Carbonatites and alkaline magmas at the margins of the North Atlantic Craton in Greenland: a vital resource of the critical metals.

Kathryn M Goodenough[1], Joshua Hughes[2,3] and Adrian Finch[3]

1: British Geological Survey, West Mains Road, Edinburgh EH9 3LA, UK. kmgo@bgs.ac.uk

2: Nuna Minerals A/S, Postboks 790, DK-3900 Nuuk, Greenland

3: Department of Earth and Environmental Sciences, University of St Andrews, Fife, KY16 9AL, UK

Alkaline magmas, and associated carbonatites, are recognised as the most important repositories of certain 'critical metals', particularly the Rare Earth Elements (REE) and niobium. The critical metals are those metals used in a range of new technologies, for which demand is increasing and there are potential threats to security of supply. Currently, much of the world's supply of REE and Nb comes from carbonatites and associated rocks, in China and Brazil respectively. In Europe, extensive exploration is ongoing, and major research projects such as EURARE aim to understand the European resources of these metals.

Perhaps the region of greatest interest for REE and Nb in Europe lies in West Greenland, at the margins of the North Atlantic Craton. The southern margin is marked by the Mesoproterozoic Gardar alkaline igneous province, where large alkaline igneous complexes such as Ilimaussaq contain abundant resources of REE and Nb. In this area, carbonatites and lamprophyres offer a 'window' into the mantle sources of the magmas, but have thus far seen limited exploration. In contrast, the northern part of the craton has seen several episodes of alkaline magmatism and emplacement of carbonatites, most notably in the Neoproterozoic and again in the Jurassic, but lacks large alkaline silicate complexes. Two of these carbonatites are being actively explored for the REE and Nb: Sarfartoq (Neoproterozoic) and Qeqertaasaq or Qaqarssuk (Jurassic).

Our previous work has shown that the parental magmas of the Gardar Province were derived from a mixture of sources, including small-degree partial melts from the asthenospheric mantle, and larger-degree partial melts of lithospheric mantle. That lithospheric mantle had been enriched in fluids and a range of incompatible elements during Palaeoproterozoic subduction around the margins of the North Atlantic Craton. This talk will present new work on the Qeqertaasaq phoscorite-carbonatite complex, which contains several pulses of carbonatitic magmatism. The latest intrusions in this complex are highly enriched in the REE and Nb, forming a significant resource of these critical metals. Our ongoing work will compare the Qeqertaasaq carbonatite with Gardar Province carbonatites to understand the mantle sources of critical metal enrichments around the North Atlantic Craton.