# The geothermal system of Copahue-Caviahue volcanic complex (Argentina): Relationship between isotopic composition of thermal fluids and fault network

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The Caviahue–Copahue volcanic complex (CCVC), located at the Argentina-Chile border, hosts six geothermal areas (Las Maquinitas, Las Maquinas, Cabañitas, Thermas Copahue, Anfiteatro, Chancho-co). Surface manifestations are thermal springs, bubbling pools and fumaroles. There is consensus that volcanism and geothermal activity are largely controlled by the NNE Liquiñe-Ofqui Fault Zone, a major intra-arc dextral strike-slip fault system. However information is lacking on how this fault network controls fluid circulation and geochemistry of the CCVC geothermal system. For this purpose, we present noble gas and stable isotope data of thermal fluids collected during 2014, 2015 and 2016, coupled with dense self-potential (SP), $CO_2$ concentration and temperature (T) measurements.

The CCVC fluids of the four geothermal areas around Copahue have a mantle $^3He/^4He$ signature (7-8Ra where Ra is the air ratio of $1.382 \times 10^{-6}$) and a crustal $\delta^{15}N$ (up to +4.9‰), consistent with a mantle wegde infiltrated by slab-derived crustal materials. These geothermal areas also show concordant SP-$CO_2$ and T maxima that occur in close spatial relationship with the NE-striking faults. Due to their high vertical permeability, these NE faults serve as preferential pathways for fluid circulation and allow the formation of a high boiling-induced, vapor-dominated zone close to the surface. The two other geothermal areas (from Chanco-co and Anfiteatro, away from the Copahue town) are associated with WNW-striking faults, and show low R/Ra (3.70-5.20Ra) and local meteoric water-like H and O isotopic compositions. This suggests that the WNW faults represent low permeability pathways for the ascent of hydrothermal fluids, promoting the infiltration of meteoric water at shallow depths.