We investigate the role of phase transformation on the strength of iron formation rocks during the deformation. The rocks come from iron formations in the Iron Quadrangle region, Brazil. Their rocks are deformed in tectonic context of variable intensity. Samples were prepared for optical microscopy and electron backscatter diffraction (EBSD). Three sets of samples were chosen. They correspond to zones of low, intermediate and highly localized deformation. The first correspond to aggregates of granular magnetite grains with variable degree of oxidation to hematite. The aggregates have a random distribution of grain shape and crystallographic planes. The deformation was accomplished mainly by microfracturing leading to a grain size reduction by cracking and a progressive transformation to hematite. In zones more intensively deformed, magnetite grains occurs as isolated clasts surrounded by a matrix of tabular hematite crystals. They are preferred oriented with their longest axis parallel to the foliation and the basal planes of hematite are orientated with their c-axes parallel to the foliation normal. In the highest deformed zones, only tabular hematite grains are present. They have a strong shape and crystallographic preferred orientations. The deformation in this highly deformed domain is accommodated by dislocation creep followed by recrystallization with some grain growth. A grain boundary sliding cannot be ruled out since the crystallographic texture consists of a single maximum around the Z-direction and a spreading of the <a> axis in the foliation plane. Another important aspect of the deformation is the stabilization of grain boundaries, characterized by a crystallography between pairs of neighboring grains in a twinning relationship. All these changes occurring progressively in these shear zones led to a complete modification of the rock fabric, from an initial aggregate of hard load-supporting magnetite phase, in the low deformed shear zones, to weaker and interconnected hematite grains in highly deformed rock.