

Physical and chemical speciation of copper in the subarctic North Pacific

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Organic complexation of Cu controls the toxicity and bioavailability of Cu for marine microorganism. In this study, we determined the concentrations of Cu and its organic ligands in the soluble ($< 0.03 \mu\text{m}$) and dissolved ($< 0.2 \mu\text{m}$) phases in the western (CL-2), central (CL-5) and eastern (CL-16) part of the subarctic North Pacific during the GEOTRACES-Japan cruise GP02 in summer 2017.

Concentrations of total dissolved and soluble Cu ranged from 1.28 nM – 4.82 nM, and 0.47 nM – 2.75 nM, respectively. At both CL-2 and CL-16, soluble Cu accounted for 30%-100% of total dissolved Cu. The proportion of the soluble Cu fraction was low in surface waters, increased to maximum in the intermediate waters, and decreased slightly in deep waters. Up to two classes of organic ligands were detected in the surface and intermediate waters, and only one class of ligand was detected in deep waters. Concentrations of the stronger ligands (L_1) and weaker ligands (L_2) ranged from 1.02 nM – 2.95 nM, and 0.77 nM – 8.78 nM, respectively. The distribution of L_1 followed closely that of total dissolved Cu in the surface waters, but no clear trend was observed in the intermediate waters. At CL-2, L_1 mainly existed in the soluble phase, whereas for CL-16, soluble L_1 accounted for 50% - 100% of total dissolved L_1 . Concentrations of L_2 were relatively constant throughout the water column but elevated concentrations were detected in the surface waters of CL-5 and in the surface and intermediate waters of CL-16. On the other hand, there was a slight depletion of L_2 in the intermediate waters of CL-2.