Dissolution of labradorite feldspar in alkaline, sodium nitrate, and simplified Hanford tank solutions

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Approximately 3.4 x 10^6 L of hazardous and radioactive waste has leaked from underground tanks into the subsurface at the U.S. Department of Energy's Hanford Site. Dissolution of primary minerals likely occurred when the saline, alkaline waste solutions contacted the sediments, affecting contaminant transport. A uranium silicate in the uranophane family was observed within microfractures of plagioclase in Hanford sediments beneath tank BX-102 [1] and amorphous aluminosilicate coatings were observed on feldspars beneath tank SX-108 [2]. The dissolution of Hanford feldspars, typically An_{45-70}, likely provided the silica for the secondary precipitates in each case.

Dissolution rates of Pueblo Park labradorite were determined in high pH, 2 m $NaNO_3$, and simplified BX-102 tank solutions in stirred-flow reactors at 25°C. Steady-state dissolution rates (mol labradorite m^{-2} s^{-1}) were slowest at pH 8 ($10^{-11.73}$) and increased as the solution became more basic (e.g., pH 12; $10^{-10.70}$). At pH 10, rates in the $NaNO_3$ and tank waste solutions were 55 and 28 % slower, respectively, than in the simple NaOH solution. Initial spikes of Ca in the $NaNO_3$ and simulated tank waste solutions were greater than those in the simple pH 10 solution by 240 and 67 % respectively, and initial Si and Al spikes were 42 and 37 % greater in the simulated tank waste solution than in the simple pH 10 solution. Dissolution rates, X-ray diffraction data, and saturation state calculations indicate the formation of secondary phases including monohydrocalcite in the tank waste solution, faujasite in the pH 9 and tank waste solutions, and gibbsite in all solutions at and below pH 10. The release of Si in $NaNO_3$ and tank waste solutions would be sufficient to induce the precipitation of a uranyl silicate (sodium boltwoodite) after 2 h if the solutions filled a typical microfracture with a surface area to volume ratio of 520 m^2/L.

References

[1] Catalano J. G. et al. (2004) *Environ. Sci. Technol.* **38**, 2822-2828.

[2] McKinley et al. (2002) RPP-7884. CH2M HILL Hanford Group, Inc.

Presentation of the FUNMIG Integrated Project within the 6th FP of the EC

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FUNMIG (FUNdamental Processes of Radionuclide MIGration) is an Integrated Project within the Euratom 6th FP of the European Commission that involves 51 partners of 15 different European countries. The list of partners includes Universities, Research Institutes, most of the Waste Management Agencies from the Old Europe, as well as some SME's. The project tackles one of the main challenges for a sustainable European energy mix, namely scientific and social credibility of geological high level nuclear waste disposal. The main objectives of FUNMIG are:

- Providing tools for scientifically sound performance assessment for radionuclide migration from near-field to hydrosphere/biosphere;
- Covering the variability of different radioactive waste disposal approaches and host-rocks types under investigation in Europe;
- Ensuring optimized use of resources and communication on this issue between Member States with large programs and a high competence levels;
- Providing for knowledge transfer in order to foster a common competence level among all European countries;
- Providing communication with national regulatory bodies responsible for the fulfilment of compliance with safety standards;
- Ensuring applicability of results for different radioactive waste disposal options and national needs.

To this aim, the project is structured into 6 different Research Technological and Development Components (RTDC 1 to 6) besides a Component specially devoted to Training, Knowledge Management and Knowledge Dissemination. The RTDC 1 to 6 are defined in order to facilitate the transfer from the basic scientific knowledge generated through the project towards the more applied tools needed in the Performance Assessment of a Deep Geological Repository for Nuclear Wastes.