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Genesis of the Florida Canyon Nonsulfide Zn(-Pb) ores (Northern Peru): new insights on mineralizing events in the Bongará district

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Florida Canyon is a carbonate-hosted Zn(-Pb) mixed sulfide-nonsulfide deposit (Nexa Resources Peru), located in the Subandean fold-and-thrust belt of Northern Peru (Bongará Province), with total resources of 12.1 million tons at a grade of 10.7% Zn and 1.2% Pb [1]. The nonsulfide mineralization, hosted by the dolomitized carbonates of the Chambará Formation (Pucará Group), has a very complex distribution developed up to hundreds of meters in depth. These secondary ores are characterized by a great variety of textures and mineral associations. Two distinct nonsulfide facies have been observed: (1) *group 1* - reddish-brown nonsulfide facies, in both smithsonite and hemimorphite-prevailing bodies, showing features and compositions suggesting direct replacement processes [2], generally only partly obliterating the primary sulfide ores, characterized by stratabound “mantos” or high-angle bodies of sphalerite and galena [3]; (2) *group 2* - white-to-grey smithsonite, defined by grey colloform bands at the macro-scale and highly crystalline textures at the micro-scale, likely derived from wall rock replacement [2].

The wide range of the C-O stable isotopes compositions suggests that the genesis of the Florida Canyon mineralization was related to the supergene processes, characterized by percolation of meteoric waters in a deep hydrological “open system” in a humid tropical environment, characterized by complex dynamics of the circulating fluids and different recharge origins and processes, resulting in variable oxidizing water chemistry and non-equilibrium fractionation processes.

Through LA-ICP-MS analyses, high Ge concentrations were observed in hemimorphite and Fe-hydroxides (average 57 and 738 ppm Ge, respectively). These results, together with the bulk-rock Ge concentrations (up to 216 ppm) in hemimorphite- and goethite-rich samples, which are close to the bulk Ge contents exhibited by sphalerite-bearing samples (mean 168 ppm), suggest that during weathering Ge was retained in secondary phases directly forming at the sphalerite expenses [4].

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