Attachment of the rock-inhabiting fungus *K. petricola* A95 to olivine enhances mineral dissolution by preventing the precipitation of iron (oxyhydr)oxides

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Free-living and mycorrhizal fungi enhance rock weathering, but the exact mechanisms of fungal-induced effects on the mineral dissolution are not well understood. Processes that happen in natural ecosystems are difficult to investigate but can be simulated by reproducible experimental models. Particularly attractive here are genetically amenable rock-weathering fungi, where certain traits can be knocked-out to identify weathering-relevant functions. Here, the effect of the rock-inhabiting fungus, *Knufia petricola* A95 on the dissolution kinetics of a Fe-bearing olivine (Fo90) was investigated at 25°C using batch and mixed flow experiments. The availability of a melanin-deficient mutant (Δ*Kppks*) of *K. petricola* A95, which produced more extracellular polymeric substances (EPS) than the wild type (WT), enabled the comparative study of the role of melanin and EPS in olivine dissolution.

In abiotic controls, the dissolution rate decreased considerably over time at pH 6 but not at pH 3.5. Precipitated Fe (oxyhydr)oxides formed on the surface of olivine, thereby inhibiting olivine dissolution. In corresponding biotic experiments at pH 6, both the WT and Δ*Kppks* solubilised and bound significant amounts of Fe released by olivine dissolution. Fe (oxyhydr)oxide precipitation was thus reduced and olivine dissolution proceeded faster than in the abiotic experiment. By taking up Fe directly at the olivine surface, the attached WT cells were particularly efficient at preventing Fe precipitation: the inhibition of olivine dissolution almost completely disappeared. The attachment capacity of these wild type cells is most likely caused by the production of WT-specific EPS. Our presented simulation systems allowed the precipitation of Fe (oxyhydr)oxides and included a rock-inhabiting fungus and thus simulated conditions that set dissolution rates in a way that is relevant to natural ecosystems.