



Bergvesenet

Postboks 3021, 7002 Trondheim

Rapportarkivet

Bergvesenet rapport nr BV 1015	Intern Journal nr	Internt arkiv nr	Rapport lokalisering Trondheim	Gradering Fortrolig
Kommer fra ..arkiv USB	Ekstern rapport nr Sul 474/77/22	Oversendt fra	Fortrolig pga	Fortrolig fra dato:

Tittel

Investigations in the Kvikne Region 1977. Geophysical, geological, investigations and diamond drilling at the Kvikne mines.

Forfatter

R. Sivertsen

Dato

1977

Bedrift

Sulfidmalm A/S

Kommune

Tynset

Fylke

Hedmark

Bergdistrikt

Østlandske

1: 50 000 kartblad

1: 250 000 kartblad

Fagområde

Geologi geofysikk boring

Dokument type

Forekomster

Kvikne Grube
Øvre Vang gruve
Nedre Vang gruve
Dals gruve

Råstofftype

Malm/metall

Emneord

Cu

Sammendrag

1. During 1973 A/S Sulfidmalm optioned from the Norwegian state 42 claims - among them the Kvikne mine.
2. In 1974 the Kvikne Region was covered by helicopter EM and mag survey (Report 347/74/20)L, regional stream sediment survey (Report 373/75/20). In the Kvikne mine area geological mapping, VLF-, slingram- and mag survey (Report 3391/74/20) was carried out. At the end of 1974 eight diamond drill holes were put down on the most promising geophysical anomalies. None of the holes hit promising mineralization.
3. In 1977 we decided to go in with a VLF survey and CP measurements and the results followed up by diamond drilling.

2/1980
h.h.

FOR FALCONBRIDGE NIKKELVERK A/S
A/S SULFIDMALM

PROJECT 905-20

Investigations in the Kvikne Region
1977

Geophysical-, geological - investigations
and diamond drilling at the Kvikne mines

By

R. Sivertsen

F. Hansen

Report No. 474/77/20

BV 1015

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Summary and conclusions

1. During 1973 A/S Sulfidmalm optioned from the Norwegian state 42 claims - among them the Kvikne mine.
2. In 1974 the Kvikne Region was covered by helicopter EM and mag survey (Report 347/74/20), regional stream sediment survey (Report 373/75/20). In the Kvikne mine area geological mapping, VLF-, slingram- and mag survey (Report 339/74/20) was carried out. At the end of 1974 eight diamond drill holes were put down on the most promising geophysical anomalies. None of the holes hit promising mineralization.
3. In 1977 we decided to go in with a VLF survey using a profile direction which favoured the SE direction of the mineralized bodies. Most of the known showings and mines were picked up, but because of the steepplunge of the bodies, they could not be followed for more than 50-100 m in the plunge direction.
4. Late autumn 1977 CP measurements were carried out by charging up three old mines:
 1. Øvre Vang mine
 2. Nedre Vang "
 3. Dals "

Grab samples gave the following results:

%Cu	%Zn	
0.80	14.6	Øvre Vangs mine assayed at FN 1977
7.00	0.68	Dals mine " " " "

5. In trying to find possible bodies along the northern extension of the main mine zone (Grabe and Segen Gottes) a resistivity survey was carried out (Gradient array)

Both CP- and the resistivity survey gave promising anomalies.

Using available geological and geophysical information four drill targets were picked out.

1. Øvre Vang mine
2. Nedre Vang mine
3. Dal mine
4. Resistivity survey anomaly zone.

The drilling was followed up by CP down hole measurements.

Diamond drill hole 9 ended in a tunnel supposedly belonging to the Nedre Vangs mine. This is also indicated by CP down hole measurements.

Diamond drill hole 10 did not hit interesting mineralization, but CP measurements indicate that an edge of the Nedre Vang mine was passed at 120 m.

It was not possible to get an indication of a down plunge extension of the Øvre Vang neither by drilling nor by CP down hole measurement.

After 1977 work at Kvikne Mines it is concluded:

1. Øvre and Nedre Vang mines and Dals mine are of limited size.
2. The hole put down in the resistivity survey anomaly zone gave interesting mineralization (Cpy, py, sph). Future work in the area should be concentrated to this zone.

Geology

For a more detailed introduction to the geology of the Kvikne mines see Report 339/74/20. The enclosed map (scale 1:5000) in this report is based on mapping from 1974.

The main rock units in the mine area are different schist types going from quartz biotite - to quartz sericite schist inter-layered with amphibolite and later intruded by trondhjemite and a small gabbroic body.

Rapid change between the amphibolite and schist types is the normal case. This is also visible in the diamond drill core.

The schistosity is striking NNE/SSW and dipping 20-40° east.

A strong lineation in the plane of the schistosity is defined by parallel arrangements of minerals, boudinage structures, quartz rods etc. The mineralized bodies are orientated parallel to this SE direction.

The mineralized bodies occur in two different horizons. The structurally upper zone includes the main mines (Gabe - and segen Gottes), while the structurally lower zone includes the showings and mines we have been concentrating on in 1977 (Øvre and nedre Vang mine and Dal mine).

The map picture indicates that these two horizons are separated by the main amphibolite zone.

Geophysics

In 1977 the following surveys were carried out:

1. VLF - EM measurements.
2. CP measurements both on surface and down hole.
3. Resistivity survey gradient array measurements in part of the 1977 grid.

VLF - EM survey

The VLF survey was carried out with a Norwegian unit (Paulsen) using station NAA.

Most of the mines and showings were picked up but could not be followed for more than 50-100 m because of the plunge of the mineralized bodies.

CP-measurements

As mentioned in summary and conclusions the three old mines were charged up by means of the CP-method. Technically the survey went well, but there are certain factors which made a limitation to the data obtained and the usage of these.

- 1) The area as a whole is well conductive and gives very little contrast in the data. The cause of this is the rapid change between conductive layers (graphite and mineralized horizons).
2. The relatively steep plunge of the bodies with reference to the terrain.

Apart from the anomalies caused by the body in which the active electrode is grounded - weaker secondary anomalies have been picked up.

Enclosures 6 and 7 show the pattern arising from activating Øvre and Nedre Vang Mine and vice versa. The patterns are very identical, each showing the other as a secondary anomaly. Two other secondary anomalies are also visible on the maps. One on line 850W = 225-250N absolutely identical on both maps. The others are not so clearly displayed on both maps. Activating Øvre Vang gives the best display of the anomaly (675W-400N). Nedre Vang activated is too close to this anomaly and it does not manage to bend the contours enough, but having both maps one can also see the disturbance here. The outcropping of the anomaly was more exactly located later after having drilled DDH9 and one found a mineralization zone between 52.5 and 53.1 m. By activating this another map came out, enclosure 9.

By activating Dals mine a similar story can be told, see enclosure 8. Dals mine itself appears strong together with two-three secondary anomalies (contours expanding). One is already explained by the DDH 9 zone.

The interference between the conducting zones are best made visible on enclosure 10, compilation of CP-measurements.

The method failed to indicate down plunge extension because of the combination of the plunge terrain and surrounding conductors. The drilling was followed up by down hole measurements. This gives good contrasts of separating conductive conductors.

A list of these measurements is enclosed in enclosure 11, 12 and 13. The data clearly indicate that data on the bottom of DDH 9 just above the open shaft belongs to surface data related to Nedre Vangs Mine i.e. the -200 contour. Øvre Vang data in the same hole has the same pattern but different values. This is all repeated by measuring in DDH 10. Øvre Vang seems to have no significant extension but is electrically connected to the Nedre Vang.

Data measured in DDH 11 clearly indicated that the mineralized zone at 40 m is the down plunge extension of the Dals mine.

Resistivity survey (gradient array). In order to find other mineralized bodies along the main mine zone a resistivity survey was carried out using McPhar's IP equipment in the gradient array configuration.

The data are presented in enclosure 14. Data in brackets was not possible to take because of heavy frost. The main mine zone stands out very well as a half circular shaped anomaly limited by the 10-mft contour.

Within these we find the old mines. There are several anomalies on the maps, but two caught our attention. According to data they both seem to suboutcrop on line 400W at about 275N and 420N and trending towards SE. This also coincides with known geological observations. The supposed down plunge extension of the anomaly on 275N was then drilled (DDH 12 300W/375N). The anomaly was found to be caused by a mineralized zone at a depth of 5 m.

Diamond drilling

On the basis of the geophysical survey from 1974 and 1977 and the knowledge of geology and structural development in the area a short diamond drill program was planned and carried out during late autumn 1977.

The main drill targets were to test the down plunge extension of the Vangs- and Dals mines, both giving VLF and CP anomalies, and the resistivity survey anomaly zone at 300W/275N. Drill log data are enclosed. Block diagram shows the relation between DDH 9-10-11 and the Vangs- and Dal mines. The different ore bodies are also tried indicated - this interpretation is based on available geological and geophysical (CP) information. Diamond drill holes 1-8 drilled 1974 (Report 339/74/20).

DDH 9

Put out to test the down plunge extension of the lower Vangs mine. The hole was stopped at 84.2 m where we hit an old shaft. Down hole CP measurements indicated that we had hit the lower Vangs mine at depth.

DDH 10

Put out to test the down plunge extension of the upper Vang mine. The hole was taken down to 144.2 m without hitting any mineralization. CP down hole measurements (charging up both upper and lower Vangs Mines) indicate that a possible mineralized body was passed at 120 m. Most probably an edge of nedre Vang mine.

DDH 11

Put out to test the down plunge extension of the Dal mine. Two mineralized zones were hit; one at 28 m and one at 40 m. CP measurements by charging up Dals mine indicate that the zone at 40 m could be the down plunge extension of this mine.

DDH 12

Put out to test the resistivity survey anomaly zone at 300W/275N. A well mineralized zone occurs at 4.8 m. This is believed to cause the anomaly. Because of loss of core it is not possible to tell the exact thickness of the zone.

U.S. IL 100

U.S. IL 100

CP-measurements in DDH10

Depth down hole in m.	Øvre Vangs Mine ⁽¹⁾		Nedre Vangs Mine ⁽²⁾		Dals Mine ⁽³⁾		DDH9 52.5-53.1 m	
	x)	xx)	x)	xx)	x)	xx)	x)	xx)
0								
5	-239	-539	-153	-453	-162	-462	- 21	-321
10	-238	-538	-154	-454	-163	-463	- 14	-314
15	-235	-535	-151	-451	-161	-461	- 14	-314
20	-235	-535	-149	-449	-161	-461	- 9	-309
25	-233	-533	-148	-448	-161	-461	- 6	-306
30	-232	-532	-147	-447	-162	-462	- 6	-306
35	-227	-527	-142	-442	-154	-454	+ 19	-281
40	-221	-521	-138	-438	-148	-448	+ 43	-257
45	-220	-520	-138	-438	-148	-448	+ 47	-253
50	-219	-519	-137	-437	-145	-445	+ 53	-247
55	-218	-518	-133	-433	-126	-426	+ 97	-203
60	-215	-515	-130	-430	-111	-411	+136	-164
65	-214	-514	-129	-429	-108	-408	+142	-158
70	-210	-510	-125	-425	-111	-411	+138	-162
75	-203	-503	-120	-420	-113	-413	+131	-169
80	-195	-495	-112	-412	-117	-417	+123	-177
85	-143	-443	- 67	-367	-139	-439	+ 76	-224
90	- 94	-394	- 22	-322	-159	-459	+ 33	-267
95	- 68	-368	0	-300	-169	-469	+ 10	-290
100	- 52	-352	+ 14	-286	-174	-474	- 5	-305
105	- 32	-332	+ 33	-267	-181	-481	- 15	-315
110	- 25	-315	+ 49	-251	-185	-485	- 25	-325
115	- 1	-301	+ 65	-235	-188	-488	- 33	-333
120	+ 5	-295	+ 71	-229	-191	-491	- 38	-338
125	- 11	-311	+ 57	-243	-191	-491	- 40	-340
130	- 46	-346	+ 25	-275	-194	-494	- 45	-345
135	-111	-411	- 32	-332	-195	-495	- 54	-354
140	-160	-460	- 71	-371	-196	-496	- 61	-361
145	-164	-464	- 75	-375	-204	-504	- 61	-361

x) field data

xx) normalized contoured data

CP-measurements in DDH11

Depth down hole in m.	Dals mine ⁽³⁾		DDH9 52.5-53.1 m	
	x)	xx)	x)	xx)
0				
5	-82	-382	-16	-316
10	-69	-369	- 6	-306
15	-45	-345	+ 1	-299
20	-22	-322	+ 5	-295
25	- 3	-302	+14	-286
30	+30	-270	+25	-275
35	+49	-251	+29	-271
40	+57	-243	+35	-265
45	+42	-258	+41	-259
50	+16	-284	+46	-254

x) field data

xx) normalized contoured data

A/s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 590W/375N BEARING: DIP 90 HOLE NO 9 SHEET NO 1
LOGGED BY: R. Sivertsen STARTED: FINISHED: 25.10.77 PROPERTY: Kvikne Kopperverk
CASING: 0 TESTS (CORRECTED)
CORE SIZE: 32 mm

From	To	Description
		<u>Summary log</u>
0	17.0	Quartz biotite schist with graphite.
17.0	21.0	Amphibolite (calc silicate)
21.0	29.3	Quartz sericite schist.
29.3	38.0	Quartz biotite schist with some graphite.
		35.4-36.4 Quartzite with 10% sulphides (po, cpy).
38.0	84.2	Interlayered quartzbiotite schist amphibolite (calc silicate) quartz sericite schist
		Sulphides: 52.5-53.1 25% in a quartz rich matrix po, cpy, cph?
	84.2	End of hole.

1/s SULFIDMALM

DIAMOND DRILL RECORD

590W/375N
 LOCATION: _____ BEARING: _____ DIP: 90 HOLE NO: 9 SHEET NO: 2
 LOGGED BY: R. Sivertsen STARTED: _____ PROPERTY Kvikne Kopperverk
 CASING: 0 FINISHED: _____
 CORE SIZE: 32 mm TESTS (CORRECTED): _____

From	To	Description
0	17.0	Quartz biotite schist with garnets.muscovite is common and the content increases downwards. The rock has suffered a strong deformation as shear tight folds porphyroclasts.
17.0	21.0	Amphibolite (calc silicate layers) The upper part is fine grained and laminated, the lower more massive and coarse grained.
21.0	29.3	Quartz sericite schist with biotite porphyroblasts. Garnets occure in varying amounts and size. There seems to be a relation between the content of biotite and garnets - more biotite more garnets.
		22.05-22.1 massive layer of po.
29.3	38.0	Quartz biotite schist eith graphite. 35.4-36.4 Quartsitic layer with a total of 10-15% sulphides including 1% cpy.
38.0	43.8	Amphibolite (calc, silicate) Garnets are common.
43.8	46.5	Quartz sericite schist with biotite porphyroblasts.
46.5	49.5	Calc silicate layers alternating with narrow band of quartz biotite schist.

^{A/s} SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 590W/375N BEARING: _____ DIP: 90 HOLE NO: 9 SHEET NO: 3
LOGGED BY: R. Sivertsen STARTED: _____ PROPERTY Kvikne Kopperverk
CASING: 0 FINISHED: _____
CORE SIZE: 32 mm TESTS (CORRECTED): _____

From	To	Description
49.5	60.1	Quartz biotite schist 52.5-53.2 Quartzitic layer containing 25% sulphides including 1% cpy sph?
60.1	62.4	Amphibolite
62.4	72.2	Quartzbiotite schist
72.2	73.9	Amphibolite (calc silicate)
73.9	78.3	Quartzbiotite schist
78.3	80.2	Calc silicate layers with po at . 78.3-79 } 10% 79.9-80.2 }
80.2	84.2	Quartzbiotite schist with garnets.
	84.2	End of hole:

A/s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 550W/280N BEARING: _____ DIP: 90 HOLE NO: 10 SHEET NO: 1
LOGGED BY: R. Sivertsen STARTED: _____ PROPERTY Kvikne Kopperverk
CASING: 2.5 m FINISHED: _____
CORE SIZE: TT (32 mm) TESTS (CORRECTED): _____

From	To	Description
		Summary log
0	2.5	Overburden
2.5	11.05	Amphibolite
11.05	41.7	Quartzbiotite schist
41.7	66.5	Interlayered amphibolite Quartz biotite schist Quartz sericite schist 63.0-63.4 Po with cpy specks
66.5	144.2	Quartz biotite schist narrow layers of amphibolite and quartz sericite schist.
	144.2	End of hole

A/s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 550W/280N BEARING: DIP: 90 HOLE NO: 10 SHEET NO: 2
LOGGED BY: R. Sivertsen STARTED: PROPERTY Kvikne Kopperverk
CASING: 2.5 m FINISHED:
CORE SIZE: TT (32 mm) TESTS (CORRECTED):

From	To	Description
0	2.5	Overburden
2.5	11.05	Fine grained and laminated amphibolite.
11.05	34.5	Quartz biotite schist. Strongly deformed and banded. Garnets are common. Narrow bands of massive po. at 29.9 and 30-31.
34.5	35.5	Quartz sericite schist with biotite and garnet porphyroblasts.
35.5	40.0	Quartz biotite schist with garnets.
40.0	40.7	Quartz sericite schist with biotite and garnet porphyroblasts.
40.7	41.7	Quartz biotite schist with garnets.
41.7	47.5	Fine grained and laminated amphibolite.
47.5	48.6	Quartz sericite schist with big (1-5 mm) garnets in the lower parts.
48.6	49.0	Fine grained and laminated amphibolite.
49.0	50.0	Quartz biotite garnet schist.
50.0	51.2	Fine grained and laminated amphibolite.
51.2	55.3	Quartz biotite garnet schist.
55.3	60.5	Fine grained and laminated amphibolite.

^A/_s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 550W/280N
 LOGGED BY: R. Sivertsen
 CASING: 2.5 m
 CORE SIZE: 32 mm
 BEARING: _____ DIP: 90 HOLE NO: 10 SHEET NO: 3
 STARTED: _____ PROPERTY Kvikne Kopperverk
 FINISHED: _____
 TESTS (CORRECTED): _____

From	To	Description
60.5	63.4	Quartz biotite garnets schist
		Sulphides: 63.0-63.4 massive Po with cpy specks.
63.4	66.5	Quartz sericite schist with biotite porphyroblasts.
66.5	97.05	Quartz biotite schist with garnets.
97.05	97.7	Fine grained and laminated amphibolite.
97.7	117.5	Quartz biotite schist with garnets.
117.5	118.5	Fine grained and laminated amphibolite.
118.5	140.1	Quartz biotite schist with garnets.
140.1	140.7	Amphibolite.
140.7	143.2	Quartz sericite schist.
143.2	144.2	Quartz biotite schist.
	144.2	End of hole.

A/s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 550W/280N BEARING: DIP: 90 HOLE NO: 10 SHEET NO: 4
LOGGED BY: R. Sivertsen STARTED: PROPERTY Kvikne Kopperverk
CASING: 2.5 m FINISHED:
CORE SIZE: TT (32 mm) TESTS (CORRECTED):

From	To	Description	
		Core angle	
		3.5 m - 65°	Schistosity
		6.1 - 67°	"
		7.2 - 65°	"
		11.1 - 70°	"
		14.3 - 65°	"
		19.4 - 75°	"
		22.4 - 70°	"
		26.7 - 75°	"
		29.8 - 65°	"
		31.2 - 78°	"
		36.9 - 75°	"
		38.5 - 73°	"
		42.4 - 75°	"
		46.3 - 70°	"
		48.9 - 75°	"
		52.8 - 70°	"
		65.9 - 75°	"
		72.4 - 74°	"
		81.2 - 76°	"
		90.7 - 78°	"
		103.4 - 75°	"
		114.5 - 83°	"
		126.7 - 81°	"
		135.6 - 85°	"

^A/_s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 509.5W/419N BEARING: DIP: 90 HOLE NO: 11 SHEET NO: 1
 LOGGED BY: R. Sivertsen STARTED: 1977 PROPERTY Kvikne Kopperverk
 CASING: 0 FINISHED: 1977
 CORE SIZE: 32 mm TESTS (CORRECTED):

From	To	Description
		Summary log
0	12.5	Quartz biotite garnet schist
12.5	24.05	Fine grained laminated amphibolite
24.05	27.4	Interlayered quartz biotite schist and amphibolite
27.4	28.15	Quartzite with garnets and 25% sulphides mainly Po, cpy 1%
28.15	31.0	Interlayered quartzbiotite schist and amphibolite
31.0	34.5	Quartz sericite schist with narrow bands of massive Po.
34.5	35.9	Amphibolite
35.9	39.5	Quartz biotite schist
39.5	40.5	Quartzite with garnets and approx. 20-25% sulphides possibly 1% cpy.
40.5	41.9	Quartz sericite schist
41.9	50.0	Quartzbiotite schist with some graphite
	50.0	End of hole.

A/s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 509.5/419N BEARING: DIP: 90 HOLE NO: 11 SHEET NO: 2
 LOGGED BY: R. Sivertsen STARTED: 1977 PROPERTY Kvikne Kopperverk
 CASING: 0 FINISHED: 1977
 CORE SIZE: 32 mm TESTS (CORRECTED):

From	To	Description
0	1.0	Quartz biotite schist with garnets.
1.0	8.0	Interlayered quartz biotite garnet schist and amphibol garnet schist.
8.0	12.15	Quartz biotite schist with garnets.
12.15	24.05	Fine grained and laminated amphibolite with some garnets.
		20.9-23 fracture zone with clay.
24.05	25.4	Quartz biotite schist with garnets.
25.4	26.7	Interlayered quartz biotite schist and amphibolite - both rock types with garnets.
26.7	28.15	Massive quartzite with garnets.
		Sulphides 25% mainly Po possible 1% cpy, sph?
28.15	29.1	Quartz biotite schist with garnets.
29.1	30.1	Amphibolite
30.1	31.0	Quartz biotite garnet schist
31.0	34.5	Quartz sericite schist with 10 cm massive po with visible cpy at 31.1 and 31.5.

A/s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 509.5W/419N BEARING: DIP: 90 HOLE NO: 11 SHEET NO: 3
LOGGED BY: R. Sivertsen STARTED: 1977 PROPERTY Kvikne Kopperverk
CASING: 0 FINISHED: 1977
CORE SIZE: 32 mm TESTS (CORRECTED):

From	To	Description
34.5	35.9	Fine grained and laminated amphibolite.
35.9	39.5	Quartz biotite schist with garnets.
39.5	40.5	Quartzite with garnets.
		Sulphides mainly Po (massive) with visible cpy (1%) and possible sph.
40.5	41.9	Quartz sericite schist.
41.9	50.0	Quartz biotite schist with some graphite.
	50.0	End of hole.
		Core angles
	4.3 - 65°	Schistosity
	7.8 - 65°	"
	16.1 - 70°	"
	19.8 - 67°	"
	25.9 - 70°	"
	37.8 - 68°	"
	41.9 - 70°	"
	49.2 - 70°	"

^{A/s} SULFIDMALM

DIAMOND DRILL RECORD

300W/275N
LOCATION:
LOGGED BY: R. Sivertsen
CASING: 4.5 m
CORE SIZE: 32 mm

BEARING: DIP: 90 HOLE NO: 12 SHEET NO: 1
STARTED: PROPERTY Kvikne Kopperverk
FINISHED: 1/12-1977
TESTS (CORRECTED):

From	To	Description
		Summary log
0	4.0	Overburden
4.0	5.9	Amphibolite with sulphides from 4.7-5.15. Po, py, cpy, sph.
5.9	29.4	Quartz sericite schist with calc silicate layers.
29.4	54.0	Amphibolite with schist bands.
54.0	68.5	Interlayered quartz biotite schist quartz sericite schist calc silicate layers
		Sulphides: mainly po 60.7-60.8 61.6-61.8
68.5	74.8	Amphibolite
74.8	91.0	Quartz sericite schist with fracture zones at 85.
	91.0	End of hole.

¹/_s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 300W/275N BEARING: DIP: 90 HOLE NO: 12 SHEET NO: 2
 LOGGED BY: R. Sivertsen STARTED: PROPERTY Kvikne Kopperverk
 CASING: 4.5 m FINISHED: 1/12-1977
 CORE SIZE: 32 mm TESTS (CORRECTED):

From	To	Description
0	4.0	Overburden
4.0	5.9	Fine grained amphibolite. Sulphides: a massive band of py rich in sph. from 4.8-4.95? The massive band is enveloped fine dissemination of py, po, sph? from 4.7-5.15. The massive band of py is very granular (sugar like) and core loss taken place.
5.9	24.5	Quartz sericite schist with garnet and biotite porphyroblasts. 9.7-10.4 Calc silicate layer 17.6-18.0 Core loss
24.5	25.6	Calc silicate layer
25.6	27.4	Quartz silicate schist with garnets and biotite porphyroblasts.
27.4	28.0	Calc silicate layer.
28.0	29.4	Quartz sericite schist with garnets and biotite porphyroblasts.
29.4	54.0	Fine grained and laminated amphibolite. Schist layers occur. Garnets are common around 40 m.
54.0	57.7	Interlayered quartz biotite schist and calce silicate layers. Sulphides. 54.4-54.8 massive Po layers.

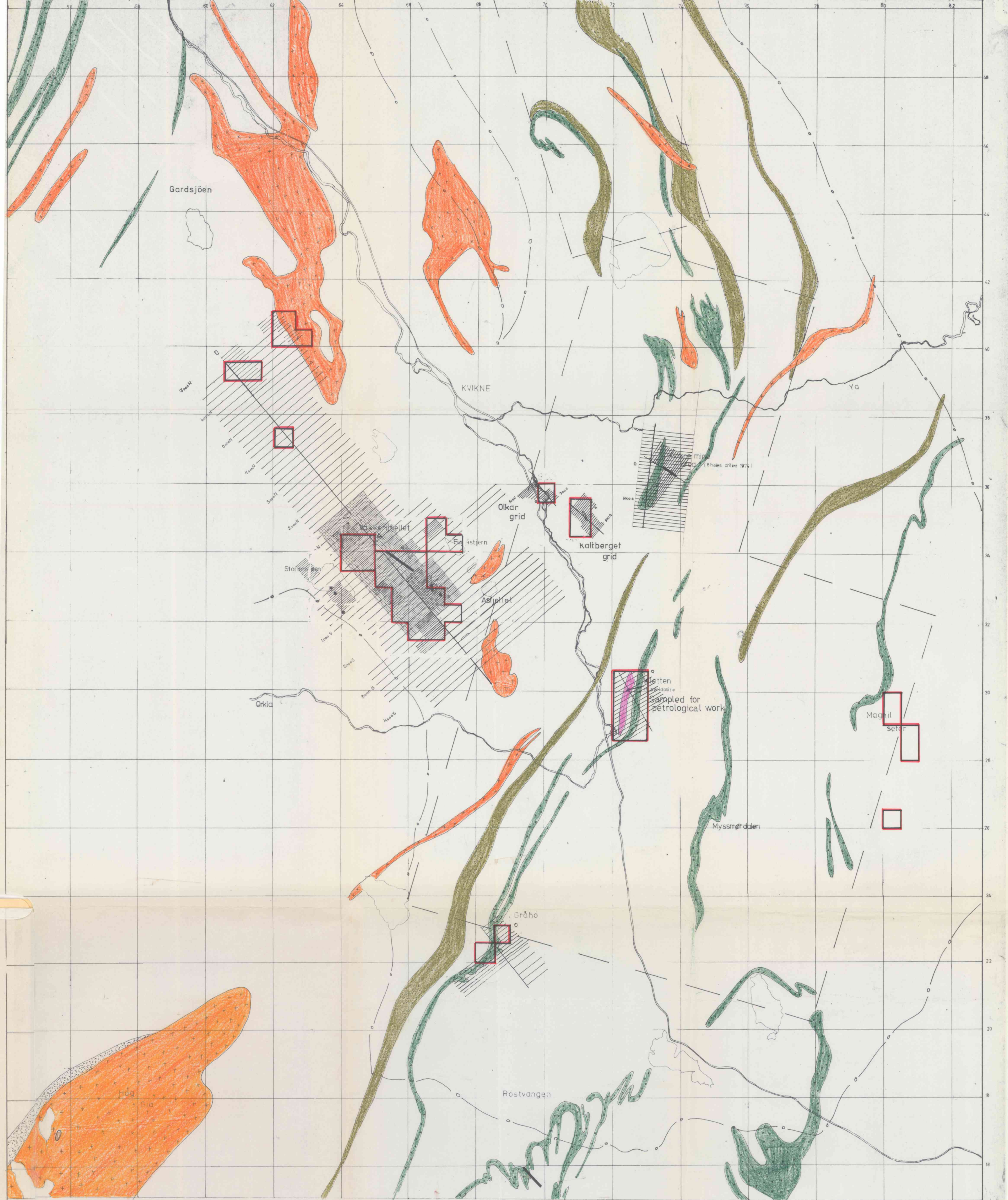
A/s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 300W/275N BEARING: _____ DIP: 90 HOLE NO: 12 SHEET NO: 3
 LOGGED BY: R. Sivertsen STARTED: _____ PROPERTY Kvikne Kopperverk
 CASING: 4.5 m FINISHED: 1/12-1977
 CORE SIZE: 32 mm TESTS (CORRECTED): _____

From	To	Description
57.7	67.7	Quartz sericite schist with garnets and biotite porphyroblasts. Layers rich in po 67.7-60.8 61.6-61.8
67.7	74.8	Fine grained amphibolite with garnets.
74.8	91.0	Quartz sericite schist with garnets and biotite porphyroblasts.
	91.0	End of hole.
		Core angle
	6.4	60° Schistosity
	13.5	60° "
	15.5	60° "
	19.7	62° "
	25.5	67° "
	28.3	70° "
	33.5	65° "
	38.4	65° "
	42.9	64° "
	46.5	67° "
	54.4	75° "
	66.5	73° "
	88.5	80° "

LOCATION	HOLE NO.	BEARING	DIP	LENGTH	MINERALIZATION					REMARKS
					FROM	TO	LENGTH	Cu	Zn	
590W/375N	DDH 9	-	90	84.2	35.4 52.5	36.4 53.1	1.0 m 0.6 m	0.58% 2.00%	400 ppm 1.10%	
550W/280N	DDH 10	-	90	144.2						
500W/410N	DDH 11	-	90	50.0	27.4 39.5	28.15 40.5	0.75 m 1.0 m	0.64% 2.20%	0.17% 0.33%	
300W/275N	DDH 12	-	90	91.0	4.5 4.8	4.8 4.9	0.4 m 0.1 m	0.66% 1.8%	0.6% 10.8%	Uncertain length because of core loss



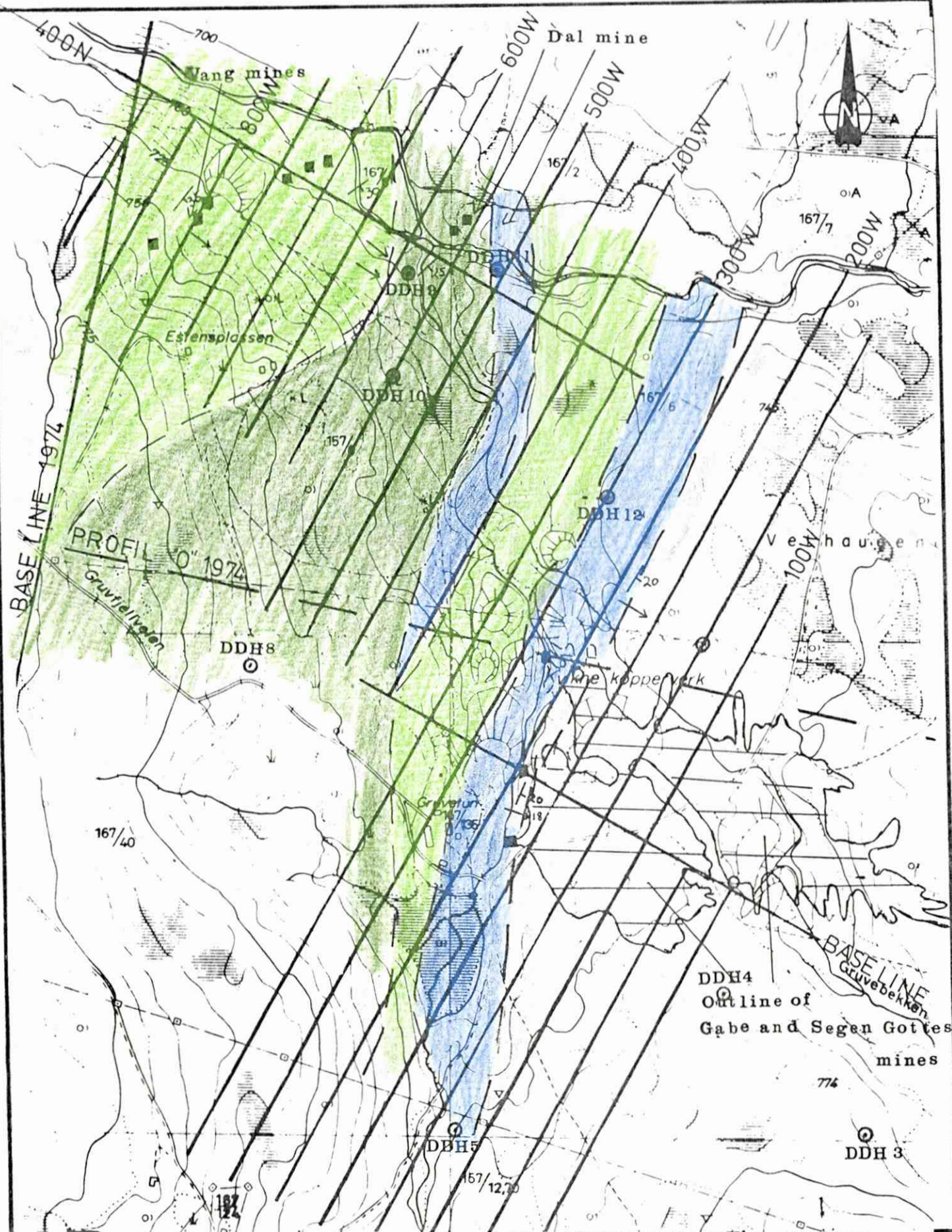
- Greenstone } STÖREN GROUP
- Siltstone }
- Greenstone } GULA GROUP
- Graphite schist }
- Schist }
- Ultrabasic
- Gabbro
- Acid intrusives

- Stream sed sampled area
- Helicopter survey area
- Claim blocks
- Vakkerlien grid summer 1975.
- Vakkerlien grid winter 1976.
- Detailed geophysical grid
- Position and direction of known mineralized bodies

KVIKNE AREA
LOCATION AND SUMMARY

1/5 SULFIDMALM

SCALE	OBS.	O.N.
1:50000	DRAW	R.S.
	TRAC.	R.S.
	CHK.	
MAP NO.		
20-75-A1		
MAP SHEET		



20° Schistosity
 10° Lineation
 Swamp
 Mine opening

Quartz biotite sch.
 " sericite "
 Amphibolite

A/S SULFIDMALM

Kvikne mines

Geologi. DDH

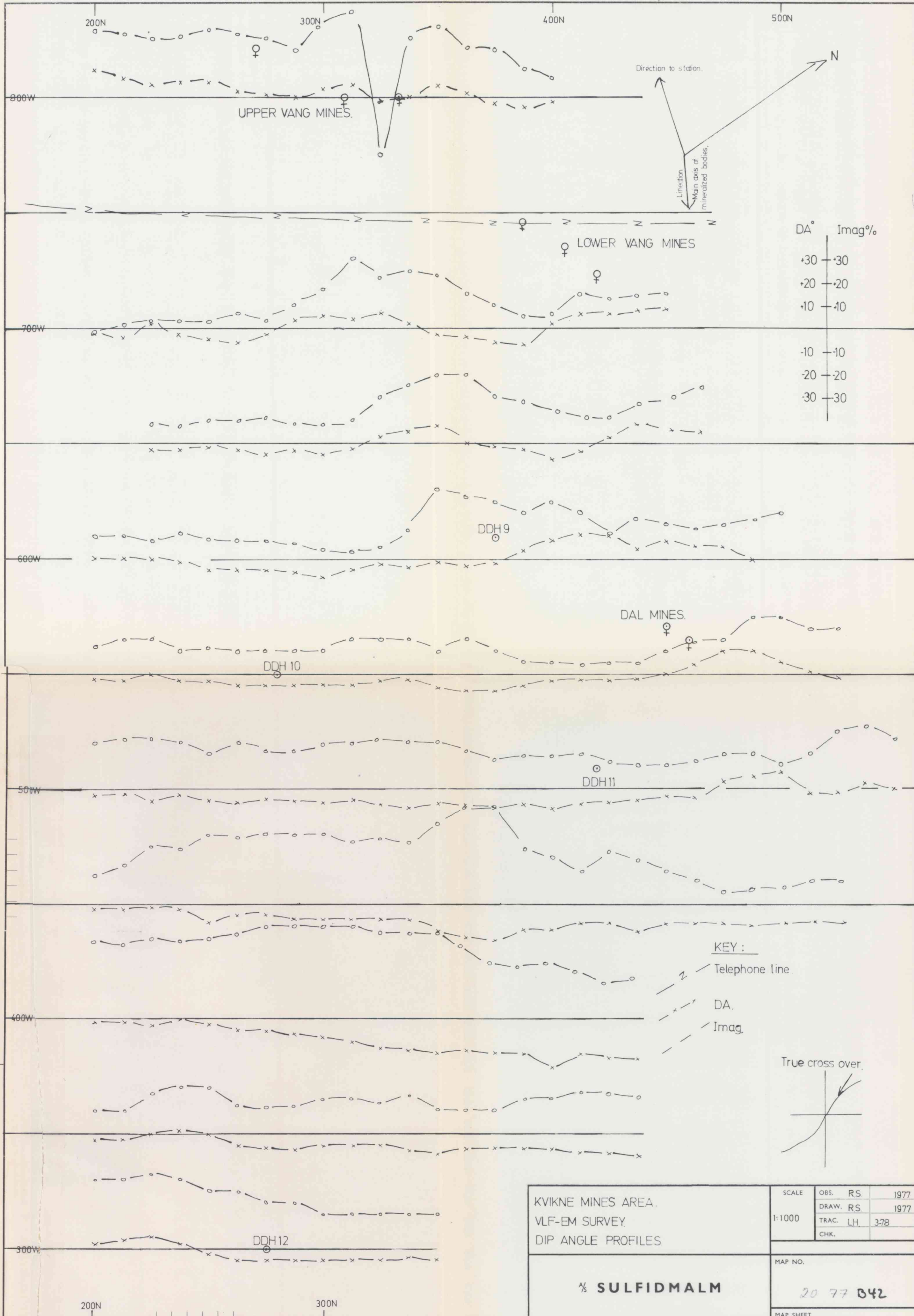
SCALE 1:5000

DRAWN ES

DATE 1.78

TRACED RS

A-1 Terraplot, 2000 A-2, E-9-21, 10-71, Sentrum Trykkeri.

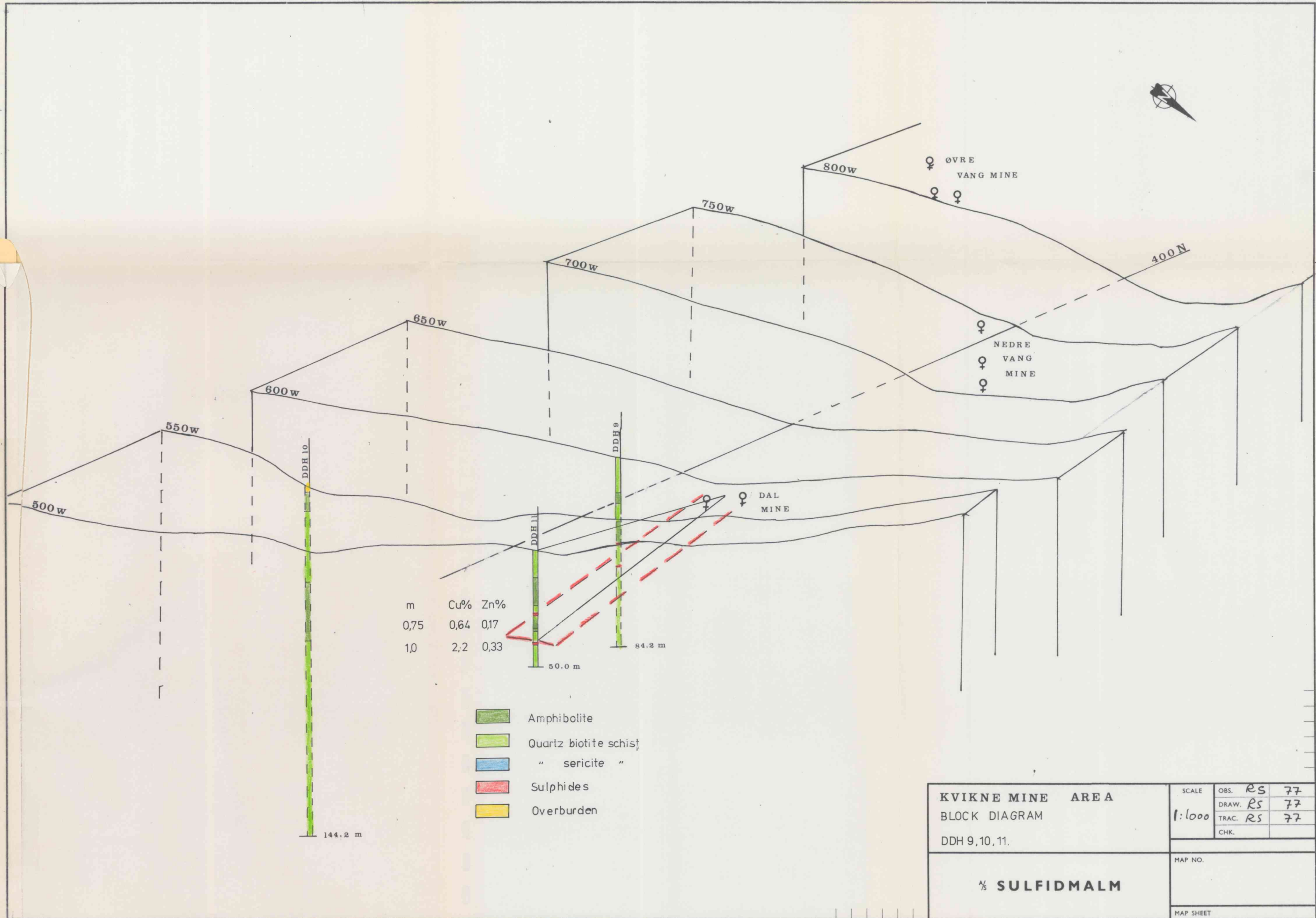


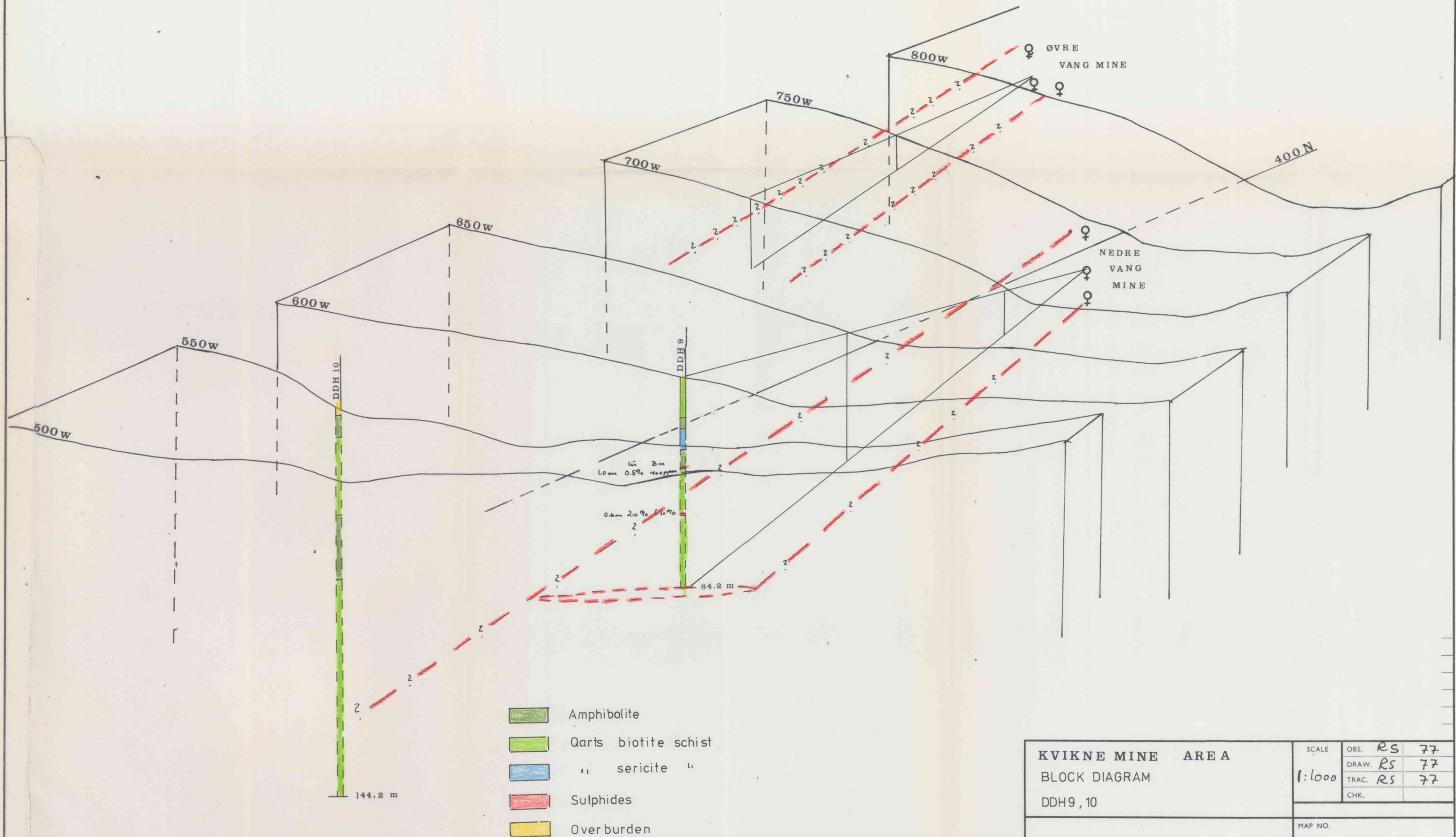
KVIKNE MINES AREA.
VLF-EM SURVEY.
DIP ANGLE PROFILES

% SULFIDMALM

SCALE 1:1000	OBS.	RS	1977
	DRAW.	RS	1977
	TRAC.	LH	378
	CHK.		

MAP NO.
20 77 042
MAP SHEET







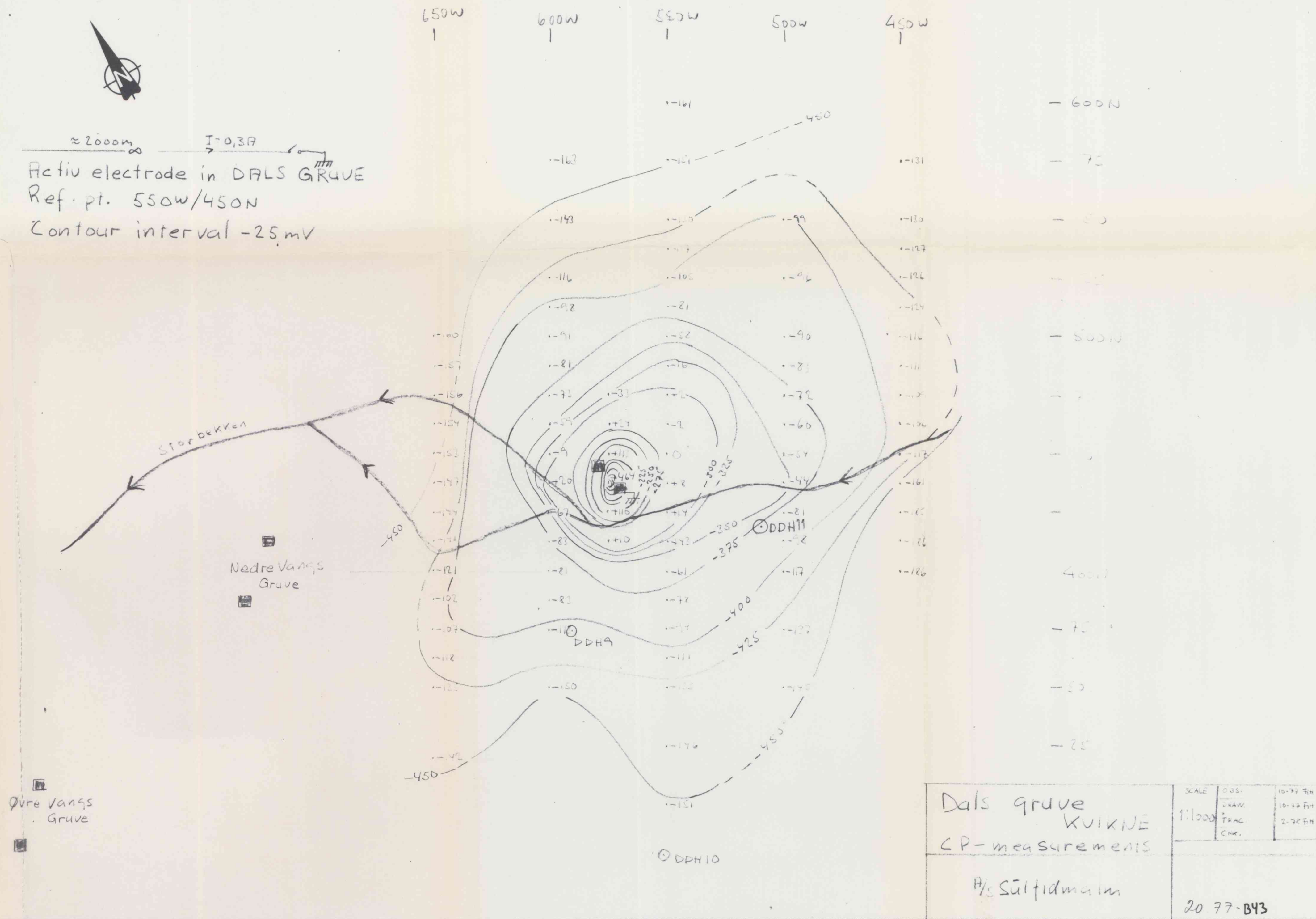
≈ 2000m

I = 0,3A

Activ electrode in DALS GRUVE

Ref. pt. 550W/450N

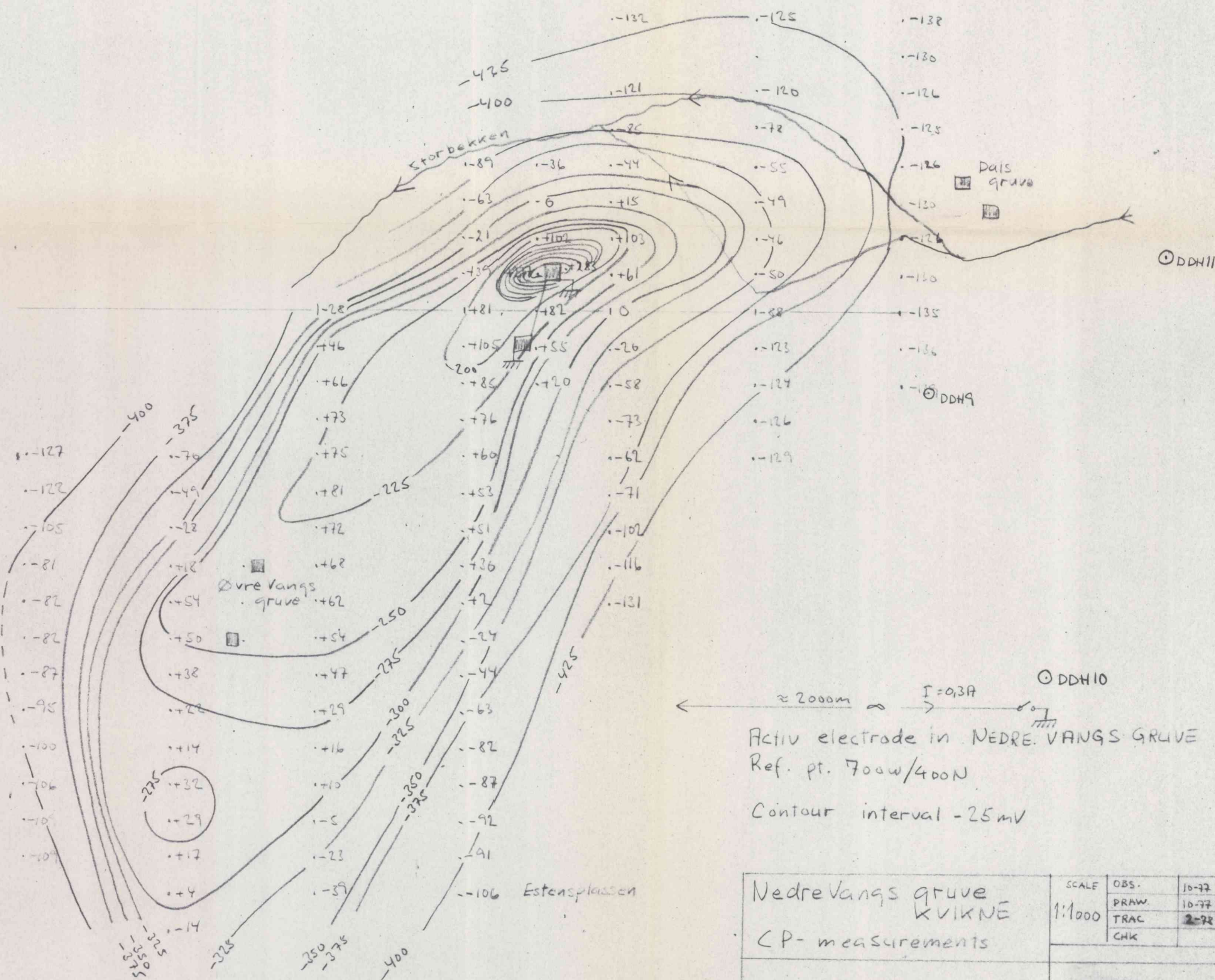
Contour interval -25.mV





900W | 850W | 800W | 750W | 700W | 650W | 600W

500N —
75 —
50 —
25 —
400N —
75 —
50 —
25 —
300N —
75 —
50 —
25 —
200N —



Nedre Vangs gruve KVIKNE CP-measurements	SCALE	OBS.	10-77 FH
	1:1000	PRAW.	10-77 FH
		TRAC	2-72 FH
		CHK	
P/Sulfidmalm		20 77 B46	


$$I = 0,3 A$$

Ref. pt. 800w/300w

Contour interval - 25mV



⊙DDH11

① D D H 9

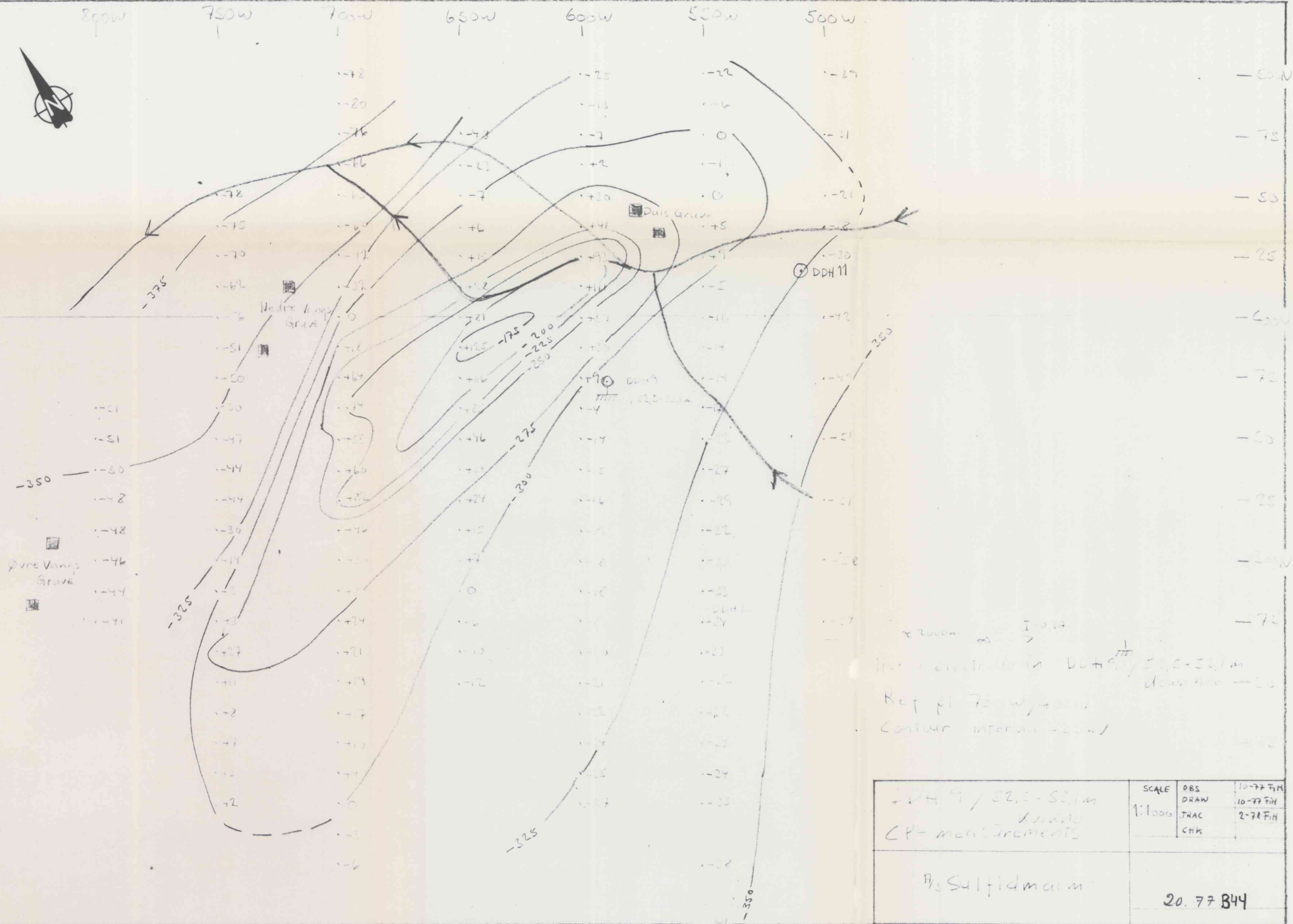
① PDI 10

Øvre Vangs grave
kvikne
CP-measurements

A/S Sulfidmalm

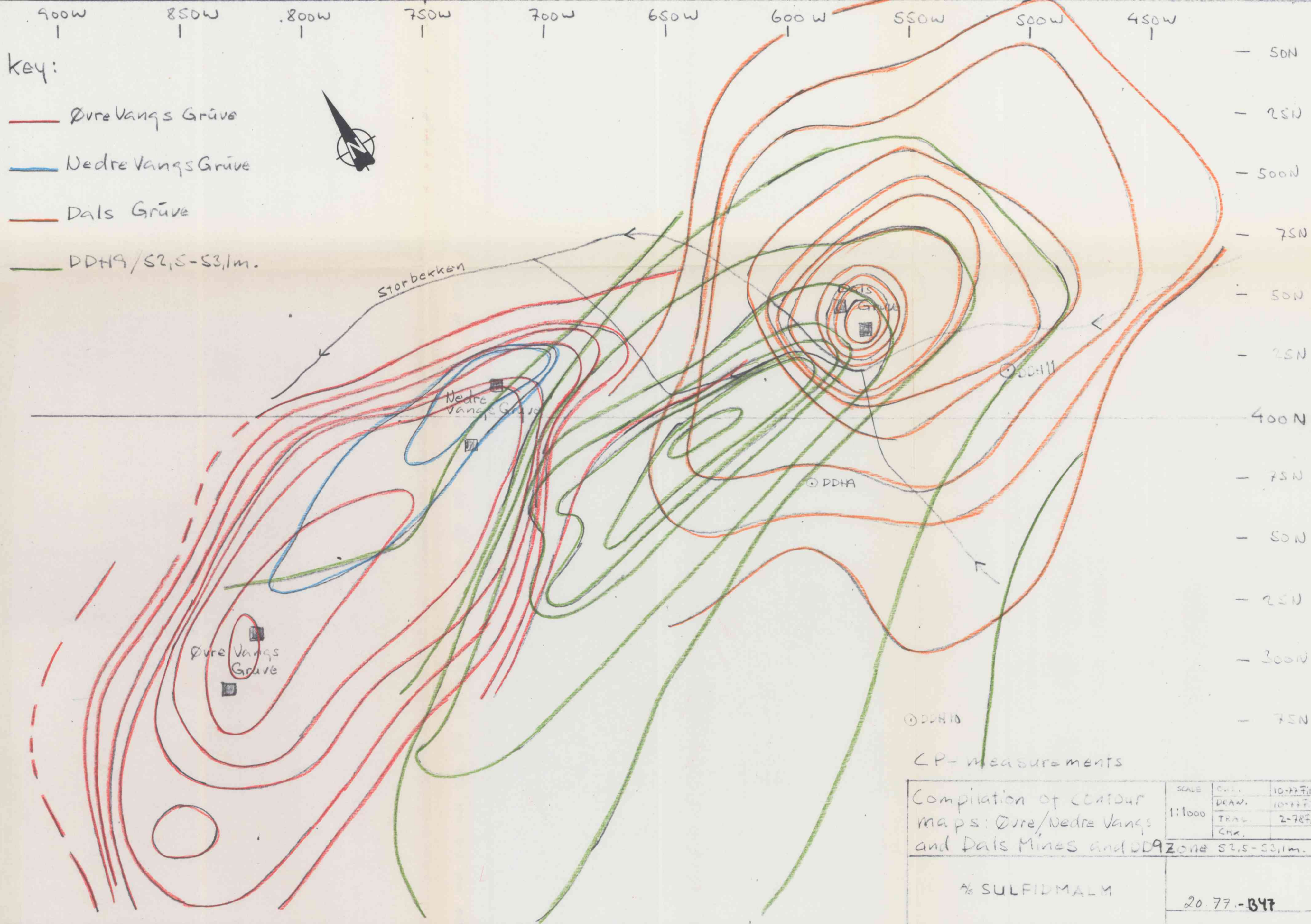
SCALE	OBS.	10-77 FH
1:1000	DRAW.	10-77 FH
	TRAC.	2-78 FH
	CHK.	

20 77 B45

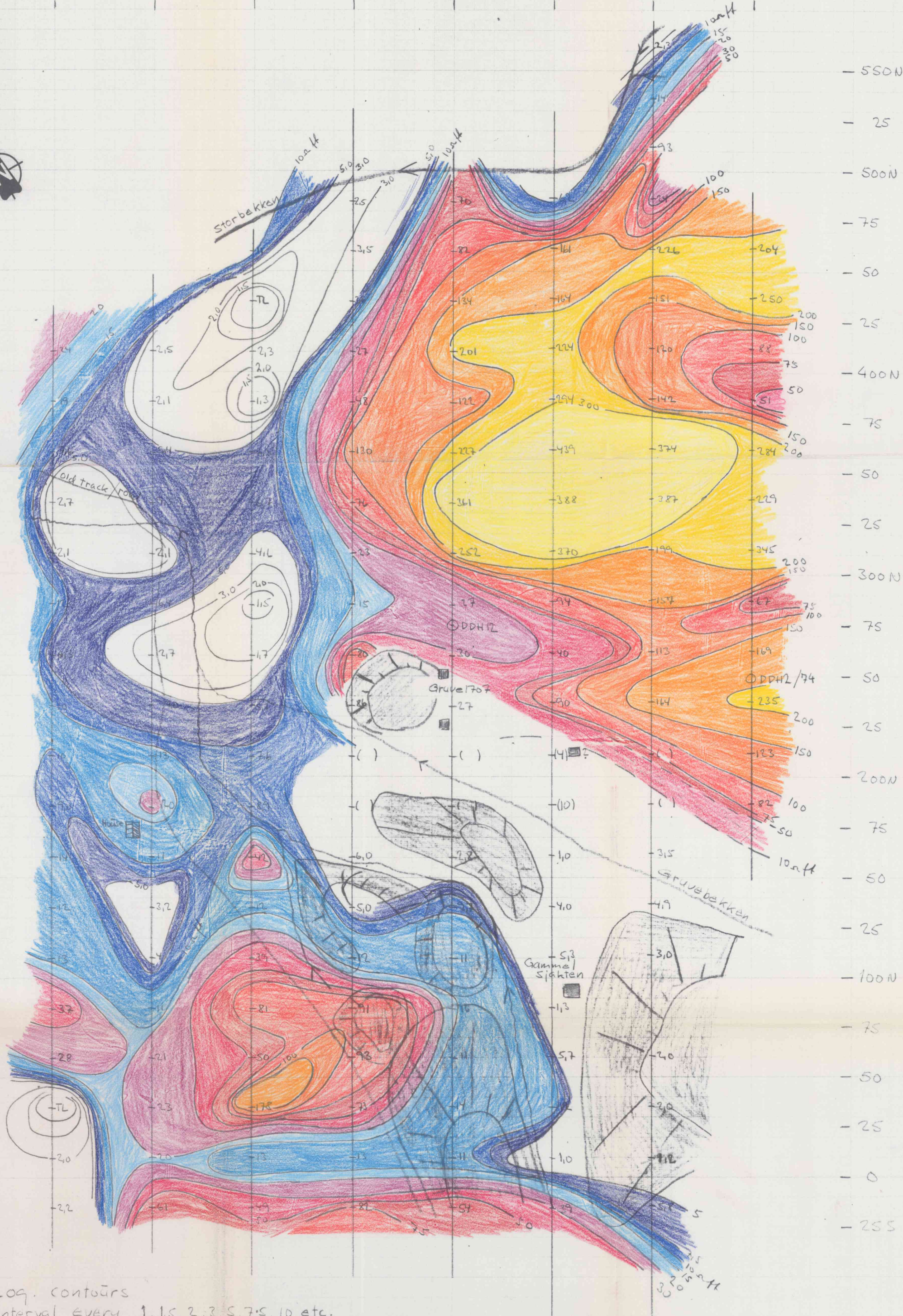


2000m I-0.1A
The elevation in Dais 9 is 52.5-53.1m
down hole - 20
Ref pt 750w, 400w
Contour interval - 25m

Dais 9 / 52.5-53.1m CP - measurements	SCALE	DBS	10-77 F.H.
	1:1000	DRAW	10-77 F.H.
P. Salfidman		TRAC	2-78 F.H.
		CHK	
20. 77 B44			



500w 450w 400w 350w 300w 250w 200w 150w



- $< 5 \Omega \cdot ft$
- 5-7.5
- 7.5-10
- 10-15
- 15-20
- 20-30
- 30-50
- 50-75
- 75-100
- 100-150
- 150-200
- 200-300
- $> 300 \Omega \cdot ft$

Log. contours
Interval every 1, 1.5, 2, 3, 5, 7.5, 10 etc.

Innst.: McPhar IP eqū. Rx P660 ($f=5 \text{ Hz}$)

Kvikne Mine area, KVIKNE
Resistivity survey
Gradient array

4_s SULFIDMALM

$S = 350 \text{ m}$
 $a = 25 \text{ m}$

SCALE	OBS.	11-77 FH
1:1000	DRAW.	11-77 FH
	CHK.	3-78 FH
		20.77. BXB