An Early Thrusting and a Late Sinistral Transcurrent Shear Along the Eastern Margin of the Chitradurga Belt in a Convergent Tectonic Regime in Archaean Dharwar Craton, Karnataka, Southern India

SILADITYA SENGUPTA[1] and ABHINABA ROY[2]

[1]*Geological Survey of India, Kolkata, India*

[2]*Presidency College, Kolkata, India*

The 400 km long, crustal scale Chitradurga Eastern Margin Shear Zone (CEMSZ) has major significance in the tectonic evolution of the Dharwar craton. It is considered by many recent workers to be the boundary between the two subcratonic blocks of the Precambrian Dharwar craton namely the West Dharwar Craton (WDC) and the East Dharwar Craton (EDC) (Chadwick et al, 2000, 2007, Rollinson, 1981, Kaila et al, 1979).

A detailed study of the macro-, meso- and micro-structural features of the CEMSZ between Javanahalli in the north and Koppa in the south for a strike length of more than 150 km revealed the disposition, dimension and kinematics of this crustal scale shear zone and present it in proper perspective in the Dharwar tectonics.

The CEMSZ varies in width from 2 to 4 km and for its major part it anastomoses along the N-S to NNWSSE trending eastern Margin of the Chitradurga Schist Belt (CSB), which is in contact with either the contrasting supracrustal belt of Javanahalli (JB) or the granite gneisses occurring to the east. However, in the southern part, near Mallur, the shear zone veers away from the N-S trending narrow linear belt of the CSB and passes well within the gneisses in a NNW-SSE trend in the Yediyur-Koppa sector.

The field structures recorded in the sheared rocks of the CEMSZ like S-C fabric, C-C/ fabric, asymmetric porphyroclasts, consistent sinistral fold asymmetry and a steep easterly dipping mylonitic foliation (C) with dominantly subhorizontal stretching lineation indicate a predominant sinistral strike slip kinematics in the shear zone. However, the consistent westward vergence of the folds viewed on sections

and the consistent sinistral asymmetry of the folds observed on the plan within the shear zone indicate that both thrusting as well as strike slip components acted in the shear zone.

Comparative antiquity of the thrusting event is evident from the obliteration of all other thrust related features, if any, by the subsequent event of intense transcurrent shear along the CEMSZ. No subsequent structural feature is found to superpose over the event of strike slip shear. The microstructural characters of the mylonites of the shear zone indicate a brittle- ductile transitional nature under the green schist grade. The simultaneous and repeated development of mylonite and pseudotachylyte in a strike-slip movement regime (Roy et al, 2008), the brittle as well as ductile deformation of the feldspar grains are indicative of the low metamorphic grade (green schist) under which the deformation in the CEMSZ took place. The study of the microstructural features in the oriented sections of the sheared rocks also established a sinistral strike slip movement in the shear zone. The JB, occurring to the east of CEMSZ, either directly in contact with the CSB or separated by a thin veneer of syntectonic granite, has contrasting geometry and metamorphic grade in comparison to that of the CSB. The JB has a higher metamorphic grade (amphibolite) compared to the CSB, which is of low green schist grade. The JB exhibits a large asymmetric overturned antiformal geometry with a shallow to moderate easterly dipping axial planar fabric and a very shallow easterly dipping ($10 - 20^{o}$) to subhorizontal eastern limb and a steep easterly dipping western limb. The western limb is affected by the CEMSZ (Sengupta and Mandal, 2008). The presence of the large scale asymmetric antiform, very tight to isoclinal, asymmetric recumbent to overturned mesoscopic folding of the supracrustal rocks and the underlying gneisses hints at an early thick skinned westward thrusting event preceding the major transcurrent movement. The former event brought the two contrasting belts into juxtaposition along the CEMSZ by an E – W to ENE-WSW compression. Similar early thrusting related to the duplex geometry followed by a late sinistral movement in an oblique transpression regime has been reported by Chadwick et al (2000) from the Gadag area. The CSB rocks, occurring to the west, on the contrary, show dominantly upright fold geometry in macro- to meso-scale having steep to subvertical axial plane.

A number of linear granitoid bodies namely the Koppa Granite, the Bukkapatna Granite and the Honnemaradi Granite got syntectonically emplaced in the zones of dilatancy within the CEMSZ and participated in the transcurrent shearing as evident from the subparallel magmatic state foliation and solid state deformation fabric (C) with a prominent subhorizontal stretching lineation.

The field and the microstructural records indicate an early thrusting followed by a concluding sinistral transcurrent movement along the crustal scale CEMSZ that resulted from the compressional tectonism between the Archaean WDC and EDC.

References

[1] B. Chadwick, , V.N. Basudev, and G.V. Hegde, Precamb. Res., 99, 91 (2000).

[2] B. Chadwick, V.N. Basudev, G.V. Hegde, and A.P. Nutman, Jour. Geol. Soc. Ind., 69, 5 (2007).

[3] H.R.Rollinson , B.F. Windley, and M. Ramakrishnan, Contrib. Min. Pet., 76, 420 (1981).

[4] K.L. Kaila, K. Roy Chowdhury, P.R. Belly, V.G. Krishna, , S.I. Harinarain, B. Subbotin, V. Sollogub, A.V.
Tekunov, , G.E. Kharetchko, M.A. Lazarenko, and T.V. Ilchenko, 120, 307 (1979).

[5] Abhinaba Roy, S. Sengupta and A. Mandal, J. Geol. Soc. Ind., 72, 447 (2008).

[6]S.Sengupta, and A.Mandal, Unpub. GSI report., (2008).