Master's degree internship – experimental and geochemical characterization of H_2 production during olivine serpentinization

Project description

This project aims at developing the newly setup fluid-rock interactions laboratory at Chrono-environnement, University Marie & Louis Pasteur, Besançon. This will involve setting up the low-pressure-medium temperature experimental apparatus and calibrating the gas chromatography (GC) instrument. In order to do so, the project will use well constrained H_2 producing serpentinization experiments. The student will characterize olivine grains before and after serpentinization experiments with the combination of optical and electronic microscopy (SEM and EPMA). Produced gas, mainly H_2 concentrations, will be monitored throughout the experiments using the GC. The fluid composition (dissolved elements) after experiments will be measured using ICP-AES in order to compare the experimental results with reaction path thermodynamic models using EQ3-6. One of the goals is to better understand the incorporation of Cl into the serpentine minerals, this will be achieved through high resolution X-ray Cl mapping of the dissolution-precipitation interface. The master student will mainly be working at the Chrono-environnement Lab in Besançon (experiments, GC measurements, SEM characterization), with temporary missions at the University of Lausanne to carry out EPMA analyses.

Tasks

- Prepare sample and run serpentinization experimental
- Analyze gases produced during the serpentinization experiment
- Petrological and geochemical analysis of experimental products
- Interpretation of experiments using thermodynamic modeling computations with EQ3-6
- Presentation preparation and final report writing

Candidate Profile

Candidate must be in a Master's degree program in geology or applied chemistry with a background in geology. Strong interest in research and experimental work is required. We are looking for a curious and meticulous candidate, eager to be involved in developing new techniques and working in the Lab.

Practical details

Start date: mid-january to mid-february but can be discussed
Duration: 6 months
Gratification: ca. 650 €/month
Location: Campus La Bouloie, Besançon

Funding

This internship will be funded by the ANER GAZHEL from région Bourgogne Franche-Comté (C. Dusseaux) and CPJ natural hydrogen from UMLP (G. Siron).

Application process

CV, motivation letter and 3rd year Bachelor transcripts should be sent to Camille Dusséaux (camille.dusseaux@umlp.fr) and Guillaume Siron (guillaume.siron@umlp.fr)

Relevant articles

1. McCollom, T. M. *et al.* Temperature trends for reaction rates, hydrogen generation, and partitioning of iron during experimental serpentinization of olivine. *Geochim. Cosmochim. Acta* **181**, 175–200 (2016).
2. Lafay, R., Montes-Hernandez, G., Renard, F. & Vonlanthen, P. Intracrystalline Reaction-Induced Cracking in Olivine Evidenced by Hydration and Carbonation Experiments. *Minerals* **8**, 412 (2018).
3. Markl, G. & Bucher, K. Composition of fluids in the lower crust inferred from metamorphic salt in lower crustal rocks. *Nature* **391**, 781–783 (1998).
4. Klein, F., Bach, W. & McCollom, T. M. Compositional controls on hydrogen generation during serpentinization of ultramafic rocks. *Lithos* **178**, 55–69 (2013).