

Iron-rich clays and Si-bearing magnetite produced by iron-reducing bacteria

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Ancient anaerobic micrograms may have had the capacity to reduce iron [1]. If such micrograms indeed existed in the Archean sea, they could have utilized iron precipitation to create the Banded Iron Formations (BIFs). However, there is no direct evidence linking iron-reducing micrograms and BIFs. We conducted iron-reducing experiments of two-line silica-ferrihydrite using modern iron-reducing bacteria to explore what kind of BIF minerals they could produce.

Two-line silica-ferrihydrite was synthesized following the method described by Campbell *et al.* [2]. We used the medium described in Sekikawa *et al.* [3] and a slightly modified medium excluding NaH₂PO₄. Iron-reducing bacteria isolated from a mud sample collected in Fukushima, Japan. The particular species has not yet been identified. The vials containing two-line silica-ferrihydrite and bacteria were incubated in the dark at 30°C for up to around two months.

In this study, we confirmed that iron-rich clay with ~7Å spacing and Si-bearing magnetite formed. Goethite and vivianite were also detected. Iron-reducing bacteria can change two-line silica-ferrihydrite to Si-bearing magnetite and greenalite-like clays, which are both common in the mineral assemblage of the least-metamorphosed BIF [4] [5].

[1] Vargas *et al.* (1998) *Nature* **395**, 65–67. [2] Campbell *et al.* (2002) *Langmuir* **18**, 7804–7809. [3] Sekikawa *et al.* (2013) *Geo Jpn. J. Wat. Treat. Biol.* **49**, 37–46. [4] Klein (2005) *American Mineralogist* **90**, 1473–1499. [5] Huberty *et al.* (2012) *American Mineralogist* **97**, 26–37.