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Li isotope analytical protocol and standard development using Secondary Ion Mass Spectrometry (SIMS)

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Lithium isotope study in tourmaline and Li-rich minerals, such as spodumene, petalite and mica, from evolved magmatic systems has rapidly grown in the last decade fostered by the development of analytical techniques using MC-ICP-MS and SIMS. The resulting Li isotopic signatures have been used as a geological tool to trace the evolution of these evolved magmatic systems from the emplacement and magma differentiation, through magmatic-hydrothermal transition, to solidification and cooling [1, 2], uncover the protoliths of melts [3]; and together with B isotopes, to discern gem provenance [4].

One of the advantages of *in situ* microanalyses by SIMS is the spatial resolution required to measure Li isotopic ratios of different stages of mineral growth from an individual crystal and inherited core and rims in the same grain. However, setting a new analytical protocol by SIMS is quite challenging due to the difficulty of finding chemical and isotopically homogenous Reference Materials (RMs) which can subsequently be utilised as matrix-matched to unknown targets. A recent inter-lab research project has characterised three new tourmaline RMs for Li isotopic analyses and has provided a new analytical SIMS protocol for tourmalines [5]. Nonetheless, new RMs for this microanalytical technique still need to be identified for other important Li-rich mineral phases. Here, we present the results of our work on several potential RMs for spodumene and petalite as well as the optimal analytical protocol for the analysis of Li isotopes developed in the Cameca IMS 7f Geo and IMS 1270 from the NERC Ion Microprobe Facility.

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