

Transmission electron microscopy study of magnetites in a freshwater population of magnetotactic bacteria

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ABSTRACT

A freshwater population of magnetotactic bacteria has been extracted from the Seine River (France) and studied using transmission electron microscopy. Seventeen different morphotypes were recognized using morphological criteria, which rely on the number of magnetite crystals and their organization within cells, the size and shape of the cells and their statistical distribution. This study revealed new features in some magnetotactic bacteria that have not been described in the literature. In addition X-ray energy dispersive spectroscopy and electron diffraction analyses revealed cells containing Ba-rich and CaO inclusions. Two major modes of magnetite crystals growth were derived from the distributions of the crystal shapes in this population. Numerous cases of crystals elongations along axes different from the [111] axis are related to one singular process of crystal growth. Thus, this population of magnetites collected from cells extracted from the Seine River does not meet some of the criteria for biogenicity, which have been used so far for biomagnetites, particularly those concerning the [111] elongation axis.

Keywords: Magnetotactic bacteria, biogenic magnetite, crystal growth, transmission electron microscopy, biomineralization, crystal morphology, magnetosomes, morphotype census, morphology of biomagnetite, CSD