

Origin and metamorphic evolution of corundum (or kyanite)-bearing amphibolites from the Paleoproterozoic Usagaran belt, Tanzania

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Occurrence of Paleoproterozoic eclogitic rocks have been known in the Usagaran belts of Tanzania. Due to severe retrogression and high-variance mineral assemblage of eclogitic rocks, however, the regional metamorphism is not fully constrained. In order to better understand the metamorphism, we studied corundum (or kyanite)-bearing aluminium-rich amphibolites occurring near the locality of Paleoproterozoic 'eclogitic rocks'. The amphibolites are characterized by the mineral assemblage of Ca-amphibolite + kyanite \pm corundum + talc \pm garnet \pm plagioclase \pm quartz. Bulk-rock major and trace elements geochemistry of the investigated three samples suggest that the protolith was troctolic or anorthositic cumulates; they have high values of normative plagioclase and olivine, and show a negative correlation between Ni and Sr, and positive Eu and Sr anomalies in spidergram. The presence of talc + kyanite and the abundance of cordierite and yoderite indicate the minimum pressure of a peak metamorphic condition of $P > 1.1$ GPa and $T = 700-850^\circ\text{C}$. In a quartz-bearing sample, kyanite contains precursor corundum as inclusion. Relict orthopyroxene was found in a plagioclase-rich sample. Our petrological study indicates that the amphiboles recorded a metamorphic trajectory from low-pressure granulite-facies (or igneous) stage, where orthopyroxene was stable, to a high-pressure stage characterized by the mineral assemblage talc + kyanite \pm garnet. Bulk-rock compositions, P-T pseudosection analyses and the talc + kyanite stability suggest that the studied amphibolites formed by a collision/subduction of the Archean continental crust at a high-pressure granulite-facies condition rather than eclogite-facies. Such a high geothermal gradient is an indicative of 'hot' subduction-zone geotherm in Paleoproterozoic.