Characterization of hydrothermally altered colloids and effects on radionuclide transport

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The safe permanent disposal of nuclear waste in deep geologic repositories requires a multi-barrier engineered system to prevent the migration of radionuclides. The final barrier separating the waste package from the host rock is a bentonite backfill. Erosion of this bentonite may lead to colloid-facilitated transport (CFT) of radionuclides, an important process to incorporate into performance assessments for the geologic disposal safety assessment (GDSA) framework. Our previous work has parameterized CFT of radionuclides on FEBEX colloids through numerous geologic materials. However, recent work suggests that aging and hydrothermally altering colloids increases their affinity for radionuclides, thus increasing transport efficiency. Understanding how hydrothermally altered bentonite affects radionuclide transport is crucial for a realistic simulation of CFT from repositories.

Here we present data characterizing the mineralogy of colloids that have been hydrothermally altered and quantify how this clay alteration affects radionuclide transport. Microscopy techniques were used to identify the phase transformations of clay to secondary phases. Data indicate that bentonite colloids undergo transformation to zeolite minerals during hydrothermal treatment (Fig. 1). Batch and column experiments were then conducted to determine how the increased sorption capacity of the altered colloids alters CFT of radionuclides.

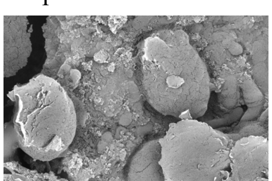

Fig. 1 Secondary zeolite formation from heating FEBEX colloids