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Neoproterozoic transpression and polyphase fault reactivation in Gavilgarh-Tan shear zone: Implications for the tectonic evolution of central Indian craton

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East-west trending Gavilgarh-Tan shear zone (GTSZ) is one of the most prominent tectonic lineaments of the Central Indian craton. GTSZ is a part of the crustal-scale Proterozoic mobile belt called Central Indian Tectonic Zone (CITZ), along which the northern and southern Indian cratonic fragments were stitched together in the Meso-Neoproterozoic (Bhowmik et al. [1]). GTSZ comprises a variety of granitoid rocks (e.g. porphyritic granite, granodiorite, aplitic granite) sheared at varying intensity to form a mylonite series i.e. Proto- to Ultramylonites, from the margin towards the center of the shear zone, with a consistent sinistral shear sense. Microscopic study of the mylonites reveals that ductile deformation and mylonitization of the granitoids occurred at upper greenschist-amphibolite grade (T>450°C) at >15 km depth. Vorticity analysis of mylonites shows that the bulk transpressional deformation in GTSZ was partitioned into pure- and simple shear domains. While the central part of the shear zone was dominated by simple shear, the marginal part accommodated the pure shear component of bulk strain (Chattopadhyay and Khasdeo [2]). The mylonitic rocks were overprinted by two distinct sets of pseudotachylyte veins. One set of pseudotachylyte (Pt-M) formed at ca. 11-15 km depth with a local mylonitic overprint of dextral shear sense, and another set (Pt-C) formed at a shallower depth (<10 km) by wholly brittle deformation (Chattopadhyay et al. [3]). The successively lesser depths (and decreasing P-T condition) of deformation was correlated with successive ductile, brittle-ductile and brittle deformation events when the shear zone exhumed from deeper plastic zone through brittle-plastic transition zone to shallower brittle zone of the crust. U-Pb Zircon dating of mylonites and ^{40}Ar-^{39}Ar dating of Pt-M and Pt-C yield early Neoproterozoic (ca. 900 Ma) age of sinistral ductile shearing, followed by a late Neoproterozoic (ca. 672 Ma) dextral brittle-ductile shearing and a broadly Pan-African (ca. 459 Ma) brittle faulting event in the shear zone (Chattopadhyay et al. [4]). Recent geochronological data (e.g. Bhowmik et al. [1], Chattopadhyay et al. [5]) suggest that a major collisional orogeny (viz. Sausar Orogeny) took place in the southern part of CITZ in the Meso-Neoproterozoic (between ca. 1050 Ma and ca. 940 Ma) which can be correlated with the global Grenvillian orogeny and final crustal assembly of supercontinent Rodinia. Continued north-south crustal shortening in the terminal phases of this orogeny was likely responsible for oblique compression along GTSZ which manifested in wrench-dominated transpression.

Recent geological and geomorphic studies, supported by Luminescence dating, have further identified multiple phases of Phanerozoic fault reactivation within this shear/fault zone, with ages ranging from Permian to Holocene (Bhattacharjee [6]). Gavilgarh-Tan Shear Zone is therefore one of the longest-surviving fundamental weak zones within the Indian craton.

References:

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