Geophysical Research Abstracts, Vol. 7, 10288, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10288


# Fe Mössbauer spectroscopy as a tool in astrobiology

**C. Schröder** (1), G. Klingelhöfer (1) and J. Toporski (2)

(1) Institut für Anorganische und Analytische Chemie, Johannes Gutenberg-Universität, Staudinger Weg 9, 55128 Mainz, Germany, (2) Institut für Geowissenschaften, Christian-Albrechts-Universität, Olshausenstr. 40, 24098 Kiel, Germany (schroedc@uni-mainz.de)

Mössbauer spectroscopy is a powerful technique to analyze Fe and its compounds. The method measures Fe oxidation states, identifies Fe-bearing minerals, and yields clues about their crystallinity and particle size.

The element Fe plays an important role in biology, in particular in rock formations on Earth associated with the origin of life, and in extreme environments on Earth generally taken as analogues for potential extraterrestrial biological habitats. Banded Iron Formations (BIFs) are linked to the emergence of oxygen-producing lifeforms. The oldest fossil preserving rocks contain Fe in the form of numerous minerals, such as carbonates and oxides/oxyhydroxides. The redox potential of Fe between its ferrous and ferric states can be utilized by microbiota in such extreme environments as deep sea hydrothermal vent systems or acid mine drainage systems.

The portable miniaturized Mössbauer spectrometer (MIMOS II) [1] opens up new applications. Two of these instruments are currently on Mars as part of the payload of the Mars Exploration Rovers "Spirit" and "Opportunity". The identification of the Fe-minerals jarosite [2] and Goethite [3] provided direct ground evidence for water interaction at the surface of Mars, and further constrains environmental conditions such as pH-levels during the time of formation. Mössbauer spectroscopy thus played a vital role in the discovery of a once habitable environment at Opportunity's landing site at Sinus Meridiani on Mars [4].

Carbonate concretions of terrestrial origin and in the Martian meteorite ALH84001 were studied using a laboratory version of MIMOS II. The setup of MIMOS II in backscattering geometry enables non-destructive analysis of the samples and leaves them available for further analyses using different techniques. Mössbauer results high-

light the capabilities of the technique in an astrobiological context.

[1] G. Klingelhöfer et al. (2003), JGR, Vol. 108, NO. E12, 8067. [2] G. Klingelhöfer et al. (2004), Science, 306, pp. 1704-1745. [3] A.H. Knoll et al., submitted to EPSL. [4] C. Schröder et al., this issue.