# Chlorine isotopes in volcanology : exemple from La Soufriere de Guadeloupe (FWI)

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Chlorine is moderately soluble in magmas, highly soluble in waters and, unlike most other volatiles, is considered chemically non-reactive. Such unique combination of geochemical features can be used to inimitably characterize the origin of magmas, their differentiation, degassing and interaction with liquids. Chlorine stable isotope compositions ($\delta^{37}Cl$) of Earth's reservoirs have been used for 10 years to constrain the origin of Cl in arc magmas [*e.g.,* 1-4], and only more recently used in volcanology, as tracers of magmatic degassing and/or subsurface gas/liquid interactions [5-6].

Here we studied the volcanic-hydrothermal system of La Soufrière de Guadeloupe in the Lesser Antilles. We present: *i/* $\delta^{37}Cl$ data on samples recently collected from fumarole CSC (mean temperature of 97°C, $\delta^{37}Cl$ up to +8‰); *ii/* a 40 years record of $\delta^{37}Cl$ values and Cl, Br, F and I concentrations of one thermal spring (Galion, with discrete peaks of Cl contents that are anti-correlated with $\delta^{37}Cl$ values down to -1.3‰), and *iii/* a 13 years record of the summit acid pond (Tarissan, with pH from -0.8 to +0.8; [Cl] = 1-15 wt.%, $\delta^{37}Cl$ decreasing from +0.3 to -0.9‰). We quantify that more than 90% of the HCl escaping the large geothermal aquifer of La Soufrière is likely lost (ie. not sampled) via scrubbing over subsurface water condensation on its way up to the surface, at least at site CSC. More broadly, we suggest that for locations where the magma $\delta^{37}Cl$ is known, the $\delta^{37}Cl$ value of the emitted gas is a quantitative tracer for scrubbing of chlorine and other water-soluble gas species. Comparison with $\delta^{37}Cl$ from gas in other volcanoes will strengthen the interpretational framework of this new tracer in volcanology. Finally, we anticipate that coupling to bromine stable isotope compositions developed at IPGP [7] will improve our understanding of volcanic systems.

[1] Bonifacie, *Encyclopedia of Geochemistry* (2017). [2] Bonifacie et al., (2008), *Science* 319, 1518-1521. [3] Li et al. (2015), *EPSL* 413, 101–110. [4] Manzini et al. (2017), *Chem. Geol.* 449, 112-122. [5] Liotta et al. (2017) *JVGR 336, 168-178*. [6] Rodriguez et al. (2016) *JVGR* 325, 70-85. [7] Louvat et al. (2016), *Analytical Chemistry*, 88, 3891-3898.