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Thoughts for the Co-Production of the Rare Earth Elements from Kaolin and Bauxite, Georgia Coastal Plain

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ABSTRACT

Sizeable occurrences of the rare earth elements (REE) have been described for both mined kaolin units in Georgia. Siliciclastic minerals forming the mined kaolin units were eroded from Piedmont and other crystalline rocks north of the Fall Line. The weathering products were transported and deposited as fluvial sediments into the Coastal Plain during the late Mesozoic Era (Cretaceous Period) to the early Cenozoic Era. Additional chemical weathering processes produced the highly weathered rocks having high contents of kaolinite. The coarse fraction of the mined kaolins comprises roughly 5–10% of the total mass. The coarse fraction is separated from the fine-grained kaolin early in processing of kaolin ore. The coarse fraction is used to help backfill previous mined open-pit quarries. Sizeable amounts (0.1–0.5 wt. %) of the REE are found in a heavy subfraction of the coarse fraction. This heavy subfraction is enriched by 50 to 150 times in the heavy REE (HREE) (Y, Gd–Lu) relative to their concentrations in upper continental crust (UCC). Xenotime and zircon appear to harbor the REE in this subfraction. The observed REE contents are simulated by a mixture of 99.50% zircon and 0.5% REE phosphates (xenotime + monazite). In contrast, Light REE (Sc, La–Eu) phosphate minerals are observed in the fine fractions of the mined kaolin. The REE displayed some mobility within the fine fractions. The REE found in the heavy subfraction is equal to 0.5% of the annual non-Ce coarse fraction imported REE. The heavy subfraction of kaolins represent a novel domestic resource for the REE (and HREE). The REE would need to be recovered from the phosphate and zircon hosts via chemical or other separation techniques.

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