

# ANNUAL REPORT 2017 ON NORDIC MINING'S MINERAL DEPOSITS; EXPLORATION RESULTS, MINERAL RESOURCES AND MINERAL RESERVES

## Introduction

On an annual basis, Nordic Mining ASA reports on the Group's mineral projects. The Nordic Mining Group's ("Nordic Mining" or "the Group") operations currently comprise the following main companies with its respective mineral projects:

1. Nordic Rutile AS (100%): Engebø rutile and garnet deposit in Naustdal municipality in Norway
2. Nordic Quartz AS (100%): Kvinnherad quartz deposit in Kvinnherad municipality in Norway
3. Nordic Mining ASA (100%): Exploration project (palladium, platinum, nickel and copper) at Reinfjord in Kvænangen municipality in Norway

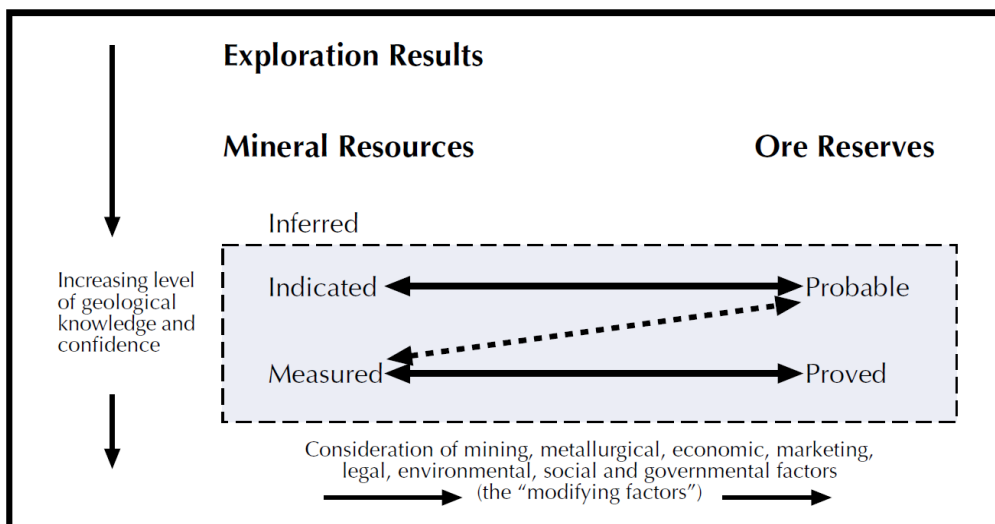
This report (the "Report") sets out the details of the Group's exploration results/prospects, mineral resources and, where applicable, ore reserves in connection with the mineral projects. The Report is updated per 24 November 2017<sup>1</sup>.

In addition, Nordic Mining has a shareholding of approximately 22% in Keliber Oy ("Keliber") in Finland. The investment in Keliber is classified as shares in an associated company. Keliber has several spodumene pegmatite deposits (lithium) in the Ostrobothnia region in Finland. For information of Keliber's mineral resources and ore reserves, please see Keliber's webpage: [www.keliber.fi](http://www.keliber.fi).

Reports/sources of information referred in this Report are available at Nordic Mining's webpage [www.nordicmining.com](http://www.nordicmining.com).

Nordic Mining reports in accordance with the JORC Code 2012. For more information about the JORC Code, please see [http://www.jorc.org/docs/jorc\\_code2012.pdf](http://www.jorc.org/docs/jorc_code2012.pdf). The JORC Code reporting standard differentiates between three different *Mineral Resource* classes: Measured, Indicated and Inferred, depending on the level of geological knowledge and confidence. A mineral deposit may also be classified into Proven and Probable *Ore Reserve* categories based on considerations of so called "modifying factors" such as mining, market, economy and environment.

The figure below gives an overview of the JORC Code classification system and the relation between exploration results, Mineral Resources and Ore Reserves.



Results or estimates that were prepared in accordance with the previous JORC Code 2004 and reported before the 2012 Code took effect will, in accordance with the transitional provisions for the

<sup>1</sup> This 2017 report comprises updates for the period 2016 to the date of this report.

2012 Code, be referred unchanged unless it is established that there have been material changes in those results or estimates.

Please note that estimates described in section 3 of this Report are not in accordance with the JORC Code or estimations recognised by the JORC Code.

## **1. Nordic Rutile AS - Engebø rutile and garnet deposit**

### **1.1 General**

In 2006, Nordic Mining acquired 100% of ConocoPhillips Investments Norge AS' interest in the Engebø deposit in Naustdal municipality in Sogn og Fjordane County in Norway. The Engebø deposit is recognised internationally as a significant rutile and garnet deposit.

Two minerals, rutile (TiO<sub>2</sub>) and garnet, will be produced from Engebø. Rutile is a titanium feedstock, primarily used in the production of titanium pigment, titanium metal and welding rods. The Engebø garnet, which is almandine, is used commercially in the abrasives and waterjet cutting industries.

The deposit is situated in a sparsely populated part of western Norway next to an existing deepwater, ice free port. The port is situated in a fjord adjacent to the North Sea, providing efficient and environmentally friendly shipping to Europe and North America. The coastal climate with mild winters and summers will enable mining and processing operations to continue uninterrupted throughout the year.

The regulatory setting for the Engebø project is driven by two key legislative requirements, namely the discharge permit and the zoning plan (planning permit). Both permits have been granted by Norwegian authorities, without further possibility for appeal.

Nordic Mining's wholly owned subsidiary Nordic Rutile AS holds the following Extraction Permits for the Engebø deposit:

<b>Identification number</b>	<b>Name of area</b>	<b>Duration (extensions can be granted)</b>
Extraction Permit no. FU-1/1997 VB	Engebøfjellet 1	23 October 2027
Extraction Permit no. FU-2/1997 VB	Engebøfjellet 2	23 October 2027
Extraction Permit no. FU-3/1997 VB	Engebøfjellet 3	23 October 2027
Extraction Permit no. FU-4/1997 VB	Engebøfjellet 4	23 October 2027
Extraction Permit no. FU-5/1997 VB	Engebøfjellet 5	23 October 2027
Extraction Permit no. FU-6/1997 VB	Engebøfjellet 6	23 October 2027
Extraction Permit no. FU-7/1997 VB	Engebøfjellet 7	23 October 2027
Extraction Permit no. FU-8/1997 VB	Engebøfjellet 8	23 October 2027
Extraction Permit no. FU-9/1997 VB	Engebøfjellet 9	23 October 2027

A prefeasibility study (PFS) for the Engebø project was published on 30 October 2017. The business case developed for the project is based on two product revenue streams from a 1.5 Mtpa mining and processing operation, with open pit mining starting in 2021 and continuing for 16 years. Development of the underground mine will start in year 13 to enable underground production to take over from the open pit. The current Life of Mine in accordance with the JORC Code runs until 2049 (29 years). Extensions of the production period will be possible due to the large orebody at Engebø.

### **1.2 Engebø geology**

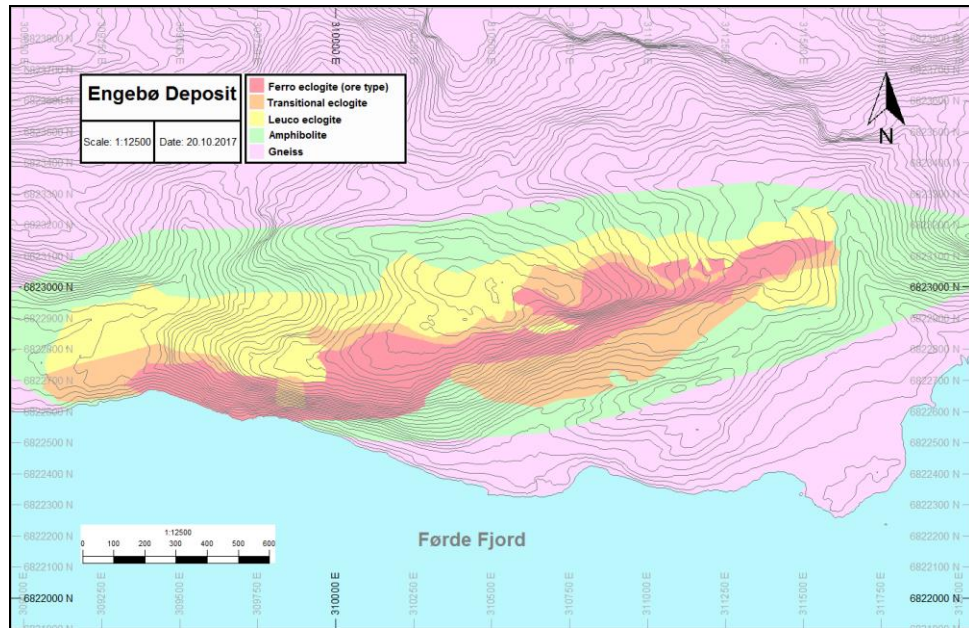
The Engebø deposit is one of the world's highest-grade rutile deposits and is unique due to its substantial content of garnet. With negligible contents of radioactive elements and heavy metals, the deposit is a clean source of high-grade and high-quality titanium and garnet minerals. Unlike most rutile deposits, the Engebø rutile is contained in a hard-rock ore, a massive body of eclogite.

The deposit forms a 2.5 km long east-west trending lens that runs parallel with the Førde Fjord and the ridge, Engebøfjellet (Norwegian for Engebø Mountain). The deposit dips steeply towards the north with a dip of 60° to 85° degrees. Structural studies reveal many episodes of complex major folding and development of foliation.

Geological investigations have determined that the eclogite can be subdivided into three different types, based on appearance and titanium content:

- Ferro-eclogite; dark and massive appearance, generally >3% TiO<sub>2</sub>
- Transitional-eclogite; intermediate dark, generally 2 to 3% TiO<sub>2</sub>
- Leuco-eclogite; light coloured and foliated, generally <2% TiO<sub>2</sub>.

The contacts between the eclogite types are gradational, moving from ferro- to transitional- and leuco-eclogite. The figure below shows the relationship between the different eclogite types.



**Geology of the Engebø Deposit**

The main titanium bearing mineral is rutile. Only 5% of the titanium is found as ilmenite, and the presence of titanite/sphene is negligible. The mineral assemblage gives the rock a characteristic green and red colour. In general, the eclogite contains 40% to 50% almandine type garnet. The garnet content decreases gradually with the TiO<sub>2</sub> grade. Other major minerals present in the ore are pyroxene and amphibole.

### 1.3 Engebø drilling

DuPont/Conoco carried out an extensive drilling campaign between 1995 and 1997.

In 2016, Nordic Mining initiated a new drilling campaign. The drilling included recovery of 6,348 m of drill cores, collection of 77 surface samples and outcrop mapping. The cores were logged and sampled at Nordic Mining's core storage facility in Naustdal. 1,517 whole rock chemical analyses (XRF) and 336 rutile specific analyses (ME-ICP41) were carried out by ALS Minerals in Sweden. QEMSCAN was carried out by SGS Canada on 68 samples to investigate mineralogical, textural and petro-graphical variations within the deposit. Garnet was successfully quantified by correlating QEMSCAN data with iron content from chemical assays.

As part of the drilling program, historical datasets have been re-assessed and old drill cores were re-logged and re-analysed. The results show a good correlation between new and historical data and thereby fully validate the historical datasets.

The principal reasons for the 2016 drilling included:

- To provide a better coverage of sample data in the prospective open pit area, and thereby achieve at least an Indicated Resource category for the majority of the ore in this area

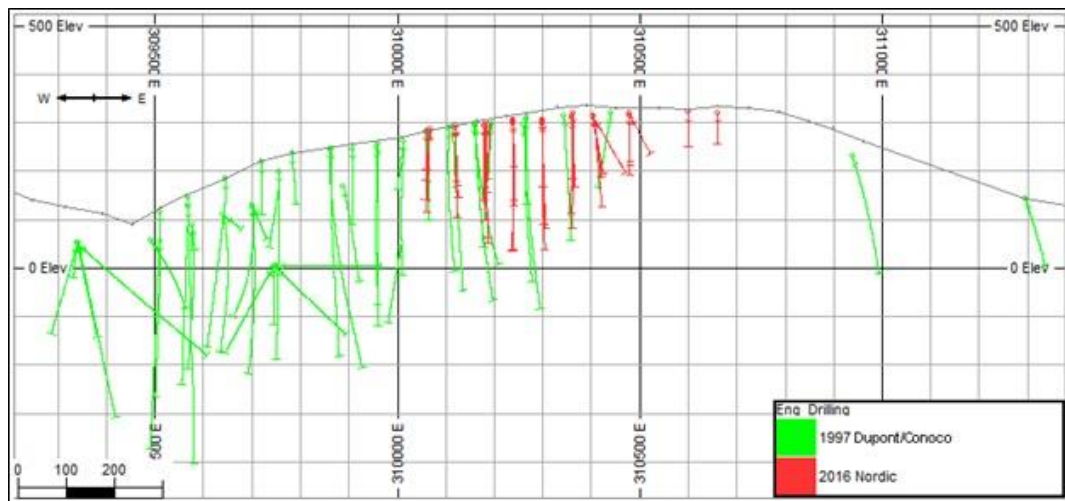
- To provide a bank of recent data which would help verify the 1997 drill hole data
- To provide samples for metallurgical testing in the potential open pit area
- To provide geotechnical samples and data to assist with selection of mine and slope design parameters
- To provide extensive additional data for assessment of garnet and different mineralisation qualities.

A summary of all diamond drilling carried out at Engebø both by DuPont/Conoco and Nordic Mining is shown in the table below.

**Summary of Drilling Campaigns**

Drilling Campaign	Drillholes	Length (m)	Average Length/hole (m)
1997 DuPont/Conoco	49	15,198	310
2016 Nordic Mining	38	6,348	167

The figure below illustrates the historic drilling by DuPont (shown in green) and the 2016 drilling by Nordic Mining (shown in red). The historic drilling was concentrated in the western part of the deposit while the new drilling was centered in the planned open pit area located in the central part of the deposit.



**Long Section of Drillhole Data**

#### 1.4 Mineral resource estimates

In 2008, Nordic Mining assigned the independent Qualified Person, Adam Wheeler to make an updated resource estimation for the Engebø deposit in accordance with the guidelines of the JORC Code. The resource estimate was published in a scoping study.

The mineral resource estimate for Engebø was updated in 2016 by Mr. Wheeler following completion of the 2016 diamond drilling and surface sampling campaign. The estimate substantially improved and increased the 2008 classification and enabled a qualified quantification of the garnet.

The resource figures are published in a separate geological report for the deposit and the PFS report for the Engebø project. Both reports are available on Nordic Mining's webpage [www.nordicmining.com](http://www.nordicmining.com).

The two tables below shows the resource estimates for 3% and 2% TiO<sub>2</sub> cut-off, respectively.

#### 2016 Mineral Resource Estimate (3% TiO<sub>2</sub> Cut-off)

TiO <sub>2</sub> Cut-off	Classification	Tonnes (Mt)	Total TiO <sub>2</sub> (%)	Garnet (%)
3%	Measured	15.0	3.97	44.6
	Indicated	77.5	3.87	43.6
	<b>Total – Measured and Indicated</b>	<b>92.5</b>	<b>3.89</b>	<b>43.7</b>
	Inferred	138.4	3.86	43.5

#### 2016 Mineral Resource Estimate (2% TiO<sub>2</sub> Cut-off)

TiO <sub>2</sub> Cut-off	Classification	Tonnes (Mt)	Total TiO <sub>2</sub> (%)	Garnet (%)
2%	Measured	19.0	3.68	43.9
	Indicated	105.7	3.51	43.0
	<b>Total – Measured and Indicated</b>	<b>124.7</b>	<b>3.53</b>	<b>43.2</b>
	Inferred	254.5	3.22	42.5

*Notes:*

*Resource below sea level has been restricted by a boundary no closer than 50 m to the edge of the fjord*

*Above Mineral Resources are inclusive of Ore Reserves.*

*A third party independent review of the mineral resource estimate has been carried out by SRK Consulting (UK) Limited (SRK) in December 2016. SRK concluded that the mineral resource estimate did not contain any fatal flaws and that the geological model produced was fit for Pre-Feasibility level purpose.*

The 2% cut-off includes ferro- and transitional-eclogite and has been included to facilitate the investigation of mining and processing options. The transitional-eclogite represents a potential future ore reserve. All leuco-eclogite (<2% TiO<sub>2</sub>) has been excluded from the resource.

The resource remains open to the east, west and at depth, with potential to convert Inferred resources to Measured and Indicated Resources with additional drilling.

### 1.5 Ore reserve estimates

The Ore Reserve is defined with a 3% cut-off.

The Ore Reserve for the prefeasibility study mine plan was estimated and qualified by Mr. Wheeler. The Ore Reserve Statement is presented in the table below. The reserve estimation was carried out using Datamine and DESWIK software.

### Ore Reserve Statement

Ore Type	Proven Reserves			Probable Reserves		
	M Tonnes	TiO <sub>2</sub> %	Garnet %	M Tonnes	TiO <sub>2</sub> %	Garnet %
Ferro Ore - Open Pit	8.519	3.87	43.8	13.826	3.54	41.8
Ferro Ore - Underground	1.675	3.49	37.8	17.876	3.21	37.8
Ferro Ore - Total	10.194	3.81	43.4	31.702	3.35	39.5

The basis of conversion of Mineral Resources to Ore Reserves is as follows:

- Ore Reserve estimate is as of 30 September 2017
- Only Measured and Indicated Resources have been used to determine reserves; all Inferred Resources within the mineable envelope have been classified as waste
- Open pit mining is carried out for the first 16 years; thereafter the mining method is bulk underground mining (long hole open stoping)
- The open pit mine design is based on the recommendations of the geotechnical consultants for all pit design parameters
- The underground mine design is based on recommendations of the geotechnical consultants, assuming 100 m-long stopes, 45 m wide and 60 m high, with continuous pillars 20 m wide between stopes and sills 15 m thick above and below the stopes
- The garnet grades as reported above were not used to determine the final product volumes for garnet. Instead, a yield approach was used, which was considered to be more applicable for determining recoveries of a bulk mineral such as garnet. The yield approach assumed a yield of 17.5% garnet for ferro ore
- A rutile recovery of 58.5% was assumed
- A cut-off of 3% on TiO<sub>2</sub> has been applied to ferro ore
- Ore losses of 5% have been assumed throughout the mine plan
- Dilution of 4% for open pit and 6% for underground has been applied with a dilution grade of 0% for rutile and garnet.

#### 1.6 Exploration results in 2017

No exploration has been executed in 2017 to the date of this report. A drilling programme will be considered as part of the Definite Feasibility Study phase of the project. The following objectives for drilling will be considered:

- To increase the amount of Measured in the mineral resource
- To increase the amount of Indicated in the mineral resource
- To aid the overall understanding of the structural geology of the orebody
- To enable a feasibility standard geotechnical model to be compiled, in part using additional geology drill holes.

## 2. Nordic Quartz AS - Kvinnherad quartz deposit

### 2.1 General

Nordic Mining has entered into agreements with landowners and secured exclusive rights for investigation and development of a quartz deposit in Kvinnherad municipality in Hordaland County in Norway. Pursuant to the agreement, Nordic Mining is entitled to explore the deposit in order to assess whether the project is commercially viable. The Company has exclusive right to exploit the deposit against a consideration to the landowners, such consideration to be negotiated prior to production start.

The quartz deposit is an approximately 600 meter long hydrothermal quartz vein and on average 15 meters wide. A cross-cutting of the hillside shows that the deposit in parts extends to at least 100 meters depth.

The Kvinnherad quartz project is developed through Nordic Quartz AS, a wholly owned subsidiary of Nordic Mining.

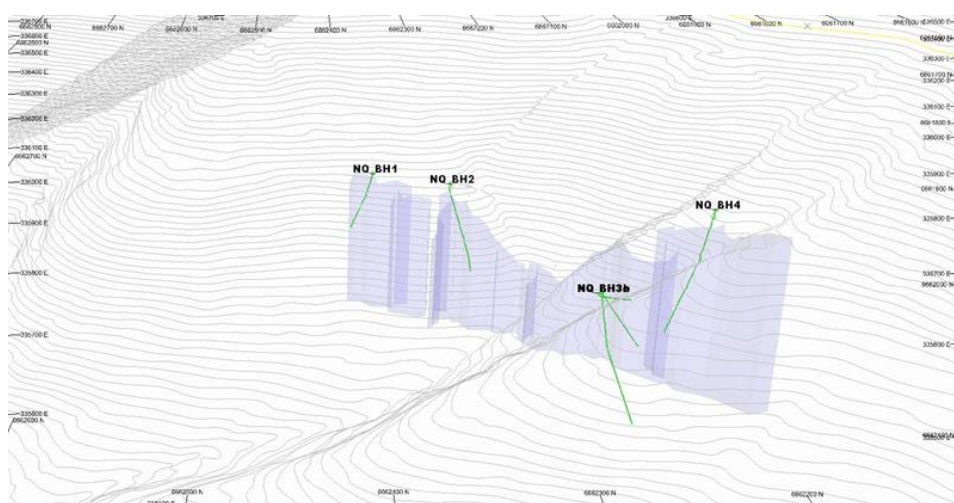
The Kvinnherad quartz project is in a pre-commercial stage of development. No investment commitment has been undertaken and no operational activity has yet been started.

### 2.2 Exploration

The Kvinnherad deposit consists of hydrothermal quartz situated in Proterozoic basement rocks south of the Hardanger Fault Zone. The quartz vein is exposed on the surface and detailed mapping was carried out in 2011. The quartz vein is about 600 meter long and on average 15 meters wide. A cross-cutting of the hillside shows that the deposit in parts extends to at least 100 meters depth.

A magnetic survey was carried out by Geovista AB in 2012 to get a better confidence for the size and geometry of the vein. The geophysical data indicated a continuation of the vein to at least 150 meters depth confirming and increasing the depth observations from the geological mapping. A further extension of the vein down to 300 meters and a possible horizontal extension towards the south-east were also indicated in the geophysical data.

In 2015 a drilling program of the deposit was carried out. 6 drill holes were drilled across the deposit as indicated in the figure below. All holes were logged, sampled and analyzed by ICP-MS to investigate impurity content of the quartz vein. Massive quartz was found in all drill holes and confirmed the vertical extension of the quartz vein.



### 2.3 Mineral resource estimate

An independent assessment of the Kvinnherad hydrothermal quartz deposit has estimated the total contained quartz in the deposit.

The Competent Person responsible for the assessments and resource statement is Lars-Åke Claesson, a titled European Geologist in accordance with the Federation of European Geologists.

A resource estimation report was compiled by B.Sc. Johan Camitz, designated by the Fennoscandian Review Board ("FRB") as accredited Qualified Person. Mr. Camitz has carried out the technical estimations and modeling of the quartz deposit. The report follows the FRB-standard based on "The International Template for public reporting of exploration results, mineral resources and mineral reserves, July 2006", issued by The Committee for Mineral Reserves International Reporting Standards ("CRISCO"). The Australasian JORC Code recognises resource estimations according to the CRISCO template.

Three zones of quartz have been specified with increasing amount of quartz; transition zone, semi-massive zone and massive quartz zone. The tables below show the overall estimated resource tonnage and quartz contained in the deposit.

Resource estimate		
Resource class	Quartz vein tonnage	Quartz content
Indicated	2 947 644	65 %
Inferred	1 340 615	66 %

The estimations are based on the results from the core drilling in fall 2015 and information from previous exploration work. The extension of the quartz deposit towards depth is still unknown and further core drilling may be carried out at a later stage. A model of the quartz deposit has been developed according to international standards and practice.

### 2.4 Mineral analysis and processing tests

Analysis show the quartz from the Kvinnherad deposit is of very high purity. Advanced processing tests show that the impurity level can be reduced by physical and chemical processing to a level of the best products in the market, comparable with the Iota 4 and Iota 6 high-purity quartz ("HPQ") products.

HPQ is quartz which is extremely pure, with low level of contaminating elements such as alkalis, iron and heavy metals. HPQ is used in various high-tech applications. There is a growing demand for HPQ in industry applications such as semiconductors, telecommunication, optics, electronics and solar silicon. The HPQ world market is currently limited in volume, but with high value.

Nordic Mining has carried out comprehensive analysis and an advanced processing test program at Dorfner Anzaplan's laboratory in Germany. A suitable processing route for the quartz has been developed. To confirm that high quality products could be obtained from a larger part of the deposit four samples of 250 to 1,000 kg have been blasted from different locations across the vein. Homogeneity of the quartz has been confirmed by processing of all samples to high quality products both in terms of impurity levels and glass quality.

### 2.5 Scoping Study

An independent preliminary evaluation ("Scoping Study") was carried out by Dorfner Anzaplan for the quartz project in 2012. The Scoping Study described the status for development of the deposit including a review of previous work and studies (e.g. exploration, geology, deposit size, processing etc.), proposal of a mining and processing method for the quartz and a preliminary economic analysis for the project. The Scoping Study gave principal recommendations and described various risk factors to be considered in the project development going forward.



The Scoping study estimated a preliminary size of the deposit of 3.45 million tonnes of quartz down to 150 meters depth. The estimate was based on geological mapping and geophysical results and is not in accordance with the JORC Code.

The Scoping Study indicated an initial mine life of more than 40 years based on mining down to about 100 meters depth and production of 5,000 tonnes of high purity quartz concentrate per year. The Scoping Study estimated a preliminary after tax NPV of USD 60 million using 8% WACC based on a 30 years project period.

Additional information about the Kvinnherad quartz project including the report from the geophysical survey and the Scoping Study is available on Nordic Mining's web page:  
<http://www.nordicmining.com/kvinnherad-quartz/category276.html>

## **2.6 Exploration results in 2017**

No resource mapping or drilling has been carried out in 2017.

## **3. Nordic Mining ASA - Reinfjord exploration project (100%) for palladium, platinum, nickel and copper**

### **3.1 General**

Nordic Mining holds the Exploration Rights number 0125-0127/2011 named "Reinfjord" for nickel ("Ni"), copper ("Cu"), cobalt ("Co") and platinum group elements ("PGE") in Kvænangen municipality in Troms County in Norway. The Exploration Rights are located within the "Seiland Magmatic Province" on the Øksfjord Peninsula. The Exploration Rights are valid until 28 February 2018 and can upon application be extended for three more years. The exploration area is located approximately 5 km from the seaside and the populated area of Reinfjord, at an altitude of approximately 600 meters above sea level.

Nordic Mining is prospecting for sulphide mineralisation within the area that is hosted by an ultramafic intrusion, "The Reinfjord Intrusion". The intrusion has specific characteristics in terms of ore-forming processes and share geological features with large ore-forming provinces such as "Bushveld" in South Africa.

Nordic Mining's prospecting model is that a high-grade base and precious metals deposit is located within the depths of the central part of the intrusion related to wall rock contamination and magma replenishment. Geophysical surveys in the area have detected a large electromagnetic anomaly centrally placed in the intrusion at approximately 100 meters depth. Drilling has revealed mineralisation of Ni, Cu, Co and PGE at about the same depth as the interpreted conductor.

The Reinfjord exploration project is in an early, pre-commercial phase. No mineral resource estimates have so far been made. No investment commitment has been undertaken and no operational activity has been started.

### **3.2 Exploration**

Nordic Mining has carried out several prospecting activities in Reinfjord since 2011. The area consists of an ultramafic intrusion, so called "The Reinfjord Intrusion". Electromagnetic (EM) measurements by helicopter were carried out in 2011. The measurements revealed that a conductor was present within the intrusion. In 2012, a ground electromagnetic survey was completed to get a more detailed picture of the discovered conductor. The survey confirmed a sizeable conductor at an approximate depth of 100 meters.

The EM survey was followed up by drilling of two drill holes to test whether the conductor was related to a metal containing mineralisation. This drilling led to the discovery of Ni, Cu, Co, PGE and gold ("Au") enriched sulphide mineralisation at around 100 meters depth fitting well with the interpreted conductor. The best intersected metal values were found in drill hole RF-1 as showed in the table below.

Hole ID	From	To	Meters	Nickel	Copper	Cobalt	Gold	Palladium	Platinum	PGE+Au	Sulphur
	(m)	(m)	(m)	%	%	%	g/t	g/t	g/t	g/t	%
RF-1	86	93	7	0.38	0.12	0.02	0.03	0.03	0.03	0.09	0.61
RF-1*	107.75	117	9.25	0.27	0.06	0.02	0.07	0.20	0.15	0.42	0.58
*including	107.75	113	5.25	0.24	0.05	0.01	0.10	0.31	0.23	0.64	0.41

Source: Aqua regia multielement ICP-OES analysis by Labtium Rovaniemi, 2012

Additional information about the Reinfjord exploration project and complete drillhole assays are available on:

<http://www.nordicmining.com/new-nickel-copper-and-platinum-group-element-discoveries-in-north-norway/category139.html>

In March 2014, the research program "Platinum Probe", coordinated by NTNU and where Nordic Mining is a partner, was granted NOK 2 million from NordMin for further exploration in the Reinfjord area. NordMin is a research network funded by the Nordic Council of Ministers. As part of the program drilling of two drill holes were carried out.

The chemical analysis showed elevated copper and nickel in both drill holes with the highest grade found between 160 and 180 meters depth. The drill hole aiming at intersecting the conductor revealed a Cu content of 0.11% over a 5 meter interval. The cores will be subject to further chemical analysis to locate the exact position and grade of the mineralisation. The PGE content in the drill cores were in general lower than discovered in 2012. This leads to the conclusion that the PGE reef found in 2012 was not intersected.

### 3.3 Exploration results in 2017

No resource mapping or drilling has been carried out in the Reinfjord area in 2017.