American Mineralogist, Volume 87, pages 1727–1730, 2002

LETTER

Crystal morphology of MV-1 magnetite

SIMON J. CLEMETT,[1] KATHIE L. THOMAS-KEPRTA,[1,*] JOEL SHIMMIN,[2] MARY MORPHEW,[2] J. RICHARD MCINTOSH,[2] DENNIS A. BAZYLINSKI,[3] JOSEPH L. KIRSCHVINK,[4] SUSAN J. WENTWORTH,[1] DAVID S. MCKAY,[5] HOJATOLLAH VALI,[6] EVERETT K. GIBSON JR.,[5] AND CHRISTOPHER S. ROMANEK[7]

[1]Lockheed Martin Space Operations (NASA/Johnson Space Center Astrobiology Institute), 2400 NASA Road 1, Mail Code C23, Houston, Texas 77058, U.S.A.
[2]Department of Molecular, Cellular & Developmental Biology, University of Colorado, Boulder, Colorado 80309, U.S.A.
[3]Iowa State University, Department of Microbiology, 207 Science I, Ames, Iowa 50011, U.S.A.
[4]California Institute of Technology, Division of Geological and Planetary Sciences, 1200 East California Boulevard, Pasadena, California 91125, U.S.A.
[5]NASA, Johnson Space Center, Houston, Texas 77058, U.S.A.
[6]McGill University, Department of Earth and Planetary Sciences, 3450 University Street, Montreal, PQ H3A 2A7, Canada
[7]Savannah River Ecology Laboratory, Drawer E, University of Georgia, Aiken, South Carolina 29802, U.S.A.

ABSTRACT

Intracellular magnetite (Fe_3O_4) crystals produced by magnetotactic bacteria strain MV-1 are in the single-domain size range, and are chemically pure. We have previously suggested that they exhibit an unusual crystal habit described as truncated hexa-octahedral. Such a crystal morphology has not been demonstrated for any inorganic population of magnetite, nor would it be expected, given considerations of symmetry and free energy. By inference, this morphology is a physical signature of a biological origin. Here we report data from transmission electron microscope (TEM) tomography of such crystals isolated from magnetotactic bacteria, which confirm the unusual geometry, originally proposed from classical TEM tilt imaging.