

**PhD position in rock deformation-petrology-geochemistry**  
**- University of Orléans (Orléans, France) -**

A PhD position is opened at the Institute of Earth Sciences of Orléans (ISTO) at the University of Orléans on the topic: **“Strain localization in the continental crust: the role of chemical interactions in mica-bearing rocks”**.

The mechanisms of rock weakening and strain localization within the Earth crust control the formation of large-scale shear and fault zones, as well as the dynamics of mountain belts and extensional basins. In shear zones of the continental crust, deformation is often associated to mineralogical transformations promoted by fluid percolation and to the growth of hydrated minerals such as micas. From field observations, mica is often considered as a mechanically weak phase, leading to shear zone weakening. However, experimental data to support this view are extremely scarce, so that the rheology of mica-bearing assemblages, and the underlying deformation processes, are still largely unknown. Deformation of mica-bearing assemblages is indeed a complex combination of purely mechanical (i.e. related to plastic deformation of individual phases) and chemical aspects, both contributing to macroscopic strength. Understanding these elementary processes is a prerequisite to decipher the rheology of mica-bearing assemblages and understand strain localization in shear zones.

Building on a sequence of experimental results on pure-quartz assemblages (Fukuda et al., 2019; Ghosh et al., 2022; Nègre et al., 2021), the aim of the present PhD is to investigate the role of chemical interactions as weakening mechanisms in mica-bearing rocks, from the scale of crystal defects to the one of the polycrystalline aggregate.

The project combines a **mechanical approach**, to retrieve the rheological behaviour of the aggregates, with a **geochemical approach** to unravel **element transfer** occurring during **deformation**. Analytical development of a method to chemically trace reactions and deformation processes will be at core of the project. During the PhD, both quartz-mica aggregates **deformed in laboratory experiments** and **naturally deformed granitic samples** will be investigated by using multiple techniques, such as the new generation Griggs apparatus, electron microscopy, electron backscatter diffraction, secondary ion mass spectrometry and transmission electron microscope.

The project will be supervised by Laura Airaghi (Associate professor, ISTO) and Hugues Raimbourg (Professor, ISTO), and will be carried out in close collaboration with Jacques Précigout (Research engineer, ISTO). The starting date is planned in the **early October 2023**. The position is funded for **3 years**.

The project will be hosted in the **Institute of Earth Sciences of Orléans** (<https://www.isto-orleans.fr/en/home/>) at the University of Orléans ( <https://www.univ-orleans.fr> ). ISTO has a strong expertise in experimental geology and well-equipped experimental (Griggs and Paterson apparatus, autoclaves, etc.) and analytical laboratories (e.g. SEM, Raman and FTIR spectroscopy, EPMA, cathodoluminescence, LA-ICP-MS, MC-ICP-MS, Ar-Ar and TEM within the CNRS campus). This project is integrated in the Magma-Geodynamic research group of ISTO whose main focuses include the understanding of the mechanical behaviour of the lithosphere and the interplay between mineral reactions and deformation.

We are looking for a highly motivated student with a strong interest in deformation processes and/or mineralogy-geochemistry. Experience with one of the analytical techniques mentioned above and/or phyllosilicate-rich rocks will be a plus. The applicant should hold a Master degree (or equivalent) in

Earth Sciences. Enquiries regarding the specifics of the project should be directed to Laura Airaghi: [laura.airaghi@univ-orleans.fr](mailto:laura.airaghi@univ-orleans.fr)

The application should include a full CV, transcripts of academic degrees, a statement of research interests and the contact information of two potential referees. The application should be submitted to [laura.airaghi@univ-orleans.fr](mailto:laura.airaghi@univ-orleans.fr) as a single pdf. Applications will be possible until the **15<sup>th</sup> of April 2023**.

## References

- Fukuda, J., Raimbourg, H., Shimizu, I., Neufeld, K., and Stunitz, H., 2019, Experimental grain growth of quartz aggregates under wet conditions and its application to deformation in nature: *Solid Earth*, v. 10, p. 621-636.
- Ghosh, S., Stünitz, H., Raimbourg, H., and Précigout, J., 2022, Quartz rheology constrained from constant-load experiments: Consequences for the strength of the continental crust: *Earth Planet. Sc. Lett.*, v. 117814, p. 1-14.
- Nègre, L., Stünitz, H., Raimbourg, H., Lee, A., Précigout, J., Pongrac, P., and Jeřábek, P., 2021, Effect of pressure on the deformation of quartz aggregates in the presence of H<sub>2</sub>O: *J. Struct. Geol.*, v. 148, p. 104351.