

## Effects of organic acids on interaction of actinides with microorganisms

T. OHNUKI<sup>1</sup>, T. OZAKI<sup>1</sup>, T. YOSHIDA<sup>1</sup>, T. NANKAWA<sup>1</sup>,  
Y. SUZUKI<sup>1</sup> AND A.J. FRANCIS<sup>2</sup>

<sup>1</sup>Japan Atomic Energy Agency, Tokai, Ibaraki, 319-1195  
Japan

<sup>2</sup>Brookhaven National Laboratory, Upton, NW, 11973, USA

Actinides are highly toxic because they emit high-energy alpha-particles and have long half-lives. Plans to dispose of HLW and TRU wastes in geological disposal repositories have raised a number of concerns about polluting the environment through dissolution and subsequent mobilization of actinides; thus, long-term assessments of safety are required. TRU wastes contain cellulosic materials, scintillation fluids, waste oils, decontamination reagents, and chemical reagents. Among them, organic acids, such as citric acid, malic acid, and EDTA form stable complexes with multivalent actinides, enhancing their mobility by increasing their solubility. However, little is known of the interaction of actinides with microorganisms and organic acids. In this paper, we summarize our findings on the interactions of actinides with microorganism and organic acids.

Adsorption of Pu(IV)-, Th(IV)- and Eu(III)-desferrioxamine B (DFO) on bacteria of a Gram-negative bacterium *Pseudomonas fluorescens* or a Gram-positive bacterium *Bacillus subtilis* was studied. Adsorption of Pu(IV), Th(IV) and Eu(III) on *P. fluorescens* cells decreased in the order Eu(III) > Th(IV) > Pu(IV), which corresponds to the increasing the stability constant of the DFO complexes. These results indicate that Th(IV), Pu(IV) and Eu(III) dissociate from DFO by contact with cells, after which the metals ions are adsorbed.

Effect of Eu(III) on the degradation of malic acid by the bacterium *P. fluorescens* was studied. The chemical species of Eu(III) estimated by the thermodynamic data indicated that the degradation of malic acid was independent of  $\text{Eu}(\text{Mal})_2^-$ , and was hindered by the presence of  $\text{EuMal}^+$  and free  $\text{Eu}^{3+}$ . The degradation was followed by the production of metabolites which were associated with Eu(III). One of the metabolites was analysed to be pyruvic acid.

## A new geochemical index for evaluating crustal weathering and paleoclimate

T. OHTA<sup>1\*</sup>, A. KANEKO<sup>1</sup> AND H. ARAI<sup>2</sup>

<sup>1</sup>Dept. of Earth Sci., Schl. of Edu., Waseda Univ., 1-6-1,  
Nishiwaseda, Shinjuku, Tokyo 169-8050, Japan  
(\*correspondence: tohta@waseda.jp)

<sup>2</sup>Adv. Res. Cent. for Sci. and Eng., Waseda Univ., Tokyo,  
Japan

The present work introduces a new chemical weathering index that is derived from multivariate statistical analysis of a large weathering profile database (major oxide composition). Extracted latent variables from the database have been reformulated to a ternary "MFW diagram". The M and F values characterize mafic and felsic parent materials, respectively, while the W value identifies the degree of weathering of these materials. The degree of weathering represented by the W index is mathematically independent to the chemistry of the parent material. Two potential applications of the MFW diagram for the crustal recycling and the weathering processes will be discussed.

(1) Weathered materials and detritus delineate a weathering trend on the MFW diagram. Therefore, the composition of the destructed continental crust can be reconstructed simply by tracing the weathering trend backward to the unweathered domain. For example, weathering trends of the Archean and post-Archean sediments commonly extend backward to the domain of mafic and felsic source, respectively, which reflects the compositional evolution of the continental crust.

(2) Figure 1 compares W values of the recent soils developed in a various climate. The W index increases progressively as a climate becomes temperate and moist. Therefore, climates can be predicted by determining the W values of soils and paleosols, which aids to understand the Earth's surface condition and the recycling of continental crust.

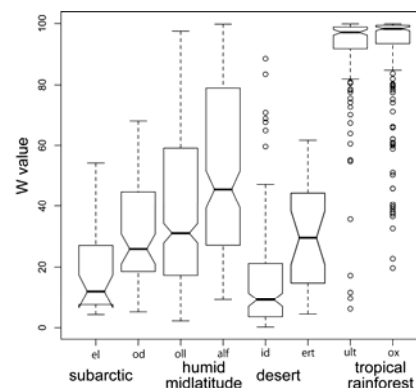


Figure 1: Boxplots of W values for various zonal soils.