

Africa's lithium pegmatites: a critical resource for the energy transition

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Lithium is considered as one of the most critical raw materials for batteries, used in electric vehicles and energy storage, and as such is expected to see rapid demand growth in the coming years. Currently, over half of global lithium supply comes from mining of pegmatites, particularly in Australia. The continent of Africa has very extensive lithium pegmatite resources, which are the subject of exploration by a number of companies. This talk will provide an overview of our ongoing work on some of the most important of these pegmatites. Two major research questions are being considered: 1) what are the controls on the genesis of Li-rich pegmatite-forming magmas; and 2) How did the mineralogy and geochemistry of the pegmatites evolve once the magmas were emplaced? The first question is essential for exploration targeting, whilst the second is important for geometallurgy and mineral economics.

Zimbabwe is a country of particular importance for its lithium pegmatites, including the Archaean pegmatite at Bikita, currently the only lithium mine in Africa. The Mesoproterozoic Kamativi pegmatite, in the west of the country, has also been mined in the past for tin. Kamativi, like many lithium pegmatites, lacks a consistent internal zonation. Instead, we have identified a 4-stage paragenesis, in which an initial magmatic assemblage is progressively altered by albitisation, then by a quartz-muscovite stage (greisenisation), and finally by lower-temperature alteration. Lithium ore minerals (spodumene and petalite) principally crystallised during the magmatic stage and were subsequently altered, whilst tin (cassiterite) and tantalum (columbite-tantalite) were introduced during the albitisation and greisenisation stages. Similar features have been identified in recent studies of other pegmatites worldwide, e.g. in Ireland[1] and South Africa[2]. We will compare the features recognised at Kamativi with those in other pegmatites from Zimbabwe and across Africa, with the aim of building up a global model for the evolution of African pegmatites.

[1] Kaeter et al 2018, *Geochim Cosmochim Acta*, <https://doi.org/10.1016/j.gca.2018.08.024>

[2] Ballouard et al 2020, *Ore Geology Reviews*, <https://doi.org/10.1016/j.oregeorev.2019.103252>