Heiskalanmäki

Occurence type: occurrence

Commodity	Rank	Total measure	Total production	Total resource	Importance
nickel	1	297 t	NA	297 t	Occurrence
copper	3	135 t	NA	135 t	Occurrence
cobalt	3	8,1 t	NA	8,1 t	Occurrence
sulphur	5	1447,2 t	NA	1447,2 t	Occurrence

Easting EUREF: 543352,033
Northing EUREF: 6849777,456

Easting YKJ: 3543540
Northing YKJ: 6852650

Discovery year: 1990
Province: Puumala (Ni, Co)
District: Niinimäki (Ni, Co)
References: 1, 3, 4, 7

Mineral deposit type

Group: Metallogenic deposit
Main type: Ultramafic-mafic (magmatic)
Sub type 1: Orogenic intrusion Ni-Cu

Dimension

Expression: exposed
Form: concordant
Shape: lensoidal
Length (m): 15
Width (m): 15
Thickness (m): NA
Depth (m): 100

Area (ha): NA
Dip azim: NA
Dip: 85
Plunge azim: NA
Plunge dip: NA
Orientation method: NA

Holder history

Previous holders:

Company	Years	Holding type	Comments
Suomen Nikkeli Oy	NA	NA	NA
Vulcan Resources Ltd	2004-2012	Claim (old law)	NA
Geological Survey of Finland	1990-1996	NA	NA

EXPLORATION ACTIVITY

Geological Survey of Finland

Years	Activity type	Geologist	Exploration result	Ref
1990-1991	detailed geophysics	Hannu Makkonen, Aimo Ruotsalainen	geophysical anomaly	4
	Detailed magnetic survey. Rocky and compact till however prevented deeper sampling and the magnetic anomalies remained unsolved.			
1982-1982	detailed geology	Hannu Makkonen, Aimo Ruotsalainen	key geological features	4, 5
1981-1981	excavation	Hannu Makkonen, Aimo Ruotsalainen	key geological features	4, 5
1980-1980	detailed geophysics	Hannu Makkonen, Aimo Ruotsalainen	geophysical anomaly	4, 5
1980-1992	core drilling	Hannu Makkonen, geophysicist Aimo Ruotsalainen	mineral occurrences	5
	Core drilling (reconnaissance drilling): 22 holes totalling 3019 m (T-46, 34 mm core); 25 m profile distance, mainly 40 m hole distance; The first drill hole on the magnetic maximum hit the deposit.			
	Intersections			
	HoleID	R325		
	From-To	NA		
	Length	20m		
	nickel	0,56%		
	copper	0,27%		
	HoleID	R332		
	From-To	NA		
	Length	7,5m		
	nickel	0,99%		
	copper	0,41%		
	HoleID	R340		
	From-To	NA		
	Length	8,8m		
	nickel	0,66%		
	copper	0,43%		
1980-1980	detailed geology	Hannu Makkonen, Aimo Ruotsalainen	key geological features	4, 5

RESOURCES AND RESERVES

Most recent

Type:	Company:	Year:	Date:	Calc Method:	Reference:
Resource	Geological Survey of Finland	1996	NA	Non-compliant resource estimate	5
	Comments: Three separate ore bodies.				
	Category:	**Inferred mineral resource**			
	Tonnage:	**0,054 Mt**			
	nickel	0,55 %			
	copper	0,25 %			
	cobalt	0,015 %			
	sulphur	2,68 %			
	Cutoff:	**nickel 0,3 %**			

GEOLOGY

Host rock: Gabbro
Wall rock: Garnet-Cordierite Gneiss

Gabbro (Host rock)

Rock type: Host rock
Proportion: present
Grain size: NA
Color: NA
References: 2, 5, 6
Comments: Composed of metamorphic orthopyroxene, clinoamphibole, plagioclase and biotite. The deposit is hosted by a folded sill like gabbro intrusion, ca 50 m in thickness. The gabbro body is subvertical and it is connected to a larger gabbro body northwards.

Ore minerals:

Mineral	Proportion	Mineral texture
Chalcopyrite	major	Dissemination, Massive
	Anhedral grains < 1 mm. In places cubanite exolutions.	
Cubanite	minor	
Mackinawite	minor	
Pentlandite	major	Dissemination, Massive
	Subhedral grains with pyrrhotite usually 0.3 - 0.5 mm in diameter (max. 1 mm). Also as rows of grains in the fractures of pyrrhotite. Sometimes altered to violarite or rarely to mackinawite.	
Pyrite	minor	
Pyrrhotite	major	Dissemination, Massive
	Anhedral grains usually 1 mm in diameter (max. 2 mm). Mostly fresh but sometimes altered to pyrite	
Violarite	minor	

Other minerals:

Mineral	Proportion	Mineral texture
Amphibole	present	Alteration product
Biotite	present	Alteration product
Hornblende	present	
Orthopyroxene	present	
Plagioclase	present	

Structures
Folded

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: The granulite facies area belongs to the so called Sulkava Thermal Dome, which was formed during a late stage (1830¿1810 Ma) Sulkava zonal metamorphism.					

Geological age:

Geological era:	Max age - Minage (Ma):	Inferred age (Ma):	Age of mineralization:
Paleoproterozoic (2500-1600 Ma)	1600-2500	1900	N

Garnet-Cordierite Gneiss (Wall rock)

Rock type: Wall rock
Proportion: present
Grain size: NA
Color: NA
References: 2

Metamorphic description:

Other minerals:

Mineral	Proportion	Mineral texture
Cordierite	present	
Garnet	present	

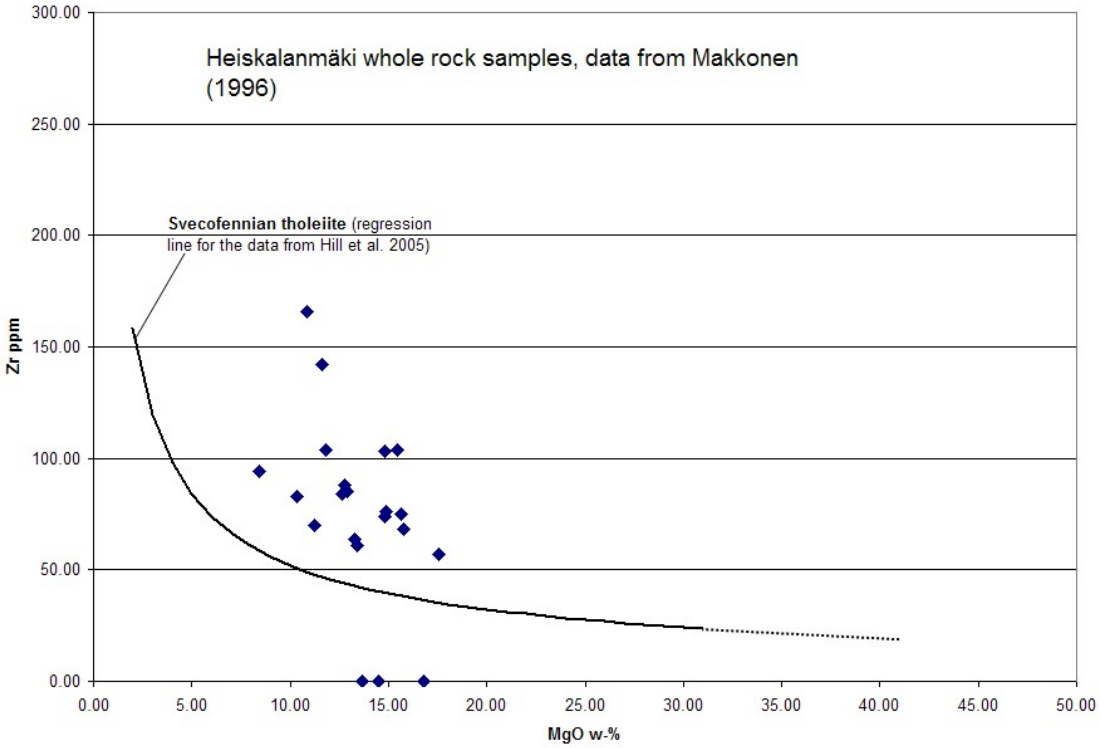
Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)
Regional	granulite facies	high metamorphic grade	NA		
Comments: The granulite facies area belongs to the so called Sulkava Thermal Dome, which was formed during a late stage (1830¿1810 Ma) Sulkava zonal metamorphism; Garnet, cordierite, sillimanite, orthopyroxene.					

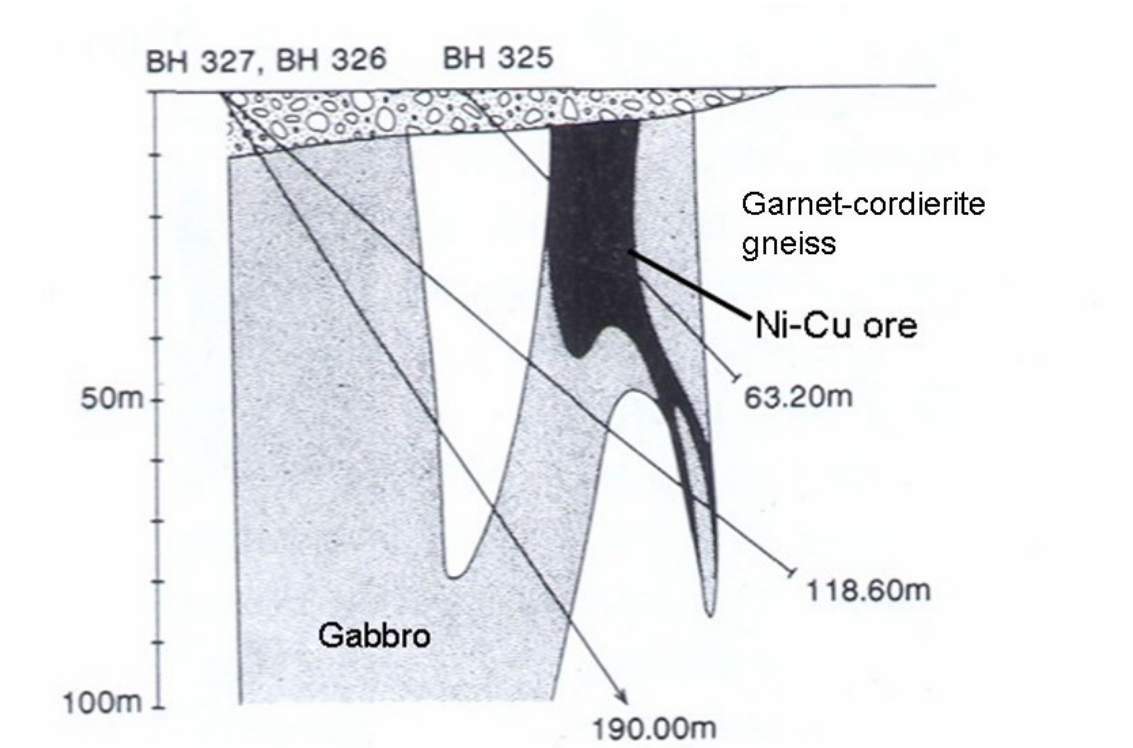
Geological age:

Geological era:	Max age - Minage (Ma):	Inferred age (Ma):	Age of mineralization:
Paleoproterozoic (2500-1600 Ma)	1600-2500	1900	N

Figures

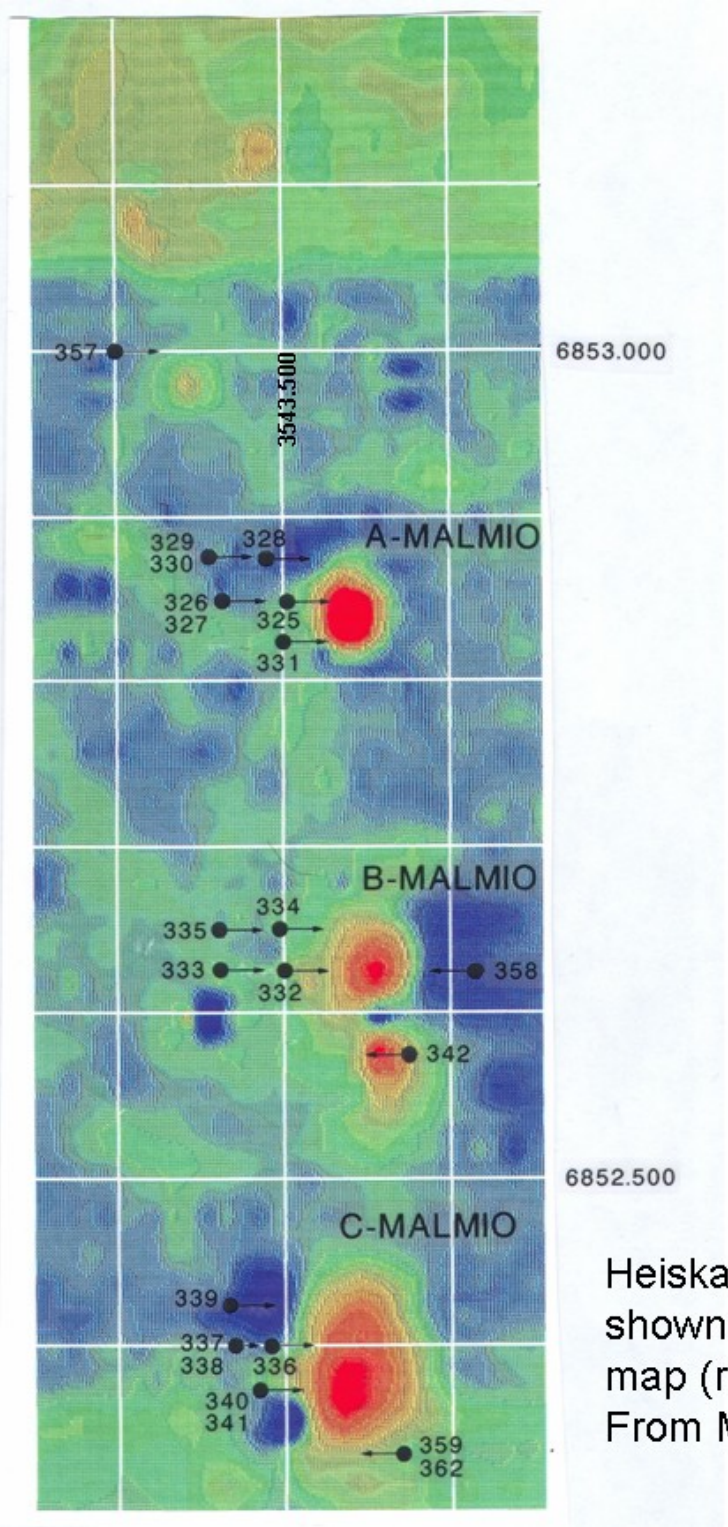
Whole rock Zr vs MgO plot:





Cross section through the northernmost ore body of the Heiskalanmäki Ni-Cu deposit. From Makkonen (1996).

Magnetic map:

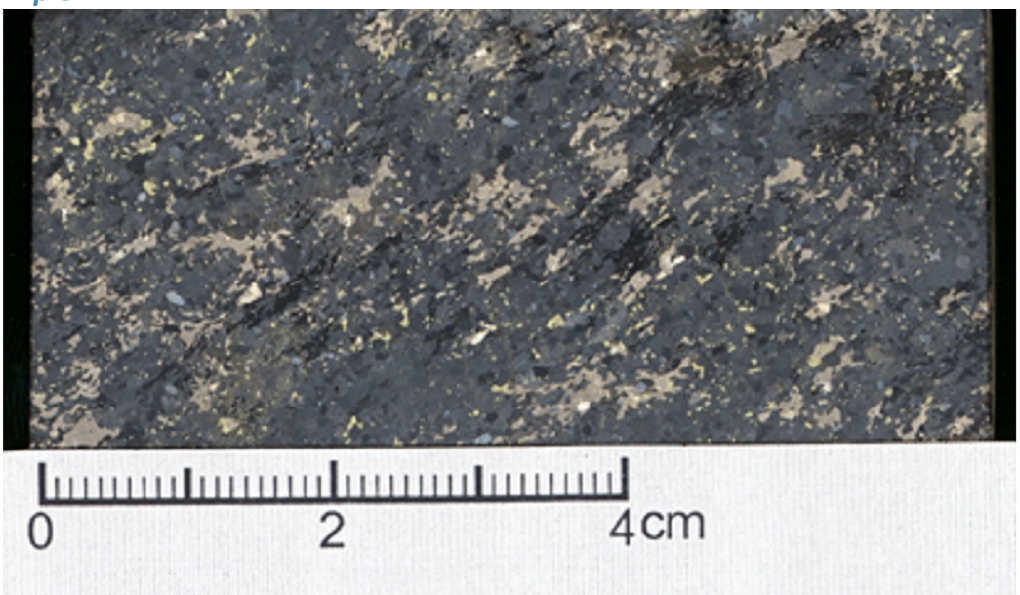


Heiskalanmäki ore bodies shown on the magnetic map (red = maximum). From Makkonen (1996a).

Ore sample:

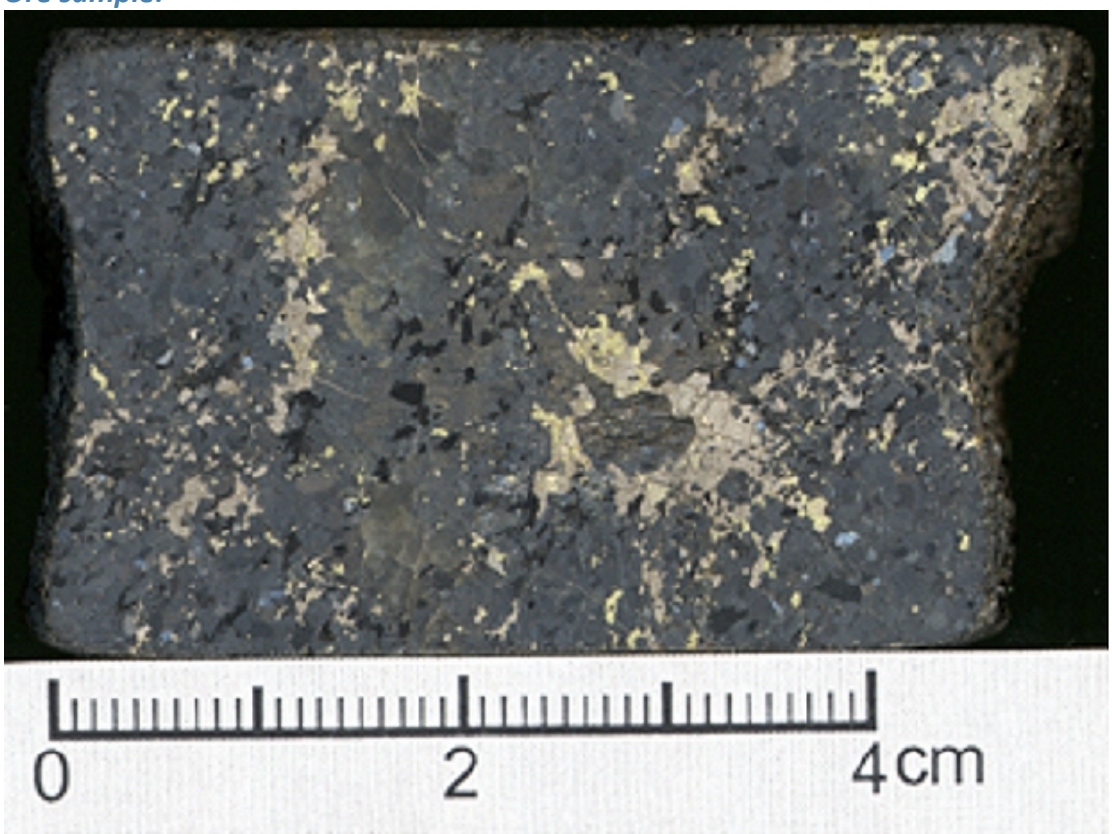
Heterogeneous pyrrhotite-pentlandite dissemination in metagabbro at Heiskalanmäki. BH3144/R331/56.75 m.

Ore sample:



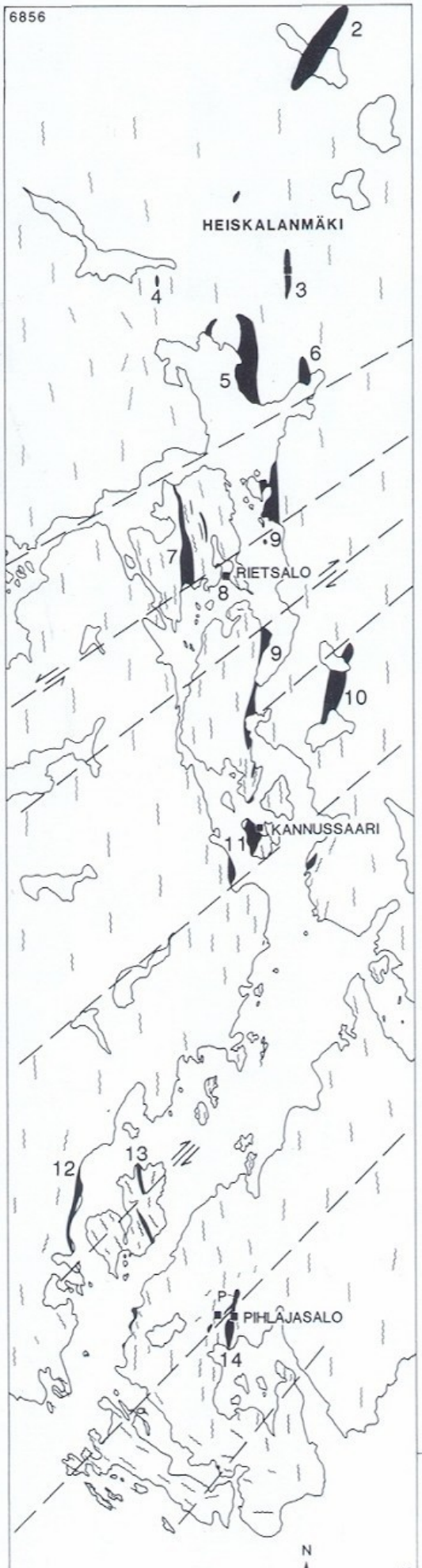
Pyrrhotite-pentlandite-chalcopyrite dissemination in schistose metagabbro at Heiskalanmäki. BH3144/R332/66.50 m.

Ore sample:



Heterogeneous pyrrhotite-pentlandite-chalcopyrite dissemination in metagabbro at Heiskalanmäki. BH3144/R336/65.60 m.

Luonteri-Heiskalanmäki zone:

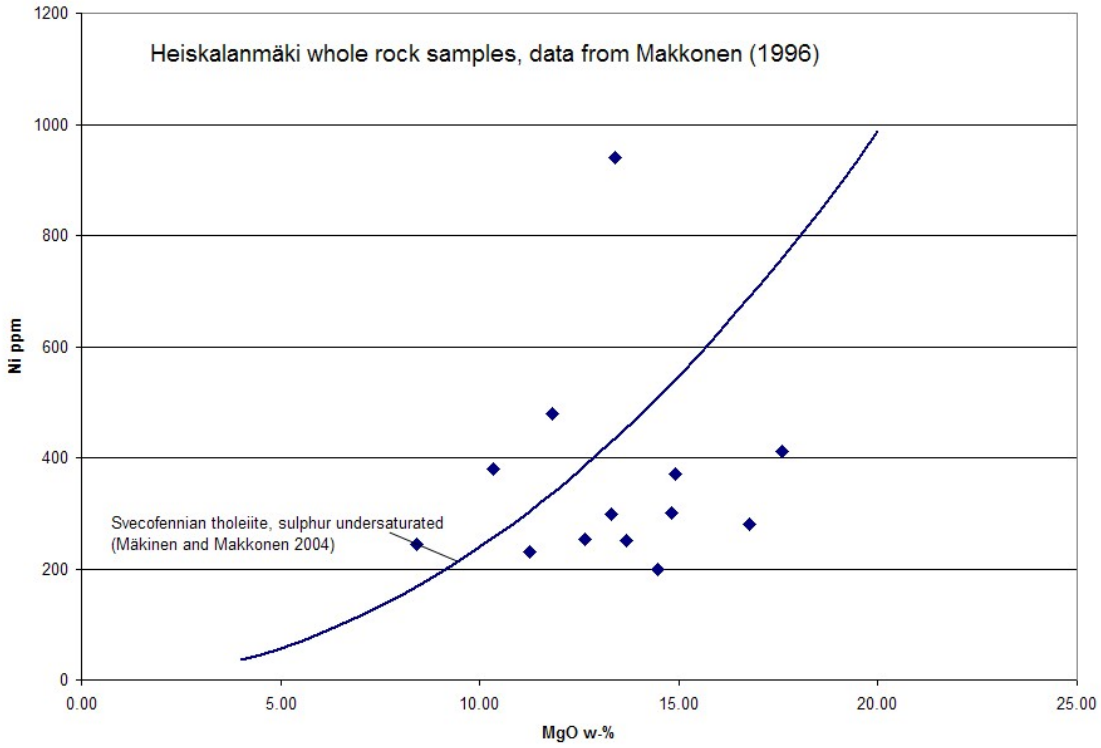


Luonteri-Heiskalanmäki zone intrusions:

2 Alanen, 3 Heiskalanmäki, 4 Syömäjärvi, 5 Kolkanranta, 6 Virmaanlahti, 7 Rietsalo, 8 Rietsalo BH303, 9 Kololahdenselkä, 10 Vekarainen, 11 Siikavesi, 12 Rantavuori, 13 Siikasaari, 14 Pihlajasalo

Gabbro
P=Peridotite
Ni-Cu-occurrence
Fault
Gar-cord-sill-

Whole rock Ni vs MgO plot:



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