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# Shallow Copper Transport and Deposition in the Puyehue–Cordón Caulle Volcanic Complex Hydrothermal System, Southern Chile

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The Puyehue – Cordón Caulle (PCC) Volcanic Complex hosts one of the largest hydrothermal systems of the Andean Southern Volcanic Zone. The PCC is a long-lived, NW-trending ~20x8 km volcano-tectonic depression (graben), that hosts numerous fumaroles, hotsprings and steaming grounds. It is also characterized by an unusually high frequency of rhyodacitic to rhyolitic eruptions over the past century (1921, 1960 and 2011). Fumarolic activity occurs both at recent eruptive vents (1960, 2011) and along the main bounding normal faults, the latter unrelated to Holocene eruptive features.

We investigated the mineralogy of acid-sulfate fumarolic deposits from different sites of the volcano, using petrographic microscope and Scanning Electron Microscope (SEM). Sulfide-bearing samples were further analyzed to characterize mineral assemblages and textures. Selected pyrite grains were analyzed with an Electron Microprobe to determine trace element contents (Co, Ni, As, Ag, Cu and Mo). Also, pyrite and native sulfur concentrates from 5 different hydrothermal sites of the volcano were analyzed for $\delta^{34}S$.

Our preliminary results document the presence of covellite within the fumarolic deposits. It occurs mainly as fine-grained aggregates coating altered clasts and it is present in both recent, eruption related sites (1960 eruption vent) and older hydrothermal sites (Los Venados fumaroles). Pyrites in the older sites showed grain-scale zonation and measurable traces of Co (up to 2400 ppm) and Ni (up to 370 ppm), whereas pyrite from recent fumarolic deposits shows neither zoning nor trace metals above detection limits. Sulfur isotopes on pyrite ranged from 0 to 1.6‰ and from -2 to 6.4‰ on native sulfur. Ongoing work indicates inter-site differences in volatile composition, consistent with variable magmatic–hydrothermal contributions and the observed $\delta^{34}S$ variability. The occurrence of covellite across both eruptive and fault-controlled domains suggests that copper is transported and reprecipitated at shallow levels under vapor-dominated conditions.