Do fungi change the rate and Mg isotopic composition during mineral dissolution

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Mineral weathering at the Earth's surface provides nutrients for higher plants and generates element mass fluxes to rivers and oceans. An increasing number of studies highlight the importance of fungi in weathering processes. However, difference between the mass fluxes generated by biotically mediated weathering and the abiotic weathering are still poorly understood.

During weathering, metal stable isotopes are fractionated by both inorganic geochemical processes (early stage of dissolution, secondary mineral formation, etc) and biological processes (during uptake and translocation) [1]. To decipher the impact of abiotic and biotic processes associated with fungal weathering, we designed laboratory batch experiments. We chose the rock-inhabiting ascomycete *Knufia petricola* as a model fungal species, a solution with high glucose, K, N, P, Na and S as a nutrient source and the mineral olivine [$(Mg, Fe)_2SiO_4$] as a host rock.

Our results show that the presence of fungi *K. Petricola* enhances the release rate of both Mg and Si from the dissolving olivine when compared to abiotic control experiments. The steady state biotic dissolution rate was 1.2×10^{-11} mol/m^2/s, which is 15% higher than the abiotic rate. However, the δ^{26}Mg of the solution for both abiotic and biotic experiments was identical to the dissolving olivine after 30 days of experiment, consistent with kinetic models on abiotic olivine dissolution [2]. This has important implications for the application of Mg isotopes in weathering studies, as our result indicate that for both biotic and abiotic dissolution, the dissolved δ^{26}Mg constrain to the source rock signature at steady state.

[1] von Blanckenburg, F., et al. (2009). "Fractionation of metal stable isotopes by higher plants." *Elements* **5(6)**: 5.

[2] Maher, K., et al. (2016). "A spatially resolved surface kinetic model for forsterite dissolution. "*Geochimica et Cosmochimica Acta* **174**: 313-334.