# Trace Element Geochemistry and Petrogenesis of the Granitoids and High-K Andesite Hosting Gold Mineralisation in the Archean Musoma-Mara Greenstone Belt, Tanzania

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**Abstract**

Modern and ancient active continental margins are well known for their potential for hosting important gold deposits. The Neoarchean Musoma-Mara Greenstone Belt of the Tanzania Craton is also known for hosting several important gold deposits. Previous geochemical studies of the belt demonstrated that the rocks formed along Neoarchean convergent margins. The host rocks of the three important deposits in this belt had not yet been geochemically investigated. Therefore, we studied the host rocks of the Gokona, Nyabigena and Nyabirama gold deposits in the Neoarchean Musoma-Mara Greenstone Belt of the Tanzania Craton to determine the tectonic setting of their formation and constrain their petrogenesis. The host rocks of the Gokona and Nyabigena deposits are classified as high-K andesite, whereas the host rocks of the Nyabirama deposit are classified primarily as trondhjemite and granite and minor granodiorite (TGG). The high-K andesite and TGG were formed in an active continental margin similar to that of other Neoarchean volcanic rocks found in the Musoma-Mara Greenstone Belt. The host rocks contain low Ni and Cr concentrations and are characterised by negative Eu anomalies ($Eu/Eu* = 0.67 - 0.72$ and $0.17 - 0.6$). The chondrite-normalised rare earth element (REE) patterns of the rocks display strong enrichment in light REEs over heavy REEs (high-K andesite $(La-Yb)N = 21.7 - 35.6$, and TGG $(La-Yb)N = 2.4 – 94.4$). Moreover, the primitive normalised diagrams show enrichment in large-ion lithophile elements (Ba, Rb, Th and K), negative Nb and Ta anomalies and depletion in heavy rare earth elements and high field-strength elements (Y and Ti). The high-K andesite has a Nb/Ta value close to that of depleted mantle (mean = 15.0), lower Zr/Sm values (19.4 – 30.6) and higher concentrations of REEs, large ion lithophile elements, Sr (607 ppm) and Y than in the TGG. The TGG has a low mean Nb/Ta value (13.2) and Sr concentration (283 ppm) and a lower amount of HREEs and higher values of Zr/Sm (32.5 – 91.0) compared to the high-K andesite. However, all of the rock types contain high Ta/Yb and Th/Yb values (high-K andesite and granitoids; mean = 5.9 and 0.8, 17 and 21.3). These characteristics are interpreted as an indication of the formation of the Gokona, Nyabigena and Nyabirama host rocks from the hydrous partial melting of mantle peridotite, similar to the evolution of classical island arc rocks. The primary melts subsequently underwent fractional crystallisation to form high-K andesite, dacite and TGG prior to their extrusion or emplacement in the continental crust.