

**Dissolved Nickel – values in nmol/kg  
Consensus values ( $\pm$  1 std. dev.) for SAFe Reference Samples as of  
May 2013**

**SAFe S = 2.28  $\pm$  0.09 nmol/kg**

**SAFe D2 = 8.63  $\pm$  0.25 nmol/kg**

**SAFe D1 = 8.58  $\pm$  0.26 nmol/kg**

These above concentrations are considered to be the consensus values for the SAFe reference samples as of May 2013. There does not appear to be a significant difference between samples that were UV-oxidized or non UV-treated.

**Labs participating in the analysis of the SAFe reference samples to determine  
consensus values for dissolved Ni:**

**Mike Gordon/Kenneth Coale (MLML, U.S.)**

Dissolved Ni was concentrated by solvent extraction (Bruland et al., 1979) and subsequently analyzed by ICP-MS.

**Yoshiki Sohrin (U. Kyoto, Japan):**

Off line concentration using an EDTri-A-type chelating resin with subsequent analyses by ICP-MS using the method of Sohrin et al. (2008).

**Michael Ellwood (Australian National U, Australia):**

Dissolved Ni was concentrated by solvent extraction (Bruland et al., 1979) and analyzed by ICPMS.

**Peter Croot/Peter Streu (IMF/GEOMAR, Germany):**

Samples were analyzed by solvent extraction with DDC/Freon and ICP-MS according to the method described in Kremling and Streu (2001).

**Angie Milne/Bill Landing (FSU, U.S.):**

Off-line extraction using IDA Toyopearl AF-Chelate-650 M resin followed by analysis using isotope dilution ICP-MS (Milne et al. 2010).

**Pete Morton/John Donat/Bill Landing (ODU/FSU, U.S.):**

Use of 8-hydroxyquinoline chelating resin off-line with subsequent analysis by ICP-MS.

**Geoff Smith/Ken Bruland (UCSC, U.S.):**

On-line flow injection analysis of 4 ml of sea water using an EDTri-A-type chelating resin (Sohrin et al., 2008) followed by detection with ICPMS.

**Kristen Buck/Kathy Barbeau (SIO/UCSD, U.S.):**

Adsorptive cathodic stripping voltammetry on UV oxidized samples (Saito et al., 2004).

**Antonio Cobelo-Garcia (IIM-CSIC, Spain)**

Adsorptive cathodic stripping voltammetry on UV oxidized samples (Cobelo-Garcia et al., 2005).

**Dondra Biller/Ken Bruland (UCSC, U.S.):**

Off-line concentration using an EDTri-A-type chelating resin with subsequent analyses by ICP-MS (Biller and Bruland, 2012) based upon the method of Sohrin et al. (2008).

**Christian Schlosser and Eric Achterberg (Plymouth, UK)**

Off-line extraction using a WAKO chelating resin (Kagaya, 2009) followed by analysis on an Element XR ICP-MS. Samples were UV digested for 3 hours.

**Rob Middag and Ken Bruland (UCSC, US)**

Off-line extraction with Nobias PA-1 chelating resin and analysis on an Element XR ICP-MS (Middag et al., submitted).

**Maria Lagerstrom and Rob Sherrell (Rutgers University, US)**

On-line flow injection with a modified seaFAST system, the Nobias PA-1 resin, isotope dilution and ICP-MS detection.

## **References:**

1. Milne, A., W. Landing, M. Bizimis and P. Morton. Determination of Mn, Fe, Co, Ni, Cu, Zn, Cd and Pb in seawater using high resolution magnetic sector inductively coupled mass spectrometry (HR-ICP-MS). *Analytica Chimica Acta*, **665**: 200-207 (2010).
2. Biller, D.V. and K.W. Bruland. Analysis of eight trace metals in seawater using the Nobias-chelate PA-1 resin and magnetic sector inductively coupled plasma mass spectrometry. *Marine Chemistry*, **130/131**: 12-20 (2012).
3. Bruland, K.W., R.P. Franks, G. Knauer and J. Martin. Sampling and analytical methods for the determination of copper, cadmium, zinc, and nickel in seawater. *Analytica Chimica Acta*, Vol. **105**: 233-245 (1979).
4. Danielsson, L.G., B. Magnusson, and S. Westerlund. An improved metal extraction procedure for the determination of trace metals in seawater by atomic absorption spectrometry with electrothermal atomization. *Analytica Chimica Acta*, **98**: 47-57 (1978).
5. Kremling, K. and P. Streu. Behaviour of dissolved Cd, Co, Zn, and Pb in North Atlantic near-surface waters (30°N/60°W to 60°N/2°W). *Deep Sea Research I*, **48**(12): 2541-2567 (2001).
6. Saito MA, J.W. Moffett, and G.R. DiTullio. Cobalt and nickel in the Peru upwelling region: a major flux of labile cobalt utilized as a micronutrient. *Global Biogeochemical Cycles* **18**:GB4030 (2004).
7. Sohrin, Y., S. Urushihara., S. Nakatsuka, T. Kono, E. Higo, T. Minami, K. Norisuye, and S. Umetani. Multielemental determination of GEOTRACES key trace metals in seawater by ICP-MS after preconcentration using an ethylenediaminetriacetic acid chelating resin. *Analytical Chemistry*, **80**: 6267-6273 (2008).
8. Cobelo-Garcia, A., Santos-Echeandia, J., Prego, R., Nieto, O. Direct simultaneous determination of Cu, Ni and V in seawater using adsorptive cathodic stripping voltammetry with mixed ligands. *Electroanalysis*, **17**: 906-911 (2005).
9. Kagaya et al. A solid phased extraction using a chelate resin immobilizing ..., *Talanta*, **79**: 146-152 (2009).
10. Middag, R., K.W. Bruland and H.J.W. de Baar. GEOTRACES intercomparison of dissolved trace metals at the Bermuda Atlantic Time Series station. Submitted to *Limnology and Oceanography: Methods*.