

Microbial Weathering of Coal for REE Extraction

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The rare earth elements (REEs) are a group of seventeen elements which includes scandium, yttrium, and fifteen of the lanthanide series elements. These elements are vital to the U.S. because they are used in a variety of consumer goods, advanced technology, and in defense purposes. Acquiring a domestic profitable source of REEs is a critical national need. Coal contains REEs and can serve as an alternate source as demonstrated by the fact that some Alaskan coal deposits contain REEs in concentrations as high as 950 ppm. Microbes have profoundly affected Earth's surface over geologic time by playing critical roles in weathering of minerals. This project examined the process of bio-weathering coal to release REEs into solution. Alaskan coal was incubated with *Shewanella oneidensis* at a circum-neutral pH and cycled between oxic and anoxic conditions. Total REE had a maximum recovery rate of 98.4%. Abiotic controls did not produce measurable levels of any REE. Furthermore, depending on the source of coal bio-weathering performed comparable to or better than acid leaching (1.2M H₂SO₄ at 75°C). These results show that microbial weathering of coal offer an alternative method to extract REEs that may be more efficient and more environmentally friendly than current technologies.