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Cation isotopes trace chemical weathering

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Chemical weathering of rocks/minerals alters the geochemical composition of the lithosphere, hydrosphere and atmosphere through the time and thus sustains Earth's surface temperature by consuming atmospheric CO2, so as to sustain our habitable planet. As the most easily mobile elements in the processes of chemical weathering, cations are thought to be robust geochemical tracers of chemical weathering. For decades, a large number of tracers have been proposed for chemical weathering, based on the contents and ratios of cations. Because of the difference among the nature of the cation properties, the knowledge gained of chemical weathering at different time scales is inconsistent or even opposite, entering into a bottleneck period. Owing to no difference of properties between isotopes of the same element and the high-dimensional information carried, the stable isotopes of cations have been employed to trace chemical weathering processes objectively and become a rapidly developing direction of chemical weathering. In this review, we summarize the progress of tracing chemical weathering using the stable cation isotopes (δ7Li, δ26Mg, δ41K, δ44/40Ca, δ87/85Rb, δ 88/86Sr, δ138/134Ba) and then point out their development trends and existing problems. After considering the virtues and defects of various cation isotopes, we recommend the combination of multiple cation isotopes that complement and support each other as the future direction to obtain the true information of each process of chemical weathering. It is almost the best way to objectively trace chemical weathering, so as to deepen our understanding regulation mechanism on the habitable surficial temperature.