Using Geochemistry to Inform Geometallurgy at the Productora Cu-Au-Mo Deposit, Chile

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The key aims of this project are to investigate relationships between alteration patterns, geochemical zonation, and ore textures at the Productora Cu-Au-Mo deposit, Chile, and assess their impact on liberation behavior and recovery response. Quantitative and predictive geometallurgical models are being developed based on geochemistry to reflect variability across the deposit in mineralogy encapsulated in the ore classification: oxide, transitional oxide, transitional sulfide, sulfide, and nonrecoverable Cu. This ore classification was based on Cu sequential leach data.

Productora, located in the coastal range of northern Chile, is a magmatic-hydrothermal, tourmaline breccia-hosted, structurally controlled, Mesozoic Cu-Au-Mo deposit hosted by a thick sequence of Jurassic rhyodacitic volcanic rocks. N- and NW-striking fault sets control the distribution of mineralized breccias. Alteration is widespread, complex, and pervasive. Hypogene alteration assemblages range from distal magnetite-amphibole to sodic-calcic, to sodic, to phyllic, to proximal potassic compositions. Low-temperature advanced argillic assemblages are locally juxtaposed to proximal high-temperature K-feldspar-tourmaline assemblages. The dominant hypogene Cu phase is chalcopyrite.

Quantitative and predictive geometallurgical models are being developed to integrate a range of geological and geometallurgical data. Modal mineralogy, calculated on assay intervals using multielement geochemistry and quantitative X-ray diffraction data, is being used to generate geometallurgical domains relevant to comminution. A proxy for ore classification (as determined from sequential leaching) was developed based on K %, Ca %, Fe %, Mn ppm, S %, Cu %, and Ln(Cu/S) plus sample depth, thus allowing ore classification to be extrapolated across the deposit.

The validity of the proxy ore classification model and calculated mineralogy models is being tested against the results of flotation and comminution analysis. Initial results indicate that geochemical proxies can be used to successfully predict ore class and provide a high density of classification data. The modeled data has been used to generate deposit-wide 3-D models for ore classification and mineralogy, including total quartz + feldspar % and total pyrite %. Geometallurgical domains inferred from these models are being characterized at the mesoscale through graphic core logging, and at the microscale through a range of techniques including optical microscopy, mineral liberation analysis, and X-ray fluorescence mapping.