Investigating non-Newtonian fluid flow in rough fractures

The understanding of flow processes involving non-Newtonian fluids in the subsurface is of interest for many engineering applications, from in-situ remediation to enhanced oil recovery. The fluids of interest in such applications (f.e., polymers in remediation) often present shear-thinning properties, i.e., their viscosity decreases as a function of the local shear rate (local velocity gradient). This project aims at investigating transmissivity evolution for Newtonian and Non-Newtonian fluid flow through natural fractures (granodiorite) under different effective normal stress at the laboratory scale. The student will take part in the operation of a hydro-mechanical coupled experiment. The experiment will consist in 1) imposing different normal loads on a natural fracture using a loading press and 2) injecting fluid at the center of the fracture with a controlled pump system. The main objective is to define how the non-Newtonian behavior diverges from what is known for Newtonian fluids in term of effective transmissivity of rough fractures and discuss the implications for the aforementioned engineering applications.

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