Tracking volatiles in OIB mantle reservoirs with B isotopes in melt inclusions

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Recycling of the lithosphere drives the chemical evolution of the mantle by supplying both solids and volatiles to the Earth's interior. Yet, the volatile character of Earth's present-day mantle, often characterized by the radiogenic isotope variability sampled by ocean island basalts (OIB) globally, is extremely difficult to quantify. Boron is an ideal tracer of volatile recycling because it behaves similarly to volatiles during high-temperature processes, should only be fractionated at/near the Earth's surface, and will have a strong influence when recycled because mantle compositions are characterized by very low B concentrations <0.2 ppm and $\delta^{11}B$ -7.1±1.3‰ [1]. Here, we present and compare the trace element, volatile (H_2O, CO_2, Cl and F), and the B isotope compositions (measured by SIMS) of basaltic glasses and olivine-hosted melt inclusions from a HIMU-like (Barranco Fagundo, La Palma, Canary Islands) and "FOZO" (Piton Caille, Réunion) ocean island localities. We find that relationships between Cl/Nb and Cl/K_2O in melt inclusions represent differences in source enrichments and fractionation, and are unlikely the result of seawater contamination, illustrating that melt inclusions protect the primary magmas from contamination during ascent to the surface and provide more robust estimates of initial $\delta^{11}B$ than previous bulk glass studies. Our results also indicate that the HIMU-like sample is characterized by $\delta^{11}B$ values that are distinctly isotopically light (-10.5±1.1‰ 2SD) when compared to those from Réunion (-7.9±0.6‰ 2SD). The $\delta^{11}B$ of Réunion melt inclusions also statistically overlap with the recently defined MORB datum [1] as opposed to the previously determined OIB value (-9.9±1.3‰) [2]. We suggest the isotopically light values measured at La Palma reflect a contribution from recycled materials preserved in the deep mantle. Although further work is required to determine the origins and processing of that material, these initial results highlight the potential for using B isotopes to better understand the volatile budget of the deep mantle.

[1] Marschall (2017) *GCA* **(in press)**. [2] Chausiddon and Marty (1995) *Science* **269,** p. 383.