Numerical modelling of migration tests through a fracture

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Radionuclides transport characterisation is one of the fundamental information for repository safety assessment. Since the naturally fractured environment is typically too complex to describe, it is common to mimic its behavior by means of numerically simulated fracture network. The groundwork for applicable simulation of large-scale structures comes out from comprehension and verification of parameters for basic components such as a single fracture. For this reason, number of numerical simulations were performed to infer hydraulic and transport properties of an artificial single fractures in a granite block on a laboratory scale. Equivalent porous continuum approach using finite difference method was used for the numerical modelling purposes.

Significant contribution to the exact model representation of the flow regime is the precise fracture topography description, derived from the method of the laser scanning. This allows the model resolution up to 100 µm for each of the two granite blocks used in the study and subsequently the identification of the preferential pathways for the contaminant migration.

The focus of the numerical modelling effort were transport experiments, using various types of conservative and reactive compounds. NaCl, KI, Pb(ClO4)2 and 3H were chosen as a set of tracers to fully describe the hydraulic and transport properties of the fractured granite environment. Pressure field distribution across the fracture and breakthrough curves at the outlet were used for the fracture parameters calibration and evaluation of the model overall fidelity.

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