Geophysical Research Abstracts
Vol. 16, EGU2014-5666-1, 2014
EGU General Assembly 2014


# The Lost Gardar Intrusion: Critical Metal Exploration at the Paatusoq Syenite Complex, South East Greenland

Mark Stacey (1), Adrian Finch (1), Josh Hughes (2), and Ole Christiansen (2)

(1) Dept. Earth and Env. Sciences, University of St Andrews, North Street, St Andrews, Fife, KY16 9AL, UK., (2) NunaMinerals A/S, Issortarfimmut 1, Postbox-790, DK-3900, Nuuk, Greenland

Regional mapping by GEUS (Garde, 1998) of the Paatusoq region, South-East Greenland, defined two intrusive centres, the Paatusoq Gabbro ($\sim$23km$^2$) and the Paatusoq Syenite ($\sim$240km$^2$). These intruded the lithospherically weak boundary between Ketilidian meta-sedimentary rock to the East and to the West the Pelite-Psammite zone sediments unconformably overlying the Julianehåb batholith. Following the discovery of high rare earth element (REE=La-Yb+Y) anomalies in stream sediments (Steenfeldt, 2012) in the Paatusoq region, Paatusoq was the target of exploration by Nuna Minerals A/S in June 2013. The objective was to provide an assessment of the critical metal potential of the region. Exploration involved helicopter reconnaissance and sampling.

The Paatusoq syenite (1144$\pm$1 Ma) was recognised by Garde (2002) as part of the Gardar Alkaline Igneous Province (1300-1140 Ma). Gardar centres are predominantly found on the South-Western coast and represent products of magmatism associated with repeated Mesoproterozoic rifting. Globally significant critical metal deposits are associated with the province including Motzfeldt (Ta-Nb) and Ilímaussaq (REE-Zr-Nb). Gardar intrusions with significant critical metal mineralisation often record interaction with late-stage fluorine-bearing fluids.Analysis integrated petrography and geochemistry, supplemented by two indicators of fluid interaction with the syenite; the cathodoluminescence textures of feldspars and the halogen content of biotite.

The Paatusoq Gabbro showed heterogeneous primary layering and pegmatite schlieren to the West against the syenite. A Gardar Lamprophyre dyke cuts the Gabbro. Petrology showed; subhedral olivine, labradorite, biotite and quartz. Incompatible element geochemistry showed the gabbro has a Zr/Nb ratio $>$15 consistent with a Ketilidian affinity and the lamprophyre has a Zr/Nb ratio $\sim$5, comparable with other Gardar lamprophyres.

The Paatusoq syenite showed lithological variation from quartz-augite-syenite to syenodiorite. Steep contacts and xenolith zones indicate stoping was the mechanism of intrusion. The last expressions of magmatism were alkali granite sheets, often subsequently bisected by dolerite. Petrology showed cryptoperthitic feldspars with quartz, aegirine-augite, biotite and ilmenite-pyrophanite. The syenite has a Zr/Nb ratio $<$10 consistent with a Gardar signature.

Cathodoluminescence shows the alkali feldspars display bright blue-green $Fe^{2+}$ luminescence in contrast to the red $Fe^{3+}$ luminescence observed in many other Gardar intrusions which have experienced fluid interaction. Orange luminescent carbonate micro-veins and striking green luminescent apatite and zircon with concentric zonation textures are preserved in the roof zone of the intrusion. Analysis of the halogen content of the biotites in syenite and lamprophyre samples demonstrated Fe/(Fe+Mg) ratios between 0.3-1 and Fwt% values with a variation of 0-2.5. An inferred Maximum Fluorine Line (Finch, 1995) defines a trend comparable to the evolved Motzfeldt centre, which is among the most F-rich fluid environments in the Province.

This exploratory assessment develops our understanding of the easternmost extent of Gardar magmatism. The high fluorine content of biotite and apatite, zircon and carbonate mineralisation, indicate the syenite, particularly the roof zone, experienced interaction with fluorine and carbon dioxide-bearing late stage fluids. Apatite zoning shows REEs were mobile in this fluid. Preliminary observations indicate that Paatusoq is an unusual Gardar centre commensurate to the main Motzfeldt centre making it an area of consideration for future REE exploration.

**REFERENCES:**

Finch, A. A., Parsons, I. & Mingard, S. (1995) Biotites as indicators of flourine fugacities in late stage magmatic fluids; the Gardar Province of South Greenland. **Journal of Petrology**, Volume 36.

Garde, A. A., Chadwick, B., Grocott, J. & Swager, C. P., 1998. GEUS Lindenow Fjord 60 Ø.1 NORD. **Geological Survey of Denmark and Greenland**.

Garde, A. A. et al., 2002. The Ketilidian origin of South Greenland: Geochronology and tectonics, magmatism and for - arc accretion during Palaeoproterozoic oblique convergence. **Canadian Journal of Earth Science**,Volume 39, pp. 756-93.

Steenfelt, A., 2012. REEs in Greenland:known and new targets identified and characterised by regional stream sediment data. s.l., **Geological Society of London**.