Ecole Doctorale des Sciences Fondamentales

Title of the thesis: Chorine isotopes in melt inclusions from subdcution zone volcanism

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Project Summary:

A subduction zone is a complex geochemical filter separating the elements injected through the slab. Some elements are flushed out from the slab eventually incorporated into arc magmatism, while others are retained and carried deep into the mantle. Chlorine is derived from seawater and crustal fluids and is present as saline fluids (e.g. up to 7wt. % NaCl eq. in Pinatubo; Kawamoto et al., 2013). Chlorine also promotes the transport of lithophile elements to the sub-arc mantle (Kawamoto et al., 2014). Thus we identify that chlorine isotopes ($\delta^{37}Cl$) are potentially a tracer of 'salty fluids' (e.g. John et al., 2010), and aim to capture such signals in arc magmas via a melt inclusions (MI) approach. Primary MI in early-formed crystals isolate mantle-derived melts prior to mixing at shallower levels. Thus they can be used to decipher the processes that create magmas and the nature of their mantle sources. We propose to measure $\delta^{37}Cl$ in MI in combination with boron isotopes ($\delta^{11}B$; a stable isotope system used to trace oceanic material) to track the sources of "salty fluid" in Vanuatu arc. Chlorine isotope fractionation during magma evolution will be determined to propose a combined model for chlorine and boron isotope fractionations in subduction zone.

The target volcanoes are in the Vanuatu arc, specifically MI from Gaua, Aoba, Ambrym and Yasur.

The candidate will prepare the MI and use the instruments of the laboratory such as EMP, BSE, LAICPMS and Raman. Several travels to Lausanne University are scheduled to work with co-advisor Dr. Bouvier, to measure $\delta^{37}Cl$ and $\delta^{11}B$ in MI *in situ* by multi-collection SIMS (Manzini et al., 2016).