Dynamics and geochronology of deformational fabric in the lower crustal rocks, a case study of Ambaji granulites, NW India

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Nearly 200 sq. Km triangular shaped granulite block (Ambaji granulites) represents one of the few exposures of the lower crustal rocks in the Aravalli-Delhi mobile belt, NW India. The block belongs to the Neoproterozoic South Delhi terrane and includes pelitic granulites, calc granulites, basic granulites and four phases of granites (G0, ca. 960 Ma; G1, ca. 850 Ma; G2, ca. 840 Ma and G3, ca. 750 Ma). Granulites bear the imprint of penetrative subhorizontal gneissic fabric (S1) and NE-SW trending fold axis and intersection lineation, developed during F1 folding. Shape preferred growth of garnet, cordierite, spinel, sillimanite define the S1 fabric. Garnet and cordierite developed from spinel, sillimanite and biotite in a fluid absent (H2O) condition, in granulite facies metamorphism (≥ 850˚ C and 5.5–6.8 kb). The F1 folds underwent coaxial folding by F2 folds along NE-SW axis. The S2 fabric occurs as crenulation and shear bands; large scale ductile shear zones developed syn- to late kinematic to F2 folding parallel to the axial plane of the fold. Granulites underwent decompression during F2 folding. Biotites developed in the shear zones, from the fluid assisted alteration of garnet, cordierite, and feldspars. Further, undeformed as well as deformed pseudotachylites associate with the coeval mylonites in the shear zones, which suggests the present level of exposure of granulites was the paleo-brittle-ductile transition zone (BDT) during Neoproterozoic. The shear zones show sinistral shearing with transpressive strain; transpression was probably contributed for the upliftment of granulites to the BDT zone. Subsequently, the granulites underwent F3 folding followed by brittle extensional tectonics; that produced strike-slip and normal faults and fractures (S3 fabric). Granite and quartz veins intruded the fractures and brought alteration to the rock. The S1 monazites (Low-Y) underwent dislocation creep at high temperature producing equidimensional grains (ca. 860 Ma). Dissolution-precipitation creep produced elliptical grains (high-Y) during S2 strain (ca. 820-780 Ma). S3 strain monazites (higher-Y) precipitated (ca. 780 to 660 Ma age) in the altered zone adjoining the fractures. Hence Ambaji granulites underwent a ca. 860 to 660 Ma tectonic history, that temporally matches with early part of Pan-African Orogeny in the Arabian- Nubian shield.

Keywords: S1, S2 and S3 fabric in granulites, EPMA Monazite geochronology, Ambaji granulites, South Delhi terrane.