Li isotopes as a probe for continental weathering and mineral growth processes

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The two lithium isotopes have a large relative mass difference and exhibit a range of isotope ratio of at least 50‰ in the surface earth environment [1]. The processes involved in chemical weathering are amongst the principle causes of this variability, particularly due to the preferential release of ^{7}Li during dissolution and secondary mineral growth at low temperature. The development of MC-ICP-MS techniques to provide quick and precise analysis of Li isotopes now allows this system to be readily applied to understand present and past weathering intensity.

I will summarize existing and new records of temporal Li-isotope variation which provide information about weathering changes at a global and catchment level. Global reconstruction is possible through the use of marine carbonates such as forams [2] and belemnites, with the latter providing information about changes in weathering regime across abrupt climate events in the Mezosoic. Records in speleothems may allow assessment of changes in the style of weathering at a catchment scale and I will present new results testing this potential from a cave in central China which test this application.

Any interpretation of past wethering intensity from a sedimentary archive also requires understanding of the controls on isotope fractionation associated with incorporation of Li into that archive. Because most records are captured in carbonates, I will also summarize recent work investigating the role of temperature, salinity [3], minerology, solution chemistry, and growth rate on the Li isotope composition of marine and freshwater carbonates.

References

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