Structural geology and tectonic evolution of the Western Dharwar Craton: some new insights into the Archean tectonics of the Dharwar Craton

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The Dharwar Craton (DC) is the largest Archean craton in India. Based on lithology, age and geochemistry DC is divided into Western Dharwar Craton (WDC) and Eastern Dharwar Craton (EDC). The WDC is older and has wider schist belts than EDC and preserved key geological and structural features associated with evolutionary history of the DC. The WDC consists of two volcanosedimentary sequences older Sargur Group (>3.0 Ga) and younger Dharwar Supergroup (<3.0 Ga). In the EDC schist belts are comparatively narrow and intruded by younger (~2.5 Ga) granites. In this study we present detailed structural and stratigraphic relations across different schist belts in the Dc giving preference to the schist belts in the WDC. Especially in the Chitradurga Schist Belt (CSB), Bababudan Schist Belt (BSB) and Shimoga Schist Belt (SSB). Six stages of deformation events were identified from the study area; among those two events (D2 and D3) were regional-scale deformations. D2 event represent reverse faults and upright folds while D3 event is strike-slip sinistral fault. Schist belts are dominated by volcano-sedimentary rocks and boarded by granitic gneisses. The contact between schist belts and basement gneiss is marked by the presence of conglomerate with oversized quartzite pebbles in amphibole rich matrix. In some locations the conglomerate is oligomict with quartz pebbles in sandy matrix. The boundary between schist belts also dominated by D2 reverse faults. sedimentary rocks in the schist belts show dominance of shallow marine indicators and slump folding structures. Most of the rock formation in the WDC is folded during D2 event and the intensity of the folding increases from the west to east. Tightly folded sequences are present in the CSB, that is the eastern margin of WDC. Unfolding of the layers show that the schist belts are narrow, short-lived basins typically resembling aborted-rift settings in the Phanerozoic. Folded layers seem to be sandwiched between reverse faults (D2) in the margin of the schist belts, in total represents a fold-and-thrust belt. The overall structural architecture of WDC suggest that the schist belts in probably represent multiple stages of failed rifts later amalgamated during regional-scale deformation. Present day structures in the schist belts of the DC possibly represent an inverted failed rift basin. Sediments and volcanic rocks deposited in basin formed by rifted granitic basement and several immature basins were formed in different parts of the WDC.

Another regional-scale deformation event is strike-slip sinistral shear (D3). Gadag–Mandya Shear Zone (GMSZ) present in the eastern margin of the WDC is part of this event. GMSZ is considered as a terrain boundary by in previous research, but our detailed fieldwork shows that it is difficult to find a broad shear zone in the eastern margin of the WDC. This implies that the actual terrain boundary between cratonic units will be in the east probably near Kolar schist belt. An interesting unit of conglomerate unit identified from the eastern margin of the Kolar schist belt has horizontal bedding and almost unaffected by later phase of deformations. We suppose this conglomerate unit with mafic and felsic clast and silicious to volcaniclastic matrix represent the youngest event in the DC. So, the youngest event in the DC probably not compression, later stage extensional events occurred near the Kolar schist belts and those regions probably represent the terrain boundary of the cratonic units. These statements should be supported by both geochemical and geochronological analysis.

Our investigations points that the CSB or other schist belts in the WDC is not an accretionary complex or not preserved remnants of an oceanic crust. Schist belts in the WDC represents multiple stages of failed rifts. Terrain boundary between cratonic units probably lies more towards the eastern margin of the Kolar schist belt. Our findings are majorly based on field and structural investigations, so to support this more evidence from geochronology and geochemistry of the key rock units are necessary.