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Geochemistry of metabasites and gabbros associated with gold mineralization in the Katuma Block of the Proterozoic Ubendian Belt, Tanzania

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The Proterozoic Ubendian Belt in SW Tanzania is made up of eight lithological-structural blocks, among which the Lupa and Katuma Blocks host significant gold and base metal mineralizations. In the Katuma Block, gold occurs in quartz-carbonate-sulphide veins hosted within sheared and deformed orthogneisses, metapelites and metabasites. The metabasites and gabbros that are associated with the mineralization contain numerous sulphide bearing fluid veins, the significance and relationship of which with the mineralization is not yet established. Proximal to the ore bearing veins the amphibolite to granulite facies host rocks show hydrothermal alteration, muscovite formation and an increase in sulphide disseminations.

Recent studies revealed that the Paleoproterozoic Ubendian Belt experienced two further Proterozoic orogenic reworking events that affected the different blocks to a different degree and suggests, in post-Paleoproterozoic time, separate geodynamic evolutions of the blocks in the Ubendian Belt (Boniface et al., 2012, Boniface & Schenk, 2012). This study is aimed to unravel the geodynamic evolution, the age and the setting of the gold mineralization in the Katuma Block. We have determined the geochemical characteristics of the metabasites and gabbros and dated some host rocks and the hydrothermal alteration near the veins.

The metabasites and gabbros of the Katuma Block are sub alkaline in composition ranging from basalt to basaltic andesite. The metabasites are more evolved compared to the gabbros, with Mg numbers of 18.6 to 45.6 (mean = 32) and 62.6 to 67.8 (mean = 66.6), respectively.

Both rock types have high concentrations of large ion lithophile elements (Cs, Rb, Ba, K, U) and are depleted in high field strength elements (Nb, Ta, Zr, Hf, Ti) compared to normal mid-oceanic ridge basalts. The rocks are characterised by enrichment of light rare earth elements compared to the heavy rare earth elements; La/Yb$_{CN}$-ratios range between 1.6 and 16.3 (mean = 5.1). These characteristics resemble those of primitive and evolved arc lavas extruded in magmatic arc settings.

HFSE-ratios, like Zr/Y 2.5 – 9.4 (mean = 4.2), Ta/Yb 0.05 – 0.4 (mean = 0.15) and Th/Yb 0.3 – 3.9 (mean = 1.0), suggest a continental arc setting for the emplacement of the precursor melts of the metabasites and gabbros. The absence of metamorphic features, the primitive nature and lower concentrations of the heavy rare earth elements in the gabbros compared to the metabasites evokes for a multistage magmatic process, by which the later stage is marked by a higher degree of partial melting in the source region.

Preliminary geochronological results from a recrystallized monazite of a hydrothermally altered metapelite, dated with the U-Th-total Pb method, indicate a Mesoproterozoic age (∼1200 Ma) for the hydrothermal alteration event. Dating of zircon and muscovite from the host rocks and the alteration zone adjacent to the mineralization vein is still in progress.

Boniface, N. and Schenk, V., 2012. Precambrian Research, 208-211, 72-89.

Boniface, N., Schenk, V. and Appel, P., 2012. Precambrian Research, 192-195, 16-33.