Geochemistry and geochronology of Neoarchaean volcanic rocks of the Iramba–Sekenke greenstone belt, central Tanzania

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Abstract

The late Archaean volcanic rocks of the Iramba–Sekenke greenstone belt consist of tholeiitic basalts and basaltic andesites that are associated with a subordinate amount of intermediate to felsic volcanic rocks. Sm–Nd geochronology shows that the entire volcanic suite was emplaced at 2742 ± 27 Ma (MSWD = 1.6, ε_{Nd} = 2.3).

REE patterns in the tholeiitic basalts and basaltic andesites are flat or slightly depleted in the LREE and are characterized by La/Sm_{CN} and La/Yb_{CN} ratios of 0.70–1.17 and 0.74–1.35, respectively. On primitive mantle normalized extended trace element diagrams, two groups of basalts and basaltic andesites can be identified. Rocks of the first group display NMORB-like patterns and are characterized by minor negative Ti anomalies as well as slight depletion of the incompatible elements Th, Nb and Ta relative to the LREE. The second group only differs from the first group in having negative anomalies of Nb and Ta.

The intermediate to felsic volcanic rocks are characterized by fractionated REE patterns (La/Sm_{CN} = 2.77–6.22 and La/Yb_{CN} = 15–103) with only minor to absent Eu anomalies. On primitive mantle- and NMORB-normalized extended trace element diagrams, the samples display large negative anomalies of Nb, Ta and Ti (Nb/La_{pm} = 0.07–0.21) as well as enrichment of Th relative to the LREE (Th/La_{pm} = 1.24–3.44).

Trace element and isotope geochemistry suggests that crustal contamination did not play a role in the genesis of the Iramba–Sekenke volcanic rocks. Geochemical modelling is consistent with derivation of the tholeiitic basalts and basaltic andesites by 6% non-modal partial melting of a spinel peridotite depleted mantle source. The volumetrically minor intermediate to felsic volcanic rocks are interpreted to have been derived from the parental magmas of the tholeiitic basalts and basaltic andesites by 85–90% Rayleigh fractionation of clinopyroxene, hornblende and minor plagioclase. Tectonic setting discrimination diagrams and trace element ratios in the rocks are consistent with formation of the Iramba–Sekenke greenstone belt in a back-arc setting.

Keywords

Tanzania Craton; Iramba–Sekenke; Greenstone Belt; Sm–Nd geochronology; Basalts; Geochemistry