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Calculating Quantitative Mineralogy from Assay Data Using Comet™: Case Studies from Magmatic-Hydrothermal Cu-Au Systems

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The fundamental objective of mining is to extract and purify economically viable products, which are physically bound within minerals. Collection of geochemical assay data does not provide the necessary information to understand mineralogy and therefore how the rock will be processed in a multi-million-dollar operation, where an incomplete mineralogy model can create significant risk and inefficiency throughout the mining lifecycle. The most common solution has been determining mineralogy by visually logging drill core by geologists; however, this is inherently low-resolution and highly subjective, and critical changes in mineral assemblages can be missed or misinterpreted.

Comet™ is a web-based app optimised for 4 acid digest assay data to calculate the mineral assemblage that produces the minimum Gibbs Free Energy of the system at a given temperature/pressure, converting bulk rock composition into estimated weight percentages of key minerals.

From an exploration perspective, understanding mineralogical zonation assists with drill hole targeting. Mineralogy dictates rock behaviour, influencing mill throughput, energy consumption, recovery rates, and environmental outcomes.

The Valeriano porphyry deposit in Chile has been modelled with key minerals occurring throughout the 2-km vertical transition from the deep-seated potassic core to shallow HS epithermal mineralization. The calculated distributions of feldspar and muscovite can be utilised to optimise metallurgical sampling and de-risk processing strategies. Cu-Fe sulfides discrimination was also achieved, providing estimations of chalcopyrite, bornite, and chalcocite abundances.

At Red Mountain in Queensland, a strong spatial relationship between elevated gold grades and the content of white mica, ankerite, pyrite, and quartz refines the understanding of alteration controls and gold distribution within the system. The resulting mineral distribution models can be directly integrated into future drilling programs, supporting more precise targeting of high-grade zones.

By converting known elemental data into critical mineralogical information, Comet™ reduces uncertainty, improves efficiency, and supports more informed decision-making across the mining lifecycle.