Geophysical Research Abstracts
Vol. 13, EGU2011-7523, 2011
EGU General Assembly 2011

Anisotropy as a key to detect magnetotactic bacteria and magnetofossils

Andreas U. Gehring (1), Jessica Kind (1), Michalis Charilaou (1), and Inés García-Rubio (2)

(1) Institute of Geophysics, ETH Zurich, 8092 Zurich, Switzerland (agehring@ethz.ch), (2) Laboratory of Physical Chemistry, ETH Zurich, Switerland

An important characteristic of magnetotactic bacteria (MTB) is the anisotropy of one-dimensionally aligned stable single domain magnetite particles, known as magnetosome chains. We introduce the use of ferromagnetic resonance spectroscopy (FMR) at two different frequencies (X- and S-band) to compare the anisotropic properties of magnetosomes in chains of cultured intact MTB with those of lake sediments of Holocene age in order to detect magnetofossils and to characterize their preservation in a geological system. Magnetite particles in chains of intact MTB cells exhibit predominant interaction-induced shape anisotropy, which results in characteristic spectral features. In the lake sediments, where diagenetic processes generally disintegrate the magnetosomes chains and diminish their uniaxiality, preserved magnetite chains or chain fragments and dissociated magnetosomes differ in their anisotropy properties. The contribution of the two groups of configurations of magnetosomes to a FMR spectrum can be distinguished by an empirical spectral separation approach. This straightforward use of characteristic of magnetic anisotropy properties provides a way to detect magnetofossils experimentally in geological systems, and thus opens a door for a better insight into microbial ecology during Earth's history.