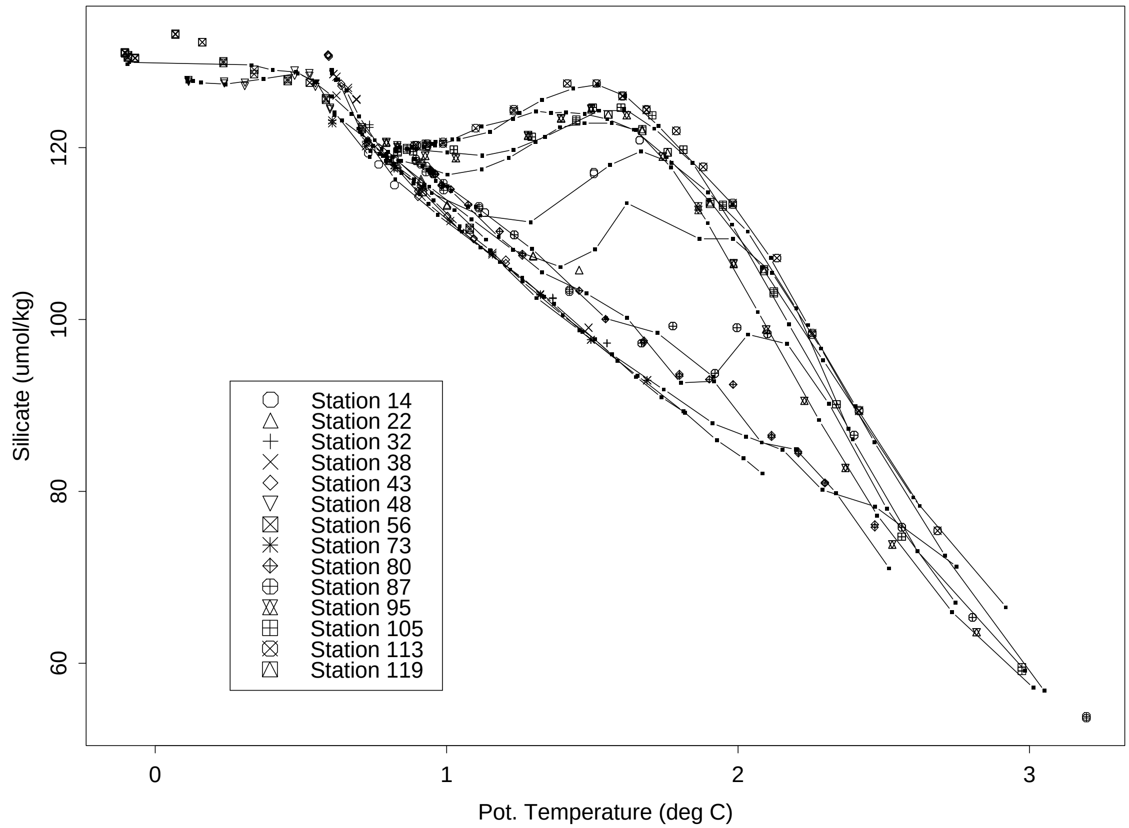


Figure 4: Plot includes silicate data from both Gerard and piggyback Niskin samples. Rosette/CTD data from the same stations and depth ranges are overlain (small filled squares).

been measured on 131 (79%). Existing ^{14}C data for the area sampled on this cruise is limited to a few GEOSECS measurements and the WOCE Juno-2 cruise. Comparison of these data sets indicates that they are in agreement to the precision of the measurements.

4.0 Data Summary

Figures 5 & 6 summarize the large volume ^{14}C data collected on this leg. All $\Delta^{14}C$ measurements with a quality flag value of 2 are included in each figure. Figure 5 shows the $\Delta^{14}C$ values plotted as a function of pressure . The stations taken north of ~45°S (14, 95, 105, 113 & 119) all have the mid-depth minimum which is characteristic of the deep Pacific. Stations 22-80 are essentially uniform in concentration from 2000 dB to the bottom and are first order indistinguishable from the deep values collected somewhat further to the south on Juno-2. Station 87 is intermediate with three samples having lower concentration due to the addition of low $\Delta^{14}C$ water similar to that seen at stations further north at the same depth. Figure 6 shows the $\Delta^{14}C$ values plotted against measured Gerard barrel silicate values. The angled heavy line is the relationship suggested by Broecker *et al.* (1995) to be representative of the mean global pre-bomb $\Delta^{14}C$ - silicate correlation. Three distinct trends can be seen in Figure 6:

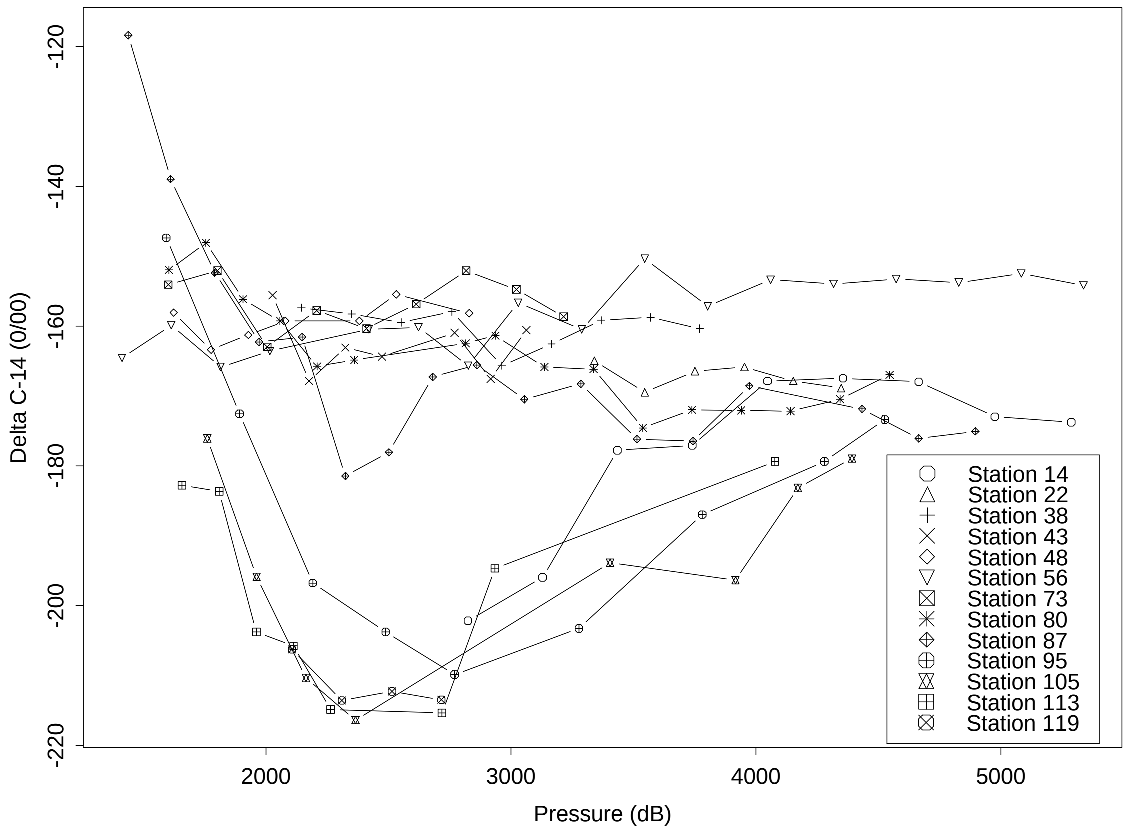


Figure 5: All LV $\Delta^{14}C$ values as a function of pressure. Vertical bars indicate one sigma (4‰) errors.

- The linear trend between low silicate (~50µmol/kg) high $\Delta^{14}C$ (~-120‰) waters of the upper thermocline and high silicate (~125µmol/kg) low $\Delta^{14}C$ (~-215‰) waters found at mid-depth (~2400 dB). This is the trend which should be useful in predicting pre-bomb near surface $\Delta^{14}C$. For these samples which were all taken north of 45°S, the least squares relationship is $\Delta^{14}C = -61 \pm 2 + -1.30 \pm 03\dot{S}i$ with an R^2 of 0.987. The intercept value is not too different from Broecker's (1995) value of -70, but the slope is significantly steeper than his estimate of -1.

- The second trend is made of samples collected at stations south of 45°S which have essentially uniform $\Delta^{14}C$ at ~155‰ and a limited silicate range of 100-130µmol/kg.

- The third trend is made up of deep water samples collected depths below the silicate maximum - $\Delta^{14}C$ minimum. Like the samples in the first trend, these all come from stations which are north of 45°S. These samples have almost uniform silicate, range from 120-125µmol/kg and a $\Delta^{14}C$ range of -155‰ - -220‰.

The three water types are more easily seen in Figure 7. In this figure, the top panel indicates the latitude range covered in each of the three lower panels. The lower left panel demonstrates the circumpolar water trend, the lower right demonstrates the typical South Pacific deep and bottom water trend, and the center panel is intermediate (Station 87).

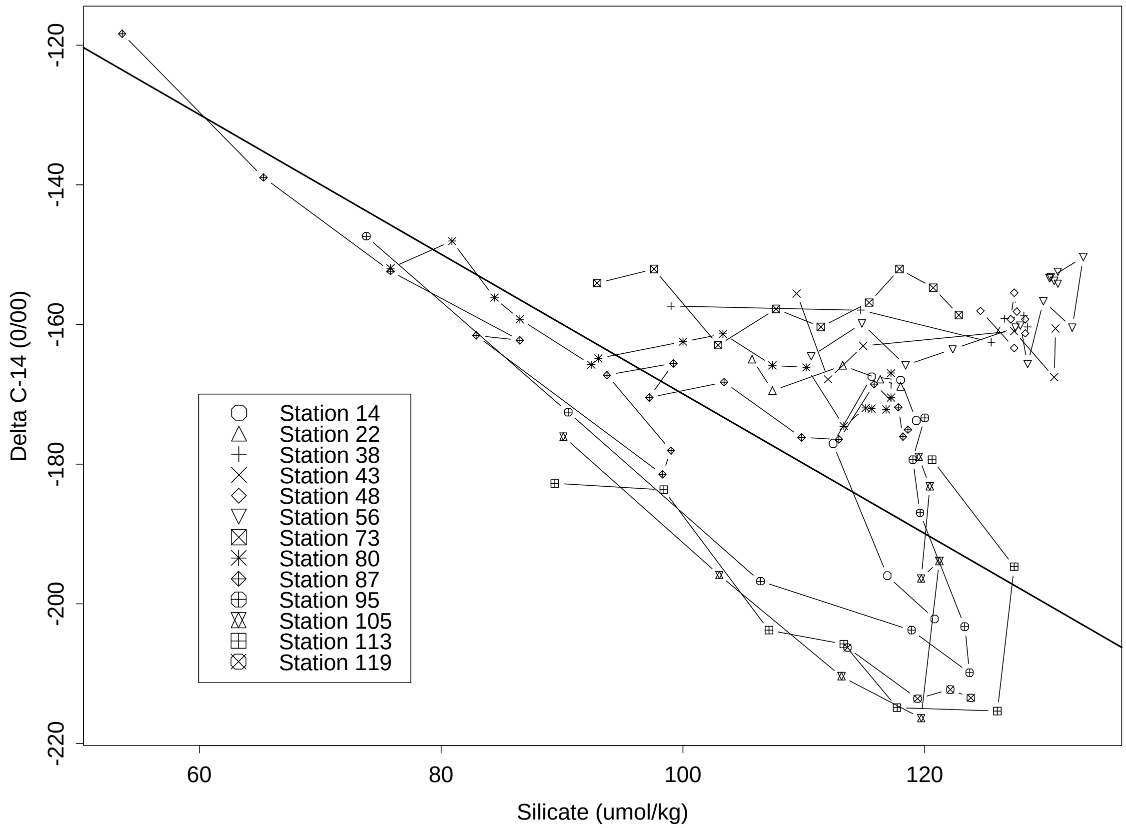


Figure 6: All LV $\Delta^{14}C$ measurements having a quality control flag value of 2 or 6 are plotted. The heavy line is that suggested by Broecker, *et al.* (1995) to be representative of the global relationship between pre-bomb ^{14}C and silicate.

5.0 Quality Control Flag Assignment

Quality flag values were assigned to all bottles and all measurements using the code defined in Tables 0.1 and 0.2 of WHP Office Report WHPO 91-1 Rev. 2 sections 4.5.1 and 4.5.2 respectively. In this report the only bottle flag values used were 2, 3, 4, and 9. For the measurement flags values of 2, 3, 4, 5 or 9 were assigned. The interpretation of measurement flag 5 or 9 is unambiguous, however the choice between values 2, 3 or 4 involves some interpretation. For this data set, the salt and nutrient values were checked by plotting them over the same parameters taken from the rosette at the same station. Points which were clearly outliers were flagged “4”. Points which were somewhat outside the envelop of the other points were flagged “3”. In cases where the entire cast seemed to be shifted to higher or lower concentrations (in nutrient values), but the values formed a smooth profile, the data was flagged as “2”. Once the nutrient and salt data had been flagged, these results were considered in flagging the ^{14}C data. There is very little overlap between this data set and any existing ^{14}C data, so that type of comparison was impractical. In general the lack of other data for comparison led to a more lenient grading on the ^{14}C data. When flagging ^{14}C data, the measurement error was taken into consideration.

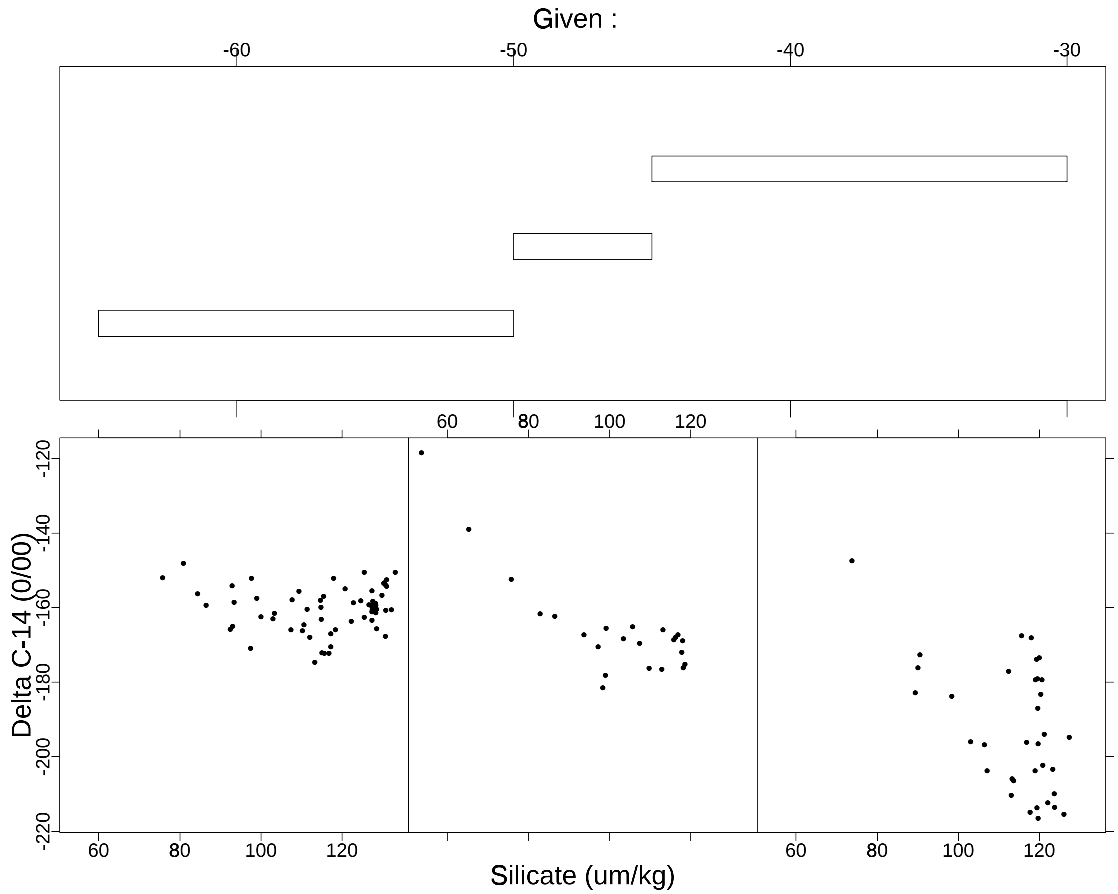


Figure 7: The top panel shows the latitude band which corresponds to each of the lower scatter plots. The lower left panel is typical of the $\Delta^{14}C$ - Silicate relation for Pacific sector Southern Ocean waters. The lower right panel demonstrates the backward check-mark typical of profiles collected in the South Pacific.

That is, approximately one-third of the ^{14}C measurements are expected to deviate from the true value by more than the measurement precision of ~4‰. No measured values have been removed from this data set. When using this data set, it is advised that the nutrient data only be considered as a tool for judging the quality of the ^{14}C data regardless of the quality code value. A summary of all flags is provided in Table 2. Since no inventory data was available when preparing this table, flag values 5 and 9 were used synonymously. For

TABLE 2. Quality Code Summary

		WHP Quality Codes								
	Levels	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
BTLNBR	332	0	327	0	5	0	0	0	0	0
SALNTY	327	0	318	4	5	5	0	0	0	0
SILCAT	301	0	297	2	2	31	0	0	0	0
PHSPHT	332	0	68	0	2	262	0	0	0	0
NITRAT	332	0	70	0	0	262	0	0	0	0
NITRIT	332	0	70	0	0	262	0	0	0	0

TABLE 2. Quality Code Summary

		WHP Quality Codes								
	Levels	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
REVPRS	332	0	332	0	0	0	0	0	0	0
REVTMP	302	0	298	0	4	30	0	0	0	0
DELC14[a]	165	0	126	5	0	34	0	0	0	0

a. ^{14}C large volume samples can not be collected from piggyback Niskin bottles

example, the phosphate, nitrate and nitrite values which are flagged “5 - not reported” may never have been collected. If this is the case, the flag should be 9. Regardless, the end result is the same - there is no value for those bottles.

6.0 References and Supporting Documentation

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P16A17A
Final Report
for AMS ^{14}C Samples

Robert M. Key
April 3, 1997

1.0 General Information

WOCE cruise P16A17A was the first of three legs carried out aboard the R/V Knorr in the south central and southeastern Pacific Ocean. The WHPO designation for this leg was 316N138/11. Joe Reid of SIO was chief scientist. The cruise departed Papeete, Tahiti on October 6, 1992 and returned to Papeete on November 25, 1992. The cruise consisted of two meridional sections along 155°W and 135°W. The reader is referred to cruise documentation provided by the chief scientist as the primary source for cruise information.

This report covers details of the small volume radiocarbon samples. The AMS station locations are shown in Figure 1 and summarized in Table 1. A total of 627 samples were collected

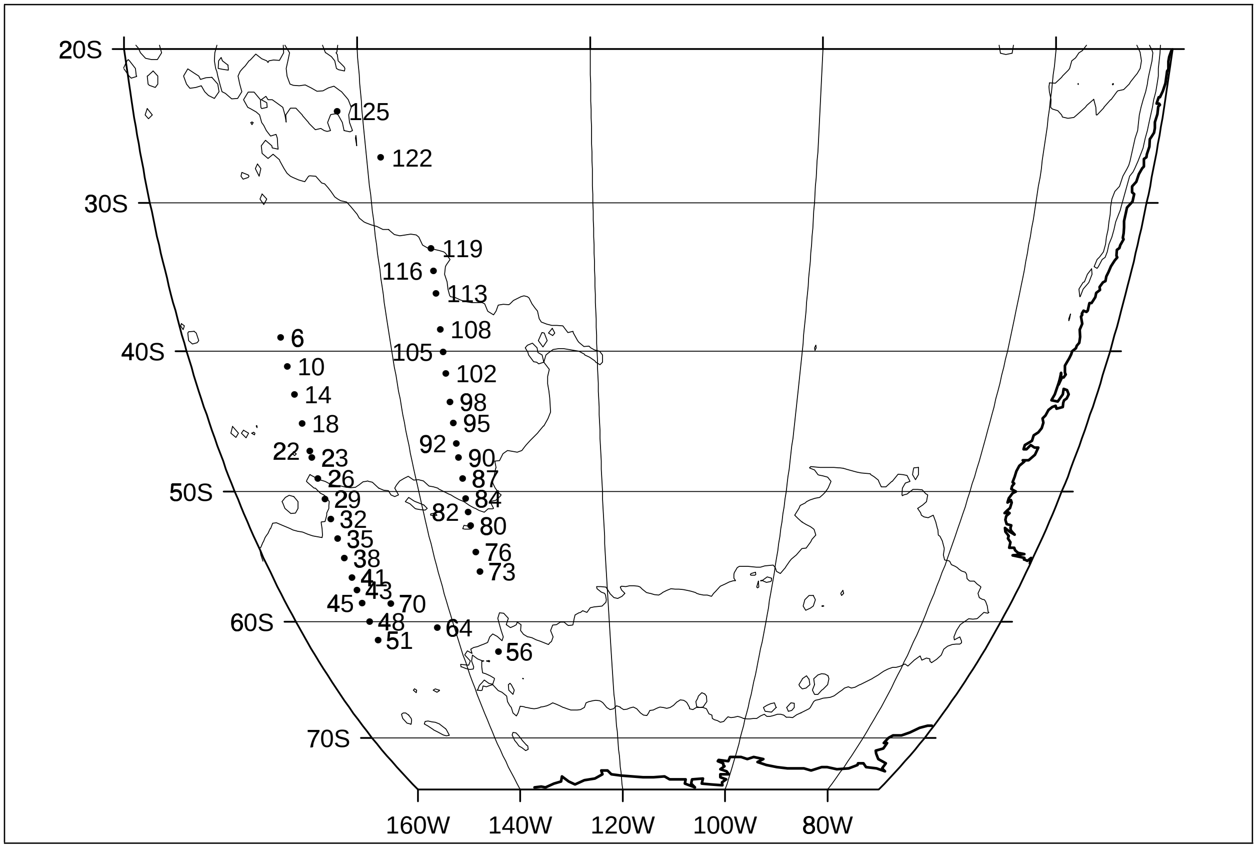

Figure 1: AMS ^{14}C station locations for WOCE P16A17A.

at the 37 stations sampled for Δ^{14}C. Thirteen of the stations were also sampled using the large volume technique. The results of the large volume sampling program were reported by Key (1996).

Table 1: AMS Station Locations

Station	Date	Latitude	Longitude	Bottom Depth (m)
6	10/14/92	-39.030	-150.527	5468
10	10/15/92	-41.008	-150.501	5009
14	10/16/92	-42.995	-150.501	5198
18	10/17/92	-45.026	-150.490	4760
22	10/18/92	-47.003	-150.488	4882
23	10/19/92	-47.496	-150.490	4677
26	10/19/92	-49.007	-150.485	4277
29	10/21/92	-50.514	-150.439	4617
32	10/22/92	-51.986	-150.485	4383
35	10/23/92	-53.507	-150.486	4091
38	10/24/92	-54.982	-150.509	3782
41	10/25/92	-56.498	-150.485	3542
43	10/26/92	-57.494	-150.497	3117
45	10/26/92	-58.495	-150.491	2980
48	10/27/92	-59.996	-150.538	2833
51	10/28/92	-61.497	-150.520	3390
56	11/1/92	-62.444	-135.098	4755
64	11/3/92	-60.458	-142.140	3795
70	11/4/92	-58.521	-146.966	3024
73	11/7/92	-56.034	-135.028	3195
76	11/7/92	-54.493	-135.006	2520
80	11/9/92	-52.521	-135.000	4325
82	11/9/92	-51.511	-135.007	4608
84	11/10/92	-50.503	-135.016	4602
87	11/11/92	-49.000	-134.957	4985
90	11/12/92	-47.494	-135.004	4914
92	11/12/92	-46.491	-135.013	4930
95	11/13/92	-45.004	-134.979	5010
98	11/14/92	-43.497	-135.001	5070
102	11/15/92	-41.505	-135.004	4899
105	11/16/92	-40.009	-134.988	5033
108	11/17/92	-38.480	-135.006	5080
113	11/19/92	-35.999	-134.997	4783
116	11/20/92	-34.503	-134.997	4637
119	11/20/92	-33.000	-135.000	4472
122	11/22/92	-27.003	-138.742	4323
125	11/23/92	-23.986	-142.154	4757

2.0 Personnel

^{14}C sampling for this cruise was carried out by R. Key from Princeton U. ^{14}C analyses were performed at the National Ocean Sciences AMS Facility (NOSAMS) at Woods Hole Oceanographic Institution. Salinities, nutrients and oxygen were analyzed by the SIO CTD group. Key collected the data from the originators, merged the files, assigned quality control flags to the ^{14}C and submitted the data files to the WOCE office (4/97) and is P.I. for the ^{14}C data.

3.0 Results

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

3.1 Hydrography

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

3.2 ^{14}C

The $\Delta^{14}C$ values reported here were originally distributed in two data reports (NOSAMS, July 31, 1995 & March 3, 1997). Those reports included preliminary results which had not been through the WOCE quality control procedures. This report supersedes those data distributions.

All of the AMS samples from this cruise have been measured. Replicate measurements were made on 14 of the water samples. These replicate analyses are tabulated in Table 2. The

Table 2: Summary of Replicate Analyses

Sta-Cast-Bottle	$\Delta^{14}C$	Err	E.W.Mean[a]	Uncertainty[b]
6-1-27	-213.1	3.9	-214.9	2.8
	-216.9	4.0		
10-1-2	82.9	3.2	84.3	6.5
	92.1	7.5		
10-1-18	-126.6	2.8	-131.2	6.9
	-136.4	3.0		
10-1-22	-193.3	4.3	-196.6	4.1
	-199.4	3.9		
18-1-11[c]	-159.4	2.8	-164.1	6.4
	-168.5	2.7		
18-1-16	-52.5	4.2	-54.4	2.3
	-55.2	2.8		
29-3-7	26.8	3.6	27.1	2.7
	27.5	4.0		
35-1-10	-32.0	3.0	-35.5	4.7
	-38.6	2.8		
35-1-20	-155.2	3.0	-160.6	6.8
	-164.9	2.7		
64-1-12	-148.3	4.4	-154.5	6.1
	-157.0	2.8		
84-1-18	-108.6	2.9	-115.0	10.1
	-122.9	3.2		

Table 2: Summary of Replicate Analyses

Sta-Cast-Bottle	$\Delta^{14}C$	Err	E.W.Mean[a]	Uncertainty[b]
98-1-1	76.0	3.8	76.6	3.3
	78.2	6.5		
98-1-5	43.0	3.7	43.4	2.6
	43.8	3.7		
116-1-8	106.7	5.0	109.0	2.9
	110.2	3.5		
116-1-12	5.7	6.2	7.6	2.6
	8.0	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.

c. ^{14}C flagged as bad (4) rather than replicate (6) due to leaky niskin bottle

table shows the error weighted mean and uncertainty for each set of replicates. The uncertainty is defined here as the larger of the standard deviation and the error weighted standard deviation of the mean. For these replicates, the average uncertainty is 4.7‰. This precision estimate is approximately correct for the time frame over which these samples were measured (Mar.-Jul., 1995 and Jul.-Dec., 1996). Note that the errors given 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*.

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 little overlap between this data set and any existing ^{14}C data, so that type of comparison was difficult. 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 (~4.7‰). 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	583
3	19
4	9
5	2
6	14

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 (circles). Large volume results

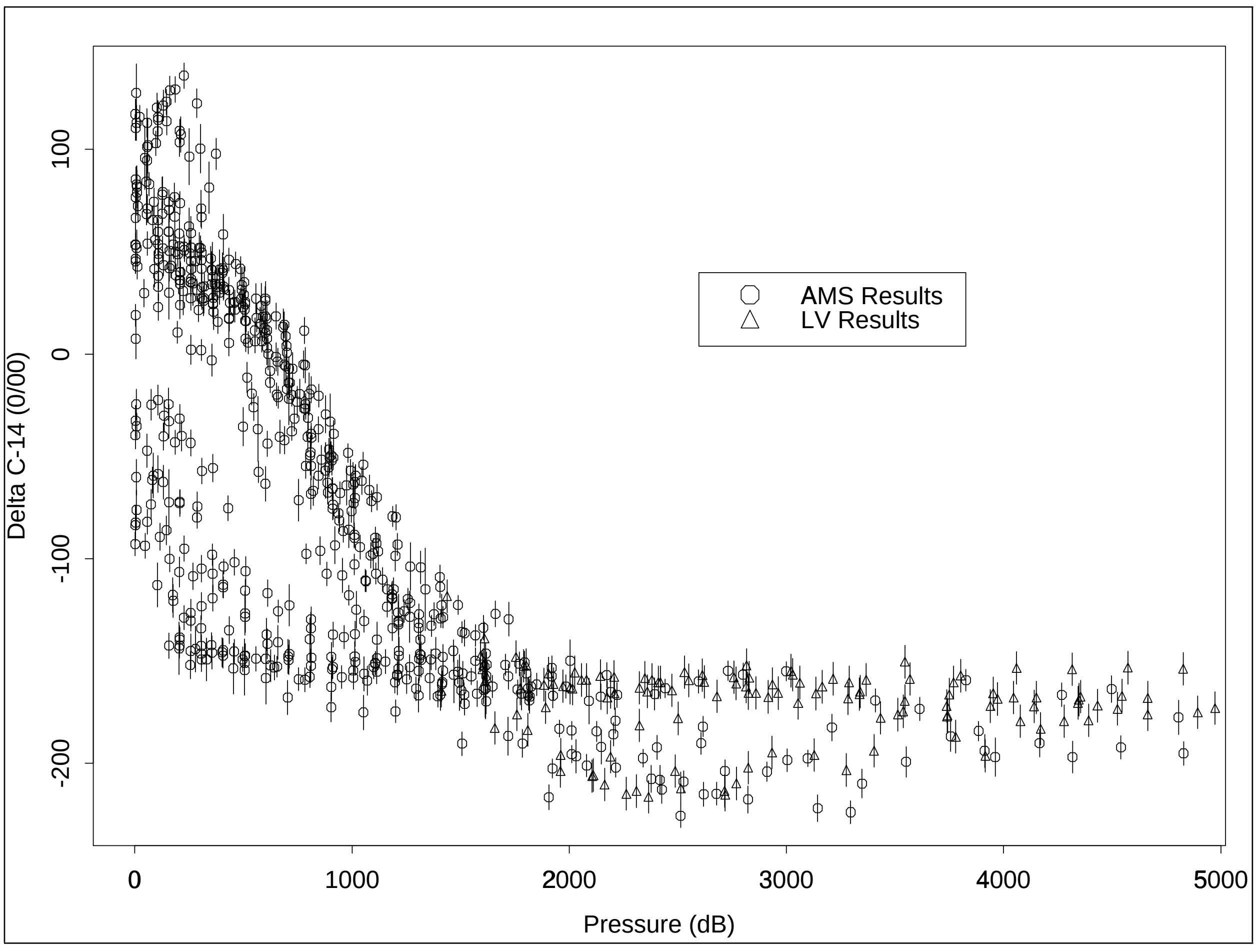

Figure 2: $\Delta^{14}C$ results for P16A17A stations shown with 2σ error bars.Only those measurements having a quality control flag value of 2 are plotted.

from this cruise are also shown in Figure 2 (triangles) for comparison. The data distribution in this figure demonstrates the scheme for the small volume sampling - AMS samples were used primarily to cover the surface and thermocline waters while large volume samples covered deep and bottom waters (at a significantly decreased density). The deep AMS samples collected on this leg were primarily substitutes for large volume sampling when the weather was too harsh to allow Gerard bottle casts. Two distinct trends are present in Figure 2. The stations south of the circumpolar frontal regions have surface $\Delta^{14}C$ values ranging from -25 to -100‰. The values in these profiles decrease to approximately -160‰ over the upper kilometer of the water column then remain essentially constant from there to the bottom. The profiles collected at stations which were north of the frontal region have $\Delta^{14}C$ values of 50 to 125‰ near the surface, decrease through the thermocline to a minimum at a depth of approximately 2.5 kilometers, then increase toward the bottom to values that are the same as seen in the southern stations. The uniform concentration over most of the depth range at the southern stations is due to intense vertical mixing and the fact that the isopycnals are extremely steep in this area. More interesting is the fact that the waters around Antarctica are so old. Toggweiler *et al.* (1997) have recently presented arguments that the extreme age is due to the fact that most of the deep and bottom water sinking in this area is formed from "old" southward flowing waters at mid depths in the Pacific and Indian Oceans. Additionally, it is likely that the upwelled waters around Antarctica are not at the surface long enough to reach equilibrium with the atmosphere and therefore have anomalously low $\Delta^{14}C$ values. Worth noting is the fact that this conclusion is in direct conflict with recent work by Peacock and Broecker (1997) who argue that approximately 15 Sv of deep water must be formed in the Southern Ocean based mass balance calculations using radiocarbon and PO_4^*.

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. It is unlikely that the points falling above the line with silicate concentrations greater than 100 µm/kg are elevated due to the addition of bomb-produced $\Delta^{14}C$. If the GEOSECS Pacific data from the same latitude range were added to Figure 3, the points would fall within the envelop of the WOCE data. The two trends discussed in reference to Figure 2 are evident in Figure 3 only for silicate concentrations greater than about 90 µm/kg. In this region the points in the upper cluster are from the southern stations and those in the lower cluster from the stations north of the circumpolar frontal region. If the southern stations were eliminated and a regression calculated for the deep (>1 km) waters of the northern stations, the intercept would be higher and the slope steeper than the global line estimated by Broecker. Regardless, those samples having silicate concentrations lower than approximately 30 µm/kg are clearly contaminated with bomb produced radiocarbon.

Figure 4 and Figure 5 show contoured sections of the $\Delta^{14}C$ distribution for the two meridional sections occupied during this cruise. In both figures, the large volume data was included to help fill out the data set. The "A" portion of each figure shows the data plotted as a section in depth - latitude space and the "B" portion shows data from the upper 1.5 kilometers of the water column in potential density (σ_θ) - latitude space. The data in these sections were girded using the "loess" methods described in Chambers *et al.* (1983), Chambers and Hastie (1991), Cleveland (1979) and Cleveland and Devlin (1988). Figure 4 shows the section which runs approximately along 155°W and Figure 5 the section on 135°W.

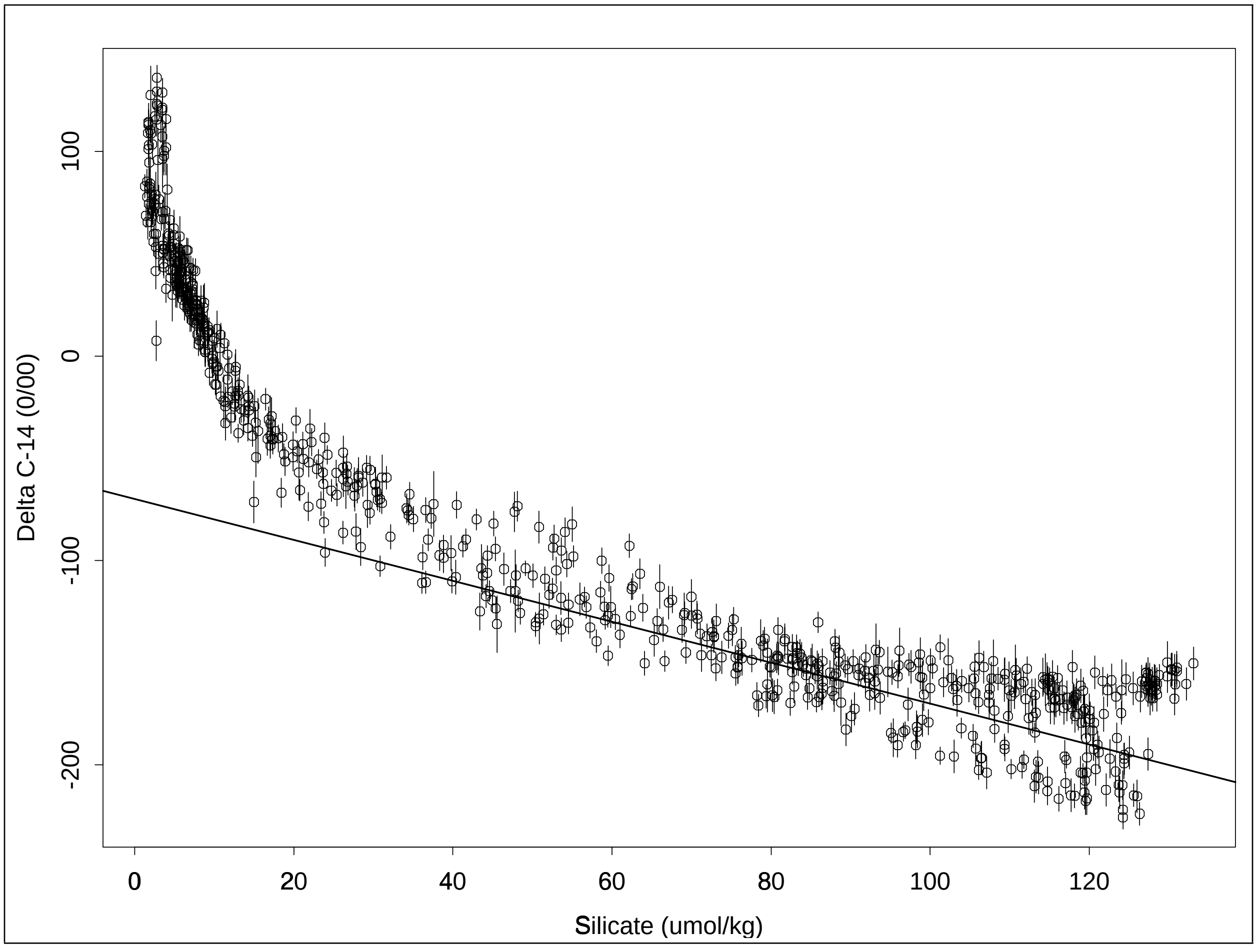

Figure 3: $\Delta^{14}C$ as a function of silicate for P116A17A AMS samples. The straight line shows the relationship proposed by Broecker, *et al.*, 1995 ($\Delta^{14}C$ = -70 - Si with radiocarbon in ‰ and silicate in μmol/kg).

Not surprisingly, the two depth sections are quite similar. Both show a minimum at the north end of the section centered around 2.5 km depth. This is the same minimum which is present throughout the Pacific and is thought to be coincident with the return flow of old waters from the north. Below the minimum are generally northward flowing - somewhat younger waters which originated in the circumpolar region. In the upper kilometer of the water column for both sections, the $\Delta^{14}C$ isolines have a strong upward gradient between 50°S and 60°S in the vicinity of the circumpolar current. The $\Delta^{14}C$=-160‰ contour deepens from north to south, reaching maximum depth at approximately 55-56°S and 2.0 km before turning sharply upward.

As with the depth sections, the potential density sections (4B & 5B) are similar. It is evident in these figures, however, that while the two sections had the same southern extent, the surface waters were quite different. The only implication of this is that the circumpolar current was displaced further south at 135°W than at 155°W. South of 30°S the $\Delta^{14}C$ isolines with values between -20‰ and -120‰ are nearly flat and parallel except very near the southern outcrop region where they show a slight deepening. The near-surface isolines at the north end of P17A are higher than those at the north end of P16A simply because this section extends further north (Note that both the horizontal and vertical scales are different for 4B and 5B).

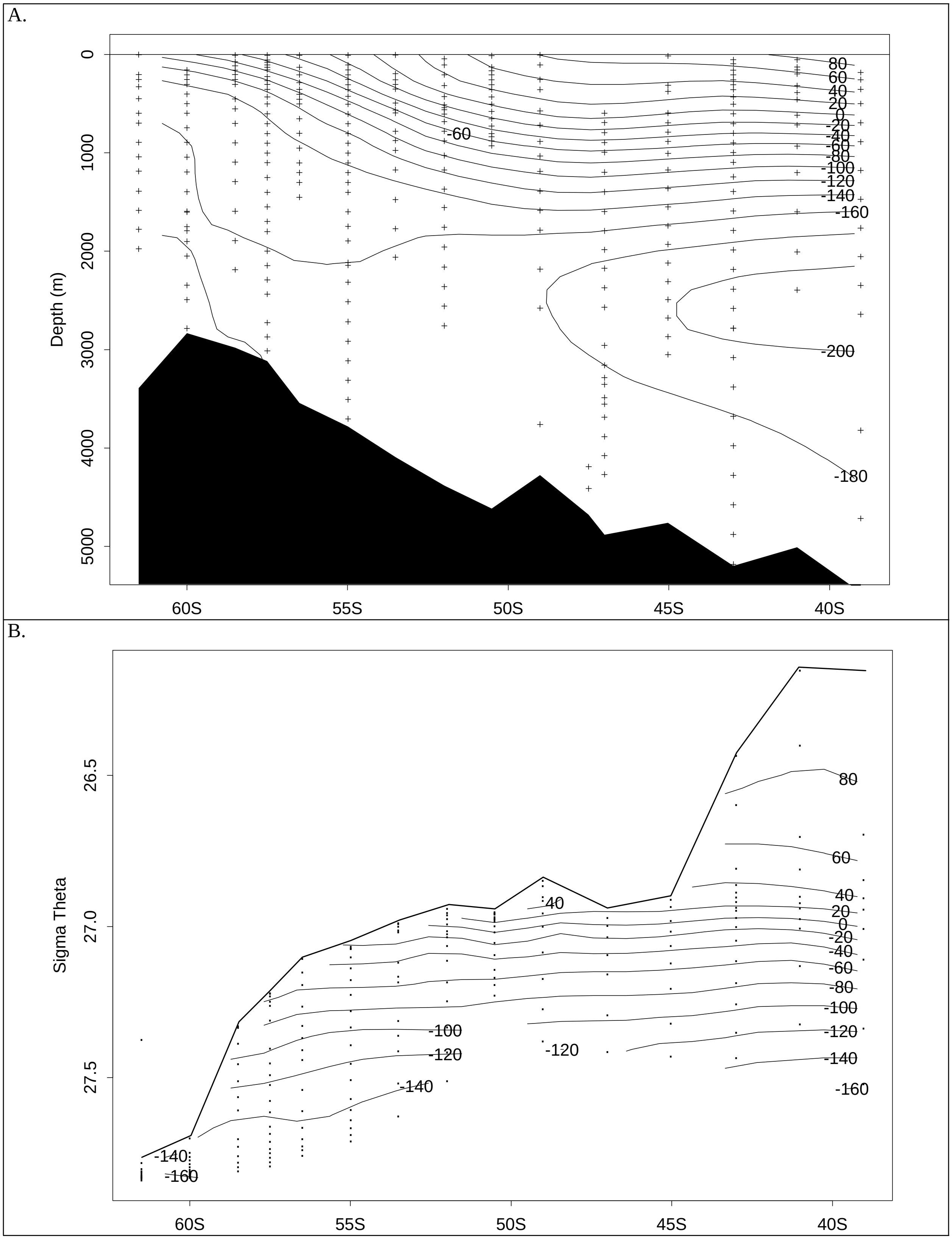

Figure 4: $\Delta^{14}C$ for Juno-2 (WOCE line P16A) along 155°W (both AMS and LV results). Gridding done using a loess method (references given in text). In B. the heavy line indicates the ocean surface and only the upper 1.5 km of the water column is included.

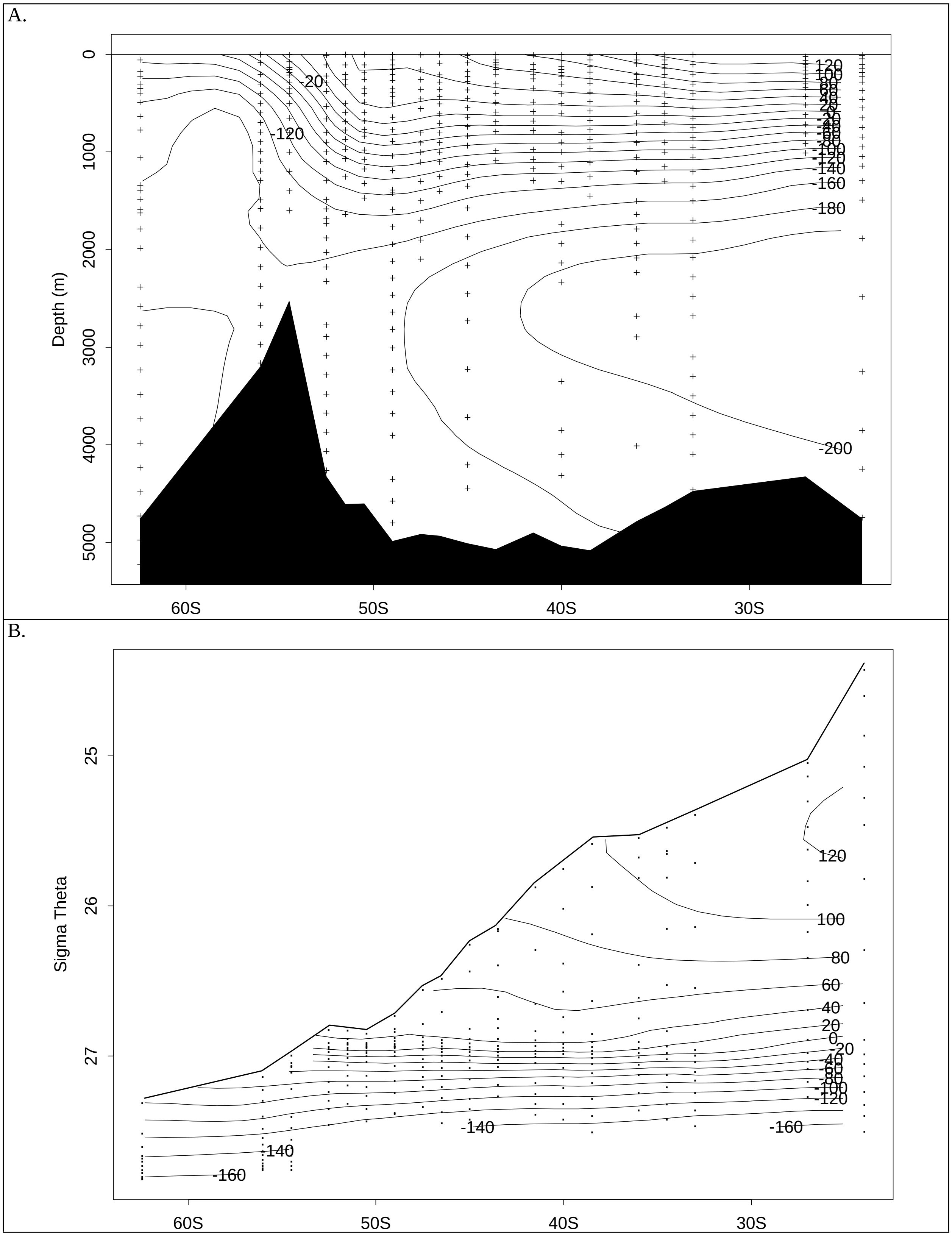

Figure 5: $\Delta^{14}C$ for Juno-2 (WOCE line P17A) along 135°W (both AMS and LV results). Gridding done using the loess method (references in text). In B. the heavy line indicates the ocean surface and only the upper 1.5 km of the water column is included.

5.1 References and Supporting Documentation

Broecker, W.S., S. Sutherland and W. Smethie, Oceanic radiocarbon: Separation of the natural and bomb components, *Global Biogeochemical Cycles, 9(2)*, 263-288, 1995.

Chambers, J.M. and Hastie, T.J., 1991, Statistical Models in S, Wadsworth & Brooks, Cole Computer Science Series, Pacific Grove, CA, 608pp.

Chambers, J.M., Cleveland, W.S., Kleiner, B., and Tukey, P.A., 1983, Graphical Methods for Data Analysis, Wadsworth, Belmont, CA.

Cleveland, W.S., 1979, Robust locally weighted regression and smoothing scatterplots, J. Amer. Statistical Assoc., 74, 829-836.

Cleveland, W.S. and S.J. Devlin, 1988, Locally-weighted regression: An approach to regression analysis by local fitting, J. Am. Statist. Assoc, 83:596-610.

Joyce, T., and Corry, C., *eds*., Corry, C., Dessier, A., Dickson, A., Joyce, T., Kenny, M., Key, R., Legler, D., Millard, R., Onken, R., Saunders, P., Stalcup, M., *contrib.*, Requirements for WOCE Hydrographic Programme Data Reporting, WHPO Pub. 90-1 Rev. 2, 145pp., 1994.

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NOSAMS, National Ocean Sciences AMS Facility Data Report #95-066, Woods Hole Oceanographic Institution, Woods Hole, MA, 02543, 1995.

NOSAMS, National Ocean Sciences AMS Facility Data Report #97-023, Woods Hole Oceanographic Institution, Woods Hole, MA, 02543, 1997.

Peacock, S.L. and W.S. Broecker, The Southern Ocean deep water production dilemma, *Nature, submitted*, 1997.

Toggweiler, J.R., B. Samuels and R.M. Key, Why is the deep water around Antarctica so old?, submitted for inclusion in *Ewing Symposium on Ocean Tracers* collection, 1997.

Final CFC Data Quality Evaluation (DQE) Comments on P16AP17A.
(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

(R. Weiss, rfw@gaslab.ucsd.edu)
or
David Wisegarver (wise@pmel.noaa.gov).

Additional information on WOCE CFC synthesis may be available at:
http://www.pmel.noaa.gov/cfc.

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.

WHPO Data Processing Notes

Date	Contact	Data Type	Data Status Summary
07/07/96	Key	DELC14lvs	DQE Report rcvd @ WHPO
08/08/96	Mantyla	NUTs/S/O	DQE Report rcvd @ WHPO
12/11/96	Millard	CTD	DQE Report rcvd @ WHPO
03/13/98	Kozyr	TCARBN/PCO2/TMP	Final Data Rcvd @ WHPO
12/14/98	Key	DELC14lvs	Data are Public see note
	Public: All of P16 (P16N (GCG91-2), P16C, P16S17S, P16A17A)		
04/29/99	Quay	DELC13	Data Data and/or Status info Requested (DMB)
10/08/99	Evans	DELHE3	Data Update
02/04/00	Kozyr	TCARBN/PCO2/TMP	Final Data Rcvd @ WHPO
03/10/00	Hohmann	HELIUM/NEON	Submitted for DQE
04/14/00	Key	DELC14lvs	Data are Public See note: 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.		
06/21/00	Bartolacci	helium/delhe3	Data Update
	not yet merged into btl file. I have placed updated data file for HE and DELHE3 for both p16a and p17a in "orignal" subdirectory for p16A. Two files both need merging into current bottle file.		
07/09/00	Anfuso	He/Tr	Corrected Quality flags, remerged

The quality flags in the hyd file were not correct for previously merged tritium data. I suspect there were errors in the hyd file when SIOWHPO received this data set. The errors were confusing and not consistent from station to station. Also, all quality words contained a trailing '1' that didn't seem to be associated with any data property.

The original Helium/tritium data file was saved in ...1997/juno1.trt. I reran mrgsea in attempt to remerege the tritium data and associated flags; this did not correct the problem. I verified that the tritium in the exsisting hyd file was exactly what was in the ...1997/juno1.trt file. Using a privious version of the hyd file, p16ahy_rplcd_2000.08.31.txt, I removed the lagging '1' from the quality word, then removed the existing tritium data column (reformatted file, not incorporating tritium column). Then, I remerged the juno1.trt tritium values. After verifying that all parameters had a properly positioned matching flag, I merged into this file new EVANS helium data.

FILE in this directory: juno1_edt.trt : this is a modification of the original tritium data in ...1997/juno1.trt. I removed all data except the tritium data and associated flags for merging. p16ahy_notritium.txt: this is the p16ahy_rplcd_2000.08.31.txt hyd data file after reformatting (removed tritium and lagging '1' in quality word).

p16ahy_trt.dat: this is the corrected hyd data file with tritium and data flag correctly merged. copied to p16a dir as p16ahy.txt. Then, merged in new EVANS helium data and saved this file to origina/p16ahy_rplcd_2000.09.07.txt

07/25/00	Johnson	DOC	ODF Report rcvd @ WHPO

I transferred files over to the ftp-incoming directory the easy way (for me)... You will find the following "new" directories in /usr/export/ftp-incoming on whpo:

p16a_p17a
p17c_p17s_p16s
p17e_p19s

I already gave you p19c (which I see is in P19Cdoc). I thought it was redundant to put long names in every filename, so I made the directory name with the cruise lines, and the files are all the same. The figs files are all figxx.ps (where xx should indicate the figure numbers referenced in the documentation). I also included ps and ascii versions of the original documentation and applicable appendices. (appendix a and b will be missing - they are outdated now and shouldn't be included in anything.)

08/31/00	Anfuso	HELIUM/DELHE3	Data Merged into BTL file

Merged %deltaHe and molal[He] data into BTL file. Merging notes are in original subdir 1999.10.08_P16A_HE_LUPTON-EVANS.

2000.08.31 SRA
Merged 2 helium data files into BTL file.

**Note: some helium data already exsist in current BTL file. Not sure where it came from. However, data in two files to be merge will not overwrite any existing helium data (different stations). I am a little suspicious of some helium values that existed in BTL file. There are several instances of %deltaHe = 000.00 (flag 2), and molal[He] = 0.0000 (flag 1). Possible these were bad merges? Should values be -999.00 and -9.000 and flagged 5?

p16ahe_edt.dat: copied p16awoce.csv.txt into this file and edited to prepare for merging. Substituted spaces for column delimiting ','s. Replaced missing data white space with -9.0000 for molal[He] data on sta/cst/btl: 5/1/24;8/1/25;20/1/21,26;32/1/19;36/1/25;50/1/21,27,36

p17ahe_edt.dat: copied p17awoce.csv.txt into this file and edited to prepare for merging. Substituted spaces for column delimiting ','s. Replaced missing data white space with -9.0000 for molal[He] data on sta/cst/btl: 93/1/35;97/1/24;101/1/16;105/3/32;113/2/20.

Runtime formats:	p16ahe_edt.dat:	%deltaHe	(a6,i6,a7,f9.2,i6) --> p16aheA_delhe.dat
		molal[He]	(a6,i6,a7,15x,f11.4,i6) --> p16aheA_delhe_he.dat
	p17ahe_edt.dat:	%deltaHe	(a7, i6, a7, f9.2,i6) --> p16aheB_delhe.dat
		molal[He]	(a7, i6, a7, 15x, f11.4, i6) --> p16aheB_delhe_he.dat

original/p16ahy_rplcd_2000.08.31.txt : former BTL data, prior to helium data merge. (contains only previously existing helium data).

09/07/00 Anfuso He/Tr, delhe3 Data Merged into BTL file

Remerged tritium data into hyd file. Previously merged data had incorrect quality flags. See notes in subdir original/HYD_REMERGE. Merged helium data from L.Evans into correct hyd file. Updated hyd file put on-line.

2000.09.07 SRA

>>>> HAD TO REPLACE PREVIOUSLY MERGED DATA FILE (2000.08.31).<<<<

There were errors in the tritium data flags that had been merged prior to WHPOSIO work on the hyd file.

See README notes in original subdir HYD_REMERGE (07/09/00). The tritium problem was corrected, then the Evans helium data was remerged into the corrected hyd file. This corrected file, without the EVANS helium data is in the original subdir called p16ahy_rplcd_2000.09.07.txt. NOTE: there was some preexisting helium data in this file that came from the ....1997/juno1.trt file.

Run time formats and file naming convention remains as previosly stated.

10/05/00 Anfuso tcarbn, pco2 Data merged into online Bottle file

Merged TCARBN and PCO2 for p16a/p17a. Updated hyd file is on line. Merging notes in p16a original subdir 1998.03.13_P16A_CO2_XXX.

10/09/00 Hohmann BTL Update Needed

Thanks for your correction. Apparently this sample was read incorrectly into our database. Sample 0326, which I reported as station 72, cast 1, bottle 36, was taken at Station 77! -- Roland

--On Monday, October 9, 2000 1:05 PM -0700 Stacey Anfuso
<stacey@odf.ucsd.edu> wrote:

> Dear Dr. Hohmann:

> I am merging helium and neon data from the P16A/P17A WOCE expedition into
> a composite bottle data file and I have a question regarding the data
> you submitted for station 72. There are two listing of data for station
>. Would you please review the data, and let me know
> if this was an error in the bottle value entry, or if these are dupliate
> samples (in which case, would you prefer to submit one data value over
> another, or to submit a mean data value?).

> Thank you for your time.

> Stacey Anfuso > Staff Research Associate, SIO

10/10/00 Anfuso HELIUM Website Updated: Data merged

into online file Bottle: (helium, delhe3, neon, helier, delher, neoner)

Merged HELIUM, HELIER, DELHE3, DELHER, NEON, and NEONER from Hohmann/Schlosser into hyd file. Updated file is on line. Merging notes in original subdir 2000.03.10_P16A_HE_NE_HOHMANN.

10/25/00 Anfuso PCO2TMP Website Updated: Data merged

into BTL file Merged PCO2TMP data from 1998.03.13_P16A_CO2_XXX subdir into hyd file. Updated hyd file is on-line.

12/11/00	Uribe	DOC	Submitted

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. Received 1997 August 15th.

02/06/01	Stuart	DELC13	Submitted: Pacific C13 data is PUBLIC.

02/26/01	Schlosser	NEON	Data are Public minor corrections

may be needed post-intercal. effort following up on bill jenkins's message, i would like to ask you to make public all ldeo woce tritium/he data that have been submitted to you. because the tritium/he community has not yet finished the final calibration of the data, i might have to apply minor corrections to these data once the intercal. effort has been completed. our acce work was funded over a 5-year period that ended in 2000. consequently, this data set is further behind in quality control before submission, but i expect that we will get these data ready soon.

SR3 was never funded in a 'regular' fashion, but i used noaa corc funds to keep the measurements of this sample set moving. i expect to finish the analyses this summer and submit them in fall.

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.

07/19/01 Bartolacci SUM Data Update Edited header line

edited header line from CDEPTH to DEPTH (COR) was included in the header line above DEPTH. new date/name stamp was entered in file.

10/08/01 Bartolacci CFCs Data Ready to be Merged

I have moved the updated CFC's from Wisegarver into the original subdirectory for p16a in: ..../pacific/p16/p16a/original/20010709_CFC_UPDT_WISEGARVER_P16AP17A

data are ready for merging.

10/24/01 Muus BTL/SUM CFCs Merged into online BTL and CSV files

Merged July 2001 CFCs into bottle file and placed new woce format and exchange format files on web. Made minor modification to Summary file. Changed Quality Code 1 to 9 where appropriate.

Notes on P16A CFC merging Oct 24, 2001.

1. New CFC-11 and CFC-12 from: /usr/export/html- public/data/onetime/pacific /p16/p16a/original/20010709_CFC_UPDT_WISEGARVER_P16AP17A 20010709.174019_WISEGARVER_P16AP17A_p16a_CFC_DQE.dat merged into SEA file from web Oct 24, 2001. (20010403WHPOSIOKJU)

   Changed all quality code "1"s to "9" in QUALT1 and copied QUALT1 to QUALT2 prior to merging.
2. Added left-justified "x"s to Summary File WOCE SECT for Stations 1-2, 54-72 and 120-127 to give proper column count.
3. Exchange file checked using Java Ocean Atlas.

01/07/02	Uribe	CTD	Website Updated: CSV File Added	

CTD has been converted to exchange using the new code and put online. The stations missing an ID were filled in with knorr92.

01/22/02	Hajrasuliha	CTD/BTL	Internal DQE completed	

created .ps files, check with gs viewer. Created *check.txt file.

03/11/02	Schlosser	TRITUM	Data Update	See Note:

we have gone through all juno tritium data and flagged them according to woce procedures. we also plotted sections to check if there are flyers in the data set. the final step we have to complete before submission is to determine the cosmogenic tritium that we subtract from the present numbers. this is only relevant for very low tritium concentrations such as those found in the southern ocean deep and bottom waters (ca. 0.005 to 0.01 TU). i hope that we can finish this by tomorrow and then submit the final tritium and helium isotope numbers to the whpo.

04/09/02	Muus	He/Tr/DelHe3	Data Reformatted/OnLine Merged	

LDEO helium and tritium into bottle file and put on-line. Changed QUALT2 flags for 15 WHOI HELIUM and DELHE3 samples from 2 to 3 because values are zero. New WHOI tritium data are incomplete so not merged.

Notes on P16A/P17A merging April 8, 2002 D. Muus

1. Merged Helium, DelHe3 and Tritium from: comma-separated_value file attached to Bob Newton message 14:59:05 PST, Mar 14, 2002 into current web bottle file (20011024WHPOSIODM).
2. QUALT2 same as QUALT1 for all merged values.
3. Original file had two tritium values for Sta 48, Ca 2, Sample 12 at 8.1db: -0.111 error 0.011 flag 4 0.009 2 Hand edited bottle file to use second value.
4. Jenkins WHOI tritium available on U. of Southhampton web site: http://www.soes.soton.ac.uk/staff/wjj/p16atrits.txt but only includes stations 3, 6, 10 14, 18, 22 & 26.

   Original WHOI helium/tritium data file: /usr/export/html-public/data/onetime/pacific/p16/p16a/original/1997/juno1.trt (dated: 12-in files.doc file)AUG-1996 15:54:52:00 contained data for stations 87, 91, 95, 99, 103, 107, 111, 115, 119, 122& 125 in addition to the above.

   Fifteen of the Helium and DelHe3 samples have values of 0.0000 and 0.00 with quality flags 2. Adjacent values indicate these are errors.

Sta 3	Ca 1	Smp 1	Pres 4.8
3	1	9	308.5
14	2	7	209.0
14	2	12	508.2
18	1	23	2147.9
22	1	16	101.2
26	1	1	3.8
26	1	20	1044.9
87	2	1	3.8
87	2	20	1404.9
99	1	18	1718.3
103	1	17	1261.4
107	1	18	995.5
111	1	5	109.6

115	1	5	132.2

Did not merge any new WHOI helium or tritium data at this time. Will wait for complete data set. But did change QUALT2 flags for the 15 "zero" Helium and DelHe3 from 2 to 3 to indicate problem.

5. Made new exchange file for Bottle data.
6. Checked new bottle file with Java Ocean Atlas.

04/11/02 Muus He/Tr/DelHe3 Data Merged into online BTL file

Merged Jenkins WHOI tritium into bottle file and put on-line. Changed 15 WHOI HELIUM and DELHE3 samples from 0.0000 and 0.00 to -9.0000 and -999.00 and quality flags to 5s. See notes file for details.

Notes on P16A/P17A merging April 10, 2002 D. Muus

1. Merged Tritium and Tritium error from:
   http://www.soes.soton.ac.uk/staff/wjj/p16atrits.txt
   http://www.soes.soton.ac.uk/staff/wjj/p17atrits.txt

   into current web bottle file (20020408WHPOSIODM).
2. QUALT2 same as QUALT1 for all merged values.
3. Fifteen of the Helium and DelHe3 samples have values of 0.0000 and 0.00 with quality flags 2. Adjacent values indicate these are errors.

Sta 3	Ca 1	Smp 1	Pres 14.8
3	1	9	308.5
14	2	7	209.0
14	2	12	508.2
18	1	23	2147.9
22	1	16	101.2
26	1	1	3.8
26	1	20	1044.9
87	2	1	3.8
87	2	20	1404.9
99	1	18	1718.3
103	1	17	1261.4
107	1	18	995.5
111	1	5	109.6
115	1	5	132.2

   Bill Jenkins message of April 10, 2002, says these values had processing problems and are not reported. 0.0000 and 0.00 to -9.0000 and -999.00 and changed quality flags to "5"s.
4. Made new exchange file for Bottle data.
5. Checked new bottle file with Java Ocean Atlas.

05/02/02 Muus DELC13 Data Merged into online BTL file

P17A DELC13 merged into bottle file and put on line together with new exchange file.

Notes on P16A/P17A merging May 2, 2002 D.Muus

1. Merged P17A DELC13 from:
   /usr/export/html-public/data/onetime/pacific/p17/original/20010206_C13_P17_
   STUART.e mail into bottle file (20020410WHPOSIODM)
2. Only sample reference in C13 data file is station, cast and niskin. SAMPNO appears same as BTLNBR in bottle file so no apparent problem.

3. No DELC13 data for the P16A stations.
4. Made new exchange file for Bottle data.
5. Checked new bottle file with Java Ocean Atlas.

05/21/02 Anderson DELC14 Data merged into online file

Merged DELC14 and C14ERR from file p16a17a.c14 sent by Bob Key, found in web site: /p16/p16a/original/COMPARE_C14 into online file p16ahy.txt (20020502WHPOSIOSM).

06/11/02 Talley TRITUM Update Needed

I'm still trying to figure out what happened with tritium on P17A:

Station 81, bottle 22, 1807 dbar: 0.009 (probably fine - zero within error?) Station 81, bottle 24, 2210 dbar: 0.112 - high

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06/13/02 Anderson DELC13 Data Merged into online BTL file

Remerged DELC14 and C14ERR into previous online file (20020502WHPOSIODM) since I noticed that I had made a mistake and put a QUALT1 and QUALT2 flag for C14ERR. There was not Q1 or Q2 flag in the original file from Key. After remerging I changed the Q2 flags that are set to 1 by the merging program to be the same as the Q1 flags.

Merged the DELC13 for P16A only since Dave Muus had already merged the DELC13 data for P17A. The DELC13 data was retrieved from Bob Key's ftp site in May of 2001.

Merging notes:
Noticed that when I merged the DELC14 and C14ERR I had made a mistake and put a QUALT1 and QUALT2 flag for C14ERR. There was no Q1 or Q2 flag in the original file from Key. I remerged these two parameters and changed the Q2 flags that were set to 1 by the merging program for DELC14 to the same as the Q1 flag.

Merged the DELC13 for P16A only since Dave Muus had already merged the DELC13 data for P17A. The DELC13 was retrieved from Bob Key's ftp site in May of 2001.

Put new file online and made new exchange file.

Put file online and made new exchange file.

06/13/02 Anderson DELC14 Data Merged into online BTL file

Remerged DELC14 and C14ERR into previous online file (20020502WHPOSIODM) since I noticed that I had made a mistake and put a QUALT1 and QUALT2 flag for C14ERR. There was not Q1 or Q2 flag in the original file from Key. After remerging I changed the Q2 flags that are set to 1 by the merging program to be the same as the Q1 flags.

Merged the DELC13 for P16A only since Dave Muus had already merged the DELC13 data for P17A. The DELC13 data was retrieved from Bob Key's ftp site in May of 2001.

Merging notes:
Noticed that when I merged the DELC14 and C14ERR I had made a mistake and put a QUALT1 and QUALT2 flag for C14ERR. There was no Q1 or Q2 flag in the original file from Key. I remerged these two parameters and changed the Q2 flags that were set to 1 by the merging program for DELC14 to the same as the Q1 flag.

Merged the DELC13 for P16A only since Dave Muus had already merged the DELC13 data for P17A. The DELC13 was retrieved from Bob Key's ftp site in May of 2001.

Put new file online and made new exchange file.

06/17/02	Talley	TRITUM	Data Update	Tritium flag update

Peter - thanks - OK, will flag it as questionable. But the value in the WHPO file is 0.112 (not 0.011 as in your email) - (station 81, bottle 24) - I'll double check this against the original submission as well.

06/17/02	Schlosser	TRITUM	Update Needed

We only have two data points from this station. I agree that the second value (0.011) is high in comparison to all the other values from this depth range. we probably should flag it as 'questionable' data point.

06/26/02	Anderson	LVS	LVS file reformatted

Minor reformatting of .lvs file p16a17lv.c14 found in p16a/original/COMPARE_C14/LARGE_VOLUME. File needs to be linked.

Here are my notes for the p16ap17a .lvs formatting.

Checked format, corrected first header, added date, whp-id, and time stamp

06/28/02	Uribe	LVS	Website Updated: LVS data linked to web site.

Large Volume Sample data was linked to website.

06/28/02	Anderson	LVS	Corrections made,

file needs to be linked to web site Checked format of lvs file p16a17lv.c14 found in p16a/original/COMPARE_C14/LARGE_VOLUME. Made minor adjustments, corrected first header, added date, whp-id, and timestamp. This file need to be linked to web site.

07/30/02	Kappa	DOC	Updated text file, added pdf file

Both files now contain DQE reports for CTDs, Bottle Data, CFCs, LV C14 and SV C14. PDF file also contains all figures and links between text and figures/tables/appendicies.