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Profile analysis of Aare granite samples after radionuclide migration

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Several laboratory through-diffusion experiments with HTO, ³⁶Cl, selenate, ²²Na, ⁸⁵Sr, ¹³⁴Cs, and ¹³³Ba were performed on samples from experimental and monitoring borehole of the Long Term Diffusion Phase III experiment in Grimsel Test Site. Salinity dependent cation excess and anion exclusion effects were observed. Anion effective diffusivities were almost half of water effective diffusivity. Na and Sr effective diffusivities were 1.5 and 5.5 times higher than water effective diffusivity, respectively. Heterogeneous character of granite diffusion path was observed experimenting with Cs and Ba.
Using numerical modeling, unknown parameters of porosity, geometrical factor, and distribution coefficient can be evaluated from the break-through and depletion curves. The associated uncertainty of diffusion parameters might be thus significant. It might be reduced by obtaining tracer concentration profile in the rock sample. We applied two experimental procedures for profile analysis. The first consisted in sawing the sample on thin slices using Struers Secotom Hot Cell saw and diamond cut-off wheel. The second procedure was an abrasive technique commonly used for cementitious materials and argillaceous rocks. Instead of grinding paper, artificial corundum (Al₂O₃:B80 and Al₂O₃:B150) mixed with cooling water was used. Benefits and drawbacks of both methodologies will be discussed. The profit of having the concentration profile, as the third dataset from the through-diffusion experiments, will be demonstrated, presenting Na, Sr, and Cs experiments.

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