Apatite—A Resource for Life and Critical Elements

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Massive sedimentary fluorapatite deposits occur in the U.S. and Africa and Asia. They are readily mined and purified through acid dissolution and precipitation into fertilizer (ammonium phosphate), a critical material for sustenance. Though phosphorus is not presently in short supply, resources could be depleted. Thus, great care should be given to the processing of this valuable mineral. Fluorapatite contains a cornucopia of less common elements, including uranium, thorium, radium and the rare earths. Their partitioning during processing is a major concern, especially for radioactive Th, U, and Ra. At the same time, the fluorapatite and its products represent significant potential sources of rare earths critical to modern technology. Igneous apatite in association with other rare earth minerals occurs widely and is another potential source of these elements. From a geochemical point of view, the thermodynamics of rare earth incorporation/partitioning in apatite, other solids, and aqueous solutions is essential to understand the formation of these deposits and to provide guidance for rare earth extraction. This talk will discuss thermochemical data for rare earths in various mineral phases and trends of stability.

This research is supported by the Critical Materials Institute, an Energy Innovation Hub funded by the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Advanced Manufacturing Office. Grant number DE-FOA-0000687.