Geothermal fluids and mineral scales at Irrupputuncu and Olca, Chile; searching for strategic minerals

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Geothermal fluids contain dissolved solids under conditions of elevated temperatures and pressure. The most common components present in geothermal systems are silica, calcium carbonate in some cases precious and base metals. In geothermal systems in the Andes there is little work related to geothermal fluids and associated mineral and their use for strategic mineral exploration. In our research, we focus on two active hydrothermal systems, the Irruputuncu and Olca volcanoes which are located between Chile and Bolivia. Regional mapping shows hydrothermal alteration at the surface associated with a structural trend N-S to NW-SE fractures. The local trend shows E-W structures similar to the Altiplano uplift and deformation of the basement rocks [1].

More than 200 samples were collected from drill cores from these volcanoes. The drill cores PEM 02 and 03 from Olca shows evidence of pyrite and hematite below 400 m. The PGC 02 from Irruputuncu shows evidence of bladed calcite below 350 m and pyrite below 400m. Thin sections from samples of these cores were examined using a petrographic microscope, and fluid inclusion and mineralogical evidence for boiling of the hydrothermal fluids was recorded.

This evidence included Fluid Inclusion Assemblages consisting of coexisting liquid-rich and vapor-rich inclusions, and the presence of bladed calcite and/or chalcedonic quartz. Thus, the presence of platy/bladed calcite is strong evidence for boiling in the active hydrothermal systems there. The loss of CO_2 to vapor results in the rapid precipitation of calcite, which favors formation of platy or bladed crystals rather than rhombohedral crystals that form during slower growth.

[1]Reyes et al. (2011). *GRC* **35**, 983-986 p.