

# SEG 2026 Conference in Salt Lake City, United States

---

## **Leveraging the National USGS Earth MRI Mine Waste Geochemistry and Mineralogy Database to Provide Insights on Critical Mineral Enrichment**

**Kathryn Hobart**<sup>1</sup>, Nadine Piatak<sup>1</sup>, Robert Seal<sup>1</sup>, Kate Campbell<sup>2</sup>, Darryl Hoppe<sup>1</sup>, Carlin Green<sup>1</sup>

<sup>1</sup>United States Geological Survey; Geology, Energy, and Minerals Science Center, Reston, United States,

<sup>2</sup>United States Geological Survey; Geology, Geophysics, and Geochemistry Science Center, Denver, United States

Mine waste characterization through the U.S. Geological Survey's (USGS) Earth Mapping Resources Initiative (Earth MRI) – a collaboration between the USGS and State geological surveys – represents an opportunity to assess critical mineral (CM) enrichment in mine waste. Nineteen States have sampled mine waste, including waste rock, ore stockpiles, tailings, and slag, for bulk geochemical and mineralogical characterization. The characterization data from individual States are being synthesized into a national-level database. Using the mineral systems framework developed for Earth MRI (Hofstra and Kreiner, 2020), we evaluate these data to identify systematic trends in the abundance of CMs in mine waste, which can then be interpreted within the context of the parent ore deposit type and waste type, providing insight into factors that result in CM enrichment.

We find that similarities in chemical composition occur for samples from the same parent ore deposit type, despite significant variations in the concentrations of elements found in waste rock and tailings at a single mine site. In general, waste is enriched in elements that coincide with the major and byproduct commodities and CMs typical in ore from that deposit type. Primary commodities, such as copper, are typically lower in waste rock and tailings than in ore samples from the same deposit, while elements that were not targeted during processing, such as antimony, can be at similar or higher concentrations in waste than in ore samples. The fate of CMs is controlled by their mineralogical hosts. Ultimately, this dataset, along with tonnage information from the Earth MRI mine waste inventory, can be used to estimate the concentration of CMs in mine waste from a specific deposit type.