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Crystallographic Behavior of Iron Oxide Minerals in the Deformed Iron Formation of Quadrilátero Ferrífero

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The Quadrilátero Ferrífero (QF) which is located in Brazil represents a mineral province of great importance for hosting Banded Iron Formation deposits (BIFs). The Alegria mine which belongs to Vale Company is located in the east part of Quadrilátero Ferrífero and it explores iron ore from a region of great structural complexity. A deformed BIF sample that presents a micro-fold on quartz and hematite bands was analyzed through Electron Backscatter Diffraction technique (EBSD) in order to relate the crystallographic orientations with the microstructures along the micro-fold envelop. For the sample orientation the Z-axis is taken parallel to the fold limb, Y-axis is perpendicular to the fold hinge and X-axis perpendicular to the YZ plane. In the limbs hematite grains are mostly stretched whereas at the hinge grains tend to be somewhat equant. On the other hand, quartz grain shapes are invariable along the fold, with a few exceptions in the hinge where grains are slightly elongated. Grains of hematite present a strong c-axis ({0001}) preferred orientation forming a subtle girdle somewhat parallel to the XY plane of the strain ellipsoid determined macroscopically (XY being the foliation plane), and a strong <a> (<2bar1bar10>) crystallographic fabric approximately parallel to the Z-axis. Similarly, the poles to the prismatic planes ({m} or {10bar10}) also have a stronger crystallographic fabric parallel to the Z axis. It seems that there are two crossing planes for the orientation of <a> and {m} with the two maxima at the intersection of the two planes. Typical hematite crystallographic fabrics are somewhat distinct, since {c} axis commonly forms a very strong fiber texture parallel to the pole of the foliation. Most studies regard such crystallographic texture as evidence for high activity of {c}<a> slip. The {c} girdles observed here are common for mica grains under rigid body rotation in constriction strain, which mechanism is commonly observed in the hematite grains of the sample. The next possibility is to evoke {10bar10}<0001> slip to explain the strong {m} crystallographic fabric. However, experimental studies show that this slip system has high activity with very high temperatures, whereas the known temperature estimates for the area of the rock studied are rather lower. Hence, this is interpreted as a crystallographic texture intermediate between complete randomness, typical of hematite crystals in undeformed banded iron formations of the Quadrilátero Ferrífero, and the strong {c} fabric parallel to the macroscopic foliation with <a> and {m} girdles normal to it.