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Investigating the enrichment of critical metals in granitic pegmatites from NE Scotland: melting process or protolith?

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The higher global demand for electric vehicles has resulted in a marked increase in demand for Li. Global supply of Li is controlled by a handful of countries, magnifying the risk of disruption to the global supply. Li, Ta and Be are often associated with Sn-W granites and (LCT) pegmatites. This project aims to track these elements from the primary source to the mineralisation and to assess whether these pegmatites represent the most evolved melts derived from parental granites, or are genetically unrelated to a fractionated granitic pluton and instead may be associated with direct melting of a metasedimentary source.

To better understand the potential role of these processes we are investigating the potential concentration pathways of these critical elements by *in situ* trace element analysis of individual mineral phases and by applying K/Rb ratios of white micas to determine fractionation trends. By analysing a wide suite of samples, we are gaining insights into the mobility and enrichment of critical metals during different stages of the melting process.

Portsoy, NE Scotland, provides excellent examples of *in situ* partial melting of Dalradian metasediments and both associated diffuse granite pegmatites and the larger irregular cross-cutting Portsoy pegmatite can be observed. Portsoy straddles the Portsoy shear zone — along strike of the shear zone the Glenbuchat (LCT) pegmatite is located. This means that Portsoy provides an excellent opportunity to evaluate the roles *in situ* partial melting and shear zones play in the development and enrichment of LCT pegmatites.

- We report concentrations of Li, Ta and Cs from metasedimentary migmatites and granitic pegmatites with the highest values observed in the Portsoy pegmatite pockets
- Lepidolite from the mineralised pockets has high concentrations of Li (≤ 30,600 ppm), Cs (≤ 6400 ppm) and Ta (≤ 100 ppm).
- Li concentrations in migmatites are generally lower than in pegmatites; within migmatites biotite has relatively high Li values (≤ 534 ppm) compared to muscovite (≤ 110 ppm).
- We present K/Rb ratios of white mica that demonstrate internal fractionation of the Portsoy pegmatite from low fractionated marginal zone to the Li-enriched highly fractionated mineralised pockets.