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Observations on particulate metal stoichiometry and metal remineralization rates in the North Pacific Subtropical Gyre

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While trace elements such as iron (Fe), nickel (Ni), copper (Cu), zinc (Zn), and cadmium (Cd) contribute to essential functions among marine phytoplankton, they have fundamentally different chemical properties and exhibit variable stoichiometries throughout the oceans. Sinking and suspended particulate samples throughout the upper 300 meters of the water column were collected in the summer of 2021 during the SCOPE PARAGON I expedition in the North Pacific Subtropical Gyre using a broad range of techniques including the use of large-mouth Net traps, particle collection in traditional particle interceptor traps (PITs), and collection of suspended particles filtered directly from seawater. From these various samples, we report trace metal compositions and metal stoichiometries from six depths between 50 and 300 meters. At 150 meters, sinking particles exhibited the following metal:P ratios (all units reported as mmol/mol): Fe:P – 42.8, Zn:P – 4.4, Ni:P – 0.5, Cu:P – 0.3, Cd:P – 0.1. Suspended particles from 150 meters exhibited the following metal:P ratios: Fe:P – 309.0, Zn:P – 851.5, Ni:P – 6.9, Cu:P – 2.3, Cd:P – 0.2.

Further data will be presented on metal partitioning during remineralization of sinking and suspended particles from degradation incubations conducted with the same particles. From these incubations, metals have been partitioned into separate dissolved, adsorbed, and particulate phases. Preliminary data suggests metal uptake by heterotrophs below the deep chlorophyll maximum. We will highlight the role of adsorption of metals during the remineralization process and discuss its impact on metal cycling in the upper ocean.