



# Bergvesenet

Postboks 3021, N-7441 Trondheim

## Rapportarkivet

Bergvesenet rapport nr	Intern Journal nr	Internt arkiv nr	Rapport lokalisering	Gradering
5361				
Kommer fra ..arkiv	Ekstern rapport nr	Oversendt fra	Fortrolig pga	Fortrolig fra dato:
Falconbridge				
Tittel				
Evje-Iveland prosjektet. Diverse rapporter fra 1968-1970.				
Forfatter		Dato    År	Bedrift (oppdragsgiver og/eller oppdragstaker)	
			Sulfidmalm AS	
Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad
Iveland	Aust-Agder	Østlandske	15123	Mandal
Fagområde		Dokument type	Forekomster (forekomst, gruvefelt, undersøkelsesfelt)	
Geologi Kjemiske analyser			Skripeland	
Råstoffgruppe		Råstofftype		
Malm/metall				
Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse				

AGDER  
EVE-IVELAND.

Vertikalmappe nr. 1026  
For A 4



554.02.17. GEOLOGI SKRIPELAND - LI

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GEOLOGI

SKRIPELAND - LI

EVE

IVELAND.

LOCATION

SKRIPELAND prospect situated beside the road 150 m SE of Northern Skripeland farm (414 m a.s.l.) in Iveland kommune. In the north-eastern part of map unit D12 on air photograph No. 1-61 64-2342. The farm is reached by car along a 3 km long road from Fossheim, a crossroad 1 km N of Birketveit in Iveland.

STATUS

"Anmeldt" (claimed) by A/S SULFIDMALM the 20th December, 1967.

HISTORY

The prospect is described in H. Bjørlykke's diary (Dagbok for arbeide for A/S Raffineringsverket, Evje. Sommeren 1940) and is briefly mentioned by Tom F.B. Barth in NGU publication 168a: "The nickeliferous Iveland-Evje amphibolite and its relation." Frank Nixon carried out regional mapping in the area in 1967 (see diary). Judging by the weathering of oreblocks and by the overgrowth the pit was probably blasted around the turn of the century.

GEOLOGICAL SETTING

The prospect is situated within a massif of meta-gabbro/massive amphibolite coinciding with an aeromagnetic anomaly high. It is situated around 700 m to the east of the Skripeland-Li lineament and within a heavily granitized part of the basic massif where patches of more or less basic and massive rocks occur together with hornblende gneisses (see geophysical map of Skripeland-Li lineament in scale 1:2'000 and geophysical map 2/electromagnetic map 1 from Ni prospect at Skripeland in scale 1:1'000). The prospect which is situated in the corner of a meadow consists of a 5 m long and 3½ m wide open cut and a 3½ x 3 m pit filled with trees and water. The depth of the latter is estimated to 2 - 3 meters. The mineralization is confined to a wedge of massive amphibolite, surrounded by hornblende gneiss. This rock is fine-medium grained and exhibits an equigranular texture. A thin section consisted mainly of hornblende and plagioclase (labrador with 57% An) in equal amounts. Minor constituents were hypersthene (3%), biotite (2%), Opaques (2%). The texture is allotriomorphic.

The pyroxene occurs as kernels within the amphibole, and a few remnants of clinopyroxene seem to be present. The plagioclase has partly bent lamellas and is slightly sericitized. Most of the opaques are oxides. The rock is classified as a meta-norite or meta-hyperite. 25 m to the south of the prospect is situated a 10 m wide dark gabbroic rock which has been described as a dyke of hyperite or as a diabase. A thin section shows it is a medium-grained cataclastic meta-hyperite with mortar texture containing approximately 50% of long and very bent plagioclase laths (labrador), 20% hornblende, 20% polygonized grains of hypersthene and augite/diopside in equal amounts, 5% actinolite, 3% opaques (mainly oxides) and carbonate, spinel and biotite as accessories. Similar varieties of the basic intrusive with high and irregularly distributed magnetite content occur further towards the SE as well as near the northern farm.

### STRUCTURES

In the Skripeland area the strike of foliations is dominantly N-S with mainly steep dips to the east. In the environments of the farms, however, the strike is very irregular, and E-W directions are very common with dips to the north from less than  $30^{\circ}$  up to  $80^{\circ}$ . Near the prospect the strike varies from  $300^{\circ}$  -  $335^{\circ}$  and dips from  $20^{\circ}$  -  $60^{\circ}$  towards NE.

Jointing is frequent at the pit with a major system with average strike  $190^{\circ}$  and dip  $80^{\circ}$  -  $85^{\circ}$  to W. Minor systems have strike  $105^{\circ}$  with dip  $50^{\circ}$  -  $70^{\circ}$  to S and strike  $285^{\circ}$  and dip  $70^{\circ}$  to N. A flat shear with strike approximately  $190^{\circ}$  and dip  $12^{\circ}$  to W seems to contain small fragments of sulphides and hence should be younger than the mineralization.

Sulphides, mainly pyrrhotite occur as more or less massive pods or as fracture fillings related to the jointing at the prospect (see Fig. 1).

It can be mentioned that the longest conductor outlined by the EM survey has a strike nearly parallel to the major joint system. The intersection line between the joints  $190^{\circ}/82^{\circ}$  -  $105^{\circ}/60^{\circ}$  gives a plunge of  $60^{\circ}$  in direction  $203^{\circ}$  which also is practically parallel to the conductor.

### CHARACTERISTICS OF ORE

Most of the weathered ore samples on the dumps consist of massive sulphides (pyrrhotite, pyrite, minor chalcopyrite), but some of disseminated sulphides as well. Magnetite was noticed in most of the samples as well as in outcrops in and near the pit where it occurs together with sulphides and also in irregular distribution in barren rock.

Sulphide mineralization which is tectonically controlled, is visible only in the rock-walls of the pit. A polished section of a pyrrhotite-rich sample taken from the dumps contained:

Pyrrhotite	= 60%
Marcasite	= 2%
Chalcopyrite	= 2%
Pentlandite	accessory
Magnetite + Ilmenite	= 5%
Gangue silicates	= 30%

The massive pyrrhotite is to some extent altered to marcasite, mainly along fractures. Chalcopyrite occurs as individual grains and as fracture fillings in silicates, oxydes and in a few cases in pyrrhotite. Magnetite and ilmenite with average grain size of 0.3 mm (anhedral) seem to be replaced by sulphides. Some grains are intersected by veins of chalcopyrite and pyrrhotite. Pentlandite occurs as scattered exsolution laths or blades in the pyrrhotite parallel to its parting planes. Maximum length is 0.08 mm and the average = 0.03 mm. This shows that the sulphide fluid was very poor in nickel which is also confirmed by chemical assays.

## FALCONBRIDGE NIKKELVERK, AKTIESELSKAP

ANALYSES

Specimen No.	Ni	Co	Cu	Fe	S	$\frac{\text{Cu}}{\text{Ni}}$	$\frac{\text{Ni}}{\text{Co}}$	$\frac{\text{S-Sch}}{\text{Ni}}$
10 D12 Sample from dumps with disseminated sulphides	0.07	0.02	0.10	13.1	1.8	1.43	3.5	24.25
11a/68 - D12a Weathered sample from dumps of massive sulphides	0.88	0.16	0.19	47.2	31.4	0.216	5.5	36.0
11b/68 - D12a Sample of massive amphibolite from dumps with disseminated pyrrhotite	0.086	0.014	0.081	17.5	2.9	0.94	9.0	31.0

The assays were carried out at FN K'sand in February and September 1968.

NAME of examiner: *Erna Overlien*

WORK DONE AND TIME SPENT in examination:

Geological investigation of  
prospect and neighbourhood:  
about half a day.

Geophysical work with assistants:  
1½ days.

EOv/hm 14th February, 1969



Photo E.O. 1.8.1968.

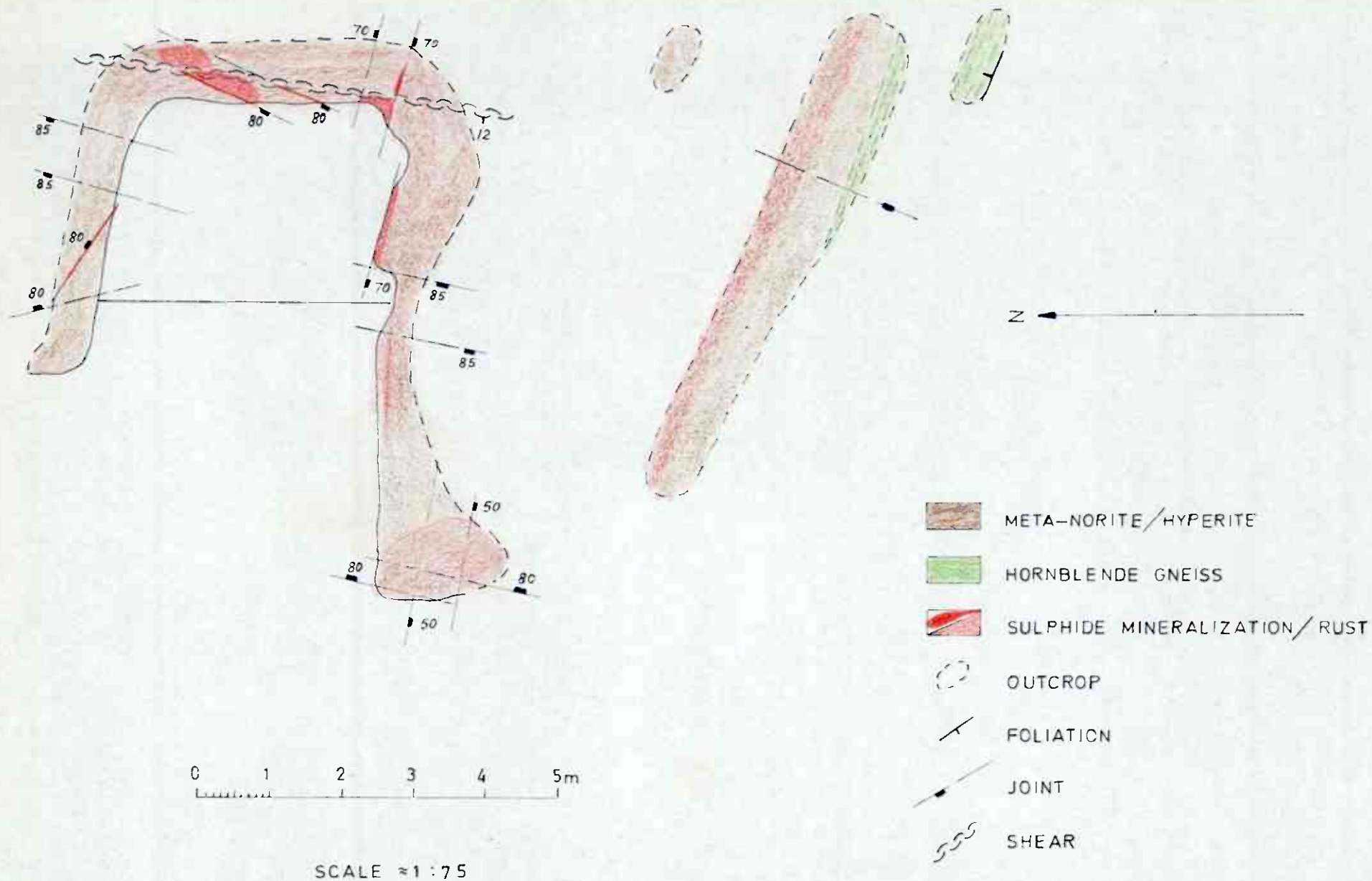
Looking N towards Skripeland prospect (X) which cannot be seen because of covering trees and bushes. Small ore dump is seen S of the prospect near the road.



Photo E.O. 1.8.1968.

Looking E at open cut and pit near Skripeland. Massive pods of mainly pyrrhotite occur on both sides of flatlying shear seen on upper part of rock face. Sulphides also occur as fracture fillings and minor disseminations in the meta-norite.





SKETCH MAP OF  
SKRIPELAND PROSPECT

FIG. 1

80 Febr. 1969

LOCATION

Prospect ca. 800 m NE of northend Litjern in "Iveland Kommune". No specific name. On southern border of map unit D9. Air photograph Nos. 1-61 64-2540 and 1-61 64-2633. The prospect consists of a small open cut and pit. It is reached on foot from the Evje-Frikstad road: from the road bend 400 m E of Litjern, a footpath is followed in a northerly direction along a stream for 300 m to a little swamp. After crossing the stream, the path first follows the swamp in a NNW direction then turns N along a narrow, steep valley for about 400 m.

STATUS

"Anmeldt" (claimed) by A/S SULFIDMALM in November 1967. *20/12*

HISTORY

Little is known about the history of this prospect. The place was probably opened up about 50 years ago judging by the overgrowth and general appearance of the rock face and pit. It was shown to V.H. Wiik by Orest Landsverk in July 1967.

GEOLOGICAL SETTING

Generally speaking, the prospect is situated in the Litjern zone on the west side of the center of the Iveland-Evje amphibolite complex. The Litjern zone of dominantly amphibolitic rocks changes in a northerly direction into hornblende gneiss and dioritic gneiss, and the prospect is actually within a few hundred meters of this area of mixed gneisses.

The rock exposed at the prospect is dioritic gneiss and sheared meta-ultrabasics. The latter are referred to as meta-pyroxenite, but on account of shearing and weathering there is a wide range of alteration products. One sample was identified by V.H. Wiik as cumingtonite rock in the Lab. (cf. ANALYSES).

The pit below the 3 m high rock face is 2 x 1.5 m and about 1 m deep. There are outcrops of amphibolite under a large sheet of pegmatite, about 30 m to the N and 40 m to the E of the pit. Pegmatites are very numerous in the neighbourhood. Detailed geological observations are recorded on Fig. 1 and Plates I & II.



FALCONBRIDGE NIKKELVERK, AKTIESELSKAP

STRUCTURES

Locally, the strike of the foliation varies from  $185^{\circ}$  to  $217^{\circ}$ , and the dip is at  $80^{\circ}$  to  $85^{\circ}$  to W or NW. Shearing parallel to foliation planes was noted. The prospect lies 250 m west of a conspicuous structural feature (strike  $10^{\circ}$ ) observed on air photographs. A shear in the meta-ultrabasics at the prospect strikes  $150^{\circ}$ - $155^{\circ}$  and dips at  $65^{\circ}$  to SW. The alignment of this shear can be noticed in the terrain over a distance of at least 200 m.

The intersection of the SSE-striking shear with a certain horizon in the country rock, or shear parallel to the foliation, controls the mineralization. Since the intersection is a steeply plunging linear feature, the resulting "ore body" has a long, cylindrical or pipe-like shape with a very small diameter. The lack of lateral extent of the mineralization may explain why EM-test profiles both over the foliation and shear alignments were negative.

CHARACTERISTICS OF ORE

The visible lateral extent of the mineralization is very small. Disseminated sulphides and thin ore veins, dominantly pyrrhotite and minor chalcopyrite, occur in sheared meta-ultrabasics. A minor dissemination of pyrrhotite was noted in hard, dioritic gneiss. The best ore samples were collected on the dump.

ANALYSES

Specimen No.	Ni	Co	Cu	Fe	S	Ca	Mg
No.1-D10a * (ore)	0.13	0.07	0.61	25.2	12.0		
17(A)D9 ** Cummingtonite rock	0.04	<0.01	0.03	14.4	0.17	1.1	12.5

\* Carried out at FN K'sand July 1968.

\*\*Carried out at FN K'sand March 1968 .

NAME of examiner:

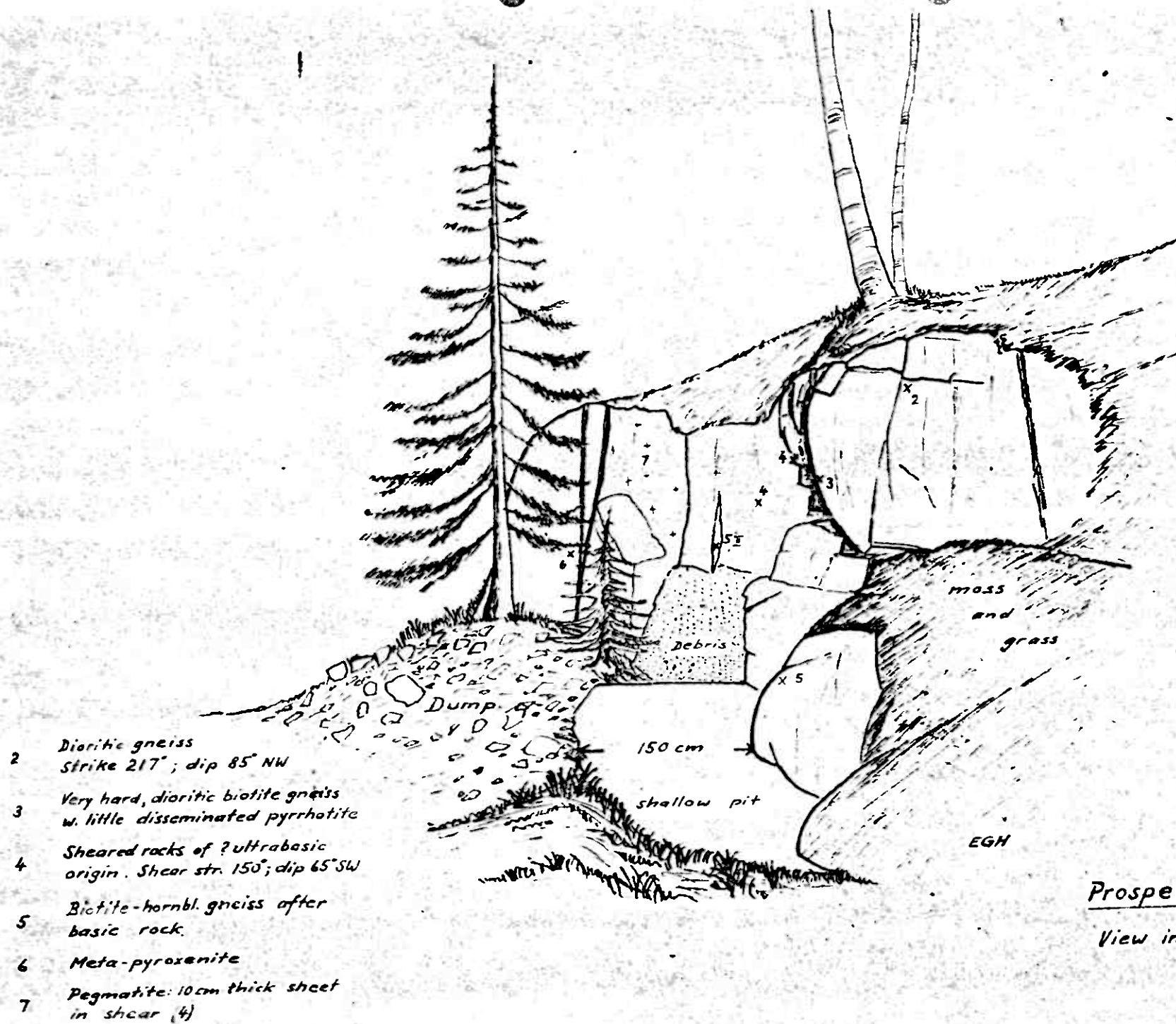
*E. J. Haldermann*

WORK DONE AND TIME SPENT in examination:

Geological investigation of prospect and neighbourhood; about 6 hours.

EM- tests with E. Overwien and party; about 2 hours.

EGH/8.November, 1968.



Prospect 800 m NE of Litjern

View in northerly direction uphill

## LITJERN-SKRIPELAND ZONE S. (E.O.)

### Introduction

During 1968 detailed mapping was carried out along this zone over approximately 8 km. Dr. E.G. Haldemann covered the northern part and the writer the southern part including the map sheets D 10, D 11 and to some extent E 11c, E 11d and E 12 d. This chapter will only deal with the southern part. No detailed map is drawn from this area, and the observations made on the following blown up air photographs in scale 1:5'000 2340, 2342, 2439, 2441 are plotted on the regional geological map of the Evje-Iveland area (scale 1:25'000).

The N-S trending zone was known to parallel an aeromagnetic anomaly high in the southern area co-insiding with massive basic rocks to the east and to carry several bodies of meta-ultrabasic rocks. A few known nickel prospects are situated in or close to the alignment as well. It was decided to carry out a more detailed investigation of the zone since it was regarded as potential ground for mineralizations. In the southern area some traverses were extended up to 2 km east of the zone to get a better knowledge of the broad mag anomaly and the relationship to the known basic intrusives in the Tortveit - Mølland area.

### General geology

The main rock types co-insiding with the mag high over the high ground at Skripeland, Solheia and Rostadheia are various varieties of basic rocks such as meta-gabbro and massive and foliated amphibolites. The anomaly is to the SE bounded by the Tortveit NE shear zone, to the S by acid gneisses in the lower country N of Grossvann and to the W by the Litjern-Skripeland zone. The latter zone is covered by a mag low, and the magnetic gradient from the mag high just N of Skripeland farm is 1100  $\gamma$  over a distance of 300 m.

Within the N-S striking zone the dominant rocks consist of foliated dioritic gneisses and hornblende gneisses as well as more or less foliated amphibolites. Strike of foliation is between N-S and N 30° E or nearly parallel to the magnetic trend, while dips are vertical or steep - mainly to the east. Steeply dipping joints and minor shears with strikes between NNW and NNE were observed.

From field observations it can, therefore, be stated that the southern part of the depression or valley called the Litjern-Skripeland zone is caused by more acid and tectonized gneisses compared to the more massive and basic rocks of igneous origin to the east which also contain a fair amount of magnetite giving rise to a dominant mag high. From the regional geological map one sees that the rocks to the west mainly consist of amphibolites which surely are more resistant to erosion than the more acid gneisses situated along the zone.

### Brief rock description

For a more thorough description it is referred to "Description of rock types and a brief note on the geological history of the area" by F. Nixon, Jan. 1970.

The following rock types were encountered during the mapping:



Dykes and veins.	12 granitic/pegmatitic veins
	11 quartz-feldspar veins with hornblende/biotite
	10 meta-dolerites
	9 ultramafics
<hr/>	
Massifs and bodies (mainly massive)	8 pegmatite (dominant)
	7 granite
	6 meta-ultrabasics
	5 hornblende dioritic rock
	4 gabbro/meta-gabbro/massive amphibolite (dominant)
<hr/>	
Foliated rocks	3 amphibolite (dominant)
	2 hornblende gneiss (dominant)
	1 dioritic gneiss (dominant)
<hr/>	

### 1 and 2. Dioritic gneiss and hornblende gneiss

These usually well foliated gneisses are mainly confined to the Li-Skipeland zone and are believed to belong to a basement complex into which the basic rocks intruded. Hornblende and biotite are often present in the dioritic gneiss and may cause banding. When the hornblende content becomes high, the rock is called hornblende gneiss. However, similar gneisses are mapped within areas where granitization has taken place, and here the hornblende gneiss especially seems to be an alteration product of amphibolite (to example the Skipeland farm vicinity).

### 3. Amphibolite (foliated)

Like elsewhere in the Evje-Iveland area foliated amphibolites surrounds the more massive meta-gabbroic rocks. In this case the amphibolite obviously is a metamorphic and foliated gabbro which in this particular area encircles the massif situated near Skipeland. Amphibolite occur as concordant bands among the gneisses as well and is in these cases probably a constituent of an older gneiss complex, like in the main Skipeland-Li zone.

### 4. Gabbro/meta-gabbro/massive amphibolite

This group of igneous rocks with different texture make up a dominant part of the bedrock mapped east of the zone. They may together with foliated amphibolite form just a part of an extensive massif which probably once covered most of the central amphibolite complex today approximately bounded by a line Tortveit-Eptevann-Vatne-Birkeland-Vaanne-Landås-Solberg-Gaudestad-Tortveit and only containing local inclusions or wedges of the basal gneisses as well as heavily granitized and tectonized basic rocks. This is partly postulated by T. Barth, but today we have evidences of younger intrusions as well as suggested by H. Bjørlykke.

Only a very small part of the intrusive being delt with here is mapped as gabbro. Most of it is converted to meta-gabbro and amphibolite. In the hills N of Skipeland farm there are situated outcrops of fairly fresh gabbro. Patches of a similar rock can also be seen among hornblende gneisses between the farm and the prospect to the S of it as described in the Catalogue of prospect descriptions (Skipeland).

One variety of a fairly fresh gabbroic rock is a very magnetic, dark and medium to coarse grained rock with massive texture. The rock which sometimes becomes foliated, seems locally to pass into hornblende gneiss (granitization). Even though it often looks comparatively fresh, it may not necessarily represent a younger intrusive phase into the basic complex but just a special variety of the intrusive. A sample collected 25 m S of Skripeland prospect pit contained approximately 50% of labrador feldspar laths, 20% of hypersthene and augite in equal amounts, 20% hornblende, 5% actinolite, 3% opaques (mainly oxides) and carbonate, spinel and biotite as accessories. Hence the rock could be classified as a meta-hyperite.

The dominant variety of the basic intrusive is a fine to medium grained rock with massive and sometimes sugary character containing approximately 50% plagioclase. It has an allotriomorphic texture and thin sections show from 25% to nil of augite + hypersthene, the pyroxenes mainly occurring as kernels within amphibole. The original composition must have been that of a norite-hyperite. When foliation develops in this rock, it passes into amphibolite.

Within some localities the fine to medium-grained massive rock gets lighter because of increasing content of feldspar and also quartz. Alternating zones of light and dark colour with widths from one cm to tenths of cm give one an impression of primary layering. However, small veins of quartz and feldspar are seen to branch out discordant from lighter "layers" and into darker ones. This structure which especially has been recognized in the hill slopes N of the farm and along the road to the south seems to be caused by secondary processes and may be related to later granitization.

In some localities the massive varieties have a high content of biotite and some chlorite. For instance an outcrop by a cart track 350 m N-NW of the farm which carries 3 - 10% of disseminated pyrrhotite, contains around 50% andesine feldspar, 30% actinolite + hornblende, 15% biotite and minor chlorite and augite. It has now a dioritic composition, but obviously represents an altered phase of the original norite-hyperite.

The transition against well foliated gneisses is not sharp. Usually the meta-gabbroic massif passes into massive and so foliated amphibolite before one meets hornblende gneiss and dioritic gneiss. It is impossible to locate the exact position of the contact.

Except from the known sulphide mineralization near the Skripeland farm only insignificant amounts of sulphides, related to the basic intrusive, were recognized. Magnetite is the main opaque mineral.

#### 5. Hornblende dioritic rock

The rock which has only been noticed at a few localities, is mainly coarse-grained and is massive or slightly foliated. It may exhibit a linear texture caused by a parallel orientation of the feldspar constituent, and it seems to be associated to massive or foliated amphibolite or hornblende gneiss.

From a fairly large exposure of this rock just N of the road in Støledalen some 350 m E-SE of the famous beryl bearing pegmatite quarry, V.H. Wiik reports a "dark med. grained amphibolitic gneiss with good schistosity". A thin section description by Wiik determines the rock as a "metamorphic plagioclase-hornblende rock" which contains 40% andesine feldspar and 40 - 50% of common hornblende grains the "aggregate in clusters of considerable size" (1 - 4 cm).



Similar rocks are reported from the Mølland and Birkeland area and might be what T. Barth described as hornblende gabbro or evjite. Its mode of origin is obscure, but it has never been observed as a host rock for sulphides.

#### 6. Meta-ultrabasics

Five relatively small bodies of ultrabasic composition have been located of which 3 are situated in or close to the Skripeland-Li zone and 2 approximately 600 m to the east of it. E.G. Haldemann has mapped several similar bodies along the continuation of the zone to the north.

The mineral composition varies from one occurrence to the other and often within the same one (see also: "Ultrabasic rocks of the Iveland-Evje area", Febr. 1968 by V.H. Wiik). Several of these bodies consist of aggregates of amphiboles, hornblende being a major constituent. They are close to hornblendites in composition and probably represent altered pyroxenites. A few contain locally minor amounts of feldspar.

A small magnetite rich body situated by the Støledalen road some 600 m ESE of the large pegmatite quarry contains a fair amount of olivine and serpentine and represents a meta-peridotite. One sample contained 0.11% Ni. The supposed size of the body is 30 m x 70 m.

The largest occurrence mapped in this area is situated near some swamps 300 m SE of the deserted farm of Aandal. Surrounded mainly by weakly sheared amphibolite with minor dissemination of pyrite and by pegmatites this body is approximately 70 m x 100 m large. The massive and medium-grained dark green rock consists mainly of hypersthene and augite in equal amounts with variable amounts of hornblende plus 5% of spinel and opaques. Of the latter pyrite makes up a minor part as small disseminated grains scattered throughout the rock. The meta-pyroxenite contains locally minor amounts of feldspar, and seems to be situated concordant within the amphibolites.

It is not clear whether the meta-ultrabasics represent basic segregations within the amphibolites comparable to those within the Mølland basic massif. The apparent relationship to the Skripeland-Li zone for a number of them suggests that they are structurally controlled and was intruded at a later stage. None of them have been seen to contain significant amounts of sulphides in this area.

#### 7 and 8. Granite and Pegmatite.

Only a few outcrops of fine to medium-grained red granite have been mapped, while the younger pegmatite is an ubiquitous rock especially in the northern part. Here on the higher ground pegmatites occur as undulating and nearly flat-lying sheets cutting the foliated amphibolites and gneisses. In this hilly terrain they are often situated on the top of the hills, now cut by the valleys. The largest sheet in this area probably had an continuous extension of 1200 m in the E-W direction. Some of the pegmatites are situated concordant amongst the surrounding rocks.

#### 9 - 12. Dyke rocks and veins.

A vertical dyke, 15 cm wide, of ultramafic composition (meta-pyroxenite) intersects meta-gabbroic rocks 500 m NW of Skripeland farm. Fine-grained dark dykes (meta-dolerites), some cm to one m wide, intersects massive basic rocks as well as gneisses. The steeply dipping dykes which strike 280° - 315° and a few 20° and 45° seem to follow the structural pattern of the area.

Fine-grained N-S striking dykes of "massive amphibolite" are also seen. Irregular concordant as well as discordant light to grey coloured quartz-feldspar veins and dykes with variable amount of hornblende and biotite are seen among the gneisses, amphibolite and meta-gabbroic rocks and also intersect a dyke of "massive amphibolite". They represent together with more granitic veins observed within the gneisses, part of the granitization processes of the area, which took place after the intrusion of the norite-hyperite.

### Structures

General strike of foliation within the Skripeland-Li zone and elsewhere is N-S to N-30° E with steep dips, mainly to the east. Local variations (flexures) occur near structure alignments.

The structure in the meta-gabbroic rock N of Skripeland farm which resembles layering has a more E-W strike as well with moderate dips to the north. N-S foliation or shearing seems to be superimposed on this structure.

From the air-photographs strong alignments appear on the direction W 25° - 50° N as well as NE - SW, E-W and N-S to N - 30° E, of which the latter mainly occur within the zone already described. In the field most of these alignments appear as elongated swamps. They must have been active at a relatively late stage since they cut through pegmatites. Flexure structures mentioned above indicate that horizontal movements have taken place along some of them. The local joint system follows the same directions, as do observed shears. Lineation (4 observations) within the foliated rocks plunges 30° towards N 15° E, 70° towards S 30° - 35° W (2 points) and 50° towards N 60° W. Fold axis (2 observations) plunge 70° towards S 5° W and 80° towards S - 45° W.

### Mineralization

The only sulphide occurrence within the area where any blasting of importance has been carried out is the Skripeland prospect situated 150 m SE of the northernmost farm with the same name. Sulphides, mainly pyrrhotite, occur as more or less massive pods or as fracture fillings related to the jointing within a wedge of massive amphibolite or meta-gabbroic rock surrounded by hornblende gneiss. A sample of massive sulphides from the dumps was found to carry 0.88% Ni - 0.19% Cu - 0.16% Co - 47.2% Fe - 31.4% S. The ratio (S-Sch):Ni for 3 samples varied between 24.25 and 36.0 (see prospect description).

Minor sulphides were observed at some localities as poor dissemination or accessories within various rock types: gneisses, amphibolites as well as meta-gabbroic and meta-ultrabasic rocks. Out of 11 registered localities excluding Skripeland prospect pit 4 are in foliated rocks along the Li-Skripeland zone and 2 in massive altered gabbroic rock within 200 m distance from it. At 3 other localities the sulphides are confined to sheared amphibolite and dioritic gneiss.

The content of sulphides of which pyrite is by far the dominant mineral, has not been observed to exceed 5% except from two localities 500 m (sample 10/68 - D12a) and 350 m (sample 19/68 - D12a) N-NW of Skripeland farm respectively where the content locally is up to 10%: 500 m W-NW of the farm, by a cart track, a shot has been blasted in a small outcrop of gneiss only 30 m W of the contact of the meta-gabbroic massif. The rock contains locally 5 - 10% of pyrrhotite and minor chalcopyrite as disseminations.

350 m W-NW of the farm also by a cart track, an outcrop of altered meta-gabbroic rock already described contains up to 10% of fine disseminated pyrrhotite. The actinolite - biotite rich massive rock is situated about 100 m E of the supposed gneiss contact. A thin section shows that the pyrrhotite is connected to biotite and actinolite - hornblende.



A nearby outcrop of a similar rock rich in magnetite is intersected by vertical feldspar rich veins, 2 - 4 cm wide, which carry minor amounts of pyrite and pyrrhotite.

Specimen No.	Ni	Co	Cu	Fe	S	$\frac{Cu}{Ni}$	$\frac{Ni}{Co}$	$\frac{S-Sch}{Ni}$
11a/68 - D12a Weathered sample of massive sulphides from dumps, Skripeland prospect	0.88	0.16	0.19	47.2	31.4	0.22	5.5	36.00
11b/68 - D12a Massive amphibolite with disseminated pyrrhotite from dumps, Skripeland prospect	0.086	0.014	0.081	17.2	2.9	0.94	9.0	31.0
10/68 - D12a Dioritic gneiss with dissem. sulphides 500 m W-NW of Skripeland farm N.	0.02	0.01	0.03	8.2	3.6	1.5	2.0	180.0
19/68 - D12a Meta-gabbroic rock with dissem. pyrrhotite 350 m W-NW of Skripeland farm N.	0.01	0.01	0.09	13.0	3.4	0.09	1.0	340.0

The assays were carried out at FN K'sand in February and September 1968

The two latter samples show a completely different Ni:Co and (S-Sch):Ni ratio than samples from Skripeland prospect and seem to represent a different type of mineralization which is not of economic interest.

The meta-pyroxenite 300 m SE of Amdal farm which is mainly surrounded by slightly sheared amphibolite containing up to a few per cent of pyrite is already described. An outcrop of massive amphibolite 350 m SW of Støledalen farm contains up to 5% of disseminated pyrite.

In the writers opinion it is likely that the sulphides recorded within basic and ultrabasic intrusives during the mapping (including Skripeland prospect) are of secondary origin or represent remobilized sulphides.

The sulphur to nickel ratio in the analysed samples is high. Even the mineralization at the Skripeland prospect seems to have a ratio which makes it of dubious economic interest.

It should be mentioned that four EM traverses (60 m connection cable) with 120 m intervals to the west of Skripeland farm across the contact of the meta-gabbroic massif were negative (see geophysical map from Skripeland-Li lineament in Iveland in 1968).

April 1, 1970  
EOv/lm

## LITJERN-SKRIPELAND ZONE S. (E.O.)

### Introduction

During 1968 detailed mapping was carried out along this zone over approximately 8 km. Dr. E.G. Haldemann covered the northern part and the writer the southern part including the map sheets D 10, D 11 and to some extent E 11c, E 11d and E 12 d. This chapter will only deal with the southern part. No detailed map is drawn from this area, and the observations made on the following blown up air photographs in scale 1:5'000 2340, 2342, 2439, 2441 are plotted on the regional geological map of the Evje-Iveland area (scale 1:25'000).

The N-S trending zone was known to parallel an aeromagnetic anomaly high in the southern area co-insiding with massive basic rocks to the east and to carry several bodies of meta-ultrabasic rocks. A few known nickel prospects are situated in or close to the alignment as well. It was decided to carry out a more detailed investigation of the zone since it was regarded as potential ground for mineralizations. In the southern area some traverses were extended up to 2 km east of the zone to get a better knowledge of the broad mag anomaly and the relationship to the known basic intrusives in the Tortveit - Mølland area.

### General geology

The main rock types co-insiding with the mag high over the high ground at Skripeland, Solheia and Rostadheia are various varieties of basic rocks such as meta-gabbro and massive and foliated amphibolites. The anomaly is to the SE bounded by the Tortveit NE shear zone, to the S by acid gneisses in the lower country N of Grossvann and to the W by the Litjern-Skripeland zone. The latter zone is covered by a mag low, and the magnetic gradient from the mag high just N of Skripeland farm is 1100  $\gamma$  over a distance of 300 m.

Within the N-S striking zone the dominant rocks consist of foliated dioritic gneisses and hornblende gneisses as well as more or less foliated amphibolites. Strike of foliation is between N-S and N 30° E or nearly parallel to the magnetic trend, while dips are vertical or steep - mainly to the east. Steeply dipping joints and minor shears with strikes between NNW and NNE were observed.

From field observations it can, therefore, be stated that the southern part of the depression or valley called the Litjern-Skripeland zone is caused by more acid and tectonized gneisses compared to the more massive and basic rocks of igneous origin to the east which also contain a fair amount of magnetite giving rise to a dominant mag high. From the regional geological map one sees that the rocks to the west mainly consist of amphibolites which surely are more resistant to erosion than the more acid gneisses situated along the zone.

### Brief rock description

For a more thorough description it is referred to "Description of rock types and a brief note on the geological history of the area" by F. Nixon, Jan. 1970.

The following rock types were encountered during the mapping:

	12 granitic/pegmatitic veins
Dykes	11 quartz-feldspar veins with hornblende/biotite
and	10 meta-dolerites
veins.	9 ultramafics

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Massifs	8 pegmatite (dominant)
and	7 granite
bodies	6 meta-ultrabasics
(mainly massive)	5 hornblende dioritic rock
	4 gabbro/meta-gabbro/massive amphibolite (dominant)

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Foliated	3 amphibolite (dominant)
rocks	2 hornblende gneiss (dominant)
	1 dioritic gneiss (dominant)

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#### 1 and 2. Dioritic gneiss and hornblende gneiss

These usually well foliated gneisses are mainly confined to the Li-Skripeland zone and are believed to belong to a basement complex into which the basic rocks intruded. Hornblende and biotite are often present in the dioritic gneiss and may cause banding. When the hornblende content becomes high, the rock is called hornblende gneiss. However, similar gneisses are mapped within areas where granitization has taken place, and here the hornblende gneiss especially seems to be an alteration product of amphibolite (to example the Skripeland farm vicinity).

#### 3. Amphibolite (foliated)

Like elsewhere in the Evje-Iveland area foliated amphibolites surrounds the more massive meta-gabbroic rocks. In this case the amphibolite obviously is a metamorphic and foliated gabbro which in this particular area encircles the massif situated near Skripeland. Amphibolite occur as concordant bands among the gneisses as well and is in these cases probably a constituent of an older gneiss complex, like in the main Skripeland-Li zone.

#### 4. Gabbro/meta-gabbro/massive amphibolite

This group of igneous rocks with different texture make up a dominant part of the bedrock mapped east of the zone. They may together with foliated amphibolite form just a part of an extensive massif which probably once covered most of the central amphibolite complex today approximately bounded by a line Tortveit-Eptevann-Vatne-Birkeland-Vaanne-Landås-Solberg-Gaudestad-Tortveit and only containing local inclusions or wedges of the basal gneisses as well as heavily granitized and tectonized basic rocks. This is partly postulated by T. Barth, but today we have evidences of younger intrusions as well as suggested by H. Bjørlykke.

Only a very small part of the intrusive being delt with here is mapped as gabbro. Most of it is converted to meta-gabbro and amphibolite. In the hills N of Skripeland farm there are situated outcrops of fairly fresh gabbro. Patches of a similar rock can also be seen among hornblende gneisses between the farm and the prospect to the S of it as described in the Catalogue of prospect descriptions (Skripeland).



One variety of a fairly fresh gabbroic rock is a very magnetic, dark and medium to coarse grained rock with massive texture. The rock which sometimes becomes foliated, seems locally to pass into hornblende gneiss (granitization). Even though it often looks comparatively fresh, it may not necessarily represent a younger intrusive phase into the basic complex but just a special variety of the intrusive. A sample collected 25 m S of Skripeland prospect pit contained approximately 50% of labrador feldspar laths, 20% of hypersthene and augite in equal amounts, 20% hornblende, 5% actinolite, 3% opaques (mainly oxides) and carbonate, spinel and biotite as accessories. Hence the rock could be classified as a meta-hyperite.

The dominant variety of the basic intrusive is a fine to medium grained rock with massive and sometimes sugary character containing approximately 50% plagioclase. It has an allotriomorphic texture and thin sections show from 25% to nil of augite + hypersthene, the pyroxenes mainly occurring as kernels within amphibole. The original composition must have been that of a norite-hyperite. When foliation develops in this rock, it passes into amphibolite.

Within some localities the fine to medium-grained massive rock gets lighter because of increasing content of feldspar and also quartz. Alternating zones of light and dark colour with widths from one cm to tenths of cm give one an impression of primary layering. However, small veins of quartz and feldspar are seen to branch out discordant from lighter "layers" and into darker ones. This structure which especially has been recognized in the hill slopes N of the farm and along the road to the south seems to be caused by secondary processes and may be related to later granitization.

In some localities the massive varieties have a high content of biotite and some chlorite. For instance an outcrop by a cart track 350 m N-NW of the farm which carries 3 - 10% of disseminated pyrrhotite, contains around 50% andesine feldspar, 30% actinolite + hornblende, 15% biotite and minor chlorite and augite. It has now a dioritic composition, but obviously represents an altered phase of the original norite-hyperite.

The transition against well foliated gneisses is not sharp. Usually the meta-gabbroic massif passes into massive and so foliated amphibolite before one meets hornblende gneiss and dioritic gneiss. It is impossible to locate the exact position of the contact.

Except from the known sulphide mineralization near the Skripeland farm only insignificant amounts of sulphides, related to the basic intrusive, were recognized. Magnetite is the main opaque mineral.

#### 5. Hornblende dioritic rock

The rock which has only been noticed at a few localities, is mainly coarse-grained and is massive or slightly foliated. It may exhibit a linear texture caused by a parallel orientation of the feldspar constituent, and it seems to be associated to massive or foliated amphibolite or hornblende gneiss.

From a fairly large exposure of this rock just N of the road in Støledalen some 350 m E-SE of the famous beryl bearing pegmatite quarry, V.H. Wiik reports a "dark med. grained amphibolitic gneiss with good schistosity". A thin section description by Wiik determines the rock as a "metamorphic plagioclase-hornblende rock" which contains 40% andesine feldspar and 40 - 50% of common hornblende grains the "aggregate in clusters of considerable size" (1 - 4 cm).

Similar rocks are reported from the Mølland and Birkeland area and might be what T. Barth described as hornblende gabbro or evjite. Its mode of origin is obscure, but it has never been observed as a host rock for sulphides.

#### 6. Meta-ultrabasics

Five relatively small bodies of ultrabasic composition have been located of which 3 are situated in or close to the Skripeland-Li zone and 2 approximately 600 m to the east of it. E.G. Haldemann has mapped several similar bodies along the continuation of the zone to the north.

The mineral composition varies from one occurrence to the other and often within the same one (see also: "Ultrabasic rocks of the Iveland-Evje area", Febr. 1968 by V.H. Wiik). Several of these bodies consist of aggregates of amphiboles, hornblende being a major constituent. They are close to hornblendites in composition and probably represent altered pyroxenites. A few contain locally minor amounts of feldspar.

A small magnetite rich body situated by the Støledalen road some 600 m ESE of the large pegmatite quarry contains a fair amount of olivine and serpentine and represents a meta-peridotite. One sample contained 0.11% Ni. The supposed size of the body is 30 m x 70 m.

The largest occurrence mapped in this area is situated near some swamps 300 m SE of the deserted farm of Aamdal. Surrounded mainly by weakly sheared amphibolite with minor dissemination of pyrite and by pegmatites this body is approximately 70 m x 100 m large. The massive and medium-grained dark green rock consists mainly of hypersthene and augite in equal amounts with variable amounts of hornblende plus 5% of spinel and opaques. Of the latter pyrite makes up a minor part as small disseminated grains scattered throughout the rock. The meta-pyroxenite contains locally minor amounts of feldspar, and seems to be situated concordant within the amphibolites.

It is not clear whether the meta-ultrabasics represent basic segregations within the amphibolites comparable to those within the Mølland basic massif. The apparent relationship to the Skripeland-Li zone for a number of them suggests that they are structurally controlled and was intruded at a later stage. None of them have been seen to contain significant amounts of sulphides in this area.

#### 7 and 8. Granite and Pegmatite.

Only a few outcrops of fine to medium-grained red granite have been mapped, while the younger pegmatite is an ubiquitous rock especially in the northern part. Here on the higher ground pegmatites occur as undulating and nearly flat-lying sheets cutting the foliated amphibolites and gneisses. In this hilly terrain they are often situated on the top of the hills, now cut by the valleys. The largest sheet in this area probably had an continuous extension of 1200 m in the E-W direction. Some of the pegmatites are situated concordant amongst the surrounding rocks.

#### 9 - 12. Dyke rocks and veins.

A vertical dyke, 15 cm wide, of ultramafic composition (meta-pyroxenite) intersects meta-gabbroic rocks 500 m NW of Skripeland farm.

Fine-grained dark dykes (meta-dolerites), some cm to one m wide, intersects massive basic rocks as well as gneisses. The steeply dipping dykes which strike 280° - 315° and a few 20° and 45° seem to follow the structural pattern of the area.

Fine-grained N-S striking dykes of "massive amphibolite" are also seen. Irregular concordant as well as discordant light to grey coloured quartz-feldspar veins and dykes with variable amount of hornblende and biotite are seen among the gneisses, amphibolite and meta-gabbroic rocks and also intersect a dyke of "massive amphibolite". They represent together with more granitic veins observed within the gneisses, part of the granitization processes of the area, which took place after the intrusion of the norite-hyperite.

### Structures

General strike of foliation within the Skripeland-Li zone and elsewhere is N-S to N-30° E with steep dips, mainly to the east. Local variations (flexures) occur near structure alignments.

The structure in the meta-gabbroic rock N of Skripeland farm which resembles layering has a more E-W strike as well with moderate dips to the north. N-S foliation or shearing seems to be superimposed on this structure.

From the air-photographs strong alignments appear on the direction W 25° - 50° N as well as NE - SW, E-W and N-S to N - 30E, of which the latter mainly occur within the zone already described. In the field most of these alignments appear as elongated swamps. They must have been active at a relatively late stage since they cut through pegmatites. Flexure structures mentioned above indicate that horizontal movements have taken place along some of them.

The local joint system follows the same directions, as do observed shears.

Lineation (4 observations) within the foliated rocks plunges 30° towards N 15° E, 70° towards S 30° - 35° W (2 points) and 50° towards N 60° W.

Fold axis (2 observations) plunge 70° towards S 5° W and 80° towards S - 45° W.

### Mineralization

The only sulphide occurrence within the area where any blasting of importance has been carried out is the Skripeland prospect situated 150 m SE of the northernmost farm with the same name. Sulphides, mainly pyrrhotite, occur as more or less massive pods or as fracture fillings related to the jointing within a wedge of massive amphibolite or meta-gabbroic rock surrounded by hornblende gneiss. A sample of massive sulphides from the dumps was found to carry 0.88% Ni - 0.19% Cu - 0.16% Co - 47.2% Fe - 31.4% S. The ratio (S-Sch):Ni for 3 samples varied between 24.25 and 36.0 (see prospect description).

Minor sulphides were observed at some localities as poor dissemination or accessories within various rock types: gneisses, amphibolites as well as meta-gabbroic and meta-ultrabasic rocks. Out of 11 registered localities excluding Skripeland prospect pit 4 are in foliated rocks along the Li-Skripeland zone and 2 in massive altered gabbroic rock within 200 m distance from it. At 3 other localities the sulphides are confined to sheared amphibolite and dioritic gneiss.

The content of sulphides of which pyrite is by far the dominant mineral, has not been observed to exceed 5% except from two localities 500 m (sample 10/68 - D12a) and 350 m (sample 19/68 - D12a) N-NW of Skripeland farm respectively where the content locally is up to 10%: 500 m W-NW of the farm, by a cart track, a shot has been blasted in a small outcrop of gneiss only 30 m W of the contact of the meta-gabbroic massif. The rock contains locally 5 - 10% of pyrrhotite and minor chalcopyrite as disseminations.

350 m W-NW of the farm also by a cart track, an outcrop of altered meta-gabbroic rock already described contains up to 10% of fine disseminated pyrrhotite. The actinolite - biotite rich massive rock is situated about 100 m E of the supposed gneiss contact. A thin section shows that the pyrrhotite is connected to biotite and actinolite - hornblende.

A nearby outcrop of a similar rock rich in magnetite is intersected by vertical feldspar rich veins, 2 - 4 cm wide, which carry minor amounts of pyrite and pyrrhotite.

Specimen No.	Ni	Co	Cu	Fe	S	Cu Ni	Ni Co	S-Sch Ni
11a/68 - D12a Weathered sample of massive sulphides from dumps, Skripeland prospect	0.88	0.16	0.19	47.2	31.4	0.22	5.5	36.00
11b/68 - D12a Massive amphibolite with disseminated pyrrhotite from dumps, Skripeland prospect	0.086	0.014	0.081	17.2	2.9	0.94	9.0	31.0
10/68 - D12a Dioritic gneiss with dissem. sulphides 500 m W-NW of Skripeland farm N.	0.02	0.01	0.03	8.2	3.6	1.5	2.0	180.0
19/68 - D12a Meta-gabbroic rock with dissem. pyrrhotite 350 m W-NW of Skripeland farm N.	0.01	0.01	0.09	13.0	3.4	0.09	1.0	340.0

The assays were carried out at FN K'sand in February and September 1968

The two latter samples show a completely different Ni:Co and (S-Sch):Ni ratio than samples from Skripeland prospect and seem to represent a different type of mineralization which is not of economic interest.

The meta-pyroxenite 300 m SE of Aamdal farm which is mainly surrounded by slightly sheared amphibolite containing up to a few per cent of pyrite is already described. An outcrop of massive amphibolite 350 m SW of Støledalen farm contains up to 5% of disseminated pyrite.

In the writers opinion it is likely that the sulphides recorded within basic and ultrabasic intrusives during the mapping (including Skripeland prospect) are of secondary origin or represent remobilized sulphides. The sulphur to nickel ratio in the analysed samples is high. Even the mineralization at the Skripeland prospect seems to have a ratio which makes it of dubious economic interest.

It should be mentioned that four EM traverses (60 m connection cable) with 120 m intervals to the west of Skripeland farm across the contact of the meta-gabbroic massif were negative (see geophysical map from Skripeland-Li lineament in Iveland in 1968).

April 1, 1970  
EOv/hm

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### Introduction

During 1968 detailed mapping was carried out along this zone over approximately 8 km. Dr. E.G. Haldemann covered the northern part and the writer the southern part including the map sheets D 10, D 11 and to some extent E 11c, E 11d and E 12 d. This chapter will only deal with the southern part. No detailed map is drawn from this area, and the observations made on the following blown up air photographs in scale 1:5'000 2340, 2342, 2439, 2441 are plotted on the regional geological map of the Evje-Iveland area (scale 1:25'000).

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### Brief rock description

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The following rock types were encountered during the mapping:



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-----	
Massifs and bodies (mainly massive)	8 pegmatite (dominant)
	7 granite
	6 meta-ultrabasics
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-----	
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-----	

### 1 and 2. Dioritic gneiss and hornblende gneiss

These usually well foliated gneisses are mainly confined to the Li-Skripeland zone and are believed to belong to a basement complex into which the basic rocks intruded. Hornblende and biotite are often present in the dioritic gneiss and may cause banding. When the hornblende content becomes high, the rock is called hornblende gneiss. However, similar gneisses are mapped within areas where granitization has taken place, and here the hornblende gneiss especially seems to be an alteration product of amphibolite (to example the Skripeland farm vicinity).

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The rock which has only been noticed at a few localities, is mainly coarse-grained and is massive or slightly foliated. It may exhibit a linear texture caused by a parallel orientation of the feldspar constituent, and it seems to be associated to massive or foliated amphibolite or hornblende gneiss.

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The largest occurrence mapped in this area is situated near some swamps 300 m SE of the deserted farm of Aandal. Surrounded mainly by weakly sheared amphibolite with minor dissemination of pyrite and by pegmatites this body is approximately 70 m x 100 m large. The massive and medium-grained dark green rock consists mainly of hypersthene and augite in equal amounts with variable amounts of hornblende plus 5% of spinel and opaques. Of the latter pyrite makes up a minor part as small disseminated grains scattered throughout the rock.

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A vertical dyke, 15 cm wide, of ultramafic composition (meta-pyroxenite) intersects meta-gabbroic rocks 500 m NW of Skripeland farm.

Fine-grained dark dykes (meta-dolerites), some cm to one m wide, intersects massive basic rocks as well as gneisses. The steeply dipping dykes which strike 280° - 315° and a few 20° and 45° seem to follow the structural pattern of the area.

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### Structures

General strike of foliation within the Skripeland-Li zone and elsewhere is N-S to N-30° E with steep dips, mainly to the east. Local variations (flexures) occur near structure alignments.

The structure in the meta-gabbroic rock N of Skripeland farm which resembles layering has a more E-W strike as well with moderate dips to the north. N-S foliation or shearing seems to be superimposed on this structure.

From the air-photographs strong alignments appear on the direction W 25° - 50° N as well as NE - SW, E-W and N-S to N - 30° E, of which the latter mainly occur within the zone already described. In the field most of these alignments appear as elongated swamps. They must have been active at a relatively late stage since they cut through pegmatites. Flexure structures mentioned above indicate that horizontal movements have taken place along some of them.

The local joint system follows the same directions, as do observed shears. Lineation (4 observations) within the foliated rocks plunges 30° towards N 15° E, 70° towards S 30° - 35° W (2 points) and 50° towards N 60° W. Fold axis (2 observations) plunge 70° towards S 5° W and 80° towards S - 45° W.

### Mineralization

The only sulphide occurrence within the area where any blasting of importance has been carried out is the Skripeland prospect situated 150 m SE of the northernmost farm with the same name. Sulphides, mainly pyrrhotite, occur as more or less massive pods or as fracture fillings related to the jointing within a wedge of massive amphibolite or meta-gabbroic rock surrounded by hornblende gneiss. A sample of massive sulphides from the dumps was found to carry 0.88% Ni - 0.19% Cu - 0.16% Co - 47.2% Fe - 31.4% S. The ratio (S-Sch):Ni for 3 samples varied between 24.25 and 36.0 (see prospect description).

Minor sulphides were observed at some localities as poor dissemination or accessories within various rock types: gneisses, amphibolites as well as meta-gabbroic and meta-ultrabasic rocks. Out of 11 registered localities excluding Skripeland prospect pit 4 are in foliated rocks along the Li-Skripeland zone and 2 in massive altered gabbroic rock within 200 m distance from it. At 3 other localities the sulphides are confined to sheared amphibolite and dioritic gneiss.

The content of sulphides of which pyrite is by far the dominant mineral, has not been observed to exceed 5% except from two localities 500 m (sample 10/68 - D12a) and 350 m (sample 19/68 - D12a) N-NW of Skripeland farm respectively where the content locally is up to 10%: 500 m W-NW of the farm, by a cart track, a shot has been blasted in a small outcrop of gneiss only 30 m W of the contact of the meta-gabbroic massif. The rock contains locally 5 - 10% of pyrrhotite and minor chalcopyrite as disseminations.

350 m W-NW of the farm also by a cart track, an outcrop of altered meta-gabbroic rock already described contains up to 10% of fine disseminated pyrrhotite. The actinolite - biotite rich massive rock is situated about 100 m E of the supposed gneiss contact. A thin section shows that the pyrrhotite is connected to biotite and actinolite - hornblende.

A nearby outcrop of a similar rock rich in magnetite is intersected by vertical feldspar rich veins, 2 - 4 cm wide, which carry minor amounts of pyrite and pyrrhotite.

Specimen No.	Ni	Co	Cu	Fe	S	Cu Ni	Ni Co	S-Sch Ni
11a/68 - D12a Weathered sample of massive sulphides from dumps, Skripeland prospect	0.88	0.16	0.19	47.2	31.4	0.22	5.5	36.00
11b/68 - D12a Massive amphibolite with disseminated pyrrhotite from dumps, Skripeland prospect	0.086	0.014	0.081	17.2	2.9	0.94	9.0	31.0
10/68 - D12a Dioritic gneiss with dissem. sulphides 500 m W-NW of Skripeland farm N.	0.02	0.01	0.03	8.2	3.6	1.5	2.0	180.0
19/68 - D12a Meta-gabbroic rock with dissem. pyrrhotite 350 m W-NW of Skripeland farm N.	0.01	0.01	0.09	13.0	3.4	0.09	1.0	340.0

The assays were carried out at FN K'sand in February and September 1968

The two latter samples show a completely different Ni:Co and (S-Sch):Ni ratio than samples from Skripeland prospect and seem to represent a different type of mineralization which is not of economic interest.

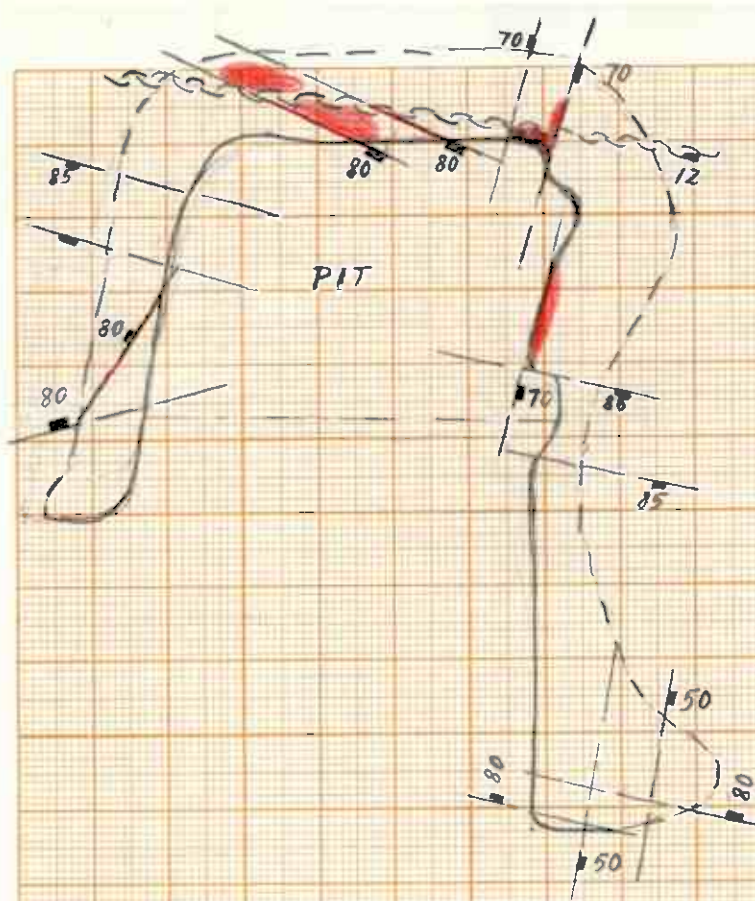
The meta-pyroxenite 300 m SE of Aandal farm which is mainly surrounded by slightly sheared amphibolite containing up to a few per cent of pyrite is already described. An outcrop of massive amphibolite 350 m SW of Støledalen farm contains up to 5% of disseminated pyrite.

In the writers opinion it is likely that the sulphides recorded within basic and ultrabasic intrusives during the mapping (including Skripeland prospect) are of secondary origin or represent remobilized sulphides. The sulphur to nickel ratio in the analysed samples is high. Even the mineralization at the Skripeland prospect seems to have a ratio which makes it of dubious economic interest.

It should be mentioned that four EM traverses (60 m connection cable) with 120 m intervals to the west of Skripeland farm across the contact of the meta-gabbroic massif were negative (see geophysical map from Skripeland-Li lineament in Iveland in 1968).

April 1, 1970  
EOv/hm





SCALE = 1:75

- META-NORITE/HYPERITE
- HORNBLende GNEISS
- SULPHIDE MINERALIZATION
- OUTCROP
- FOLIATION
- JOINT
- SHEAR

SKETCH MAP OF  
SKRIPELAND PROSPECT



LOCATION

SKRIPELAND prospect situated beside the road 150 m SE of Northern Skripeland farm (414 m a.s.l.) in Iveland kommune. In the north-eastern part of map unit D12 on air photograph No. 1-61 64-2342. The farm is reached by car along a 3 km long road from Fossheim, a crossroad 1 km N of Birketveit in Iveland.

STATUS

"Anmeldt" (claimed) by A/S SULFIDMALM the 20th December, 1967.

HISTORY

The prospect is described in H. Bjørlykke's diary (Dagbok for arbeide for A/S Raffineringsverket, Evje. Sommeren 1940) and is briefly mentioned by Tom F.B. Barth in NGU publication 168a: "The nickeliferous Iveland-Evje amphibolite and its relation." Frank Nixon carried out regional mapping in the area in 1967 (see diary). Judging by the weathering of oreblocks and by the overgrowth the pit was probably blasted around the turn of the century.

GEOLOGICAL SETTING

The prospect is situated within a massif of meta-gabbro/massive amphibolite coinciding with an aeromagnetic anomaly high. It is situated around 700 m to the east of the Skripeland-Li lineament and within a heavily granitized part of the basic massif where patches of more or less basic and massive rocks occur together with hornblende gneisses (see geophysical map of Skripeland-Li lineament in scale 1:2'000 and geophysical map 2/electromagnetic map 1 from Ni prospect at Skripeland in scale 1:1'000). The prospect which is situated in the corner of a meadow consists of a 5 m long and 3½ m wide open cut and a 3½ x 3 m pit filled with trees and water. The depth of the latter is estimated to 2 - 3 meters. The mineralization is confined to a wedge of massive amphibolite, surrounded by hornblende gneiss. This rock is fine-medium grained and exhibits an equigranular texture. A thin section consisted mainly of hornblende and plagioclase (labrador with 57% An) in equal amounts. Minor constituents were hypersthene (3%), biotite (2%), Opaques (2%). The texture is allotriomorphic.

The pyroxene occurs as kernels within the amphibole, and a few remnants of clinopyroxene seem to be present. The plagioclase has partly bent lamellas and is slightly sericitized. Most of the opaques are oxides. The rock is classified as a meta-norite or meta-hyperite. 25 m to the south of the prospect is situated a 10 m wide dark gabbroic rock which has been described as a dyke of hyperite or as a diabase. A thin section shows it is a medium-grained cataclastic meta-hyperite with mortar texture containing approximately 50% of long and very bent plagioclase laths (labrador), 20% hornblende, 20% polygonized grains of hypersthene and augite/diopside in equal amounts, 5% actinolite, 3% opaques (mainly oxides) and carbonate, spinel and biotite as accessories. Similar varieties of the basic intrusive with high and irregularly distributed magnetite content occur further towards the SE as well as near the northern farm.

### STRUCTURES

In the Skripeland area the strike of foliations is dominantly N-S with mainly steep dips to the east. In the environments of the farms, however, the strike is very irregular, and E-W directions are very common with dips to the north from less than  $30^{\circ}$  up to  $80^{\circ}$ . Near the prospect the strike varies from  $300^{\circ}$  -  $335^{\circ}$  and dips from  $20^{\circ}$  -  $60^{\circ}$  towards NE.

Jointing is frequent at the pit with a major system with average strike  $190^{\circ}$  and dip  $80^{\circ}$  -  $85^{\circ}$  to W. Minor systems have strike  $105^{\circ}$  with dip  $50^{\circ}$  -  $70^{\circ}$  to S and strike  $285^{\circ}$  and dip  $70^{\circ}$  to N. A flat shear with strike approximately  $190^{\circ}$  and dip  $12^{\circ}$  to W seems to contain small fragments of sulphides and hence should be younger than the mineralization.

Sulphides, mainly pyrrhotite occur as more or less massive pods or as fracture fillings related to the jointing at the prospect (see Fig. 1).

It can be mentioned that the longest conductor outlined by the EM survey has a strike nearly parallel to the major joint system. The intersection line between the joints  $190^{\circ}/82^{\circ}$  -  $105^{\circ}/60^{\circ}$  gives a plunge of  $60^{\circ}$  in direction  $203^{\circ}$  which also is practically parallel to the conductor.

### CHARACTERISTICS OF ORE

Most of the weathered ore samples on the dumps consist of massive sulphides (pyrrhotite, pyrite, minor chalcopyrite), but some of disseminated sulphides as well. Magnetite was noticed in most of the samples as well as in outcrops in and near the pit where it occurs together with sulphides and also in irregular distribution in barren rock.

Sulphide mineralization which is tectonically controlled, is visible only in the rock-walls of the pit. A polished section of a pyrrhotite-rich sample taken from the dumps contained:

Pyrrhotite	= 60%
Marcasite	= 2%
Chalcopyrite	= 2%
Pentlandite	accessory
Magnetite + Ilmenite	= 5%
Gangue silicates	= 30%

The massive pyrrhotite is to some extent altered to marcasite, mainly along fractures. Chalcopyrite occurs as individual grains and as fracture fillings in silicates, oxydes and in a few cases in pyrrhotite. Magnetite and ilmenite with average grain size of 0.3 mm (anhedral) seem to be replaced by sulphides. Some grains are intersected by veins of chalcopyrite and pyrrhotite. Pentlandite occurs as scattered exsolution laths or blades in the pyrrhotite parallel to its parting planes. Maximum length is 0.08 mm and the average = 0.03 mm. This shows that the sulphide fluid was very poor in nickel which is also confirmed by chemical assays.

ANALYSES

Specimen No.	Ni	Co	Cu	Fe	S	$\frac{\text{Cu}}{\text{Ni}}$	$\frac{\text{Ni}}{\text{Co}}$	$\frac{\text{S-Sch}}{\text{Ni}}$
10 D12 Sample from dumps with disseminated sulphides	0.07	0.02	0.10	13.1	1.8	1.43	3.5	24.25
11a/68 - D12a Weathered sample from dumps of massive sulphides	0.88	0.16	0.19	47.2	31.4	0.216	5.5	36.0
11b/68 - D12a Sample of massive amphibolite from dumps with disseminated pyrrhotite	0.086	0.014	0.081	17.5	2.9	0.94	9.0	31.0

The assays were carried out at FN K'sand in February and September 1968.

NAME of examiner: .....

WORK DONE AND TIME SPENT in examination:

Geological investigation of  
prospect and neighbourhood:  
about half a day.

Geophysical work with assistants:  
1½ days.

EOv/hm 14th February, 1969