Biogeochemistry of iron on the West Antarctic Peninsula continental shelf

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The West Antarctic Peninsula (WAP) is a dynamic region for the cycling of the marine micronutrient iron (Fe). Not only is the WAP a region of natural Fe fertilization, where continental Fe sources allow for primary production at rates well above that of the rest of the Fe-limited Southern Ocean, but the close proximity of the WAP shelf to the eastward flowing Souther Boundary front of the Antarctic Circumpolar Current allows for perhaps the highest potential of offshore transport of shelf-derived Fe into the greater Southern Ocean. However, until recently, the distribution of Fe on the WAP continental shelf was completely unknown.

Here we report the distriution of dissolved Fe (<0.2 μm) and its partitioning into soluble (<0.02 μm) and colloidal (0.02-0.2 μm) size fractions from 24 stations along the Palmer Long Term Ecosystem Research 3-D grid, extending from Anvers Island south to Charcot Island. Decreasing surface concentrations of dissolved Fe to <0.1 nM near the shelf-break will be placed in the context of +Fe incubations of natural phytoplankton communities in order to pair Fe delivery with observed biological Fe stress. Below the euphotic ocean, where dissolved Fe concentrations increased rapidly to concentrations as high as 5 nM inshore, dissolved Fe gradients across the pycnocline will be used to calculate Fe fluxes into the surface ocean from below. Additionally, linear increases in dissolved Fe concentrations toward the seafloor will be used to calculate Fe fluxes from sediments, which we hypothesize serve as a major source of Fe to the WAP. By pairing the size fractionated dissolved Fe data with the distributions of other dissolved metals (including Mn, Zn, Cu, Cd, Ni, and Pb), we aim to constrain the identity of Fe sources to the WAP and the potential for those sources to be transported offshore into the ACC. We will compare this with other Southern Ocean shelf regions, including the Ross Sea and the Amundsen Sea, where Fe sources have been found to be differentially sourced by sediments and glaciers, respectively.