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Kinematics, strain pattern and geochronology of the Salem-Attur shear zone: Tectonic implications for the multiple sheared Salem-Namakkal blocks of the Southern Granulite terrane, India

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ABSTRACT

Structural mapping, strain analysis, and a variety of geochronological studies were carried out to determine the tectonothermal evolution of the Salem-Attur shear zone in the Southern Granulite terrane of South India. The Salem-Namakkal blocks containing the shear zone consisted of quartzofeldspathic gneiss, charnockite and mafic granulite, and had undergone multiple phases of magmatism spanning over a period of 3.2–0.5 Ga. The rocks were deformed by four phases of deformation D_1–D_4. The D_1 deformation was characterized by isoclinal and recumbent NE-SW trending F_1 fold with a pervasive subhorizontal axial planar granulitic fabric, S_1, and associated quartzofeldspathic leucosomes. Granulite metamorphism was dated at ca. 2.5–2.3 Ga. The F_1 fold and S_1 fabric were coaxially refolded by tight to isoclinal, upright to steeply inclined NE-SW trending F_2 folds during D_2 deformation. The D_2 deformation was associated with F_2 axial planar shear zones, crenulations and leucosomes, S_2 fabric. Large-scale D_2 shear zones characterized by high-temperature ductile shear fabric with a vertical flow host syntectonic syenite pluton which was dated at ca. 2.5–2.4 Ga. A P-T condition of 7 kb/600 °C was inferred for the D_2 deformation. The D_3 deformation was characterized by NW-SE to E-W trending F_3 folds and the Salem-Attur shear zone. The shear zone was a greenschist to amphibolite facies shear zone being characterized by mylonitic foliation and dominantly down-dip stretching lineation defined by quartz, biotite and hornblende minerals and dated at ca. 2.0 Ga. It indicated N-NNE vergence of thrusting with the mean kinematic vorticity number, *Wm*, as 0.7 suggesting general simple shear strain with 50% pure shear component. The D_4 deformation was manifested as NNE-SSW striking strike-slip faults and NW-SE striking extensional normal faults. Pseudotachylite veins having an age of 1.9 Ga injected during strike-slip faulting and granite-pegmatite veins showing age of 0.8–0.5 Ga intruded during normal faulting. The Salem-Namakkal blocks thus recorded a long-lived shearing history. We suggest that the Salem-Attur shear zone and other shear zones such as Palghat-Cauvery, Moyar, Bhavani, Karur-Kambam-Painavu-Trichur and Achankovil shear zones, were Paleoproterozoic intraterrane shear zones which were overprinted by Meso-Neoproterozoic-Cambrian ductile and brittle deformations.

1. Introduction

The structural architecture of an orogen is often defined by shear zones which divide the orogen into a number of domains characterized by distinctive lithology, metamorphic history, structural style and geochronology (e.g., Himalaya orogen- Valdiya, 1984; Limpopo mobile belt- McCourt and Vearncombe, 1987; Cap de Creus shear zone- Carreras and Druguet, 1994; Sierras Pampeanas shear zone- Sims et al., 1998; Eastern Ghats mobile belt- Biswal et al., 2007; Sierra Ballena shear zone- Oyhantcabal et al., 2010; Southern Granulite terrane, Plavsa et al., 2015). Shear zones undergo principally simple shear deformation, pure shear deformation associates in different proportions.

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