Sirkka

Occurence type: deposit

Commodity	Rank	Total measure	Total production	Total resource	Importance
gold	1	0,21 t	0,01 t	0,2 t	Occurrence
nickel	2	885,04 t	85,04 t	800 t	Occurrence
cobalt	2	265,2 t	15,2 t	250 t	Small deposit
copper	2	997,52 t	47,52 t	950 t	Occurrence
silver	3	NA	NA	NA	NA

Easting EUREF: 404456,019
Northing EUREF: 7523917,382
Easting YKJ: 3404590
Northing YKJ: 7527061

Discovery year: 1939
Discovered by: Atri Oy
Province: Kittilä (Au, Cu)
District: Sirkka (Cu, Au, Ni, Co)
Comments: Discovery of an auriferous boulder at the mouth of the River Levijoki, west of the village of Sirkka, in 1939 led the prospectors to the mineralised area.
References: 6, 12, 18, 19

Mineral deposit type

Group: Metallogenic deposit
Main type: Orogenic (metamorphic hydrothermal)
Sub type 1: Au-Co-Cu
Comments: Clearly epigenetic, "mesothermal" mineralisation with a distinct structural control. Although, the reference is written to support a late-magmatic model.
References: 8, 9, 11, 18

Dimension

Expression: exposed
Form: discordant
Shape: irregular
Length (m): 1500
Width (m): 150
Thickness (m): NA
Depth (m): NA
Area (ha): NA
Dip azim: 180
Dip: 85
Plunge azim: NA
Plunge dip: NA
Orientation method: NA
Dimension comments: Six gold-bearing lodes along the the Sirkka Line shear zone: 40-200 m long, 1-6 m wide, apparently subvertical, all open at depth of 30–60 m.

Holder history

Previous holders:

Company	Years	Holding type	Comments
Magnus Minerals Oy	2019	Application for exploration permit	NA

Sakumpu Exploration Oy	2014	Reservation	NA
Magnus Minerals Oy	2011-2012	Claim reservation (old law)	NA
Northern Lion Gold Corporation	2005-2010	Claim (old law)	NA
Lappland Goldminers Oy	2005-2010	Claim (old law)	NA
Oy SES Finland Ltd	1997	NA	NA
Outokumpu Oy	1966-1978	NA	NA
Vuoksenniska Oy	1953-1966	NA	NA
Atri Oy	1939-1953	NA	NA

EXPLORATION ACTIVITY

Oy SES Finland Ltd

Years	Activity type	Geologist	Exploration result	Ref
1997-1997	core drilling	Alf Björklund	NA	
	A few RC-drill holes.			

1997-1997	excavation	Alf Björklund	NA	1
	Trenching and channel sampling			

Geological Survey of Finland

Years	Activity type	Geologist	Exploration result	Ref
1979-1979	regional geophysics	NA	key geological features	
	Low-altitude airborne magnetic, electromagnetic and radiometric survey			

Outokumpu Oy

Years	Activity type	Geologist	Exploration result	Ref
1967-1967	core drilling	Pauli Isokangas	NA	8, 9
	Four diamond-drill holes, total 572 m.			

1966-1978	detailed geochemistry	Pauli Isokangas	NA	5, 8, 9, 11, 13, 14, 18

1966-1978	detailed geology	Pauli Isokangas	NA	5, 8, 9, 11, 13, 14, 18

Vuoksenniska Oy

Years	Activity type	Geologist	Exploration result	Ref
1955-1956	core drilling	NA	NA	11
	About 70 diamond-drill holes.			

1955-1956	mining pilot	NA	NA	8, 11, 17, 18

1953-1966	detailed geophysics	NA	NA	8, 11, 17, 18

Atri Oy

Years	Activity type	Geologist	Exploration result	Ref
1939-1953	core drilling	Birger Ohlsson	NA	8, 10, 13

	About 110 diamond-drill holes.	
	Intersections	
	HoleID	N:o 54
	From-To	NA
	Length	1,4m
	silver	203ppm
	HoleID	N:o 55
	From-To	NA
	Length	3m
	copper	3,9%
	HoleID	N:o 55
	From-To	NA
	Length	1m
	gold	30ppm
	Comments	*Monttu 5 vein*
	HoleID	NA
	From-To	NA
	Length	2m
	nickel	5,17%
	Comments	*Kuukeri vein*
	HoleID	NA
	From-To	NA
	Length	1,3m
	cobalt	1,82ppm
	Comments	*Kuukeri vein*
	HoleID	NA
	From-To	NA
	Length	0,5m
	gold	8,3ppm
	copper	1,95%
	Comments	*Kuukeri vein*

1939-1953	detailed geology	Birger Ohlsson	NA	8, 9, 11, 18
	Auriferous boulders in adjacent lake shores led the prospectors to the mineralised area.			

1939-1953	excavation	Birger Ohlsson	NA	8, 9, 11, 18

1939-1953	detailed geophysics	Birger Ohlsson	NA	8, 9, 11, 18
	ground magnetic and electromagnetic survey			

Figures

An exploration trench which was excavated in 1997:

An exploration trench at Sirkka kaivos, excavated during 1997.
Photo Pasi Eilu, 19/8/1998.

RESOURCES AND RESERVES

Most recent

Type:	Company:	Year:	Date:	Calc Method:	Reference:
Resource	Vuoksenniska Oy	1956	NA	Non-compliant resource estimate	3
	Category:	**Poorly estimated mineral resource, poorly documented**			
	Tonnage:	**0,25 Mt**			
	gold	0,8 ppm			
	nickel	0,32 %			
	copper	0,38 %			
	cobalt	0,1 %			
	Cutoff:	**NA**			

MINING

Sirkka

Alternative Names: Sirkka Kuukeri
Easting EUREF: 404456,019
Northing EUREF: 7523917,382
Status: Closed
Operating years: 1953-1956
Years in production: 3
Total ore mined: 5375 t
References: 16

Total production:

Product	Product measure
copper	47,52 t
nickel	85,04 t
gold	9,51 kg
cobalt	15,2 t

Other materials:

Material type	Material measure
Waste rock	5500 t

Mining activity:

Year	Ore mined	Ore processed	Activity type	Production	Other material
1956	2375 t	2375 t	underground mining		
				gold 2,38 kg cobalt 3,8 t copper 11,88 t nickel 21,26 t	Waste rock 1375 t
1955	2375 t	2375 t	underground mining		
				copper 11,88 t nickel 21,26 t cobalt 3,8 t gold 2,37 kg	Waste rock 1375 t
1954	2375 t	2375 t	underground mining		
				gold 2,38 kg cobalt 3,8 t copper 11,88 t nickel 21,26 t	Waste rock 1375 t
1953	2375 t	2375 t	underground mining		
				gold 2,38 kg cobalt 3,8 t copper 11,88 t nickel 21,26 t	Waste rock 1375 t

Figures

Local geology:

Sirkka kaivos, Kittilä. The area of the "old mine" which has been a local focus of exploration intermittently since 1939. The 2-4 m high heaps of crushed rock are from the 1950's. Photo Pasi Eilu 19/8/1998.

GEOLOGY

Host rock: Basalt, Sulphide facies banded ironstones, Mafic tuff, Graphite Phyllite, Komatiite
Wall rock: Quartzite

Basalt (Host rock)

Rock type: Host rock
Proportion: major
Grain size: NA
Color: NA
References: 5, 7, 8, 10, 11, 13, 18
Comments: The deposit is in a E-W trending sequence of mafic metavolcanic rocks, metatuffites, metakomatiites, graphitic phyllites and sulphide-facies iron formation.

Ore minerals:

Mineral	Proportion	Mineral texture
Argentopentlandite	minor	
Arsenopyrite	minor	
Chalcopyrite	major	
Cobaltite	minor	
Gersdorffite	minor	
Gold	minor	
	Dominantly native gold which chiefly occurs associated with gersdorffite and arsenopyrite (mostly as inclusions).	
Greigite	minor	
Ilmenite	minor	
Mackinawite	minor	
Pentlandite	minor	
Pyrite	major	
Pyrrhotite	major	
Rutile	minor	
Sphalerite	minor	
Violarite	minor	

Other minerals:

Mineral	Proportion	Mineral texture
Ankerite	present	
Quartz	present	
Siderite	present	
Tourmaline	present	

Structures
Fractured

Textures
Massive
Granoblastic

Alteration:	Distribution:	Degree:	Relation to mineralization:
albitic alteration	NA	NA	Pre

Comments: Albitisation and part of carbonation may have preceded gold mineralisation, taken place before regional deformation, as a synvolcanic, spilitic stage of alteration.			
sericitic alteration	NA	NA	Syn
sulphidation	NA	NA	Syn
carbonate alteration	NA	Strong	Syn

Metamorphic description:

Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)
Regional	amphibolite metamorphic facies	medium metamorphic grade	NA		
Comments: Metamorphic peak during D2, thrusting during D3 was at least partly post-peak, late metamorphic; Albite-actinolite-epidote-titanite ± chlorite.					

Sulphide facies banded ironstones (Host rock)

Rock type: Host rock
Proportion: minor
Grain size: NA
Color: NA
References: 2, 4, 7, 8, 11, 13, 18

Textures
Banded

Metamorphic description:

Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)
Regional	amphibolite metamorphic facies	medium metamorphic grade	NA		
Comments: Metamorphic peak during D2, thrusting during D3 was at least partly post-peak, late metamorphic.					

Mafic tuff (Host rock)

Rock type: Host rock
Proportion: major
Grain size: NA
Color: NA
References: 2, 7, 8, 10, 11, 13, 18
Comments: Quartz-carbonate, chalcopyrite-pyrrhotite-quartz ± albite and carbonate, arsenopyrite-carbonate, arsenopyrite-pyrrhotite, gersdorffite-carbonate, and chalcopyrite-pyrite-quartz-carbonate veins which are, on average 10-20 cm wide

Metamorphic description:

Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)
Regional	amphibolite metamorphic facies	medium metamorphic grade	NA		
Comments: Metamorphic peak during D2, thrusting during D3 was at least partly post-peak, late metamorphic; Quartz-albite-chlorite-actinolite-ilmenite or titanite ± sericite, biotite, epidote.					

Graphite Phyllite (Host rock)

Rock type: Host rock
Proportion: minor
Grain size: NA
Color: NA
References: 2, 5, 7, 8, 9, 11, 13, 18

Metamorphic description:
Ore minerals:

Mineral	Proportion	Mineral texture
Graphite	minor	

Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)
Regional	amphibolite metamorphic facies	medium metamorphic grade	NA		
Comments: Metamorphic peak during D2, thrusting during D3 was at least partly post-peak, late metamorphic.					

Komatiite (Host rock)

Rock type: Host rock
Proportion: minor
Grain size: NA
Color: NA
References: 2, 7, 8, 9, 11, 13, 18

Metamorphic description:

Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)
Regional	amphibolite metamorphic facies	medium metamorphic grade	NA		
Comments: Metamorphic peak during D2, thrusting during D3 was at least partly post-peak, late metamorphic; Talc-chlorite-magnesite.					

Quartzite (Wall rock)

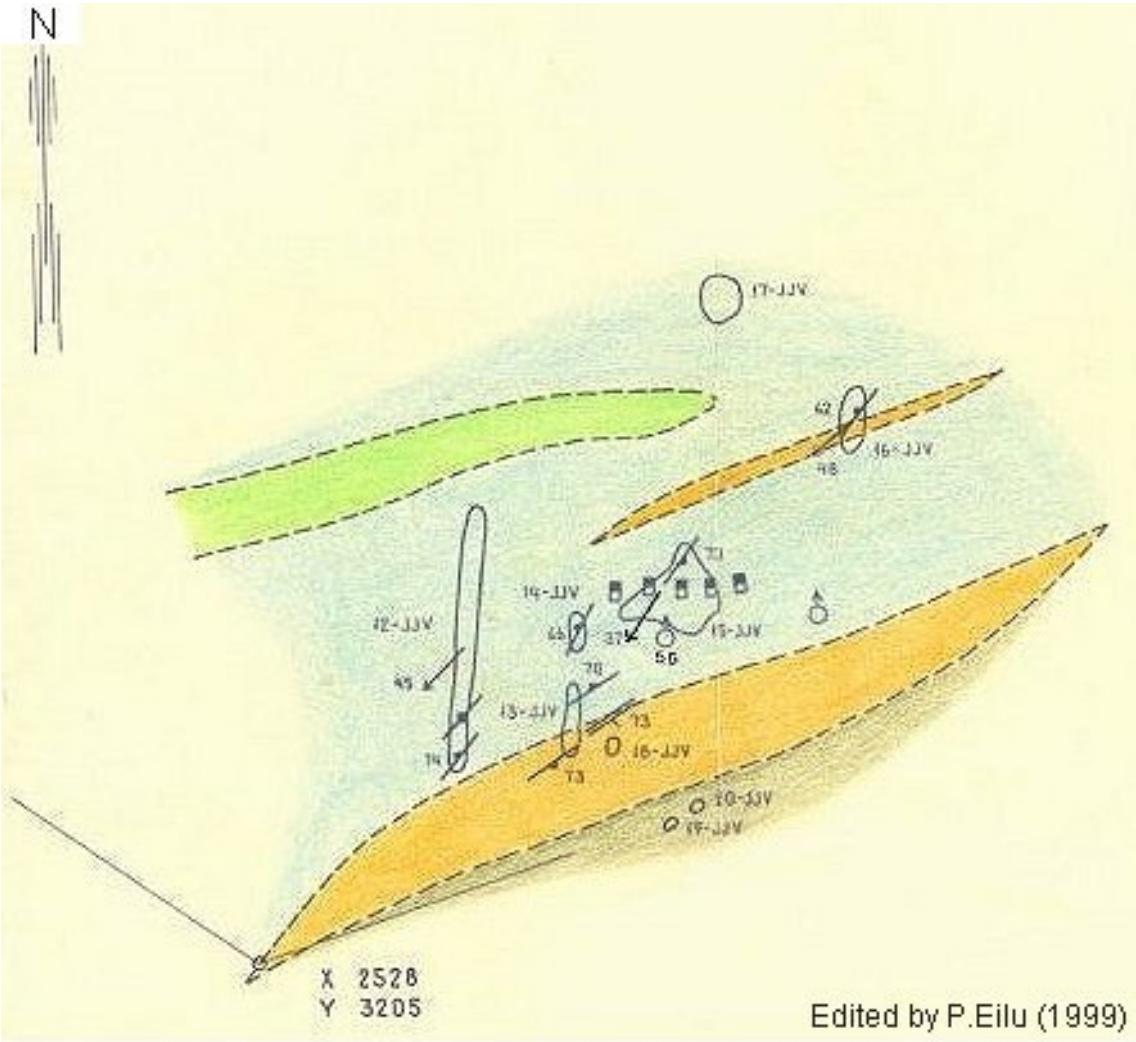
Rock type: Wall rock
Proportion: minor
Grain size: NA
Color: NA
References: 7, 8, 10, 11, 13, 15, 18

Metamorphic description:

Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)
Regional	amphibolite metamorphic facies	medium metamorphic grade	NA		
Comments: Metamorphic peak during D2, thrusting during D3 was at least partly post-peak, late metamorphic; Albite-quartz-sericite-chlorite-biotite ± graphite, pyrrhotite.					

Figures

Local geology:

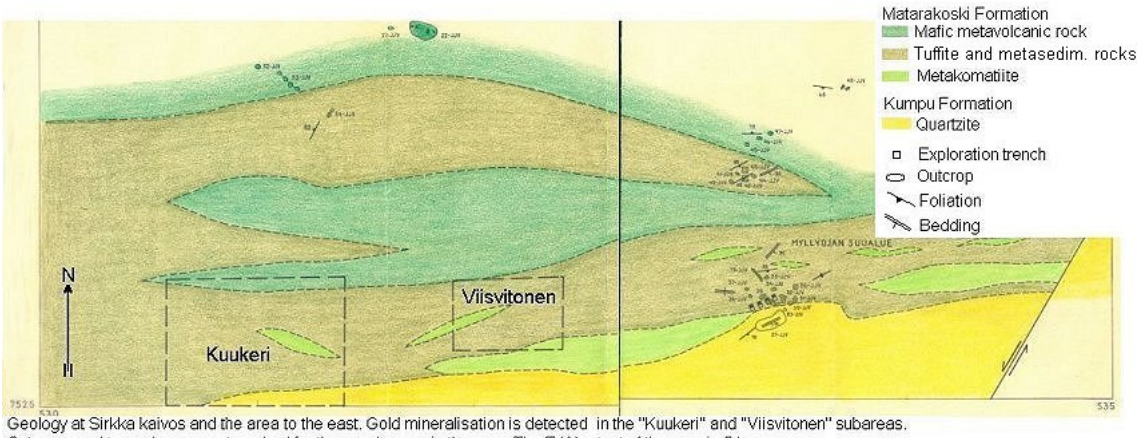


Matarakoski Formation
- Mafic tuffite
- Metakomatiite
- Biotite-chlorite rock
- Intensely carbonated rock
- Albitised dolerite

Outcrop
Foliation
Bedding
Lineation

Geology of the Viisvitonen subarea, Sirkka kaivos.
Field of view approx. 500 m. From Vesanto (1978).

Regional geology:

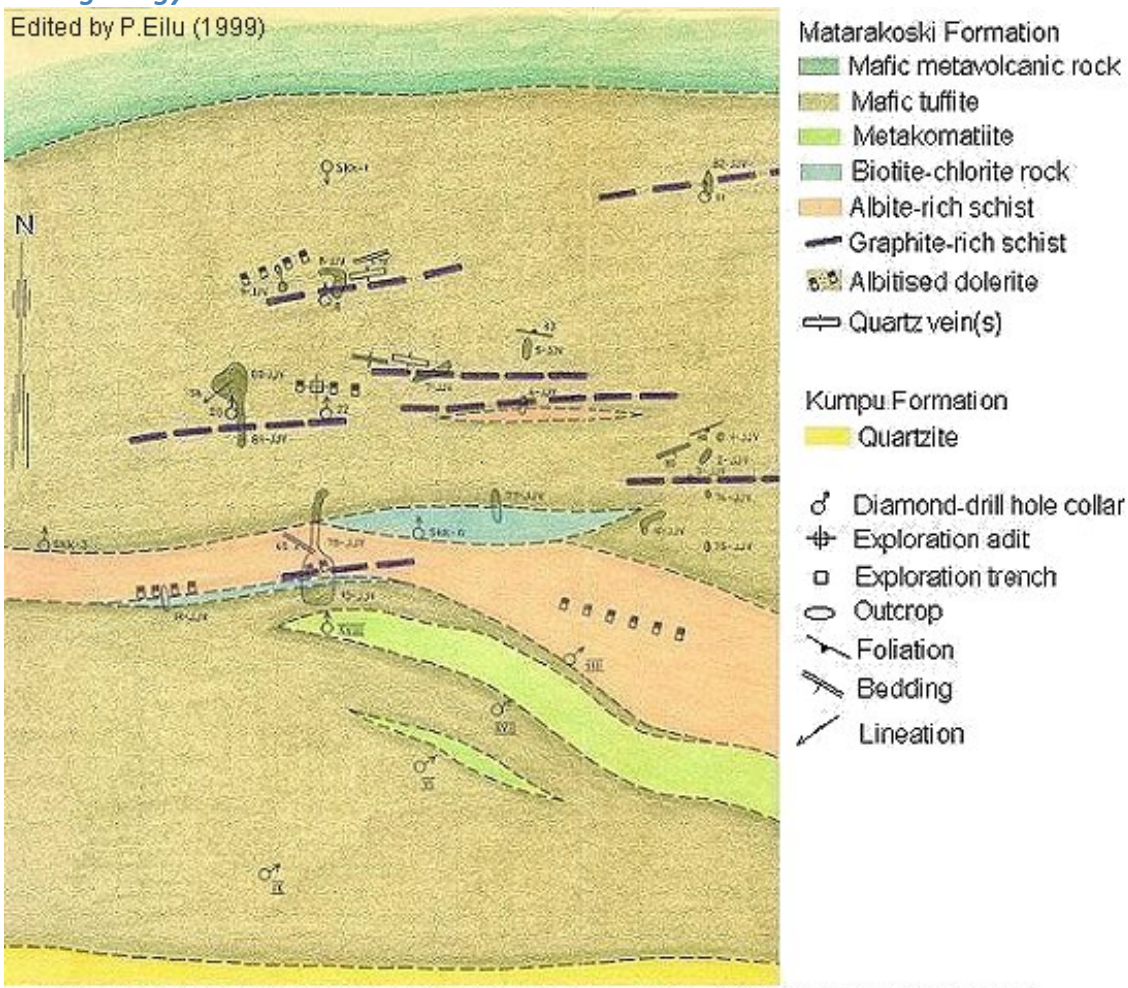


Geology at Sirkka kaivos and the area to the east. Gold mineralisation is detected in the "Kuukeri" and "Viisvitonen" subareas. Outcrops and trencehes are not marked for these subareas in the map. The E-W extent of the map is 5 km.
From Vesanto (1978), formation names from Lehtonen et al. (1998). Edited by P.Eilu (1999)

Structure:

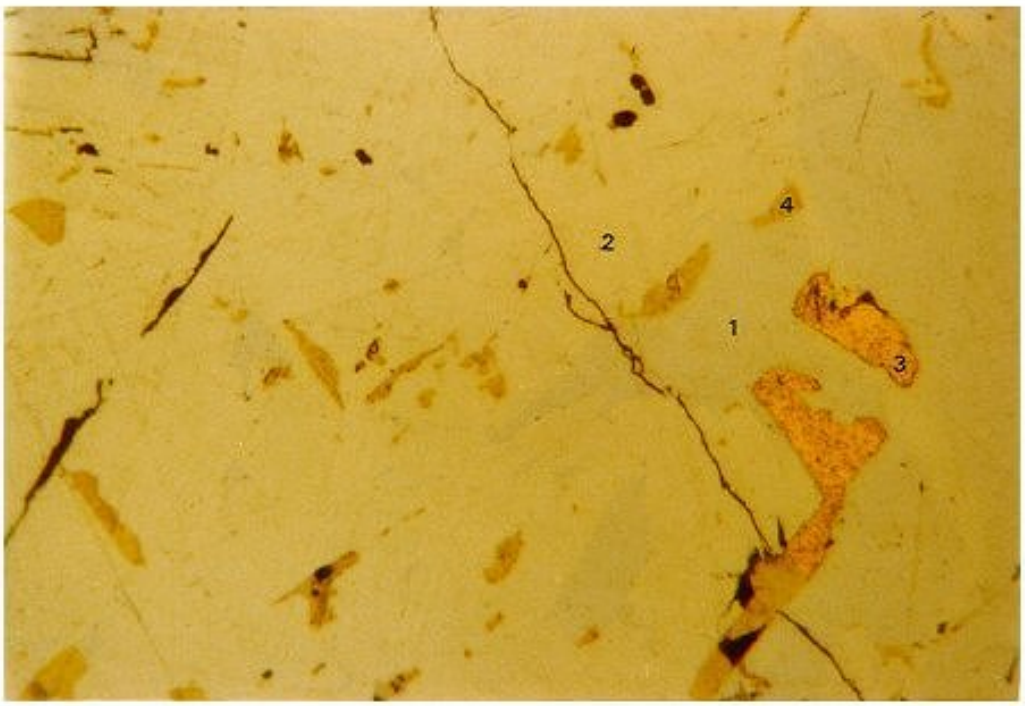
Sirkka, Kittilä. Partially sericitised(?) tuffite or phyllite. Mineral assemblage probably quartz - albite - sericite - chlorite ± graphite, pyrrhotite, rutile. Field of view 13 cm. Photo Jari Väätäinen.

Local geology:



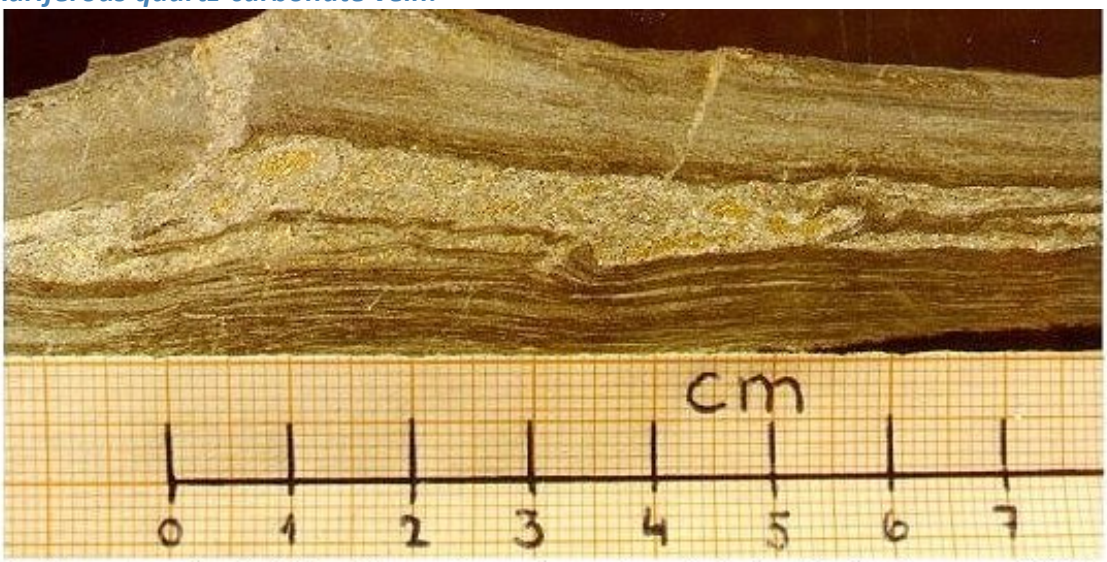
The Kuukeri subarea of the Sirkka kaivos. The E-W extent of the map is approx. 1 km. Chiefly from Vesanto (1978); names of the formations are from Lehtonen et al. (1998).

Gold and chalcopyrite as inclusions in gersdorffite:



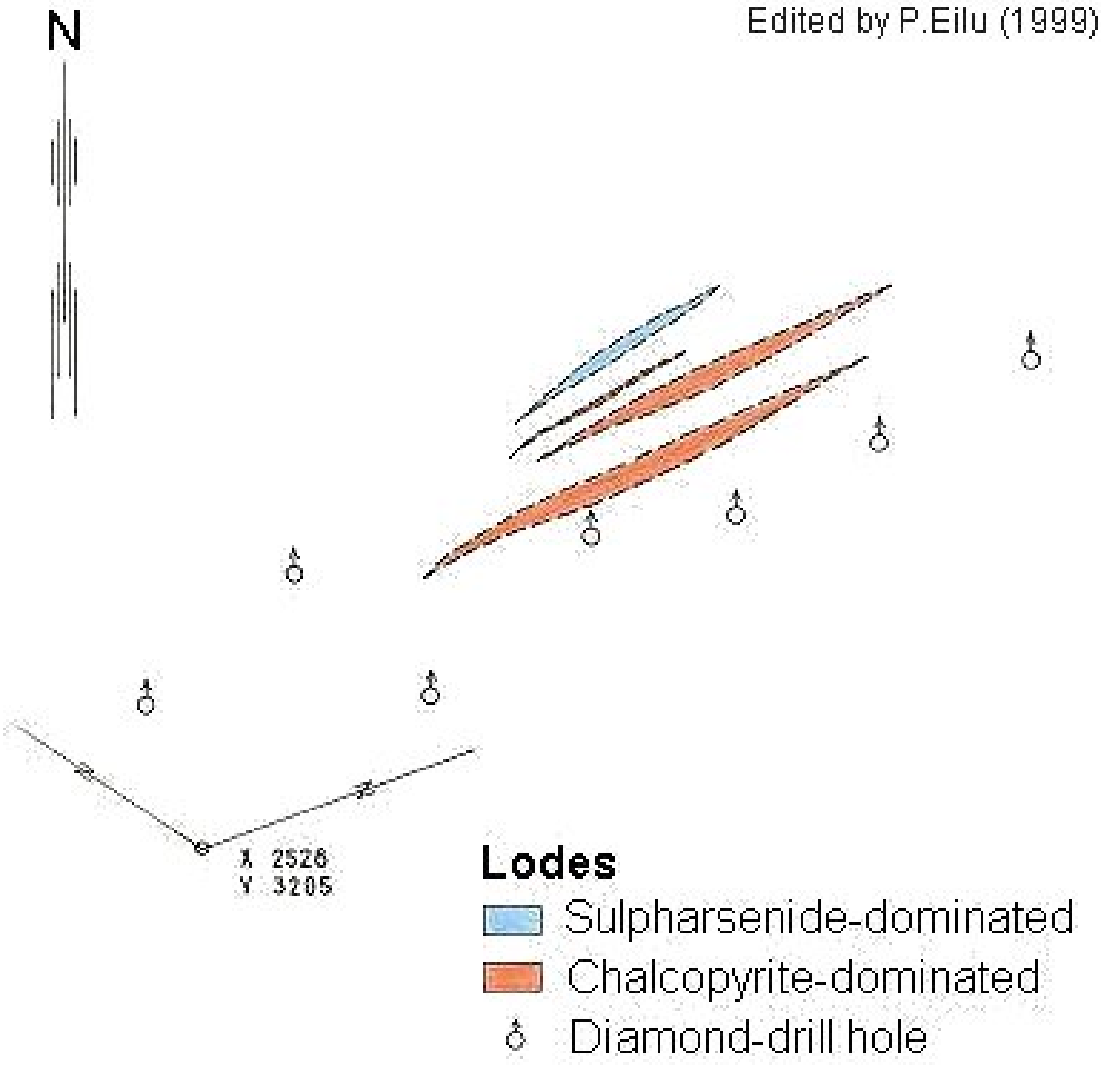
Gold and chalcopyrite as inclusions in gersdorffite in the Kuukeri area at Sirkka kaivos. 1: "pure" gersdorffite, 2: Fe- and Co-rich gersdorffite, 3: native gold, 4: chalcopyrite. Field of view 0.45 mm. From Vesanto (1978).

Auriferous quartz-carbonate vein:



Auriferous and sulphide-rich quartz-carbonate vein in the Kuukeri area at Sirkka kaivos. From Vesanto (1978).

Lodes in the Viisvitonen subarea:

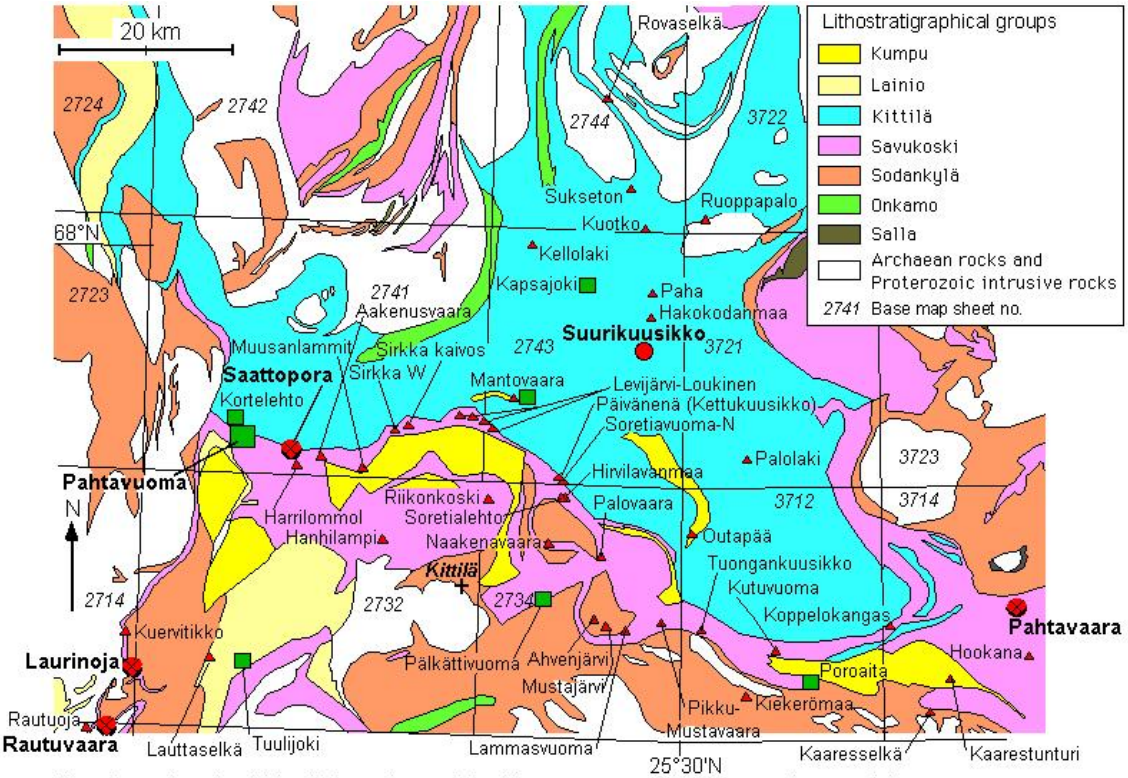


Lodes in the Viisvitonen subarea, Sirkka kaivos.
Field of view approx. 500 m. From Vesanto (1978).

Ore outcrop:

Graphitic mica schist (tuffite) brecciated by gold-related carbonate-quartz veins in the Kuukeri area at Sirkka kaivos. Field of view approx. 65 cm. From Vesanto (1978).

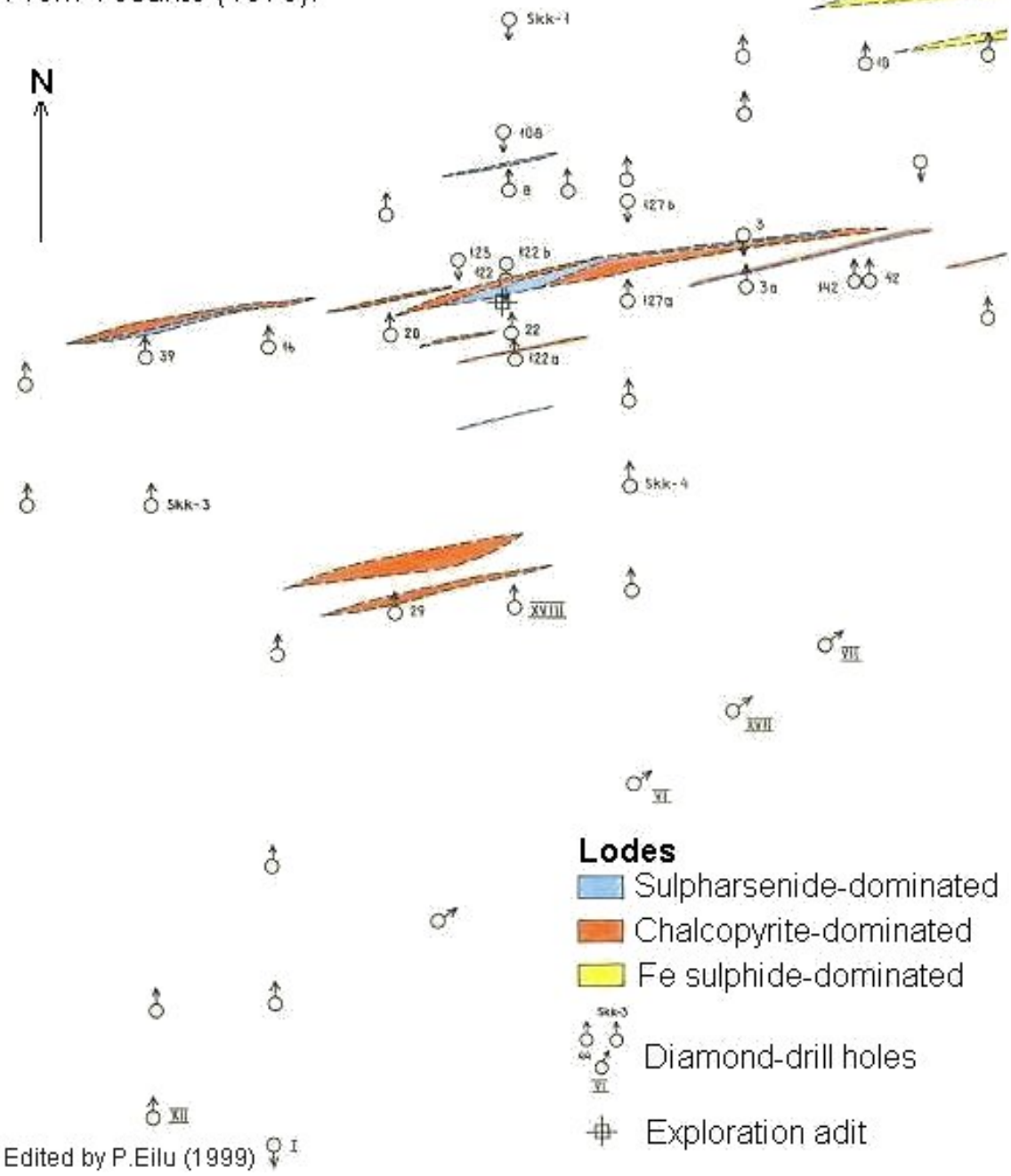
Regional geology:



Zinc (green) and gold (red) deposits and significant prospects in the central parts of the Central Lapland greenstone belt. Lithostratigraphy from Lehtonen et al. (1998). Edited by P. Eilu (2007)

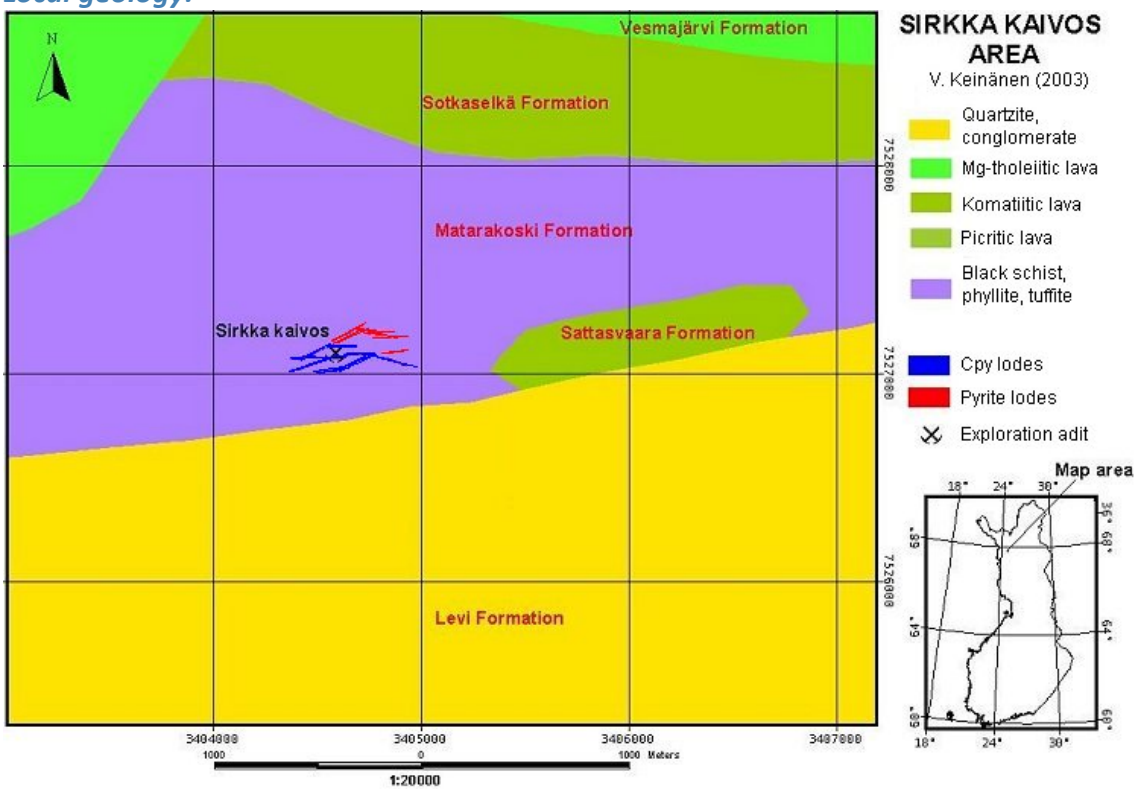
Lodes and drilling in the Kuukeri subarea:

Lodes and drilling in the Kuukeri subarea, Sirkka kaivos.
From Vesanto (1978).



Edited by P.Eilu (1999)

Local geology:



REFERENCES

1. Björklund, A. 1998. Personal communication 07/08/1998.

2. Eilu, P., Pankka, H., Keinänen, V., Kortelainen, V., Niiranen, T. & Pulkkinen, E. 2007. Characteristics of gold mineralization in the greenstone belts of northern Finland. Geological Survey of Finland, Special Paper 44, 57-106.*http://tupa.gtk.fi/julkaisu/specialpaper/sp_044_pages_057_106.pdf*

3. GTK Ore Deposit Data Base 1997.

4. Holma, M.J., Törmänen, T. and Gehör, S. 2006. Characteristics of the sulfide-facies iron formation near the Sirkka kaivos gold occurrence, northern Finland. Geol. Soc. Finland, Bull. Spec Issue 1, p. 51.

5. Hänninen, E. 1977. Kittilän Sirkan malmityypeistä. Outokumpu O, Report 070/2741 10B/EH/77. (in Finnish)*http://tupa.gtk.fi/raportti/arkisto/070_2741_10_b_eh_77.pdf*

6. Hölttä, P. & Karhu, J. 2001. Oxygen and carbon isotope compositions of carbonates in the alteration zones of orogenic gold deposits in central Finninsh Lapland. Geological Survey of Finland Special Paper 31, 25-29.*http://tupa.gtk.fi/julkaisu/specialpaper/sp_031_pages_025_029.pdf*

7. Hölttä, P., Väisänen, M., Väänänen, J. & Manninen, T. 2007. Paleoproterozoic metamorphism and deformation in Central Lapland, Finland. Geological Survey of Finland, Special Paper 44, 7-56. *http://tupa.gtk.fi/julkaisu/specialpaper/sp_044_pages_007_056.pdf*

8. Inkinen, O. 1985. Kittilän Sirkan kulta-kupariesiintymästä. Summary: Gold-copper occurrence at Sirkka, Kittilä. Geologi 37 (1), 8-11.

9. Isokangas, P. 1967. Kaivospiirien Sirkka I-V hylkäämisilmoitus. Outokumpu Oy, Report M17/Ktä-58-67/1. 2 p. (in Finnish)*http://tupa.gtk.fi/raportti/arkisto/m17_kta_58_67_1.pdf*

10. Korkalo, T. 2006. Gold and copper deposits in Central Lapland, northern Finland, with special reference to their exploration and exploitation. Acta Univ. Oulensis, A Scientiae Rerum Naturalium 461. 122 p.*http://herkules.oulu.fi/isbn951428108X/isbn951428108X.pdf*

11. Lehtinen, M. 1987. Kittilän tutkimusalue: Sirkka. In: H. Papunen (ed.) Lapin vulkaniittien tutkimusprojekti. Loppuraportti. Department of Geology, University of Turku, Report. 85-96. (In Finnish)

12. Lehtonen, M., Airo, M.-L., Eilu, P., Hanski, E., Kortelainen, V., Lanne, E., Manninen, T., Rastas, P., Räsänen, J. & Virransalo, P. 1998. Kittilän vihreäkivialueen geologia: Lapin vulkaniittiprojektin raportti. Summary: The stratigraphy, petrology and geochemistry of the Kittilä greenstone area, northern Finland: a report of the Lapland Volcanite Project. Geological Survey of Finland, Report of Investigation 140. 144 p.*http://tupa.gtk.fi/julkaisu/tutkimusraportti/tr_140.pdf*

13. Mikkola, A. & Sandström, G. 1964. Kittilän malmitutkimukset. Outokumpu Oy, Malminetsintä, Report. 20 p. (In Finnish)*http://tupa.gtk.fi/raportti/arkisto/001_2741_am_64.pdf*

14. Outokumpu Oy malminetsintä 1986. XXXVII vuosikertomus 1986. Outokumpu Oy, Espoo. 111 p. (in Finnish)

15. Patison, N.L. 2007. Structural controls on gold mineralisation in the Central Lapland Greenstone Belt. Geological Survey of Finland, Special Paper 44, 107-124.

http://tupa.gtk.fi/julkaisu/specialpaper/sp_044_pages_107_124.pdf

16. Puustinen, K. 2003. Suomen kaivosteollisuus ja mineraalisten raaka-aineiden tuotanto vuosina 1530-2001, historiallinen katsaus erityisesti tuotantolukujen valossa. Geological Survey of Finland, Report M 10.1/2003/3. 578 p. (in Finnish)*http://weppi.gtk.fi/aineistot/kaivosteollisuus/sisallys.htm*

17. Räisänen, K. 2001. Kun Kätkätunturin maisemissa vedettiin vesiperä. Vuoriteollisuus 59, 56-57.

18. Vesanto, J. 1978. Sirkan malmi ja sitä ympäröivä kallioperä. Unpublished MSc thesis, Department of Geology, University of Oulu. 89 p. (in Finnish)

19. Väisänen, M. 2002. Structural features in the Central Lapland greenstone belt, northern Finland. Geological Survey of Finland, Report K 21.42/2002/3. 20 p.
http://tupa.gtk.fi/raportti/arkisto/k21_42_2002_3.pdf