Geochemistry and U–Pb zircon dating of the high-K calc-alkaline basaltic andesitic lavas from the Buanji Group, south-western Tanzania

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Abstract

SHRIMP zircon U–Pb and Sm–Nd isotopic data together with major and trace elements data are presented for the basalt andesitic lavas from the Buanji Group, south-western Tanzania in order to establish their emplacement age, ascertain their mantle sources and processes responsible for their generation. Zircon U–Pb data shows that the Buanji Group lavas were emplaced at 1674 ± 15 Ma and do not therefore belong to the Neoproterozoic Bukoban Supergroup. Having erupted on top of sedimentary rocks, the 1674 ± 15 Ma age of the volcanic rocks provides the younger limit to the age of deposition of underlying un-dated sediments.

The Bunaji Group lavas are amygdaloidal and contain euhedral phenocrysts of plagioclase + orthopyroxene + clinopyroxene as well as subhedral quartz and opaque minerals mainly magnetite with quartz filling in the interstices. As a suite, they are compositionally uniform and are classified as high-K calc-alkaline basaltic andesites. The samples display coherent and fractionated REE patterns with La/Sm_{CN} and La/Yb_{CN} ratios of 2.48–2.72 and 4.03–5.92, respectively; and are characterized by negative Eu anomalies (Eu/Eu^{*} = 0.76–0.84). They are depleted in Nb, Ta, Ti and Sr but enriched in the most incompatible elements Rb, Ba, Th, U, K, and Pb leading to high ratios of Ba/Ta (531–1358) and Ba/Nb (35–91, with one outlier). They exhibit Hf/Yb ratios = 1.31–1.52, sub-chondritic ratios of Nb/Ta (13–18) and Zr/Hf (32–38), characteristics of shallow melting of mantle derived magmas. The samples display Th/Nb ratios of 0.48–0.95 and have εNd (1.67 Ga) values of +0.22 to +2.34 which are much lower than the corresponding εNd (1.67 Ga) mantle value of +6.55; characteristics indicative of contamination by the older crust.

The geochemical features of the Buanji Group high-K calc-alkaline basaltic andesites are interpreted in terms of derivation of these rocks by partial melting of the a spinel lherzolite mantle wedge that has been metasomatized by the subduction related fluids in a late Paleoproterozoic continental convergent margin. The resultant magmas were subsequently contaminated by the felsic crust prior to their emplacement.

Keywords

Buanji Group; U-Pbzircon dating; Crustal contamination; Continental arc; Palaeoproterozoic