

Hydrothermal Evolution of the Cerro El Diablo Barite-polymetallic System (Neuquén Basin) Based on Fluid Inclusion Studies and Integrated Analytical Approaches

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Barite-polymetallic deposits from the Cerro El Diablo area, within the Colipilli region in the central-western sector of the Neuquén Basin, represent a complex hydrothermal system controlled by the interaction between tectono-structural evolution, magmatism, and fluid circulation within Jurassic-Cretaceous sedimentary sequences. These deposits, hosted in units such as the Vaca Muerta and Mulichinco formations and Colipilli igneous rocks, consist of barite associated with Pb, Zn, Fe, and Cu sulfides and show strong structural control related to N-S fracture systems. This study re-evaluates the hydrothermal evolution of this polymetallic district using an integrated approach combining fluid inclusion petrography and microthermometry, UV fluorescence for detecting organic compounds, X-ray diffraction of host rocks, and structural analysis supported by satellite imagery.

Preliminary results reveal a multi-stage hydrothermal system characterized by at least three mineralizing pulses, identified through crosscutting relationships between successive barite generations and associated sulfides, as well as the presence of breccia and cockade textures indicative of episodic fluid circulation and repeated mineral precipitation. Fluid inclusion data indicate that mineralizing fluids correspond to high-salinity basinal brines that were likely mobilized and heated by magmatic activity associated with the Naunauco Group. In addition, UV fluorescence analyses suggest a potential contribution of organic-derived components from the sedimentary host rocks.

These observations support a model in which structurally focused circulation of basinal brines, thermally driven by magmatic activity, controlled the evolution of the hydrothermal system. The results provide new constraints on the genesis of Ba-polymetallic mineralization in sedimentary basins and highlight the close relationship between hydrothermal mineralizing processes and petroleum system dynamics.