FRANKLIN CRUISES FR 5/92
DATA DOCUMENTATION
JGOFS WESTERN EQUATORIAL PACIFIC PROCESS STUDY

[1] General:

Parameter:	Sea surface fugacity of carbon dioxide
Level 1:	Yes
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List of Parameters:	date, time, latitude, longitude, sea surface temperature, salinity, atmospheric pressure, fCO2
List of Units:	dd/mm/1992, UTC, decimal degrees, decimal degrees, degrees centigrade, psu, hectopascals, microatmospheres

[2] Sampling:

Gear (e.g. CTD, pump, etc.):	seawater intake at about 4m depth
Standard Depths:	
Chemicals used:	None
Special Procedures:	See below
Comments and Notes:	See below

3] Analysis:

Instrument:	Licor 6252 NDIR
Method:	1 second data averaged over 5 minutes.
Precision:	estimated precision +/- 2 microatmospheres
Comments:	Copin-Montegut warming correction applied.

[4] Results:

Quality of Data:	See precision notes above.
Known Problems:	Problems with low water flow rates and excessive temperatures in the laboratory caused the loss of some data.

[5] Brief description of analytical method:

The fCO_2 measuring system is based on a half size "Weiss" type equilibrator and a LICOR 6252 Infrared Gas Analyser. Seawater is sprayed into the equilibration chamber at a flow rate of 6-8 litres/min. Gas from the equilibrator headspace was circulated in a loop between the equilibrator and infrared gas analyser at a flow rate of about 400ml/min. The equilibrator was vented to the atmosphere. The gas was dried using magnesium perchlorate prior to flowing into the infrared gas analyser.

All data were recorded as five minute averages of one second readings. The system was calibrated using two CO_2-in-air standards, which were analysed for 10 minutes each. Clean outside air, pumped from the ship‘s bow was analysed for another 10 minutes immediately after the CO2-in-air standards. Headspace gas was analysed over 5 minute intervals between running standards and air. The CO_2-in-air standards had mole fractions (dry air) of 367.5 and 318.2 ppmv. The CO_2-in-air standards were referenced to the WMO X-85 molar scale and were calibrated before and after use at CSIRO Atmospheric Research, Melbourne.. The first 5 minutes of data were discarded each time the gas stream was switched to ensure the gas lines in the system were well flushed.

The pressure in the infrared gas analyser was monitored continuously and the output for the standards, air and water samples were all normalised to the same pressure. The pressure difference between standards and sample was typically about 3 hPa. The mole fraction of CO_2 in the equilibrator headspace gas and outside air was converted to CO_2 fugacity using the equations of Weiss (1974), assuming the gas was saturated with respect to water vapor at the temperature of the water-air interface. The vapor pressure of water (pH_20) is calculated after Weiss and Price (1980).

The surface water fCO_2 data were corrected for the effect of warming the sample between the seawater intake and the equilibrator according to Copin-Montegut (1988) and Copin-Montegut (1989). Sea surface temperatures were recorded at the seawater intake and the equilibrator using 4-wire platinum resistance thermometers. Both sensors were calibrated to an accuracy and precision of better than ±0.03°C.

[6] Comments:

The Franklin was poorly set up for analysing gases in seawater. The warming between the intake and equilibrator was generally less than 0.5°C due to a poorly ventilated lab and warm surface seawater. The overheated lab restricted condensation of water in the tubing circulating headspace gas between the equilibrator and NDIR. However, some data was lost when condensation needed to be cleared from the gas lines.

The data presented that was used in:

Mackey, D. J., Parslow, J. S., Griffiths, F. B., Higgins, H. W. and Tilbrook, B. (1997) Phytoplankton productivity and the carbon cycle in the western equatorial Pacific under ENSO and non-ENSO conditions. *Deep-Sea Research,* **44**, 1951-1978.