Clay nanoparticle and RN release from the geotechnical barrier: Insights from the CFM Long-term In situ Test (LIT) at GTS

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The influence of colloidal/nanoparticulate phases on radionuclide (RNs) mobility as well as the long-term erosion rates of the geo-engineered barrier under glacial melt water conditions still represent uncertainties in repository safety assessment [1]. Within the Colloid Formation and Migration (CFM) project at the Grimsel Test Site (GTS, Switzerland) a huge geo-technical effort was taken to control the flow within a shear-zone and emplace a compacted bentonite source labelled with radionuclide tracers (Se, Tc, Th, U, Np, Pu, and Am). Before the emplacement of the compacted bentonite source, dipole experiments on suspended montmorillonite colloids (48-52% recovery) and associated RN's (Am(III) 21-22% and Pu(IV) 30-35% recovery) demonstrated a partial mobility of clay colloids in the shear zone with the conservative tracer Amino-G quantitatively recovered [2].

The bentonite source of the LIT experiment was emplaced in May 2014 and has been continuously monitored until the start of overcoring started at the end of 2018. Water was sampled from one of 3 near-field monitoring boreholes, drilled between 5 and 10 cm from the bentonite source interval. The controlled outflow from the shear zone was also monitored and sampled. Online measurements of water geochemistry are supplemented by regular sampling and periodic colloid characterisation using a mobile Laser Induced Breakdown Detection (LIBD) system. The experimental data including AMS analysis [3] will be discussed in the presentation and compared to laboratory mock-up tests with respect to geochemical conditions.

[1] Shelton, Sellin, Missana, Schäfer, Červinka, Koskinen (2018) SKB Technical report TR-17-17.
[2] Reiche, Noseck, Schäfer (2016) *Transport in Porous Media* 111, 143-170.
[3] Quinto, Busser, Faestermann, Hain, Koll, Korschinek, Kraft, Ludwig, Plaschke, Schäfer, Geckeis (2019, in press) *Anal. Chem.* DOI: 10.1021/acs.analchem.8b05765.