



MSc Project in Geomicrobiology

The research group for Geomicrobiology at the Center for Applied Geosciences at the University of Tübingen is looking for a MSc student who will work on:

Fe atom exchange between Fe-sulfides and aqueous Fe(II)

Pyrite (FeS_2) is a key mineral involved in the biogeochemical cycles of Fe, S, oxygen and trace metals throughout Earth's history. The rate and extent of pyrite formation/burial in sediments directly control the available Fe and S in the environment, which then affects how much oxygen is released into the atmosphere over geological timescales. Microbial Fe and S cycling are vital for pyrite formation; therefore, characteristics of pyrite may also be used to constrain biogenicity. Each of the processes involved in pyrite formation – from the microbial production of Fe(II) to mineral transformation from metastable Fe-sulfides – impart distinct Fe isotopic ($\delta^{56}\text{Fe}$) fractionations, which can be used to determine how much, how rapid, and under what conditions were pyrite formed in ancient environments. This information is of great importance to understanding the Great Oxidation Event ca. 2.4 billion years ago.

Interpretations of pyrite isotopic compositions are dependent upon knowing how pyrite and its precursor minerals (e.g., greigite, Fe_3S_4) interacts with Fe^{2+} in the environment after formation. Specifically, the exchange of atoms between Fe-sulfides and the surrounding water alters the mineral's Fe isotopic ratio. This process, referred to as "atom exchange", has not been well quantified. The lack of information about atom exchange between Fe-sulfides and aqueous Fe^{2+} limits the interpretation of $\delta^{56}\text{Fe}$ in nature. In this project, the kinetics and mechanisms of atom exchange will be investigated. Pyrite and greigite will be synthesized via different biotic and abiotic pathways and atom exchange will be tracked as a function of mineral properties (e.g., morphology) and environmental conditions (e.g., temperature). The results of this work will inform the use of pyrite as a proxy for ancient life and environments and add to our understanding of its role in biogeochemical cycles.

Whom are we looking for? We are looking for a highly motivated MSc student with background in (bio)geochemistry, mineralogy and isotopic processes. Experience in the three areas are preferred but not required. The student should be willing to learn new methods and able to work in a team. We expect the student to be highly motivated and interested in pursuing interdisciplinary research. Start date is flexible. The project can count towards Scientific Practice (SP) or the MSc thesis.

What are we offering? An exciting project in an international and multidisciplinary group with great opportunities to learn wet chemical, mineralogical (e.g., Mössbauer, XRD, Raman), ICP-MS and isotopic techniques.

If you are interested, please contact:

Dr. Muammar Mansor; muammar.muammar-bin-mansor@uni-tuebingen.de; +49-7071-2978999

Dr. Prachi Joshi; prachi.joshi@uni-tuebingen.de; +49-7071-2978935

Prof. Dr. Andreas Kappler, andreas.kappler@uni-tuebingen.de; +49-7071-2974992