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Structural studies and their implications for Palaeoproterozoic collision along Bhavani shear zone, southern India

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The contact zone between Dharwar Craton (DC) and Southern Granulite Terrain (SGT) of India is marked by a series of high strain zones. They include the Moyar, Bhavani, Attur and Palghat-Cauvery shear zones. The ENE-WSW trending Attapadi Sector (AS) of Bhavani Shear Zone (BSZ) bounded by the Nilgiri Massif in the north and Vellingiri Granite in the south was considered earlier as the western termination of the BSZ. The central portion is occupied by migmatites, hornblende gneiss and biotite gneiss. Metamorphosed ultramafics, mafics and banded iron formations are seen as bands and enclaves within the gneisses. Two episodes of granite emplacements are identified. Thin linear granitic bodies that are highly sheared are interpreted to be syntectonic emplacements. Mafic dyke emplacements are also of two episodes, the older being Palaeoproterozic and the younger being Late-Cretaceous.

Structural studies have shown that the area has been subjected to at least three episodes of deformation. The tight isoclinal rootless folds within the banded iron formation with a N70°E axial trace represent F_1 fold due to D_1 deformation. This is coeval with the S_1 development in the gneisses. D_2 deformation has produced tight to open F_2 folds with axial trace trending N70°E. F_1 and F_2 are coaxial. With the axial trace trending N70°E. Major shearing activity is related with D_2, which has produced S_2 foliation. The D_3 deformation has produced F_3 warps with a NS axis on the limbs of F_2 folds. These broad warps are reflected by the synoptic π diagrams of F_2 fold axes from different sub-sectors yielding sub-horizontal to shallow plunges to both N70°E and S70°W.

The area was subjected to intense ductile shearing. A spectrum of mylonites that include protomylonite, mylonite, and ultramylonite define the high strain zones in the valley. In the high strain zones, recumbent, reclined and sheath folds are well developed. These provide a complex picture of ductile deformation and shear movement in the area. Various authors have also considered BSZ as a dextral shear zone. Based on the field studies, a dominant sinistral sense could be deciphered for the BSZ in the Attapadi Sector during the present work. The structure of this sector is highly complex.

The area was divided into three sectors for structural analysis. The disposition of the shear foliations changes from vertical to horizontal and from northerly to southerly dipping. The lineation also varies from horizontal, oblique to vertical indication variation in the movement direction. In the central sector, the stretching lineations on the northerly and southerly dipping foliations within the sector show a westerly shallow plunge with the maxima of 12% density having a plunge of 12° towards 274°. The stretching lineations on the northerly dipping foliations from the southern sector have two maxima, one with 3% density with a plunge of 15° towards 265° and the other with 5% density with a plunge of 42° towards 324°. In the northern sector, the maximum with 7% density has a shallow plunge of 10° towards

230°, while the down-dip lineations with a maximum having 13% density has a plunge of 58° towards 160°. The structural studies have indicated that the region has undergone transpressional tectonics due to north-south compressional regime that led to the folding, shearing and thrusting during progressive deformation. The Attapadi Sector of the BSZ thus preserves a relict portion of a fold thrust belt possibly formed due to a collision of the SGT with the Dharwar Terrain during the Palaeoproterozoic.