Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11307

Nickel and zinc cycling in the Southern Ocean: insights from isotopes

NOLWENN LEMAITRE[1], HÉLÈNE PLANQUETTE[2], CATHERINE JEANDEL[3], MICHAEL ELLWOOD[4], CHRISTEL HASSLER[5] AND DEREK VANCE[1]

[1]ETH Zürich
[2]University Brest, CNRS, IRS
[3]CNRS (LEGOS)
[4]Australian National University
[5]Swiss Polar Institute, EPFL

Presenting Author: nolwenn.lemaitre@erdw.ethz.ch

Nickel (Ni) and zinc (Zn) are essential micronutrients for phytoplankton and directly influence the biological pump, but their biogeochemical cycles are not fully understood. In particular, both Ni and Zn are isotopically homogeneous in the deep ocean, but the drivers of contrasting variability in the upper ocean are still under debate. Recent studies have shown that photic zone Ni isotope fractionation only occurs in low latitude regions[1-4], consistent with minimal drawdown in the high latitude surface ocean[2]. The shift to heavier isotopes in low latitude photic zones may be related to the high Ni requirements of prokaryotes and the possible exhaustion of the bio-available pool[3-5]. In contrast, Zn shows dramatic drawdown in the Southern Ocean, but with very limited isotope variability[6]. Zinc is isotopically lighter in the upper 100m in the low latitudes only, driven either by scavenging of heavy Zn onto particles[7] or by the supply of light Zn from anthropogenic sources[8-9].

Here, we present new data from the Indian sector of the Southern Ocean for dissolved Ni (ACE cruise in 2017 and SWINGS cruise in 2021) and Zn (SWINGS cruise). Both studied areas traverse diverse biogeochemical and ecological zones from the subtropics to the Polar Front zone, and the regions of formation of different Southern Ocean water masses. Results from ACE show that the shift to heavier Ni isotopes (up to +1.63‰) in upper waters occurs in the sub-Antarctic zone, while values in the Antarctic Zone remain close to the deep ocean (~1.25‰). These two datasets also provide insights into sources and sinks (sediments, glaciers and the South West Indian ridge), in particular via high resolution sampling close to continental margins during SWINGS.

1. Takano et al. (2017) Analytica Chimica Acta 967, 1-11. **2**. Wang et al. (2019) Chemical Geology 511, 452-464 **3**. Archer et al. (2020) EPSL 535, 116118. **4**. Yang et al. (2021) GCA 309, 235-250. **5**. Lemaitre et al., in review, **6**. Sieber et al. (2020) GCA 268, 310-324. **7**. Weber et al. (2018) Science 80, 72-76. **8**. Liao et al. (2020) GBC 34, 1-18. **9**. Lemaitre et al. (2020) EPSL 539, 116216.