Experimental determination of a Diffusion-chrono-thermometer to better characterize terrestrial and planetary processes

We seek a highly motivated doctoral student who is interested in basic research in Geosciences. The candidate should have basic knowledge in the areas of Geosciences and thermodynamics. The candidate should also be prepared to travel frequently between Bochum and Bayreuth for measurements. Required qualifications are an interest in experimental work and a degree in Geosciences or a neighbouring discipline.

The Project: There is an increasing recognition that many geological processes occur in pulses, or are too short to be captured by long-lived radiogenic isotopes. Moreover, thermal histories in many high temperature settings in the Earth (e.g. metamorphic, plutonic and volcanic systems) as well as in planetary systems such as asteroid parent bodies or the lunar or Martian interior often follow non-linear paths.

These require tools that can monitor processes continuously and over a range of different timescales. Diffusion chronometry or Geospeedometry is one such tool that is being increasingly used to address these issues. In spite of the rapid developments, there remain critical experimental parameters that are needed for the determination of timescales in all of the above settings that could not be collected so far because of experimental limitations. New experimental developments and advances in analytical techniques now make it possible to determine these critical parameters.

In this project we wish to use these novel experimental advances to determine diffusion coefficients and partition coefficients in the garnet-orthopyroxene-clinopyroxene system. The tools that would be used include:

- Production of thin films using pulsed laser ablation (PLD)
- High pressure and high temperature synthesis, phase equilibria and measurement of diffusion coefficients
- Chemical analysis using analytical transmission electron microscopy (ATEM) supported by focused ion beam (FIB) sample preparation; Rutherford Backscattering Spectroscopy (RBS) using particle accelerators, and high resolution electron microprobe analyses.

These should provide the doctoral student an excellent training in modern methods in the Materials science.

The Geothermometer and Geospeedometer that is developed can be widely used in all of the above settings. Therefore, results from this study would considerably expand the scope of diffusion chronometry. An added advantage of studying this system is that compositions of these phases are used to determine pressures, temperatures and fluid activities. Thus, timescales obtained from diffusion chronometry with these minerals can be directly related to specific processes and conditions that a rock experienced during its evolution.

An application including a statement of purpose, a CV, copies of certificates of graduation from Secondary school and completion of a Master's degree as well as the names of 2 Referees should be sent as a single PDF file by 19.02.2017 to **Sumit.Chakraborty@rub.de**

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