



# Proposition de post-doctorat

## *Vacant Research Associate Position*

**Duration : 1 year**  
**January 2021 to December 2021**

### **DISCIPLINES**

Fluid mechanics, digital image correlation, granular materials, soil mechanics, microstructure

### **TITLE**

**Hydro-mechanical instabilities in low permeability geomaterials**

### **SUMMARY**

Storage of energy surplus (converted in CH<sub>4</sub>) into underground reservoirs is one of the current solutions to solve irregularities between energy production and needs. For short or long term storage, the interface between the reservoir material and the caprock is a potential area for critical hydro-mechanical behavior due to different materials and fluid properties. This interface generates possible instabilities and environmental risks so that the characterization of its mechanical properties is a high scientific challenge.

The topic deals with the experimental identification of quantitative interactions between the micro-structure of low permeability geomaterials, the heterogeneous fluid flow through them and their deformation. In particular coupled hydro-mechanical instabilities, say couplings between fluid fingering and strain localization, will be quantitatively investigated.

At the laboratory scale (0.5μm-cm), analogous materials of low permeability soils will be used to study their response to hydro-mechanical loading, using a new bi-axial apparatus, adapted to unsaturated soils, designed and realized for this purpose (see the figure below).

The evolution of the micro-structure and of the heterogeneous fluid flow within the sample will be followed by high speed cameras through the transparent cell surface of the bi-axial machine. Full-field measurements of displacements, strains, fluid distributions and micro-structure changes will be quantified by digital image correlation and mark tracking.

The challenge of this experimental activity is multi-fold, from the preparation of analogous geomaterials to the experiments and the development of a new

methodology to compare quantitatively strains, fluid distribution and micro-structure in low permeability materials.



The expected results will strongly improve the understanding of quantitative relationships between fluid interfaces and deformation of low permeability geomaterials which constitute the caprock of underground reservoirs.

### **KEY WORDS**

Low permeability materials, fluid fingering, strain localization, digital image correlation, interface, micro-structure

### **REQUIRED COMPETENCES**

- Strong competences in fluid mechanics, soil mechanics, engineering geology and programming ; knowledge in digital image correlation will be appreciated.
- Ability to work in a group
- Ability to assist with the supervision of master students, produce reports and presentations for project meetings and publications

### **ADDITIONAL INFORMATION**

The study is developed within the framework of the ANR project called «STOWENG» underground STorage of reneWable ENergies in low permeability Geomaterials. The candidate will be actively included in the team in charge of STOWENG's management.

## **STARTING DATE**

2021-01-01

## **SALARY**

28 000 euros / year for one year.

## **REFEREES TO CONTACT**

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