Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.27165

Li and Mg adsorption onto oxi/hydroxides and associated isotope fractionation

JEAN-MICHEL BRAZIER, ANNA L. HARRISON, MARIE HAKIMI AND VASILEIOS MAVROMATIS

University of Bern

The removal of atmospheric CO_2 occurring during silicate weathering represents one of the key natural processes that regulates climate over long timescales. Continental weathering can be quantified using lithium and magnesium isotopes, because these isotopic systems can trace elemental sources and secondary processes. The combination of δ^7Li and δ^{26}Mg compositions of riverine waters reaching the oceans can provide valuable information on continental weathering processes such as (1) the balance between silicate and carbonate rock altered along the river catchment, or (2) the balance between primary rock dissolution and secondary mineral precipitation. However, numerous processes occurring within the critical zone apart from secondary mineral precipitation can potentially fractionate Li and Mg isotopes, but their effect on isotopic compositions remains poorly constrained. For example, adsorption onto oxi/hydroxides is an important element retention mechanism within soils that often generates isotope fractionation and can influence the elemental and isotope budget of river waters. The aim of this study is therefore to explore the adsorption behaviour of Li and Mg on oxi/hydroxides (vernadite (δ-MnO_2), gibbsite ($Al(OH)_3$), and ferrihydrite ($Fe^{3+}_{10}O_{14}(OH)_2$)) commonly encountered within soil environments, and to determine the Li and Mg isotope fractionation generated during adsorption. Adsorption experiments were conducted in batch reactors over a large range of initial cation concentration and pH, and with fixed ionic strength for each mineral investigated. The first results show a general tendency of increased adsorption of Li and Mg with increased pH. Interestingly, the magnitude of Mg isotope fractionation generated during adsorption seems to be related to the pH of the solution, with greater fractionation at higher pH. These results provide insights into additional processes controlling Li and Mg mobility and generating isotope fractionation that can ultimately affect the composition of river waters.