

Hydrogeological Characterization of the Transition Opalinus Clay – Passwang Formation

This master thesis presents an investigation of a zone of approximately 20 m width along the transition of the Opalinus Clay and the Passwang formation at the Mont Terri rock laboratory location situated in St. Ursanne, Switzerland. The investigation was conducted on different scales with the integration of data from former bore cores and boreholes crossing this transition. Different features, that could possibly influence the water flow along them, were detected and represented in the scale of the rock laboratory. An additional borehole BHC-1 was drilled perpendicularly to bedding. The bore core was highly fractured and the borehole wall was interpreted, by aid of the logging results, to be prone to desaturation due to an orientation upwards.

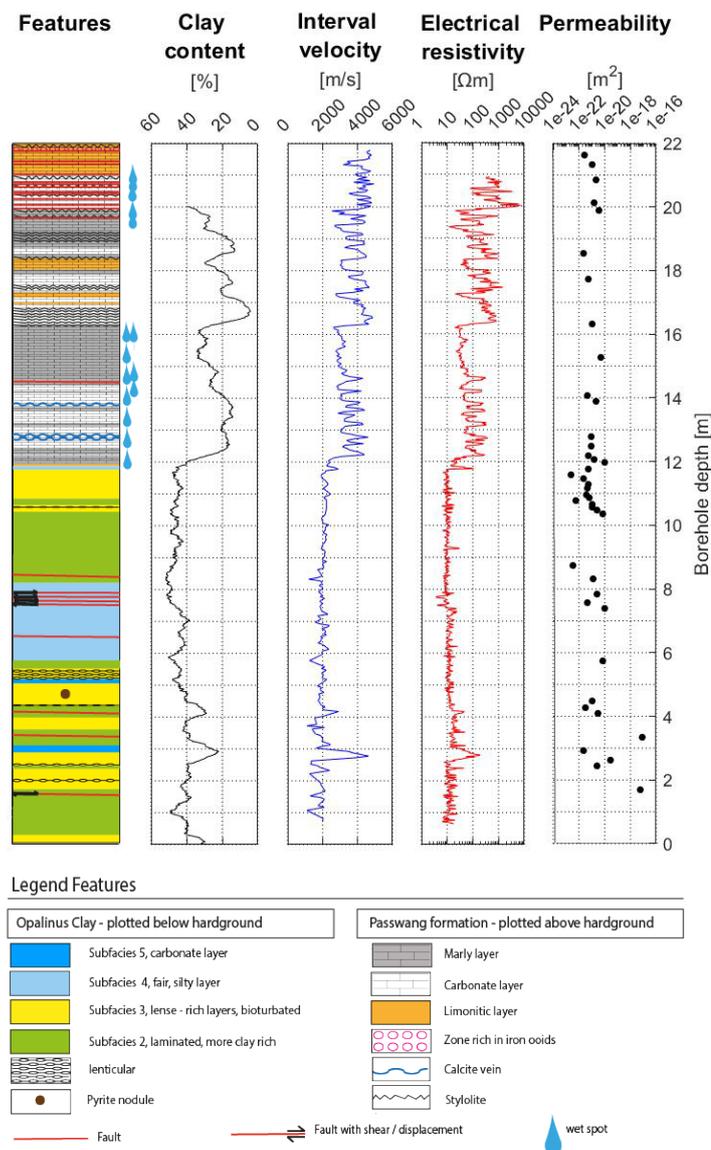


Figure: Comparison of logging results to permeability measurements for the key borehole studied in this thesis, BHC-1.

Logging methods applied in the borehole BHC-1 are optical televiewer imaging, natural gamma, spectral gamma, induction log, electrical resistivity (ERT) and interval velocity measurements (IVM).

Optical televiewer imaging aids in the depth-matching of the scans and the geological mapping of the highly fractured bore core attained. Additionally, it assists in the detection of features in the borehole that were estimated to have an influence on the permeability of the rock. Permeability tests (pneumatic tests, with injection of nitrogen, and hydraulic tests) were also conducted in these intervals in the borehole BHC-1 containing such features. Pneumatic tests were analyzed twice. The first analysis, which was realized in the scope of this master thesis, is based on a numerical modelling tool. A second analysis was conducted by BGR with a program based on the code called OpenGeoSys. Taking into account that various saturation states along the borehole have not been regarded for the pneumatic test analysis and that the concept of two-phase flow was not integrated in the former method of analysis of the test data, it is interpreted that the results do not represent real permeability values of the formation. For this reason, and due to the small investigation radius attained during the permeability tests, the permeability results could not be linked to undisturbed encountered features of the rock, which were estimated to be important for water flow. Nevertheless, it has been shown that permeability in the Passwang formation is slightly higher than in the Opalinus Clay. The results of the permeability tests show that the extent of the transition from the Opalinus Clay to the Passwang formation is limited to some meters.