

Formation of dendritic olivines: Studying olivine growth and cumulate formation in the Seiland Igneous Province (Northern Norway).

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Context

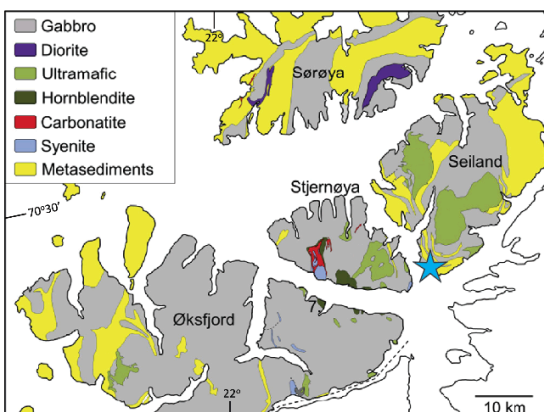
Gabbroic and ultramafic cumulates are an essential component of magmatic systems and are the complement to the more evolved magmas dominant in the upper continental crust. However, many details of the formation of these cumulates, and particularly the extraction of melt from them remains uncertain. The Seiland Igneous Province, a large mafic and ultramafic lower-mid crustal cumulate complex in northern Norway, represents an exceptional location to study many of these processes. This project will focus on the Rognsund Gabbro, a rhythmically layered olivine-gabbro with exceptional dendritic olivines present (see attached photo). The main goal of this project will be to understand the growth of these olivines, and what this implies for the state of the mushy magma that was present at this time. This will be accomplished through detailed chemical mapping of dendritic olivines combined with electron back-scatter diffraction to characterize their crystallographic orientations.

Objectives and Methods

The aim of this project is to document the chemical zoning in dendritic olivines from the harrisites described in the Rognsund Gabbro. Through this work, we will examine the growth behavior of olivine and the formation mechanisms for these unusual dendritic olivines, with important implications for the formation of olivine cumulates. The planned work will include: (1) (Optional) Field work including detailed textural observations and sampling at outcrop scale. (2) Major and trace element bulk rock geochemistry. (3) In-depth petrological investigations combining optical microscopy, scanning electron microscopy (including electron back-scatter diffraction), electron microprobe and laser ablation ICP-MS to characterize the chemical zoning and orientation of the dendritic olivines.

Literature

Larsen, R.B., et al., (2018) Portrait of deep-seated magmatic conduit system: The Seiland Igneous Province. *Lithos*, 296-299, pp 600-622. Grant, T.B., Larsen, R.B., Brown, E.L., Müller, A.B., and McEnroe, S., (2020) Robins, B., (1972) Crescumulate Layering in a gabbroic body on Seiland, northern Norway. *Geological Magazine* 109 (6) pp. 533-542. Welsch, B., Hammer, J., and Hellebrand, E., (2014) Phosphorus zoning reveals dendritic architecture of olivine. *Geology*, 42(10), pp 867-870.



Seiland Igneous Province. Rognsund Gabbro location marked with blue star (Map after Larsen et al., 2018)



Dendritic olivine in Rognsund Gabbro. Photo from Robins, (1973)