

**Dissolved Cobalt – values in pmol/kg  
Consensus values ( $\pm$  1 std. dev.) for North Atlantic GEOTRACES  
Reference Samples as of May 2013**

**GEOTRACES GS =  $31.8 \pm 1.1$  pmol/kg**

**GEOTRACES GD =  $65.2 \pm 1.2$  pmol/kg**

These are considered to be the consensus values for the GEOTRACES Reference Samples as of May 2013. It is clear that a UV oxidation step is necessary to determine the total dissolved Co in the reference samples. Older data sets for dissolved cobalt where samples were not UV-oxidized prior to analysis are not accurate.

**Labs participating in the analysis of the North Atlantic GEOTRACES reference samples to determine consensus values for dissolved Co (listed in random order):**

**Rachel Shelley/Maeve Lohan (U. Plymouth, U.K.):**

Flow injection chemiluminescence method (Shelley et al., 2010) modified after Canizzaro et al. (2000). Modifications included UV-oxidation, use of IDA Toyopearl AF Chelate resin and an ammonium acetate conditioning and rinse step.

**Abigail Noble/Mak Saito (WHOI, U.S.):**

Adsorptive cathodic stripping voltammetry based upon modifications of Saito and Moffett (2000).

**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).

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

Off-line concentration using the Nobias PA-1 EDTriA-type chelating resin with subsequent analyses by ICP-MS (Biller and Bruland, submitted) based upon the method of Sohrin et al. (2008). The method entails an eight column manifold enabling eight separate ~ 40 mL samples to be processed simultaneously. The samples were UV oxidized for 1.5 hrs, amended with H<sub>2</sub>O<sub>2</sub> (final concentration of 10  $\mu$ M), and adjusted to pH 6.5 with ammonium acetate prior to the concentration step. The resin columns were rinsed with a weak ammonium acetate buffer at a pH of 6.5 and eluted with 3 mL of 1 N nitric acid for a concentration factor of ~12, with subsequent analyses by ICP-MS.

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

Samples were analyzed according to the method described in Kremling and Streu (2001). For the analysis of Cd, Co, Cu, Fe, Ni, Pb and Zn, 300–500 g portions of the samples were subjected to a dithiocarbamate–freon extraction modified from the procedure by Danielsson et al. (1978) implying maximum concentration factors of 500. The final extracts with the metals were measured by electrothermal atomic absorption spectrometry with Zeeman background correction (ETAAS; Perkin-Elmer Model 4100 ZL).

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

Off-line extraction using IDA Toyopearl AF-Chelate resin followed by analysis using ICPMS (Milne et al., 2010). Prior to extraction the samples (12 mL) were UV oxidized and buffered to pH ~6.2.

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

Concentrated by solvent extraction (Bruland et al., 1979) and analyzed by ICP-MS. 100 g seawater samples were buffered to a pH of 4.5 with purified ammonium acetate buffer. Purified ammonium pyrrolidinedithiocarbamate (PDC) and sodium diethyldithiocarbamate (DDC) were added to the samples which were then extracted twice by shaking following the addition of purified chloroform. The two chloroform extracts obtained were combined, acidified with nitric acid, shaken for 1 min and then diluted with purified water. Trace metal concentrations were determined by ICP-MS (820-MS Varian, Australia).

**Johann Bown/Marie Boye/David Nelson (IUEM, Univ. Brest, France)**

Measurement by flow injection using an IDA chelating resin and chemiluminescence detection (Shelley et al., 2010) 48 hours after UV oxidation step.

**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.

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