

Franklin Cruise FR 9008
Data Documentation
JGOFS Western Equatorial Pacific Process Study

[1] General

Parameters	Concentrations of total dissolvable cadmium, copper and nickel.
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List of Units	nmol kg ⁻¹

[2] Sampling

Gear	Samples were collected using Teflon coated General Oceanics Niskin bottles (10 litre) fitted with Teflon (PTFE) taps, Kel-F bleed valves, and silicone O-rings and closures.
Locations	5°N 155°E, 0° 155°E, 5°S 155°E at 16 depths from the surface to 3451 m (5°N), 2520 m (0°) and 3275 m (5°S).
Sampling Procedure	The GO bottles were cleaned with 2.5% Extran, rinsed with Milli Q and filled with 10% HNO ₃ for a week. They were then rinsed with Milli Q water and stored in polyethylene bags until they were deployed on the CTD. All Teflon fittings were acid cleaned.

Plastibrand LDPE sample bottles (1 L) were soaked in 2.5% Extran for a week, rinsed with Milli Q water, acid-cleaned for 20 hours with boiling quartz-distilled 6 M HCl in an Ausdampf cleaning apparatus and rinsed again with Milli Q water. The bottles were stored in polyethylene bags / tote boxes. Gloves were used for all sampling procedures.

The CTD was equilibrated at depth for about 5 minutes then lowered at 10 m min⁻¹ and fired after 30 sec so that samples were collected approximately 5 m below the initial depth. The Niskin bottles were removed from the CTD rosette, mounted on the outside of a portable clean laboratory, fitted with powder-coated stainless steel clamps and pressurised to 7 psi with 0.2 µm filtered air supplied by a small pump (Millipore). Teflon lines and taps (PTFE) were connected to the taps of the bottles. The lines were passed through ports into a laminar flow clean cabinet inside the clean laboratory where the samples were collected.

[3] Analysis

Instrument	Perkin Elmer Zeeman 5000
Method	GFAAS after extraction of DDDC/APDC complexes into Freon TF and back extraction into HNO ₃ (see details below).
Precision	Estimated to be ≈ 10%
Comments	The cleaning of the GO bottles and sample bottles (Ausdampf apparatus) was done in a general laboratory. All other cleaning of reagents and equipment, analyses and sample manipulations were performed in a Class 100 clean laboratory using standard ultra-clean procedures. All sample bottles, reagent bottles, separating funnels etc were made from Teflon or LDPE.

[4] Results

Quality of data	Blanks were measured at all stages of the procedure and the detection limits (3 × standard deviation of blanks) were Cd (0.005 nmol kg ⁻¹), Cu (0.27 nmol kg ⁻¹) and Ni (0.59 nmol kg ⁻¹). Replicate analyses were performed for all ‘anomalous’ results and the data were verified by analyses of NASS certified reference materials at the beginning and end of all of the analyses.
Known problems	Samples were also analysed for iron but the data are considered unreliable since there was considerable scatter in the data.

[5] Brief description of analytical method

On returning to Hobart, the samples were acidified with 1 ml of HCl (sub-boiled in an all Teflon apparatus) and stored for at least 3 months before being analysed. A subsample (50 ml) was adjusted to pH 4-5 by the addition of NH₄OH followed by an ammonium citrate buffer. Trace metals in the subsample were then complexed by adding 0.3 ml of a solution containing 1% (w/v) each of diethylammonium diethyldithiocarbamate (DDDC) and ammonium pyrrolidinedithiocarbamate (APDC), extracted into 10 ml of quartz-distilled Freon TF (1,1,2 trichloro- 1,2,2 trifluoroethane) and back extracted with 25 µl of concentrated Seastar HNO₃ followed by 1 ml of Milli Q water. The dilute HNO₃ extract was then analysed for Cd, Cu and Ni by GFAAS. The NH₄OH (≈ 6 M) was prepared by diffusion of NH₃ from concentrated NH₄OH into Milli Q water in a closed container. The mixed dithiocarbamate reagent was cleaned by repeated extraction with Freon. The citrate buffer was cleaned by adding a small amount of the DDDC/APDC reagent and extracting repeatedly with Freon. All reagents were cleaned until trace metal concentrations in the (DDDC/APDC)/Freon/HNO₃ extracts were negligible.

References

- Mackey, D.J., 1983. The strong complexing capacity of seawater - an investigation of south-eastern Australian coastal waters. *Marine Chemistry* 14, 73-87.
- Mackey, D.J., O'Sullivan, J.E., Watson, R., 2002. Iron in the western Pacific: a riverine or hydrothermal source for iron in the Equatorial Undercurrent. *Deep-Sea Research I* 49, 877-893.
- Mackey, D.J., O'Sullivan, J.E., Watson, R., XXXX. Trace metals in the western Pacific: temporal and spatial variability in the concentrations of Cd, Cu, Mn and Ni. *Deep-Sea Research I* – submitted.

[6] Comments

None