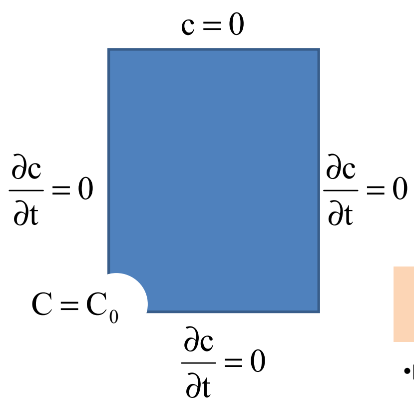
The basis of PA calculation



$$\frac{\partial c}{\partial t} = \nabla(D\nabla C) + \nabla(K\nabla P)$$

$$D = 10^{-9}\,m^2/s$$

$$K = 10^{-12}\,m/s$$

$$\frac{\partial c}{\partial t} = \nabla(D\nabla C)$$

To prove the validity of the basic assumptions of PA calculation.

- K doesn´t increase very much
- D doesn´t change much
- Geometry simplification is valid

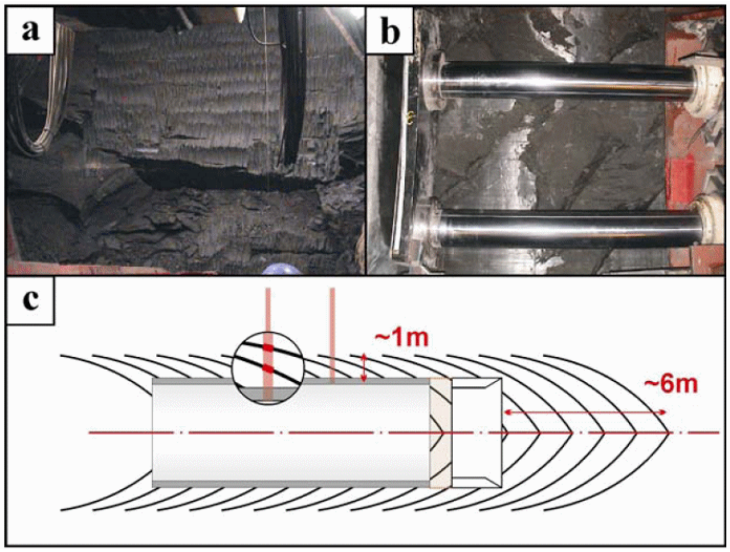
K doesn´t increase much?

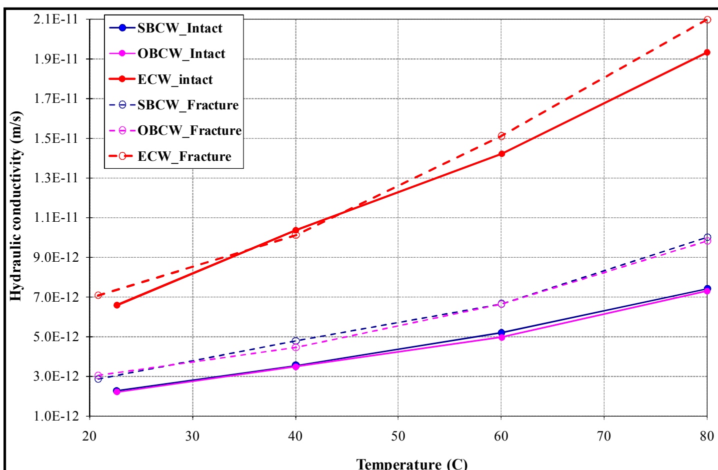
$$k = \frac{k_r k_{in}}{\mu}$$

- Damage(EDZ)-no much effect on K
- Temperature-doesn´t increase intrinsic permeability
- Saturation-fully saturated after 100 years
- Good-sealing capacity is still valid (high smectite content)

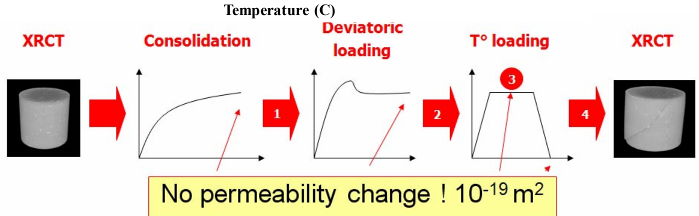
EDZ after excavation

1. In-situ test

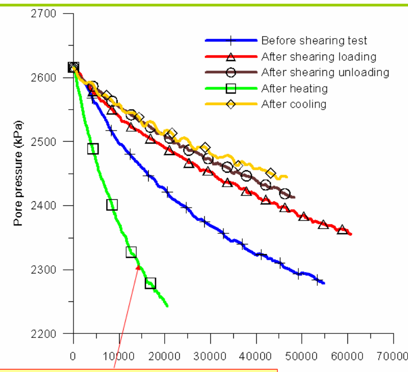




Source: Permeability test of SCK



UJF



Thermal expansion of water in crack

Test results from UJF

Source:lecture from Prof. Delage

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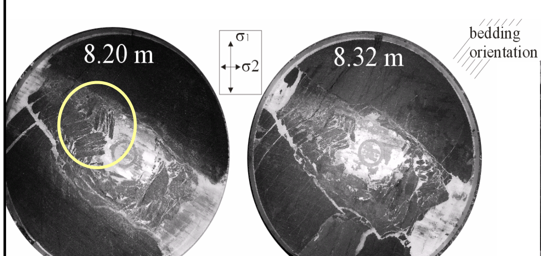
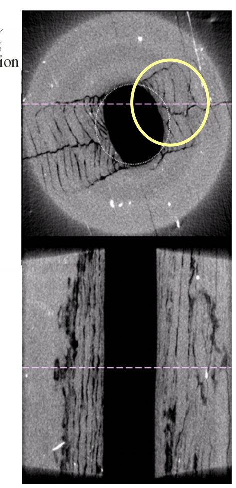
WP 3.1
- Difficult low permeability materials (lonnng tests)
- Many new THM(D) devices
- Induced damage in samples
- Very good THM(D) response: no effect of cracks, good sealing
- Independently obtained from various labs with various techniques on various materials

WP 3.2
- Good reproduction of excavation damaged zone

Cross reference to lab work





- In situ

➢ lab

➢ High degree of similarity between failure modes
➔ Increases confidence in the applicability of lab test results

Evolution of disturbed zone

- Initial state
  - No crack
  - Low permeability
  - Fully saturated
- Excavation
  - Stress redistribution - convergence
  - Formation of EDZ
  - Desaturation
- Open drift
  - Decrease S_ℓ
- Early closure phase
  - Heating
  - Resaturation
  - Sealing of crack
- Longterm post-closure phase
  - Recovery of K
  - Cooling
  - Radionuclide release

Conclusions

Uncertainties :

Diffusion coefficient

Adsorption capacity of clay

Something impossible to imagine but it´s … an acceptable solution ☺