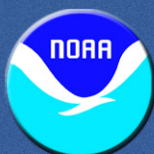




Carbon Dioxide Information
Analysis Center
Oak Ridge National Laboratory
Oak Ridge, Tennessee



Pacific Marine
Environmental Laboratory
National Oceanic and
Atmospheric Administration
Seattle, Washington

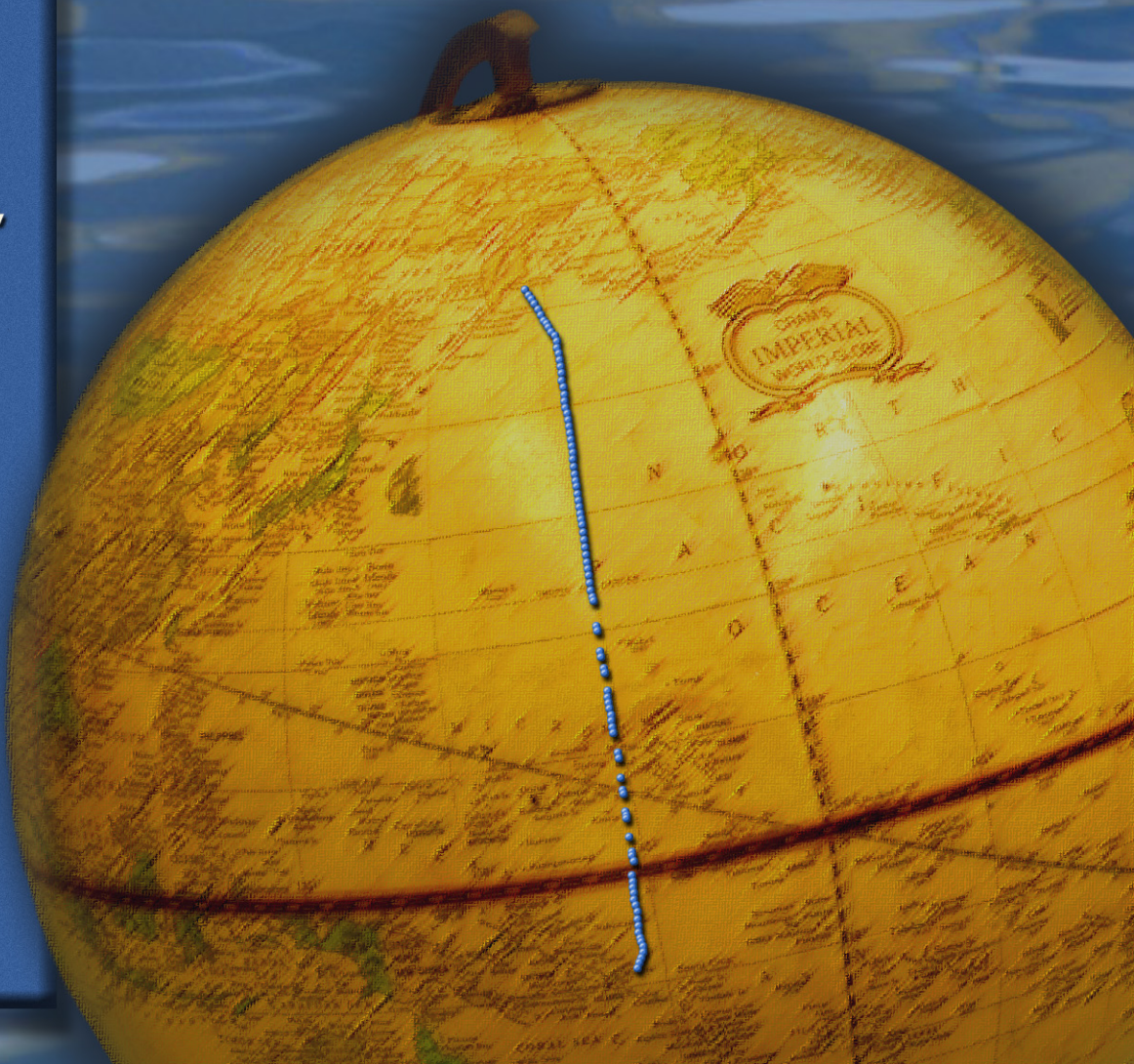


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Carbon Dioxide, Hydrographic, and Chemical Data Obtained During the *R/V John V. Vickers* Cruise in the Pacific Ocean

(WOCE Section P13, NOAA CGC92 Cruise,
August 4 - October 21, 1992)



**CARBON DIOXIDE, HYDROGRAPHIC, AND CHEMICAL DATA OBTAINED
DURING THE R/V *JOHN V. VICKERS* CRUISE IN THE PACIFIC OCEAN
(WOCE SECTION P13, NOAA CGC92 CRUISE, AUGUST 4–OCTOBER 21, 1992)**

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**Environmental Sciences Division
Publication No. 5007**

Date Published: December 2000

**Prepared for the
Environmental Sciences Division
Office of Biological and Environmental Research
U.S. Department of Energy
Budget Activity Numbers KP 12 04 01 0 and KP 12 02 03 0**

**Prepared by the
Carbon Dioxide Information Analysis Center
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managed by
UT-BATTELLE, LLC
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-00OR22725**

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ACRONYMS

ADCP	acoustic Doppler current profiler
CDIAC	Carbon Dioxide Information Analysis Center
CFC	chlorofluorocarbon
CGC	Climate and Global Change
CO ₂	carbon dioxide
COARE	Coupled Ocean-Atmosphere Response Experiment
CTD	conductivity, temperature, and depth sensor
DOE	U.S. Department of Energy
FTP	file transfer protocol
GMT	Greenwich mean time
GO	General Oceanics, Inc.
IAPSO	International Association for the Physical Sciences of the Ocean
nm	nautical mile
NBIS	Neil Brown Instrument System
NDP	numeric data package
NOAA	National Oceanic and Atmospheric Administration
pCO ₂	partial pressure of CO ₂
PMEL	Pacific Marine Environmental Laboratory
PSS	Practical Salinity Scale
QA	quality assurance
R/V	research vessel
SIO	Scripps Institution of Oceanography
SOMMA	Single-Operator Multiparameter Metabolic Analyzer
SOP	standard operating procedure
TALK	total alkalinity
TCO ₂	total carbon dioxide
TOGA	Tropical Ocean Global Atmosphere
UH	University of Hawaii
USF	University of South Florida
UW	University of Washington
WHOI	Woods Hole Oceanographic Institution
WHPO	WOCE Hydrographic Program Office
WOCE	World Ocean Circulation Experiment

ABSTRACT

Dickson, A. G., C. D. Keeling, P. R. Guenther, and J. L. Bullister. 2000. Carbon Dioxide, Hydrographic, and Chemical Data Obtained During the R/V *John V. Vickers* Cruise in the Pacific Ocean (WOCE Section P13, NOAA CGC92 Cruise, August 4–October 21, 1992), A. Kozyr (ed.). ORNL/CDIAC-128, NDP-075. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee, 96 pp. doi: 10.3334/CDIAC/otg.ndp075

This data documentation discusses the procedures and methods used to measure total carbon dioxide (TCO₂) and total alkalinity (TALK) at hydrographic stations during the R/V *John V. Vickers* oceanographic cruise in the Pacific Ocean (Section P13). Conducted as part of the World Ocean Circulation Experiment (WOCE) and the National Oceanic and Atmospheric Administration's Climate and Global Change Program, the cruise began in Los Angeles, California, on August 4, 1992, with a transit line (Leg 0) to Dutch Harbor, Alaska. On August 16, the ship departed Dutch Harbor on Leg 1 of WOCE section P13. On September 15, the R/V *John V. Vickers* arrived in Kwajalein, Marshall Islands, for emergency repairs, and after 11 days in port departed for Leg 2 of Section P13 on September 26. The cruise ended on October 21 in Noumea, New Caledonia. Measurements made along WOCE Section P13 included pressure, temperature, salinity [measured by a conductivity, temperature, and depth sensor (CTD)], bottle salinity, bottle oxygen, phosphate, nitrate, nitrite, silicate, chlorofluorocarbons (CFC-11, CFC-12), TCO₂, and TALK.

The TCO₂ was measured by coulometry using a Single-Operator Multiparameter Metabolic Analyzer (SOMMA). The overall precision and accuracy of the analyses was ± 2 $\mu\text{mol/kg}$. Samples collected for TALK were measured by potentiometric titration; precision was ± 2 $\mu\text{mol/kg}$. The CO₂-related measurements aboard the R/V *John V. Vickers* were supported by the U.S. Department of Energy.

The WOCE Section P13 data set is available free of charge as a numeric data package (NDP) from the Carbon Dioxide Information Analysis Center. The NDP consists of two oceanographic data files, two FORTRAN 90 data-retrieval routine files, a documentation file, and this printed report, which describes the contents and format of all files as well as the procedures and methods used to obtain the data. Instructions on how to access the data are provided.

Keywords: carbon dioxide; TCO₂; coulometry; World Ocean Circulation Experiment; Pacific Ocean; hydrographic measurements; alkalinity; carbon cycle.

PART 1:
OVERVIEW

1. BACKGROUND INFORMATION

The World Ocean plays a dynamic role in the Earth's climate: It captures heat from the sun, transports it, and releases it thousands of miles away. These oceanic-solar-atmospheric interactions affect winds, rainfall patterns, and temperatures on a global scale. The oceans also play a major role in global carbon-cycle processes. Carbon is unevenly distributed in the oceans because of complex circulation patterns and biogeochemical cycles. The oceans are estimated to hold 38,000 gigatons of carbon, 50 times more than that in the atmosphere and 20 times more than that in plants, animals, and soil. If only 2% of the carbon stored in the oceans were released, the level of atmospheric carbon dioxide (CO₂) would double. Every year, the amount of CO₂ exchanged across the sea surface is more than 15 times that produced by the burning of fossil fuels, deforestation, and other human activities (Williams 1990).

To better understand the ocean's role in climate and climatic changes, several large experiments have been conducted, and others are under way. The largest oceanographic experiment ever attempted is the World Ocean Circulation Experiment (WOCE). A major component of the World Climate Research Program, WOCE brings together the expertise of scientists and technicians from more than 30 nations. In the United States, WOCE is supported by the federal government under the Global Change Research Program. The multiagency U.S. effort is led by the National Science Foundation and is supported by major contributions from the National Oceanic and Atmospheric Administration (NOAA), the U.S. Department of Energy (DOE), the Office of Naval Research, and the National Aeronautics and Space Administration. Although total carbon dioxide (TCO₂) is not an official WOCE measurement, a coordinated effort, supported in the United States by DOE, was made on WOCE cruises to measure the global distributions of TCO₂ and other carbon-related parameters [total alkalinity (TALK), partial pressure of CO₂ (pCO₂), and pH]. The goal of the DOE's CO₂ survey includes estimation of the meridional transport of inorganic carbon in a manner analogous to the oceanic heat transport (Bryden and Hall 1980; Brewer et al. 1989; Roemmich and Wunsch 1985), evaluation of the exchange of CO₂ between the atmosphere and the ocean, and preparation of a database suitable for carbon-cycle modeling and subsequent assessment of anthropogenic CO₂ in the oceans. The final data set is expected to cover ~23,000 stations.

This report presents CO₂-related measurements obtained during the Research Vessel (R/V) *John V. Vickers* NOAA Climate and Global Change (CGC92) expedition along the WOCE meridional Section P13 (Fig. 1).

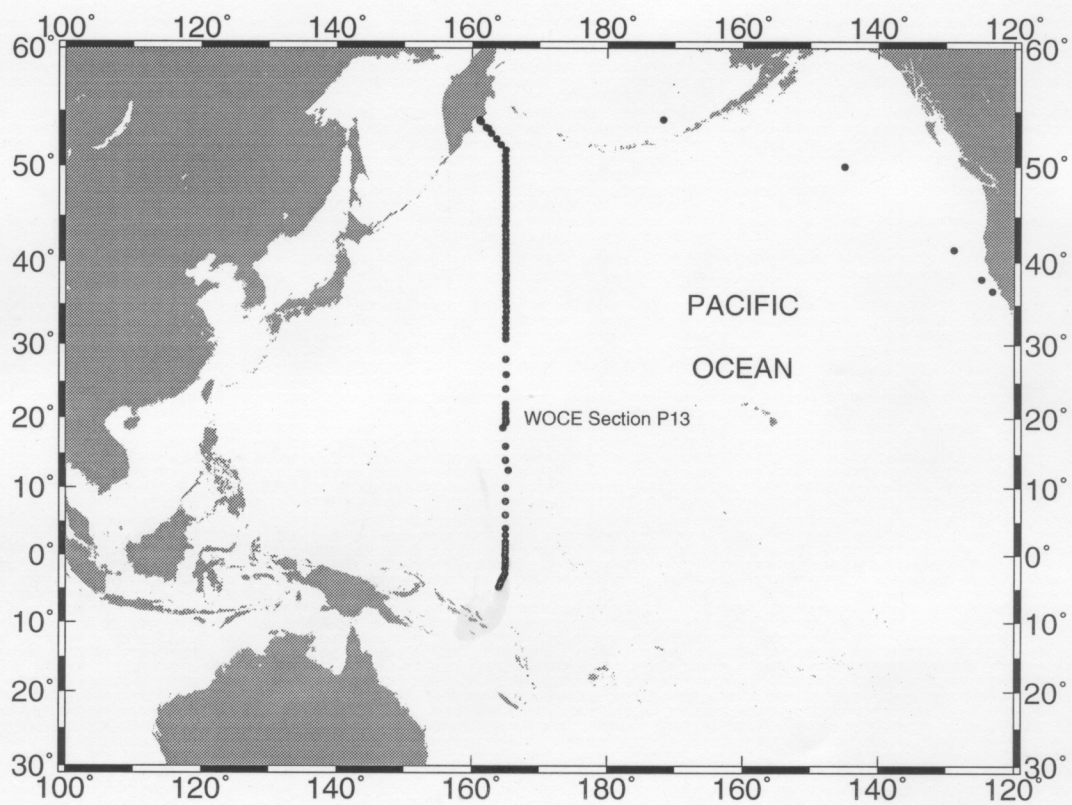


Fig. 1. The cruise track during the R/V *John V. Vickers* expedition in the Pacific Ocean along WOCE Section P13.

2. DESCRIPTION OF THE EXPEDITION

2.1 R/V *John V. Vickers* Cruise Information

R/V *John V. Vickers* cruise information follows:

Ship name	<i>John V. Vickers</i>
Expedition code	3220CGC92/0, 1, 2
WOCE Section	P13
Location	Los Angeles, California, U.S.A., to Noumea, New Caledonia
Dates	August 4–October 21, 1992
Chief Scientist	Legs 0 and 1, John Bullister, NOAA/PMEL Leg 2, Bruce Taft, NOAA/PMEL (retired)

Parameters measured	Institution	Principal investigators
CTD, ¹ salinity	PMEL	B. Taft
Oxygen	PMEL	J. Bullister
Nutrients	USF	K. Fanning
Chlorofluorocarbons (CFCs)	PMEL	J. Bullister
Tritium and helium-3	WHOI	W. Jenkins
TCO ₂	SIO	A. Dickson
TALK	SIO	C. Keeling
Radiocarbon (¹⁴ C)	UW	P. Quay
Underway ADCP ²	SIO	R. Pinkel
Lowered ADCP	UH	P. Hacker

Participating Institutions

PMEL	Pacific Marine Environmental Laboratory
USF	University of South Florida
UW	University of Washington
WHOI	Woods Hole Oceanographic Institution
SIO	Scripps Institution of Oceanography
UH	University of Hawaii

¹Conductivity, temperature, and depth sensor.

²Acoustic Doppler current profiler.

2.2 Brief Cruise Summary

The CGC92 expedition was carried out on the U.S. registered R/V *John V. Vickers*. This vessel was operated by the University of Southern California together with officers from the NOAA corps.

The goal of the cruise was to carry out a WOCE one-time hydrographic measurement along section P13 which runs along longitude 165E E from the Kamchatka peninsula to New Caledonia. The cruise was split into three legs for logistical regions.

2.2.1 Leg 0: Expedition Code 3220CGC92/0

Leg 0 of the CGC92 expedition consisted of a transit from Los Angeles, California, to Dutch Harbor, Alaska, with 4 stations occupied along the cruise track to test the CTD/rosette system (stations 1–4 are not included in the data set). One of these stations was a re-occupation of Station “P” (50E N, 145E W). Scientists from SIO tested an underway ADCP system along the cruise track.

2.2.2 Leg 1: Expedition Code 3220CGC92/1

The chief scientist for Leg 1 of the cruise was Dr. John Bullister of NOAA/PMEL. The R/V *John V. Vickers* left Dutch Harbor on August 16, 1992, to carry out the sampling along the cruise track, and arrived at Kwajalein, Marshall Islands, on September 15, 1992.

Leg 1 consisted of 51 stations (Nos. 5–55). The first station on this leg (No. 5) was a CTD/rosette cast test (not included in the data set) made in the Bering Sea, along the transit from Dutch Harbor to the start of the P13 line near the Kamchatka Peninsula. Sampling of the P13 section began with occupation of station No. 6 on August 21, 1992, near the 200-meter isobath off Kamchatka. A series of stations were occupied on a southeastward transit down the continental slope and across the Kamchatka trench. The section turned directly southward at about 51E 30' N and 165E 00' E and continued along the 165E E meridian for the remainder of Leg 1. Nominal station spacing was 30 nautical miles (nm) from the start of the section to about 40E N. Because of a series of delays during the first part of Leg 1, a decision was made to stretch nominal station spacing for the remainder of Leg 1 to 40 nm.

Because of concerns about possible structural deformation to the ship and concern over the failure of a watertight door to close properly, work on the P13 CTD/rosette section was halted on September 9, 1992, at about 30E N, and R/V *John V. Vickers* was ordered to steam directly to Kwajalein.

2.2.3 Leg 2: Expedition Code 3220CGC92/2

The chief scientist for the second leg of the cruise was Dr. Bruce Taft from NOAA/PMEL. The R/V *John V. Vickers* remained at the dock in Kwajalein for an extended period of time for evaluation of structural integrity by two marine architects and for repair. The ship left Kwajalein

on September 26, 1992, and began steaming back to the break-off point to continue work on the P13 section.

Despite the delay caused by these repairs, the R/V *John V. Vickers* had to arrive in Noumea, New Caledonia, in time for its subsequent use by Tropical Ocean Global Atmosphere/Coupled Ocean-Atmosphere Response Experiment (TOGA/COARE) investigators. This schedule did not allow enough time to complete the WOCE Section P13 to even minimum WOCE Hydrographic Program (WHPO) specifications.

With the remaining time, R/V *John V. Vickers* occupied CTD/rosette stations at a nominal spacing of about 60 nm from 28E N to 4E N, and closer spacing from 4E N to 4E 30' S. Lowered ADCP measurements were made on stations between 4E N and 4E S. The section was terminated on October 17, 1992, at 4E 45' S and 164E 00' E in order to arrive in Noumea by the October 21 deadline. A total of 32 stations (Nos. 56–88) were occupied during Leg 2 (station No. 60 was aborted and not included in the listings).

Throughout the cruise along WOCE Section P13, samples for shipboard analysis of TCO_2 and TALK were collected from 10-L Niskin bottles on the 36-position small-volume rosette water sampling system. Of the total of 88 stations on the three legs, CO_2 samples were collected from all Niskin bottles throughout the water column on 39 stations. On an additional 41 stations CO_2 samples were collected from surface bottles only (Fig. 2).

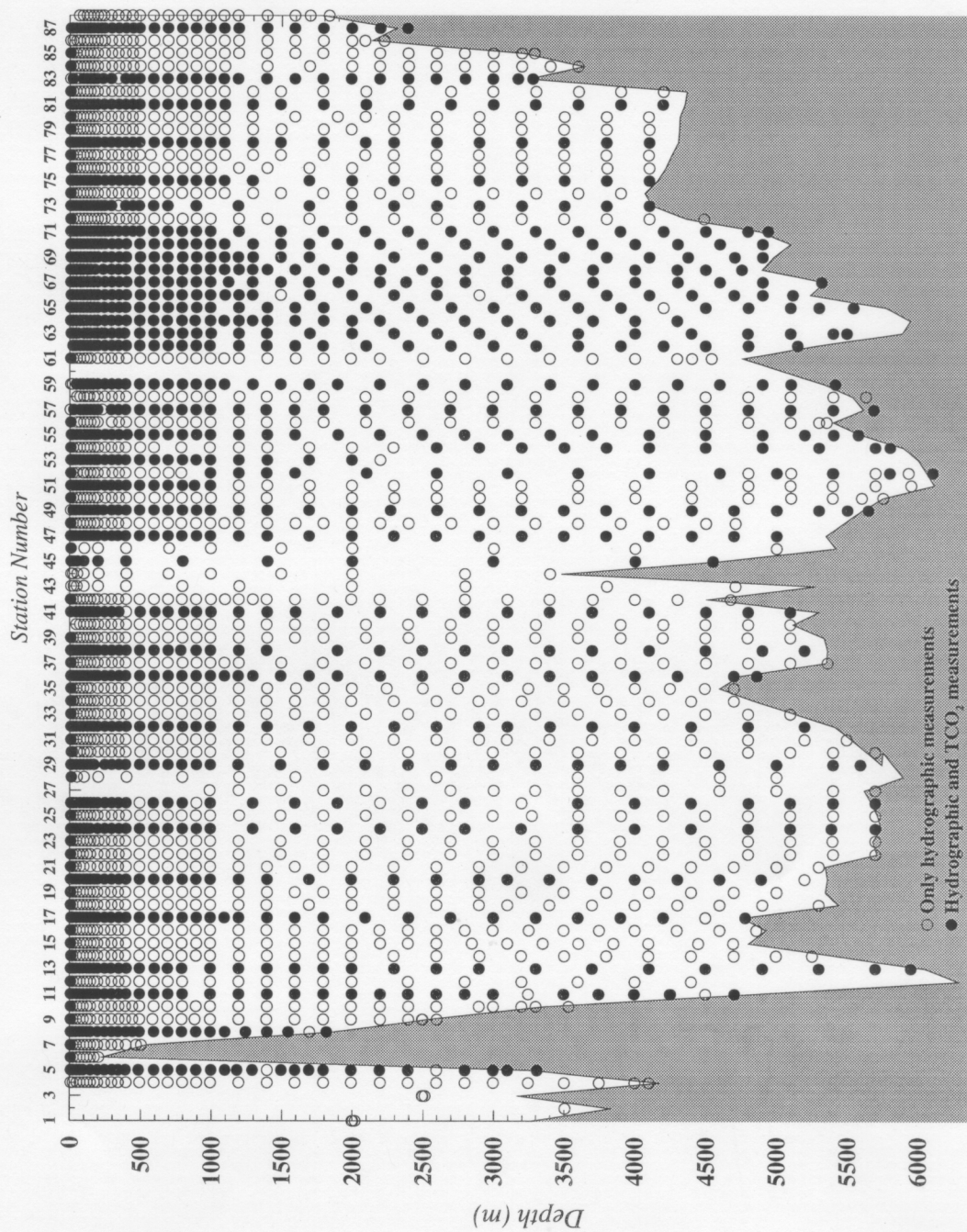


Fig. 2. Sampling depths at all hydrographic stations occupied during the R/V John V. Vickers expedition along WOCE Section P13.

3. DESCRIPTION OF VARIABLES AND METHODS

3.1 Hydrographic Measurements

A NOAA/PMEL-designed, 36-position, 10-L rosette frame was used at 84 of the 88 stations during the expedition. A smaller 12-position, 2.4-L rosette was used as a bad-weather backup system at several stations during the cruise. A General Oceanics (GO) 36 “Intelligent” underwater array (pylon) and deck unit was used with the PMEL 36-position system, along with a Neil Brown Instrument Systems (NBIS) MARK III CTD (serial # 1111). The CTD pressure, temperature, and conductivity data were processed and corrected according to laboratory calibrations. Pressure values are expected to be accurate to ± 3 dbar, temperature values to $\pm 0.002^\circ\text{C}$.

The salinity analysis aboard R/V *John Vickers* was determined exclusively with a Guildline 8400 Autosol. This instrument was located in a temperature-controlled room at $20.5 \pm 1^\circ\text{C}$. The bath of the autosol was kept at 21°C and proved to be very stable throughout the cruise. Standardization of the autosol was carried out with International Association for the Physical Sciences of the Ocean (IAPSO) Standard Seawater batch P114.

Samples of dissolved oxygen were collected soon after the rosette sampler was brought on board and after CFC and helium samples were collected. Calibrated 125-mL nominal volume iodine determination flasks (Corning 5400-125) were used for sampling. Titration was performed by Carpenter’s (1965) whole bottle technique with a modification of the system described by Friederich et al. (1991).

All analyses for nutrients were done with an Alpkem RFA/2 320 autoanalyzer. The methods used were modified from those recommended by the Alpkem Corporation. The working nutrient standards used were a mixture of phosphate, silica, nitrate, and nitrite in a low-nutrient natural seawater matrix. Simultaneous analyses were run on the RFA/2 for all of these nutrients.

For more detailed information on hydrographic measurements, please see the Chief Scientist report at <http://whpo.ucsd.edu/data/onetime/pacific/p13/p13/index.htm>.

3.2 Total Carbon Dioxide Measurements

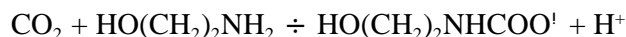
The samples for TCO_2 were taken in 500-mL borosilicate glass bottles in accordance with the procedure specified in *Handbook of Methods for the Analysis of the Various Parameters of the Carbon Dioxide System in Sea Water* (DOE 1994), an earlier version of which was available at the time in manuscript version to the DOE Science Team. The samples were poisoned with mercuric chloride to minimize biological activity prior to analysis.

Two duplicate samples were taken and analyzed for each profile: one in surface water (near the top of the cast) and one in deep water (near the bottom of the cast). These are used to assist in the assessment of the measurement quality.

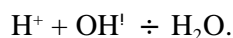
3.2.1 Analysis Technique

The samples were analyzed using a Single Operator Multiparameter Metabolic Analyzer (SOMMA) developed by K. Johnson (Johnson et al. 1985; 1987). The procedure using this specific instrument is described in detail in the SOMMA operating manual (Johnson 1991 - unpublished manuscript), and a description of the procedure is available in the DOE handbook (DOE 1994).

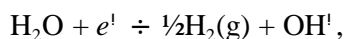
The principle behind this analysis is as follows: A known amount of seawater is dispensed into a stripping chamber where it is acidified and purged with an inert gas. The presence of solid carbonates, such as CaCO_3 , thus constitutes an interference in the method. The amount of CO_2 in the resulting gas stream is determined by absorbing the CO_2 in an absorbent containing ethanolamine and titrating coulometrically the hydroxyethylcarbamic acid that is formed. The pH of the solution is monitored by measuring the transmittance of a thymolphthalein indicator at approximately 610 nm. Hydroxide ions are generated by the coulometer circuitry so as to maintain the transmittance of the solution at a constant value. The relevant chemical reactions occurring in the solution are:



and



The hydroxide ions used are generated at the cathode by electrolyzing water:



while silver is dissolved at the anode:



The overall efficiency of the coulometric procedure is calibrated using known amounts of CO_2 gas, either from gas loops or from seawater-based reference materials.

3.2.2 Order of Analyses

The samples were analyzed in the order surface-to-deep. This order allowed the cooler deep samples to come to room temperature before they were analyzed. However, this means that it is not possible to ascertain from the analytical measurements alone if there is a systematic variation in the calibration with the life of the coulometric cell (see Sect. 3.2.3 below).

3.2.3 Calibration of the Analyses

The calibration of the analyses reported here was problematic. The original plan was to use gas loops to calibrate the coulometer system and to check the performance of the analyses using certified reference materials (CRM Batch 13, certified TCO_2 value 2015.13 $\mu\text{mol/kg}$). Unfortunately, a post-cruise examination of the results showed that the calibration factor calculated for gas loops was unexpectedly variable; an examination of the calibration factor that would have been calculated from the analyses of the CRMs also showed similar variability (equivalent to a standard deviation of measurement of 2.4 $\mu\text{mol/kg}$).

A more detailed examination showed that the variability was restricted to those measurements that had been made in the early stages of a cell's lifetime; measurements on gas loops (Fig. 3) or on CRMs (Fig. 4) made later in the cell's lifetime were much more stable as well as being lower (counts/ μmol) than the initial measurements.

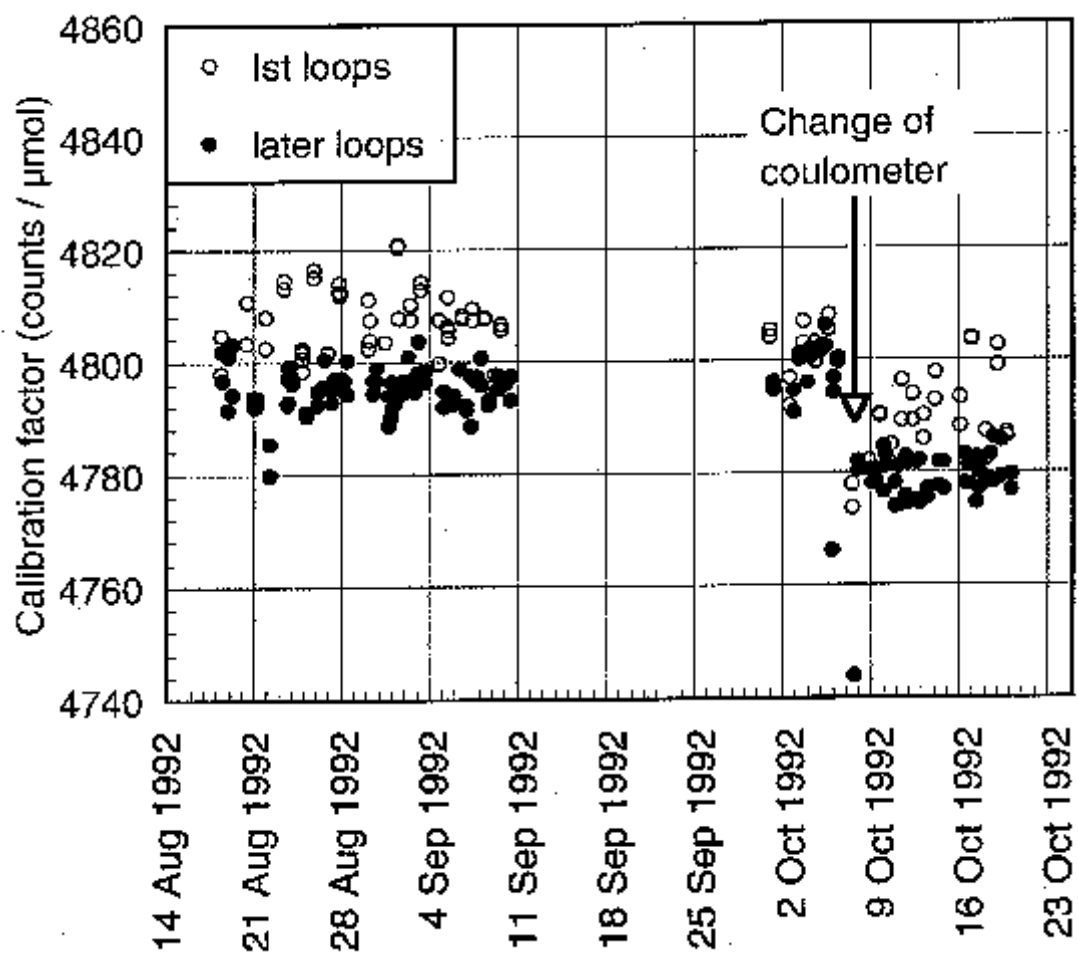


Fig. 3. Calibration factors from gas loops expressed as counts/Fmol.

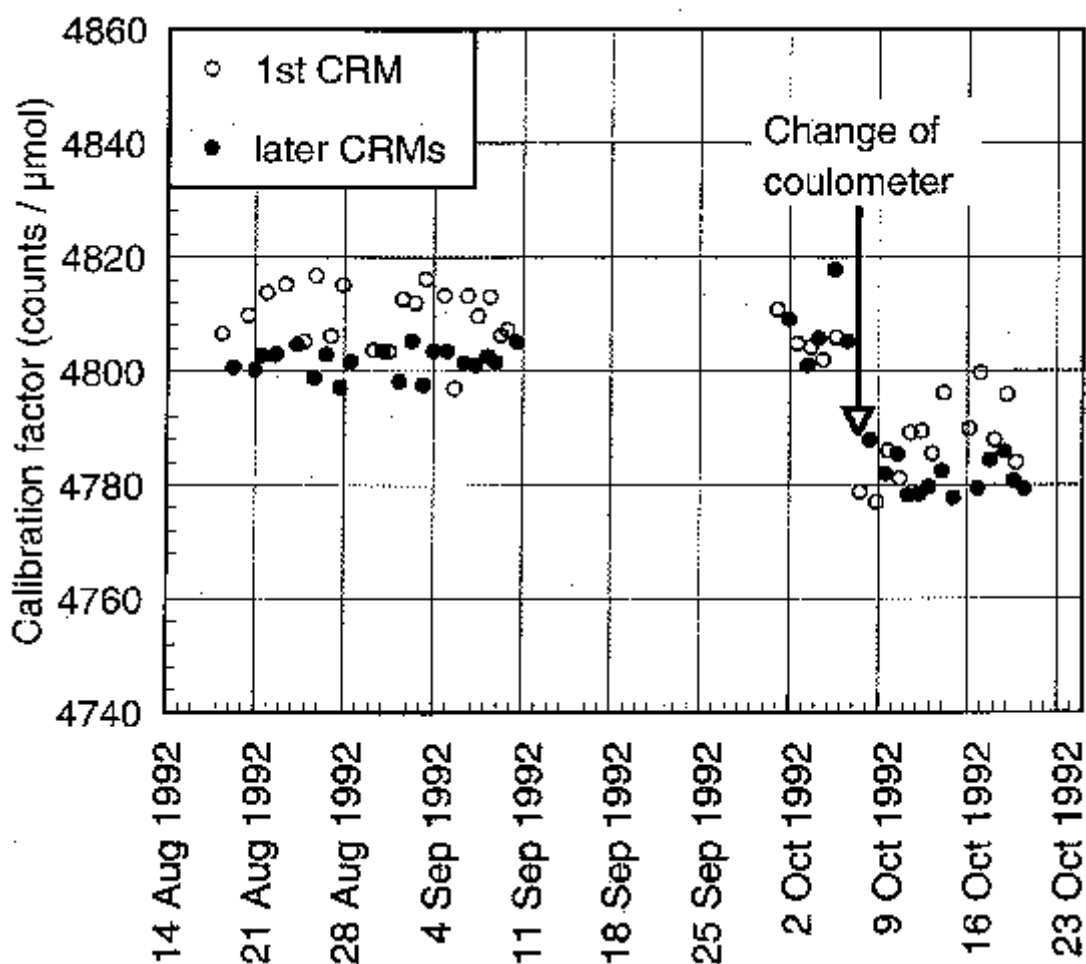


Fig. 4. Calibration factors from CRMs expressed as counts/Fmol.

The reason for this variability appears to be that the cell was not adequately conditioned prior to being calibrated and used (Ken Johnson, BNL, personal communication). Consequently, measurements made early in the cell lifetime are suspect. These include all of the initial gas loop calibrations as well as the initial measurement of the reference material. The early measurements that were made on water from the upper ocean may also be somewhat degraded (see Sect. 3.2.4 below).

The calibration approach used to calculate the results presented here was as follows:

- c The calibration of an individual coulometer was assumed to remain stable from day to day throughout its period of use. This assumption reflects the experience of most investigators (Dickson 1992) and is also borne out by the measurements from this cruise made later in the cell life (see Fig. 3 and Fig. 4). Note that a single coulometer unit was used throughout Leg 1 and for part of Leg 2; it was exchanged during Leg 2 on October 7, 1992, prior to measurement of samples from station 65.
- c Thus the measurements on reference materials were divided into two groups: one prior to station 65, the other from station 65 to the end of the cruise, and a mean calibration factor was calculated separately for each group of analyses (based on the measurements made on reference materials later in the cell lifetime).
- c This universal (coulometer dependent) calibration factor (i.e., based on the CRMs) was used to calibrate the measurements made on individual sea water samples.

3.2.4 Measurement Data Quality

Because of the difficulty in assigning a meaningful calibration to the analyses of total dissolved inorganic carbon made on this cruise, it is difficult to assess the data quality of the measurements presented here. Although it is apparent that analyses made later in the coulometric cell's lifetime are less variable (see Fig. 3 and Fig. 4), it is less clear when the measuring system settles down. Thus the measurements that are made early in the cell lifetime are also necessarily suspect (this is discussed in more detail below).

One indication of the potential accuracy of the measurement system is the degree of agreement between the calibration factors based on gas loops and those based on CRMs. The average difference is of the order of 0.1% (Leg 1: 0.14%, Leg 2: 0.06%), thus indicating that the gas loops had the potential of providing an accurate calibration if the cell had been adequately conditioned.

The precision of measurement is harder to assess. Duplicate samples were taken at each full station. These were typically a surface sample (in the top 10 m) and a deep sample (usually from one of the two deepest Niskin bottles). The duplicates were analyzed with the surface pair being analyzed at the beginning of a run and the deep pair being split between the beginning and end of a run.

The standard deviation of a single measurement calculated from these duplicates was 1.3 $\mu\text{mol/kg}$ for the surface samples (analyzed together); and 2.0 $\mu\text{mol/kg}$ for the deep samples (analyzed at the start and end of a run).

However, the standard deviation figures are somewhat misleading. The mean difference for the surface samples (first and second) is 0.4 $\mu\text{mol/kg}$; that for the deep samples is 1.2 $\mu\text{mol/kg}$. This suggests that even during the measurement of these duplicates the calibration of the cell is changing in the direction shown in Fig. 3 and Fig. 4. Hence, the measurements on the samples done in the first part of a run, those from the upper ocean, may, on occasion, be biased high by the use of a calibration factor more appropriate to the later measurements. An examination of the data on duplicates indicates that the extent of this bias is unlikely to exceed 4 $\mu\text{mol/kg}$ and may on many occasions be less than that (see Section 3.4 for an evidence from the shore-based replicate measurements). The measurements on the later (deep) samples would be expected to

have a precision similar to that found for the later CRMs: a standard deviation of 1.1 $\mu\text{mol/kg}$ (i.e., a similar magnitude to that found for those duplicate measurements that were run side-by-side at the beginning of the run).

3.3 Total Alkalinity Measurements

The TALK concentrations were determined by potentiometric titration of 1153 Niskin samples, 574 from Leg 1 and 579 from Leg 2. Samples from throughout the water column were measured on 39 stations (nominally 36 depths per station) and from surface Niskins only on 41 additional stations. The TALK was measured on an aliquot of seawater taken from the same 500-mL bottle previously analyzed for TCO_2 . Calibration of the shipboard measurements of TALK reported in this numeric data package depends upon the standardization of the HCl titrants with titrations of primary standard sodium carbonate solutions at SIO. The titration system and its calibration are described in Guenther et al. (1994a), a reprint of which is provided in Appendix A of this report. Adjustments to the TALK calibration scale are likely to be made in the future.

Data quality was assessed at sea by titration of replicate seawater samples, secondary standard bicarbonate solutions prepared at SIO before expedition, and bottles of CRM batch number 13. Aliquots from the replicate seawater samples and the CRMs were titrated after aliquots had been removed for TCO_2 measurements.

The short-term repeatability was estimated by analyzing the agreement of pairs of replicate seawater samples titrated simultaneously, using equation (3) in Standard Operating Procedure (SOP) 23 of DOE (1994). One or two pairs usually were measured on each day of analysis. On Leg 1, for 33 pairs, the sample standard deviation, s_i , of a single measurement was estimated to be 1.56 $\mu\text{mol/kg}$. On Leg 2, for 30 pairs, s_i was estimated to be 2.13 $\mu\text{mol/kg}$.

Two batches of bicarbonate reference materials were titrated during the cruise. Usually four measurements were made per day. Analysis of the results using the normal equation for sample standard deviation yields an estimate of the reproducibility of the measurements over the entire cruise. The s_i was found to be 2.77 $\mu\text{mol/kg}$ for 75 measurements of batch "A" and 2.03 $\mu\text{mol/kg}$ for 90 measurements of batch "B."

Titration of CRM samples provided an additional estimate of reproducibility and also an estimate of the accuracy through comparison of the at-sea results with the value certified by the laboratory of A. G. Dickson at SIO. The value for CRM batch 13, certified by titrations in 1996 on archived samples, was 2203.79 $\mu\text{mol/kg}$. During the cruise 84 titrations of CRM batch 13 were made. After 6 measurements were rejected, the s_i calculated for 78 measurements was 2.29 $\mu\text{mol/kg}$. The average TALK for the 78 measurements was 2201.26 $\mu\text{mol/kg}$, nearly within one standard deviation of the certified value. The TALK measurements of seawater reported here have not been adjusted by this difference. Figure 5 is a plot of the difference between the shipboard TALK of CRM batch 13 and the certified value versus time during both legs of the cruise.

For more detailed information on TALK measurements during the R/V *John V. Vickers* cruise along WOCE section P13 please see Appendix A in this report.

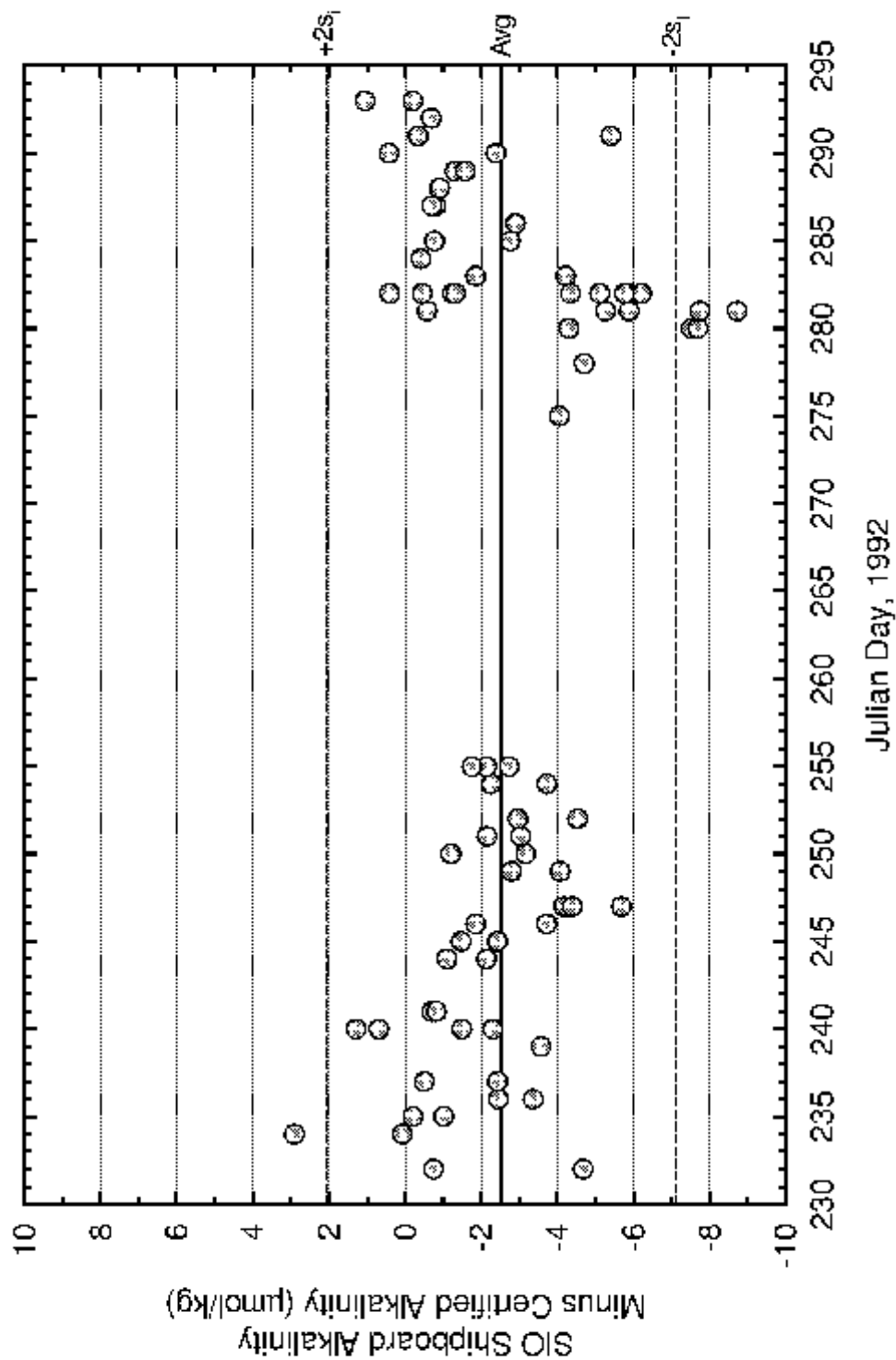


Fig. 5. Difference between SIO shipboard TALK of CRM batch 13 and the certified value vs time during WOCE Section P13. Solid line denotes the average SIO value and dotted lines denote plus/minus two times the standard deviation of an individual SIO value.

3.4 Shore-Based Replicate Measurements

During the expedition, 322 duplicate samples were collected and returned to SIO for shore-based measurements in the laboratory of C. D. Keeling. A total of 309 TCO_2 and 314 TALK measurements were performed on these samples. The $^{13}\text{C}/^{12}\text{C}$ isotopic ratio of the carbon comprising the TCO_2 was also measured (but not reported in this numeric data package). Comparisons between the shore-based measurements of TCO_2 and TALK and those made at sea on water from the same Niskin bottles provide further quality control information on the carbon data set for WOCE Section P13.

Shore-based measurements of TCO_2 were made by vacuum extraction/manometry using the procedures established for the DOE/WOCE ocean CO_2 program (Guenther et al. 1994b). Results are tabulated in Table B.1 in Appendix B. This table also lists the corresponding SOMMA TCO_2 values and the differences between the shipboard and shore-based values. Shipboard data are identified as “SIO” and shore-based as “S.I.O.” The repeatability of the shore-based results themselves can be estimated from the agreement of the duplicate samples measured (DOE 1994). The sample standard deviation, s_i , of an individual shore-based result represents the short-term imprecision of the laboratory analysis, together with imprecision introduced by sampling and storage. The s_i calculated for the set of 140 pairs of data was $0.95 \mu\text{mol/kg}$. Twelve pairs were rejected from this calculation, as shown by the flags in Table B.1. This “replicate imprecision” is approximately average for DOE/WOCE program cruises.

Of the 140 ship–shore differences corresponding to the “good” pairs of shore-based data, two were rejected for being more than $3s_i$ from the average (! 17.17 and $20.21 \mu\text{mol/kg}$). The average difference for the remaining 138 comparisons was $1.37 \mu\text{mol/kg}$, with the shore-based being higher, and the s_i of an individual difference was $3.11 \mu\text{mol/kg}$. The average difference was typical for DOE/WOCE cruises during the 1991–1994 period, but the s_i is rather large. A reason for the increased scatter is the presence of a depth-dependent bias between the ship! shore differences. The usual sampling depths for shore-based replicate samples on DOE/WOCE cruises were surface and deep (nominally 3000 m). Differences for WOCE Section P13 are plotted in Figure 6 for this subset of comparisons. “Surface” samples are the shallowest on a station, ranging from 10 to 75 m in depth, and “deep” samples are the deepest, ranging from 1000 to 3200 m. The average surface–deep bias for the subset of surface and deep samples in Figure 6 (18 differences between “good” replicate pairs) is $3.5 \mu\text{mol/kg}$ ($s_i = 2.5 \mu\text{mol/kg}$). A surface–deep bias has been evident for only a few other cruises and usually is smaller. On this cruise, shore-based replicate samples were also collected in profile from 9 to 12 Niskin bottles from the surface to nominally 3000 m on 10 stations. Ship! shore differences for the top several depths of these stations change toward the more negative deep differences. From 400 m down, the differences are relatively constant.

The surface–deep bias results agree fairly well with measurements made at sea. Shipboard measurements for surface comparisons between shore-based and shipboard measurements were made early in the measurement runs, while those for deep comparisons were made late in the runs. Use of the lower calibration factors measured late in the runs resulted in a high bias for measurements made early in the runs (see section 3.2.4). On average, CRM measurements made early in the runs were $2.6 \mu\text{mol/kg}$ higher than those made late in the runs. Also, deep samples measured early in the runs on Leg 1 on average were $2.3 \mu\text{mol/kg}$ higher than their duplicates measured late in the runs. However, this pattern was far less apparent for Leg 2.

Shore-based measurements of TALK were made by essentially the same potentiometric titration system as the measurements made at sea. The primary difference was that the

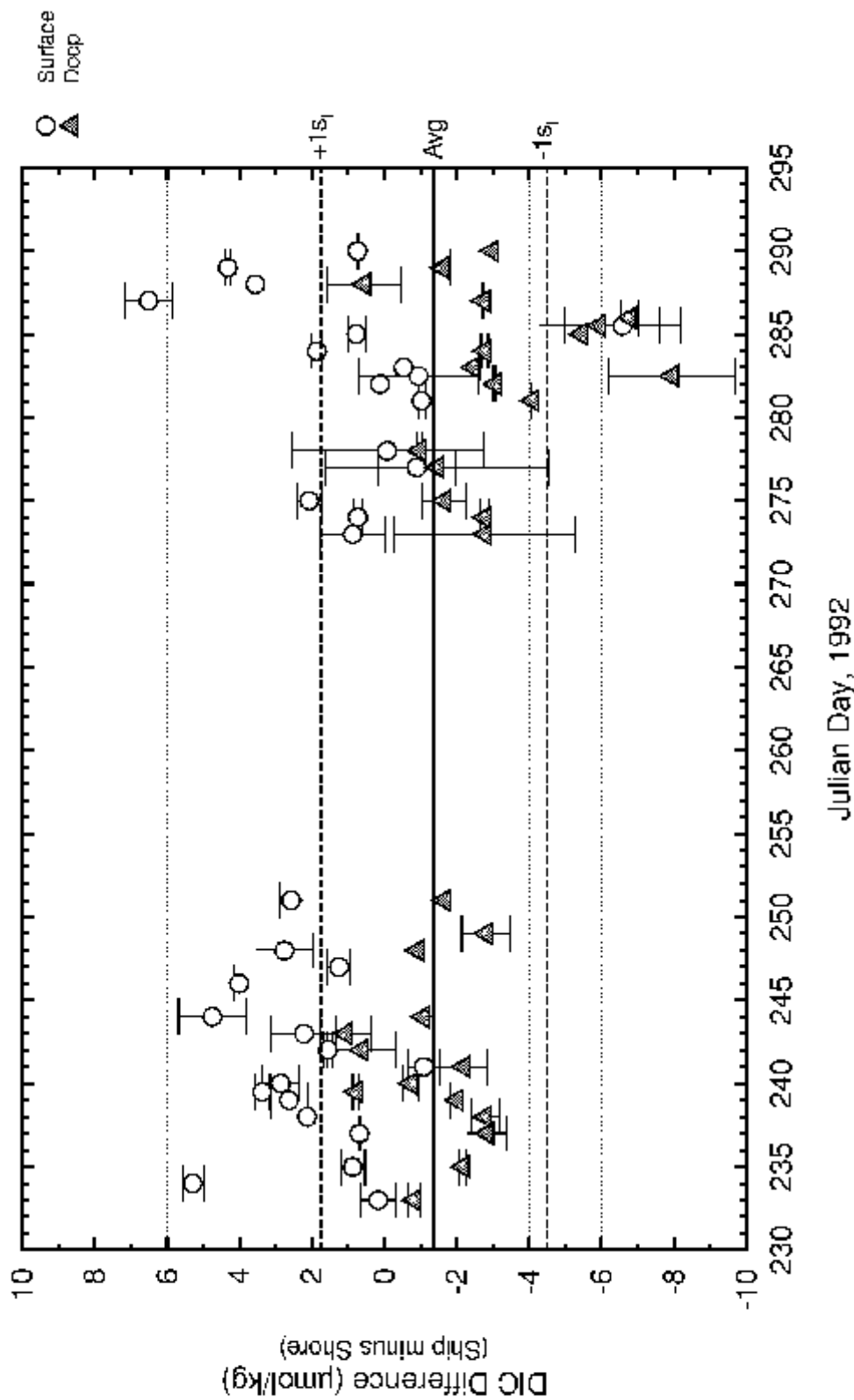


Fig. 6. Difference between shipboard and shore-based TCO₂ measurements vs date for surface and deep samples. Open circles represent near-surface samples; shaded triangles represent deep samples; and vertical bracketed lines represent replicate pair differences.

aliquots for shore-based titrations more often were dispensed gravimetrically into the titration cell, instead of volumetrically. The aliquots were removed from the sample bottles after those for shore-based TCO_2 had been removed. Results are tabulated in Table B.2. This table also lists the corresponding shipboard TALK values and the differences between shore-based and shipboard values. As described for the shore-based TCO_2 , the replicate imprecision of the shore-based TALK measurements is estimated from the agreement of the duplicate measurements. For samples with analyses from both gravimetric and volumetric systems, analyses separated by more than a week of elapsed time were rejected. For one set of titrations made within a few days on both systems, the gravimetric data were chosen over the volumetric. The s_i was $1.90 \mu\text{mol/kg}$ for 154 pairs of measurements, with four pairs rejected as shown by the flags in Table B.2. The apparent imprecisions of the shipboard TALK results (see discussion in section 3.3) and the shore-based results are similar, $\sim 2 \mu\text{mol/kg}$.

The average ship! shore difference for TALK is calculated from 147 of the total of 150 comparisons of “good” shore-based duplicates with corresponding shipboard values. Three comparisons with differences of 18.78, 15.63, and $23.01 \mu\text{mol/kg}$ (greater than $3s_i$) were rejected. The average difference is $3.35 \mu\text{mol/kg}$ (shipboard higher). The s_i of an individual difference is 4.11 Fmol/kg . Both the average ship! shore difference and its imprecision are likely to change after the anticipated adjustments to the TALK calibration scale are made, so further analysis and plotting of the data will not be presented at this time.

3.5 Chlorofluorocarbon Measurements

CFCs were usually analyzed in the first water sample collected from the 10-L bottles. Care was taken to co-ordinate the sampling of CFCs with other gas samples to minimize the time between the initial opening of each bottle and the completion of sample drawing. In most cases, helium, tritium, dissolved oxygen, TCO_2 , and TALK samples were collected within several minutes of the initial opening of each bottle. CFC samples were collected in 100-mL precision glass syringes and held immersed in a water bath until processing.

The CFC analytical system functioned relatively well during this expedition. The CFC system was installed in a specially designed laboratory van located on a deck and was isolated from possible contamination from the high levels of CFCs that are sometimes present in air inside the ship laboratories. Concentrations of CFCs in air inside this van were usually close to those of clean marine air.

Concentrations of CFC-11 and CFC-12 in air samples, seawater, and gas standards during the cruise were measured by shipboard electron capture gas chromatography, according to the methods described by Bullister and Weiss (1988). The concentrations of CFC-11 and CFC-12 in air samples, seawater samples, and gas standards are reported relative to the SIO 1986 calibration scale. CFC concentrations in air and standard gas are reported in units of mole fraction CFC in dry gas and are typically in parts-per-trillion (ppt) range. Dissolved CFC concentrations are given in unit of picomole CFC per kg seawater (pmol/kg). CFC concentrations in air and seawater samples were determined by fitting their chromatographic peak areas to multi-point calibration curves, generated by injecting known volumes of gas from a CFC working standard (PMEL cylinder 71489) into the analytical instrument. These concentrations of CFC-11 and CFC-12 in this working standard were calibrated versus a primary CFC standard (CC36743) before and after the cruise. No measurable drift in the working standard could be detected during this interval. Full range calibration curves were run at 1- to 2-day intervals. Single injections of a fixed volume of standard gas were run much more frequently

(at intervals of 1 to 2 hours) to monitor short-term changes in detector sensitivity. The estimated reproducibility of the calibrations is about 1.3% for CFC-11 and 0.5% for CFC-12. A precision (1 standard deviation) for dissolved CFC measurements was ~1%, or 0.005 pmol/kg, whichever is greater.

Sample loops filled with CFC-free gas and syringe samples of CFC-free water (degassed in a specially designed glass chamber) were run to check sampling and analytical blanks. CFC-11 and CFC-12 concentrations measured in deep samples along the section were typically in the range of 0 to 0.007 pmol/kg, near the detection limit of the analytical system (~0.004 pmol/kg). Previous studies (Warner et al. 1996) of time-dependent tracers in this region of the Pacific indicate that waters at densities $F_2 > 27.4$ should have CFC concentrations near zero at present. We attribute the low-level CFC signal in deep samples to the slow release of CFC from the walls and O-rings of the 10-L bottles into the seawater sample during storage and to contamination during the transfer and storage of the seawater samples in glass syringes prior to analysis. Based on the median concentrations observed in deep water samples along the section, the following blank corrections were applied to the seawater measurements:

CFC-11 blank corrections applied (in pmol/kg):

Stations 1–43: 0.010

Stations 44–88: 0.008

CFC-12 blank corrections applied (in pmol/kg):

Stations 1–4 0.000

Stations 5–23 0.021

Stations 24–27 0.034

Stations 28–52 0.018

Stations 53–88 0.009

As a result of these blank corrections, some concentrations reported for deep samples are less than zero.

A number of water samples had anomalously high CFC-11 and/or CFC-12 concentrations relative to adjacent samples. These high values appeared to occur more or less randomly and were not clearly associated with other features in the water column (e.g., elevated oxygen concentrations). In most cases, only one of the two CFCs measured showed these anomalous high levels. This suggests that the high values were the result of analytical variability or isolated low-level contamination events. These samples are included in this report and are flagged as either “3” (questionable) or “4” (bad) measurements. Approximately 181 analyses of CFC-11 and 76 analyses of CFC-12 were given these flags.

4. DATA CHECKS AND PROCESSING PERFORMED BY CDIAC

An important part of the numeric data packaging process at the Carbon Dioxide Information Analysis Center (CDIAC) involves the quality assurance (QA) of data before distribution. Data received at CDIAC are rarely in a condition that would permit immediate distribution, regardless of the source. To guarantee data of the highest possible quality, CDIAC conducts extensive QA reviews that involve examining the data for completeness, reasonableness, and accuracy. The QA process is a critical component in the value-added concept of supplying accurate, usable data for researchers.

The following information summarizes the data processing and QA checks performed by CDIAC on the data obtained during the R/V *John V. Vickers* cruise along WOCE Section P13 in the Pacific Ocean.

1. The final carbon-related data were provided to CDIAC by A. G. Dickson, P. R. Guenther, and C. D. Keeling of Scripps Institution of Oceanography. The final hydrographic and chemical measurements and the station information files were provided by the WOCE Hydrographic Program Office (WHPO) after quality evaluation. A FORTRAN 90 retrieval code was written and used to merge and reformat all data files.
2. To check for obvious outliers, all data were plotted by use of a PLOTNEST.C program written by Stewart C. Sutherland (Lamont-Doherty Earth Observatory). The program plots a series of nested profiles, using the station number as an offset; the first station is defined at the beginning, and subsequent stations are offset by a fixed interval (Figs. 7 and 8). Several outliers were identified and marked with the quality flags of “3” (questionable measurement) or “4” (bad measurement) (see File Descriptions in Part 2 of this documentation).
3. To identify “noisy” data and possible systematic, methodological errors, property-property plots for all parameters were generated (Fig. 9), carefully examined, and compared with plots from previous expeditions in the Pacific Ocean.
4. All variables were checked for values exceeding physical limits, such as sampling depth values that are greater than the given bottom depths.
5. Dates, times, and coordinates were checked for bogus values (e.g., values of MONTH < 1 or > 12; DAY < 1 or > 31; YEAR < or > 1992; TIME < 0000 or > 2400; LAT < ! 10.000 or > 60.000; and LONG < 160.000 or > 170.000).
6. Station locations (latitudes and longitudes) and sampling times were examined for consistency with maps and cruise information supplied by A. Dickson and C. Keeling of SIO.
7. The designation for missing values, given as ! 9.0 in the original files, was changed to ! 999.9 for the consistency with other oceanographic data sets.

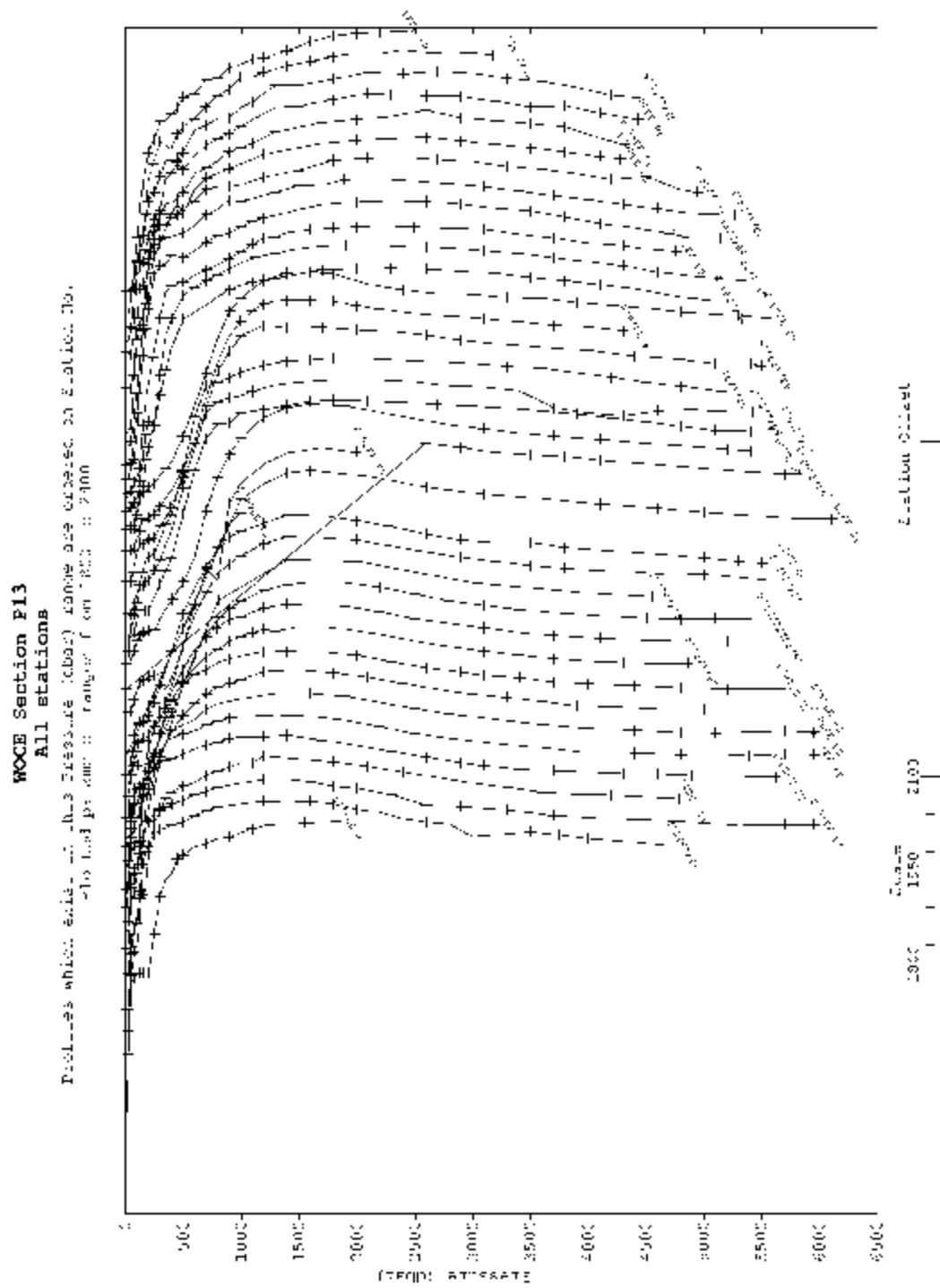


Fig. 7. Nested profiles: Total carbon dioxide (Fmol/kg) vs pressure (dbar) for all stations of WOCE Section P13.

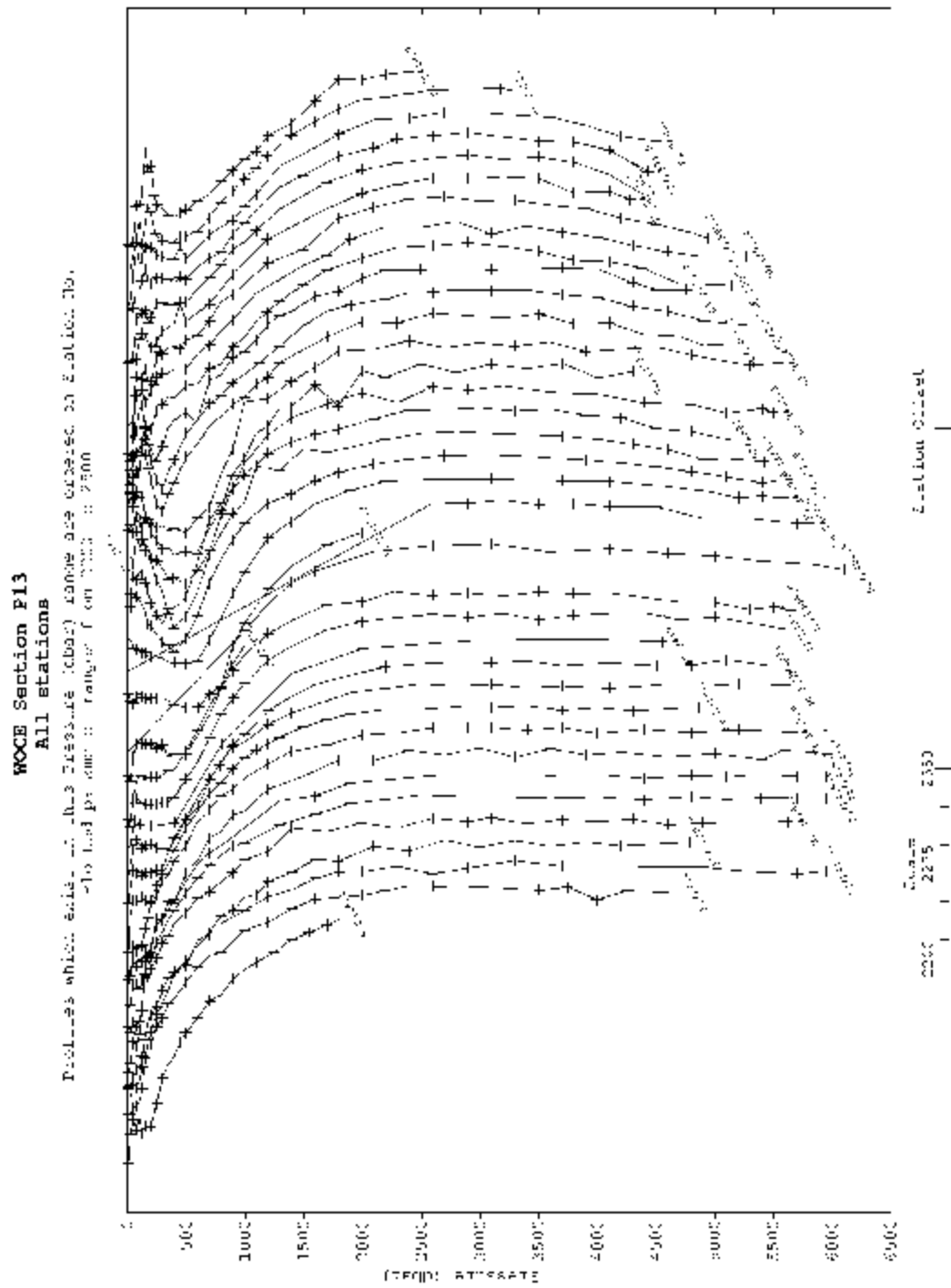


Fig. 8. Nested profiles: Total alkalinity (Fmol/kg) vs pressure (dbar) for all stations of WOCE Section P13.

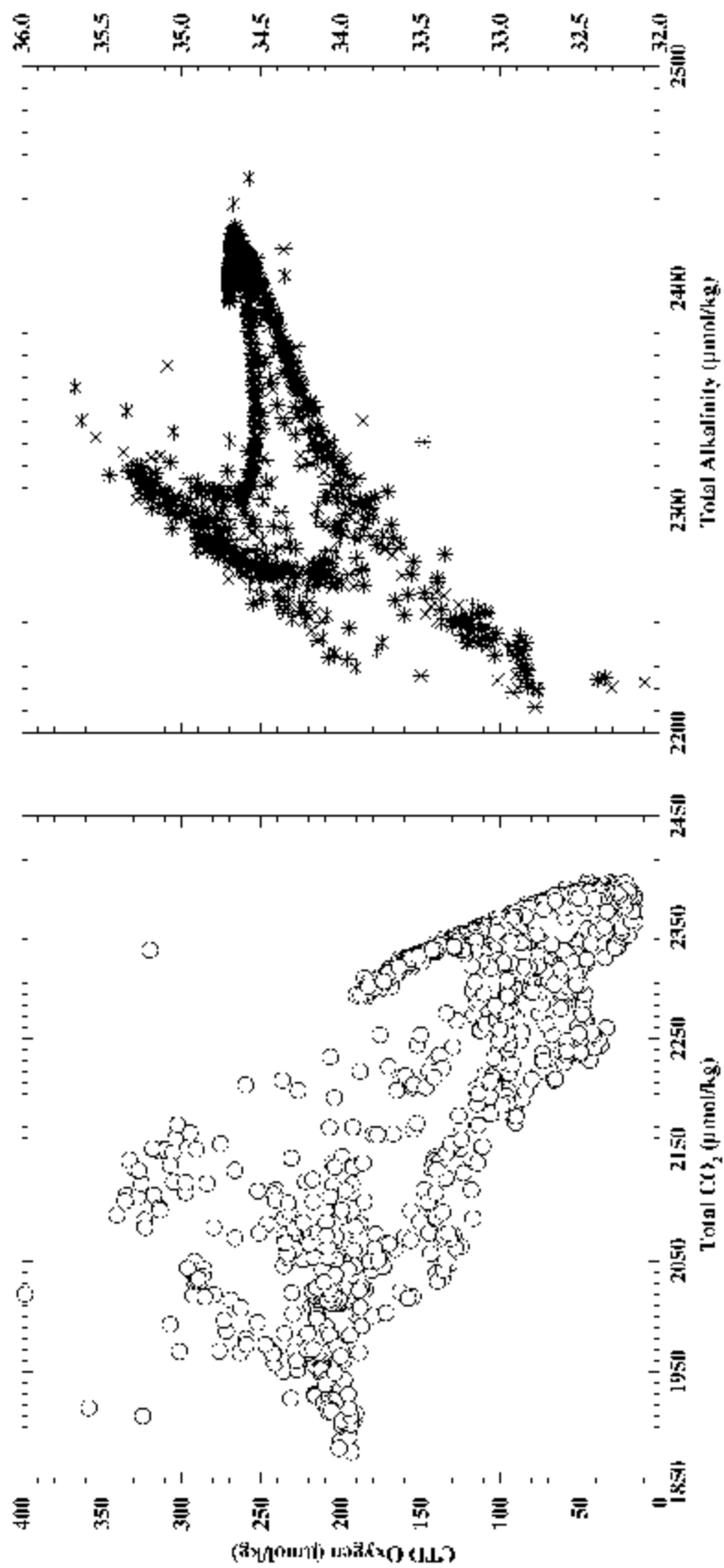


Fig. 9. Property-property plots for all stations occupied during the R/V *John V. Vickers* cruise along WOCE Section P13.

5. HOW TO OBTAIN THE DATA AND DOCUMENTATION

This database (NDP-075) is available free of charge from CDIAC. The complete documentation and data can be obtained from the CDIAC oceanographic Web site (<http://cdiac.esd.ornl.gov/oceans/doc.html>), through CDIAC's online ordering system (http://cdiac.esd.ornl.gov/pns/how_order.html), or by contacting CDIAC.

The data are also available from CDIAC's anonymous file transfer protocol (FTP) area via the Internet. Please note that your computer needs to have FTP software loaded on it (this is built in to most newer operating systems). Use the following commands to obtain the database.

```
ftp cdia.esd.ornl.gov or >ftp 128.219.24.36
Login: "anonymous" or "ftp"
Password: your e-mail address
ftp> cd pub/ndp075/
ftp> dir
ftp> mget (files)
ftp> quit
```

Contact information:

Carbon Dioxide Information Analysis Center
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, Tennessee 37831-6335
U.S.A.

Telephone: (865) 574-3645
Telefax: (865) 574-2232

E-mail: cdiac@ornl.gov
Internet: <http://cdiac.esd.ornl.gov/>

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PART 2:
CONTENT AND FORMAT OF DATA FILES

7. FILE DESCRIPTIONS

This section describes the content and format of each of the five files that comprise this NDP (see Table 1). Because CDIAC distributes the data set in several ways (via the Web, CDIAC's online ordering system, or anonymous FTP), each of the five files is referenced by both an ASCII file name, which is given in lower-case, bold-faced type (e.g., **ndp075.txt**), and a file number. The remainder of this section describes (or lists, where appropriate) the contents of each file.

Table 1. Content, size, and format of data files

File number, name, and description	Logical records	File size in bytes
1. ndp075.txt : a detailed description of the cruise network, the two FORTRAN 90 data-retrieval routines, and the two oceanographic data files	2,733	255,968
2. stainv.for : a FORTRAN 90 data-retrieval routine to read and print p13sta.dat (File 4)	47	1,440
3. p13dat.for : a FORTRAN 90 data-retrieval routine to read and print p13.dat (File 5)	57	2,186
4. p13sta.dat : a listing of the station locations, sampling dates, and sounding bottom depths for each of the 82 stations of WOCE Section P13	92	7,126
5. p13.dat : hydrographic, carbon dioxide, and chemical data from 82 stations occupied on WOCE Section P13	2,717	480,067
Total	5,646	746,787

7.1 ndp075.txt (File 1)

This file contains a detailed description of the data set, the two FORTRAN 90 data-retrieval routines, and the two oceanographic data files. It exists primarily for the benefit of individuals who acquire this database as machine-readable data files from CDIAC.

7.2 stainv.for (File 2)

This file contains a FORTRAN 90 data-retrieval routine to read and print **p13sta.dat** (File 4). The following is a listing of this program. For additional information regarding variable definitions, variable lengths, variable types, units, and codes, please see the description for **p13sta.dat** in Sect. 7.4.

```

c*****
c* FORTRAN 90 data retrieval routine to read and print the file
c* named "p13sta.dat" (File 4).
c*****

c*Defines variables*

      INTEGER stat, cast, depth
      REAL latdcm, londcm
      CHARACTER expo*11, sect*3, date*10, time*4
      OPEN (unit=1, file='p13sta.dat')
      OPEN (unit=2, file='p13sta.txt')
      write (2, 5)

c*Writes out column labels*

      5      format (1X, 'STATION INVENTORY: R/V JOHN V. VICKERS',
      1 9X, 'CRUISE DATES 08/03-10/21/1992',/,
      2 1X, 'EXPOCODE', 5X, 'SECT', 1X, 'STNBR', 2X, 'CAST', 9X,
      3 'DATE', 2X, 'TIME', 2X, 'LATITUDE', 2X, 'LONGITUDE', 2X,
      4 'DEPTH', /)

c*Sets up a loop to read and format all the data in the file*

      read (1, 6)
      6      format (/////////)

      7      CONTINUE
      read (1, 10, end=999) expo, sect, stat, cast, date, time,
      1 latdcm, londcm, depth

      10      format (A11, 4X, A3, 4X, I2, 5X, I1, 3X, A10, 2X, A4, 3X,
      1 F7.3, 3X, F8.3, 3X, I4)

      write (2, 20) expo, sect, stat, cast, date, time,
      1 latdcm, londcm, depth

      20      format (A11, 4X, A3, 4X, I2, 5X, I1, 3X, A10, 2X, A4, 3X,
      1 F7.3, 3X, F8.3, 3X, I4)

```

```

      GOTO 7
999   close(unit=5)
      close(unit=2)
      stop
      end

```

7.3 p13dat.for (File 3)

This file contains a FORTRAN 90 data-retrieval routine to read and print **p13.dat** (File 5). The following is a listing of this program. For additional information regarding variable definitions, variable lengths, variable types, units, and codes, please see the description for **p13.dat** in Sect. 7.5.

```

c*****
c* FORTRAN 90 data retrieval routine to read and print the file
c* named "p13.dat" (File 5).
c*****
cc*Defines variables*

      INTEGER sta, cast, samp, bot
      REAL pre, ctdtmp, ctdsal, ctdoxy, theta, sal, oxy, silca
      REAL nitrat, nitrit, phspht, cfc11, cfc12, tcarb, talk
      CHARACTER qual*13
      OPEN (unit=1, file='p13.dat')
      OPEN (unit=2, file='p13.data')
      write (2, 5)

c*Writes out column labels*

5      format (2X,'STNNBR',2X,'CASTNO',2X,'SAMPNO',2X,'BTLNBR',2X,
1      'CTDPRS',4X,'CTDTMP',4X,'CTDSAL',2X,'CTDOXY',5X,'THETA',4X,
2      'SALNTY',2X,'OXYGEN',2X,'SILCAT',2X,'NITRAT',2X,'NITRIT',2X,
3      'PHSPHT',3X,'CFC-11',3X,'CFC-12',2X,'TCARB',2X,
4      'ALKALI',8X,'QUALT1',/,36X,'DBAR',4X,'ITS-90',4X,'PSS-78',
5      1X,'UMOL/KG',4X,'ITS-90',4X,'PSS-78',1X,5('UMOL/KG',1X),1X,
6      'PMOL/KG',2X,'PMOL/KG',1X,2('UMOL/KG',1X),12X,'*',/,
7      25X,'*****',21X,2('*****',1X),12X,6('*****',1X),
8      1X,'*****',2X,3('*****',1X),12X,'*')

      read (1, 6)
6      format (/////////)

7      CONTINUE
      read (1, 10, end=999) sta, cast, samp, bot, pre, ctdtmp,
1 ctdsal, ctdoxy, theta, sal, oxy, silca, nitrat, nitrit,

```

```

2 phspht, cfc11, cfc12, tcarb, talk, qualtr

10  format (5X, I3, 7X, I1, 5X, I3, 4X, I4, 1X, F7.1, 1X, F9.4,
1 1X, F9.4, 1X, F7.1, 1X, F9.4, 1X, F9.4, 1X, F7.1, 1X, F7.2,
2 1X, F7.2, 1X, F7.2, 1X, F7.2, 1X, F8.3, 1X, F8.3, 1X, F7.1,
3 1X, F7.1, 1X, A13)

      write (2, 20) sta, cast, samp, bot, pre, ctdtmp,
1 ctdsal, ctdoxy, theta, sal, oxy, silca, nitrat, nitrit,
2 phspht, cfc11, cfc12, tcarb, talk, qualtr

20  format (5X, I3, 7X, I1, 5X, I3, 4X, I4, 1X, F7.1, 1X, F9.4,
1 1X, F9.4, 1X, F7.1, 1X, F9.4, 1X, F9.4, 1X, F7.1, 1X, F7.2,
2 1X, F7.2, 1X, F7.2, 1X, F7.2, 1X, F8.3, 1X, F8.3, 1X, F7.1,
3 1X, F7.1, 1X, A13)

      GOTO 7
999  close(unit=1)
      close(unit=2)
      stop
      end

```

7.4 p13sta.dat (File 4)

This file provides station inventory information for each of the 82 stations occupied during the R/V *John V. Vickers* cruise along WOCE Section P13. Each line of the file contains an expocode, section number, station number, cast number, sampling date (month/date/year), sampling time, latitude, longitude, and sounding depth. The file is sorted by station number and can be read by using the following FORTRAN 90 code (contained in **stainv.for**, File 2):

```

      INTEGER stat, cast, depth
      CHARACTER expo*11, sect*3, date*10, time*4
      REAL latdcm, londcm

      read (1, 10, end=999) expo, sect, stat, cast, date, time,
1 latdcm, londcm, depth

10  format (A11, 4X, A3, 4X, I2, 5X, I1, 3X, A10, 2X, A4, 3X,
1 F7.3, 3X, F8.3, 3X, I4)

```

Stated in tabular form, the contents include the following:

Variable	Variable type	Variable width	Starting column	Ending column
expo	Character	11	1	11
sect	Character	3	16	18
stat	Numeric	2	23	24
cast	Numeric	1	30	30
date	Character	10	34	43
time	Character	4	46	49

latdcm	Numeric	7	53	59
londcm	Numeric	8	63	70
depth	Numeric	4	74	77

The variables are defined as follows:

expo	is the expedition code of the cruise;
sect	is the WOCE section number;
stat	is the station number;
cast	is the cast number;
date	is the sampling date (month/day/year);
time	is the sampling time [Greenwich mean time (GMT)];
latdcm	is the latitude of the station (in decimal degrees; negative values indicate the Southern Hemisphere);
londcm	is the longitude of the station (in decimal degrees; negative values indicate the Western Hemisphere);
depth	is the sounding depth of the station (in meters).

7.5 p13.dat (File 5)

This file provides hydrographic, carbon dioxide, and chemical data for the 82 stations occupied during the R/V *John V. Vickers* cruise along WOCE Section P13. Each line consists of a station number, cast number, sample number, bottle number, CTD pressure, CTD temperature, CTD salinity, CTD oxygen, potential temperature, bottle salinity, bottle oxygen, silicate, nitrate, nitrite, phosphate, CFC-11, CFC-12, total CO₂, total alkalinity, and data-quality flags. The file is sorted by station number and pressure and can be read by using the following FORTRAN 90 code (contained in **p13dat.for**, File 3):

```

CHARACTER qualt*13
INTEGER sta, cast, samp, bot
REAL pre, ctdtmp, ctdsal, ctdoxy, theta, sal, oxy, silca
REAL nitrat, nitrit, phspht, cfc11, cfc12, tcarb, talk

read (1, 10, end=999)sta, cast, samp, bot, pre, ctdtmp,
1 ctdsal, ctdoxy, theta, sal, oxy, silca, nitrat, nitrit,
2 phspht, cfc11, cfc12, tcarb, talk, qualt

```

```

10      format (5X, I3, 7X, I1, 5X, I3, 4X, I4, 1X, F7.1, 1X, F9.4,
1 1X, F9.4, 1X, F7.1, 1X, F9.4, 1X, F9.4, 1X, F7.1, 1X, F7.2,
2 1X, F7.2, 1X, F7.2, 1X, F7.2, 1X, F8.3, 1X, F8.3, 1X, F7.1,
3 1X, F7.1, 1X, A14)

```

Stated in tabular form, the contents include the following:

Variable	Variable type	Variable width	Starting column	Ending column
sta	Numeric	3	6	8
cast	Numeric	1	16	16
samp	Numeric	3	22	24
bot	Numeric	4	29	32
pre	Numeric	7	34	40
ctdtmp	Numeric	9	42	50
ctdsal	Numeric	9	52	60
ctdoxy	Numeric	7	62	68
theta	Numeric	9	70	78
sal	Numeric	9	80	88
oxy	Numeric	7	90	96
silca	Numeric	7	98	104
nitrat	Numeric	7	106	112
nitrit	Numeric	7	114	120
phspht	Numeric	7	122	128
cfc11	Numeric	8	130	137
cfc12	Numeric	8	139	146
tcarb	Numeric	7	148	154
talk	Numeric	7	156	162
qualt	Character	13	164	176

The variables are defined as follows:

sta is the station number;

cast is the cast number;

samp is the sample number;

bot is the bottle number;

pre is the CTD pressure (dbar);

ctdtmp	is the CTD temperature (°C);
ctdsal^a	is the CTD salinity [on the Practical Salinity Scale (PSS)];
ctdoxy^a	is the CTD oxygen (Fmol/kg);
theta	is the potential temperature (°C);
sal^a	is the bottle salinity (on the PSS);
oxy^a	is the oxygen concentration (Fmol/kg);
silca^a	is the silicate concentration (Fmol/kg);
nitrat^a	is the nitrate concentration (Fmol/kg);
nitrit^a	is the nitrite concentration (Fmol/kg);
phosph^a	is the phosphate concentration (Fmol/kg);
cfc11^a	is the chlorofluorocarbon 11 concentration (pmol/kg);
cfc12^a	is the chlorofluorocarbon 12 concentration (pmol/kg);
tcarb^a	is the total carbon dioxide concentration (Fmol/kg);
alkali^a	is the total alkalinity concentration (Fmol/kg);
qualt	is a 13-digit character variable that contains data-quality flag codes for parameters underlined with asterisks (*****) in the file header.

^aVariables that are underlined with asterisks in the data file's header indicate they have a data-quality flag. Data-quality flags are defined as follows:

- 1 = sample for this measurement was drawn from water bottle but analysis was not received;
- 2 = acceptable measurement;
- 3 = questionable measurement;
- 4 = bad measurement;
- 5 = not reported;
- 6 = mean of replicate measurements;
- 7 = manual chromatographic peak measurement;
- 8 = irregular digital chromatographic peak integration;
- 9 = sample not drawn for this measurement from this bottle.

APPENDIX A:
REPRINT OF PERTINENT LITERATURE

**Oceanic CO₂ Measurements for the WOCE
Hydrographic Survey in the Pacific Ocean:
Shipboard Alkalinity Measurements on CGC92 Legs 1 and 2, 1992**

**Prepared for the U.S. Department of Energy
Special Research Grant Program 89-7A:
Global Survey of Carbon Dioxide in the Ocean
(Grant No. DE-FG03-91ER61116)
Submitted: October 24, 1994**

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December 1994

S.I.O. Reference Series No. 94-30

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1. Cruise Summary

Shipboard measurements of CO₂ system parameters in sea water were made on the Climate and Global Change 92 (CGC92) cruise of the Pacific Marine Environmental Laboratory (PMEL) of the National Oceanic and Atmospheric Administration (NOAA). The ship used for the cruise was the R/V *John Vickers* of the University of Southern California. The Chief Scientists were Dr. John Bullister on Leg 1 and Dr. Bruce Taft on Leg 2. Both are staff scientists at PMEL. The cruise, along approximately 165° E longitude between Dutch Harbor, Alaska and Noumea, New Caledonia, was designated Line P13 of the one - time survey of the World Ocean Circulation Experiment (WOCE). CO₂ system measurements on this cruise were carried out by the Carbon Dioxide Research Group (CDRG) of Scripps Institution of Oceanography (SIO) (Dr. Charles Keeling, Principal Investigator), with the assistance of Battelle NW Laboratory and of Dr. Andrew Dickson of SIO. Dr. Dickson and his group were responsible for measurements of Total Dissolved Inorganic Carbon (DIC) with a SOMMA coulometric titrator. The DIC analysts on Leg 1 were Mr. George Anderson of SIO and Mr. Ronald Citterman of Battelle NW and on Leg 2, Ms. Lori Bell of SIO and Mr. Citterman. The CDRG of SIO was responsible for measurements of Titration (or "Total") Alkalinity (ALK) with a potentiometric acid titration system. The ALK analysts on Leg 1 were Mr. Peter Guenther and Mr. Guy Emanuele, both of SIO, and on Leg 2, Dr. Andrew Dickson of SIO and Mr. Emanuele.

This report concerns only the ALK data. Dr. Dickson reports the DIC data in a separate report.

2. Shipboard Water Sampling Program

Samples for shipboard analysis of DIC and ALK were collected from 10 liter Niskin bottles on the 36 position small volume rosette water sampling system. Of the total of 84 stations on the two legs, CO₂ samples were collected from all Niskins throughout the water column on 39 stations (nominally 36 Niskins, but fewer depths were sampled on a number of stations). On an additional 41 stations CO₂ samples were collected from surface Niskins only. Stations sampled were located along about 165° E longitude between 54° N and 5° S latitude.

Samples were collected by established procedures (DOE,1994) in 500 ml borosilicate glass bottles equipped with greased ground glass joints held closed with rubber bands. Single samples were collected from most Niskins. On stations where CO₂ samples were collected throughout the water column, duplicate

samples were collected from two Niskins, one near the surface and one near the bottom, for quality assessment purposes. All samples were collected by the CO₂ analysts. Two persons worked as a team during sample collection. One analyst filled the bottles from the Niskins and the other adjusted the water volume, added the mercuric chloride poison and prepared and sealed the bottle joints. Additionally, replicate samples for shore based analyses of DIC and ALK were collected in duplicate from 161 Niskins on 34 stations.

Analyses of DIC and ALK were performed on aliquots of water subsampled from the same bottle of water. Single aliquots for DIC analysis were removed from the bottles first. Aliquots for ALK analysis were later removed from the same bottles. Enough water was available to perform at least two ALK titrations on each bottle.

3. Alkalinity Measurement Summary

Samples from a total of 1153 Niskins, 574 from Leg 1 and 579 from Leg 2, were titrated to determine ALK. Usually all 36 samples collected on a station were analyzed for ALK. A total of 72 duplicate samples, 36 on each leg, were also analyzed. For quality assessment purposes, 84 titrations were performed on 68 bottles of the natural sea water Certified DIC Reference Material Batch No. 13 and 182 more titrations were performed on 38 bottles of bicarbonate reference material solutions prepared at SIO. A total of 1636 individual titrations were performed during 44 days on the cruise, including all multiple trials on individual bottles of sea water and quality assessment samples.

4. Description of Analytical System and Procedures

4.1 Overall system description

The closed cell potentiometric acid titration system was designed and constructed at SIO by David Moss with the developmental and experimental assistance of Timothy Lueker. Figure 1 is a schematic diagram of the analytical system. It differs from other alkalinity titration systems in the method employed to define the volume of seawater to be titrated. This was accomplished by dispensing simultaneously constant volumes of water from two syringes into two titration cells so that two titrations could be run at the same time. Between titrations the cells were rinsed with purified water to remove all traces of acid or alkalinity from the cell. The cell volumes, after filling with water, were adjusted using a bladder to minimize the air space. This scheme eliminated the need to determine and

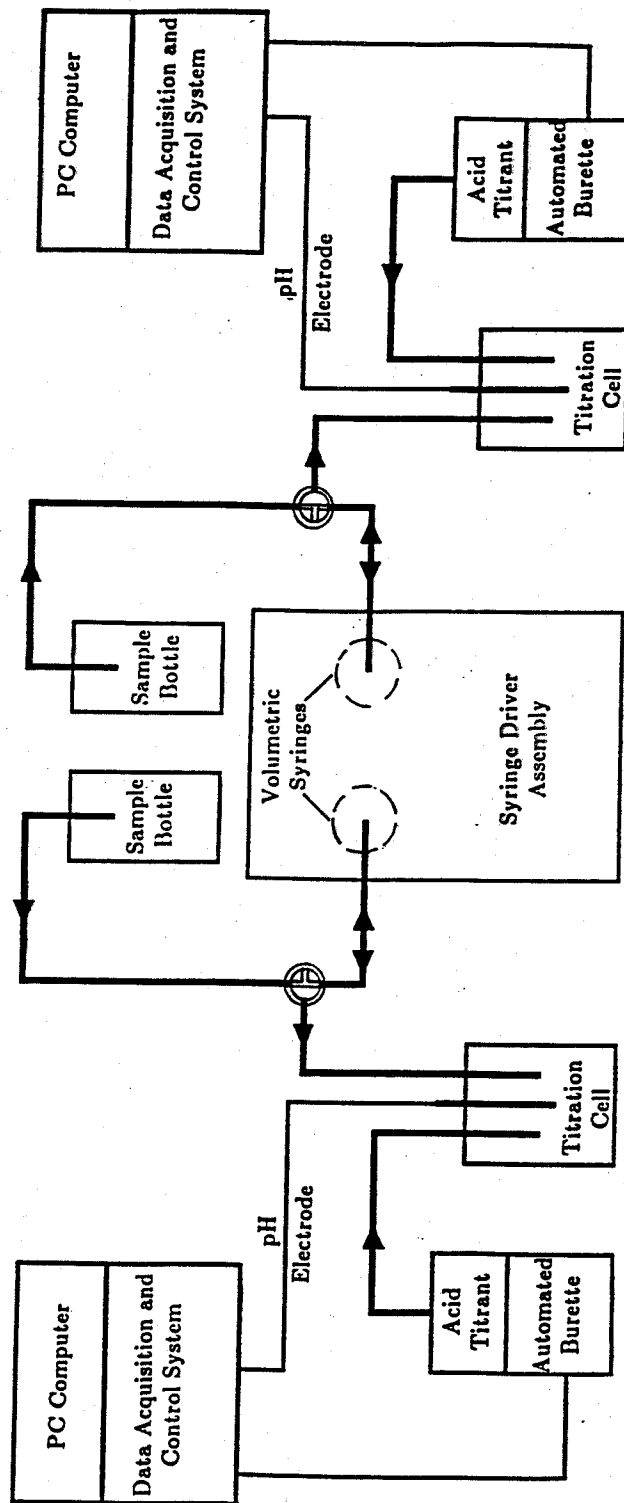


Figure 1. Schematic Diagram of the Dual Volumetric Alkalinity Titrator

control the cell volume. It added the requirement of calibrating and controlling the delivery of constant volumes by the syringe system. Calibration of the syringes was readily monitored at sea by delivering samples into pre - weighed septum bottles for later weighing at the shore laboratory.

The analytical system was modified in several ways after the TUNES Leg 3 cruise in 1991. Surface thermistor probes were attached to the outside surfaces of the glass syringes for measurement of the temperatures of the volumetric aliquots. A different type of glass electrode was used, and it was electrically shielded with a copper sleeve and a coaxial cable sleeve. A "bubble catcher" consisting of a section of glass tubing with a bulb was added in the plastic acid line to prevent air bubbles from injection into the titration cell. A plastic cage was erected around the system to reduce temperature fluctuations and a damping system built under the titrator to ameliorate expected vibration problems on the R/V *Vickers*.

After the titration cell had been filled and adjusted, the analytical procedures were typical of those used by other investigators. Acid doses were added using an automated burette and the resultant EMF recorded, all under computer control. All of the titration points were fit to a model of the system using a non - linear least squares approach. The alkalinity that minimized the residuals of this fit was found.

Details of the several main parts of the system and operating procedures follow.

4.2 *Titration cell*

Figure 2 is a schematic diagram of the titration cell. The cell bottom is a borosilicate glass Sybron/Brinkmann "90 ml" size water jacketed cell, modified by a glassblower to include a drain outlet equipped with a Teflon plug stopcock. The cell top was fabricated of plexiglass at SIO, and is attached to the bottom with an O - ring seal. The cell top has seven holes or ports with the following functions: 1) Combination glass pH electrode; 2) Glass sheathed temperature sensor (thermistor); 3) Water (sample) inlet (glass tube); 4) Glass capillary tip for acid delivery; 5) Glass vent tube for an approximately 5 ml capacity bladder made of a finger of a latex rubber surgical glove; 6) Valve made of glass rod bent to allow sealing of water inlet; 7) Glass cell vent tube with cap. All ports have O - ring seals.

The electrodes used were Radiometer combination glass pH electrodes (general use model GK2402C). This electrode, in comparison to the previously used Orion - Ross electrode, proved to be longer lasting, to have a significantly faster

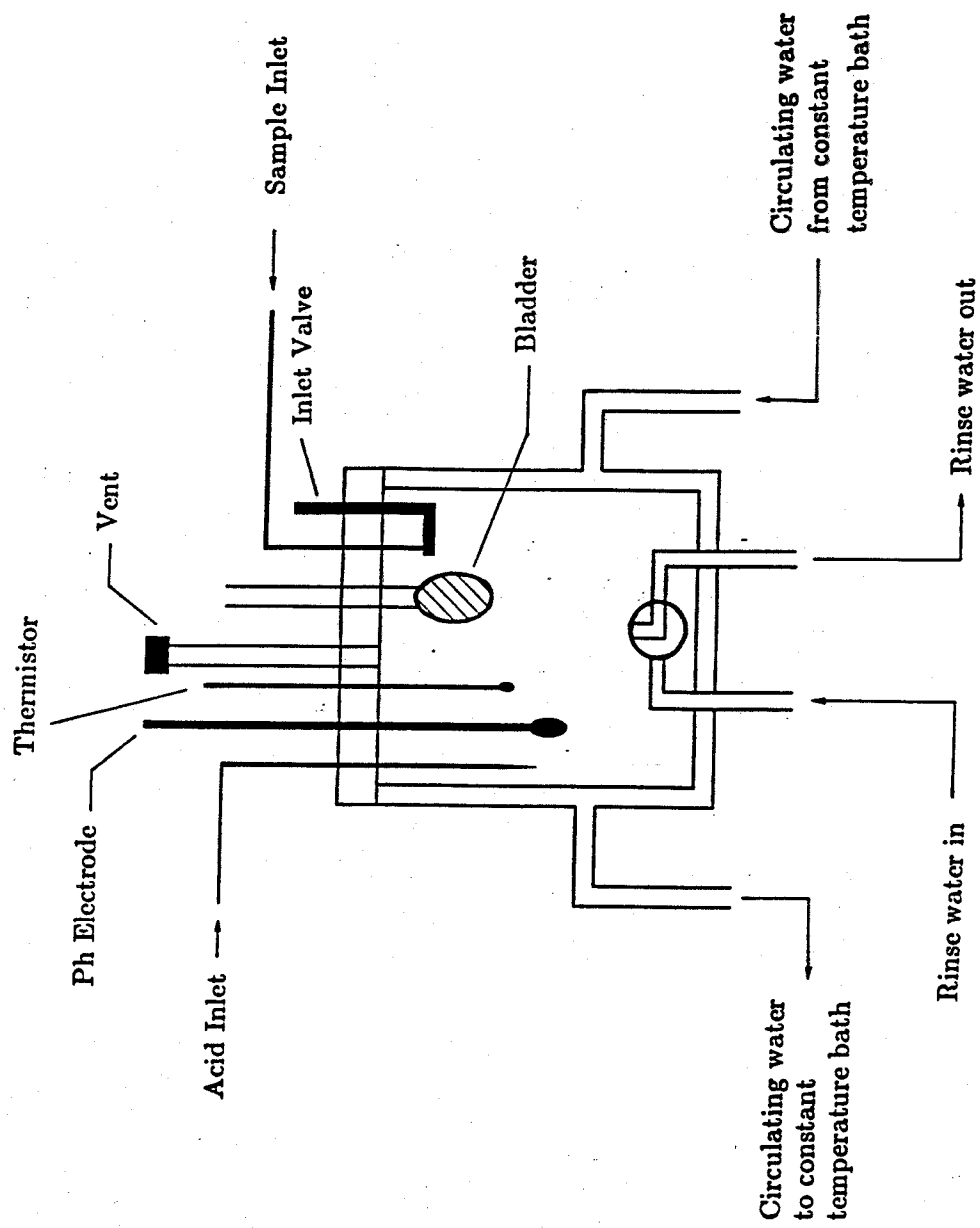


Figure 2. Schematic Diagram of Alkalinity Titration Cell

response and to be more stable. A pH meter was not used; instead, the electrode voltage output was connected to an isolation amplifier (voltage follower) that served as an impedance buffer between the electrode and a digital voltmeter.

4.3 *Sample aliquoting system and calibration*

Two 100 ml size glass syringes (of Japanese manufacture by "Star") were mounted on an optical bench and the syringe plungers were driven by a stepper motorized precision lead screw. Delivery of a constant volume of sample was accomplished by commanding the stepper motor to turn a preset number of counts.

Syringe volume calibrations were done by weighing deliveries of samples of known density (either pure water or sea water). The means of the pre - cruise laboratory calibrations of the syringe delivery volumes agreed with the means of the post - cruise calibrations to better than one part in 6000. Four sets of calibrations of both syringes were made at sea by delivering sea water samples of known salinity into pre - weighed bottles. The bottles were sealed with rubber septums and later weighed in the shore laboratory. Six deliveries were done for each calibration set; the sample standard deviation for each set was better than one part in 5000. All of the sets agreed with the laboratory calibrations to within one part in 1800. The sets on the left side agreed to better than one part in 3600; those on the right side, to one part in 2300 on average. The ALK data reported here were calculated using the pre - cruise volume calibrations for the syringes (91.151 ml for the left side syringe, serial number 7736; and 91.210 ml for the right side syringe, serial number 7754). The average for all shore calibrations (APR 91 to MAR 94) of the left side syringe is 91.150 ml ($\pm 1/10000$ for 7 sets); for the right side syringe, the average is 91.181 ml ($\pm 1/2800$ for 9 sets). A possible future small adjustment to the data would be to use the overall average volume for the right side, which agrees to one part in 7000 with the shipboard values. This change would raise the right side ALK's by one part in 3000. No significant change based on the calibration data would be possible for the left side results.

4.4 *Acid titrant delivery system and calibration*

The acid titrant was 0.1N hydrochloric acid in an aqueous sodium chloride matrix of approximately 0.7 ionic strength. Doses of acid were added to the titration cell under computer control from a Metrohm Dosimat 665 automatic burette. The plastic acid line from the Dosimat (5 ml size burette) was connected to a capillary glass tip for entrance into the titration cell.

A total of 26 doses were made during a titration, with a total of 3.4 ml of added acid titrant. Prior to and after the second (bicarbonate) equivalence point, the doses were of 200 microliters. Around the equivalence point, from 2.0 ml to 2.6 ml, the doses were of 50 microliters in order to weigh the titration curve fit to that region for total alkalinity determination.

The acid titrants were prepared in batches (designated batch numbers 9 and 11) of 20 liters and bottled in one liter reagent bottles with greased stoppers. During the cruise ten different bottles of acid were used. Bottles were changed when half empty. Three pairs of acid batch 11 bottles were used on Leg 1. After the first few days of Leg 2, two pairs of batch 9 bottles were used until the end of the cruise.

Acid densities were measured with a pycnometer at two different temperatures, 21 and 25 °C. A linear equation, using a universal slope of 0.28261, was used to calculate the acid density for a titration according to the temperature measured with a thermistor (surface probe) attached to the glass Dosimat burette.

The acid titrant concentration was determined by titration of sodium carbonate solutions. These were prepared by solution in purified water of primary standard sodium carbonate heated to constant weight at 270 °C. Titrations of standard carbonate were done on two bottles of acid batch 9, one prior to the cruise and one during the period of the cruise, and on one bottle of acid batch 11, during the cruise. These titrations were performed on the shore based gravimetric titration system in the CDRG laboratory at SIO (Guenther et al, 1994a). Results are summarized in the following table:

Date	STD Bottle-Trial	Acid Bottle No.	[HCl](eq/kg)
23 May 91	59-2	9D	0.09731
23 May 91	60-2	9D	0.09725
1 Sep 92	69-4	9B	0.09729
1 Sep 92	70-3	9B	0.09724
28 Aug 92	70-2	11C	0.09709
31 Aug 92	68-3	11C	0.09698
31 Aug 92	69-2	11C	0.09712

The average of the four determinations of acid batch 9 is 0.09727 ± 0.00033 equivalents per kilogram (eq/kg). The value used to calculate the reported data is a preliminary value of 0.09724 eq/kg, representing about 0.75 microequivalents per kilogram ($\mu\text{eq/kg}$) difference in calculated alkalinity. Pending further retrospective analysis of the acid calibrations, it was not deemed worthwhile to adjust the tabulated data. The average of the three determinations of batch 11 is 0.09706 ± 0.00007 eq/kg. The value used to calculate the reported data is a preliminary value of 0.09690 eq/kg, representing about $3.8 \mu\text{eq/kg}$ difference in calculated alkalinity. This latter value was determined before the cruise by titrating water from a number of bicarbonate quality assessment bottles (STD batch A) with both batch 9 and batch 11 acids, and then choosing an acid concentration for batch 11 that produced the same concentration for STD A as obtained with batch 9. If the average batch 11 value from the above table is used, an offset would appear in the quality assessment standards when batch 9 acid was substituted on Leg 2; the offset would be such that the quality assessment standards would agree less well with the shore based results on the gravimetric system. If the preliminary batch 11 value is used, no offset is discernible when the acids were changed. For that reason, pending further analysis, we have not used the sodium carbonate calibrations of acid batch 11 listed in the above table.

4.5 *Temperature measurement and calibration*

Several temperatures were measured in the titration procedure, using YSI thermistor probes. The aliquot temperature was measured with a surface probe attached to the outside surface of the syringe. This temperature was read and recorded in the data set when a key was pressed on the computer after the water had been in the syringe for at least ten minutes and just before injection of the aliquot into the titration cell. The acid temperature was measured with a surface probe attached to the Dosimat burette and recorded for every dose of titrant. The average temperature during the titration was used for calculation of the acid density. The cell temperature was measured with a glass sheathed immersion probe and recorded for every dose. The temperature at the midpoint of the titration was used in the calculation of alkalinity. The ambient air temperature was measured with an air probe during the titration and recorded, but not used in the calculations.

Thermistors were calibrated at the Oceanographic Data Facility of SIO by comparison to standard thermometers, with the assistance of Mr. Robert Williams. One set of calibrations was done prior to the cruise, in summer 1992. Calibration curves for the probes were very close to those done prior to the TUNES Leg 3 cruise, in summer 1991.

4.6 *Data acquisition system*

The titrator had two identical computerized data acquisition systems, one for each side of the titrator. The thermistor resistances and the electrode voltage (after passing through the isolation amplifier) were measured with a 5 1/2 digit Hewlett Packard digital multimeter. The electrode voltages were measured on the ± 300 mv scale and recorded to 0.01 mv. A switching box and scanner allowed the multiple inputs to be recorded on hard disc under program control of a Zenith 286 lap top computer equipped with a data acquisition expansion chassis. The operating program also controlled the addition of acid titrant doses by the Dosimat burette.

At the end of a titration, recorded data were copied to a 3 1/2" HD diskette for archiving and later calculation of the alkalinity. One saved file contains one set of data for each titration point, i.e. the final stable electrode EMF's and associated temperatures. Another saved file contains 1/2 second averages of the electrode EMF's throughout the titration, allowing the electrode behavior and stability for every titration to be recreated.

4.7 *Calculation of titration alkalinity*

The titration alkalinity, ALK, was calculated from the titration data set using a non-linear least squares fit of the entire titration curve. A description of this procedure is given in the Department of Energy Handbook of Methods (DOE, 1994). In this procedure, the residuals of the fit are minimized by adjustment of four parameters: the bicarbonate equilibrium constant, K_1 ; the ALK; the DIC; and f , related to the E_0 of the system. Codes entered by the operator identified the sample as either sea water or bicarbonate in sodium chloride solution and the appropriate constants and densities were then selected by the program.

The sets of chemical equilibrium constants used in the fit routine to calculate the alkalinity were as follows:

For 0.7M NaCl:	K1 (bicarbonate)	: Dyrssen and Hansson	(1972)
	K2 (carbonate)	: Dyrssen and Hansson	(1972)
	Kw (water)	: Dyrssen and Hansson	(1972)
For sea water:	K1 (bicarbonate)	: Dickson and Millero	(1985)
	K2 (bicarbonate)	: Dickson and Millero	(1985)
	Kw (water)	: Dickson and Riley	(1979)
	Kb (borate)	: Johansson and Wedborg	(1981)
	Ks (sulfate)	: Khoo et. al.	(1977)
relation to SAL:	Kf (fluoride)	: Dickson and Riley	(1979)
	Total borate	: Uppstrom	(1974)
	Total sulfate	: Morris and Riley	(1966)
	Total fluoride	: Riley	(1965)

Phosphate and silica were assumed to be equal to zero. According to Dickson (DOE, 1994), this assumption has a negligible effect on the calculated alkalinity.

For every titration a graph was produced that displayed the residuals of the fit versus the actual data. Titration data files were copied into a master computer directory to allow refits of the titration data after final calibrations and adjustments to the data. All data, including the 1/2 second averages, have been archived at SIO.

4.8 *Titration operating procedure*

Two bottles of water to be analyzed are placed in holders above the syringe driver assembly and allowed to adjust to ambient temperature. Residual prior samples are emptied from the syringes using the three way valves at the tips. The syringes and connective tubing are filled and emptied with small volumes of new samples, then the syringes are allowed to fill through a mostly glass (Tygon connection pieces) tubing system from the bottoms of the sample bottles.

The titration cells and water delivery tubing are prepared by a rinsing and flushing procedure. First the caps are removed from the cell vent tubes. The previous samples of acidified water are drained from the cells, then the cells are rinsed with purified water. The glass tubing leading from the syringes to the cells are flushed simultaneously with preset injections of 15 ml, using the syringe driver mechanism. The syringes are now set at a constant starting point. The valves at the sample inlets to the cells are closed. The cells are rinsed two more times and allowed to soak for a few minutes while stirring. The acid titrant tips in the cells are flushed with injections of 50 microliters; and the cells are drained then rinsed again to just below the acid tips. The cell drain stopcocks are closed and the

syringe delivery tubing again opened to the cells. The cells are now ready to be filled with samples. The computers are signaled to record the current temperatures of the surface thermistor probes attached to the outside surfaces of the syringes: these temperatures are used as the aliquot temperatures. The syringe driver motor is switched on to move the syringes a constant distance for simultaneous injection of aliquots into both cells. The sample entry tubes in the cells are closed with the valves. The submerged bladders are inflated using rubber pipette bulbs to reduce the cell air spaces to a minimum volume, one to two cc including the visible bubble and the volume of the cell vent tube. The cells are then closed by placing air tight plastic caps on the cell vent tubes. The bulbs are removed from the tubes leading to the bladders so that the insides of the bladders remain at atmospheric pressure during the titrations. The stirrers are turned on and the cells allowed to equilibrate to the operating temperature maintained by flowing water from a refrigerated constant temperature bath through the water jackets on the cells.

The computer data acquisition program prompts the operator to enter sample identification, sample type (sea water or bicarbonate in sodium chloride solution), and salinity. The "salinities" assigned to the bicarbonate reference materials were 39.39 for SIO STD batch A and 38.15 for SIO STD batch B. The salinity used for the natural sea water Certified DIC Reference Material, batch number 13, was 32.864 (A. Dickson, private communication). All of these apparent salinities were calculated from pycnometer density measurements using an equation of state for sea water (Fofonoff, 1985). When temperature stability has been reached, in about ten minutes, the titration programs are started and the first doses added. At each point on the titration curve, the program evaluates the electrode output stability according to a preset criterion. When stability is reached, the electrode EMF and the cell, acid burette and ambient air temperatures are recorded and the next dose of acid is injected.

The complete analysis cycle is about 30 minutes long; thus, about four titrations can be completed per hour, with dual titrators.

4.9 *Daily analysis schedule*

With two operators on board ship, the titrator was operated essentially around the clock during the cruise, interrupted by water sampling activities on station. An average of 37 titrations per analysis day were run. The usual analysis sequence was as follows. Before and after every eight sets of sea water samples (16

titrations), a set of reference materials for quality assessment were run. These reference materials were bicarbonate solutions prepared by the CDRG at SIO. These solutions were prepared in 50 liter batches by bubbling ambient air through solutions of sodium carbonate in 0.7 ionic strength sodium chloride until the pH reached stability. One liter borosilicate glass bottles were filled with solutions from two batches (designated STD batches A and B). Normally five titrations were performed on each bottle during the cruise. Each time these reference materials were titrated they were switched side to side on the system. Once a day, approximately every 40 titrations, a pair of bottles of Dr. Andrew Dickson's Certified DIC Reference Material Batch No. 13 were titrated. This batch was prepared from natural sea water. Normally one analysis was done on each CRM bottle after a DIC analysis had been made on the SOMMA coulometric system. Twice a day duplicate sea water samples collected on profile stations were titrated, one bottle of the pair on each side of the titrator. Samples were normally analyzed in order of depth, from shallow to deep. Thus on one day of 40 titrations there would be two pairs of STD's and one pair of CRM's in addition to 17 pairs of collected sea water samples, including two pairs of duplicate samples.

5. Summary of Results

5.1 *Data quality assessments*

5.1a Duplicate sea water samples

During each leg of the cruise thirty six pairs of duplicate samples were collected and analyzed, i.e. two sample bottles were filled with water from the same Niskin bottle. The bottle pairs were titrated together, one bottle on the right side of the titrator and the other on the left. The sample standard deviations calculated from the pair data, assuming the left and right sides were not systematically different, are summarized in the following table:

Leg	No. of duplicate pairs	s, $\mu\text{eq/kg}$
1	33	1.56
2	30	2.13

For Leg 1, one duplicate pair was flagged (identified malfunction or error) and one pair was omitted from consideration by the three sigma criterion (side to side delta of $11.7 \mu\text{eq/kg}$). For leg 2, three pairs were flagged and the data record

was lost for one pair. Two pairs were omitted by the three sigma criterion (delta's of 12.5 and 9.9 $\mu\text{eq/kg}$).

5.1b SIO bicarbonate reference materials

A total of 86 titrations on bottles of STD batch A were done on both legs. Eleven were omitted from consideration due to operator error or titrator malfunction and by the three sigma criterion (one result: 11.2 $\mu\text{eq/kg}$ low). For batch B, there were 92 total titrations, with two omissions (including one greater than three times sigma at 7.2 $\mu\text{eq/kg}$ low). The results are summarized in the following table:

STD Batch	No. of analyses	Avg. ALK	Sample std dev ($\mu\text{eq/kg}$)
A	75	2304.24	2.77
B	90	2298.75	2.03

In comparison, analyses of samples of these batches of STD were made before and after the cruise in the shore laboratory on the gravimetric titration system, with the following results:

STD Batch	No. of analyses	Avg. ALK	Sample std dev ($\mu\text{eq/kg}$)
A	26	2307.03	1.59
B	26	2302.15	1.94

We have not determined the reason why the shore data are higher than the shipboard data.

Figures 3 and 4 are versions of control charts for the shipboard STD data. The individual results are plotted for each STD batch, with the overall mean and the two times and three times standard deviation levels shown. Six of the omitted data points are plotted on the STD A chart - the six points greater than the three times level. All of the other omitted data are off the scale of the chart. One of the omitted data points is plotted on the STD B chart - the only one below the three times level.

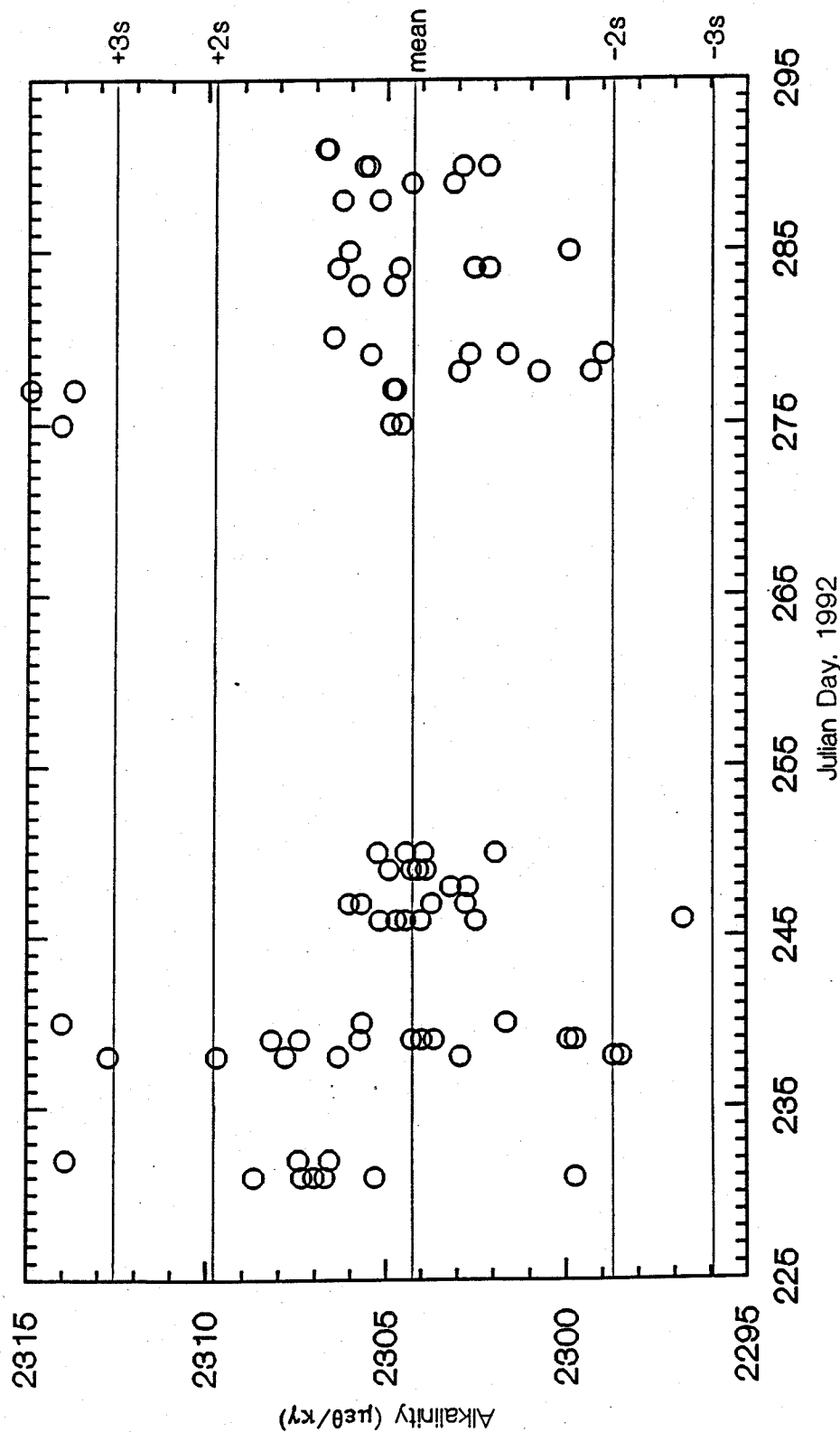


Figure 3: Control chart for CDRG Bicarbonate Reference Material Batch A shipboard alkalinity data from CGC92 Legs 1 and 2 (WOCE line P13). Average alkalinity for batch A: 2304.24 \pm 2.77 $\mu\text{eq/kg}$ for 75 analyses.

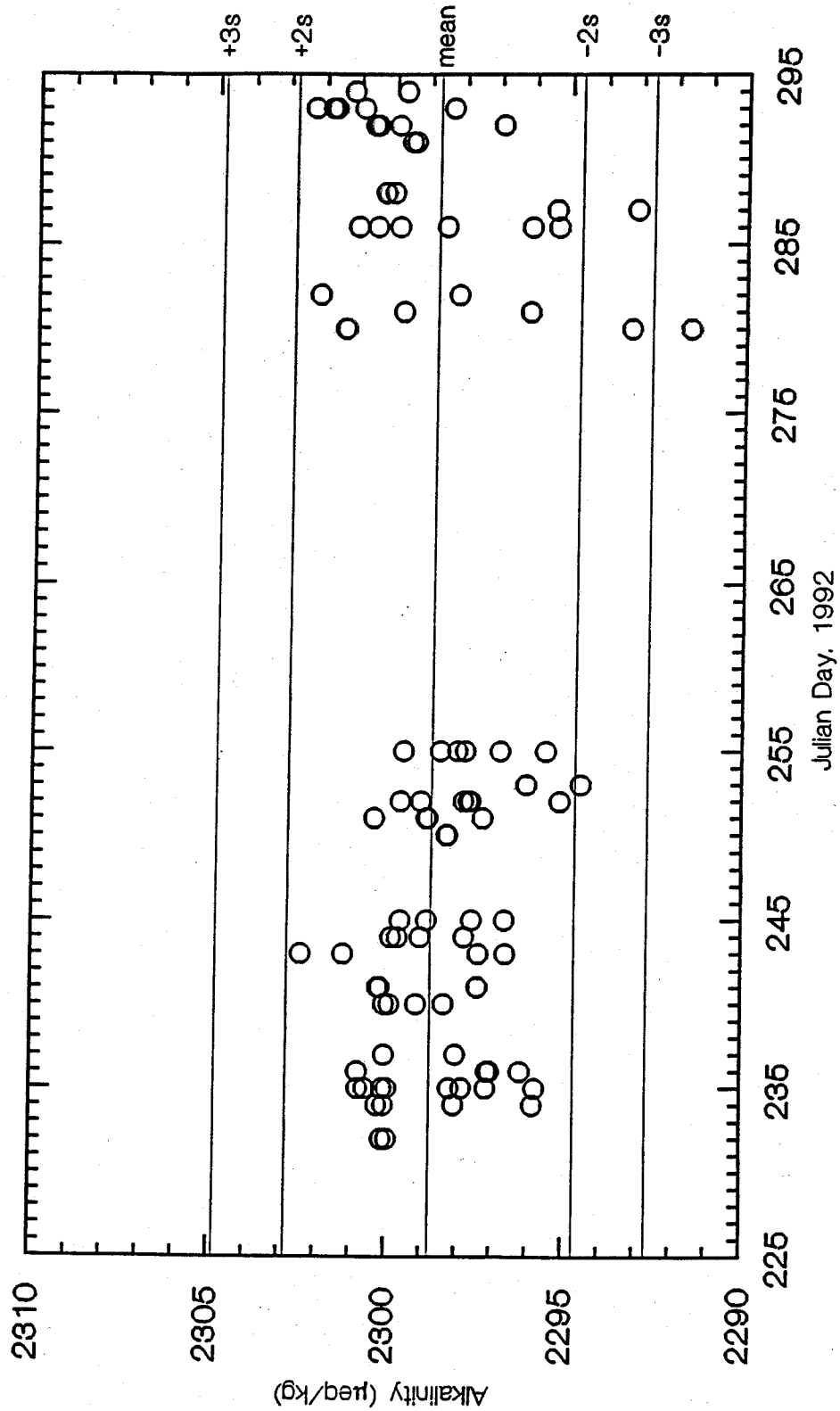


Figure 4: Control chart for CDRG Bicarbonate Reference Material Batch B shipboard alkalinity data from CGC92 Leg 1 and 2 (WOCE line P13). Average alkalinity for batch B: 2298.75 \pm 2.03 µeq/kg for 90 analyses.

5.1c CRM sea water reference materials, batch 13

A total of 84 titrations of CRM batch 13 samples were done during the cruise. In most cases aliquots had previously been removed from the CRM bottles for coulometric DIC analysis. Six titrations were omitted from consideration due to operator error or instrument malfunction and by the three times sigma criterion (two results, at 15.0 $\mu\text{eq/kg}$ high and 19.0 $\mu\text{eq/kg}$ low). At the shore laboratory, 6 titrations were made on this batch of CRM on the gravimetric titration system. One was omitted. These results are shown in the following table:

Titration	No. of analyses	Avg. ALK ($\mu\text{eq/kg}$)	Sample std dev ($\mu\text{eq/kg}$)
volumetric (sea)	78	2201.26	2.29
gravimetric(shore)	5	2198.67	3.87

Figure 5 is a control chart for the shipboard analyses of CRM batch 13 samples.

5.1d Discussion of data quality

Multiple titrations of duplicate sea water samples, CRM's and STD's during the cruise demonstrate that the imprecision of the shipboard titration system for the CGC92 cruise is at the level of approximately 2.5 microequivalents per kilogram (one standard deviation). The three types of quality assessment samples titrated actually give different results. The duplicate sea waters yield a standard deviation of a single measurement (s) of 1.6 $\mu\text{eq/kg}$ on Leg 1 and 2.1 on Leg 2. The two bicarbonate STD reference materials do not agree well. Batch A has the highest standard deviation at 2.8 $\mu\text{eq/kg}$ overall, but batch B is significantly lower at 2.0. Moreover, the scatter in STD A decreased on Leg 2 in comparison with Leg 1, while STD B increased, as did the other quality assessment samples. The primary reason for the general increase in scatter on this cruise, in comparison to the TUNES Leg 3 cruise the previous year, is the frequent appearance of significant bias between the two sides of the titrator. The bias varied to some extent, and fortuitously had a larger effect on the STD A set than the other quality assessment data sets. The side to side bias also became more severe on Leg 2, accounting for the general increase in scatter from Leg 1 to Leg 2. We have not been able to identify the cause of the side to side bias. On average it was about $1.8 \pm 2.3 \mu\text{eq/kg}$, right side being higher, as determined from 172 runs of the

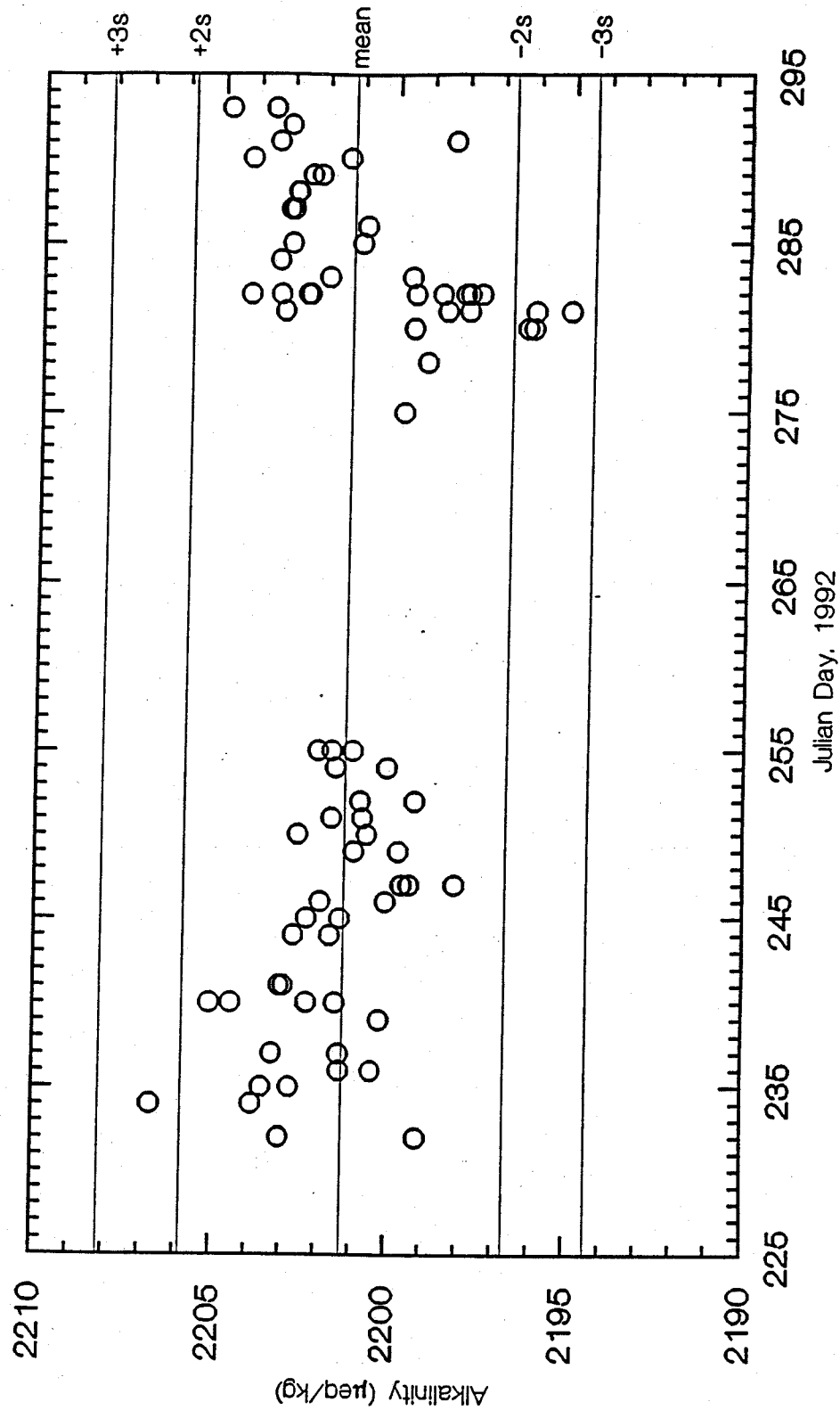


Figure 5: Control chart for SIO Certified DIC Reference Material Batch 13 shipboard alkalinity data from CGC92 Legs 1 and 2 (WOCE line P13). Average alkalinity for CRM 13: 2201.26 \pm 2.29 $\mu\text{eq/kg}$ for 78 analyses.

"same" water simultaneously on both sides of the titration system, i.e. for duplicate sea water samples run side by side, and also for CRM's and STD's run side by side.

Comparison of CRM and STD results at sea on the volumetric titrator to those in the shore laboratory obtained on the gravimetric titrator reveals an offset between the two systems. For STD A, the shore results are on average $2.8 \mu\text{eq/kg}$ higher than the shipboard results, and for STD B, the shore results are 3.5 higher. The side to side offset tends to be averaged out for these comparisons. For CRM 13, the few shore results are on average $2.6 \mu\text{eq/kg}$ lower than the shipboard results. The standard deviation for the shore CRM results is very high, however, with the data set split between low numbers and others higher than the shipboard result.

The lack of a definitive calibration of the acid titrant batch 11 (see section 4.4 above) implies another possible source of systematic error. As discussed above, the concentration of acid 11 was chosen to produce results for bicarbonate STD reference materials that agreed with those obtained using acid batch 9, for which the acid calibration is better and shows consistency with other results, as discussed in Guenther et al. (1994b). Some further scrutiny of the data may result in an improvement of the results in this area.

In conclusion, it can be stated that influences due to temperature, density and volume measurements on the accuracy of the results are likely to be small, close to the analytical imprecision, based on results reported here. The side to side bias in the titrator system seen in this cruise could lead to a systematic error of up to $2 \mu\text{eq/kg}$ in a single sea water result, although the sign of this possible error is as yet unknown. The offset between bicarbonate STD reference materials analyzed at sea and in the shore laboratory indicates that the shipboard results may be up to $3 \mu\text{eq/kg}$ low. The question of the accuracy of the acid calibration and indeed of the titration method overall is less clear due to the lack of a Certified Reference Material for ALK. Interlaboratory comparisons indicate that the accuracy level may be $\pm 10 \mu\text{eq/kg}$ or more.

5.2 *Data tabulations of shipboard alkalinity results*

5.2a Sea water sample data

The table lists results from all titrations in the data set. The seventh column, headed TRIAL, lists the sequential number of the titration on the same sample bottle of water. In most cases, only one was made. The "A" and "B" refer to

duplicate samples collected from the same Niskin bottle. The eighth column, headed FLAG, identifies with an "X" those calculated titrations that were affected by identified operator error or titrator system malfunctions. Such problems included: 1) Loss of water during filling of the titration cell (sometimes identified after the titration had been run); 2) problems with the pH electrodes or isolation amplifiers, often evidenced by poor residuals on the titration fit; 3) operator mistakes, such as forgetting to turn on the stir bar or to close the drain or inlet valves. The titrations identified with the flag "EX" refer to those titrations off by a large margin, usually 20 $\mu\text{eq/kg}$ or more, presumably due to operator error or system malfunction, but not identified. The ninth column, headed TRIAL ALK, is the individual result for one titration trial. The tenth column, headed TRIAL DELTA, is the difference between good trials on aliquots from a single sample of water. The eleventh column, headed BOTTLE ALK, is the average of all the good trials made on water from one bottle. The twelfth column, headed BOTTLE DELTA, is the difference between analyses of water from duplicate sample bottles. The thirteenth column, headed "NISKIN" AVG is the average alkalinity obtained for a single Niskin bottle. In most cases, with a single titration per Niskin bottle, columns nine, eleven and thirteen are identical, and nothing appears in columns ten and twelve.

5.2b SIO bicarbonate reference material data

Two tables report the shipboard alkalinity results for the SIO bicarbonate reference materials, designated STD A and STD B. The tables are arranged in order of analysis date during the cruise. The individual bottles of each batch are identified by a number after the A or B. The third column, headed TRIAL, is the sequential number of the titration on the same bottle of water. The fourth column, headed FLAG, identifies with an "X" those calculated titrations that are affected by identified operator error or titrator system malfunctions (same examples as listed above). Bottle number A2, titrated on 1 and 3 Oct 92 was given an "X" flag on all five titrations because the bottle was a "bad" one, consistently high by 10 $\mu\text{eq/kg}$. The titrations identified with the flag "EX" refer to those titrations off by a large margin, 30 $\mu\text{eq/kg}$ or more, presumably due to operator error or system malfunction, but not identified. The fifth, sixth and seventh columns list the individual trial alkalinities and the overall average and sample standard deviation of all the alkalinity titrations of the STD batch during the cruise.

5.2c CRM sea water reference material data

The last table reports the shipboard alkalinity results for Certified DIC Reference Materials, batch number 13. The columns have the same meaning as described above for the SIO reference materials. The letters following the CRM sample bottle number are used for internal accounting purposes.

References

- DOE, Handbook of methods for the analysis of the various parameters of the carbon dioxide system in sea water; version 2, A. G. Dickson and C. Goyet, eds. ORNL/CDIAC-74, 1994.
- Fofonoff, N. P., Physical properties of sea water: a new salinity scale and equation of state of sea water, *J. of Geophys. Res.*, 90, 3332-3342, 1985.
- Guenther, P. R., Keeling, C. D. and Emanuele, G. Oceanic CO₂ measurements for the WOCE hydrographic survey in the Pacific Ocean, 1990-1991: Shore based analyses, SIO Reference Series, No. 94-28, 192 p., 1994a.
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SUMMARY OF ALKALINITY DATA

A-28

13	1 33	74	23AUG92	23AUG92	A725	1	2244.53	2244.53			
13	1 32	99	23AUG92	23AUG92	A724	1	2250.14	2250.14			
13	1 31	126	23AUG92	23AUG92	A723	1	2260.82	2260.82			
13	1 30	146	23AUG92	23AUG92	A722	1	2282.76	2282.76			
13	1 29	174	23AUG92	23AUG92	A721	1	2296.15	2296.15			
13	1 28	200	23AUG92	23AUG92	A720	1	2302.27	2302.27			
13	1 27	248	23AUG92	23AUG92	A719	1	2308.82	2308.82			
13	1 26	298	23AUG92	23AUG92	A718	1	2321.51	2321.51			
13	1 25	348	23AUG92	23AUG92	A717	1	2331.33	2331.33			
13	1 24	403	23AUG92	23AUG92	A716	1	2336.03	2336.03			
13	1 23	499	23AUG92	23AUG92	A715	1	2344.63	2344.63			
13	1 22	600	23AUG92	23AUG92	A714	1	2356.73	2356.73			
13	1 21	696	23AUG92	23AUG92	A713	1	2365.34	2365.34			
13	1 20	797	23AUG92	23AUG92	A712	1	2374.09	2374.09			
13	1 19	996	23AUG92	23AUG92	A711	1	2384.57	2384.57			
13	1 18	1198	23AUG92	23AUG92	A710	1	2395.17	2395.17			
13	1 17	1398	23AUG92	23AUG92	A709	1	2400.79	2400.79			
13	1 16	1598	23AUG92	23AUG92	A708	1	2409.86	2409.86			
13	1 15	1799	23AUG92	23AUG92	A707	1	2414.84	2414.84			
13	1 14	1999	23AUG92	23AUG92	A706	1	2419.29	2419.29			
13	1 13	2300	23AUG92	23AUG92	A705	1	2413.35	2413.35			
13	1 12	2597	23AUG92	23AUG92	A704	1	2418.00	2418.00			
13	1 11	2900	23AUG92	23AUG92	A703	1	2423.95	2423.95			
13	1 10	3301	23AUG92	23AUG92	A702	1	2419.08	2419.08			
13	1 09	3701	23AUG92	23AUG92	A701	1	2419.37	2419.37			
13	1 08	4101	23AUG92	23AUG92	A700	1	2418.97	2418.97			
13	1 07	4502	23AUG92	23AUG92	A699	1	2418.41	2418.41			
13	1 06	4903	23AUG92	23AUG92	A698	1	2415.12	2415.12			
13	1 05	5301	23AUG92	23AUG92	A697	1	2411.12	2411.12			
13	1 03	5701	23AUG92	23AUG92	A696 A	1	2415.41	2415.41			
13	1 03	5701	23AUG92	23AUG92	A695 B	1	2415.32	2415.32			
13	1 01	5951	23AUG92	23AUG92	A696	1	2236.81	2236.81			
14	1 36	11	23AUG92	23AUG92	A729	1	2240.25	2240.25			
14	1 36	11	23AUG92	23AUG92	A729	2	2226.98	2226.98			
16	1 36	10	24AUG92	24AUG92	A730	1	2226.44	2226.44			
16	1 36	10	24AUG92	24AUG92	A730	2	2224.38	2224.38			
16	1 36	10	24AUG92	24AUG92	A731	1	2227.76	2227.76			
17	1 35	11	25AUG92	25AUG92	A764	1	2225.25	2225.25			
17	1 36	11	25AUG92	25AUG92	A765 A	1	2226.03	2226.03			
17	1 36	11	25AUG92	25AUG92	A765 B	1	2229.09	2229.09			
17	1 34	25	25AUG92	25AUG92	A763	1	2235.07	2235.07			
17	1 33	50	25AUG92	25AUG92	A762	1	2240.98	2240.98			
17	1 32	76	25AUG92	25AUG92	A761	1	2240.76	2240.76			
17	1 31	100	25AUG92	25AUG92	A760	1	2251.66	2251.66			
17	1 30	125	25AUG92	25AUG92	A759	1	2251.06	2251.06			
17	1 29	149	25AUG92	25AUG92	A758	1	2230.89	2230.89			
17	1 28	175	25AUG92	25AUG92	A757	1	2270.84	2270.84			
17	1 27	200	25AUG92	25AUG92	A756	1	2284.49	2284.49			
17	1 26	249	25AUG92	25AUG92	A755	1	2304.02	2304.02			
17	1 25	298	25AUG92	25AUG92	A754	1	2317.38	2317.38			
17	1 24	349	25AUG92	25AUG92	A753	1	2323.40	2323.40			
17	1 23	399	25AUG92	25AUG92	A752	1	2342.82	2342.82			
17	1 22	489	25AUG92	25AUG92	A751	1	2348.99	2348.99			
17	1 21	599	25AUG92	25AUG92	A750	1	2362.53	2362.53			
17	1 20	698	25AUG92	25AUG92	A749	1	2366.74	2366.74			
17	1 19	798	25AUG92	25AUG92	A748	1	2376.98	2376.98			
17	1 18	898	25AUG92	25AUG92	A747	1	2379.25	2379.25			
17	1 17	998	25AUG92	25AUG92	A746	1	2389.36	2389.36			
17	1 16	1098	25AUG92	25AUG92	A745	1					
17	1 15	1198	25AUG92	25AUG92	A744	1					

X

EX

+4.29 2413.27
2415.32+0.78 2225.64
2229.09
2235.07
2240.98
2240.76
2251.66
2251.06+1.44 2239.53
-6.54 2223.71
2224.38
2227.76
2225.25
2226.03
2229.09
2235.07
2240.98
2240.76
2251.66
2251.06

24	1 33	48	27AUG92	27AUG92	8835	2241.78	-1.11	2242.33	2242.33		2242.33
24	1 32	75	27AUG92	27AUG92	8834	2239.33		2239.33	2239.33		2239.33
24	1 31	120	27AUG92	27AUG92	8833	2242.96		2242.96	2242.96		2242.96
24	1 30	125	27AUG92	27AUG92	8832	2255.32		2255.32	2255.32		2255.32
24	1 29	149	27AUG92	27AUG92	8831	2280.33		2280.33	2280.33		2280.33
24	1 27	200	27AUG92	27AUG92	8830	2293.50		2293.50	2293.50		2293.50
24	1 26	249	27AUG92	27AUG92	8829	2305.36		2305.36	2305.36		2305.36
24	1 25	299	27AUG92	27AUG92	8828	2314.35		2314.35	2314.35		2314.35
24	1 24	349	27AUG92	27AUG92	8827	2323.83		2323.83	2323.83		2323.83
24	1 23	400	27AUG92	27AUG92	8826	2330.38		2330.38	2330.38		2330.38
24	1 22	499	27AUG92	27AUG92	8825	2344.60		2344.60	2344.60		2344.60
24	1 21	599	27AUG92	27AUG92	8824	2356.08		2356.08	2356.08		2356.08
24	1 20	699	27AUG92	27AUG92	8823	2368.36		2368.36	2368.36		2368.36
24	1 19	799	27AUG92	27AUG92	8822	2374.50		2374.50	2374.50		2374.50
24	1 18	898	27AUG92	27AUG92	8821	2381.13		2381.13	2381.13		2381.13
24	1 17	998	27AUG92	27AUG92	8820	2383.87		2383.87	2383.87		2383.87
24	1 16	1298	27AUG92	27AUG92	8819	2398.22		2398.22	2398.22		2398.22
24	1 15	1601	27AUG92	27AUG92	8818	2406.49		2406.49	2406.49		2406.49
24	1 14	1897	27AUG92	27AUG92	8817	2415.19		2415.19	2415.19		2415.19
24	1 13	2199	27AUG92	27AUG92	8816	2418.42		2418.42	2418.42		2418.42
24	1 12	2499	27AUG92	27AUG92	8815	2421.78		2421.78	2421.78		2421.78
24	1 11	2800	27AUG92	27AUG92	8814	2420.80		2420.80	2420.80		2420.80
24	1 10	3197	27AUG92	27AUG92	8813	2420.45		2420.45	2420.45		2420.45
24	1 09	3600	27AUG92	27AUG92	8812	2419.17		2419.17	2419.17		2419.17
24	1 08	4001	27AUG92	27AUG92	8811	2420.40		2420.40	2420.40		2420.40
24	1 07	4402	27AUG92	27AUG92	8810	2418.04		2418.04	2418.04		2418.04
24	1 06	4801	27AUG92	27AUG92	8809	2420.67		2420.67	2420.67		2420.67
24	1 05	5102	27AUG92	27AUG92	8808	2418.25		2418.25	2418.25		2418.25
24	1 04	5390	27AUG92	27AUG92	8807	2419.73		2419.73	2419.73		2419.73
24	1 03	5701	27AUG92	27AUG92	8806	2419.14		2419.14	2419.14		2419.14
24	1 01	5950	27AUG92	27AUG92	8805	2419.52		2419.52	2419.52		2419.52
26	1 36	10	27AUG92	27AUG92	8804	2418.92		2418.92	2418.92		2418.92
26	1 35	10	27AUG92	27AUG92	8803	2234.64		2234.64	2234.64		2234.64
26	1 34	24	27AUG92	27AUG92	8802	2236.20		2236.20	2236.20		2236.20
26	1 32	74	27AUG92	27AUG92	8801	2235.91		2235.91	2235.91		2235.91
26	1 31	100	27AUG92	27AUG92	8800	2237.93		2237.93	2237.93		2237.93
26	1 30	123	27AUG92	27AUG92	8805	2254.22		2254.22	2254.22		2254.22
26	1 29	149	27AUG92	27AUG92	8804	2254.15		2254.15	2254.15		2254.15
26	1 28	173	27AUG92	27AUG92	8803	2251.02		2251.02	2251.02		2251.02
26	1 27	199	27AUG92	27AUG92	8802	2257.65		2257.65	2257.65		2257.65
26	1 26	248	27AUG92	27AUG92	8801	2263.32		2263.32	2263.32		2263.32
26	1 25	299	27AUG92	27AUG92	8800	2277.02		2277.02	2277.02		2277.02
26	1 24	347	27AUG92	27AUG92	8805	2279.93		2279.93	2279.93		2279.93
26	1 23	399	27AUG92	27AUG92	8804	2304.65		2304.65	2304.65		2304.65
26	1 22	499	27AUG92	27AUG92	8803	2313.27		2313.27	2313.27		2313.27
26	1 21	595	27AUG92	27AUG92	8802	2321.18		2321.18	2321.18		2321.18
26	1 20	698	27AUG92	27AUG92	8801	2349.20		2349.20	2349.20		2349.20
26	1 19	798	27AUG92	27AUG92	8800	2358.20		2358.20	2358.20		2358.20
26	1 18	1300	27AUG92	27AUG92	8805	2363.95		2363.95	2363.95		2363.95
26	1 17	1597	27AUG92	27AUG92	8804	2399.42		2399.42	2399.42		2399.42
26	1 16	1897	27AUG92	27AUG92	8803	2403.32		2403.32	2403.32		2403.32
26	1 15	2199	27AUG92	27AUG92	8802	2413.40		2413.40	2413.40		2413.40
26	1 14	2498	27AUG92	27AUG92	8801	2418.39		2418.39	2418.39		2418.39
26	1 13	2799	27AUG92	27AUG92	8800	2420.25		2420.25	2420.25		2420.25
26	1 12	3000	27AUG92	27AUG92	8805	2419.09		2419.09	2419.09		2419.09
26	1 11	3600	27AUG92	27AUG92	8804	2419.72		2419.72	2419.72		2419.72
26	1 10	4001	27AUG92	27AUG92	8803	2418.94		2418.94	2418.94		2418.94
26	1 09	4805	27AUG92	27AUG92	8802	2419.12		2419.12	2419.12		2419.12
26	1 08	5100	27AUG92	27AUG92	8801	2418.12		2418.12	2418.12		2418.12

+0.38

-0.29

26	1 04 5401	27AUG92	29AUG92	1841	1	2420.27	2420.27		2420.27
26	1 03 5700	27AUG92	29AUG92	1840 A	1	2417.02	2417.02		2417.02
26	1 03 5700	27AUG92	29AUG92	1840 B	1	2419.59	2419.59	+2.57	2419.31
26	1 01 5954	27AUG92	29AUG92	1839	1	2417.28	2417.28		
28	1 12 9	28AUG92	30AUG92	1838	2	2419.02	2419.02		2418.15
28	1 12 9	28AUG92	29AUG92	1838	2	2251.38	2251.38	+1.74	
28	1 36 9	30AUG92	30AUG92	1838	2	2251.79	2251.79	+0.41	
29	1 35 19	30AUG92	30AUG92	1837	1	2240.51	2240.51		2251.58
29	1 35 19	30AUG92	30AUG92	1837	1	2243.02	2243.02		2240.51
29	1 34 50	30AUG92	30AUG92	1837	1	2244.01	2244.01		2240.51
29	1 33 73	30AUG92	30AUG92	1837	1	2255.52	2255.52	+0.99	2243.52
29	1 32 99	30AUG92	30AUG92	1837	1	2255.52	2255.52		2255.52
29	1 31 124	30AUG92	30AUG92	1837	1	2256.96	2256.96		2250.95
29	1 30 149	30AUG92	30AUG92	1837	1	2256.72	2256.72		2250.95
29	1 29 173	30AUG92	30AUG92	1836	1	2253.60	2253.60		2250.95
29	1 27 248	30AUG92	30AUG92	1835	1	2252.20	2252.20		2253.60
29	1 26 298	30AUG92	30AUG92	1835	1	2259.54	2259.54		2252.20
29	1 25 348	30AUG92	30AUG92	1834	1	2259.54	2259.54		2259.54
29	1 24 398	30AUG92	30AUG92	1833	1	2282.99	2282.99		2282.99
29	1 23 498	30AUG92	30AUG92	1833	1	2288.58	2288.58		2282.99
29	1 22 598	30AUG92	30AUG92	1832	1	2302.12	2302.12		2288.58
29	1 21 697	30AUG92	30AUG92	1831	1	2300.81	2300.81		2302.12
29	1 20 797	30AUG92	30AUG92	1831	1	2324.58	2324.58		2300.81
29	1 19 898	30AUG92	30AUG92	1830	1	2324.58	2324.58		2324.58
29	1 18 998	30AUG92	30AUG92	1829	1	2334.33	2334.33		2334.33
29	1 17 1198	30AUG92	30AUG92	1828	1	2352.06	2352.06		2352.06
29	1 16 1495	30AUG92	30AUG92	1827	1	2352.06	2352.06		2352.06
29	1 15 1798	30AUG92	30AUG92	1827	1	2357.26	2357.26		2357.26
29	1 14 2094	30AUG92	30AUG92	1826	1	2370.48	2370.48		2370.48
29	1 13 2398	30AUG92	30AUG92	1825	1	2373.02	2373.02		2370.48
29	1 12 2702	30AUG92	30AUG92	1824	1	2390.48	2390.48		2373.02
29	1 11 3000	30AUG92	30AUG92	1823	1	2400.39	2400.39		2390.48
29	1 10 3301	30AUG92	30AUG92	1822	1	2413.36	2413.36		2400.39
29	1 09 3601	30AUG92	30AUG92	1821	1	2413.36	2413.36		2413.36
29	1 08 3903	30AUG92	30AUG92	1820	1	2421.22	2421.22		2413.36
29	1 07 4203	30AUG92	30AUG92	1819	1	2417.62	2417.62		2421.22
29	1 06 4597	30AUG92	30AUG92	1818	1	2423.21	2423.21		2417.62
29	1 05 5007	30AUG92	30AUG92	1817	1	2415.49	2415.49	+0.70	2423.21
29	1 04 5400	30AUG92	30AUG92	1816	1	2416.19	2416.19		2415.84
29	1 03 5595	30AUG92	30AUG92	1815	1	2422.33	2422.33		
29	1 02 5952	30AUG92	30AUG92	1814	1	2422.48	2422.48		
29	1 02 5952	30AUG92	30AUG92	1813	1	2417.70	2417.70	+0.15	2422.41
30	1 36 11	31AUG92	31AUG92	1812	2	2419.79	2419.79		2417.70
30	1 36 10	31AUG92	31AUG92	1811	2	2416.22	2416.22		2419.79
31	1 36 9	31AUG92	31AUG92	1810	1	2418.62	2418.62		2416.22
31	1 36 9	31AUG92	31AUG92	1809	1	2413.98	2413.98		2418.62
31	1 36 11	31AUG92	31AUG92	1808	1	2421.40	2421.40		2413.98
32	1 36 9	31AUG92	31AUG92	1807	1	2415.58	2415.58		2421.40
32	1 36 9	31AUG92	31AUG92	1806	1	2421.81	2421.81	+0.23	2418.70
32	1 36 9	31AUG92	31AUG92	1805	1	2220.24	2220.24		2418.70
32	1 36 9	31AUG92	31AUG92	1804	1	2226.27	2226.27		2220.24
32	1 36 9	31AUG92	31AUG92	1803	1	2218.33	2218.33		2226.27
32	1 36 9	31AUG92	31AUG92	1802	1	2219.12	2219.12	+0.79	2218.73
32	1 36 9	31AUG92	31AUG92	1801	1	2223.66	2223.66		2218.73
32	1 36 9	31AUG92	31AUG92	1800	1	2223.66	2223.66		2223.66
32	1 36 9	31AUG92	31AUG92	1799	1	2249.25	2249.25		2223.66
32	1 36 9	31AUG92	31AUG92	1798	1	2244.32	2244.32		2249.25
32	1 36 9	31AUG92	31AUG92	1797	1	2248.35	2248.35		2244.32
32	1 36 9	31AUG92	31AUG92	1796	1	2249.62	2249.62		2248.35
32	1 36 9	31AUG92	31AUG92	1795	1	2262.84	2262.84		2249.62
32	1 36 9	31AUG92	31AUG92	1794	1	2271.13	2271.13		2262.84
32	1 36 9	31AUG92	31AUG92	1793	1	2283.04	2283.04		2271.13
32	1 36 9	31AUG92	31AUG92	1792	1	2289.01	2289.01		2283.04
32	1 36 9	31AUG92	31AUG92	1791	1	2301.24	2301.24		2289.01
32	1 36 9	31AUG92	31AUG92	1790	1	2305.12	2305.12		2301.24
32	1 36 9	31AUG92	31AUG92	1789	1				2305.12

32	1	22	399	31AUG92	31AUG92	1	1	2315.85	2315.85	
32	1	21	497	31AUG92	31AUG92	1	1	2328.12	2328.12	
32	1	20	594	31AUG92	31AUG92	1	1	2346.84	2346.84	
32	1	19	698	31AUG92	31AUG92	1	1	2356.51	2356.51	
32	1	18	799	31AUG92	31AUG92	1	1	2367.58	2367.58	
32	1	17	897	31AUG92	31AUG92	1	1	2372.84	2372.84	
32	1	16	997	31AUG92	31AUG92	1	1	2381.20	2381.20	
32	1	15	1197	31AUG92	31AUG92	1	1	2392.58	2392.58	
32	1	14	1397	31AUG92	31AUG92	1	1	2402.33	2402.33	
32	1	13	1696	31AUG92	31AUG92	1	1	2407.77	2407.77	
32	1	12	1996	31AUG92	31AUG92	1	1	2415.40	2415.40	
32	1	11	2299	31AUG92	31AUG92	1	1	2417.07	2417.07	
32	1	10	2699	31AUG92	31AUG92	1	1	2420.72	2420.72	
32	1	09	2900	31AUG92	31AUG92	1	1	2420.78	2420.78	
32	1	08	3100	31AUG92	31AUG92	1	1	2421.33	2421.33	
32	1	07	3402	31AUG92	31AUG92	1	1	2419.14	2419.14	
32	1	06	3701	31AUG92	31AUG92	1	1	2421.09	2421.09	
32	1	05	3998	31AUG92	31AUG92	1	1	2416.82	2416.82	
32	1	04	4402	31AUG92	31AUG92	1	1	2419.69	2419.69	
32	1	03	4802	31AUG92	31AUG92	1	1	2417.52	2417.52	
32	1	02	5201	31AUG92	31AUG92	1	1	2419.55	2419.55	
32	1	01	5603	31AUG92	31AUG92	1	1	2417.14	2417.14	
32	1	01	5803	31AUG92	31AUG92	1	1	2418.14	2418.14	
33	1	36	10	31AUG92	31AUG92	1	1	2219.92	2219.92	
34	1	36	10	31AUG92	31AUG92	1	1	2221.34	2221.34	
35	1	36	9	01SEP92	01SEP92	1	1	2218.08	2218.08	
36	1	36	10	01SEP92	01SEP92	1	1	2225.68	2225.68	
36	1	35	23	01SEP92	01SEP92	1	1	2252.43	2252.43	
36	1	35	23	01SEP92	01SEP92	1	1	2253.87	2253.87	
36	1	34	50	01SEP92	01SEP92	1	1	2267.06	2267.06	
36	1	33	75	01SEP92	01SEP92	1	1	2267.15	2267.15	
36	1	32	99	01SEP92	01SEP92	1	1	2265.70	2265.70	
36	1	31	125	01SEP92	01SEP92	1	1	2269.75	2269.75	
36	1	30	149	01SEP92	01SEP92	1	1	2268.75	2268.75	
36	1	29	174	01SEP92	01SEP92	1	1	2265.92	2265.92	
36	1	27	201	01SEP92	01SEP92	1	1	2266.44	2266.44	
36	1	26	249	01SEP92	01SEP92	1	1	2279.02	2279.02	
36	1	25	297	01SEP92	01SEP92	1	1	2288.12	2288.12	
36	1	24	350	01SEP92	01SEP92	1	1	2297.19	2297.19	
36	1	23	398	01SEP92	01SEP92	1	1	2306.30	2306.30	
36	1	22	497	01SEP92	01SEP92	1	1	2324.22	2324.22	
36	1	21	598	01SEP92	01SEP92	1	1	2337.42	2337.42	
36	1	20	697	01SEP92	01SEP92	1	1	2351.13	2351.13	
36	1	19	797	01SEP92	01SEP92	1	1	2359.60	2359.60	
36	1	18	897	01SEP92	01SEP92	1	1	2370.70	2370.70	
36	1	17	997	01SEP92	01SEP92	1	1	2379.38	2379.38	
36	1	16	1097	01SEP92	01SEP92	1	1	2385.61	2385.61	
36	1	15	1198	01SEP92	01SEP92	1	1	2390.51	2390.51	
36	1	14	1298	01SEP92	01SEP92	1	1	2395.58	2395.58	
36	1	13	1498	01SEP92	01SEP92	1	1	2404.15	2404.15	
36	1	12	1698	01SEP92	01SEP92	1	1	2409.64	2409.64	
36	1	11	1898	01SEP92	01SEP92	1	1	2414.04	2414.04	
36	1	10	2198	01SEP92	01SEP92	1	1	2417.50	2417.50	
36	1	09	2500	01SEP92	01SEP92	1	1	2417.51	2417.51	
36	1	08	2798	01SEP92	01SEP92	1	1	2419.53	2419.53	
36	1	07	3100	01SEP92	01SEP92	1	1	2419.22	2419.22	
36	1	06	3399	01SEP92	01SEP92	1	1	2420.57	2420.57	
36	1	05	3701	01SEP92	01SEP92	1	1	2416.70	2416.70	
36	1	04	4001	01SEP92	01SEP92	1	1	2419.02	2419.02	
36	1	03	4302	01SEP92	01SEP92	1	1	2416.60	2416.60	

36	1 02 4702	01SEP92	02SEP92	A943	1	2418.57	2418.57		
36	1 01 4866	01SEP92	02SEP92	A942 A	1	2418.27	2418.27		
36	1 01 4866	01SEP92	02SEP92	A942 B	1	2419.89	2419.89	+1.62	2419.08
37	1 36 10	02SEP92	02SEP92	A977	1	2241.04	2241.04		2241.04
38	1 36 10	02SEP92	02SEP92	A1010A	1	2246.38	2246.38		
38	1 34 24	02SEP92	02SEP92	A1010B	1	2248.29	2248.29	+1.91	2247.33
38	1 33 50	02SEP92	02SEP92	A1008	1	2259.10	2259.10		2259.10
38	1 32 73	02SEP92	02SEP92	A1007	1	2273.43	2273.43		2273.43
38	1 31 99	02SEP92	02SEP92	A1006	1	2270.67	2270.67		2270.67
38	1 30 124	02SEP92	02SEP92	A1005	1	2271.94	2271.94		2271.94
38	1 29 148	02SEP92	02SEP92	A1004	1	2268.70	2268.70		2268.70
38	1 27 173	02SEP92	02SEP92	A1003	1	2270.81	2270.81		2270.81
38	1 26 200	02SEP92	02SEP92	A1002	1	2271.03	2271.03		2271.03
38	1 25 247	02SEP92	02SEP92	A1001	1	2271.24	2271.24		2271.24
38	1 24 299	02SEP92	02SEP92	A1000	1	2272.80	2272.80		2272.80
38	1 23 349	02SEP92	02SEP92	A999	1	2273.89	2273.89		2273.89
38	1 22 399	02SEP92	02SEP92	A998	1	2288.30	2288.30		2288.30
38	1 21 498	02SEP92	02SEP92	A997	1	2298.50	2298.50		2298.50
38	1 19 697	02SEP92	02SEP92	A996	1	2313.67	2313.67		2313.67
38	1 18 786	02SEP92	02SEP92	A995	1	2329.63	2329.63		2329.63
38	1 17 896	02SEP92	02SEP92	A994	1	2355.92	2355.92		2355.92
38	1 16 996	02SEP92	02SEP92	A993	1	2370.00	2370.00		2370.00
38	1 15 1197	02SEP92	02SEP92	A992	1	2373.89	2373.89		2373.89
38	1 14 1396	02SEP92	02SEP92	A991	1	2387.88	2387.88		2387.88
38	1 12 1898	02SEP92	02SEP92	A990	1	2398.70	2398.70		2398.70
38	1 11 2196	02SEP92	02SEP92	A989	1	2412.76	2412.76		2412.76
38	1 10 2498	02SEP92	02SEP92	A988	1	2416.18	2416.18		2416.18
38	1 09 2800	02SEP92	02SEP92	A987	1	2419.65	2419.65		2419.65
38	1 08 3101	02SEP92	02SEP92	A986	1	2418.25	2418.25		2418.25
38	1 07 3400	02SEP92	02SEP92	A985	1	2419.28	2419.28		2419.28
38	1 06 3701	02SEP92	02SEP92	A984	1	2416.61	2416.61		2416.61
38	1 05 4102	02SEP92	02SEP92	A983	1	2417.95	2417.95		2417.95
38	1 04 4501	02SEP92	02SEP92	A982	1	2416.38	2416.38		2416.38
38	1 03 4903	02SEP92	02SEP92	A981	1	2418.68	2418.68		2418.68
38	1 02 5201	02SEP92	02SEP92	A980	1	2417.95	2417.95		2417.95
38	1 01 5802	02SEP92	02SEP92	A979	1	2419.82	2419.82		2419.82
38	1 01 5802	02SEP92	02SEP92	A978 A	1	2419.13	2419.13		2419.13
39	1 36 9	02SEP92	02SEP92	A978 B	1	2419.33	2419.33	+0.20	2419.23
40	1 36 10	03SEP92	03SEP92	A1011	1	2236.94	2236.94		2236.94
41	1 36 9	03SEP92	03SEP92	A1012	1	2252.03	2252.03		2252.03
41	1 36 9	03SEP92	03SEP92	A1043A	1	2248.84	2248.84		
41	1 33 49	03SEP92	03SEP92	A1043B	1	2251.16	2251.16	+2.31	2250.00
41	1 32 74	03SEP92	03SEP92	A1042	1	2271.62	2271.62		2271.62
41	1 30 102	03SEP92	03SEP92	A1041	1	2270.32	2270.32		2270.32
41	1 29 148	03SEP92	03SEP92	A1040	1	2272.49	2272.49		2272.49
41	1 27 174	03SEP92	03SEP92	A1039	1	2274.80	2274.80		2274.80
41	1 26 198	03SEP92	03SEP92	A1038	1	2273.97	2273.97		2273.97
41	1 25 249	03SEP92	03SEP92	A1037	1	2275.06	2275.06		2275.06
41	1 24 300	03SEP92	03SEP92	A1036	1	2274.66	2274.66		
41	1 24 300	03SEP92	03SEP92	A1035	2	2270.57	2270.57	-4.09	2272.61
41	1 23 351	03SEP92	03SEP92	A1034	2	2273.13	2273.13		
41	1 21 601	03SEP92	03SEP92	A1033	1	2271.60	2271.60	-1.53	2272.36
41	1 20 605	03SEP92	03SEP92	A1032	1	2295.18	2295.18		2295.18
41	1 19 700	03SEP92	03SEP92	A1031	1	2308.12	2308.12		2308.12
41	1 18 811	03SEP92	03SEP92	A1030	1	2326.64	2326.64		2326.64
41	1 17 900	03SEP92	03SEP92	A1029	1	2342.72	2342.72		2342.72
41	1 16 1000	03SEP92	03SEP92	A1028	1	2353.92	2353.92		2353.92
41	1 16 1000	03SEP92	03SEP92	A1028	1	2362.41	2362.41		2362.41

47	1 07 3501	06SEP92	A1064	2410.90	2416.90	2416.90
47	1 06 3798	06SEP92	A1063	2420.25	2420.25	2420.25
47	1 05 4100	06SEP92	A1062	2421.50	2421.50	2421.50
47	1 04 4403	06SEP92	A1061	2421.79	2421.79	2421.79
47	1 03 4703	06SEP92	A1060	2416.81	2416.81	2416.81
47	1 02 5003	06SEP92	A1059	2418.68	2418.68	2418.68
47	1 01 5595	06SEP92	A1058A	2408.07	2408.07	2408.07
47	1 01 5595	06SEP92	A1058B	2410.49	2410.49	2409.28
48	1 36 9	06SEP92	A1092	2254.34	2254.34	+2.42 2409.28
49	1 36 24	06SEP92	A1126	2253.58	2253.58	2254.34
49	1 34 47	06SEP92	A1125	2258.22	2258.22	2253.58
49	1 33 70	06SEP92	A1124A	2269.25	2269.25	2258.22
49	1 32 70	06SEP92	A1124B	2269.19	2269.19	-0.06 2269.22
49	1 31 101	06SEP92	A1123	2276.85	2276.85	2276.85
49	1 31 120	06SEP92	A1122	2275.88	2275.88	2276.85
49	1 30 148	06SEP92	A1121	2271.81	2271.81	2275.88
49	1 29 171	06SEP92	A1120	2274.48	2274.48	2271.81
49	1 28 200	06SEP92	A1119	2274.38	2274.38	2274.48
49	1 27 243	06SEP92	A1118	2274.55	2274.55	2274.38
49	1 26 300	06SEP92	A1117	2276.67	2276.67	2274.55
49	1 25 348	06SEP92	A1116	2280.15	2280.15	2276.67
49	1 24 399	06SEP92	A1115	2280.64	2280.64	2280.15
49	1 23 498	06SEP92	A1114	2295.53	2295.53	2280.64
49	1 22 599	06SEP92	A1113	2311.81	2311.81	2295.53
49	1 21 700	06SEP92	A1112	2331.07	2331.07	2311.81
49	1 20 798	06SEP92	A1111	2345.64	2345.64	2331.07
49	1 19 898	06SEP92	A1110	2358.78	2358.78	2345.64
49	1 18 998	06SEP92	A1109	2371.14	2371.14	2358.78
49	1 17 1199	06SEP92	A1108	2387.76	2387.76	2371.14
49	1 16 1399	06SEP92	A1107	2398.17	2398.17	2387.76
49	1 15 1698	06SEP92	A1106	2410.83	2410.83	2398.17
49	1 14 2000	06SEP92	A1105	2413.05	2413.05	2410.83
49	1 13 2275	06SEP92	A1104	2421.24	2421.24	2413.05
49	1 12 2602	06SEP92	A1103	2418.07	2418.07	2421.24
49	1 11 2899	06SEP92	A1102	2420.15	2420.15	2418.07
49	1 10 3198	06SEP92	A1101	2417.60	2417.60	2420.15
49	1 09 3498	06SEP92	A1100	2420.75	2420.75	2417.60
49	1 08 3798	06SEP92	A1099	2419.53	2419.53	2420.75
49	1 07 4101	06SEP92	A1098	2420.02	2420.02	2419.53
49	1 06 4701	06SEP92	A1097	2412.85	2412.85	2420.02
49	1 04 5003	06SEP92	A1096	2412.27	2412.27	2412.85
49	1 03 5301	06SEP92	A1095	2408.88	2408.88	2412.27
49	1 02 5601	06SEP92	A1094	2409.10	2409.10	2408.88
49	1 01 5851	06SEP92	A1093A	2408.02	2408.02	2409.10
50	1 35 10	07SEP92	A1093B	2407.10	2407.10	+1.08 2408.56
51	1 36 9	07SEP92	A1146A	2251.64	2251.64	2407.10
51	1 36 9	07SEP92	A1146B	2258.90	2258.90	+1.58 2257.69
51	1 34 24	07SEP92	A1145	2258.48	2258.48	2258.90
51	1 33 48	07SEP92	A1144	2253.71	2253.71	2258.48
51	1 32 73	07SEP92	A1143	2272.69	2272.69	2253.71
51	1 31 99	07SEP92	A1142	2282.99	2282.99	2272.69
51	1 30 124	07SEP92	A1141	2284.58	2284.58	2282.99
51	1 29 150	07SEP92	A1140	2283.35	2283.35	2284.58
51	1 28 175	07SEP92	A1139	2283.90	2283.90	2283.35
51	1 27 199	07SEP92	A1138	2282.24	2282.24	2283.90
51	1 26 250	07SEP92	A1137	2283.66	2283.66	2282.24
51	1 25 298	07SEP92	A1136	2279.72	2279.72	2283.66
51	1 24 347	07SEP92	A1135	2282.25	2282.25	2279.72
51	1 23 399	07SEP92	A1134	2272.86	2272.86	2282.25
51	1 23 399	07SEP92	A1134	2274.85	2274.85	2272.86

51	1 22	498	07SEP92	07SEP92	A1133	1	2375.08	2375.08		2375.08
51	1 21	598	07SEP92	07SEP92	A1132	1	2290.14	2290.14		2290.14
51	1 20	699	07SEP92	07SEP92	A1131	1	2306.36	2306.36		2306.36
51	1 19	798	07SEP92	07SEP92	A1130	1	2326.84	2326.84		2326.84
51	1 18	886	07SEP92	07SEP92	A1129A	1	2344.07	2344.07		2344.07
51	1 18	886	07SEP92	07SEP92	A1129B	1	2345.60	2345.60		2345.60
51	1 17	998	07SEP92	07SEP92	A1128	1	2360.11	2360.11	+1.53	2344.84
52	1 36	10	08SEP92	08SEP92	A1161	1	2259.47	2259.47		2360.11
52	1 19	999	08SEP92	08SEP92	A1160	1	2354.41	2354.41		2259.47
52	1 18	1199	08SEP92	08SEP92	A1159	1	2376.67	2376.67		2354.41
52	1 17	1398	08SEP92	08SEP92	A1158	1	2392.20	2392.20		2376.67
52	1 16	1698	08SEP92	08SEP92	A1157	1	2401.42	2401.42		2392.20
52	1 15	2105	08SEP92	08SEP92	A1156	1	2416.76	2416.76		2401.42
52	1 14	2600	08SEP92	08SEP92	A1155	1	2421.49	2421.49		2416.76
52	1 13	3100	08SEP92	08SEP92	A1154	1	2422.93	2422.93		2421.49
52	1 12	3600	08SEP92	08SEP92	A1153	1	2416.71	2416.71		2422.93
52	1 11	4103	08SEP92	08SEP92	A1152	1	2419.15	2419.15		2416.71
52	1 10	4601	08SEP92	08SEP92	A1151	1	2415.24	2415.24		2419.15
52	1 09	5002	08SEP92	08SEP92	A1150	1	2413.28	2413.28		2415.24
52	1 08	5400	08SEP92	08SEP92	A1149	1	2409.29	2409.29		2413.28
52	1 07	5800	08SEP92	08SEP92	A1148	1	2407.33	2407.33		2409.29
52	1 06	6104	08SEP92	08SEP92	A1147	1	2402.54	2402.54		2407.33
53	1 25	10	08SEP92	08SEP92	A1184A	1	2286.30	2286.30	+1.17	2402.54
53	1 25	10	08SEP92	08SEP92	A1184B	1	2287.47	2287.47		2286.30
53	1 23	24	08SEP92	08SEP92	A1183	1	2281.29	2281.29		2287.47
53	1 22	48	08SEP92	08SEP92	A1182	1	2279.67	2279.67		2281.29
53	1 21	75	08SEP92	08SEP92	A1181	1	2284.80	2284.80		2279.67
53	1 20	99	08SEP92	08SEP92	A1180	1	2287.27	2287.27		2284.80
53	1 19	123	08SEP92	08SEP92	A1179	1	2283.76	2283.76		2287.27
53	1 18	150	08SEP92	08SEP92	A1178	1	2283.06	2283.06		2283.76
53	1 17	174	08SEP92	08SEP92	A1177	1	2282.67	2282.67		2283.06
53	1 16	199	08SEP92	08SEP92	A1176	1	2283.45	2283.45		2282.67
53	1 15	249	08SEP92	08SEP92	A1175	1	2282.82	2282.82		2283.45
53	1 14	300	08SEP92	08SEP92	A1174	1	2282.85	2282.85		2282.82
53	1 13	348	08SEP92	08SEP92	A1173	1	2281.49	2281.49		2282.85
53	1 12	398	08SEP92	08SEP92	A1172	1	2277.98	2277.98		2281.49
53	1 11	498	08SEP92	08SEP92	A1171	1	2275.97	2275.97		2277.98
53	1 10	600	08SEP92	08SEP92	A1170	1	2276.43	2276.43		2275.97
53	1 09	697	08SEP92	08SEP92	A1169	1	2286.64	2286.64		2276.43
53	1 08	798	08SEP92	08SEP92	A1168	1	2292.77	2292.77		2286.64
53	1 07	895	08SEP92	08SEP92	A1167	1	2324.44	2324.44		2292.77
53	1 06	997	08SEP92	08SEP92	A1166	1	2342.46	2342.46		2324.44
53	1 05	1199	08SEP92	08SEP92	A1165	1	2369.46	2369.46		2342.46
53	1 04	1398	08SEP92	08SEP92	A1164	1	2387.35	2387.35		2369.46
53	1 03	1695	08SEP92	08SEP92	A1163A	1	2403.86	2403.86	+0.58	2387.35
53	1 02	1996	08SEP92	08SEP92	A1163B	1	2404.44	2404.44		2403.86
54	1 35	10	09SEP92	09SEP92	A1162	1	2413.93	2413.93		2404.44
54	1 13	2597	09SEP92	09SEP92	A1161	1	2287.01	2287.01		2413.93
54	1 12	2899	09SEP92	09SEP92	A1160	1	2419.05	2419.05		2287.01
54	1 11	3201	09SEP92	09SEP92	A1159	1	2419.26	2419.26		2419.05
54	1 10	3501	09SEP92	09SEP92	A1158	1	2421.67	2421.67		2419.26
54	1 09	3800	09SEP92	09SEP92	A1157	1	2417.80	2417.80		2421.67
54	1 08	4102	09SEP92	09SEP92	A1156	1	2418.91	2418.91		2417.80
54	1 07	4502	09SEP92	09SEP92	A1155	1	2416.61	2416.61		2418.91
54	1 06	4902	09SEP92	09SEP92	A1154	1	2416.01	2416.01		2416.61
54	1 05	5302	09SEP92	09SEP92	A1153	1	2407.11	2407.11		2416.01
54	1 04	5702	09SEP92	09SEP92	A1152	1	2407.04	2407.04		2407.11
54	1 03	5804	09SEP92	09SEP92	A1151	1	2403.36	2403.36		2407.04
54	1 03	5804	09SEP92	09SEP92	A1150	1	2401.89	2401.89	+2.82	2403.36
54	1 03	5804	09SEP92	09SEP92	A1185	2	2404.71	2403.30		2401.89

55	1 35	1 10SEP92	09SEP92	A1231	1	2294.28	2294.28		2294.28
55	1 34	1 10SEP92	10SEP92	A1230A	1	2294.75	2294.75		2294.75
55	1 34	1 10SEP92	10SEP92	A1230B	1	2291.85	2291.85		2291.85
55	1 33	1 10SEP92	10SEP92	A1229	1	2286.43	2286.43	-2.90	2293.30
55	1 32	1 10SEP92	10SEP92	A1228	1	2286.13	2286.13		2286.43
55	1 31	1 10SEP92	10SEP92	A1227	1	2285.01	2285.01		2286.13
55	1 30	1 10SEP92	10SEP92	A1226	1	2282.45	2282.45		2285.01
55	1 30	1 10SEP92	10SEP92	A1225	2	2282.29	2282.29		2285.01
55	1 29	1 10SEP92	10SEP92	A1224	2	2282.16	2282.16	-1.16	2282.87
55	1 29	1 10SEP92	10SEP92	A1223	2	2283.01	2283.01		2282.87
55	1 28	1 10SEP92	10SEP92	A1222	1	2280.16	2280.16	-1.15	2283.58
55	1 27	1 10SEP92	10SEP92	A1221	1	2279.98	2279.98		2280.16
55	1 26	1 10SEP92	10SEP92	A1220	1	2279.67	2279.67		2279.98
55	1 25	1 10SEP92	10SEP92	A1219	1	2279.33	2279.33		2279.67
55	1 24	1 10SEP92	10SEP92	A1218	1	2275.62	2275.62		2279.33
55	1 23	1 10SEP92	10SEP92	A1217	1	2275.38	2275.38		2275.62
55	1 22	1 10SEP92	10SEP92	A1216	1	2274.90	2274.90		2275.38
55	1 21	1 10SEP92	10SEP92	A1215	1	2276.79	2276.79		2274.90
55	1 20	1 10SEP92	10SEP92	A1214	1	2293.44	2293.44		2276.79
55	1 19	1 10SEP92	10SEP92	A1213	1	2310.43	2310.43		2293.44
55	1 18	1 10SEP92	10SEP92	A1212	1	2330.19	2330.19		2310.43
55	1 17	1 10SEP92	10SEP92	A1211	1	2346.85	2346.85		2330.19
55	1 16	1 10SEP92	10SEP92	A1210	1	2373.81	2373.81		2346.85
55	1 15	1 10SEP92	10SEP92	A1209	1	2386.93	2386.93		2373.81
55	1 14	1 10SEP92	10SEP92	A1208	1	2400.73	2400.73		2386.93
55	1 13	1 10SEP92	10SEP92	A1207	1	2411.57	2411.57		2400.73
55	1 12	1 10SEP92	10SEP92	A1206	1	2418.54	2418.54		2411.57
55	1 11	1 10SEP92	10SEP92	A1205	1	2419.73	2419.73		2418.54
55	1 10	1 10SEP92	10SEP92	A1204	1	2420.37	2420.37		2419.73
55	1 09	1 10SEP92	10SEP92	A1203	1	2420.61	2420.61		2420.37
55	1 08	1 10SEP92	10SEP92	A1202	1	2419.48	2419.48		2420.61
55	1 07	1 10SEP92	10SEP92	A1201	1	2418.64	2418.64		2419.48
55	1 06	1 10SEP92	10SEP92	A1200	1	2418.44	2418.44		2418.64
55	1 05	1 10SEP92	10SEP92	A1199	1	2415.19	2415.19		2418.44
55	1 04	1 10SEP92	10SEP92	A1198	1	2411.24	2411.24		2415.19
55	1 03	1 10SEP92	10SEP92	A1197A	1	2405.73	2405.73		2411.24
55	1 02	1 10SEP92	10SEP92	A1197B	1	2407.01	2407.01		2405.73
55	1 01	1 10SEP92	10SEP92	A1196	1	2405.44	2405.44		2407.01
55	1 00	1 10SEP92	10SEP92	A1195	1	2405.66	2405.66	+0.12	2405.50
55	1 35	1 10SEP92	10SEP92	A1194	1	2307.76	2307.76		2405.66
55	1 34	1 10SEP92	10SEP92	A1193	1	2301.40	2301.40		2307.76
55	1 33	1 10SEP92	10SEP92	A1192	1	2311.90	2311.90		2301.40
55	1 32	1 10SEP92	10SEP92	A1191	1	2312.02	2312.02		2311.90
55	1 31	1 10SEP92	10SEP92	A1190	1	2306.30	2306.30		2312.02
55	1 30	1 10SEP92	10SEP92	A1189	1	2303.83	2303.83		2306.30
55	1 29	1 10SEP92	10SEP92	A1188	1	2299.64	2299.64		2303.83
55	1 28	1 10SEP92	10SEP92	A1187	2	2288.09	2288.09		2299.64
55	1 27	1 10SEP92	10SEP92	A1186	2	2286.63	2286.63		2288.09
55	1 26	1 10SEP92	10SEP92	A1185	2	2273.27	2273.27		2286.63
55	1 25	1 10SEP92	10SEP92	A1184	1	2271.22	2271.22		2273.27
55	1 24	1 10SEP92	10SEP92	A1183	1	2265.83	2265.83		2271.22
55	1 23	1 10SEP92	10SEP92	A1182	1	2276.99	2276.99		2265.83
55	1 22	1 10SEP92	10SEP92	A1181	1	2295.02	2295.02		2276.99
55	1 21	1 10SEP92	10SEP92	A1180	1	2320.04	2320.04		2295.02
55	1 20	1 10SEP92	10SEP92	A1179	1	2339.30	2339.30		2320.04
55	1 19	1 10SEP92	10SEP92	A1178	1	2354.24	2354.24		2339.30
55	1 18	1 10SEP92	10SEP92	A1177	1	2367.50	2367.50		2354.24
55	1 17	1 10SEP92	10SEP92	A1176	1	2383.02	2383.02		2367.50
55	1 16	1 10SEP92	10SEP92	A1175	1	2390.48	2390.48		2383.02
55	1 15	1 10SEP92	10SEP92	A1174	1	2400.90	2400.90		2390.48
55	1 14	1 10SEP92	10SEP92	A1173	1	2400.90	2400.90		2400.90

62	1 28	148	020CT92	040CT92	01328	1	X	2316.88	2316.88	2316.88
62	1 27	176	020CT92	040CT92	01327	1	X			2286.74
62	1 26	199	020CT92	040CT92	01326	1	X			2276.72
62	1 25	250	020CT92	040CT92	01325	1	X			2260.22
62	1 24	299	020CT92	040CT92	01324	1	X			2264.96
62	1 23	346	020CT92	040CT92	01323	1	X			2273.74
62	1 22	398	020CT92	040CT92	01322	1	X			2300.99
62	1 21	497	020CT92	040CT92	01321	1	X			2333.96
62	1 20	598	020CT92	040CT92	01320	1	X			2347.61
62	1 19	697	020CT92	040CT92	01319	1	X			2358.80
62	1 18	797	020CT92	040CT92	01318	1	X			2369.13
62	1 17	896	020CT92	040CT92	01317	1	X			2386.46
62	1 16	994	020CT92	040CT92	01316	1	X			2395.61
62	1 15	1199	020CT92	040CT92	01315	1	X			2401.69
62	1 14	1396	020CT92	040CT92	01314	1	X			2405.82
62	1 13	1598	020CT92	040CT92	01313	1	X			2414.03
62	1 12	1794	020CT92	040CT92	01312	1	X			2421.26
62	1 11	2099	020CT92	040CT92	01311	1	X			2422.81
62	1 10	2398	020CT92	040CT92	01310	1	X			2420.27
62	1 09	2700	020CT92	040CT92	01309	1	X			2421.49
62	1 08	3000	020CT92	040CT92	01308	1	X			2416.87
62	1 07	3301	020CT92	040CT92	01307	1	X			2415.05
62	1 06	3602	020CT92	040CT92	01306	1	X			2408.44
62	1 05	3901	020CT92	040CT92	01305	1	X			2404.01
62	1 04	4202	020CT92	040CT92	01304	1	X			2395.46
62	1 03	4502	020CT92	040CT92	01303	1	X			2398.61
62	1 02	4802	020CT92	040CT92	01302	1	X			2308.34
62	1 01	5151	020CT92	040CT92	01301A	1	X			2305.72
62	1 01	5151	020CT92	040CT92	01301B	1	X			2311.11
63	1 36	11	040CT92	050CT92	01371	1	EX	+3.15	2397.04	2308.34
63	1 35	24	040CT92	050CT92	01370A	1	EX	+5.39	2308.42	2312.94
63	1 35	24	040CT92	050CT92	01370B	1	EX		2308.96	2319.49
63	1 34	48	040CT92	050CT92	01369	1	EX		2314.93	2292.23
63	1 33	63	040CT92	050CT92	01368	1	EX		2296.41	2285.97
63	1 32	100	040CT92	050CT92	01367	1	EX		2285.49	2285.49
63	1 31	126	040CT92	050CT92	01366	1	EX		2283.77	2277.76
63	1 30	156	040CT92	050CT92	01365	1	EX		2277.76	2269.68
63	1 29	174	040CT92	050CT92	01364	1	EX		2270.55	2270.55
63	1 28	200	040CT92	050CT92	01363	1	EX		2266.43	2266.43
63	1 27	225	040CT92	050CT92	01362	1	EX		2262.73	2262.73
63	1 26	249	040CT92	050CT92	01361	1	EX		2321.32	2321.32
63	1 25	300	040CT92	050CT92	01360	1	EX		2341.95	2341.95
63	1 24	351	040CT92	050CT92	01359	1	EX		2361.58	2361.58
63	1 23	390	040CT92	050CT92	01358	1	EX		2383.28	2383.28
63	1 22	498	040CT92	050CT92	01357	1	EX		2407.77	2407.77
63	1 21	599	040CT92	050CT92	01356	1	EX		2416.62	2416.62
63	1 20	702	040CT92	050CT92	01355	1	EX		2409.03	2409.03
63	1 19	800	040CT92	050CT92	01354	1	EX		2421.62	2421.62
63	1 18	901	040CT92	050CT92	01353	1	EX		2418.71	2418.71
63	1 17	1002	040CT92	050CT92	01352	1	EX		2422.20	2422.20
63	1 16	1196	040CT92	050CT92	01351	1	EX		2416.93	2416.93
63	1 15	1396	040CT92	050CT92	01350	1	EX			
63	1 14	1700	040CT92	050CT92	01349	1	EX			
63	1 13	2000	040CT92	050CT92	01348	1	EX			
63	1 12	2298	040CT92	050CT92	01347	1	EX			
63	1 11	2600	040CT92	050CT92	01346	1	EX			
63	1 10	2900	040CT92	050CT92	01345	1	EX			
63	1 09	3201	040CT92	050CT92	01344	1	EX			
63	1 08	3600	040CT92	050CT92	01343	1	EX			
63	1 07	4001	040CT92	050CT92	01342	1	EX			

65	1 26	299	050CT92	080CT92	A1432	1	2276.10	2276.10	2276.10	
65	1 25	349	050CT92	080CT92	A1431	1	2271.99	2271.99	2271.99	
65	1 24	397	050CT92	080CT92	A1430	1	2273.71	2273.71	2273.71	
65	1 23	498	050CT92	080CT92	A1429	1	2270.71	2270.71	2270.71	
65	1 22	598	050CT92	080CT92	A1428	1	2282.16	2282.16	2282.16	
65	1 21	698	050CT92	080CT92	A1427	1	2290.08	2290.08	2290.08	
65	1 20	797	050CT92	080CT92	A1426	1	2317.32	2317.32	2317.32	
65	1 19	898	050CT92	080CT92	A1425	1	2336.57	2336.57	2336.57	
65	1 18	999	050CT92	080CT92	A1424	1	2373.84	2373.84	2373.84	
65	1 17	1198	050CT92	080CT92	A1423	1	2376.10	2376.10	2376.10	
65	1 16	1398	050CT92	080CT92	A1422	1	2389.84	2389.84	2389.84	
65	1 15	1597	050CT92	080CT92	A1421	1	2400.84	2400.84	2400.84	
65	1 14	1800	050CT92	080CT92	A1420	1	2413.95	2413.95	2413.95	
65	1 13	2100	050CT92	080CT92	A1419	1	2415.01	2415.01	2415.01	
65	1 12	2400	050CT92	080CT92	A1418	1	2421.90	2421.90	2421.90	
65	1 11	2702	050CT92	080CT92	A1417	1	2416.58	2416.58	2416.58	
65	1 10	3002	050CT92	080CT92	A1416	1	2419.92	2419.92	2419.92	
65	1 09	3301	050CT92	080CT92	A1415	1	2417.47	2417.47	2417.47	
65	1 08	3601	050CT92	080CT92	A1414	1	2420.59	2420.59	2420.59	
65	1 07	3902	050CT92	080CT92	A1413	1	2413.42	2413.42	2413.42	
65	1 06	4502	050CT92	080CT92	A1412	1	2416.93	2416.93	2416.93	
65	1 04	4802	050CT92	080CT92	A1411	1	2410.52	2410.52	2410.52	
65	1 03	5102	050CT92	080CT92	A1410	1	2405.46	2405.46	2405.46	
65	1 02	5300	050CT92	080CT92	A1409	1	2402.47	2402.47	2402.47	
65	1 01	5544	050CT92	080CT92	A1408A	1	2403.12	2403.12	2403.12	
65	1 01	5544	050CT92	080CT92	A1408B	1	2405.85	2405.85	2405.85	
65	1 36	11	080CT92	080CT92	A1476	1	2331.48	2331.48	2331.48	
65	1 35	24	080CT92	080CT92	A1475A	1	2278.40	2278.40	2278.40	
65	1 35	24	080CT92	080CT92	A1475B	1	2288.29	2288.29	2288.29	
65	1 34	50	080CT92	080CT92	A1474	1	2279.80	2279.80	2279.80	
65	1 33	73	080CT92	080CT92	A1473	1	2282.35	2282.35	2282.35	
65	1 32	98	080CT92	080CT92	A1472	1	2305.54	2305.54	2305.54	
65	1 31	126	080CT92	080CT92	A1471	1	2316.57	2316.57	2316.57	
65	1 30	150	080CT92	080CT92	A1470	1	2313.65	2313.65	2313.65	
65	1 29	176	080CT92	080CT92	A1469	1	2303.13	2303.13	2303.13	
65	1 28	200	080CT92	080CT92	A1468	1	2294.12	2294.12	2294.12	
65	1 27	249	080CT92	080CT92	A1467	1	2276.38	2276.38	2276.38	
65	1 26	299	080CT92	080CT92	A1466	1	2269.51	2269.51	2269.51	
65	1 25	349	080CT92	080CT92	A1465	1	2282.98	2282.98	2282.98	
65	1 24	400	080CT92	080CT92	A1464	1	2291.99	2291.99	2291.99	
65	1 23	500	080CT92	080CT92	A1463	1	2312.41	2312.41	2312.41	
65	1 22	598	080CT92	080CT92	A1462	1	2322.53	2322.53	2322.53	
65	1 21	699	080CT92	080CT92	A1461	1	2337.08	2337.08	2337.08	
65	1 20	798	080CT92	080CT92	A1460	1	2344.35	2344.35	2344.35	
65	1 19	899	080CT92	080CT92	A1459	1	2354.26	2354.26	2354.26	
65	1 18	997	080CT92	080CT92	A1458	1	2358.88	2358.88	2358.88	
65	1 17	1100	080CT92	080CT92	A1457	1	2369.94	2369.94	2369.94	
65	1 16	1197	080CT92	080CT92	A1456	1	2375.02	2375.02	2375.02	
65	1 15	1297	080CT92	080CT92	A1455	1	2386.93	2386.93	2386.93	
65	1 13	1699	080CT92	080CT92	A1454	1	2407.09	2407.09	2407.09	
65	1 12	2000	080CT92	080CT92	A1453	1	2419.13	2419.13	2419.13	
65	1 11	2297	080CT92	080CT92	A1452	1	2418.15	2418.15	2418.15	
65	1 10	2599	080CT92	080CT92	A1451	1	2425.69	2425.69	2425.69	
65	1 08	3200	080CT92	080CT92	A1450	1	2421.91	2421.91	2421.91	
65	1 07	3502	080CT92	080CT92	A1449	1	2424.92	2424.92	2424.92	
65	1 06	3801	080CT92	100CT92	A1448	1	2417.31	2417.31	2417.31	
65	1 05	4102	080CT92	100CT92	A1447	1	2418.23	2418.23	2418.23	
65	1 04	4403	080CT92	100CT92	A1446	1	2408.56	2408.56	2408.56	
65	1 03	4702	080CT92	100CT92	A1445	1	2407.31	2407.31	2407.31	
65	1 02	4903	080CT92	100CT92	A1444	1	2400.42	2400.42	2400.42	

66	1 01 5117	080CT92	100CT92	A1443A	1	2399.68	2399.68		
66	1 01 5117	080CT92	100CT92	A1443B	1	2402.97	2402.97		
67	1 36 10	090CT92	100CT92	A1512	1	2275.78	2275.78	+3.29	2401.32
67	1 35 25	090CT92	100CT92	A1511A	1	2272.50	2272.50		2275.78
67	1 35 25	090CT92	100CT92	A1511B	1	2273.28	2273.28		
67	1 34 49	090CT92	100CT92	A1510	1	2278.43	2278.43	+0.78	2272.89
67	1 33 74	090CT92	100CT92	A1509	1	2283.47	2283.47		2278.43
67	1 32 99	090CT92	100CT92	A1508	1	2282.05	2282.05		2283.47
67	1 31 125	090CT92	100CT92	A1507	1	2306.21	2306.21		2282.05
67	1 30 149	090CT92	100CT92	A1506	1	2308.55	2308.55		2306.21
67	1 29 173	090CT92	100CT92	A1505	1	2303.90	2303.90		2308.55
67	1 28 198	090CT92	100CT92	A1504	1	2291.77	2291.77		2303.90
67	1 27 247	090CT92	100CT92	A1503	1	2276.16	2276.16		2291.77
67	1 26 299	090CT92	100CT92	A1502	1	2269.13	2269.13		2276.16
67	1 25 348	090CT92	100CT92	A1501	1	2283.58	2283.58		2269.13
67	1 24 404	090CT92	100CT92	A1500	1	2292.50	2292.50		2283.58
67	1 23 499	090CT92	100CT92	A1499	1	2313.08	2313.08		2292.50
67	1 22 597	090CT92	100CT92	A1498	1	2323.76	2323.76		2313.08
67	1 21 697	090CT92	100CT92	A1497	1	2336.50	2336.50		2323.76
67	1 20 797	090CT92	100CT92	A1496	1	2342.37	2342.37		2336.50
67	1 19 898	090CT92	100CT92	A1495	1	2352.96	2352.96		2342.37
67	1 18 997	090CT92	100CT92	A1494	1	2359.68	2359.68		2352.96
67	1 17 1128	090CT92	100CT92	A1493	1	2368.48	2368.48		2359.68
67	1 16 1296	090CT92	100CT92	A1492	1	2381.80	2381.80		2368.48
67	1 15 1496	090CT92	100CT92	A1491	1	2397.67	2397.67		2381.80
67	1 14 1694	090CT92	100CT92	A1490	1	2409.13	2409.13		2397.67
67	1 13 1904	090CT92	100CT92	A1489	1	2414.29	2414.29		2409.13
67	1 12 2198	090CT92	100CT92	A1488	1	2419.01	2419.01		2414.29
67	1 11 2384	090CT92	100CT92	A1487	1	2423.61	2423.61		2419.01
67	1 10 2600	090CT92	100CT92	A1486	1	2424.62	2424.62		2423.61
67	1 09 2799	090CT92	100CT92	A1485	1	2426.24	2426.24		2424.62
67	1 08 3098	090CT92	100CT92	A1484	1	2425.76	2425.76		2426.24
67	1 07 3399	090CT92	100CT92	A1483	1	2425.76	2425.76		2425.76
67	1 06 3702	090CT92	100CT92	A1482	1	2422.46	2422.46		2425.76
67	1 05 4003	090CT92	100CT92	A1481	1	2420.16	2420.16		2422.46
67	1 04 4302	090CT92	100CT92	A1480	1	2412.93	2412.93		2420.16
67	1 03 4601	090CT92	100CT92	A1479	1	2409.31	2409.31		2412.93
67	1 02 4902	090CT92	100CT92	A1478	1	2401.92	2401.92		2409.31
67	1 01 5322	090CT92	100CT92	A1477A	1	2397.36	2397.36	+0.38	2401.92
67	1 01 5322	090CT92	100CT92	A1477B	1	2397.74	2397.74		2397.36
68	1 36 9	090CT92	100CT92	A1548	1	2260.92	2260.92		2397.74
68	1 35 9	090CT92	100CT92	A1547A	1	2259.38	2259.38		2260.92
68	1 35 9	090CT92	100CT92	A1547B	1	2259.81	2259.81	+0.43	2259.38
68	1 34 25	090CT92	100CT92	A1546	1	2265.88	2265.88		2259.81
68	1 33 48	090CT92	100CT92	A1545	1	2272.17	2272.17		2265.88
68	1 32 74	090CT92	100CT92	A1544	1	2280.07	2280.07		2272.17
68	1 31 98	090CT92	100CT92	A1543	1	2282.58	2282.58		2280.07
68	1 30 123	090CT92	100CT92	A1542	1	2287.24	2287.24		2282.58
68	1 29 150	090CT92	100CT92	A1541	1	2300.79	2300.79		2287.24
68	1 28 179	090CT92	100CT92	A1540	1	2287.11	2287.11		2300.79
68	1 27 236	090CT92	100CT92	A1539	1	2273.50	2273.50		2287.11
68	1 26 298	090CT92	100CT92	A1538	1	2284.98	2284.98		2273.50
68	1 25 346	090CT92	100CT92	A1537	1	2299.46	2299.46		2284.98
68	1 24 397	090CT92	100CT92	A1536	1	2305.48	2305.48		2299.46
68	1 23 497	090CT92	100CT92	A1535	1	2311.32	2311.32		2305.48
68	1 22 596	090CT92	100CT92	A1534	1	2304.15	2304.15		2311.32
68	1 21 696	090CT92	100CT92	A1533	1	2336.74	2336.74		2304.15
68	1 20 798	090CT92	100CT92	A1532	1	2341.38	2341.38		2336.74
68	1 19 897	090CT92	100CT92	A1531	1	2354.89	2354.89		2341.38
68	1 18 996	090CT92	100CT92	A1530	1	2359.62	2359.62		2354.89

68	1	17	1098	090CT92	110CT92	A1529	1	2368.79	2368.79	
68	1	16	1197	090CT92	110CT92	A1528	1	2381.16	2381.16	
68	1	15	1295	090CT92	110CT92	A1527	1	2388.00	2388.00	
68	1	14	1398	090CT92	110CT92	A1526	1	2391.21	2391.21	
68	1	13	1698	090CT92	110CT92	A1525	1	2403.22	2403.22	
68	1	12	1797	090CT92	110CT92	A1524	1	2407.00	2407.00	
68	1	11	1997	090CT92	110CT92	A1523	1	2417.21	2417.21	
68	1	10	2199	090CT92	110CT92	A1522	1	2424.10	2424.10	
68	1	09	2498	090CT92	110CT92	A1521	1	2423.97	2423.97	
68	1	08	2800	090CT92	110CT92	A1520	1	2425.10	2425.10	
68	1	07	3100	090CT92	110CT92	A1519	1	2423.99	2423.99	
68	1	06	3400	090CT92	110CT92	A1518	1	2424.75	2424.75	
68	1	05	3702	090CT92	110CT92	A1517	1	2425.70	2425.70	
68	1	04	4001	090CT92	110CT92	A1516	1	2424.50	2424.50	
68	1	03	4301	090CT92	110CT92	A1515	1	2413.90	2413.90	
68	1	02	4501	090CT92	110CT92	A1514	1	2408.44	2408.44	
68	1	01	4758	090CT92	110CT92	A1513A	1	2407.63	2407.63	
68	1	01	4758	090CT92	110CT92	A1513B	1	2408.71	2408.71	
69	1	36	9	100CT92	120CT92	A1584	1	2257.29	2257.29	+1.08 2408.17
69	1	35	24	100CT92	120CT92	A1583	1	2255.38	2255.38	2257.29
69	1	34	50	100CT92	120CT92	A1582A	1	2275.03	2275.03	2255.38
69	1	34	50	100CT92	120CT92	A1582B	1	2275.10	2275.10	
69	1	33	73	100CT92	120CT92	A1581	1	2279.32	2279.32	+0.07 2275.07
69	1	32	100	100CT92	120CT92	A1580	1	2298.26	2298.26	2279.32
69	1	31	124	100CT92	120CT92	A1579	1	2299.04	2299.04	2298.26
69	1	30	148	100CT92	120CT92	A1578	1	2280.98	2280.98	2299.04
69	1	29	175	100CT92	120CT92	A1577	1	2279.24	2279.24	2280.98
69	1	28	200	100CT92	120CT92	A1576	1	2280.27	2280.27	2279.24
69	1	27	248	100CT92	120CT92	A1575	1	2294.74	2294.74	2280.27
69	1	26	297	100CT92	120CT92	A1574	1	2300.12	2300.12	2294.74
69	1	25	349	100CT92	120CT92	A1573	1	2308.48	2308.48	2300.12
69	1	24	399	100CT92	120CT92	A1572	1	2305.09	2305.09	2308.48
69	1	23	500	100CT92	120CT92	A1571	1	2314.75	2314.75	2305.09
69	1	22	598	100CT92	120CT92	A1570	1	2316.65	2316.65	2314.75
69	1	21	697	100CT92	120CT92	A1569	1	2328.53	2328.53	2316.65
69	1	20	799	100CT92	120CT92	A1568	1	2332.16	2332.16	2328.53
69	1	19	898	100CT92	120CT92	A1567	1	2345.58	2345.58	2332.16
69	1	18	998	100CT92	120CT92	A1566	1	2353.73	2353.73	2345.58
69	1	17	1098	100CT92	120CT92	A1565	1	2365.15	2365.15	2353.73
69	1	16	1194	100CT92	120CT92	A1564	1	2372.80	2372.80	2365.15
69	1	15	1299	100CT92	120CT92	A1563	1	2381.76	2381.76	2372.80
69	1	14	1498	100CT92	120CT92	A1562	1	2394.07	2394.07	2381.76
69	1	13	1698	100CT92	120CT92	A1561	1	2405.88	2405.88	2394.07
69	1	12	1999	100CT92	120CT92	A1560	1	2415.58	2415.58	2405.88
69	1	11	2298	100CT92	110CT92	A1559	1	2423.68	2423.68	2415.58
69	1	10	2600	100CT92	120CT92	A1558	1	2425.03	2425.03	2423.68
69	1	09	2899	100CT92	110CT92	A1557	1	2427.65	2427.65	2425.03
69	1	08	3199	100CT92	120CT92	A1556	1	2424.72	2424.72	2427.65
69	1	07	3501	100CT92	120CT92	A1555	2	2420.74	2420.74	2424.72
69	1	06	3800	100CT92	120CT92	A1554	2	2413.61	2413.61	2420.74
69	1	05	4102	100CT92	120CT92	A1553	1	2412.77	2412.77	2413.61
69	1	04	4378	100CT92	120CT92	A1552	1	2407.82	2407.82	2412.77
69	1	03	4704	100CT92	120CT92	A1551	1	2395.03	2395.03	2407.82
69	1	02	4902	100CT92	120CT92	A1550	1	2394.80	2394.80	2395.03
69	1	01	5151	100CT92	120CT92	A1549A	1	2394.08	2394.08	2394.80
69	1	01	5151	100CT92	120CT92	A1549B	1	2393.74	2393.74	2394.08
70	1	36	9	110CT92	130CT92	A1620	1	2242.95	2242.95	-0.34 2393.91
70	1	35	24	110CT92	130CT92	A1619A	1	2242.43	2242.43	2242.95
70	1	35	24	110CT92	130CT92	A1619B	1	2243.39	2243.39	+0.96 2242.91
70	1	34	50	110CT92	130CT92	A1618	1	2241.60	2241.60	2243.39

70	1 33	75	110CT92	130CT92	A1617	1	2288.67	2288.67	2288.67
70	1 32	99	110CT92	130CT92	A1616	1	2290.30	2290.30	2290.30
70	1 31	125	110CT92	130CT92	A1615	1	2293.30	2293.30	2293.30
70	1 30	149	110CT92	130CT92	A1614	1	2283.81	2283.81	2283.81
70	1 29	175	110CT92	130CT92	A1613	1	2286.60	2286.60	2286.60
70	1 28	199	110CT92	130CT92	A1612	1	2292.62	2292.62	2292.62
70	1 27	223	110CT92	130CT92	A1611	1	2297.90	2297.90	2297.90
70	1 26	248	110CT92	130CT92	A1610	1	2303.48	2303.48	2303.48
70	1 25	298	110CT92	130CT92	A1609	1	2306.67	2306.67	2306.67
70	1 24	348	110CT92	130CT92	A1608	1	2307.15	2307.15	2307.15
70	1 23	399	110CT92	130CT92	A1607	1	2309.68	2309.68	2309.68
70	1 22	499	110CT92	130CT92	A1606	1	2322.48	2322.48	2322.48
70	1 21	599	110CT92	130CT92	A1605	1	2329.29	2329.29	2329.29
70	1 20	697	110CT92	130CT92	A1604	1	2340.27	2340.27	2340.27
70	1 19	799	110CT92	130CT92	A1603	1	2348.64	2348.64	2348.64
70	1 18	897	110CT92	130CT92	A1602	1	2359.82	2359.82	2359.82
70	1 17	997	110CT92	130CT92	A1601	1	2369.71	2369.71	2369.71
70	1 16	1097	110CT92	130CT92	A1600	1	2391.55	2391.55	2391.55
70	1 15	1297	110CT92	130CT92	A1599	1	2399.60	2399.60	2399.60
70	1 14	1497	110CT92	130CT92	A1598	1	2412.57	2412.57	2412.57
70	1 13	1696	110CT92	130CT92	A1597	1	2421.85	2421.85	2421.85
70	1 12	1895	110CT92	130CT92	A1596	1	2421.92	2421.92	2421.92
70	1 11	2198	110CT92	130CT92	A1595	1	2428.52	2428.52	2428.52
70	1 10	2498	110CT92	130CT92	A1594	1	2418.78	2418.78	2418.78
70	1 09	2799	110CT92	130CT92	A1593	1	2422.81	2422.81	2422.81
70	1 08	3099	110CT92	130CT92	A1592	1	2417.91	2417.91	2417.91
70	1 07	3400	110CT92	130CT92	A1591	1	2413.67	2413.67	2413.67
70	1 06	3701	110CT92	130CT92	A1590	1	2407.55	2407.55	2407.55
70	1 05	4001	110CT92	130CT92	A1589	1	2402.28	2402.28	2402.28
70	1 04	4302	110CT92	130CT92	A1588	1	2398.64	2398.64	2398.64
70	1 03	4601	110CT92	130CT92	A1587	1	2398.44	2398.44	2398.44
70	1 02	4902	110CT92	130CT92	A1586	1	2238.33	2238.33	2238.33
70	1 01	5205	110CT92	130CT92	A1585	1	2235.64	2235.64	2235.64
71	1 38	10	120CT92	130CT92	A1584	1	2235.64	2235.64	2235.64
71	1 35	23	120CT92	130CT92	A1583	1	2235.64	2235.64	2235.64
71	1 34	49	120CT92	130CT92	A1582	1	2235.64	2235.64	2235.64
71	1 33	74	120CT92	130CT92	A1581	1	2235.64	2235.64	2235.64
71	1 32	98	120CT92	130CT92	A1580	1	2235.64	2235.64	2235.64
71	1 31	123	120CT92	130CT92	A1579	1	2235.64	2235.64	2235.64
71	1 30	148	120CT92	130CT92	A1578	1	2235.64	2235.64	2235.64
71	1 29	173	120CT92	130CT92	A1577	1	2235.64	2235.64	2235.64
71	1 28	199	120CT92	130CT92	A1576	1	2235.64	2235.64	2235.64
71	1 27	224	120CT92	130CT92	A1575	1	2235.64	2235.64	2235.64
71	1 26	247	120CT92	130CT92	A1574	1	2235.64	2235.64	2235.64
71	1 25	272	120CT92	130CT92	A1573	1	2235.64	2235.64	2235.64
71	1 24	299	120CT92	130CT92	A1572	1	2235.64	2235.64	2235.64
71	1 23	347	120CT92	130CT92	A1571	1	2235.64	2235.64	2235.64
71	1 22	398	120CT92	130CT92	A1570	1	2235.64	2235.64	2235.64
71	1 21	448	120CT92	130CT92	A1569	1	2235.64	2235.64	2235.64
71	1 20	498	120CT92	130CT92	A1568	1	2235.64	2235.64	2235.64
71	1 19	595	120CT92	130CT92	A1567	1	2235.64	2235.64	2235.64
71	1 18	695	120CT92	130CT92	A1566	1	2235.64	2235.64	2235.64
71	1 17	797	120CT92	130CT92	A1565	1	2235.64	2235.64	2235.64
71	1 16	897	120CT92	130CT92	A1564	1	2235.64	2235.64	2235.64
71	1 15	996	120CT92	130CT92	A1563	1	2235.64	2235.64	2235.64
71	1 14	1197	120CT92	130CT92	A1562	1	2235.64	2235.64	2235.64
71	1 13	1494	120CT92	130CT92	A1561	1	2235.64	2235.64	2235.64
71	1 12	1794	120CT92	130CT92	A1560	1	2235.64	2235.64	2235.64
71	1 11	2094	120CT92	130CT92	A1559	1	2235.64	2235.64	2235.64

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+0.58

71	1 10	2395	120CT92	140CT92	A1630	1	2428.16	2428.16
71	1 09	2697	120CT92	140CT92	A1629	1	2428.01	2428.01
71	1 08	2998	120CT92	140CT92	A1628	1	2424.58	2424.58
71	1 07	3298	120CT92	140CT92	A1627	1	2425.64	2425.64
71	1 06	3599	120CT92	140CT92	A1626	1	2421.33	2421.33
71	1 05	3898	120CT92	140CT92	A1625	1	2418.80	2418.80
71	1 04	4201	120CT92	140CT92	A1624	1	2411.12	2411.12
71	1 03	4500	120CT92	140CT92	A1623	1	2406.48	2406.48
71	1 02	4799	120CT92	140CT92	A1622	1	2399.75	2399.75
71	1 01	4944	120CT92	140CT92	A1621A	1	2395.78	2395.78
71	1 36	10	120CT92	140CT92	A1621B	1	2394.58	2394.58
72	1 35	9	120CT92	140CT92	A1657	1	2233.17	2233.17
73	1 33	48	120CT92	140CT92	A1685	1	2229.65	2229.65
73	1 31	73	120CT92	140CT92	A1684	1	2233.79	2233.79
73	1 30	73	120CT92	140CT92	A1683A	1	2282.98	2282.98
73	1 30	73	120CT92	140CT92	A1683B	1	2280.94	2280.94
73	1 29	99	120CT92	140CT92	A1682	1	2297.53	2297.53
73	1 28	123	120CT92	140CT92	A1681	1	2302.42	2302.42
73	1 27	147	120CT92	140CT92	A1680	1	2301.80	2301.80
73	1 26	173	120CT92	140CT92	A1679	1	2295.29	2295.29
73	1 25	200	120CT92	140CT92	A1678	1	2291.22	2291.22
73	1 24	223	120CT92	140CT92	A1677	1	2291.95	2291.95
73	1 23	247	120CT92	150CT92	A1676	1	2296.24	2296.24
73	1 22	297	120CT92	150CT92	A1675	1	2304.06	2304.06
73	1 20	398	120CT92	150CT92	A1674	1	2310.36	2310.36
73	1 19	448	120CT92	150CT92	A1673	1	2326.82	2326.82
73	1 18	495	120CT92	150CT92	A1672	1	2311.64	2311.64
73	1 17	594	120CT92	150CT92	A1671	1	2318.55	2318.55
73	1 16	695	120CT92	150CT92	A1670	1	2325.31	2325.31
73	1 14	894	120CT92	150CT92	A1669	1	2348.72	2348.72
73	1 12	1195	120CT92	150CT92	A1668	1	2378.58	2378.58
73	1 10	1696	120CT92	150CT92	A1667	1	2400.53	2400.53
73	1 09	1997	120CT92	150CT92	A1666	1	2412.91	2412.91
73	1 08	2298	120CT92	150CT92	A1665	1	2420.18	2420.18
73	1 07	2698	120CT92	150CT92	A1664	1	2424.46	2424.46
73	1 06	2899	120CT92	150CT92	A1663	1	2424.44	2424.44
73	1 05	3200	120CT92	150CT92	A1662	1	2425.81	2425.81
73	1 04	3501	120CT92	150CT92	A1661	1	2424.64	2424.64
73	1 03	3800	120CT92	150CT92	A1660	1	2413.21	2413.21
73	1 02	4102	120CT92	150CT92	A1659	1	2414.21	2414.21
73	1 01	4281	120CT92	150CT92	A1658A	1	2407.86	2407.86
73	1 01	4281	120CT92	150CT92	A1658B	1	2250.44	2250.44
74	1 36	10	130CT92	140CT92	A1686	1	2261.55	2261.55
75	1 35	11	130CT92	150CT92	A1718	1	2262.51	2262.51
75	1 35	26	130CT92	150CT92	A1717A	1	2262.74	2262.74
75	1 34	51	130CT92	150CT92	A1716	1	2265.94	2265.94
75	1 33	75	130CT92	150CT92	A1715	1	2295.32	2295.32
75	1 32	101	130CT92	150CT92	A1714	1	2297.52	2297.52
75	1 31	124	130CT92	150CT92	A1713	1	2299.98	2299.98
75	1 30	151	130CT92	150CT92	A1712	1	2302.81	2302.81
75	1 29	180	130CT92	150CT92	A1711	1	2292.71	2292.71
75	1 28	208	130CT92	150CT92	A1710	1	2296.87	2296.87
75	1 27	248	130CT92	150CT92	A1709	1	2307.63	2307.63
75	1 26	300	130CT92	150CT92	A1708	1	2308.49	2308.49
75	1 25	349	130CT92	150CT92	A1707	1	2307.45	2307.45
75	1 24	399	130CT92	150CT92	A1706	1	2306.90	2306.90
75	1 23	449	130CT92	150CT92	A1705	1	2306.58	2306.58
75	1 22	499	130CT92	180CT92	A1704	1	2309.50	2309.50
75	1 21	598	130CT92	180CT92	A1703	1	2319.13	2319.13

X

-1.20 2395.18
2233.17
2229.65
2233.79

-2.04 2281.96
2297.53
2302.42
2301.80
2295.29
2291.22
2291.95
2296.24
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2304.06
2310.36
2326.82
2311.64
2318.55
2325.31
2348.72
2378.58
2400.53
2412.91
2420.18
2424.46
2424.44
2425.81
2424.64
2413.21
2414.21
2414.21

+0.23 2262.63
2265.94
2295.32
2297.52
2299.98
2302.81
2292.71
2296.87
2307.63
2308.49
2307.45
2306.90
2306.58
2309.50
2319.13

75	1	20	699	130CT92	160CT92	A1702	1	2328.90	2328.90		
75	1	19	799	130CT92	160CT92	A1701	1	2338.32	2338.32		
75	1	18	896	130CT92	160CT92	A1700	1	2350.80	2350.80		
75	1	17	997	130CT92	160CT92	A1699	1	2358.84	2358.84		
75	1	16	1058	130CT92	160CT92	A1698	1	2365.80	2365.80		
75	1	12	1498	130CT92	160CT92	A1697	1	2382.28	2382.28		
75	1	10	1897	130CT92	160CT92	A1696	1	2403.42	2403.42		
75	1	09	1998	130CT92	160CT92	A1695	1	2413.42	2413.42		
75	1	08	2297	130CT92	160CT92	A1694	1	2419.03	2419.03		
75	1	07	2597	130CT92	160CT92	A1693	1	2422.55	2422.55		
75	1	06	2899	130CT92	160CT92	A1692	1	2425.16	2425.16		
75	1	05	3201	130CT92	160CT92	A1691	1	2422.13	2422.13		
75	1	04	3502	130CT92	160CT92	A1690	1	2423.45	2423.45		
75	1	03	3799	130CT92	160CT92	A1689	1	2419.48	2419.48		
75	1	02	4101	130CT92	160CT92	A1688	1	2409.68	2409.68		
75	1	01	4311	130CT92	160CT92	A1687A	1	2399.19	2399.19		
75	1	01	4311	130CT92	160CT92	A1687B	1	2397.77	2397.77		
76	1	36	11	130CT92	160CT92	A1719	1	2270.81	2270.81	-1.42	2398.48
77	1	36	9	140CT92	160CT92	A1720	1	2277.06	2277.06		
78	1	36	24	140CT92	160CT92	A1753	1	2285.54	2285.54		
78	1	35	24	140CT92	160CT92	A1752A	1	2282.36	2282.36		
78	1	34	49	140CT92	160CT92	A1751	1	2286.16	2286.16	+3.80	2284.28
78	1	33	72	140CT92	160CT92	A1750	1	2286.32	2286.32		
78	1	32	98	140CT92	160CT92	A1749	1	2300.06	2300.06		
78	1	31	124	140CT92	160CT92	A1748	1	2299.82	2299.82		
78	1	29	174	140CT92	160CT92	A1747	1	2308.16	2308.16		
78	1	28	198	140CT92	160CT92	A1746	1	2317.15	2317.15		
78	1	27	249	140CT92	160CT92	A1745	1	2308.62	2308.62		
78	1	26	298	140CT92	160CT92	A1744	1	2305.36	2305.36		
78	1	25	348	140CT92	160CT92	A1743	1	2310.53	2310.53		
78	1	24	398	140CT92	160CT92	A1742	1	2310.01	2310.01		
78	1	23	448	140CT92	160CT92	A1741	1	2309.39	2309.39		
78	1	22	497	140CT92	160CT92	A1740	1	2308.82	2308.82		
78	1	21	596	140CT92	160CT92	A1739	1	2311.09	2311.09		
78	1	20	695	140CT92	160CT92	A1738	1	2309.36	2309.36		
78	1	19	798	140CT92	160CT92	A1737	1	2318.62	2318.62		
78	1	18	895	140CT92	160CT92	A1736	1	2325.68	2325.68		
78	1	17	998	140CT92	160CT92	A1735	1	2330.46	2330.46		
78	1	16	1097	140CT92	160CT92	A1734	1	2344.18	2344.18		
78	1	14	1298	140CT92	160CT92	A1733	1	2353.61	2353.61		
78	1	12	1498	140CT92	160CT92	A1732	1	2362.64	2362.64		
78	1	10	1798	140CT92	160CT92	A1731	1	2382.04	2382.04		
78	1	09	2097	140CT92	160CT92	A1730	1	2391.25	2391.25		
78	1	08	2396	140CT92	160CT92	A1729	1	2406.28	2406.28		
78	1	07	2599	140CT92	160CT92	A1728	1	2412.67	2412.67		
78	1	06	2899	140CT92	160CT92	A1727	1	2419.84	2419.84		
78	1	05	3200	140CT92	160CT92	A1726	1	2422.39	2422.39		
78	1	04	3501	140CT92	160CT92	A1725	1	2424.93	2424.93		
78	1	03	3801	140CT92	160CT92	A1724	1	2421.41	2421.41		
78	1	02	4103	140CT92	160CT92	A1723	1	2418.29	2418.29		
78	1	01	4332	140CT92	160CT92	A1722	1	2417.52	2417.52		
78	1	01	4332	140CT92	160CT92	A1721A	1	2410.86	2410.86		
78	1	01	4432	140CT92	160CT92	A1721A	2	2397.48	2397.48	+1.98	2398.47
78	1	01	4432	140CT92	160CT92	A1721B	1	2399.46	2399.46		
79	1	36	10	140CT92	160CT92	A1721B	1	2390.56	2390.56	-7.91	2394.52
80	1	36	10	160CT92	160CT92	A1754	1	2286.42	2286.42		
81	1	36	9	160CT92	160CT92	A1755	1	2272.70	2272.70		
81	1	35	25	160CT92	160CT92	A1788	1	2270.35	2270.35		
81	1	35	25	160CT92	160CT92	A1787A	1	2274.53	2274.53		
81	1	35	25	160CT92	160CT92	A1787B	1	2275.77	2275.77	+1.24	2275.15

81	1	34	49	150CT92	170CT92	A1786	1	2294.75	2294.75		2294.75
81	1	33	74	150CT92	170CT92	A1785	1	2320.16	2320.16		2320.16
81	1	32	99	150CT92	170CT92	A1784	1	2303.55	2303.55		2303.55
81	1	31	124	150CT92	170CT92	A1783	1	2308.09	2308.09		2308.09
81	1	30	150	150CT92	170CT92	A1782	1	2316.86	2316.86		2316.86
81	1	29	173	150CT92	170CT92	A1781	1	2317.57	2317.57		2317.57
81	1	28	199	150CT92	170CT92	A1780	1	2316.87	2316.87		2316.87
81	1	27	247	150CT92	170CT92	A1779	1	2310.48	2310.48		2310.48
81	1	26	298	150CT92	170CT92	A1778	1	2309.21	2309.21		2309.21
81	1	25	351	150CT92	170CT92	A1777	1	2308.60	2308.60		2308.60
81	1	24	397	150CT92	170CT92	A1776	1	2307.48	2307.48		2307.48
81	1	23	447	150CT92	180CT92	A1775	1	2317.80	2317.80		2317.80
81	1	22	496	150CT92	180CT92	A1774	1	2307.60	2307.60		2307.60
81	1	21	597	150CT92	180CT92	A1773	1	2316.57	2316.57		2316.57
81	1	20	698	150CT92	180CT92	A1772	1	2326.49	2326.49		2326.49
81	1	19	797	150CT92	180CT92	A1771	1	2332.58	2332.58		2332.58
81	1	18	897	150CT92	180CT92	A1770	1	2337.74	2337.74		2337.74
81	1	17	999	150CT92	180CT92	A1769	1	2348.85	2348.85		2348.85
81	1	16	1100	150CT92	180CT92	A1768	1	2358.40	2358.40		2358.40
81	1	14	1297	150CT92	180CT92	A1767	1	2380.75	2380.75		2380.75
81	1	12	1497	150CT92	180CT92	A1766	1	2390.11	2390.11		2390.11
81	1	10	1797	150CT92	180CT92	A1765	1	2405.78	2405.78		2405.78
81	1	09	2100	150CT92	180CT92	A1764	1	2416.90	2416.90		2416.90
81	1	08	2399	150CT92	180CT92	A1763	1	2418.35	2418.35		2418.35
81	1	07	2700	150CT92	180CT92	A1762	1	2422.95	2422.95		2422.95
81	1	06	3001	150CT92	180CT92	A1761	1	2422.57	2422.57		2422.57
81	1	05	3299	150CT92	180CT92	A1760	1	2438.24	2438.24		2438.24
81	1	04	3601	150CT92	180CT92	A1759	1	2419.22	2419.22		2419.22
81	1	03	3901	150CT92	180CT92	A1758	1	2412.79	2412.79		2412.79
81	1	02	4200	150CT92	180CT92	A1757	1	2403.88	2403.88		2403.88
81	1	01	4501	150CT92	180CT92	A1756A	1	2399.41	2399.41		2399.41
81	1	01	4501	150CT92	180CT92	A1756B	1	2401.33	2401.33		2401.33
82	1	36	10	150CT92	180CT92	A1755A	1	2280.80	2280.80	+1.92	2400.37
83	1	35	24	180CT92	180CT92	A1754	1	2281.53	2281.53	-0.04	2280.80
83	1	32	99	180CT92	180CT92	A1753	1	2281.49	2281.49		2281.49
83	1	31	122	180CT92	180CT92	A1752	1	2319.99	2319.99		2319.99
83	1	30	148	180CT92	180CT92	A1751	1	2300.85	2300.85		2300.85
83	1	29	173	180CT92	180CT92	A1750	1	2313.01	2313.01		2313.01
83	1	28	197	180CT92	180CT92	A1749	1	2333.23	2333.23		2333.23
83	1	27	239	180CT92	180CT92	A1748	1	2326.48	2326.48		2326.48
83	1	26	296	180CT92	180CT92	A1747	1	2308.85	2308.85		2308.85
83	1	24	398	180CT92	180CT92	A1746	1	2303.69	2303.69		2303.69
83	1	23	446	180CT92	180CT92	A1745	1	2302.22	2302.22		2302.22
83	1	22	498	180CT92	180CT92	A1744	1	2307.35	2307.35		2307.35
83	1	21	594	180CT92	180CT92	A1743	1	2307.37	2307.37		2307.37
83	1	20	693	180CT92	180CT92	A1742	1	2310.89	2310.89		2310.89
83	1	19	798	180CT92	180CT92	A1741	1	2321.92	2321.92		2321.92
83	1	18	895	180CT92	180CT92	A1740	1	2333.93	2333.93		2333.93
83	1	17	995	180CT92	180CT92	A1739	1	2342.50	2342.50		2342.50
83	1	16	1094	180CT92	180CT92	A1738	1	2352.23	2352.23		2352.23
83	1	14	1194	180CT92	180CT92	A1737	1	2361.10	2361.10		2361.10
83	1	12	1398	180CT92	180CT92	A1736	1	2370.71	2370.71		2370.71
83	1	10	1598	180CT92	180CT92	A1735	1	2387.08	2387.08		2387.08
83	1	09	1794	180CT92	180CT92	A1734	1	2397.55	2397.55		2397.55
83	1	08	1995	180CT92	180CT92	A1733	1	2407.38	2407.38		2407.38
83	1	07	2194	180CT92	180CT92	A1732	1	2415.05	2415.05		2415.05
83	1	06	2398	180CT92	180CT92	A1731	1	2416.97	2416.97		2416.97
83	1	05	2595	180CT92	180CT92	A1730	1	2419.90	2419.90		2419.90
83	1	04	2798	180CT92	180CT92	A1729	1	2422.29	2422.29		2422.29
83	1	04	2798	180CT92	180CT92	A1728	1	2422.97	2422.97		2422.97

EX

83	1 03 2997	160CT92	190CT92	A1792	1	2423.81	2423.81
83	1 02 3174	160CT92	190CT92	A1791	1	2424.03	2424.03
83	1 01 3277	160CT92	190CT92	A1790A	1	2422.52	2422.52
83	1 01 3277	160CT92	190CT92	A1790B	1	2421.82	2421.82
84	1 36 11	160CT92	180CT92	A1819	1	2286.63	2286.63
85	1 36 10	160CT92	180CT92	A1820	1	2281.62	2281.62
86	1 32 10	160CT92	180CT92	A1821	1	2286.56	2286.56
87	1 32 11	160CT92	190CT92	A1850	1	2282.94	2282.94
87	1 31 25	160CT92	190CT92	A1849A	1	2279.89	2279.89
87	1 31 25	160CT92	190CT92	A1849B	1	2282.98	2282.98
87	1 30 50	160CT92	190CT92	A1848	1	2285.04	2285.04
87	1 29 75	160CT92	190CT92	A1847	1	2313.27	2313.27
87	1 28 100	160CT92	190CT92	A1846	1	2314.34	2314.34
87	1 27 124	160CT92	190CT92	A1845	1	2324.08	2324.08
87	1 26 149	160CT92	190CT92	A1844	1	2355.44	2355.44
87	1 25 174	160CT92	190CT92	A1843	1	2340.51	2340.51
87	1 24 198	160CT92	190CT92	A1842	1	2344.68	2344.68
87	1 23 224	160CT92	190CT92	A1841	1	2321.78	2321.78
87	1 22 249	160CT92	190CT92	A1840	1	2314.25	2314.25
87	1 21 299	160CT92	190CT92	A1839	1	2310.87	2310.87
87	1 20 350	160CT92	190CT92	A1838	1	2305.96	2305.96
87	1 19 399	160CT92	190CT92	A1837	1	2304.99	2304.99
87	1 18 450	160CT92	190CT92	A1836	1	2307.50	2307.50
87	1 17 499	160CT92	190CT92	A1835	1	2310.25	2310.25
87	1 16 598	160CT92	190CT92	A1834	1	2317.47	2317.47
87	1 14 699	160CT92	190CT92	A1833	1	2322.63	2322.63
87	1 12 798	160CT92	190CT92	A1832	1	2332.52	2332.52
87	1 10 897	160CT92	190CT92	A1831	1	2341.40	2341.40
87	1 09 998	160CT92	190CT92	A1830	1	2350.39	2350.39
87	1 08 1097	160CT92	190CT92	A1829	1	2356.39	2356.39
87	1 07 1198	160CT92	190CT92	A1828	1	2368.76	2368.76
87	1 06 1397	160CT92	190CT92	A1827	1	2378.61	2378.61
87	1 05 1595	160CT92	200CT92	A1826	1	2398.27	2398.27
87	1 04 1797	160CT92	200CT92	A1825	1	2413.22	2413.22
87	1 03 1999	160CT92	200CT92	A1824	1	2412.77	2412.77
87	1 02 2198	160CT92	200CT92	A1823	1	2417.09	2417.09
87	1 01 2390	160CT92	200CT92	A1822A	1	2417.09	2417.09
87	1 01 2390	160CT92	200CT92	A1822B	1	2418.71	2418.71
88	1 33 8	170CT92	180CT92	A1851	1	2289.52	2289.52

Flags: X: Observed titrator malfunction or operator error

EX: Data excluded from analysis

NOTE: Dilution factor of 1.000170 has been applied.

ANALYSIS DATE	SAMPLE BOTTLE	TRIAL	FLAG	ALK (UEQUIV/KG)	AVG ALK	STD DEV
18AUG92	A34	1		2308.68		
18AUG92	A34	2		2299.75		
18AUG92	A34	3		2306.72		
18AUG92	A42	1		2307.36		
18AUG92	A42	2		2305.31		
18AUG92	A42	3		2307.02		
19AUG92	A42	4	X	2313.92		
19AUG92	A42	5		2306.59		
19AUG92	A34	4	X	2319.77		
19AUG92	A34	5		2307.45		
25AUG92	A25	1		2306.34		
25AUG92	A25	2		2302.91		
25AUG92	A25	3		2298.68		
25AUG92	A25	4		2309.70		
25AUG92	A40	2		2312.72		
25AUG92	A40	3		2307.81		
25AUG92	A40	4		2298.47		
26AUG92	A44	1		2299.94		
26AUG92	A44	2		2308.20		
26AUG92	A44	3		2304.27		
26AUG92	A25	5		2299.74		
26AUG92	A30	1		2303.98		
26AUG92	A30	2		2303.64		
26AUG92	A30	3		2305.73		
26AUG92	A40	5		2307.43		
27AUG92	A30	4	X	2331.80		
27AUG92	A30	5	X	2314.02		
27AUG92	A44	4		2305.67		
27AUG92	A44	5		2301.64		
02SEP92	A5	1		2304.70		
02SEP92	A5	2		2296.75		
02SEP92	A5	3		2305.17		
02SEP92	A47	1		2304.01		
02SEP92	A47	2		2302.48		
02SEP92	A47	3		2304.44		
03SEP92	A47	4		2306.04		
03SEP92	A47	5		2302.76		
03SEP92	A5	4		2303.71		
03SEP92	A5	5		2305.69		
04SEP92	A17	1		2303.18		
04SEP92	A6	1		2302.70		
05SEP92	A17	2		2304.28		
05SEP92	A17	3		2304.09		
05SEP92	A6	2		2303.87		
05SEP92	A6	3		2304.91		
06SEP92	A17	4		2303.94		
06SEP92	A17	5		2304.44		
06SEP92	A6	4		2305.23		
06SEP92	A6	5		2301.94		
01OCT92	A2	1	X	2314.08		
01OCT92	A2	2	X	2315.84		
01OCT92	A45	1		2304.56		
01OCT92	A45	2		2304.88		

				46	
030CT92	A2	3	X	2313.74	
030CT92	A2	4	X	2378.68	
030CT92	A2	5	X	2314.95	
030CT92	A45	3		2304.74	
030CT92	A45	5		2304.83	
040CT92	A46	1	EX	2379.80	
040CT92	A46	2		2299.31	
040CT92	A1	1		2300.76	
040CT92	A1	2		2302.97	
050CT92	A1	3		2302.68	
050CT92	A1	4		2301.61	
050CT92	A46	3		2298.96	
050CT92	A46	4		2305.45	
060CT92	A46	5		2306.50	
060CT92	A1	5		2293.04	
090CT92	A23	1		2305.80	
090CT92	A48	1		2304.79	
100CT92	A48	2		2306.38	
100CT92	A48	3		2302.55	
100CT92	A23	2		2302.13	
100CT92	A23	3		2304.64	
110CT92	A48	4		2306.07	
110CT92	A23	4		2299.93	
140CT92	A10	1		2305.20	
140CT92	A38	1		2306.25	
150CT92	A10	2		2303.13	
150CT92	A38	2		2304.30	
160CT92	A10	3		2302.17	
160CT92	A10	4		2305.50	
160CT92	A38	3		2305.63	
160CT92	A38	4		2302.87	
170CT92	A38	5		2306.74	
170CT92	A10	5		2306.67	2304.24 2.77

FLAGS: X: Observed titrator malfunction or operator error

EX: Data excluded from analysis

NOTE: Dilution factor of 1.000170 has been applied.

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THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
 GC92 CDRG SHIPBOARD ALK 5-OCT-94
 Bicarbonate Reference Material (STD B) Titration Data

ANALYSIS DATE	SAMPLE BOTTLE	TRIAL	FLAG	ALK (UEQUIV/KG)	AVG ALK	STD DEV
19AUG92	B2	1		2299.95		
19AUG92	B22	1		2300.10		
21AUG92	B22	2		2300.05		
21AUG92	B22	3		2295.82		
21AUG92	B2	2		2298.05		
21AUG92	B2	3		2300.24		
22AUG92	B22	4		2300.58		
22AUG92	B22	5		2300.78		
22AUG92	B2	4		2295.76		
22AUG92	B2	5		2298.19		
22AUG92	B26	1		2297.83		
22AUG92	B26	2		2297.14		
22AUG92	B44	1		2300.09		
22AUG92	B44	2		2299.96		
23AUG92	B44	3		2297.11		
23AUG92	B44	4		2297.03		
23AUG92	B26	3		2300.80		
23AUG92	B26	4		2296.17		
24AUG92	B26	5		2300.04		
24AUG92	B44	5		2298.01		
27AUG92	B7	1		2299.15		
27AUG92	B7	2		2299.91		
27AUG92	B25	1		2298.37		
27AUG92	B25	2		2300.06		
28AUG92	B25	3		2300.24		
28AUG92	B25	4		2300.18		
28AUG92	B7	3		2300.24		
28AUG92	B7	4		2297.40		
30AUG92	B7	5		2301.23		
30AUG92	B13	1		2302.43		
30AUG92	B25	5		2296.62		
30AUG92	B45	1		2297.38		
31AUG92	B45	2		2299.88		
31AUG92	B45	3		2299.05		
31AUG92	B13	2		2297.79		
31AUG92	B13	3		2299.69		
01SEP92	B13	4		2297.58		
01SEP92	B13	5		2298.87		
01SEP92	B45	4		2299.62		
01SEP92	B45	5		2296.65		
06SEP92	B9	1		2298.32		
06SEP92	B28	1		2298.29		
07SEP92	B28	2		2300.38		
07SEP92	B28	3		2297.29		
07SEP92	B9	2		2298.90		
07SEP92	B9	3		2298.86		
08SEP92	B9	4		2297.63		
08SEP92	B9	5		2299.64		
08SEP92	B19	1		2297.70		
08SEP92	B28	4		2299.06		
08SEP92	B28	5		2297.84		
08SEP92	B39	1		2295.12		
09SEP92	B39	2		2296.06		

09SEP92	B19	2		2294.54		
11SEP92	B19	3		2298.03		
11SEP92	B19	4		2298.52		
11SEP92	B19	5		2299.57		
11SEP92	B39	3		2296.81		
11SEP92	B39	4		2297.80		
11SEP92	B39	5		2295.52		
06OCT92	B20	1		2293.25		
06OCT92	B20	2		2291.57		
06OCT92	B34	1	EX	2346.30		
06OCT92	B34	2		2301.37		
07OCT92	B34	4		2296.11		
07OCT92	B20	4		2299.73		
08OCT92	B34	5		2302.11		
08OCT92	B20	5		2298.16		
12OCT92	B4	1		2298.53		
12OCT92	B4	2		2295.34		
12OCT92	B4	3		2301.05		
12OCT92	B46	1		2296.09		
12OCT92	B46	2		2300.50		
12OCT92	B46	3		2299.88		
13OCT92	B46	4		2295.40		
13OCT92	B4	4		2293.13		
14OCT92	B4	5		2300.29		
14OCT92	B46	5		2300.04		
17OCT92	B10	1		2299.56		
17OCT92	B16	1		2299.45		
18OCT92	B16	2		2299.93		
18OCT92	B16	3		2300.62		
18OCT92	B10	2		2296.95		
18OCT92	B10	3		2300.52		
19OCT92	B10	4		2300.93		
19OCT92	B10	5		2298.38		
19OCT92	B16	4		2301.71		
19OCT92	B16	5		2301.83		
19OCT92	B36	1		2301.80		
19OCT92	B40	1		2302.32		
20OCT92	B36	2		2299.73		
20OCT92	B40	2		2301.21	2298.68	2.15

FLAGS: X: Observed titrator malfunction or operator error

EX: Data excluded from analysis

NOTE: Dilution factor of 1.000170 has been applied.

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
 GC92 CDRG SHIPBOARD ALK 5-OCT-94
 Certified DIC Reference Material (No. 13) Titration Data

ANALYSIS DATE	SAMPLE BOTTLE	TRIAL	FLAG	ALK (UEQUIV/KG)	AVG ALK	STD DEV
19AUG92	1PM	1		2203.05		
19AUG92	220PM	1		2199.12		
21AUG92	13PM	1		2203.86		
21AUG92	33PM	1		2206.70		
22AUG92	231PM	1		2203.58		
22AUG92	436PM	1		2202.77		
23AUG92	4PM	1		2201.34		
23AUG92	170PM	1		2200.43		
24AUG92	486PM	1		2203.29		
24AUG92	478PM	1		2201.36		
26AUG92	9PM	1		2200.22		
26AUG92	52PM	1		2216.25		
27AUG92	356PM	1		2201.48		
27AUG92	356PM	2		2205.08		
27AUG92	443PM	1		2204.48		
27AUG92	443PM	2		2202.30		
28AUG92	452PM	1		2203.09		
28AUG92	487PM	1		2202.97		
31AUG92	121PM	1		2201.65		
31AUG92	320PM	1		2202.69		
01SEP92	44PM	1		2202.32		
01SEP92	380PM	1		2201.37		
02SEP92	165PM	1		2200.07		
02SEP92	209PM	1		2201.94		
03SEP92	122PM	2		2199.62		
03SEP92	274PM	1		2199.40		
03SEP92	274PM	2		2198.11		
05SEP92	438PM	1		2199.71		
05SEP92	425PM	1		2200.99		
06SEP92	97PM	1		2202.59		
06SEP92	472PM	1		2200.62		
07SEP92	182PM	1		2201.64		
07SEP92	193PM	1		2200.76		
08SEP92	298PM	1		2199.26		
08SEP92	226PM	1		2200.83		
10SEP92	7PM	1		2200.06		
10SEP92	150PM	1		2201.54		
11SEP92	232PM	1		2201.65		
11SEP92	232PM	2		2202.04		
11SEP92	445PM	1		2201.06		
01OCT92	294PM	1		2199.74		
03OCT92	353PM	1	X	2270.76		
04OCT92	148PM	1		2199.09		
04OCT92	290PM	1	EX	2279.33		
06OCT92	240PM	1	EX	2261.49		
06OCT92	250PM	2		2196.27		
06OCT92	296PM	2		2199.49		
06OCT92	407PM	1		2196.10		
07OCT92	264PM	1		2197.91		
07OCT92	264PM	2		2195.06		
07OCT92	264PM	3		2196.05		
07OCT92	387PM	1		2203.21		
07OCT92	387PM	2	EX	2237.63		

07OCT92	387PM	3	2198.53		
08OCT92	67PM	1	2198.68		
08OCT92	80PM	1	2203.34		
08OCT92	80PM	2	2197.89		
08OCT92	366PM	1	2199.45		
08OCT92	366PM	2	2202.55		
08OCT92	195PM	1	2197.57		
08OCT92	195PM	2	2204.20		
08OCT92	421PM	1	2202.55		
08OCT92	421PM	2	2198.02		
08OCT92	484PM	1	2202.47		
09OCT92	281PM	1	2199.57		
09OCT92	348PM	1	2201.94		
10OCT92	253PM	1	2182.30		
10OCT92	418PM	1	2203.38		
11OCT92	107PM	1	2201.02		
11OCT92	499PM	1	2203.02		
12OCT92	64PM	1	2200.89		
13OCT92	423PM	1	2202.98		
13OCT92	446PM	1	2203.09		
14OCT92	235PM	1	2202.90		
14OCT92	385PM	1	2202.88		
15OCT92	230PM	1	2202.48		
15OCT92	317PM	1	2202.21		
16OCT92	475PM	1	2201.40		
16OCT92	500PM	1	2204.22		
17OCT92	333PM	1	2198.38		
17OCT92	360PM	1	2203.45		
18OCT92	222PM	1	2203.10		
19OCT92	54PM	1	2204.84		
19OCT92	318PM	1	2203.58	2201.26	2.29

FLAGS: X: Observed titrator malfunction or operator error

EX: Data excluded from analysis

NOTE: Dilution factor of 1.000170 has been applied.

APPENDIX B:

**SUMMARY OF SHORE-BASED TCO₂ AND TALK REPLICATE
MEASUREMENTS**

Table B.1 Summary of Shore-Based TCO₂ Replicate Measurements

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF DISSOLVED INORGANIC CARBON DATA

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	EXTRAC DATE	ANALYSIS DATE	MANO TYPE	SAMPLE BOTTLE	FLAG	S.I.O. RUN	BOTTLE DIC	BOTTLE "NISKIN" DELTA (μMOLES/KG SW)	SIO DIC	SIO -S.I.O.
1 8	54-8N 161-10E	1 25	10	21AUG92	17NOV92	19NOV92	M	R5288	001	1917.06	1917.06	+0.93	1917.53	0.17
		1 1	1820		17NOV92	19NOV92	M	R5289	001	1917.99	1917.99			
					17NOV92	19NOV92	M	R5286	001	2392.69	2392.69			
					17NOV92	19NOV92	M	R5287	001	2392.36	2392.36	-0.33	2392.53	-0.83
1 11	53-29N 162-10E	1 36	10	22AUG92	02DEC92	03DEC92	M	R5292	001	2014.12	2014.12			
					02DEC92	03DEC92	M	R5293	001	2014.69	2014.69	+0.57	2014.41	5.29
		1 9	3000		02DEC92	03DEC92	M	R5290	001	2350.18	2350.18			
					02DEC92	03DEC92	M	R5291	001	2347.96	2347.96	-2.22	2349.07	-17.17
1 13	53-1N 162-52E	1 36	10	23AUG92	08APR93	09APR93	E	R5296	001	2018.77	2018.77			
					08APR93	09APR93	E	R5297	001	2018.09	2018.09	-0.68	2018.43	0.87
		1 11	2900		07APR93	09APR93	E	R5294	001	2346.07	2346.07			
					07APR93	09APR93	E	R5295	001	2346.25	2346.25	+0.18	2346.16	-2.16
1 17	50-59N 164-58E	1 36	10	25AUG92	19NOV92	20NOV92	M	P5708	001	2039.55	2039.55			
					19NOV92	20NOV92	M	P5709	001	2039.48	2039.48	-0.07	2039.52	0.68
		1 8	3000		18NOV92	19NOV92	M	P5706	001	2348.98	2348.98			
					18NOV92	20NOV92	M	P5707	001	2350.07	2350.07	+1.09	2349.53	-2.83
1 20	49-30N 165-1E	1 36	10	26AUG92	30NOV93	03DEC93	E	R5320	001	2058.24	2058.24			
					30NOV93	03DEC93	E	R5321	001	2043.07	2043.07			
		1 33	50		01APR94	05APR94	E	R5318	A001	2113.45	2113.45			
					01APR94	05APR94	E	R5318	B001	2113.04	2113.25	-0.41	2113.04	7.96
					30MAR94	05APR94	E	R5319	001	2112.83	2112.83			
		1 31	100		01APR94	22APR94	E	R5316	001	2166.11	2166.11			
					01APR94	22APR94	E	R5317	001	2165.39	2165.39	-0.72	2165.75	-0.05
		1 27	200		04APR94	22APR94	E	R5314	001	2326.65	2326.65			
					05APR94	22APR94	E	R5315	001	2326.62	2326.62	-0.03	2326.64	-3.74
		1 25	300		04APR94	22APR94	E	R5312	001	2347.01	2347.01			
					04APR94	22APR94	E	R5313	001	2349.76	2349.76	+2.75	2348.39	-5.09
		1 23	400		05APR94	22APR94	E	R5310	001	2354.59	2354.59			
					05APR94	22APR94	E	R5311	001	2354.07	2354.07	-0.52	2354.33	-4.23

MANOMETER TYPE:
M = CONSTANT VOLUME MERCURY MANOMETER DATUM
E = ELECTRONIC CONSTANT-VOLUME MANOMETER DATUM
BOTTLE TYPE:
R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:
X: Analytical flag
EX: Data excluded from statistical analysis
3s: Bottle delta larger than 3s criteria

Table B.1 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF DISSOLVED INORGANIC CARBON DATA (cont)

LEG STN	LAT.	CST	DEPTH (M)	SAMPLE DATE	EXTRAC DATE	ANALYSIS DATE	MANO TYPE	BOTTLE	RUN	FLAG	S.I.O. RUN	DELTA	BOTTLE DIC	BOTTLE DELTA	"NISKIN" AVG	SIO DIC	SIO -S.I.O.
														(μMOLES/KG SW)			
		1 21	600		08APR94	22APR94	E	R5308	001		2371.79		2371.79				
					05APR94	22APR94	E	R5309	001		2368.54		2368.54		-3.25	2370.17	2365.10 -5.07
		1 18	900		06APR94	03MAY94	E	R5306	001		2381.73		2381.73				
					06APR94	03MAY94	E	R5307	001		2382.17		2382.17		+0.44	2381.95	2381.30 -0.65
		1 16	1200		06APR94	22APR94	E	R5304	001		2391.44		2391.44				
					06APR94	22APR94	E	R5305	001		2392.94		2392.94		+1.50	2392.19	2384.40 -7.79
		1 14	1700		08APR94	03MAY94	E	R5302	001		2381.13		2381.13				
					08APR94	03MAY94	E	R5303	001		2380.60		2380.60		-0.53	2380.86	2379.30 -1.56
		1 13	2000		12APR94	03MAY94	E	R5300	001		2373.26		2373.26				
					12APR94	03MAY94	E	R5301	001		2372.99		2372.99		-0.27	2373.13	2370.90 -2.23
		1 10	2900		11APR94	03MAY94	E	R5298	001		2346.26		2346.26				
					11APR94	03MAY94	E	R5299	001		2345.50		2345.50		-0.76	2345.88	2343.10 -2.78
1 47-30N 24 165-0E		1 36	10	27AUG92	08DEC92	10DEC92	M	P5712	001		2034.32		2034.32				
					08DEC92	10DEC92	M	P5713	001		2033.32		2033.32		-1.00	2033.82	2036.45 2.63
		1 11	2800		08DEC92	09DEC92	M	P5710	001		2348.11		2348.11				
					08DEC92	10DEC92	M	P5711	001		2348.48		2348.48		+0.37	2348.30	2346.30 -2.00
1 46-30N 26 165-1E		1 36	10	27AUG92	30NOV93	03DEC93	E	P5772	001		2011.57		2011.57				
					30NOV93	03DEC93	E	P5773	001		2011.98		2011.98		+0.41	2011.78	2015.15 3.37
		1 11	2800		12MAY94	16MAY94	E	P5770	001		2348.43		2348.43				
					12MAY94	16MAY94	E	P5771	001		2348.61		2348.61		+0.18	2348.52	2349.30 0.78
1 44-58N 29 164-59E		1 36	10	30AUG92	02DEC93	03DEC93	E	R5323	001		2029.63		2029.63				
					02DEC93	03DEC93	E	R5324	001		2030.64		2030.64		+1.01	2030.14	2033.00 2.86
		1 11	3000		12MAY94	26MAY94	E	R5322	001		2345.82		2345.82				
					12MAY94	26MAY94	E	R5325	001		2346.23		2346.23		+0.41	2346.03	2345.30 -0.73
1 43-30N 32 165-1E		1 36	10	31AUG92	02DEC93	03DEC93	E	P5776	001		1970.46		1970.46				
					02DEC93	03DEC93	E	P5777	001		1969.61		1969.61		-0.85	1970.04	1968.95 -1.09
		1 8	3100		13MAY94	26MAY94	E	P5774	001		2342.34		2342.34				
					13MAY94	26MAY94	E	P5775	001		2341.03		2341.03		-1.31	2341.69	2339.50 -2.19

MANOMETER TYPE:

M = CONSTANT VOLUME MERCURY MANOMETER DATUM

E = ELECTRONIC CONSTANT-VOLUME MANOMETER DATUM

BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.1 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
 CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF DISSOLVED INORGANIC CARBON DATA (cont)

LEG STN	LAT. LONG.	CST NISK	DEPTH (M)	SAMPLE DATE	EXTRAC DATE	ANALYSIS DATE	MANO TYPE	BOTTLE	RUN	FLAG	S.I.O. RUN	DELTA	BOTTLE DIC	BOTTLE "NISKIN" DELTA	AVG	SIO DIC	SIO -S.I.O.
1 36	41-30N 165-0E	1 36	10	01SEP92	03DEC93	03DEC93	E	R5348	001		1949.24		1949.03	-0.21	1949.14	1950.70	1.56
1 34		1 34	50	25APR94	16MAY94		E	R5346	001		2070.01		2070.01				
1 32		1 32	100	25APR94	16MAY94		E	R5347	001		2070.51		2070.51	+0.50	2070.26	2070.80	0.54
1 27		1 27	200	22APR94	10MAY94		E	R5344	001		2097.39		2097.39		2097.39	2099.10	1.71
1 25		1 25	300	21APR94	10MAY94		E	R5340	001		2120.51		2120.51		2120.47	2121.00	0.53
1 23		1 23	400	19APR94	10MAY94		E	R5338	001		2212.17		2212.17		2212.10	2211.00	-1.10
1 21		1 21	600	18APR94	10MAY94		E	R5336	001		2262.33		2262.33		2262.35	2261.90	-0.45
1 18		1 18	900	18APR94	10MAY94		E	R5337	001		2318.92		2318.92		2318.49	2316.00	-2.49
1 15		1 15	1200	15APR94	10MAY94		E	R5332	001		2362.09		2362.09		2361.61	2358.20	-3.41
1 13		1 13	1500	15APR94	10MAY94		E	R5330	001		2381.15		2381.15		2380.35	2377.90	-2.45
1 11		1 11	1900	14APR94	03MAY94		E	R5328	001		2385.50		2385.50		2385.69	2382.00	-3.69
1 7		1 7	3100	13APR94	03MAY94		E	R5326	001		2383.57		2383.57		2381.83	2377.90	-3.93
1 38	40-30N 165-1E	1 36	10	02SEP92	09DEC92	11DEC92	M	P5716	001		2341.33		2341.33		2342.27	2342.90	0.63
1 8		1 8	3100	09DEC92	10DEC92		M	P5714	001		1959.48		1959.48		1958.58	1960.80	2.22
				09DEC92	10DEC92		M	P5715	001		2343.71		2343.71		2343.02	2344.10	1.08

MANOMETER TYPE:

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BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.1 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF DISSOLVED INORGANIC CARBON DATA (cont)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	EXTRAC DATE	ANALYSIS DATE	MANO TYPE	BOTTLE	RUN	FLAG	S.I.O. RUN	DELTA	BOTTLE DIC	BOTTLE "NISKIN" AVG	SIO DIC	SIO -S.I.O.	
1 39- 41	1N 165- 1E	1 36	10	03SEP92	03DEC93	20DEC93	E	P5720	001		1954.82		1954.82	-1.85	1953.90	1958.65	4.75
					03DEC93	20DEC93	E	P5721	001.		1952.97		1952.97				
		1 8	3100		13MAY94	26MAY94	E	P5718	001		2345.91		2345.91				
					13MAY94	26MAY94	E	P5719	001		2345.23		2345.23	-0.68	2345.57	2344.50	-1.07
1 36- 47	1N 165- 1E	1 36	10	05SEP92	10DEC93	20DEC93	E	P5780	001		1964.57		1964.57	+0.25	1964.69	1968.70	4.01
					10DEC93	20DEC93	E	P5781	001		1964.82		1964.82				
1 34- 49	42N 165- 3E	1 35	25	06SEP92	25AUG93	27AUG93	E	R5372	001		1948.63		1948.63	+0.63	1948.95	1950.20	1.25
					25AUG93	27AUG93	E	R5373	001		1949.26		1949.26				
		1 34	50		24AUG93	27AUG93	E	R5370	001		1964.84		1964.84	+0.02	1964.85	1966.60	1.75
					24AUG93	27AUG93	E	R5371	001		1964.86		1964.86				
		1 32	100		24AUG93	27AUG93	E	R5368	001		2005.90		2005.90	-0.33	2005.73	2003.70	-2.03
					24AUG93	27AUG93	E	R5369	001		2005.57		2005.57				
		1 28	200		10AUG93	11AUG93	E	R5366	001		2075.47		2075.47	+0.68	2075.81	2075.70	-0.11
					10AUG93	11AUG93	E	R5367	001		2076.15		2076.15				
		1 26	300		09AUG93	11AUG93	E	R5364	001		2108.77		2108.77	+0.38	2108.96	2107.80	-1.16
					09AUG93	11AUG93	E	R5365	001		2109.15		2109.15				
		1 24	400		09AUG93	11AUG93	E	R5362	001		2165.81		2165.81	-0.23	2165.70	2163.30	-2.40
					09AUG93	11AUG93	E	R5363	001		2165.58		2165.58				
		1 22	600		06AUG93	11AUG93	E	R5360	001		2269.06		2269.06	+0.16	2269.14	2265.00	-4.14
					06AUG93	11AUG93	E	R5361	001		2269.22		2269.22				
		1 19	900		06AUG93	11AUG93	E	R5358	001		2348.55		2348.55	-0.06	2348.52	2346.10	-2.42
					06AUG93	11AUG93	E	R5359	001		2348.49		2348.49				
		1 17	1200		13JUL93	14JUL93	E	R5356	001		2372.53		2372.53	+1.60	2373.33	2368.50	-4.83
					13JUL93	14JUL93	E	R5357	001		2374.13		2374.13				
		1 15	1700		13JUL93	14JUL93	E	R5354	001		2382.55		2382.55	+0.94	2383.02	2381.10	-1.92
					13JUL93	14JUL93	E	R5355	001		2383.49		2383.49				
		1 14	2000		12JUL93	14JUL93	E	R5352	001		2373.91		2373.91	+0.05	2373.94	2372.80	-1.14
					12JUL93	14JUL93	E	R5353	001		2373.96		2373.96				

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BOTTLE TYPE:

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FLAGS:

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EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.1 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
 CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF DISSOLVED INORGANIC CARBON DATA (cont)

LEG STN	LAT. LONG.	CST NISK	DEPTH (M)	SAMPLE DATE	EXTRAC DATE	ANALYSIS DATE	MANO TYPE	BOTTLE TYPE	FLAG	S.I.O. RUN	DELTA	BOTTLE DIC	BOTTLE DELTA (UMOL/KG SW)	SIO DIC	SIO -S.I.O.
1	33-23N	1 36	10	07SEP92	10DEC93	20DEC93	E	R5350	001	2361.09		2361.09		2361.09	
51	165-1E				16JUN93	17JUN93	E	R5351	001	2362.73		2362.73	+1.64	2361.91	2341.70 -20.21
1	30-41N	1 35	10	10SEP92	10DEC93	20DEC93	E	P5784	001	1926.31		1926.31		1926.31	
55	164-58E				10DEC93	20DEC93	E	P5785	001	1927.77		1927.77	+1.46	1927.04	1929.80 2.76
1	32-ON	1 2	2000	08SEP92	10OCT94	30NOV94	E	P5782	001	2349.51		2349.51		2349.51	
53	165-0E				10OCT94	30NOV94	E	P5783	001	2363.37		2363.37		2348.60	-0.91
1	30-41N	1 35	10	10SEP92	10OCT94	30NOV94	E	R5374	001	2377.44		2377.44		2377.44	
55	164-58E				10OCT94	30NOV94	E	R5375	001	2378.77		2378.77	+1.33	2378.10	2375.30 -2.80
1	30-41N	1 35	10	10SEP92	15DEC93	20DEC93	E	P5724	001	1961.59		1961.59		1961.59	
55	164-58E				15DEC93	20DEC93	E	P5725	001	1962.26		1962.26	+0.67	1961.93	1964.50 2.57
1	30-41N	1 35	10	10SEP92	07OCT94	30NOV94	E	P5722	001	2342.45		2342.45		2342.45	
55	164-58E				07OCT94	30NOV94	E	P5723	001	2353.66		2353.66		2340.80	-1.65
2	21-19N	1 35	25	30SEP92	05JAN94	07JAN94	E	R5400	001	1947.12		1947.12		1947.12	
57	165-0E				05JAN94	07JAN94	E	R5401	001	1948.94		1948.94	+1.82	1948.03	1948.90 0.87
1	34	50			01NOV94	07DEC94	E	R5398	001	1965.21		1965.21		1965.21	
1	31	125			01NOV94	07DEC94	E	R5399	001	1963.66		1963.66	-1.55	1964.44	1966.80 2.36
1	28	200			31OCT94	07DEC94	E	R5396	001	2011.95		2011.95		2011.95	
1	26	300			31OCT94	07DEC94	E	R5397	001	2013.32		2013.32	+1.37	2012.64	2014.80 2.16
1	24	400			28OCT94	07DEC94	E	R5394	001	2020.60		2020.60		2020.60	
1	22	600			28OCT94	07DEC94	E	R5395	001	2031.25		2031.25		2020.60	2014.50 -6.10
1	19	900			21OCT94	07DEC94	E	R5392	001	2057.15		2057.15		2057.15	
1	17	1200			21OCT94	07DEC94	E	R5393	001	2054.16		2054.16	-2.99	2055.66	2056.80 1.14
1	15	1500			20OCT94	07DEC94	E	R5390	001	2100.98		2100.98		2100.98	
1	13	1800			20OCT94	07DEC94	E	R5391	001	2099.80		2099.80	-1.18	2100.39	2097.40 -2.99
1	11	2100			19OCT94	07DEC94	E	R5388	001	2245.97		2245.97		2245.97	
1	9	2400			19OCT94	07DEC94	E	R5389	001	2244.35		2244.35	-1.62	2245.16	2238.30 -6.86
1	7	2700			18OCT94	07DEC94	E	R5386	001	2318.60		2318.60		2318.60	
1	5	3000			18OCT94	07DEC94	E	R5387	001	2321.65		2321.65	+3.05	2320.13	2314.20 -5.93

MANOMETER TYPE:

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BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

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EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.1 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF DISSOLVED INORGANIC CARBON DATA (cont)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	EXTRAC DATE	ANALYSIS DATE	MANO TYPE	BOTTLE TYPE	RUN	FLAG	S.I.O. RUN	RUN DELTA	BOTTLE DIC	BOTTLE "NISKIN" DELTA (μMOLES/KG SW)	SIO DIC	SIO -S.I.O.
		1 17	1200	27APR95	08MAY95	E R5384	001				2342.22		2342.22		2335.90	-6.22
				27APR95	08MAY95	E R5404	001	EX			2353.76					
				17OCT94	07DEC94	E R5382	001				2349.31		2349.31		2348.60	0.51
				17OCT94	07DEC94	E R5383	001				2346.88		2346.88			
	1 13	2100		14OCT94	07DEC94	E R5380	001				2348.45		2348.45		2349.60	1.47
				14OCT94	07DEC94	E R5381	001				2347.81		2347.81			
				14OCT94	30NOV94	E R5378	001				2346.78		2346.78			
				14OCT94	30NOV94	E R5379	001	3s			2341.75		2341.75		2341.50	-2.77
2 19-59N 59 165-0E	1 33	75		01OCT92	04FEB93	13APR93	E R5405	001			1969.91		1969.91		1970.75	0.73
				04FEB93	13APR93	E R5406	001				1970.12		1970.12			
				04FEB93	05APR93	E R5402	001				2338.54		2338.54		2335.90	-2.76
				04FEB93	05APR93	E R5403	001				2338.78		2338.78			
2 18-40N 62 164-36E	1 35	10		02OCT92	02FEB93	05APR93	E P5728	001			1937.27		1937.27		1939.00	2.07
				02FEB93	05APR93	E P5729	001				1936.59		1936.59			
				02FEB93	05APR93	E P5726	001				2338.84		2338.84		2337.80	-1.65
				02FEB93	05APR93	E P5727	001				2340.05		2340.05			
2 24-3N 63 164-59E	1 36	10		04OCT92	16DEC93	07JAN94	E R5409	001			1955.46		1955.46		1953.50	-0.90
				16DEC93	07JAN94	E R5410	001				1953.33		1953.33			
				11OCT94	30NOV94	E R5407	001				2352.14		2352.14		2347.60	-1.45
				11OCT94	30NOV94	E R5408	001	3s			2345.97		2345.97			
2 26-2N 64 165-4E	1 36	10		05OCT92	16DEC93	20DEC93	E R5433	001			1964.75		1964.75		1967.30	-0.09
				16DEC93	20DEC93	E R5434	001				1970.02		1970.02			
				09NOV94	04JAN95	E R5431	001				1966.99		1966.99		1966.60	-0.59
				09NOV94	04JAN95	E R5432	001				1967.39		1967.39			
	1 32	100		09NOV94	04JAN95	E R5429	001				1971.36		1971.36		1971.00	-0.25
				09NOV94	04JAN95	E R5430	001				1971.14		1971.14			
				08NOV94	04JAN95	E R5425	001				2021.27		2021.27		2019.80	-1.78
				08NOV94	04JAN95	E R5426	001				2021.88		2021.88			

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Table B.1 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
 CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF DISSOLVED INORGANIC CARBON DATA (cont)

LEG STN	LAT. LONG.	CST NISK	DEPTH (M)	SAMPLE DATE	EXTRAC DATE	ANALYSIS DATE	MANO TYPE	BOTTLE SAMPLE	RUN	FLAG	S.I.O. RUN	RUN DELTA	BOTTLE DIC	BOTTLE "NISKIN" DELTA	AVG	SIO DIC	SIO -S.I.O.
		1 23	500	08NOV94	04JAN95	08NOV94	E	R5423	001		2065.11		2065.11				
				08NOV94	04JAN95	08NOV94	E	R5424	001		2065.88		2065.88	+0.77	2065.50	2063.60	-1.90
		1 21	650	07NOV94	04JAN95	07NOV94	E	R5421	001		2144.07		2144.07				
				07NOV94	04JAN95	07NOV94	E	R5435	001		2145.96		2145.96	+1.89	2145.02	2141.60	-3.42
		1 19	800	07NOV94	04JAN95	07NOV94	E	R5419	001		2270.45		2270.45				
				07NOV94	04JAN95	07NOV94	E	R5420	001		2269.73		2269.73	-0.72	2270.09	2266.30	-3.79
		1 17	1000	04NOV94	04JAN95	04NOV94	E	R5417	001		2341.80		2341.80				
				04NOV94	04JAN95	04NOV94	E	R5418	001		2345.52		2345.52	+3.72	2343.66	2333.80	-9.86
		1 15	1200	04NOV94	04JAN95	04NOV94	E	R5415	001		2366.48		2366.48				
				04NOV94	04JAN95	04NOV94	E	R5416	001		2365.61		2365.61	-0.87	2366.05	2362.20	-3.85
		1 12	1600	03NOV94	07DEC94	03NOV94	E	R5413	001		2371.79		2371.79				
				03NOV94	07DEC94	03NOV94	E	R5414	001		2369.47		2369.47	-2.32	2370.63	2367.30	-3.33
		1 9	2200	03NOV94	07DEC94	03NOV94	E	R5411	001		2354.20		2354.20				
				03NOV94	07DEC94	03NOV94	E	R5412	001		2354.32		2354.32	+0.12	2354.26	2353.30	-0.96
2 66	16- ON 166- OE	1 36	10	08OCT92	10FEB93	10FEB93	E	R5438	001		1930.12		1930.12				
				10FEB93	13APR93	10FEB93	E	R5439	001		1929.93		1929.93	-0.19	1930.03	1929.00	-1.03
		1 8	3200	08FEB93	13APR93	08FEB93	E	R5436	001		2342.83		2342.83				
				08FEB93	13APR93	08FEB93	E	R5437	001		2342.75		2342.75	-0.08	2342.79	2338.70	-4.09
2 67	14- ON 165- OE	1 36	10	09OCT92	17FEB93	20APR93	E	R5442	001		1922.68		1922.68				
		1 8	3100	10FEB93	16APR93	10FEB93	E	R5440	001		2342.21		2342.21				
				10FEB93	16APR93	10FEB93	E	R5441	001		2342.28		2342.28	+0.07	2342.25	2339.20	-3.05
2 68	12-35N 165-22E	1 36	10	09OCT92	17DEC93	20DEC93	E	R5466	001		1907.10		1907.10				
				17DEC93	20DEC93	17DEC93	E	R5467	001		1910.40		1910.40	+3.30	1908.75	1907.80	-0.95
		1 34	25	14DEC94	17JAN95	14DEC94	E	R5464	001		1916.69		1916.69				
				14DEC94	17JAN95	14DEC94	E	R5465	001		1916.56		1916.56	-0.13	1916.63	1914.70	-1.93
		1 32	75	14DEC94	17JAN95	14DEC94	E	R5462	001		1936.41		1936.41				
		1 29	150	12DEC94	17JAN95	12DEC94	E	R5460	001		2029.01		2029.01				

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BOTTLE TYPE:

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Table B.1 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CG92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF DISSOLVED INORGANIC CARBON DATA (cont)

LEG STN	LAT. LONG.	CST NISK	DEPTH (M)	SAMPLE DATE	EXTRAC DATE	ANALYSIS DATE	MANO TYPE	BOTTLE	RUN	FLAG	S.I.O. RUN	BOTTLE DIC	BOTTLE "NISKIN" DELTA (μMOLES/KG SW)	SIO DIC	SIO -S.I.O.
											2028.74	2028.74	-0.27	2028.88	2023.80 -5.08
				12DEC94	17JAN95		E	R5461	001		2200.71	2200.71			
		1 26	300	09DEC94	17JAN95		E	R5458	001		2202.86	2202.86	+2.15	2201.79	2196.10 -5.69
				09DEC94	17JAN95		E	R5459	001						
		1 24	400	09DEC94	17JAN95		E	R5456	001		2260.67	2260.67			
				09DEC94	17JAN95		E	R5457	001	3s	2255.33	2255.33	-5.34	2258.00	2248.10 -9.90
		1 22	600	08DEC94	17JAN95		E	R5455	001		2269.69	2269.69		2269.69	2263.80 -5.89
		1 19	900	07DEC94	17JAN95		E	R5452	001		2299.98	2299.98			
				07DEC94	17JAN95		E	R5468	001		2300.10	2300.10	+0.12	2300.04	2291.20 -8.84
		1 16	1200	06DEC94	17JAN95		E	R5450	001		2329.43	2329.43			
				06DEC94	17JAN95		E	R5451	001		2329.34	2329.34	-0.09	2329.39	2324.10 -5.29
		1 13	1600	05DEC94	17JAN95		E	R5448	001		2344.66	2344.66			
				05DEC94	17JAN95		E	R5449	001		2344.99	2344.99	+0.33	2344.82	2337.30 -7.52
		1 11	2000	05DEC94	17JAN95		E	R5446	001		2349.58	2349.58			
				05DEC94	17JAN95		E	R5447	001		2350.82	2350.82	+1.24	2350.20	2341.90 -8.30
		1 7	3100	02DEC94	12JAN95		E	R5444	001		2347.60	2347.60			
				02DEC94	12JAN95		E	R5445	001		2344.08	2344.08	-3.52	2345.84	2337.90 -7.94
2 69	10- 0N 165- 0E	1 36	10	10OCT92	18FEB93	20APR93	E	R5471	001		1902.93	1902.93		1902.93	1902.40 -0.53
		1 9	2900	17FEB93	20APR93		E	R5469	001		2345.32	2345.32			
				17FEB93	20APR93		E	R5470	001		2344.98	2344.98	-0.34	2345.15	2342.70 -2.45
2 70	8- 8N 165- 1E	1 36	10	11OCT92	25FEB93	07MAY93	E	R5476	001		1886.50	1886.50			
				25FEB93	07MAY93		E	R5477	001		1886.77	1886.77	+0.27	1886.64	1888.50 1.86
		1 8	3100	18FEB93	23APR93		E	R5474	001		2337.57	2337.57			
				18FEB93	23APR93		E	R5475	001		2337.77	2337.77	+0.20	2337.67	2334.90 -2.77
2 71	6- 0N 165- 1E	1 36	10	12OCT92	24MAR93	07MAY93	E	R5480	001		1882.59	1882.59			
				24MAR93	07MAY93		E	R5481	001		1883.08	1883.08	+0.49	1882.83	1883.60 0.77
		1 8	3100	23MAR93	07MAY93		E	R5478	001	X	2340.23	2340.23			
				23MAR93	07MAY93		E	R5479	001		2344.23	2344.23		2344.23	2338.80 -5.43

MANOMETER TYPE:
M = CONSTANT VOLUME MERCURY MANOMETER DATUM
E = ELECTRONIC CONSTANT-VOLUME MANOMETER DATUM
BOTTLE TYPE:
R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:
X: Analytical flag
EX: Data excluded from statistical analysis
3s: Bottle delta larger than 3s criteria

Table B.1 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
 CGC92 Legs 1 & 2 WOCE Line Pl3C

SUMMARY OF DISSOLVED INORGANIC CARBON DATA (cont.)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	EXTRAC DATE	ANALYSIS DATE	MANO TYPE	BOTTLE TYPE	RUN	FLAG	S.I.O. RUN	DELTA	BOTTLE DIC	BOTTLE "NISKIN" DELTA	AVG	SIO DIC	SIO -S.I.O.
2 73	3- ON 165- 0E	1 33	10	12OCT92	17DEC93	07JAN94	E R5500	E R5501	001		1875.28		1875.28				
					17DEC93	07JAN94	E R5501	E R5501	001		1872.08		1872.08		-3.20	1873.68	1867.10 -6.58
		1 31	50		11JAN95	26JAN95	E R5498	E R5498	001		1880.54		1880.54				
					11JAN95	26JAN95	E R5499	E R5499	001		1880.87		1880.87		+0.33	1880.71	1881.70 0.99
		1 29	100		10JAN95	26JAN95	E R5496	E R5496	001		2018.06		2018.06				
					10JAN95	26JAN95	E R5497	E R5497	001		2017.37		2017.37		-0.69	2017.72	2017.80 0.08
		1 23	250		09JAN95	26JAN95	E R5494	E R5494	001		2151.50		2151.50				
					09JAN95	26JAN95	E R5495	E R5495	001		2151.70		2151.70		+0.20	2151.60	2151.20 -0.40
		1 20	400		06JAN95	26JAN95	E R5492	E R5492	001		2224.78		2224.78				
					06JAN95	26JAN95	E R5493	E R5493	001		2225.41		2225.41		+0.63	2225.09	2219.00 -6.09
		1 16	700		04JAN95	26JAN95	E R5490	E R5490	001		2278.62		2278.62				
					04JAN95	26JAN95	E R5491	E R5491	001		2279.69		2279.69		+1.07	2279.16	2277.00 -2.16
		1 14	900		04JAN95	23JAN95	E R5488	E R5488	001		2294.96		2294.96				
					04JAN95	23JAN95	E R5489	E R5489	001		2293.66		2293.66		-1.30	2294.31	2291.80 -2.51
		1 10	1700		03JAN95	23JAN95	E R5486	E R5486	001		2334.56		2334.56				
					03JAN95	23JAN95	E R5487	E R5487	001		2332.15		2332.15		-2.41	2333.35	2332.20 -1.15
		1 9	2000		03JAN95	23JAN95	E R5484	E R5484	001		2344.95		2344.95				
					03JAN95	23JAN95	E R5485	E R5485	001		2341.63		2341.63		-3.32	2343.29	2337.60 -5.69
		1 6	2900		29DEC94	23JAN95	E R5482	E R5482	001		2342.66		2342.66				
					29DEC94	23JAN95	E R5483	E R5483	001		2342.20		2342.20		-0.46	2342.43	2336.50 -5.93
2 75	1-30N 164-59E	1 6	2900	13OCT92	12OCT94	30NOV94	E R5502	E R5502	001		2343.45		2343.45				
					12OCT94	30NOV94	E R5503	E R5503	001		2344.90		2344.90		+1.45	2344.18	2337.40 -6.78
2 78	0- ON 165- 0E	1 36	10	14OCT92	11OCT93	12OCT93	E R5528	E R5528	001		1918.75		1918.75				
					11OCT93	12OCT93	E R5529	E R5529	001		1920.03		1920.03		+1.28	1919.39	1925.90 6.51
		1 34	50		06OCT93	12OCT93	E R5526	E R5526	001		1919.50		1919.50				
					06OCT93	12OCT93	E R5527	E R5527	001		1919.84		1919.84		+0.34	1919.67	1922.80 3.13
		1 31	125		06OCT93	12OCT93	E R5524	E R5524	001		2060.64		2060.64				
					06OCT93	12OCT93	E R5525	E R5525	001		2062.08		2062.08		+1.44	2061.36	2062.30 0.94

MANOMETER TYPE:

M = CONSTANT VOLUME MERCURY MANOMETER DATUM

E = ELECTRONIC CONSTANT-VOLUME MANOMETER DATUM

BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.1 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
 CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF DISSOLVED INORGANIC CARBON DATA (cont)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	EXTRAC DATE	ANALYSIS DATE	MANO TYPE	BOTTLE RUN	FLAG	S. I. O. RUN	DELTA	BOTTLE "NISKIN" DIC	BOTTLE DELTA (μMOLES/KG SW)	SIO DIC	SIO -S. I. O.
1	27	250		05OCT93	12OCT93		E R5522	001		2145.54		2145.54			
				05OCT93	12OCT93		E R5523	001		2142.09		2142.09	-3.45	2143.82	2139.60 -4.22
				05OCT93	12OCT93		E R5520	001		2232.04		2232.04			
				05OCT93	12OCT93		E R5521	001		2232.26		2232.26	+0.22	2232.15	2230.10 -2.05
1	21	600		27SEP93	04OCT93		E R5518	001		2241.28		2241.28			
				27SEP93	04OCT93		E R5519	001		2241.90		2241.90	+0.62	2241.59	2239.80 -1.79
1	19	800		27SEP93	04OCT93		E R5516	001		2268.71		2268.71			
				27SEP93	04OCT93		E R5517	001		2268.94		2268.94	+0.23	2268.82	2267.60 -1.22
1	16	1100		24SEP93	04OCT93		E R5514	001		2298.49		2298.49			
				24SEP93	04OCT93		E R5515	001		2299.04		2299.04	+0.55	2298.77	2298.60 -0.17
1	12	1500		24SEP93	04OCT93		E R5512	001		2321.50		2321.50			
				24SEP93	04OCT93		E R5513	001		2322.19		2322.19	+0.69	2321.84	2320.80 -1.04
1	9	2100		23SEP93	04OCT93		E R5510	001		2340.74		2340.74			
				23SEP93	04OCT93		E R5511	001		2341.21		2341.21	+0.47	2340.98	2341.00 0.02
1	7	2600		23SEP93	04OCT93		E R5508	001		2340.71		2340.71			
				23SEP93	04OCT93		E R5509	001		2341.36		2341.36	+0.65	2341.04	2337.30 -3.74
1	5	3200		26AUG93	27AUG93		E R5506	001		2330.91		2330.91			
				26AUG93	27AUG93		E R5507	001		2330.95		2330.95	+0.04	2330.93	2328.20 -2.73
2	1-30S 81 164-59E	1 36	10	15OCT92	24MAR93	11MAY93	E R5532	001		1902.74		1902.74			
				25MAR93	11MAY93		E R5533	001	X	1912.50		1902.74		1902.74	1906.30 3.56
1	6	3000		24MAR93	11MAY93		E R5530	001		2335.10		2335.10			
				29MAR93	11MAY93		E R5534	001		2337.15		2337.15	+2.05	2336.13	2336.70 0.57
2	2-48S 83 164-55E	1 35	25	16OCT92	05JAN94	07JAN94	E R5551	001		1913.02		1913.02			
				05JAN94	07JAN94		E R5552	001		1913.13		1913.13	+0.11	1913.08	1917.40 4.32
1	32	100		08FEB95	21FEB95		E R5549	001		1998.98		1998.98			
				08FEB95	21FEB95		E R5550	001		1998.07		1998.07	-0.91	1998.53	2000.80 2.27
1	27	250		07FEB95	21FEB95		E R5547	001		2155.75		2155.75			
				07FEB95	21FEB95		E R5548	001		2153.52		2153.52	-2.23	2154.64	2155.70 1.06

MANOMETER TYPE:

M = CONSTANT VOLUME MERCURY MANOMETER DATUM

E = ELECTRONIC CONSTANT-VOLUME MANOMETER DATUM

BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.1 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF DISSOLVED INORGANIC CARBON DATA (cont)

LEG STN	LAT. LONG.	CST NISK	DEPTH (M)	SAMPLE DATE	EXTRAC DATE	ANALYSIS DATE	MANO TYPE	SAMPLE BOTTLE	RUN	FLAG	S.I.O. RUN	DELTA	BOTTLE DIC	BOTTLE "NISKIN" DELTA (μMOLES/KG SW)	SIO DIC	SIO -S.I.O.
2 87 164-11E	4-22S 1 32	10	170CT92 10	06FEB95 21FEB95	06FEB95 21FEB95	06FEB95 21FEB95	E	R5545	001		2180.55		2180.55			
				06FEB95 21FEB95	06FEB95 21FEB95	06FEB95 21FEB95	E	R5546	001		2179.02		2179.02	-1.53	2179.79	2180.50 0.71
				02FEB95 21FEB95	02FEB95 21FEB95	02FEB95 21FEB95	E	R5543	001		2227.04		2227.04			
				02FEB95 21FEB95	02FEB95 21FEB95	02FEB95 21FEB95	E	R5544	001		2227.63		2227.63	+0.59	2227.33	2228.30 0.97
				26JAN95 21FEB95	26JAN95 21FEB95	26JAN95 21FEB95	E	R5541	001		2289.69		2289.69			
				26JAN95 21FEB95	26JAN95 21FEB95	26JAN95 21FEB95	E	R5542	001		2290.60		2290.60	+0.91	2290.15	2294.90 4.75
				26JAN95 21FEB95	26JAN95 21FEB95	26JAN95 21FEB95	E	R5540	001		2314.29		2314.29			
				26JAN95 21FEB95	26JAN95 21FEB95	26JAN95 21FEB95	E	R5555	001		2315.34		2315.34	+1.05	2314.82	2313.40 -1.42
				25JAN95 21FEB95	25JAN95 21FEB95	25JAN95 21FEB95	E	R5537	001		2335.59		2335.59			
				25JAN95 21FEB95	25JAN95 21FEB95	25JAN95 21FEB95	E	R5538	001		2337.15		2337.15	+1.56	2336.37	2333.70 -2.67
				25JAN95 15FEB95	25JAN95 15FEB95	25JAN95 15FEB95	E	R5535	001		2335.11		2335.11			
				25JAN95 15FEB95	25JAN95 15FEB95	25JAN95 15FEB95	E	R5536	001		2334.68		2334.68	-0.43	2334.90	2333.30 -1.60
2 87 164-11E	1 30	50	170CT92 10	06JAN94 07JAN94	06JAN94 07JAN94	06JAN94 07JAN94	E	R5572	001		1916.24		1916.24			
				06JAN94 07JAN94	06JAN94 07JAN94	06JAN94 07JAN94	E	R5573	001		1916.27		1916.27	+0.03	1916.26	1917.00 0.74
				17FEB95 01MAR95	17FEB95 01MAR95	17FEB95 01MAR95	E	R5570	001		1916.64		1916.64			
				17FEB95 01MAR95	17FEB95 01MAR95	17FEB95 01MAR95	E	R5571	001		1916.60		1916.60	-0.04	1916.62	1915.70 -0.92
				15FEB95 01MAR95	15FEB95 01MAR95	15FEB95 01MAR95	E	R5568	001		2005.43		2005.43			
				15FEB95 01MAR95	15FEB95 01MAR95	15FEB95 01MAR95	E	R5569	001		2004.42		2004.42	-1.01	2004.93	2003.80 -1.13
				15FEB95 01MAR95	15FEB95 01MAR95	15FEB95 01MAR95	E	R5566	001		2140.25		2140.25			
				15FEB95 01MAR95	15FEB95 01MAR95	15FEB95 01MAR95	E	R5567	001		2140.22		2140.22	-0.03	2140.24	2138.30 -1.94
				14FEB95 01MAR95	14FEB95 01MAR95	14FEB95 01MAR95	E	R5564	001		2204.31		2204.31			
				14FEB95 01MAR95	14FEB95 01MAR95	14FEB95 01MAR95	E	R5565	001		2201.73		2201.73	-2.58	2203.02	2200.80 -2.22
				13FEB95 01MAR95	13FEB95 01MAR95	13FEB95 01MAR95	E	R5562	001		2234.62		2234.62			
				13FEB95 01MAR95	13FEB95 01MAR95	13FEB95 01MAR95	E	R5563	001		2234.48		2234.48	-0.14	2234.55	2232.40 -2.15
2 87 164-11E	1 10	900	170CT92 10	10FEB95 01MAR95	10FEB95 01MAR95	10FEB95 01MAR95	E	R5560	001		2276.45		2276.45			
				10FEB95 01MAR95	10FEB95 01MAR95	10FEB95 01MAR95	E	R5574	001		2276.06		2276.06	-0.39	2276.26	2274.00 -2.26
				10FEB95 21FEB95	10FEB95 21FEB95	10FEB95 21FEB95	E	R5558	001		2293.33		2293.33			
				10FEB95 21FEB95	10FEB95 21FEB95	10FEB95 21FEB95	E	R5559	001		2293.39		2293.39	+0.06	2293.36	2290.50 -2.86

MANOMETER TYPE:

M = CONSTANT VOLUME MERCURY MANOMETER DATUM

E = ELECTRONIC CONSTANT-VOLUME MANOMETER DATUM

BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.1 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF DISSOLVED INORGANIC CARBON DATA (cont)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	EXTRAC DATE	ANALYSIS DATE	MANO TYPE	BOTTLE RUN	FLAG	S.I.O. RUN	DELTA	BOTTLE DIC	BOTTLE DELTA	"NISKIN" AVG	SIO DIC	SIO -S.I.O.
		1	5	1600	09FEB95	21FEB95	E R5556	001		2318.45		2318.45				
					09FEB95	21FEB95	E R5557	001		2318.15		2318.15	-0.30	2318.30	2315.70	-2.60
		1	3	2000	08FEB95	21FEB95	E R5553	001		2332.78		2332.78				
					08FEB95	21FEB95	E R5554	001	EX	2274.19				2332.78	2329.80	-2.98

MANOMETER TYPE:

M = CONSTANT VOLUME MERCURY MANOMETER DATUM
E = ELECTRONIC CONSTANT-VOLUME MANOMETER DATUM
BOTTLE TYPE:
R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag
EX: Data excluded from statistical analysis
3s: Bottle delta larger than 3s criteria

NOTE: Dilution factor of 1.000170 has been applied.

Table B.2 Summary of Shore-Based TALK Replicate Measurements

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SYST	SAMPLE BOTTLE	TRIAL	FLAG	S.I.O. TRIAL	BOTTLE DELTA (μEQUIV/KG SW)	BOTTLE ALK	"NISKIN" AVG	SIO ALK	-S.I.O.
1	54-8N	1 25	10	21AUG92	09MAR93	V	R5288	1		2212.95					
8	161-10E				09MAR93	V	R5288	2		2215.06	+2.11	2214.01			
					09MAR93	V	R5289	1		2216.69					
					09MAR93	V	R5289	2		2217.83	+1.14	2217.26	+3.25	2215.64	2220.51 4.87
		1 1	1820		09MAR93	V	R5286	1		2409.93					
					09MAR93	V	R5286	2		2412.20	+2.27	2411.06			
					09MAR93	V	R5287	1		2410.96					
					09MAR93	V	R5287	2		2413.60	+2.64	2412.28	+1.22	2411.67	2414.06 2.39
1	53-29N	1 36	10	22AUG92	10MAR93	V	R5292	1		2239.54					
11	162-10E				10MAR93	V	R5292	2		2240.35	+0.81	2239.95			
					10MAR93	V	R5293	1		2238.97					
					10MAR93	V	R5293	2		2241.40	+2.43	2240.19	+0.24	2240.07	2241.76 1.69
		1 9	3000		10MAR93	V	R5290	1		2419.25					
					10MAR93	V	R5290	2		2420.58	+1.33	2419.92			
					10MAR93	V	R5291	1		2420.16					
					10MAR93	V	R5291	2		2420.29	+0.13	2420.23	+0.31	2420.07	2421.26 1.19
1	53-1N	1 36	10	23AUG92	30APR93	V	R5296	1		2226.28					
13	162-52E				30APR93	V	R5296	2		2227.76	+1.48	2227.02			
					30APR93	V	R5297	1		2225.83					
					30APR93	V	R5297	2		2224.96	-0.87	2225.40	-1.62	2226.21	
		1 11	2900		30APR93	V	R5294	1		2415.61					
					30APR93	V	R5294	2		2416.65	+1.04	2416.13			
					30APR93	V	R5295	1		2416.88					
					30APR93	V	R5295	2		2418.40	+1.52	2417.64	+1.51	2416.89	2418.00 1.11
1	50-59N	1 36	10	25AUG92	05MAR93	V	P5708	1		2218.12					
17	164-58E				05MAR93	V	P5708	2		2222.03					
					17MAR93	G	P5708	3	X	2223.37	+3.91	2220.08			
					05MAR93	V	P5709	1		2219.01					
					05MAR93	V	P5709	2		2220.13					
					18MAR93	G	P5709	3	X	2223.59	+1.12	2219.57	-0.51	2219.82	2225.64 5.82
		1 8	3000		05MAR93	V	P5706	1		2418.09					
					05MAR93	V	P5706	2	EX	2481.15					
					17MAR93	G	P5706	3	X	2399.76					
					17MAR93	G	P5706	4	X	2423.05		2418.09			
					05MAR93	V	P5707	1		2419.29					
					05MAR93	V	P5707	2		2421.19					

TITRATION SYSTEM:

G = GRAVIMETRIC

V = VOLUMETRIC

BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SYST	SAMPLE BOTTLE	TRIAL	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK (μEQUIV/KG SW)	BOTTLE "NISKIN" DELTA	SIO ALK	SIO -S.I.O.
1	49-30N	1 36	10	26AUG92	17MAR93	G	P5707	3	X	2421.94	+1.90	2420.24	+2.15	2419.17	2416.46 -2.70
20	165-1E				10JUN94	G	R5320	1		2217.78		2217.78			
					05JUL94	G2	R5320	2	X	2200.23					
					10JUN94	G	R5321	1		2219.22		2219.22			
					05JUL94	G2	R5321	2	X	2201.67			+1.44	2218.50	2220.84 2.34
		1 33	50		21SEP94	G2	R5318	1		2233.69		2233.69			
					21SEP94	G2	R5319	1		2236.58		2236.58	+2.89	2235.14	2245.06 9.92
		1 31	100		27SEP94	G2	R5316	1		2247.29		2247.29			
					27SEP94	G2	R5317	1		2249.01		2249.01	+1.72	2248.15	2251.09 2.94
		1 27	200		09SEP94	G2	R5314	1		2298.90		2298.90			
					12SEP94	G2	R5315	1		2296.29		2296.29	-2.61	2297.59	2302.59 5.00
		1 25	300		08NOV94	G2	R5312	1		2320.54		2320.54			
					08NOV94	G2	R5313	1		2314.38		2314.38	-6.16	2317.46	2322.90 5.44
		1 23	400		15AUG94	G2	R5310	1		2335.94		2335.94			
					15AUG94	G2	R5311	1		2331.82		2331.82	-4.12	2333.88	2338.19 4.31
		1 21	600		12AUG94	G2	R5308	1		2357.24		2357.24			
					12AUG94	G2	R5309	1		2359.36		2359.36	+2.12	2358.30	2358.49 0.19
		1 18	900		11AUG94	G2	R5306	1		2382.51		2382.51			
					11AUG94	G2	R5307	1		2382.00		2382.00	-0.51	2382.26	2378.41 -3.85
		1 16	1200		10AUG94	G2	R5304	1		2397.56		2397.56			
					10AUG94	G2	R5305	1		2396.93		2396.93	-0.63	2397.25	2395.30 -1.95
		1 14	1700		10AUG94	G2	R5302	1		2414.19		2414.19			
					10AUG94	G2	R5303	1		2415.00		2415.00	+0.81	2414.59	2410.93 -3.66
		1 13	2000		05AUG94	G2	R5300	1		2415.35		2415.35			
					08AUG94	G2	R5301	1		2416.65		2416.65	+1.30	2416.00	2417.37 1.37
		1 10	2900		04AUG94	G2	R5298	1		2420.67		2420.67			
					04AUG94	G2	R5299	1		2418.91		2418.91	-1.76	2419.79	2418.84 -0.95
1	47-30N	1 36	10	27AUG92	11MAR93	V	P5712	1		2230.56					
24	165-0E				11MAR93	V	P5712	2		2230.02					
					18MAR93	G	P5712	3	X	2233.73	-0.54	2230.29			

TITRATION SYSTEM:

G = GRAVIMETRIC

V = VOLUMETRIC

BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT. LONG.	CST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SYST	BOTTLE	TRIAL	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK	BOTTLE DELTA	"NISKIN" AVG	SIO ALK	SIO -S.I.O.
												(μ EQV/KG SW)				
			1 11 2800		11MAR93	V	P5713	1		2227.19						
					18MAR93	G	P5713	3		2228.58						
					12MAR93	V	P5713	4	X	2226.94	-0.25	2227.07	-3.23	2228.68	2239.21	10.53
					11MAR93	V	P5710	1		2416.67						
					11MAR93	V	P5710	2		2417.32						
					18MAR93	G	P5710	3	X	2421.00	+0.65	2417.00				
					11MAR93	V	P5711	1		2417.36						
					11MAR93	V	P5711	2		2417.95						
					18MAR93	G	P5711	3	X	2421.06	+0.59	2417.66	+0.66	2417.33	2420.80	3.47
					24JUN94	G	P5772	1		2225.80		2225.80				
					29JUN94	G2	P5772	2	X	2221.63						
					30JUN94	G2	P5772	3	X	2220.50						
					24JUN94	G	P5773	1		2225.80		2225.80				
					30JUN94	G2	P5773	2	X	2223.49						
					14SEP94	G2	P5770	1		2418.15		2418.15				
					14SEP94	G2	P5771	1		2417.60		2417.60	-0.55	2417.88	2420.25	2.37
					09JUN94	G	R5323	1		2236.01		2236.01				
					09JUN94	G	R5324	1		2235.20		2235.20	-0.81	2235.60	2240.51	4.91
					08SEP94	G2	R5322	1		2419.70		2419.70				
					07SEP94	G2	R5325	1		2420.17		2420.17	+0.47	2419.94	2423.21	3.27
					24JUN94	G	P5776	1		2209.04		2209.04				
					01JUL94	G2	P5776	2	X	2206.22						
					06JUL94	G2	P5776	3	X	2209.20						
					01JUL94	G	P5777	1		2207.13		2207.13				
					05JUL94	G2	P5777	2	X	2202.95						
					06JUL94	G2	P5777	3	X	2204.13						
					12SEP94	G2	P5774	1		2417.19		2417.19				
					13SEP94	G2	P5775	1		2417.05		2417.05	-0.14	2417.12	2421.33	4.21
					26APR94	G	R5348	1		2218.74		2218.74				
					26MAY94	G	R5349	1		2215.27		2215.27	-3.47	2217.01	2225.68	8.67
					17AUG94	G2	R5346	1		2266.13		2266.13				
					17AUG94	G2	R5347	1		2263.28		2263.28	-2.85	2264.71	2267.06	2.35
					07DEC94	G2	R5344	1		2266.89		2266.89				

TITRATION SYSTEM:

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BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

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EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT. LONG.	CST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SYST	BOTTLE TRIAL	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK	BOTTLE DELTA (μ EQV/KG SW)	"NISKIN" AVG	SIO ALK	SIO -S.I.O.
					07DEC94	G2	R5345	1	2265.36		2265.36	-1.53	2266.13	2265.70	-0.43
		1 27	200		12DEC94	G2	R5342	1	2269.38		2269.38				
					12DEC94	G2	R5343	1	2268.19		2268.19	-1.19	2268.78	2266.44	-2.34
		1 25	300		06DEC94	G2	R5340	1	2288.66		2288.66				
					06DEC94	G2	R5341	1	2288.83		2288.83	+0.17	2288.75	2288.12	-0.63
		1 23	400		01DEC94	G2	R5338	1	2305.75		2305.75				
					02DEC94	G2	R5339	1	2303.03		2303.03	-2.72	2304.39	2306.30	1.91
		1 21	600		13DEC94	G2	R5336	1	2340.93		2340.93				
					13DEC94	G2	R5337	1	2338.87		2338.87	-2.06	2339.90	2337.42	-2.48
		1 18	900		08DEC94	G2	R5334	1	2366.28		2366.28				
					07DEC94	G2	R5335	1	2369.89		2369.89	+3.61	2368.08	2370.70	2.62
		1 15	1200		09DEC94	G2	R5332	1	2385.44		2385.44				
					12DEC94	G2	R5333	1	2389.75		2389.75	+4.31	2387.59	2390.51	2.92
		1 13	1500		09DEC94	G2	R5330	1	2403.33		2403.33				
					09DEC94	G2	R5331	1	2400.38		2400.38	-2.95	2401.85	2404.15	2.30
		1 11	1900		01SEP94	G2	R5328	1	2407.00		2407.00				
					02SEP94	G2	R5328	2	2408.20	+1.20	2407.60				
					01SEP94	G2	R5329	1	2413.75		2413.75				
					02SEP94	G2	R5329	2	2411.08	-2.67	2412.42	+4.82	2410.01	2414.04	4.03
		1 7	3100		17AUG94	G2	R5326	1	2417.15		2417.15				
					17AUG94	G2	R5327	1	2418.08		2418.08	+0.93	2417.61	2419.22	1.61
1 40-30N 38 165-1E		1 36	10	02SEP92	12MAR93	V	P5716	1	2242.20		2242.20				
					12MAR93	V	P5716	2	2243.28		2243.28				
					19MAR93	G	P5716	3	2244.90		2244.90				
					24MAR93	G	P5716	4	2248.31	+1.08	2242.74				
					12MAR93	V	P5717	1	2243.52		2243.52				
					12MAR93	V	P5717	2	2243.84		2243.84				
					19MAR93	G	P5717	3	2252.15		2252.15				
					24MAR93	G	P5717	4	2249.22	+0.32	2243.68	+0.94	2243.21	2247.33	4.12
		1 8	3100		12MAR93	V	P5714	1	2414.12		2414.12				
					12MAR93	V	P5714	2	2416.56		2416.56				
					19MAR93	G	P5714	3	2418.01	+2.44	2415.34				

TITRATION SYSTEM:

G = GRAVIMETRIC

V = VOLUMETRIC

BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SVST	SAMPLE BOTTLE	TRIAL	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK DELTA (μEQUIV/KG SW)	"NISKIN" AVG	SIO ALK	SIO -S.I.O.
1	39- 1N	1 36	10	03SEP92	12MAR93	V	P5715	1		2416.09					
41	165- 1E				12MAR93	V	P5715	2		2416.48					
					19MAR93	G	P5715	3	X	2420.82	+0.39	2416.29	+0.95	2415.81	2419.28 3.47
1	39- 1N	1 36	10	03SEP92	17JUN94	G	P5720	1		2247.64					
41	165- 1E				30JUN94	G2	P5720	2	X	2245.61					
					24JUN94	G	P5721	1		2251.02					
					30JUN94	G2	P5721	2	X	2251.67			+3.38	2249.33	2250.00 0.67
		1 8	3100		13SEP94	G2	P5718	1		2423.00					
					13SEP94	G2	P5719	1		2418.96			-4.04	2420.98	2418.57 -2.41
1	36- 1N	1 36	10	05SEP92	25JUL94	G2	P5780	1		2257.91					
47	165- 1E				25JUL94	G2	P5781	1		2257.50			-0.41	2257.71	2259.45 1.74
1	34-42N	1 35	25	06SEP92	20SEP93	V	R5372	1		2248.52					
49	165- 3E				20SEP93	V	R5372	2		2251.11	+2.59	2249.82			
					20SEP93	V	R5373	1		2250.28					
					20SEP93	V	R5373	2		2248.45	-1.83	2249.36	-0.46	2249.59	2253.58 3.99
		1 34	50		20SEP93	V	R5370	1		2246.73					
					20SEP93	V	R5370	2		2247.89	+1.16	2247.31			
					20SEP93	V	R5371	1		2248.39					
					20SEP93	V	R5371	2		2245.75	-2.64	2247.07	-0.24	2247.19	2258.22 11.03
		1 32	100		03SEP93	V	R5368	1		2271.43					
					03SEP93	V	R5368	2		2270.37	-1.06	2270.90			
					03SEP93	V	R5369	1		2273.45					
					03SEP93	V	R5369	2		2271.35	-2.10	2272.40	+1.50	2271.65	2276.85 5.20
		1 28	200		03SEP93	V	R5366	1		2266.80					
					03SEP93	V	R5366	2		2266.34	-0.46	2266.57			
					03SEP93	V	R5367	1		2265.36					
					03SEP93	V	R5367	2		2262.81	-2.55	2264.09	-2.48	2265.33	2274.36 9.03
		1 26	300		03SEP93	V	R5364	1		2270.23					
					03SEP93	V	R5364	2		2270.49	+0.26	2270.36			
					03SEP93	V	R5365	1		2272.27					
					03SEP93	V	R5365	2		2270.93	-1.34	2271.60	+1.24	2270.98	2276.67 5.69
		1 24	400		02SEP93	V	R5362	1		2276.76					
					02SEP93	V	R5362	2		2275.03	-1.73	2275.90			
					02SEP93	V	R5363	1		2275.99					

TITRATION SYSTEM:

G = GRAVIMETRIC

V = VOLUMETRIC

BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SVST	BOTTLE	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK	BOTTLE DELTA	"NISKIN" AVG	SIO ALK	SIO -S.I.O.
					02SEP93	V	R5363	2	2275.91	-0.08	2275.95	+0.05	2275.93	2280.64	4.71
		1 22	600		02SEP93	V	R5360	1	2305.03						
					02SEP93	V	R5360	2	2304.59	-0.44	2304.81				
					02SEP93	V	R5361	1	2306.05						
					02SEP93	V	R5361	2	2304.62	-1.43	2305.34	+0.53	2305.08	2311.81	6.73
		1 19	900		02SEP93	V	R5358	1	2352.58						
					02SEP93	V	R5358	2	2351.99	-0.59	2352.29				
					02SEP93	V	R5359	1	2355.34						
					02SEP93	V	R5359	2	2353.90	-1.44	2354.62	+2.33	2353.46	2358.78	5.32
		1 17	1200		23JUL93	V	R5356	1	2381.38						
					23JUL93	V	R5356	2	2384.66	+3.28	2383.02				
					23JUL93	V	R5357	1	2377.59						
					23JUL93	V	R5357	2	2380.81	+3.22	2379.20	-3.82	2381.11	2387.76	6.65
		1 15	1700		26JUL93	V	R5354	1	2406.45						
					26JUL93	V	R5354	2	2406.45	+0.00	2406.45				
					26JUL93	V	R5355	1	2407.55						
					26JUL93	V	R5355	2	2408.99	+1.44	2408.27	+1.82	2407.36	2410.83	3.47
		1 14	2000		23JUL93	V	R5352	1	2412.30						
					23JUL93	V	R5352	2	2414.95	+2.65	2413.63				
					23JUL93	V	R5353	1	2415.14						
					23JUL93	V	R5353	2	2416.79	+1.65	2415.97	+2.34	2414.80	2413.05	-1.75
		1 11	2900		27JUL93	V	R5350	1	2424.30						
					27JUL93	V	R5350	2	2428.83	+4.53	2426.57				
					27JUL93	V	R5351	1	2417.55						
					72FEB93	V	R5351	2	2423.33	+5.78	2420.44	-6.13	2423.51	2420.15	-3.36
1 33-23N 51 165-1E	1 36	10	07SEP92		09JUN94	G2	P5784	2	2251.55						
					09JUN94	G2	P5784	3	2235.69						
					10JUN94	G2	P5784	4	2255.97		2255.97				
					03JUN94	G	P5785	1	2257.23						
					10JUN94	G2	P5785	2	2249.08						
					10JUN94	G2	P5785	3	2256.00		2257.23	+0.03	2255.99	2257.69	1.71
		1 17	1000		18OCT94	G2	P5782	1	2360.47		2360.47				
					18OCT94	G2	P5783	1	2358.09		2358.09				
1 32-ON	1 2	2000	08SEP92		13DEC94	G2	R5374	1	2412.26		2412.26				

TITRATION SYSTEM:

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BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
 CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SYST	SAMPLE BOTTLE	TRIAL	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK	BOTTLE DELTA (μEQUIV/KG SW)	SIO ALK	SIO -S.I.O.	
53	165- 0E				13DEC94	G2	R5375	1		2411.36		2411.36	-0.90	2411.81	2413.93	2.12
1 30-41N 55 164-58E		1 35	10	10SEP92	17JUN94	G	P5724	1		2293.77		2293.77				
					17JUN94	G	P5725	2	EX	2306.99						
					17JUN94	G	P5725	3	EX	2279.61						
					23JUN94	G	P5725	4		2290.23		2290.23	-3.54	2292.00	2294.28	2.28
2 21-19N 57 165- 0E		1 9	3100		20OCT94	G2	P5722	1		2418.70		2418.70				
					20OCT94	G2	P5723	1		2415.67		2415.67	-3.03	2417.19	2420.61	3.42
		1 35	25	30SEP92	02AUG94	G2	R5400	1		2306.92		2306.92				
					02AUG94	G2	R5401	1		2305.96		2305.96	-0.96	2306.44	2301.40	-5.04
		1 34	50		19JAN95	G2	R5398	1		2305.70		2305.70				
					19JAN95	G2	R5399	1		2309.16		2309.16	+3.46	2307.43	2311.90	4.47
		1 31	125		08FEB95	G2	R5396	1		2298.21		2298.21				
					08FEB95	G2	R5397	1		2302.98		2302.98	+4.77	2300.59	2303.83	3.24
		1 28	200		23JAN95	G2	R5394	1		2284.18		2284.18				
					23JAN95	G2	R5395	1	EX	2248.68						
		1 26	300		02MAR95	G2	R5392	1		2275.96		2275.96				
					02MAR95	G2	R5393	1		2279.58		2279.58	+3.62	2277.77	2273.27	-4.50
		1 24	400		23JAN95	G2	R5390	1		2263.92		2263.92				
					23JAN95	G2	R5391	1		2262.22		2262.22	-1.70	2263.07	2265.83	2.76
		1 22	600		11JAN95	G2	R5388	1		2286.04		2286.04				
					11JAN95	G2	R5389	1		2285.75		2285.75	-0.29	2285.90	2295.02	9.12
		1 19	900		10JAN95	G2	R5386	1		2355.79		2355.79				
					10JAN95	G2	R5387	1		2356.07		2356.07	+0.28	2355.93	2354.24	-1.69
		1 17	1200		13MAY96	G2	R5384	1		2363.02		2363.02				
					13MAY96	G2	R5404	1	EX	2337.70				2363.02	2383.02	20.00
		1 15	1600		18JAN95	G2	R5382	1		2396.04		2396.04				
					18JAN95	G2	R5383	1		2389.36		2389.36	-6.68	2392.70	2400.90	8.20
		1 13	2100		23JAN95	G2	R5380	1		2414.56		2414.56				
					24JAN95	G2	R5380	2		2416.79		2416.79				
					24JAN95	G2	R5381	1		2414.76		2414.76	-0.92	2415.22	2414.15	-1.07

TITRATION SYSTEM:

G = GRAVIMETRIC

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BOTTLE TYPE:

R = 0.5 LITER PYREX

P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SYST	SAMPLE BOTTLE	TRIAL	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK	BOTTLE DELTA	"NISKIN" AVG	SIO ALK	SIO -S.I.O.
----- (μEQUIV/KG SW) -----																
2 59	19-59N 165-0E	1 33	75	01OCT92	27JAN95	G2	R5378	1		2418.66		2418.66				
					27JAN95	G2	R5379	1		2418.51		2418.51	-0.15	2418.58	2421.61	3.03
					03MAY93	V	R5405	1		2302.28						
					03MAY93	V	R5405	2		2304.36	+2.08	2303.32				
2	18-40N 164-36E	1 35	10	02OCT92	03MAY93	V	R5406	1		2300.97						
					03MAY93	V	R5406	2		2303.00	+2.03	2301.99	-1.33	2302.66	2304.95	2.29
					03MAY93	V	R5402	1		2412.37						
					03MAY93	V	R5402	2		2413.05	+0.68	2412.71				
2 62	18-40N 164-36E	1 35	10	02OCT92	03MAY93	V	R5403	1		2411.02						
					03MAY93	V	R5403	2		2411.63	+0.61	2411.32	-1.39	2412.02	2420.55	8.53
					03MAY93	V	P5728	1		2292.48						
					03MAY93	V	P5728	2		2293.18	+0.70	2292.83				
2 63	24-3N 164-59E	1 36	10	04OCT92	03MAY93	V	P5729	1		2296.86						
					03MAY93	V	P5729	2		2297.57	+0.71	2297.22	+4.39	2295.03	2301.30	6.27
					22FEB93	G	P5726	1		2422.80						
					19FEB93	V	P5726	2	EX	2419.59		2422.80				
2 64	26-2N 165-4E	1 36	10	05OCT92	22FEB93	G	P5727	1		2419.99						
					19FEB93	V	P5727	2	EX	2410.66		2419.99	-2.81	2421.40	2422.81	1.41
					25JUL94	G2	R5409	1		2310.33		2310.33				
					26JUL94	G2	R5410	1		2305.62		2305.62	-4.71	2307.98	2308.34	0.36
2 66	26-2N 165-4E	1 36	10	05OCT92	07FEB95	G2	R5407	1		2422.48						
					07FEB95	G2	R5408	1		2418.67		2422.48	-3.81	2420.57	2421.62	1.05
					15AUG94	G2	R5433	1		2313.04		2313.04				
					15AUG94	G2	R5434	1		2316.99		2316.99	+3.95	2315.02	2312.54	-2.48
2 68	26-2N 165-4E	1 34	50	05OCT92	31JAN95	G2	R5431	1		2316.04						
					01FEB95	G2	R5432	1		2316.39		2316.04	+0.35	2316.22	2316.76	0.54
					31JAN96	G2	R5429	1		2318.51		2316.39				
					31JAN96	G2	R5430	1		2316.29		2318.51	-2.22	2317.40	2320.56	3.16
2 70	26-2N 165-4E	1 34	50	05OCT92	14MAR95	G2	R5425	1		2285.93						
					15MAR95	G2	R5426	1		2284.16		2285.93	-1.77	2285.04	2288.19	3.15
					03APR95	G2	R5423	1		2273.72		2284.16				
					03APR95	G2	R5423	1		2273.72		2273.72				

TITRATION SYSTEM:

G = GRAVIMETRIC

V = VOLUMETRIC

BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SYST	SAMPLE BOTTLE	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK	BOTTLE DELTA	"NISKIN" AVG	SIO ALK	SIO -S.I.O.
											(μ EQV/KG SW)				
					31MAR95	G2	R5424	1	2269.69		2269.69	-4.03	2271.71	2270.91	-0.80
		1 21	650		11JAN95	G2	R5421	1	2278.06		2278.06				
					12JAN95	G2	R5435	1	2275.98		2275.98	-2.08	2277.02	2271.93	-5.09
		1 19	800		12JAN95	G2	R5419	1	2312.45		2312.45				
					11JAN95	G2	R5420	1	2313.29		2313.29	+0.84	2312.87	2305.85	-7.02
		1 17	1000		17JAN95	G2	R5417	1	2346.90		2346.90				
					17JAN95	G2	R5418	1	2342.83		2342.83	-4.07	2344.86	2346.84	1.98
		1 15	1200		16MAR95	G2	R5415	1	2375.26		2375.26				
					16MAR95	G2	R5416	1	2376.02		2376.02	+0.76	2375.64	2372.55	-3.09
		1 12	1600		31MAR95	G2	R5413	1	2402.56		2402.56				
					31MAR95	G2	R5414	1	2402.02		2402.02	-0.54	2402.29	2405.11	2.82
		1 9	2200		13MAR95	G2	R5411	1	2415.10		2415.10				
					14MAR95	G2	R5412	1	2413.31		2413.31	-1.79	2414.21	2410.85	-3.36
2 66	16- ON 166- OE	1 36	10	08OCT92	04MAY93	V	R5438	1	2274.97						
					04MAY93	V	R5438	2	2278.79	+3.82	2276.88				
					04MAY93	V	R5439	1	2273.21						
					04MAY93	V	R5439	2	2276.47	+3.26	2274.84	-2.04	2275.86		
		1 8	3200		03MAY93	V	R5436	1	2411.88						
					03MAY93	V	R5436	2	2412.90	+1.02	2412.39				
					03MAY93	V	R5437	1	2410.64						
					03MAY93	V	R5437	2	2411.62	+0.98	2411.13	-1.26	2411.76	2421.91	10.15
2 67	14- ON 165- OE	1 36	10	09OCT92	04MAY93	V	R5442	1	2261.53						
					04MAY93	V	R5442	2	2264.40	+2.87	2262.97				
					04MAY93	V	R5443	1	2264.30						
					04MAY93	V	R5443	2	2267.69	+3.39	2266.00	+3.03	2264.49	2275.78	11.29
		1 8	3100		04MAY93	V	R5440	1	2404.10						
					04MAY93	V	R5440	2	2405.67	+1.57	2404.89				
					04MAY93	V	R5441	1	2408.01						
					04MAY93	V	R5441	2	2410.11	+2.10	2409.06	+4.17	2406.98	2425.76	18.78
2 68	12-35N 165-22E	1 36	10	09OCT92	27JUL94	G2	R5466	1	2257.63		2257.63				
					27JUL94	G2	R5467	1	2260.25		2260.25	+2.62	2258.94	2260.92	1.98

TITRATION SYSTEM:

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BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SYST	BOTTLE TRIAL	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK	BOTTLE DELTA (μEQUIV/KG SW)	"NISKIN" AVG	SIO ALK	SIO -S.I.O.
1	34	25			08FEB95	G2	R5464	1	2266.97		2266.97				
					08FEB95	G2	R5465	1	2265.67		2265.67	-1.30	2266.32	2265.88	-0.44
					15FEB95	G2	R5462	1	2274.03		2274.03				
					15FEB95	G2	R5463	1	2279.51		2279.51	+5.48	2276.77	2280.07	3.30
1	29	150			10FEB95	G2	R5460	1	2292.35		2292.35				
					10FEB95	G2	R5461	1	2291.77		2291.77	-0.58	2292.06	2300.79	8.73
1	26	300			09FEB95	G2	R5458	1	2283.47		2283.47				
					09FEB95	G2	R5459	1	2285.07		2285.07	+1.60	2284.27	2284.98	0.71
1	24	400			09FEB95	G2	R5456	1	2307.81		2307.81				
					09FEB95	G2	R5457	1	2298.78		2298.78	-9.03	2303.30	2305.48	2.18
1	22	600			08FEB95	G2	R5454	1	2322.10		2322.10				
					09FEB95	G2	R5455	1	2317.46		2317.46	-4.64	2319.78	2304.15	-15.63
1	19	900			14DEC94	G2	R5452	1	2351.70		2351.70				
					14DEC94	G2	R5468	1	2353.49		2353.49	+1.79	2352.59	2354.89	2.30
1	16	1200			16FEB95	G2	R5450	1	2374.83		2374.83				
					16FEB95	G2	R5451	1	2378.54		2378.54	+3.71	2376.69	2381.16	4.47
1	13	1600			17JAN95	G2	R5448	1	2401.11		2401.11				
					18JAN95	G2	R5449	1	2403.38		2403.38	+2.27	2402.25	2403.22	0.97
1	11	2000			01FEB95	G2	R5446	1	2415.71		2415.71				
					01FEB95	G2	R5447	1	2416.65		2416.65	+0.94	2416.18	2417.21	1.03
1	7	3100			17FEB95	G2	R5444	1	2426.36		2426.36				
					17FEB95	G2	R5445	1	2417.25		2417.25	-9.11	2421.81	2423.99	2.18
2 69	10- 155- OE	ON 1 36 10 100CT92 10			04MAY93	V	R5471	1	2247.21		2247.21				
					04MAY93	V	R5471	2	2249.39	+2.18	2248.30				
					04MAY93	V	R5473	1	2250.93		2250.93				
					04MAY93	V	R5473	2	2252.83	+1.90	2251.88	+3.58	2250.09	2257.29	7.20
1	9	2900			04MAY93	V	R5469	1	2417.01		2417.01				
					04MAY93	V	R5469	2	2420.16	+3.15	2418.58				
					04MAY93	V	R5470	1	2417.31		2417.31				
					04MAY93	V	R5470	2	2418.72	+1.41	2418.02	-0.56	2418.30	2427.65	9.35

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BOTTLE TYPE:

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3s: Bottle delta larger than 3s criteria

Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT.	LONG.	CAST	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SYST	BOTTLE TRIAL	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK	BOTTLE DELTA (μEQUIV/KG SW)	"NISKIN" AVG	SIO ALK	SIO -S.I.O.
2	8- 8N	1 36	10	110	CT92	05MAY93	V	R5476	1	2234.97						
70	165- 1E					05MAY93	V	R5476	2	2238.48	+3.51	2236.73				
						05MAY93	V	R5477	1	2232.64						
						05MAY93	V	R5477	2	2235.23	+2.59	2233.94	-2.79	2235.33	2242.95	7.62
						04MAY93	V	R5474	1	2416.23						
						04MAY93	V	R5474	2	2416.98	+0.75	2416.60				
						04MAY93	V	R5475	1	2408.28						
						04MAY93	V	R5475	2	2410.83	+2.55	2409.56	-7.04	2413.08	2416.78	3.70
2	6- 0N	1 36	10	120	CT92	05MAY93	V	R5480	1	2229.68						
71	165- 1E					05MAY93	V	R5480	2	2233.52	+3.84	2231.60				
						05MAY93	V	R5481	1	2229.73						
						05MAY93	V	R5481	2	2230.99	+1.26	2230.36	-1.24	2230.98	2236.33	5.35
						05MAY93	V	R5478	1	2410.01						
						05MAY93	V	R5478	2	2412.93	+2.92	2411.47				
						05MAY93	V	R5479	1	2410.62						
						05MAY93	V	R5479	2	2413.04	+2.42	2411.83	+0.36	2411.65	2424.58	12.93
2	3- 0N	1 33	10	120	CT92	09JUN94	G	R5500	1	2226.65						
73	165- 0E					10JUN94	G	R5501	1	2226.36						
						05APR95	G2	R5498	1	2236.28						
						07APR95	G2	R5499	1	2235.12						
						27FEB95	G2	R5496	1	2291.25						
						27FEB95	G2	R5497	1	2292.54						
						27FEB95	G2	R5494	1	2291.68						
						27FEB95	G2	R5495	1	2295.86						
						24FEB95	G2	R5492	1	2306.83						
						24FEB95	G2	R5493	1	2307.51						
						01MAR95	G2	R5490	1	2326.36						
						02MAR95	G2	R5491	1	2325.15						
						01MAR95	G2	R5488	1	2342.71						
						02MAR95	G2	R5488	2	2347.65						
						01MAR95	G2	R5489	1	2349.49						
						30MAR95	G2	R5486	1	2401.26						

TITRATION SYSTEM:

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BOTTLE TYPE:

FLAGS:

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Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SYST	SAMPLE BOTTLE	TRIAL	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK	BOTTLE DELTA	"NISKIN" AVG	SIO ALK	SIO -S.I.O.
												(μ EQUIV/KG SW)				
					30MAR95	G2	R5487	1		2397.76		2397.76	-3.50	2399.51	2400.53	1.02
					06APR95	G2	R5484	1		2416.51		2416.51				
					07APR95	G2	R5485	1		2408.22		2408.22	-8.29	2412.36	2412.91	0.55
					04APR95	G2	R5482	1		2419.91		2419.91				
					04APR95	G2	R5483	1		2421.17		2421.17	+1.26	2420.54	2424.44	3.90
2	1-30N	1	6	2900	13OCT92											
75	164-59E				19JAN95	G2	R5502	1		2420.88		2420.88				
					19JAN95	G2	R5503	1		2421.66		2421.66	+0.78	2421.27	2425.16	3.89
2	0-0N	1	36	10	14OCT92											
78	165-0E				20MAY94	G	R5528	1		2284.15		2284.15				
					20MAY94	G	R5529	1		2280.59		2280.59	-3.56	2282.37	2285.54	3.17
					09FEB94	V	R5526	1		2275.65		2275.65				
					09FEB94	V	R5527	1		2273.88		2273.88	-1.77	2274.76	2286.32	11.56
					09FEB94	V	R5524	1		2295.81		2295.81				
					09FEB94	V	R5525	1		2294.41		2294.41	-1.40	2295.11	2308.16	13.05
					09FEB94	V	R5522	1		2290.72		2290.72				
					09FEB94	V	R5523	1		2284.32		2284.32	-6.40	2287.52	2310.53	23.01
					09FEB94	V	R5520	1		2300.61		2300.61				
					09FEB94	V	R5521	1		2298.22		2298.22	-2.39	2299.42	2311.09	11.67
					08FEB94	V	R5518	1		2302.07		2302.07				
					08FEB94	V	R5519	1		2307.80		2307.80	+5.73	2304.94	2318.62	13.68
					08FEB94	V	R5516	1		2325.34		2325.34				
					08FEB94	V	R5517	1		2323.65		2323.65	-1.69	2324.50	2330.46	5.96
					08FEB94	V	R5514	1		2352.75		2352.75				
					08FEB94	V	R5515	1		2350.51		2350.51	-2.24	2351.63	2362.64	11.01
					01FEB94	V	R5512	1		2381.60		2381.60				
					01FEB94	V	R5513	1		2379.40		2379.40	-2.20	2380.50	2391.25	10.75
					01FEB94	V	R5510	1		2406.59		2406.59				
					01FEB94	V	R5511	1		2410.56		2410.56	+3.97	2408.58	2412.67	4.09
					01FEB94	V	R5508	1		2410.89		2410.89				
					01FEB94	V	R5509	1		2411.44		2411.44	+0.55	2411.17	2422.39	11.22

TITRATION SYSTEM:

G = GRAVIMETRIC
V = VOLUMETRIC

BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

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3s: Bottle delta larger than 3s criteria

Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT. LONG.	CAST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	TITR SYST	BOTTLE	TRIAL	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK	BOTTLE DELTA	"NISKIN" AVG	SIO ALK	SIO -S.I.O.
2	1-30S	1 36	10	15OCT92	21SEP93	V	R5506	1		2414.62						
					21SEP93	V	R5506	2		2415.82	+1.20	2415.22				
					21SEP93	V	R5507	1		2413.43						
					21SEP93	V	R5507	2		2413.97	+0.54	2413.70	-1.52	2414.46	2421.41	6.95
					05MAY93	V	R5532	1		2265.80						
					05MAY93	V	R5532	2		2268.24	+2.44	2267.02				
					05MAY93	V	R5533	1		2268.33						
					05MAY93	V	R5533	2		2267.98	+2.95	2266.51	-0.51	2266.77	2270.35	3.58
					05MAY93	V	R5530	1		2414.24						
					05MAY93	V	R5530	2		2417.78	+3.54	2416.01				
2	2-48S	1 35	25	16OCT92	05MAY93	V	R5534	1		2421.18						
					05MAY93	V	R5534	2		2422.74	+1.56	2421.96	+5.95	2418.99	2422.57	3.58
					16JUN94	G	R5551	1		2279.10		2279.10				
					01JUL94	G2	R5551	2	X	2275.15						
					16JUN94	G	R5552	1		2280.36		2280.36				
					01JUL94	G2	R5552	2	X	2273.66			+1.26	2279.73	2281.51	1.78
					20MAR95	G2	R5549	1		2317.15		2317.15				
					20MAR95	G2	R5550	1		2316.31		2316.31	-0.84	2316.73	2319.99	3.26
					13MAR95	G2	R5547	1		2307.04		2307.04				
					13MAR95	G2	R5548	1		2306.37		2306.37	-0.67	2306.71	2308.85	2.14
2	1-24	1 24	400		10MAR95	G2	R5545	1		2301.13		2301.13				
					13MAR95	G2	R5546	1		2299.86		2299.86	-1.27	2300.50	2302.22	1.72
					10MAR95	G2	R5543	1		2308.01		2308.01				
					10MAR95	G2	R5544	1		2309.80		2309.80	+1.79	2308.91	2310.89	1.98
					07FEB95	G2	R5541	1		2351.36		2351.36				
					07FEB95	G2	R5542	1		2348.76		2348.76	-2.60	2350.06	2352.23	2.17
					06FEB95	G2	R5540	1		2384.74		2384.74				
					06FEB95	G2	R5555	1		2387.47		2387.47	+2.73	2386.10	2387.08	0.98
					06MAR95	G2	R5537	1		2412.49		2412.49				
					06MAR95	G2	R5538	1		2412.81		2412.81	+0.32	2412.65	2415.05	2.40
2	1-4	1 4	2800		06MAR95	G2	R5535	1		2419.16		2419.16				

TITRATION SYSTEM:

G = GRAVIMETRIC

V = VOLUMETRIC

BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria

Table B.2 (continued)

THE CARBON DIOXIDE PROJECT OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY
CGC92 Legs 1 & 2 WOCE Line P13C

SUMMARY OF ALKALINITY DATA (cont.)

LEG STN	LAT. LONG.	CST NISK	DEPTH (M)	SAMPLE DATE	ANALYSIS DATE	FTTR SYST	BOTTLE TRIAL	FLAG	S.I.O. TRIAL	TRIAL DELTA	BOTTLE ALK	BOTTLE DELTA	"NISKIN" AVG	SIO ALK	SIO -S.I.O.
2	4-22S	1 32	10	17OCT92	07MAR95	G2	R5536	1	2419.26		2419.26	+0.10	2419.21	2422.97	3.76
87	164-11E				02NOV94	G2	R5572	1	2285.43		2285.43				
					02NOV94	G2	R5573	1	2283.04		2283.04	-2.39	2284.24	2282.94	-1.30
		1 30	50		29MAR95	G2	R5570	1	2282.00		2282.00				
					30MAR95	G2	R5571	1	2281.18		2281.18	-0.82	2281.59	2285.04	3.45
		1 28	100		21MAR95	G2	R5568	1	2310.84		2310.84				
					21MAR95	G2	R5569	1	2311.69		2311.69	+0.85	2311.27	2314.34	3.07
		1 24	200		17MAR95	G2	R5566	1	2340.45		2340.45				
					20MAR95	G2	R5567	1	2339.63		2339.63	-0.82	2340.04	2344.66	4.62
		1 19	400		17MAR95	G2	R5564	1	2301.95		2301.95	+0.90	2302.40	2304.99	2.59
					17MAR95	G2	R5565	1	2302.85		2302.85				
		1 16	600		06APR95	G2	R5562	1	2317.10		2317.10				
					06APR95	G2	R5563	1	2311.52		2311.52	-5.58	2314.31	2317.47	3.16
		1 10	900		20MAR95	G2	R5560	1	2339.24		2339.24				
					21MAR95	G2	R5574	1	2338.53		2338.53	-0.71	2338.89	2341.40	2.51
		1 7	1200		01MAR95	G2	R5558	1	2361.45		2361.45				
					01MAR95	G2	R5559	1	2362.46		2362.46	+1.01	2361.96	2368.76	6.80
		1 5	1600		28FEB95	G2	R5556	1	2389.61		2389.61				
					28FEB95	G2	R5557	1	2390.10		2390.10	+0.49	2389.86	2396.27	6.41
		1 3	2000		16MAR95	G2	R5553	1	2404.14		2404.14				
					17MAR95	G2	R5554	1	2402.40		2402.40	-1.74	2403.27	2412.77	9.50

TITRATION SYSTEM:

G = GRAVIMETRIC

V = VOLUMETRIC

BOTTLE TYPE:

R = 0.5 LITER PYREX P = 1 LITER PYREX

NOTE: Dilution factor of 1.000170 has been applied.

FLAGS:

X: Analytical flag

EX: Data excluded from statistical analysis

3s: Bottle delta larger than 3s criteria