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Crystallographic texture of the magnetite-hematite transformation: Evidence for topotactic relationships in natural samples from Quadrilátero Ferrífero, Brazil

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Abstract

The transformation of magnetite to hematite is described and analyzed in three natural samples of banded iron formation, from Quadrilátero Ferrífero, Brazil. In each sample, a particular microstructure related to the transformation process is described. In the first, magnetite crystals are large and euhedral, and they display the beginning of the transformation into hematite. In the second sample, a relict crystal of magnetite was found and the fabric of the transformed hematite was evaluated. In the last sample, the foliation was the main observed structure and the correlations of magnetite and hematite lattices were measured. All the microstructures were analyzed in a scanning electron microscope equipped with a detector for electron backscatter diffraction allowing the complete analysis of crystallographic orientations of hematite and magnetite on a local scale. The results show that the orientations of the basal planes of hematite coincide with the orientations of the octahedral planes of magnetite, indicating that the hematite crystals are a direct product from the magnetite transformation.

Keyword: Magnetite, hematite, mineral transformation, electron backscatter diffraction (EBSD), banded iron formation (BIF)