The Achankovil Shear Zone, Southern India: A terrain boundary?

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The Achankovil Shear Zone (ASZ) is a WNW-ESE trending ductile shear zone that extends about ~130 km across the southern parts of Kerala and Tamil Nadu. While some consider the ASZ to represent a Pan African terrain boundary between the Trivandrum Block (TB) in the Kerala Khondalite Belt (KKB) and the Madurai Block (MB) of the South Granulite Terrain, SGT (Drury et al. 1984, Santosh, 1987; Harris and Santosh 1994; Santosh et al., 1992, 2005, 2006; Guru Rajesh and Chetty, 2006; Sreejith and Ravindra Kumar, 2013) that can be traced into now-dispersed crustal fragments of Madagascar and the Sri Lanka (Braun and Kriegsman, 2003; Guru Rajesh and Chetty, 2006; Santosh et al., 2009; Sreejith and Ravindra Kumar, 2013). Others consider the MB and TB evolved coherently and the the ASZ to be a high-strain zone within the Southern Granulite Terrain, SGT (Ghosh et al., 2004). Ghosh et al., (2004) preclude the ASZ from being a terrain boundary shear zone because of two reasons, e.g, similar lithology and magmato-metamorphic ages of granulite facies rocks across the shear zone, and the structural trend lines in MB observed in remote sensing maps are continuous within the TB across the dislocation zone.

Detailed structural mapping in 1:50,000 scale in large, albeit accessible, parts of Kerala (Trivandrum, Kollam and Pathanamthitta districts) and Tamil Nadu (Tirunelveli, Thoothukudi and Nagercoil districts) across the ASZ has helped to reconstruct the structural evolutionary history of the multiply-deformed (D_1-S_1, D_2-S_2 and D_3-S_3 deformations) anatectic para-gneisses (garnet–biotite±cordierite gneisses and garnet–sillimanite–K-feldspar gneisses), and the younger ortho-gneisses (foliated charnockites, and charno-enderbites) characterized by a single tectonic fabric ($\approx S_2$) in the two blocks. The results of our investigations show the geometry of the superposed fold structures in the Trivandrum and Madurai Blocks are widely different. It is significant that, north of the ASZ, the high-T gneissose fabric (S_2) in the Madurai block describes steeply-plunging reclined D_3 folds with NNW-trending axial planes in regional scale, as opposed to the Trivandrum block in the south with gently-plunging upright D_3 folds with steep-dipping WNW-trending axial plane in regional scale. The near-orthogonal obliquity of F_3 fold axes in the two blocks indicates that the continuity of trend lines in the two blocks (Ghosh et al., 2004) across the ASZ is an oversimplification. Taking the argument a step further, we argue the two crustal blocks (TB and MB) were at different orientations and therefore evolved differently prior to their accretion in the Pan African (D_3-S_3) along the ASZ, consistent with the suggestion by Santosh et al. (1992, 2005, 2006) based on geochronological and geochemical constraints.