Biogeochemistry on Mars, both possible and realistic: Magnetite.

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Sufficient information exists to devise biogeochemical approaches for search for traces of life on Mars, but non-scientific (mostly economical) factors impose practical limits: In the coming decades at least, we are likely to be limited to surface-close zones (where in all likelihood organic molecules have been destroyed by the highly oxidizing atmosphere) as well as to easily identifiable landing sites.

Magnetotactic bacteria, ubiqitous on Earth in aquatic habitats, form in their bodies chains of single-domain magnetite crystals (ca. 20-100 nm in diam.) that are preserved as *magnetofossils*, known since 1984. On Mars, fossil lakebeds (e.g. Gusev Crater) are likely sites of such magnetofossils. However, single-domain magnetite crystals are also common in the mineral world and it may not be possible to determine with certainty whether a *single* crystal is biogenic or not.

In contrast, crystal chains of bacteria are cell organelles, *complex* structures of strictly defined morphology that can only be produced following a blueprint encoded in genetic information. In fossil material, crystal chains easily fall apart upon preparation and their *in situ* study *inside* the sediment is difficult. However, advancement in instrumentation is encouraging.

We studied magnetofossil material from Mururoa Atoll (South Pacific) and from the Pleistocene Lisan lake in the Dead Sea rift with backscattered scanning electron microscopy (SEM-BSE) and other methods. Results will be demonstrated and further outlook discussed.