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Characterizing Fe sources on the Alaska Margin and tracing their influence through the North Pacific along the GEOTRACES GP15 section

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The micronutrient iron (Fe) limits growth of phytoplankton over much of the surface ocean, especially in high-nutrient low-chlorophyll regions such as the subarctic North Pacific. However, the pathways by which Fe is supplied to North Pacific waters remain poorly understood. Dissolved stable isotope ratios of Fe (δ^{56}Fe) can help to distinguish key Fe sources, better understand the regional cycling of Fe and trace the influence of Fe on phytoplankton ecology in the chronically Fe-starved surface waters. Here, we present dissolved Fe and δ^{56}Fe data from the recent US GEOTRACES transect along 152°W (GP15) in the North Pacific, as well as insights on submarine groundwater discharge, riverine and shelf δ^{56}Fe endmembers from associated small boat campaigns on the Alaskan Shelf. Our data highlight the importance of sedimentary Fe sources on the Alaska Margin and their influence on the large-scale Fe and δ^{56}Fe distributions in the subarctic North Pacific. Coastal and shallow near-shelf waters (<500 m) exhibit elevated Fe and low δ^{56}Fe values (down to −1‰). The most striking feature however, is a large plume of isotopically light Fe occuring on the continental slope, similar to recent observations in the Southeast Pacific [1]. This slope plume extends south to ~30°N at intermediate depths (1000 - 2500 m), carrying a low δ^{56}Fe signature through the oxygen minimum zone into the waters of the subarctic North Pacific. In contrast, at depth (>3000 m), Fe released from sediments carries a crustal isotope signatue (~0.1‰), suggesting that this plume is separately sourced form the one above. Using the dissolved Fe and δ^{56}Fe data, in conjuction with particulate trace metal and δ^{56}Fe, dissolved Al, Mn and Ra isotope data, we aim to characterize the supply mechanisms of dissolved Fe governing each plume and identify the influence of sedimentary Fe release along the margin on the subarctic North Pacific.

[1] John et al., Mar. Chem. 201, 66-76 (2018).