

## MAGNETITE BACKGROUND

### 1. What is magnetite?

Magnetite is an iron oxide mineral with the composition  $\text{Fe}_3\text{O}_4$ . The mineral has a black to brownish black metallic finish and is distinguished as being the most magnetic of all the naturally occurring minerals on Earth.

The Earth's mantle is composed mainly of ultramafic rocks, meaning rocks rich in magnesium and iron. Through serpentinization, a geological low-temperature metamorphic process involving heat and water, these ultramafic rocks are oxidized and hydrolyzed with water into serpentinite. More specifically, olivine and pyroxene is converted to serpentine, brucite, magnetite, and other minerals. Small grains of magnetite occur in almost all metamorphic rocks.

### 2. How is the magnetite located and formed in the ore at Rönnbäcken?

The host rock at Rönnbäcken is serpentinized ultramafic rock, which was altered from mainly olivine, but also pyroxene. Due to the serpentinization process, elements such as iron and nickel in the olivine and pyroxene was released and was able to form iron oxides and different nickel bearing sulphides depending on sulphur availability. The formation of magnetite was at the cost of the primary chromite (Figure 1 & 2). A rim of magnetite surrounds some of the chromite, while in other cases the chromite was totally altered into secondary magnetite. The magnetite occurs as fine well formed grains, mainly in the fraction between 0.01-0.3mm, as a thin reaction zones around the chromite or capsulates nickel-sulphide grains. It also occurs together with carbonates as fracture fillings.

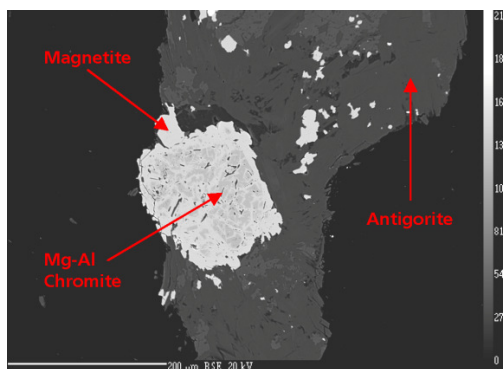


Figure 1. Microprobe backscattered electron image showing the magnetite-chromite in association with antigorite (serpentine mineral).

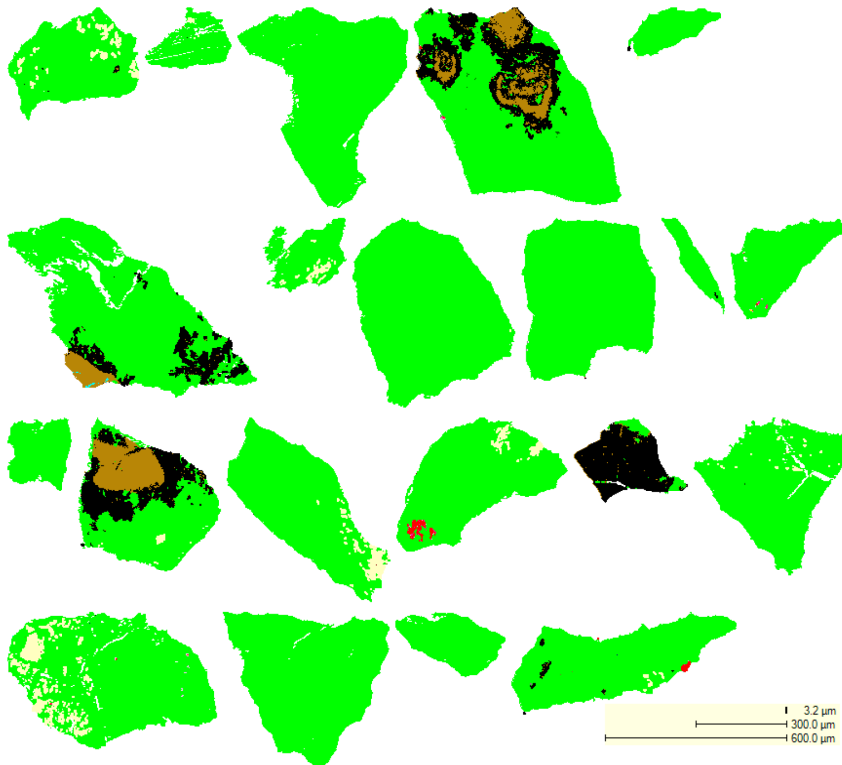


Figure 2. QEMSCAN (Quantitative Evaluation of Materials by Scanning Electron Microscope) showing magnetite in black, Mg Al Chromite in brown, serpentine in green, pentlandite in red, carbonates in pale yellow. Test on composite sample from drill hole VIN30, -600 $\mu$ m/+300 $\mu$ m fraction unsorted.

The gangue (non-nickel- sulphide) mineralogy is dominated by antigorite, olivine, pyroxene, chlorite, carbonates, magnetite, and chromite.

Most of the chromite in the Rönnebäcken deposits is completely altered into magnetite. Since the magnetite is a secondary mineral and is replacing chromite, the chromium grade is still elevated at approximately 0.67 wt%. A small amount of primary chromite is also present, but more common is numerous altered Cr-bearing minerals carrying different levels of chromite. These altered chromites carry about 73% of all Cr and the rest is carried by the magnetite.

Since magnetite is an alteration product in the serpentinization process, it occurs throughout the three deposits and is evenly distributed in the serpentinite host rock (Figure 3). The content in the Rönnebäcken deposits is between 5-6 % Fe. According to the Mineral Resource Statement for magnetite (Table 1), there are 20.501 million tonnes of iron as magnetite in the resources of the three deposits.

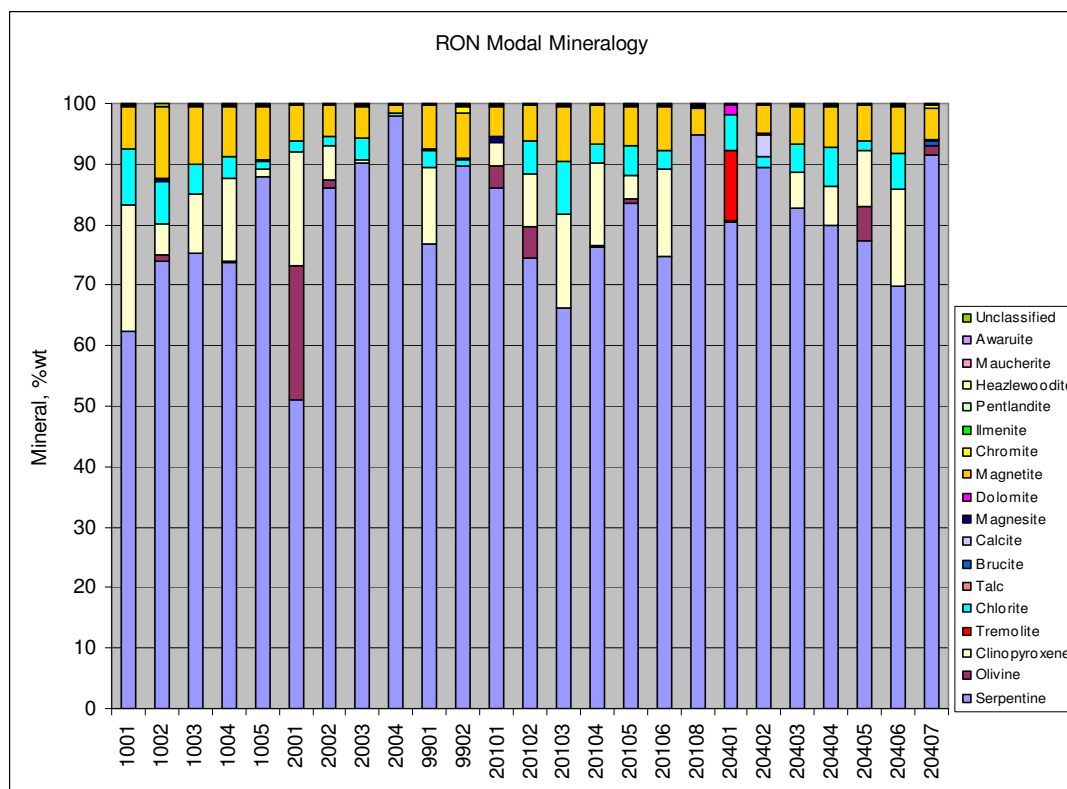


Figure 3. Modal mineralogy in 25 thin section samples from Rönnbäcknäset.

Table 1. Combined SRK-MRG Mineral Resource Statement, Fe.

DEPOSIT	CLASSIFICATION	TONNES (Mt)	Fe %	MAGNETITE Fe tonnes
Rönnbäcknäset	Inferred	311.9	5.46	11 410
Vinberget	Inferred	58.3	5.17	2 019
Sundsberget	Inferred	185.7	5.95	7 071
<b>TOTAL</b>	<b>Inferred</b>	<b>555.9</b>	<b>5.59</b>	<b>20 501</b>

(1) The effective date of the Mineral Resource Statement for Rönnbäcknäset and Vinberget is February 25, 2011. The effective date of the Mineral Resource Statement for Sundsberget is October 27, 2010.

(2) The Mineral Resource reported for Rönnbäcknäset and Vinberget was constrained within a Lerchs-Grossman pit shell defined by a marginal cut-off-grade of 0.031% Ni-AC, a metal price of USD11/lb; slope angles of 50 and 48° respectively; a mining recovery of 95%; a mining dilution of 2.5%; a base mining cost of USD1.35/tonne and an incremental mine operating costs of USD0.07/tonne/10 m below the 450m reference RL and USD0.05/tonne/10 m above the 450m reference RL); process operating costs of USD4.96/tonne ore; an effective charge per lb Ni in smelter feed of USD1.14, G&A costs of USD0.40/tonne ore and concentrate transport cost USD0.10/tonne.

(3) The Mineral Resource Estimate for Sundsberget was constrained within a Lerchs-Grossman pit shell defined by a marginal cut-off-grade of 0.05% Ni-AC, a metal price of USD9/lb; a slope angle of 52

*degrees; a mining recovery of 95%; a mining dilution of 2.5%; a base mining cost of USD1.0/tonne and an incremental mine operating costs of USD0.07/tonne/10 m below the 450m reference RL and USD0.05/tonne/10 m above the 450m reference RL); process operating costs of USD4.24/tonne ore; an effective charge per lb Ni in smelter feed of USD2.26, G&A costs of USD1.0/tonne ore and concentrate transport costs of USD0.35 /tonne.*

Due to magnetism imparted by the magnetite to the serpentine rock, the Company's geologists used this property as an exploration tool, especially in the field, as well as during core logging, to identify areas of serpentinization and possible nickel sulphide mineralisation, since the surrounding rocks and the less-serpentinized ultramafic rock are less magnetic (Figure 4). Magnetic susceptibility measurements on core were initially taken routinely every metre, on every bag of coarse rejects, as well as on outcrops during the geological mapping programme.

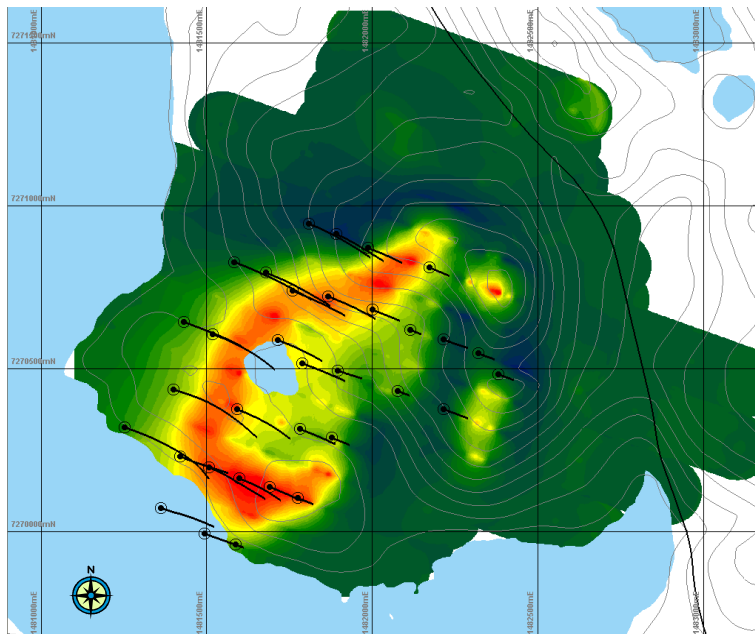


Figure 4. Ground magnetic for Sundsberget, high magnetic in red.

### 3. How is the magnetite processed?

The process for producing the nickel sulphide concentrate from ore includes crushing, grinding, flotation, and dewatering steps, typical of concentrator operations in Sweden and Finland. A high proportion of the sulphide nickel is recovered in the flotation process whereas the non-sulphide nickel reports predominantly to tailings. The Company has initiated studies into the recovery of a magnetite concentrate. Preliminary test-work to investigate the recovery of a magnetite concentrate from the sulphide flotation tailings was performed in late-2010 and early-2011.

In order to avoid complications with the sulphide flotation, preliminary magnetic separation tests were performed on head samples of both Vinberget and Rönnbäcknäset ores. Consequently, the levels of nickel, cobalt and sulphur in the magnetite concentrate are likely to be higher than would be expected from the testing or treatment of flotation tailings. Samples typically contained 5 to 6% Fe and most of the recoverable iron is in the form of magnetite.

Initial tests during December 2010-March 2011 by Outotec and GTK in Finland have focused on low intensity magnetic separation, using roughing and up to three stages of cleaning followed by de-sliming and/or reverse flotation. Published results to date have indicated that 53% of the contained iron (approaching 80% of the magnetite) can be recovered in to a low grade iron concentrate (57% Fe) with minimal sulphur.

Additional tests during March 2011 achieved concentrate grades up to 62% Fe. The tests that were launched in September 2011 are being done on the tailings which is the waste from the nickel separation, where the ore has already been crushed to approximately 40 microns. This fine fraction is needed for liberating the nickel sulphides and the magnetite from the serpentine host rock.

#### **4. What will the final product be? What will be the estimated annual production?**

While the 62% Fe concentrate grade achieved to-date is in the lower range of marketable concentrates, further test-work has been undertaken to improve the iron grade, increase the recovery, simplify the flow sheet, reduce operating costs and reduce the chrome content as much as possible. Currently, the chrome content in the magnetite iron concentrate by-product is expected to be approximately 2%, which would limit the number of potential customers. Nevertheless, a magnetite concentrate with an iron content above 65% may command a premium price. The company is targeting to demonstrate the viability of producing in excess of 1 million tonnes of a magnetite iron concentrate per year as a by-product. A magnetite concentrate by-product has the potential to significantly improve the overall economics.

#### **5. What is the use of magnetite? What are the possible markets?**

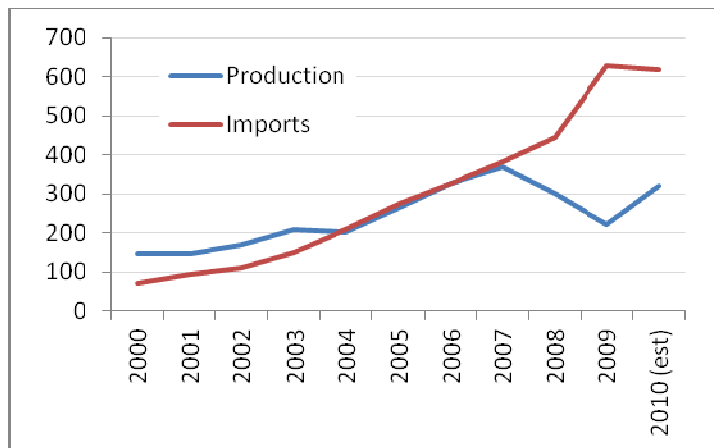
Iron is the world's most commonly used metal - steel, of which iron is the key ingredient, represents almost 95% of all iron metal used per year. According to the Australian department of Resources, Energy and Tourism, steel is the most useful metal known being used 20 times more than all other metals put together. About 60% of steel products are used in transportation and construction, 20% in machinery manufacture, and most of the remainder in cans and containers, in the oil and gas industries, and in various appliances and other equipment.

Magnetite concentrate is a high-quality feedstock for the production of premium quality steel. Further processing of the concentrate is required by way of agglomeration and thermal treatment to produce pellets, which can be used directly in a blast furnace or direct reduction steel-making plant.

World consumption of iron ore is forecast to grow 4.8% per annum on average until 2020, with the main consumer being China. China is currently the largest consumer of iron ore, being the world's largest steel producing country. In 2010, China produced 640 million tonnes of steel, accounting for 46% of global steel production.

The rapid growth in Chinese steel production has been by far the most important factor for world iron ore demand. Since most of China's own iron ore deposits are low grade and relatively small, China has to a large extent depended on imports to feed its steel industry, as seen from Figure 5. In 2009, China accounted for two thirds of global imports of iron ore.

**Figure 5. Chinese iron ore production and imports, 2000-2010, Mt.**



*Note: Production has been converted from Chinese data for total weight to 63 % Fe content in order to make the figures comparable to imports.*

Source: UNCTAD Iron Ore Trust Fund