

Petrology and geochronology of sapphirine-quartz-bearing metapelites from the Madurai Block: evidence for polyphase Neoproterozoic high-grade metamorphism in the Southern Granulite Terrain of India.

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Strongly migmatitic sapphirine-bearing granulites occur as dm- to m-sized enclaves in garnetiferous leucogranites in the southeastern part of the Madurai Block (MB), which represents the largest section of Neoproterozoic crust in the Southern Granulite Terrain of India (SGT). Early mineral assemblages (bt-sil-qtz, grt-bt-qtz) break down via successive dehydration melting reactions to high-T and high-P phase assemblages (e.g. grt-liq, opx-sil-liq, opx-crd-liq). Melt-consuming reactions along the retrograde path led to partial resorption of garnet to orthopyroxene-sillimanite, orthopyroxene-sapphirine and/or orthopyroxene-cordierite as well as orthopyroxene-sillimanite assemblages to cordierite-biotite-quartz symplectites. UHT metamorphism is indicated by the presence of sapphirine-quartz intergrowths which occur as small inclusions in garnet (Tateishi et al 2004). This reaction sequence is interpreted in a KFMASH partial petrogenetic grid taking both melt-producing and melt-consuming reactions into account which yields a clockwise heating-cooling-decompression PT path culminating at 8-11 kbars and 1000-1100 °C.

U-Th-Pb single monazite dating (Paquette et al 2004) has been performed to constrain more precisely ages given by chemical electron-microprobe on monazite in various textural positions (Braun & Appel 2006). Monazite inclusions in garnet often occur adjacent and, rarely, in contact with spr-qtz intergrowths which suggests that they were both formed during an early stage of high-grade metamorphism. Indeed such grains often yield a bimodal distribution of early (950 – 850 Ma) and late Neoproterozoic (600 – 500 Ma) ages. By contrast, monazite inclusions in other mafic minerals or as interstitial phase exclusively yield a single Pan-African population. U-Pb TIMS dating of monazite inclusions in orthopyroxene, quartz and feldspar exclusively display concordant late Neoproterozoic ages between 550 and 480 Ma which is in good agreement with the ages in other places of the SGT. U-Pb TIMS dating of a single monazite inclusion in garnet yields a slightly discordant age of 850 Ma providing additional support for the occurrence of two episodes of high grade metamorphism in the SGT.

It is therefore assumed that the early Neoproterozoic population reflects the time of migmatitisation and peak UHT metamorphism whereas the late Neoproterozoic ages date the time when the sapphirine-bearing rocks were cooled and taken up by the granitic magmas and transferred to a higher crustal level of the Madurai Block.

REFERENCES

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