

## **Proxies of Ancient Life through Magnetotactic Bacteria**

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Magnetotactic bacteria (MTB) have been considered as possible proxies of ancient life due to their ability to synthesize magnetite with distinct characteristics through biologically controlled mineralization. These microbes lyse when they die and release magnetosome crystals into the environment, creating what are referred to as magnetofossils, which have been recovered from soils, freshwater and deep-sea sediments, and perhaps even Mars. As MTB are controlled by various environmental chemistry and mineralogy conditions, these organisms provide windows to Earth's present and past chemical and biological systems, as well as perhaps other planetary conditions. The discoveries of nano-sized magnetite chains in Martian samples, such as the 1996 ALH84001 meteorite, has led to controversy as to whether they indicate life on Mars or are created through abiotic processes. Recent discoveries by Steele et al. (2022) have proven this phenomenon in the ALH84001 sample as an abiotic process, but, despite this, there is still reason to explore biomagnetic processes in extraterrestrial samples. MTB synthesizes magnetite in conditions much like the younger Martian environment; astrobiological studies on Martian samples should consider MTB as a proxy due to these favorable conditions and other biomagnetic markers. While not found in ALH84001, magnetofossils are possible proxies of ancient life and can be identified through the distinct characteristics of the various biogenic magnetite crystals.