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Flow and transport properties of a 200 meters multi scale fractured block at the Äspö (Sweden) underground laboratory

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Within the framework of nuclear spent fuel storage, special care is put on experimentation and modelling work to improve the modelling capabilities for the transfers of radionuclides within a natural fractured media. Several aspects make it a challenging task, among which the heterogeneity of the system, the scarcity of the available information, the strong contrasts in the parameter values between mobile and immobile zones. In addition to these difficulties relative to the system, the assessment of storage capacity of a repository involves predictions at very large time scales (typically 10^5years) which are not accessible to experimentation.

We provide here with some of the results obtained within the SKB Task Force (Task6) in relation with the Äspö granitic underground laboratory in Sweden. The purpose of this task, involving several other modelling teams, is to provide a bridge between detailed SC (Site Characterization) models operating at experimental and local time scale and more simple PA (Performance Assessment) models operating at large spatial and time scales.

The present step involves a study of a 200 meters complex fractured system involving several scales of fracturation or heterogeneity: deterministic features identified from the Block Scale project, synthetic background fractures simulated based on in situ measurements of smaller scale fracturation and complexity of the fractures at different scales (fault zones with several channels along Cataclasite to simple joints with

fracture coating). Tracer tests conducted within local portions of the system during Block Scale project are provided as well as laboratory measurements of the different properties of the system.

We present an overview of our modelling strategy for this complex system as well as major results focusing here mainly on (i) the sensitivity of fractured block flow and transport properties (equivalent permeability, main flow and transport paths, retention properties associated with matrix diffusion and sorption) to the number of features considered (main fractures, back ground fracturing, complexity of the fractures); (ii) the issues of homogenisation of flow and transport processes for the lower scales of fracturation or heterogeneity and the ways considered to simplify the system to its major features in view of a Performance assessment model.

We modelled the system with our Cast3M code considering an explicit representation and meshing of fracture planes, diffusion into various matrix zones close to these features, influence of back ground fracturing by means of dual porosity approach, incorporation of tracer test data.