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Quebrada de la Mina, a new porphyry Au deposit (31º 29' S, 70º 32' W) in the Andean Main Cordillera of San Juan, Argentina: a petrogenetic analysis

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Exploration activity indicates that the Andean Main Cordillera of San Juan (Argentina) hosts large copper reserves with a cluster of Cu deposits as Altar, Piuquenes, Rincones de Araya, Yunque, Los Azules, and Los Bagres [1]. Recently, the Quebrada de la Mina (QDM) Au porphyry deposit (31º 29' S, 70º 32´ W) has been discovered near the Altar deposit [2]. The QDM prospect is centered on a porphyry stock that underwent appreciable gold introduction. Porphyry gold deposits have not been previously recognized at these Andean latitudes and its confirmation could have tectonic and magmatic implications for the region. In this study we analyse the correlation between geochemistry and hydrothermal alteration along the main section of the mining prospect.

The QDM porphyry intrusion has an U-Pb age of 11.91±0.33 Ma and intruded the deformed Early-Miocene volcanic sequence. On the western ridges of the project, the porphyry is cut by silicified structures and cores of vuggy quartz. In the centre of the project, the QDM porphyry is affected by sericitization with disseminated grains of pyrite and sphalerite, overprinted by an event tourmaline + pyrite (± quartz ± sericite), and laterally grade into zones of weak sericite + chlorite (± pyrite ± sphalerite) alteration. According to the drill holes conducted to date, gold mineralization is concentrated within a range of depths between 3600 and 3900 m.a.s.l associated with sericitic and tourmaline + pyrite (± quartz ± sericite) alteration types.

Early quartz A veins are very scarce in QDM drill-holes and absent in the outcrops. Type D veins with straight walls were observed cutting the porphyry at the surface and also in the drill-holes. D veins consist of subhedral pyrite grains (0.4-4 mm, which constitute 90% of the vein) ± sericite ± quartz crystals. Irregular and discontinuous late microveinlets of chalcopyrite, bornite, tennantite, pyrite, enargite, marcasite, and covellite (type E) cut the previous veins.

Mass balance calculations were obtained using Al_2O_3 and TiO_2 as immobile oxides. The results show that in the chlorite ± sericite zones the content of SiO_2, K_2O, and MnO increase slightly, while Na_2O decrease, and Fe_2O_3, and CaO decrease slightly. The depletion in Na and Ca is due to the breakdown of plagioclase. High values of Zn are present in this alteration linked to disseminated sphalerite crystals (Zn content increases in the range of 1900 to 7500 ppm compared to the fresh porphyry), whereas Au and Cu decrease. In the sericitic alteration K_2O, SiO_2, and Na_2O increase (sericite ± hydrothermal quartz), and Fe_2O_3 and CaO decrease (linked to the process of hydrolysis). Zn and Au increase slightly, and Cu decrease. In the tourmaline + pyrite (± quartz ± sericite) alteration SiO_2, K_2O, and FeO total increase, explained by sericite and pyrite linked to this event, and CaO and Na_2O decrease. The highest values of Au, Ag, Zn, and Cu occur in this alteration. Compared to the fresh porphyry, Zn increases (in a range between 2300 to 11000 ppm), Cu increases 870 to 1400 ppm, and Au increases 240 to 390 ppm.

The areas with high Au mineralization in QDM have a high content of fine-grained disseminated late pyrite. We suggest that this late pyrite may be the main carrier of gold. The good correlation between

Au and Ag indicates that gold should be present as electrum. The weak Au-As correlation suggests that some of the gold may be linked to arsenian pyrite. In QDM Au is not correlated with Zn.

References:

[1] Mpodozis C and Cornejo P (2012) Society of Economic Geologists Special Publication 16: 329–360.

[2] Maydagán L et al. (2015) Economic Geology 110: 889–923.