CSC-RUB PhD Project Proposal

Title: The behavior of the moderately volatile elements during mantle melting and crystallization

Sector of research: Experimental Petrology and Geochemistry

Degree awarded: PhD

Keywords: Moderately volatile elements, Experimental Petrology, high-temperature, redox conditions

Supervisor of PhD project: Prof. Dr. Raúl Fonseca, IGMG

Research focus of supervisor:
- Equilibrium stable isotope fractionation at high temperature
- Magmatic sulfides and noble metal alloy formation
- Trace element partitioning behavior during magmatic differentiation
- Magmatic degassing of volatile species
- In situ trace element determination of natural and synthetic minerals and glasses

Publications:

Selected publications:


In total: 66 publications with 1399 citations, h-index: 25 (source: Google Scholar)

Full publication list: https://orcid.org/0000-0002-0897-4884
### Summary of research plan

**Background:** The behavior of the so-called moderately volatile elements (MVE), which include elements like Sn, In, Bi, Ge, Ga, Sb and Pb, during planetary differentiation and terrestrial magmatism is poorly understood. Owing to their moderately siderophile and chalcophile nature, the MVE are thought to be controlled by metals and sulfides during high-temperature magmatism. However, the extent to which the more numerous silicates that comprise Earth’s mantle affect MVE behavior is largely unknown due to a lack of experimental data investigating their mineral-melt partitioning during mantle melting. Such data would be essential to understand both MVE behavior during planetary scale magmatism, as well as to better constrain their abundances in the bulk silicate Earth (BSE).

**Study objective:** In this research project, the partitioning behavior of the MVE will be investigated over a range of temperatures, pressures, and redox conditions, employing state-of-the-art experimental methodologies. The partitioning data obtained during the project will then be used to model MVE behavior during partial melting of planetary interiors, as well as fractional and equilibrium crystallization in a crustal environment. The final goal of this project is to better constrain the moderately volatile abundances of the BSE and have a firmer grasp on the extent of moderately volatile depletion of the Earth as a whole.

**Expected Results:** It is expected that this project results in several scientific publications in which the experimental partitioning data, the experimental methods used are described. Given the impactful nature of the dataset obtained during the project, there is a strong potential for high-profile publications resulting from this dataset, the modelling carried out throughout the project, and the implications of these data to terrestrial planetary formation.

**Methods:** The PhD candidate will have access to state-of-the-art experimental facilities, including two piston-cylinder presses, a multi-anvil apparatus, and four fully geared gas-mixing furnaces, all of which will be used to cover the range of pressures, temperatures and redox conditions that are prevalent during planetary magmatism. Moreover, the candidate will utilize a range of microanalytical facilities, such as SEM, FIB-SEM, electron microprobe and LA-TQ-ICP-MS during this project.

**Candidate Requirements:** An MSc. degree, or equivalent, in Earth Sciences, inorganic chemistry, or material sciences are preferred. High proficiency in the English language, both spoken and written is a requirement.

**Motivation for CSC application:** The successful candidate will be a member of the Petrology and Geochemistry workgroup at the Institute for Geology, Mineralogy and Geophysics (IGMG), which is a multidisciplinary research and teaching-oriented nexus of the Ruhr-Universität Bochum. The PhD candidate will also have access to multiple facilities at the RUB, as well as be part of the Research School where they will have access to additional training that may enhance the success of their PhD. The PhD candidate will have access to many technical facilities and expert support not only in the IGMG but also at the RUB at large, in which her/his research project can be conducted in an efficient way. The IGMG is made up from team-working people from diverse backgrounds that often engaging in many team-building and social activities.