

# Geological setting, geochemistry, and genesis of tsavorite deposits associated with graphitic gneisses in the Davis Mine, Mwatate (Taita Taveta region, Kenya)

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The Davis Tsavorite Mine is geologically located within the Neoproterozoic Metamorphic Mozambique Belt (NMMB) in Mwatate area of the Taita Taveta region, South East Kenya. The Lualenyi Member in the Mgama-Kuranze area hosts open pit Lualenyi Tsavorite Mines, including the Davis Tsavorite Mine itself located on Kide Hill in the Mgama Ridge. The Davis Mine has two active mine pits referred to as Pit 2 and Pit 3 which have two and five tsavorite mineralization horizons respectively, consisting of graphitic gneiss and graphitic schist. Tsavorite occurs as nodules in boudins within the host horizons in both pits. Samples from the Mine show that it is on a continental margin (0.5-5.5 for  $\text{Na}_2\text{O}/\text{Fe}_2\text{O}_3$  and 2-14.4 for  $\text{K}_2\text{O}/\text{CaO}$ ) with turbidite sequences (0.1-0.4 for  $\text{Na}_2\text{O}/\text{Fe}_2\text{O}_3$  and 0.5-1.5 for  $\text{K}_2\text{O}/\text{CaO}$ ).  $\text{Na}_2\text{O}/\text{Fe}_2\text{O}_3$  ratio with increasing  $\text{SiO}_2$  content is low at 0.1. Chondrite-normalized REE patterns show La/Yb (3.3-17.1) ratios for host rock and La/Yb (8.9-12.3) ratios for tsavorite; with a negative steep Eu anomaly. La/Yb and Gd/Yb ratios are used simultaneously to determine sediment REE enrichment. The high chondrite-normalized La/Yb ratios and Gd/Yb (1.0-1.8 for host rock and 1.1 and 1.7; for tsavorite) that indicate LREEs sediment enrichment which is consistent with active continental crust values in post-Archean record. In mineralized nodules, tsavorite is composed of 0.6-2.4 wt%  $\text{V}_2\text{O}_3$  and carbonates (5.7-15%). Ferromagnesian elements V and Cr are used to derive V/Cr ratios which range from 3.1-4.3. These V/Cr ratios are lower than worldwide deposits of Tanzania, Madagascar, and Pakistan (V/Cr ratio > 5.8) but higher than the local Kenyan mines from Mgama mining district (V/Cr ratio < 1). The Davis Tsavorite Mine is interpreted to be in an active continental crust environment of sedimentary origin and the tsavorites were formed in metasedimentary facies.

Key words: Neoproterozoic Metamorphic Mozambique Belt (NMMB), Lualenyi, Mwatate, geochemistry, lithostratigraphy