Transient deformation and excavations in claystones

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Transient behaviour is dominated by two parallel phenomena: pore water pressure dissipation and the «viscous» contribution. The presentation discusses first the characterization of permeability, which is a fundamental property to interpret and predict flow-related transient behaviour. Some tests are first reviewed to illustrate the dominant role of existing or induced discontinuities. Microscope and Mercury Intrusion Porosimetry observations underline the relevance of cracks and planar defects.

Accurate modelling requires procedures to include the effect of discontinuities on the hydraulic characterization of shales and claystones. Cracks originate as a result of tensile straining. This, in turn, has different origins: shearing, drying, tensile straining. A simple but powerful model to include them into a general Thermo-Hydro-Mechanical computational model will be outlined. Then, as an illustration of the model, the results of tests performed on anisotropic shale will be presented.

In the final part of the presentation the recent modelling of a large scale test (HGA test at Mt. Terri Laboratory), performed on Opalinus clay, will be described. The test was designed to monitor flow of water and gas in the disturbed zone around a 1 m diameter horizontal excavation. Particular attention was paid to the effect of confining stress. The analysis performed indicates the relevance of a correct characterization of permeability for an accurate reproduction of «in situ» observations.