

Metasomatic Agents responsible for the Evolution of lithosphere beneath Orapa, the margin of cratons

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A detailed petrographic, major and trace element study is presented on peridotitic xenoliths from Orapa kimberlites, Botswana. The samples represent typical coarse or deformed texture in peridotitic xenoliths worldwide. The geotherm drawn by P-T estimations of Orapa peridotites is similar to the geotherm at Kaapvaal Craton. High Mg# of Olivine and Cr# of garnet suggest the lithosphere beneath Orapa experienced high degree-depletion event as primary formation. Moreover zonations in garnets and REE concentration of clinopyroxenes and garnets showed metasomatic re-enrichment processes after primary depletion events. This is consistent with the two-stage model for the subcratonic lithosphere firstly proposed by Frey & Green (1974). REE patterns of garnet (normal or humped) and those of clinopyroxenes revealed the melts/fluids responsible for such metasomatism are combinations of CHO-fluid and low-volume mantle melt. Highly metasomatised characteristics based on the melt estimation is supported by geological setting of Orapa kimberlites i.e. margin of two Cratons at where subduction events have occurred more frequently than other localities of the central region above thick cold lithosphere. This is consistent with the high productivity of diamonds at the Orapa kimberlite mine, because CHO-fluid might have been provided into the lithosphere by subduction to generate diamond formation