

Li isotopes in inorganic carbonates – proxy-development for localized and global weathering

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We report D(Li) and α^7 carbonate-water from carbonate growth experiments in cave-analogue conditions in the laboratory, with growth of pure calcite, aragonite and high-magnesium calcite (HMC). Li isotopes respond significantly to weathering (e.g. [1]) and speleothem-Li is showing great promise for reconstructing local silicate weathering variation over short timescales, such as during glacial cycles [2]. A primary goal is to characterise the Li-response to temperature and growth rate, to check whether weathering signals are altered by these factors. We explore Li-fractionation more widely by comparing our results from different mineralogies with existing inorganic and biogenic fractionation factors. This can lead to more robust interpretations of global weathering reconstructions.

The experimental setup closely mimics natural processes (e.g. precipitation driven by CO_2 -degassing, low ionic strength solution, thin solution film) but with a tight control on growth conditions (temperature, pCO_2 , drip rate, calcite saturation index and solution chemistry) [3, 4]. $CaCO_3$ is dissolved in deionized water in a 20,000 ppmV pCO_2 environment, with trace-elements (Li, Na, Mg, Co, Sr, Cd, Ba, U) at appropriate concentrations to mimic natural solutions. Mg concentrations are used to control the growth mineralogy.

We see good agreement between aragonite and HMC datasets. There is agreement and disparities between the inorganic and biogenic calcites, with discussion of hypotheses for explaining the differences between data sets.

[1] Dellinger et al. 2015. Riverine Li isotopic fractionation in the Amazon River basin controlled by the weathering regimes. *Geochimica et Cosmochimica Acta*, **164**, 71–93. [2] Philip A.E. Pogge von Strandmann et al. (in review). Lithium isotopes in speleothems: Temperature-controlled variation in silicate weathering during glacial cycles. *EPSL*. [3] Day, C.C., & Henderson, G.M. 2011. Oxygen isotopes in calcite grown under cave-analogue conditions. *Geochimica et Cosmochimica Acta*, **75**, 3956–3972. [4] Day, C.C., & Henderson, G.M. 2013. Controls on trace-element partitioning in cave-analogue calcite. *Geochimica et Cosmochimica Acta*, **120**, 612–627.