EVALUATION OF STRESS CONDITIONS DURING MYLONITIZATION IN THE EAST PERNAMBUCO SHEAR ZONE (BORBOREMA PROVINCE, NE BRAZIL)

Gustavo Viegas[1], Raylline Silva[1], Frederico Meira Faleiros[2], Carlos Archanjo[2], Paulo Castellan[1]

[1]Instituto de Geociências, Universidade de Brasília, Brasília, DF, Brazil - lgviegas@unb.br
[2]Instituto de Geociências, Universidade de São Paulo, São Paulo, SP, Brazil

The East Pernambuco shear zone (EPSZ) consists of high-temperature mylonitic granites that grade laterally into low-grade mylonites. In order to assess the effect of different deformation mechanisms along the EPSZ, we have evaluated the stress conditions based on the grain size of recrystallised quartz. Two domains can be individualised along the lateral extension of the EPSZ: i) the Caruaru domain, located west of the town of Caruaru, and ii) the Gravatá domain, east of Caruaru. In the Caruaru area, recrystallised quartz ribbons consist of foliation-parallel flattened aggregates that are typically observed within a fine-grained matrix of recrystallised feldspar. In the Gravatá domain, polygonalyzed quartz grains are in contact with biotite and muscovite laths that define the mylonitic foliation in fine- grained, greenschist-facies mylonites to ultramylonites. The ribbons are immersed in a fine-grained ($\leq$ 20 µm) polyphase matrix. Plagioclase is retrogressed to sericite and biotite is partially replaced by chlorite, suggesting that deformation occurred in the presence of fluids. We have conducted image analysis of 966 recrystallised quartz grains in order to quantitatively evaluate the grain size distributions in both domains of the EPSZ. Quartz ribbons from the Caruaru domain have a mean grain size of 45 µm and are characterised by continuous aggregates that define an equigranular, polygonal fabric. Alternatively, the Gravatá domain is marked by discontinuous, parallel ribbons (50 µm) that are interlayered with phyllosilicates. Differential stresses calculated through recrystallised grain size piezometry of seven samples from both domains yield values of i) 30 MPa (d=50µm), 84 MPa (d=14µm), 48 MPa (d=27µm) and 18 MPa (d=17µm) for the mylonites of the Caruaru domain, and ii) 20 MPa (d=82µm), 35 MPa (d=40µm) and 45 MPa (d=30µm) in the Gravatá domain. When plotted across the length of the EPSZ, the differential stresses define a peak curve in the Caruaru domain, followed by a stress drop at the transition of both domains and then a gradual increase towards East in the Gravatá domain. These data suggest that, although mean grain sizes are similar in both domains (45 µm vs 50 µm), differential stresses may vary across the shear zone length as a function of dominant deformation mechanisms and fluid availability. The Caruaru domain records peak differential stresses that are the result of brittle fracturing acting as an effective mechanism of strain localisation under fluid-absent conditions. The Gravatá domain, on the other hand, is mostly deformed in the presence of fluids and therefore records a gradual increase in differential stresses that are consistent with progressive mylonitization. We speculate that initially dry, mechanically strong domains of the EPSZ are prone to record anomalously high differential stresses that may experience sudden drops in magnitude due to the transient, short-lived character of brittle failure. Conversely, fluid-rich sectors of the structure deform via reaction weakening and record a progressive increase in differential stresses that may be the result of efficient strain localisation via fluid-assisted reaction softening. Such characteristics suggest that deformation along the EPSZ is accommodated mainly via brittle-ductile deformation mechanisms that may be potentially controlled by heterogeneous exhumation rates along the length of the structure.