

# SEG 2024 Conference: Sustainable Mineral Exploration and Development

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## Hyperspectral Outcrop Surveys for 3-D Geological Mapping

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Digital outcrop models based on photogrammetry, attributed with hyperspectral reflectance data, represent a 3-D environment for mineralogical mapping of natural cliffs or mine faces. With the collection of such spatially continuous datasets, the possibility arises for mapping extensive natural or human-made outcrops at high resolution and with a short turnaround time.

Such workflows rely on the integration of high resolution photogrammetric pointclouds and hyperspectral scans, acquired either from a tripod-based system or a drone. Once the hyperspectral data are projected onto a photogrammetric pointcloud, the derived hypercloud can be analysed using various techniques.

Endmember extraction methods allow for the identification of spectral endmembers characteristic of different mineral assemblages. Using this information, a selection of methods can be used for mapping the relative abundance of different spectrally diagnostic minerals, delivering relative abundance, alteration, or lithological maps.

With these extensive 2.5-D (i.e., surface) maps that are available to geologists on the ground just shortly after data acquisition, decision making can be improved for both exploration sampling as well as material handling during production. With the collection of samples and additional ground truth mineralogical or geochemical data, machine learning techniques can be employed to extend the relative abundance results to semi-quantitative abundances.

These obtained outcrop maps can be then integrated with drill-core data to improve the 3-D modeling of a specific deposit.