74-6 - CRITICAL MINERAL PARTITIONING IN COAL-HOSTED CLAYS OF THE POWDER RIVER BASIN, WY DETERMINED BY SEQUENTIAL EXTRACTION

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Abstract

Increasing demand for a more robust domestic supply of rare earth elements (REE) and critical minerals (CM) has led to significant investigation into unconventional sources. Coal and coal byproducts from the Powder River Basin (PRB) of Wyoming are potential sources of REE and CM. The association between strategic metals and their mineral hosts has important implications for extractability. Samples of overburden, underclays, and clay-rich partings were selected for analysis from core and bucket samples from three PRB coal mines. Quartz, illite, and kaolinite-group minerals are abundant in clay-rich portions of the PRB coal strata. We performed a five-step sequential extraction to constrain critical metal partitioning in samples of overburden and underclays (n=10). Unlike the occurrences of REE in other clay deposits, insignificant amounts of total REE + Y (TREY) were recovered in the ion-exchangeable fraction (< 0.5 ppm). A significant amount of TREY was leached from the acid-soluble fraction by 0.1M HCl, suggesting REE may be tied up within crystal lattices rather than sorbed to clay surfaces. The acid-soluble fraction contained between 3 and 250 ppm TREY, with an average TREY concentration of 60 ppm. Relative standard deviations for each extraction step were generally < ±10%. Whole-rock samples (n=72) contained greater TREY enrichment in overburden than in underclays and partings, however, the opposite is true for other CM, such as Ti and V. Other locations in the PRB show different enrichment trends. Our findings supplement a broader effort to couple REE and CM extraction with existing domestic coal production and contribute to the fundamental understanding of how these metals concentrate in low-temperature basin environments.

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