Correlation of Geological Terrane Boundaries with Lineaments Interpreted from Remote Sensing Data for Doddaballapur-Kolar Area, Eastern Dharwar Craton

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The study area forms a part of the Precambrian Eastern Dharwar Craton. This part of the craton is characterized by presence of different lithological and chronological successions including the basement Peninsular Gneissic Complex, older supracrustals (equivalent to Sargurs), younger supracrustals (equivalent to Dharwars), younger granites and basic dyke swarms. The above components show a protracted tectono-magmatic evolution between 3.5 to 2.5 b.y., ending in the 2.5 b.y. accretions with the Western Dharwar Craton. The above cratonic components are under cover of Proterozoic sediments in the north and east. The study area is bounded by north latitudes 13°15'0"N-13°45'0"N and east longitudes 77°15'0"E-78°15'0"E.

During the present course of work IRS 1D LISS III, georectified satellite images with spatial resolution of 23.5 m obtained from the NRSC and geological maps from the GSI were used. Three image enhancement techniques were adopted for lineament extraction: (1) Histogram Equalization, (2) Principal Component Analysis (PCA) and (3) study of False Colour Composites (3:2:1). Erdas 9.1 imagine software was used for raster and partly vector analyses.

Lineaments on the image have been identified through visual interpretation by using tone, colour, texture, vegetation and stream alignments. Based on image interpretation sixty five (65) representative lineaments have been demarcated. They trend in NNW-SSE, NNE-SSW, ENE-WSW and also in NW-SE and NE-SW directions. High lineament density is recorded in the southwestern, north-central and northeastern parts of the area.

The older supracrustal terrane is bounded by ENE-WSW trending lineament to the north and south, NNW-SSE trending lineament in the west and NNE-SSW trending lineament in the eastern part. This terrane shows dark tone, fine texture and low relief. The supracrustal bands have been faulted and dragged along NNE-SSW and E-W trending zones; these could also represent thrust planes. The Kolar Greenstone Belt is bounded by a NNE-SSW trending lineament on its west and shows fine texture, dark tone, high relief and sub-dendritic drainage pattern. Penukonda Greenstone Belt is identified by its linear pattern, alignment of water bodies, fine texture, light tone and fault zones showing drag effects and trending NNW-SSE. The N-S trending Closepet Granite itself defines a lineament and shows light tone, rough surface, coarse texture, moderate relief and trellis drainage pattern. Younger granite terrane shows light tone and is coarse heterogeneous textured, massive, and marked by dendritic to sub-dendritic and trellis drainage pattern. The laterite area is bounded to the north by E-W to ENE-WSW trending lineaments and by NNE-SSW trending lineaments on its western and eastern margins. This area shows dark tone, very fine texture and low relief and is well dissected by numerous nalas and several sets of minor faults and fault displacements.

Field work has been carried out in different parts of the study area, especially of lineaments probably defining terrane margins. The older supracrustals show imprints of mylonite fabric over early schistosity and ductile shear zone at margins. The lineament defining the ductile shear zone in the western margin separates the older Supracrustals from the younger Closepet Granite. The feldspar in the granite show augen fabric, sinistral asymmetry and quartz and K-feldspars are grained refined. The younger granite bordering the eastern margin of the older supracrustals shows presence of ductile shear zone with sinistral sense. This is evidenced by grain refinement, asymmetric porphyroblasts and strongly developed mineral lineation. Field study has shown that the lineament defining the margin between the NNW-SSE trending, narrow Penukonda Schist Belt. The younger granite also shows ductile shearing and feldspar in the granite shows presence of strong flattening, mineral lineation and augen tails depict sinistral asymmetry. A N-S to NNW-SSE trending lineament in the eastern part of the area occurs within younger granitoids. It is interpreted that these may represent margins of different sheets of granites emplaced during emplacement of the younger granite pluton. The major, partly discontinuous, E-W to ENE-WSW lineaments in the central part of the study area are marked by small basic dyke swarms at the western and eastern parts. These lineaments are interpreted to represent a relatively late, post-tectonic Neoarchaean to Palaeo-Mesoproterozoic (as known from isotope dates of basic dykes) tectonism in the study area. This is evidenced by displacement of N-S to NNW-SSE ductile shear zone by E-W ones in the southwestern, central and central-eastern parts of the study area. The lineaments bordering the laterite terrane in the south-central part of the study area are interpreted to represent late-stage (post-tectonic) brittle faults resulting in the small scale block movements in the area.

The result has shown that different terrane boundaries are separated by major lineaments characterized by ductile and brittle shear zones. The ductile shear zones in the Sargur supracrustal terrane also show presence of possible minor thrusts. Thus, the mainly N-S to NNW-SSE trending lineaments may represent tectonic glide- planes along which older crustal components may have been exhumed.

The lineaments within the younger granitoids are interpreted to represent both magmatic-stage and late-solid state ductile shear zones representing emplacement of granitoids and continuing solid-state deformation. The major E-W trending lineament in the central part of the study area could represent a major brittle shear (a fault zone) now healed partly by basic dyke swarms that cut across the N-S structural grain of other terrane components. The laterite area in the south-central is bounded by lineaments that could have been responsible for local scale block movements.

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