Fourier transform infrared spectroscopy for geometallurgy modelling - GRE46 gold deposit (NSW, Australia)

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The mineralogy of a given rock mass is a fundamental geological property that can directly influence our ability to adequately consider, plan and predict the full down-stream environmental and social impacts that a project may encounter. Understanding the mineralogy at the deposit scale provides orebody knowledge that can help inform key project decisions (i.e. extraction sequencing, comminution planning, processing optimization, waste or by product management, and rehabilitation strategies).

The GRE 2.74 Moz gold deposit (34.8 Mt @ 2.45 g/t Au) is one of several low- to intermediate-sulfidation epithermal deposits located in the Cowal Igneous Complex, forming part of the Ordovician to early Silurian Macquarie Arc in central New South Wales (Australia). Gold mineralization at GRE46 is associated with low-density high-grade quartz-carbonate-pyrite veins, hosted within a sequence of calc-alkalic subaqueous volcanic and volcaniclastic rocks. Underground production from the GRE46 deposit began in 2023, introducing a new variable ore type into the process circuit. Understanding the spatial distribution and variability of both primary and alteration mineral assemblages at early stages of deposit characterization has significant implications for mining, processing, metal recovery and waste-rock management.

Fourier transform infrared (FT-IR), and near-infrared (FT-NIR), spectroscopy generates high-resolution data over a wide spectral range with a low signal-to-noise ratio and allows the full spectrum to be utilized in modelling. FT-IR and FT-NIR is applied to conventional drill pulp (p80 <75 µm) samples of the major rock types at GRE46 that have measured quantitative modal mineralogy and comminution parameters. Partial Least Squares (PLS) regression models use the processed spectral data to produce validated predictive mineralogy and comminution models for the deposit. This study highlights the potential for FT-IR and FT-NIR as a rapid, non-consumptive, and cost-effective options for mineralogy modelling and as an upscaling enabler to improve ore body knowledge.