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Mineralogical Characterization, Resource Estimation and 3D Modeling of Sulfidic Tailings at the Neves Corvo Mine: An On-going Assessment

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Neves Corvo is an underground high-grade Cu-(Sn)-Zn mine, currently producing copper, zinc and lead concentrates. Copper production started in 1989, followed by tin production, between 1990 and 2001, and zinc / lead production started in 2006. The operation is owned by SOMINCOR, a subsidiary of Lundin Mining, with a maximum capacity of 2.6Mtpy for the copper processing plant and 1.0Mtpy (ongoing expansion to 5.6Mtpy) for the zinc processing plant.

The Neves Corvo VMS deposit is located in the Portuguese part of the world-class Iberian Pyrite Belt (IPB) and is composed of seven orebodies. The Neves, Corvo, Zambujal and Lombador orebodies are currently in production, whereas the Semblana and Monte Branco orebodies are relatively recent discoveries still under development and evaluation, and the Graça orebody has been already fully mined.

From 2010 till end of 2019, the mine has accumulated 7.3Mt of waste rock and 17Mt of thickened tailings. These mining residues are stored in Cerro do Lobo Tailings Management Facility (Cerro do Lobo TMF), which completes a volume of 47Mt since the beginning of the operation in 1989 (30Mt are slurry tailings).

The deposition method changed in 2010 from slurry subaquatic deposition to sub-aerial thickened tailings stack (vertical expansion) in co-deposition with potentially acid-generating (PAG) waste rock. The thickened tailings have an average of 63% solids. X-ray fluorescence analysis have shown copper and zinc grades variation in the waste rock between 0.3 and 0.9%, and 0.4% and 1.1%, respectively, and concentrations up to 0.3% and 0.4% of copper and zinc, respectively, in the tailings.

Mineralogically, the tailings consist mainly in pyrite, sphalerite, chalcopyrite, +/- arsenopyrite, +/- tetrahedrite-tennantite, gangue minerals such as quartz, phyllosilicates, carbonates and some oxides, and have a non-uniform particle size distribution ranging between 1 and 100 μm . The waste rock fraction is millimetric to centimetric in size, and is formed by the local host rocks, which include acid volcanic rocks, schists and graywackes, all of them containing variably significant disseminated sulfides, largely dominated by pyrite.

On-going research is being undertaken aiming to build a geometallurgical model for the Neves Corvo mine, ground on a huge database on the chemical and mineralogical composition, and particle size distribution of the mine tailings, coupled with (and calibrated by) new analytical and automated data acquired in a large set of carefully selected representative samples, in order to assess the potential recovery of base metals and their by-products out of these potentially valuable mine residues. The model construction and consequent resource estimation will be based on the daily monitoring of the tailings deposition at the disposal units, over the past 10 years (i.e., since the subaerial deposition has started at Neves Corvo), in terms of volume/tonnage, chemical and mineralogical compositions and physical characterization of the material.

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