Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30196

Dissolved copper concentration and isotopes in a 60°S–60°N meridional transect of the Pacific Ocean

SHUN-CHUNG YANG[1], DR. XIAOPENG BIAN, PH.D.[1], MR. ROBERT J. RAAD[1], ADAM ROSS[1], CATHERINE E ODENDAHL[1], NATHAN T. LANNING[2], MATTHIAS SIEBER[3], KUO-FANG HUANG[4], JAMES MOFFETT[1], JESSICA N. FITZSIMMONS[5], TIM M. CONWAY[3] AND SETH G. JOHN[1]

[1]University of Southern California
[2]Massachusetts Institute of Technology
[3]University of South Florida
[4]Institute of Earth Sciences, Academia Sinica
[5]Texas A&M University

Copper (Cu) is often considered as a “Goldilocks” element in marine chemistry. It is an essential micronutrient for phytoplankton, but can also be toxic at high concentrations. Understanding the role of Cu as a nutrient and toxin requires knowledge of the processes which control Cu availability in seawater. Here we analyzed dissolved Cu (dCu) and its isotopic composition (d65Cu) in seawater samples from a 60°S–60°N meridional transect of the Pacific Ocean. In the past, recovery of Cu from seawater has been hampered by strong complexation of Cu by ligands in samples, even after long periods of acidification. Here we addressed that issue by addition of hydrogen peroxide during sample storage.

Dissolved Cu increases with depth, from 0.3 to 4 nM between 60° and 20°S and from 0.4 to 6 nM between 20°S and 60°N. The Cu concentrations we measure are 20-40% higher than for previous studies which did not use hydrogen peroxide or UV treatment. Measured d65Cu mostly ranges from +0.3 to +0.6‰, a variability which isn’t much larger than our analytical uncertainty of ±0.07‰ (2SD). However, there are still two significant large-scale features can be recognized. First, d65Cu is negatively correlated with PO4 in the deep Pacific (>700 m) (Fig. 1). Second, variations in surface and subsurface d65Cu align closely with the distribution of water masses.

Compared to the previous studies on seawater without hydrogen peroxide treatment, which measured d65Cu near +0.65‰ in global deep oceans, our new dataset has lighter and more variable d65Cu (from +0.6 to +0.3‰). This suggests our method is accessing an inert Cu pool with low d65Cu which was not captured in earlier analyses.