A REVIEW OF THE JÖHVI MAGNETITE DEPOSIT, ESTONIA

Prepared For

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Report Prepared by

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1 INTRODUCTION

SRK has been commissioned to undertake a high-level desktop review of the Jöhvi magnetite deposit in Estonia and to provide appropriate recommendations as to the work required to develop the asset further.

SRK has been provided with a limited amount of information, most of which is contained in a report by the University of Tartu (Appendix 1), which summarises historic work on the project. The reader is referred to Appendix 1 for the property descriptions and geological setting, which SRK does not attempt to repeat in this report.

In undertaking this review, SRK focused initially on exploration data (drilling and ground geophysics) in an attempt to establish a reasonable “order of magnitude” tonnage and grade for the Jöhvi deposit, as a basis for benchmarking against other operating mines and to identify key risks and opportunities in developing the asset further.

2 DATA REVIEWED

The data provided for review as a basis for this study comprises:

- A brief summary report of the Jöhvi deposit by Kalle Kirsimäe, University of Tartu, 2016 (Appendix 1); and
- Email communication with Tiit Kaasik, Adviser to the Estonian Ministry of the Environment.

SRK understands that there is additional unpublished material reporting the results of exploration activities at the Estonian Geological Survey.

3 DRILLING

Table 3-1 below summarises historic drilling undertaken on the property. These campaigns were carried out in two phases (1930’s and 1960’s), in order to test three magnetic anomalies at the property. SRK understands that limited core from the two holes drilled in the 1930’s is available for review and that all core from the 1960’s programme has been discarded. No photographs of drill core are currently available. Figure 3-1 provides the location of these drill holes with respect to the magnetic anomalies and a sectional interpretation of geology.

Table 3-1: Summary of drilling at the Jöhvi deposit

Period of drilling campaign	Number of drill holes	Total meterage	Number of holes intersecting mineralisation	Core diameter	Dip
1930's	2 (J-I, J-II)	1 226	2	3cm	Vertical
1960's	14	Unknown	5	5-7cm	Unknown

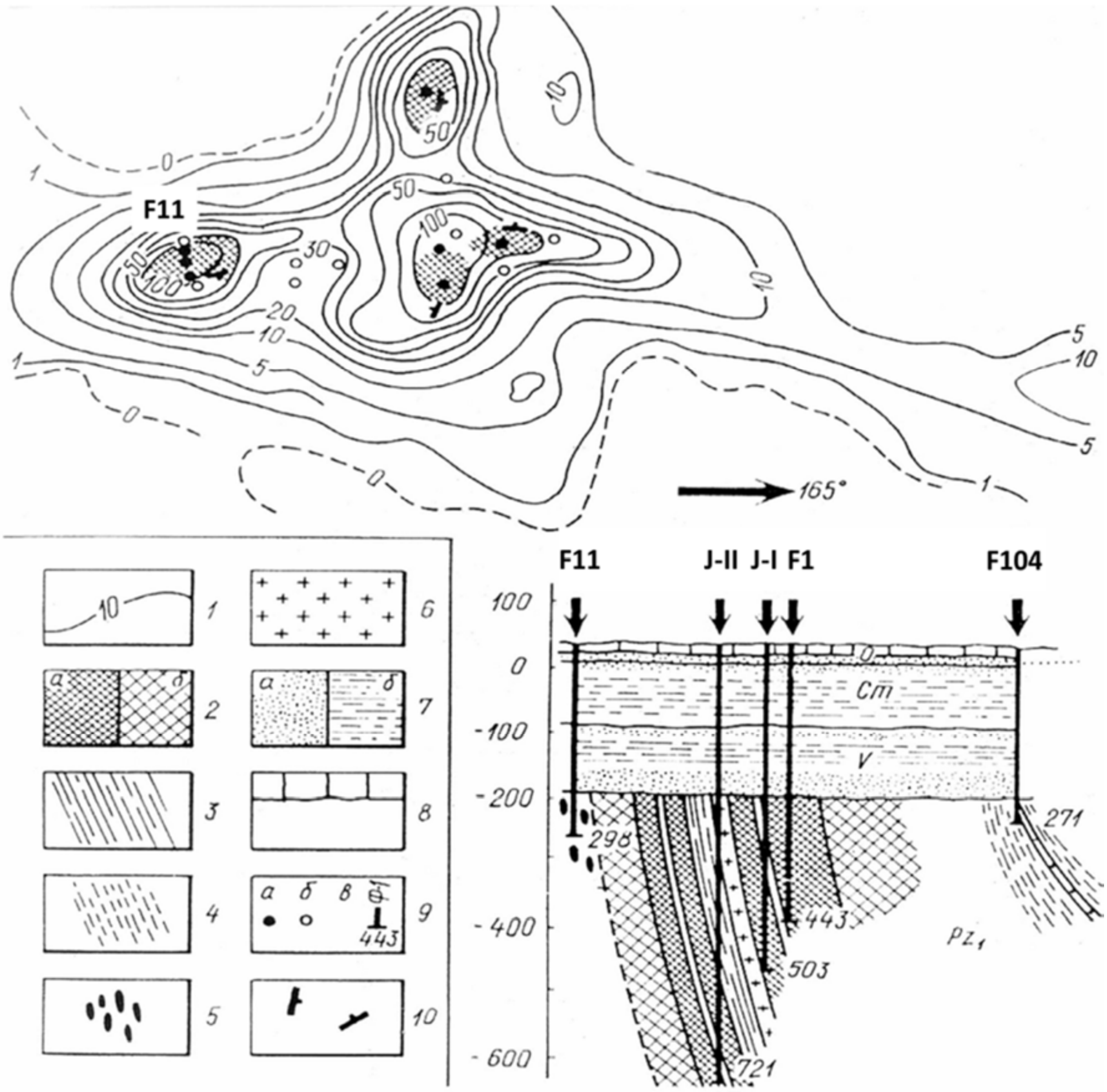


Figure 3-1: Schematic geological cross-section of the sedimentary and crystalline rocks in Jõhvi magnetic anomaly. 1 – isolines of the magnetic field strength, 2 – magnetite quartzite (a – drilled, b – suggested), 3 – mica-aluminogneiss, 4 – biotite gneiss, 5- biotite-amphibole gneiss, 6 – pegmatoid granite, 7 – terrigenous sedimentary rocks (a – sandstone, b – claystone), 9 - carbonate rocks, a – intersecting magnetite quartzite, b, drillcore into country rocks, depth of the core in meters. Modified from Shtokalenko et al. (2009) after Petersell et al. (1985).

SRK notes that exploration drilling appears to have effectively tested the peaks of these magnetite anomalies and the possible strike extensions between. Figure 3-1 above suggests that magnetite mineralisation may be restricted to the peaks of the magnetic anomalies. Black coloured drill collars are located at the centre of each magnetic anomaly (“9a”), whereas drill collars with no fill (“9b”) intersect barren country rock.

4 MODELLING

In order to provide a very rough assessment of the size of the deposit, SRK imported and georeferenced images from Appendix 1 into modelling software, using available drill collar co-ordinates as reference points.

5 STRIKE OF MINERALISED INTERSECTIONS

On the basis of collar locations, geological sections and size of the magnetic anomalies, the approximate strike length of sub-cropping magnetite mineralisation beneath the peak of each magnetic anomaly would appear to be in the order of 400m to 600m (Figure 5-1).

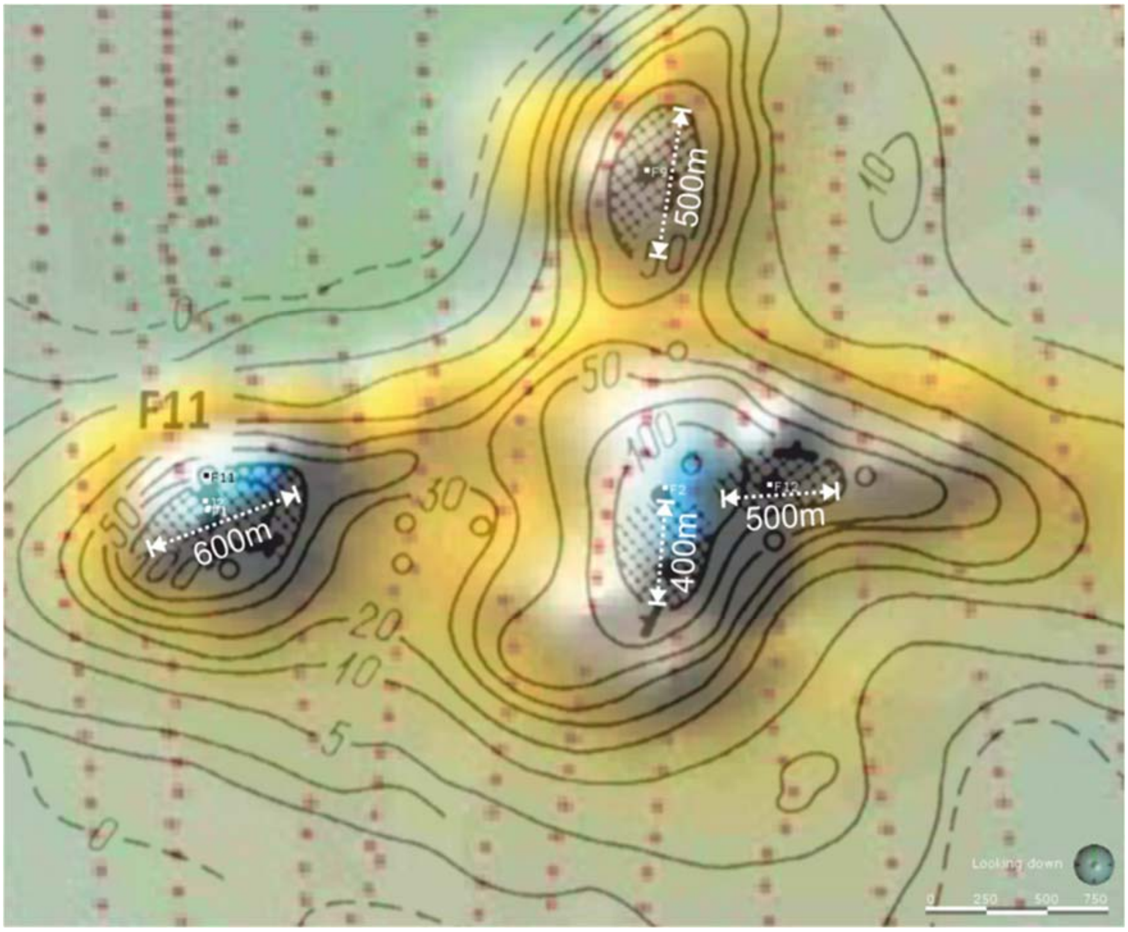


Figure 5-1: Estimated strike length of mineralised intersections

6 THICKNESS OF MINERALISED INTERSECTIONS

The true thickness of the mineralised units is impossible to determine, given the absence of lithological logs and systematic drill core sampling with known depth intervals. Linari (1940) and Luha (1946) suggest that the total thickness of significant mineralisation (Fe 27-40%) is 48m, on the basis of drill core from holes JI and JII. This would seem to be reasonable and may be a slight underestimate, given mineralised intersections in later holes from the 1960's (hole F1, Figure 3-1), which were not considered Luha's intrepretation.

Petersell (1985) has suggested an average mineralised thickness of 350m based on ground geophysics. This may correspond to the "suggested" zones of magnetite quartzite in the cross-section of Figure 3-1 ("2b"). SRK notes however, that there does not appear to be any drilling supporting this interpretation and suggests that the geophysical anomaly in these zones may be due to a wider zone of weaker disseminated magnetite.

For the purposes of this report, SRK has assumed an overall true intersection width of the mineralised package of between 50m and 100m.

7 SURFACE AREA OF SUB-CROPPING MAGNETITE MINERALISATION

Petersell assumes sub-cropping magnetite mineralisation over an area of $8km^2$. This seems optimistic and does not correspond with barren holes drilled between the peaks of the anomalies. Given the interpreted strike length and estimated true thicknesses a sub-cropping surface area of mineralisation is estimated in Table 7-1 below.

Table 7-1: Estimated surface area of sub-cropping magnetite mineralisation

Anomaly	Sub-crop strike length (m)	True thickness (m)	Sub-crop area (km^2)
West	600	50 to 100	0.03 to 0.06
East	500		0.05 to 0.09
Northeast	500 + 400		0.03 to 0.05
		Total	0.1 to 0.2

8 TONNAGE ESTIMATES

The tonnage estimate given by Petersell (Appendix 1), seems optimistic, although no Fe grade is provided, so this may be referring to a wider zone of weaker disseminated magnetite, as a source of the broader magnetic anomaly surrounding the anomaly peaks. Based on the interpretation of strike length and intersection widths discussed above, and assuming an average overburden thickness of 240m, a range of potential tonnages at various depths may be considered as follows:

- (A) Total strike length = 2 000m
- (B) True thickness = Between 50m and 100m
- (C) Depth below surface range = 500m to 1 000m
- (D) Overbuden thickness = 240m
- (E) Specific gravity (at 20% Fe) = 3.5 t/m^3
- Tonnage estimate = A*B*(C-D)*E

Table 8-1: Tonnage range estimate

Depth below surface (m)	Tonnage range (Mt)
500	90 to 180
750	180 to 360
1000	270 to 530

SRK notes this tonnage estimate is largely speculation and simply provides an "order of magnitude" of deposit size, in order to allow high-level benchmarking against other operating iron ore mines. For the avoidance of doubt, the tonnages quoted do not constitute a mineral resource estimate as defined by international reporting standards.

9 GRADE

Two sets of drill core assay data have been provided in the 2016 report (Appendix 1). Supporting information for this data concerning sampling protocol, sample preparation, quality control and analytical techniques is very limited and is summarised in Table 9-1 below.

Table 9-1: Drill core assays, supporting data

	Shtokalenko 2009 (Appendix 1, Table 1)	Kivisilla 1995 (Appendix 1, Table 2)
Samples selection based on	Visual magnetite	Visual magnetite
Sample depth	Unknown	Known
Sample interval	Unknown	Unknown
Sample size	Unknown (Total 55kg)	20-30cm
Sampling method	Split half core	Split half or quarter core
Sample preparation	Unknown	Unknown
Assay method	Gravimetric (wet silicate)	Gravimetric (wet silicate)
Quality control	Unknown	Unknown

The arithmetic average Fe grade of each magnetic anomaly peak is summarised in Table 9-2 below.

Table 9-2: Average total Fe

Anomaly	Shtokalenko 2009 Average Fe% (N = number of samples)	Kivisilla 1995 Average *Fe% (N = number of samples)	Difference Fe%
West	24 (N=27)	27 (N=22)	3
East	19 (N = 40)	19 (N=10)	0
Northeast	16 (N = 12)	26 (N=3)	10

**Fe2O3tot multiplied by 0.72358*

Taken at face value, the average Fe grade from the two sampling programmes at the West and East anomalies correspond reasonably well. The average grade of samples at the Northeast anomaly appears to be quite different, which may be explained by the low number of samples (3) taken from the single drill hole (F9) intersecting this anomaly in the 1995 sampling programme.

The graphic log of drill hole J-I (Figure 9-1), arguably provides the best indication of the nature and grade of magnetite mineralisation at the Jöhvi deposit.

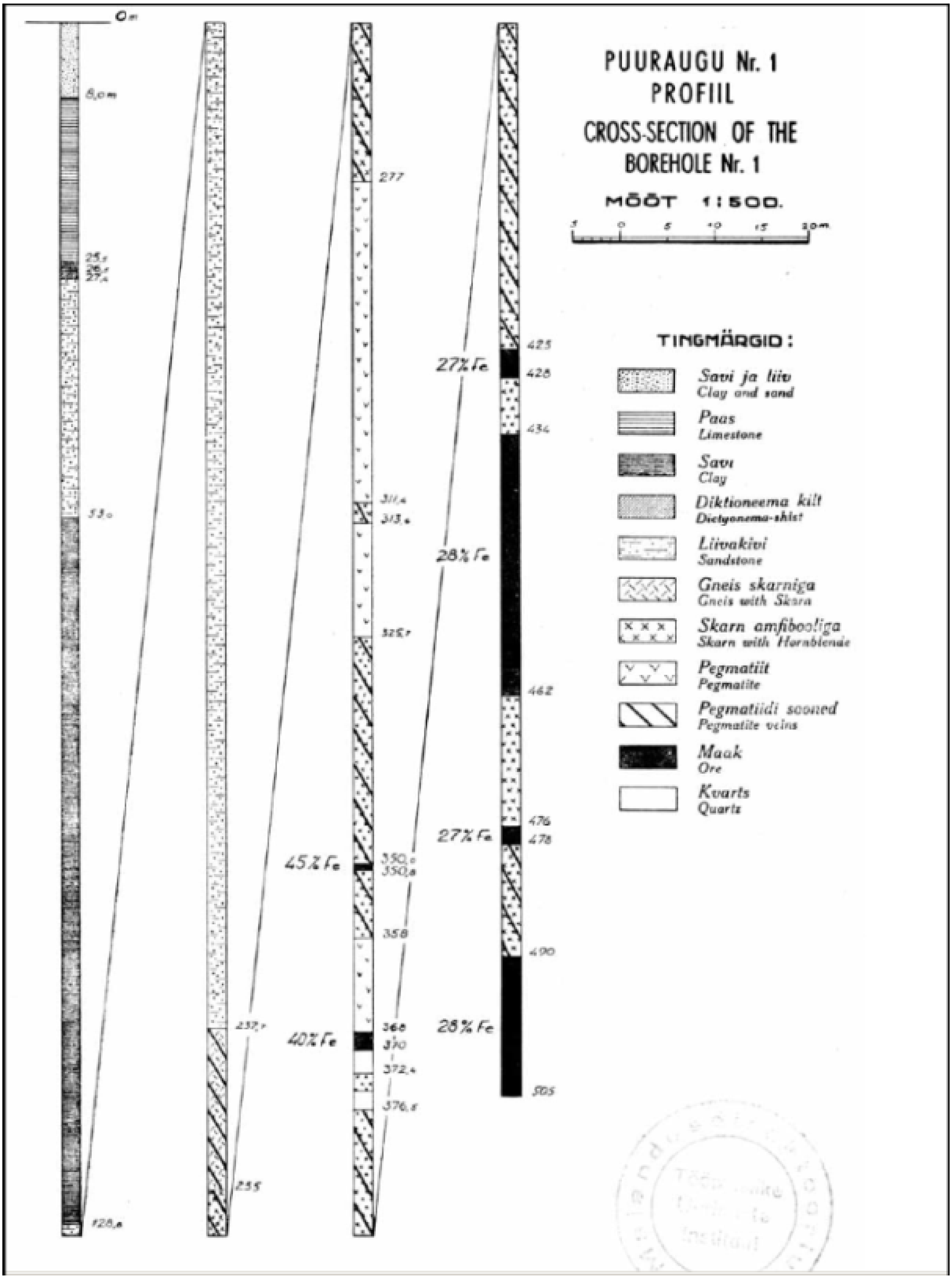


Figure 9-1: Graphic log of drill hole J-I

According to Figure 3-1, hole J-I was drilled vertically into the centre of the western magnetic anomaly and intersected sub-vertically dipping stratigraphy at a high angle. The best mineralised intersection from hole J-I is from 434m to the end of the hole at 505m. This is an intersection of 71m and gives a weighted average Fe grade of 18%, assuming the intersections between the logged "ore" intervals are barren of recoverable Fe. The geological interpretation in Figure 3-1 suggests a true width of this mineralised intersection is in the order of 10 to 15m.

Comparing the J-I graphic log and the tabulated assay results in Table 9-2 for the West anomaly, it seems the "average grades" presented in Table 9-2 may be taken purely from intersections of magnetite mineralisation, without taking into account barren intersections of host rock between these mineralised lenses. In any bulk mining scenario, it is likely that barren zones of host rock of a few metres in thickness would be mined along with mineralised material, constituting internal waste and lowering the overall grade of the material taken to the processing plant. Consequently, a more representative average grade of the West anomaly maybe more aligned with the weighted average grade in hole J-I, i.e. 18% Fe.

Given the very limited available information, there is no way to be certain the reported Fe grades from the assay tables or J-I graphic log are representative of the magnetite mineralisation at Jöhvi. At best, these results may provide an indication as to the typical Fe grades encountered and also the intensity of magnetite mineralisation.

10 GEOLOGICAL INTERPRETATION

SRK notes an apparent conflict between the geological interpretation in cross-section (Figure 3-1) and J-I graphic log (Figure 9-1). The geological interpretation assumes J-I intersects magnetite mineralisation at the basement contact (237m), whereas the graphic log indicates "gneiss with skarn" and "pegmatite veins" at the basement contact. The first intersection of mineralisation in hole J-I is a narrow magnetite vein (less than 1m in width) at a depth of 350m.

11 NON-RECOVERABLE IRON AND DELETERIOUS ELEMENTS

SRK understands that no Satmagan or Davis Tube tests have been carried out on Jöhvi drill core samples. Both these tests provide an assessment of Fe recoverable through conventional crushing, grinding and magnetic separation. Whilst some metallurgical testwork was reported from the 1930's (suggesting recovery of a 65% iron concentrate), the grade, size and depth intersection of the original sample is not known, which precludes any comment as to recoverable iron content from this work.

It is not clear as to the assay methods used in the two sampling campaigns summarised in Table 9-2 and what proportion of reported Fe grades are recoverable by conventional methods. It is typical that a proportion of the reported Fe is non-recoverable, being associated with for example Fe-sulphides, Fe-oxides, Fe-hydroxides and / or silicates. The actual recoverable Fe maybe 1% or 2% lower than reported total Fe, depending on the nature of the host rock, sample digestion method and assay techniques used.

The multi-element analysis in Appendix 1, Table 2, indicates the presence of elevated MnO and P_2O_5. Whilst these oxide levels are not considered by SRK to be critically high for typical magnetite ores, they are certainly deleterious elements at elevated levels and as such the content of these would need to be investigated in the concentrate to assess the saleability of a final product.

12 COMPARISON WITH OTHER NORDIC IRON PROJECTS

The deposits in the Nordic Region amenable to open pit mining (for example Tapuli, Sahavaara, Pellivuoma, Hannukainen, Mertainen and Leveäniemi) typically contain recoverable iron above 30%, and in some cases significantly above this. The Nordic deposits where production is envisaged form underground methods have recoverable iron closer to 40% Fe (for example Dannemora and the Ludvika deposits). The average grades of Kiruna and Malmberget (operating underground mines) are closer to 50% Fe. In addition, all these deposits are near-surface and/or have existing underground and surface infrastructure in place.

In comparison, Jöhvi may have recoverable Fe grades at around 20% (or less) over typical bulk mining widths and would require significant capital investment in order to establish the necessary infrastructure to access the deposit through an overburden averaging 240m in thickness.

SRK notes that (a) Jöhvi does not compare favourably with other iron deposits in the Nordic Region and (b) that some of these Nordic projects were arguably marginal even during the high iron prices experienced during 2011-2012. The value of Jöhvi material per tonne would be significantly less than these Nordic projects, if the estimated grades and tonnages presented herein are correct.

13 CONCLUSIONS

Magnetite mineralisation at the Jöhvi deposit would appear to be a characterised by a series of narrow lenses hosted within steep to moderately dipping stratigraphy. Based on this high-level assessment of the limited available data as discussed above, the Jöhvi deposit may have a grade-tonnage range of between 200Mt and 350Mt at around 20% Fe, to a depth of 750m below surface. This grade-tonnage range is very speculative, but provides an “order of magnitude” sense of what the key challenges will be in developing the project further.

It is clear there are three main challenges facing further development of the deposit. In priority order, these are:

1. **Grade**: The overall Fe grade within the mineralised package of rocks at intersections amenable to bulk mining methods is probably around 20% Fe or less. SRK would consider this to be low in comparison to most operating open pit iron ore mines. There are comparatively few producing underground iron ore mines in the world and these typical operate at grades of over 50% Fe.
2. **Overburden**: The average thickness of overburden is 240m of partially unconsolidated sediments. Three aquifers have been defined in this stratigraphy, all of which are used for public water supply.
3. **Steeply Dipping Stratigraphy**: The generally steeply dipping nature of the stratigraphy, in combination with 240m of overburden would make an open pit mining scenario unlikely. The capital cost of pre-stripping the overburden and the subsequent cost of cut backs to remove waste in order to access ore during production, would likely make any open pit scenario uneconomic.

Jöhvi does not compared favourably to iron ore projects in the Nordic Region, principally because the grade and consequent value per tonne of material at Jöhvi is likely to be significantly lower. The other aspects of the Jöhvi deposit, for example proximity to port, levels of deleterious elements, by-product revenue, dip of ore body and potential suitability for sub-level caving are practically irrelevant at grades of 20% Fe and intersection depths and widths evident from the single available log J-1.

In summary, the overall grade of the mineralisation at Jöhvi does not appear to be sufficiently high to support production from underground methods and is even considered low in comparison to most operating open pit iron ore mines in the Nordic Region and globally. The thickness of overburden and to a lesser extent the steep geometry of the stratigraphy effectively precludes production from open pit methods.

Any discussion of an iron price at which Jöhvi could be economic is considered misleading at this stage and further work would need to be done in order to confirm existing historic data and investigate the potential for any higher grade zone of mineralisation.

14 RECOMMENDATIONS

Whilst SRK's high-level assessment suggests that magnetite mineralisation at Jöhvi is sub-economic, it is certainly worth stressing that these conclusions are largely speculative and based on a review of summarised historic data. In order to draw conclusions with any certainty and to explore the potential for higher grade zones, a new drilling programme would need to be carried out and accompanied by sampling, assay and Davis Tube test programmes to industry best practices. The drill programme would need to investigate whether (a) historic assays were biased (too low) and (b) there are wide, significantly higher grade zones of Fe (+/-base metal and gold). There is no substitute for drilling. A ground geophysical (magnetic and perhaps induced polarisation) survey prior to drilling is recommended. The benefit of this would be to guide drill programme planning and may indeed save money by helping to predict the depth of drill hole intersection into the mineralisation. This may also help with determining which of the three anomalies to test first.

As an indication, potential collar locations for a next phase drill programme are provided in Figure 14-1 below.

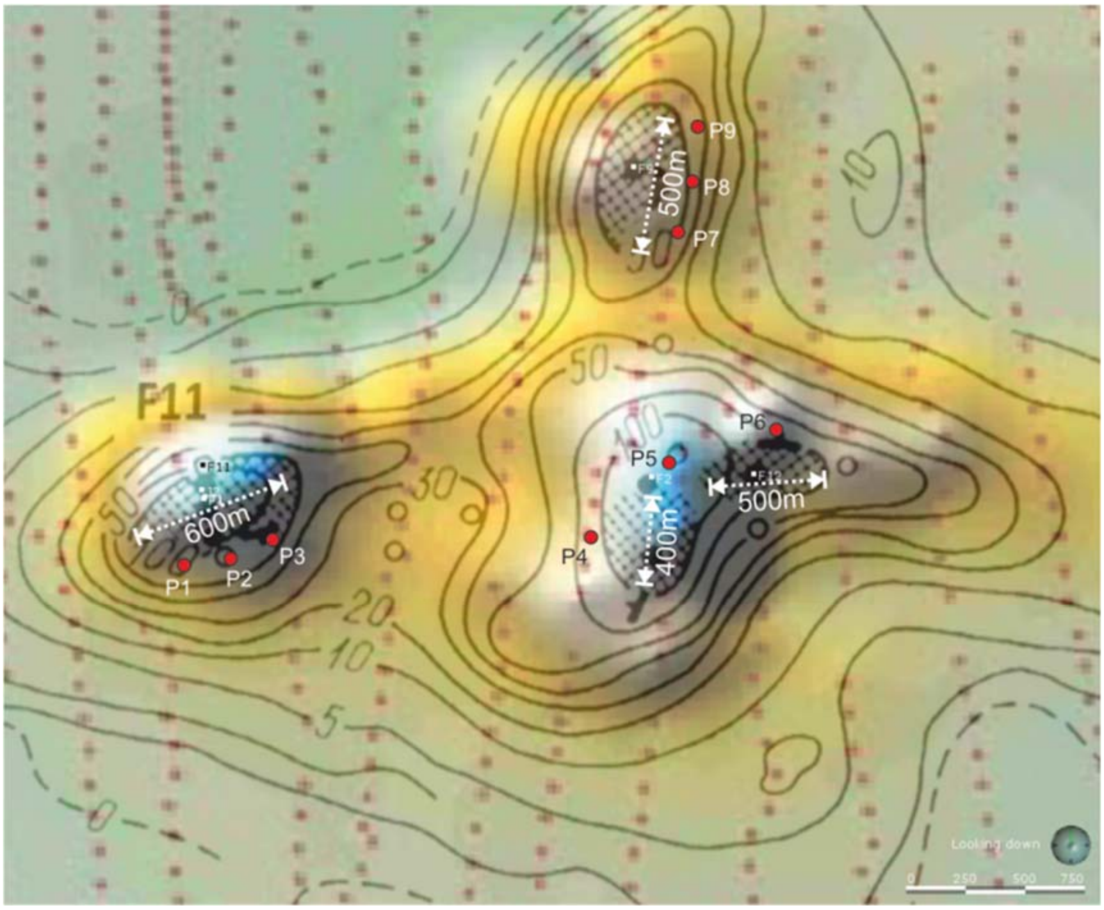
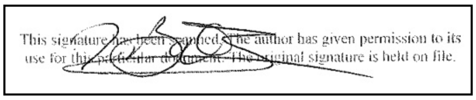


Figure 14-1: Suggested drill collar locations

SRK would be happy to discuss any aspect of the conclusions drawn in this review and to support the Ministry of Environment with planning of any follow-up drill programme, should this be of interest.

For and behalf of SRK Consulting (Sweden) AB



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