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Brittle deformation in Southern Granulite Terrane (SGT): A study of pseudotachylyte bearing fractures along Gangavalli Shear Zone (GSZ), Tamil Nadu, India.

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High grade metamorphism and intense deformation have given a well recognition to the Southern Granulite Terrane (SGT) in India. TTG-Charnockite and basic granulites constitute the dominant lithoassociation of the area. Dunite-peridotite-anorthosite-shonkinite and syenites are the intrusives. TTG-charnockite-basic granulite have undergone F1 (isoclinal recumbent), F2 (NE-SW) and F3 (NW-SE) folds producing several interference pattern. E-W trending Neoarchean and Palaeoproterozoic Salem-Attur Shear Zone exhibits a low angle ductile thrust as well as some foot print of late stage brittle deformation near Gangavalli area of Tamil Nadu. The thrust causes exhumation of basic granulites to upper crust. Thrusting along the decollement has retrograded the granulite into amphibolite rock. Subsequently, deformation pattern of Gangavalli area has distinctly marked by numerous vertical to sub-vertical fractures mostly dominating along 0-15 and 270-300 degree within charnockite hills that creates a maximum stress ($\sigma 1$) along NNW and minimum stress ($\sigma 3$) along ENE. However, emplacement of pseudotachylyte vein along N-S dominating fracture indicates a post deformational seismic event. Extensive fractures produce anastomose vein with varying thickness from few millimeters to 10 centimeters on the outcrop. ICP-AES study results an isochemical composition of pseudotachylyte vein that derived from the host charnockitic rock where it occurs. But still some noticeable variation in FeO-MgO and Na2O-CaO are obtained from different parts within the single vein showing heterogeneity melt. Electron probe micro analysis of thin sections reveals the existence of melt immiscibility during its solidification. Under dry melting condition, albitic rich melts are considered to be the most favorable composition for microlites (e.g. sheaf and acicular micro crystal) re-crystallization. Especially, acicular microlites preserved tachylite texture that suggest its formation before the final coagulation. Profuse sub-rounded clasts embedded in the melt are identified as hexagonal β-quartz (through XRD technique) that has undergone decrepitation along grain boundary. Thus partial melting of quartz can be suggested an ultrahigh temperature of 1550 degree Celsius has reached during formation of Gangavalli pseudotachylyte. Magmatic zircon grains from the pseudotachylyte veins are providing two age groups; the oldest ages are 2550$\pm$16 and 2508$\pm$14 Ma while the younger ages are 1848$\pm$24 and 1875$\pm$22 Ma. Here, we interpret that these zircons have no relation with the formation of pseudotachylyte because of its fast solidification. Hence, protolith belongs to 1848$\pm$24 and 1875$\pm$22 Ma age with xenocrysts of 2550$\pm$16 and 2508$\pm$14 Ma.