Gold Deportment and Geometallurgical Recovery Model for the La Colosa, Porphyry Gold Deposit, Colombia

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Gold Deportment and Geometallurgical Recovery Model for the La Colosa, Porphyry Gold Deposit, Colombia

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ABSTRACT

The goal of this project was to develop a predictive geometallurgical recovery model for the La Colosa porphyry gold deposit using the gold deportment, analytical data (multi-element assays), mineralogy, and recovery data. The aim of geometallurgy is to reduce risk and uncertainty by understanding the variability within the ore body, to increase the confidence in forecasting and planning of production as well as optimizing recovery. Through different levels of testwork, such as reference, support, and proxy, relationships and predictions are made. Geometallurgy uses geology, statistics, and metallurgy to develop models that predict the behaviour or variability in the ore body due to geological or mineralogical changes.

The La Colosa porphyry gold deposit is a world-class deposit located in the Central Cordillera of Colombia. It is unusual because it is gold rich and has low amounts of copper and trace molybdenum. The deposit consists of multiple intrusions of early, intermineral, and late porphyritic phases of diorites, dacite, and quartz diorites that have intruded into the schist and hornfels basement rock. The dominant alteration assemblage is potassic with weaker amounts of potassic-calcic and sodic calcic alteration. Gold-related veins include quartz-sulfide (A type) and sulfide (S and D type) veins. Geologic aspects of the deposit were used to create a general geologic model for gold mineralisation at La Colosa that was used to help create a recovery model.

The gold mineralisation at La Colosa occurs predominantly as native gold, gold tellurides, and gold-silver tellurides, and in veins with a halo of disseminated (vein poor) gold mineralisation. Grain size, association, and deportment of the gold at La Colosa were
examined and the results used to understand the variability in the gold recoveries (cyanide leach, gravity, and flotation). Recovery data was used with leaching as the primary process, with tests such as shake leach and bottle roll analyses. Results of the geologic model, detailed visual logging, gold recovery testwork, multi-element analyses, and mineralogy testwork were used to build geometallurgical predictive models to estimate the gold recovery using multivariate statistical techniques, such as correlation analysis, Mahalanobis Distance, Principal Components Analysis (PCA), and multiple regressions. The steps used to develop the geometallurgical model were the following:

1. Identify anomalies using Mahalanobis Distance.
2. Perform correlation analysis to identify similar characteristics.
3. Perform a Principal Components Analysis (PCA) to constrain variability and develop discriminant diagrams for the data.
4. Define classes and perform linear and non-linear regressions to model the desired parameter.
5. Create process performance domains of the data and wireframe to check.
6. Evaluate and re-iterate the model as newer data is gathered.
7. Apply to resource or geologic block model.

By using the recovery and gold mineralogy data along with the multivariate statistical techniques, a predictive geometallurgy model to estimate gold recovery was constructed. This model can be incorporated with the planning and resource models for the site to efficiently extract and process the gold.
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