

**FRANKLIN CRUISES FR 8/90, 5/92 AND 8/93  
DATA DOCUMENTATION  
JGOFS WESTERN EQUATORIAL PACIFIC PROCESS STUDY**

**[1] General:**

Parameter: Surface pH  
Level 1: <Yes >  
Principal Investigator: Denis Mackey  
Institute Address: CSIRO Division of Marine Research  
E-Mail Address: Denis.Mackey@marine.csiro.au

List of Parameters: pH  
List of Units: Synthetic seawater, 'free' hydrogen ion concentration

**[2] Sampling:**

Gear (e.g. CTD, pump, etc.): Oceandata Thermosalinograph.  
Standard Depths: Intake at 3 m  
Chemicals used: Hansson Buffers  
Special Procedures: Water taken from thermosalinograph via a T-connection. Flow was controlled at 500 ml min<sup>-1</sup> by a peristaltic pump. pH electrode output (mV) and seawater temperature were logged at 1 sec intervals and stored as 1 min averages  
Comments and Notes: Electrode calibrated daily against Hansson buffers which were made up every 1-2 days

**3] Analysis:**

Instrument: Ross electrode (Orion 81-03SC), Radiometer PHM 85 pH meter with temperature probe T801. In-house flow cell fitted with a pulse dampener and Pt earth for seawater.

Method: See Mackey et al., Deep-Sea Research 42, 499-533, 1995.

Precision: Estimated as 0.001, accuracy estimated as 0.007

Comments: Electrode drift was taken into account by fitting a linear (FR08/90) or cubic (FR05/92 and FR08/93) regression line to the emf. On FR08/93, two Ross electrodes were used and the RMS difference between them was 0.004. The temperature response of the Ross electrodes in seawater and in buffers were determined pre-cruise. The pH was

calculated at the thermosalinograph temperature according to the method of Fuhrman and Zirino, *Deep-Sea Research*, 35, 197-208, 1988.

#### **[4] Results:**

Quality of Data: On FR05/92, the difference between pCO<sub>2</sub> calculated from the pH and direct measurements had an RMS difference of  $\pm 8 \mu\text{atm}$ .

Known Problems:

#### **[5] Brief description of analytical method**

Mackey, D. J., Higgins, H. W., Mackey, M. D. and Holdsworth, D. (1998) Algal class abundances in the western equatorial Pacific: estimation from HPLC measurements of chloroplast pigments using CHEMTAX. *Deep-Sea Research*, **45**, 1441-1468.

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.

#### **[6] Comments:**

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DATA DOCUMENTATION  
JGOFS WESTERN EQUATORIAL PACIFIC PROCESS STUDY**

**[1] General:**

Parameter: Surface pCO<sub>2</sub>  
Level 1: <Yes >  
Principal Investigator: Denis Mackey  
Institute Address: CSIRO Division of Marine Research  
E-Mail Address: Denis.Mackey@marine.csiro.au

List of Parameters: pCO<sub>2</sub>  
List of Units: μatm

**[2] Sampling:**

Gear (e.g. CTD, pump, etc.): Oceandata Thermosalinograph.  
Standard Depths: Intake at 3 m  
Chemicals used: Hansson Buffers for pH measurement  
Special Procedures: Water taken from thermosalinograph via a T-connection. Flow was controlled at 500 ml min<sup>-1</sup> by a peristaltic pump. pH electrode output (mV) and seawater temperature were logged at 1 sec intervals and stored as 1 min averages  
Comments and Notes: Electrode calibrated daily against Hansson buffers which were made up every 1-2 days

**3] Analysis:**

Instrument: Ross electrode (Orion 81-03SC), Radiometer PHM 85 pH meter with temperature probe T801. In-house flow cell fitted with a pulse dampener and Pt earth for seawater.

Method: Since the surface waters were always nutrient depleted, we calculated the alkalinity from the salinity and a specific alkalinity of 0.1194 (Skirrow in Chemical Oceanography, Riley and Skirrow editors, Academic Press, London, 1975). The pCO<sub>2</sub> was then calculated from pH and alkalinity using the carbonic acid constants of Goyet and Poisson (Deep-Sea Research, 36, 1635-1654, 1989), the boric acid constants of Hansson (Acta Chemica Scandinavica, 27, 924-939, 1973; Deep-Sea

Research, 20, 461-478, 1973; Almgren et al., Deep-Sea Research, 22, 635-646, 1975) and the CO<sub>2</sub> solubility data of Weiss (Marine Chemistry, 2, 203-215, 1974; Skirrow, In Chemical Oceanography, Riley and Skirrow editors, 1-192, 1975)

Precision: estimated as 1  $\mu$ atm, accuracy estimated as 8  $\mu$ atm  
Comments: pCO<sub>2</sub> was calculated from 5 minute averages of the pH

#### **[4] Results:**

Quality of Data: On FR05/92, the difference between pCO<sub>2</sub> calculated from the pH and direct measurements had an RMS difference of  $\pm$  8  $\mu$ atm.

Known Problems:

#### **[5] Brief description of analytical method**

Mackey, D. J., Higgins, H. W., Mackey, M. D. and Holdsworth, D. (1998) Algal class abundances in the western equatorial Pacific: estimation from HPLC measurements of chloroplast pigments using CHEMTAX. *Deep-Sea Research*, **45**, 1441-1468.

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#### **[6] Comments:**