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Applied gamma ray spectrometry and remote sensing in delineation of nepheline syenites in rift tectonic settings

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The United Nations (2016) observes that 'Neglected Development Minerals' including industrial minerals such as nepheline syenites have great potential for sustainable development, yet their exploitation has not been equally promoted like high value minerals. Nepheline syenites have great potential as alternative potassium (K) silicate fertiliser, as well as a source of Rare Earths. Demand for K fertiliser keeps rising by 3-3.5% annually (Jena et al., 2014) due to increased need to replace K removal from the soil (Sheldrick et al., 2002). The situation is most critical in Sub-Sahara Africa where nutrient loss due to intensive farming accounts to 22kg N, 2.5 kg P and 15 kg of K per hectare annually (Keeble, 2012). Ironically, Africa with 15% of global population, which is also expected to double by 2040 (Manning, 2015), uses only 1.5% of global K fertiliser.

In this study, we use recently acquired countrywide airborne geophysical gamma ray data of Malawi (Bates & Mechennef, 2013) and satellite remote sensing data to identify nepheline syenites, suitable as sources of K silicate fertilizer, in rift tectonic settings. Initial focus was on the East African Rift System (EARS) starting with Malawi. Results from these two techniques are compared with X-ray fluorescence (XRF) geochemical analyses of sample collected from fieldwork in some potential areas of Malawi. With lessons from the Rochagem movement (Theodoro & Leonardos, 2006), identification of novel alternative potash sources in Africa will greatly benefit millions of farmers in developing countries, especially in Sub Sahara Africa where fertiliser costs are very high. Considering that high-resolution airborne geophysical data is not available in many African countries due to high costs associated with data acquisition campaigns, alternative and effective remote sensing approaches for delineating nepheline syenite rocks are necessary.

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