Ni isotope fractionation associated with phytoplankton uptake in the Sth. Atlantic Ocean - is it significant?

C. ARCHER*[1], D. VANCE[1] , M. LOHAN[2]

[1] Inst. of Geochemistry and Petrology, Dept of Earth Sciences, ETH Zürich, CH (*corey.archer@erdw.ethz.ch)
[2] Ocean and Earth Science, National Oceanography Centre, University of Southampton, UK

In common with many of the transition metals, the isotopic composition of dissolved Nickel (Ni) in the oceans is heavier than known inputs [1]. Known outputs are close to or heavier than the dissolved pool in the oceans [2], requiring a corresponding light sink to balance the oceanic isotope budget. The oceanic cycles of many transition metals, including Ni, are dominated by biological uptake in the photic zone and regeneration at depth, as evidenced by depth profiles in the real ocean (e.g.[3]). Recent data [4] suggests that where dissolved Ni is depleted in the surface ocean it is accompanied by a shift in its isotopic composition towards heavier values, consistent with a the metabolic requirement of phytoplankton for Ni [5].

Here we report full vertical profile Ni data from samples collected as part of two UK-GEOTRACES S. Atlantic Ocean cruises along a transect at 40°S. At all stations, dissolved Ni displays an expected "nutrient-type" vertical profile with concentration decreasing from ~6-7 nM at depth to ~2 nM at the surface. This depletion is associated with an isotopic fractionation, with δ^{60}Ni increasing from a constant, homogenous deep ocean value below the thermocline to values ~0.45‰ heavier at the surface. The interpretation of this fractionation as a simple signature of phytoplankton uptake providing a light isotopic sink for Ni, is complicated however by two factors. Firstly, this isotopic pattern is not seen at all stations, with one station displaying no isotopic variation throughout the water column, despite similar concentration profiles. Secondly available Ni data in the oceans suggests a concentration minmum of ~2 nM, as seen here in the S. Atlantic, that is bio-*un*available. This suggests that virtually all of the available Ni is consumed by phytoplankton within the photic zone, and by inference the fractionation involved with this process is small. We explore this data within the wider context of the geochemical cycle of Ni in the ocean.

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