

Interactive comment on “The response of Opalinus Clay when exposed to cyclic relative humidity variations” by Katrin M. Wild et al.

Anonymous Referee #2

Received and published: 26 January 2017

This scientific contribution focuses on the effect of ambient Relative Humidity (RH) variations on hydro-mechanical behaviour of OPA clay. Specimens of OPA clay were placed in chamber with different constant RH value (66 % or 93 %) in order to mimic in situ cyclic variations observed in Mont Terri URL. Monitoring of strains in major directions show an anisotropic response with irreversible volumetric strains in the direction normal to bedding. Observed damage such as cracks do not seem to affect the tensile strength (from Brazilian tests) of the specimens.

This is an interesting contribution well-written. I recommend the publication after minor revisions.

I have several comments :

Why focus on tensile strength ? What is the interest in the context of EDZ problematics?

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Page 1 Line 21

"The evolution of the EDZ is an important factor for the long-term safety of a nuclear repository as it may significantly influence the permeability of the confining host rock and offer pathways for radionuclide transport."

Page 2 Line 20

"irreversible deformation components (due to seasonale RH variations) can contribute to both long-term tunnel convergence and self- sealing of the EDZ."

Please precise the "long-term" scale. In a long-term scale, what should be the RH variations in a sealed repository ?

Please discuss the involved spatial scales in shrinkage and swelling and how these small-scale processes could be involved in larger one such as EDZ sealing, or tunnel convergence.

Involved scales should be more discussed in the paper

Please, prefer "cracking" than "fissuring"

In 2.1 Material description

Please discuss the pore fluid nature of the OPA Clay

2.2 2.2 Sampling and specimen preparation

Line 29 "electronic strain gauges" do you mean "electric resistive strain gauges" ?

Could you please precise the position of the extracted samples from the tunnel and in particular from the EDZ ?

Page 4 Line 2

What is the impact of such a preparation time (30 minutes) on saturation state ?

In 2.3 Experimental layout

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Please precise clearly how the RH cyclic variations is performed.

How the homogeneity of the ambient humidity in desiccator boxes was checked or controlled ?

For all quantity please add the associated errors (due to instruments or others)

What is the accuracy for temperature measurements, for mass monitoring ?

Please precise the sampling rates (dt) for temperature, mass and RH monitoring.

In 2.5 Mechanical testing procedure

"A, E" specimens

"P" and "N" to gain in clarity

Please precise the constant loading rate and accuracy

In 3 Results

"The temperature was kept between 19 and 23°C throughout the experiment" Should be presented/discussed in the 2.3.

Fig. 7

Please discuss and quantify the sparcity of the results for each cycle. Median points with associated ranges should be a better representation.

"Thus, a change in Brazilian tensile strength as a response to the RH variations was not measurable" why ? "or insignificant." why ?

In 4 Discussion

4.1 Fig. 8 is not clear : hysteresis is not clear in the figure.

Please change the focus, two figures should be clearer

first discuss the contribution results (zoom in) then add the other datas

4.2 Strain and Damage

Please discuss the concerned scales : interlayer scales etc.

Last paragraph, Page 7, Line 5 to 12

Do we have here an estimate of crack aperture ? Is it corroborating the volumetric deformation estimates ? What are the volume/surface concerned by cracks ? What are the orientation/direction of these damage features ? Are they interconnected ?

Please also discuss the number and duration of performed drying/wetting cycles and observed damage and impact on tensile strength.

Discuss the representativity of the procedure with regard to in situ RH variations.

5 Conclusions

From (e.g.) Benavente et al. Engineering Geology 59 (2001) 313±325 we can read that "Salt weathering , i.e. salt crystallization/dissolution into the pore space, is one of the most important degradation mechanisms that a porous stone undergoes at and near the Earth's surface."

What would be the results of drying/wetting cycles on salty poral fluid in the OPA Clay ? Could we have salt crystals precipitation during drying cycles ? What would be the impact of such crystallization/dissolution cycles on the poral structure ?

Interactive comment on Solid Earth Discuss., doi:10.5194/se-2016-171, 2016.