Thermo-hydro-mechanical behaviour of a porous sandstone

Fanny Descamps & J-P Tshibangu

1. Thermo-hydro-mechanical coupling is a key feature in Rock Mechanics today

- Drilling deeper and deeper
- Common field conditions:
  - Stresses \( \times 10 \text{ MPa} \)
  - Pore pressure \( \times 10 \text{ MPa} \)
  - Temperature \( \approx 100^\circ \text{C} \)

- Our equipments:
  - A true triaxial cell \( \rightarrow \) complex confining states
  - Need for a triaxial system with pore pressure and temperature control

2. The triaxial cell

The main features of the triaxial system are:

- \( \sigma_1, \sigma_3 \): hydraulic bench
- \( p_{\text{pore}} \): worm gear screw jack + stepper drive
- \( T^\circ \): heating jacket, thermocouple, controller
+ automation of the tests

3. Experimental phase

Triaxial tests were performed under various confining pressures, pore pressures and temperatures on a porous rock. The tested rock is the Vosges sandstone (porosity: 21.7%).

4. Conclusions

As expected, the strength increases with the confining pressure and decreases with pore pressure. However, whereas no noticeable effect was observed with increasing temperature, a strong coupling is observed by combining both temperature and pore pressure: in fact, for comparable pore pressure, the rock exhibits a strength decrease when the temperature is higher.