



**PhD position at ISTERRE laboratory (Univ. Grenoble, France) in experimental geochemistry  
Research collaboration with Shell**

*Abiotic reactivity of minerals at elevated H<sub>2</sub> concentrations  
Experiments and reactive transport modeling applied to deep aquifers*

**Starting date:** January 2022

**Duration:** 36 months

**Net salary:** approx. 17 k€/year net (includes medical insurance)

**PhD supervisors (ISTerre):** Prof Laurent Truche & Dr Roland Hellmann

**PhD work and schedule:** The proposed PhD thesis aims at exploring fluid-rock alteration processes at play within deep aquifers pressurized with H<sub>2</sub>. The purpose of the research deals with underground hydrogen storage as part of the energy transition. The first part of the project is dedicated to measuring kinetic dissolution parameters of individual phases, including sulfides (pyrite) and ferrous minerals (hematite, nontronite, biotite) in simplified experimental systems. The experiments will measure the dissolution rates as a function of temperature, pH, H<sub>2</sub> partial pressure, and salinity in Ti batch reactors equipped for fluid and gas sampling. Analyses of fluids and gases include H<sub>2</sub>S and H<sub>2</sub>, as well as ionic composition. Post-reaction mineral phases will be characterized by a suite of complementary techniques: XRD, FESEM, Mössbauer, FIB-TEM,  $\mu$ Raman, and eventually STXM-XANES. The second part of the project aims at evaluating the reactivity of reservoir rocks (clastic rocks) and caprocks (mudstones) in the presence of H<sub>2</sub> and saline fluids. The design of the experiments will be similar to part 1, but the conditions will be chosen to mimic as close as possible the temperature, fluid composition, and H<sub>2</sub> pressure of relevant reservoirs. The third part will incorporate the rate laws previously derived into 1D/2D reactive transport models to assess H<sub>2</sub> abiotic reactivity under reservoir conditions. This part of the project will involve close collaboration with a research group at Shell.

**Operational facilities:** [ISTerre laboratory](#) (Grenoble, France) is a world leading research institution in the geosciences (ranked 18<sup>th</sup> by the Shanghai QS ranking, Earth Sciences), with 110 permanent scientists and 41 technical staff. ISTerre has strong expertise in the field of hydrogen generation, migration, and reactivity in geological environments, with 5 permanent scientists and 3 technical staff actively working in this field for more than one decade. The lab is fully equipped for the needs of this project:

- titanium batch autoclaves;
- chemistry lab fully equipped for experiments under anoxic conditions, including glove boxes;
- analytical facilities: gases (GC, GC-MS), aqueous solutions (HPLC, ICP-OES, ICP-MS), and minerals (XRD, SEM, EPMA, Raman, BET, AFM) analysis.

**Prerequisites and applications:** Applicants should hold a Masters degree in Geology, Chemistry or Physics by January 2022. We seek a highly motivated person, particularly interested in mineralogy, geochemistry and hydrothermal processes, and having considerable experience in laboratory-based experimental and analytical work. Candidates should have a strong background in chemistry and thermodynamics. Knowledge of French is not mandatory, but the candidate must have an excellent command of written and spoken English.



Institut des Sciences de la Terre



Interested candidates should submit by email a single pdf file containing a statement of research experience and interests, a detailed CV including a complete list of publications / abstracts / conferences, and the names and contact information for two potential referees to: Prof. Laurent Truche, [laurent.truche@univ-grenoble-alpes.fr](mailto:laurent.truche@univ-grenoble-alpes.fr), phone: (+33) 4.76.51.40.54. General information about the ISTerre laboratory can be found at: <http://isterre.fr>