Are lithium isotopes good proxies of continental silicate weathering?

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Chemical weathering plays an important role on continental crust evolution, as it preferentially removes solutable elements such as Mg and can shift the crust composition towards more felsic compositions, thus helping to solve the crustal composition paradox [e.g., 1]. In addition, chemical weathering is critical in making Earth's surface habitable by regulating the global carbon and oxygen cycles and by transporting nutrients into the oceans. Lithium isotopes have been developed to trace continental weathering, especiall continental silicate weathering due to its low content in carbonate rocks.

Using Li isotopic compositions in planktonic foraminifera as a seawater proxy, Misra and Froelich [2] demonstrated that the δ^7Li of seawater increased by 9‰ during the Cenozoic. They suggested this change was due to an increase in incongruent weathering, resulting in increased clay formation, which could elevate δ^7Li in the riverine input into the ocean associated with uplift of the Himalaya around 40 Ma. However, the interpretation of this δ^7Li curve is complicated by the many variables that influence δ^7Li in seawater. Although substantial changes in seawater δ^7Li over the Cenozoic are probably influenced by inputs from riverine Li derived from continental weathering, the observed increase can be influenced by changing hydrothermal flux through time. In addition, many different parameters have been explored to explain this Cenozoic δ^7Li increase in seawater, including but not limited to increasing Li riverine flux without increasing δ^7Li, significant change in denudation rates, increasing fluid-rock interactions between river water and itssuspended loads, or floodplains associated with mountain formation caused clay formation. In summary, the causes of the observed increase in seawater δ^7Li through the Cenozoic is still very difficult to explain, complicating the usage of Li isotopes as tracers of continental weathering.

[1] Liu and Rudnick (2011) *Proceedings of National Academy of Sciences* **108**, 20873-20880. [2] Misra and Froelich (2012) *Science* **335**, 818–823.