Investigating trace metal nutrient co-limitation of marine phytoplankton growth

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Phytoplankton are responsible for the majority of primary production in the oceans and play a central role in global nutrient cycling. The availabilty of nutrients to these photosynthesising microbes limits their fitness and abundance, placing a critical control on the biological pump and the global carbon cycle. Nitrate and iron comprise the two predominant nutrient limiting regimes in the ocean, however phosphate, vitamins and other trace metals may frequently co-limit phytoplankton growth. Global observations have revealed regions with surface waters depleted in iron, zinc, cobalt, copper, nickel, and manganese, beyond minimum requirements for pytoplankton growth. The extent and spatiotemporal variability with which trace metal nutrient co-limitation influences marine productivity remains relatively unknown.

As different phytoplankton species have evolved alongside changing geochemical conditions, they have developed optimal growth requirements for concentrations of specific nutrients (Fig. 1.) Through laboratory culture experiments we hone in on these elemental 'sweetspots' for algae by mapping out physiological responses to changing elemental concentrations amongst key functional groups (coccolithophores, diatoms and cyanobacteria). We probe the potential for lesser scrutinised trace metals with known biological functions, such as manganese and cadmium, to co-limit phytoplankton growth in the oceans.

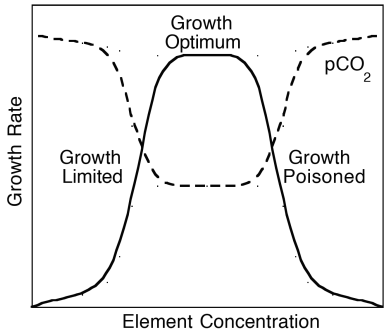

Figure 1: A theoretical dose-response curve for an organism and idealised influence on pCO2 of optimum growth