

Magnetofossil Chains and Cellular Size on Earth and Expectations for Other Planets.

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Introduction: Biomineralization of magnetic particles such as intracellular magnetite may provide unique markers for biological fossils on Earth [1][2]. Several micro-organisms, including magnetotactic bacteria, incorporate magnetite in linear chains and utilize these to align themselves with respect to the Earth's magnetic field in order to (for example) provide an advantage in seeking out or avoiding oxygen rich layers in water. To be effective, the magnetic force provided by the magnetite chain must exceed other forces acting on the organism (chiefly gravity and friction) and therefore the ratio of microbe weight and surface area must at least balance the magnetic turning force. We provide this ratio for the Earth in the current epoch and predictions for ancient Earth, as well as other planets including Mars in an effort to provide predictive capabilities as we search for life and evidence of life in the solar system.

References:

[1] Bazylinski, D. A., and R. B. Frankel (2004), Magnetosome formation in prokaryotes, *Nature Reviews: Microbiology*, 2, 217-230.

[2] Kopp, R. E., and J. L. Kirschvink (2008), The identification and biogeochemical interpretation of fossil magnetotactic bacteria, *Earth-Science Reviews*, 86, 42-61, doi:10.1016/j.earscirev.2007.08.001.