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EPITHERMAL GOLD MINERALIZATION AT CAPILLITAS, CATAMARCA PROVINCE, ARGENTINA

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Capillitas (27°21'S, 66°23'W) is located in the Department of Andalgalá, Catamarca Province, north-western Argentina, at elevations between 2800 and 3400 m above sea level. It is part of the Farallón Negro Volcanic Complex, known for porphyry Cu-Au (e. g. Bajo de la Alumbrera, Agua Rica) and epithermal vein-type deposits (Farallón Negro - Alto de la Blenda, Capillitas) [1, 2, 3].
The Capillitas diatreme is located in the Capillitas granite (upper Ordovician - lower Silurian age) and is host of a subvolcanic, polymetallic, epithermal vein-type deposit [4, 5]. It has been the source of gem-type rhodochrosite for more than 50 years. The diatreme is composed of intrusive and volcaniclastic rocks (ignimbrite, rhyolite porphyry, dacite porphyry and tuffs) of Miocene age (~ 5 Ma) and melanocratic and leucocratic dykes are exposed within the granite north and west of the diatreme [4, 5, 6, 7]. During late stages hydrothermal fluids altered the diatreme volcanics and a series of epithermal polymetallic veins were formed in and around the diatreme [6, 7]. Both the dykes and mineralized veins are structurally controlled, following the main joint systems in the Capillitas granite [6, 7].
The epithermal veins, hosted in rhyolite, ignimbrite and granite, generally strike ENE-WSW (e. g. La Rosario, La Grande, La Argentina and Nueva Esperanza veins) or WNW-ESE (e. g. Capillitas, Nueve, Ortiz, Restauradora and Bordon veins) and are associated with silicification, advanced argillic and sericitic alteration [4, 5]. They consist of many smaller veins and veinlets that pinch, swell and anastomose; their average thickness is 50–70 cm and they extend laterally between 100 and 800 m [4, 5]. Open space filling, rhythmic banding and brecciation are common textural features. At the surface, mineralized veins are only observed in the Capillitas granite, where they form silicified outcrops with brown to black color, due to oxidation of sulfides and rhodochrosite. The possible and probable ore reserves are approximately 387.000 tons, the average grades are Au 2.6 g/t, Ag 108 g/t, Cu 2.32 %, Pb 1.62 % and Zn 3.10 % [5].
On the basis of the geologic environment, the alteration and the ore mineralogy both low- and high-sulfidation mineralization can be distinguished. A number of separate mineralization stages were identified [4, 5], showing a complex Cu-Pb-Zn-Fe-As-Sb-Au-Ag paragenesis, with Bi, W, Sn, Te, Ge, Cd, In, V, Ni, Co and Tl in traces [4, 5, 8]. Quartz, rhodochrosite, barite and alunite are the associated gangues. Mineralization of the high-sulfidation style with pyrite, enargite, tennantite, hübnerite, Bi-sulfosalts, Sn-sulfides, bornite and ± native gold in a quartz-alunite gangue is mainly restricted to the diatreme volcanics. The veins hosted in granite and some distance away from the diatreme show typical low-sulfidation features and are composed of galena, iron-poor sphalerite, tennantite-tetrahedrite, chalcopyrite, pyrite and marcasite, associated with rhodochrosite, quartz and barite as gangues. The silver carriers of the ore are native silver, acanthite, proustite, pearceite and argyrodite.

Native gold is a rare constituent of the microparagenesis and associated with different ore types and mineral assemblages. It usually has microscopic dimensions (up to 25 μm) and microprobe analyses show a wide range of compositions from $Au_{0.88}Ag_{0.12}$ to $Au_{0.67}Ag_{0.33}$.
In ores from the Nueva Esperanza vein gold was observed as fracture-fillings in pyrite, tennantite and sphalerite or as tiny inclusions in tennantite and chalcopyrite (6.8 to 16.8 wt.% Ag, 0 to 0.15 wt.% Cu). Only traces o f gold were detected in pyrite-rich mineralization from the Bordon vein, where it occurs in association with hessite and Bi-sulfosalts as inclusions in pyrite and chalcopyrite. In a stockwork-like bornite-digenite-chalcocite mineralization from old dumps near the Rosario vein gold is usually silver-rich (18.2 to 20.2 wt.% Ag) and forms inclusions in Te-tennantite/goldfieldite, associated with hessite, bornite, digenite, covellite and mawsonite.
Within the upper levels of several veins gold is enriched and forms platy aggregates up to 15 millimeters in size, sometimes well crystallized. This gold shows a weak chemical zonation with silver-rich cores (18.6 to 20.9 wt.% Ag) and rims slightly depleted in silver (13.5 to 14.5 wt.% Ag). It is usually associated with quartz, clay minerals and limonite.

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