BioFe delivery to the Southern Ocean through glacial systems

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Glacial systems transfer sediment, rich in essential nutrients and bioavailable iron (BioFe) from continental sources to the ocean through iceberg transport, resulting in Heinrich layers during deglacial phases. The Southern Ocean is currently nutrient-rich but iron limited, so any increase in continental sediment supply could enhance primary productivity in the Southern Ocean and ultimately drawdown atmospheric CO\textsubscript{2}; potentially limiting predicted global temperature rise. The contribution of continental sediments to this negative climate feedback loop, termed the ‘Fe hypothesis’ has yet to be considered in IPCC reports. As other sources of BioFe are decreasing, global temperatures are warming, and CO\textsubscript{2} levels are rising at glacial terminations it is now critical to assess BioFe flux through the glacial system. In this project, we use established laboratory procedures to extract nanoparticulate Fe from Antarctic sediments, recovered from nunataks, glacial moraines and debris bands in wind scoured blue ice areas in and around the Sør Rondans Mountains in East Antarctica (72°S, 24°E). These coastal margin mountains channelise ice (and entrained sediments) from the polar plateau towards the local Roi Baudouin Ice Shelf, at flow speeds of 30 – 60 m a\textsuperscript{-1}. Concentrations of FeA - comprising fresh ferrihydrite (potentially bioavailable) and FeD - comprising all remaining (oxyhydr)oxide Fe are reported at all sites, with elevated concentrations along nunataks that define the edges of deep subglacial valleys which support ice flows over 2 km thick. Terrestrial surveys of these nunataks, combined with ice penetrating radar data and numerical modelling studies show how these nutrient-rich sediments are entrained and transported through the ice, from continental Antarctica, to the Southern Ocean, where ice-influenced phytoplankton blooms have been reported.