Mineralogical Evolution and Gold-Silver Zonation in the Segovia-Remedios Mining District, Colombia

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The Segovia-Remedios Mining District (SRMD) is located on the eastern flank of the Central Cordillera of Colombia. It is considered the major gold producer in the country. In 2020, Gran Colombia Gold Company (GCG) extracted around 220.194 gold ounces, representing 13.1% of the gold obtained in Colombia that year. The mineralization comprises quartz veins hosted in granodiorite Jurassic rocks, exhibiting NE-SW and NW-SE orientations. Geochemical data reveals variations in Au:Ag ratios: 1:1 and 1:400 in the NW and SE sectors of the district, respectively. However,we still don't know ocurrence of silver mineral phases and the metallogenic processes associated with gold-silver zonation.

Ore petrography descriptions and EPMA analysis in samples collected in four mines along SRMD reveal *three hydrothermal stages. Stage I* is characterized by massive milky quartz + subhedral pyrite, which is later affected by shear episodes related to Stage II formation. *Stage II*consists of pseudomorphic and early pyrite (after marcasite-pyrrhotite) fractured by the zonal sphalerite (2.58 – 17.61 molar % FeS) + a later galena event. Besides at *Stage II*some late euhedral pyrite occurs. Finally, *Stage III* is identified by the occurrence of carbonate sheeted veinlets. Gold mineralization occurs as electrum associated with *Stage II* in three different styles. At the northwest area, electrum appears as small inclusions of zoned sphalerite; also related to galena in fractured pseudomorphic pyrite and as microscopic inclusions in euhedral pyrite. Nevertheless, on the SE, electrum can only be found associated with galena, as well with tetrahedrite, freibergite, pyrargyrite, and argentite.

Sulfide paragenetic variations and silver sulphosalts ocurrence suggest changes in the sulfidation state as the first cause of gold-silver zonation. In addition, we are conducting micro-thermometric analysis in quartz and sphalerite of *Stage II* to know fluid facts and processes associated with silver-gold precipitation mechanisms and their zonations.