

PhD study on Geochemical and petrological variability of the Fjallgarðar volcanic ridge

Applications are invited for a 3-year PhD fellowship at the Nordic Volcanological Center (NordVulk), University of Iceland, in collaboration with Helsinki University, Finland. The position is available from June 1st 2021, and no later than July 1st, 2021.

Title:

Geochemical and petrological variability of the Fjallgarðar volcanic ridge: constraints on the spatial and temporal evolution of off-axis Quaternary basalt formation in Central East Iceland

Research area:

Geochemistry and petrology

Project description:

The Fjallgarðar Volcanic Ridge (FVR) in Central East Iceland stretches for almost 190 km from the northern border of Vatnajökull to the Slétta peninsula in the North. The FVR consists of a series of interglacial and subglacially erupted volcanic strata, likely formed during dyke-fed fissure eruptions over the last 0.8 Ma. Volcanic glasses occur in pillow lavas and hyaloclastites of the glacial units. The stratigraphic evolution of flow series from individual eruptive centres, as well as the chemical and petrological variability of the dyke systems, however, remain largely unknown. A previous petrochemical study based on XRF data, suggested a temporal change from low-K basalts to high-K basalts along the entire FVR that may reflect changing magma source compositions (Helgason, 1989).

Through fieldwork and by using readily available samples, we propose to stratigraphically sample several sections at different locations along the entire length of FVR to elucidate its temporal magmatic evolution by means of trace elements and radiogenic isotopes. We will test whether the stratigraphic evolution of a single fissure swarm displays variations in magma sources and degrees of partial melting and the potential relation of these to jumps of the ridge axis to its current position at the Northern Rift Zone (NRZ). We will test if the individual along-dyke variability shows decreasing influence of enriched mantle plume material with increasing distance from the plume centre close to Vatnajökull. We will also compare these data to those available from the Kverkfjöll volcanic system which display a unique geochemical fingerprint for NRZ magmas but may not sample the same plume component as indicated by their He isotope ratios. We will also target the compositional variation of basalts erupted during glacial and interglacial conditions in order to test the model of suppressed partial melting during glacial times (Jull and McKenzie, 1996; Hjartardóttir and Einarsson, 2012).

This project will be aiming at a) detailed sampling of the volcanic strata over the entire length of the FVR axis, and b) the major element, trace element and Sr-Nd-Hf-Pb isotope geochemistry of whole rocks, glasses and glass inclusions from subaerial- and subglacially-erupted material will be used to determine the sources and processes of melting and melt

ascent. If suitable samples are found, we will also aim at analysing He isotopes and U-Th disequilibria. We plan to use mineral-melt thermo-barometry to develop a model of magma stagnation in the crust and explore how changes in the melting regime may impact storage and ascent of melts through the crust.

The analytical work of the project will be performed at NordVulk (major elements, trace elements, Sr-Nd-Hf-Pb isotopes) and in Helsinki (in-situ major and trace element analysis of glass and glass inclusions), as well as initiating a collaboration with the University of Hawai'i (U-series)

Qualifications and specific competences:

MS-degree in geology. Mobility of the selected candidate for this position is required, with study time divided mainly between Reykjavik, Iceland and Helsinki, Finland.

Place of employment and place of work:

The PhD student will join the NordVulk team within the Institute of Earth Sciences, University of Iceland for a period of three years. During the studies several periods of various length will be spent at University of Helsinki, Finland and possibly at University of Hawai'i, USA. Furthermore, the student will be enrolled at Helsinki University, Finland, pending a cotutelle agreement between the two Universities (secures that a student will receive a dual degree upon graduation).

Field campaigns will be carried out in Iceland in the summer of 2021 and 2022.

PhD Supervisors:

Sæmundur A. Halldórsson, NordVulk, Institute of Earth Sciences, University of Iceland, Iceland

Christoph Beier, Professor of geochemistry, Helsinki University, Finland

Other collaborators and potential members of the PhD committee

Karsten Haase, professor of endogenous geodynamics, Friedrich-Alexander Universität Erlangen-Nürnberg, Germany,

Jóhann Helgason, Iceland Geodetic Survey,

Ken Rubin, professor of geochemistry, University of Hawai'i, USA

Application procedures

1. Before you apply

Documentation of language skills:

English language qualifications may be documented by one of the following tests:

- **TOEFL test** (internet-based), minimum score: 83. The graduate school does not accept the paper-based test, nor the TOEFL ITP test. Remember to ask the test center to send your test results to University of Iceland in order to enable verification of your test results. **University of Iceland's TOEFL code is 7949.**
- **IELTS (academic) test**, minimum average score: 6.5 points
- **Cambridge English Language Assessment:**
Cambridge Certificate of Proficiency (**CPE**)
Cambridge English: Certificate of Advanced English with grade A,B or C (**CAE**)
Cambridge English: First Certificate with grade A (**FCE**)

The test result must not be more than two years old at the time of application.

The English language test should be taken before applying and included in the application documents.

The following applicants are exempted from documenting their English qualifications:

- Applicants with citizenship from the following countries: Australia, Canada, Ireland, New Zealand, the United Kingdom, the United States, or one of the Nordic countries (Denmark, Finland, Iceland, Norway or Sweden).
- Applicants with a Bachelor's or Master's programme completed in Australia, Canada, Ireland, New Zealand, the United Kingdom, or the United States.

2. How to apply:

All information in the application must be in English or a Scandinavian (i.e. Norwegian, Swedish or Danish) language, preferably English. A certified English translation is required for documents written in languages other than English or one of the Scandinavian languages.

The application must contain the following information:

As a minimum all applications must include (pdf-files only, max. 10 MB, no zip):

- Personal information

- Academic background
- Names on two references. The reference letters may be sent directly to rikke@hi.is
- Curriculum vitae of applicant, including list of publications
- Motivation letter (max. 2 pages)
- Transcripts, grade point averages (weighted and unweighted), and diploma(s) for both Bachelor's and Master's degree. If the original documents are not in English or one of the Scandinavian languages then copies of the original documents as well as a certified English translation must be attached.
- Documentation of language skills if required.

After submission of the application, you will receive a confirmation e-mail.

Please be aware that you must scan/merge all documents into one large PDF file and send as an attachment to rikke@hi.is. If you wish to refer to scientific papers, large reports, theses and the likes, please indicate a URL where the information is available.

NordVulk reserves the right to verify the authenticity of your educational diploma and transcripts:

- Request additional information to verify an application.
- Reject the application if it is proven, or if the Programme Committee has reasonable belief, that the information provided is false or if the applicant refuses to provide the requested information, whether or not an offer has already been made.

Please note:

- The Programme Committee may request further information or invite the applicant to attend an interview.

All interested candidates are encouraged to apply, regardless of their personal background.

Applicants seeking further information are invited to contact:

NordVulk leader Rikke Pedersen, phone +354 525 5483 , e-mail: rikke@hi.is.