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### Lithium isotopic composition of altered oceanic crust at ODP Site 1256, Leg 206

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Lithium isotopic composition can be a very effective tracer of seawater-basalt interaction during alteration of oceanic crust, and previous work has shown high concentrations of Li (5.6-27 ppm) and high  $\delta^7\text{Li}$  (6.6-20.8‰) in altered rocks of the upper volcanic section at ODP Holes 504B and 896A compared to fresh MORB (3-6 ppm and 1.5-5‰) [1,2]. However, it remains unclear whether the observations at these two sites are characteristic of altered ocean crust as a whole. Furthermore, the mineral hosts of the Li isotopic signature are not well-characterized, which will control to a large extent whether the Li isotopic signature of subducted crust will survive the subduction process.

We present analyses of Li isotopic composition and concentration in samples of altered basalt from the upper ~500 m of igneous crust drilled at ODP Site 1256 on Leg 206. These samples likely represent the majority of the volcanic section in this location, and are from the first leg of a multi-leg drilling program designed to provide a complete in-situ section of oceanic crust. They also provide an important comparison to analyses of ODP Holes 504B and 896A [1].

Preliminary data for variably altered basalt from Holes 1256C and 1256D show Li concentrations of ~4-17 ppm (generally 4-6 ppm, comparable to fresh MORB), and highly variable Li isotopic compositions, also generally similar to fresh MORB (most samples have  $\delta^7\text{Li}$  ~2-5‰) but ranging to somewhat lighter values ( $\delta^7\text{Li}$  = 0.98‰) and to substantially heavier values ( $\delta^7\text{Li}$  up to 19‰). There is no consistent pattern of either  $\delta^7\text{Li}$  or Li concentration with depth in the section or with macroscopic alteration. These data suggest that on average the volcanic section at Site 1256 may have  $\delta^7\text{Li}$  lower than averages for the upper volcanics at Holes 504B and 896A. Work is currently in progress to analyze samples of vein minerals, fresh glass, and altered glass throughout the section to identify the main hosts of Li in the volcanic section, and to help delimit fluxes of Li from seawater to crust during alteration at this site.

#### References

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### Lithium and crustal recycling during subduction

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Lithium has potential as a tracer of crustal recycling in the mantle as it is enriched in surface materials relative to those of mantle provenance, and most subducted material has relatively high  $\delta^7\text{Li}$ . Thus, the presence of surface material in source regions may be detected by elevated Li abundances and  $\delta^7\text{Li}$  in arc lavas. In this study we present lithium isotope and concentration data for a suite of subduction-related lavas from the New Georgia Volcanic Group, Solomon Islands.

The samples show an enrichment in large ion lithophile elements and fluid mobile elements (FMEs) compared to MORB, which implies the involvement of slab material into the zone of melting. Lithium concentrations are also enriched in the samples compared to MORB, with concentrations ranging from 5.17ppm to 12.5ppm (with one extreme value of 21.3ppm). Li abundances correlate with other FMEs, including Rb, Ba and Sr. Of interest is the strong positive correlation between Li/Th and Ba/Th. Ba/Th is considered to increase with increasing addition of a hydrous fluid into the source region, and the correlation implies that this fluid also contains lithium. This process cannot be thought of as simple mixing between a fluid and N-MORB endmember, but rather that there must be mixing between a low Li/Th and Ba/Th source (possibly OIB or sediment).

$\delta^7\text{Li}$  values both overlap and extend beyond the range of values for MORB, indicating that some samples have been enriched in  $^7\text{Li}$ . However, there is no obvious correlation between  $\delta^7\text{Li}$  and Li abundance, or the abundance of other FMEs. Thus although Li is added by subduction related fluids, our isotope data suggests that these fluids are modified in some way either before entering the zone of melting, during melt migration, or as a result of post-emplacement weathering. This may be due to preferential removal of  $^7\text{Li}$  from the slab in the early (cool) stage of subduction, or interaction with the mantle during fluid/melt percolation or channel flow. This supports the idea that fluid/melt interactions may buffer the Li isotopic composition of arc lavas [1].

#### References

- [1] Tomascak P.B. et al., (2002) *EPSL* **196**, 227-238.