Halogen abundances in OIB source regions

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The moderate (F, Cl) to highly (I) volatile and moderate (F) to highly (I) incompatible behavior of halogens implies that their distribution is influenced by fluid mobility, partial melting, fractionation and degassing. This makes them very good tracers for volatile transport processes in Earth and planetary systems. The determination of halogen abundances and ratios in different reservoirs will give us the ability to understand and quantify volatile input mechanisms into the Earth's mantle during subduction.

We determined experimentally the F and Cl partitioning behavior between forsterite, orthopyroxene and silicate melt at temperatures (1500°-1600°C) and pressures (1.0-2.3 GPa) representative of the mantle mid ocean ridge and ocean island basalt source region. We will also present the first experimentally determined Iodine partition coefficients between forsterite and silicate melt.

Combining our data with recent studies [1] [2] shows that the F and Cl partitioning between forsterite and melt increases by 1.5-2.0 orders of magnitude between 1350-1600°C but shows no pressure dependence between 1.0 and 2.3 GPa. Partitioning between orthopyroxene and melt increases by about 1.0-1.5 (Cl) and 0.5 (F) orders of magnitude for a temperature increase of 100°C (between 1300 and 1600°C) and decreases with increasing pressure.

Halogen abundances in OIB source regions (F=35-65; Cl=11-45ppm) were estimated by combining our data with natural halogen concentrations in oceanic basalts [3] [4]. The OIB source mantle region has a Cl concentration that is indistinguishable from primitive mantle estimates but is enriched in fluorine by a factor of at least 1.2-3.2. An explanation for the relative F enrichment is that compared to Cl, F may be incorporated to a greater extent into the crystal structure of minerals that are stable at high P-T conditions (e.g. garnet) and may thus be transported more efficiently into the deeper mantle through subduction of oceanic crust.

[1] Beyer et al. (2012) *EPSL* **337-338**, 1-9. [2] Dalou et al. (2009) *CMP* **163**, 591-609. [3] Kendrick et al. (2012) *Geol.* **40**, 1075-1078. [4] Ruzié et al. (2012)V31A-2762, AGU Fall Meeting.