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COHERENT CRUST AND UPPER MANTLE DEFORMATION AROUND A CRATONIC CORE: EVIDENCE FROM SURFACE GEOLOGY, NUMERICAL MODELING AND SHEAR WAVE SPLITTING

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Preliminary results on core shear wave splitting in the Ribeira and Brasilia Neoproterozoic belts in Brazil, which formed at southern termination of the São Francisco craton, show a good correlation between the direction of the fast split shear wave polarization plane (ϕ) and the surface tectonic grain. In the southern NW-trending Brasilia belt ϕ trends NW. In the southern Ribeira belt, where orogen-parallel wrench-faulting dominates, ϕ trends ENE, rotating to NE and NNE in the central part of the belt. Northwards, a transition from orogen-parallel wrench-faulting to orogen-transverse thrusting is accompanied by a shift in ϕ from NNE to WNW, i.e., from parallel to perpendicular to the structural trend of the belt.
Numerical modeling of the deformation of a lithospheric plate involving a stiff block (craton) shows that the change in tectonic style from wrench-faulting to thrusting within the Ribeira belt, as well as the cross-cutting relationship between the Brasilia and Ribeira belts may be explained by the termination of the São Francisco craton and the related change in rheology of the lithosphere. It also suggests that, in such a geodynamic system, the deformation of the lithospheric mantle is coherent with the crustal deformation. This implies that the upper mantle fabric and the resultant shear wave splitting parameters should correlate positively with the surface geology.