Thermo-hydro-mechanical behaviour of a porous sandstone

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

- Drilling deeper and deeper

- Common field conditions :
  - Stresses x 10 MPa
  - Pore pressure x 10 MPa
  - Temperature ≈ 100°C
- Our equipments :
  - A true triaxial cell → complex confining states
  - Need for a triaxial system with pore pressure and temperature control

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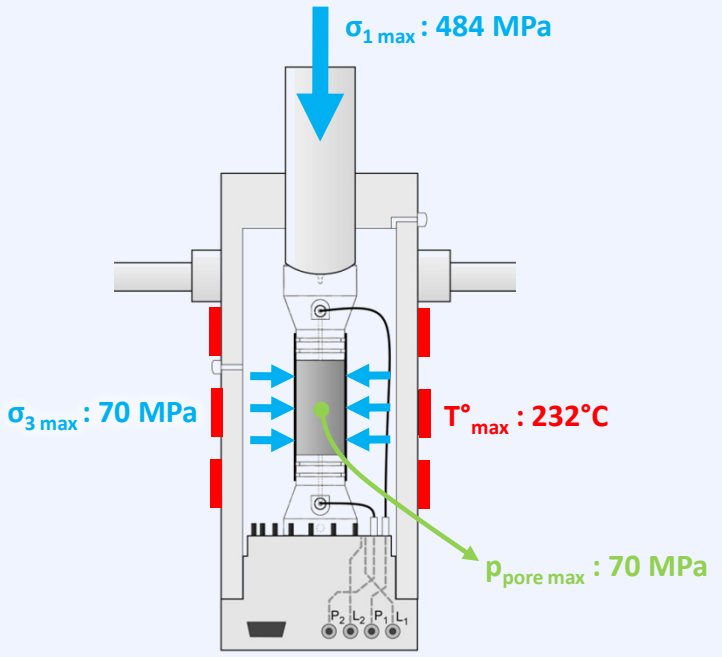
The triaxial cell

The main features of the triaxial system are :

- σ_1, σ_3 : hydraulic bench
- p_{pore} : worm gear screw jack + stepper drive
- T° : heating jacket, thermocouple, controller

+ automation of the tests



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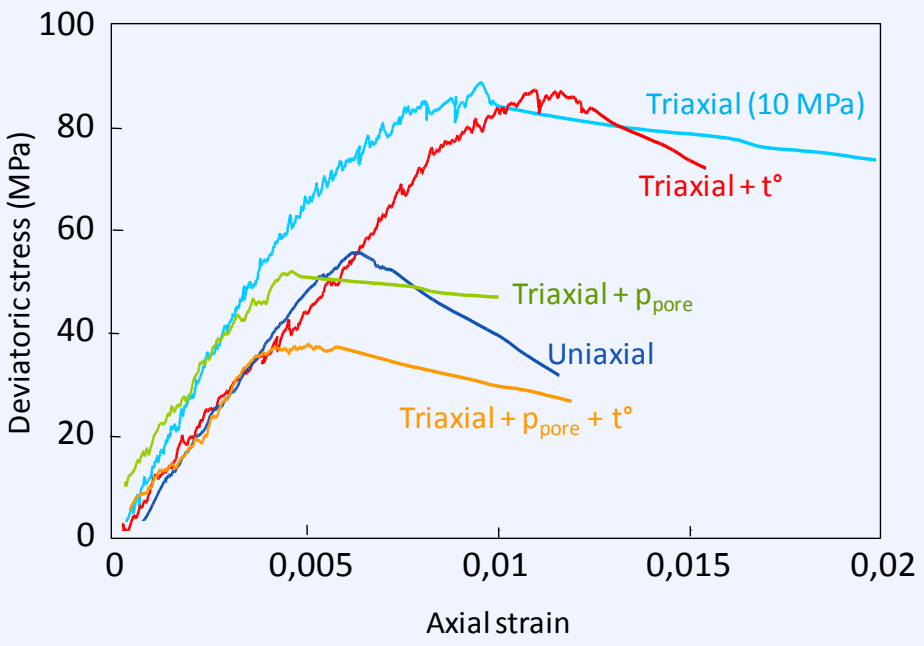
Experimental phase

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 %).



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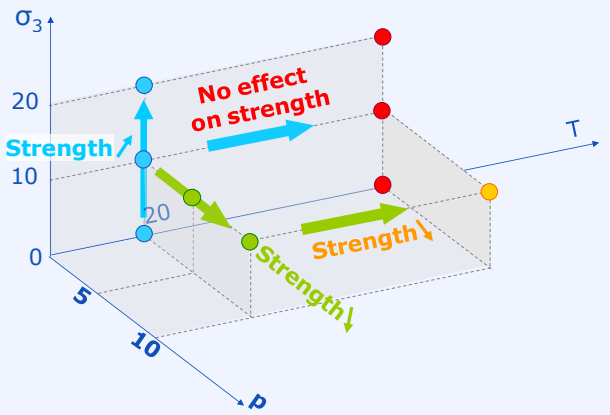
Conclusions



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.