ISTerre

Institut des Sciences de la Terre

PhD position

at

ISTERRE (Univ. Grenoble, France) in experimental geochemistry

Research collaboration with Shell

Abiotic reactivity of minerals at elevated H_2 concentrations

Experiments and reactive transport modeling applied to deep aquifers

- **Starting date: beginning 2022**
- **Duration: 36 months**
- **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 H2. 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, H2 partial pressure, and salinity in Ti batch reactors equipped for fluid and gas sampling. Analyses of fluids and gases include H2S and H2 analyses, as well as aqueous chemical compositions. Post-reaction mineral phases will be characterized by a suite of complementary techniques: XRD, FESEM, Mössbauer, FIB-TEM, µRaman, 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 H2 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 H2 pressure of relevant reservoirs. The third part will incorporate the rate laws previously derived into 1D/2D reactive transport models to assess H2 abiotic reactivity under reservoir conditions. This part of the project will involve close collaboration with a research group at Shell.

Operational facilities: ISTerre laboratory (http://isterre.fr; Grenoble, France) is a world leading research institution in the geosciences (ranked 18th 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 31 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.

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 / conference talks, and the names and contact information for two potential referees, to: Prof. Laurent Truche, laurent.truche@univ-grenoble-alpes.fr, phone: (+33) 4 76 51 40 54.