Silicon isotope geochemistry of altered oceanic crust

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Si isotope fractionation is significant in low-temperature environments by several‰ but it is limited in magmatism (~0.2‰) [e.g. 1-2]. Therefore, Si isotopes may be a useful tracer for recycled crustal material in the mantle. Previous studies found that recycled altered oceanic crust in the mantle could attribute to OIBs with enriched isotope signatures [3]. Therefore, it is important to understand Si isotopes of altered oceanic crust which could result in mantle heterogeneity.

Here we analyzed Si isotopes of altered basalts and gabbros recovered from the IODP site 1256 by Neptune Plus MC-ICP-MS. The long term precision of δ^{30}Si is better than ±0.05‰ (2SD). This site represents a carbonate-barren altered oceanic crust (AOC) formed at the East Pacific Rise produced by interaction of seawater-derived fluids with oceanic crust at different temperatures and water/rock [3].

Our results present that the δ^{30}Si of these AOC samples varies from -0.265 to -0.636‰, ranging from fresh MORB value (δ^{30}Si = -0.29 ± 0.08‰) to a lighter end-member [5]. The δ^{30}Si negatively correlates with δ^{18}O reported by Gao *et al*. (2012), reflecting the effect of temperature variations during alteration [4]. The preliminary results indicate that during alteration, the seawater-derived fluids took away heavier Si isotopes and left a lighter δ^{30}Si in the AOC. Therefore, an important implication is that the mixing the recyled AOC with the mantle could produce a source enriched in light Si isotopes. This may explain the light δ^{30}Si (-0.39 ± 0.04‰) in Iceland OIBs with HIMU component relative to fresh MORB (δ^{30}Si = -0.29 ± 0.08‰) [5] if their mantle source contains recycled AOC.

[1] Ziegler *et al*. (2005) *GCA* **33**, 817-820. [2] Savage *et al*. (2011) *GCA* **75**, 6124-6139. [3] Zhu *et al*. (2007) ESF **14**, 24-36. [4] Gao *et al*. (2012) *G*^{3} **13** (10). [5] Savage *et al*. (2010) *EPSL* **295**, 139-146. [6] Pringle *et al*. (2014) *AGU* V33C-4874.