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Transpressional tectonics vs. superposed deformation in the Rengali Province, eastern Indian shield

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A primary concern in ancient transpressional shear zones is to demonstrate that the shortening and strike-slip components of deformation operated simultaneously. In the eastern Indian shield, ultrahigh grade granulite terrane of the Eastern Ghats Belt collided with the Archaean Indian craton around $\sim$ 1 Ga. Subsequently, the northern boundary of the granulite belt was affected by a dextral strike-slip system that juxtaposed it against the Singhbhum Province. The strike-slip system is characterized by two WNW-ESE trending strands that enclose a multiply deformed (D_1 to D_3) intervening domain that is referred to as the Rengali Province. D_1 and D_2 represent a deformation continuum that operated under granulite / amphibolite facies conditions. Available zircon ages from amphibolite facies gneisses within the province indicate a late Archaean age for the D_1-D_2 deformation. In a granulite lens in the central part of the province, an early fabric-forming deformation (D_{gr}) is represented by cylindrical D_1-D_2 folding. D_3 shortening was superimposed on D_1-D_2 folds in the surrounding lithologies of the province, generating complex non-cylindrical geometries. However, there is no evidence of D_3 shortening strain within the granulites. Microstructures in the province-bounding D_3 strike-slip shear zones indicate that mylonitization and dynamic recrystallization was associated with greenschist facies metamorphism. In quartzite bands within these shear zones, syn-D_3 folds can be correlated with rotation of D_1-D_2 structures through the shortening zone of bounding dextral shears. Strain analyses and Anisotropy of Magnetic Susceptibility studies in these quartzites indicate that post-D_2 strain ellipsoids are characterized by sub-vertical axial planes and extrusion directions consistent with crustal shortening. Samples from high D_3 strain zones are associated with sub-horizontal extrusion parallel to the inferred direction of strike-slip shearing, and have kinematic vorticity numbers > 0.90 indicating dominantly simple shear deformation. Thus, D_3 strike-slip shearing was associated with a limited pure shear component, indicating that it is unrelated to the widespread shortening structures documented from the region. Chlorite bearing syn-D_3 assemblages within the mica schists yield ages of 490-470 Ma, indicating that greenschist facies metamorphism in the Rengali Province operated 2000 Ma after the amphibolite facies event. Since the province-bounding shears form a step-over zone, the structural complexity within the Rengali Province arises from superposition of syn-D_3 shortening structures on earlier cylindrical D_1-D_2 folds. The predominant shortening observed within the province, therefore, is genetically unrelated to the Cambro-Ordovician strike-slip deformation.