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The benthic flux of Ni from reducing environments: the example of the Baltic Sea

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Nickel (Ni) is an important bio-essential trace metal in the ocean, and an important component of several enzymes central to the global carbon, nitrogen, and oxygen cycles [e.g. 1–2]. The reactivity and isotope fractionation of Ni is strongly influenced by biological and redox-related processes in the ocean, giving the isotope system (expressed as δ^{60} Ni) some potential for studying past ocean environments [3]. This application, however, requires, an understanding of its modern oceanic budget and biogeochemical cycling. Like other similar bio-essential trace metals, Ni appears to show a major imbalance in its modern oceanic metal concentration and isotope budgets [e.g. 3–4], so that some sources and sinks of Ni to an from the ocean, as well as processes fractionating Ni isotopes, are currently not completely understood.

The benthic source of Ni to the dissolved pool is perhaps the least well understood, but potentially significantly impacts ocean metal budgets. In order to better understand mechanisms determining fluxes of Ni and its isotopes from the sediment-porewater system in reducing ocean settings, we present trace metal concentrations and Ni isotope data from porewaters of the shallow-water Kiel Bight, in the Western Baltic Sea. The porewaters just below the sediment-water interface vary from iron-reducing to sulfidic redox conditions in the different investigated cores. The data show a decrease in Ni concentration with depth beneath the sediment-water interface that appears to be correlated with phosphorous, consistent with release of Ni to porewaters from respired organic matter. Porewater Ni isotopes increase from around 0.5‰ at the top to up to 2.2‰ in the bottom of the cores. This suggests an isotopically heavy benthic Ni flux from these reducing sediments, one that could ultimately help to close the oceanic budget of Ni.

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