High-temperature mylonitization, partial melting and low-grade reworking in the Patos shear zone (Borborema Province, NE Brazil)

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The Patos shear zone consists of a 600 km long E-trending transcurrent structure that deforms the Precambrian rocks of the Borborema Province. Vertical gneissic mylonites constitute the northern margin of the central domain of the shear belt, while a narrow strip of low temperature (LT) mylonites and phyllonites outlines its southern margin. Lenses of anatectic rocks occur sandwiched between the high and low temperature mylonitic belts. A gradual transition of structures is recorded from highly deformed gneissic mylonites to weakly deformed migmatites. However, the corridor of mylonites along the southern margin of the Patos shear zone reworks in greenschist conditions a former high temperature fabric. A microstructural study was carried out from migmatites to mylonites in order to understand the fabric evolution from the melt-assisted to melt-absent deformation. Fabrics were investigated by optical and SEM microscopy and crystallographic preferred orientations were measured by Electron Backscatter Diffraction (EBSD). High-temperature mylonites and migmatites with a low melt fraction (metatexite) show mainly solid-state microstructures with intense recrystallization of quartz grains as large-size ribbons and lobate contacts towards feldspar minerals. Feldspar exhibits grain-scale fractures and myrmekite exsolutions at their the boundaries. Towards the contact with the diatexites and nebulites, fabrics become typically magmatic with granular texture and abundant interstitial quartz nucleated at grain boundaries or within feldspar cracks. The microstructure in the transition with LT-mylonites consist of fine-grained quartz-feldspar crystals containing relics of quartz ribbons and fractured feldspar clasts. Preferred orientation of quartz was measured across a temperature gradient from high- to low-grade mylonites, including the anatexite. [0001] axis fabrics show concentrations near Z in the low-grade mylonites, while high-temperature fabrics display complex patterns more difficult to interpret. Quartz CPO in the anatexite is weak or diffuse, but at the boundaries with mylonites concentrations around Y can be locally observed. These data suggest that the main deformation mechanisms involved in mylonitization are high-temperature dislocation creep with a large participation of diffusion through grain boundary migration (GBM) in the northern part, submagmatic flow in the migmatite and low-temperature dislocation creep with extensive dynamic recrystallization in the low-grade mylonites. Such characteristics suggest that mylonites and the anatexite were deformed within the same strain field, with textural changes due to the combined contribution of deformation mechanisms activated under decreasing temperature conditions.

PALAVRAS-CHAVE: MYLONITES, MICROFABRICS, MIDDLE-CRUST