Halogens (F, Cl, Br, I) in high pressure subduction zone minerals from the Western and Central Alps

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The cycling of halogens in subduction zones is poorly understood due to low abundances in natural minerals and also analytical limitations. We have used electron probe micro-analysis (EPMA), time-of-flight secondary ion mass spectrometry (TOF-SIMS) and neutron-irradiation noble gas mass spectrometry (NI-NGMS) to determine F, Cl, Br and I concentrations and distributions in eclogitic and high pressure hydrous minerals from the western and central Alpine ophiolitic zone, to determine halogen behaviour in subduction zones, and to identify potential host phases able to transport halogens into the deeper mantle. NI-NGMS analysis of mineral separates shows that individual halogen concentrations vary in mineral fractions by up to three orders of magnitude. They are, however, an order of magnitude lower relative to abundances in altered oceanic crust, suggesting major halogen loss has occurred either during or prior to reaching eclogite facies. Positive correlation between Cl, Br and I show that the heavy halogens exhibit similar behaviour in subduction zone settings. A lack of correlation between F and Cl suggests that F is decoupled from the heavier halogens, likely due to its substitution for the OH^- ion and incorporation in point defects in hydrous and anhydrous mineral structures respectively. *In-situ* analysis and mapping of thin sections, grains and grain boundaries using EPMA and TOF-SIMS reveals that Cl, Br and I are located within the mineral structure as opposed to fluid inclusions, with homogeneous distribution patterns. Our results significantly extend the halogen dataset for high pressure minerals found within subduction zones.