Pampalo

Alternative Names: Ward
Occurence type: deposit

Commodity	Rank	Total measure	Total production	Total resource	Importance
gold	1	9,1 t	6,5 t	2,6 t	Small deposit

Easting EUREF: 716021,816
Northing EUREF: 6991319,287
Easting YKJ: 3716281
Northing YKJ: 6994248

Discovery year: 1990
Discovered by: Geological Survey of Finland
Province: Ilomantsi (Au)
District: Hattu (Au)
Comments: Visible gold detected in outcrop during targetted geological mapping and exploration
References: 2, 5, 6, 7, 8, 10, 15, 16, 18, 19, 21, 25, 28, 29, 30, 34, 37, 53, 54, 63, 64, 68, 69, 71, 75, 76, 78, 79, 81, 85, 88, 90, 91

Mineral deposit type

Group: Metallogenic deposit
Main type: Orogenic (metamorphic hydrothermal)
Comments: Precipitation of gold by desulphidation of fluid and, possibly, by decomposition of Au-bisulphide, -thiosulphide and -telluride complexes of fluid due to cooling and/or changes in pH and fO2. Probably, gold precipitated just below 500°C with sulphides due to reaction between the mineralising fluid and wall-rock (chiefly by sulphidation).
References: 52, 53, 57, 58, 75, 77

Dimension

Expression: exposed
Form: discordant
Shape: tabular
Length (m): 500
Width (m): 200
Thickness (m): NA
Depth (m): 750
Area (ha): NA
Dip azim: 45
Dip: 85
Plunge azim: 45
Plunge dip: 35
Orientation method: NA
Dimension comments: The deposit comprises three main NE-plunging ore lenses or shoots. Two of these have a significant continuation to the north, and there are indications of further ore bodies, 200 m to the E of the open pit, at Juttuhuuhta. The main ore bodies are open at the depth of 800 m. A fourth ore body, S-2, occures at depth - it does not extend to the surface but is open at the depth of >600 m. The Juttuhuuhta ore bodies are intersected up to 269 m down-hole depth. Ore-grade intercepts at >800 m depth

Holder history

Current holder: Endomines Oy

Years: 2007
Holding type: Mining concession (old law)

Previous holders:

Company	Years	Holding type	Comments
Polar Mining Oy	2003-2006	NA	NA
Outokumpu Oy	1994-2003	NA	NA
Geological Survey of Finland	1990-1994	NA	NA

EXPLORATION ACTIVITY

Endomines Oy

Years	Activity type	Geologist	Exploration result	Ref
2021	core drilling systematic	Jani Rautio	mineralized zone identified	42, 45, 46, 47
	Underground systematic drilling below the so-far mined ore. In 2021, between the 755 and 855 mine levels; 86 diamond-drill holes, in total 6852 m. 2022: 64 diamond holes, in total 4509 m drilling. 2023 spring-summer ug drilling: 47 diamond holes, 4,487 m in total.			
	Intersections			
	HoleID	T-1667		
	From-To	58,5-60,5		
	Length	2m		
	gold	164,3ppm		
	HoleID	T-1691		
	From-To	76-80		
	Length	4m		
	gold	40,1ppm		
	HoleID	T-1703		
	From-To	77,4-84,5		
	Length	7,1m		
	gold	20,5ppm		
	HoleID	T-1704		
	From-To	75-79		
	Length	4m		
	gold	17,7ppm		
	HoleID	T-1786		
	From-To	34,3-38,5		
	Length	4,2m		
	gold	45,6ppm		
	Comments	*ug drilling, true(?) depth 835 m*		
	HoleID	T-1796		
	From-To	40,9-46		
	Length	5,1m		
	gold	60,1ppm		
	Comments	*ug drilling, true(?) depth 835 m*		
	HoleID	T-1827		
	From-To	234-240		
	Length	6m		
	gold	9,2ppm		
	Comments	*Underground drilling, true(?) depth 827 m*		
	HoleID	T-1833		
	From-To	NA		
	Length	4,7m		
	gold	22,3ppm		
	Comments	*Underground drilling 2023 at about 900 m depth*		
	HoleID	T-1856		
	From-To	NA		
	Length	6,4m		
	gold	20ppm		
	Comments	*Underground drilling 2023 at about 900 m depth*		

2018-2018	detailed geochemistry	Jani Rautio	geophysical anomaly	37
	Altogether 1023 base-of-till samples were taken within an approximately five kilometers radius from the Pampalo mine. Within the mining lease area, anomalus gold values detected to the E and SW from the mine.			

2018-2018	detailed geophysics	Jani Rautio	geophysical anomaly	37
	Ground gravity survey, comprising five 5 kilometer profiles in the Pampalo area. Survey stations every 20 meters along each profile. The purpose of the survey is get information about the depth extent of the large rock units around Pampalo, including the Korpivaara tonalite intrusion in the north and the large ultramafic unit near the Pampalo mineralization. Survey profiles will provide gravimetric data to the depth of 1km.			

2018-2018	core drilling	Jani Rautio	mineral occurrences	37
	Near-mine exploration: Diamond drilling at Juttuhuuhta and to the sourth of the mine: no new ore bodies detected to the S, whereas the presence of mineralisation confirmed at Juttuhuuhta, 200 m from the main ore bodies of the Pamplao deposit.			
	Intersections			
	HoleID	P-424		
	From-To	209-210,1		
	Length	1,1m		
	gold	2,8ppm		

2018-2020	detailed geology	Jani Rautio	key geological features	37, 41
	Hyperspectral scanning of 30 km of diamong-drill core for selected deposits and occurrences within the Hattu belt. No results yet reported. In addition, comprehensive structural mapping over the central duplex was completed during the summer 2018. 2020: 3D modelling with GTK, and selctive sampling and geological mapping at and near surface.			

2017-2017	core drilling systematic	Jani Rautio	mineral resource defined	40
	40 diamond-drill holes, a total of 4 736 m, all below the existing mine workings (the 755m level).			
	Intersections			
	HoleID	T-1569		
	From-To	92,4-96,5		
	Length	4,1m		
	gold	28,9ppm		
	HoleID	T-1596		
	From-To	45,8-53,7		
	Length	7,9m		
	gold	7,9ppm		
	HoleID	T-1602		
	From-To	126,5-128,3		
	Length	1,8m		
	gold	99,3ppm		

2016-2016	core drilling	Markus Ekberg	mineral resource indicated	34
	In total, 20,886 m diamond-drill core drilled during 2016, and new resources and reserves indicated at depth			

2015-2015	detailed geochemistry	NA	NA	
	Sampling the base of till, campaign started in March 2015			

2011-2011	detailed geophysics	Jaakko Liikanen	geophysical anomaly	
	Airborne low-altitude (SkyTEM) geophysical surveys were completed over the entire permit area			

2010-2012	geostatistical estimates	NA	mineral reserve defined	65, 66, 68

	Mineral resource and ore reserve assessments by Maptek (2009) and Outotec Oyj (2010, 2012) for Endomines. The 2010 assessment is based on 802 drill holes with a total length of 59823.3 m. The number of assayed intervals is 26538. Cut off grade is 1 ppm Au. The 2012 assessment update is based on 871 drill holes with a total length of 65315.15 m.

2007-2015	core drilling	Jaakko Liikanen, Jyrki Bergström, Markus Ekberg	mineral reserve defined	15, 17, 18, 19, 20, 21, 22, 23, 25, 28, 29, 30, 48, 49, 50, 54
	Hundreds of diamond-drill holes. The 2013 drilling indicates extension of the two main ore bodies to the north, or indicates two new lodes (Lietoja and D-Zone) immediately to the north of the known ore bodies. Underground drilling of deep parts ongoing in 2015. report of 6 Sept 2015: High- gold grade intersections reported from potential depth extension of the known reserce at Pampalo mine, and the mineralised zone remains open at depth. During 1 Spt to 21 Oct 2015, 32 underground holes drilled.			
	Intersections			
	HoleID	T-1006		
	From-To	NA		
	Length	10m		
	gold	18,2ppm		
	HoleID	T-916		
	From-To	NA		
	Length	7m		
	gold	12,2ppm		
	HoleID	T-934		
	From-To	NA		
	Length	9m		
	gold	4,4ppm		
	HoleID	T-942		
	From-To	NA		
	Length	6m		
	gold	10,6ppm		
	HoleID	T-965		
	From-To	NA		
	Length	2m		
	gold	54,6ppm		
	HoleID	NA		
	From-To	NA		
	Length	2,6m		
	gold	6,5ppm		
	HoleID	NA		
	From-To	NA		
	Length	2,4m		
	gold	6,1ppm		
	HoleID	NA		
	From-To	NA		
	Length	2,9m		
	gold	10,1ppm		
	HoleID	NA		
	From-To	NA		
	Length	4,8m		
	gold	10,5ppm		
	HoleID	NA		
	From-To	NA		
	Length	7,2m		
	gold	8,9ppm		
	HoleID	NA		
	From-To	NA		
	Length	1,3m		
	gold	14,2ppm		
	HoleID	NA		
	From-To	NA		
	Length	1,5m		

	gold	12,5ppm
	HoleID	NA
	From-To	NA
	Length	7,1m
	gold	23,6ppm
	HoleID	NA
	From-To	NA
	Length	22,4m
	gold	12,9ppm
	HoleID	NA
	From-To	NA
	Length	3,1m
	gold	12,1ppm
	HoleID	NA
	From-To	NA
	Length	2,5m
	gold	13,1ppm
	HoleID	NA
	From-To	NA
	Length	14m
	gold	6,1ppm
	HoleID	NA
	From-To	NA
	Length	2,9m
	gold	15,2ppm
	HoleID	NA
	From-To	NA
	Length	14m
	gold	1,11ppm
	HoleID	NA
	From-To	NA
	Length	6,5m
	gold	10,7ppm

Polar Mining Oy

Years	Activity type	Geologist	Exploration result	Ref
2003-2006	core drilling	Esa Sandberg	mineral resource defined	9, 10, 54
	Intersections			
	HoleID	NA		
	From-To	NA		
	Length	50,6m		
	gold	1,5ppm		
	HoleID	NA		
	From-To	NA		
	Length	3,4m		
	gold	36ppm		

2003-2006	percussion drilling	Esa Sandberg	mineral resource defined	9, 10, 54

2003-2006	mining pilot	Esa Sandberg	NA	9, 10, 54

Outokumpu Oy

Years	Activity type	Geologist	Exploration result	Ref

1997-2001	feasibility study	Esa Sandberg	mineral reserve defined	

1996-1996	subsurface exploration	Esa Sandberg	NA	64, 79, 86

1996-1997	mining pilot	Esa Sandberg	mineral resource defined	
	Test pit in 1996, decline construction started 1997, followed by underground drilling and further test mining.			

1994-2003	core drilling	Esa Sandberg	mineral resource defined	64, 79, 86
	From surface, 135 diamond-drill holes, total 8093 m; from underground, 127 diamond-drill holes, total 4687 m in 10 x 10 m network.			

Geological Survey of Finland

Years	Activity type	Geologist	Exploration result	Ref
1993-1993	regional geophysics	Martti Damsten	key geological features	
	Low-altitude airborne magnetic, electromagnetic and radiometric survey			

1990-1993	core drilling	Martti Damsten	mineral occurrences	4, 67, 75, 76, 77
	103 diamond-drill holes, total 12569 m, 25 m distance between the drilling profiles.			
	Intersections			
	HoleID	NA		
	From-To	NA		
	Length	1,5m		
	gold	90ppm		
	HoleID	NA		
	From-To	NA		
	Length	2,5m		
	gold	70ppm		
	HoleID	NA		
	From-To	NA		
	Length	8m		
	gold	47,4ppm		
	HoleID	NA		
	From-To	NA		
	Length	6,8m		
	gold	18,4ppm		
	HoleID	NA		
	From-To	NA		
	Length	20m		
	gold	5,4ppm		
	HoleID	NA		
	From-To	NA		
	Length	18m		
	gold	8,9ppm		
	HoleID	NA		
	From-To	NA		
	Length	11m		
	gold	8,6ppm		
	HoleID	NA		
	From-To	NA		
	Length	116m		
	gold	10,7ppm		

1986-1994	detailed geochemistry	Martti Damsten	geochemical anomaly	77, 103

	Till-bedrock interface sampled, samples collected across the rergional Au anomaly along traverses 100 m apart with sampling distance 10-30 m. Local peat deposits are anomalous on Au, As, Cu, Mo, Ni, S and Te. In peat, Au has the best positive correlation with Te. Lithogeochem: Au, S, Se, Te and W enriched in all host rocks; K and LOI enrichment in metatuffite, but depletion in porphyries. In metatuffite, Au has the best correlation with Te, S, W and Ag, and in porphyry with S, Se and Pb.

1986-1994	detailed geophysics	Martti Damsten	geophysical anomaly	75
	ground-magnetic, -slingram and -IP survey. SIP investigations. No response on magnetic, slingram or IP methods. Magnetic and electric methods do show the structural features of the area, including those which control gold mineralisation.			

1986-1994	excavation	Martti Damsten	NA	4, 55, 61, 67, 75, 76, 77, 82, 102, 103

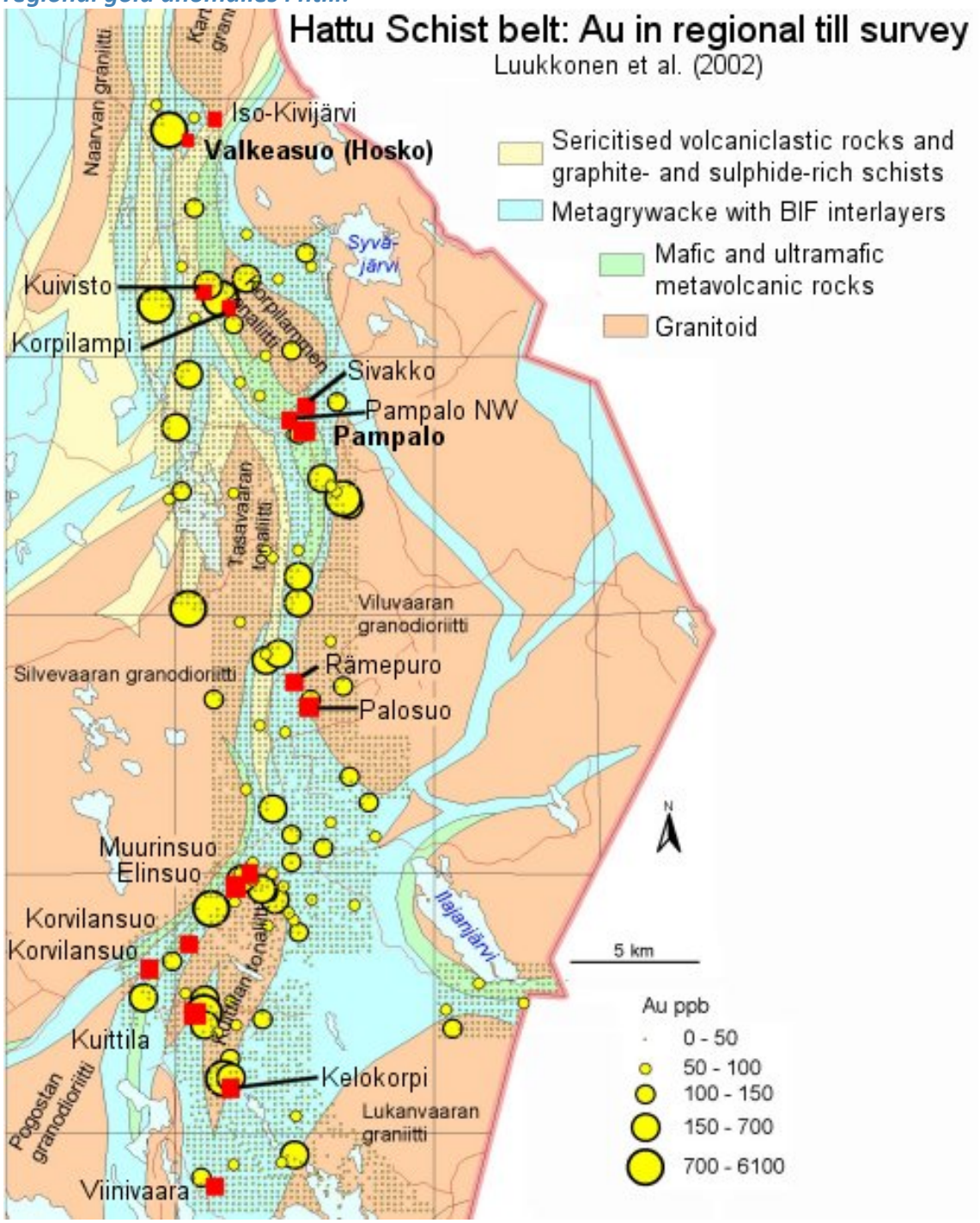
1986-1994	detailed geology	Martti Damsten, Peter Sorjonen-Ward	NA	4, 67, 75, 76, 77, 91, 103
	Investigation of an outcrop in a structurally favourable location in an area of till-geochemical Au anomaly led to discovery of visible gold in the outcrop.			

1984-1984	regional geochemistry	Aimo Hartikainen	geochemical anomaly	
	Country-wide till-geochemical survey			

1983-1989	regional geochemistry	Aimo Hartikainen	geochemical anomaly	
	Sampling grid 250x250 m over the greenstone belt covering 400 km2. Regional Au, As and B till anomaly, local Au, Te and Bi anomaly. Au content within the till anomaly is from tens of ppb to >1 ppm. Best combination for defining exploration targets: Au + Te + Bi - better than Au alone.			

Figures

regional gold anomalies i ntill:



RESOURCES AND RESERVES

Most recent

Type:	Company:	Year:	Date:	Calc Method:	Reference:
Resource	Endomines Oy	2022	31.12.2022	JORC code	44
	Comments: The mineral resources are additional. to the ore reserves				
	Category:	**Indicated mineral resource**			
	Tonnage:	**0,029 Mt**			
	gold	2,45 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**0,117 Mt**			
	gold	5,92 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**0,164 Mt**			
	gold	1,88 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**0,281 Mt**			
	gold	1,51 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**0,103 Mt**			
	gold	1,8 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Indicated and inferred mineral resource**			
	Tonnage:	**0,694 Mt**			
	gold	2,423 ppm			
	Cutoff:	**NA**			

Type:	Company:	Year:	Date:	Calc Method:	Reference:
Reserve	Endomines Oy	2022	31.12.2022	JORC code	44
	Comments: The mineral resources are additional to the ore reserves.				
	Category:	**Proved ore reserves**			
	Tonnage:	**0,219 Mt**			
	gold	3,64 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Probable ore reserves**			
	Tonnage:	**0,102 Mt**			
	gold	1,17 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Proved and probable ore reserves**			
	Tonnage:	**0,321 Mt**			
	gold	2,855 ppm			
	Cutoff:	**NA**			

Previous calculations

Type:	Company:	Year:	Date:	Calc Method:	Reference:

Resource	Endomines Oy	2021	31.12.2021	JORC code	42
	Comments: The mineral resources are additional to the ore reserves.				
	Category:	**Indicated mineral resource**			
	Tonnage:	**0,229 Mt**			
	gold	1,8 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Indicated mineral resource**			
	Tonnage:	**0,029 Mt**			
	gold	2,5 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**122461 t**			
	gold	5,24 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**164110 t**			
	gold	1,9 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**62000 t**			
	gold	1,4 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**103000 t**			
	gold	1,8 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Indicated and inferred mineral resource**			
	Tonnage:	**709571 t**			
	gold	2,41 ppm			
	Cutoff:	**NA**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Reserve	Endomines Oy	2021	31.12.2021	JORC code	42
	Comments: The mineral resources are additional to the ore reserves.				
	Category:	**Proved ore reserves**			
	Tonnage:	**0,161 Mt**			
	gold	3,55 ppm			
	Cutoff:	**gold 1,5 ppm**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Resource	Endomines Oy	2020	31.12.2020	JORC code	36, 39
	Comments: Mineral resources are additional to ore reserves. *Mineral resources have been the same since 2018.*				
	Category:	**Indicated mineral resource**			
	Tonnage:	**101503 t**			
	gold	5,1 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Indicated mineral resource**			
	Tonnage:	**229000 t**			
	gold	1,8 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Indicated mineral resource**			
	Tonnage:	**29000 t**			
	gold	2,5 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**118125 t**			
	gold	5,36 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**164110 t**			

	gold	1,9 ppm
	Cutoff:	**gold 1,5 ppm**
	Category:	**Inferred mineral resource**
	Tonnage:	**62000 t**
	gold	1,4 ppm
	Cutoff:	**gold 0,5 ppm**
	Category:	**Inferred mineral resource**
	Tonnage:	**103000 t**
	gold	1,8 ppm
	Cutoff:	**gold 0,5 ppm**
	Category:	**Indicated and inferred mineral resource**
	Tonnage:	**806738 t**
	gold	2,751 ppm
	Cutoff:	**gold**

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Reserve	Endomines Oy	2020	31.12.2020	JORC code	39
	Comments: The mineral resources are additional to the ore reserves.				
	Category:	**Probable ore reserves**			
	Tonnage:	**131000 t**			
	gold	2,93 ppm			
	Cutoff:	**gold 1,5 ppm**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Resource	Endomines Oy	2017	30.11.2017	JORC code	14
	Comments: Indicated and Inferred Mineral Resources are additional to the Ore Reserves				
	Category:	**Indicated mineral resource**			
	Tonnage:	**101503 t**			
	gold	5,1 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Indicated mineral resource**			
	Tonnage:	**199000 t**			
	gold	1,8 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Indicated mineral resource**			
	Tonnage:	**29000 t**			
	gold	2,5 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**62000 t**			
	gold	1,4 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**103000 t**			
	gold	1,8 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**164110 t**			
	gold	1,9 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**118125 t**			
	gold	5,4 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Indicated and inferred mineral resource**			
	Tonnage:	**776738 t**			
	gold	2,794 ppm			
	Cutoff:	**gold**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**

Reserve	Endomines Oy	2017	30.11.2017	JORC code	14
	Comments: Indicated and Inferred Mineral Resources are additional to the Ore Reserves. *The lodes are 5-10 m wide, 50-80 m in height and extend for >700 m down plunge. The Pampalo East lode is about 100 m to the east, and the Juttuhuuhta lode(s) 500 m to the SE of the main mineralised zone (main lodes), respectively.*				
	Category:	**Proved ore reserves**			
	Tonnage:	**223513 t**			
	gold	2,8 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Probable ore reserves**			
	Tonnage:	**32000 t**			
	gold	1,3 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Proved and probable ore reserves**			
	Tonnage:	**255513 t**			
	gold	2,612 ppm			
	Cutoff:	**NA**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Resource	Endomines Oy	2016	NA	JORC code	13
	Comments: 31.12.2016 *Resources do not include reserves*				
	Category:	**Indicated mineral resource**			
	Tonnage:	**31000 t**			
	gold	3,2 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Indicated mineral resource**			
	Tonnage:	**199000 t**			
	gold	1,8 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Indicated mineral resource**			
	Tonnage:	**29000 t**			
	gold	2,5 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**62000 t**			
	gold	1,4 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**103000 t**			
	gold	1,8 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**170000 t**			
	gold	2 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**127000 t**			
	gold	3,5 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Indicated and inferred mineral resource**			
	Tonnage:	**721000 t**			
	gold	2,201 ppm			
	Cutoff:	**NA**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Reserve	Endomines Oy	2016	NA	JORC code	13
	Comments: 31.12.2016 *Resources do not include reserves*				
	Category:	**Proved ore reserves**			

	Tonnage:	**100000 t**
	gold	2,4 ppm
	Cutoff:	**gold 1,5 ppm**
	Category:	**Probable ore reserves**
	Tonnage:	**60000 t**
	gold	2,7 ppm
	Cutoff:	**gold 1,5 ppm**
	Category:	**Probable ore reserves**
	Tonnage:	**32000 t**
	gold	1,3 ppm
	Cutoff:	**gold 0,5 ppm**
	Category:	**Proved and probable ore reserves**
	Tonnage:	**192000 t**
	gold	2,31 ppm
	Cutoff:	**NA**

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Resource	Endomines Oy	2015	NA	JORC code	27, 51
	Comments: 30.11.2015				
	Category:	**Indicated mineral resource**			
	Tonnage:	**199000 t**			
	gold	1,8 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Indicated mineral resource**			
	Tonnage:	**139900 t**			
	gold	4,2 ppm			
	Cutoff:	**gold 1 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**62000 t**			
	gold	1,4 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**284200 t**			
	gold	2,57 ppm			
	Cutoff:	**gold 1 ppm**			
	Comments: Pampalo (51 200 t @ 3.9 g/t) + Pampalo Deep Resource (80 000 t @ 2.8 g/t Au) + Pampalo D-zone (153 000 t @2.0 g/t Au) ´				
	Category:	**Indicated and inferred mineral resource**			
	Tonnage:	**685100 t**			
	gold	2,57 ppm			
	Cutoff:	**NA**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Reserve	Endomines Oy	2015	NA	JORC code	27
	Comments: 30.11.2015				
	Category:	**Proved ore reserves**			
	Tonnage:	**107000 t**			
	gold	2,1 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Probable ore reserves**			
	Tonnage:	**32000 t**			
	gold	1,3 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Probable ore reserves**			
	Tonnage:	**36000 t**			
	gold	2,2 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Proved and probable ore reserves**			
	Tonnage:	**175000 t**			
	gold	1,97 ppm			
	Cutoff:	**NA**			

	Comments: Pampalo + Pampalo East Rämepuro excluded				
Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Resource	Endomines Oy	2014	NA	JORC code	49
	Comments: 31.12.2014				
	Category:	**Indicated mineral resource**			
	Tonnage:	**137000 t**			
	gold	1,8 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**397000 t**			
	gold	2,5 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**11000 t**			
	gold	1,7 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Indicated and inferred mineral resource**			
	Tonnage:	**545000 t**			
	gold	2,308 ppm			
	Cutoff:	**NA**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Reserve	Endomines Oy	2014	NA	JORC code	49
	Comments: 31.12.2014				
	Category:	**Proved ore reserves**			
	Tonnage:	**56000 t**			
	gold	3,3 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Probable ore reserves**			
	Tonnage:	**86000 t**			
	gold	2,8 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Probable ore reserves**			
	Tonnage:	**85000 t**			
	gold	1,3 ppm			
	Cutoff:	**gold 0,5 ppm**			
	Category:	**Proved and probable ore reserves**			
	Tonnage:	**227000 t**			
	gold	2,362 ppm			
	Cutoff:	**NA**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Resource	Endomines Oy	2013	NA	JORC code	48
	Comments: 31.12.2013				
	Category:	**Inferred mineral resource**			
	Tonnage:	**634000 t**			
	gold	2 ppm			
	Cutoff:	**gold 1,5 ppm**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**829000 t**			
	gold	1,812 ppm			
	Cutoff:	**NA**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**195000 t**			
	gold	1,2 ppm			
	Cutoff:	**NA**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Reserve	Endomines Oy	2013	NA	JORC code	48

	Comments: 31.12.2013	
	Category:	**Proved ore reserves**
	Tonnage:	**230000 t**
	gold	3 ppm
	Cutoff:	**gold 1,5 ppm**
	Category:	**Probable ore reserves**
	Tonnage:	**108000 t**
	gold	2,4 ppm
	Cutoff:	**gold 1,5 ppm**
	Category:	**Probable ore reserves**
	Tonnage:	**140000 t**
	gold	1,3 ppm
	Cutoff:	**NA**
	Category:	**Proved and probable ore reserves**
	Tonnage:	**478000 t**
	gold	2,367 ppm
	Cutoff:	**NA**

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Resource	Endomines Oy	2010	NA	JORC code	50
	Comments: The lodes are 5-10 m wide, 50-80 m in height and extend for >700 m down plunge. The Pampalo East lode is about 100 m to the east, and the Juttuhuuhta lode(s) 500 m to the SE of the main mineralised zone (main lodes), respectively.				
	Category:	**NA**			
	Tonnage:	**1,523 Mt**			
	gold	4,3 ppm			
	Cutoff:	**gold 1 ppm**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Resource	Polar Mining Oy	2003	NA	NA	7, 10, 87
	Category:	**NA**			
	Tonnage:	**0,915 Mt**			
	gold	6,9 ppm			
	Cutoff:	**NA**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Resource	Outokumpu Oy	2000	NA	NA	7, 10, 72, 80, 87
	Category:	**NA**			
	Tonnage:	**0,9 Mt**			
	gold	7 ppm			
	Cutoff:	**NA**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Resource	Outokumpu Oy	1999	NA	NA	7, 10, 86, 87
	Category:	**NA**			
	Tonnage:	**0,6 Mt**			
	gold	7,4 ppm			
	Cutoff:	**NA**			

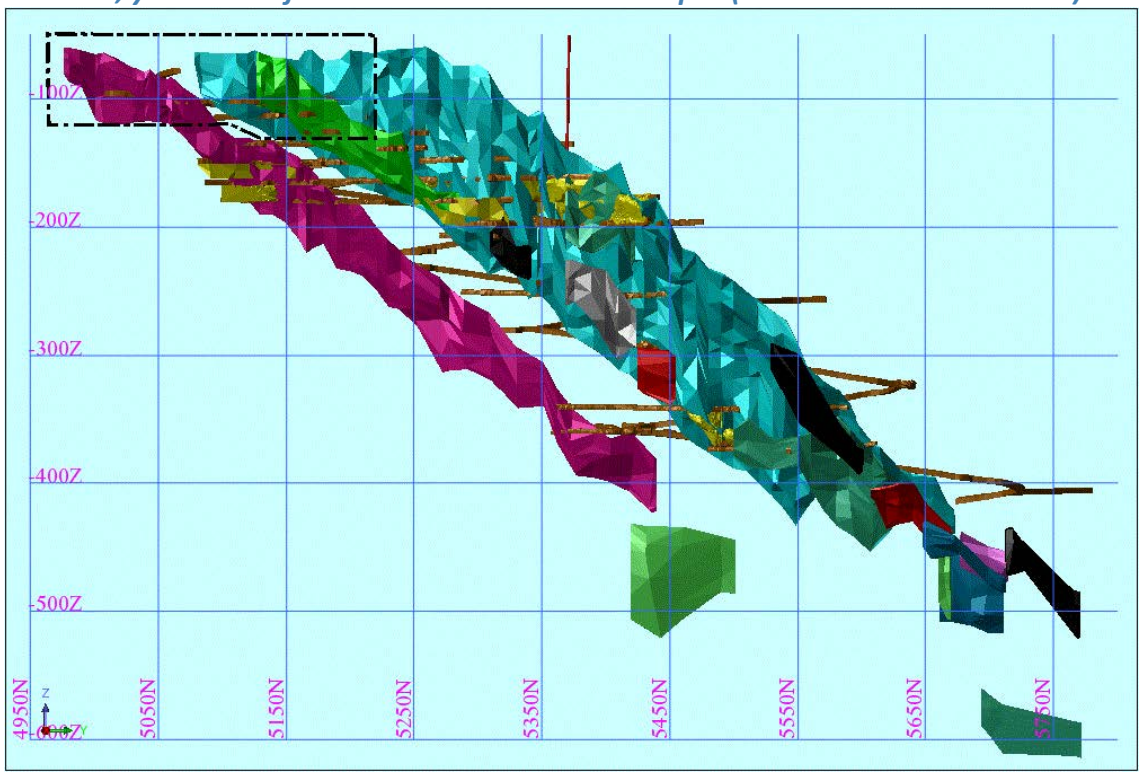
Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**
Resource	Geological Survey of Finland	1997	NA	NA	7, 10, 78, 84, 87, 103
	Category:	**NA**			
	Tonnage:	**0,6 Mt**			
	gold	7,3 ppm			
	Cutoff:	**NA**			

Type:	**Company:**	**Year:**	**Date:**	**Calc Method:**	**Reference:**

Resource	Geological Survey of Finland	1993	NA	NA	7, 10, 75, 77, 87
	Category:	**NA**			
	Tonnage:	**0,59 Mt**			
	gold	7,9 ppm			
	Cutoff:	**NA**			

Figures

North-South projection of the resource model looking west; dashed line: historically mined out area, yellow wireframes: 2010- 2011 mined stopes (Loven & Meriläinen 2012). :



MINING

Pampalo

Easting EUREF: 716021,816
Northing EUREF: 6991319,287
Status: Operating intermittently
Previous status: Care and maintenance
Operating years: 1996-2022
Years in production: 18
Total ore mined: 2083615 t
Comments:

References: 1, 87, 100, 101

Total production:

Product	Product measure
gold	6,5 t

Other materials:

Material type	Material measure
Waste rock	1280831 t

Mining activity:

Year	Ore mined	Ore processed	Activity type	Production	Other material
2022	138717 t	138717 t	open-pit and underground mining		
				gold 267,5 kg	Waste rock 179555 t
2021	12504 t	12504 t	underground mining		
				gold 0 kg	Waste rock 68381 t
2018	117220 t	116456 t	underground mining		
				gold 331,3 kg	Waste rock 0 t
2017	170389 t	165539 t	underground mining		
				gold 398,1 kg	Waste rock 10000 t
2016	147625 t	150917 t	underground mining		
				gold 325 kg	Waste rock 0 t
2015	239000 t	239000 t	underground mining		
				gold 360 kg	Waste rock 6000 t
2014	343062 t	343062 t	underground mining		
				gold 676,1 kg	Waste rock 232678 t
2013	339583 t	239583 t	underground mining		
				gold 790 kg	Waste rock 222712 t
2012	250790 t	249949 t	underground mining		
				gold 866,5 kg	Waste rock 117210 t
2011	176745 t	210547 t	underground mining		
				gold 616 kg	Waste rock 43255 t
2010	33500 t	0 t	underground mining		
					Waste rock 18900 t
2009	0 t	0 t	underground mining		
2008	0 t	0 t	underground mining		
					Waste rock 39500 t
2007	0 t	0 t	underground mining		
					Waste rock 4930 t

1999	55694 t	57969 t	NA		
				gold 836 kg	Waste rock 189904 t
1998	31986 t	29958 t	NA		
				gold 40 kg	Waste rock 145306 t
1997	11800 t	11800 t	NA		
				gold 48 kg	Waste rock 0 t
1996	15000 t	26073 t	open-pit mining		
				gold 946 kg	Waste rock 2500 t

Figures

Open pit panorama in 2001:

Pampalo pit in 3rd September 2001. Panoramic view to E-SE-S. Photo J. Ojala
Note the strong northerly plunging lineation.

Open pit view in 2001:

Pampalo pit in 3rd September 2001. Panoramic view to S-SW-W.
Note the strong northerly plunging lineation. Photo J. Ojala

Open pit view in 2001:

Pampalo pit in 3 September 2001. View to the east.
Photo Juhani Ojala.

Boudinaged felsic interbed or dyke:

Pampalo. Felsic, boudinaged interlayer or dyke in ore.
Field of view about 1 m. Photo J. Ojala.

Open pit view in 1997:

Pampalo pit 3/10/1997.
Photo P. Eilu

Ore, wall rocks, underground:

Pampalo Central Lode west contact with mafic schist. RL208. Photo P. Nurmi

Open pit view in about 1999:

Pampalo pit at about 1999. From Goode 2004.

Airphoto of mine site:

GEOLOGY

Host rock: Intermediate tuff, Komatiite
Wall rock: Porphyry

Intermediate tuff (Host rock)

Rock type: Host rock
Proportion: major
Grain size: Fine grained 0.2 - 1 mm
Color: Grey
References: 4, 7, 15, 53, 54, 56, 61, 62, 63, 69, 70, 75, 76, 87, 89, 91
Comments: Fusswinkel et al. (2017): All the three successive fluid generations show metamorphic fluid features, prograde metamorphic devolatilisation (main components, Cl/Br ratio, Pb and Zn concentrations) with no indications of magmatic-hydrothermal source. The high Br concentration is inconsistent with evaporitic source, but suggest organic matter in metasedimentary rocks. Kalliomäki et al. (2019): Hydrothermal calcite REE patters give a strong support to metamorphic source for the mineralisation.

Ore minerals:

Mineral	Proportion	Mineral texture
Altaite	minor	
Aurostibite	minor	
Bismuth	minor	
Calaverite	minor	
Chalcopyrite	minor	
Chromite	minor	
Cubanite	minor	
Electrum	minor	
Frohbergite	minor	
Galena	minor	
Gold	minor	
	Free Au occurs: 1) at pyrite grain boundaries and as inclusions in pyrite with chalcopyrite and pyrrhotite, 2) in fractures of pyrite grains, 3) intergrown with tellurides amongst silicates, 4) intergrown with titanite, rutile and goethite, 5) as inclusions in K feldspar, quartz, biotite and calcite. Some of Au occurs as gold tellurides. 91% of Au occurs as native Au, most of gold grains is <10 µm, and 70-79% of native Au is as <80 µm grains. Fineness 69-98% Au (avg 91%), 8% Ag (avg).	
Hedleyite	minor	
Hematite	minor	
Hessite	minor	
Ilmenite	minor	
Mackinawite	minor	
Magnetite	minor	
Molybdenite	minor	
	Predates gold ineralisation	
Montbrayite	minor	
Pentlandite	minor	
Petzite	minor	
Pyrite	minor	
Pyrrhotite	minor	
Rucklidgeite	minor	

Rutile	minor
Sphalerite	minor
Tellurium	minor
Tellurobismuthite	minor
Tetrahedrite	minor
Tsumoite	minor
Volynskite	minor

Other minerals:

Mineral	Proportion	Mineral texture
Albite	major	
Biotite	major	
Calcite	present	
Chlorite	present	
Garnet	present	
K-Feldspar	minor	
Muscovite	major	
Quartz	present	
Scheelite	present	
	Predates gold mineralisation	
Titanite	present	
Tourmaline	present	

Structures
Folded
Comments: The deposit is in a duplex formed by the main and secondary shear zones of the Pampalo Shear Zone system

Textures
Foliated
Granoblastic

Alteration:	Distribution:	Degree:	Relation to mineralization:
potassic alteration	Disseminated	Weak	Post
Comments: Palaeoproterozoic replacement of albite by K-feldspar (adularia) at 350-400ºC, 1.8-2.4 kbar (Molnar et al. 2016)			
albitic alteration	Disseminated	Moderate	Pre
Comments: Mainly detected in the porphyry dykes. Not certain if this alteration is pre- or syn-mineralisation			
pyritic alteration	Disseminated	Moderate	Syn
Comments: calcite-biotite-pyrite assemblage			
biotite alteration	Disseminated	Strong	Syn
Comments: calcite-biotite-pyrite assemblage			
carbonate alteration	Disseminated	Moderate	Syn
Comments: calcite-biotite-pyrite assemblage			

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	Post		-550
Comments: Hölttä et al. (2017): PT Regional metamorphism from 480-500C, 2-4 kbar to 560-570C, 6-7 kbar in the northernmost part of the belt. Regional metamorphic timing: monazite gives 2664 Ma, 2620 Ma + late overprint at 1837 Ma					

Geological age:

Geological era:	Max age - Minage (Ma):	Inferred age (Ma):	Age of mineralization:		
Neoarchean (2800-2500 Ma)	2600-2710	2708	Y		
Comments: Fusswinkel et al. (2017): only the first generation of the fluids is gold-rich, the indication is, that mineralistion was early, contemporaneous with Archaean metamorphism, and is against of any significat later Au introduction, such as during the Palaeoproterozoic. Hölttä et al. (2017): metamorphic timing: monazite gives 2664 Ma, 2620 Ma + late overprint at 1837 Ma					
Radiometric age:	**Method:**	**Age:**	**Error (Ma):**	**Mineral:**	**Reference:**
	K-Ar	1810		Biotite	70
	U-Pb	1837	13	Monazite	56
	U-Pb	2620	24	Monazite	56
	U-Pb	2664	33	Monazite	56
	U-Pb	2708		Titanite	75
	U-Pb	2710	100	Zircon	

Komatiite (Host rock)

Rock type: Host rock
Proportion: minor
Grain size: Fine grained 0.2 - 1 mm
Color: Dark coloured
References: 62, 75, 76, 89
Comments: The main host rock is located between fine-grained metasedimentary rocks and metakomatiite, and the sequence is intruded by thin felsic porphyry dykes.

Other minerals:

Mineral	Proportion	Mineral texture
Biotite	present	
Chlorite	major	
Dolomite	major	
Talc	major	
Tremolite	present	

Structures
Folded

Textures
Foliated

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	Post		-550
Comments: Hölttä et al. (2017): PT Regional metamorphism from 480-500C, 2-4 kbar to 560-570C, 6-7 kbar in the northernmost part of the belt. Regional metamorphic timing: monazite gives 2664 Ma, 2620 Ma + late overprint at 1837 Ma					

Geological age:

Geological era:	Max age - Minage (Ma):	Inferred age (Ma):	Age of mineralization:
Neoarchean (2800-2500 Ma)	2726-2754		N

Porphyry (Wall rock)

Rock type: Wall rock
Proportion: major
Grain size: Fine grained 0.2 - 1 mm
Color: Greyish
References: 62, 75, 76, 89
Comments: The main porphyry host is located between fine-grained metasedimentary rocks and metakomatiite, and the sequence is intruded by thin felsic porphyry dykes.

Ore minerals:

Mineral	Proportion	Mineral texture
Scheelite	trace	
	Predates gold mineralisation	

Other minerals:

Mineral	Proportion	Mineral texture
Albite	minor	
	Alteration product	
Biotite	major	
Chlorite	present	
Microcline	major	
Quartz	major	
Rutile	present	
Sericite	major	
Tourmaline	variable	
	Alteration product?	
Tremolite	trace	

Structures
Boudinaged

Textures
Foliated
Granoblastic

Alteration:	Distribution:	Degree:	Relation to mineralization:
potassic alteration	Disseminated	Weak	Post
Comments: Palaeoproterozoic replacement of albite by K-feldspar (adularia) at 350-400ºC, 1.8-2.4 kbar (Molnar et al. 2016)			
albitic alteration	Disseminated	Moderate	Pre
Comments: Timing relative to mimneralisation is uncertain: either pre- or syn-mineral			
calcite alteration	Disseminated	Moderate	Syn
sericitic alteration	Disseminated	Moderate	Syn
pyritic alteration	Disseminated	Weak	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	Post	-550
Comments: Progressive regional metamorphism in ca. 2750-2700 Ma, apparently peaked soon after gold mineralisation, at a temperature of about 550±50°C. Thermal peak was synchronous or outlasted deformation. A regional, relatively strong, but unevenly distributed Palaeoproterozoic overprint; K feldspar-albite ± tremolite-biotite-sericite-calcite(-quartz-epidote-titanite-rutile-garnet-tourmaline). Quartz-albite-actinolite. Hölttä et al. (2017): PT Regional metamorphism from 480-500C, 2-4 kbar to 560-570C				

Geological age:

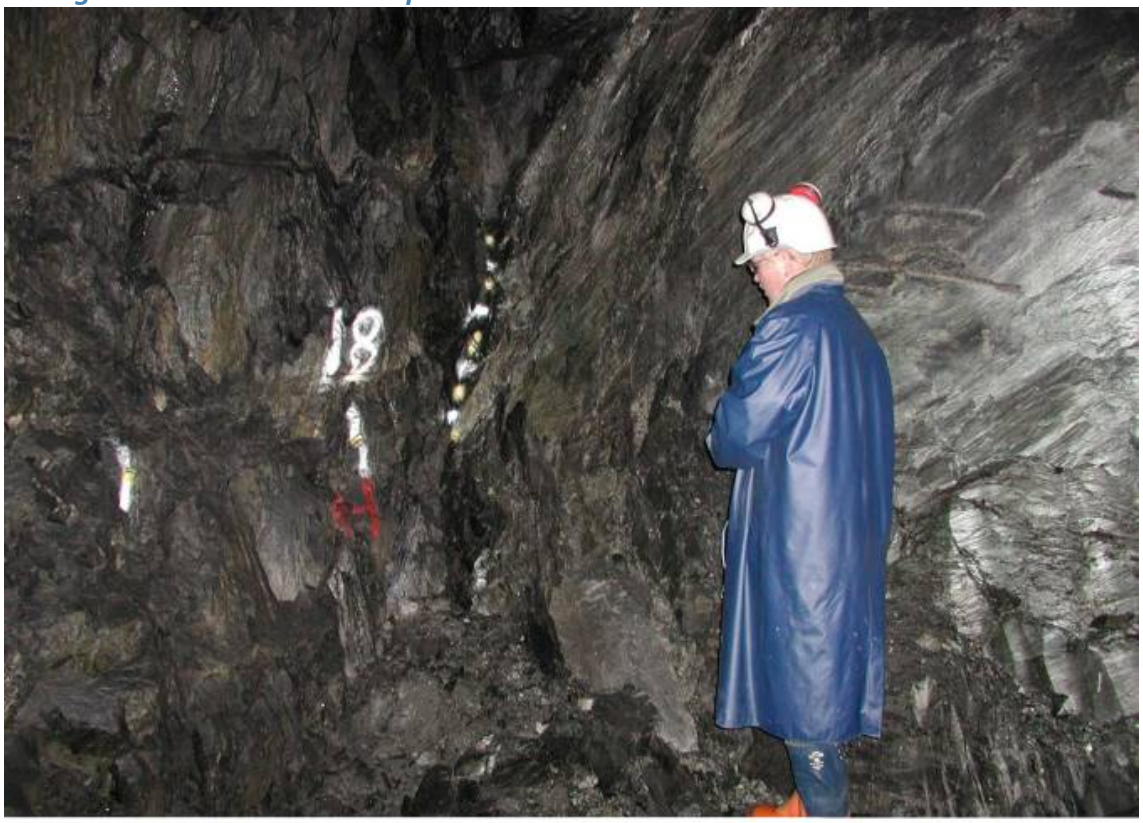
Geological era:	**Max age - Minage (Ma):**	**Inferred age (Ma):**	**Age of mineralization:**		
Neoarchean (2800-2500 Ma)	2720-2760		N		
Radiometric age:	**Method:**	**Age:**	**Error (Ma):**	**Mineral:**	**Reference:**
	U-Pb	2720			
	U-Pb	2760		Zircon	

Figures

Ore outcrop photo:

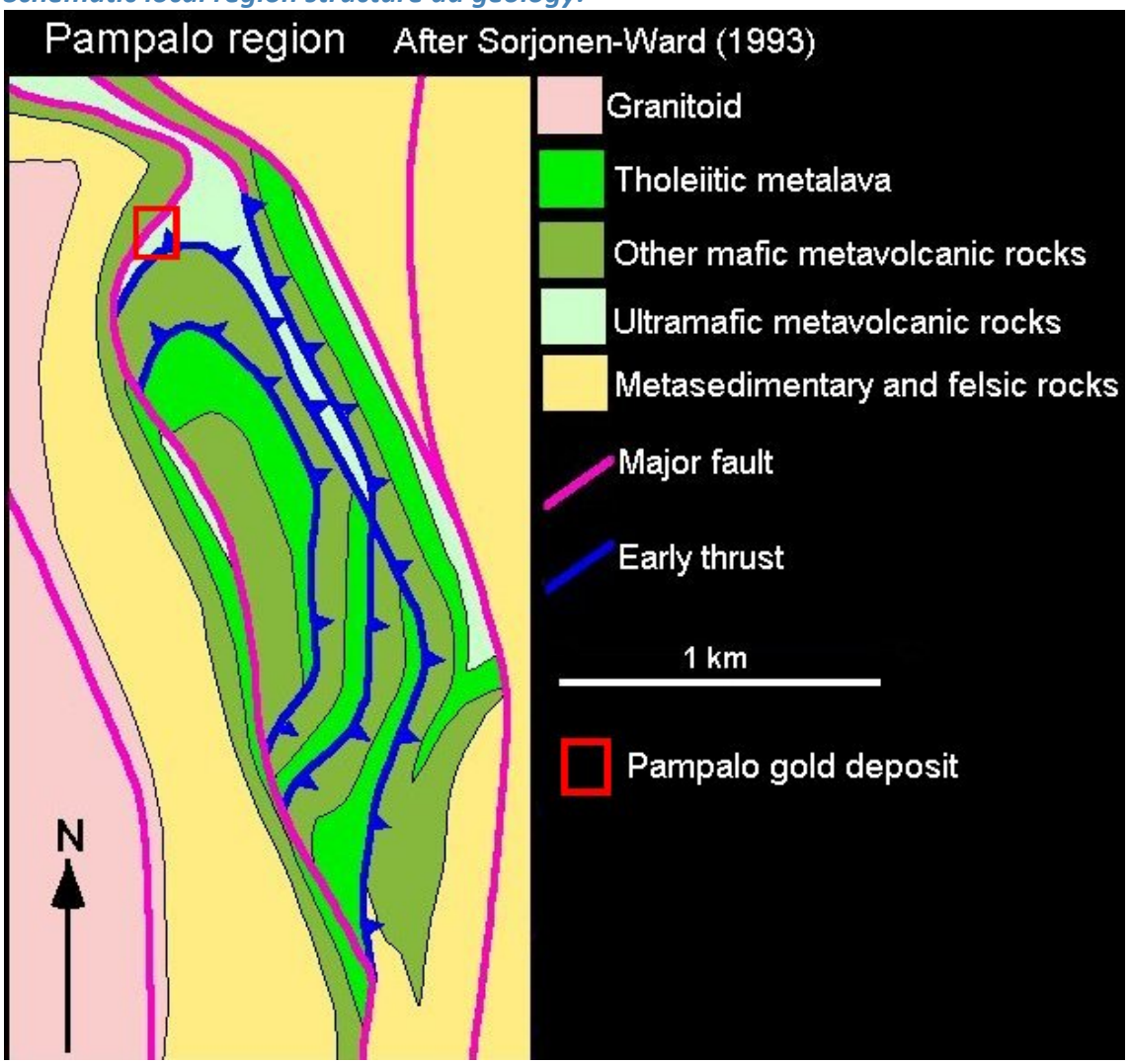
Pampalo. Intermediate and felsic hosts of ore. Photo J. Ojala.

Undeground ore and wallrock photo:



Pampalo Central Lode east contact with ultramafic schist. Note strong N plunging lineation. RL208. Photo P. Nurmi

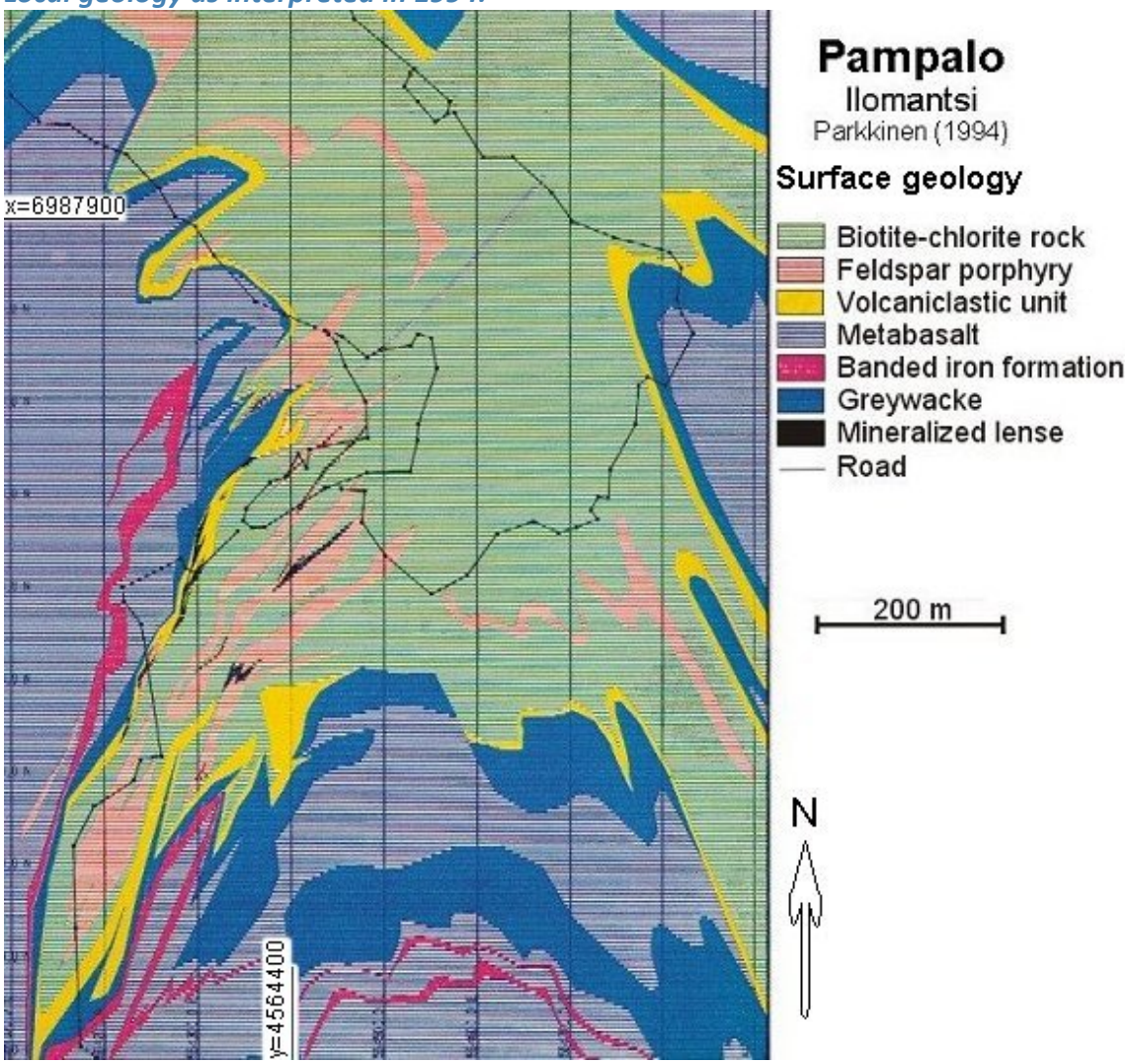
Schematic local region structure ad geology:



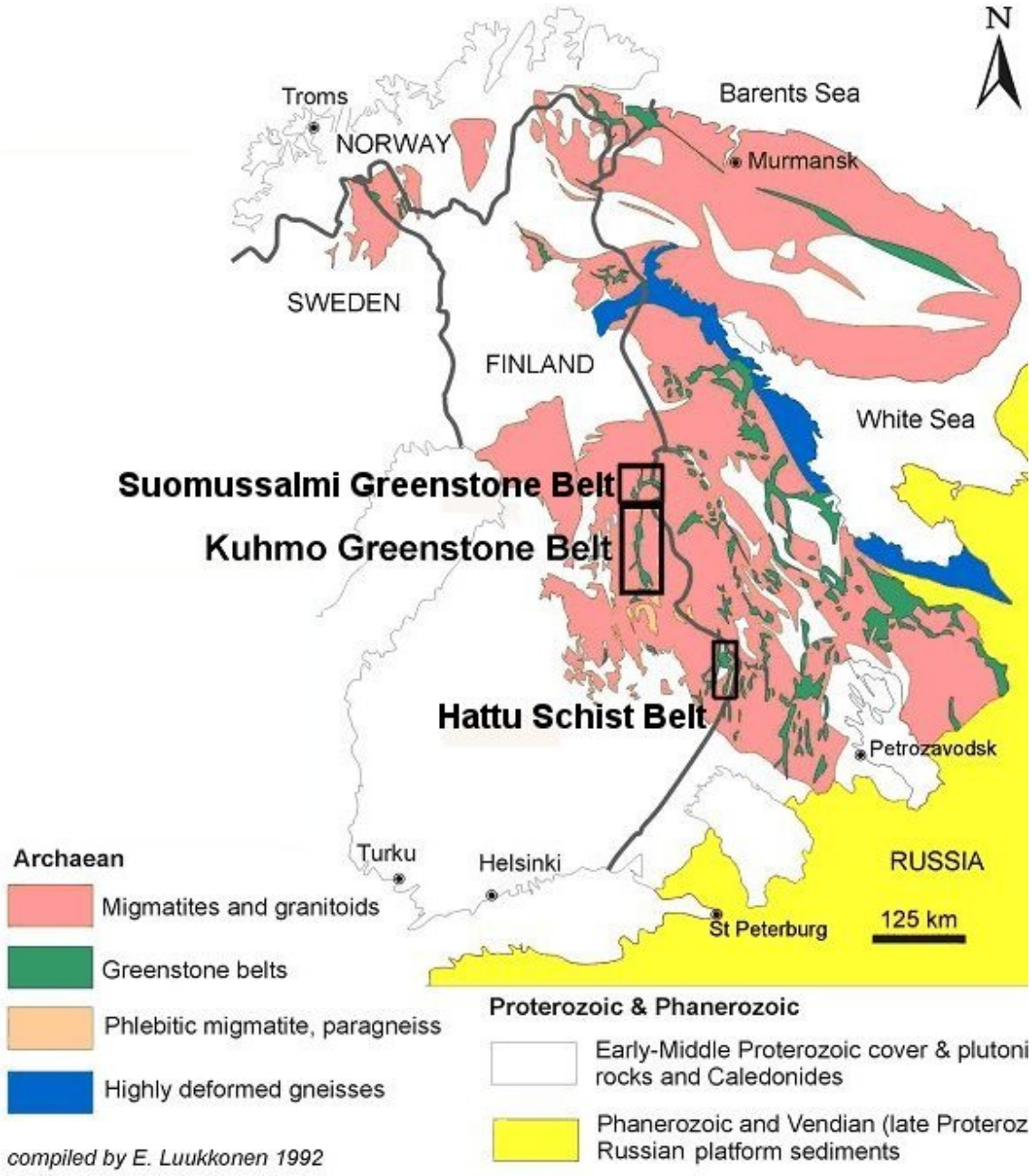
Boudis structure in outcrop:

Pampalo, Ilomantsi. Boudins of felsic porphyry in intermediate tuffite. The length of the handle of the hammer is 60 cm. (Photo by P. Eilu)

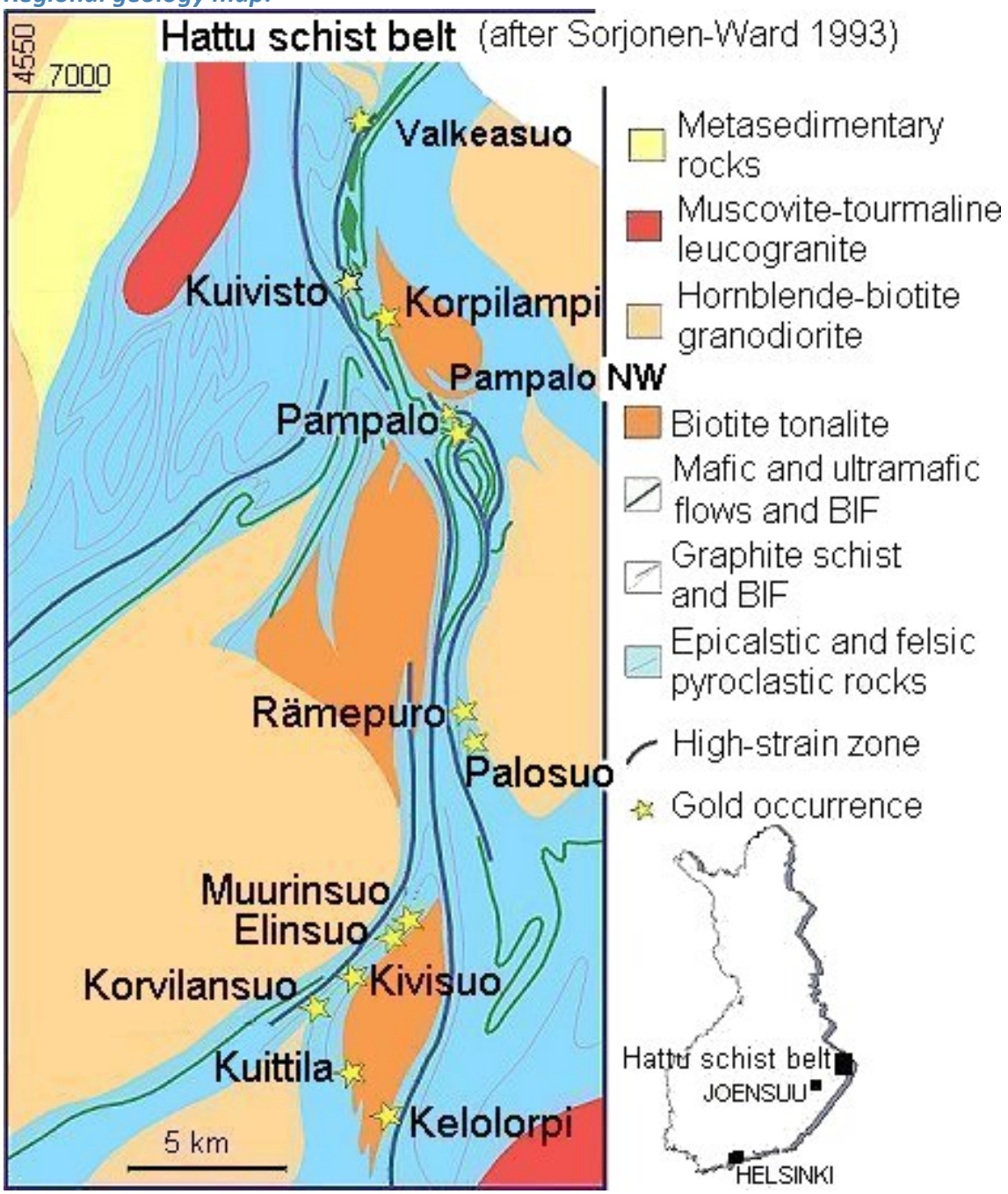
Local geology as interpreted in 1994:



Location in the Carelian craton:



Regional geology map:



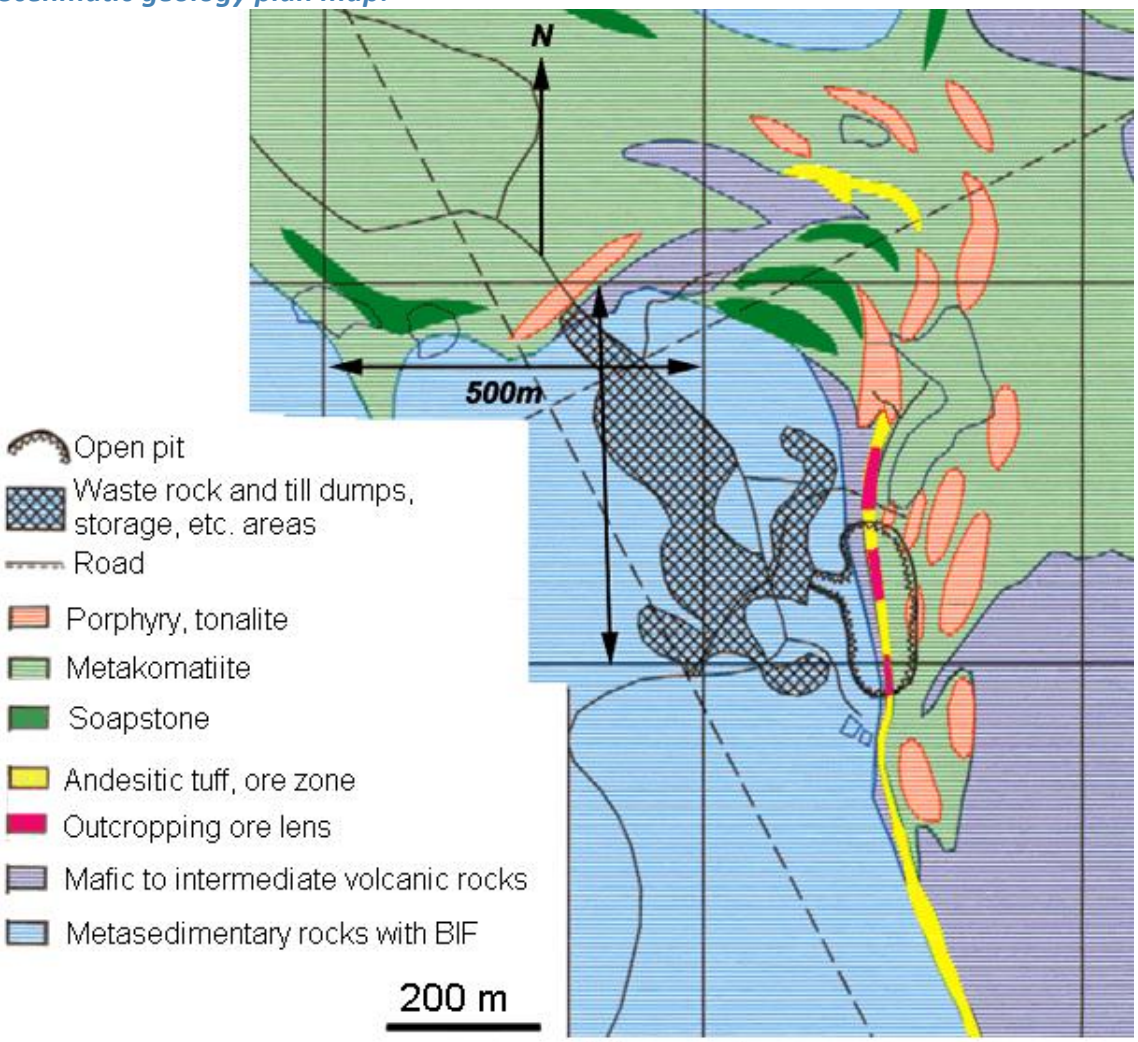
Ore outcrop photo:

Gold ore in feldspar porphyry at Pampalo.
Scale 9 cm. Photo Pasi Eilu.

Close up of an ore outcrop:

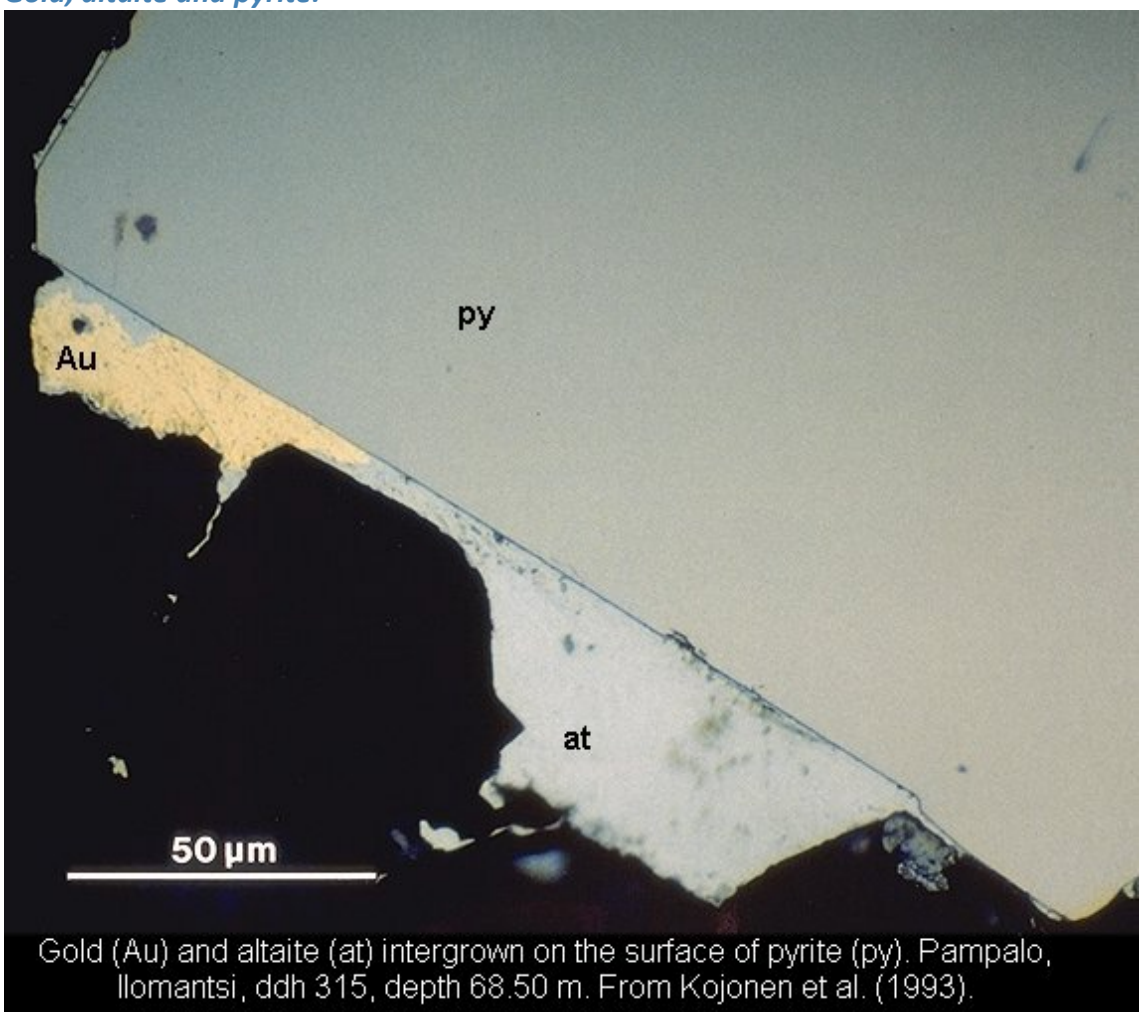
Gold ore in feldspar porphyry at Pampalo.
Scale 9 cm. Photo Pasi Eilu.

Scehmatic geology plan map:



Pampalo local geology
From Goode (2004)

Gold, altaite and pyrite:

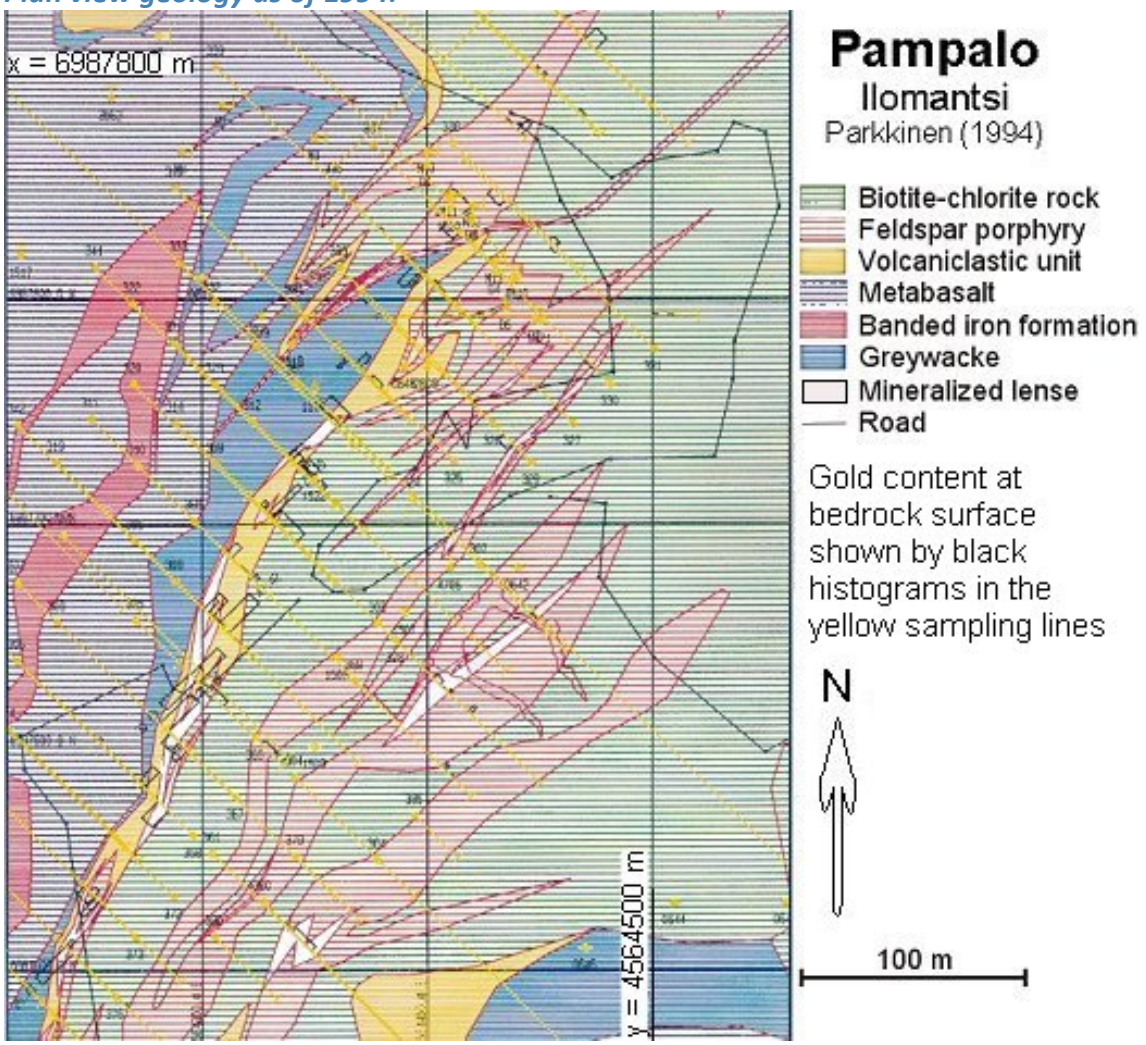


Gold (Au) and altaite (at) intergrown on the surface of pyrite (py). Pampalo, Ilomantsi, ddh 315, depth 68.50 m. From Kojonen et al. (1993).

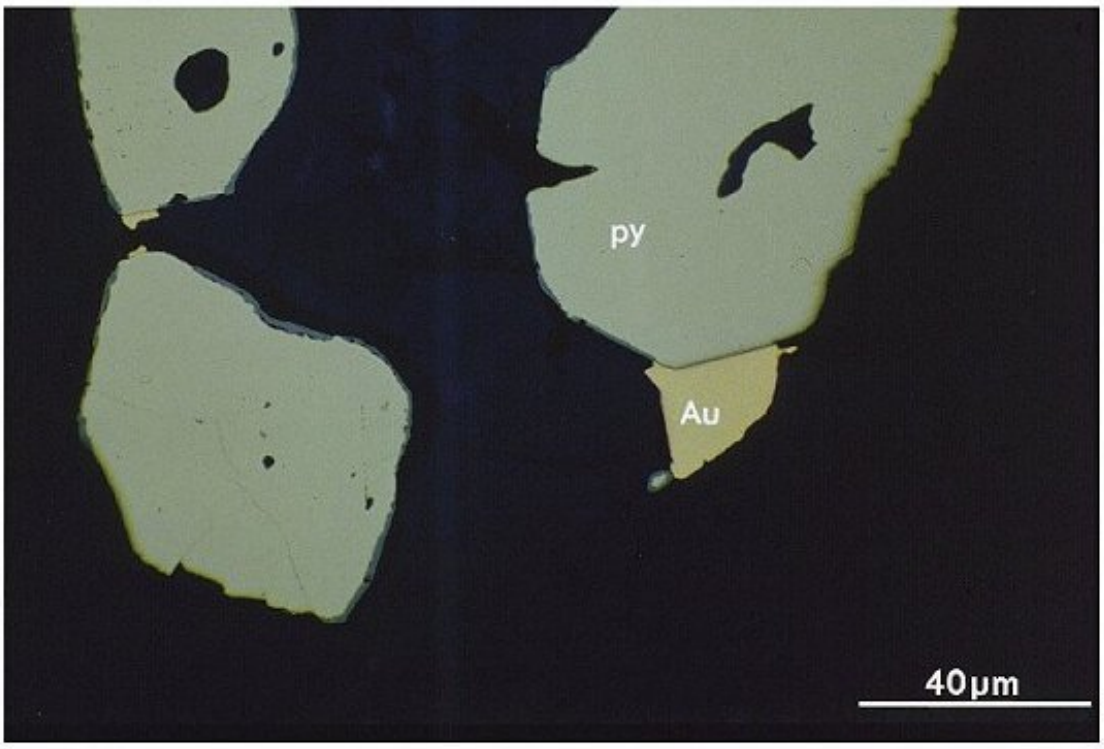
Quartz vein, ore, main host rock:

Pampalo, close-up of 7 ppm Au ore. Scale in cm. Photo Juhani Ojala.

Plan view geology as of 1994:

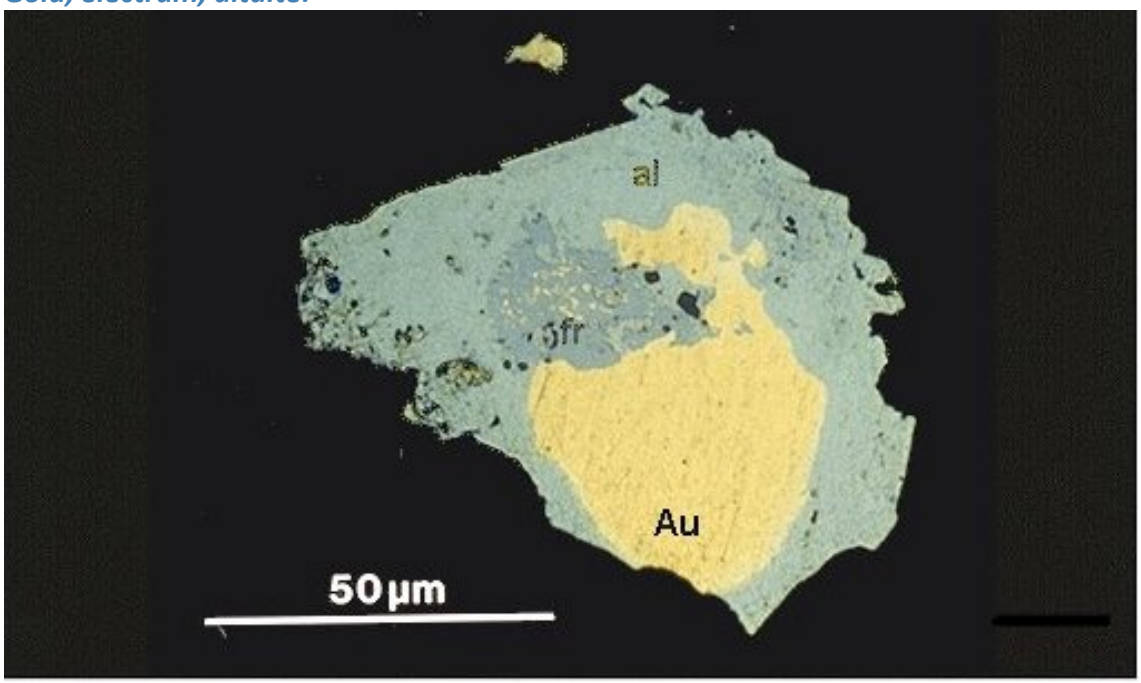


Gold and pyrite:



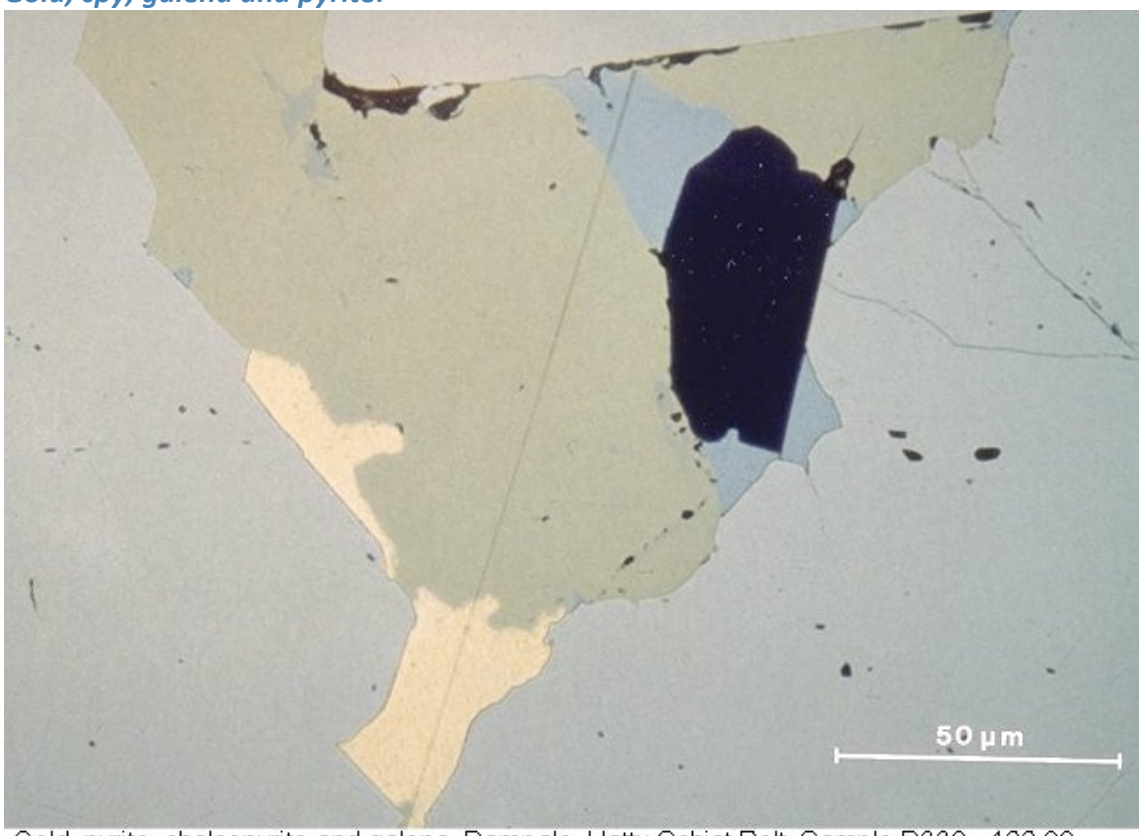
Subhedral pyrite (py) grains encrusted in goethite and intergrown with gold (Au) grains, host rock is feldspar porphyry, Pampalo, Ilomantsi, outcrop sample.
From Kojonen et al. (1993).

Gold, electrum, altaite:



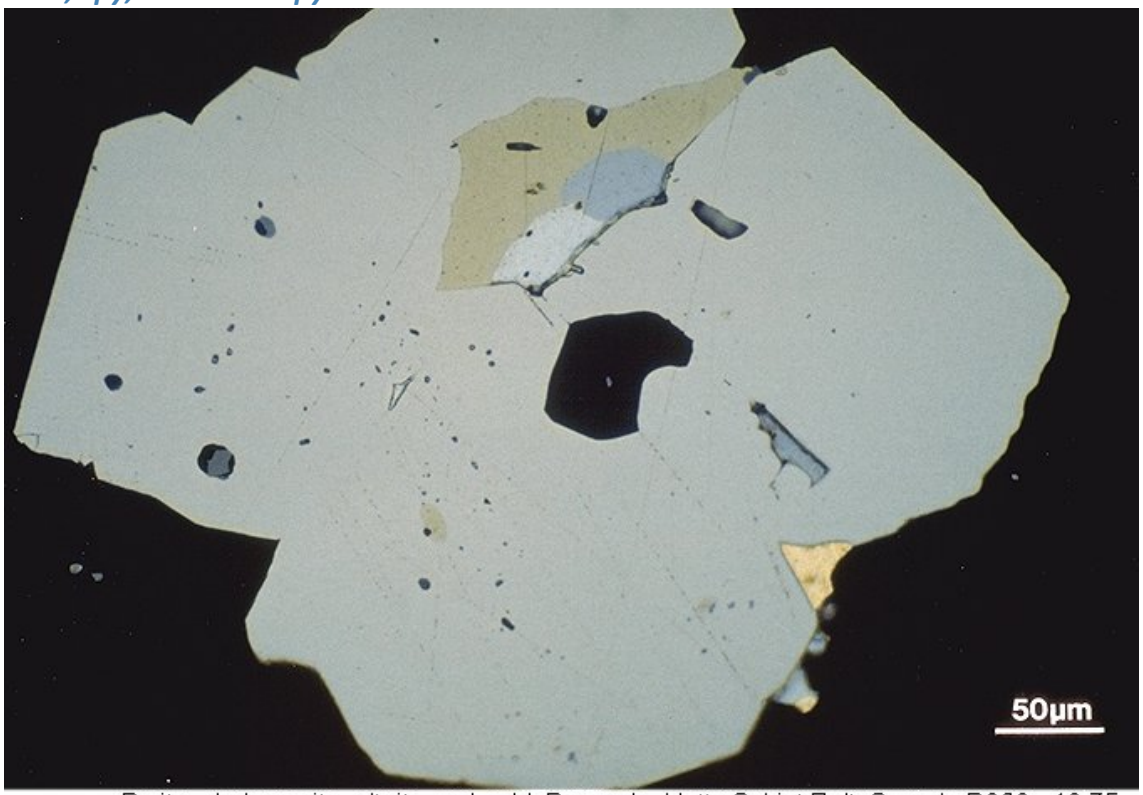
Native gold (Au) rimmed with electrum (el), and intergrown with altaite (al) and frohbergite (fr). Calaverite occurs as tiny inclusions in frohbergite, Pampalo, Ilomantsi, ddh 315, depth 69.35 m. From Kojonen et al. (1993).

Gold, cpy, galena and pyrite:



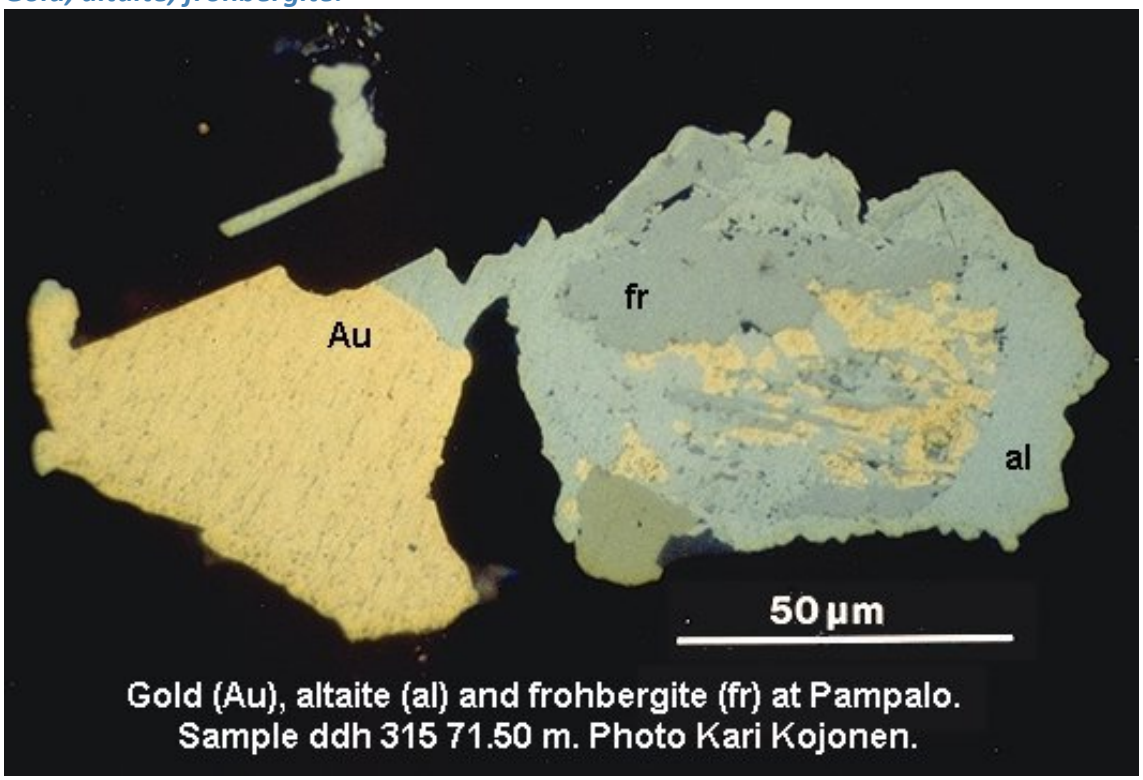
Gold, pyrite, chalcopyrite and galena. Pampalo, Hattu Schist Belt. Sample R330 - 122.80.
Photo Kari Kojonen

Gold, cpy, altaite and pyrite:



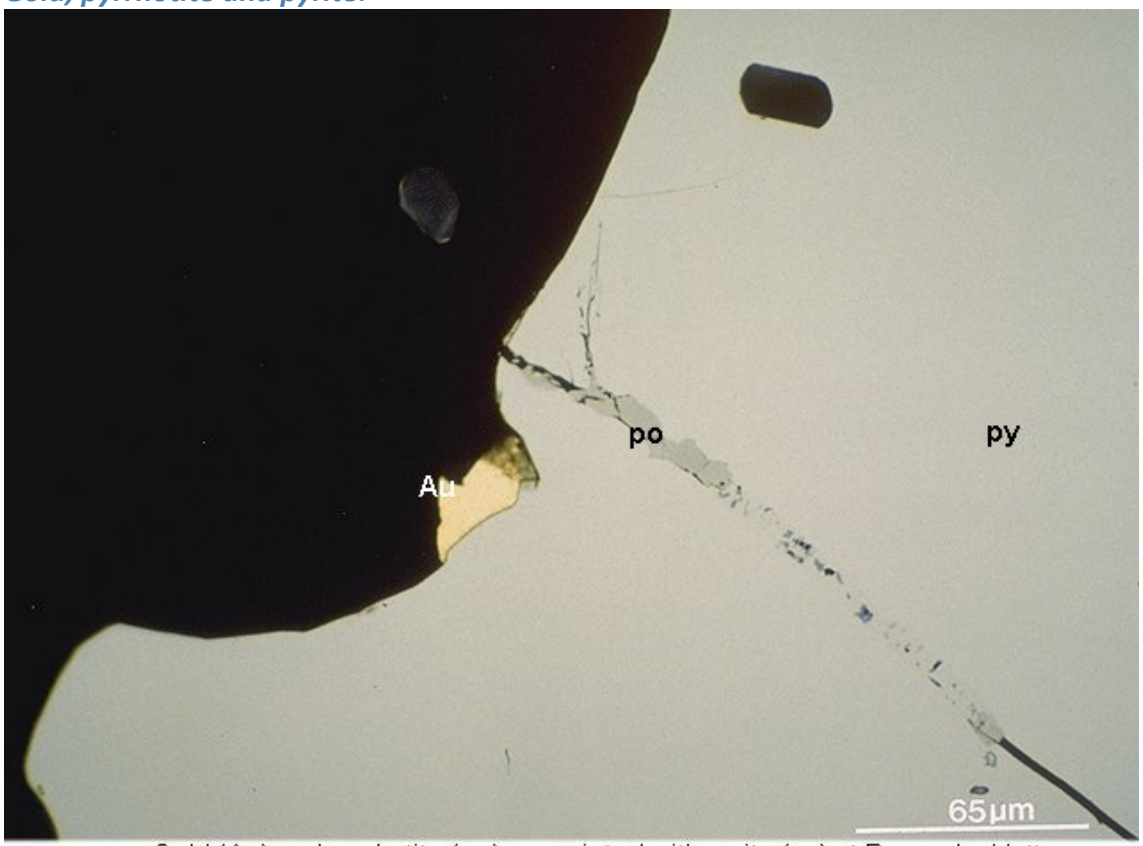
Pyrite, chalcopyrite, altaite and gold. Pampalo, Hattu Schist Belt. Sample R329 - 19.75.
Photo Kari Kojonen

Gold, altaite, frohbergite:



Gold (Au), altaite (al) and frohbergite (fr) at Pampalo.
Sample ddh 315 71.50 m. Photo Kari Kojonen.

Gold, pyrrhotite and pyrite:



Gold (Au) and pyrrhotite (po) associated with pyrite (py) at Pampalo, Hattu Schist Belt. Sample ddh 305, 48.00 m. Photo Kari Kojonen.

Close up of an ore outcrop:

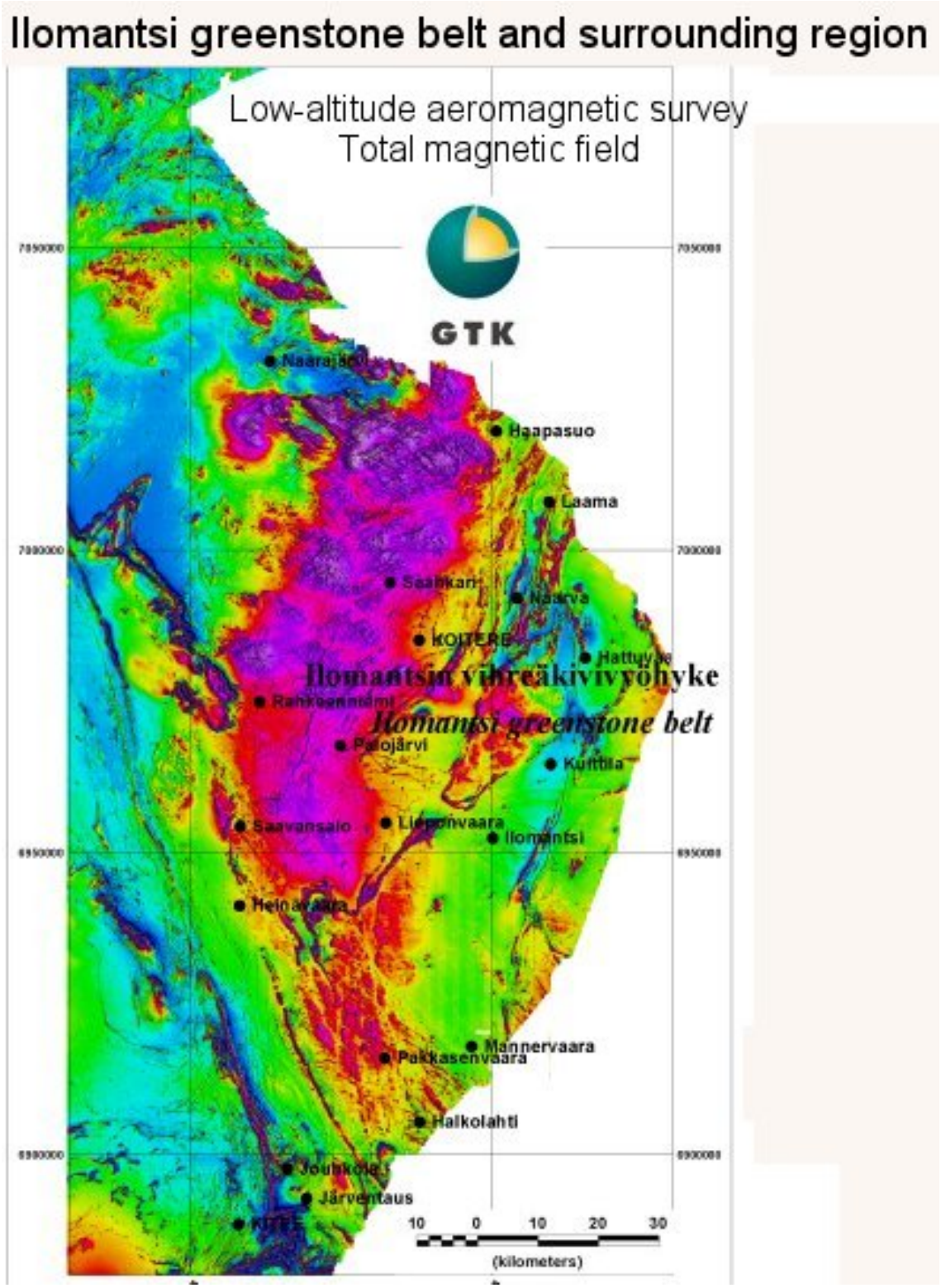
Pampalo, piece of ore (7 ppm Au). 3 September 2001, photo Juhani Ojala.

Boudinaged host rock:

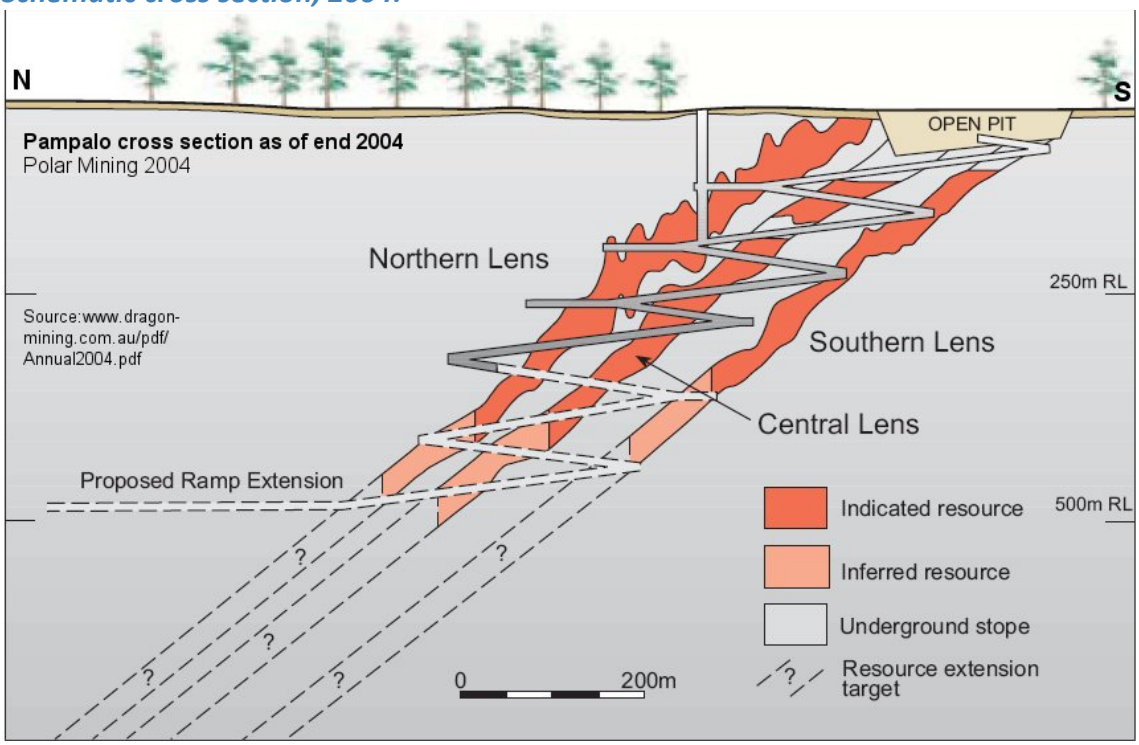
Pampalo, Ilomantsi. Boudinaged main host rock, intermediate tuffite. The scale bar is 20 cm.

(Photo by P. Eilu)

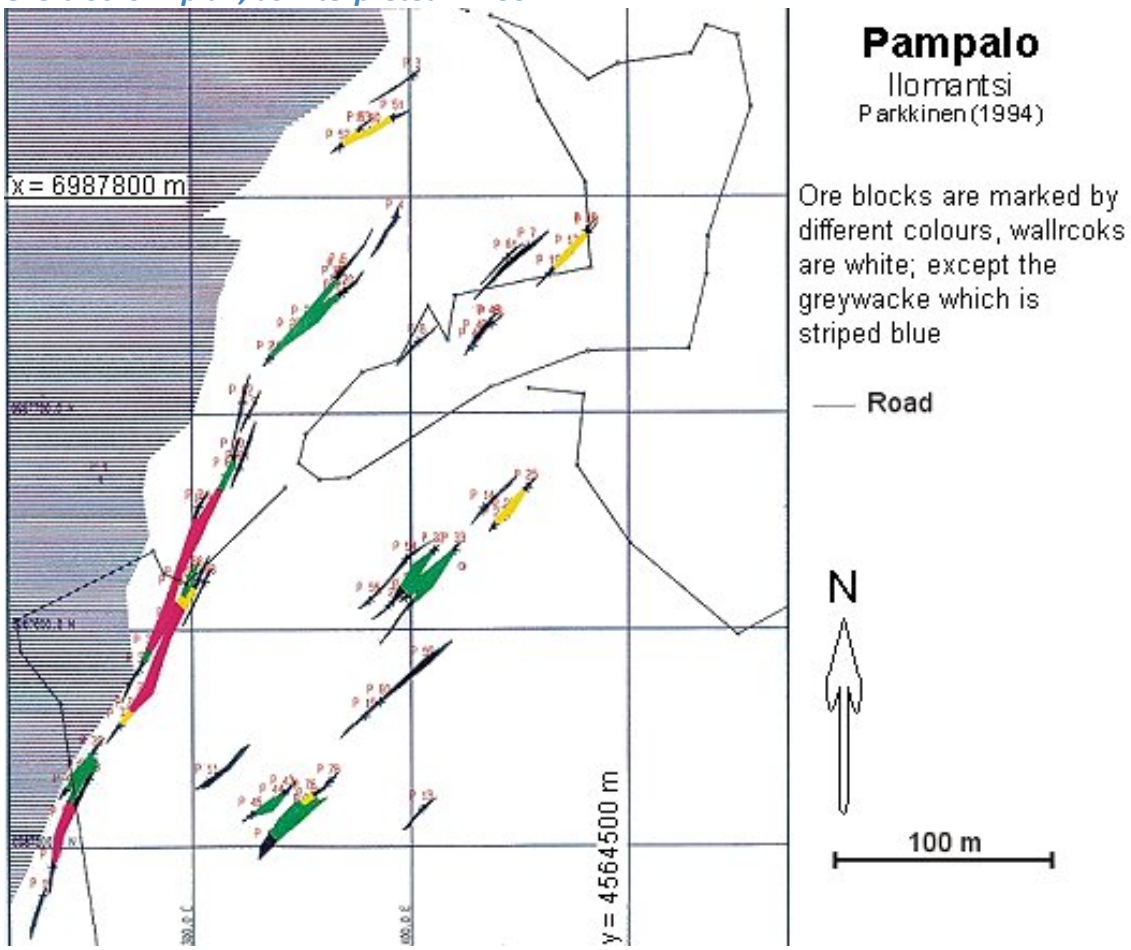
Regional low-altitude airborne magnetic image:



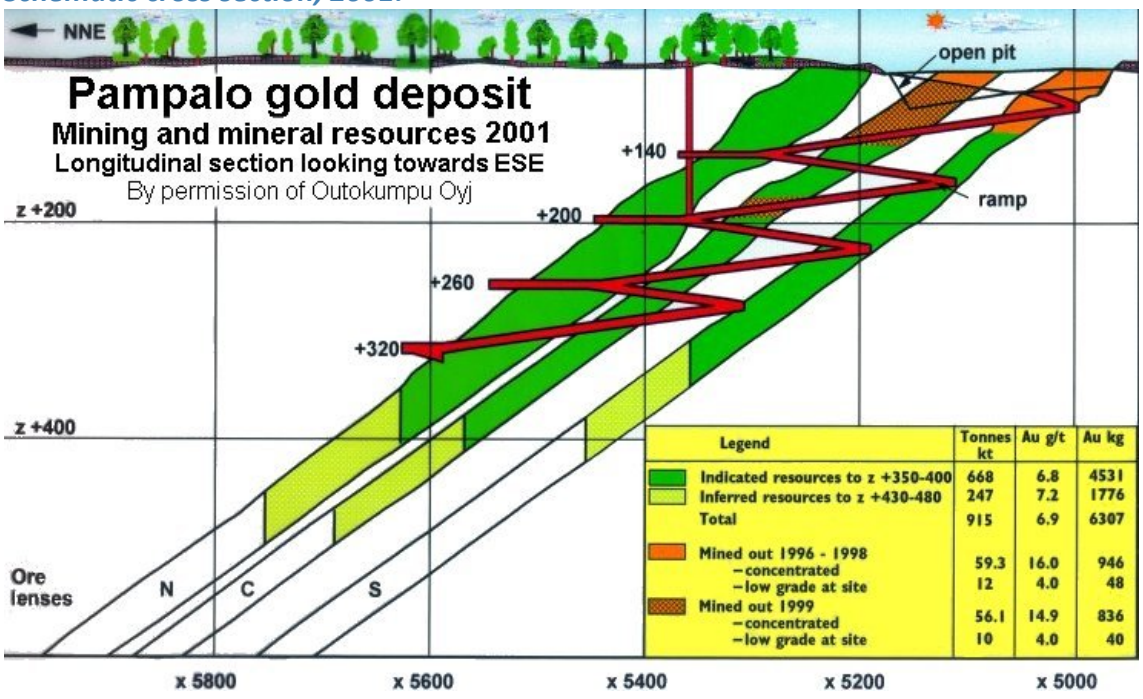
Schematic cross section, 2004:



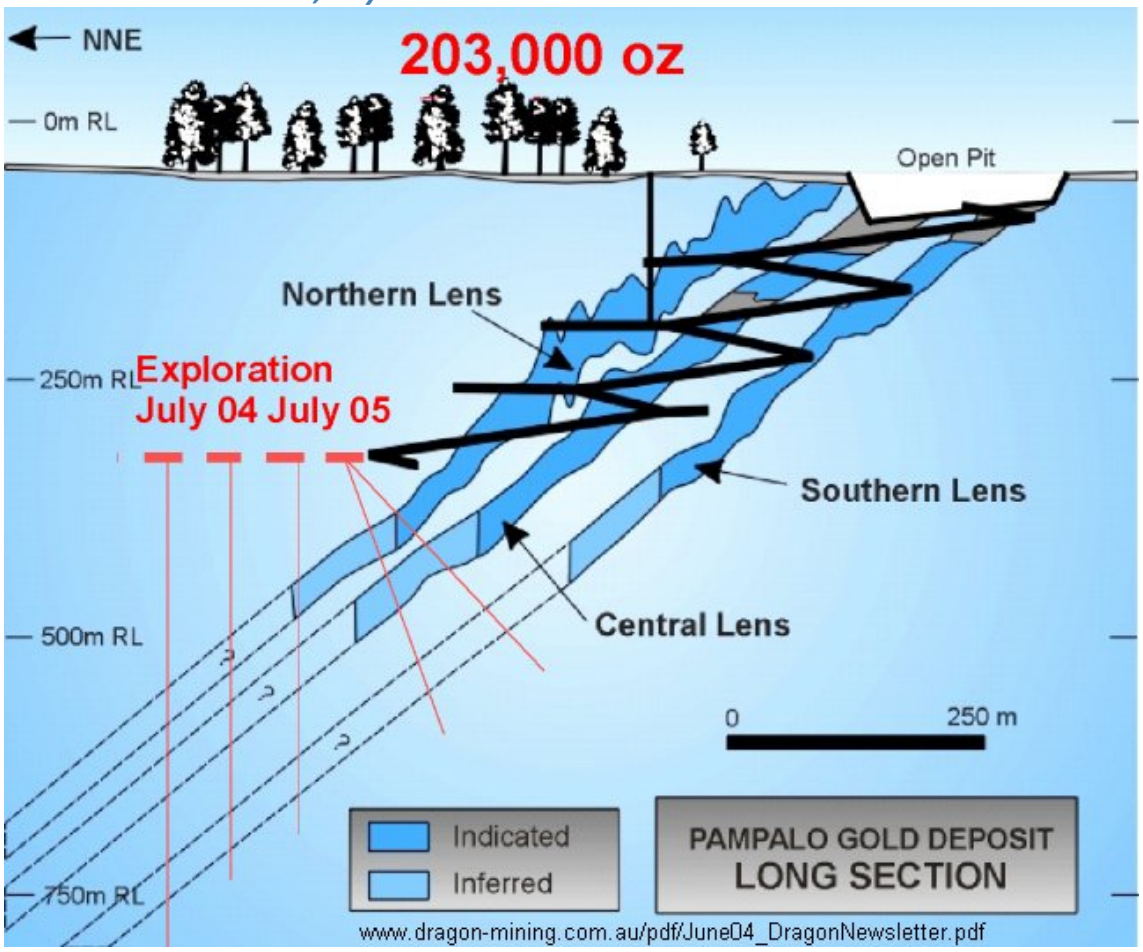
Ore blocks in plan, as interpreted in 1994:



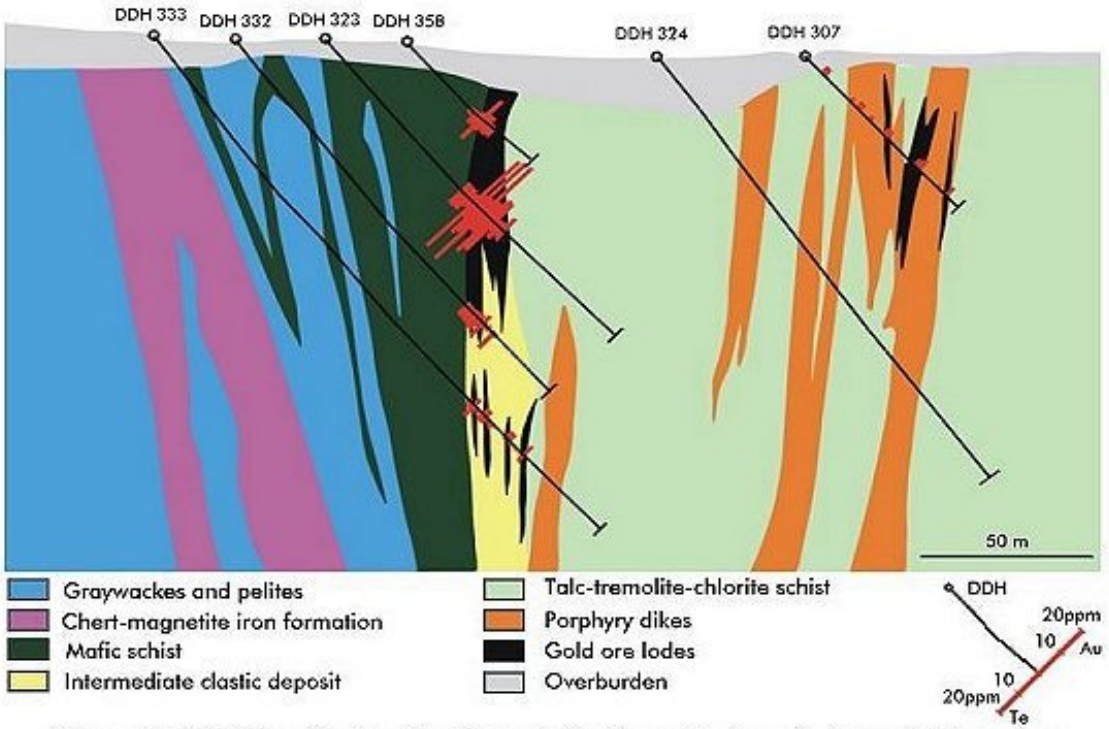
Schematic cross section, 2001:



Schematic cross section, July 2004:



Geology cross section, early 1990s:

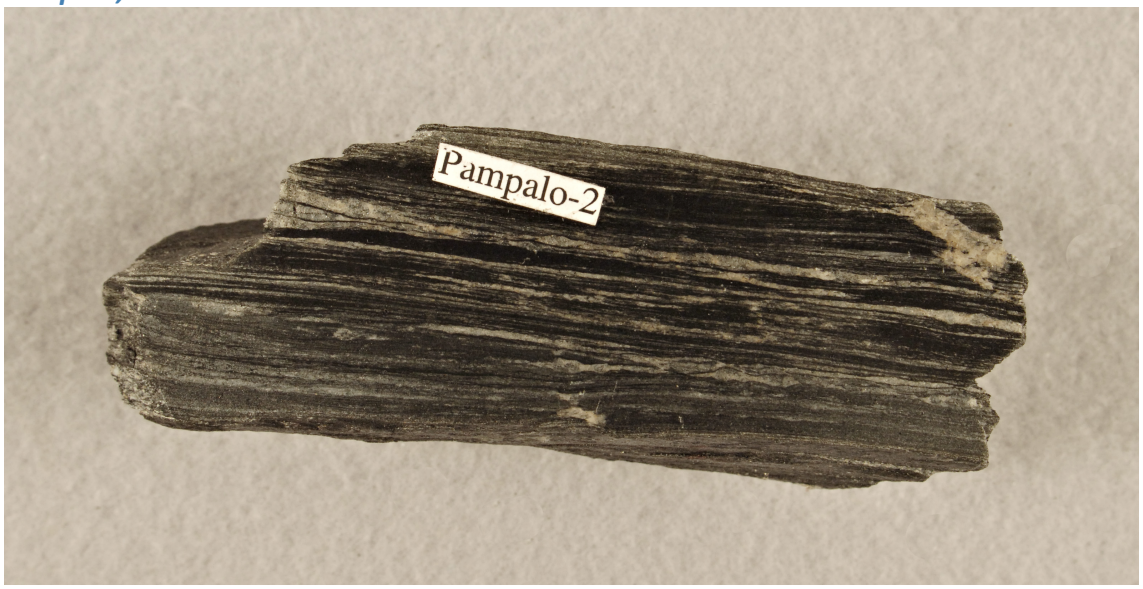


Schematic NW-SE vertical section through the Pampalo deposit, Ilomantsi, based on computer graphical analysis of drill hole data by J. Parkkinen.
(from Nurmi & Sorjonen-Ward 1993)

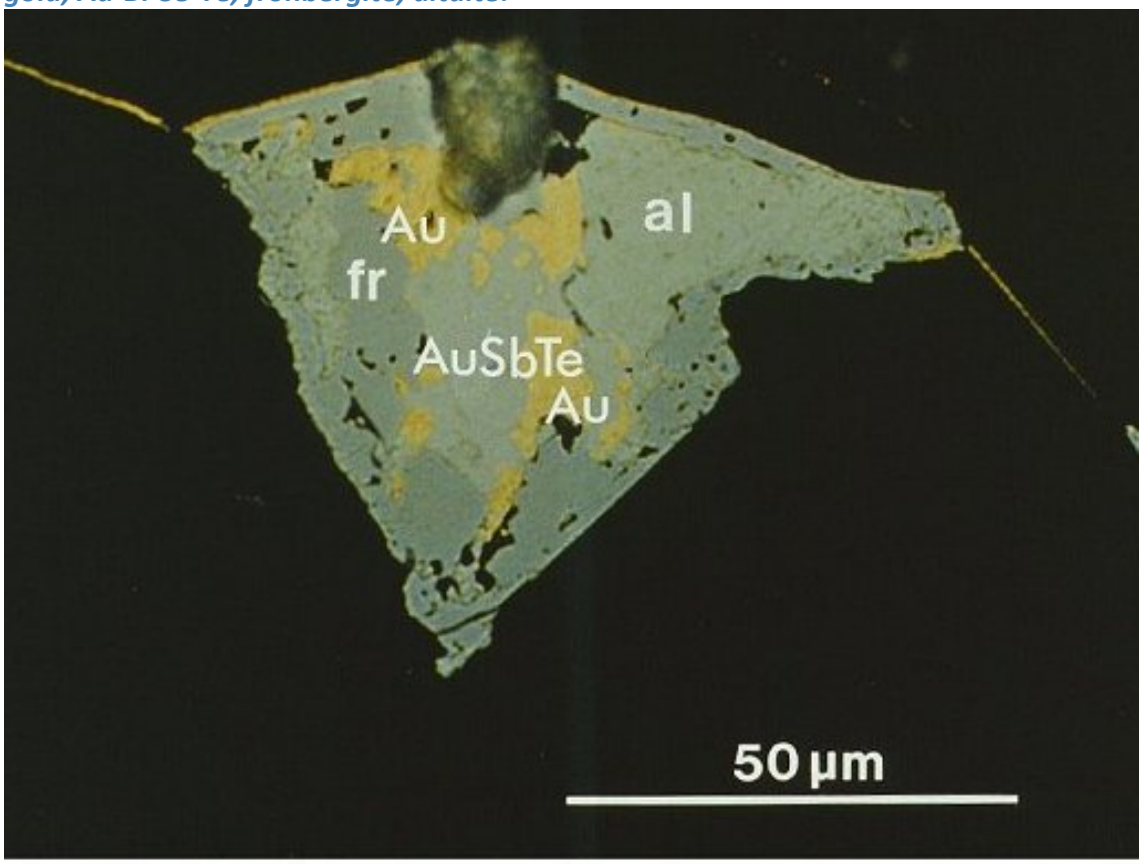
A 40 cm sample from the richest ore (probably several tens of ppm Au) in metatuffite. Assemblage: biotite - quartz - K feldspar - albite - calcite - chlorite - epidote - pyrite - rutile - tremolite-actinolite - tourmaline - gold. Photo Reijo Lampela:

Low-grade ore (1–4 ppm Au) in the metatuffite. Note the abundant biotite, deformed thin quartz veins and idioblastic pyrite porphyroblasts. Sample length 10 cm. Photo Reijo

Lampela, GTK:



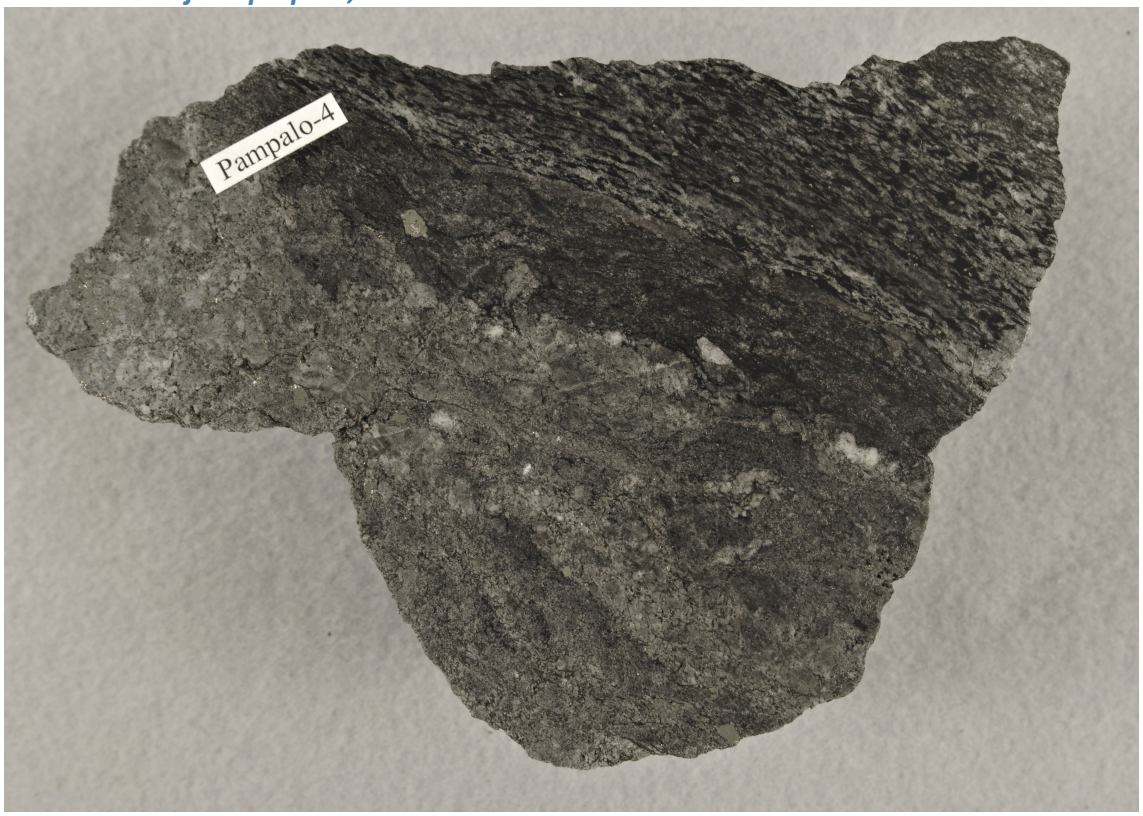
gold, Au-Bi-Se-Te, frohbergite, altaite:



An AuSbTe-mineral intergrown with altaite (al), frohbergite (fr) and native gold (Au), Pampalo, Ilomantsi, ddh 315, depth 71.50 m. From Kojonen et al. (1993).

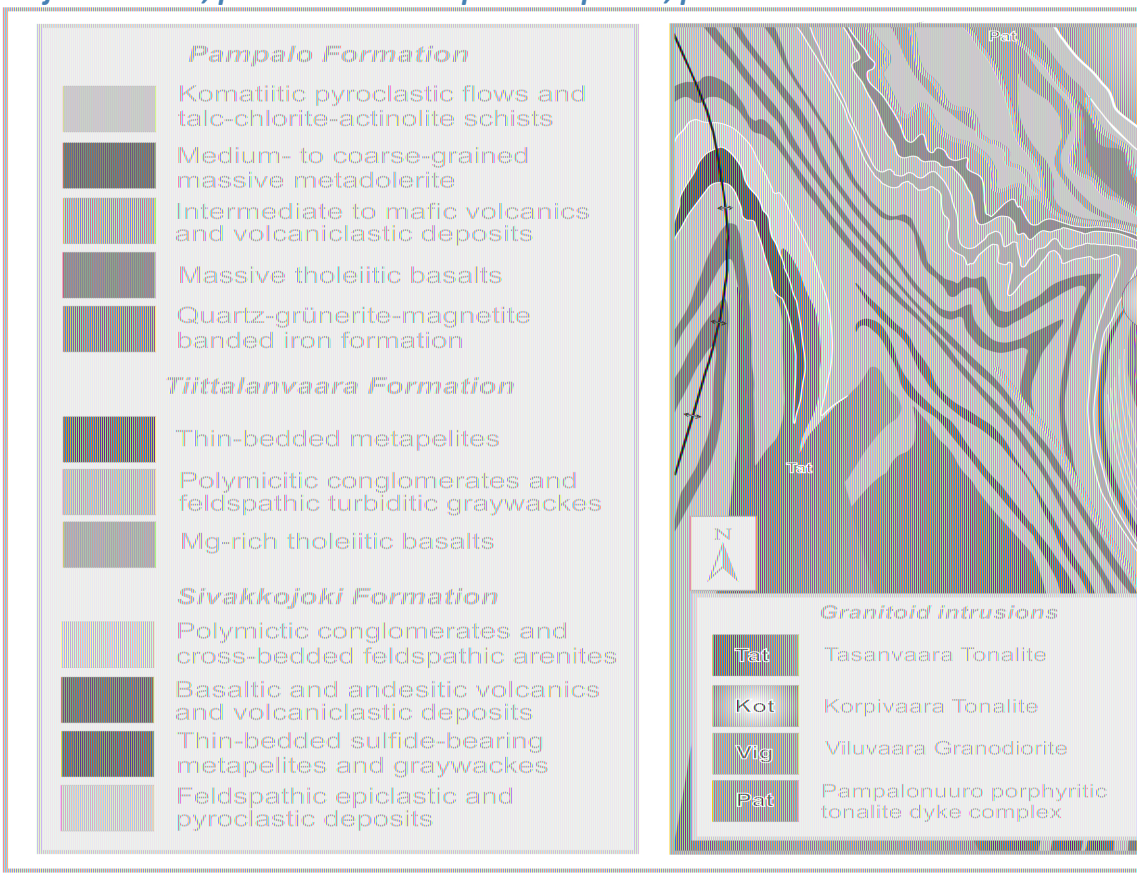
High-grade, intensely biotitised and deformed ore with abundant pyrite. Sample length 17

cm. Photo Reijo Lapmpela, GTK:



Stratigraphic setting of the Pampalo Zone in the northern part of the Hattu schist belt; location of the Pampalo gold deposit is indicated by the symbol P. Image by Peter

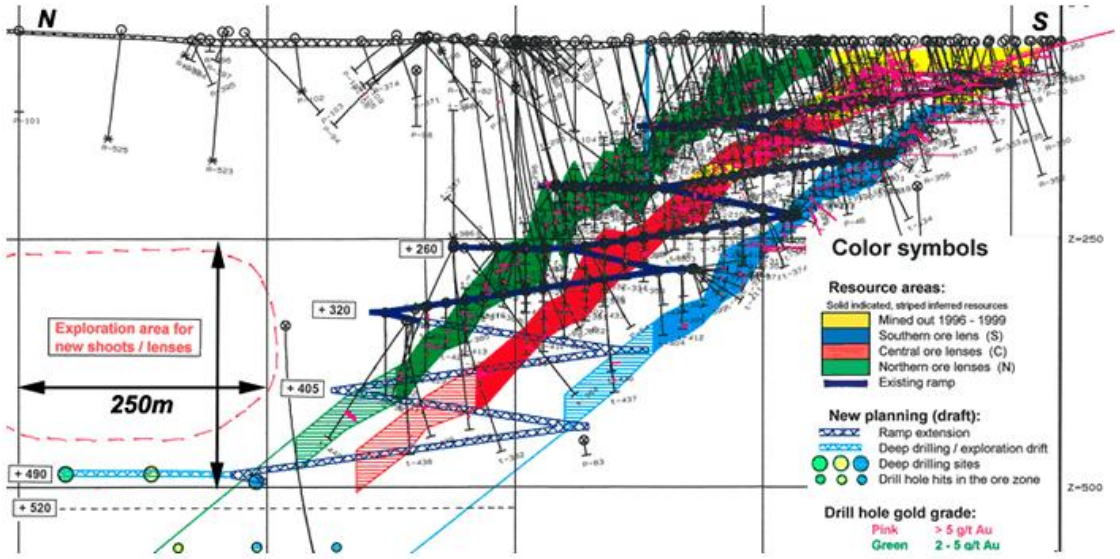
Sorjonen-Ward, published in GTK Special Paper 53, p. 259:



Close up of an ore outcrop:

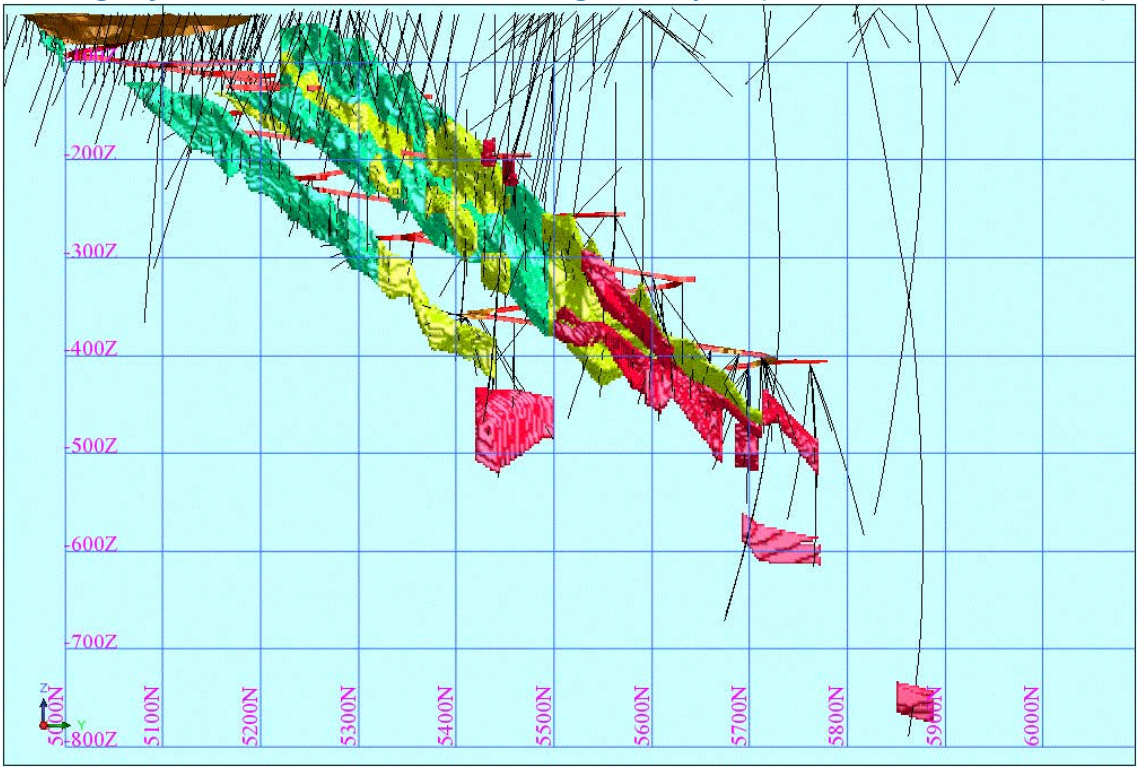
Pampalo, deformed veins in a 7 ppm Au ore. Photo Juhani Ojala.

Long section with lodes and drilling, 2004:



Pampalo long section, drilling and underground exploration in 2004. From Goode 2004.

3D image of the main ore bodies and drilling at Pampalo (Loven & Meriläinen 2010):



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