Geophysical Research Abstracts
Vol. 21, EGU2019-10839, 2019
EGU General Assembly 2019
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Contaminant migration in fractured rocks: insights from tracer tests in core scale

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Contaminant migration (radionuclides, heavy metals and nanomaterials) in crystalline rocks is driven mainly by advective transport in fractures. The main goal of the project “Development of tools for Studying Contaminant Transport in fractured rock environment” (TH02030543; 2lsConTra), is to develop tools for evaluation of release, migration, and retention of potential contaminants in the rock environment as the key input values for safety assessment of anthropogenic activities. The potential release contaminants (radionuclides, heavy metals, nanoparticles) into the environment is of critical importance for groundwater pollution.
The physical models of both artificial and natural fracture has been built (rock block, rock core with natural fracture) in a dedicated laboratory. The rock block has been instrumented, allowing performing migration experiments (conservative tracers, heavy metals) that would study migration processes of the species in the rock environment, including dispersion, diffusion and sorption. The experiments are being modelled using both conventional software (MODFLOW) and in-house code (FLOW123).
Moreover, radionuclide tracer propagation through rock cores with natural fractures is studied in collaboration between HZDR and UJV [1]. Spatiotemporal images of the tracer concentration during conservative transport were recorded with positron emission tomography (PET), and the underlying fracture structure was characterized by μCT-imaging. The latter yields a structural model for reactive transport modelling, whereas the PET sequences are used as experimental control of the spatial flow velocity simulations, and are also utilized for parametrizationof new, experimentally-based simulations.

[1] J. Kulenkampff, L. Karimzadeh, F. Jankovsky, M. Zuna, V. Havlova, C. Fischer : Improving fracture-flow models by experimental evidence from process tomography. (presentation in this session)