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Novel potash fertiliser from nepheline syenite for Africa's agriculture

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Food security is largely dependent on soil nutrient supply for crops and one major food nutrient is potassium (K). K demand for agricultural use is on the increase by about 3-3.5% annually (Jena et al., 2014). Studies of K removal from the soil (Sheldrick et al., 2002), indicate that global production of potash fertilisers needs to be doubled in order to replenish the amount of K removed from soils by food crops considering that both demand for food and global population keep on increasing. Manning, (2015) adds that the situation is most critical in Africa, where 15% of global population use just 1.5% of the world's fertiliser and Africa's population is expected to double by 2050.

In most African countries, nutrient depletion is increasing and depletion is estimated at around 100-140kg ha-1 plant removal of nutrients from soil (Sheldrick & Lingard, 2004; Sheldrick et al., 2002). For instance, Sheldrick & Lingard (2004) noted that Africa's three main staple crops, rice, maize and wheat, jointly removed 140Kg ha^{-1} of soil macronutrients. By 2020, without any increase in fertilizer use and assuming no limitation on crop production, due to soil nutrient deficiency, annual depletion rates will likely increase to 36 kg ha^{-1} for K (Sheldrick et al., 2002). The cost of conventional K fertiliser is sufficiently high such that many African farmers cannot afford. Alternatives are locally available which may help farmers to replenish K removed by crops (Manning, 2015). One such alternative is nepheline syenite (Jena et al., 2014). The study is the first such research in Africa's Great East African rift system, a region which is blessed with numerous nepheline syenite intrusions and other peralkaline rocks.

This research applied airborne geophysical gamma ray data coupled with satellite remote sensing to identify nepheline syenites, suitable as sources for K fertilizer, in rift tectonic settings. Focus is on the East African Rift System (EARS) starting with a countrywide delineation of nepheline syenites of Malawi. Results from the geologic remote sensing and airborne radiometry analyses have been combined to guide field verification on the suitability of the nepheline syenites for K fertilisers. Identification of novel alternative potash sources in Africa will greatly benefit millions of farmers in the developing World particularly in the Sub Saharan Africa who are adversely affected by high fertiliser costs. Ultimately, this can contribute to attainment of the Sustainable Developmental Goal (SDG) 2 which seeks to end hunger, achieve food security and improve nutrition and agricultural sector production across the globe by 2030 (Griggs et al., 2014). Airborne gamma ray spectrometry has been used in geological determination of surface abundances of radioactive elements (Youssef & Elkhodary, 2013). However, high resolution airborne geophysical data is not available in many African countries due to high costs

associated with airborne geophysical data acquisition campaigns. Therefore, successful application of alternative remote sensing approaches for delineating nepheline syenite rocks could be more ideal.

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