Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05420, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05420
EGU General Assembly 2008

Nanometer-scale study of iron biomineralization by anaerobic nitrate-dependent iron-oxidizing bacteria.

J. Miot (1), K. Benzerara (1), G. Morin (1), F. Skouri-Panet (1), C. FÈrard (1), F. Guyot (1), A. Kappler (2)

1. Institut de MinÈralogie et de Physique des Milieux CondensÈs, UMR 7590, CNRS and IPGP, Paris, France, (2) Center for Applied Geoscience (ZAG), Tuebingen, Germany

(Jennyfer.Miot@impmc.jussieu.fr / Phone: +33-144279832)

Iron-oxidizing bacteria, coupling Fe(II) oxidation to nitrate reduction under anoxic conditions, may have a deep impact on the Earth's surface geochemistry. They may be especially implicated in the weathering of sea-floor basalts and are considered as potential descendants of primitive prokaryotes, which may have promoted the formation of massive sedimentary iron deposits, known as Banded Iron Formations. However, mineral phases formed through such bacterial iron oxidation are still poorly documented, partly because of the necessity to investigate their composition and structure at the submicrometer scale.

The iron-oxidizing strain BoFeN, coupling iron oxidation to nitrate reduction, was cultured in the laboratory under anoxic conditions. The mineralogy of the biominerals formed through Fe(II) bio-oxidation was determined by X-ray diffraction (XRD) and X-ray absorption spectroscopy (XAS). The texture, structure and chemistry of these minerals were followed at the nanometer scale by Scanning Transmission Electron Microscopy (STEM) and synchrotron-based Scanning Transmission X-ray Microscopy (STXM) through the time course of a culture. STEM observations of BoFeN highlighted the connections of iron-bearing phases with microbial ultrastructures. Besides, STXM analyses provided information on the speciation (type of bonding and redox state) of both carbon and iron at the 20-nm scale. In particular, the redox state of iron-bearing phases was mapped at the submicrometer-scale. The progressive oxida-

tion of Fe(II) and subsequent changes in the mineralogy of Fe rich phases were shown to be associated to the progressive encrustation of the cells. Additionally, an intimate mixture of organic carbon species, carbonates and iron-rich minerals resulting from bacterial activity could be evidenced.

This study provides a precise scenario - at the submicrometer scale - of the mineralogical evolution of iron biomineralization, triggered by iron-oxidizing bacteria, under anoxic conditions.