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UNIV. OF HAWAII

Progress Report
(1993)

Measurement of DIC, Alkalinity and pH of the WOCE/HP Cruises

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Overview

During the first year in which we have received funding from the Department of Energy, we have set up the laboratory to make measurements on the WOCE-HP survey and we have participated in one transect cruise.

Instrumentation and Analytical Methods

During the early part of 1993, we have developed the methodology and assembled the instrumentation necessary to make inorganic carbon measurements on the WOCE/HP cruises. We have developed a spectrophotometric system for the measurement of pH. This approach to the measurement of pH in seawater has gained favor in recent years because it avoids the problems inherent in the use of potentiometric electrodes. The system we have developed, is computer controlled and has a specially designed cell holder for maintaining temperature at 25° Celsius. We have also become familiar with the closed cell titration techniques for the measurement of total alkalinity, and have intercalibrated this procedure with the standard open cell techniques used in our laboratory to ensure analytical consistency. We have adopted the closed-cell approach for use on the WOCE lines, as opposed to our standard open-cell methodology in order to be consistent with the other laboratories participating in the WOCE/HP inorganic carbon survey. Although we were able to use the closed titration cells constructed in Dr. Frank Millero's laboratory on our first WOCE leg, we are in the final stages of assembling our own closed-cell system for use on future WOCE cruises. This system is comprised of two closed cells, in order to speed sample analysis and is computer controlled in order to provide for maximum analytical precision. We have also received a Department of Energy SOMMA in May of this year and have become familiar with this rather complex instrument. This instrument was successfully used on our first WOCE leg in July and August on 1993.

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Field Work

We recently participated in WOCE P-14N on the R/V Thomas G. Thompson. This WOCE leg extended across the Bering Sea and across the center of the North Pacific Ocean along 180° W. The cruise departed Dutch Harbor in the Aleutian Islands on July 5th, and arrived in Tarawa in the Equatorial Pacific on August 10th. All four carbon system parameters were measured on this cruise. These measurements included total dissolved inorganic carbon, titration alkalinity, spectrophotometric pH. These measurements were made on discrete samples collected from water sampling bottles attached to the CTD rosette system. Samples were collected for these measurements over the entire water column. In addition to these parameters, we also measured pCO₂ in the surface ocean and in the marine boundary layer was measured using an automated continuous sampling device. To our knowledge, this is the first WOCE line on which all four carbon system parameters have been measured. On the basis of the analysis of certified standard materials at sea, the quality of the data obtained on this leg was quite good (Figures 1 and 2). Contour plots of total dissolved carbon, titration alkalinity and pH for the transect down 180° W are shown in Figures 3-5. As of this writing, we have not received the "final" physics data for this transect for the Scripps Oceanic Data Facility (ODF). The contour plots attached may change slightly when the quality controlled physics data is received from ODF. However, the major features observed in these plots will not be altered significantly. We anticipate receiving the final data from the Scripps group within a week or two. When these data arrive, we should be able to complete our internal quality control work and submit these data to CDIAC.

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CRI Results WOCE P-14

Figure 1. DIC versus analysis number for certified reference material run on the SORNA during WOCE section number p-14.

WOCE P-14 Alkalinity System A & B CCMs

Figure 2. As in Figure 1 except for total alkalinity. Two separate closed cells (A & B) were used on this cruise. The offset in cell A at analysis number 15 was caused by a change in cell volume as a consequence of a broken-electrode.

Figure 3. Contour plot of DIC versus latitude for WOCE section number P-14.

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