



## December 2013 Quarterly Report

Wednesday 29<sup>th</sup> January, 2014

### Highlights

- Process engineering design for Kvanefjeld refining circuit complete in late 2013
- The refinery circuit utilises simple equipment and elegant chemistry that:
  - *effectively leaches both REEs and uranium from the mineral concentrate with a sulphuric acid leach under atmospheric conditions;*
  - *creates a natural division between the steps to the recovery of REE and uranium; and*
  - *allows for the effective management of impurities in the leach stream;*
  - *refinery circuit has produced high-purity RE concentrate with 15% of the total REO's as heavy REO's.*
- The metallurgical flowsheets for both the mineral concentrator and the refinery have now been finalised
- On October 24<sup>th</sup>, Greenland's parliament repealed the long-standing zero-tolerance policy toward uranium exploitation, following several years of discussion at both the community and political level, shifting the focus on Kvanefjeld from political to regulatory and permitting aspects
- In December, Greenland wins 'Best Country' award at Europe's largest mining conference, Mines and Money, in London, in recognition of its active pursuit of establishing a mining industry
- In early January, 2014, Greenland and Denmark announce that both states expect to have a cooperation agreement on the mining and export of uranium in readiness before the end of the year



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## Introduction

Greenland Minerals and Energy Ltd ('GMEL' or 'the Company') is a mineral exploration and development company operating in southern Greenland. The Company is primarily focused on advancing the 100% owned Kvanefjeld multi-element project (*critical rare earth elements, uranium, and zinc*) through the feasibility and permitting phase and into mine development.

The Kvanefjeld project is centred on the northern Ilimaussaq Intrusive Complex in southern Greenland. The project includes several large scale multi-element resources including Kvanefjeld, Sørensen and Zone 3. Global mineral resources now stand at **956 Mt** (JORC-code compliant). The deposits are characterised by thick, persistent mineralisation hosted within sub-horizontal lenses that can exceed 200m in true thickness. Highest grades generally occur in the uppermost portions of deposits, with overall low waste-ore ratios. Less than 20% of the prospective area has been evaluated, with billions of tonnes of lujavrite (host-rock to defined resources) awaiting resource definition.

While the resources are extensive, a key advantage to the Kvanefjeld project is the unique rare earth and uranium-bearing minerals. These minerals can be effectively beneficiated into a low-mass, high value concentrate, then leached with conventional acidic solutions under atmospheric conditions to achieve particularly high extraction levels of both heavy rare earths and uranium. This contrasts to the highly refractory minerals that are common in many rare earth deposits.

The Kvanefjeld project area is located adjacent to deep-water fjords that allow for shipping access directly to the project area, year round. An international airport is located 35km away, and a nearby lake system has been positively evaluated for hydroelectric power.

GMEL finalised a comprehensive, multi-year pre-feasibility program in March 2012 that focussed on identifying and evaluating the best possible process flow sheet for the Kvanefjeld project, taking into account economic metrics, environmental considerations, technical and market risk. A feasibility-level Mine and Concentrator Study has since been finalised further reducing capital costs. The study outcomes are extremely positive and reiterate the potential for Kvanefjeld to become a long-life, cost competitive operation. A large heavy REE output and significant uranium output differentiate Kvanefjeld from other potential emerging RE producers.

Rare earth elements (REEs) are now recognised as being critical to the global manufacturing base of many emerging consumer items and green technologies. Uranium forms an important part of the global base-load energy supply, with demand set to grow in coming years as developing nations expand their energy capacity.

## **December Quarter Activities**

The December Quarter saw major political developments in Greenland with the Fall sitting of parliament. On October 24<sup>th</sup>, Greenland's parliament made the land-mark decision to repeal the long-standing zero-tolerance policy toward uranium. This critical decision reflects the forward looking direction from their leaders and populace, and comes after several years of discussion on issues surrounding uranium exploitation at both community and political levels.

In November, GMEL presented at the China Mining Congress in the Greenland special session, alongside representatives of Greenland's government. The event proved to be another positive promotional exercise that effectively presented both the industry and government perspectives. GMEL also participated in the latest EURARE (Rare earth metallurgical research sponsored by the European Union) meeting, held in Brussels in December, 2013.

In December, Greenland's focus on advancing a mining industry was recognised at Europe's largest mining conference 'Mines and Money', in London. Significantly, Greenland received the 2013 Country Award under the Mining Journal's 'Outstanding Achievements Awards'. Key reasons for Greenland's selection included the removal of the zero-tolerance uranium policy, as well as the award of an exploitation license to the Isuakasia iron project that demonstrated effective operation of Greenland's permitting process. Such a high-profile award reinforces Greenland's growing profile to the global investment community and resource industry.

Test work on the refinery circuit for Kvanefjeld continued to yield positive results, and serves to reinforce the quality and effectiveness of the rigorously-developed process flow-sheet. An important testwork program was conducted in the quarter that involved a continuous 100 hour leach on 20 kg's on mineral concentrate. This confirmed the ability to effectively manage impurities during the leach process, and demonstrate that REEs could be effectively isolated from deleterious elements.

## **The Kvanefjeld Refining Circuit**

The refinery circuit for Kvanefjeld consists of an atmospheric leaching stage that utilises simple mechanical equipment. This differs from refinery circuits that have been common in rare earth production, which require complex, high-temperature 'mineral cracking' processes in order for REEs to be leachable owing to the highly refractory nature of common rare earth ore minerals. As process development has advanced on the Kvanefjeld Project, it has confirmed that the unique value minerals at Kvanefjeld are readily leachable under gentler conditions with a simpler metallurgical process.

The refinery circuit utilises simple equipment and elegant chemistry that:

- 1) effectively leaches both REEs and uranium from the mineral concentrate with a sulphuric acid leach under atmospheric conditions;
- 2) creates a natural division between the steps to the recovery of REE and uranium; and
- 3) allows for the effective management of impurities in the leach stream.

The uranium is recovered from the leach solution using conventional solvent extraction technology which is applied in most uranium mines in the world, and is, therefore, of low technical risk. The rare earths are then recovered in a conventional manner to produce a mixed rare earth carbonate.

## **Key Outcomes of Recent Testwork**

The final phase of recent testwork involved a weak acid leach test conducted over 100 hours on 20kg's of mineral concentrate from Kvanefjeld. The main aims of this test program were to confirm the ability to control impurities in the leach and prove that rare earths could selectively be separated from the majority of impurities.

- One impurity of specific concern was silica, as the key ore minerals at Kvanefjeld are phospho-silicate minerals, and the management of silica is essential to an effective leaching process. The management of silica in the leach process remains a challenge for many proposed REE producing operations that are dealing with silicate minerals; most of which involve significantly lower-grade minerals than steenstrupine; the dominant REE and uranium bearing mineral at Kvanefjeld. Importantly, the 100 hour leach test has

confirmed that silica can be effectively managed throughout the leach process on the REE-U mineral concentrates from Kvanefjeld.

- The testwork program also demonstrated that high extractions of rare earth elements and uranium can be readily achieved with the weak acid leaching stage only, owing to the non-refractory nature of the value minerals. A pregnant leach solution containing uranium can be produced which is free of solids providing a suitable feed to uranium solvent extraction. This is achieved using an optimised combination of flocculating chemicals and standard thickeners. Rare earth elements are also effectively leached from the minerals, but then react to form sulphate salts that remain with the residue, thereby creating a clean separation from the uranium via liquid-solid separation.

GMEL previously outlined in a company announcement (October 1<sup>st</sup>, 2013) that it has confirmed the effective management of radionuclides in the refining process, ensuring the generation of clean REO intermediate products that are under the threshold levels required by separation facilities. The mixed rare earth intermediate product is a chemical precipitate formed by the addition of sodium carbonate to a purified rare earth chloride stream. This produces a mixed rare earth carbonate intermediate product. It is low in impurities and contains 94% rare earth oxide (REO) after calcination. The rare earth carbonate product has a favourable REO distribution with 15% of the contained rare earths being the more valuable heavy RE elements

### **Greenland Repeals Long-Standing Zero-Tolerance Uranium Policy**

On Thursday 24<sup>th</sup> October, Greenland's parliament voted in favour of removing a long-standing zero-tolerance policy concerning uranium and other radioactive elements. This landmark decision represents a significant moment for Greenland, as it places Greenland on the path to uranium-producer status, and thereby opens up coincident resources of rare earth elements to exploitation. The removal of the zero-tolerance policy is in alignment with Greenland's broader intent to develop mining projects as a core to its future economic prosperity.

Kvanefjeld is widely recognised as one of the world's largest undeveloped resources of rare earth metals and uranium that is ideally located with direct shipping access, year-round in

south Greenland. The Preliminary Feasibility Study on Kvanefjeld, released by GMEL in 2012, outlined a long-life, internationally cost-competitive operation that would stand to make Greenland a major supplier of REEs and a substantial long-term supplier of uranium oxide. For these reasons Kvanefjeld represents one of Greenland's most significant, and strategically important mining opportunities.

### **Denmark and Greenland Aim for Cooperation Agreement in 2014**

Greenland's self-rule status gives Greenland the authority over the exploitation of mineral and hydrocarbon resources. Denmark retains an influential role in Greenland's foreign policy and national security. Therefore, when considering the production and export of uranium, a proactive dialogue between Greenland and Denmark is required to effectively map out where the responsibilities lie. Independent legal opinions have been conducted as a basis for discussions and to aid in setting a regulatory framework.

Following the removal of the zero-tolerance policy in October 2013, discussions between Greenland and Denmark have progressed. On January 8<sup>th</sup>, Greenland and Denmark announced that while there were aspects that needed to be worked through, both states expect to have a cooperation agreement on the issue of mining and exporting uranium in readiness before the end of the year.

### **EURARE Update**

GMEL participated in the recent EURARE meeting which was held in Leuven, Belgium. This research work is aimed at encouraging the development of Europe's rare earth resources in a sustainable manner. GMEL is the work package leader for Beneficiation technologies for European REE Deposits due to their process development skills and technical knowledge. The EURARE program has planned to perform a beneficiation pilot plant, which will treat 10 tonnes of Kvanefjeld ore. The concentrates from this beneficiation program will then be subjected to pilot plant evaluation of refining process methodologies in a variety of European universities and technical institutions. The EURARE program continues to provide an excellent forum for a diverse collective of high-level expertise to exchange ideas on the processing of rare earth ores. As a participant and program leader, GMEL stands to benefit from the ongoing collaborative

investigations by EURARE into the processing of RE ores, as well as the discussions and research on downstream processing and value-add in the RE supply chain.

## **2014 Focus and Outlook**

In 2014, GMEL is aiming to work in close consultation with Greenland stakeholders and all necessary regulatory bodies to finalise the development strategy for the Kvanefjeld project. GMEL personnel will be conducting a first series of meetings in Greenland in late January with members of the Ministry of Industry & Mineral Resources (formerly the Bureau of Minerals and Petroleum), in addition to meetings with key stakeholder groups. These meetings are aimed at establishing the steps and timeline to firming up the development strategy, which will then allow for the finalisation of both environmental and social impact assessments. These represent key components of an exploitation license application. Subsequent workshops in Greenland in March-April will aim to then lock in a development strategy.

GMEL will present alongside Greenland government representatives at a Greenland special session during the PDAC meeting in Toronto in early March. The forum aims to provide an overview of what is happening in the resources industry in Greenland, and update on the regulatory framework and overall prospectivity, along with a showcase of the key emerging mining projects.

GMEL will continue the Company's focus on advancing discussions with potential project partners, with the aim of firming up appropriate development partners, and moving toward commercial discussions. The Company has been evaluating top-tier advisory groups to aid in establishing the optimal development strategy and financing/investment structure, in order to maximise shareholder value.

Test work programs that are looking to significantly increase metal recovery are underway, along with a program that is looking to optimise the 'critical' REE content of the mixed concentrate. Updates on the outcomes of these programs will be released in the coming weeks when the results have been fully evaluated.



## **Tenure, Permitting and Project Location**

### ***Tenure***

Greenland Minerals and Energy Ltd (ABN 85 118 463 004) is a company listed on the Australian Securities Exchange. The Company is conducting exploration of license EL2010/2. The Company controls 100% of EL2010/2 through its Greenlandic subsidiary.

The tenement is classified as being for the exploration of minerals. The project hosts significant multi-element mineralisation within the Ilimaussaq Intrusive Complex.

Historically the Kvanefjeld deposit, which comprises just a small portion of the Ilimaussaq Complex, was investigated by the Danish Authorities. The project has received significant past exploration and feasibility evaluation in the form of drilling, geophysics, geochemistry, an exploratory adit and numerous and varying metallurgical test work and technical papers.

### ***Permitting***

Greenland Minerals and Energy Limited is permitted to conduct all exploration activities and feasibility studies for the Kvanefjeld REE-uranium project. The company's exploration license is inclusive of all economic components including uranium and REEs. The Company holds the right to apply to exploit the Kvanefjeld project. The approval of an exploitation license is largely dependent on establishing an economically robust, and environmentally and socially acceptable development scenario.

### ***Location***

The exploration lease covers an area of 80km<sup>2</sup> in Nakkaalaaq North on the southwest coast of Greenland. The project is located around 46° 00'W and 60 55'N.

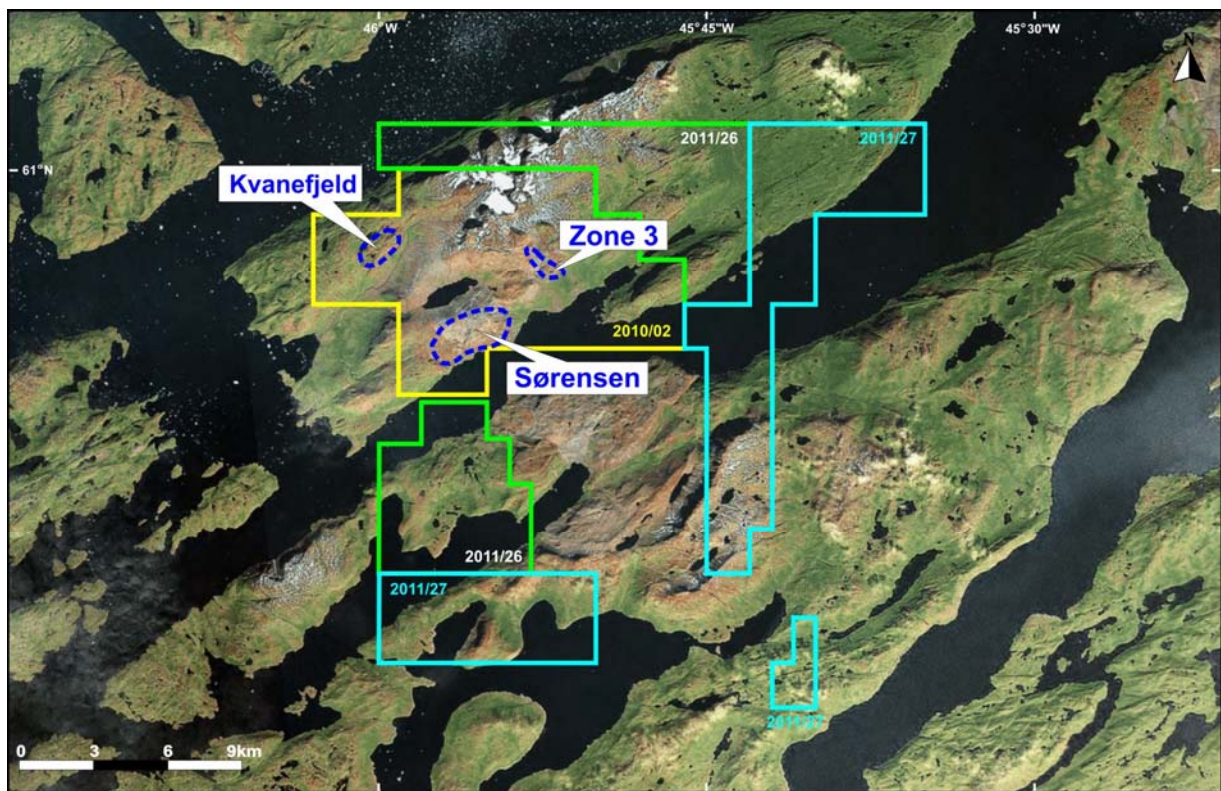
The town of Narsaq is located approximately 8 kilometres to the south west of the license area. Narsaq is connected to Narsarsuaq International Airport by commercial helicopter flights operated by Air Greenland. Local transport between settlements is either by boat or by helicopter.

The Company has office facilities in Narsaq where storage, maintenance, core processing, and exploration activities are managed. This office supports the operational camp located on the Kvanefjeld Plateau above the town where the operational staff are housed.

Access to the Kvanefjeld plateau (at approximately 500m asl) is generally gained by helicopter assistance from the operations base located on the edge of the town of Narsaq. It is possible to access the base of the plateau by vehicle and then up to the plateau by a track.

## Other Exploration License Holdings

As announced on 18 May 2011 GMEL had applied for, and was granted license holdings to consolidate its ground position in the Kvanefjeld area. The new license areas occur immediately adjacent to the Ilimaussaq Complex and may be prospective for specialty metal mineralization hosted near the margins of the complex (see Figure 1). GMEL aims to conduct evaluations to assess the potential for mineralization, in conjunction with sterilising key areas that are under assessment for plant and infrastructure locations. The Company is considering a number of possible locations for key infrastructure items, which include areas adjacent to the Kvanefjeld resource, as well as the broad area on the northeastern side of the Ilimaussaq Complex. Stakeholder input and environmental considerations are critically important to the site selection process.



**Figure 1.** GMEL's license holdings over and adjacent to the Ilimaussaq complex in south Greenland. All licences are held outright by GMEL.

Exploration Licence	Location	Ownership
EL 2010/02	Southern Greenland	100% held by Greenland Minerals and Energy (Trading) A/S
EL 2011/26	Southern Greenland	100% held by Greenland Minerals and Energy Limited
EL 2011/27	Southern Greenland	100% held by Greenland Minerals and Energy Limited
EL 2013/05	Western Greenland	100% held by Greenland Minerals and Energy Limited

Capital Structure – As at 31 <sup>st</sup> December, 2013	
Total Ordinary shares	574,572,911
Quoted options exercisable at \$0.60	25,769,191
Unquoted options exercisable at \$0.75	4,999,520
Performance rights (refer to announcement 21/10/11 for terms)	12,000,000
Employee rights (refer to announcement 4/10/2013 for terms)	9,985,500

Please visit the company's website at [www.ggg.gl](http://www.ggg.gl) where recent news articles, commentary, and company reports can be viewed.

Yours faithfully,



Roderick McIlree

Managing Director

Greenland Minerals and Energy Ltd.

Statement of Identified Mineral Resources, Kvanefjeld Multi-Element Project (Independently Prepared by SRK Consulting)

Cut-off (U <sub>3</sub> O <sub>8</sub> ppm) <sup>1</sup>	Multi-Element Resources Classification, Tonnage and Grade									Contained Metal				
	Classification	M tonnes Mt	TREO <sup>2</sup> ppm	U <sub>3</sub> O <sub>8</sub> ppm	LREO ppm	HREO ppm	REO ppm	Y <sub>2</sub> O <sub>3</sub> ppm	Zn ppm	TREO Mt	HREO Mt	Y <sub>2</sub> O <sub>3</sub> Mt	U <sub>3</sub> O <sub>8</sub> M lbs	Zn Mt
<b>Kvanefjeld - March 2011</b>														
150	Indicated	437	10929	274	9626	402	10029	900	2212	4.77	0.18	0.39	263	0.97
150	Inferred	182	9763	216	8630	356	8986	776	2134	1.78	0.06	0.14	86	0.39
150	<b>Grand Total</b>	619	10585	257	9333	389	9721	864	2189	6.55	0.24	0.53	350	1.36
200	Indicated	291	11849	325	10452	419	10871	978	2343	3.45	0.12	0.28	208	0.68
200	Inferred	79	11086	275	9932	343	10275	811	2478	0.88	0.03	0.06	48	0.20
200	<b>Grand Total</b>	370	11686	314	10341	403	10743	942	2372	4.32	0.15	0.35	256	0.88
250	Indicated	231	12429	352	10950	443	11389	1041	2363	2.84	0.10	0.24	178	0.55
250	Inferred	41	12204	324	10929	366	11319	886	2598	0.46	0.02	0.03	29	0.11
250	<b>Grand Total</b>	272	12395	347	10947	431	11378	1017	2398	3.33	0.12	0.27	208	0.65
300	Indicated	177	13013	374	11437	469	11906	1107	2414	2.30	0.08	0.20	146	0.43
300	Inferred	24	13120	362	11763	396	12158	962	2671	0.31	0.01	0.02	19	0.06
300	<b>Grand Total</b>	200	13025	373	11475	460	11935	1090	2444	2.61	0.09	0.22	164	0.49
350	Indicated	111	13735	404	12040	503	12543	1192	2487	1.52	0.06	0.13	98	0.27
350	Inferred	12	13729	403	12239	436	12675	1054	2826	0.16	0.01	0.01	10	0.03
350	<b>Grand Total</b>	122	13735	404	12059	497	12556	1179	2519	1.68	0.06	0.14	108	0.31
<b>Sørensen - March 2012</b>														
150	Inferred	242	11022	304	9729	398	10127	895	2602	2.67	0.10	0.22	162	0.63
200	Inferred	186	11554	344	10223	399	10622	932	2802	2.15	0.07	0.17	141	0.52
250	Inferred	148	11847	375	10480	407	10887	961	2932	1.75	0.06	0.14	123	0.43
300	Inferred	119	12068	400	10671	414	11084	983	3023	1.44	0.05	0.12	105	0.36
350	Inferred	92	12393	422	10967	422	11389	1004	3080	1.14	0.04	0.09	85	0.28
<b>Zone 3 - May 2012</b>														
150	Inferred	95	11609	300	10242	396	10638	971	2768	1.11	0.04	0.09	63	0.26
200	Inferred	89	11665	310	10276	400	10676	989	2806	1.03	0.04	0.09	60	0.25
250	Inferred	71	11907	330	10471	410	10882	1026	2902	0.84	0.03	0.07	51	0.2
300	Inferred	47	12407	358	10887	433	11319	1087	3008	0.58	0.02	0.05	37	0.14
350	Inferred	24	13048	392	11392	471	11864	1184	3043	0.31	0.01	0.03	21	0.07
<b>Project Total</b>														
Cut-off (U <sub>3</sub> O <sub>8</sub> ppm) <sup>1</sup>	Classification	M tonnes Mt	TREO <sup>2</sup> ppm	U <sub>3</sub> O <sub>8</sub> ppm	LREO ppm	HREO ppm	REO ppm	Y <sub>2</sub> O <sub>3</sub> ppm	Zn ppm	TREO Mt	HREO Mt	Y <sub>2</sub> O <sub>3</sub> Mt	U <sub>3</sub> O <sub>8</sub> M lbs	Zn Mt
150	Indicated	437	10929	274	9626	402	10029	900	2212	4.77	0.18	0.39	263	0.97
150	Inferred	520	10687	272	9437	383	9820	867	2468	5.55	0.20	0.45	312	1.28
150	<b>Grand Total</b>	956	10798	273	9524	392	9915	882	2351	10.33	0.37	0.84	575	2.25

<sup>1</sup>There is greater coverage of assays for uranium than other elements owing to historic spectral assays. U<sub>3</sub>O<sub>8</sub> has therefore been used to define the cut-off grades to maximise the confidence in the resource calculations.

<sup>2</sup>Total Rare Earth Oxide (TREO) refers to the rare earth elements in the lanthanide series plus yttrium.

Note: Figures quoted may not sum due to rounding.

## **ABOUT GREENLAND MINERALS AND ENERGY LTD.**

Greenland Minerals and Energy Ltd (ASX – GGG) is an exploration and development company focused on developing high-quality mineral projects in Greenland. The Company's flagship project is the Kvanefjeld multi-element deposit (Rare Earth Elements, Uranium, Zinc), that is rapidly emerging as a premier specialty metals project. A comprehensive pre-feasibility study has demonstrated the potential for a large-scale, cost-competitive, multi-element mining operation. For further information on Greenland Minerals and Energy visit <http://www.ggg.gl> or contact:

**Roderick Mcillree**  
**Managing Director**  
**+61 8 9382 2322**

Greenland Minerals and Energy Ltd will continue to advance the Kvanefjeld project in a manner that is in accord with both Greenlandic Government and local community expectations, and looks forward to being part of continued stakeholder discussions on the social and economic benefits associated with the development of the Kvanefjeld Project.

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*The information in this report that relates to exploration targets, exploration results, geological interpretations, appropriateness of cut-off grades, and reasonable expectation of potential viability of quoted rare earth element, uranium, and zinc resources is based on information compiled by Mr Jeremy Whybrow. Mr Whybrow is a director of the Company and a Member of the Australasian Institute of Mining and Metallurgy (AusIMM). Mr Whybrow has sufficient experience relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined by the 2004 edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr Whybrow consents to the reporting of this information in the form and context in which it appears.*

*The geological model and geostatistical estimation for the Kvanefjeld and Zone 2 deposits were prepared by Robin Simpson of SRK Consulting. Mr Simpson is a Member of the Australian Institute of Geoscientists (AIG), and has sufficient experience relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined by the 2004 edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr Simpson consents to the reporting of information relating to the geological model and geostatistical estimation in the form and context in which it appears.*