



The Abiotic versus Biotic Control of Magnetites Formation

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Magnetite (Fe_3O_4) is key mineral because of its significance in biological systems and of primary importance as environmental indicator. This mineral is assumed to be formed biochemically by bacteria, protiste and a variety of animals and humans tissues under the form of nano-sized particles. Determination of the origin of magnetite nano-crystals is of primary importance because of magneto reception or magneto taxis identification. However stability of this solid nanoparticle involves kinetic and thermodynamic aspects that are responsible for the control of their dimension and abundance of this 'biological bar magnets'.

A critical analysis of the literature indicates that morphology and magnetic properties of the crystals do not necessarily quantitatively allow differentiation of biogenic from abiotic nano-magnetite crystals. Mineralogical properties of magnetosomes and of inorganic crystals such as size and shape factors and their distributions, morphology and defects and twinning are presented and compared. Isotopic properties and the fractionation of oxygen and iron isotopes of the nano-sized particles are reviewed. These properties are then examined as potential tools if the process and conditions formation responsible for their genesis are known. Exploration of properties such as crystal size distributions and oxygen isotope fractionation at given temperature seems to allow the discrimination of biogenic from abiotic nano-crystals of magnetite.