

Unravelling of Li fractionation and mobility at high pressure by quantitative compositional and isotopic mapping

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Context

Lithium is an energy transition critical element and plays a key role in the development of clean energy production, transmission and storage. Lithium is highly soluble as an ion in aqueous fluids and is therefore a fluid mobile element in the Earth's interior. In subduction zones, Li stored in altered oceanic crust and sediments is progressively lost during subduction-related prograde metamorphism. However, as the fluid produced interacts with other rocks, it remains unclear how much Li is actively extracted from the subducting slab and how much is recycled into the deep mantle. In-situ analyses of Li content and Li isotopes in key metamorphic minerals such as garnet allows the elucidation of fluid-rock interaction cycles. However, these quantities are usually measured for bulk rocks or individual spot analyses in a single mineral.

Aims and Methods

The aims of this project are (1) to measure $\delta^7\text{Li}$ in situ in several minerals (e.g. garnet, phengite, epidote, etc.) of a single sample and (2) to develop a new analytical technique to map $\delta^7\text{Li}$ using the SIMS. Uncorrected $\delta^7\text{Li}$ maps will be calibrated using an internal standard procedure to correct for matrix effects. This dataset will be combined with quantitative compositional maps of Li in several minerals obtained by LA-ICPMS mapping (see figure). Key high pressure samples of different lithologies will be selected from the Alps and from the Cyclades.

References

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- Hoover, W.F., Penniston-Dorland, S., Baumgartner, L., Bouvier, A.S., Dragovic, B., Locatelli, M., Angiboust, S., & Agard, P. (2022). *Episodic fluid flow in an eclogite-facies shear zone: Insights from Li isotope zoning in garnet. Geology* **50**, 746–750.
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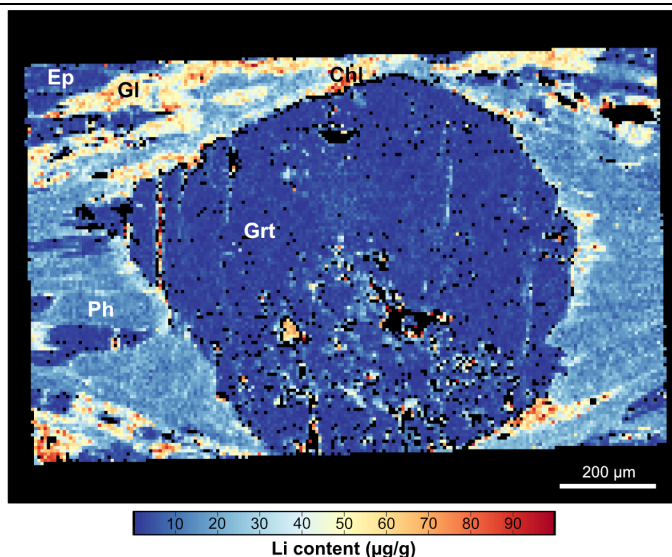


Figure: Distribution of Li expressed in $\mu\text{g/g}$ in a high-pressure mafic rock from Syros (Cyclades, Greece). Minerals reported by increasing Li content: garnet (Grt), epidote (Ep), phengite (Ph), glaucophane (Gl), Chlorite (Chl).

Website

Prerequisite

Module "Chemical analysis and imaging techniques"