The *in situ* halogen content of MORB-like eclogites, Rapas Complex, Ecuador

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To elucidate the abundance and distribution of volatiles during subduction, we conducted *in situ* SIMS analyses of co-existing garnet, omphacite, phengite, amphibole, and apatite from a suite of early Cretaceous MORB-like eclogites from the Raspas Complex, southern Ecuador as well as bulk rock pyrohydrolysis measurements. Garnet contains < 10 µg/g F and omphacite < 60 µg/g F, whereas Cl for each phase is < 0.5 µg/g and < 2 µg/g, respectively. Phengite contains > 500 µg/g F and ~1 µg/g Cl, implying that phengite stabilization effectively fractionates F from Cl. Amphibole F contents are up to 4000 µg/g, whereas Cl is less than 15 µg/g in all samples. Apatite halogen abundances are 1.47–3.25% wt% F and 0.019–0.051 wt% Cl; in the absence of amphibole, apatite contains > 90% of mineral-hosted Cl and the majority (ca. 50–80%) of mineral-hosted F.

Reconstructed bulk rock halogen abundances (based on *in-situ* SIMS and modal proportions) and bulk rock pyrohydrolysis provide similar F total abundances within uncertainty, however Cl abundances are a factor of three higher in pyrohydrolysis-derived concentrations than those reconstructed based on mineral-hosted SIMS analyses. We attribute this discrepancy to the presence of primary fluid inclusions, which may host the majority (ca. 65–80%) of Cl in pristine eclogites.

We calculate that at least 95% of subducted Cl is removed from the bulk rock by the time the slab reaches eclogite facies conditions whereas ~ 90% of F is retained, based on pre-subduction altered oceanic crust estimates[1]. Eclogitized AOC parcels contain MORB-like F (199 ± 54 µg/g) and low Cl abundances (<10 µg/g) that could contribute to F-enrichment in ocean island basalts during subsequent mantle melting. However, another Cl-bearing lithology (i.e. serpentinite as proposed by previous workers[2]) is likely required to satisfy OIB source constraints with respect to Cl enrichments.

References

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