Geophysical Research Abstracts
Vol. 17, EGU2015-11034, 2015
EGU General Assembly 2015

Chlorine Stable Isotopes to reveal contribution of magmatic chlorine in subduction zones: the case of the Kamchatka-Kuril and the Lesser Antilles Volcanic Arcs

Pierre Agrinier (1), Svetlana Shilobreeva (2), Gerard Bardoux (1), Agnes Michel (1), Alexandr Maximov (3), Elena Kalatcheva (3), Gennady Ryabinin (4), and Magali Bonifacie ()

(1) IPGParis, France , (2) Venardsky Institute of Geochemistry, Moscow, Russia, (3) Institute of Volcanology and Seismology, Petropavlovsk-Kamchatsky, Russia, (4) Kamchatka Branch of Geophysical Survey of Russian Academy of Sciences, Petropavlovsk-Kamchatsky, Russia

By using the stable isotopes of chlorine (δ^{37}Cl), we have shown that magmatic chlorine (δ^{37}Cl $\leq$-0.6 ‰ [1]) is different from surface chlorine (δ^{37}Cl $\approx$ 0 ‰ [1]) in hydrothermal system of Soufrière and Montagne Pelée from the young arc volcanic system of Lesser Antilles. First measurements on condensed chlorides from volcanic gases (e.g. [2], [3]) did not permitted to get sensible δ^{37}Cl values on degassed chlorine likely because chlorine isotopes are fractionated during the HCl_{gas} – chloride equilibrium in the fumaroles or during sampling artifacts. Therefore we have developed an alternative strategy based on the analysis of chloride in thermal springs, streams, flowing on the flanks of the volcanoes. Due to the highly hydrophilic behavior of Cl, we hypothesize that thermal springs incorporate chlorine without fractionation of chlorine isotopes and might reflect the chlorine isotopic composition degassed by magmas [1]. Indeed Thermal spring with low δ^{37}Cl chlorides ($\leq$-0.6 ‰) are linked with magmatic volatiles characters (^{3}He ratio at 5 R_a at and δ^{13}C CO_2 $\approx$ -3 ‰).

To go further in the potentiality of using the Chlorine isotopes to reveal contribution of magmatic chlorine in volcanic systems, we have started the survey of thermal springs and wells waters in the Kamchatka-Kuril volcanic mature Arc (on sites Mutnovsky, Paratunka, Nalychevsky, Khodutkinsky, Paramushir Island, identified by Taran, 2009 [4] for concentrations of chloride). Preliminary results show δ^{37}Cl values ranging from 0.5 to -0.2 ‰ and generally higher chloride concentrations. The δ^{37}Cl values are higher than the value recorded for the young arc volcanic system of lesser Antilles. At present moment very few negative δ^{37}Cl have been measured in the Kamchatka-Kuril volcanic mature Arc.

[1] Li et al., 2015 EPSL in press. [2] Sharp et al. 2010 GCA. [3] Rizzo et al., 2013, EPSL, 371, 134. [4] Taran, 2009, GCA, 73, 1067