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Evaluation of Coal-Associated Sediments, Wastes and Byproducts in the Southeastern United States as CM-REE Feedstock Materials

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Identifying new domestic resources for REE and other CM is considered essential to protect the U.S. economy from the threat of supply chain disruptions. This study is examining the potential for coal-associated sediments, wastes and byproducts to serve as feedstock materials for the domestic critical mineral supply chain. Samples of underclay (N = 14) and roof rock (N = 12) adjacent to coal seams known to have elevated REE contents, coal processing refuse (N = 5), coal mining AMD waste (N = 11), and coal combustion byproduct (N = 82) samples were collected and analyzed for REE, Y, Sc, and Li concentrations by ICP-MS (EPA 200.8) after complete digestion (ASTM D6357), and concentrations were reported on a dry weight basis. Of these potential feedstock materials analyzed for this study, coal ash is the only viable resource for REE (Average Total REE = 473.5 $\pm$ 167.2 ppm, Average Total REE+Y+Sc = 587.8 $\pm$ 208.4 ppm). Of the coal-associated sediments, underclay samples were higher in Average Total REE content (222.6 $\pm$ 34.23 ppm) and Average Total REE+Y+Sc content (270.1 $\pm$ 37.95 ppm) than roof rock samples (Average Total REE = 195.9 $\pm$ 57.5 ppm, Average Total REE+Y+Sc = 237.4 $\pm$ 68.57 ppm). Four of the 14 underclay samples exceeded the 'ore grade' Total REE value of 300 ppm. Coal processing refuse samples were lower in Average Total REE (150.5 $\pm$ 68.1 ppm) and Average Total REE+Y+Sc contents (183.1 $\pm$ 83.5 ppm) than in-situ coal-associated sediments, likely due to leaching of the refuse piles by meteoric water. AMD sludge and water samples were lowest in Average Total REE and Total REE+Y+Sc. The average Li concentration of coal ash was 281.3 $\pm$ 122.8 ppm, only slightly higher than the underclay sample average of 217.4 $\pm$ 143.0 ppm. To better understand the extractability of REE and other CM from coal ash and underclay materials, selected samples are being characterized for major and minor mineral contents by XRD and Rietveld refinement, and the trace mineral contents and trace element concentrations of these samples are being determined by SEM/EDX analysis and micro-XRF mapping to determine mineral/REE-CM associations.