

## Si isotope systematics of acidic alteration of fresh Kilauean basalts

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Silicon isotopes are fractionated by low-temperature aqueous processes, making them potentially useful as a weathering proxy. Previous authors have reported that secondary minerals like clays and opal are lower in <sup>30</sup>Si/<sup>28</sup>Si than the dissolved reservoirs from which they precipitated [1-2]. Young basalts from Kilauea, on the big island of Hawai'i, frequently feature opaque amorphous silica coatings, 2-80 μm thick, that form *in situ*, apparently by acidic surface leaching [3]. Here we show that, in contrast to secondary minerals in other settings, these coatings have higher δ<sup>30</sup>Si than their basaltic substrate (which is presumed to be the source of Si in the surficial solutions from which the coatings precipitate).

Silica coated basalt samples were collected from 1974 and 1998 flows along Kilauea's East and Southwest Rift Zones. We removed the coating material by scraping and then dissolved it in dilute HF and HNO<sub>3</sub> [4]. The resulting solutions were purified by ion-exchange chromatography and analyzed by MC-ICP-MS. Basalt glasses had δ<sup>30</sup>Si = -0.10 to -0.24‰; silica coatings had δ<sup>30</sup>Si = +0.92 to 1.36‰. These isotopic compositions are difficult to reconcile with previously reported fractionation factors (i.e. Δ<sup>30</sup>Si<sub>solid-aqueous</sub> < 0‰). We hypothesize that the atypical direction of fractionation is a result of unusual aqueous Si speciation (e.g. fluoride, chloride and/or sulfate complexation).

Batch experiments in which fresh glassy basalt gravel was reacted in HCl or HF (0.1 or 1 M) at 60° C replicated Hawaiian amorphous silica layer morphology. The fluids preferentially mobilized Al, Mg, Fe, Na, and Ca, leaving behind amorphous silica residues up to 100 μm thick. In HCl-bearing experiments, reacted fluids were <sup>30</sup>Si-enriched (up to δ<sup>30</sup>Si = 2.29‰). HF-bearing experiments produced <sup>28</sup>Si-enriched fluids, suggesting preferential incorporation of <sup>30</sup>Si into precipitated silica or volatilization of <sup>30</sup>Si. These results indicate that fluid chemistry influences the direction and magnitude of Si isotope fractionation during weathering.

[1] Georg *et al.* (2007), *EPSL* **261**, 476-490. [2] Milligan *et al.* (2004) *Limnol. Oceanogr.* **49**, 322-329. [3] Chemtob *et al.* (2010), *JGR* **115**, 2009JE003473. [4] Ziegler *et al.* (2010) *EPSL* **295**, 487-496.

## First Tritium-Helium Dating Results of Groundwater in Central Taiwan

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We applied Tritium-Helium (T-He) dating method (Clarke *et al.*, 1976), for the first time, to obtain the ages of groundwater from central part of Taiwan as a case study. The groundwater wells are located on the recharge area of Jhoshui river basin and Beigang River. Three groundwater samples have been collected from different monitoring wells, which are artificial and all around 100 meters deep, and the altitude of them are less than 402 meters. Samples sent to University of Utah and University of Tokyo for further T-He dating analysis. We could obtain total helium-3 concentrations in groundwater samples, although they might contain different signatures other than radiogenic source from tritium decay. In order to obtain the radiogenic helium-3 concentration, we needed to eliminate helium-3 concentrations of air-saturated water and terrigenous source in spite of air contamination. In this study, we can successfully separate the radiogenic source of helium-3 from terrigenous (crustal) source, assuming no air contamination for the studied samples. After helium-3 corrections, we can obtain the age results ca. 7-25 years, which are consistent with each other from the analysis results of two independent labs. The result suggests that the T-He dating technique could be a good method for determining the age of young groundwater in Taiwan.