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Towards a better understanding of nickel cycling in the modern ocean: development of an automated chromatography method for Ni isotope analysis and the generation of a GEOTRACES Ni isotope dataset in the Pacific Ocean

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Nickel (Ni) is an important micronutrient for phytoplankton in the ocean, serving as the cofactor for many important enzymes, including those which influence the global carbon and nitrogen cycles. Within the past five years, Ni isotopes have been increasingly used as a powerful tool to study Ni cycling in the modern ocean, yet Ni cycling in the modern ocean is still not fully understood, and the issue of Ni isotope mass balance in the oceans is not resolved.

To facilitate Ni isotope studies and better understand Ni cycling in the modern ocean, here we develop an automated chromatography method for seawater Ni isotope analysis, and we present the Ni isotope data from the Pacific Ocean, from the recent US GEOTRACES GP15 cruise. The GP15 transect spanned from the southern coast of Alaska across the equator to Tahiti, crossing several regions of particular interest for Ni cycling. Near the Alaska continental margin, lower seawater δ^{60}Ni values were observed, probably indicating riverine input of Ni. Hydrothermal Ni inputs were observed near the Loihi hydrothermal vent associated with elevated ^{3}He, dFe, and dMn, though Ni enrichments were not associated with the distal South East Pacific Rise (SEPR). In the surface Pacific we observe the impact of biological Ni uptake on dissolved δ^{60}Ni, with the GP15 transect providing a unique opportunity to observe the isotopic imprint of seasonal Ni cycling at boundary between the oligotrophic gyre and the HNLC North Pacific, which was previously sampled in springtime [1]. In the deep Pacific Ocean, our data show the isotopic imprint of sedimentary Ni sources and sinks, providing a unique opportunity to see whether δ^{60}Ni increases along the flow path from the deep Atlantic to the deep Pacific, with important implications for understanding the global Ni isotope mass balance.

[1] A new purification method for Ni and Cu stable isotopes in seawater provides evidence for widespread Ni isotope fractionation by phytoplankton in the North Pacific, Yang et al. (2020), *Chemical Geology* 547, 119662.