UNIVERSITÉ DE NEUCHÂTEL

CHYN
Centre d'hydrogéologie et de géothermie

MSc in Hydrogeology and Geothermics

Thesis topic proposal 2017

THERMALLY INDUCED BOREHOLE BREAKOUT EXPERIMENT AT THE GRIMSEL TEST SITE

Context and objectives

Borehole breakouts are the result of the failure of borehole walls due to the stress concentration arising when drilling a well in deep, high-stress conditions. On one hand, borehole breakouts provoke drilling difficulties, increase the risk during well completion and can even jeopardize the integrity of the borehole. On the other hand, borehole breakouts give an invaluable insight in the stress conditions at depth.

Borehole breakouts often occurs in deep geothermal wells. In this case, in addition to the purely mechanical effects, thermo-mechanical response occurs due to the cooling of the rock in the vicinity of the borehole walls in contact with the cool drilling fluid. These effects are currently not well understood, particularly for the crystalline rocks typically encountered in deep geothermal boreholes.

Developing a good understanding of these processes will permit to drill and complete deep geothermal boreholes in a more effective and safer manner as well as provide a better insight on the stress conditions in the geothermal reservoir. Both advances will contribute to the development of deep geothermal energy projects.

Research approach and methodology

In this project, we will study the process of thermally induced breakouts by performing an in-situ experiment in the crystalline rocks of the Grimsel test site. The experiment consists in heating a borehole in order to induce borehole wall failure. We will record thermo-mechanical parameters during the experiment and assess wellbore failure using televiewers. In addition, we will determine the rock mechanical and thermo-mechanical characteristics of the rock through laboratory test. Finally, we will use all the collected data to calibrate thermal, mechanical and thermo-mechanical wellbore models.

Partners and collaboration

Prof. B. Valley will supervise the project. The experiment will take place at the Grimsel Test Site managed by the NAGRA. Mechanical testing will be performed at the rock mechanics laboratory from EPFL. The project will thus permit to develop working with various research groups in Switzerland.

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