Dissolved lithium flux and isotopic composition from weathering of an active volcanic system, Aso Caldera, Japan

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Volcanic arcs contribute significantly to the dissolved flux of elements delivered to the oceans and can influence the carbon cycle as well as isotopic records of weathering. In order to quantify the controls on dissolved lithium (Li) fluxes and Li isotope composition during high- and low-temperature arc weathering, this work explores the Li systematics of an active volcanic caldera in Japan, at Mount Aso. Li and its isotopes are a promising proxy for the intensity of silicate weathering. Studies of rivers show a wide range of Li isotopic signatures and generally low [Li] [1]. Studies of geothermal systems reveal that high temperature rock-water interactions tend to yield a narrow range of δ^7Li, close to bedrock composition, and are highly concentrated in Li [2]. However, general understanding of how high- and low-temperature reactions conspire to determine the signature of weathering from active volcanic fields remains lacking.

In this study, high spatial resolution samples were collected from Aso Caldera over multiple field seasons. Major anions and cations, trace elements, water isotopes, and δ^7Li were analyzed. The water composition can be described by three endmembers: (i) hot springs, (ii) cold springs with relatively short residence times, and (iii) cold springs with longer residence times. We use a mixing model to quantify the contributions to the flux at the single river outlet from the caldera. The significant inferred high-temperature dissolved Li flux and the accompanying low δ^7Li brings into question how geothermal fluids could impact other river systems and affect the global budget of dissolved Li delivered to the ocean over time.

[1] Dellinger et al. 2015. *Geoch. Cosmoch. Acta*, v164, 71-93
[2] Millot et al. 2007. *Applied Geochemistry*, v22, 2307-2325