Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.16242

Using experiments to interpret lithium isotope records of weathering and erosion across past climate events

DR. DAVID J WILSON[1], LONG-FEI GOU[2,3], GARY TARBUCK[3] AND PROF. PHILIP POGGE VON STRANDMANN[3,4]

[1]Dept of Earth Sciences, University College London
[2]Chang'an University
[3]London Geochemistry and Isotope Centre (LOGIC), Institute of Earth and Planetary Sciences, University College London and Birkbeck, University of London
[4]Institute of Geosciences, Johannes Gutenberg University Mainz

Presenting Author: david.j.wilson@ucl.ac.uk

Lithium (Li) isotopes are thought to be a powerful tracer for present and past silicate weathering, being sensitive to the balance between rock dissolution and secondary mineral formation, but largely independent of carbonate weathering and biological effects. Marine carbonate Li isotope records have therefore been applied to reconstruct past changes in chemical weathering and erosion across a range of timescales and periods. Past carbon cycle perturbations have been closely associated with both increases (e.g. Ordovician Hirnantian glaciation [1]) and decreases (e.g. Paleocene-Eocene Thermal Maximum [2]) in Li isotopes, of varying magnitudes, while there was also a secular evolution in Li isotopes from the Precambrian to the present-day [3].

While our understanding of the Li isotope systematics in modern systems is improving, the effects of lithology, grain size, and water/rock ratios have not yet been systematically explored. It could be speculated that differences in the Li isotope response to past weathering changes could be a function of such properties. To explore this possibility, we conducted a set of 'weathering-analogue' laboratory experiments, monitoring changes in element release and Li isotope fractionation over timescales of hours to years.

Here we will discuss our findings, in particular exploring the controls of lithology and grain size on the reaction rates, and the roles of lithology and water/rock ratios in determining the balance between Li sources and sinks. Ultimately, we hope such experiments will contribute towards a better understanding and quantification of past weathering changes, as recorded by Li isotope variability in the geological record.

[1] Pogge von Strandmann et al. (2017), *Geochemical Perspectives Letters* 3, 2.

[2] Pogge von Strandmann et al. (2021), *Science Advances* 7, eabh4224.

[3] Kalderon-Asael et al. (2021), *Nature* 595, 394-398.