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# High-field-strength element (HFSE) mobility in late-stage fluids, Gardar Rift Province, South Greenland

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One of the focal points for current European resource industries is the continued exploration for regions where HFSEs and rare-earth elements (REE) are present in economically attractive levels. Many branches of development of modern electronics, materials, low-carbon technologies, as well as the energy industry are increasingly reliant on a supply of such chemical components contributing to the rising global demand. In mineral exploration, locating such HFSE-REE deposits and providing new petrogenetic insights to aid their discovery has become an important area of research.

It is widely recognised that such high-value elements concentrate particularly in and around the areas of alkaline-carbonatitic magmatism, such as the Kangankunde Carbonatite Complex, Malawi or the Bayan Obo REE-Nb-Fe deposit, China. These deposits most commonly form within intraplate-to-extensional geodynamic settings, but the magmato-hydrothermal fluid overprint is very often linked to enrichment of the HFSE/REE-bearing species in relatively common syenites. Investigating the fluid composition via analysis of rocks formed by alkali metasomatism of plutons and the surrounding country rock, often referred to as "fenitisation", is thus of interest for our understanding of chemical behaviour of critical elements during the latest stages of magmatic activity.

The purpose of this project is to discern the mobilisation and transport of elements during the fenitisation associated with syenitic rocks, and to infer mechanisms by exploring their concentrations in alkali pyroxenes, amphiboles and REE-bearing species. We focus on the fenitised margins of alkaline centres across the Proterozoic Gardar Rift Province to explore the geochemical expression of alteration within individual variant rock types, and the structural factors driving the extent of alteration around these intrusions on both macro- and micro- scale. The strata along the entirety of the rift are cut by at least 3 generations of dyke swarms at $\sim$50-70° with individual bodies ranging between 10m and 0.8km in width that serve as structural pathways for outward fluid migration. Bearing in mind those structural controls, we compare the fenitisation styles around several Gardar systems in different sections of the chamber wall zones.

Field survey of the western edge of the Illerfissalik centre, part of the Igaliko Nepheline Syenite Complex (Emeleus & Harry, 1970), and the eastern edge of Ilímaussaq Complex confirms strong metasomatic alteration of the surrounding supracrustal Eriksfjord Formation and autometasomatism around the Illerfissalik pluton. Through petrographic and geochemical study of a suite of samples, we seek to resolve the origin of secondary lineament fabrics, "spotty" and plastic deformation textures all highlighted by alkali mafic minerals within Eriksfjord quartzite. We will analyse altered and unaltered samples for major and trace elements and use EPMA to ascertain mineral chemistry within samples of complex composition, such as Narsârsuk pegmatites. Use of Lu-Hf, U-Pb, Rb-Sr and Sm-Nd isotope systematics will be considered to determine the degree of isotopic opening of Gardar systems.

References:

Emeleus, C.H. & Harry, W.T (1970). The Igaliko Nepheline Syenite Complex, South Greenland. Meddr. Grønland, 186, 115pp