

## **Silician magnetite from the Dales Gorge Member of the Brockman Iron Formation, Hamersley Group, Western Australia**

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### **ABSTRACT**

We report silician magnetite from banded iron formation (BIF) in the Dales Gorge Member of the Brockman Iron Formation, Hamersley Group, Western Australia. Magnetite mesobands typically consisting of individual  $\sim 100$   $\mu\text{m}$  microlaminae are revealed to be composed of silician magnetite overgrowths on magnetite. Silician magnetite overgrowths contain from 1 to 3 wt%  $\text{SiO}_2$ , whereas (low-Si) magnetite domains contain less than 1 wt%  $\text{SiO}_2$ . Silicon solid solution is present in the magnetite crystal lattice as determined by in situ micro-X-ray diffraction and high-resolution transmission electron microscopy. Three textures are distinguished in magnetite mesobands: (1) magnetite sub-microlaminae with silician magnetite overgrowths, (2) recrystallized magnetite fragments with silician magnetite overgrowths, and (3) a complex intergrowth of magnetite and silician magnetite. All three textures are found in magnetite mesobands from the BIF4-5 and BIF12-16 macrobands of the Dales Gorge type-section drill core DDH-47A from Wittenoom, Western Australia. Magnetite domains contain numerous submicrometer-to-micrometer inclusions of quartz, carbonate, stilpnomelane, and apatite, whereas silician magnetite overgrowths are devoid of mineral inclusions. The presence of mineral inclusions in magnetite indicates the BIF oxide precipitate was not chemically pure iron oxyhydroxide/oxide. Magnetite domains display textures formed during soft sediment deformation that are the earliest and best preserved relict sedimentary structures in this BIF. Silician magnetite is the dominant iron oxide in the Dales Gorge BIF and is present in many other sub-greenschist facies BIFs worldwide. We suggest the former presence of organic matter creates reducing conditions necessary to stabilize silician magnetite. Thus, silician magnetite is a potential biosignature in BIFs.

**Keywords:** Magnetite, silician magnetite, banded iron formation, Dales Gorge, Hamersley, bio-signature