Critical Mineral by-Product Potential in the Permian-age Phosphoria Formation

Jake Alexander[1], Andrew Rupke[1], and Taylor Boden[1]

[1]Utah Geological Survey

Abstract

The Permian-age Phosphoria Formation is a well-studied petroleum source and the largest resource of phosphate in the western United States. Phosphate has been produced for over 100 years across the Western Phosphate Field dominantly from the Meade Peak Member of the Phosphoria Formation. In Utah, the Meade Peak Member intertongues with the Park City Formation. Ore-grade phosphate (~20% P_2O_5 or higher) is mined at the Simplot mine north of Vernal, Utah, and at Keras Resources' Diamond Creek mine east of Spanish Fork, Utah. Notably, the rare earth elements (REE) praseodymium and neodymium, as well as vanadium, chromium, and fluorine, are known to occur in anomalous concentrations within phosphorites and phosphatic shales of the Meade Peak Member. These five elements are currently classified as critical minerals by the U.S. Geological Survey (USGS). A USGS-funded project to understand this critical mineral enrichment of phosphorites and phosphatic shales is underway by a consortium of state geological surveys across the Rocky Mountain Cordillera. Here, we present a combined stratigraphic, geochemical, and petrographic reconnaissance study of the Meade Peak Member in Utah to better constrain the potential of REE and other critical minerals as by-products of phosphate production. Six stratigraphic sections were measured from outcrops and diamond drill cores located across Utah that provide a geographically widespread dataset for this study. Initial geochemistry data indicates positive correlation between P_2O_5 content (up to 36 wt%), REE enrichment (300–1200 ppm), and chromium content (200–1400 ppm). By integrating stratigraphic analysis with geochemistry, microscopic petrography, elemental mapping, and semi-quantitative compositional analysis, we aim to better understand the genesis and distribution of critical minerals in Utah's phosphate resources.