Marine sediments as a source of dissolved Nickel to the global ocean

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Nickel (Ni) is a micronutrient that is essential for marine life. The distribution of Ni in the marine environment reflects its cycling with the biological pump. In addition to organic matter, Ni cycling in seawater is influenced by the cycling of Fe and Mn oxides. These carrier phases thus have the potential to serve as either a source or a sink for Ni. Indeed, the oceanic budget of Ni requires a substantial recycled Ni component and our data indicate that marine sediment may be an important source of this Ni.

This study presents concentrations of Ni and other metals in pore fluids and sediments from study sites on the California and Mexican margin. Our results show variable Ni concentrations in pore fluids that range from typical bottom water concentrations (~15 nM) up to 2 μM. These elevated dissolved concentrations occur at locations of high and low bottom water oxygen concentrations. Diffusive flux calculations suggest that all sites investigated here are a benthic souce of Ni, with fluxes as high as 10 nmol cm^{-2} y^{-1}. Where pore fluid Mn concentrations are high (≈ 50 to 100 μM Mn), Ni concentrations are also high, suggesting metal oxides as a source of Ni to pore fluids. However, at the more reducing sites where there is little pore fluid Mn and Fe, but where C_{org} burial rates are high, we propose that high pore fluid Ni derives from a source other than amorphous oxides. Such potential sources are lithogenic mineral phases or organic matter. The resultant high Ni concentrations in pore fluids indicate that any authigenic phase discriminates against Ni during their formation and at least during the earliest phases of diagenesis.