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Greenland's Unique Kvanefjeld Multi-element Rare Earth Project

Producing a suite of rare earth products

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At a time of consolidation and increased regulation of the rare earth sector in China, Greenland may become an important new source of rare earth elements, particularly the elements critical to the growing magnet sector.

Greenland is located in the North Atlantic Ocean between North America and Europe and is the world's largest island, 2.2 million km^2, of which approximately 80% is permanently covered with ice. The Kvanefjeld project, one of the largest rare earths deposits in the world, can be found in the south of Greenland near the town of Narsaq.

The project comprises three linked deposits (Kvanefjeld itself, Zone 3 and Sørensen). These three deposits contain 1 billion tonnes of mineralised ore. The predominant mineral is steenstrupine, which hosts both rare earths and uranium in significant quantities.

The Kvanefjeld project is owned by Greenland Minerals and Energy (GME) who acquired the Kvanefjeld project in 2007 and has spent approximately US$60 million developing the project to its current advanced stage.

Greenland Minerals and Energy and the Kvanefjeld Project

In total the three deposits contain approximately 270,000 tonnes of uranium and 11 million tonnes of rare earth oxide. The Kvanefjeld deposit is the largest and most rigorously defined of the three deposits and as a result it is this deposit that is the focal point of studies to evaluate the feasibility of mining and processing for the project.

GME has undertaken extensive metallurgical test work on material from the project area, including bench scale and pilot plant tests, and has developed a flow sheet for economically processing Kvanefjeld ore. The flow sheet, which utilises well developed technologies, comprises a beneficiation circuit, an atmospheric leach circuit and solvent extraction circuit.

At the project site GME plans to construct a mine, a concentrator, a uranium and rare earth refinery and rare earth separation plant (see **Figure 1**). These will be supported by sulfuric and hydrochloric acid plants and supporting infrastructure (power plant, port, accommodation, roads) some of which will be located near the town of Narsaq.

The project will produce a suite of rare earth products comprising a premium rare earth oxide concentrate ('Premium REE') containing primarily terbium, dysprosium, neodymium and praseodymium, and three separate lanthanum and cerium products. The distribution (by value) in GME's product suite is shown in **Figure 2**.

Fig. 1. Rare earth refinery pilot plant leach circuit (Image courtesy of GME Ltd, used with permission)

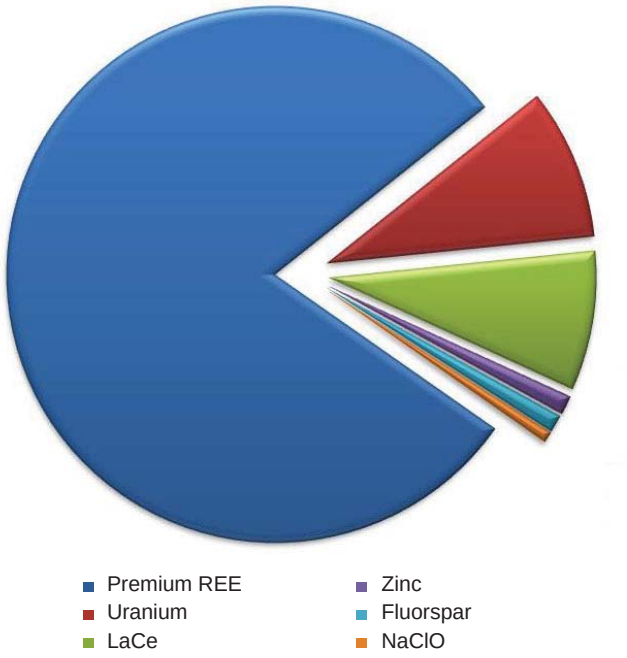

Fig. 2. GME's product suite

In addition to rare earths and uranium, the Kvanefjeld processing plant has been configured to produce commercial quantities of:

- zinc concentrate
- fluorspar
- sodium hypochlorite (NaClO).

GME acknowledges that there is currently only one significant rare earths producer outside China. The Kvanefjeld ore body offers a low cost, long life source of useful rare earth elements, financially benefitted by valuable byproducts, in a new resource country which is positive about becoming a reliable long term supplier.

The Author

Damien Krebs is the Metallurgy Manager for the Kvanefjeld Rare Earth Project located in Southern Greenland. He has been working in rare earths since 2010 with Greenland Minerals and Energy and developed the Kvanefjeld process. He has over 20 years' experience in hydrometallurgy from working with nickel, cobalt and uranium as well as rare earths. Prior to joining GME, Damien was working in Metallurgical Consulting and spent nine years with BHP Billiton, Australia, in various project and technology development roles. His operational experience includes commissioning of one of the second generation of nickel laterite high pressure acid leaching plants at Bulong near Kalgoorlie in Western Australia. He holds a Bachelor of Minerals Engineering from the Western Australian School of Mines and a Masters of Mineral Economics from the Curtin Business School in Western Australia. He has worked in mining and technology projects around the world and is currently based in Perth, Western Australia.