

Metamorphic conditions of pelitic metasediments in the middle-Archaean Kalyadi greenstone belt, Western Dharwar Craton, Southern India.

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The middle-Archaean (>3.0Ga) medium-grade Kalyadi greenstone belt consists of ultramafic-mafic volcanic rocks interbedded with chemogenic chert, detrital high Al-Mg schists and siliceous schists. The high Al-Mg sediments are now represented by garnet-staurolite - biotite schists exposed in the underground copper mines at Kalyadi. These rocks contain gt, st, bt, plag, qtz, perth, chl and ser with opaques such as mt, il, cp and py. Garnet occurs as highly fractured, coarse porphyroblasts containing inclusions of qtz, plag and st. Almandine is the predominant molecule with subordinate amounts of pyrope and grossular and does not exhibit any compositional zoning. Staurolite is Fe-staurolite and occurs as medium-grained deformed crystals in garnet. ^xMg in st increases from core to in. Plagioclase is oligoclase in composition and shows minor zoning. Biotite in contact with garnet has low Ti as compared to matrix biotite in which Ti increases from core to in with a concomitant decrease in Al VI. Temperature estimates by mica thermometry yielded 562°C for core and 580°C for rim compositions of biotite occurring away from garnet. Biotite in contact with garnet yields a comparatively uniform and low temperature of 550°C. It appears that rim compositions of biotite probably represent compositions that prevailed at near peak conditions of metamorphism. Gt-bt thermometry using rim composition of bt and core composition of gt yields 572°C. St-gt thermometry based on core compositions of st and gt gives 591°C. The available temperature estimates reveal a temperature range of 570-590°C. A late stage retrogression is indicated by chlorite replacing gt and alteration of biotite to chlorite in these rocks. Amphibolite facies metamorphism is witnessed in some parts of the Kalyadi greenstone belt. The metamorphic sequences of Kalyadi resemble that of the Barrovian metamorphic zones of Central Scotland.