Ecole Doctorale des Sciences Fondamentales

Title of the thesis: Constraining pre-eruptive timescales of an active volcano

Supervisor : Olgeir SIGMARSSON
Laboratory : LMV
University : UCA et
Email and Phone : olgeir.sigmarsson@uca.fr: 0473346720
Possible co-supervisor : Esther R. Gudmundsdottir
Laboratory : Earth Science Institut University
University : Université d'Islande

Summary :
Accumulation of CO_2 in a magma chamber may generate large enough overpressure on timescales shorter than a decade leading to explosive eruption of low-viscosity magma (Woods and Cardoso, 1997). Volcanoes that frequently start with explosive eruption, which progressively turn to effusive activity and produce magma of similar composition, are likely to possess a deep magma chamber where water remains in solution but a gasphase composed of CO_2 accumulates. Deep segregation of CO_2 from melt can lead to bubble accumulation at the top of the chamber with consequent build-up of the inert gas Rn. Radon decay to ^{210}Pb would then leave a trace for the CO_2 accumulation process, which can be tested by measuring short-lived disequilibria between the radon-daughters in the 238U-decay series in the first emitted tephra of an explosive eruption (Berlo et al., 2006; Sigmarsson et al., 2015).
The PhD-project concerns the magma system of Hekla volcano, in particular, together with evaluation of the gas phase for understanding deformation measurements at other active volcanoes. The project involves careful sampling of tephra layers from the last century at Hekla, mineralogy and elemental diffusion for estimating timescales of differentiation processes at depth together with radioactivity measurements of short-lived radionuclides. The aim is to better understand measured real-time signals and pre-eruptive magmatic timescales.

The project recently received funding for three years by the Icelandic Research Fund. It is submitted as a collaborative project between University of Iceland and Université Clermont Auvergne starting 2021 or 2022.