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A/S SULFIDMALM
ENGELANDSHEIA PROJECT
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To: Falconbridge Mikkilverk A/S.
From: P. Nixon, A/S Sulfidmalm.

1/S Sulfidmalm Engelandsheia Project Report on Investigations Carried Out on the Engelandsheia Property in 1970 With a Summary of the Preceding Years' Work.

Introduction

Sulfidmalm were approached in the summer of 1968 by Th. Gaustestad regarding this copper property. Gaustestad was acting on behalf of the owners, John Loland and Torkjell Brandsdal.

Sulfidmalm have now an agreement with the above-mentioned gentlemen, giving us full prospecting rights for 3 years and first option on an eventual sale of the property.

Location

Engelandsheia lies approximately 20 km N.-W.W. of Kristiansand. Accessibility and approach are excellent, the deposit being only 15 mins. by foot from the nearest road. The property lies approximately 10 km to the south of the southern limits of the Evje-Iveland basic complex.

The height of the deposit above sea level is approx. 250 m., the terrain being locally quite rugged, heavily dissected and forested.

Old Workings

In all probability old workings here date from 1917. A 4 x 4m shaft has been sunk to a depth of 20m. In from the outcrop of the mineralization there have been driven two adits, the distance between them being 17m. The southernmost is 20m long and a shaft sunk in this adit possibly connected with a raise driven from the main shaft. The northernmost adit is approximately 20 m long.

No production has been carried out here and all workings reflect an investigation of the vertical and lateral continuations of the mineralization.

The tips are quite extensive and consist almost entirely of mineralized blocks.

Surface Showings

The old workings have been carried out on the outcrop of the mineralization which carries pyrrhoite, chalcopyrite and pyrite, together with magnetite. The sulphides are in part massive and in part as impregnation, being exposed over a length of approximately 40 m in a steep rock wall which lies on the western side of a N.E./S.W. running swamp. The host rock is an amphibolite/hornblende gneiss. The mineralization wedges out towards N.E. and disappears under the swamp to the S.W.

In the northernmost adit massive sulphides are seen to be connected to shear zones.

Both massive and impregnation ore types are present. The ore is composed of pyrrhotite (30 to 60%) chalcopyrite (1 to 10%), magnetite (5 to 15%) and in places pyrite (up to 35%)

In all mineralization types pyrrhotite is the dominant sulphide mineral. Some blocks show some pyrite but generally this mineral seems to be subordinate.

In a polished section of a massive ore taken from the tips Overviken recorded the following minerals:

Pyrrhotite	=	60% (somewhat altered to marcasite)
Chalcopyrite	=	10%
Magnetite	=	15%
Silicate	=	1% (probably hornblende)

The magnetite occurs as rounded grains with an average diameter of 1 mm and seems to be cut by the sulphides as well as by the silicate minerals. Pyrrhotite with an average grain size of 3 mm cuts magnetite and silicate. Chalcopyrite with a grain size of 1.5 mm is seen to cut all other minerals.

Two samples of massive ore from the tips and a sample with sulphide impregnation from the northernmost adit gave the following assay results:

No	Type	Ni	Co	Cu	Fe	S
EGH/683	impregnation	0.01	0.02	0.24	25.5	11.6
EGH/68-2	massive	0.03	0.04	2.2	60.5	32.4
EGH/68-1	massive	0.04	0.04	1.05	56.5	35.0

From the analyses it can be seen that it is the copper content which is of economic interest.

Geological Location

Regionally speaking, Englandsheia lies in a Pre-Cambrian area which is dominated by granitic gneisses and associated migmatitic rocks. The regional foliation is N/S.

The rocks in the actual property location, however, consist of amphibolites, both foliated and massive varieties. Pegmatites and aplitic dykes are common. These cut the amphibolites, which are, in places, due to slight granitization, of hornblende gneiss composition.

Foliation varies but is dominantly N/S with dips being to the west.

INVESTIGATIONS IN 1968.

Geological investigations

No geological investigations were carried out, except for some brief notes made around the actual workings.

Geophysical Investigations

These consisted of an E.M. survey together with some exploratory magnetometer profiles.

A base line (N 41°S (N 45° magn. E)) was pegged out with the zero point at the shaft.

The 40m cable was used and the distance between profiles was 20m.

The highly dissected terrain plus some external interference complicated this survey, several conductors, however, were located. See enclosed map 1.

Geochemical Investigations

A total of 72 soil samples were taken in the vicinity of the old workings. These were analysed for Cu and Ni by Atomic adsorption. Taking a threshold value of 35 p.p.m. (established by Band for this area in 67) several anomalous areas were apparent. In some cases values as high as 1900 p.p.m. were recorded.

The geochemical results compared quite well with the conductive zones recorded by E.M. and a combined interpretation suggested three areas to be of interest:

1. A continuation of the outcropped mineralization in a S.W. direction along the swamp line.
2. A zone running approx. N.W. from the shaft (a continuation of the southernmost adit).
3. An area to the west of the shaft. E.M. indicated several short conductors and soil sampling gave indications of irregular mineralization.

At the end of 1968 E. Overvien in a report to Dir. Jahnsen concluded that the property was of little economic interest.

INVESTIGATIONS IN 1969

In spite of Overvien's negative report it was decided to continue investigations in 1969. More thorough magnetic and geochemical surveys were carried out.

Magnetic Survey

An area of approx. 0.95 km^2 was covered. Profiles were taken for every 20m, measurements for every 10 or 5 m. Something in the region of 700 observations were taken and the results plotted in the form of a contour map in scale 1:1000. See enclosed map.

Several interesting positive and negative anomalies were recorded. The amphibolitic rocks in the general area were now known to contain a good deal of magnetite somewhat erratically distributed. This and the fact that the N.G.U. type G.M. 59 A magnetometer has not a great depth penetration makes results difficult to interpret from an economic point of view.

Geochemistry

Soil samples were taken in the same grid net as the magnetometer observations. The results were plotted on a contour map in scale 1:1000.

Large areas were found to be anomalous with some large values > 200 ppm occurring to the N.W. of the main shaft. The main anomaly seems to trend roughly in an E/W direction, this fitting in with one of the possible magnetic trends.

INVESTIGATIONS IN 1970Stream Sediments

Stream sediments were collected in an area of approx. 100 km² around the Englandsheia property. A total of 92 samples were collected. The -80 mesh fraction was analysed for Ni and Cu. Rather surprisingly, 60 of the samples contain more than 30 ppm Ni which was the background value calculated by R. Band in 1968. 4 samples contain over 100 ppm Ni. The copper values contain generally lower values than Ni. 8 samples contain over 30 ppm Cu and these show also a high Ni content. (see enclosed map)

The Englandsheia copper deposit would not have been found by this survey.

The high Ni areas will be followed up in 1971.

Geological mapping

This consisted of detailed mapping in the gridnet around the prospect at Englandsheia together with investigations of some aeromagnetic anomalies in the general area. Most of these anomalies can be explained by impregnation of magnetite in various gneissic rocks.

Detailed mapping shows that the dominant rock types that outcrop in the vicinity of the mineralisation are amphibolite and pegmatite. The amphibolite is fairly massive, although in the vicinity of pegmatites is often migmatitic and somewhat granitised. Foliation is in places developed and is dominantly N/S with a westerly dip. Several zones of garnetiferous amphibolite were observed and in one such zone to the N.W. of the shaft traces of pyrrhotite and chalcopyrite were observed. The amphibolites and in some places the pegmatites contain an irregular magnetite content, varying from coarse blebs to fine gr. impregnation.

The basic rocks at Englandsheia are interpreted as being of an intrusive origin, lying in migmatitic and granitic gneisses.

Diamond Drilling

Diamond drilling was planned to investigate some of the E.M. anomalies recorded in 1968, and in order to collect fresh mineralized samples if possible. Three holes to a combined depth of 308.32m were drilled.

Hole	Location	Dip	Direction	Length
1	120N/60W	35	90° mag.	146.40 m
2	88N/20W	45	67.5° mag.	61.40 m
3	40N/28W	50	109.5° mag.	100.52 m

General geology

The main rock types intersected in the drill cores consist of amphibolitic varieties and pegmatitic varieties.

The amphibolites vary from massive to foliated and often in the vicinity of pegmatites are altered and have undergone some granitization.

Garnets are developed in some sections. Magnetite is freely developed and is unevenly distributed, mineralized sections are however as a rule fairly rich in coarse (5mm) blebs.

Pegmatites and aplites are very numerous and of the 308m drilled 109.51m consisted of these rocks. The pegmatites are younger than the amphibolites and often show sharp intrusive contacts. In some cases the contact zones are slightly sheared and brecciation was also recorded.

Pegmatization is also taken to be younger than the mineralization, and in one section mineralized amphibolite inclusions are to be seen in a pegmatite.

Some shearing and fracturing has been in progress after the intrusion of the pegmatites.

Mineralization

Sulphide minerals seen in the drill cores were pyrrhotite, pyrite and chalcopryrite. Pyrrhotite was by far the dominant sulphide, pyrite and chalcopryrite being very subordinate.

These sulphide mineralizations occur as massive sulphides, coarse, medium and fine gr. disseminations and stringers and fracture fillings. The medium and finer grained types are usually orientated parallel to the foliation.

Four mineralized zones were intersected in hole no. 1. Around 18m - 20m there is a slight impregnation of pyrite and pyrrhotite near the contact with a pegmatite vein. Some pyrite is also present as fracture fillings in the pegmatite which in the contact zone shows some evidence of brecciation. Cu % 0.21.

Between 50m and 56m is a mineralized zone consisting of somewhat massive sulphide ore together with weaker dissemination. Again pyrrhotite is dominant with chalcopryrite occurring as a very fine and uneven impregnation within the pyrrhotite mineralization. Magnetite is also very dominant in this section with blebs of up to 1 cm being noted. Cu % 0.15

Another mineralized zone occurs in amphibolite between 65.90m and 70m. Here the mineralization is very uneven and irregular, fine to medium grained disseminations parallel to the foliation. Pyrrhotite is again dominant. Cu % 0.038

From 138.22 - 138.60 the rock runs about 2% sulphides as fine disseminations of pyrrhotite together with a few coarser blebs of chalcopryrite. Cu % 0.13

In hole no. 2 a mineralized zone was picked up between 8.70 and 9.70 in amphibolites. The mineralization begins with a fine dissemination of pyrrhotite parallel to the foliation with in places larger blebs of chalcopryrite, which is the later sulphide. A couple of specks of pyrite were noted. Around 9.00m the sulphides become more numerous and larger concentrations of pyrrhotite and chalcopryrite are developed which cut across the foliation. Analyses showed the Cu content to be very low - 0.075%

An aplite vein at 9.71 - 12.50m contained over 70cms inclusions of mineralized country rock of the same type as mentioned above. The Cu content here running 0.053% Cu.

From 13.00 - 15.85 the hole cut an uneven mineralization of pyrrhotite with minor chalcopryrite ranging from fine dissemination to coarse blebs. Cu 0.21%

Hole no. 3 which was put down near the old workings intersected the following mineralizations:

From 21.70 - 22.45 a biotite rich garnetiferous amphibolite contains 2-5% pyrrhotite with minor chalcopyrite. Magnetite blebs are also present. Dominantly in the form of small disseminations and stringers parallel to the foliation.

Between 31.84 and 35.50 amphibolites carry a very fine, weak dissemination of pyrrhotite with very minor chalcopyrite.

A quartz dyke carries between 35.80 and 36.10 massive pyrrhotite with some clumps of cp. The same mineralization type is present between 40.33 and 40.44m. where the quartz dyke is seen to be intrusive into mineralized amphibolites. In both cases the quartz is fine grained and has a distinct greenish hue.

Between 45.32 and 50.00m a fairly massive amphibolite carries a very fine gr. sulphide dissemination again dominantly pyrrhotite but with noticeable chalcopyrite.

Between 52.92 and 53.26m the same massive amphibolite carries up to 10% disseminated sulphides. Pyrrhotite and pyrite are in equal amounts with chalcopyrite as the minor sulphide Cu % is 0.20.

Between 87.00 and 88.00m a strongly granitized and aplitized amphibolite contains fine disseminations and stringers of sulphides, stringers being dominant in the latter half of the section. The dominant sulphide here is pyrite.

A similar type of mineralization is present between 93 and 94m.

Magnetite is present in all rock types and is somewhat erratically distributed, although it tends to be concentrated together with the sulphides.

Assay Results

Hole	Dip	Sample	Core length m.	Ni %	Co %	Cu %	Zn %	Fe %	S %
1		18.58 - 19.34	0.76	0.010	0.004	0.021	0.017	11.5	0.63
1		49.88 - 53.30	3.15	0.005	0.003	0.075	0.053	15.3	1.3
1		53.30 - 54.25	0.95	0.015	0.014	0.38	0.085	25.9	6.2
1		54.25 - 55.00	0.75	0.010	0.004	0.093	0.14	17.6	1.6
1		55.00 - 55.54	0.54	0.006	0.009	0.39	0.089	16.6	5.3
1		65.90 - 70.00	4.10	0.004	0.003	0.038	0.053	12.7	1.2
1		138.22 - 138.60	0.38	0.006	0.008	0.13	0.044	14.2	2.9
2		8.70 - 9.70	1.00	0.004	0.005	0.075	0.066	13.0	2.2
2		10.00 - 10.70	0.70	0.006	0.003	0.053	0.036	4.7	1.2
2		13.00 - 15.85	2.85	0.007	0.009	0.21	0.16	20.2	4.2
2		15.85 - 17.00	1.15	0.005	0.003	0.008	0.026	10.5	0.29
3		20.42 - 21.70	1.28	0.006	0.003	0.013	0.044	9.5	0.49
3		21.70 - 22.45	0.75	0.006	0.003	0.063	0.068	17.4	3.00
3		31.84 - 32.28	0.44	0.006	0.008	0.093	0.081	14.8	4.2
3		32.28 - 35.50	3.22	0.006	0.001	0.069	0.14	11.4	1.8
3		35.80 - 36.10	0.30	0.028	0.026	0.71	0.032	42.0	20.0
3		40.33 - 40.87	0.54	0.010	0.034	0.20	0.032	40.7	23.0
3		45.32 - 50.00	4.68	0.005	0.001	0.19	0.024	10.9	0.72
3		52.92 - 53.26	0.34	0.008	0.021	0.20	0.029	15.3	11.3
3		87.00 - 88.00	1.00	0.007	0.004	0.079	0.027	10.9	1.0
3		93.00 - 94.00	1.00	0.005	0.004	0.015	0.024	11.0	0.43

The assay results confirmed the visual observations that pyrrhotite is the dominant sulphide with chalcopyrite being only of minor importance. Of the 21 samples analysed, only 1 contains over 0.5% Cu and only 8 contain over 0.1% Cu. The pyrrhotite is non-nickeliferous and the cobalt and zinc values are not of any economic significance.

The following meterages assay at over 0.1% Cu.

Hole 1

49.80m - 55.54m (5.66m) 0.15% Cu
138.22m - 138.60m (0.38m) 0.13% Cu

Hole 2

13m - 17m (4m) 0.15% Cu

Hole 3

35.80m - 36.10m (0.30m) 0.71% Cu
40.33m - 40.87m (0.54m) 0.20% Cu
45.32m - 50.00m (4.68m) 0.19% Cu
52.92m - 53.26m (0.34m) 0.20% Cu

Conclusion

The operation can be regarded as being geologically successful in that diamond drilling verified the results of geophysical and geochemical surveys. As can be seen from the drill sections, E.M. anomalies observed can be correlated with sulphide mineralizations intersected.

From an economic viewpoint, however, the results have been negative, the mineralizations intersected have been of fairly small extent and dominantly pyrrhotite (non-nickeliferous with copper being minor).

Taking into account the general geological set-up and the results of investigations so far completed, it is suggested that the Engelandshøia property is of no economic significance and that activity should be discontinued.

Frank Nixon

29/12-70
FN/jr

REFERENCE

E. OVERWIEN Undersøkelse av en kobberforekomst i Engelandshøia,
Vennesla i Vest Agder. 1968.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 120N/80W BEARING: 100 DIP: 35 HOLE No: 1 SHEET No: 1A
LOGGED BY: F. NIXON STARTED: 1.10.1970 PROPERTY: ENGELANDS HEIA
CASING: 1.25m FINISHED: 19.10.1970 YENNEJLA WEST AS DER
CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION	SUMMARY
0.00	1.00	Oresburden.	
1.00	18.58	Alternation between foliated and massive amphibolite types and pegmatites.	
18.58	23.80	Amphibolite. 18.75-19.90 garnet rich, 18.58-19.34. 2% sulphides, mainly py. po.	
23.80	27.11	Pegmatite.	
27.11	44.10	Massive amphibolite with some garnet rich sections.	
44.10	46.02	Aplite.	
46.02	75.06	Dominantly amphibolite: 49.88-53.30 an uneven sulphide dissemination. 53.30-54.25 10% sulphides 54.25-55.00 2% sulphides 55.00-55.54 5% sulphides. po. py. cp. plus magnetite. 65.90-70.50. mineralized zone. very uneven 1-2%.	
75.46	146.40	Alternation between amphibolites and pegmatitic - aplitic zones. 138.22-138.60 2% sulphides.	
		From W to E the EM anomalies are interpreted as follows.	
		Anomaly 1 is not explained.	
		Anomaly 2 is possibly caused by the sulphide concentration around 18-19 m.	
		Anomaly 3 is probably caused by the main sulphide zone from 49.88-55.54 m.	
		Anomaly 4 is probably caused by the mineralized zone between 65.90 and 70 m.	

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 120N/80W BEARING: 100° DIP: 35° HOLE NO: 1 SHEET NO: 1
 LOGGED BY: F. NIXON STARTED: 1.10.1970 PROPERTY: ENGELANDSHEIA
 CASING: 1.25 m FINISHED: 19.10.1970 VENNESLA. VEST. NOIDER.
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
0.00	1.00	Overburden
1.00	2.00	Pegmatite med. gr. feldspar rich.
2.00	2.66	Foliated amphibolite with in part some late feldspar introduction. med. gr.
2.66	3.38	Med. gr. pink pegmatite.
3.38	10.80	Amphibolite for the most part medium grained and fairly massive although there are some foliated fractions. 3.80 conc. of mt. Cut by a few younger quartz/feldspar veins
10.80	11.45	Med. gr. pegmatite vein, over last 20 cms some brecciation.
11.45	11.82	Med. gr. massive amphibolite.
11.82	14.14	Med. coarse gr. pegmatite, upper contact is slightly sheared.
14.14	16.00	Gradual change over into an extremely granitized and pegmatized amphibolite, in parts almost of a granodioritic grain composition. Contains in parts a few small garnets. 15.00 - 15.30 weakly magnetic.
16.00	18.58	Again gradual change over to pegmatite. Coarse feldspar rich, red in colour.
18.58	23.80	Foliated to massive med. gr. amphibolite. 18.75 - 19.70 garnet rich especially around 19.40 - 19.70. 18.58 - 19.54 fine dissemination of sulphides

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 120N/80W BEARING: 103° DIP: 35° HOLE NO: 1 SHEET NO: 2
 LOGGED BY: F. NIXON STARTED: 1.10.1970 PROPERTY: ENGELANDSHEIA
 CASING: 1.25 in FINISHED: 19.10.1970 VENNESLA, VEST. NORR
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
		parallel to foliation mainly po and py less than 2%.
		18.90 magnetite concentration.
		19.40-53 magnetite concentration.
		20.00-23.80 very massive.
		At 20.42-20.48 there is a slight sulphide development - py specks.
		At 20.50-60 slight garnet development.
23.80	27.11	Pegmatite coarse. Fds/qz, biotite. Upper contact shows some evidence of brecciation and some pyrite as fracture fillings.
		Lower contacts with country rock is biotite rich and shows some very slight shearing.
27.11	44.10	Dominantly massive amphibolite although we have present some foliated sections.
		30.00-30.80 garnet rich zone.
		30.30 magnetite concentration.
		30.00-33.00 weakly to strongly magnetic.
44.10	46.02	Fine / med. gr. aplitic dyke that contains some amphibolite inclusions.
46.02	75.06	From to 49.77 fairly massive amphibolite.
		49.77-49.82 small quartz vein that contains a small amount of po.
		From 49.88-53.30 there is an uneven distribution of sulphides mainly po with some minor cp. py approx 2%. Also starting to get development of garnets.
		From 52.00-56.30 there is a heavy development of garnets, also from 52.50-53.40 quartz development.
		53.30-54.25 heavy dissemination (10%) of sulphides in part massive, again dominantly po with only minor cp and py.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 120N/80W BEARING: 150 DIP: 35 HOLE NO: 1 SHEET NO: 3
 LOGGED BY: F. NIXON STARTED: 1.10.1970 PROPERTY: ENGELHARDT
 CASING: 1.25 in FINISHED: 19.10.1970 VENNESJA VEST NAPER
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
		54.25-55.00 ca. 2% sulphides as dissemination dominantly po. Rock is very basic - lbs. rich.
		55.00-55.54. 5% sulphides again dominantly po as dissemination and some stringers in early part however some good stringers of cp.
		The mineralized zone also contains a good amount of magnetite.
		From 55.54 down to 60.00 heavily pegmatized amphibolite with a good deal of biotite.
		60.00-65.00 the amphibolite is fairly massive after this becoming more foliated.
		65.40-70.00 mineralized zone very uneven and irregular. Fine to med. gr dissemination parallel to the foliation. Dominantly po. with minor py. cp. Richest zone is 67.70-67.85 with over 10% sulphides but over the entire zone the average is between 1 and 2%.
		72.00-75.00 fairly magnetic with quite a lot of visible magnetite.
75.46	105.85	Pegmatite, coarse gr. fld qtz. biotite. upper contact very uneven
105.85	109.78	Massive amphibolite, med. gr. some introduction of feldspar. Rich in magnetite dissemination.
109.78	116.28	Aplitic vein grey, fine-med. gr. upper contact sheared
116.28	120.44	Amphibolite, slightly altered and fractured 116.28-116.60 fracture zone. 118.20-118.40 fracture zone. Zone is strongly magnetite.
120.44	128.48	Pegmatitic/aplitic zone. 125-127 extremely sheared and fractured

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 120N/80W BEARING: 100 DIP: 35 HOLE NO: 1 SHEET NO: 4
 LOGGED BY: F. N. Nixon STARTED: 1.10.1970 PROPERTY: ENGELANDS HILL
 CASING: 1.25m FINISHED: 19.10.1970 VENNBLA VEST AGDER
 CORE SIZE: 32mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
		Zone Epidote, chlorite and carbonate development.
		from 127.00 - 128.48 more aplite.
128.48	128.75	Sheared and fractured amphibolite.
128.75	129.45	Sheared and fractured pegmatite.
129.45	130.00	Sheared and fractured amphibolite.
130.00	130.60	Small aplite vein.
130.60	146.40	Amphibolite massive to foliated locally sheared and fractured and locally with introduced feldspar
		138.22 - 138.60 ca. 2% sulphides, fine dissemination of py and a few coarse blebs of cp.
	146.40	End of hole.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 120N/80W BEARING: 100 DIP: 35 HOLE No.: 1 SHEET No.: 5
LOGGED BY: F. NIXON STARTED: 6/10/1970 PROPERTY: ENGELANDSHEILA
CASING: 1-25" FINISHED: 19/10/1970 VENNESLA WEST BORDER
CORE SIZE: 32 (44) TESTS (CORRECTED):

FROM	TO	DESCRIPTION
		CORE ANGLES
	2.50	70
	2.66	74 contact.
	3.38	90 contact.
	4.50	60
	10.80	52 contact
	11.45	88 contact
	11.82	44 contact
	14.14	52
	15.70	68
	18.58	65 contact
	23.80	86 contact
	27.11	90 contact
	33.00	63
	34.50	62
	44.10	90 contact
	46.02	59 contact
	48.50	68
	50.80	82
	55.50	75
	66.50	68
	69.70	65
	72.50	64
	75.46	25 contact.
	105.85	77
	118.00	61
	126.00	48 shear
	128.48	42 contact.
	129.60	55
	130.60	65 contact
	133.80	74
	136.00	68
	139.80	64 shear
	144.50	55.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 88N/20W BEARING: 75 DIP: 45 HOLE NO: 2 SHEET NO: 1A
 LOGGED BY: F. NIXON STARTED: 21.10.1970 PROPERTY: ENSELANSHEIA
 CASING: 1.50 m FINISHED: 26.10.1970 VENNESLA VEST AIDER
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
		SUMMARY.
0.00	0.66	Overburden.
0.66	1.27	Amphibolite.
1.27	1.75	Pegmatite.
1.75	2.00	Amphibolite. massive
2.00	2.35	Pegmatite.
2.35	3.31	Amphibolite. massive
3.31	3.62	Pegmatite.
3.62	9.71	Amphibolite. foliated and massive .8.70-9.70. 2-10/sulphide
9.71	12.50	Aplite.
12.50	21.00	Foliated amphibolite. 13.00-15.85 mineralized zone
21.00	27.92	Pegmatite.
27.92	30.20	massive amphibolite.
30.20	32.00	Aplite.
32.00	35.82	Biotite, hb. fld gneiss.
35.82	37.10	Aplite.
37.10	39.58	Amphibolite with small aplite dykes.
39.58	41.55	Pegmatite and aplite.
41.55	48.43	Amphibolite.
48.43	52.41	Pegmatite.
52.41	54.20	Foliated biotite feldspar hb. gneiss.
54.20	55.52	Quartz dyke.
55.52	60.62	Massive amphibolite.
60.62	61.40	Pegmatite.
	61.40	End of hole.

The EM anomaly at 80N/0 is caused by the sulphide concentration between 8.70 and 15.85.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 88N/20W BEARING: 75 DIP: 45 HOLE NO: 2 SHEET NO: 1
 LOGGED BY: F. NIXON STARTED: 21.10.1970 PROPERTY: ENSENDAHNSHED
 CASING: 1.50 m. FINISHED: 26.10.1970 VENNESLA HETT HEDER
 CORE SIZE: 32 mm. TESTS (CORRECTED):

FROM	TO	DESCRIPTION
0.00	0.66	Overburden.
0.66	1.27	Medium grained amphibolite. Over the first 40cms biotite rich and contains quite a lot of feldspar. After this is darker in colour with Bt. being dominant over plag. First 40cms is fairly magnetic.
1.27	1.75	Pegmatite dyke (predominantly quartz rich) that from 1.36-1.58 contains an inclusion of the host rock that is extremely granitized. Pegmatite contains very low, at least a few specks of py and pg.
1.75	2.00	Fairly massive med. gr. amphibolite non-magnetic.
2.00	2.35	Peg. vein. Qtz/feldspar, mica peg. coarse gr. Lower contact very uneven.
2.35	3.31	Fairly massive med. gr. amphibolite cut in places by a few small (1cm) quartz-qtz/feld veins. 3.24-3.31. shear zone // to peg. contact.
3.31	3.62	Pegmatite that passes over into a more aplite looking rock.
3.62	9.71	Mainly med.-grained, in parts foliated in parts massive amphibolite. 5.60-5.80 cut by irregular peg. 5.90-6.13 aplite dyke, med gr. 7.18-7.34 Qtz/feldspar dyke, med. gr. with a little biotite development. Granodioritic in composition. From 7.00-7.71 the amphibolite becomes slightly more feldspar rich and more coarse grained.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 88N/20W BEARING: 75 DIP: 45 HOLE NO: 2 SHEET NO: 2
 LOGGED BY: F. NIXON STARTED: 21.10.1970 PROPERTY: ENGELINASHAIA
 CASING: 1.50 m FINISHED: 26.10.1970 VENNESLA VEST AGDER
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
		From 7.00 - 9.00 becomes fairly rich in magnetite especially from 8.00 - 8.30
		8.70 - 9.70. from 2-10% sulphides, also a good concentration of magnetite. Zone begins with fine dissemination of po parallel to the foliation, in places some large spots of cp which seems to be the later sulphide. A couple of specks of pyrite were noted. Around 9.00 the sulphides become more numerous and larger concentrations of po and cp (dominantly po) cut across the foliation.
9.71	12.50	Aplite, grey in colour, med. gr. From 10.00 - 10.72 contains fragments of country rock that is mineralized.
12.50	21.00	For the most part med. gr. foliated amphibolite, in places more massive. 12.50 - 12.66 very mylonitic zone at this aplitic contact. 13.00 - 15.85 mineralized zone, mainly po with minor cp. Uneven distribution but mostly with the sulphides parallel to the foliation, but more massive disseminations break across the foliation. From very fine disseminations to coarser po clumps, cp is very minor. 12.50 - 20.00 rich in magnetite.
21.00	27.92	Peg. coarse gr
27.92	30.20	Pass over again into a fairly massive med. gr amphibolite.
30.20	32.00	Fine med. gr. grey white aplitic upper contact is sheared. Around 30.90 specks of py. po.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 88N/20W BEARING: 75 DIP: 45 HOLE NO: 2 SHEET NO: 3
 LOGGED BY: F. NIXON STARTED: 21.10.1970 PROPERTY: ENGELANDS KEIA
 CASING: 1.50 m FINISHED: 26.10.1970 VENNESLA VEST ACER
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
32.60	35.82	Although still same rock type it is perhaps more correct to call the rock a biotite hb. fed gneiss. Caused no doubt by proximity of the aplitic material, some of which occurs also as small bands in the rock. Contains a good deal of magnetite.
35.82	37.10	Peg./aplite dyke.
37.10	39.58	Amphibolite with some small aplite dykes. At 38.24 there is an aplite dyke that contains a stringer (in a biotite rich part) of ep + po. For a distance of about 2 cms above this aplite dyke the amphibolite has a good impregnation of po. Also stringer of po in aplitic material at 38.80.
39.58	41.55	Peg. and aplite. Aplitic near contacts, more pegmatic in centre of the dyke. Contains specks of magnetite.
41.55	48.43	Amphibolite which has quite a high feldspar content and looks coarser than the normal. Seems to be somewhat granitized. Still retains a fairly massive character however. Contains a good impregnation of magnetite and in places some large blabs up to 1 cm across. Specks of po and py in places.
48.43	52.41	Peg. coarse feldspar / gk / biotite peg.
52.41	54.20	Well foliated biotite feldspar hb gneiss, granitization product of the amphibolite contains magnetite.
54.20	55.52	Quartz dyke.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 88N/20W BEARING: 75 DIP: 45 HOLE No: 2 SHEET No: 4
 LOGGED BY: F. NIXON STARTED: 26.10.1970 PROPERTY: ENGELHARDT
 CASING: 1.50 m FINISHED: 26.10.1970 VENNERLA VEST AGDER
 CORE SIZE: 32 mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
58.52	60.62	massive med. gr. amphibolite.
60.62	61.40	Pyromphite
	61.40	End of hole
CORE ANGLES		
	1.10	75.
	1.27	74 contact.
	2.35	90 contact.
	3.31	70 contact.
	5.90	74 contact
	8.10	88
	8.80	85.
	9.50	55.
	12.50	45 contact shear.
	14.20	88
	15.50	70
	16.90	72
	21.00	58 contact
	27.92	90 contact.
	30.20	44 contact shear
	33.60	70
	35.60	80
	35.82	62 contact.
	37.10	74
	41.55	45
	45.60	90
	46.90	64
	48.43	68 contact.
	52.41	60 contact.
	52.70	48.
	53.52	68 contact

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 40N/28W BEARING 103.4 DIP: 50 HOLE NO: 3 SHEET NO: 1A
 LOGGED BY: F. NIXON STARTED: 29.10.1970 PROPERTY: ENGELANDS HEIA
 CASING: --- FINISHED: 10.11.1970 VENNESLA: VEST AGDER
 CORE SIZE: 32 mm TESTS (CORRECTED): ---

FROM	TO	DESCRIPTION
		SUMMARY.
0.00.	20.42.	Alternation between amphibolite and pegmatitic types.
20.42.	22.45.	Granitized amphibolite. 21.70-22.45 mineralized zone po. cp. py. 2-5%.
22.45.	31.84	Pegmatite.
31.84	35.50	Amphibolite. 31.84-35.50. weak mineralization po. py. cp.
35.50	36.41.	Quartz dyke. 35.80-35.96 coarse disseminations of po with minor cp. 35.96-36.10 massive po with little cp.
36.41	41.00.	Amphibolite. 40.33-40.44. massive po. little cp. 40.44-40.8. 20% sulphides. dominant po. some cp. py.
41.00	45.32	Pegmatite.
45.32	83.50.	Massive amphibolite. 45.32-50.00 <2% sulphides. 52.92-53.26 10% sulphides dominantly py.
83.50	100.52	Alternation of amphibolite and peg. and aplite. 87.00-88.00 <2% sulphides dominantly pyrite 93.00-93.50. slight sulphide content.
	100.52	End of hole.
		E.M. anomaly at 20N/15W is possibly related to the mineralized zone between 21.70 and 22.45.
		E.M. anomaly at 10N/6W is probably due to mineralized zone around 31-36m.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 40N/28W BEARING: 103.4 DIP: 50 HOLE NO: 3 SHEET NO: 1
 LOGGED BY: F. NIXON STARTED: 29.10.1970 PROPERTY: ENGELANDSHEIA
 CASING: --- FINISHED: 10.11.1970 VENNESLA VEST ASGER.
 CORE SIZE: 32mm TESTS (CORRECTED): ---

FROM	TO	DESCRIPTION
0.00	0.12	Foliated amphibolite, a couple of pyrite specks.
0.12	4.84	Pegmatite. coarse gr. feldspar, quartz, biotite peg. Feldspar dominant. reddish pink in colour.
4.84	7.39	Pegmatized amphibolite, fine/med. gr. amphibolite interwoven and cut by aplite and pegmatitic development. Amphibolite is in part biotite rich. Some remnants of a foliation present.
7.39	8.45	Foliated amphibolite which in part is granitized to a feldspar biotite kt gneiss.
8.45	9.87	Pegmatite. coarse fd. gtz biotite, fd development, reddish.
9.87	12.00	Fairly massive amphibolite med gr. 11.20-11.60. fracture zone biotite lined fractures.
12.00	19.65	Granitized amphibolite or perhaps more correctly termed a feldspar, biotite gneiss, from 12m - 14m still retains some amphibolite characteristics, but after 14m is extremely light in colour and feldspar rich. From 14-15m there is a slight garnet content. This section is in part weakly magnetic.
19.65	20.42	Aplite pegmatitic dyke/med-coarse gr. grey- white in colour contains the odd pyrite speck.
20.42	22.45	Partly granitized amphibolite, quite well foliated At 20.90 biotite rich and magnetite rich. 21.70-22.45 mineralized zone. The rock is biotite rich and also contains numerous small garnets. Large magnetite blobs are

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 40N/28W BEARING 703.4 DIP 50 HOLE NO. 3 SHEET NO. 2
 LOGGED BY: F. NIXON STARTED: 29.10.1970 PROPERTY: ENGELHARDT HEIR
 CASING: --- FINISHED: 10.11.1970 VENNESLA VEST HEDER
 CORE SIZE: 32mm TESTS (CORRECTED): ---

FROM	TO	DESCRIPTION
		present.
		Sulphides consist of po with minor cp and py. Dominantly as small disseminations and stringers parallel to the foliation 2-5%.
22.95	31.84	Peg coarse feldspar rich with some graphic granite intersections.
31.84	35.50	Amphibolite, partly pegmatized. From 32.00 - 32.28 zone which is biotite rich and appears to have undergone some shearing. This zone is also fairly heavily mineralized, dominantly po as coarse blobs and clumps minor py and cp. From 31.84 - 32.00 fine dissemination of po. 32.28 - 35.50 in amphibolites there is a very fine gr dissemination of sulphides mainly po (under 2%) All this zone is rich in magnetite dissemination.
35.50	36.41	Quartz dyke, which has a greenish colour 35.80 - 35.96 coarse dissemination of po with minor cp. 35.96 - 36.10 massive po with a little cp.
36.41	41.00	Amphibolite, foliated in part. Partly granitized and pegmatized. 40.33 - 40.44 massive po with a little cp that seems to occur together with younger quartz. This quartz has also a greenish hue. 40.44 - 40.87 over 20% sulphides, from disseminated - massive. Dominant po, some cp and py.
41.00	45.32	Peg. coarse gr. Fd/qtz biotite.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 40N/28W BEARING: 103°4' DIP: 50 HOLE NO: 3 SHEET NO: 3
 LOGGED BY: F. NIXON STARTED: 29.10.1970 PROPERTY: ENGLANDS HEIA
 CASING: _____ FINISHED: 10.11.1970 PENNIESLA VEST AGER
 CORE SIZE: 32 mm TESTS (CORRECTED): _____

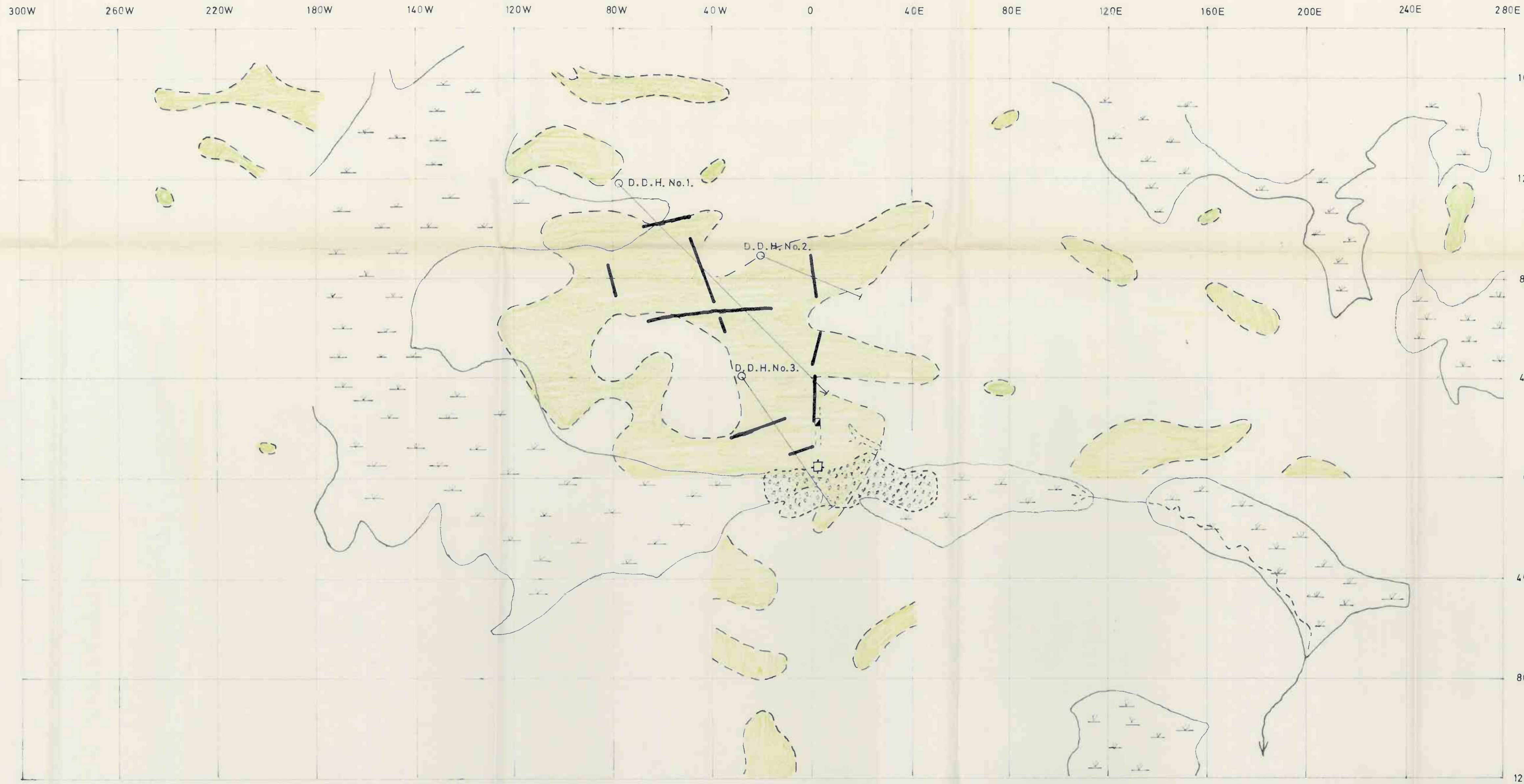
FROM	TO	DESCRIPTION
45.32	83.50	Fairly massive amphibolite. 45.32 - 50.00 carries fine gr. sulphide dissemination, less than 2% dominant po. 52.10 - 52.32 coarse (qtz) feldspar vein with coarse pyrite blebs up to 3 cms. Some slight concentration of pyrite also in the footwall contact. 51.55 - 52.00 fractured zone. 52.92 - 53.26 mineralized zone, up to 10% med gr disseminated pyrite. Amphibolite varies from fairly massive to foliated, in place. - 58.00 - 59.00 some development of garnets. Some sulphide specks now and again. 61.50 - 62.20 garnet rich zone. 61.80 magnetite rich. RCL zone is fairly magnetic.
83.50	86.70	Pegmatite, coarse gr. feld/qtz minor biotite. lower contact diffuse. Country rock in upper contact is rich in magnetite.
86.70	89.00	Strongly granitized and aplitized amphibolite. 87.00 - 88.00 fine dissemination and some stringers of sulphides. Stringers dominant in latter half of section less than 2% and dominantly pyrite.
89.00	93.00	Peg. Ab/feldspar 50-50. white in colour. At 89.00 good heavy concentration of magnetite.
93.00	100.52	Amphibolite mainly foliated, although contains some massive parts. 93.00 - 93.50. slight sulphide content. py. some po. seen.
	100.52	End of hole.

A/S SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 40N/28W BEARING: 103°4' DIP: 50 HOLE NO.: 3 SHEET NO.: 4
 LOGGED BY: F. NIXON STARTED: 29.10.1970 PROPERTY: ENGELAND SITE 112
 CASING: FINISHED: 10.11.1970 VENNELA VEST AG DER
 CORE SIZE: 32mm TESTS (CORRECTED):

FROM	TO	DESCRIPTION
		CORE ANGLES.
	8.12	65 contact.
	4.84	58 contact.
	5.50	59
	7.39	58 contact.
	8.00	56
	8.45	64 contact.
	9.87	79 contact.
	13.10	60
	16.50	76
	18.60	85
	19.65	89 contact.
	22.10	54
	22.45	75 contact.
	31.84	55 contact.
	32.10	65 shear.
	33.60	64
	35.50	55 contact.
	36.41	70 contact.
	39.00	61
	45.32	59 contact.
	51.50	64
	53.50	82
	57.90	55
	71.70	62
	76.85	69 shear.
	78.53	44 shear.
	79.80	80
	83.50	86
	93.00	90 contact.
	95.10	80
	97.50	63
	98.50	90



EXPLANATION

- MAIN SHAFT.
- ▴ EXPLORATION SHAFT.
- - - ADIT.
- ⊗ TIPS.
- v SWAMP.
- GEOCHEMICAL SOIL ANOMALY > 45 p.p.m. Cu.
- - - SUPPOSED CONDUCTOR (FROM E.M. SURVEY.)
- DIAMOND DRILL HOLE.

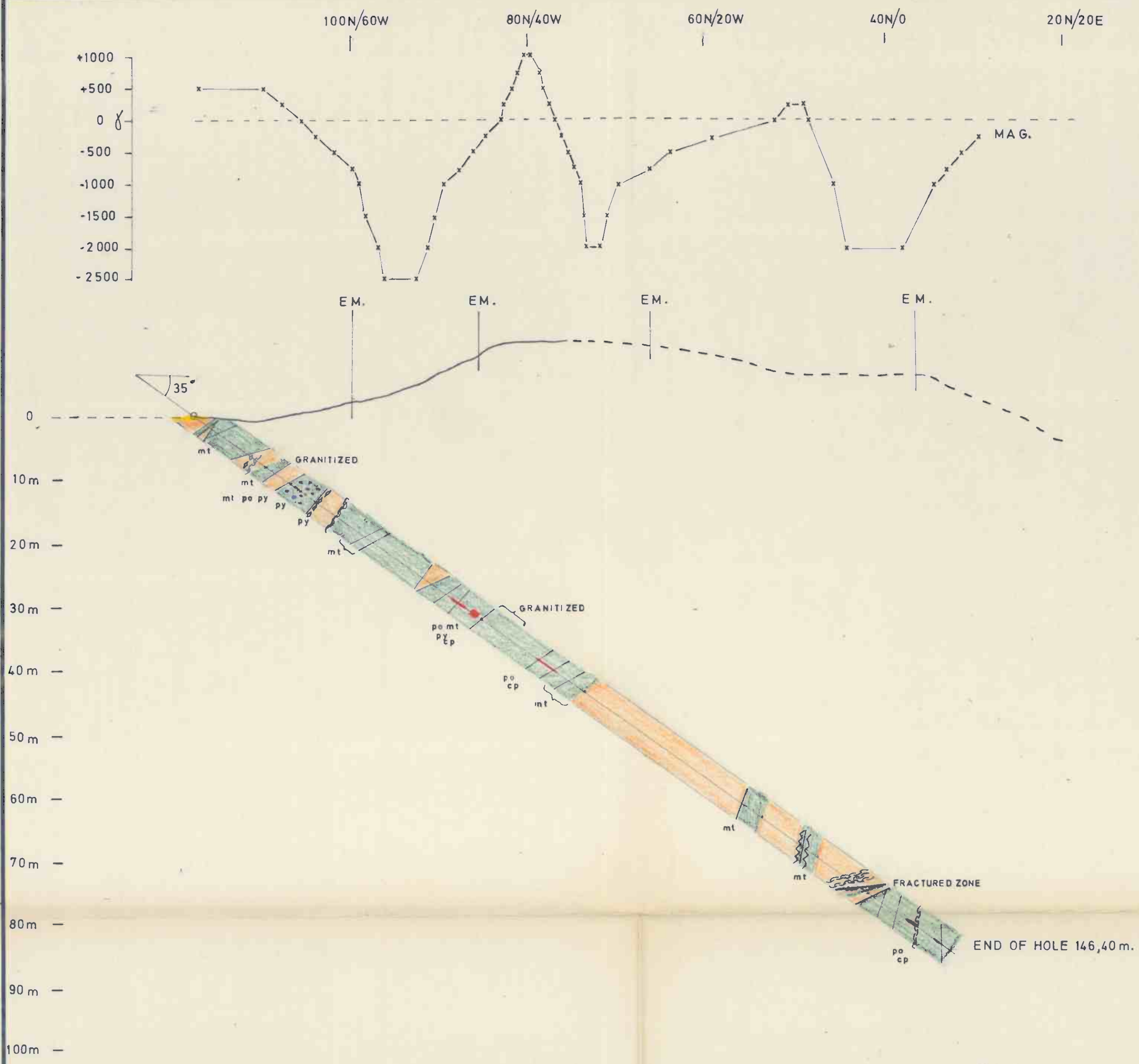
MAP SHOWING LOCATION OF DRILL HOLES,
GEOCHEMICAL ANOMALIES AND E.M.
ANOMALIES.
ENGELANDSHEIA, VENNESLA, VEST AGDER.

SCALE 1:1000
OBS.
DRAW. F.N. DES. 70
TRAC. J.J. DES. 70

A/S SULFIDMALM KRISTIANSAND.

MAP NR.

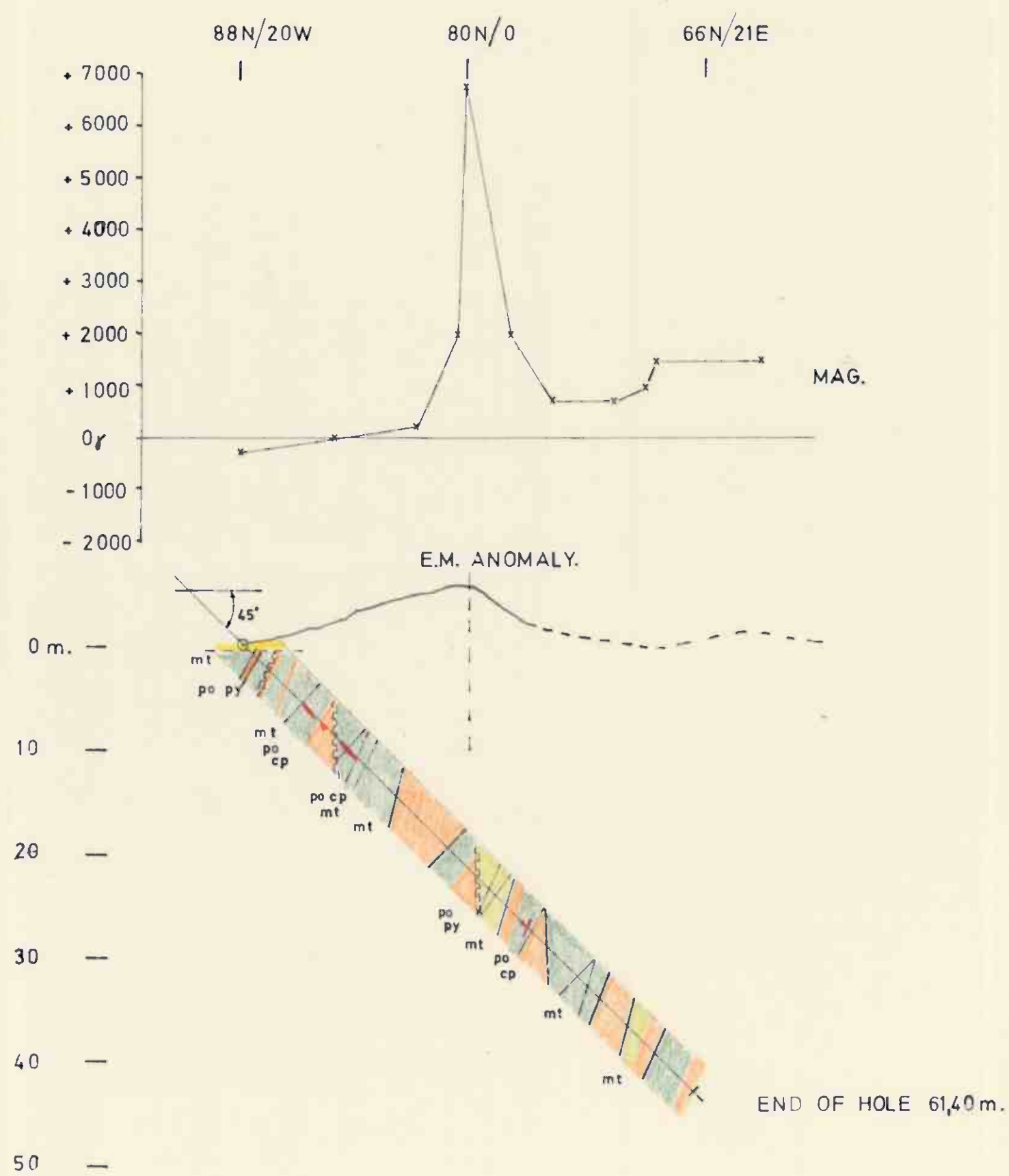
MAP SHEET.



LEGEND.

- OVERBURDEN.
- AMPHIBOLITE.
- GARNETIFEROUS AMPHIBOLITE.
- PEGMATITE-APLITE-QUARTZ VEIN.
- FOLIATION.
- CONTACT.
- FRACTURE ZONE.
- SHEAR ZONE.
- BRECCIA ZONE.
- mt MAGNETITE.
- po PYRRHOTITE.
- py PYRITE.
- cp CHALCOPYRITE.
- SULPHIDES.
- SPECKS.
- 2-5 %
- 5-10 %
- 10 %

ENGELANDSHEIA. D. D. H. No. 1. 117,5N/77,5 DIP 35° DIRECTION 90° VENNESLA. VEST AGDER. NORWAY.	SCALE 1:500	OBS. F.N. OCT: NOV. 70
		DRAW. F.N. NOV. 1970
		TRAC. J.J. DES. 1970
A/S SULFIDMALM KRISTIANSAND.	DRILLING A/S GRUNNBORING. OSLO.	
	MAP NR.	MAP SHEET



LEGEND.

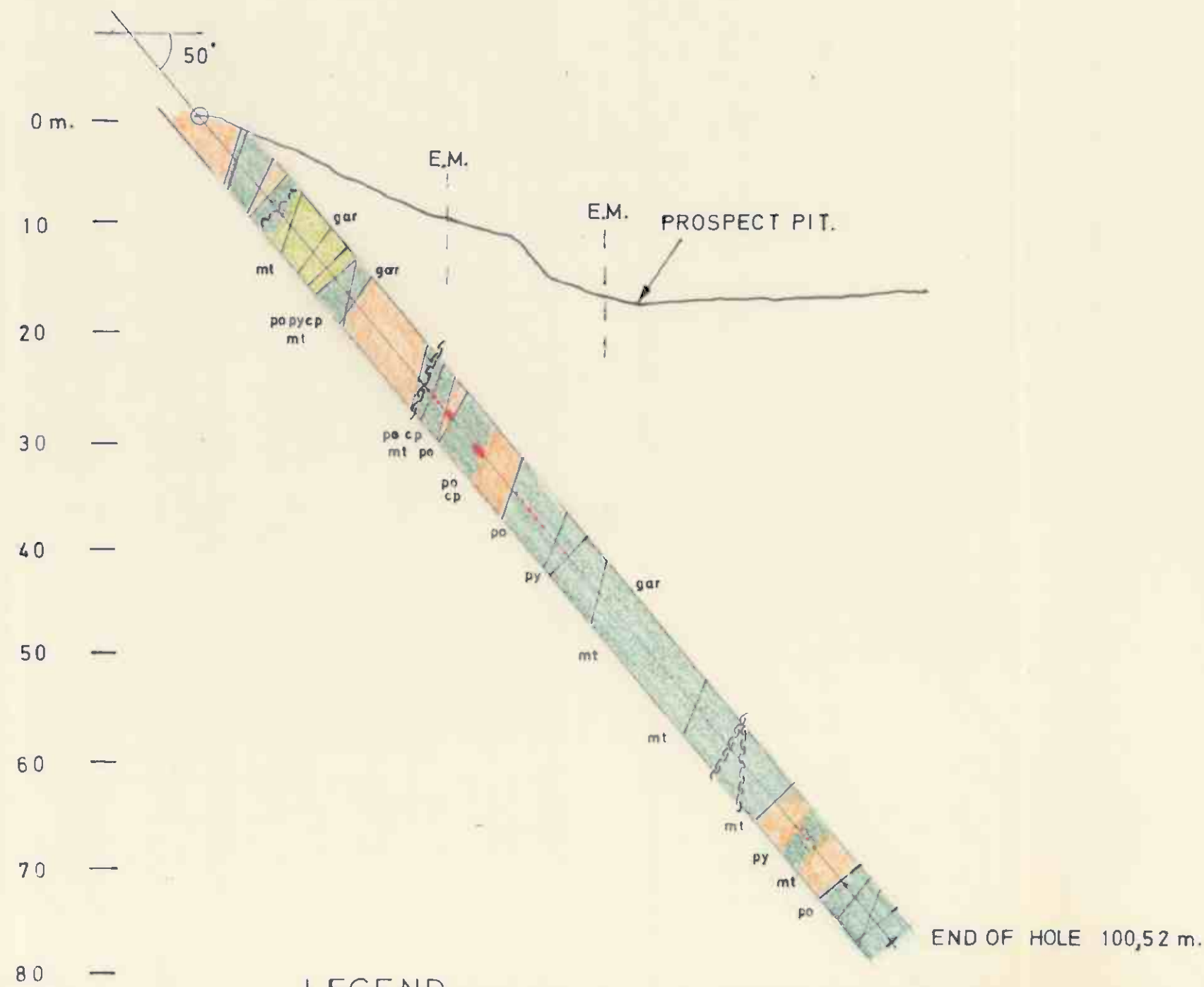
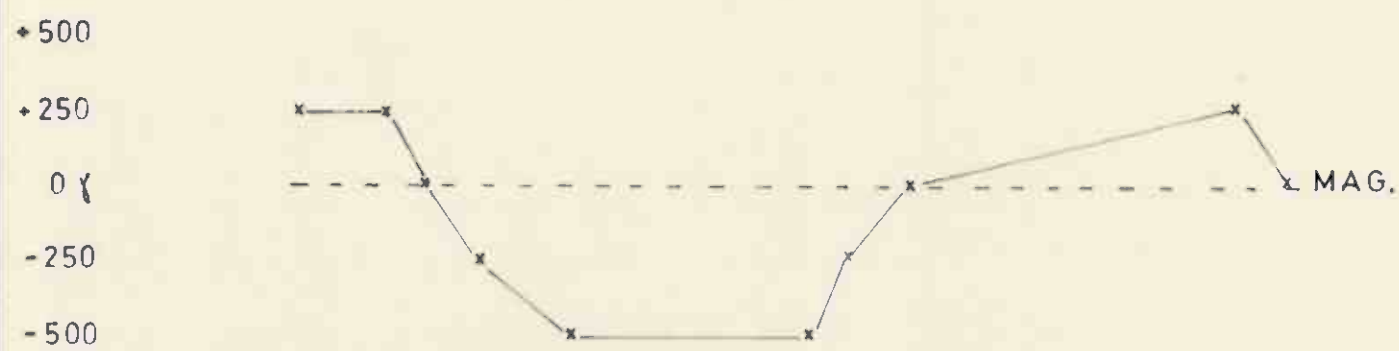
- AMPHIBOLITE
- BIOTITE FELDSPAR HORNBLENDE GNEISS
- PEGMATITE APLITE
- OVERBURDEN
- FOLATION
- CONTACT
- SHEAR
- po PYRRHOTITE
- py PYRITE
- cp CHALCOPYRITE
- mt MAGNETITE
- SULPHIDES 2-10%

ENGELANSHEIA. D.D.H. No. 2. 88N/20W DIP 45°. DIRECTION 67,5° mag. VENNESLA. VEST AGDER. NORWAY.	SCALE 1:500	OBS. F.N.	OCT. NOV. 70.
		DRAW. F.N.	NOV. 70.
		TRAC. J.J.	DES. 70.
		DRILLED A/S GRUNNBORING OSLO.	
A/S SULFIDMALM. KRISTIANSAND.S.	MAP NR.	MAP SHEET.	

40N/28W

20N/17W

0/0



LEGEND.

- AMPHIBOLITE.
- FELDSPAR BIOTITE GNEISS.
- PEGMATITE-APLITE-QUARTZ VEIN.
- FOLIATION
- CONTACT
- SHEAR
- FRACTURE ZONE
- po PYRRHOTITE
- py PYRITE
- cp CHALCOPYRITE
- mt MAGNETITE
- gar GARNET
- ... 0 - 2 % SULPHIDES
- 2 - 5 % "
- 10-20 "
- MASSIVE "

ENGELANDSHEIA.

D.D.H. No.3 40N/28W DIP 50. DIRECTION 109,5°
 VENNESLA. VEST-AGDER.
 NORWAY.

SCALE
 1: 500

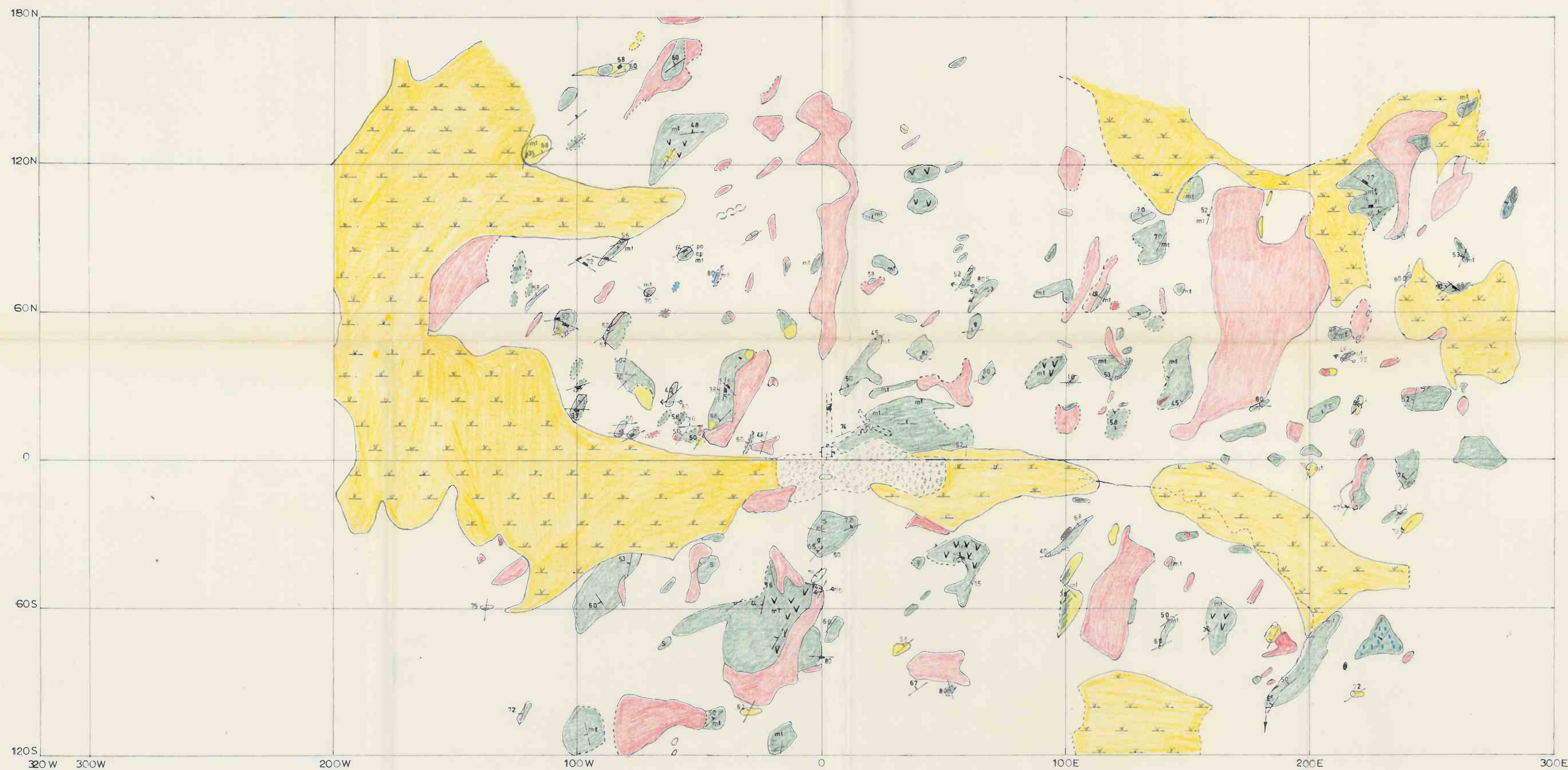
OBS. F.N.	NOV. 1970
DRAW. F.N.	NOV. 1970
TRAC. J.J.	DES. 1970

DRILLED A/S GRUNNBORING. OSLO.

A/S SULFIDMALM, KRISTIANSAND.

MAP. NR.

MAP. SHEET.



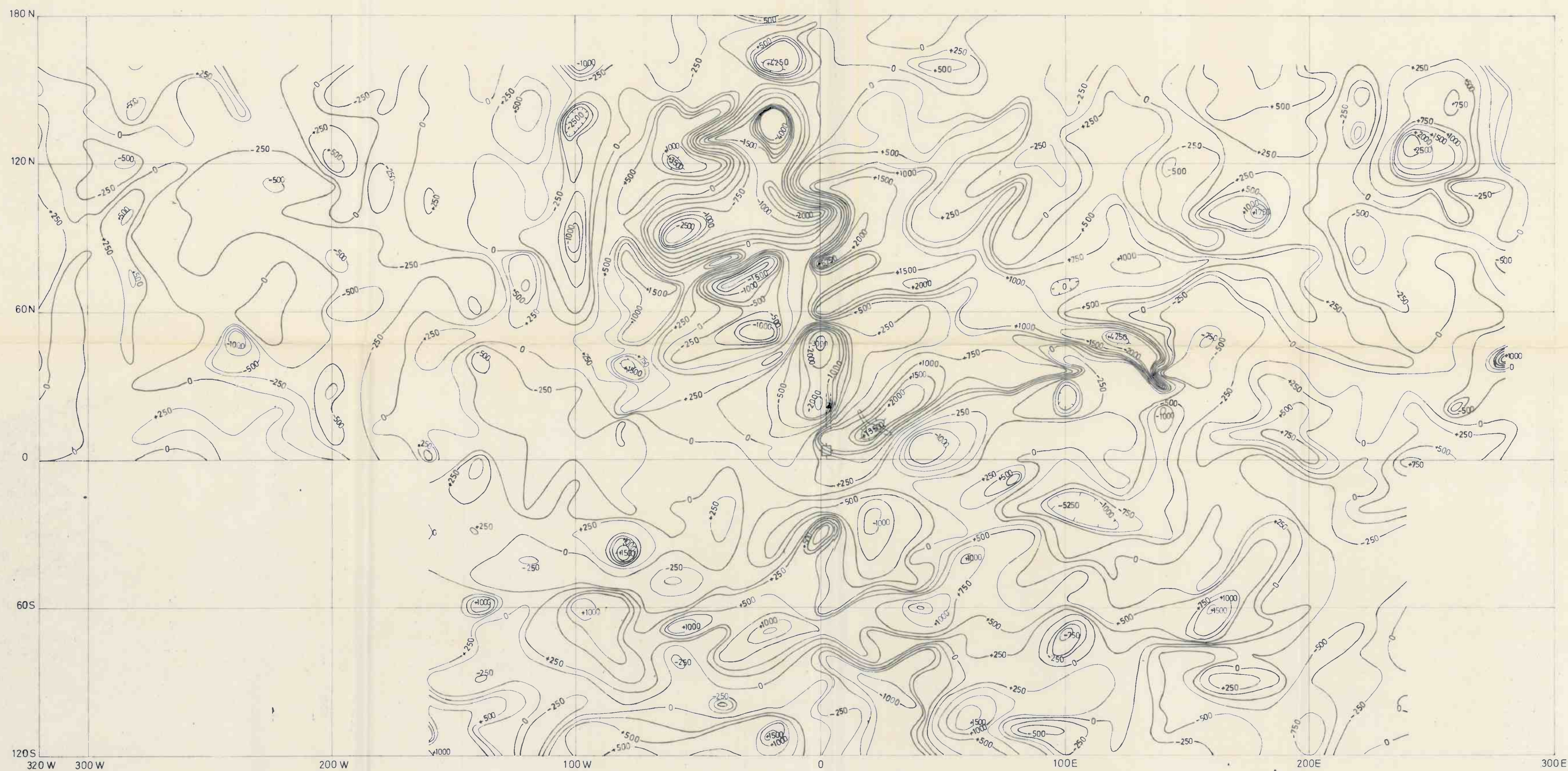
- | EXPLANATION | |
|-------------|---------------------------|
| | AMPHIBOLITE |
| | AMPHIBOLITE GARNETIFEROUS |
| | MASSIVE AMPHIBOLITE |
| | HORNBLLENDE GNEISS |
| | PEGMATITE APLITE |
| | FOLIATION |
| | JOINT |
| | SHEAR |
| | LINEATION |
| mt | MAGNETITE |
| po | PYRRHOTITE |
| cp | CHALCOPYRITE |
| | SWAMP |
| | TIPS |
| | MAIN SHAFT |
| | EXPLORATION SHAFT |
| | ADIT |

OUTCROP MAP FROM ENGELANDSHEIA,
VENNESLA,
VEST AGDER, NORWAY.

SCALE	OBS: E.N.	JUNE 70
1 1000	DRAW: E.N.	JUNE 70
	TRAC: J.J.	NOV. 70

A/S SULFIDMALM
KRISTIANDSAND. S.

MAP NR.	MAP SHEET
	1511 IV



□ OLD MINE WORKING
 ■ EXPLORATION SHAFT
 — ADIT

MAGNETIC MAP FROM A GROUND
 SURVEY AT ENGELANDSHEIA,
 ØVREBØ, NORWAY.

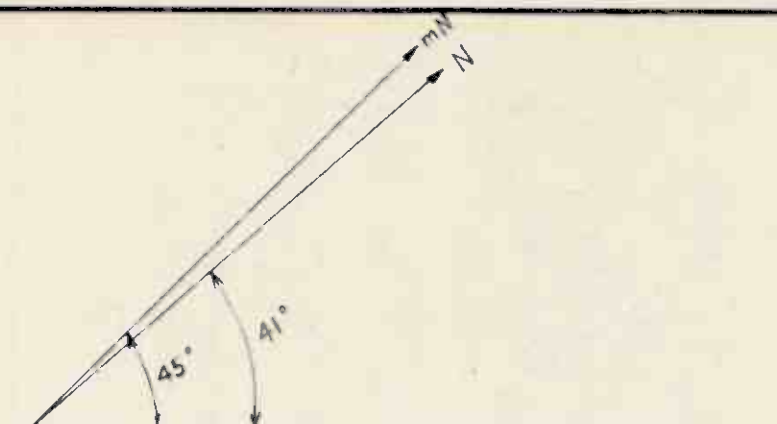
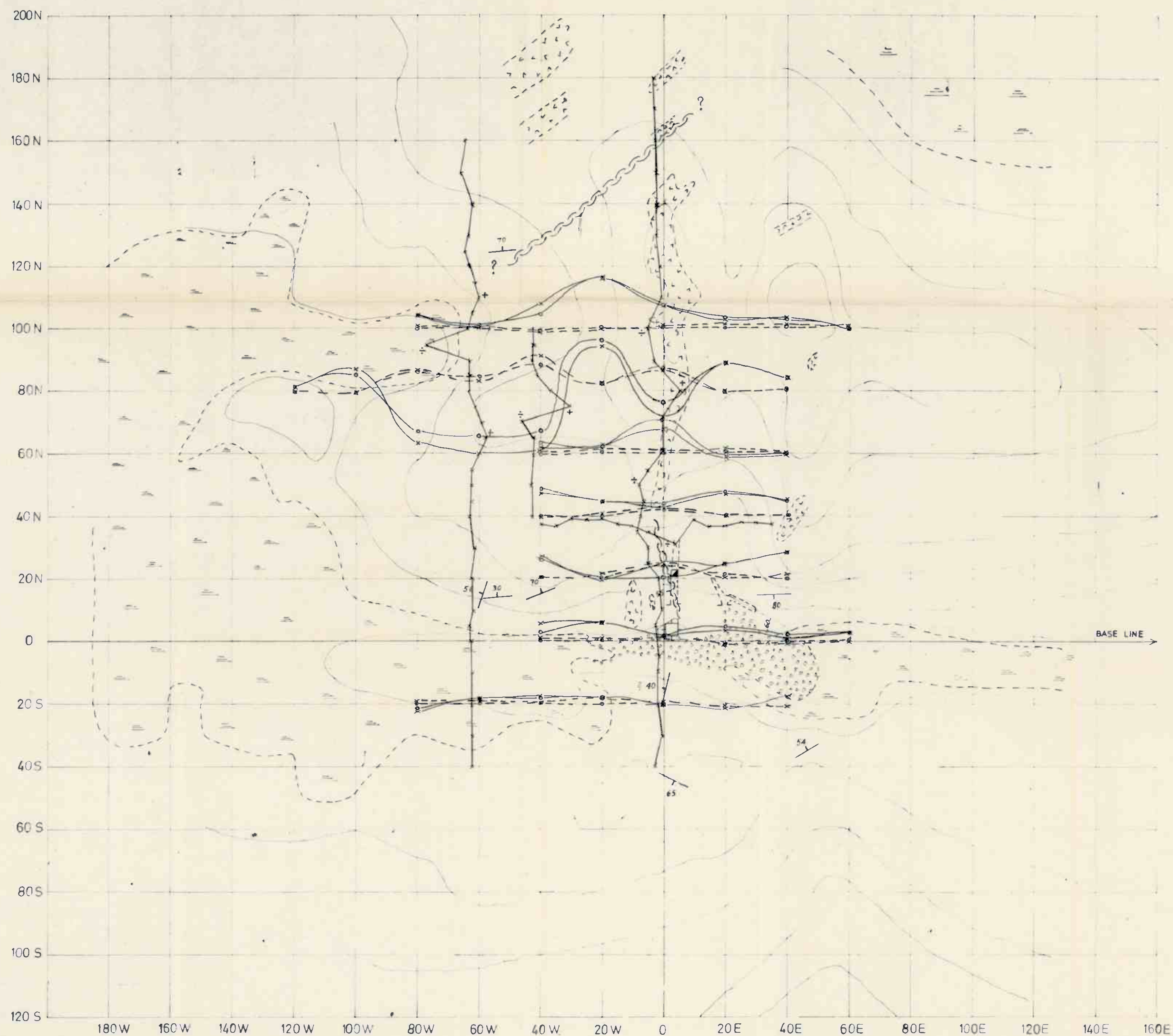
SCALE
 1:1000

OBS: F. N. S. J.	1969
DRAW: —	—
TRAC: S. J.	NOV. 1969

A/S SULFIDMALM
 KRISTIANDSAND, S.

MAP NR.

MAP SHEET
 1511 IV



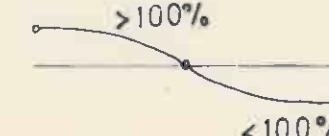
- PEGMATITE
- SWAMP
- DUMP
- ADIT
- EXPLORATION SHAFT
- OLD MINE WORKING
- SHEAR
- JOINT
- FOLIATION
- FORM LINES 5m INTERVAL

E.M. ANOMALIES

1mm = 1%

x 1760 $\frac{C}{S}$

o 440 $\frac{C}{S}$

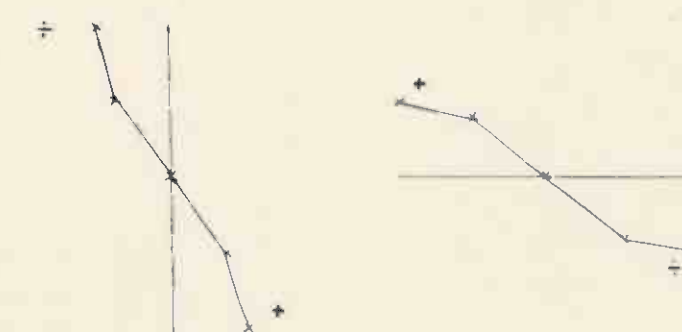


OUT OF PHASE

IN PHASE

40 m cable

MAGNETIC ANOMALIES



1mm = 500%

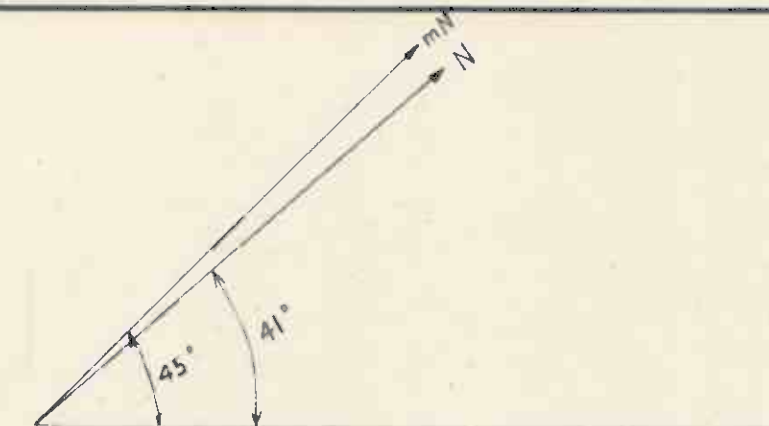
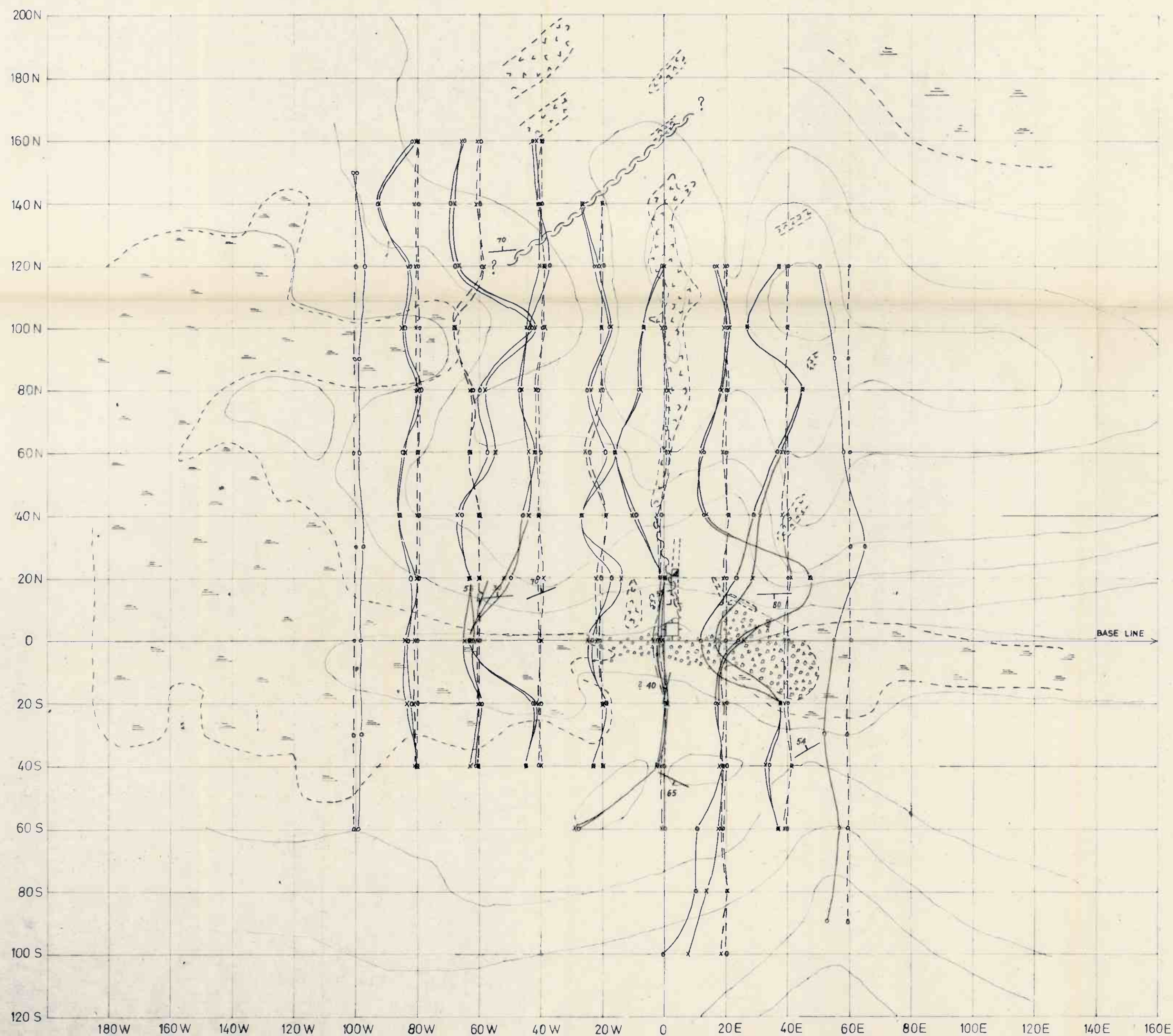
GEOPHYSICAL MAP 2 FROM
OLD COPPER MINE AT
ENGELANDSHEIA IN ØVREBO,
VESTAGDER, NORWAY.

SCALE
1:1000

OBS	EGH EO	AUG. 1966
DRAW	EGH EO	SEPT. 1968
TRAC	FN EO	OCT. 1968

A/S SULFIDMALM
KRISTIANSAND S.

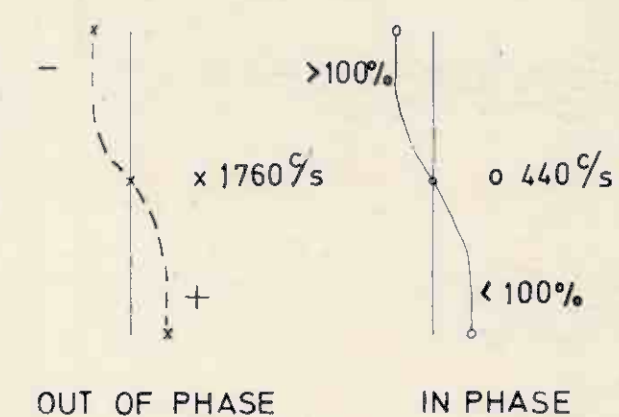
MAP SHEET
1511 IV



- PEGMATITE
- SWAMP
- DUMP
- ADIT
- EXPLORATION SHAFT
- OLD MINE WORKING
- SHEAR
- JOINT
- FOLIATION
- FORM LINES 5m INTERVAL

EM ANOMALIES

1mm = 1%



40m cable

(60m cable in lines 100W, 60E.)

ELECTROMAGNETIC MAP I FROM
OLD COPPER MINE AT
ENGELANDSHEIA IN ÖVREBÖ,
VESTAGDER, NORWAY.

A/S SULFIDMALM
KRISTIANSAND S.

SCALE
1:1000

OBS: EGH EO	AUG. 1968
TD: DVW	
DRAW: EGH	SEPT. 1968
EO	
TRAC: FN EO	OCT. 1968

MAP SHEET
151 IV