



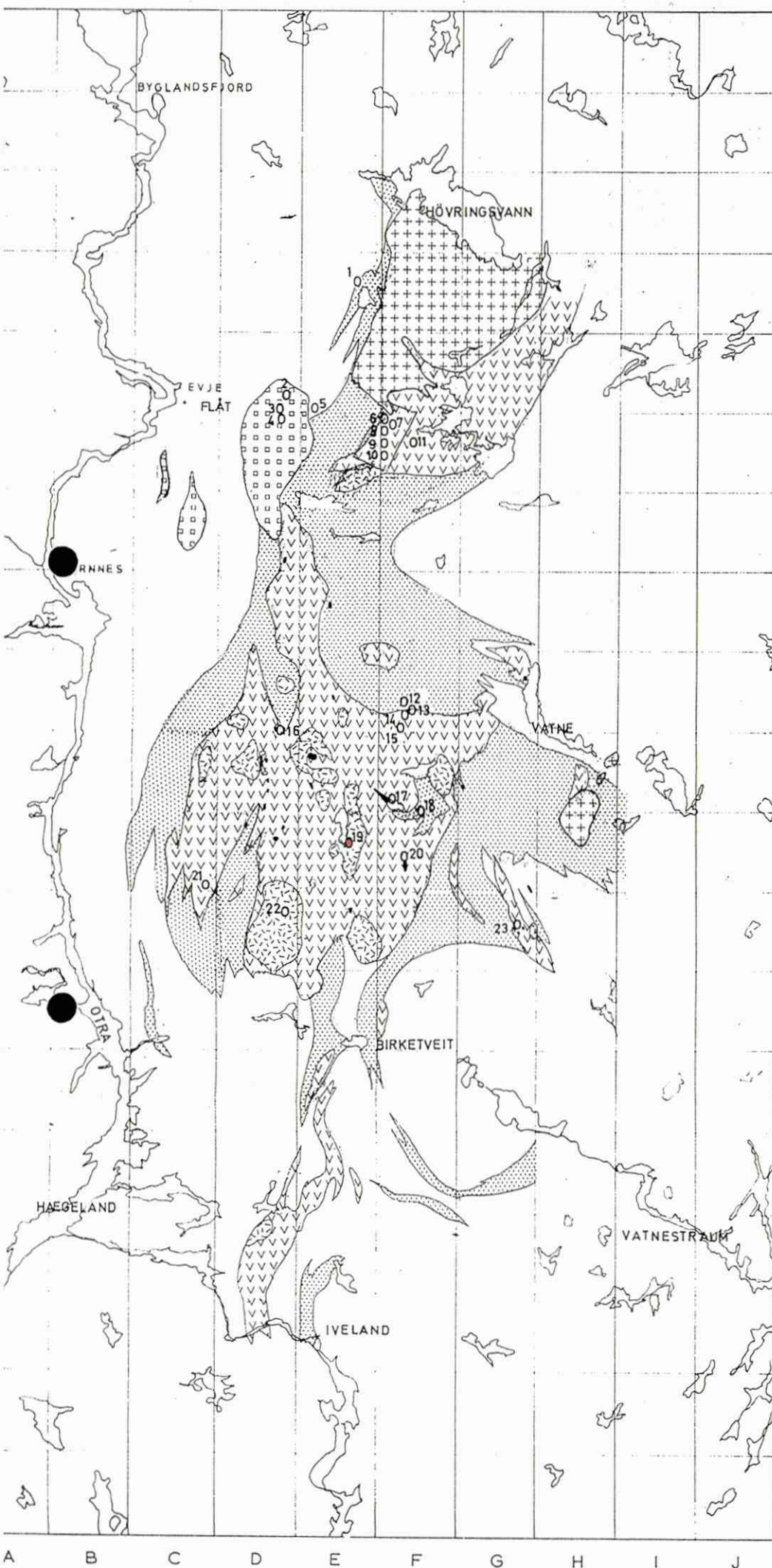
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Tittel Report on Diamond Drilling at Kjettevann, Mølland Farm, Iveland				
Forfatter F. Nixon		Dato 11.12 1969	Bedrift Sulfidmalm a.s.	
Kommune Iveland	Fylke Aust-Agder	Bergdistrikt Østlandske	1: 50 000 kartblad 15114	1: 250 000 kartblad Mandal Arendal
Fagområde Geologi geofysikk geokjemi boring	Dokument type Rapport	Forekomster Kjettevann		
Råstofftype Malm/metall	Emneord Ni Cu Co S			
Sammendrag Noe mangelfull rapport (mangler logg for borhull4 og alle geokjemiske og geofysiske kartbilag) Tilsammen 4 borhull ble boret i 1969. Boringen fortsatte i 1970				

EVJE-IVELAND ARE.



- GRANITIC AND DIORITIC GNEISS
- AMPHIBOLITE FOLIATED AND MASSIVE
- HORNBLÉNDE GNEISS
- GABBRO
- HORNBLÉNDE DIORITE
- ULTRABASIC
- GRANITE

- | | | |
|----|-------------|------------------|
| 1 | st. AAFLOU | PROSPECT |
| 2 | FLATERYGD | " |
| 3 | FLÅT | MINE |
| 4 | MYKLEÅSEN | PROSPECT |
| 5 | STABBESTEN | " |
| 6 | HESTÅSEN | " |
| 7 | LANGTJERN | " |
| 8 | LOMTJERN | " |
| 9 | GULREGN | " |
| 10 | BYTTINGSMYR | " |
| 11 | VIKSTØL | " |
| 12 | N. PAASCHE | " |
| 13 | S. PAASCHE | " |
| 14 | BEKKEN | " |
| 15 | ORREKNAPPEN | " |
| 16 | LITJERN | " |
| 17 | KLEPP TJERN | " |
| 18 | EPTVASSMYR | " |
| 19 | MÖLLAND | <i>Kjelleren</i> |
| 20 | HAALAND | " |
| 21 | LANDAAS | " |
| 22 | SKRIPELAND | " |
| 23 | ELSHAUGEN | " |

AAVITSLANDSHEIA GRID AREA

0 1 2 3 4 5 KM

EVJE - IVELAND PROJECT

Report on Diamond Drilling at Kjettevann,
Malland, 1969, by F. Nixon
with Maps, Sections, Drill Logs, Lab. Reports

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Kristiansand,
6th February, 1970.

TO : A. M. CLARKE
FROM : E. G. HALDEMANN
SUBJECT : EVJE-IVELAND PROJECT

DIAMOND DRILLING AT KJETTEVANN,
(MOLLAND), 1969.

PROGRESS REPORT AND PRELIMINARY RESULTS

1. Diamond Drilling at Kjettevann (Molland) was interrupted on December 11th, 1969. F. Nixon has logged all cores; his report as well as supporting maps, sections, and other records are herewith submitted for your information.
2. DDH No.2-69 intersected a sulphide mineralization from 55.92 to 65.42 m as you know from your visit in October, 1969. Analyses gave no spectacular results but at least they were encouraging. The best meter (61 to 62 m) assayed 0.73% Ni, 0.24% Cu, 4.7% S; the S/Ni ratio being 6.1. The average ratio for 74 samples available from Kjettevann is 6.25. F. Nixon has calculated sulphide ratios for the whole Evje-Iveland area. The Kjettevann (Molland) samples show the most favourable S/Ni ratios in the whole area.
3. DDH No.3-69 failed to intersect a continuation of the mineralized zone encountered in DDH No.2. So far, our drilling results have not given an answer as to the geometry of the mineralized ground or "ore bodies". Thus we shall resume drilling after Easter with a set of vertical holes to probe known mineralizations and some magnetic features.
4. There also remain some geological problems for which we have no final explanations: Both the field work and the drill records show that foliated metagabbro and massive amphibolite can occur between norite and gabbro, and that the western boundary of the "Molland Massif" is a gradational one. The "Molland Massif" is probably not a separate, younger mass of basic intrusives but the central part of a more widespread gabbro-norite body. This central part was little affected by, or escaped metamorphism. As a consequence of this interpretation, the gneissic rocks and amphibolites at the south and west side of Kjettevann cannot represent the true border of the "Molland Massif" but merely a wedge between it and other basic rocks further to the west and south-west. An analogous situation exists on the east side of the "Molland Massif" (cf. Geol. Map).
5. Attention is also drawn to the nature of the ultrabasic rocks differentiated in the norite and gabbro of the "Molland Massif". These ultrabasics are clino-amphibole-rich rocks or, in places, hornblendites. Nixon has observed a kind of fine layering in norite/gabbro produced by concentrations of mafic minerals. Ultrabasics of the peridotite-harzburgite group which occur elsewhere in the region are not present in the "Molland Massif".

E. G. Haldemann .

Evje Iveland Project

Preliminary Report on Diamond Drilling at Kjettevann, Mølland Farm, Iveland.

F. Nixon. 11th December 1969.

General Remarks

Exploratory diamond drilling is being carried out on the eastern side of Kjettevann Lake, Mølland farm in Iveland. The purpose of the investigation being to locate economically interesting nickel sulphide mineralizations and at the same time to throw more light on the basic rock suite at Kjettevann and the nature and occurrence of its contained sulphides.

The drilling contractor is the Norwegian firm A/S grunnboring, Oslo. The drill team consists of one driller and one helper who work one twelve hour shift per day.

The machine being used is a Graellius, type XF which has a capacity of 300 - 400 m. The recovered core diameter is 32 mm. The water supply is obtained from Kjettevann by means of a mono-pump with a 6 H.P. diesel motor.

Preparative Work

Regional mapping on a scale of 1:15000 was carried out by the writer in 1967. Geophysical work (E.M.) was carried out on the eastern side of Kjettevann by Overwien in the same year, these E.M. surveys were extended onto the ice in the early part of 1968 by Wiik and the writer. The results of E.M. work were fairly negative.

Detailed geological mapping of the Mølland area and the old workings there was carried out by Overwien and the writer in the summer of 1968. This investigation indicated considerable variations in the basic rocks.

Detailed magnetic and geochemical surveys were carried out by the writer in the summer of 1969.

The results of the various investigations were difficult to evaluate from an economic point of view but there were certain indications that a sulphide zone found at surface might possibly plunge southwards. It was decided to investigate this theory, and at the same time anomalous magnetic zones, by diamond drilling.

Using modern surveying instruments a new base line with starting point at our old zero-point was marked out over a distance of 460 m. Points at 20 m intervals along this line were measured for their height over Kjettevann. Between 240S and 220N all our old points were plotted in relation to the new base line, this was also done for various outstanding topographic features.

This information provided the raw data for an accurate topographic map of the area of interest, this being essential for the siting of the drill-holes.

The east-west profiles for the drill-hole sites were also marked out.

Factual Information

A/S Grunnborings team arrived at Kjettevann on the 17th of September and three days were spent unloading and setting up the equipment. Details of location and time spent on each drill hole is given below.

Diamond drill hole no. 1, location, 13.60S/8.68E, dip 53° direction 270°. Started 22nd september, stopped 6th october. The following meterages were achieved.

<u>Date</u>	<u>Total m. drilled</u>	
22/9	8.38 m	
23/9	15.87 m	
24/9	12.00 m	
25/9	14.78 m	
26/9	11.92 m	
27/9	8.00 m	
28/9	9.08 m	
29/9	13.76 m	
30/9	11.07 m	
1/10	12.83 m	
2/10	11.06 m	
3/10	10.44 m	
4/10	0	Free day
5/10	0	Free day
6/10	6.95 m	

Total depth of hole 145.90 m.

Diamond drill hole nr. 2, location 13.60S/9.00E, dip 70° direction 270°. Started 6th october, stopped 24th october.

<u>Date</u>	<u>Total m. drilled</u>	
7/10	12.38 m	
8/10	15.28 m	
9/10	13.97 m	
10/10	13.74 m	
11/10	10.75 m	
12/10	8.86 m	
13/10	13.45 m	
14/10	10.88 m	
15/10	14.69 m	
16/10	14.26 m	
17/10	13.70 m	
18/10	0	Free day
19/10	0	Free day
20/10	9.02 m	
21/10	11.75 m	
22/10	10.64 m	
23/10	8.71 m	
24/10	2.38 m	

Total length 185.42 m

Diamond drill hole no. 3, location 13.60S/25.78E, dip 70, direction 270°. Started 27th october, stopped 5th november.

<u>Date</u>	<u>Total m. drilled</u>	
27/10	14.36 m	
28/10	13.84 m	
29/10	13.62 m	
30/10	14.87 m	
31/10	9.08 m	
1/11	0	Free day
2/11	0	Free day
3/11	7.62 m	
4/11	13.36 m	
5/11	8.65 m	
6/11	13.86 m	
7/11	6.82 m	

Total length 116.50 m.

Diamond drill hole no. 4, located at 75.19S/28.74E. The hole was started on the 7th of november and at the time of writing has just reached a depth of 170 m. The slow progress being due to the extremely cold weather which gives great difficulties with the supply of water.

Geology

The results of diamond drilling confirmed the fact that the geology of the Mølland area is complex. However, various observations noted in the drill cores throw new light on the geology and in this report various tentative theories as to the origins of the rocks are forwarded.

The basic rocks embrace a number of varieties which are suggested to be of a co-magmatic origin. The most abundant basic rock type both in surface outcrop and in drill cores is a small to medium grained, massive, granular rock which in hand specimen can often be seen to carry a brownish to violet feldspar and hypersthene.

This rock varies between norite and hyperite, depending on the relative amounts of clino and ortho-pyroxenes. It may or may not carry sulphides.

Both in surface outcrop and in drill cores this rock type looks fairly fresh and microscopic examination confirms this. Under the microscope the rock is a fresh two pyroxene gabbro with usually between 50 and 60 % plagioclase (labradorite). The relative amounts of clino and ortho-pyroxenes vary. Reaction rims of hornblende are formed around the anhedral pyroxene grains. Biotite, chlorite and apatite are usually present as accessories. The plagioclase forms equidimensional well twinned grains and there is no sericitization or other corrosion of the plagioclase.

The texture in this rock type is usually modified through moderate tectonization which produces slight deformation of the twin lamellae and protoclastesis along grain boundaries.

It is suggested that this rock type is the main end product of the "Mölland magma" and was the first rock type to solidify. Bent twin lamellae and protoclasis point to some slight tectonization during and after consolidation. Because of the general massive nature of the rock these forces were not very strong and may have been entirely internal and confined to the magma chamber.

Various modifications of this rock type also occur, the most frequent being finer grained varieties and more basic varieties. These basic types are very dominant in drill hole no. 3, and from the evidence of the three drill holes there seems to be an increase in the amount of basic rocks as one goes eastwards.

Gradual transitions occur between all three types.

The basic types seem predominantly to be rich in hypersthene. A thin section of a similar rock type sampled on the surface showed that hypersthene was predominant and only slightly altered, whereas the original clino-pyroxene is almost completely replaced by amphibole.

In drill hole no. 2 around 74 m a fine grained non-magnetic noritic rock has a sharp upper contact with a med grained norite variety, whilst at the lower contact there is merely a gradual grain-size increase from fine to medium. This phenomena in the writers opinion be explained by magma currents.

All the above mentioned rocks are early consolidated rocks in the complex. This is apparant from drill cores where they can be seen to be cut by younger rock types, which can be divided into two groups; basic and acid.

The basic group consists of three rock types, these being A) Medium to coarse grained hypersthene - clino - pyroxene, amphibole rock. Contains little or no primary feldspar and usually carries sulphides.
B) An ultrabasic variety rich in amphibole
C) Fine grained basic dyke rocks which have a high magnetite content.

Type A) which has been identified in all three holes and seems to form an easterly dipping belt has not previously been noted on the surface. The rock is dark green in colour and can clearly be seen to intrude the normal norite. In holes one and two the rock seems to have been injected or squeezed into the medium grained norite whilst this was in a semi solid, plastic state. In hole three the rock is more concentrated over a longer core length and intrusive contacts are difficult to find.

It is suggested that this rock type has been formed from the same magma as the norite and that it represents a concentration of early formed pyroxenes and amphiboles. These early formed crystals sank in the magma chamber and were later redistributed by magma currents or some slight tectonic influence, so that they were injected into the semi-solid normal norite.

This rock is important and interesting, as it in part contains up to 10 % sulphides mainly as pyrrhotite with minor pyrite and chalcopyrite. The best sulphide mineralization and the best nickel values found so far during drilling, were in connection with this rock type.

Type B) is an ultrabasic chiefly hornblenditic phase. In some cases fibrous amphiboles can be seen and may be due to local uralitization. This rock can also be seen to cut the medium grained norite and is therefore somewhat younger than this. From the nature of the contacts it is suggested that the normal norite was fairly brittle at the time of the ultrabasic intrusion and one can draw the conclusion that this ultrabasic phase is younger than the hypersthene amphibole rock. This is not conclusive evidence and it is probable that the two types are intimately related to each other.

Type C) is probably the youngest type of basic intrusive. These are fine/med grained basic rocks that have a high magnetic content. They are seen to have sharp intrusive contacts and are transcordant to the rocks they intrude.

It is suggested that these represent the rest magma which was now deplete in silica so that any remaining iron crystallized out as oxide. This rest magma was squeezed into the gabbro/norite complex and also onto the surrounding country rocks, along fractures and lines of weakness, the gabbro at this time being solid.

Various coarse grained sections occur in the noritic rocks. Most of these are due to the introduction of coarse feldspar, but others seem to have some petrogenetic significance and could possibly have been formed in static pockets of the magma chamber where the crystals were allowed to grow.

In two sections of the drill core from hole 2 and hole 3 a regular layering can be seen, a massive compact meta-gabbroic rock in hole no. 2 shows a remarkable uniform alteration of medium grained lighter portions and darker portions which are more basic and coarser. Usually the layering is uniform with 5 or 6 cms between the dark layers which have a thickness of 1 cm. In other parts the darker layers seem to cut transcordantly across the lighter. It is possible that magma currents, such as density currents, may have produced this delicate stratification.

The contact of the gabbro complex with the gneisses to the west is very gradational and in none of the holes were sharp contacts seen. Layering which is present in the norite in hole 2 seems to persist as ghost layering into the gneisses, this strongly suggesting that at least some of the amphibole gneisses are in fact sheared gabbro.

The geology is complex and all conclusions drawn above are based mainly on field observations. To get a more complete picture of the petrogenesis much microscopic and chemical work should be done. This, however, is beyond the needs of A/S Sulfidmalm and would purely be of academic interest.

Mineralizations

From the drill sections and from other information it seems that at Kjettevann we are dealing with many small mineralized zones of irregular size and shape and varying sulphide content.

No one zone can definitely be said to be continuous from one hole to another. Pyrite, pyrrholite and chalcopyrite are the sulphide minerals observed, the pyrrhotite in this area is known to carry pentlandite and violarite. The oxydic ore minerals observed were magnetite and ilmenite (in one case only). It is possible that the magnetite where it occurs in and at the contact of quartz and pegmatite veins is of secondary origin.

The sulphides were observed in all rock types except the basic dyke rocks and most of the acid dyke rocks, and they occur as fine to coarse grained disseminations, stringers and fracture fillings. In most of the weaker disseminations i.e. under 2% pyrite is the dominant sulphide, in the richer disseminations pyrrhotite is the most dominant. Chalcopyrite is not abundant and only occurs in limited concentrations. All three sulphides are found as fracture fillings.

In the gneisses to the west, pyrite is the dominant sulphide mineral.

The most interesting mineralized zone from an economic point of view occurs between 55.92 m and 65.42 m in drillhole no. 2. Here the medium grained massive norite has been intruded (injected) by an ultrabasic pyroxene/amphibole fraction which carries upto 10 % sulphides, pyrrhotite, pyrite and chalcopyrite as coarse dissemination. The nickel content of this zone averages about 0,5 % Ni.

This "ore zone" has not been traced over to holes 1 or 3 although the host rock - the ultrabasic pyroxene/amphibole rock can be seen in both holes and forms (in E/W section) a zone approx. 15 m wide and dipping gently eastwards.

No attempt will be made here to go into detail regarding the mode of formation of the mineralizations as this is being covered in another report. Sampling and Assay results.

Diamond drill hole no. 1

Depth.	Description	Ni %	Co ppm	Cu %	Fe %	S %
37 - 38 m	med. gr. norite 2% sulphides	0.13	100	0.04	9.1	0.52
65.8 - 66.8 m	basic meta - gabbro	0.09	100	0.04	7.6	0.69
81 - 82 m	basic norite 2 - 5 % sulphides	0.28	150	0.10	10.3	1.6
86 - 87.4 m	med. gr. norite 2% sulphides	0.17	110	0.06	9.0	1.1

Diamond drill hole no. 2

Depth.	Description	Ni %	Co ppm	Cu %	Fe %	S %
55 - 56 m	Norite intruded by pyroxene/amphibole rock, specks of sulphides	0.03	50	0.03	5.2	0.37
56 - 57 m	as above with approx. 10 % sulphides	0.58	150	0.19	15.7	3.4
57 - 58 m	" " " "	0.65	160	0.23	13.4	4.2
58 - 59 m	" " " "	0.25	75	0.065	9.3	1.3
59 - 60 m	" " " "	0.32	90	0.11	9.9	2.2
60 - 61 m	" " " "	0.21	75	0.079	8.1	1.1
61 - 62 m	" " " "	0.73	180	0.24	12.6	4.7

	Ni %	Co ppm	Cu %	Fe %	S %
62 - 63 m as above with approx. 10% sulphides	0.66	150	0.22	12.8	3.9
63 - 64 " " " "	0.26	75	0.098	8.9	1.6
64 - 65 " " " "	0.64	150	0.16	12.3	3.6
80.42 - 81.42 m massive amphibolite with basic patches	0.21	120	0.06	9.1	0.86
84 - 85 m basic gabbro 2% sulphides	0.18	100	0.05	7.8	0.78
85 - 86 m " " " "	0.19	120	0.05	9.7	0.72
86 - 87 m " " " "	0.16	100	0.04	9.2	0.47
87 - 88 m " " " "	0.23	150	0.06	10.0	0.92
88 - 89 m " " " "	0.26	160	0.06	11.4	1.2
89 - 90 m " " " "	0.29	160	0.10	10.2	1.7
90.3 - 91.3 m " " " "	0.19	120	0.08	7.7	1.6
170.65-171.72 m meta " " " "	0.13	110	0.02	11.7	0.84

Diamond drill hole No. 3

65.5 - 66.5 m gabbro with poor dissemination	0.06	<0.01	0.04	5.3	0.58
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Diamond drill hole No. 4

137 - 138 m basic gabbro with poor dissemination	0.11	<0.01	0.09	7.4	0.52
141 - 142 m " " " "	0.08	<0.01	0.06	6.4	0.55

APPENDIX

This short appendix is concerned with diamond drill hole No. 4, located at 75.19S/28.74E. The hole was started on the 7th November but due to extreme winter conditions was not finished until the 12th December.

The dip of the hole was 65° and the direction 270. The following meterages were achieved:

Date	Total meters drilled	Remarks
10/11	13.20	
11/11	13.65	
12/11	11.71	
13/11	12.18	
14/11	11.78	
15/11	0	Free day
16/11	0	" "
17/11	9.55	
18/11	11.26	
19/11	11.78	
20/11	11.51	
21/11	13.01	
22/11	8.48	

Date	Total meters drilled	Remarks
23/11	0	Free day
24/11	13.53	2½ hours de-icing
25/11	9.05	3 " "
26/11	0	8 " "
27/11	0	Too cold
28/11	0	" "
29/11	0	" "
30/11	0	" "
1/12	8.30	
2/12	9.46	
3/12	0	4 hours de-icing
4/12	0	5 " "
5/12	0	5 " "
6/12	0	Free day
7/12	0	" "
8/12	0	
9/12	0	5 hours de-icing
10/12	7.29	5 " "
11/12	6.58	

Geology

Drill hole No. 4 is still within the gabbro complex and the gabbro types found further north are found again here. There seems, however, to be more alteration of the rocks here than farther north.

An interesting feature are the fairly coarse grained gabbro variations of which are coarse grained hypersthene gabbro, and coarse grained amphibole gabbro.

Younger basic dyke-like intrusions are much less frequent here than in the previous holes.

Mineralizations

Mineralization is poor, only in one or two places does the sulphide content come near 2% and then only over very small distances. The dominant sulphide mineral noted was pyrite.

Around 156 - 158 m there is a good dissemination of magnetite, it is this magnetite that is most probably the cause of the recorded magnetic anomaly.

Future work.

Diamond drilling was stopped on the 11th December, for the duration of the winter, drilling is planned to start again in April.

First plans for 1970 consist of 5 or 6 fairly shallow (100 m) vertical holes in the general vicinity of holes 1 - 3 (1969). A deeper hole is also planned further east in order to investigate the gabbro at a great depth, and if possible to locate a basal contact of the gabbro complex.

30th Jan., 1970

FN/hm

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 13.60S - 8.68E BEARING: 270 DIP: 53 HOLE NO: 1 SHEET NO: 1
 LOGGED BY: F. NIXON STARTED: 22.9.69 PROPERTY: RJETTEVANN MÖLLAND
 CASING: 1.45 m FINISHED: 7.10.69 FARM: IVELAND NORWAY
 CORE SIZE: 82 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
0	1.45	Overburden fill and boulders.
1.45	20.77	Massive medium grained gabbro/norite with poor and sporadic dissemination.
20.77	23.63	Ultrabasic rock, rich in amphibole, intrusive, weak dissemination of py & po
23.63	33.00	Massive meta gabbro/amphibolite. Some banding or layering.
33.00	37.60	Massive medium grained gabbro/norite.
37.60	40.93	Basic gabbro/norite weak dissemination.
40.93	41.34	Coarse grained gabbroic rock.
41.34	57.27	Medium grained gabbro/norite with disseminations (in part up to 2%) mainly pyrite.
57.27	59.73	Coarse grained gabbro with poor dissemination
59.73	67.95	Medium grained meta gabbroic rock into which has been intruded ultrabasic - hypersthene / amphibole rock. Poor dissemination in both rock types.
67.95	75.00	Coarse grained gabbro with poor dissemination.
75.00	78.00	Medium grained gabbro/norite 2-5% sulphides mainly po.
78.00	85.18	Coarse / medium grained norite / gabbro with dissemination. In parts up to 10% but generally poor. Coarse / medium grained amphibolite / meta gabbro, in part with good disseminations of sulphides.
85.18	92.00	Medium grained norite / gabbro with dissemination in parts up to 10% but generally poor.
92.00	102.09	Slightly foliated meta. gabbro poor dissemination.
102.09	145.90	Foliated amphibolite / amphibole gneiss with sporadic disseminations of pyrite
145.90		End of hole:

F. Nixon

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 13.60 S - 8.68 E BEARING: 270 DIP: 53 HOLE No: 1 SHEET No: 2
 LOGGED BY: F. NIXON STARTED: _____ PROPERTY: _____
 CASING: 1.45 m. FINISHED: 7.10.69
 CORE SIZE: _____ TESTS (CORRECTED): _____

FROM	TO	DESCRIPTION
0	1.45	Overburden.
1.45	20.77	Massive, medium grained, gabbro/norite, with for the most part a brown feldspar. Some small amount of introduced qtz.?
		1.79 - 1.82 specks of py.
		At 2.43 and 2.60 chlorite coated joint planes
		2.86 - 2.89 small zone along which movement has taken place, rock is slightly sheared. Rock seems in part to be weathered and has probably been an open fracture here.
		3.00 - 3.40 specks of py.
		3.19 - 3.23 small shear zone, upper and lower boundary planes are biotite (phlogopite) rich and show signs of weathering.
		3.55 - 3.65 fracture (possibly shear zone) mu biotite (phlogopite)
		3.80 biotite rich fracture, biotite seems to persist on either side of fracture for a few cm's
		3.80 - 3.90 specks of py & po.
		4.07 - 6.62 from 0 - 2% sulphides. Py and po seem to be equally distributed as specks, blobs and stringers. A few small specks of cp seen.
		6.20 - 6.24 quartz feldspar vein
		7.08 - 7.60 specks to 1% sulphides mainly po
		7.88 - 8.19 sulphides seen on fracture planes.
		9.08 - 9.50 specks of po & py.
		9.50 - 10.13 fractured zone with carbonate on fracture plane.
		10.30 carbonate lined joint
		10.48 carbonate lined joint
		11.28 - 11.33 small shear zone
		12.92 - 13.15 fracture zone with carbonate on fracture planes.
		13.98 chlorite coated fracture plane.
		17.14 - 17.18 5% sulphides dominantly po.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 13.60S - 8.68E BEARING: 270° DIP: 53° HOLE NO.: --- SHEET NO.: 3
 LOGGED BY: F. NIXON STARTED: --- PROPERTY: ---
 CASING: 1.45m FINISHED: 7.10.69
 CORE SIZE: --- TESTS (CORRECTED): ---

FROM	TO	DESCRIPTION
		From about 18m the rock seems to be changing slightly in character, still massive gabbroic but in places contains more white and from 18.00-18.15 white specks which fizz weakly with HCl.
		18.34-18.36 small shear zone.
		18.36-18.52 more basic (amphibole rich part)
		20.15-20.36 fracture zone
20.77	23.63	Fine/med grained basic/ultrabasic section carrying much amphibole, contains introduced feldspar as irregular veins and near the lower contact seems to contain fragments of country rock - here a med. gr. massive amphibolitic rock.
		Over entire length it contains from 0-2% sulphides per py.
23.62	33.00	Massive med/coarse (in parts fine grained) amphibolite. In part metagabbroic. Also in part a distinct layering. Near 30m the rock becomes more meta-gabbroic. Some introduced qtz & feldspar.
		26.67-26.72. Qtz feldspar vein
		29.00-29.60. What looks like layering - basic (fine gr.) alternating with med grained amphibolitic rock.
		32.27-33.00 specks of sulphides.
33.00	37.60	Gradual change over to more gabbroic rock. To about 37.60 typical med gr. brownish feldspar variety.
37.60	40.93	From 37.60 onwards the character of the rock changes becoming basically darker / more basic but in part with some white spots / feldspar on the core surface.
		35.84-35.93 very fine or slightly sheared basic rock. Intrusive?
		Between 37.70 and 37.85 there seems to be some kind of layering or could it be due to multiple intrusion? Two fine grained bands - gabbroic

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 13.60S-868E BEARING: 270 DIP: 53 HOLE NO: 1 SHEET NO: 4
 LOGGED BY: F. NIXON STARTED: _____ PROPERTY _____
 CASING: 1.45 FINISHED: 7.10.69 _____
 CORE SIZE: _____ TESTS (CORRECTED): _____

FROM	TO	DESCRIPTION
		bands 4 cms wide, in the more basic rock.
		33.00 - 37.90 specks to 2% sulphides, py & po with a little cp. Best impregnation from 37.20 - 37.60 where it is over 2%.
		From 40.00 - 40.93 the rock is very basic in character
		40.00 - 40.40 specks to 2% sulphides, po & py dominantly po.
		40.80 - 40.86 over 2% py on both sides of small shear.
		40.88 small shear, carbonate lined.
40.93	41.34	Coarse grained gabbro/norte with pinky brown feldspar and occasional specks of pyrite and po.
41.34	57.27	Med gr. gabbro/norte, massive, contains in part coarse fractions that are distributed unevenly, possible due to introduction of feldspar and a little qb. Only at one place 40.45 - does it look as if the coarser variety may be a uniform "layer" with the med. gr. variety as host rock.
		44.33 small joint or shear.
		45.70 - 46.12 slightly fractured zone.
		47.30 joint
		47.30 - 47.80 the rock is distinctly coarser.
		48.38 - 48.52 the rock is fine gr. and seems to have a distinct mineral orientation.
		49.00 carbonate enriched fracture zone.
		41.34 - 41.46 stringers and specks of sulphides po, py, cp?, in limited areas up to 2%.
		41.73 - 42.00 2% sulphides po & py mainly as stringers "core angle" of these stringers averages about 46.
		42.42 - 42.46 Up to 2% sulphides associated with iron oxides?
		42.95 - 43.66 2% sulphides down to specks

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 13.60S - 8.68E BEARING: 270 DIP: 53 HOLE NO.: 1 SHEET NO.: 5
 LOGGED BY: E. NIKON STARTED: _____ PROPERTY: _____
 CASING: 1.45 FINISHED: 7.10.69 TESTS (CORRECTED): _____
 CORE SIZE: _____

FROM	TO	DESCRIPTION
		mostly po & py as disseminations and stringers with some fracture fillings
		43.95 - 45.00 2% sulphides as stringers, fracture fillings and disseminations, mainly po & py and cp. 44.30 - 44.70 2-5%.
		45.34 - 45.40 over 5% sulphides
		46.60 - 46.80 2% sulphides dominantly py. Specks of sulphides are distributed through the core lengths not mentioned above.
		50.00 - 50.50. Contains sulphides as specks and fracture fillings, mostly pyrite and is slightly more than accessory.
		Between 50.50 and 51.00 the rock is coarser and more acid? due to increase in feldspar - typical pinky brown variety - again in places this looks as if it could be some kind of layering.
		50.80 - 50.86 Fine dissemination of sulphides mainly py.
		51.00 - 53.00 Odd sulphides and as fine impregnation and stringers. Stringers when they occur seem to be orientated in a definite direction i.e. 60-65.
		53.20 - 53.27 Over 2% sulphides mainly py.
		53.62 - 53.69 "layer" of fine gr. gabbroic rock
		54.12 - 54.70 Over 2% sulphides po & py. py seem to dominate. Again stringers trend approx 60.
		53.27 - 54.12 specks of sulphides
		54.60 - 56.70. fractured zone
		55.00 - 57.27. specks of sulphides
57.27	59.73	Coarse grained gabbroic rock, the feldspar forms large crystals of a slightly pinky colour set in a matrix of smaller crystals of pyroxene and feldspar. At the upper contact there is a slight enrichment of sulphides, mainly py. Otherwise contains occasional specks of sulphides
		57.60 - 57.80 Evidence of open fractures
		57.27 - 57.62 Specks to 2% sulphides mainly py

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 13.60S - 8.68E BEARING: 270° DIP: 53° HOLE NO.: 1 SHEET NO.: 6
 LOGGED BY: F. NIXON STARTED: _____ PROPERTY: _____
 CASING: 1.45 m FINISHED: 7.10.69
 CORE SIZE: _____ TESTS (CORRECTED): _____

FROM	TO	DESCRIPTION
		Gradual change around 59.70 into med. gr. variegated
59.73	67.95	med. gr. fairly massive gabbroic rock, in parts quite basic. Carbonate, talc and chlorite noted on fracture planes.
		61.37 - 61.70 sheared and fractured zone carbonate and chlorite on shear planes.
		63.48 - 63.67 fracture zone
		66.06 - 66.33 slightly sheared zone
		66.71 - 67.12 fine grained sheared (foliated) zone sulphides in this lie to shearing.
		60.00 - 61.00 specks to 1% sulphides (in part between 1% and 2%) dominantly pyrite
		61.00 - 64.00 Occasional specks of sulphides again mostly pyrite.
		64.20 - 64.50 2% sulphides, as small disseminations - again dominantly pyrite.
		65.84 - 66.81 2-5% sulphides as stringers and disseminations, dominantly pyrite.
		66.95 - 67.70. specks to 2% sulphides dominant pyrite. At 67.70 the rock type changes slightly into a more uniform med gr. compact gabbro type and the sulphides whilst enriched around this contact do not seem to pass into the new rock type.
67.95	75.00	Coarse gabbro/norite of the type that is seen in outcrop at Mjelland. Brownish pink feldspar is dominant. Round 69.71 seems to be becoming gradually more medium grained. Up to 70m only the odd specks of sulphides seen.
		67.95 - 71.08 specks and isolated clumps of pyrite.
		71.08 - 71.42 specks to 2% of sulphides mainly py
		74.16 - 74.21 sheared gabbro/feldspar vein

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 13.60S-8.68E BEARING: 270 DIP: 53 HOLE NO: 1 SHEET NO: 7
 LOGGED BY: F. NIXON STARTED: 22.9.69 PROPERTY: _____
 CASING: 1.45m FINISHED: 7.10.69 _____
 CORE SIZE: _____ TESTS (CORRECTED): _____

FROM	TO	DESCRIPTION
75.00	78.00	Medium grained, massive, compact gabbroic rock with in part introduced qtz & feldspar. Over entire length contains 2-5% sulphides mainly po. Last 15 cms contain up to 10% sulphides. Occur as blebs, stringers, disseminations and small fracture fillings. Again the stringers seem to have a definite trend ch. 50.
78.00	85.18	For the most part a coarse gr. feldspar/amphibol rock with a patchy mottled appearance, contains in part a more med. gr. gabbroic rock. 78.94 - 79.02 qtz/feldspar vein. 79.40 - 79.70 sheared and fractured zone Round about 80m it passes into a more med. gr. basic/ultrabasic variety. 80.70 - 81.94 2-5% sulphides py + po and a little cp. 81.68 - 81.94 over 10% sulphides some massive. In the rest of the length the rock contains isolated specks and stringers of sulphides.
85.18	102.09	Gradual change over into a medium grained compact noritic/gabbroic rock, massive in nature except for the first half meter which has a slight foliation. 85.27 - 85.47 2% sulphides as very fine disseminations. 85.95 - 86.56 5-10% sulphides mainly po as blebs, disseminations and fracture fillings. 87.15 - 87.35 over 5% sulphides. Between 87.15 and 87.56 there is a fine impregnation which in parts approaches 2%. 87.86 - 88.03 fine grained meta doleritic/amphibolite rock, upper contact is sharp and concordant against coarse variety of the gabbro, the lower contact is much for more diffuse and difficult to see. 87.56 - 87.86 specks of sulphides. Up to 90.00 there are occasional specks of sulphides. 88.27 conc. of over 2% over a couple of cm's 88.64 py lined fracture.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN
13.60S - 8.68E BEARING: 270° DIP: 53° HOLE NO: 1 SHEET NO: 8
 LOGGED BY: F. NIXON STARTED: 22.9.69 PROPERTY KJETTEVANN, MOLLAND FARM
 CASING: 1.45 FINISHED: 7.10.69 IVELAND, NORWAY
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
		The rock contains bands of coarse material and some of these have a definite orientation. One measured at 89.43. was 52°.
		The rock is also becoming gradually more and more foliated and from 92m there is a definite foliation. The rock however must still be called a meta-gabbro.
		92.70 - 92.90 2% sulphides as dissemination and stringers, po & py.
		90.00 - 100.00. occasional specks, stringers and fracture fillings - mainly py.
102.09	145.90	The rock gradually becomes more and more foliated and although it may still be part (a very foliated sheared part) of the gabbro body - it must be classed here as a hornblende gneiss, consisting of lib. feldspar, biotite ± qtz.
		103.00 - 103.37 5% sulphides but almost all pyrite. on fracture surface 40% pyrite.
		103.37 - 105.00 specks to 2% dominantly pyrite. At 104.16 and 104.48 there are fracture fillings of massive pyrite.
		105.00 - 119.45 specks to 2% sulphides
		108.50 - 108.60 over 2% mainly py.
		109.50 - 110.00 over 2% sulphides mainly py.
		111.70 - 111.78 Qtz vein.
		113.75 - 114.12 more massive section - more amphibolitic, no sulphides.
		112.00 - 113.30 epidote noted.
		119.06 - 119.22 fine gr. meta dolomite?
		119.75 - 119.88 fine gr meta dolomite? concordant
		The rock in many places can be called a foliated amphibolite.
		110.00 - 110.25. 5-10% sulphides as dissemination and stringers. Dominantly pyrite
		110.25 - 111.00 2-5% py as dissem & stringers
		111.00 - 113.10 approx. 2% pyrite
		113.68 - 113.77 shear zone.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 13.60S - 8.68E BEARING: 270 DIP: 53 HOLE NO.: 1 SHEET NO.: 9
 LOGGED BY: F. NIKON STARTED: 22 9. 69 PROPERTY: KJETTEVANN MYLLAND F.
 CASING: 1.45 m FINISHED: 7 10. 69 IVLAND NORWAY
 CORE SIZE: 32 mm TESTS (CORRECTED): -----

FROM	TO	DESCRIPTION
		114.12 - 114.50 2-5% pyrite
		114.70 - 115.07 massive amphibolite
		115.07 - 115.87 more than 2% py as fine dissem. x stringers.
		116.00 - 116.10 2-5% py.
		116.10 - 120.00 specks, in some places more (1-2 of pyrite plus po?
		From 117.50 the rock is becoming quite strongly magnetic and magnetite can be seen around 119.06 (near the contact here) and between 119.90-120.0
		Am still calling all these foliated rocks amphibole gneisses, although in fact they do vary a little, from more acid varieties through to more basic, gabbroic varieties;
		127.20 - 127.24. granite vein
		127.39 - 127.62 granite dyke
		125.96 - 126.19 compact massive fine gr. gabbroic rock, seems to be concordant.
		From 128.70 start getting the occasional speck of pyrite.
		130.31 - 130.37. Qtz vein
		137.58 - 137.68 Qtz vein
		136.90 - 137.35. Sheared zone
		130.13 - small blob of magnetite
		130.37 - 130.80 specks of py as fine disseminat.
		130.80 - 130.82 noticeable py. stringers
		130.82 - 131.84 specks of py.
		From 131.84 downwards, keep getting specks and at 136.60 they become quite numerous.
		137.28 - 137.46 over 2% py.
		137.46 - 139.50 from specks to 1% py.
		138.33 - 138.34 magnetite visible
145.90		End of hole

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DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 1360S - 8.68E BEARING: 270 DIP: 53 HOLE NO.: 1 SHEET NO.: 112
 LOGGED BY: F. NIXON STARTED: 22. 9. 69. PROPERTY: KJETTEVANN MYLLAND FAR
 CASING: 1.45 m FINISHED: 7. 10. 69. IVELAND. NORWAY
 CORE SIZE: 32 mm TESTS (CORRECTED): _____

FROM	TO	DESCRIPTION
		<i>Core Angles.</i>
	2.43 m	53° joint 85.50 m 52°
	2.60 m	40° joint 87.36 m 52°
	3.20 m	55° shear 87.41 m 57° mineralized fracture
	6.20 m	70° 92.50 m 48°
	6.24 m	70° contact 94.64 m 42°
	10.30 m	75° joint 97.90 m 43°
	10.48 m	88° joint 99.85 m 42°
	11.30 m	64° shear 102.30 m 53°
	13.98 m	40° joint 105.20 m 41°
	15.36 m	30° joint 108.50 m 55°
	15.47 m	25° joint 111.10 m 63°
	16.57 m	50° joint 114.20 m 45°
	17.52 m	45° joint 117.20 m 55°
	18.35 m	62° shear 120.10 m 59°
	29.45 m	45° layering 122.15 m 45°
	35.84 m	65° contact 124.70 m 55°
	37.74 m	54° layering 127.80 m 46°
	40.82 m	37° shear 130.10 m 40°
	44.33 m	55° shear 133.10 m 54°
	46.30 m	45° joint 136.50 m 59°
	50.58 m	62° 139.90 m 60°
	51.65 m	18° fracture 142.80 m 52°
	52.20 m	62° stringers 144.70 m 55°
	53.95 m	57°
	57.15 m	56°
	61.44 m	50° shear
	66.23 m	50°
	66.90 m	55°
	62.30 m	57°
	67.77 m	50°
	70.14 m	53°
	70.70 m	48°
	74.18 m	55°
	79.15 m	60°
	81.30 m	46°
	84.65 m	48°

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 13.60S - 8.68E BEARING: 270 DIP: 70 HOLE NO: 2 SHEET NO: 1
 LOGGED BY: E. NIXON STARTED: 7.10.69 PROPERTY: KJETTEVANN MÖLLAN
 CASING: 1.55 m FINISHED: 24.10.69 FARM: IVELAND NORWAY
 CORE SIZE: 32 mm TESTS (CORRECTED): -----

FROM	TO	DESCRIPTION
0	1.55	Overburden fill and boulders.
1.55	19.00	Massive medium gr. fairly basic gabbro/norite.
19.00	24.90	Ultrabasic amphibole rich specks of sulphides.
24.90	71.00	Massive medium grained norite.
		From 55.00-71.00 it is intruded by an ultrabasic pyroxene/amphibole rock which between 55.92 and 65.42 carries approx 10% sulphides.
71.00	73.90	Complex section of med gr amphibolitic rocks and fine gr basic rocks. This section is also intruded by the ultrabasic.
73.90	77.30	Med gr. gabbroic rock.
77.30	79.67	Coarse grained amphibolitic rock.
79.67	80.34	Hornblende.
80.34	82.62	Medium coarse grained meta gabbroic rock contains in part up to 10% sulphides.
82.62	92.00	Basic gabbro over 2% sulphides, disseminated.
92.00	97.20	Medium gr. meta gabbro/amphibolitic rock, with in part over 2% sulphides.
97.20	124.90	Very basic to ultrabasic rock.
124.90	128.15	Coarse gr. feldspar/amphibole rock rich in magnetite.
128.15	131.00	Basic/ultrabasic rock.
131.00	135.00	Amphibolitic rock gradually changing to —
135.00	153.23	Amphibole gneiss (foliated).
153.23	158.20	Basic/ultrabasic rock.
158.20	161.52	Foliated coarse/medium grained amphibole gneiss.
161.52	172.07	Medium grained gabbro/norite with a distinct layering, odd sulphides.
172.07	185.42	Foliated amphibole gneiss.
185.42		End of hole.

F Nixon

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 13.60S. 8.68E BEARING: 270 DIP: 30 HOLE NO: 2 SHEET NO: 2
 LOGGED BY: F NIXON STARTED: 7.10.69 PROPERTY: KJETTEVANN. MOLLAND
 CASING: 155m FINISHED: 24.10.69 FARM: IVELAND. NORWAY
 CORE SIZE: 32mm TESTS (CORRECTED): -----

FROM	TO	DESCRIPTION
0	1.55	Overburden
1.55	24.90	Massive medium grained fairly basic variety of gabbro. From around 19m the rock becomes very basic in character and this continues down to 24.90, although feldspar appears before this point. Carbonate was noted on some fracture planes. 3.86-3.87 small carbonate rich shear zone. 7.55-7.56 small sheared Qtz feldspar vein 8.00-8.35 slightly fractured zone 11.31-11.33 small fine grained sheared zone. All the way down to 20m it contains occasional specks of sulphides dominantly pyrite. These specks become more concentrated around 15.90-16.00. From 20m down to 25m we get specks and blebs of pyrite some of the blebs being quite large.
24.90	27.27	Med grained gabbroic rock in part quite basic and with irregular patches of feldspar in parts. In other parts the feldspar is distributed more evenly and regularly the rock then looking like a coarse facies of the gabbro. 24.23 26.80-26.92 fine gr. gabbroic/ amphibolite rock with higher magnetic content than the surrounding rocks. Intrusive? upper contact is difficult to identify and delimit, but the lower contact is quite sharp and uniform.
27.27	28.20	Coarse gabbro with pinky brown feldspar as is seen in outcrop at Kjettevann. From 28.00 to 28.20 it becomes gradually less coarse. Contains some specks of pyrite.
28.20	55.92	massive medium grained gabbro/norite 29.45-29.52 med gr. granodioritic? intrusive with fine impregnation of pyrite at least 2%. In parts (due to what looks like the introduction of feldspar) the rock is quite coarse grained. Down to 34.72 find isolated specks of sulphides mainly py.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 1360S. 8.68E BEARING: 270 DIP: 70 HOLE NO.: 2 SHEET NO.: 3
 LOGGED BY: E. NIXON STARTED: 7.10.69 PROPERTY: KJETTEVANN, MOLLAND
 CASING: 1.55 m FINISHED: 24.10.69 FARM: IVELAND NORWAY
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
28.20	55.92	cont 34.72 - 36.05 disseminations of up to 2% pyrite From 40.00 - 41.24 the rock is partly coarse grained. 42.67 - 43.03 - Very fine gr. sheared, magnetic, compact basic rock which looks to be intrusive into the surrounding rocks both upper and lower. contacts seem to be concordant. 45.75 - 46.27 fine gr. meta amphibolitic? rock, could be intrusive, it contains some coarser fragments which are possibly fragments of country rock that have been partly assimilated. However these coarser fragments could also have developed by crystal growth. The same kind of rock seems to occur between 46.30 and 46.35. 54.92 - 54.95 Qtz vein.
55.92	65.42	"One zone". The medium grained gabbro seems to have been intruded by a basic/ultrabasic amphibole rich fraction carrying much sulphides po. py and cp - predominantly po. 56.29 - 56.35 Qtz/feldspar vein very rich in magnetite, the country rock around the top contact is also enriched in magnetite. 58.72 - 58.83. Evidence of a small fault or thrust which displaces a small 2 cms Qtz vein over a distance of 4 cms. The fault has a core angle of 10° and is in part occupied by sulphides. Over entire zone contains approx 10% sulphides
65.42	71.40	The med gr. gabbroic rock continues til 71.40, still with the uneven patches of dark hb rich rock but only with the old sulphides.
71.40	71.60	Med/fine gr. massive amphibolitic/gabbroic rock with sharp even upper contact (53°)
71.60	72.25	round about 71.60 there is a gradual change into a more med gr. rock of the same composition

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DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 13.60S 8.68E BEARING: 270 DIP: 70 HOLE NO.: 2 SHEET NO.: 4
 LOGGED BY: F. NIXON STARTED: 7.10.69 PROPERTY: KJETTEVANN. MÖLLAN
 CASING: 1.55 m FINISHED: 24.10.69 FARM. IVELAND. NORWAY.
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
71.60	72.25	cont. Both fine gr. and med gr. rocks contain clumps of darker (amph rich) material.
72.25	72.60	The same fine gr rock with patches of coarser basic material.
72.60	72.97	Med/coarse gr. fairly massive gabbroic rock with what looks like some growth of feldspar in places.
72.97	73.55	Fine/med gr. amphibolitic/gabbroic rock.
73.55	73.90	Coarse feldspar/amphibole rock with a conc 2 cm. of dark minerals at the upper contact. Lower contact is a more gradual change over into more med. gr. rocks.
73.90	77.30	Essentially med. gr. gabbroic rock but it contains both fine gr and coarser gr patches and it is very difficult to decide if there has been some kind of layering that has been disturbed or that the different textures reflect different intrusions, or? 76.50 - 76.90 coarse section.
77.30	79.67	The rock is now becoming more amphibolitic in nature, it is med to coarse grained and seems to consist essentially of amphibole and feldspar the respective amounts varying. 78.00 - 78.40 very basic 79.00 - 79.67 sheared zone.
79.67	80.34	Dark biotite with odd patches of feldspathic material. At upper contact is a small zone of massive sulphides.
80.34	81.70	Med in part coarse gr. gabbroic rock with irregular basic patches 80.42 - 80.70. 2% sulphide, po. py. cp. 80.70 - 81.00 specks. 81.00 - 81.12 10% po. cp. py. 81.12 - 81.70 specks to 2%.
81.70	82.62	Zone containing much quartz as vein material. 82.00 - 82.20 strong shear zone.
82.62	87.00	Basic med. gr gabbroic rock. Over the first 20-30 cm almost ultrabasic. The main rock type has a

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN
13.60S. 8.68E BEARING: 270 DIP: 70 HOLE NO: 2 SHEET NO: 5
 LOGGED BY: F. NIXON STARTED: 7.10.69 PROPERTY: KJETTEVANN MØLLAND
 CASING: 1.55m FINISHED: 24.10.69 FARM: IVELAND NORWAY.
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
82.62	97.00	cont mottled appearance with white patches (acid, ^{dtz} minerals 1 dtz feldspar). It is difficult to decide whether this is just the nature of the rock or whether the basic stuff is a later intrusion. 83.50 - 85.00 much introduced qtz and feldsp 83.00 - 84.00 specks to 1% po py cp. 84.00 - 85.00 2% sulphides po. py cp mostly as blebs and disseminations. 85.00 - 87.00 2% sulphides 87.00 - 89.00 at least 2% po. cp. py. 89.00 - 90.00 over 2% sulphides From 90.00 onwards the rock becomes less blotchy and more uniform 92.80 - 92.84 dtz vein with concentration of magnetite in the host rock near the upper and lower contacts. 94.43 - 94.50 Brecciated qtz/feldspar vein. 95.79 - 95.97 pinkish granite. 90.80 - 91.10. 2% sulphides po. py. cp. 93.00 - 93.50 2% sulphides a lot of pyrite Between 91.10 and 93.00 get specks which sometimes approach 1-2%. From 92.70 onwards the rock becomes more amphibolitic.
97.00	97.20	Very weathered rotten fracture zone.
97.20	124.90	Very basic to ultrabasic fraction, amphibole rich plus some pyroxene and a mica (phlogopite) Also contains remnants of med gr. nrite. 109.57 - 109.81. finer gr. intrusive From 118.00 the rock has a distinct green colour and is essentially a biotite. 118.58 - 118.75 Qtz feldspar amphibole green type rock with a fine dissemination of sulphides mainly py + a very little cp. Between 110 and 120 it contains some odd sulphides as fine disseminations but nothing approaching noteworthy quantities.

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DIAMOND DRILL RECORD

LOCATION: 13.60S 8.68E BEARING: 270 DIP: 70 HOLE NO: 2 SHEET NO: 6
 LOGGED BY: F. NIXON STARTED: 7.10.69 PROPERTY: KJETTEVANN MØLLAN
 CASING: 1.55 m FINISHED: 24.10.69 FARM: IVELAND, NORWAY
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
124.90	128.15	Gradual change into a coarse gr. rock (metamorph) consisting essentially of feldspar and amphibole and carrying quite a large amount of magnetite. In some cases the nature of the mineral intergrowth gives one the impression that the rock has been formed in some kind of breccia zone - it looks crushed. Contains specks of sulphides over its entire length both as disseminations and on fracture planes. 127.50 - 127.80 Around 2% py.
128.15	135.00	Compact massive very basic/ultrabasic rock. Low magnetics. From 131.00 this rock is gradually getting more acid until at around 135.00 it
135.00	146.00	passes into an amphibole gneiss. Contains a lot of biotite although no actual foliation is developed. 139.90 - coarse hb feldspar rock which continues to 140.25. Up to 144 it is still fairly massive, even though it now is a typical metamorphic rock. 144.00 - 145.00 an intermediate rock type that contains amphibole and a whitish feldspar. Feldspar content increases with depth. and there is also a foliation developing.
146.00	152.89	Amphibole gneiss, med/coarse gr. The foliation changes rapidly, so at 150 m to 151 or so we are still almost along the foliation.
152.89	153.23	White quartz (pure) vein.
153.23	158.20	Dark green massive basic to ultrabasic amphibole rock. Contains minor amounts of feldspar in parts. Rich in actinolite? 153.46 - 153.57, dk vein contacts 36° Between 156.27 - 156.32 and 157.12 - 157.13 are small bands of med gr. amphibolite - must be younger intrusives. Contains odd specks of sulphides.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 13.60S. 8.68E BEARING: 270 DIP: 70 HOLE NO: 2 SHEET NO: 7
 LOGGED BY: F. NIXON STARTED: 7.10.69 PROPERTY: KJETTEVANN
 CASING: 1.55 m FINISHED: 24.10.69 MOLLUND. IVELAND. NORWAY.
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
158.20	161.52	At 158.20 we get an increase in feldspar and for the first meter the rock is a coarse gr. feldspar amphibole ± biotite rock before passing into a less coarse gr more gneissic variety. 160.12 - 160.19 sheared quartzitic vein, shearing is // to the contacts. Between 160.19 and 160.57 there is some kind of folding going on the core angles change direction. 160.91 - 161.12 amphibole rich section.
161.52	172.07	A more massive compact meta gabbroic rock. Shows a remarkable alternation of med. gr lighter portions and more darker portions, which are more basic & coarser, contain lycopods here. Some parts are so uniform that there is almost a kind of repetitive layering, 5 or 6 cms between layers and the layers having a core angle of approx 45°. In other parts there is no such uniform layering, here the darker portions seem to cut haphazard into the lighter. 164.00 - 164.15 2-5% sulphides po. py. c.p. 164.15 - 164.30 0-2% as fine dissemination. 170.70 - 171.65 2% sulphides mainly po. Apart from the above mentioned it contains other odd sulphides.
172.07	185.42	Foliated amphibole gneiss much feldspar and quartz. At least, down to 176.00 there seem to be "ghost remnants" of an original light and dark layering structure (as above). Foliation orientated across these in some cases. From 178 to end of hole - much epidote 180.75 - 180.80 mylonitic zone. In parts quite a rich dissemination of pyrite End of Hole.
185.42		

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 13.60.S. 8.68E BEARING: 270 DIP: 70 HOLE NO: 2 SHEET NO: 8
 LOGGED BY: E. NIKON STARTED: 7.10.69 PROPERTY: KLETTEVANN
 CASING: 1.55 m FINISHED: 24.10.69 MOLLAND. IVELAND, NORW.
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
		<u>Core Angles</u>
		177. 33 joint 177.50 32
		2.25 26 joint 180.50 50
		3.86 50 shear 183.15 40
		7.55 53 shear 184.70 60.
		11.32 68 shear
		26.92 45 contact
		29.45 29 contact
		29.52 32 contact
		33.25 52
		38.30 55
		39.45 29 joint
		48.50 65
		45.75 33 contact
		46.27 40 contact
		49.47 15 vein
		51.70 51
		55.58 17 fracture
		56.29 49 contact
		56.35 45 contact
		63.42 49
		76.50 48
		79.10 65 shear
		92.84 60 contact
		94.50 70 contact.
		95.79 60 contact
		95.97 65 contact
		144.50 51
		146.80 38
		151.50 27
		158.70 47
		160.19 55 contact
		160.25 45 normal
		160.50 48 other way
		171.50 40
		174.50 45

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 13.605-25.78E BEARING: 270 DIP: 70 HOLE NO: 3 SHEET NO: 1
LOGGED BY: F. NIXON STARTED: 27.10.69 PROPERTY: KJETTEVANN MÖLLAND
CASING: 1.10 m FINISHED: 7.11.69 FARM: IVELAND NORWAY
CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
0	1.10	Overburden fill and boulders.
1.10	22.50	Basic med gr. gabbro
22.50	27.00	Above rock enriched in amphibole.
27.00	40.00	Medium grained basic gabbro.
40.00	72.00	Med grained gabbro/norite in parts basic. with in part poor sulphide dissemination.
72.00	87.50	Extremely basic section
87.50	95.50	Coarse/medium grained gabbroic rock in parts hornblendeitic in parts more amphibolitic.
95.50	110.00	massive medium grained gabbro/norite.
110.00	115.70	Coarse grained gabbro
115.70	116.50	Medium grained gabbro.
116.50		End of hole.

F. Nixon

A/S SULFIDMALM

DIAMOND DRILL RECORD

KJETTEVANN
 LOCATION: 13.60 S 25.78 E BEARING: 270 DIP: 70 HOLE NO: 3 SHEET NO: 2
 LOGGED BY: F. NIXON STARTED: 27.10.69 PROPERTY: KJETTEVANN MOLLAND
 CASING: 110 m FINISHED: 7.11.69 FARM: IVELAND NORWAY
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
0	1.10	Overburden - till and boulders.
1.10	22.50	Extremely basic med gr. gabbroic rock, not entirely fresh. In some sections it could be called ultrabasic. In some sections it seems to contain both ortho and clino pyroxenes amphiboles. After the first 4 m. the rock becomes more massive and fresher and pyroxene can be seen. 2.80 - 2.90 injection of quartzitic material 9.31 - 9.60 fine gr. fairly magnetic basic intrusive, meta gabbroic in nature. 11.41 - 12.00 the rock is slightly sheared and contains abundant biotite and more feldspar than in the surrounding rocks. 12.69 - 12.77 pegmatite vein. 19.30 - 19.44 sheared fracture zone. 20.24 - 20.25 small peg vein. 20.46 - 21.44 somewhat fractured zone 21.48 - 21.56 small shear zone with much chlorite. 0 - 17.00 just the odd speck of sulphides. 17.00 - 17.36 over 2% sulphides, mainly py as fine to med. gr. impregnation. 17.68 - 17.93 specks to 2% med. gr. disseminated mainly pyrite.
22.50	27.00	The basic gabbro is still essentially the same although here the rock is slightly greener in colour which could reflect an increase in the amphibole content. 23.16 - 23.20 small intrusive band of a fine/med gr. dioritic? rock with fine dissemination of pyrite. Same rock type occurs between 23.43 and 23.58.
27.00	40.00	Med gr. basic gabbro. From 28.70 - 29.43 the drill follows the line of a fracture and consequently the rock here is very fractured - with carbonate

A/S SULFIDMALM

KJETTEVANN

DIAMOND DRILL RECORD

LOCATION: 1360S 25.73E BEARING: 270 DIP: 70 HOLE NO: 3 SHEET NO: 3
 LOGGED BY: F. NIXON STARTED: 27.10.69 PROPERTY: KJETTEVANN MOLLAND
 CASING: 1.10 m FINISHED: 7.11.69 FARM IVELAND NORWAY
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
		on the fracture planes.
		29.70 - 29.84 fractured and sheared zone
		34.33 - 34.49 quartz filled (partly) fractured and sheared zone.
		35.42 - 36.08 drill follows line of fracture which is lined with carbonate and chlorite.
		37.50 - 37.60 uneven qtz vein with a few isolated specks of sulphides
40.00	60.00	From around 40m the rock is increasing in feldspar content and becoming more like the normal norite.
		44.58 - 44.68 small shear zone
		46.20 - 46.70 introduction of feldspar makes the rock here quite coarse grained.
		45.81 - 45.88 fine gr. basic magnetic rock - meta gabbro?
		44.20 - 44.50 specks to 2% disseminated sulphides mainly pyrite.
		49.20 - 50.00 specks to 1% sulphides.
		The rock is still basically the same basic noritic type but around 53.00 seems to be getting a more even, finer gr norite type, but this in part is still fairly basic
		52.41 - 52.48 dtz vein with some reddish mineral. The rocks on either side of this vein over a distance of 10 cm are green in colour - Normal ^{contact} metamorphism?
		54.00 - 54.27 fractured zone.
		57.82 - 58.17 extremely fine gr. meta-dolerite? rich in magnetite.
		Between 50 and 60m sulphides occur sporadically as fine disseminations but in no place approach 1%.
60.00	70.00	From 60m begin to get the introduction of feldspar and between 60m and 70m the rock is partly med/fine gr. and partly

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 13.60S. 25.78E BEARING: 270 DIP: 70 HOLE NO.: 3 SHEET NO.: 4
 LOGGED BY: F. NIXON STARTED: 27.10.69 PROPERTY: KJETTEVANN MOLLAND
 CASING: 1.10 m FINISHED: 7.11.69 FARM IVELAND. NORWAY.
 CORE SIZE: 32 mm TESTS (CORRECTED): _____

FROM	TO	DESCRIPTION
		fairly coarse grained; where coarse grained and carrying much feldspar the rock type is very unlike a gabbro and it could almost be taken for a granitic gneiss
		62.00 - 62.32 more than specks but less than 2% sulphides as med/coarse disseminations
		62.60 63.45 weak dissemination of sulphides
		65.00 - 67.50 averages less than 2% sulphides starting with fine - through to med. and then coarse dissemination mostly po.
70.00	87.50	The rock is essentially a med. gr basic gabbroic rock, the basicity varies, sometimes it is strongly basic, other times it is more like a normal gabbro. The rock is massive and in surface characteristics does not show much variation. - although in some places a few more specks of biotite can be seen than in others.
		72.93 - 73.00 small peg. vein. uneven contacts
		72.00 - 72.15 slight shear zone with a small enrichment of pyrite.
		71.00 - 74.15 odd specks of sulphides mainly pyrite.
		74.15 - 74.50 there is a slight increase in the sulphide content, but this is still very minor.
		From 74.50 down to 80.00 we still get odd specks of sulphides, slight enrichment from 77.00 - 77.50.
		80.20 - 80.55 slightly sheared with development of quite a lot of biotite and some fine pyrite specks.
		83.20 - 83.40 less than 2% sulphides
		84.32 - 84.36 small shear zone
		84.67 - 84.80 sheared biotite rich zone
		85.20 - 85.34 very coarse hypersthene/feldspar zone

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: KJETTEVANN 13.60 S. 25.79 E BEARING: 270 DIP: 70 HOLE NO: 3 SHEET NO: 5
 LOGGED BY: F. NIKON STARTED: 27.10.69 PROPERTY: KJETTEVANN MØLLAND
 CASING: 1.10 m FINISHED: 7.11.69 FARM: IVELAND NORWAY
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
		85.42 - 85.45 small shear zone.
		85.82 small carbonate vein
		86.00 - 87.00 The rock is greener in colour and contains more amphibole.
		86.25 - 86.29 Qtz vein
		83.40 - 90.00 occasional specks of sulphides mainly pyrite occur.
87.50	90.00	Coarse grained gabbro contains introduced quartz
90.00	95.50	Med / coarse grained, fractured (in part) and sheared (in part) more amphibolitic rock - in part much like hornblende in other parts & shows a coarse intergrowth of feldspar and amphibole.
		94.00 - 94.18 med gr. red granite.
95.50	110.00	The rock reverts back to a massive med. gr more normal gabbro / norite
		95.50 - 96.70 contains specks of sulphides py. po. But in amount are slightly over average, perhaps in places up to 1% but not more.
		Between 99.00 and 100.00 are darker bands about 1 cm thick that occur at regular intervals and seem to be of essentially the same mineral composition as the rest of the rock. This is some kind of layering. Core Angle is approx 45°
		This layering continues down to 109 m and is essentially the same as we see in hole no. 2 around 160 m.
		109.32 - 109.43 peg vein.
		109.00 - 110.00. The rock is not showing layering seems to have been slightly affected by shearing although only slightly
		104.13 - 104.30 and 108.70 - 108.90 1% sulphides.
110.00	115.70	Fairly coarse grained gabbro with much reddish feldspar.

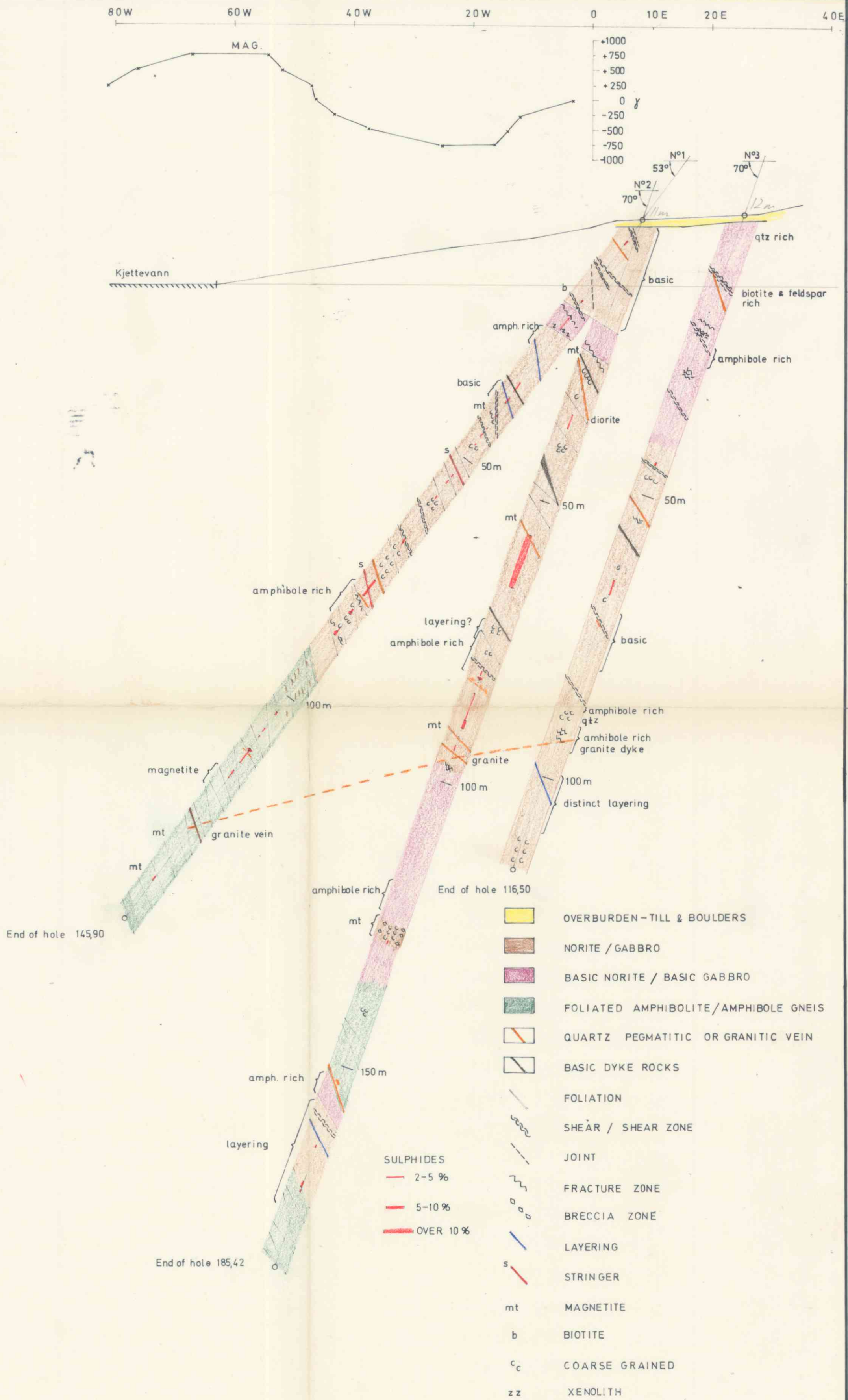
A/S SULFIDMALM

KJETTEVANN

DIAMOND DRILL RECORD

LOCATION: 13.60.3 25.78E BEARING: 270 DIP: 70 HOLE NO: 3 SHEET NO: 6
 LOGGED BY: F. NIXON STARTED: 27.10.69 PROPERTY: KJETTEVANN MOLLAND
 CASING: 1.10 m FINISHED: 7.11.69 ARM: IVELAND NORWAY
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
		115.00 - 115.27. fine/med gr. part.
		111.22 - 111.26 2% sulphides
		115.10 - 115.44. po and a little cp as fracture linings. Otherwise odd specks of sulphides.
115.70	116.50	med gr gabbro
116.50		End of hole
Core Angles.		
		11.80 60 shear.
		12.77 38 contact
		21.50. 48 shear
		34.36 53 shear
		44.60 74 shear
		45.81 } 63 contact.
		45.88 }
		52.41. 52 contact
		57.82. 45 contact.
		72.10 45 shear
		84.34 54 shear
		86.25 55 contact
		101.50. 40 layering.



KJETTEVANN.

D.D.H. Nº1. (1969) at 13,60 S/8,68 E. DIP 53° BEARING, 270
D.D.H. Nº2. (1969) at 13,60 S/ 90 E. DIP 70°. BEARING, 270
D.D.H. Nº3 (1969) at 13,60 S/25,78 E DIP 70°. BEARING, 270
MÖLLAND, IVELAND, NORWAY.

A/S SULFIDMAL M
KRISTIANDSAND. S.

SCALE

1 : 500

OBS: F.N.

DRAW: F.N.

TRAC: S.J.

NOV. -69

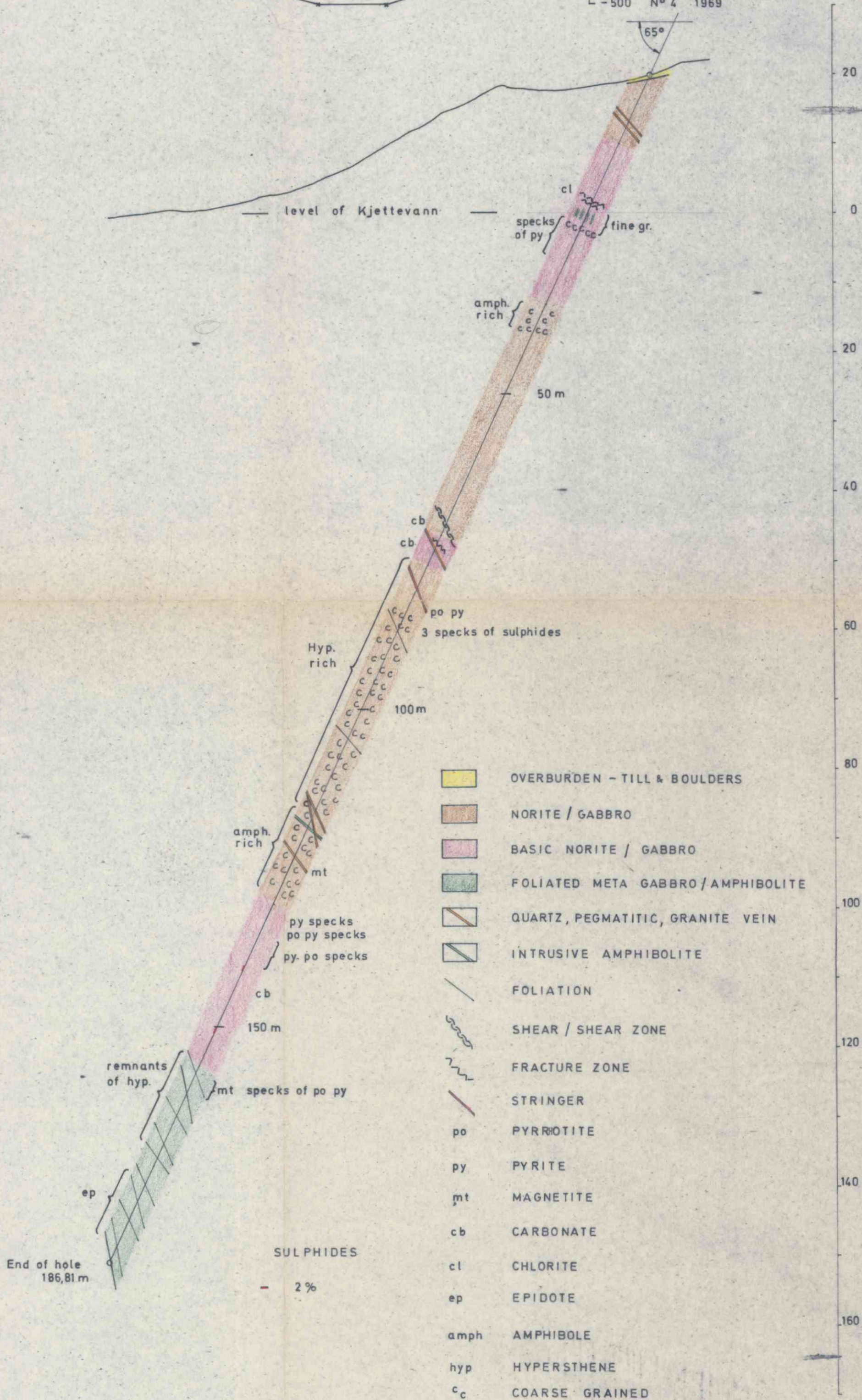
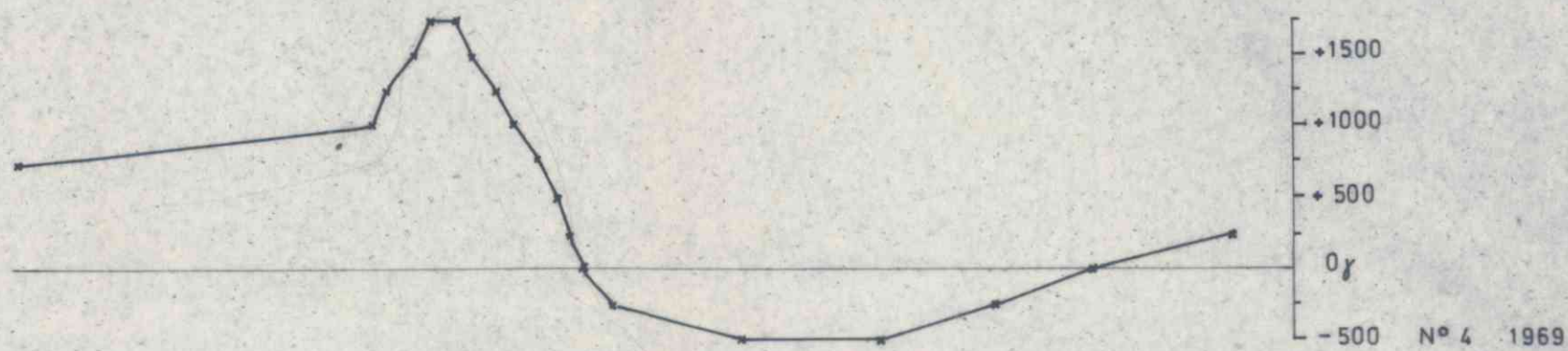
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MAP NR.

MAP SHEET

11.

100W 80W 60W 40W 20W 0 20E 40E



KJETTEVANN.
D.D.H.4(1969) 75,19S/ 28,74E. DIP 65°
BEARING 270°.
MÖLLAND, IVELAND, NORWAY.

SCALE
1:500

OBS: F.N.	DEC. - 69
DRAW: F.N.	JAN. - 70
TRAC: S.J.	

DRILLED BY E.O.-K.D. GR. BORING A/S

A/S SULFIDMALM
KRISTIANSAND, S.

MAP NR.
12

MAP SHEET



MAP SHOWING THE LOCATION OF DIAMOND DRILLHOLES AT KJETTE- VANN, MÖLLAND, IVELAND, NORWAY.	SCALE 1:1000	OBS:	
		DRAW: E.O.	1969
		TRAC: S.J.	DEC. -69
A/S-SULFIDMALM KRISTIANSAND S.	MAP NR. 10	MAP SHEET	
		1512 II	

