PhD or Post-Doc position at RWTH Aachen University,

interdisciplinary project to quantify and model microstructural evolution in hydrothermal crack-seal veins

The project:
Syntaxial crack-seal veins are first order structures in deep, hydrothermal and reactive (THMC) environments where fluids create and moderate permeability and reactions interact with deformation. In previous work, we modelled these veins using the Phase Field Method (PFM) to model epitaxial crystal growth from an aqueous solution, using simplified crack geometry and Discrete Element Method (DEM) to model the growth of crack-seal veins in 3D, with simplified assumptions on crystal morphology.

This project will couple detailed measurements of crack and vein microstructure with numerical modelling of microstructure evolution and fluid flow in fractures, in carbonates and sandstones, to further develop our understanding of the coupled thermal, hydraulic, mechanical and chemical evolution of syntaxial crack-seal veins. The project is a collaboration between the Institute of Structural Geology, Tectonics and Geomechanics at RWTH Aachen University (contributing vein and host rock microstructural data) and the Institute of Applied Materials - Computational Materials Science (IAM-CMS) at KIT - Karlsruher Institut für Technologie (contributing Phase-Field simulations of crystal growth and fluid flow).

The models will lead to a better understanding of the feedback mechanisms between fracturing and sealing processes, quantify the evolution of mechanical and transport processes, help define new diagnostic microstructures in natural veins and form the basis for upscaling. A parametric study of syntaxial quartz and calcite veins will be based on natural and experimental microstructures and test hypotheses on (i) evolution of vein microstructure, (ii) rate of opening versus rate of crystal growth, (iii) relative strength of vein cement and host rock, and of the (iv) connectivity of vein porosity and evolution of permeability.

The successful candidate will study microstructure of natural and artificial fractures in limestones and quartzites, to determine fracture location and roughness, index crystal facets and measure crystal orientations in partly healed fractures and in syntaxial veins in close collaboration with numerical simulation.

Observations of syntaxial vein microstructures will provide data on microstructure, vein crystal morphology and facet crystallography for comparison of our results with natural prototypes.

Your profile
Excellent command of English (German is not a requirement). MSc or PhD in Geoscience or Materials Science.
Curious, motivated, quantitative, able to develop interdisciplinary collaborations. Relevant experience with the methods used in this project.

Methods used will be Microstructural analysis, Digital Image processing, Digital microscopy

Surface roughness analysis, Scanning Electron Microscopy, Ion Beam milling, EBSD, Cathodeluminescence, experimental rock deformation, Crystal facet indexing. Experience with crystal growth experiments is an advantage.

The position will be open until filled. Candidates for the PhD position (3 years) or the Post-doc position (2 years) can both apply.

To apply, please send send one pdf file containing a letter of application, resume with list of publications, statement of research and career interests, and contact of references (at least two academic) via e-mail to j.urai@ged.rwth-aachen.de.

For more information, please contact
Prof. Dr. Janos L. Urai
Structural Geology, Tectonics and Geomechanics
RWTH Aachen University, Lochnerstrasse 4-20
D-52056 Aachen, Germany
T: +49 241 809 5723 e-mail: j.urai@ged.rwth-aachen.de
www.ged.rwth-aachen.de