

Eclogite xenoliths with subducted oceanic crust signatures from the Wajrakarur kimberlites, Southern India: Evidences from trace element and O isotope geochemistry

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Mantle xenoliths entrained in the kimberlite pipes of Southern India provide important constraints on the nature of the lithospheric mantle beneath the Central block of the Dharwar craton. The diamondiferous Mesoproterozoic KL2 and P3 kimberlites hosts a suite of biminerally and kyanite-bearing eclogites, with eclogites in the KL2 pipe constituting more than 95% of the xenolith population. This dominance of eclogite xenoliths is unusual and compares with that at Roberts Victor in South Africa as well as Zagadochnaya in Siberia. Garnets in the biminerally eclogites are predominantly of the pyrope-almandine variety, while those in the kyanite-bearing samples are rich in Ca. Equilibration temperatures of 1060 to 1220°C are consistent with a depth of derivation on the order of 150 to 180 km (i.e. a pressure of 4.5-5.4 GPa).

Trace element abundance patterns of the garnets comprise of two varieties, being Group 1 with relatively flat HREE and slightly depleted LREE ($Sm_N/La_N=34$), and Group 2 with slightly increasing HREE and more strongly depleted LREE ($Sm_N/La_N=120$). Group 1 samples are characterised by pronounced positive Eu ($Eu/Eu^*=1.4-3.2$) and Sr anomalies in recombined whole rock trace element patterns, and are some of the strongest anomalies for eclogite xenoliths worldwide. In contrast, Group 2 samples exhibit only subtle Eu anomalies ($Eu/Eu^*=1.1-1.3$), and a higher abundance of compatible trace elements than Group 1 samples. Oxygen isotope ratios of the garnets range between +5.3 and +7.8 ‰ $\delta^{18}O$ which extends significantly beyond the range of primary mantle. These geochemical characteristics are consistent with an origin from gabbroic and basaltic protoliths, through the subduction of oceanic crust below the Central Dharwar craton.