

Surface control of inorganic particulate iron solubility by the pennate diatom *Phaeodactylum tricornutum*

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Iron's limited bioavailability in the ocean results from the rapid hydrolysis and precipitation of dissolved iron (Fe) as stable Fe oxyhydroxides. Little is known about the interactions between diatoms and particulate-bound Fe, despite the ability of diatoms to survive for extended periods of time in Fe-limited regions of the ocean, and the dominance of diverse Fe particulates in the operationally-defined "dissolved" fraction of Fe in these regions. In previous work conducted by our lab, the pennate diatom *Phaeodactylum tricornutum* was observed to utilize Fe from highly insoluble Fe oxides just as efficiently as Fe from more soluble mineral and chelated Fe species. To isolate the effect of abiotic dissolution and dissolution mediated by small organics on this observation, we conducted culture experiments in defined, low-Fe Aquil media with dialysis bags impermeable to Fe colloids but permeable to highly bioavailable but highly unstable Fe hydrolysis products and typical Fe chelates. We found that laboratory cultures of the highly Fe-efficient *P. tricornutum* required close contact with both hematite (representing highly insoluble Fe oxides) and basalt (representing more soluble Fe silicates) to use them as an Fe source. Diffusion limitation was ruled out with consistent mixing of the cultures and the quick equilibrium of the dialysis bags. Since particulate-bound Fe promoted better growth than the control (no Fe added) only when the particles were allowed to come in close contact with the diatom surface, there is likely some degree of biological control on Fe mineral solubility that is independent of the bulk concentration of organic ligands, as these compounds were not added and would have passed freely through the dialysis membrane. An overview of similar experiments with natural aerosols sourced in Patagonia will also be presented, with a focus on the effect of the heterogeneous mineralogy of these colloids. The role of reductive dissolution by the diatom as a mechanism for this observation will be discussed, given X-ray spectroscopy-based evidence of speciation changes in colloids that were in contact with *P. tricornutum*.