Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.4851

Using chromium isotopes to study chromium cycling in the Eastern Tropical South Pacific oxygen deficient zones

TIANYI HUANG AND EDWARD ALLEN BOYLE

Massachusetts Institute of Technology

Presenting Author: tyhuang@mit.edu

The Eastern Tropical South Pacific (ETSP) is one of the largest oxygen deficient zones (ODZs) in the global ocean, thus is also a suitable region to study the redox processes of chromium (Cr). Filtered seawater samples of the ETSP were collected from GEOTRACES Eastern Tropical Pacific Transect (GP16). Frozen samples from two stations in the ODZ (79.2°W, 12°S; 94°W, 12°S) were analyzed for Cr(III) isotopes. The Cr(III) concentration ranges from 0.79 to 1.85 nmol/kg, accounting for 24% to 71% of the total dissolved Cr at the same depth. The Cr(III) has isotopic compositions ranging from -0.26‰ to 0.98‰. Both the highest Cr(III) concentration and heaviest Cr(III) occur in the upper core of the ODZ ($\sigma_\theta \sim 26.4$ kg/m^3). This density layer is also where the largest Cr depletion was observed when comparing ODZ stations to an oxic station (145°W, 10.9°S) in the western gyre. And the calculated scavenged Cr is isotopically lighter than the total dissolved Cr, with an average δ^{53}Cr difference between the scavenged Cr and Cr(III) being -0.03‰ (n=5). This implies that the isotopic fractionation of scavenging is small. We also found that the isotopic fractionation of Cr reduction in the ETSP is similar to that in the ETNP (-1.3 ± 0.1‰), as is reported in a recent study [1]. Another similarity between the two ODZs is the co-occurrence of Cr(III) maximum and other reduced species, such as Fe(II), iodide and nitrite [2]. This indicates that for both ETSP and ETNP, Cr reduction might be coupled with these redox species or microbial denitrification.

[1] Huang, T., Moos, S. B., & Boyle, E. A. (2021). Trivalent chromium isotopes in the eastern tropical North Pacific oxygen-deficient zone. *Proceedings of the National Academy of Sciences, 118*(8) e1918605118.

[2] Cutter, G. A., Moffett, J. W., Nielsdóttir, M. C., & Sanial, V. (2018). Multiple oxidation state trace elements in suboxic waters off Peru: In situ redox processes and advective/diffusive horizontal transport. *Marine Chemistry, 201*, 77-89.