Integrating Mineralogical and Geochemical Data Across Scales for Improved Geophysical Data Interpretation: a Case Study from the Idaho Cobalt Belt, USA

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The Idaho cobalt belt (ICB) includes several stratabound cobalt and copper deposits hosted in metasedimentary rocks of the Belt basin that contain significant cobalt. Despite its economic and strategic importance, the processes that form these deposits are still poorly understood, and therefore the potential for concealed critical mineral resources is uncertain. The U.S. Geological Survey's Earth Mapping Resources Initiative has funded geologic mapping by the Idaho Geological Survey and, in conjunction with industry partners, aeromagnetic and radiometric surveys across the ICB.

The goal of this collaboration is to improve our understanding of the potential for critical mineral resources in the ICB and elsewhere by designing a workflow that combines both mineralogical and geochemical characterization across a range of scales. These fully co-registered heterogeneous remote sensing and sub-surface datasets will help inform geophysical data interpretation and subsequent construction of interpretive 3D geologic models to better understand the mineralogy and geochemistry of the alteration and ore zones.

Drone-based hyperspectral surveys, to be completed in the summer of 2022, will be combined with continuous XRF and hyperspectral core scans, and magnetic susceptibility data collected on drill core and automated mineralogy from select thin sections to form heterogeneous but fully co-registered datasets. Selected drill core from the Iron Creek deposit has been scanned using continuous XRF analysis and co-registered with hyperspectral core scans. Cluster analysis was used to define host rock types and ore zones based on these data. Sub-sampling strategies were developed, and samples were selected for thin section preparation. Thin sections were inspected using quantitative automated mineralogy to unravel host rock, alteration, and ore zone mineralogy. Results will be integrated with the geology to aid forward and inverse modeling of the geophysical data.