



Bergvesenet

Postboks 3021, 7002 Trondheim

Rapportarkivet

Bergvesenet rapport nr BV 1219	Intern Journal nr	Internt arkiv nr	Rapport lokalisering Trondheim	Gradering Åpen
Kommer fra ..arkiv Falconbridge	Ekstern rapport nr Sul	Oversendt fra	Fortrolig pga	Fortrolig fra dato:
Tittel A/S Sulfidmalm Evje Iveland Project. Mineralization catalogue				
Forfatter Uten forfatter V Wiik, E Overwien, E G Haldemann		Dato 28.09 1968	Bedrift Sulfidmalm	
Kommune Evje og Hornnes Iveland	Fylke Aust-Agder	Bergdistrikt Østlandske	1: 50 000 kartblad 15124 15133	1: 250 000 kartblad Mandal Arendal
Fagområde Geologi	Dokument type Rapport	Forekomster Elshaugen skj, Skripeland skj, Kjettevann skj, Stemmen?, Orreknappen mine, Bekken skj, Paasche skj, Litjern skj, Lomtjern skj, Guldregn skj, Byttingsmyr skj, Heståsen skj, Langtjern skj, Småhaugan, Byttingsmyra, Mykleåsen, Flåt gruve, Åvesland, Åflau, Håland, Klepptjern, Hornesund, Dalene, Mygland, Vassvatn, Vikstølvann, Landås, Stemtjern		
Råstofftype Malm/metall	Emneord Ni Co Cu Fe S			
Sammendrag Dette er en samlig over tilgjengelige opplysninger om skjerp og gruver i Evje Ivelandområdet, antagelig forut for undersøkelsene som er nedfelt i Sulfidmalm rapport Sul 81-69-7 (se også BV 994). Se også BV 994 (Sul 81-69-7).				

LOCALITY F6A. Lomtjern (photo. 64,2927)

PREVIOUS DATA:- see file 3. "ang. Lomtjern - Aavitslandsheia"

<u>1910:</u> - 4 analyses	% Ni	% Cu
	1.87	0.10
	2.20	-
	1.65	0.96
	2.53	-

1914: Prospect pit 8 m deep mentioned in reports.
At the base of the shaft ore is presumably cut off
by an aplite vein.

2 analyses	% Ni	% Cu
	1.60	1.28
	0.90	1.22

3 boreholes.

I Found no ore, impregnation

II Ore found at 12 m. - 1 · 5 m pure ore and aplite
holding 2% nickel.

III Barren.

1938: 6 diamond drill holes bored.

No. 1 Sulphide impregnation. 3 analyses.

	Ni	Cu	S	
15 m	0	0.05	2.20	impregnated gabbro
17 m	0.18	0.05	5.51	" "
21 m	0.15	0.05	2.37	" "

No. 2

	Ni	Cu	S	
7 m	0.13	0.20	1.61	impregnated gabbro
10 m (0.55 m ore)	0.63	0.44	13.10	ore

No. 3

	Ni	Cu	S	
14 m	0.10	0.18	1.77	impregnated gabbro
15 m	0.13	0.16	1.92	" "

No. 4 Barren.

No. 5

	Ni	Cu	S	
5 m	0.00	0.04	1.68	mica rich rock
	0.05	0.08	5.51	" " "

No. 6

	Ni	Cu	S	
6 m	0.03	0.08	3.30	compressed gabbro

Available data

Ref. Wiik, Overwien.

Samples 21 F 6, 0/206, 0/207a, 0/207 b.

Microscopic T.S. 153 shows 21 F 6 to be metagabbro.

Geophysics Electromagnetic map, scale 1:1'000 (map sheet 1512III)
Autumn 1967.

28/9/68

"

"

Spec. nr.	Ni	Co	Cu	Fe	S			
29.68.F6.	1.64	0.086	0.12	44.0	32.0			
29.68.F6.B.	0.11	0.011	0.12	13.0	1.9			
29.68.F6.C	1.61	0.064	0.19	42.7	29.0			

Further geophysics carried out in March 1968 on frozen swamps. Results were added to Overwiens map of 1967.

LOCALITY F6B. Langtjern (photo 64-2927)

Previous data. (see file 3). As early as 1914 a small prospect pit had been sunk in an area of very weak impregnation, no further work was carried out however.

Available data.

ref. Wiik

Samples 22F6

Geophysical. Survey by Overwien, autumn 1967, supplemented by a survey on the frozen lake in March 1968. Both sets of results are shown on the same map.---Electromagnetic map from Lomtjern in Aaveslands Heia, Evje. scale 1:1'000. (map sheet 1512 III)

Spec. nr.	Ni	Co	Cu	Pb	S
19.68 F6	0,16	0,015	0,61	12,7	3,9

LOCALITY F6E. 650 m SE from Lomtjern (photo 64-2927).

Previous data - None.

Available data

Ref. Wiik.

Samples 16 F 16

Prospect pit 2 x 3 m, 1 - 2 m deep. Impregnated amphibolite. In hand specimen, pyrite, pyrrhotite, and possibly chalcopyrite recognized. D.M.G. - ve Ore zone $\frac{1}{2}$ - 2 m wide?

[illegible]

LOCALITY F6F. Hestaasen.

Previous data, see file 3.

<u>1914:</u>	Ni	Cu
	2.50	0.09
	2.12	0.16
	2.26	0.10

Available data

Ref. Overwien.

Samples 0/200EG2927

28/9/68
" "

Spec. nr.	Ni	Co	Cu	Fe	S			
28.68.F6(A)	0,93	0,068	0,20	31,0	19,8			
28.68.F6	0,40	0,031	0,46	20,4	8,7			

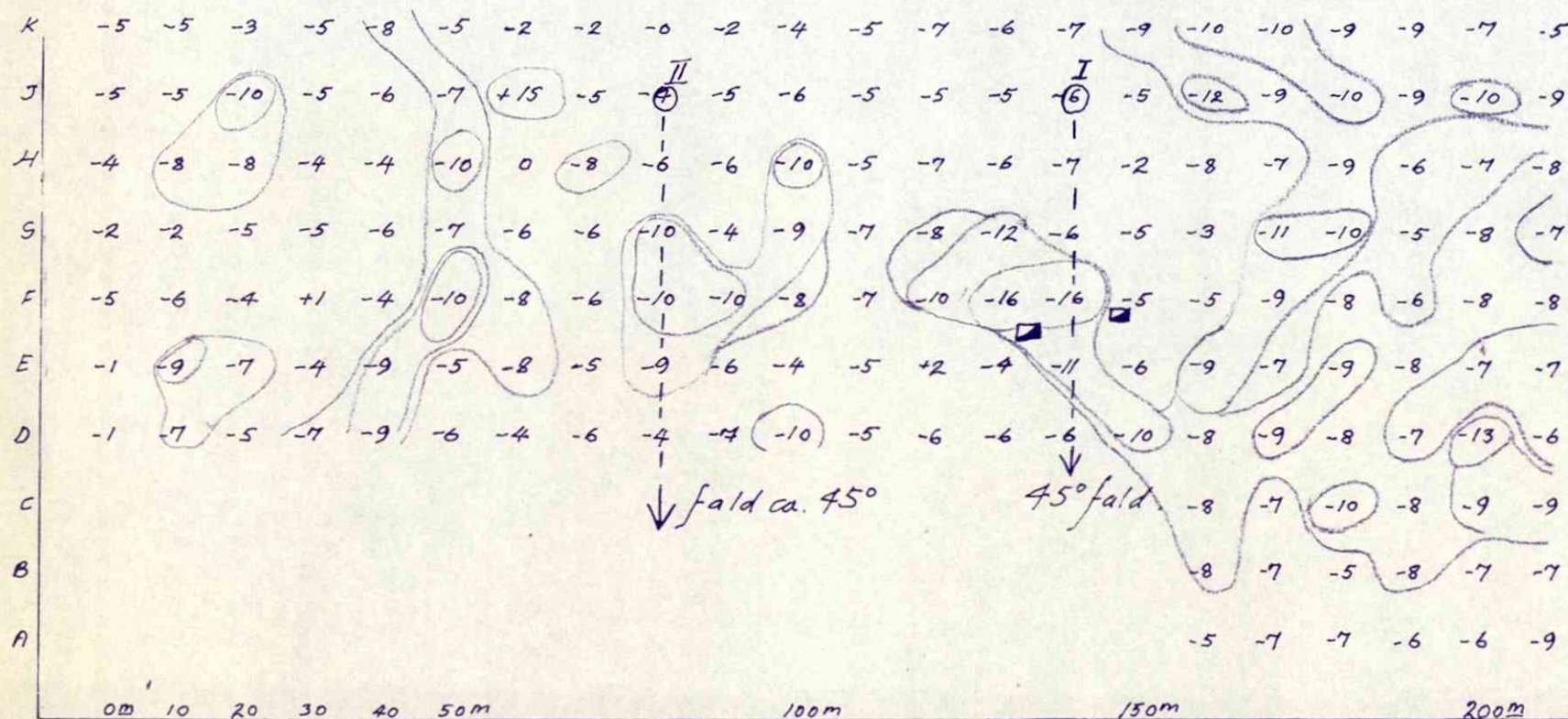
MAGNETOMETER KART

over

HESTAASEN SKJÆRP

Scala = 1: 1000

4. m. o.



Vertikalintensiteten er avsat i grader.

H. Mørch Olsen 1914

Norges Geologiske
Undersøkelse

Fort.

Tegn.

Trec.

M =

Tegn. nr.

LOCALITY F6G. 100 m SE of F6D

Previous data - None

Available data

Ref. Wiik.

Samples 10^AF6

Microscopic TS 117 - fine grained bronzite hb. gabbro with
sulphide impregnation.

LOCALITY F6D. Byttingsmere ^{myr} (photo 64-2927)

Previous data, see file 3.

1914 magnetometer survey.

Available data

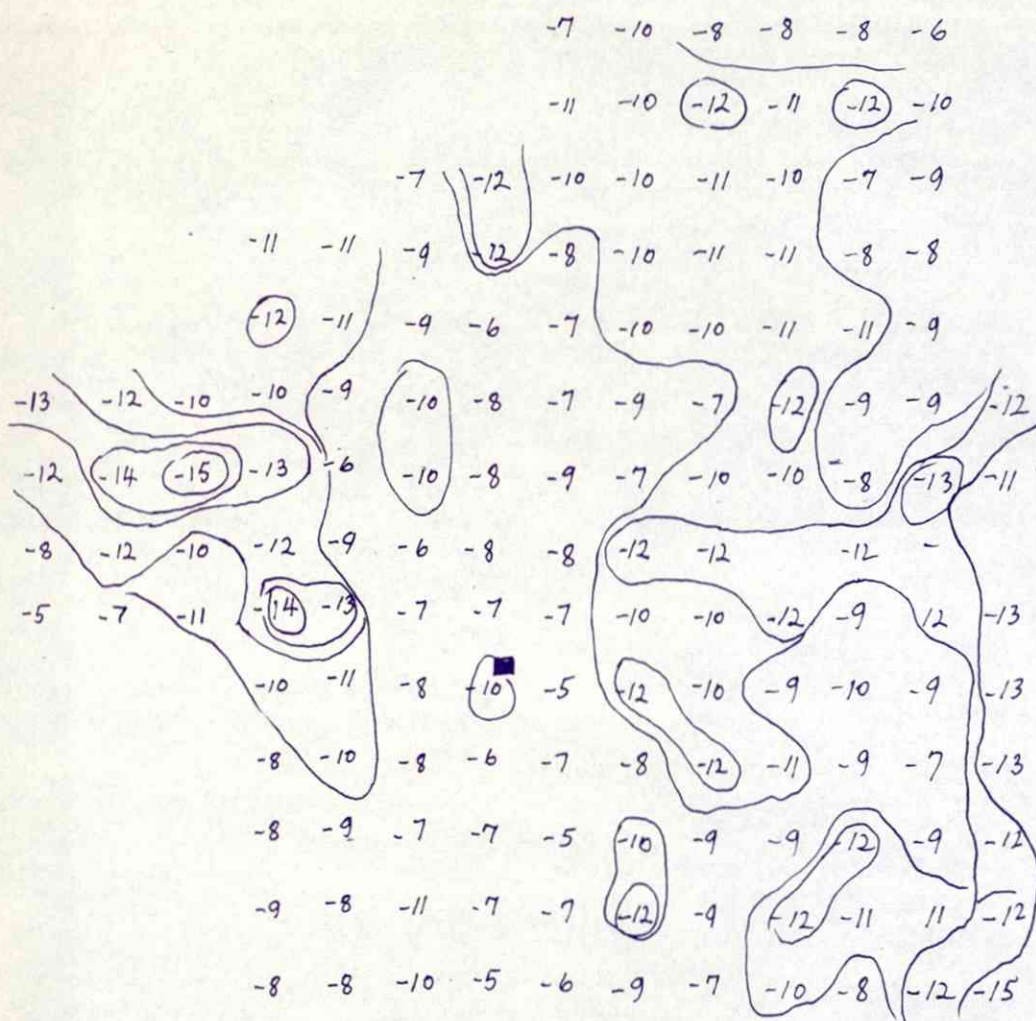
Ref. Wiik, Overwien.

Samples 0/203E62927 - gabbro.

12F6 - at the actual pit, biotite rich gneiss
and amphibolite.

28/9/68

Spec. nr.	Ni	Co	Cu	Fe	S			
0/203 E6	0,15	0,023	0,29	13,0	4,6			



Magnetometrisk Drag

over

BYTTINGSMYR.

0 10 20 30 m

Norges Geologiske Undersøkelse	Forf.	
	Tegn.	
	Trac.	
	M =	
H. Mørch Olsen 1914?	Tegn. nr.	

LOCALITY F6C. Gullregn (photo 64-2927)

Previous data, see file 3.

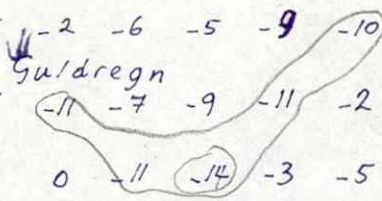
1914. Small prospect pit in impregnation zone is said to lie on a gneiss contact. No analyses available.

Available data.

Ref. Wiik, Overwien.

Samples. 0/201EG-2927. In amphibolite, cp + po noted, mainly associated with joints and vein fillings.

N	-2	-7	-7	-6	-6	-8	-4	-5	-7	-7		-5	-5	+2	0	-4	-5
M	-5	-5	-7	-3	-8	-10	-8	-6	-8	-9	-6	-7	-4	-6	-6	-4	-7
L	-5	-8	-6	-5	-4	-7	-5	-7	-9	-5	-5	-6	-4	-6	+5	-5	-5
K	-7	-4	-6	-7	-6	-9	-5	-5	-4	-5	-5	-6	-2	-5	-5	-6	-5
J	-5	-2	-6	-5	-9	-10	-7	-6	-3	-6	-5	-6	-5	-6	-7	-5	-6
H	-5	-11	-7	-9	-11	-2	-9	-6	-6	-4	-6	-6	-3	-3	-5	-4	-5
G	-3	0	-11	-14	-3	-5	-6	-6	-5	-4	-5	-5	-7	-4	0	-6	-5
F	-2	-2	-5	-7	-7	-5	-6	-6	-6	-4	-4	-3	-1	-3	-2	-5	-4
E		-3	-2	-7	-8	-7	-5	-5	-4	0	-5	-4	-5	-0	-3	-3	-6
D		-7	-3	-8	-6	-7	-6	-3	-2	-5	-5	-8	-3	-5	-4	-7	-5
C		-5	-9	-8	-7	-6	-7	-5	-6	-6	-6	-5	-5	-6	-5	-4	-5
B		-3	-7	-8	-5	-7	-6	-5	-7	-6	-5	-8	-5	-4	-7	-3	-3
A		-5	-8	-5	-6	-8	-5	-1	-5	-4	-2	-7	-1	-4	-6	-2	-5
O	10	20	30	40	50			100				150					



Forl.	Tegn.	Tegn.	M =	Tegn. nr.
Norges Geologiske		Undersøkelse		

200 m fra Guldregn skjær.

Magnetometrisk Drag
over

GULDREGN-LOMTJERN.

H. Mørch Olsen 1914?

LOCALITY D6/D5 A. Flåt Mine Area (photos 64.2931, 64.3021).

2 old mine workings, 2 prospect pits, 4 exploration adits plus disseminations.

Previous data - numerous.

See, files 1, 4, 6, 8-21 (Sulfidmalm)

Flåt Nickel Mine - Bjørlykke. N.G.U. 168b. 1947. etc.

Sulfidmalms files

File 1, Reports from Carstens and Bjørlykke (1940 - 45)

File 4, Borhole record Feb. 1942 - Jan. 1944.

File 6, Report on magnetometer measurements, 1934. (Hornemann).

File 8, Borhole record. Summer 1912.

File 9, " " 1/10-1932, 17/3-1933.

File 10, " " Dec. 1933 - July 1934

File 11, " " Aug. 1934 - March 1935

File 12, " " March - Nov. 1935

File 13, " " Dec. 1935 - Feb. 1936

File 14, " " March 1936 - Feb. 1937

File 15, " " March 1937 - March 1938

File 16, " " April - June 1938

File 17, " " July - Oct. 1938

File 18, " " Nov. 1938 - Dec. 1939.

File 19, " " Jan. 1940 - March 1941

File 20, " " from Himalay 1941

File 21, " " Jan. 44 - Feb. 45.

Analyses of diamond drill cords.

	Content of Ni	No. of analyses	Ni %	Cu %	S %	Average content of	
						Cu/Ni	S-Sch/Ni
Rich ore	1 - 2%	26	1.23	0.67	11.55	0.55	8.9
Usual ore	0.5 - 1%	44	0.68	0.48	5.32	0.71	7.1
Poor ore	< 0.5%	46	0.28	0.22	5.57	0.79	19.1

Calculated ratio between pyrrhotite and pentlandite is 4.9 :1.

Available data

Ref. Haldemann.

Samples. 13D6, FN50, FN51.

Microscopic. T.S. 198 gives meta-Hb diorite.

		Ni	Co	Fe	S
19/12/67	13D6	0.02	< 0.01	10.9	0.42

Spec. nr.	Ni	Co	Cu	Fe	S	$\frac{Cu}{Cu+Ni}$	$\frac{Co}{Co+Ni}$
FN51	0,17	0,01	1,1	16,4	2,2	0,866	
FN50	0,14	0,01	0,02	12,1	1,9	0,125	0,067

PRODUCTION STATISTICS, FLAT MINE.

Year	Raw Ore	Ni %	Cu %	Cu/Ni
1927	17,360	0,892	0,582	0,65
1928	68,164	0,974	0,591	0,61
1929	70,771	0,954	0,636	0,61
1930	106,402	0,884	0,577	0,65
1931	77,342	0,898	0,584	0,65
1932	148,240	0,875	0,582	0,65
1933	146,051	0,812	0,513	0,63
1934	147,292	0,750	0,524	0,70
1935	156,336	0,634	0,475	0,75
1936	166,809	0,610	0,448	0,73
1937	100,346	0,631	0,471	0,74
1938	189,506	0,588	0,409	0,69
1939	153,450	0,577	0,403	0,70
1940	163,799	0,538	0,404	0,75
1941	118,200	0,581	0,419	0,74
1942	112,107	0,614	0,428	0,70
1943	100,193	0,606	0,412	0,68
1944	94,953	0,553	0,372	0,67
Total 1927-44	2,064,625	0,690	0,475	0,68
Total 1872-1926	575,000	0,800		

Total production 1872-1944 2,639,625 tons raw ore at 0.75 Ni.

At the beginning of 1945 approx. 60,000 tons of poor quality ore left in the mine.

Nixon/kt
March 19, 1968.

	Analyser av matten Gr pr. tonn				Tonn malm pr. tonn matte	Beregnet gr pr. tonn malm					Forholdet Pt-metaller: Ni + Cu
	Pt	Pd	Au	Ag		Pt	Pd	Au	Ag	Sum Pt. met.	
Ertelien grube, Ringerike.											
Gjennomsnitt av bessemermatte 1915	0,92	3,08	4,86	366	45	0,020	0,068	0,108	8,1	0,077	1 : 260 000
— " — 1916	1,15	2,72	5,70	368	54	0,021	0,051	0,105	6,8		
— " — 1917	0,82	2,50	4,88	348	46	0,018	0,054	0,106	7,5		
✕ Flåt grube, Evje.											
Gjennomsnitt av matte, febr. 1915	0,75	0,92	1,19	195	46	0,017	0,020	0,026	4,3	0,039	1 : 500 000
— " — aug. 1916	0,84	1,11	1,26	218	47	0,018	0,024	0,027	4,7		

Analysen av malm:

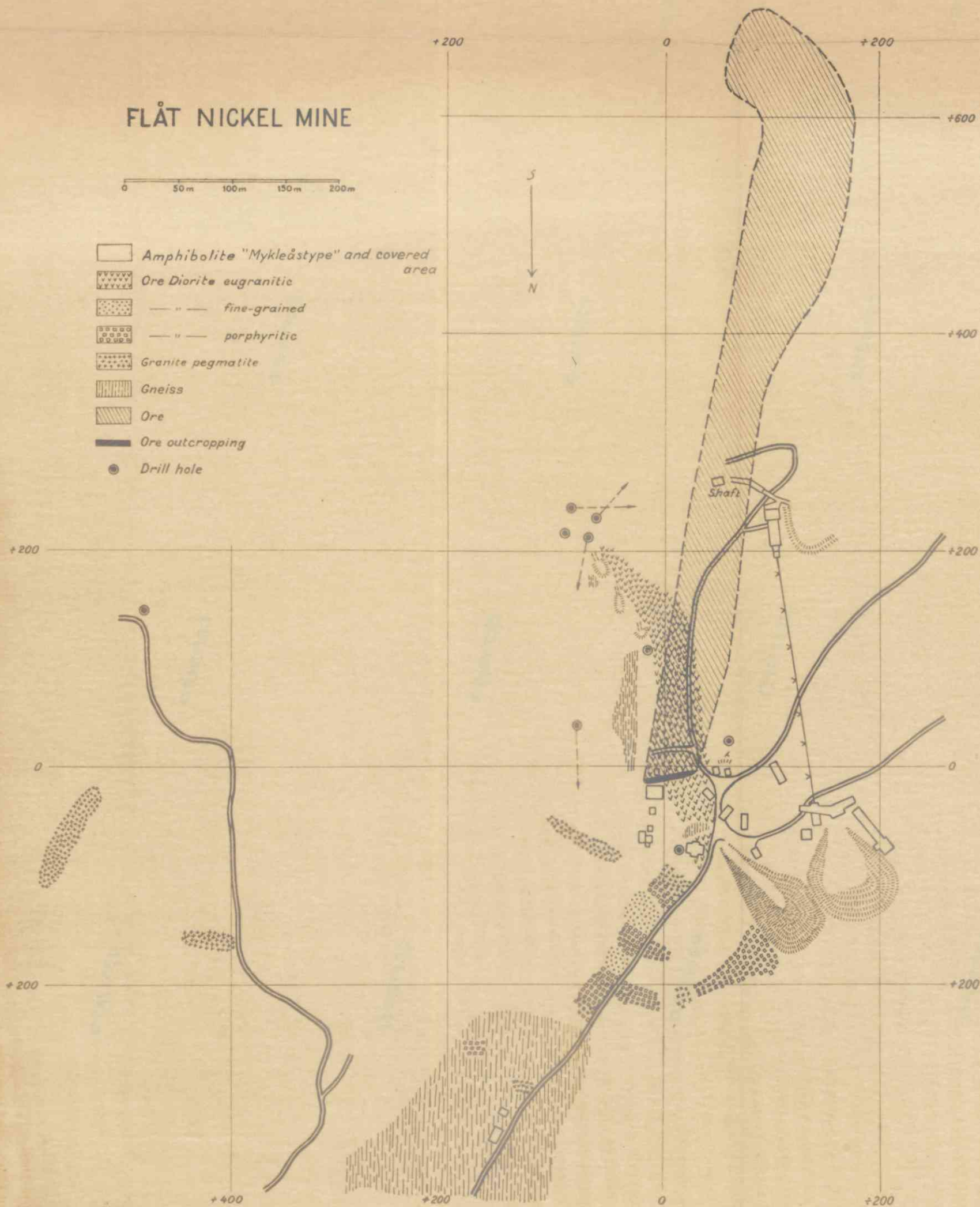
% Ni % Cu

✕ Flåt grube, Evje.											
Gjennomsnitt av malm..... 1918	-	-	-	1,00	0,65	0,023	0,047	0,111	-	0,070	1 : 235 000
Litland grube, Hosanger... 1915	-	-	-	2,35	0,83	0,042	0,142	0,045	1,0	0,184	1 : 175 000
Lien grube, Hosanger..... 1918	-	-	-	1,51	0,62	0,028	0,085	0,030	-	0,113	1 : 190 000
Høiåsen grube..... 1918	-	-	-	0,96	0,55	0,028	0,054	0,028	-	0,082	1 : 185 000
Fæø grube..... 1915	-	-	-	2,20	2,92	1,12	2,97	0,140	7,0	4,091	1 : 12 000
— " — 1918	-	-	-	2,03	2,68	1,10	2,90	0,132	-	4,011	

FLÅT NICKEL MINE

0 50 m 100 m 150 m 200 m

-  Amphibolite "Mykleåstype" and covered area
-  Ore Diorite eugranitic
-  " fine-grained
-  " porphyritic
-  Granite pegmatite
-  Gneiss
-  Ore
-  Ore outcropping
-  Drill hole



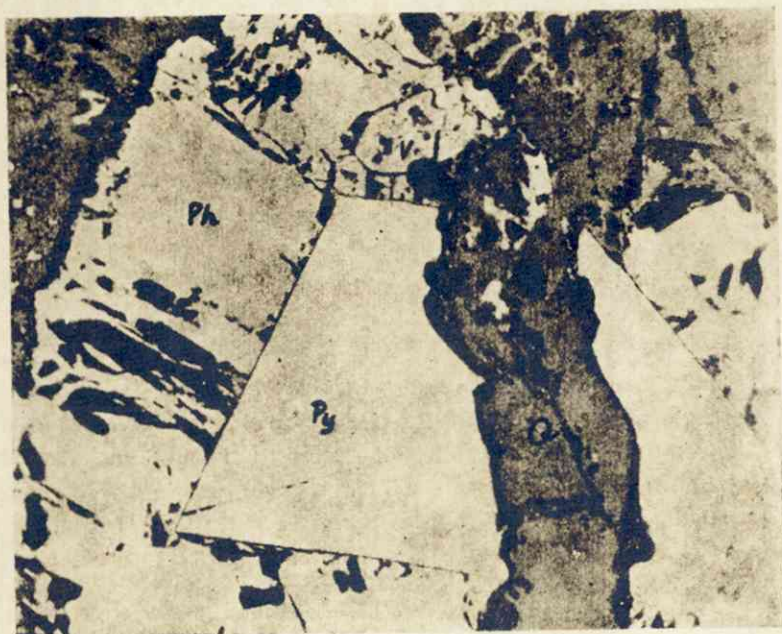


Fig. 3. Ore, Flåt mine. Crystall of pyrite (Py) imbedded in pyrrhotite (Ph) and violarite (V), Q quartz. Pol. sec. ord. light 90 X.

Table 2.
*X ray analyses of pyrite of the nickel ore deposits in the
area Iveland-Evje.*

	Co %	Intensities of Ni $k\alpha_1$ Cu $k\alpha_1$	
Flåt mine:			
1. Octaedral crystals of pyrite	0.62	0	0
2. Pyrite in fine-grained rich ore	0.60	0	0
3. — without crystall outlines	0.92	weak	weak
4. — in fine-grained ore	1.00	0	0
5. — in poor impregnation	0.88	strong	0
6. — ore, level 402	0.60	0	0
7. — without crystall outlines	0.80	0	0
Ore deposits in Iveland:			
8. Pyrite (111) (100), Lomtjern	0.55	0	0
9. — with inclusions of chalcopyrite Lomtjern	0.47	0	strong
10. — Large crystall, Paascheskjerpet...	0.87	0	0
11. — octaedral chystalls imbedded in pyrrhotite, Mølland	0.87	weak	0
12. — large crystall, Orreknappen	0.98	0	strong
13. — — —	1.00	0	0

LOCALITY D5B. Flåt (photo 64.3021)

Previous data - none.

Available data

Ref. Haldemann.

Samples 8D5.

Meta ultrabasic with pyrite veins - surrounded
by dioritic rocks and pegmatites, "Flåt mine suite".

[illegible]

LOCALITY E5A. N of Mykleåsen (photo 64.3019)

Previous data. - none.

Available data.

Ref. Haldemann, Overwien, Wiik.

Samples. YE5, XE5, 22E5.

Two prospect pits and an old blast hole, in meta basic rocks and dioritic gneisses. Meta basic rock at X carries rich disseminated pyrite, veins with quartz and coarse pyrite also noted. At Prospect Y pyrrhotite and chalcopyrite noted.

Microscopic. T.S. 131 gives quartz, dioritic chlorite gneiss.

Spec. nr.	Ni	Co	Cu	Fe	S	$\frac{Cu}{Cu+Ni}$	$\frac{Co}{Co+Ni}$
YE5	002	002	009	166	8,9	0,818	0,50
XE5	002	001	018	191	9,1	0,900	0,33

Sample YE5 examined by Buchan in Thornhill Jan. 68. See over page for result.

Location	Prospect Y, S. of road and Österhus farm	Lab. No.	6764
Sample Description	No. Y-E5 (E.G.H.)	PTS No.	1241

MINERALS	Est. ϕ . by Vol.	Grain Size (mm.)	
		Max.	Avg.
Feldspar (+ An ₃₃ , andesine (Orthoclase)	40	1.00	0.20
	4	0.50	0.15
Quartz	18	1.75	0.20
Biotite & muscovite	3	0.35	0.10
Chlorite	12	0.50	0.12
Sericite	15	-	-
Sphene	<1	0.12	0.06
Apatite	Tr	0.10	0.04
Pyrite	4	1.25	0.15
Pyrrhotite	3	1.50	0.20
Chalcopyrite	Tr	0.12	0.04
Ilmenite	<1	0.12	0.06

DESCRIPTION

The hand specimen shows vague banding of disseminated sulphides in a medium grained granular rock. This banding is again evident in polished section, where the distribution of disseminated sulphides shows a vague relationship to the concentration of quartz in the rock. The host rock consists of equigranular feldspar of two types, quartz and chlorite. Very heavy sericitization of the andesine has taken place and the chlorite has obviously derived from biotite, of which a few relict laths remain.

Some of the quartz is evidently late formed (also apparent in hand sample) and forms coarser mosaic patches in the section. Sphene and apatite, in minor amounts, suggest an igneous origin for the rock.

Pyrite and pyrrhotite are present in almost equal quantity whereas chalcopyrite occurs in a few scattered specks. Sulphides are normally irregular and intergranular but occasionally the pyrite displays subhedral form.

CLASSIFICATION

Highly altered igneous rock of granodioritic composition.

LOCALITY E5B. 1500 m No of Aavesland. (photo 64.3019)

Previous data - none.

Available data

Ref. Wiik.

Samples. 8E5

A high ridge of fine grained amphibolite.
The west side has been subjected to tectonics.
Sulphides visible.

Microscopic. T.S. 125 gives meta gabbroic rock.

LOCALITY E4A "St. Aaflau" (Photo 64.3121)

Previous data. - none.

Available data.

Ref. Wiik.

Samples. 15E4Ø, 15E4W.

2 prospect pits in heavily rusted amphibolite. In the actual pits themselves find "ore diorite", surrounded by amphibolite which is in turn surrounded by granitic material. Po and cp can be seen, as disseminations, vein fillings and quite massive ore.

Spec. nr.	Ni	Co	Cu	Fe	S	$\frac{Cu}{(Cu+Ni)}$	$\frac{Co}{(Co+Ni)}$
15E4(W)	005	003	009	269	136	0,643	0,395

Sample 15E4Ø examined by Buchan in Thornhill, Jan. 1968.
See over page for results.

Location	Small shafts N.W. of St. Aaflau, S.W. of Bertesknappen	Lab. No. 6762
Sample Description	No. 15-E4 (V.H.W.)	PTS No. 1239

MINERALS	Est. ϕ by Vol.	Grain Size (m.m.)	
		Max.	Avg.
Amphibole	80	1.85	0.20
Biotite	2	0.65	0.10
Quartz	Tr	0.20	0.08
Scapolite (?)	1	0.50	0.10
Pyrrhotite	14	1.75	0.18
Chalcopyrite	2	0.25	0.08
Pyrite	1	1.00	0.15
Graphite	Tr	0.10	0.10

DESCRIPTION

The host rock consists of equigranular pale green to neutral amphibole, showing blocky development suggestive of metamorphic origin. Rare laths of biotite are also present and occasional patches of a mineral showing properties similar to those of scapolite. A few minute grains of quartz complete the silicate assemblage.

Pyrrhotite is the major sulphide, occurring mainly in interstitial patches throughout the granular amphibole. Chalcopyrite, in small blebs, and pyrite, in part derived by pyrrhotite alteration, are both minor constituents. One flake of graphite was observed in the section.

CLASSIFICATION

Mineralized amphibolite of metamorphic origin.

LOCALITY D12A. Skripland (photo 64.2342).

Previous data see file I.

Available data.

Ref. Nixon.

Samples. 10D12

An exploration shaft about 100 m SE of Øvre Skipeland.
Shaft is sunk in a fine grained amphibolite/gabbro,
which borders to the south against a 3 - 4 m wide diabase
dyke and to the north against hornblende gneiss.
Ore is quite massive.

Spec. nr.	Ni	Co	Cu	Fe	S	$\frac{Cu}{Cu+Ni}$	$\frac{Co}{Co+Ni}$
10D12	0,07	0,02	0,10	13,11	8	0,589	0,222

LOCALITY D12B. 700 m south of D12A. (photo 64.2342)

Previous data - none.

Available data.

Ref. Nixon.

Samples. 5D12

Fine grained basic intrusive 10 cms wide in amphibolitic gneiss. The intrusive contains a small amount of disseminated sulphides. D.M.G. - ve. At the upper contact the gneiss has a sheared appearance and chalcopryrite, magnetite and pyrite occur in veins.

Spec. nr.	Ni	Co	Cu	Fe	S	$\frac{Cu}{(Cu+Ni)}$	$\frac{Co}{(Co+Ni)}$	Ca	Mg	$\frac{Mg}{(Mg+Ca)}$
37F11 b	0,04	0,01	0,10	11,9	2,1	0,714		2,1	16,-	
34 ^c F11	0,25	0,02	0,14	10,7	3,0	0,359	0,074	2,1	16,	0,884
34.68 F11.	0,17	0,015	0,20	13,5	3,9.					

LOCALITY F11B "Haaland Crossroads" (photo 64.2437)

Previous data - none.

Available data

Ref. Nixon.

Biotite rich rust zone in hb. gneiss with sulphides D.M.G. - ^{neg.}ve.

LOCALITY F11C. 1 km ESE from Klepptjern.

Previous data - none.

Available data

Ref. Nixon.

Well foliated amphibolites, rust zone with small
amount of sulphides. D.M.G. - ve.

LOCALITY B13A. SE of Hornesund (photo 64.2241.)

Previous data - none Ref. O. Landsverk.

Available data. Ref. Nixon.

Samples FN2 dark med. gr. ultrabasic.

	Ni	Cu	Fe
19/8/67 FN2	0.17	0.04	9.2

"Old Copper Mine" SE from Hornesund (photo 64.2241).

Ref. 0. Landsverk.

Ref. Nixon.

Sample FN3 small deep shaft in a dark fine grained
basic/ultrabasic. Slight dissemination of chalcopyrite.
D.M.G. - ve.

Microscopic. T.S. 146 gives meta basic to basic rock.

[illegible]

LOCALITY D16A. Dalene Rust Zone (photo 64.1928)

Previous data - none.

Available data.

Ref. Nixon.

Samples FN 4 AB. Ultrabasics and amphibolites plus heavily rusted gneisses.

	Ni	Cu	Fe
19/8-67 FN4B	0.17	0.32	16.4

[illegible]

LOCALITY D16B. Dalene Rust Zone (photo 64.1928)

Previous data. - none.

Available data.

Ref. Nixon.

Samples FN 5. Heavily rusted gabbroic and gneissic rocks.
Small amount of sulphides disseminated in gneisses.

LOCALITY D16C.

Dalene Rust Zone (photo 64,1830).

Previous data

none.

Available data.

Ref. Nixon.

Samples FN 6 A&B

Gabbroic and ultrabasic rocks associated with rust zones.
Disseminated sulphides.

Microscopic

TS.174

gives Hb. gabbroic rock.

TS.178

gives Hb. gabbroic rock showing
autometamorphic features.

[illegible]

LOCALITY F19A.

Mygland.

Previous data - none.

Ref. O. Landsverk.

Available data.

Ref. Nixon.

Samples FN7. Prospect pit in fine grained ultrabasic.
No sulphides noted.

Microscopic. T.S. 147 gives Epidosite.

LOCALITY D9A. 800 m NE of Litjern (photo 64.2540)

Previous data - none.

Ref. O. Landsverk.

Available data

Ref. Aagaard, Wiik, Nixon.

Samples. VHW6, 17D9

Small exploration shaft 2 x 2 m x 3 m deep. Rocks in the area are dominantly finegrained granoblastic amphibolite. Biotite rich rust zones run parallel to slight shear zones. Find also ultrabasic material in the shaft. Disseminated sulphides in the ultrabasics, also massive ore.

[illegible]

Bekken:

Ref. 0. Landsverk.

Ref. Wiik, Nixon, Overwien.

Small prospect pit 2 x 2 m. 5 m south of stream.
Find sheared amphibolites, also dark green ultrabasics.
Massive sulphide ore found on dumps. D.M.G. + ve.
Could be connected to a shear zone.

Electromagnetic map. No. 1512 III, Autumn 1967.

[illegible]

LOCALITY F9B. N.side of stream 330 m ENE of Aukland (photo 64.2630)

S. Päscheskyer

Previous data. - none.

Available data.

Ref. Wiik, Nixon, Overwien.

Samples. VHW3, O/BIRK.N6, O/BIRK.N7.

Two quite large prospect pits 5 m apart, 30 m from F9A.
The main rock type is finegrained granoblastic amphibolite
with some associated ultrabasics. Disseminated sulphides,
sulphides associated with veins and massive sulphides are found.

Geophysics.

Electromagnetic map No. 1512 III, Autumn 1967.

Spec. nr.	Ni	Co	Cu	Fe	S	$\frac{Cu}{Cu+Ni}$	$\frac{Co}{Co+Ni}$	
OBIRKN7	0,6	006	011	399	190	0,155	0,091	
OBIRKN6	010	001	006	206	2,7	0,375	0,09.	

LOCALITY F9C

300 m NE of Aukland (photo 64.2630)

N. Päscheskjerp

Previous data - none.

Ref. O. Landsverk.

Available data.

Ref. Wiik, Nixon, Overwien.

Samples. VHW4, O/BIRK.N7A. 36F9.

Prospect pit 3 x 4 m. Amphibolites and ultrabasics with sulphide dissemination. Massive ore with visible, pyrite, pyrrhotite and chalcopyrite.

		Ni	Cu	Fe
19/8/67	VHW4	0.24	0.12	17.8

Geophysics

Electromagnetic map No. 1512 III, Autumn 1967.

Spec. nr.	Ni	Co	Cu	Fe	S	Ca	Mg	$\frac{Cu}{Ca+Ni}$
36F9	0,19	0,03	1,6	21.5	8,2	1,3	10,0	0,894

ultrabasic sample.

LOCALITY F9D. "Orreknappen" (photo 64.2630).

Previous data

See "Ni-forekomster i Norge" N.G.U. Kollung ?
Vogt (1902) 2% Ni.

Available data

Ref. Wiik, Overwien.

Samples. O/BIRK 1,2,3.

Sulphides occur mostly as small "dykes" 10 cm wide along shearzones. In vicinity can find Hb. diorite and fine grained amphibolite.

Geophysics

Electromagnetic map. No. 1512 III, Autumn 1967.

Shaft 70 m deep.

Spec. nr.	Ni	Co	Cu	Fe	S	$\frac{Cu}{(Cu+Ni)}$	$\frac{Co}{(Co+Ni)}$	
O/BIRK1	0,6	0,04	0,4	31,8	17.	0,400	0,625	
2.68.E9.a	1.43	0,066	0,07	51,5	36.0.			
3.68.E9.	0,86	0,053	1,38	44,2	22.0			
4.68.E9.	1.45	0,05	0,06	53.0	37.0.			

28/9/68

"

"

From Bjørlykkes field notes 1940.

Orreknappen nikkelsjerp lies in a mica rich relatively fine grained gabbro. This rock is cut by irregular veins of magnetkis upto 15cm. wide. These veins have well defined svovelkis crystals upto 7-8cm. in diameter. The massive magnetkis is dark brown in colour has included lumps of gabbro. These lumps are enriched in magnetkis and kopperkis. The massive magnetkis seems to be poor in copper. The borders of these large veins however are usually rich in copper. These veins seem to indicate an hydrothermal origin.

Also present are smaller veins rich in kobberkis and svovelkis (crystals upto 10cm.)

LOCALITY D10A. 250 m S of Litjern (photo 64.2540)

Previous data - none.

Available data Ref. Nixon, Wiik.

Samples. VHW 7

Ultrabasic cut by thin bands 9 - 5 cm of asbestos.
No sulphides visible to the naked eye.

		Ni	Cu	Fe	S	Cr
19/8-67	VHW7A	0.74	0.03	8.0		
3/1/67	VHW7A	0.26	0.03	8.1	0.13	0.65
15/11/67	Spectroanalysis	see over page for results.				

Prøve

7117 - Prøve A Svakt magnetisk fraksjon

7118 - " - B Sterkt " " " "

Metode

Kvalitativ med kvantitative bedømmelser

RESULTATER: i %		— ikke påvist o spor x små mengder X større mengder	
Ag	.	Nb	—
Al	x	Ni	1-10 1-10
As	—	Os	—
Au	<.001 <.001	Pb	.
B		Pd	<.0001 <.0001
Ba	—	Pt	<.001 <.001
Be	—	Rh	<.0001 <.0001
Bi	—	Ru	<.001 <.001
Ca	x	Sb	—
Cb	—	Si	10-100 10-100
Cd	—	Sn	.
Co	x	Sr	
Cr	x	Ta	—
Cs		Te	—
Cu	x	Ti	—
Fe	3-30 10-100	V	—
Hg		W	
Ir	<.001 <.001	Zn	—
K			
Li			
Mg	3-30 3-30		
Mn	x		
Mo	.		
Na	—		

Rapportert til

H. Z. V. Wiik

Dato

15/11-67

Sign.

WP

LOCALITY D10B.

900 m E of Litjern (photo 64.2540)

Previous data

- none.

Available data.

Ref. Aagaard, Nixon, Wiik.

Samples. VHW9. 2D10.

Quite heavy sulphide impregnation. D.M.G. +

Microscopic. T.S. 179 gives anorthositic, quartz Hb. gneiss.

Kilburn 18/1/68 is of the opinion that this rock is of sedimentary origin - possibly a quartzite. ? 5800

Spec. nr.	Ni	Co	Cu	Po	S	$\frac{Cu}{(Cu+Ni)}$	
9vhw	0,02	0,01	0,04	7,0	2,1	0,667	

LOCALITY E10A. "Småhaugane" (photo 64.2540)

Previous data. - none.

Available data

Ref. Nixon, Wiik.

Samples. VHW10. V-V14.

An open area with low knolls of massive quite coarse grained ultrabasic rock. Rust covering on some of the loose blocks, but no sulphides visible to the naked eye.

		Ni	Cu	Fe
19/8/67	VHW10	0.34	0.03	9.6

[illegible]

LOCALITY ELOB. 700 m NW from Klepptjern (photo 64.2538)

Previous data - none.

Available data

Ref. Nixon, Wiik

Samples. VHW11, 8E10, VHW14.

Relatively light, dioritic gneiss with disseminated sulphides. D.M.G. + ve

Is related to the "Klepp - Frikstad" zone.

T.S. 171 gives intrusive quartz diorite.

LOCALITY E10C. 100 m S of Kleppfarm (photo 64.2538)

Previous data - none.

Ref. 0. Landsverk.

Available data.

Ref. Wiik, Nixon.

Samples. VHW12.

Microscopic T.S. 177 gives two-pyroxene gabbro or
"Norite" partly altered. Plag (An_{50}) 60%
Hy. 10%
Di. 15%
Hbl 10%
Bi & Ox

in other words the rock is part of the Mølland norite Rust zones are found at this locality associated with them are patches of quite massive ore. D.M.G. + ve.

[illegible]

LOCALITY G12A.

Elshaugen (photo 64-2334)

Previous data - none.

Available data.

Ref. Nixon.

Samples 55G12.

Small prospect pit in field close to farmhouse.
Outcrop poor, mostly biotite rich gneiss, ore seems
to be in the form of small veinlets, - chalcopryite and
pyrrhotite.

Spec. nr.	Ni	Co	Cu	Fe	S	$\frac{Cu}{(Cu+Ni)}$	$\frac{Co}{(Co+Ni)}$
55G12	0,04	0,02	0,22	25,5	17,2	0,847	0,33

LOCALITY G12B. 500 m W of Elshaugen (photo 64-2334).

Previous data - none.

Available data

Ref. Nixon.

Samples 20G12.

Rust zone associated with amphibolites and hornblendite patches - rich in biotite. Sulphide dissemination D.M.G. - ve.

Spec. nr.	Ni	Co	Cu	Fe	S	$\frac{Cu}{Cu+Ni}$	$\frac{Co}{Co+Ni}$	
20G12	005	001	004	9.8	0.79	0.444	0.167	

LOCALITY G9A. Vassvatn. (photo 64-2627).

Previous data - none.

Available data

Ref. Aagaard.

Samples. 27G9.

Rust zone in ultrabasic rocks which lie in amphibolite.
Pyrite, pyrrhotite and chalcopyrite were recognized.
D.M.G. + ve.

NB. Kommentar 18/8/67. "Kan være Barth's "Bahiaitt". En burde kanskje lete etter flere blotninger i åsen vestenfor. Etter bonden Vatne skulle det et eller annet sted være skutt etter malm der."

Thin section work will help to determine if this is indeed a true bahiaite.

It is worthy of special notice that similar bahiaites occur at several other nickeliferous ore deposits of Southern Norway, in the Bamble formation as well as at Hosanger Nickel Mine on the west coast.

Barth gives for Bahiaite.

Hypersthene - faintly pleochroic, a light brownish red.

= very light green. = colourless.

Mean index of refraction, = 1.697 (corresponding to 30FS)

(-) 2V = 85° (corresponding to 24 FS)

Hornblende, partly in individual grains, partly forming a border around hypersthene.

It is pleochroic: = yellowish green. = green.

= deep brown. Indices of refraction measured on (110 cleavage flakes: a = 1.643, = 1.660, 2V = 90°.

Spec. nr.	Ni	Co	Cu	Fe	S	$\frac{Cu}{(Cu+Ni)}$	$\frac{Co}{(Co+Ni)}$
27G9A	005	001	019	8,1	2,9	0,792	0,167
27G9B	004	001	011	108	1,1	0,734	0,20.

LOCALITY F10A. Klepptjern (photo 64-2536)

Previous data. Boring has been carried out but we have no record of this.

Available data

Ref. Overwien.

Samples. Klepp 1, 2, 3.

Old open cut? Impossible to see the country rock in the cut itself. Most of the blocks are of an ultrabasic nature.

Geophysics

Electromagnetic map 1512 III, Autumn 1967.

Klepp 2 sample sent to Thornhill 13/11/67.

Spec. nr.	Ni	Co	Cu	Fe	C	Ca	Mg	$\frac{Cu}{Cu+Ni}$	$\frac{Co}{Co+Ni}$	$\frac{Mg}{Mg+Ca}$
KLEPP"2	0,18	0,01	0,06	1,10	0,69			0,250	0,053	
Klepp3	0,15	0,02	0,03	1,03	0,30	0,9	20,-	0,167	0,118	0,96

Sample O/1-F10 (E.O.) examined by Buchan in Thornhill, Jan. 1968. See over page for results.

Location

Old trench at Klepjtjern (West side).

Lab. No. 6840

Sample Description No. 0/1-F10 (E.O.)

PTS No. 1245

MINERALS	Est. % by Vol.	Grain Size (m.m.)	
		Max.	Avg.
Olivine	20	2.20	0.80
Orthopyroxene	18	1.75	0.50
Amphibole	22	2.00	0.60
Serpentine	22	-	-
Chlorite	3	0.50	0.20
Biotite	Tr	0.30	0.10
Carbonate	Tr	0.20	0.08
Spinel	<1	0.20	0.10
Pyrrhotite	3	0.85	0.20
Violarite-Pentlandite	1	0.30	0.08
Pyrite-Marcasite	1	0.50	0.10
Magnetite	9	0.50	0.06

DESCRIPTION

In thin section, this sample exhibits textures typical of an altered peridotite. Olivine grains are partly pseudomorphed by serpentine, orthopyroxene and colourless amphibole (after clinopyroxene?) occur in coarse intergranular plates, and secondary magnetite occurs with serpentine in streaky development. Traces of chlorite, bleached biotite, carbonate and deep green spinel (probably chromiferous) complete the translucent assemblage. Scattered irregular patches of sulphides consist mainly of pyrrhotite enclosing areas of heavily violaritized pentlandite and partly digested pyrite. Other areas of iron sulphide consist of secondary marcasite probably formed under supergene conditions from pyrrhotite.

CLASSIFICATION

Altered Peridotite.

LOCALITY F10B. 600 m E of Klepptjern. (photo 64-2536)

Previous data - none.

Available data

Ref. Wiik.

Samples. 7F10.

Small prospect pit 1 x 1 m in ultrabasic rock which carries quite a lot of pyrrhotite and chalcopyrite. Towards its contact with meta gabbro it is rich in magnetite.

7F10 sent to Thornhill 13/11/67.

		Ni	Co	Cu	Fe
19/12/67	7F10	0.37	0.02	0.17	10.3

Spec. nr.	Ni	Co	Cu	Fe	S	Ca	Mg	$\frac{Cu}{Cu+Ni}$	$\frac{Co}{Co+Ni}$	$\frac{mg}{mg+Ca}$
7F10	0,35	0,02	0,17	11,1	2,1	4,3	25,0	0,327	0,054	0,853

Sample 7F10 examined by Buchan in Thornhill, Jan. 1968. See over page for results

Location

1 km. E. of Klepptjern

Lab. No. 6767

Sample Description No. 7-F10 (V.H.W.)

PTS No. 1244

MINERALS	Est. % by Vol.	Grain Size	
		Max.	(m.m) Avg.
Amphibole	60	3.00	0.4
Anthophyllite	22	1.50	0.3
Biotite	3	1.40	0.3
Pyrrhotite	4	2.00	0.1
Pentlandite	2	0.85	0.1
Chalcopyrite	1	0.70	0.0
Pyrite	Tr	0.15	0.0
Magnetite	8	0.85	0.0

DESCRIPTION

Sharp euhedral grains of anthophyllite, showing parallel extinctions, amphibole cross-section and development in long prismatic crystals, are set in a matrix of pale green to neutral amphibole. The latter occurs in coarse plates which are peppered with finely disseminated magnetite. Several interstitial laths of bleached biotite, generally associated with sulphides, complete the silicate assemblage.

In hand sample, the sulphides occur in coarse blebs scattered throughout the rock. In pol-thin section, they are seen to consist of pyrrhotite with blocky pentlandite and chalcopyrite. Pyrite occurs in a few relict grains, which have been mainly replaced by pyrrhotite. Several blades of exsolution-type pentlandite occur in the pyrrhotite, but these form less than 2% of the total pentlandite present.

CLASSIFICATION

From the textures observed, this amphibolite appears to have been a metapyroxenite which has undergone subsequent recrystallization with the formation of euhedral anthophyllite.

LOCALITY F10C. 200 m NE of F10A (photo 64-2536).

Previous data. - none.

Available data

Ref. Wiik.

Samples. 25F10.

Part of the "Klepp - Frikstad" zone. Ultrabasics
with irregular sulphide dissemination.

Spec. nr.	Ni	Co	Cu	Fe	S	$\frac{Cu}{(Cu+Ni)}$	$\frac{Co}{(Co+Ni)}$
25F10	0,13	0,03	0,19	1,14	3,9	0,594	0,188

LOCALITY G6 A&B. Vikstølvann. (photo 64-2925)

Previous data - none.

Available data

Ref. Aagaard.

Samples 25G6, 22G6.

Rust zones with sulphides in massive amphibolite.

LOCALITY C11A.

Landaas (photo 64-2344).

Previous data

- none.

Available data

Ref. Nixon.

Samples. 30C11.

Old dump, shaft filled in. Massive ore D.M.G. + ve.
Main rock type is amphibolite and gneisses.

28/9/68.

Minor sulphide disseminations at:

G10A	Stemtjern	photo 64-2534	Ref. Wiik.
G9B	Vassvatn	" 64-2627	" Aagaard
G9C	Vassvatn	" 64-2627	" "
H10A	S - Vassvatn	" 64-2531	" "
C11B	W - Landaas	" 64-2444	" Nixon
C11C		" 64-2444	" "
C12A	Langevei	" 64-2344	" "
G12C	900 m W Elshaugen	" 64-2334	" "
G12D	1 km SE "	" 64-2334	" "
F12A	Elshaugen road	" 64-2337	" "
E12A		" 64-2340	" "
E12B	T.S. 156	" 64-2340	" "
E12C		" 64-2340	" "
E12D	T.S. 155	" 64-2340	" "
C10A	Landsverk	" 64-2543	" Aagaard.

TABLE I

FALCONBRIDGE NICKEL MINES LIMITED
METALLURGICAL LABORATORIES

QUALITATIVE SPECTROGRAPHIC ANALYSIS

(WITH QUANTITATIVE ESTIMATES)

LAB. NO.	6762 15 E 4	6763 18 E 5	6764 Y-E 5	6765 20 D 6	6766 23 + 9
ALUMINUM	.5-5	5-15	1-10	5-15	5-15
ANTIMONY	-	-	-	-	-
ARSENIC	-	-	-	-	-
BARIUM	-	-	-	-	-
BERYLLIUM	-	-	-	-	-
BISMUTH	-	-	-	-	-
BORON	-	-	-	-	-
CADMIUM	-	-	-	-	-
CALCIUM	.5-5	1-10	.3-3	1-10	1-10
CHROMIUM	.001-.01	.001-.01	.001-.01	.001-.01	.001-.01
COBALT	.001-.01	.001-.01	.001-.01	.001-.01	.001-.01
COPPER	.003-.03	.001-.01	.001-.01	.001-.01	.001-.01
GALLIUM	.001-.01	.001-.01	.001-.01	.001-.01	.001-.01
GOLD	-	-	-	-	-
INDIUM	-	-	-	-	-
IRON	3-30	3-30	3-30	3-30	3-30
LEAD	-	-	-	-	-
LITHIUM	-	-	-	-	-
MAGNESIUM	3-30	3-30	1-10	3-30	1-10
MANGANESE	.01-.1	.03-.3	.03-.3	.01-.1	.03-.3
MOLYBDENUM	-	-	-	-	-
NICKEL	.001-.01	.001-.01	.001-.01	.001-.01	.001-.01
PHOSPHOROUS	I	I	I	I	I
SILICON	10-100	10-100	10-100	10-100	10-100
SILVER	-	-	-	-	-
SODIUM	.1-1	.3-3	.1-1	.5-5	.5-5
STRONTIUM	-	-	-	-	-
TANTALUM	-	-	-	-	-
TIN	-	-	-	-	-
TUNGSTEN	-	-	-	-	-
TITANIUM	.03-.3	.1-1	.03-.3	.3-3	.1-1
VANADIUM	.001-.01	.001-.01	.001-.01	.003-.03	.001-.01
ZINC	-	-	-	-	-
ZIRCONIUM	-	-	-	-	-

S = Strong Spectrum Line; Estimate Not Possible. Compare Only Between Samples.
 I = Interference Prevents Positive Identification.

DATE: _____

ANALYST: _____

FALCONBRIDGE NICKEL MINES LIMITED
METALLURGICAL LABORATORIES

QUALITATIVE SPECTROGRAPHIC ANALYSIS
(WITH QUANTITATIVE ESTIMATES)

LAB. NO.

	⁶⁷⁶⁷ 7-10	⁶⁸⁴⁰ 0/1-10	⁶⁸⁴¹ 21-311		
ALUMINUM	1-10	.3-3	.5-5		
ANTIMONY	-	-	-		
ARSENIC	-	-	-		
BARIUM	-	-	-		
BERYLLIUM	-	-	-		
BISMUTH	-	-	-		
BORON	-	-	-		
CADMIUM	-	-	-		
CALCIUM	1-10	.3-3	.5-5		
CHROMIUM	.03-.3	.03-.3	.001-.01		
COBALT	.003-.03	.001-.01	.0001-.001		
COPPER	.003-.03	.001-.01	.001-.01		
GALLIUM	.0001-.001	.0001-.001	.0001-.001		
GOLD	-	-	-		
INDIUM	-	-	-		
IRON	3-30	3-30	3-30		
LEAD	-	-	-		
LITHIUM	-	-	-		
MAGNESIUM	10-100	10-100	1-10		
MANGANESE	.03-.3	.01-.1	.01-.1		
MOLYBDENUM	-	-	-		
NICKEL	.5-5	.3-3	.001-.01		
PHOSPHOROUS	I	I	I		
SILICON	10-100	10-100	10-100		
SILVER	-	-	-		
SODIUM	.03-.3	.01-.1	.1-1		
STRONTIUM	-	-	-		
TANTALUM	-	-	-		
TIN	-	-	-		
TUNGSTEN	-	-	-		
TITANIUM	.1-1	.03-.3	.1-1		
VANADIUM	.001-.01	.001-.01	.001-.01		
ZINC	-	-	-		
ZIRCONIUM	-	-	-		

S = Strong Spectrum Line; Estimate Not Possible. Compare Only Between Samples.
I = Interference Prevents Positive Identification.

DATE: _____

ANALYST: _____