Interactions of U(VI) and Eu(III) with natural bacterial isolates

M.L. MERROUN, A. GEISSLER, M. NEDELKOVA AND S. SELENSKA-POBELL

Institute of Radiochemistry, Forschungszentrum Dresden-Rossendorf, Dresden, Germany (m.merroun@fzd.de)

The presence of the actinides uranium, plutonium, neptunium, americium and curium as well as of lanthanides in radioactive wastes is of major concern because of their potential for migration from the waste repositories and long-term contamination of the environment. It was demonstrated that abiotic processes strongly affect the migration of these elements in the environment. However, it is becoming increasingly evident that microbial processes are of importance as well. Microbial processes will act immobilizing or mobilizing radionuclides, depending on the type of process and the state of the microbes. The present work investigated the interaction of bacterial strains isolated form different uranium contaminated sites as well as from grounudwater at a deep-well monitoring site of the radioactive waste repository Tomsk-7, Siberia, Russia with U(VI) and Eu(III)(as non radioactive analogue of the trivalent actinides). A highly multidisciplinary approach consisting in a combination of wet chemistry (batch sorption), microbiological, spectroscopic (EXAFS, XANES, TRLFS) and microscopic techniques (TEM/EDX) is used. The results of this work will help in understanding the role of microbiological process in the chemical behavior of actinides in geological and environmental context for future nuclear waste disposals as well as in the optimization of bioremediation processes using these natural bacteria.

Seasonal element and Sr isotope ratio variations in Late Miocene corals from Crete, Eastern Mediterranean

R. MERTZ-KRAUS[1,2], T.C. BRACHERT[1], S.J.G. GALER[2], B. STOLL[2] AND K.P. JOCHUM[2]

[1]Institut für Geowiss., Johannes Gutenberg-Universität, 55099 Mainz, Germany (mertzre@uni-mainz.de)
[2]Max-Planck-Institut für Chemie, Postfach 3060, 55020 Mainz, Germany (sjg@mpch-mainz.mpg.de)

Trace and minor element profiles of coral skeletons may be used to infer temporal changes in environmental conditions. In paleoclimate and paleoenviromental studies diagenetically unaltered materials are required which are generally only available from Pliocene or younger localities. However, exceptionally well-preserved *Porites* corals of Late Miocene age (~9 Ma) can be found on Crete (Eastern Mediterranean) which have retained their original aragonite mineralogy. Previous stable isotope ($\delta^{18}O$, $\delta^{13}C$) profiles yielded geologically significant seasonal signals, similar to those found in present-day corals.

Here, we report element profiles of these corals by laser ablation along the axis of maximum growth at a spacial resolution of 500 µm, corresponding to eight to eleven samples per year. Analyses were done using a 213 nm Nd:YAG laser coupled to an Element2 ICP-MS (ThermoFisher). In addition, two Sr isotope profiles of several years each were measured by TIMS by microdrilling (0.8 mm bit) at a resolution of ~4 samples per year.

The $^{87}Sr/^{86}Sr$ ratios mostly cluster closely around 0.7089 which confirms the ~9 Ma-old age of the corals, and suggest a working connection of the Eastern Basin to the open ocean at that time. Nevertheless, several isotopic excursions to lower values are seen in the profiles, which could be interpreted in terms of a semi-closed basin with Nile-like (unradiogenic) influence.

Variations in many lattice-bound elemental ratios (e.g. Sr/Ca, U/Ca) co-vary with those of $\delta^{18}O$, and thus closely reflect sea surface temperature (SST) seasonality. Other element ratios in the profiles (e.g. Al/Ca, Ba/Ca, Mn/Ca, Zn/Ca) do not correlate with $\delta^{18}O$ (and thus SST), but do however exhibit strong peaks in the winter months. Therefore, this signal cannot plausibly originate from diagenetic alteration or post-growth contamination. Rather, the Al, Ba, Mn and Zn most likely represent seasonal terrigenous input into the coral reef environment syn-genetically incorporated into skeletal porosity during coral growth, though the exact mechanism of sediment inclusion remains unclear in detail. However, because of its winter dominance, we interpret it in terms of variations in riverine suspended load from Crete into the near-shore environment of the corals caused by winter rainfall. If so, our profiles are a proxy for the frequency and/or severity of winter storm events in the Eastern Mediterranean during the Late Miocene.