

Stable isotope fractionation during porous flow with fluid-solid reaction

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Chemical weathering of the crust plays a major part in global geochemical cycling by redistributing elements between Earth's surface reservoirs. On a geological time scale chemical weathering buffers Earth's climate as atmospheric CO₂ is consumed during the breakdown of silicate minerals and eventually stored as carbonates in the ocean. However there are fundamental problems in estimating chemical weathering fluxes and their climatic impact. These include distinguishing between silicate and carbonate sources of riverine dissolved loads, understanding the nature of element cycling along groundwater and river flow paths, and understanding the couplings between climate and chemical weathering rates.

We use a multi-proxy approach combining well established elemental methods and novel stable isotopic techniques to assess the importance and controlling parameters of silicate weathering in Himalayan River catchments. Lithium isotopes have been highlighted in recent years as they almost exclusively reflect silicate weathering and have been shown to correlate with weathering intensity (e.g., [1]). However, in order to understand the relationship between weathering intensity and lithium isotopic fractionation it is important to have appropriate physical models for the interaction of fluids and minerals in weathering environments.

Weathering reactions likely take place continuously within catchments with water flowing through a range of shallow to deep paths as rock is progressively exhumed through these flow paths. To model this it is necessary to consider how kinetically-limited fluid-mineral reactions will evolve along individual water flow paths and to understand the range of inputs to river systems. We present a simple one-dimensional transport reaction model to calculate Li-isotopic fractionation in a plausible weathering setting. The modelling reveals the key controlling parameters and predicts the isotopic evolution along the water flow paths.

[1] Huh, Chan & Edmond (2001) *Earth and Planetary Science Letters* **194**, 189-199.