Iron Sources for Marine Phytoplankton Growth

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Diatoms function as a biological pump taking up and transporting nutrients through the marine ecosystem, and sequestering a large amount of atmospheric carbon each year. Accounting for 40% of the 45-50 billion tons of organic matter generated annually by marine primary productivity, diatoms play and essential role in the global carbon cycle (Boyd & Ellwood 2010; Schroth et al. 2009). Diatom growth is limited in 25% of the ocean where chlorophyll levels are shockingly low despite high levels of the major nutrients (high nutrient low chlorophyll regions or HNLC regions) (de Baar et al. 2005). The control of iron over the quantity and distribution of global primary productivity has been demonstrated by experimental and observational studies. The John Martin Iron Hypothesis predicts that the fluxes of iron into HNLC regions from continental dust during global maxima produced phytoplankton blooms responsible for 25% of the drawn down in atmospheric CO_2 (Stigman & Boyle 2000). In this experiment we investigate how diatom growth responds to different types of iron, bound in different minerals and present at different oxidation states. Understanding how iron speciation and mineralogy affects the release and residence of iron in solution will generate a more concise image of how diatom growth will respond to different iron sources, and the metabolic processes related to iron uptake. The comparison of diatom growth across different iron types is intended as a preliminary investigation of whether more reactive forms of iron minerals characteristic of glacial outwash serve as a more suitable iron source in the Martin Iron Hypothesis than weathered iron oxides sources from arid regions.