Geometallurgy at Tropicana: Mine to Mill Implementation

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In the last few decades, there has been a lot of debate about what geometallurgy actually is. For a lot of companies in the mining industry, it has meant metallurgical variability test work on small data sets undertaken in the prefeasibility and feasibility studies. This work forms part of the strategic decision to go ahead (or not go ahead) with mining a "prospective" project. This study, while useful in its own right, often has very little practical application once the decision to mine has been made. When the project is in the production phase, the mine needs to make day-to-day tactical decisions that have financial impacts based on the results of the metallurgical test work, which is often lacking in detail.

For geometallurgy to succeed in the mining phase of a project, we first need to think about the implications of having such a narrowly defined scope and whether we are looking at a strategic or tactical timeframe. We need a multidiscipline approach that combines geology (what and where is it?), mining engineering (how and in what sequence do we mine it?), finance (how do we optimize our cash flow?), metallurgy (how do we mitigate the risks in the processing plant?), and environmental science (how do we mitigate environmental risks?). The implementation of the tactical geometallurgy system at Tropicana gold mine consisted of four main phases:

1. Data capture: There is an automated data collection system at the lab that collects XRF and hyperspectral readings. There is also an online data collection software system called Citect, which collects data on all aspects of the processing plant and allows continual comparison between predicted and actual processing plant performance.

2. Data processing/manipulation software systems: An automated data conversion software system for hyperspectral data has replaced the time-consuming historical process of manual data conversion from analogue wavelength data to numerical data. The output of this automated data interpretation software is then fed to a geometallurgical calculation engine, along with the XRF multielement data and, potentially, any other data sources that may contribute to the calculation of metallurgical and processing plant performance predictions.

3. Relationship analysis: This entails correlation between processing plant performance and laboratory measurements of the ore passing through the processing chain, and involves a sampling program directly from the processing plant. This is a unique approach, as this step is normally done by taking large bulk samples of material in the ground and putting this through a "mini processing plant" that simulates conditions in the "real" processing plant.

4. Application: This involves a 3-D spatial block model of the metallurgical characteristics and processing plant behavior of the orebody in the ground that can be used for mine scheduling/planning, blending strategies, forewarning of risks to the processing plant, financial scenario and risk modeling, and any other characteristics of the ore that are potentially important to the optimal mining/processing of the orebody and the environmentally friendly disposal of waste.