Keep and touch – Dust and mineral iron utilization by the marine diazotroph *Trichodesmium*

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Oceanic blooms of *Trichodesmium*, a filamentous N_2 fixing cyanobacterium, provide ~50% of the new nitrogen sources to subtropical and tropical areas, fueling primary production and influencing nutrient flow and biogeochemical cycling of organic and inorganic matter. *Trichodesmium's* extensive surface blooms require large inputs of iron that are partly supplied by aeolian dust sources. Yet the processes and mechanisms associated with dust acquisition are currently poorly defined. Here we explore how natural populations and laboratory cultures of *Trichodesmium* collect, process, and utilize iron from synthetic iron oxides and desert dust. Using a combination of uptake and dissolution experiments with microscopic observations, we find that, similar to most phytoplankton, solid-phase iron has to dissolve prior to its acquisition by *Trichodesmium*. We show that, unlike other studied phytoplankton, *Trichodesmium* apply cell-surface processes that accelerate the rate of dissolution of iron from iron oxides and mineral dust particles, and thereby increase cellular iron uptake rates. Natural puff colonies are particularly effective in dissolving dust, probably due to efficient dust trapping by the intricate colony morphology, followed by active centering and packaging of the dust within the colony core (Fig. 1). Thus, colony formation in *Trichodesmium* provides an advantageous strategy for iron acquisition from particulate sources such as dust.

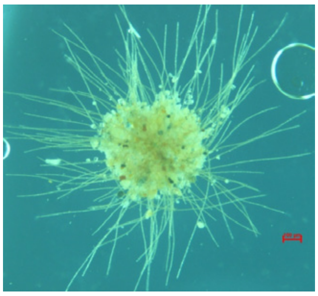

Figure 1: Active centering of dust by puff-shaped natural *Trichodesmium* colony, enabling it to dissolve and acquire iron from dust.

An experimental study on the effect of melt composition on partitioning behavior of copper in magmatic - hydrothermal systems

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Copper is one of the major ore metals in porphyry-type deposits. It has been proposed that metals in those deposits are magmatically derived. The essential feature of the magmatic-hydrothermal model is the separation of mental-rich aqueous fluid from silicate melt. Experimental studies on the partitioning of copper between granitic melt and aqueous fluids have demonstrated the importance of complexing agents, especially chloride, in the transport of copper. However, few experimental data are available concerning the role of melt composition in magmatic-hydrothermal process.

The present study was conducted to evaluate the effect of melt composition on the partitioning behavior of copper. We investigated experimentally the fluid/melt partitioning of copper in the systems synthetic haplogranite gel -H_2O-HCl at 1kbar, 850 °C with Ni-NiO buffer by using rapid-quench cold seal bombs. Experimental data show that the partition coefficient of copper $D_{Cu}^{fluid/melt}$ linearly increases with increasing HCl concentration. That agrees with results of other researchers, who interpreted this behavior as the result of the formation of CuCl complexes in the fluids. $D_{Cu}^{fluid/melt}$ show a strong melt compositon dependence, increasing from 1.28 to 10.09 with the molar $(Na_2O+K_2O)/Al_2O_3$ of melt varying from 1.56 to 0.83, and increasing from 1.35 to 22.18 with the molar Na/K of melt varying from 0.58 to 2.56. The data presented here suggest increasing partition of copper in peralkaline, especially K-rich, granitic melt phase. It implies that, like the fluids, the changes of melt composition also have great effects on the partitioning behavior of copper between aqueous fluids and silicate melt.