EVIDENCES OF RARE EARTH ELEMENTS (REE), MO, CO, LA AND NI MINERALIZATION IN THE SAN PEDRO VEIN SYSTEM, ANDACOLLO MINING DISTRICT, NEUQUÉN, ARGENTINA

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The Andacollo mining district is located at the northwest of Neuquén province, in the western hillside of the Cordillera del Viento range. This district is characterized by numerous Au, Ag, Cu, Pb and Zn mineralized veins (Strazzere et al. 2017 and references therein). These mineralized structures would have been developed by at least two hydrothermal events with Carboniferous-Triassic? and Cretaceous-Paleogene ages (Pons et al. 2022 and references therein). In this contribution present new data that evidence the presence of rare earth elements (REE), Mo, Co and Ni in the San Pedro vein system, being the first Co and Ni mineralization report for the district. These discoveries have been carried out through mesoscopic studies of drill core samples, transmitted and reflected light, and chemical and textural semi-quantitative SEM-EDS analyses.

The San Pedro vein system belongs to the Buena Vista-San Pedro Group and includes the San Pedro and San Pablo veins, hosted by volcaniclastic and volcanic rocks of the Arroyo del Torreón Formation (Dicaro et al. 2022; Pons et al. 2022 and references therein). These mineralized structures crop out in the surroundings of San Pedro hill and are characterized by a minimum of three hydrothermal episodes with their respective pulses: (1) a first episode constituted by quartz, adularia and/or sericite, (2) a second one by chlorite, pyrite and/or arsenopyrite and (3) a third one by late carbonates (Dicaro et al., 2022). The first episode represents the economically most important hydrothermal infill since it hosts the main Ag, Au, Cu, Pb and Zn mineralization (Dicaro et al., 2022).

The access to drill core samples from the San Pedro vein system allowed us to constrain the veins and their ore-shoots to heights between 1340 and 1310 masl (meter above sea level) (Dicaro et al. 2022). Notwithstanding, at deeper levels scarce quartz stockworks comparable to the first hydrothermal episode have been found.

Between 1310 and 1282 masl, veinlets with thicknesses between 0.5 and 10 cm composed of quartz (Qz), chlorite (Chl) and calcite (Cal) with allanite and rutile have been identified. Quartz develops as euhedral to subhedral prismatic crystals with hexagonal basal sections. Chlorite crystals are anhedral to subhedral and occur as vermicular aggregates with intermediate Fe-Mg compositions. Calcite occupies the interstitial space between quartz and chlorite as subhedral equant crystals and partially replace the quartz individuals. Allanite and rutile develop euhedral prismatic shapes perpendicular to the veinlets walls. SEM-EDS analyses allowed us to detect REE (La, Ce, Pr, Nd) in allanite. Allanite crystals are partially replaced by rutile, REE (Y, Ce, Pr, Nd, Sm, Gd) fluorcarbonates and late calcite. This veinlets cut the quartz veins of the first hydrothermal episode. No crosscutting relations were observed with the second hydrothermal episode, but they are cut by calcite veinlets of the third one.

In one of the studied drill holes, quartz+molybdenite (Mbd) and molybdenite+cobaltite (Cbt) veinlets were recorded at 1242 masl. Within these veinlets, molybdenite appears as laminated crystal aggregates, while the cobaltite crystals develop subhedral and equant shapes. SEM-EDS punctual analyses and compositional mappings led to the detection of La anomalies in molybdenite and Ni, Sb and Fe anomalies in cobaltite. Both veinlet types exclusively cut andesites with an intense hydrothermal alteration represented by an association of chamosite (Cha), phengitic muscovite (Msc) and minor k-feldspar. In a distal position from the veinlets, the alteration assemblage includes specularite (Hem) and rutile. Moreover, sphalerite and chalcopyrite traces were recorded disseminated within the altered andesites. The Qz+Mdb and Mbd±Cbt are cut by calcite veins from the third hydrothermal episode. No crosscutting relations were identified between the Qz+Cal+Chl and the Qz+Mbd and Mbd±Cbt veinlets since they were observed at different depths.

The Qz+Cal+Chl, Qz+Mdb and Mdb±Cbt veinlets are compositionally and texturally contrasting with the veinlets representative of the previous epithermal episodes defined for the San Pedro vein system (Dicaro et al. 2022). REE, Mo, La, Co and Ni are restricted to the ore minerals within the veinlet types described in this contribution. In this sense, the vermicular shape (intermediate Fe-Mg composition) and Fe-rich composition of the chlorites are limited to the Qz+Chl+Cal veinlets and alteration mineral assemblage given by Cha+Msc+Hem, respectively. Therefore, these veinlet types could correspond to a new hydrothermal event, with different physicochemical characteristics superimposed on the early epithermal episodes or either to a deeper and higher temperature variation of the early episodes. The alteration mineral assemblage given by Cha+Msc+Hem and its relation with an ore mineral association of Mbd±Cbt resembles a CGI hydrothermal deposit model (Copper, Gold, Iron), particularly, to a transition between IOCG-Co-REE and IOCG-REE (Skirrow 2022).

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