



C R P G

Centre de Recherches Pétrographiques et Géochimiques
www.crpq.cnrs-nancy.fr

UMR 7358

Constraining volatile storage in the lower crust of arcs

Supervisors:

Dr. Véronique Le Roux (CRPG/WHOI) & Dr. Laurette Piani (CRPG)

Contract duration: 36 months

Expected start date: 1 October 2024

Anticipated techniques:

Ion microprobe; electron microprobe; LA-ICP-MS; EA-IRMS; geochemical/petrological modeling; possible FTIR/Raman.

Thesis description:

This thesis aims to study volatile cycling in the lower crust of arcs with the goal to integrate this important reservoir in global volatile budgets. Volatile elements such as hydrogen (H), and halogens (F, Cl etc.) play a critical role in volcanic arc settings, where they induce melting of the mantle, drive volcanic eruptions, and contribute to the formation of economically important mineral resources. Global volatile budgets are estimated by quantifying and balancing volatile input and output fluxes between Earth reservoirs. Output fluxes are typically linked to volcanism and the extent of degassing, while subduction is recognized as the primary mechanism for returning surface-derived volatiles into the Earth's mantle. However, to date, the capacity for the lower arc crust to sequester and store volatiles has been largely overlooked, despite the fact that several recent studies have shown that the lower crust could be a significant repository for volatiles, for example in the Kohistan arc. The goals of the 3-year PhD thesis will be to: 1) quantify the volatile storage capacity and volatile distribution of the Jurassic Talkeetna arc section in Alaska. 2) identify deep fluid sources as well as igneous and metamorphic processes that could affect volatile abundances in deep arc crust and sub-lithospheric mantle; 3) produce new global models of volatile budgets that integrate the role of the deep lower arc crust; 4) continually improve analytical capabilities at the CRPG for both H and D/H (δD) measurements, in particular through the addition of a more exhaustive suite of reference materials. The volatile results will be interpreted along with igneous and metamorphic processes recorded by the rocks and will be integrated into new models of volatile budget on Earth. Ultimately, the results will allow a better understanding of the link between deep fluid contents of the lower crust, surficial volcanic hazards, economic resources, and global volatile cycling. This project was designed with international collaborators and will give the opportunity to collaborate and regularly interact with Dr. Michael Hudak at Williams College and Dr. Peter Barry at Woods Hole Oceanographic Institution (MA, US).

Skills:

Scientific drive, curiosity, and good communication skills required. Good command of English required. Some knowledge or experience with geochemical analyses, petrography, geochemical modeling, and/or Earth interior literature is a plus. Under-represented students are strongly encouraged to apply. Previous or anticipated DEI efforts and engagement will be valued.

Application & additional information:

You can [find the offer and apply on ADUM](https://adum.fr/as/ed/voirproposition.pl?site=adumR&matricule_prop=55450#version)
(https://adum.fr/as/ed/voirproposition.pl?site=adumR&matricule_prop=55450#version)

Deadline for application: **April, 26th 2024**

For any questions about the PhD, feel free to contact [Véronique Le Roux](mailto:veronique.le-roux@univ-lorraine.fr) (veronique.le-roux@univ-lorraine.fr) ou [Laurette Piani](mailto:laurette.piani@univ-lorraine.fr) (laurette.piani@univ-lorraine.fr).