World-class Cuiabá gold deposit, Quadrilátero Ferrífero Brazil: Mineralogical modifications with depth and their metallurgical and chemical impacts

Suellen Olívia Cândida Pinto [1, 2], Lydia Maria Lobato [1, 3], Mariana Gazire Lemos [2], Daniel Tonini Peterle [1, 2], Ricardo Oliveira de Araújo Mabub [2]

[1] Universidade Federal de Minas Gerais; [2] AngloGold Ashanti Brasil; [3] HydroFluid&Minerals

The Cuiabá Mine, located in the northeastern region of the Iron Quadrangle (IQ), south of the São Francisco Craton, is currently one of the deepest operating gold mines in Brazil. In the region, rocks belonging to the greenstone belt Rio das Velhas, of Archean age, and an association of mafic-ultramafic volcanic, volcanic-chemical-sedimentary, and clastic-chemical-sedimentary rocks outcrop. The deposit is an orogenic gold type, and three styles of mineralization are characterized in the mine. The main bodies are hosted in Algoma-type banded iron formation (BIF) in a stratabound style, where there is total or partial replacement by sulfides in Fe-rich layers. The other two types of mineralization comprise secondary bodies, with the second type having disseminated gold in metavolcanic rocks, in hydrothermally altered portions and associated with shear zones. The third type is associated with quartz±carbonate±sulfide veins hosting free gold. The orebodies are structurally controlled and associated with hydrothermal alteration zones. The mineral paragenesis shows a predominance of pyrite, pyrrhotite, and arsenopyrite. The Cuiabá's mine has reached level 23, at approximately 1,517 m, being presently mined at level 21 and 22 at the main orebodies. A particularity of recent years is that activities such as development, mining, and exploratory drilling are mostly concentrated below level 20. This leads to competition for infrastructure resources as well as physical space, and the need to prove the viability of ore at depth becomes essential for future investments in the business. The studies conducted by this work focus on the mineralogical characterization, defining the proportions of the different types of sulfide minerals that make up the deep mineralization. It also aims to characterize changes in the concentration of trace elements and contaminants present, evolving according to the advancement of the levels developed in the mine. Multielement geochemical analyses via LA ICP MS are being carried out for detailed characterization of the sulphides, and the data will be compared to previously published work to predict the long-term impacts of these changes on the processing of Cuiabá Mine ore. With the increase in depth, the sulfide mineral paragenesis has been showing some variations in composition, which are discussed based on chemical analysis data and metallurgical evaluations. In the routine analyses carried out by the geometallurgy team, a reduction in sulfur concentration is observed during the processing of the concentrate material in the plant. Petrographic observations also reveal an increase in the proportion of pyrrhotite, in relation to pyrite, which is also evidence of this change. This factor can have significant impacts on gold recovery rates and may moreover indicate the need to adapt the ore processing routine in the plant.