TRIP REPORT

SUBJECT: Fourth International Conference on the Chemistry and Migration Behavior of the Actinides and Fission Products in the Geosphere (20-5704-064 and 20-5704-073)

PLACE/DATE: Charleston, SC
December 12 - 17, 1993

AUTHORS: English C. Pearcy, David R. Turner, and James D. Prikryl

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AUTHORS:	English C. Pearcy, David R. Turner, and James D. Prikryl
PERSONS PRESENT:	English C. Pearcy, David R. Turner, James D. Prikryl (CNWRA) and 295 geochemists, geologists, and chemists from 25 countries

BACKGROUND AND PURPOSE OF TRIP:

The Migration Conferences have been held biennially since 1987 to provide an international forum for exchange of scientific information on the environmental behavior of the actinides and fission-produced isotopes. Information reported at these conferences results in a more complete understanding of the transport of these elements in geologic media. This information is required for performance assessment of long-term high-level nuclear waste (HLW) disposal. CNWRA personnel presented results from the Geochemical Analog Research Project and the Sorption Research Project in five papers entitled:

"Large-Scale Uranium Migration in Fractured, Silicic Tuff"

"Fracture and Matrix Controlled Uranium Migration at the Peña Blanca Natural Analog Site"

"Approaches to Sorption Modeling for High-Level Waste Performance Assessment"

"Uranium Sorption on Alpha-Alumina: Effects of pH and Surface-Area/Solution-Volume Ratio"

"The Effects of pH, U, and Ionic Strength on the Sorption of Uranium(VI) on Clinoptilolite"

SUMMARY OF PERTINENT POINTS:

The CNWRA presentations were well-received, generating interest from numerous international participants as well as representatives from U.S. institutions. Summaries of selected presentations by other participants are provided below.

P. Toulhoat (CEA, Section de Géochimie, France) described current research at the Oklo natural analog intended to evaluate current elemental transport out of the reactor zones into surrounding rocks and soils. This work is focused on the Okelobondo and Bangombé areas which have not yet been disturbed by mining. Results to date include determination of chemical "families of groundwaters" and their flow directions through the sedimentary rocks surrounding the uranium deposits. Depletion of the $^{235}U/^{238}U$ ratio in local groundwaters is interpreted as evidence of interaction of the groundwater with a reactor zone. Six samples have been analyzed (total U concentrations of 0.1 to 5 ppb), and two show significant depletion of $^{235}U/^{238}U$.

M. Ivanovich (AEA Technology, UK) presented results from a CEA-funded study of matrix diffusion of U through the El Berrocal granite (under consideration as a potential HLW repository host rock for Spain). Matrix diffusion is considered to be a potentially significant radionuclide retardation mechanism. Chemical, isotopic, and mineralogic profiles were studied perpendicular to natural fractures in the El Berrocal granite. Among the major elements, only Fe showed evidence of transport; maximum U migration distances measured were "a few centimeters." No detectable rare earth element transport was measured. $^{234}U/^{238}U$ data indicate mobilization within the last 1 Ma.

S. Serkiz (Westinghouse Savannah River Company) reported results from analysis of soils and pore waters collected at the Savannah River site from locations down the hydrologic gradient from unlined seepage basins into which low activity wastes were disposed for 33 years. Study of contaminant partitioning (including Tc, tritium, and Cs) between the waters and mineral surfaces (sandy aquifers with confining clay units) allowed definition of eight "operational classes" of surface binding sites. Existing surface complexation models were fit to each class of surface binding site and the resulting parameters input into MINTEQA2 for evaluation of the effects of surface binding sites on contaminant mobility. Simple K_d models were determined to be "inadequate" for describing the observed transport phenomena.

J. Leckie (Stanford University) presented a general overview of metal-ligand-surface interactions that control radionuclide partitioning onto mineral surfaces and surface complexation modeling. An argument was presented that the sorptive behavior of complex natural mineral assemblages (i.e., soils and rocks) can be readily modeled using surface complexation theory without knowing the individual constituents of the assemblage. For example, in many cases there is no need to characterize the detailed mineralogy of a soil or rock and characterization methodologies for defining model input parameters can be applied directly to the whole mineral assemblage.

T. T. Vandergraaf (AECL Research, Canada) described the results of a radionuclide migration experiment in a natural fracture in a quarried block of granite. The fracture was characterized hydraulically by measuring the pressure drop in borehole tests. Migration experiments were

performed over a 1 m distance at a flow rate of 2.2 ml/hour. Scanning of the fracture surface at the end of the migration experiments showed limited mobility of radionuclides (^{85}Sr, ^{137}Cs, ^{237}Np, and ^{238}Pu) and of the rare earth elements, observations consistent with static sorption data obtained on representative fracture surface material.

N. Marmier (University of Reims, France) presented research on the use of the constant capacitance surface complexation model with sorption of trivalent lanthanides (La^{3+} and Yb^{3+}) on hematite. The approach was similar to that used at CNWRA as part of the Sorption Modeling project. Results were very good, suggesting that a similar approach will work with the sorption of the actinide Am^{3+}, which is thought to behave in a manner analogous to the lanthanides.

J. Canepa (Los Alamos National Laboratory) presented an overview of the role of LANL in site characterization activities at Yucca Mountain. The talk consisted of a general introduction to the site and a summary of some of the geochemical studies currently underway at LANL. Current sorption and transport experiments are focusing on Np and Pu. These radioelements are important in the inventory and in the case of Np, batch experiments suggest that sorption on tuffs is low. Pu is of concern because of uncertainties in the available thermodynamic data and also because of the tendency of Pu to hydrolyze and form true radiocolloids that may be transported more readily than ions in solution.

D. Turner attended an initial meeting to organize scientists involved in applying surface complexation models to sorption problems. The meeting was organized by S. Altmann of BRGM (France) and with the support of NEA. Scientists from the United States, Europe, Japan and Australia were in attendance. The goal is to establish a network where experimental results and insights into modeling efforts can be exchanged. Initial effort will focus on applying surface complexation models to mineral mixtures and soils and to investigate ways in which these models can be adapted to performance assessment needs. Dr. Altmann will assemble a listing of laboratory capabilities and interests for circulation to those who were in attendance.

IMPRESSIONS/CONCLUSIONS:

The Migration Conferences continue to provide an important opportunity for interaction and information exchange with other researchers. The large proportion of international participants offers an advantageous forum for discussion with scientists from outside the U.S. program.

PROBLEMS ENCOUNTERED:

None.

PENDING ACTIONS:

None.

SIGNATURES:

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