

Anorthosites of the Kunene Intrusive Complex, Namibia: new evidence from oxygen and radiogenic isotope data and mineral trace element zoning

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The Kunene Intrusive Complex mainly comprises two anorthosite bodies, a pale, mainly pyroxene-bearing anorthosite suite, intruded by olivine-bearing anorthosites. The anorthosite massif was emplaced within the high-grade metamorphic Epupa Complex during the Mesoproterozoic (1.38 Ga) and experienced no metamorphic overprint after its intrusion. Oxygen and radiogenic isotope data combined with LA-ICP-MS analyses of the anorthositic mineral assemblages provide new insights into the magma source and the magmatic processes like fractional crystallization and crustal contamination.

Chondrite normalized REE patterns of plagioclase generally display variable enrichment of light REE (La_N/Nd_N : 2.1-5.3) and positive europium anomalies (Eu/Eu^* : 5-26). Trace element profiles across plagioclase display negative correlation between incompatible V and LREE, which point to the simultaneous magnetite-ilmenite fractionation. The decreasing concentration of compatible Sr from the core towards the rim is controlled by plagioclase fractionation. Increasing concentration of incompatible Zr from the core towards the rim of plagioclase in one pyroxene-bearing anorthosite in part reflects extensive assimilation of crustal material during plagioclase crystallisation.

New and published (Drüppel et al., 2007) isotope values of whole rock samples and plagioclase separates range between 6.0-7.5 ‰ $\delta^{18}O$, 0.70382-0.70423 $^{87}Sr/^{86}Sr(T)$ and -2.9-2.0 ϵNd for the pyroxene-bearing and 5.6-6.0 ‰ $\delta^{18}O$, 0.70284-0.70364 $^{87}Sr/^{86}Sr(T)$, 0.5-3.0 ϵNd for the olivine-bearing anorthosites, in accordance with a mantle-origin of the parental melts.

Trace element patterns and isotopic composition of plagioclase and isotopic composition of the corresponding whole-rock sample suggest that pyroxene-bearing older anorthosites formed by fractional crystallization of plagioclase, pyroxene, magnetite and ilmenite from a mantle-derived anorthositic magma and assimilation of lower crustal material before and during crystallization of plagioclase. In contrast, the olivine-bearing younger anorthosites mainly evolved by fractional crystallization of plagioclase, olivine, magnetite and ilmenite in an initially uncontaminated mantle-derived magma that underwent episodic replenishing with undifferentiated mantle melts.

References

Drüppel K, Littmann S, Romer R L, Okrusch M (2007) Petrology and isotope geochemistry of the Mesoproterozoic anorthosite and related rocks of the Kunene Intrusive Complex, NW Namibia. *Precamb. Res.* 156: 1-31

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