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Pre-study and Master's Project  
Fall Semester 2023

## Geomechanics for radioactive waste storage: Impact of temperature on the host-rock

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**Assistant:** H elo ise Fuselier

### Motivation of the project

Radioactive waste management is considered as a key issue to address for a successful energy transition in countries where nuclear power is a major energy supply. In western Europe, the solution of deep geological repositories in argillaceous formations have been selected for its favourable properties, such as low permeability. This project centres on the concept proposed by the French agency for nuclear waste management (ANDRA) which selected the Callovo-Oxfordian claystone (COx) as the host formation of the future repository. A good understanding of the rheological behaviour of the geomaterial under thermo-hydro-mechanical loadings must be acquired to be able to predict the response of the geological formation to the implementation of such an infrastructure. This includes a mechanical loading due the excavation process but also the temperature increase due to the introduction of the exothermic waste in the storage galleries. In this project, we aim to investigate the volumetric response of the COx claystone under thermo-mechanical loading.

### Keywords

*Nuclear waste storage, Triaxial compression experiments, Thermo-hydro-mechanical processes, Quasi-brittle behaviour, Thermal hardening, Constitutive modelling.*

### References

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### **Goal of the project**

The main goal of this project is to improve our understanding on the temperature effect on COx claystone volumetric deformation at constant stress, by performing a heating-cooling test campaign at constant stress in the high-pressure oedometric cell with temperature control developed at the LMS. In addition to the thermal effect, this campaign aims at investigating the anisotropic feature of the claystone deviatoric behaviour, which have been shown to be of great impact in the context of nuclear waste storage.

These elements will be investigation through the performance of drained non-isothermal oedometric tests at constant stress, and various loading orientations with respect to the bedding orientation of the specimens. The completion of these tests includes carrying out the specimen preparation, a re-saturation of the specimens, and the thermo-mechanical testing in the advanced thermal triaxial cell.

### **Tasks to carry out**

- Literature review on the topic (context + geomaterial + experimental procedures)
- Provide a working plan for the semester, elaboration of a testing protocol
- Acquaintance with the experimental set-up and the testing methods
- Performance of the experimental program
- Test results analysis

### **Deliverables**

- **Report**

The student will have to prepare a technical report containing the introduction and motivation for the project, the description of the accomplished work and related results as well as conclusions. The technical report will have to be prepared in an electronic format and send to the supervisor and the responsible of the project by the end of the semester.

- **Final Presentation**

The student will have to present his work during a presentation at the end of the semester. The day and the place of the presentation will be communicated to the student.

### **Meetings**

Weekly meeting with the assistant on Friday afternoon is planned. Daily communication with the assistant is encourage for any question regarding the operation of the experimental set-up.

### **Grading**

The final grade will be assigned considering the following aspects:

- Implication and initiative during the semester
- Technical report

The evaluation will also consider the work methodology, discipline and resourcefulness of the student.

### **Contacts**

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