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Impact of bacteria on Mg release and Mg isotope signatures during biotite weathering

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Interaction pathways between bacteria and silicate minerals can have implications for biogeochemical cycles and stable isotope geochemistry. However, there is no consensus yet on the relationships between bacterial silicate weathering and natural water chemical and isotopic composition. In order to investigate the potential impact of bacterial weathering on Mg release into aqueous phases, we have performed leaching experiments on phlogopite, in closed systems, using a Mg- and Fe- free Busnell-Hass mineral media, doped with glucose as the sole carbon source. The mineral media was diluted 10 times in order to mimic typical soil solution composition. For bio-leaching experiments, we have tested 3 types of chemoorganotroph bacterial strains (*Rhanella aquatilis, Pantoae agglomerans, and Agrobacterium radiobacter*), isolated from pine and wheat rhizosphere, and selected for their ability to weather silicates. On the other hand, chemical leaching experiments have been performed by adding nitric or citric acid to the sterile mineral media. Duration of the leaching experiments ranged between 6 and 13 days. Protons and organic acids produced by bacterial strains have been measured during the course of each experiment.

pH decreases significantly from 6.5 to 4-5 during the first 2 days of the experiments and then roughly stabilizes over time. In contrast, in all experiments, the fraction of released Mg is weak (0.2 to 0.7 per mill) but increases linearly with time. For *R. aquatilis* strain, which produces more organic acids than the two other strains, acetic and citric acid concentrations also increase linearly with time (by a factor of $\sim$5 in 6 days). Succinic and oxalic acid contents reach a plateau at $\sim$3 days. These results highlight a balance between acidolysis and complexolysis, the former predominating

during the first 2 days. For a given pH, more Mg is released in the presence of bacteria, when compared with nitric acid experiments. For pH$<$4.5, nitric acid and citric acid experiments yield similar dissolved Mg concentrations.

Preliminary isotope analyses indicate that δ^{26}Mg in the leaching solutions collected during and at the end of the experiments are close to the initial value of the phlogopite (δ^{26}Mg=-1 per mill $\pm$0.2 per mill). Only leaching experiments performed with *R. aquatilis* strain induce a slight enrichment in the light isotope ($\sim$-0.3 per mill) in the solution, suggesting a biotic effect that will be investigated.