Structure, petrology and chronology of the Trivandrum Block of Southern Granulite Terrain, South India

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Granulite terrains gained wide attention amongst geologists because of their importance in the interpretation of ancient tectonics. The southern part of Indian peninsula known as the Southern Granulite Terrain is such a high grade granulitic terrain which can provide detailed information about the ancient crustal dynamics. The Trivandrum Block (TB) which lies at the southern extremity of the southern granulite terrain consist of garnet-biotite gneisses and garnet-biotite-sillimanite±cordierite (khondalite) gneisses with a few narrow elongated bodies of charnockites. In garnet-biotite gneisses the melanocratic layer is defined by the shape preferred aggregate of biotite, garnet porphyroblast and opaques while the leucocratic layer is defined by quartz, plagioclase and K-feldspar. The melanocratic layer in khondalite gneisses are defined by shape preferred aggregates of biotite-sillimanite and garnet porphyroblasts and the leucocratic layers are defined by quartz-plagioclase and K-feldspar. A combination of optical microscopy and scanning electron microscopy were used to study the microstructures present in different lithologies. Most of the rocks show granoblastic texture with well equilibrated triple junctions. Dynamic recrystallization processes like sub-grain rotation recrystallization and bulge nucleation due to grain boundary migration recrystallization occurred along the quartz-feldspar boundaries. Myrmekitic textures formed due to the intergrowth of vermicular quartz and plagioclase feldspar along the K-feldspar boundary. Deformation textures like chessboard twinning and undulose extinction were observed in the quartz grains. Detailed structural and geochronological studies were carried out to understand the crustal evolution and the metamorphic history of the TB. In regional scale the TB describes gently-plunging upright D3 folds with steep to moderate-dipping WNW-trending axial plane. Texturally constrained monazites from TB were dated by U-Th-total Pb method and yielded prominent age peak at 571±19 Ma and minor age peaks at 771±17, 903±15, 1118±12, 1232±21, 1433±10 and 1838±11 Ma. From the textures it is evident that the monazite grains were grown during metamorphism and most of the younger ages obtained from the polychromous monazites are clearly metamorphic, not detrital or magmatic as suggested by earlier studies.

Key words: Trivandrum Block; Southern Granulite Terrain; Monazite geochronology.

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Structure, petrography and chronology of the Trivandrum Block of the Southern Granulite Terrain, South India

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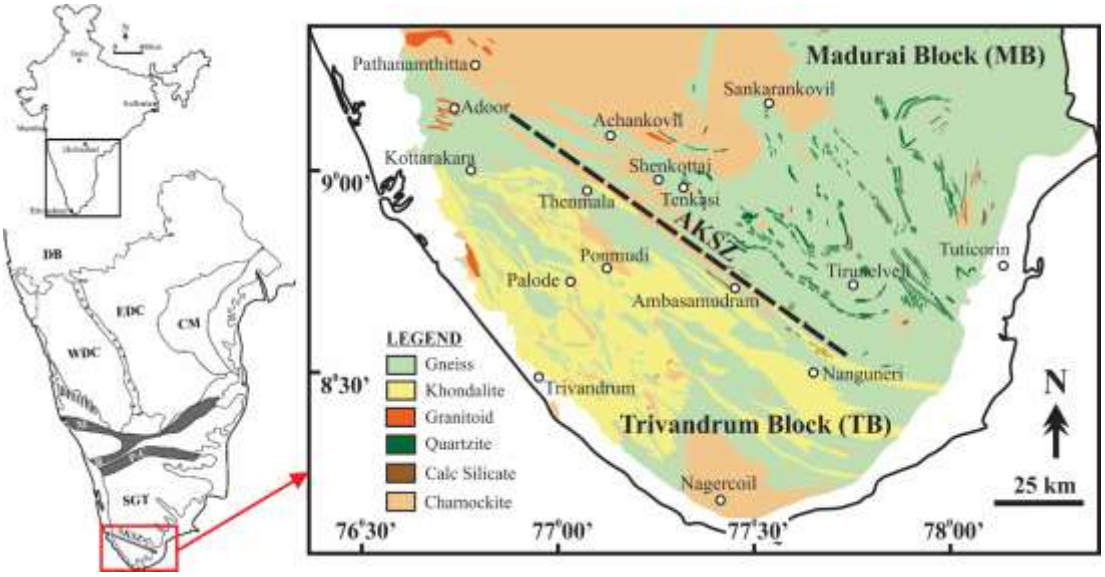
Introduction



SGT-Southern Granulite Terrain, AKSZ- Achankovil Shear Zone, WDC- Western Dharwar Craton, EDC- Eastern Dharwar Craton, CM- Cuddapah Mobile belt, DB- Deccan Basalt, M- Moyar Shear Zone, B- Bhavani Shear Zone, P-C- Palghat-Cauvery Shear Zone

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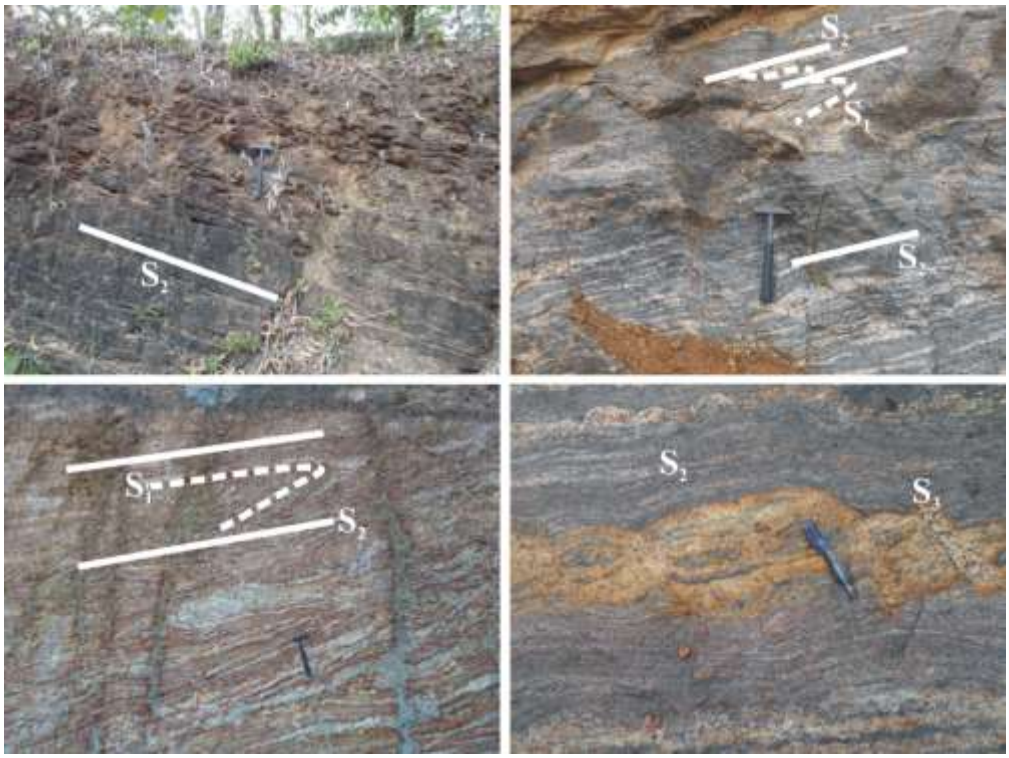
Field relations: Trivandrum Block



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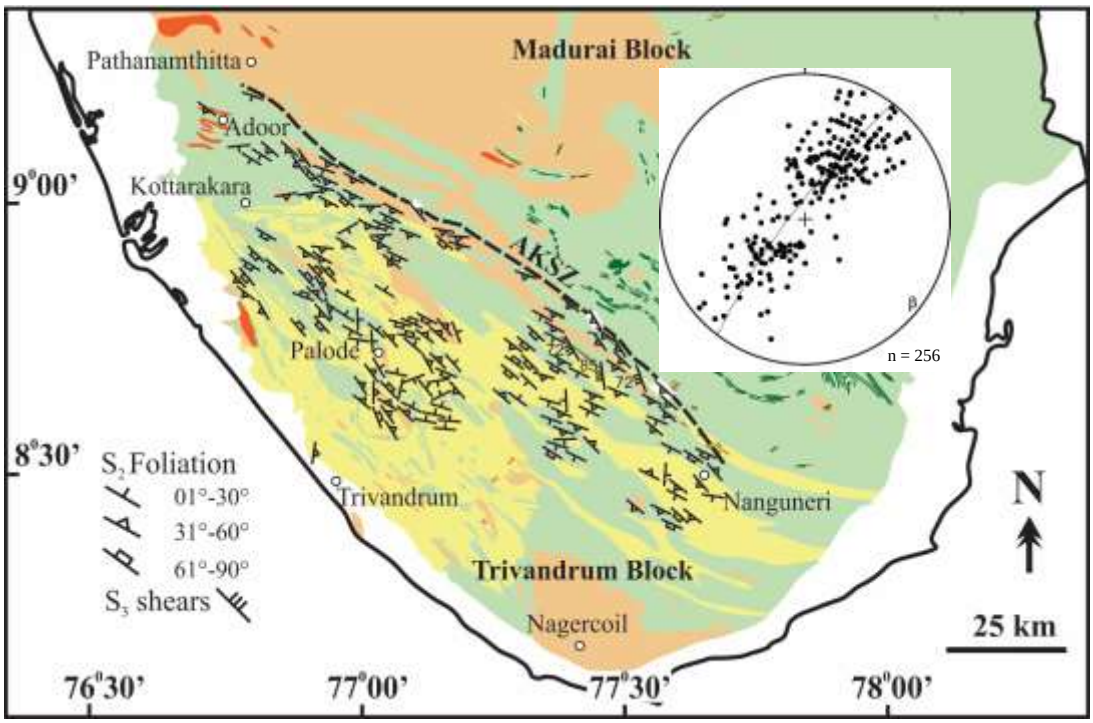
Regional structure



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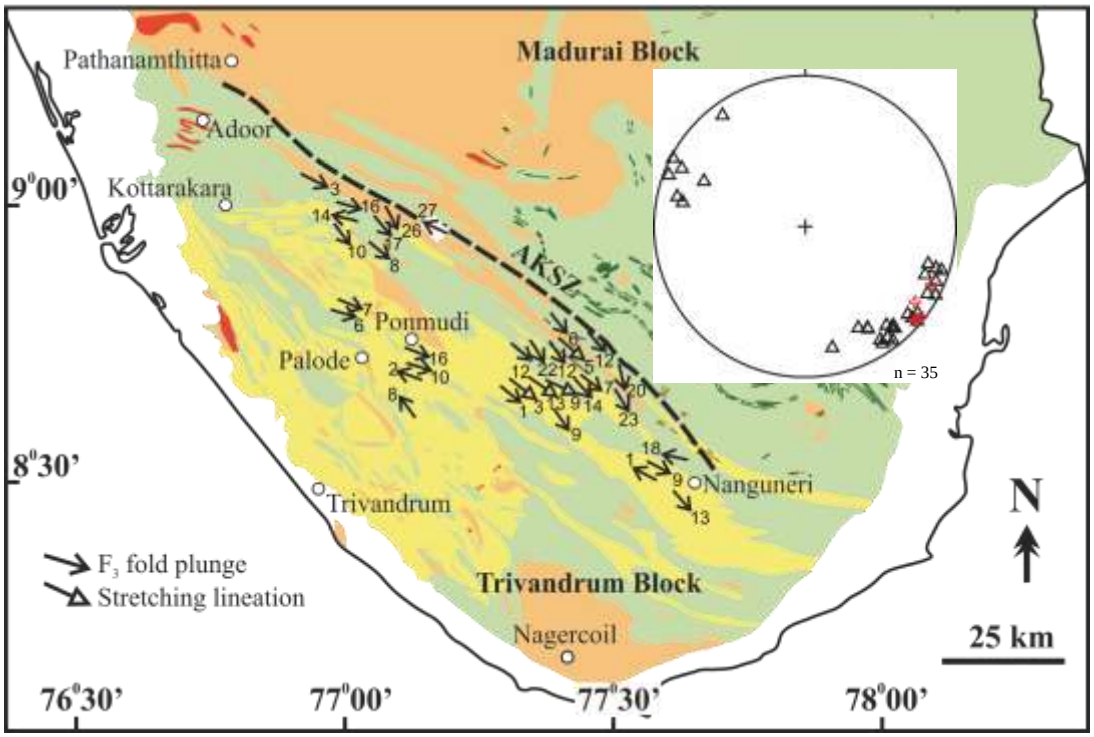
Regional structure



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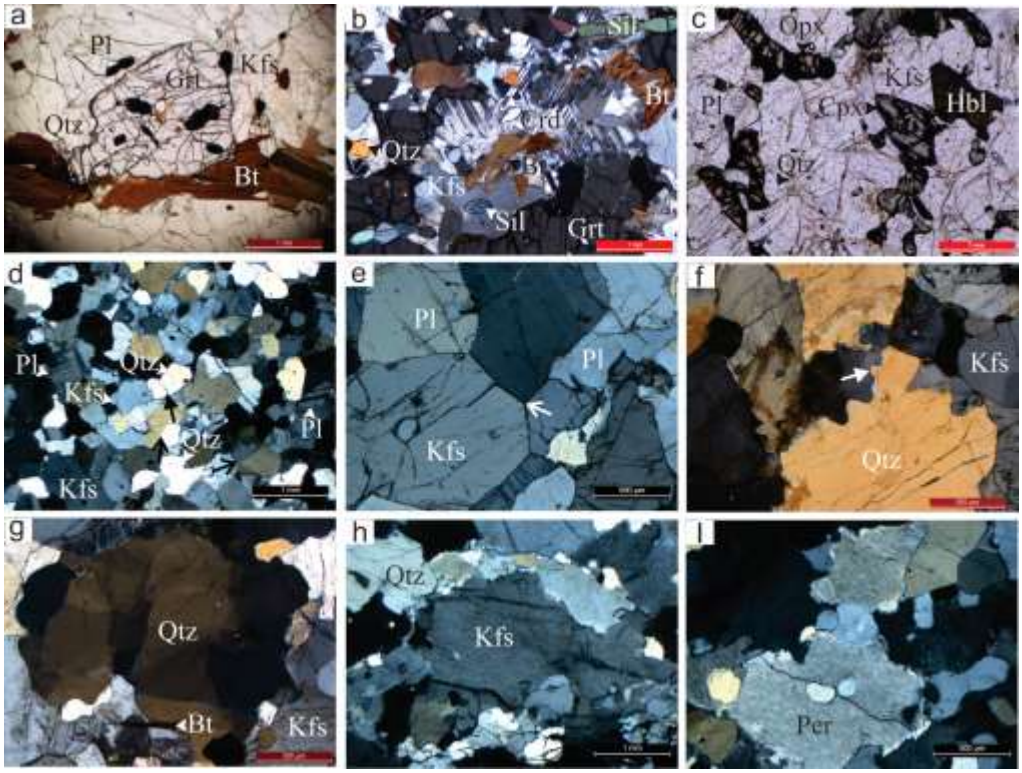
Microstructure: Trivandrum Block



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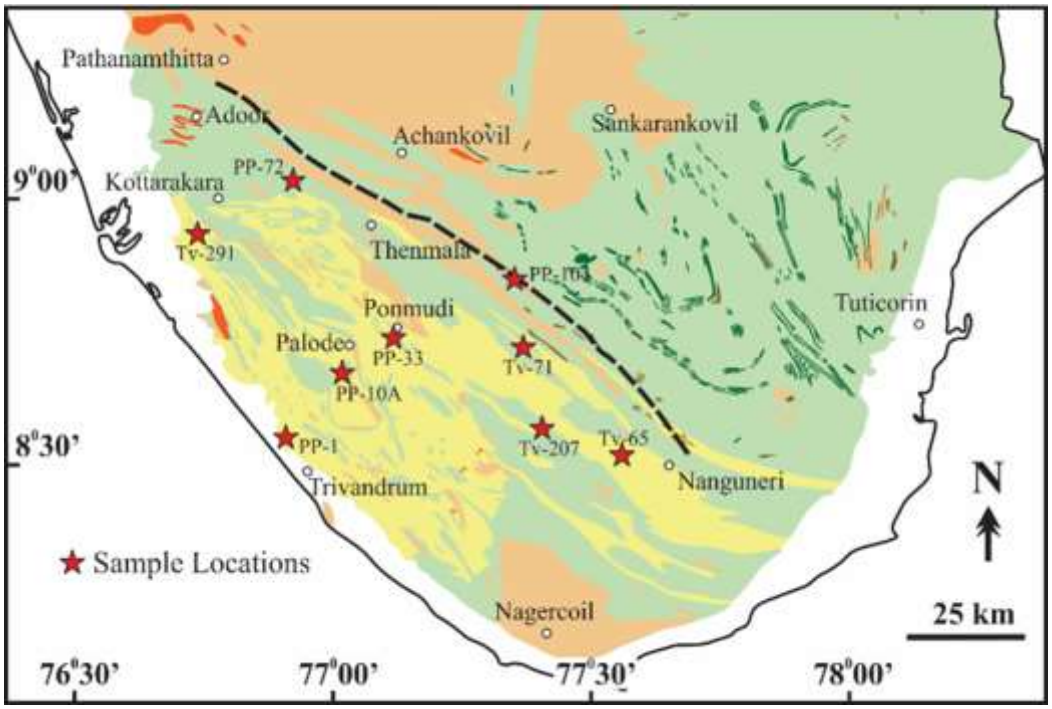
Geochronology: Trivandrum Block



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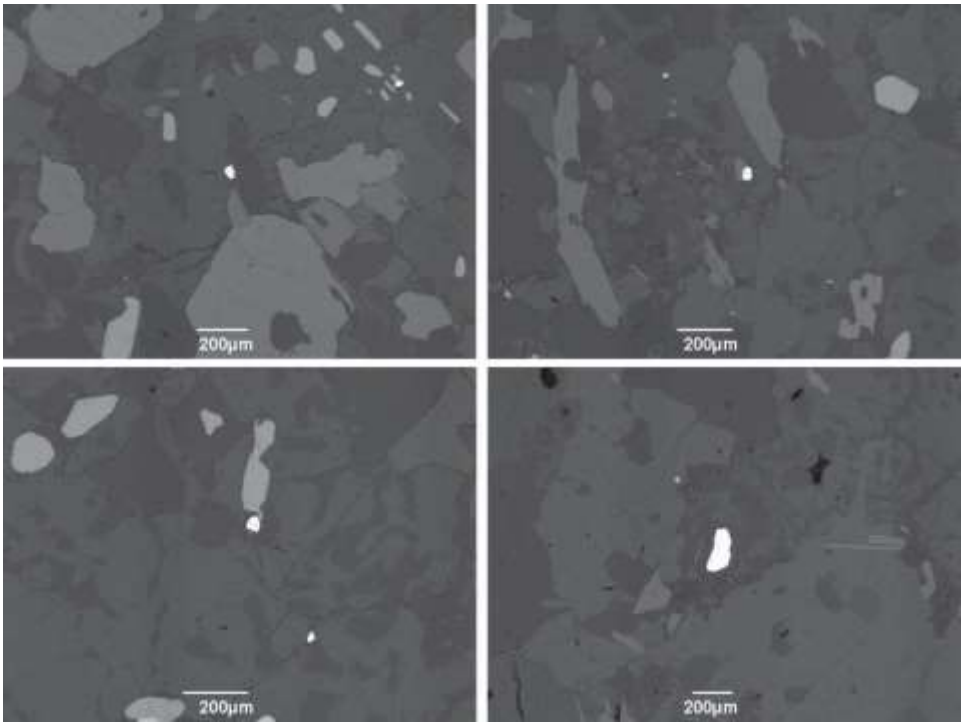
Geochronology: Trivandrum Block



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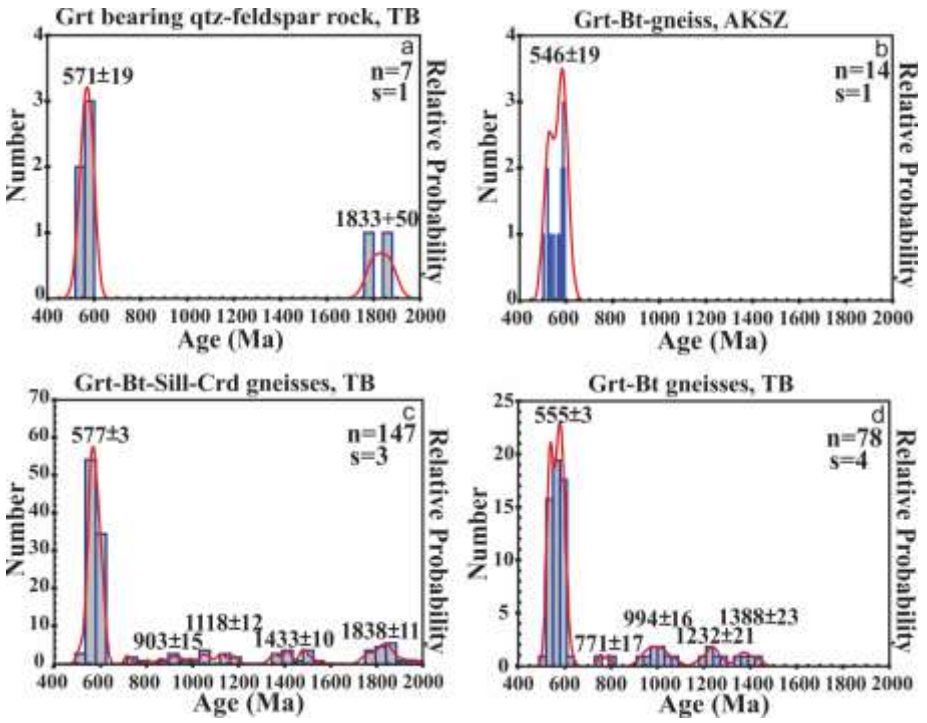
Geochronology: Trivandrum Block



Preliminary conclusions

- The Trivandrum Block has gently-plunging open folds with moderately dipping WNW-ESE trending axial plane in regional scale.
- Microtextures like granoblastic texture, triple junction and chessboard twinning in quartz indicates the high temperature deformation and metamorphism.
- The Pan-African accretion between TB and MB along AKSZ is indicated by the 550-600 Ma ages obtained from AKSZ and TB.

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