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Developing rock dissolution and lithium separation method for Early Paleozoic sedimentary rocks of the Sino-Korean block.

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Silicate weathering exerts a fundamental control on long-term climate change by removing atmospheric CO_2 [1]. Lithium isotopes are known as a global weathering proxy because it is concentrated in silicate rather than carbonate minerals and is one of the very few elements that are not biologically fractionated [2]. For this reason, paleoclimate/paleo-environment studies aim to reconstruct past seawater isotope ratio (δ^7Li_{SW}), not only for the Cenozoic but also for the Mesozoic and Paleozoic [3, 4, 5]. We developed and verified an appropriate sample preparation method for the quantitative measurement of concentration and isotopic ratio with Early Paleozoic sedimentary rocks of the Sino-Korean block.

For dissolution of rock samples, we focused on selectively dissolving only carbonate minerals, since lithium is far more abundant in silicate minerals and have different isotopic compositions. The rock samples, composed of limestone and calcareous shale, were divided into high residue (34%), moderate residue (15%), low residue (6%) groups based on the silicate residue percentage (100%-TOC%-TIC%). We found that the dissolution method requires different volumes of acid for the three groups in order to obtain a sufficient amount of lithium and at the same time prevent silicate dissolution.

For separation of lithium using a single column method [6], we found that lithium and sodium elution peak shift to earlier fraction when the silicate residue is decreased. Therefore, two-column method should be tested to ensure high recovery yield and low Na/Li ratio (<0.5 mol/mol) in samples with significant carbonate matrix.

[1] Walker *et al.* (1981) *J Geophys Res Oceans.* 86, 9776–9782. [2] Pogge von Strandmann *et al*. (2020) *Elements* 16, 253–258. [3] Misra *et al*. (2012) *Science* 335, 818–823. [4] Sun *et al*. (2018) *P Natl Acad Sci Usa* 115, 3782–3787. [5] Wang *et al.* (2021) *J Asian Earth Sci* 222, 104977. [6] Choi *et al.* (2013) *J Anal Atom Spectrom* 28, 505–509.