THERMODYNAMIC EQUILIBRIUM OF THE ITABIRITES (BIF-BANDED IRON FORMATION) AND TEXTURAL STUDY AT THE QUADRILATERO FERRIFERO, MINAS GERAIS, BRAZIL

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The banded and laminated iron formation (BIF) hosting magnetite-hematite iron ore deposits in the Proterozoic Minas Series (Itabira iron formation) at Quadrilátero Ferrífero (QF) is intercalated in meta-sedimentary clastic, pelitic and meta-volcanic rocks has been up to the Carajás the most important Brazilian iron ore producer. Magnetite as primary phase, derived hematite and quartz are ubiquitous in the BIF together with additional silicates and carbonates are distributed in metamorphic zones in the QF. Metamorphism increases eastward and characterized by three zones of BIF based on mineralogical composition: 1. Oriental Zone with magnetite-hematite-quartz-chlorite-grunerite-minnesotaite-sericite; 2. Central Zone with magnetite-hematite-cummingtonite-muscovite-stilpnomelane; 3. Ocidental Zone magnetite-hematite-actinollte-tremolite-anthophyllite-garnet. Itabirite or Banded Iron Formation (BIF) at QF was originally classified as oxide, silicate and dolomitic type and the metamorphic hematite may be arranged in groups according to its mesoscopic textural aspect into: Hematite exhibits several textural arrangements, it replaces magnetite along (111) crystallographic planes, distributed in metamorphic banding and/or thin-bedded and laminated, compact, micaceous, schistose, specular porphyroblastic-specular and breccia types. Goethite appears as a product of weathering forming lateritic plateau and due to late hydrothermal process. The “jacutinga”-type, the auriferous specular style is partly pulverulent containing abundant quartz, kaolinite, goethite, talc and psilomelane and Pd-Pt associated to gold (Joaquina placer), extracted at night by the garimpeiros. The itabirite unit is usually extremely folded into tight mesoscopic folds refolded by quasi-orthogonal synform folds and supergene kink and box folds. Kink and box fold structures derived by internal collapse due to weathering was postulated. Equilibrium conditions studied through chemical potential grids and T-logX_{H2O}. It is suggested that a synkinematic, acid and oxidant metasomatism during metamorphism and hydrothermal activity under a ductile regime responsible for hematite formation followed by brittle conditions which promoted local breccias.

The main objective of the communication is to discuss the effects of the regional metamorphism and hydrothermal process which affected the BIF-Banded iron formation of QF. Three main types of BIF occur at QF, the predominant siliceous, oxide and subordinate dolomitic types. Siliceous itabirite consists mostly of magnetite, hematite, quartz, grunerite and chlorite at the western zone, a central zone with magnetite, hematite, cummingtonite and stilpnomelane an occidental zone with magnetite-hematite-actinolite-tremolite-anthophyllite-garnet, the last one representing a great portion of the Gandarela Synform. Regional metamorphism under greenschist grading to greenschist-amphibolite facies, increasing eastward to amphibolite facies is marked by the amphibole compositions. Textural evidences show transformation of magnetite into hematite distributed along the main metamorphic foliation composed of alternate laminas or bands of Fe-oxide minerals and quartz and silicate minerals, probably superimposed to the original sedimentary bedding. Original bedding of schist and quartzite enclosing the itabirite which was originally defined from Itabira as massive iron ore (Eschewege, 1822) and the term was used for specularite schist (Derby, 1910), are

conformable with the foliation of the itabirite (Dorr, 1969) suggesting it forms the original banding. Hematite was formed through the reaction $2(Fe_3O_4) + H_2O = 3(Fe_2O_3) + 2\ H^+$ which operated initially along (111) crystallographic planes, keeping intact the octahedral shape of the magnetite. According to the progressing deformation magnetite is deformed and disrupted liberating hematite laths to siliceous matrix oriented along the metamorphic foliation.