Lithium isotope geochemistry of hot springs in South Korea

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Silicate weathering plays a crucial role to regulate the global climate in the million time scale by removing atmospheric CO_2. Lithium (Li) isotopes have been considered as one of the most suitable proxies to trace silicate weathering. It has been known that hot springs have higher Li concentration but lower Li isotopic compositions than general river waters and groundwaters because high temperature environment promotes dissolution but prohibits the formation of secondary minerals. Here, we collected twenty-nine samples from the hot springs in South Korea to understand the processes controlling Li isotope geochemistry. Temperature of hot springs in South Korea ranges from 21.9 °C to 81.0 °C, which is relatively low compared to world hot springs. The Li concentrations and δ^7Li values in the hot springs are variable (6.3 to 738 μM and -3.6‰ to 14.6‰, respectively). Also, those of bedrocks are variable (2.7 to 52.4 ppm and 0.7‰ to 15.0‰). Interestingly, negative δ^7Li value in the hot spring indicates either that Li may be derived from the lower crust [1] or that diffusion-induced isotope fractionation may occur [2]. A lack of correlation between δ^7Li and other variables, such as temperature, conductivity, Li/Na and Na/Ti, indicates that fully congruent weathering occurs with little secondary mineral formation in the hot springs. This study suggests that Li isotopes can be a useful tracer of tracking hot springs.

[1] Nishio et al., (2010), Earth Planet. Sci. Lett. **297**, 567-576.
[2] Verney-Carron et al., (2011), Geochim. Cosmochim. Acta. **75**, 3452-3468.