

Hyperspectral Mine Face Mapping: Bridging the Spatial Gap Between Drill-Hole Mineralogy

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Hyperspectral imaging, particularly through drill-core scanning, has seen growing adoption in mineral exploration over recent years. The resulting mineralogical and alteration models are increasingly incorporated into production workflows, where alteration mineralogy is often critical for understanding slope stability and metallurgical performance. However, spatial coverage remains limited, with data between drill holes typically inferred via interpolation or qualitative observations of exposed surfaces in active mine environments.

In contrast, the application of hyperspectral sensors deployed on trucks, tripods, and drones for mine face mapping is still in its early stages. Despite their potential, the complexity of data corrections, atmospheric effects, and challenges in data integration have hindered the effective use of these datasets for updating alteration models or informing mine planning.

To address these limitations, we present a workflow that calibrates and integrates mine face hyperspectral data, georeferenced through projection onto photogrammetric point clouds, with drill-core hyperspectral outputs. This approach enables co-registration and co-visualization of both datasets within 3D modelling environments, supporting the development of spatially continuous numerical and categorical models of alteration mineralogy. While applicable to a number of deposit types, this approach is particularly beneficial for mineralisation styles presenting small scale variability of alteration assemblages (e.g., skarn, porphyry copper, epithermal).