AGU FALL MEETING
San Francisco | 15–19 December 2014

T31A-4557: Strain localization in the middle- to upper continental crust: examples from the Patos and Pernambuco shear zones (Borborema Province, NE Brazil)

Wednesday, 17 December 2014
08:00 AM - 12:20 PM
Moscone_South - Poster Hall

The accommodation of deformation in the Earth's lithosphere typically results in a heterogeneous distribution of strain in the continental crust, which is a function of effective pressure, temperature and strain rate at different structural levels. In Northeast Brazil, the Borborema Province is characterized by an interconnected, crustal-scale shear zone system associated with a widespread granitic plutonism. Two of the most prominent structures of this system, the Patos and Pernambuco shear zones, are characterized by ~ 600 km long E-W striking mylonite belts in which strain localization processes are observed either in association with partial melting in the Patos strike-slip fault, or as zones of overprinting brittle-ductile deformation in the Pernambuco shear zone. Deformation mechanisms are distinct across the Patos shear zone, mainly marked by crystalline plasticity and diffusion creep in the high-temperature northern border, magmatic flow in the central region and dislocation creep coupled with microfracturing in the southern sector. The Espinho Branco migmatite (~ 565 Ma) acts as a weak rheological layer that accumulates strain in the northern portion of the fault. Alternatively, the absence of partial melting and the dominant cataclastic/plastic flow regime lead to grain-size sensitive strain localization at the southern border. The Pernambuco shear zone was nucleated at the vicinities of two granitoid batholiths at c.a. 588 Ma. Low-temperature mylonites adjacent to the batholiths show several microstructures indicating coeval activity of brittle-ductile deformation. Recent zircon U-Pb (SHRIMP) data on these mylonites yielded mean ages of ~ 539 Ma, suggesting successive events of thermal input and shearing within the structure. These features suggest that strain localization processes exert an important control on the rheology of the continental lithosphere; the accommodation of deformation in the middle crust is mainly attained by the presence of weak rheological layers such as a melt phase, which localizes strain via diffusion creep. On the other hand, the upper crustal levels are characterized by strain accumulation along pre-existing planar anisotropies through brittle-plastic mechanisms, therefore localizing deformation at the frictional-viscous transition.

First Author

Gustavo Viegas *
Plymouth University

University de Sao Paulo

Authors

Carlos Jose Archanjo
University de Sao Paulo

Alain Raymond Vauchez
University of Montpellier II

Maria Helena Hollanda
University de Sao Paulo

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