Tracing of Cl input into the sub-arc mantle through the combined analysis of B, O and Cl isotopes in melt inclusions

BOUVIER A.-S.[1*], MANZINI M.[1], ROSE-KOGA E.F.[2], NICHOLS A.R.L.[3], BAUMGARTNER L.P.[1]

[1]ISTE, Université de Lausanne, Switzerland
[2]LMV, Université Clermont Auvergne, France
[3]Department of Geological Sciences, University of Canterbury, New Zealand

The effect of recycling crust and sediments on the composition of the mantle wedge is still debated, especially for volatiles. Chlorine is an important fluid mobile element, and its stable isotopes have different concentrations in the terrestrial reservoirs making Cl-isotopes potential tracers of slab-derived fluids. Olivine-hosted melt inclusions (MI) provide a first order constraint on the δ^{37}Cl of primary magmas, since they were unaffected by near surface processes. Here, δ^{37}Cl were coupled with δ^{11}B and δ^{18}O analysis in MI from samples from Lesser Antilles, Vanuatu, Aeolian, NE Japan and Izu-Bonin arcs. This unique dataset is discussed in term of different sources of Cl input into the mantle wedge and is used to better understand the large δ^{37}Cl variation in melt inclusions from a single sample.

Cl isotopic compositions of MI form Lesser Antilles, Vanuatu and Aeolian arcs are reported in [1], whereas values for NE Japan (-2.1±0.8‰ to 0.5±0.8‰) and Izu-Bonin (4.4±0.5‰ to -1.6±0.4‰) arcs are from this study. Overall, δ^{18}O and δ^{37}Cl tend to be anti-correlated, with a larger scatter toward low δ^{37}Cl values. Two end-members can be defined: sediments and altered oceanic crust (AOC) or serpentinite. δ^{11}B and δ^{37}Cl do not correlate but suggest four end-members: serpentinites, with highest δ^{11}B and δ^{37}Cl around 0‰, AOC, with highest δ^{37}Cl (>1.5‰), and sediments, with lowest δ^{11}B and δ^{37}Cl (down to -10‰ and -4‰, respectively). Based on δ^{11}B, marine and continental sediments could be deciphered. The differentiation of marine vs. continental sediments could explain the large scatter of data toward the sediment end-member in the in O and Cl isotopes system.

Variation within a sample relate to various contributions from each end-member. We show here that a large dataset (>15 MIs) combining Cl, B and O isotope behaviour within a sample can be used to decipher Cl trends in different arc settings, and ultimately, better constrain the Cl cycle in the mantle.

[1] Manzini et al. (2017), *Chem. Geol.* **449**, 112-122