Sorption of Uranium and Radium by Biotite, Muscovite, and Phlogopite

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Abstract: The sorption of U and Ra on finely ground biotite, muscovite, and phlogopite was adequately described by the Freundlich adsorption equation, $(x/m) = KC^n$, at low U and Ra concentrations despite Ra precipitation at the higher temperature. Radium and U sorption-efficiency curves derived from the Freundlich constants generally showed decreased distribution coefficients in response to increasing temperature and increasing Ra or U concentrations. Temperatures investigated were 5 ° C, 25 ° C, and 65 ° C. Solution compositions used were 0.1 M NaCl and 0.01 M $NaHCO_3$ for U, and 0.01 M NaCl for Ra. Uranium initial solution concentrations ranged from 1.00×10^{-4} M to 4.00×10^{-7} M; the Ra initial solution concentration range was 6.80×10^{-7} M to 8.60×10^{-9} M.

In 0.01 M $NaHCO_3$ solutions, anionic uranyl carbonate complexes were prevalent, and because they are weakly sorbed relative to free uranyl ion and uranyl hydroxy complexes, the result was a relatively low U sorption efficiency on biotite and phlogopite and excellent sorption efficiency on muscovite. Uranyl carbonate complexes decreased in solubility with increasing temperature, so that U sorption efficiency on biotite increased with increasing temperature. Sorption of uranyl ion and uranyl hydroxy cations on biotite decreased with incresaing temperature.

Key Words: Anion exchange • Biotite • Cation exchange • Muscovite • Phlogopite • Radium • Sorption • Uranium

Clays and Clay Minerals; October 1983 v. 31; no. 5; p. 343-351; DOI: 10.1346/CCMN.1983.0310503

Clay Minerals Society (www.clays.org)