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Structural controls of fluid flow at the base of the Kagera Supergroup and implications for regional gold mineralization, Karagwe-Ankole Belt, north-western Tanzania

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Gold mineralization on the eastern margins of the Mugera-Nyakahura inlier, a regional scale structural window, is constrained to an intensely sheared, low-angle basement-cover detachment between Archaean basement gneisses of the Tanzania Craton and the structurally overlying, low-grade metamorphic metasediments of the Mesoproterozoic Karagwe-Ankole Belt. Laterally extensive fluid flow along this detachment is indicated by the pervasive silicification and retrogression of wall rocks to pervasively foliated phyllonites and pyritization of graphite-rich metasediments.

Artisanal gold mining is located on distinct structural sites along the detachment, but also in stratigraphically higher locations in the structurally overlying metasediments of the Kagera Supergroup. Targeted gold mineralization from the detachment correlates with NE trending ramp structures (dip angles 20^{o} – 35^{o}) that are preferably orientated for slip and reactivation within the low-angle phyllonitic detachment. Repeatedly overprinted auriferous quartz-vein stockworks in quartzo-feldspathic gneisses immediately below the detachment indicate brittle fracturing of the competent footwall lithologies during slip along the weaker detachment. In cases of massive silicification, i.e. quartz veining, up to 50 m thick quartz blows are formed along the contacts between detachment phyllonites and footwall gneisses. Multiple overprinting relationships of successive quartz-vein generations in these zones of massive silicification suggests that the quartz blows acted as competent inclusions in the weak detachment, causing repetitive overprinting of earlier silicification by later auriferous fracturing and quartz-veining events.

Gold mineralization in stratigraphically higher metasediments, above the detachment, is closely associated with fold structures that form part of the low-grade metamorphic fold and thrust belt. Quartz veining is particularly abundant in competent lithologies, such as ferruginous mafic sills and quartzite beds. Overprinting relationships between quartz vein sets illustrate fluid flow during fold amplification and, importantly, the final lock-up stage of folds, during which much of the auriferous quartz veins was introduced.

Oxygen isotope values for quartz veins tentatively show fluids where derived from clastic, mainly metapelitic sedimentary sequences of the Kagera Supergroup and that the partially reworked Archaean

granitoid-greenstone basement of the Tanzania Craton did not contribute to the fluid generation and mineralization. The extent (>100 km) of the basement-cover detachment along the Mugera-Nyakahura inlier and associated alteration is indicative for a significant regional-scale fluid system. Gold mineralization is, however, controlled by local structures and lithological contrasts that require the detailed geological mapping and sampling of the regional structure.