Bulk F, Cl, Br, I abundances and Cl isotope compositions in mafic eclogites: Implications for halogen cycling during subduction

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Bulk rock chlorine stable isotope compositions ($\delta^{37}Cl$) and halogen (F, Cl, Br, and I) abundances have been measured in mafic eclogites from three paleo-subduction settings: Cabo Ortegal in Spain, the Raspas Complex in Ecuador, and the Zambezi Belt in Zambia. Stable isotope compositions and halogen concentrations are combined with previously reported major and trace element abundances on the same samples. Selected samples experienced a range of peak metamorphic conditions and record the chemical evolution of the halogen budget during prograde metamorphism and devolatilization.

Preliminary results show a decoupling of F and Cl during prograde metamorphism and no significant Cl isotope fractionation. Relative to seafloor abundances, preliminary data from exhumed eclogites demonstrate a preferential loss of Cl and retention of F. However, results also show that F and Cl abundances are highly variable across subduction settings (10 to 5000 ppm Cl; 10 to 400 ppm F), suggesting the strong exertion of local controls. Of the samples studied, the eclogites from the Zambezi Belt span the largest range in F and Cl. Previous workers attribute elevated Cl abundances to the infiltration of a serpentinite-derived fluid at high pressures [1]. Preliminary chlorine isotope data support this hypothesis ($\delta^{37}Cl$ values = -0.6 to +0.5 ‰).

Following seafloor alteration, F and Cl partition into different host phases in altered oceanic crust. The decoupling of F and Cl during subduction zone metamorphism and devolatilization is likely controlled by the stabilty of these mineral phases. The comparison of major and trace element abundances with halogen concentrations can provide a first order approximation of important host phases. Across all samples, F abundances correlate positively with P and Ti content, indicating the retention of F in relatively stable, P- and Ti-rich mineral phases (apatite, Ti-oxides, humites, titanite). Cl abundance is loosely correlated with K, Ba, and Rb content, suggesting siting in micas and amphiboles.

[1] John & Schenk (2003) *Contrib Mineral Petrol* **146**, 174-191.