Chlorine isotope systematics in olivine-hosted melt inclusions from the Central American Volcanic Arc

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Isotope composition of chlorine, a highly hydrophile and incompatible element, can provide new insights into the processes of element recycling in subduction zone settings. We studied the Cl isotope composition of melt inclusions hosted by olivine Fo_{87-73} from 11 localities in Guatemala, El Salvador, Nicaragua and Costa Rica, representing a ca. 1000 km long segment of the Central American Volcanic Arc (CAVA). The Cl data were obtained with a CAMECA IMS 1280-HR at the University of Lausanne, following the protocol of [1].
Melt inclusions from CAVA have chlorine contents ranging from 385 to 1629 μg/g and δ^{37}Cl values from -0.4 to +2.9 ‰. The δ^{37}Cl values overlap partly with but are generally higher compared to previously published data for melt inclusions from arc rocks [1] and are clearly much higher than previously published values for ash/tephra from the CAVA [2]. The average values for each segment of the arc from north to south (Guatemala, El Salvador, Nicaragua and Costa Rica) are 1.3 ± 0.4‰, 0.9 ± 0.2‰, 1.2 ± 1.0‰ and 1.5 ± 0.4‰, respectively. The volcano averaged δ^{37}Cl exhibit a positive correlation with geochemical proxies of hydrous slab-derived fluid in the CAVA sources such as H_2O, Ba/La and B/La [3] as seen for the Ecuadorian arc too [4]. The highest δ^{37}Cl values were found for Cerro Negro volcano, the lowest – for Ilopango and San Miguel volcanoes in El Salvador and Nejapa volcanic field in Nicaragua. The data suggest that slab fluids with δ^{37}Cl ~2‰ may be a major source of Cl and H_2O in CAVA magmas. A source of low δ^{37}Cl could be a mantle wedge with less contribution of AOC and subducted sediments. The data indicate multiple sources of Cl in subduction related magmas and a potential of SIMS-based Cl isotope studies to decipher the processes of Cl recycling between the Earth's mantle and crustal reservoirs.

[1] Manzini et al., (2017), Chem. Geol. 449, 112-122; [2] Barnes et al., (2009), Geochem. Geophys. Geosyst., 10, Q11S17; [3] Sadofsky et al., (2018), CMP, 155, 433-456; [4] Chiaradia et al., (2014), EPSL, 396, 22-33.