# Age and geochemistry of coeval felsic volcanism and plutonism in the Palaeoproterozoic Ndembera Group of southwestern Tanzania: Constraints from SHRIMP U–Pb zircon and Sm–Nd data

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## Abstract

The Ndembera metavolcanic rocks represent a continuum of compositions ranging from intermediate to more siliceous calc-alkaline trachyandesites-dacites-trachytes-rhyolites which have been intruded by largely metaluminous, calc-alkaline I-type granites in the Palaeoproterozoic Usagaran Belt of southwestern Tanzania. SHRIMP U–Pb zircon age data show that the Ndembera metavolcanic rocks were extruded at 1871 ± 30 Ma, an event that was largely coeval with the emplacement of cross-cutting microcline-biotite rich granites at 1896 ± 29 Ma.Despite some compositional differences, both the granites and metavolcanic rocks share similar geochemical features including very coherent REE patterns characterized by enrichment of the LREE relative to the HREE ($La/Yb_{CN}$ = 13.6–32.8 (average = 23.9) for metavolcanic rocks and $La/Yb_{CN}$ = 10.8–38.2 (average = 21.8) for granites), negative Eu anomalies (Eu/Eu* = 0.45–1.01 (average = 0.83) for volcanic rocks and Eu/Eu* = 0.48–0.70 (average = 0.60) for granites), negative Ta, Ti and Nb anomalies ($Nb/La_{pm}$ = 0.14–0.29 (average = 0.20 for volcanic rocks and $Nb/La_{pm}$ = 0.01–0.37 (average = 0.16) for granites). The metavolcanic rocks have εNd (1871 Ma) values of −0.03 to −4.89 and $T_{DM}$ages of 2243–2714 which are broadly similar to those of the granites (εNd (1896 Ma) values of −3.56 to −4.59 and $T_{DM}$ ages of 2469–2646 Ma).The geochemical similarities between the Ndembera volcanic rocks and granites, coupled with their similar emplacement age, suggest that the two rock suites were derived by the same processes in the same tectonic setting from an isotopically similar source. These geochemical features coupled with the paucity of mafic rocks suggest the derivation of the pluto-volcanic suite by crustal anatexis of basic meta-igneous rocks mixed with a minor metasedimentary component in an intra-continental setting. The more siliceous compositions in the suite may have formed by subsequent fractionation involving hornblende, plagioclase, biotite, titanite and apatite as indicated by the negative correlation between $SiO_2$ and MgO, $Fe_2O_3$, $Al_2O_3$, CaO, $TiO_2$ and $P_2O_5$, low Sr contents and negative Eu and Ti anomalies. The ∼1.87 Ga coeval felsic volcanic and granitic magmatic event documented in the Ndembera Group is also a feature of the nearby Ubendian belt to the west pointing to a Palaeoproterozoic regional thermal event that occurred in southwestern and western Tanzania.

## Keywords

Usagaran Belt; Ndembera Group; Palaeoproterozoic; U–Pb zircon geochronology; Sm–Nd isotopes