Opaque phase petrology and geochemical modeling as a guide to abiotic organic synthesis in the Mid-Atlantic Ridge 15ºN area

W. Bach, Universität Bremen

One of the most intriguing aspects of peridotite-hosted hydrothermal systems is the strongly reduced nature of the vent fluids, due to the production of hydrogen by hydrolysis on ferrous iron in the ultramafic host rock. The levels of dissolved hydrogen in these systems are so high that reduced dissolved carbon species are more stable that dissolved inorganic carbon. While it is uncertain to what extent organic synthesis takes place in hydrothermal systems, it has potentially important ramifications for carbon flow and carbon and energy sources for microbial ecosystems within modern and ancient hydrothermal systems.
Here, I propose to determine the mineralogical inventory of oxide/sulfide/native metals phases in serpentinites from the Mid-Atlantic Ridge 15ºN area by magnetic and electron microprobe techniques. These phases are not only indicative of temperature and redox conditions during serpentinization, they are also important surface catalysts for organic synthesis reactions. Samples include serpentinites from the Logatchev hydrothermal field and from Ocean Drilling Program (ODP) Leg 209. Electron microprobe and transmission electron microscope analyses are employed to characterize the composition and intergrowth of sulfides, oxides, metal alloys as well as serpentine-brucite phases. Phase petrology and geochemical modelling will be employed to estimate temperature, fluid flux, pH, and redox conditions during serpentinization. These constraints are used in a companion project to calculate the chemical affinities of organic synthesis reactions under the prevailing conditions of water-ultramafic rock interaction. The proposed study will complement stable isotope and mineralogical investigations carried out at IFM-Geomar and geochemical fluid analyses by the University Hamburg and IU Bremen groups and will help integrating the results of these investigations into a thermodynamic framework for water-rock and potential organic synthesis reactions.