Final Exploration work report

BOLIDEN KUHMO OY

Final exploration work report Kuhmo – Arola ML2013:0003

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1. INTRODUCTION

This is a final exploration work report of nickel exploration on Arola exploration permit in town of Kuhmo at Vieksi and Tapanivaara villages (figure 1). The area of the permit is 51,57 hectares and it is located on UTM25 map sheet R5311.The permit has lapsed in July 2017. Table 1 is listing the holders of Arola tenement.

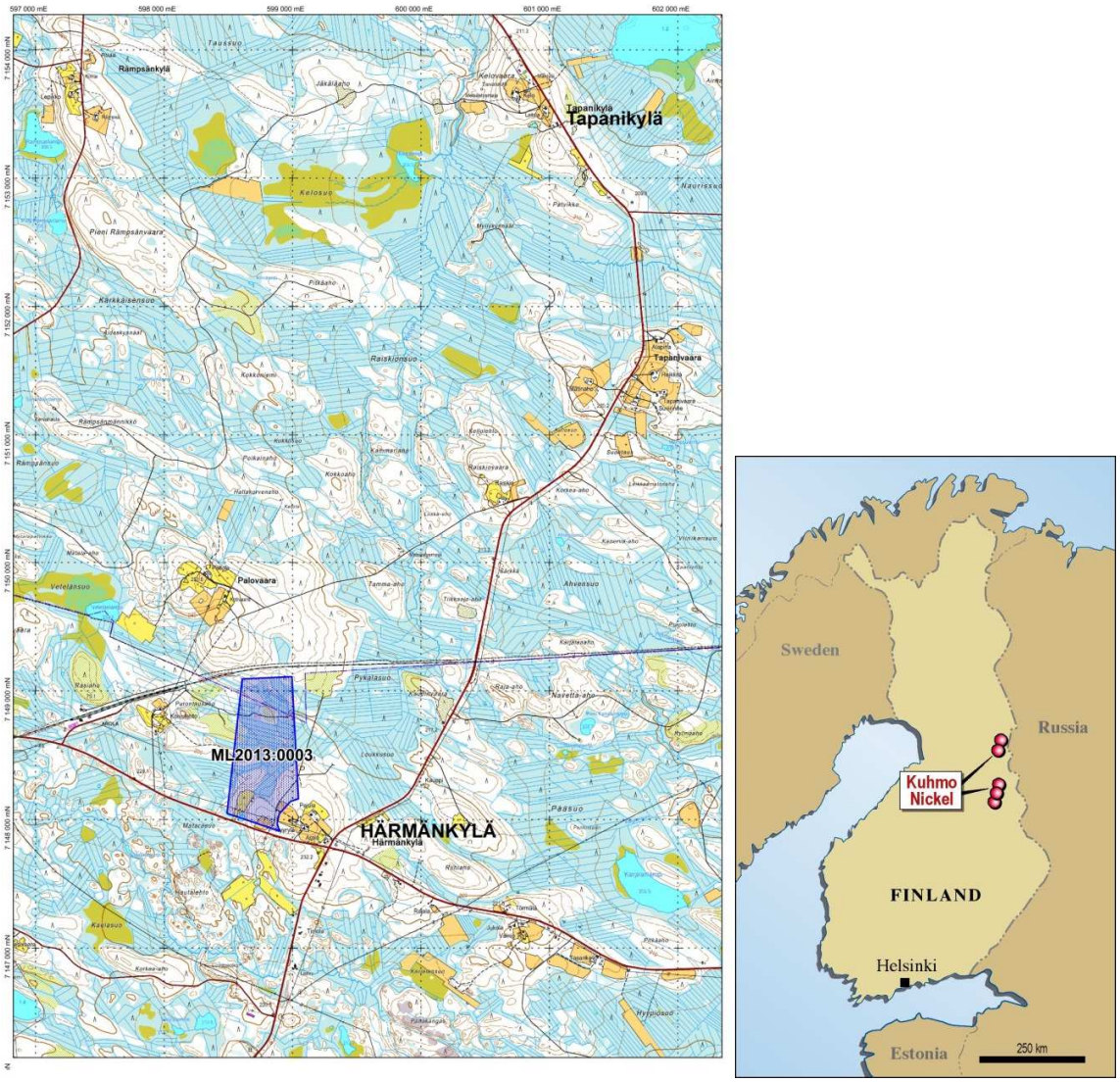

Fig 1. Location of the lapsed Arola exploration permit. Projection: ETRS-TM35FIN. Grid: 1000m x 1000m.

Table 1. Holders of Arola tenement.

Holder	Years
Suomen Malmi Oy	1962-1968
Malmikaivos Oy	1970-1989
Outokumpu Oy	1993-1997
Polar Mining Oy	2004-2005
Kuhmo Metals Oy	2005-2014
Boliden Kuhmo Oy	2014-2017

1.1 Transportation

Arola permit area is located to the north of Paltamo-Vartius road number 89. It is close to Härmänkylä village at the crossing of roads 89 and 904, between the road 89 in the south and railway in the north (figure 2). The biggest/closest towns are Kajaani about 70 km to the west, Hyrynsalmi about 45 km to the north west and Kuhmo about 50 km to the south. There are only few small forest roads and tracks at the permit area itself.

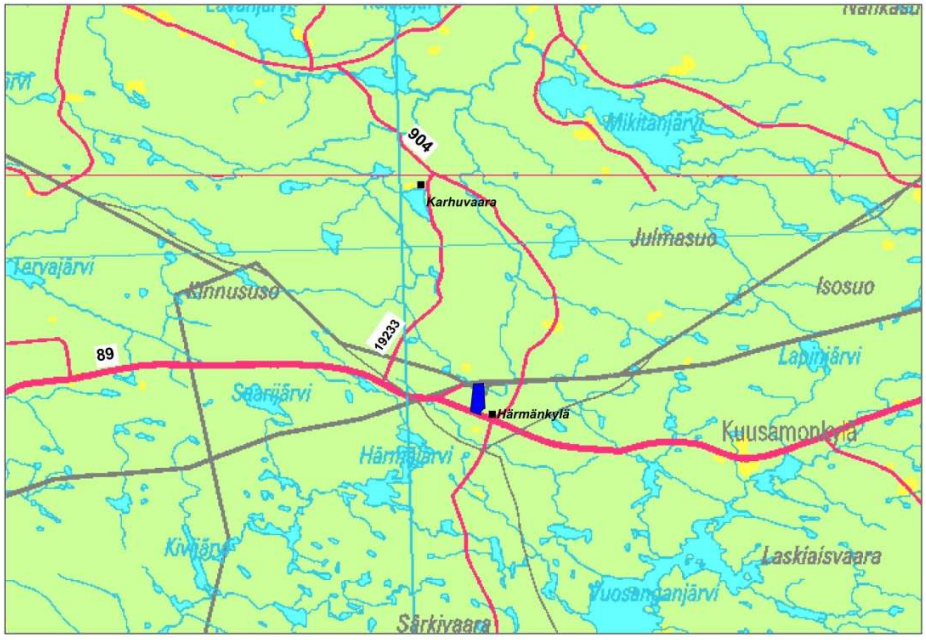

Fig 2. Access to the permit area.

1.2 Nature protection and landowners

Arola exploration permit is not located on Natura 2000 or other nature conservation area or at the close vicinity of any nature protection areas.

The closest nature protection area, Hyrynsalmi (FI1200002) Natura area is located about 3.5 kilometers to the north. The closest ground water area, Palokangas 3rd class reservoir, is located almost 5 kilometers to the southeast of the permit. Figure 3 shows the location of the nature protection areas and ground water areas closest to the permit.

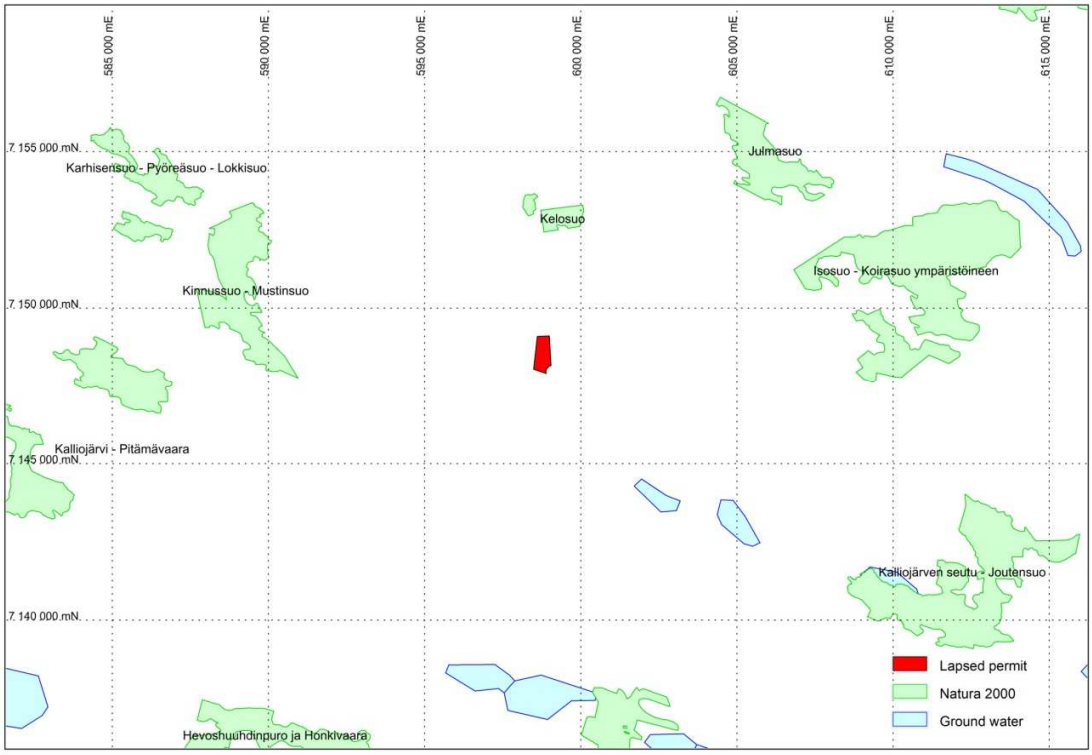

Fig 3. Lapsed permit and nature protection and groundwater areas. Projection: ETRS-TM35FIN. Grid: 5000m x 5000m.

About 14 hectares of the permit area belongs to Metsähallitus, governmental forestry institution and 9 hectares to UPM Kymmene, forestry industry company. The rest of the permit is divided between three estates that are owned by local private owners.

1.3 General geological description

The Arola prospect is located within a north-south trending greenstone belt dominated by mafic volcanic rocks and ultramafic units. The belt is less than two kilometres wide in this area; however it widens to five to eight kilometres in the north and south. The local geology comprises a sequence of amphibolite, schistose sedimentary rocks including graphitic schist, serpentinite and talc-carbonate altered ultramafic rocks. Bedding and schistosity are almost vertical and the stratigraphic bottom within the mineralised area is interpreted to be towards the east. The deposit is hosted by sheared and quartz-carbonate-chlorite altered Cr-basalt

units juxtaposed against metasedimentary rocks, including greywacke and phyllite, along the eastern contact (**Error! Reference source not found.**figure 4). These sediments are the source of the electromagnetic anomaly in the area that can be followed approximately one kilometre north and south from the deposit. Unaltered Cr-basalts, which are considered as part of the Archean komatiitic sequence are located on the western side of the mineralised chlorite schist. The deposit is interpreted as mobilised but the origin is probably komatiitic.

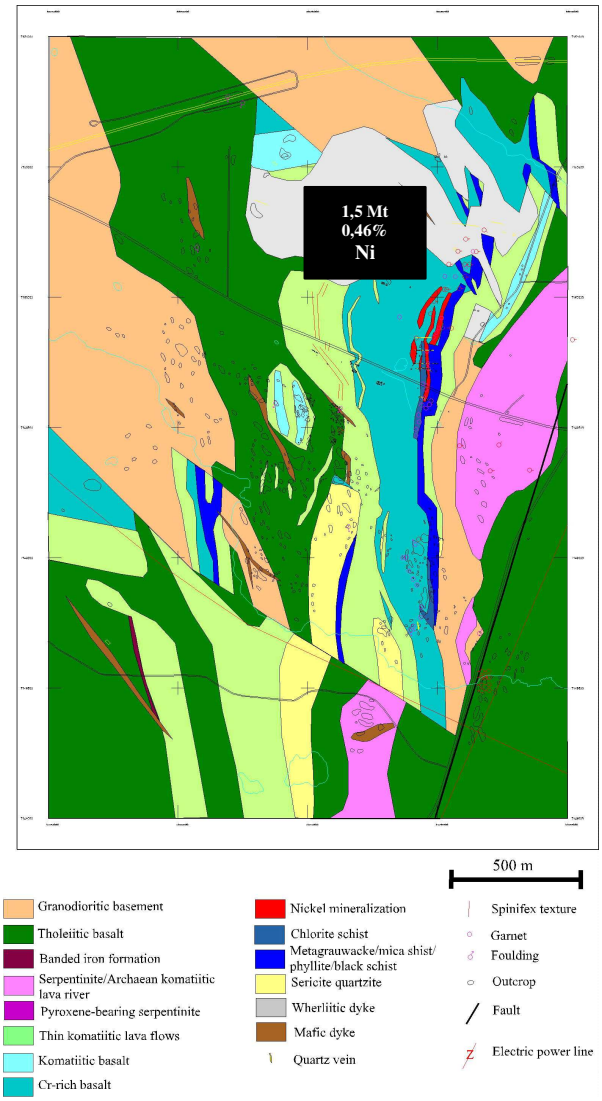

Fig 4: Geology of the Arola by GTK.

The Arola deposit can be divided into three distinct zones comprising discontinuous lenses over 400 metres of strike length and 400 metres below surface. Two of the zones are almost parallel to the orientation and shearing of the host rock and they are about 40 metres apart from each other. The third mineralised zone cross cuts the schistosity at an angle of approximately 35º. All mineralised zones are composed of several discontinuous lenses. The

more coherent lenses are interpreted to plunge approximately 40° to the north (SMOY, 1968, reference 15).

The main sulphide minerals are pyrrhotite, pyrite and pentlandite. Nickel content is commonly less than 1%; the highest grade assayed is 5.72% nickel. Copper grade is low, usually less than 0.1% and the highest value is 0.4% copper. The content of platinum group elements is very low, <0.04ppm. Nickel tenor varies quite a lot from 2% up to 25%, the average being 10-15%. Scatter plots on the Arola assays, indicative for the nature of the deposit, are presented in figure 5.

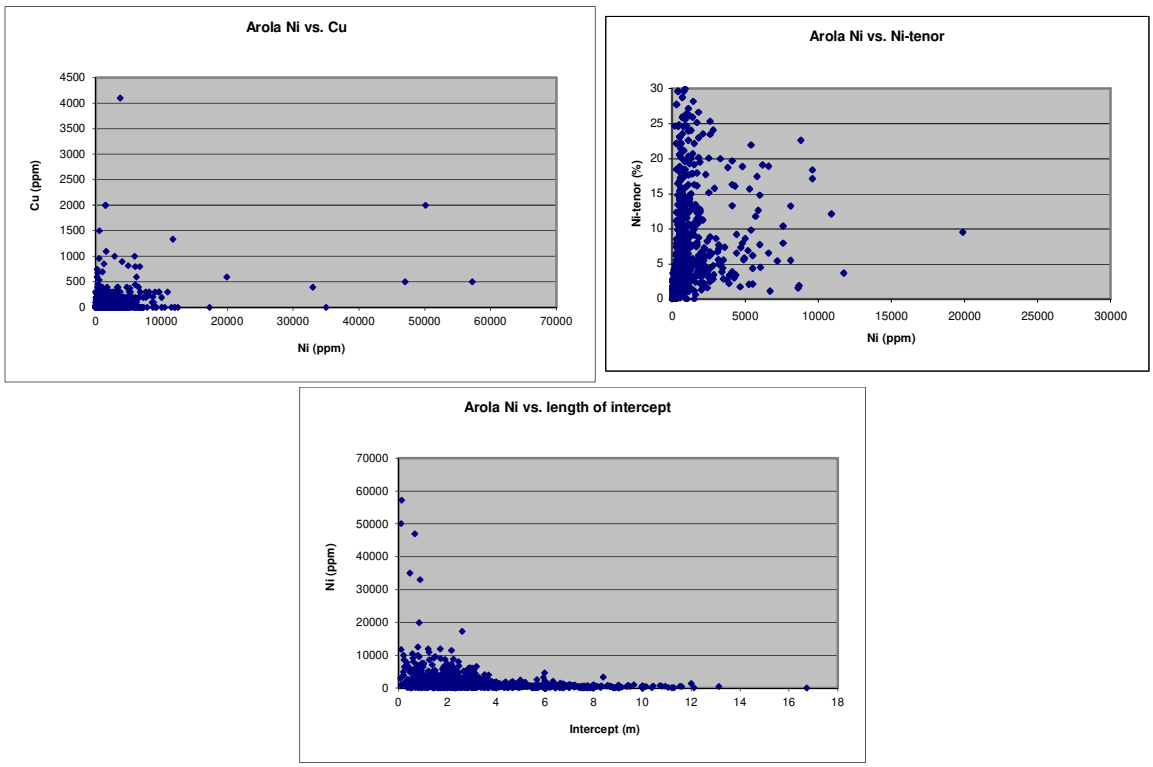

Figure 5: Scatter plots on the Arola assay data.

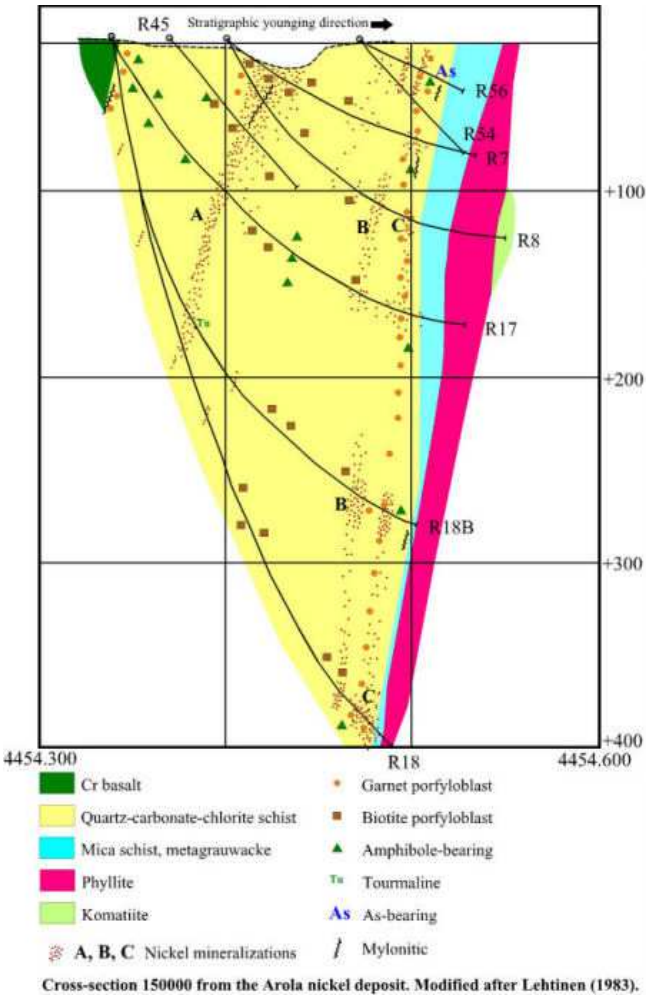

Figure 61: Cross-section 7150000 on the Arola nickel occurrence

2. EXPLORATION HISTORY

2.1 Previous exploration

Suomen Malmi OY initiated regional sampling in the Arola area during 1962 and recognised serpentinite in road cuts. A nickel-bearing glacial boulder sample was discovered and ground based magnetic and electrical geophysical surveying was initiated. The first hole drilled into a geophysical anomaly intersected schist containing up to 1% nickel. Between 1963 and 1968, additional geophysical surveys, geochemical sampling and drilling were completed over the Arola prospect area. A total of 70 diamond drill holes for 13,072 metres have been completed by SMOY and Malmikaivos in the 1960's and 1970's.

Outokumpu completed a polygonal resource estimate on vertical cross sections which quotes 1.5 million tonnes at 0.46% nickel.

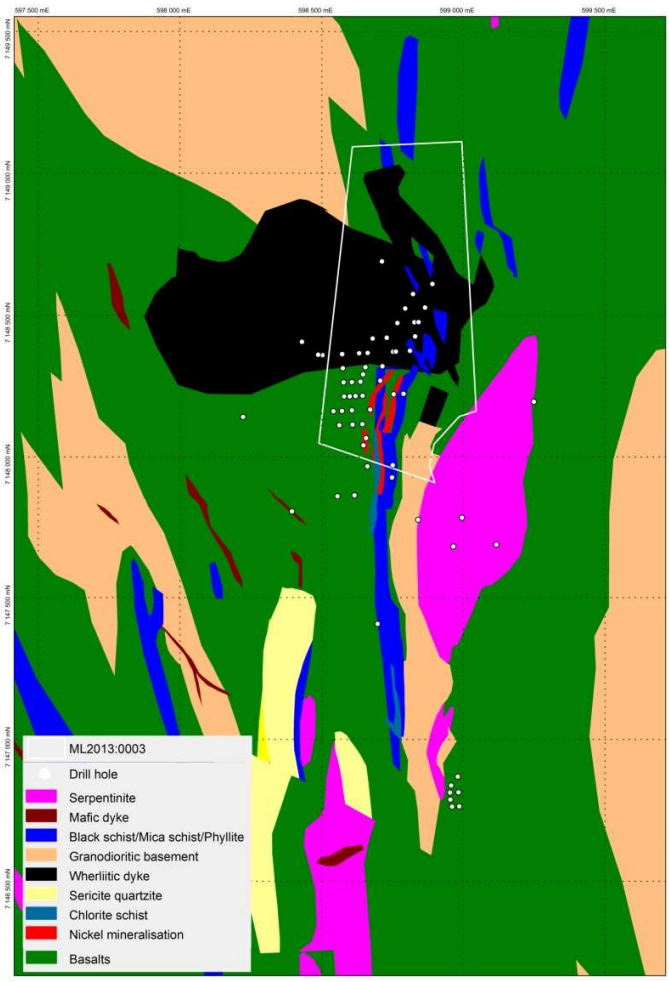

Fig 7. Geological map (after GTK) of the Arola area with drillhole locations (Loppi drillhole database and Kuhmo Metals Oy drilling). Lapsed permit is shown with white polygon. Projection: ETRS-TM35FIN. Grid: 500m x 500m.

2.2 Kuhmo Metals Oy and Boliden Kuhmo Oy exploration

Kuhmo Metals Oy, a Finnish subsidiary of Australian Altona Mining Ltd, was sold to Boliden in late 2014. The sell included all the tenement assets, exploration history and products of Kuhmo Metals and the staff. The company name was changed to Boliden Kuhmo Oy. The work completed by both companies are handled here as one.

Kuhmo Metals did explore the target mainly in 2006-2007. The work included diamond drilling and MMI (Mobile Metal Ion) –sampling. Arola was also part of a large scale VTEM airborne surveys conducted in 2008. Since the active phase the work has mainly included in-house 3D

modelling of the mineralisation and the key geological surfaces. Once the nickel prices raced down in 2008 the work on the project was decreased to minimum. Figure 8 is showing all the exploration activities completed by Kuhmo Metals.

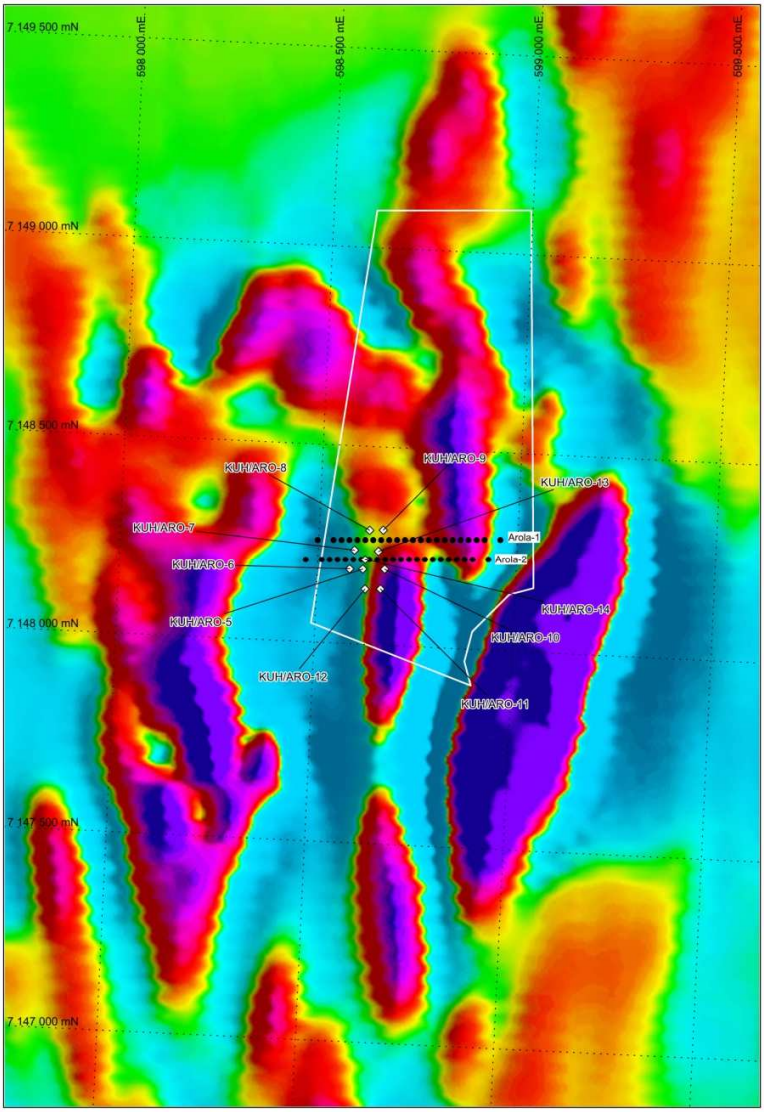

Fig 8. Arola permit area (white polygon), drilling (white diamonds) and MMI sampling points (black dots) on a magnetic image (1VD) after VTEM survey. Geochemical sampling line identification numbers are also shown. Projection: ETRS-TM35FIN. Grid: 500m x 500m.

2.2.1 Exploration results

Geophysics

Arola was part of large scale VTEM helicopter borne survey of the Kuhmo-Suomussalmi belt in 2008 (survey area 4 in the reports). The survey was contracted by Geotech Airborne Ltd. Interpretation of the results was conducted by Astrock Oy. VTEM survey was flown on 50 meter line spacing. No new high priority targets were identified around Arola. Detailed information and results are attached in appendix 3.

Geochemistry

Appendix 4 includes data related to geochemical sampling program.

MMI sampling

Two traverses were sampled in east – west direction to cover the known Arola deposit and metasedimentary rocks on the eastern side. A total of 45 samples were collected along these two lines in August 2007 using mainly 20 meter sample interval. Samples were sent to ALS Chemex laboratories to assay Au, Ce, Co, Cr, Cu, Ni, Pb, Pd ja Zn using MMI multi element package ME–MS17 (ICP-MS finish).

Figure 9 below is summarizing the grade distribution of the most important elements. Note that the graphs have been created from the raw assay data.

Nickel shows two distinctive anomalous areas. The strongest anomaly (600 - 2500ppb) is located just west from the known deposit and may be related to the sub-cropping deposit. The second anomalous area (300 - 600ppb) is related to the eastern contact of the metasedimentary unit.

Copper generally is coincident with anomalous nickel (300 - 800ppb) and also have a strong negative correlation with organic material.

Palladium shows the highest values (1.8 – 3.9ppb) west from the deposit and a moderate anomaly (1.1 – 1.4ppb) on top the deposit as well as on the eastern contact of the metasedimentary unit. Palladium anomalies are coincident with nickel.

Chromium shows the highest values (500 - 2400ppb) on the western contact of the deposit. The host rock is reported to be high-Cr basalt.

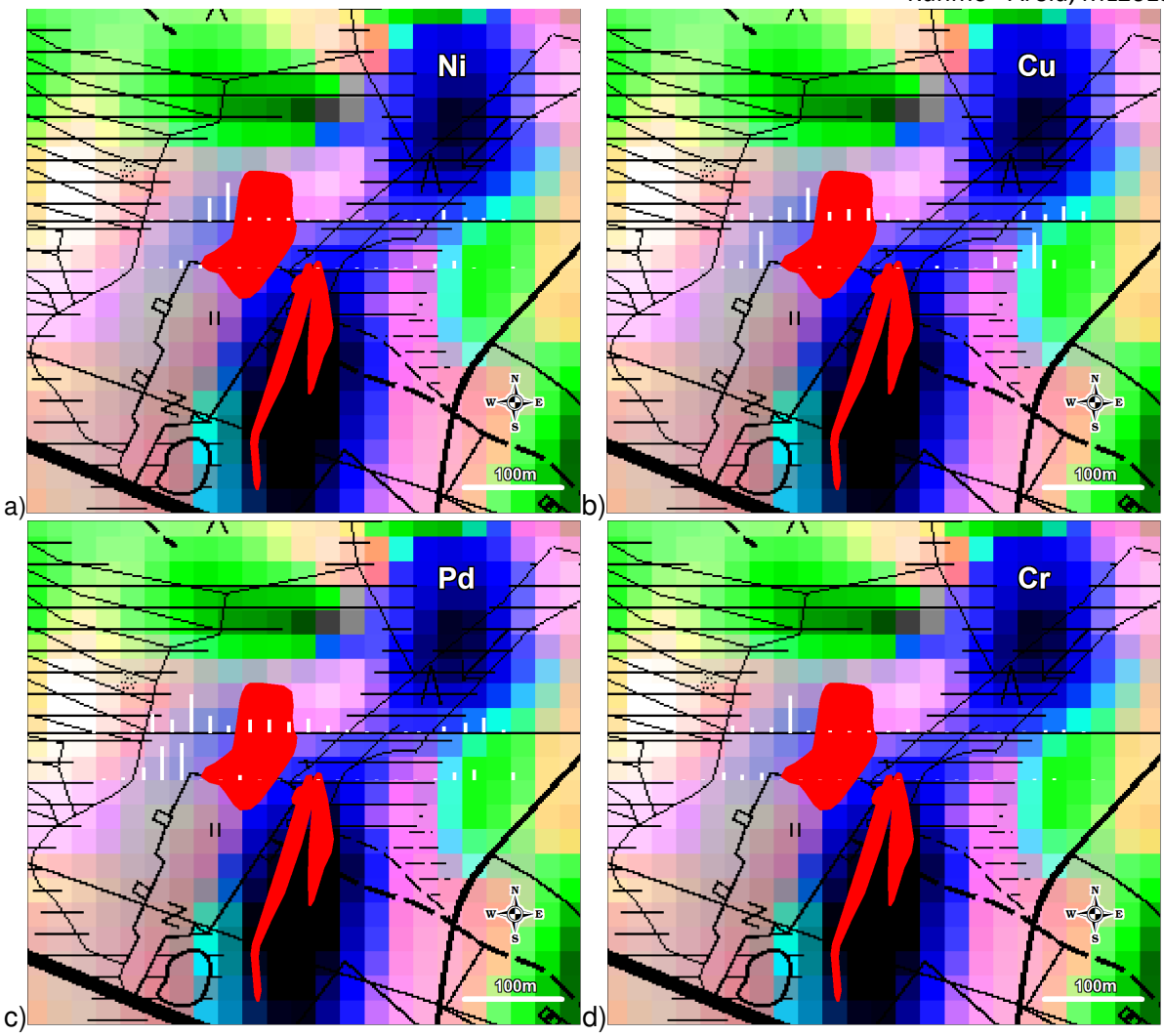

Fig 9. MMI results for nickel (a), copper (b), palladium (c) and chromium (d) at Arola on top of composite geophysical image. Magnetic anomalies are green and conductors are blue. Vertical projections of the mineralization lenses are shown in red.

Drilling

Kuhmo Metals completed a 10 hole diamond drilling programme totalling 1075 metres in 2007. The program was contracted by Geopale Oy. 731 samples were assayed in Labtium using aqua regia digestion and ICP-AES finish (Labtium method code +510P) for Ag, As, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, S, Sb, Zn. 104 samples were also sent for lead fire assaying with ICP-AES determination for Au, Pt and Pd (Labtium method code +703P or +704P). Every 10th sample has been either commercial standard/blank (in 3:1 ratio) or duplicate sample. Appendix 5 includes the collar, survey and geological information of the drill holes. Also assay results (without commercial standards and duplicates), drill hole sections and core photos are included.

The main targets of the programme were to in-fill SMOY`s historic drilling from 1960`s and 1970's, to increase understanding on geology and to obtain samples for possible metallurgical testing. All ten holes intersected nickel mineralisation. Mineralisation consists of banded pyrrhotite dominated sulphides with visible pentlandite and is hosted by quartz-sericite-chlorite-carbonate-amphibole mylonite. The style of mineralisation is generally similar to Sika-aho mineralisation but the amount of sulphides is lower. In addition it is often hard to define individual zones or lenses and the sulphides are much more widely spread within the 100m thick shear zone. Mineralised mylonite is bordered by metasedimentary rocks to the east.

Highlights of the results include:

- Longest intercept: KUH/ARO-12 : 18.05 metres at 0.46% nickel
- Highest grades: KUH/ARO-7 : 0.20 metres at 2.90% nickel

In addition one hole (KUH/ARO-4) was drilled in 2006 by Kuhmo Metals to test coincident high copper and moderate nickel geochemical anomaly approximately 500 metres south from the Arola nickel occurrence along the conductive geophysical anomaly. 19 samples were assayed in Genalysis laboratories in Perth, Australia. Fire assay with MS was used to assay Au, Pd and Pt for one sample. Co, Cu, Fe, Ni, S and Zn were assayed for all the samples using four acid digestion and ICP-OES finish (Genalysis method AT/OES). Assays did not return any significant nickel or copper values (0 – 1000ppm). Only very minor and thin chalcopyrite+pyrrhotite+pyrite sulphide veins/stringers were intersected but the amount of sulphides seems to be too low to explain the till geochemical anomaly. Drilling information is attached in Appendix 5.

Table 2. Drill hole collar information in Finnish KKJ4 projection of Kuhmo Metals oy drilling.

Hole	Easting	Northing	Elevation	Azimuth	Dip	Length (m)
KUH/ARO-4	4454428.4	7149297.1	221.6	90	-45	65.7
KUH/ARO-5	4454373.8	7149924.9	222.7	90	-49.9	167.8
KUH/ARO-6	4454340.6	7149925.6	225.2	90	-49.5	98.7
KUH/ARO-7	4454353.0	7149974.8	226.0	90	-58.6	127.9
KUH/ARO-8	4454390.9	7150024.6	227.8	90	-54.2	119.7
KUH/ARO-9	4454425.4	7150025.1	226.7	90	-54.7	82.8
KUH/ARO-10	4454428.5	7149924.6	222.8	90	-44.8	104.8
KUH/ARO-11	4454418.2	7149874.8	222.4	90	-44.2	94.6
KUH/ARO-12	4454379.1	7149874.7	222.2	90	-44.3	147.7
KUH/ARO-13	4454412.9	7149971.4	223.5	90	-49.6	58
KUH/ARO-14	4454379.7	7149949.6	223.4	90	-64.7	73
Total						**1141**

3. MINERAL RESOURCES

New mineral resource calculations haven't been conducted by Boliden.

4. FOLLOW-UP

Boliden Kuhmo has decided to relinquish the permit on expiry.