

Value Creation as a Guide for Advanced Exploration at Conchi Porphyry Copper Deposit, Chile: A Case Study and Methodology for Integration of Technical and Economic Variables

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Mineral exploration and development are commonly seen as a sequential process in which geologists are charged with understanding the natural controls that lead to the discovery and delineation of an ore deposit, subsequently relaying the data to mining engineers, who determine its economic feasibility and potential value as a mining venture.

In the case of porphyry copper deposits, the suboptimal nature of this traditional approach may not be apparent for large, high-grade, and geographically accessible targets, but it becomes clear in the current state of the industry, in which giants are scarce and a multitude of factors modify the value of a ton of ore, such as geometallurgical and geotechnical variables, operating costs, availability of infrastructure, operating and recovery factors, and, increasingly, environmental and community considerations. Therefore, it is a necessity that exploration teams integrate these variables early on into their concept of value, going beyond grade and tonnage as the sole measures of the potential of an exploration target.

This contribution presents a methodology being developed by the mining resources team at Antofagasta Minerals to attempt the creation of a virtuous cycle between geological exploration and modeling and the determination of the final value of a mining project.

A key feature of this methodology is repeated assessment cycles, concurrent with exploration and geological modeling, in which the integration of technical and economic variables, constrained by realistic scenarios, is used for precise valuation. This includes recognizing drivers that counteract value depletion through the cost and alternative use of capital investment. Additionally, the identified value drivers are implemented into a protocol for drill hole planning that maximizes the marginal probability of adding economic value with the next drilled meter, and they are also used to challenge and improve early geological unit definition and interpretation.

Conchi is a porphyry copper deposit located in northern Chile, and has been explored for decades, outlining a significant oxide, supergene, and hypogene mineral inventory. Successive drill campaigns on deep portions as well as lateral extensions of the deposit have significantly increased those initial inventories. Adding geometallurgical variables to the sulfide zone block models, such as ore recovery, copper concentrate grades, quantitative sulfide distribution, energy consumption, and work index, among other variables, allowed the evaluation team to revisit early open-pit mine plans based mostly on copper grades.

After a detailed and focused relogging effort of all available core, a new geological model update was completed. The new ore distribution shows that the deposit may even be amenable to a block caving scenario.

The “rock-to-product” approach presented here requires a team effort by geologists, metallurgists, and mining engineers evaluating a deposit, challenging early exploration evaluations and producing data that is relevant from exploration to operation.