Mäkärärova

Alternative Names: Poro, Siikalehto, Mäkärä
Occurence type: prospect

Commodity	Rank	Total measure	Total production	Total resource	Importance
gold	1	0,65 t	NA	0,65 t	Occurrence
rare earth element	4	NA	NA	NA	NA

Easting EUREF: 494220
Northing EUREF: 7564110
Easting YKJ: 3494390
Northing YKJ: 7567270

Discovery year: 1949
Discovered by: private enterprise
Comments: Discovery by Mr Holger Jalander; first indication were auriferous hematite-rich erratic boulders discovered 1.5 km to the S from the deposit.

References: 8, 9, 10, 12, 13, 14, 16, 17, 24

Mineral deposit type

Group: Metallogenic deposit
Main type: Orogenic (metamorphic hydrothermal)
Comments: Possibly, an orogenic mesothermal deposit. Oxidising fluids, as indicated by the abundant haematite. Au possibly transported as chloride complex.
References: 8, 9, 16, 17

Group: Metallogenic deposit
Main type: Magmatic hydrothermal
Comments: Distal to a porphyry Cu-Au system sugegsted
References: 8, 9, 16, 17, 24

Group: Metallogenic deposit
Main type: IOCG (mixed hydrothermal)
References: 8, 9, 16, 17

Dimension

Expression: exposed
Form: discordant
Shape: irregular
Length (m): NA
Width (m): NA
Thickness (m): 2
Depth (m): NA
Area (ha): 150
Dip azim: 90
Dip: 80
Plunge azim: NA
Plunge dip: NA
Orientation method: NA
Dimension comments: The extent of the vein swarm on the present surface is >0.5 km by >3 km and are controlled by a NW-thrending structure (shear zone?). The main vein is discontinuous, at least 1.6 km long.

Holder history

Previous holders:

Company	Years	Holding type	Comments
Geological Survey of Finland	2018-2024	Application for exploration permit	NA
Geological Survey of Finland	2014	Claim (old law)	NA
BHP Billiton World Exploration	2004	NA	NA
Nordic Diamonds Ltd	1995-2003	Claim (old law)	NA
Conroy Diamonds and Gold Plc	1995-1997	Claim (old law)	NA
Geological Survey of Finland	1979-1984	Claim (old law)	NA
Rautaruukki Oy	1970	NA	NA
Suomen Malmi Oy	1955-1957	NA	NA
Geological Survey of Finland	1950-1955	NA	NA
private enterprise	1949-1953	Claim (old law)	H. Jalander and T. Keskinarkaus

EXPLORATION ACTIVITY

Geological Survey of Finland

Years	Activity type	Geologist	Exploration result	Ref
2010-2015	core drilling	O. Sarapää	mineral resource defined	5, 19, 21, 24
	Diamond drilling in 2010-2011 (22 drill holes, in total 2883 m) and 2015 (14 drill cores, in total 796 m)			
	Intersections			
	HoleID	R318		
	From-To	9-12		
	Length	3m		
	gold	3,87ppm		
	HoleID	NA		
	From-To	NA		
	Length	5m		
	gold	2,6ppm		

2009-2011	detailed geophysics	O. Sarapää	NA	19
	magnetic, VLF-R surveys and gravity			

2009-2015	excavation	O. Sarapää	NA	19, 21, 24
	29 pits and trenches dug through the overburden into bedrock surface during 2009-2011 and 21 pits or trenches during 2014-2015. The overburden investigated indicates that the distances of till transportation have been short and subglacial erosion very weak. A 0.5- to 15-m-thick, clay-rich till layer covers the local saprolite. Macroscopic gold has been discovered by panning material from the hematite-rich regolith.			

2009-2015	detailed geochemistry	O. Sarapää	NA	7, 19, 21
	Geochemical surveys for Au and REE; weathered bedrock and till sampling in 200 x 200 m grid (in total 30 km2) and weathered bedrock sampling 50 x 50 m grid, (in total 1 km2) . Surface geochemical exploration technique (ionic leach); two profiles. Detailed saprock analyses show a positive correlation between Au, Ag, Bi, Te, and W. Also, REE anomalies in the area.			

1987-1987	regional geophysics	NA	key geological features	
	Low-altitude airborne magnetic, electromagnetic and radiometric survey			

1983-1984	core drilling	Ilkka Härkönen	NA	8, 9, 16
	Four diamond-drill holes, total 808 m.			
	Intersections			
	HoleID	R301		
	From-To	139-143		
	Length	4m		
	gold	1,7ppm		
	Comments	*re-analysed (see Nurmi et al 1991)*		
	HoleID	R301		
	From-To	NA		
	Length	3m		
	gold	2,2ppm		
	HoleID	R302		
	From-To	54-55,2		
	Length	1,2m		
	gold	1,02ppm		
	HoleID	R303		
	From-To	NA		

	Length	0,7m		
	gold	7ppm		

1982-1985	detailed geology	Osmo Auranen, Ilkka Härkönen	NA	8, 9, 17

1980-1987	regional geochemistry	NA	NA	8, 9, 17
	Regional geochemical till survey			

1979-1983	detailed geophysics	Osmo Auranen, Ilkka Härkönen	NA	9, 11, 17
	No significant response on gravimetric, magnetic or electromagnetic methods. An ground-IP anomaly around the major veins.			

1978-1984	detailed geochemistry	Pentti Ervamaa, Osmo Auranen, Ilkka Härkönen	NA	8, 9, 17

1978-1985	excavation	NA	key geological features	
	Exploration trenches dug through the overburden into bedrock surface			

Rautaruukki Oy

Years	Activity type	Geologist	Exploration result	Ref
1970-1970	detailed geology	NA	NA	6

1970-1970	excavation	NA	key geological features	6
	Exploration trenches dug through the overburden into bedrock surface			

Suomen Malmi Oy

Years	Activity type	Geologist	Exploration result	Ref
1956-1957	core drilling	NA	NA	9, 16
	Core drilling (reconnaissance drilling): 13 diamond-drill holes, total 867 m [GTK LOPPI data base].			

1955-1957	excavation	NA	key geological features	9, 22
	excavation of an exploration shaft (failed).			

Geological Survey of Finland

Years	Activity type	Geologist	Exploration result	Ref
1952-1952	core drilling	Esa Hyyppä, Pentti Ervamaa, Osmo Auranen, Ilkka Härkönen	NA	
	One diamond-drill hole, 168 m			

1950-1955	excavation	Esa Hyyppä, Pentti Ervamaa, Osmo Auranen, Ilkka Härkönen	key geological features	9, 11, 12, 22, 23
	Exploration trenches dug through the overburden into bedrock surface			

1950-1955	regional geophysics	Esa Hyyppä, Pentti Ervamaa, Osmo Auranen, Ilkka Härkönen	NA	9, 11, 12, 22, 23

1950-1955	detailed geophysics	Esa Hyyppä, Pentti Ervamaa, Osmo Auranen, Ilkka Härkönen	NA	9, 11, 17
	No significant response on gravimetric, magnetic or electromagnetic methods. An ground-IP anomaly around the major veins.			

1949-1955	detailed geology	Esa Hyyppä, Pentti Ervamaa, Osmo Auranen, Ilkka Härkönen	NA	9, 11, 12, 22, 23

private enterprise

Years	Activity type	Geologist	Exploration result	Ref
1949-1950	excavation	H. Jalander, O.V. Itkonen & T. Keskinarkaus	NA	9, 11, 22, 23

1949-1950	detailed geology	H. Jalander, O.V. Itkonen & T. Keskinarkaus	mineral occurrences	9, 11, 22, 23
	First indication were Au- and haematite-rich erratic boulders discovered 1.5 km to the S from the deposit.			

1949-1950	detailed geophysics	NA	NA	9, 11, 17
	No significant response on gravimetric, magnetic or electromagnetic methods; An ground-IP anomaly around the major veins.			

RESOURCES AND RESERVES

Most recent

Type:	Company:	Year:	Date:	Calc Method:	Reference:
UNFC	Geological Survey of Finland	2023	12.1.2024	UNFC Code	20
	Category:	**334**			
	Tonnage:	**486954 t**			
	gold	1,33 ppm			
	Cutoff:	**gold 0,5 ppm**			

Previous calculations

Type:	Company:	Year:	Date:	Calc Method:	Reference:
Resource	Geological Survey of Finland	1991	NA	Non-compliant resource estimate	15
	Category:	**Inferred mineral resource**			
	Tonnage:	**0,08 Mt**			
	gold	2,1 ppm			
	Cutoff:	**NA**			

GEOLOGY

Host rock: Granitic migmatite, Arkose gneiss, Hornblende Orthogneiss, Lamprophyre, Quartz vein
Wall rock: Norite, Meta-ultramafic-rock

Granitic migmatite (Host rock)

Rock type: Host rock
Proportion: minor
Grain size: NA
Color: NA
References: 6, 8, 9, 12, 16, 17, 18, 24
Comments: Two distinct subareas of mineralised veins with enveloping alteration.

Ore minerals:

Mineral	Proportion	Mineral texture
Chalcopyrite	rare	
Goethite	minor	
	Only occurs in saprock	
Gold	present	
	Only in alteration halo around the veins	
Hematite	present	
Magnetite	minor	
	up to 5 vol-% of the rock	
Pyrite	present	

Other minerals:

Mineral	Proportion	Mineral texture
Biotite	minor	
Calcite	present	
Chlorite	present	Alteration product
Quartz	present	
Sericite	present	Alteration product
Tourmaline	present	

Structures
Veined

Alteration:	Distribution:	Degree:	Relation to mineralization:
sericitic alteration	Veins	NA	Syn
Comments: The extent of alteration is up to 6 m from single veins			
chloritic alteration	Veins	NA	Syn
Comments: up to 5 m wide zones around the quartz-hematite veins			
silicification			Syn
Comments: up to 5 m wide zones around the quartz-hematite veins			
martitisation		NA	
propylitic alteration			

Metamorphic description:

Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)

Regional	granulite facies	high metamorphic grade	NA
Comments: Regional metamorphism peaked during D2.			

Geological age:

Geological era:	Max age - Minage (Ma):	Inferred age (Ma):	Age of mineralization:
Mesoarchean (3200-2800 Ma)	2900-3100		N
Comments: The mineralised veins apparently post-date the most pervasive deformation in the area, as they cut across the dominant foliation of the host rocks. Timing has not been defined, but relationship to deformation suggest that the mineralisation more probably is Palaeoproterozoic than Archaean. Structural control, style of alteration, ore mineral (abundant haematite) and gangue assemblages, and relative timing suggest either post-orogenic granitoid-related (non-skarn) or IOCG style of mineralisation			

Arkose gneiss (Host rock)

Rock type: Host rock
Proportion: minor
Grain size: NA
Color: NA
References: 1, 2, 3, 4, 6, 8, 9, 16, 17, 24
Comments: The mineralisation is in the high-metamorphic domain consisting of ortho(?)- and paragneisses.

Ore minerals:

Mineral	Proportion	Mineral texture
Allanite	minor	
Monazite	minor	
	+ also xenotime	
Synchysite-(Ce)	present	

Other minerals:

Mineral	Proportion	Mineral texture
Albite	minor	
Biotite	minor	
Columbite	minor	
Hematite	present	
K-Feldspar	major	
Quartz	major	
Rutile	present	
Sericite	minor	
Titanite	present	
Zircon	present	
Euxenite-(Y)	minor	

Textures
Banded

Alteration:	Distribution:	Degree:	Relation to mineralization:
sericitic alteration			Syn
Comments: up to 5 m wide zones around the quartz-hematite veins			

Metamorphic description:

Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)
Regional	granulite facies	high metamorphic grade	NA		
Comments: Regional metamorphism peaked during D2.					

Geological age:

Geological era:	Max age - Minage (Ma):	Inferred age (Ma):	Age of mineralization:
Mesoarchean (3200-2800 Ma)	2900-3100		N

Hornblende Orthogneiss (Host rock)

Rock type: Host rock
Proportion: minor
Grain size: NA
Color: Dark coloured
References: 6, 8, 9, 16, 17, 24
Comments: This rock unit is of volcanic, hypabyssal or plutonic in origin

Other minerals:

Mineral	Proportion	Mineral texture
Hornblende	present	

Textures
Banded

Alteration:	Distribution:	Degree:	Relation to mineralization:
sericitic alteration	Disseminated		Syn
chloritic alteration	Disseminated		Syn
Comments: up to 5 m wide zones around the quartz-hematite veins			

Metamorphic description:

Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)
Regional	granulite facies	high metamorphic grade	NA		
Comments: Regional metamorphism peaked during D2; Hornblende (ferrohastingsite)-quartz-K feldspar-plagioclase (An5-30)-biotite ± magnetite, garnet.					

Geological age:

Geological era:	Max age - Minage (Ma):	Inferred age (Ma):	Age of mineralization:
Mesoarchean (3200-2800 Ma)	2900-3100		N

Lamprophyre (Host rock)

Rock type: Host rock
Proportion: minor
References: 3
Comments: Host to REE mineralisation, not for gold

Geological age:
Ore minerals:

Mineral	Proportion	Mineral texture
Allanite	present	
Apatite	minor	
Xenotime-(Y)	present	
Bastnäsite-(Ce)	present	

Other minerals:

Mineral	Proportion	Mineral texture
Amphibole	major	
Biotite	major	
Microcline	major	
Plagioclase	major	

Geological era:	Max age - Minage (Ma):	Inferred age (Ma):	Age of mineralization:
Paleoproterozoic (2500-1600 Ma)	1760-1790	1775	

Quartz vein (Host rock)

Rock type: Host rock
Proportion: major
Grain size: NA
Color: NA
References: 8, 9, 12, 17, 24
Comments: Quartz-haematite-carbonate-pyrite veins, 1 mm - 2 m in thickness, which are vertical or steeply dipping. Diagonal tensional fractures of the NW-trending major shear zone. These fractures are filled with the mineralised veins. The extent of the vein swarm on the present surface is >0.5 km by >3 km. Two distinct subareas of mineralised, NNW-trending, veins with enveloping alteration

Ore minerals:

Mineral	Proportion	Mineral texture
Gold	present	
	native microscopic (≤20 µm) grains hosted by pyrite and in weathered parts in limonite	
Pyrite	minor	

Other minerals:

Mineral	Proportion	Mineral texture
Calcite	minor	
Hematite	major	
Ilmenite	rare	
Magnetite	minor	

	Common at depth >100 m below the current surface, and be more abundant than hematite
Monazite	trace
Muscovite	present
Quartz	most abundant
Titanite	rare
Xenotime-(Y)	trace

Alteration:	Distribution:	Degree:	Relation to mineralization:
sericitic alteration		NA	
martitisation		NA	
carbonate alteration		NA	
chloritic alteration		NA	

Geological age:

Geological era:	Max age - Minage (Ma):	Inferred age (Ma):	Age of mineralization:		
Paleoproterozoic (2500-1600 Ma)	1814-1872	1770	Y		
Radiometric age:	**Method:**	**Age:**	**Error (Ma):**	**Mineral:**	**Reference:**
	U-Pb	1814	21	Monazite	
	U-Pb	1871	17	Xenotime-(Y)	
	U-Pb	1872	4	Zircon	

Norite (Wall rock)

Rock type: Wall rock
Proportion: minor
References: 24

Other minerals:

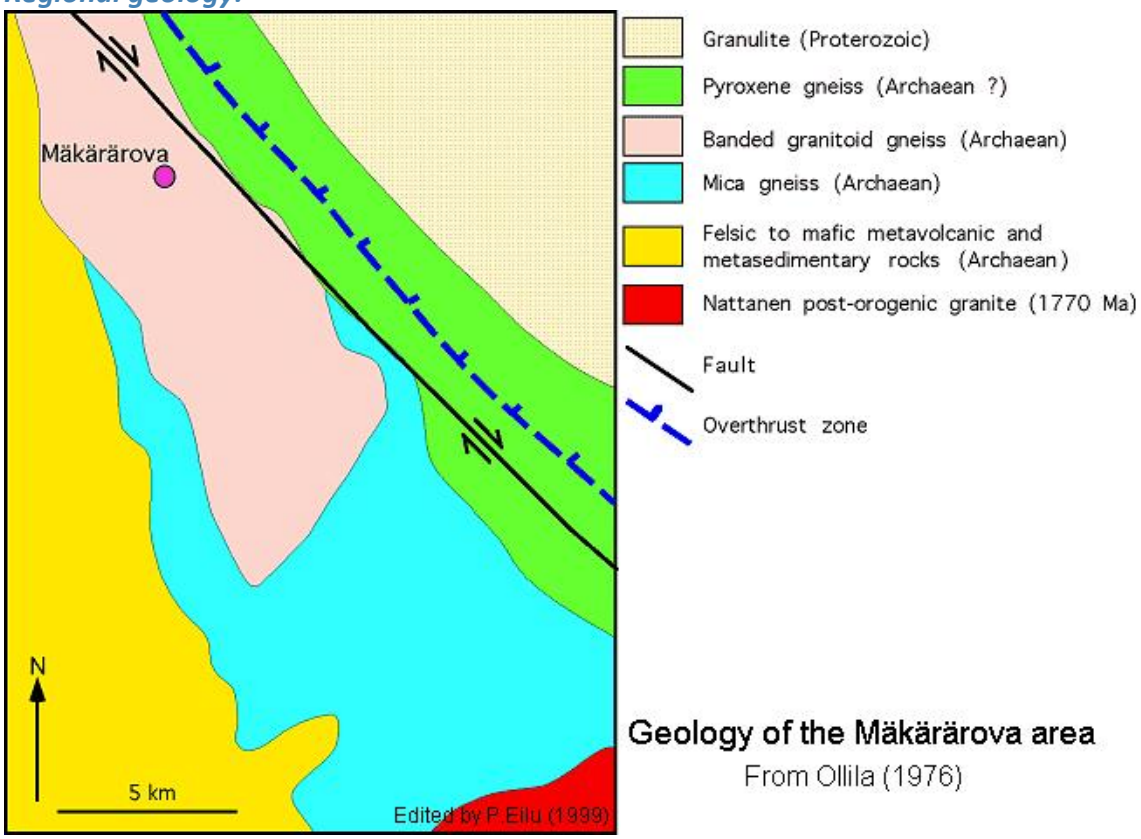
Mineral	Proportion	Mineral texture
Clinopyroxene	major	
Olivine	major	
Plagioclase	major	

Meta-ultramafic-rock (Wall rock)

Rock type: Wall rock
Proportion: minor
References: 24

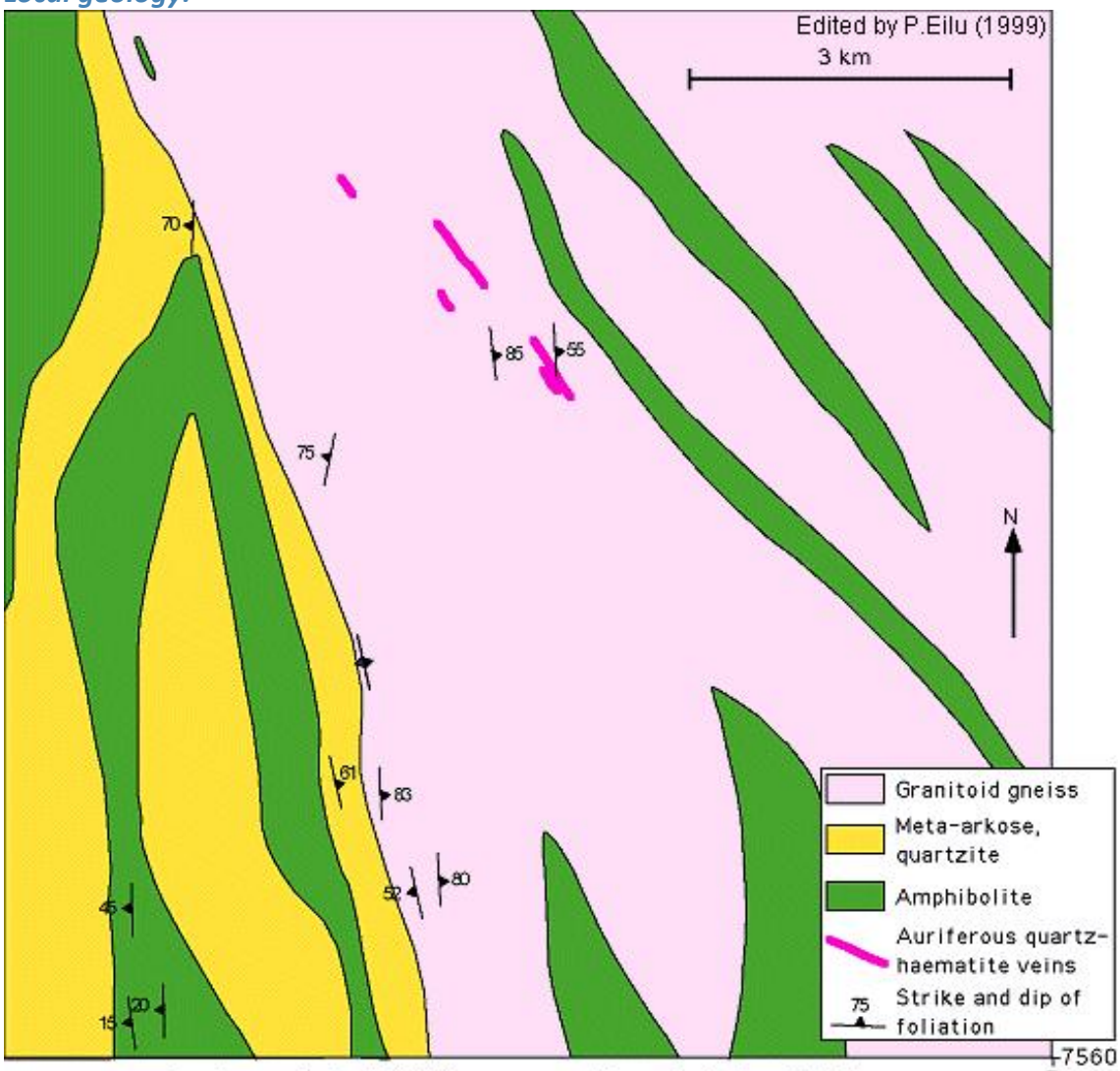
Figures

Regional geology:



Geology of the Mäkärärova area
From Ollila (1976)

Local geology:



Geology of the Mäkärärova area. From Rahkola (1982).

REFERENCES

1. Al Ani, T. 2012. Detailed SEM study on REE-bearing minerals of paragneisses Mäkärä and Vaulo, Northern Finland. Geological Survey of Finland, Report 73/2011. *http://tupa.gtk.fi/raportti/arkisto/73_2011.pdf*

2. Al Ani, T. and Sarapää, O., 2012. REE-mineralogy of arkosic gneisses from Mäkärä-Vaulo area, Tana Belt, Northern Finland. Geological Survey of Finland, Report 74/2012. *http://tupa.gtk.fi/raportti/arkisto/74_2012.pdf*

3. Al Ani, T., Molnár, F. , LintinenP. & Leinonen, S. 2018. Geology and Mineralogy of Rare Earth Elements Deposits and Occurrences in Finland. Minerals 8, 356. doi:10.3390/min8080356

4. Al-Ani, T. and Sarapää, O., 2010. Mineralogy and Geochemistry of REE-bearing minerals of Uuniniemi carbonatite, Vanttaus appinitic diorite and Mäkärä arkosic gneiss, Northern Finland. Geological Survey of Finland, Report M42/2010/68. *http://tupa.gtk.fi/raportti/arkisto/m42_2010_68.pdf*

5. Chernet, T., Lahaye, Y., Pakkanen, L. & Sarapää, O. Preliminary mineralogical and analytical information on the gold bearing quartz-hematite vein of Mäkärä, Tana Belt, Northern Finland. Geological Survoey of Finland, Report 80/2017.*https://tupa.gtk.fi/raportti/arkisto/80_2017.pdf*

6. Hugg, R. & Heiskanen, V. 1983. Suomen rautamalmiesiintymät, malmiutumat ja malmiviitteet. Rautaruukki Oy OU 2/79, RAETSU Report 8.2.1983. 412 p. (in Finnish) *http://tupa.gtk.fi/raportti/arkisto/ou_2_79.pdf*

7. Hulkki, H. ja Peltoniemi-Taivalkoski, A., 2013. Mäkärän rapakallio- ja moreeninäytteiden geokemiallisten tulosten arviointi ja tulkinta. Geological Survey of Finland, Report 130/2013 (in Finnish).*http://tupa.gtk.fi/raportti/arkisto/130_2013.pdf*

8. Härkönen, I. 1985. Tutkimustyöselostus Sodankylän kunnassa valtausalueella Siikalehto 1, kaiv.rek. n:o 3031/1 suoritetuista malmitutkimuksista. Geological Survey of Finland, Report M06/3724/-85/1/10. 4 p. (in Finnish)*http://tupa.gtk.fi/raportti/valtaus/m06_3724_85_1_10.pdf*

9. Härkönen, I. 1987. Kultatutkimukset Mäkärärovan alueella Sodankylässä vuosina 1980-1985. Geological Survey of Finland, Report M19/3724/-87/1/10. 18 p. (in Finnish) *http://tupa.gtk.fi/raportti/arkisto/m19_3724_87_1_10.pdf*

10. 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*

11. Jalander, H., Helovuori, O., Säynäjärvi, K., Hyyppä, E., Repo, R., Ervamaa, P., Vanhala, R., Penttilä, S., Savolainen, E., Virkkala, K., Penttilä, J., Saarinen, V., Hollman, L., Raja-Halli, H. 1937-1956. Lapin kultatutkimuksia. Kirjoituksia vuosilta 1937-1956. Geological Survey of Finland, Report X106. Pages in several sets. (in Finnish)

12. Laitakari, A. 1953. Vuosikertomus Geologisen tutkimuslaitoksen toiminnasta 1952. English summary: Annual Report of the Activities of the Geological Survey of Finland for the Year 1952. Geological Survey of Finland, Helsinki. 34 p.

13. 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*

14. Niska, L. 2006. Maaperägeologisia kultatutkimuksia Ruosselässä Sodankylän kunnassa. PhilLic thesis. Department of Geosciences, University of Oulu. 89 p. 8 App. (in Finnish) *http://tupa.gtk.fi/karttasovellus/mdae/references/438_Ruosselk%C3%A4/438_Niska_Lisensiaatti_2006.pdf*

15. Nurmi, P. A., Lestinen, P. & Niskavaara, H. 1991. Geochemical characteristics of mesothermal gold deposits in the Fennoscandian Shield, and a comparison with selected Canadian and Australian deposits. Geological Survey of Finland, Bulletin 351. 101 p. *http://tupa.gtk.fi/julkaisu/bulletin/bt_351.pdf*

16. Ollila, J. (1976) Mäkärärovan kultaesiintymän ja sen ympäristön geologiasta. Unpublished MSc thesis. Department of Geology, University of Helsinki. 65 p. (in Finnish)

17. Rahkola, P. 1982. Raportti Mäkärärovan ja Kiviaavan tutkimuksista. Geological Survey of Finland, Report S/41/3724/1/1982. 26 p. (in Finnish)*http://tupa.gtk.fi/raportti/arkisto/s41_3724_1_1982.pdf*

18. Sarapää, O. and Sarala, P., 2013. Rare earth element and gold exploration in glaciated terrain - example from the Mäkärä area, northern Finland. Geochemistry: Exploration, Environment, Analysis, v. 13:131-143.

19. Sarapää, O., Ahtola, T., Al-Ani, T., Grönholm, S., Karvinen, A., Kärkkäinen, N., Lahti, S., Lintinen, P., Torppa, A. ja Turunen, P., 2013. Hi-tech-metallitutkimukset Suomessa vuosina 2009-2012. Geological Survey of Finland, Report 161/2013 (in Finnish, abstract in English). *http://tupa.gtk.fi/raportti/arkisto/161_2013.pdf*

20. Sarapää, O., Hulkki, H., Lintinen, P., Ojala, J., Salmirinne, H., Sarala, P., Taivalkoski, A., Telkkälä, P. & Valkama, J. 2023. Loppuraportti Sodankylän kunnassa valtausalueella Mäkärä 1 (Kaivosnumero 8963/1) tehdyistä REE- ja kultamalmitutkimusista. Geological Survey of Finland, Claim Report, 57/2023. 49 pp.*https://tupa.gtk.fi/raportti/valtaus/8963_1.pdf*

21. Sarapää, O., Lintinen, P., Ahtola, T. ja Al-Ani, T., 2016. Kriittisten mineraalien tutkimukset Suomessa vuosina 2013-2015. Geological Survey of Finland, Report 53/2016 (in Finnish). *http://tupa.gtk.fi/raportti/arkisto/53_2016.pdf*

22. Stigzelius, H. 1986. Kultakuume. Lapin kullan historia. Gummerus, Jyväskylä. 250 p. (in Finnish)

23. Varjos, O. 2000. Written communication.

24. Vesilahti, V. 2016. Petrographic, mineralogical and geochemical study of the Mäkärä Au-Fe mineralization, Tanaelv belt, northern Finland. MSc thesis, Oulu Mining School, University of Oulu. 97 p. *http://tupa.gtk.fi/karttasovellus/mdae/references/380_M%C3%A4k%C3%A4r%C3%A4rova/380_nbnfioulu-201701031025.pdf*