Effects of aqueous phosphate on U(VI) sorption

F. MAILLOT[1]*, V. MEHTA[2], J.G. CATALANO[1], D.E. GIAMMAR[2] AND Z. WANG[3]

[1]Earth & Planetary Sciences, Washington Univ., St. Louis, MO 63130, USA, (*correspondence: fabien.maillot@wustl.edu)
[2]Energy, Environmental and Chemical Engineering, Washington Univ., St. Louis, MO 63130, USA
[3]Pacific Northwest National Lab., Richland, WA 99352 USA

Uranium contamination of soils and groundwater has resulted from past mining, processing, and waste disposal activities. Among the in-situ remediation strategies for oxic subsurface environments, phosphate-based treatments have generated significant interest [1]. The soluble uranyl ion [$U(VI)O_2^{2+}$], stable in oxidizing environments, has a strong affinity for phosphate, which can potentially reduce its aqueous concentrations by promoting the nucleation of low-solubility U(VI)-phosphate minerals or by enhancing U(VI) sorption to subsurface minerals.

We investigated the effect of aqueous phosphate on U(VI) sorption on montmorillonite (Clay Mineral Society source clay SWy-2) and goethite. Both minerals are important components in the reactive fine fraction of soils and sediments at sites contaminated with uranium [2]. We determined U(VI) adsorption isotherms at several pH conditions and initial [PO_4^{3-}]. Uranium speciation was further investigated using U L_{III}-edge EXAFS and Time Resolved Laser Fluorescence spectroscopies.

A series of possible competing and cooperating reactions may occur in the presence of U(VI) and phosphate, including the formation of U(VI)-phosphate precipitates, U(VI)-phosphate ternary surface complexation [3], and surface site competition between U(VI) and phosphate. Formation of uranyl-phosphate minerals was observed in the presence of either goethite or montmorillonite. Before the onset of precipitation however, our results show contrasting behavior between these two systems. While phosphate does not substantially influence the extent of U adsorption on montmorillonite, it was found to enhance U sorption on goethite at pH 4 and to inhibit it at pH 8. These observed differences indicate that the specific mineralogy of a contaminated field site could greatly influence the applicability of phosphate-based uranium remediation.

[1] Vermeul *et al.* (2009) *300 Area Uranium Stabilization Through Polyphosphate Injection: Final Report*. [2] Stubbs *et al.* (2009) *Geochim. Cosmochim. Acta* **73**, 1563-1576. [3] Singh *et al.* (2012) *Environ. Sci. Technol.* **46**, 6594-6603.

The effect of Alkali-Feldspar composition on mineral-melt partitioning of Trace Elements

M. MAIMAITI[1]*, F. ARZILLI [2] AND M.R. CARROLL [3]

[1]Geology Division, University of Camerino, Via Gentile III da Varano Camerino (MC) Italy,62032 (*correspondence:maierziyaguli.maimaiti@unicam.it)
[2] Geology Division, University of Camerino (arzilli.Fabio@gmail.com)
[3] Geology Division, University of Camerino (michael.carroll@unicam.it)

The aim of this work is to better understand how variations in Alkali-Feldspar composition can influence trace elements substitution and mineral-melt partitioning. Feldspars are a group of very common and important rock-forming minerals. Moreover Trace elements are useful as they are much more sensitive to partial melting, crystal fractionation and magma mixing, contamination processes, and thus Trace elements can provide geochemical and geological information out of proportion to their abundance.

To investigate systematically the trace element partitioning between alkali feldspar and silicate melt, this study examines Ba, Rb, Sr partition coefficient variations with feldspar Or, Ab, An content by using experimental data from Arzilli (2012), Mahood and Stimac (1990) and London (1996). We have discovered that for our experimental data, exponential model fits better than simple linear regression model. We suggest that the relationship between partitioning of Ba, Rb, Sr and feldspar Or, Ab, An content is not well produced by a simple linear model and better results are obtained with an exponential model involving feldspar Or content.

We are currently working more on the effect of Alkali-Feldspar crystal growth rate on trace elements partitioning as when the growth rate is fast, the crystal can be less selective in allowing trace elements to enter their structure.

[1]Lofgren et al.(2006) American Min.91,1596-1606.

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