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Investigations. Megrundstjern area. Espedalen 1976.

Forfatter D Ellen F Nixon M Ryan L Nessvoll F Hansen	Dato 1976	Bedrift Sulfidmalm A/S
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Råstofftype Malm/metall	Emneord Cu Ni	

Sammendrag

Denne har vi to eksemplarer av i Trondheim

3

FOR FALCONBRIDGE NIKKELVERK A/S
A/S SULFIDMALM

Project 905-15

INVESTIGATIONS MEGRUNDSTJERN AREA
ESPEDALEN
1976

By

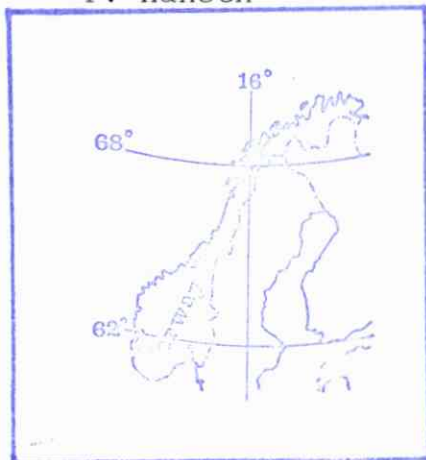
D. Ellen

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M. Ryan

L. Nessvoll

F. Hansen



Report No. 425/76/15

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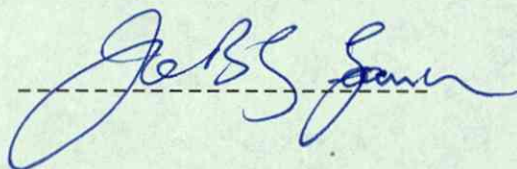
Drill logs

A/S SULFIDMALM
INTER-OFFICE MEMORANDUM

Date: 25th April, 1977 ✓
To: Falconbridge Nikkelverk A/S
cc: W. D. Harrison, H. T. Berry, R. Jahnsen, F. Nixon,
D. Ellen, Norsk Hydro v/N.A. Lenning
From: J. B. Gammon
Subject:

Report No. 425/76/15. Megrundstjern, Espedalen.

Please find attached a summary of the work carried out in 1976 on the Megrundstjern anomaly zone. Metallurgical samples from drill core obtained in this programme gave favourable results (Report No. 426/76/15). A major drill programme is planned for 1977 aimed at elucidating the structural control of, and the extent of, mineralization.



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SECTION A.

SUMMARY

- 1) Drilling totalling 825 meters in 12 holes were drilled on the MG 6/75 zone, discovered in 1975, in the Megrundstjern grid. Drilling was carried out on a mise á la masse anomaly zone measured out from hole MG 6/75.
- 2) Topographic surveying was carried out over the grid.
- 3) Geological mapping was carried out on 1:1000 scale, and the following units recognized:-

a) Ultramafic/feldspathic ultramafic b) Mafic norite c) Norite d) Leucogabbro e) Quartz-bearing schists and gneisses f) Chlorite-Actinolite "grey" schists	Espedalen Basic complex
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- 4) Mineralization was found in 9 of the holes, with variable extent and grade. All mineralization of interest occurred in norite/mafic norite.
- 5) The most interesting intersections were as follows:-

Hole	Min. section	Average Ni%	Average Cu%
MG 12/76	15 m	0.48	0.18
MG 13/76	9 m	0.66	0.22
MG 14/76	1 m	0.46	0.15
MG 17/76	35 m	0.95	0.29
MG 20/76	1 m	0.77	0.22
MG 22/76	2 m	0.45	0.21
MG 23/76	6 m	0.41	0.16

- 6) The results obtained show mineralization which has variable vertical and lateral extent, and shows variation in grade and suggests the presence of several discontinuous well mineralized zones probably structurally controlled and surrounded by disseminated type sulphides.
- 7) Mise á la masse outlines an anomaly length of at least 680 m and further drilling is required to determine the form of the body.
- 8) Mise á la masse surveys also indicate that the disseminated type of mineralization drilled off by the bulk of the 1975 drilling has no connection with the new MG 6 zone now under investigation and lies at a structurally higher level.
- 9) Drilling will continue in 1977.

INTRODUCTION - WORK CARRIED OUT

Results of drilling during the autumn of 1975, especially in one hole (MG 6/75) led to the decision to drill off the area around Megrundstjern.

The grid established in 1972 was relocated and topographically surveyed.

Two mise á la masse surveys were carried out using holes drilled in 1975 as grounding points for the active electrodes. Detailed geological mapping was carried out over the grid. Twelve holes, totalling 825 meters, were drilled in the period July - October before winter conditions prevented further drilling. Down hole mise á la masse surveys were carried out in two periods, first after the completion of MG 16 and later when snow prevented further drilling.

Two samples were sent to Canada for flotation tests.

GEOLOGY

Detailed mapping was carried out in the area from 240N to 840S, 250W to 200E. See enclosure 2.

The following units were recognized:-

- 1) Ultramafic and feldspathic ultramafic rocks
- 2) Mafic norite
- 3) Norite varieties
- 4) Leucogabbro (from drill holes only)
- 5) Chlorite-actinolite "grey" schist
- 6) Quartz-bearing schists and gneisses

1) Ultramafic and feldspathic ultramafic rocks

This group comprises peridotites consisting of dark serpentinized olivine and large pyroxenes up to 3 cms long, sometimes showing a arude alignment. The rocks frequently contain bastite, tremolite and microveins of asbestos. Weathered surfaces are generally brown, while fresh surfaces are dark green. This rock grades into feldspathic ultramafic/mafic norite or spotted mafic norite with increasing feldspar content.

2) Mafic norite

This rock is pyroxene rich and gives a dark greenish weathered surface. It consists of pyroxenes showing bronzy lustre up to 1 cm long. It grades into spotted norite and norite. The spotted mafic norite consists of equidimensional enhedral pyroxenes closely packed in a feldspar matrix.

3) Norite

This group includes typical norite-medium coarse grained pyroxene plagioclase rock grading into leuconorite with increasing feldspar content. The anorthosite has not been recognized in the Megrundstjern area.

4) Leucogabbro

This rock has only been recognized in drill cores, with possible surface outcrops noted - the similarity to the norite making distinction in outcrop very difficult. In drill holes, the rock has distinct chilled margins, and often a sheared lower contact against norite. It consists of about 50% each of mafic and feldspar minerals.

5) Chlorite-Actinolite "grey" schist

This group forms the upper contact to the norite-peridotite complex and consists of chlorite-actinolite-epidote green-schists. The rock shows a strong lineation, either horizontal trending 140, or plunging 15-18° to 300-320.

6) Quartz-bearing schists and gneisses

This group includes a variety of rocks, presumably meta-sediment rafts and screens within the igneous complex. Rocks observed include rusty quartz-graphite schist, quartz-feldspar leucogneiss showing a variety of textures either massive or foliated, mylonitic or porphyroblastic. The massive porphyroblastic quartz-feldspar rock might represent a later stage acid dyke rather than metasediment.

Structure

The structure of the Megrundstjern area is difficult to work out, due to lack of well defined structural elements - the noritic and ultramafic rocks do not show clearly defined primary layering. The ultramafic rocks from lenses within the norite complex. In the stream flowing from Megrundstjern to Espedalsvatn, several shear zones were easily recognized: These can be traced away from the stream by feature mapping and appear to slice up the igneous complex - especially when ultramafic lenses are present - into a series of units bounded by arcuate schistosity zones. The schistosity zones did not appear strongly lineated.

Enclosure 3 shows the large scale structures. From the orientation foliated igneous rocks and ultramafic/norite boundaries it could be that the western half of the map area contains a large synform plunging WNW-NW - however, the evidence for this is scanty and the structure should be considered notional. Support for the idea comes from what few linear structures within the igneous complex which are present - these tend 300-330, as do linear structures in the grey schists of the upper contact.

GEOPHYSICS

Two mise á la masse surveys were carried out. The first survey used MG 6/75 as grounding point for the active electrode, at 39 m. This survey covered profiles totalling 7.5 line kms. Mise á la masse measurements were also made down all drill holes at 5 m intervals.

Results of this survey are shown on enclosure 4. The zone outlined extends from 80N to 600S, with two strongly anomalous areas centered on 0/87.5E and 360S/12.5W. It should be noted that the mV values outside the main zone increase slowly, and leave wide areas with similar values which could suggest other mineralization zones. One of these zones is that tested by a number of drillholes (1-5, 9, 10) in 1975 and is known to contain disseminated sulphides. It should also be noted that mV values in drillholes 1-5 and 9 become lower with increasing depth, suggesting the possibility of sulphides attached to the MG 6 zone at greater depth.

The second survey used MG 3/75 as grounding point for the active electrode at 10 m. This covered a total of about 1 line km after which it was considered that the anomaly was closed off. It can be noted here (see enclosure 5) that the mV values increase rapidly away from the anomaly zone, and also down the drill holes suggesting a sharp boundary at about 30-40 meters depth. The geology of the holes (see report no. 374/75/15) confirms this, with a sharp boundary between mineralized ultrabasic/norite against leucogabbro at about this depth.

It is interesting to note the position of the two *mise á la masse* anomalies with respect to each other, the geology and the VLF anomaly (see summary map enclosure 2). The sharp boundaries of the two anomalies along a near coincident line indicates a geological break, confirmed by mapping as a shear zone, and a new coincident VLF anomaly.

DRILLING

Profile 520S.

5 holes were drilled on this profile, which already contained MG 6/75 (see section 520S). Mineralization was present in holes MG 12, 13 and 14/76. MG 15/76 showed Zn with fine grained barren pyrrhotite and was drilled for the most part in a quartz-feldspar gneiss, seeming to indicate a fault. MG 16/76 also contained barren pyrrhotite and supported a fault theory. In the MG 15 and 16 the core was extremely fractured.

Down hole mise á la masse (enclosure 7) showed good electrical connection between holes 6-14, but a break between these and holes 15 and 16.

Profile 440S.

2 holes were drilled on this profile. Both MG 20 and 21/76 were weakly mineralized (see section 440S). Down the hole mise á la masse (active electrode MG 6/75) shows contours opening to the east, indicating a possibility of better mineralization in this direction.

Profile 340S.

3 holes were drilled on this profile. MG 17/76 was very well mineralized with some sections of near-massive sulphides. MG 22 and 23/76 were only weakly mineralized (see section 340S). Mise á la masse indicates that the good mineralization in hole 17 has no direct electrical connection with the similar type of mineralization in hole 6.

Profile 200S.

2 holes were drilled on this profile. MG 18/76 showed very weak mineralization over 2 m at a depth of 47-49 m, while MG 19 was barren (see section 200S). Mise á la masse contours in down hole measurements open westwards, indicating the possibility of mineralization further west (see enclosure 12).

DISCUSSIONS

Results obtained during 1976 show mineralization in norite over 200 m of the MG 6 mise á la masse anomaly zone, while the rest of the length of the anomaly (480 m) remains to be drilled in detail. In profile 520S, MG 6/75 contains a well mineralized section, while mineralization becomes weaker westwards, extending out 55 m. To the east, a fault cuts off mineralization. In profile 440S holes MG 20, 21/76 contained only weakly mineralized sections, but mise á la masse indicates the possibility of further mineralization to the east. In profile 340S, mineralization is very good in MG 17/76, but very poor to the west. The area east of MG 17 has not been tested yet. The electrical contact with hole MG 6 is no longer direct. It seems probable that the mineralization in hole MG 17 represents mineralization in a vertical or near vertical shear zone.

Two holes drilled further north, on profile 200S, were barren, and mise á la masse suggests drilling should be carried out to the west. The anomaly continues to the north and in this region. The steep terrain may be displacing the anomaly laterally to the east and this must be allowed for in future drilling.

The picture obtained by the drilling carried out shows that the form of the mineralization is complex, and more drilling is required. At present it seems possible that there are pockets of well mineralized rock enclosed in weakly mineralized sections, both laterally and longitudinally. Extent and grade appear to be variable. There are, however, possibilities of a considerable tonnage in the area.

The first priority at present is to determine the shape of the mineralization in the area about hole MG 17. This should provide a basis for further drilling out from this area, along with the use of down the hole mise á la masse. The whole anomaly should be detailed and the extent of the mineralization determined.

7s SOLFIDVALM

DIAMOND DRILL RECORD

LOCATION: 520S/37.5W BEARING: - DIP: 90 HOLE NO: 12/76 SHEET NO: 1
 LOGGED BY: M. Ryan STARTED: 14/7-76 PROPERTY: MEGRUNDTJERN
 CASING: 5.75 m FINISHED: 10/8-76
 CORE SIZE: 33 m TESTS (CORRECTED):

From	To	Description
0	5.75	Overburden
5.75	8.5	Ultramafic rock: 50/50 pyroxene or bastite after pyroxene/serpentinised olivine. Minor po and cp. Joints with dark shiny serpentine, slickensides, streaked with minor sulphides. (6-7 m) large schillerized pyroxene crystals up to 2 cm long, interstitial sulphides and minor sulphide stringers. Pyroxenes elongate ca. 75-70° from core axis. (8 m) ? Brecciated texture.
8.5	10.3	Schistose ultramafic (10 m minus) schillerised pyroxene augen in schistose matrix with sulphide stringers parallel foliation.
10.3	14.2	Green and white schistose metabasite (metanorite); joints coated with sulphides; streaky/augen textured rock. (At 11 m) streaky, schistose meta-norite passes sharply into fine/medium grained foliated metanorite then back into streaky etc. (12-12.6) Very coarse grained - pegmatitic streaky norite. (12.6-13.3) streaky metanorite (13.3-13.5) medium grained norite, sheared contact (13.5-14.2) streaky, foliated metanorite - foliation ca 65° to core axis.

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DIAMOND DRILL RECORD

LOCATION: 520S BEARING: _____ DIP: 90 HOLE NO: 12/76 SHEET NO: 2
 LOGGED BY: M. Ryan STARTED: 14/7-76 PROPERTY: MEGRUNDSTJERN
 CASING: 5.75 m FINISHED: 10/8-76
 CORE SIZE: 35 mm TESTS (CORRECTED): _____

From	To	Description
14.2	19.1	Coarse norite with very minor sulphides. Joints slickensided; pyrite on joints.
19.1	19.8	Ultramafic rock with sulphides, esp. cp. The passage from norite → ultramafite is a rapid, gradational change i.e. normal igneous layering. (At 19.8) 7 cm clot of ca 15% po + cp.
19.8	23.1	Norite, coarse/very coarse. Feldspars recrystallised, milky white → grey.
23.1		(At 23.1) very distinct 8 cm ultramafic layer, 45° to core axis, normal igneous layer with sharp boundaries, sulphides especially at lower edge.
23.1	26.5	Norite with interstitial sulphides important from 26.5 m.
30	-	Norite with interstitial and clots of po and cp - up to 10%. (31.2-31.4) fine grained norite ca. 10% sulphides (32.3) v. coarse grained. (36.1-36.4) coarse grained (ultra) mafic with up to 30% sulphides (36.6-36.7) ultramafic (39.5-40.5) supertinised, schistose (40.5-41.1) v. coarse grained, greenish serpentinised.

^{A/s} SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 520S BEARING: - DIP: 90 HOLE NO: 12/76 SHEET NO: 3
 LOGGED BY: M. Ryan STARTED: PROPERTY: MEGRUNGSTJERN
 CASING: 5.75 m FINISHED:
 CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
		(41.1-) back onto "normal" norite
	45	End of sulphides
		(44.5-45.5)? dyke/vein of fine/medium grained norite.
45	50	"normal" norite without sulphides (At 50.1 - ca. 20 cm? intrusion of fine/medium grained basic rock -? norite) - 45° to core axis.
50	50.9	normal coarse norite without sulphides
50.9	51.3	mafic norite with sulphides
51.3	51.5	v. coarse norite with sulphides
51.5		coarse and v. coarse norite with massive ilmenite clots. 52.0
		At 52.75-90 10 cm? intrusion of fine/medium grained? norite - 45° to core axis.
		At 53.6- .7 schistose norite
		At 53.95 v. thin 2 cm band of fine/medium grained rock, lobate contact with coarse norite, contains sulphide blebs. (Are these fine/med. grained rocks - all at 45° to core axis really intrusions or igneous layers??)
	58.65	
58.65	59.75	58.65-59.75 fine/med. dark intrusions with lath/needle shaped feldspar. Contact ca 25° to core axis, lower contact sheared.

A/s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 520S BEARING: - DIP: 90 HOLE NO: 12/76 SHEET NO: 4
LOGGED BY: M. Ryan STARTED: PROPERTY MEGRUNDSTJERN
CASING: 5.75 m FINISHED:
CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
59.75	66.3	Foliated then schistose norite At 63.25 foliation 55° to core axis At 64.9 brecciation and sulphides
	66.3	End of hole

^A/_s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 518S/53W BEARING: - DIP: 90 HOLE NO: 13/76 SHEET NO: 1
 LOGGED BY: M. Ryan STARTED: 12/8-76 PROPERTY: MEGRUNDSTJERN
 CASING: 4.25 m FINISHED: 16/8-76
 CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
0	4.25	Overburden
4.25	11.6	Dark serpentinitised ultramafic-pyroxenite with olivine. Foliated, sheared etc. Foliation either flat (i.e. 90° to core axis) or 50-60° to core axis. (from 10-11.6, very schistose)
11.6		foliated norite passing rapidly into coarse and very coarse norite with fine/medium and coarse norites "intermingled".
(20.2 - 21.3)		trace sulphides (also 23.3)
25.8	25.9	10 cm fine grained dark rock, 45° to core axis
25.95	26.3	" " " " "
26.9	27.25	" " " " "
29.2	29.5	trace sulphides
	-33.8	(33.8-34.6) foliated norite, then back into coarse and very coarse norite leuconorite.
39.9		At 39.9 trace sulphides - continuous trace sulphides until 47.2 m - interstitial blebs of po and cp in coarse grained dark norite.
		At 49.75 dark serpentinitised, sheared norite followed
	-55.1	by up to 10% sulphides until 55.1 - sheared norite.
55.1	58.9	56.5-56.8 trace sulphides - norite to coarse norite with fine/med. grained facies and sulphides 58.5-58.9.
	58.9	End of hole.

↑ sulphides ↓

1/3 SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 518S/66W BEARING: - DIP: 90° HOLE NO: 14/76 SHEET NO: 1
 LOGGED BY: D. Ellen STARTED: 17/8-76 PROPERTY: MEGRUNDSTJERN
 CASING: 2.70 m FINISHED: 18/8-76
 CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
0	2.70	Overburden
2.70	11.0	Dark ultramafic rock - pyroxene with olivine. Part quite fresh, partly serpentinized, especially on joints, shiny and with slickensides. Some weak foliation at about 45° to axis.
11.0	12.90	Paler schistose rock (intermediate between pyroxenite and norite?) Schistosity first steep (45-60° to core axis) then about 80°.
12.90		Norite, first fine grained weakly foliated, then medium and coarse grained with fine and medium grained "norites" inbetween. Also some aggregations of "felsic" and "dark" minerals (eg. 18.50-19.0) Occasional accessory sulphides.
		27.3-28.0 Dark fine-medium grained "norite" with igneous contacts?
		39.25-40.05-Fine grained norite with igneous contact
		40.70-40.85-Dark norite with trace sulphides.
		41 m norite shows foliation at 75-80° to core axis medium grained. Trace sulphides.
		44 m more massive norite, still medium grained. Trace sulphides.
		48.3 - sulphides trace-5%, generally with more mafic sections.
		53-54.7 5% sulphides
		55.2 sulphides only trace -2%, less mafic norite.

^{A/s} SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 518S/66W BEARING: - DIP: 90 HOLE NO: 14/76 SHEET NO: 2
LOGGED BY: D. Ellen STARTED: 17/8-76 PROPERTY MEGRUNDSTJERN
CASING: 2.70 m FINISHED: 18/8-76
CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
		60.9. From here onwards becomes gradually more mafic, less feldspar, and serpentinitised. Sulphides trace - 2%.
63.5		66.8-69.3. Ultramafic with 1-5% sulphides. Serpentinised, often fractured.
69.3	70.02	Fine grained ultramafic with sharp contact. Barren.
70.2	75.5	Mafic norite going rapidly over into ultramafic rock. Serpentinised and fractured.
75.5		End of hole.

A/s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 520S/13.25E BEARING: - DIP: Vert. HOLE NO: 15/76 SHEET NO: 1
 LOGGED BY: D. Ellen, M. Ryan STARTED: 23/8-76 PROPERTY: MEGRUNDSTJERN
 CASING: 2.7 m FINISHED: 25/8-76
 CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
0	2.70	Overburden
2.70	20.20	Quartz-feldspar gneiss. Bluish-grey quartz and white-grey feldspar varying between 25/75 and 50-50 quartz-feldspar. Small stringers/veinlets with sulphides (<1%) Dark green chlorite Some parts schistose with horizontal foliation
		10.40 From here onwards ⁺ pale pink garnet py. pyt. cpy. smeared on joints.
20.20	20.95	Whitish-grey quartzite with chlorite clots. Very fine grained.
20.95	33.60	Quartz-feldspar gneiss - medium grained py, on joints 22 m - coarse grained Foliation becomes 20-25° then 45° More schistose from 27 m
33.60	34.30	Massive grey fine grained dolerite with lath-like feldspars
34.3	40.0	Schistose quartz-feldspar rock-quartz content lower and sometimes absent. Chlorite and pale pink garnets
40.0	43.8	Dark basic gneiss with garnets Feldspar: mafics 50:50 Possibly interstitial quartz (? was qtz gabbro?)
43.8	44.1	Chilled contact rock.

DIAMOND DRILL RECORD

From	To	Description
44.1	51.0	Green-grey feldspar and blue-grey quartz rock.
		44.3 - fine grained variation
		44.7 - Garnetiferious gneiss with sulphides (trace)
		45.75- Sheared, with sulphides in shear zone
		46.0 - Garnet gneiss - quartz content increases
		48.0 - Quartz garnet feldspar gneiss - becomes very schistose at 48.25 60° foliation
		50.0 - Very schistose - chlorite schist 45° schistosity
		50.40-50.50 Fracture zone
51.0	52.7	Basic rock - schistose gabbro/norite
		52.6 - Gabbro/norite
		52.7 End of hole

^A/_s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 533S/36W BEARING: N48°E DIP: 50° HOLE NO: 16/76 SHEET NO: 1
 LOGGED BY: D.Ellen, F.Nixon STARTED: 30/8-76 PROPERTY: MEGRUNDSTJERN
 CASING: 5.40 m FINISHED: 3/9-76
 CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
0	5.40	Overburden
5.40	25.70	Ultramafic rock: 50/50 pyroxene or biotite after pyroxene/serpentinised olivine. Trace-2% sulphides (po) Joints with dark shiny serpentine, slickensides, streaked with minor sulphides. Brown hypersthene especially 20-23.5. Generally very fractured.
25.70	30.60	Contact zone - feldspar content increases to give noritic rock with 1% sulphides. 28 m. Sheared zone with talc and serpentine 28.50-28.65 5% sulphides
30.60	52.20	Norite - sheared down to 31.0 m 30.60-31.0 2-5% sulphides in stringers 31.0 Specks - 2% sulphides 32.0 Sulphide blebs 32.5, 33.9 1-2 cm thick dark fine grained ultramafic bands 33.9-34.60 Fine grained norite 34.60-37.7 Coarse grained norite 37.7-38.0 Fine grained norite 38.0 Coarse grained norite 40.0 Dominantly coarse grained norite with feldspar aggregates, sulphide specks 43.10-43.20 Shear zone with serpentine 44.75-44.95 Finer grained more basic norite with fine grained disseminated pyrrhotite 2-3% Fracture zones 40.2-40.3, 41-41.3, 44.5-44.7, 46.5-46.75. 49.5 2-5% disseminated pyrrhotite associated with finer grained more basic norite - sheared.

1/5 SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 533S/36W BEARING: N48°E DIP: 50° HOLE NO: 16/76 SHEET NO: 2
 LOGGED BY: D.Ellen. F.Nixon STARTED: 30/8-76 PROPERTY MEGRUNDSTJERN
 CASING: 5.40 m FINISHED: 3/9-76
 CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
52.20	52.43	Younger fine grained light grey intension with norite xenoliths
52.43	66.60	Norite-specks-1% pyrrhotite associated with more basic parts of norite. Occasional fine grained stringers Very fine grained.
		54.15 Grey dyke with pink garnets (?) 5 cm thick
		54.20 Sulphides become more abundant down to 55.3
		2-3% fine grained disseminated pyrrhotite
		55.3 More basic down to 58.10 - Dominantly basic
		20% sulphides, with some massive fine grained disseminated pyrrhotite.
		Sheared from 58.0 m.
		58.6 -58.65 Fine grained dyke-dolerite
		58.65-59.7 Sheared norite
		60.0 Medium grained norite
		60.50 15 cm feldspar rich norite
		60.65 20 cm basic norite
		61.65 Coarse grained norite with feldspar rich and basic segregations
		62.0 Norite
		64.15-64.25 Coarse norite, jointed
		64.4 -64.7 Fine grained basic dolerite intension
		64.7 Jointed fractured norite
66.60	73.5	Quartz-feldspar garnet rock. Contact not visible
73.5		End of hole.

^A/_s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 341S/7W BEARING: - DIP: 90° HOLE NO: 17 SHEET NO: 1
 LOGGED BY: D. Ellen STARTED: 7/9-76 PROPERTY: MEGRUNDSTJERN
 CASING: 1.90 m FINISHED: 8/9-76
 CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
0	1.90	Overburden
1.90	8.60	Leucogabbro: approx. 50/50 mafics:feldspar Coarse first, from 6.70 grain size decreases down to 8.60 in chilled margin.
8.60	8.72	Talc chlorite schist grading into
8.72	9.00	Schistose norite, medium grained
9.0	9.10	Fine grained basic intensive
9.10	9.85	Sheared norite
9.85	11.45	Fine to medium grained schistose norite
11.45	20.05	Sheared norite becoming less sheared downwards Sulphides present - pyrrhotite, chalcopyrite. Content varies between 1-5% with thin richer zones between 11.75-11.90 and 12.05-12.10 (15%)
20.05	20.17	Fine grained sheared norite - barren
20.17	21.35	Schistose norite with specks to 3% sulphides
21.35	21.60	Fine grained dolerite intension
21.60	22.80	Medium grained schistose norite with specks to 3% po.
22.80	24.10	Norite with 1-4% sulphides.
24.10	24.80	Fine grained basic intrusive in half core 24.10-24.40 then whole core to 24.80
24.80	57.75	Coarse grained norite with 1-3% sulphides 29.0 - ca. 5% sulphides 33.85-34.0 ca. 50% sulphides 34.0 1-10% sulphides

^A/_s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 341S/7W BEARING: - DIP: 90° HOLE NO: 17 SHEET NO: 2
 LOGGED BY: D. Ellen STARTED: 7/9-76 PROPERTY: MEGRUNGSTJERN
 CASING: 1.90 m FINISHED: 8/9-76
 CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
		(po.cpy.pt) Sulphide content
		35.8-36 ca. 15%
		37.55-37.70 Dark norite 36 -42 10-20%
		40 -41 10%
		41 -42.4 10-15%
		42.4-43 70-80%
		43 -48.2 15-20%
		48.2-49.3 50-60%
		49.3-52 20%
		52 -56 20-30%
		56 -59.4 10-20%
57.75	70.0	Schistose norite 59.4-59.5 80%
		59.5-63.0 5-15%
		66.7 } 2-3 cm thick 63.0-68.0 5-10%
		67.15 } ultramafic lens, sulphide rich
		68.10-68.12 } Basic intru- 68 -69 5%
		68.35-68.40 } sive 69 - trace sulphides
		69.5 -69.55 Ultramafic
		69.8 Very schistose norite
70.0	71.60	Medium grained olivine gabbro/peridotite Sulphide specks.

^A/_s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 189S/51E BEARING: - DIP: Vert. HOLE NO: MG18/76 SHEET NO: 1
 LOGGED BY: D.Ellen STARTED: 16/9-76 PROPERTY: MEGRUNGSTJERN
 CASING: 2.50 m FINISHED: 23/9-76
 CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
0	2.50	Overburden
2.50	2.75	Fine grained norite
2.75	3.93	Norite
3.93	4.70	Fine grained basic intrusive
4.70	5.20	Norite
5.20	6.50	Fine grained basic intrusive
6.50	7.0	Norite
7.0	7.70	Fine grained basic intrusive
7.70	9.0	Norite which goes over into medium grained basic/ultra- basic rock.
9.00	20.00	Basic/ultrabasic with trace to 3% sulphides, sometimes as large blebs up to 10 mm x 20 mm. Mineralized to 19.
20.00	20.70	Basic norite
20.70	23.15	Norite
23.15	24.00	Basic norite
24.0	26.18	Norite
26.18	31.00	Leucogabbro with chilled margins 26.18-27.10, 30-31.0
31.00	33.00	Schistose norite
33.00	50.00	Med-coarse grained norite with feldspar aggregates 47-48.75 more basic norite tr-1% sulphides. ilmenite
50.00	50.1	Fine grained basic intrusive with sharp contacts
50.10		Schistose norite especially 52.5-53. Accessory ilmenite 59.5-60.10 Coarse norite with feldspar aggregates 60.10-79.63 Weakly foliated norite (30-45° core angle) with some shear zones. Medium grained with some coarse and some more basic sections.
79.63	88.75	Medium grained basic-ultrabasic rock 81.45p81.64 90% feldspar
88.75	89.6	Coarse grained basic rock with feldspar aggregates
89.6	90.70	Basic-ultrabasic rock
	90.70	End of hole.

^{A/s} SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 196S/63.5E BEARING: - DIP: 90° HOLE NO: MG19/76 SHEET NO: 1
LOGGED BY: D. Ellen STARTED: 24/9-76 PROPERTY: MEGRUNDSTJERN
CASING: 3.0 m FINISHED: 29/9-76
CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
0	3.0	Overburden
3.0	19.0	Basic to ultrabasic rock with 0-2% pyrrhotite Below 10 m large feldspars in dark medium grained matrix.
19.0	25.10	Leucogabbro with fine margins and coarse center
25.10	50.25	Norite - first sheared, then coarser, intersected by basic intrusions at 29.4 (45 cm) 30.6 (10 cm) 36.6 (20 cm) Sheared at 40.55 41.5, 41.55 41.9 From 43.1 generally sheared
50.25	57.7	Basic/ultrabasic rock
57.7		End of hole

^A/_s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 442S/12.5W BEARING: - DIP: 90° HOLE NO: MG20/76 SHEET NO: 1
 LOGGED BY: D. Ellen STARTED: 30/9-76 PROPERTY: MEGRUNDSTJERN
 CASING: 2.45 m FINISHED: 6/10-76
 CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
0	2.45	Overburden
2.45	4.30	Pyroxenite - rusty - fractured coarse grained
4.30	19.00	Sheared schistose ultrabasic with trace sulphides 8.70-12.35 Very basic sheared norite/pyroxenite 12.35 Fine-medium grained sheared norite/ 0-5% po in shears.
19.00		Foliated norite 21-22 m 5% po in shears
24.30	47.2	Medium - coarse grained basic norite, feldspar rich from 25.60 and coarser. 31.40 Coarse norite with 1-2% disseminated fine grained sulphides and magnetite 35.4-36 5% sulphides 37- Medium grained dark norite with fine grained disseminated sulphides 1-5%
47.2	47.76	Fine grained basic intrusive
47.76	65.2	Medium grained dark norite with trace -1% fine grained sulphide disseminations
65.2	70.8	Fine grained dark basic rock with sharp igneous contact Becomes coarser
70.8		End of hole

DIAMOND DRILL RECORD

From	To	Description
0	2.30	Overburden
2.30	21.20	Coarse grained pyroxenite, fractured to 5.30 5.80- 5.90 Schistose pyroxenite 13 -14 trace po 19.40 Becomes sheared and schistose
21.20	66.2	Schistose/sheared norite to 26.30 0-5% po 26.30 5 cm basic band then coarse grained norite 23.15-35.35 Very coarse grained norite 35.50 trace po - 1% tr-5% down hole
66.2	68.5	Basic intrusive - sharp igneous contact, fine grained, becomes coarser
68.5		End of hole.

A/s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 340S/17W BEARING: - DIP: 90° HOLE NO: MG22/76 SHEET NO: 1
 LOGGED BY: D. Ellen STARTED: 7/10-76 PROPERTY: MEGRUNGSTJERN
 CASING: 3.0 m FINISHED: 11/10-76
 CORE SIZE: 35 mm TESTS (CORRECTED):

From	To		Description
0	3.0	3.0	Overburden
3.0	9.15	6.15	Leucogabbro - first medium grained (2-3 mm) becoming finer from 6 m down to contact at 9.15 m. Some sulphides near contact.
9.15	70.10	60.95	Sheared norite with ca. 2-5% pyrrhotite, chalcopyrite and pentlandite
			9.20- 9.30 Basic intrusive
			20.05-20.20 Basic intrusive
			22.3 - Coarse grained norite with grainsize from 3-20 mm. trace - 5% sulphides, but mineralization weak.
			24.6 -24.85 Basic intrusive
			From 30 ca. 5% sulphides as coarse blebs with visible pentlandite
			31.4 -31.6 Basic intrusive
			32.75-33.10 Basic intrusive
			39.65-40.45 Basic intrusive
			41.2 -42.8 Basic intrusive and norite - drilled along contact
			56 m Norite sheared, ca. 5% sulphides, graphite
			66.5 Extremely sheared
			67 Trace sulphides to barren
70.10			End of hole.

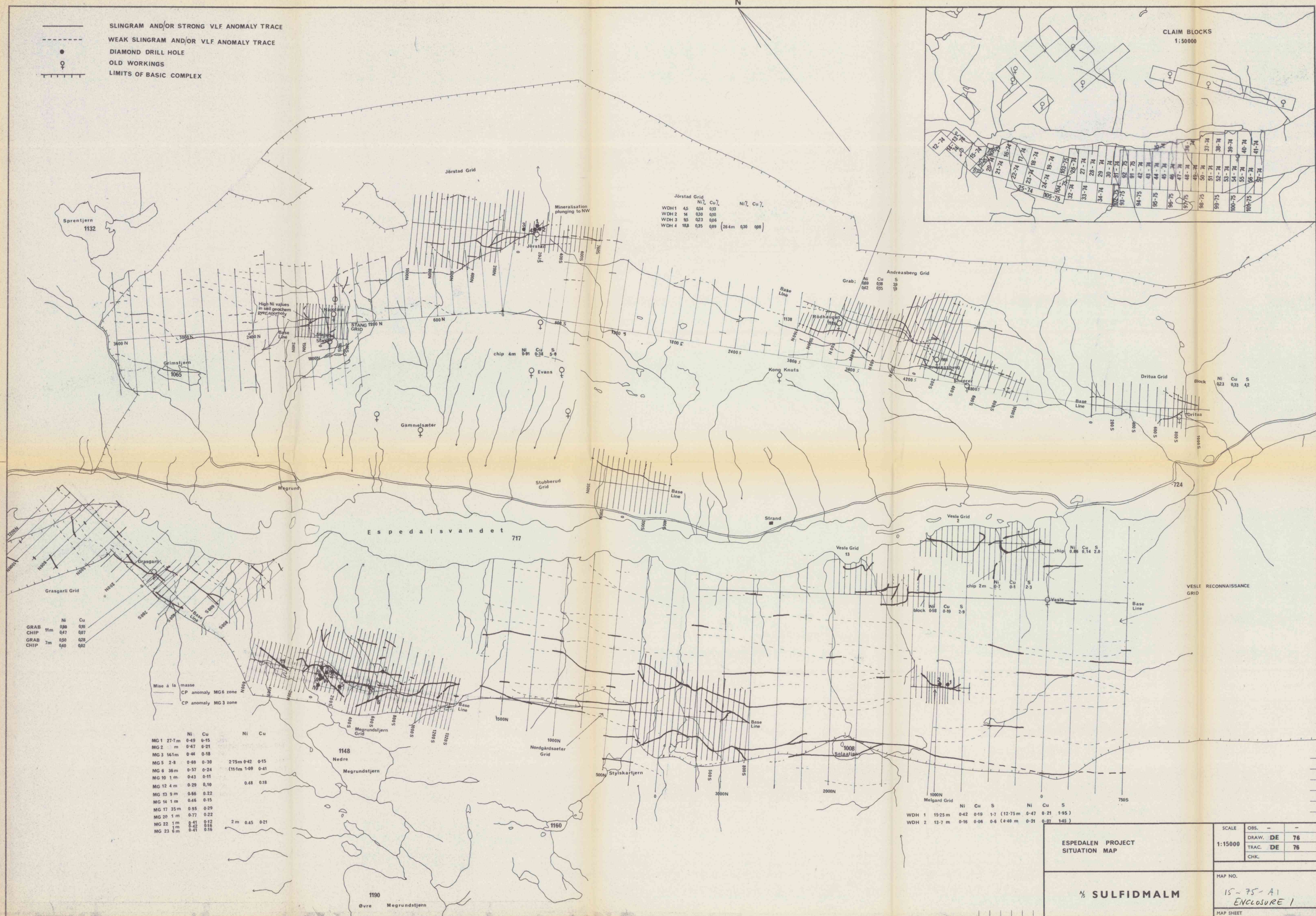
A/s SULFIDMALM

DIAMOND DRILL RECORD

LOCATION: 340S/29W BEARING: - DIP: 90° HOLE NO: 23 SHEET NO: 1
 LOGGED BY: D. Ellen STARTED: 12/10-76 PROPERTY: MEGRUNDSTJERN
 CASING: 4.0 m FINISHED: 13/10-76
 CORE SIZE: 35 mm TESTS (CORRECTED):

From	To	Description
0	4.0	Overburden
4.0	10.0	Leucogabbro, first medium grained, becoming finer down to contact.
10.0	70.70	60.70 Fine-medium grained sheared norite with trace - 2% sulphides, becoming 5% from 11 m - 17 m. 2-3% sulphides from 17 m. From 23 m trace - 1% sulphides 25.3 Coarse grained norite, occasional sulphide blebs. 0.1 30.15-31.25 Basic intrusive 0.9 38.10-39.0 Basic intrusive 45.4 Finer grained norite, sheared Ca. 5% sulphides 46.1-46.3, 47-47.3 Coarse norite from 50 m 1-2% sulphides 56 m Sheared norite, trace sulphides 59.3 m Coarse grained norite, barren trace - 1% 65-68 m. 70.25 Basic dark sheared norite with occasional sulphides in shears.
70.70		End of hole.

SLINGRAM AND/OR STRONG VLF ANOMALY TRACE
 WEAK SLINGRAM AND/OR VLF ANOMALY TRACE
 DIAMOND DRILL HOLE
 OLD WORKINGS
 LIMITS OF BASIC COMPLEX



Jörstad Grid

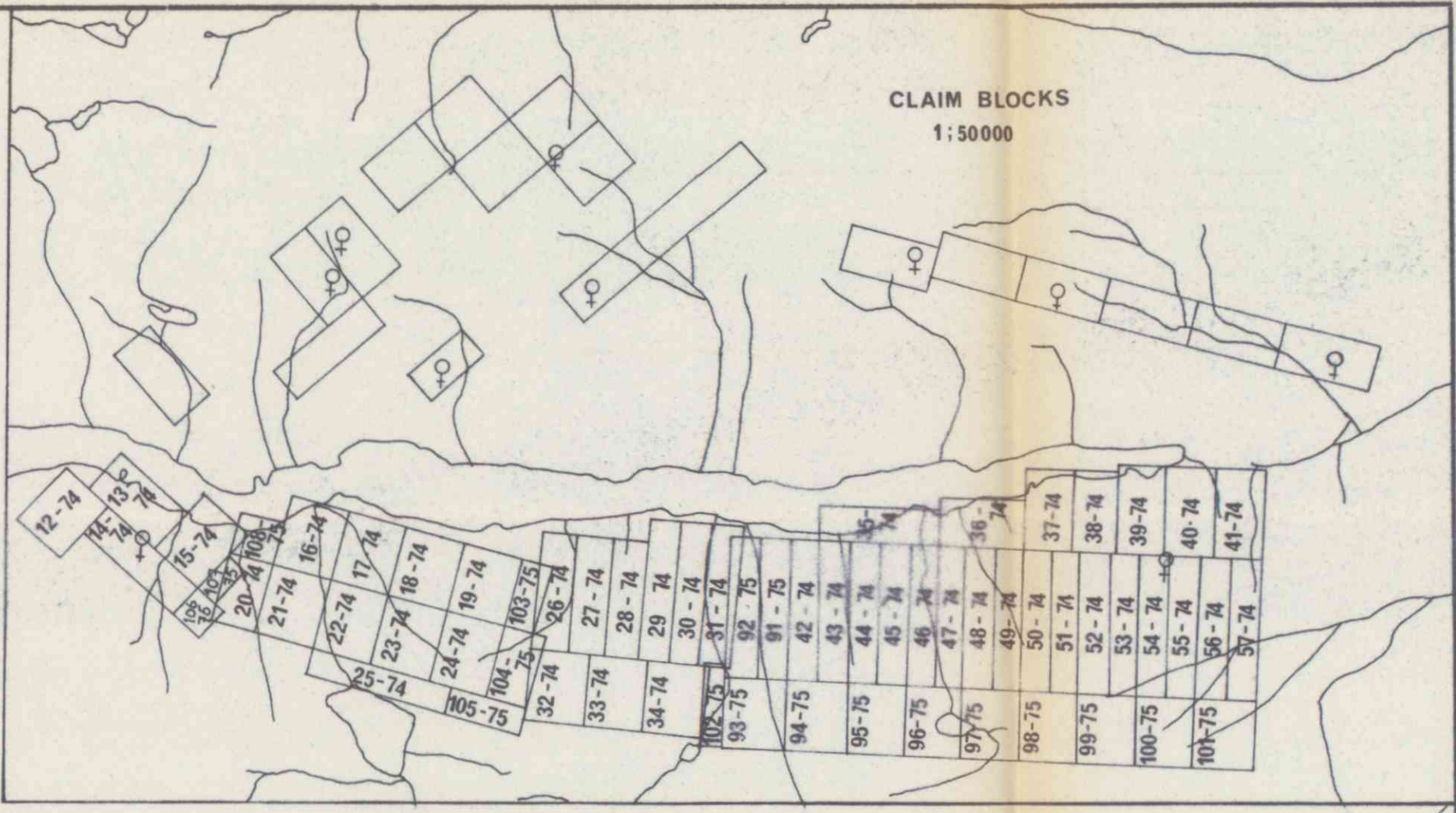
	Ni%	Cu%	S
WDH 1	45	0.34	0.13
WDH 2	14	0.30	0.10
WDH 3	85	0.23	0.06
WDH 4	18.8	0.35	0.09

(28.4m 0.30 0.08)

Andreasberg Grid

	Ni	Cu	S
Grab	889	0.18	38
	042	0.15	19

CLAIM BLOCKS
1:50000



GRAB

	Ni	Cu
GRAB 11m	0.90	0.10
CHIP 0.47	0.07	
GRAB 7m	0.50	0.28
CHIP 0.40	0.02	

Mise à la masse

	Ni	Cu
MG 1 27.7m	0.49	0.15
MG 2 m	0.47	0.21
MG 3 141m	0.44	0.18
MG 5 2.8	0.59	0.30
MG 6 36m	0.57	0.24
MG 10 1m	0.43	0.11
MG 12 4m	0.29	0.10
MG 13 9m	0.66	0.22
MG 14 1m	0.46	0.15
MG 17 35m	0.95	0.29
MG 20 1m	0.77	0.22
MG 22 1m	0.41	0.12
MG 23 1m	0.42	0.16
MG 23 6m	0.41	0.16

Ni Cu

2.75m	0.42	0.15
(11.1m)	1.09	0.41

Ni Cu

2m	0.45	0.21
----	------	------

Melgard Grid

	Ni	Cu	S
WDH 1	15.25m	0.42	0.19
WDH 2	13.7m	0.16	0.06

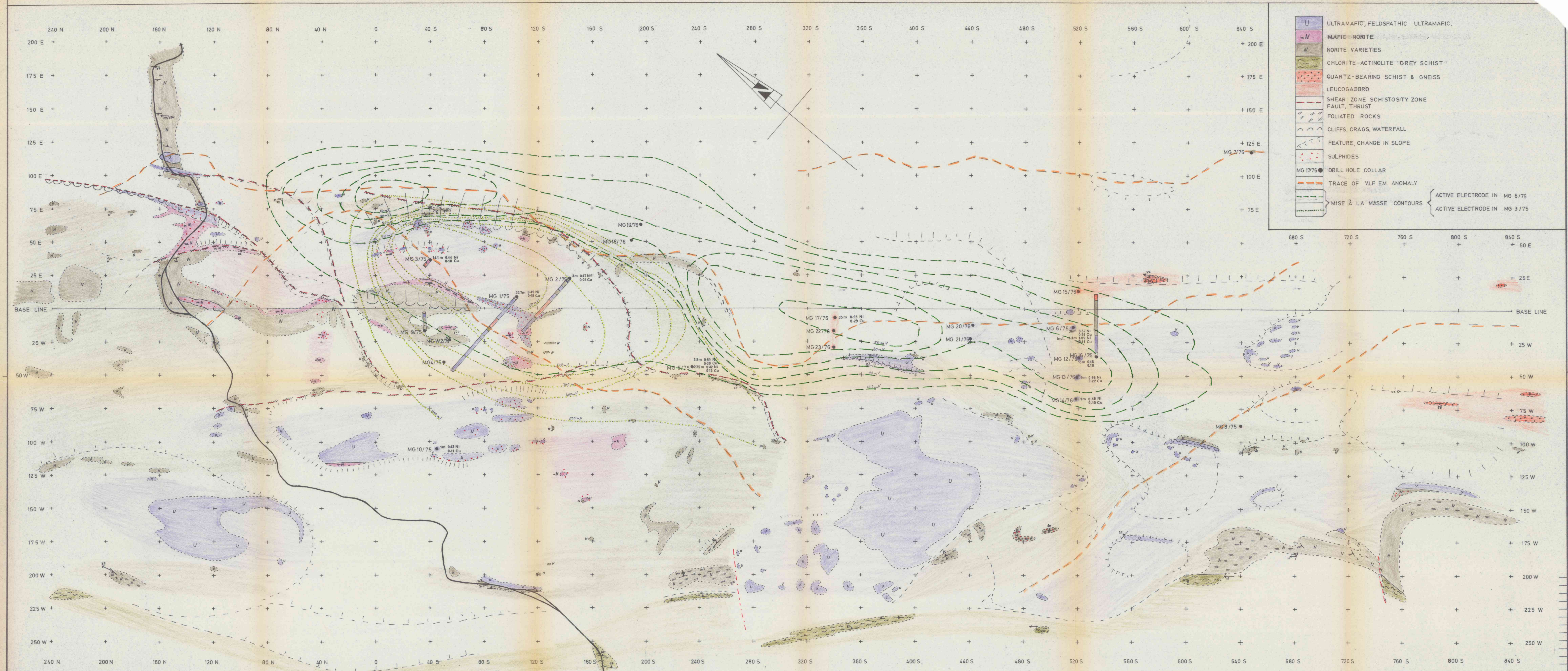
1.7 (12.75m 0.47 0.21 1.95)
0.31 0.07 1.45

ESPEDALEN PROJECT
SITUATION MAP

1/5 SULFIDMALM

SCALE	OBS.	DE
1:15000	DE	76
	TRAC.	DE
	CHK.	76

MAP NO.
15-75-A1
ENCLOSURE 1
MAP SHEET



1970: HELICOPTER EM & MAG. SURVEY OUTLINES INTERESTING ANOMALY. CHECKED ON GROUND BY HYDRO.
 1971: AREA INCLUDED IN PHOTO GEOLOGICAL SURVEY.
 1972: GROUND EM. & MAG. BY HYDRO. SULPHIDES IN ULTRABASIC DISCOVERED. 0.5% NI
 1973: DETAILED MAPPING & SAMPLING. SOIL SAMPLING.
 1974: VLF EM. & MAG. SURVEYS. GEOLOGICAL MAPPING & SAMPLING. 2 WINKIE DRILL HOLES.

1975: EXPLORATION DRILLING TOTALLING 704.4 m. IN 11 HOLES WERE DRILLED IN THE MEGRUNDSTJERN GRID ON A SERIES OF VLF & SUNGRAM ANOMALIES WITH SOME CO-INCIDENT MAG. ANOMALIES. FLOTATION TESTS.
 1976: GRID RE-ESTABLISHED & TOPOGRAPHICALLY SURVEYED. MISE A LA MASSE SURVEYS. DETAILED GEOLOGICAL MAPPING 240 N - 840 S. DRILLING ON MISE A LA MASSE ANOMALY TOTALLING 827 m. IN 12 HOLES.

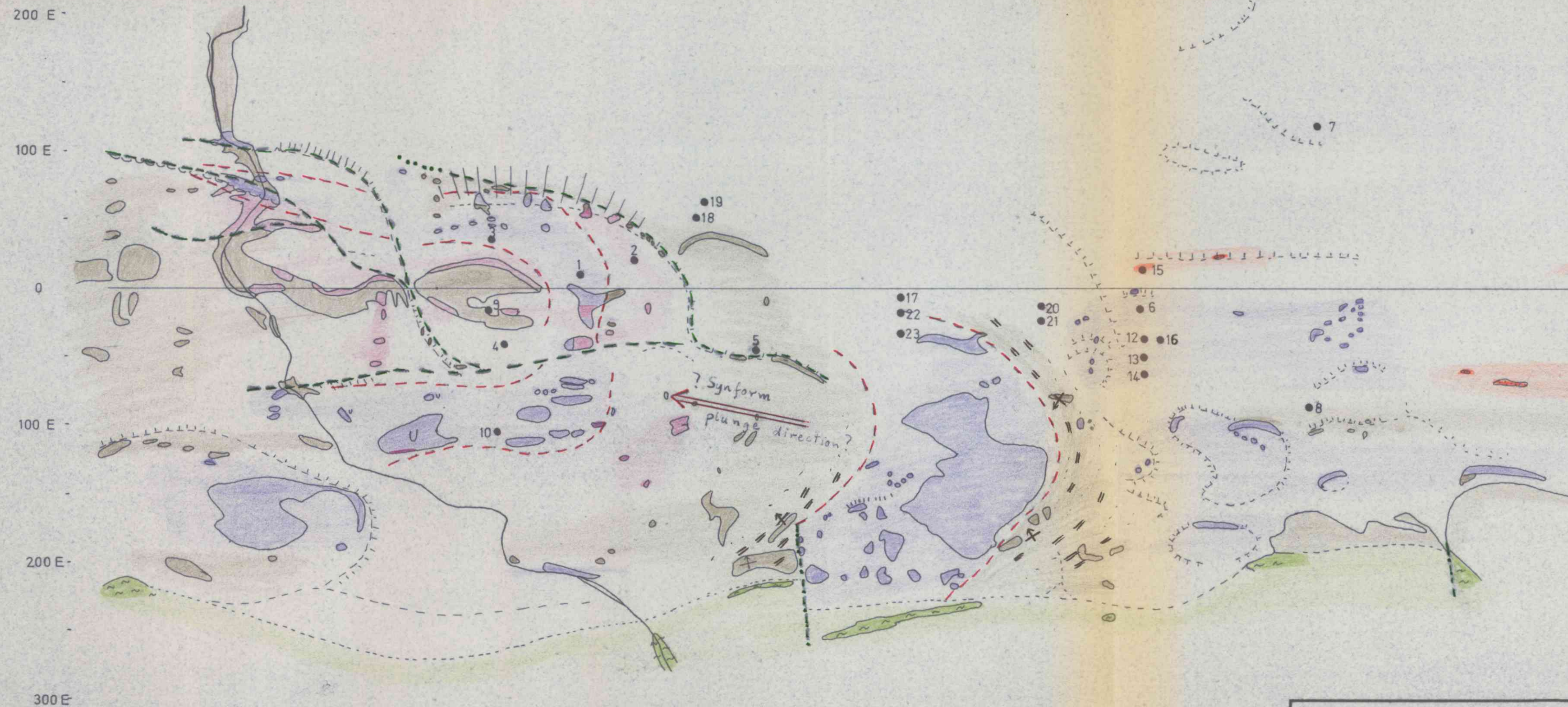
SUMMARY MAP
MEGRUNDSTJERN
ESPEDALEN

1/2 Sulfidmalm

Scale	Obs. DE 76	1:1000
Draw. DE 12-76		
Trac. DE 1-77		
Map. no.		
15-77-A1		
ENCLOSURE 2		
Map. sheet		



240 N 160 N 80 N 0 80 S 160 S 240 S 320 S 400 S 480 S 560 S 640 S 720 S 800 S



- ULTRAMAFIC/FELDSPATHIC
ULTRAMAFIC
- MAFIC NORITE
- NORITE
- QUARTZ BEARING ROCKS
- CHLORITE ACTINOLITE GREY SCHIST

- SHEAR, SCHISTOSITY ZONE
- FOLIATED ROCKS
- FEATURE
CLIFF
- DRILL HOLES

STRUCTURAL MAP
MEGRUNDSTJERN GRID
ESPEDALEN

$\frac{1}{2}$ SULFIDMALM

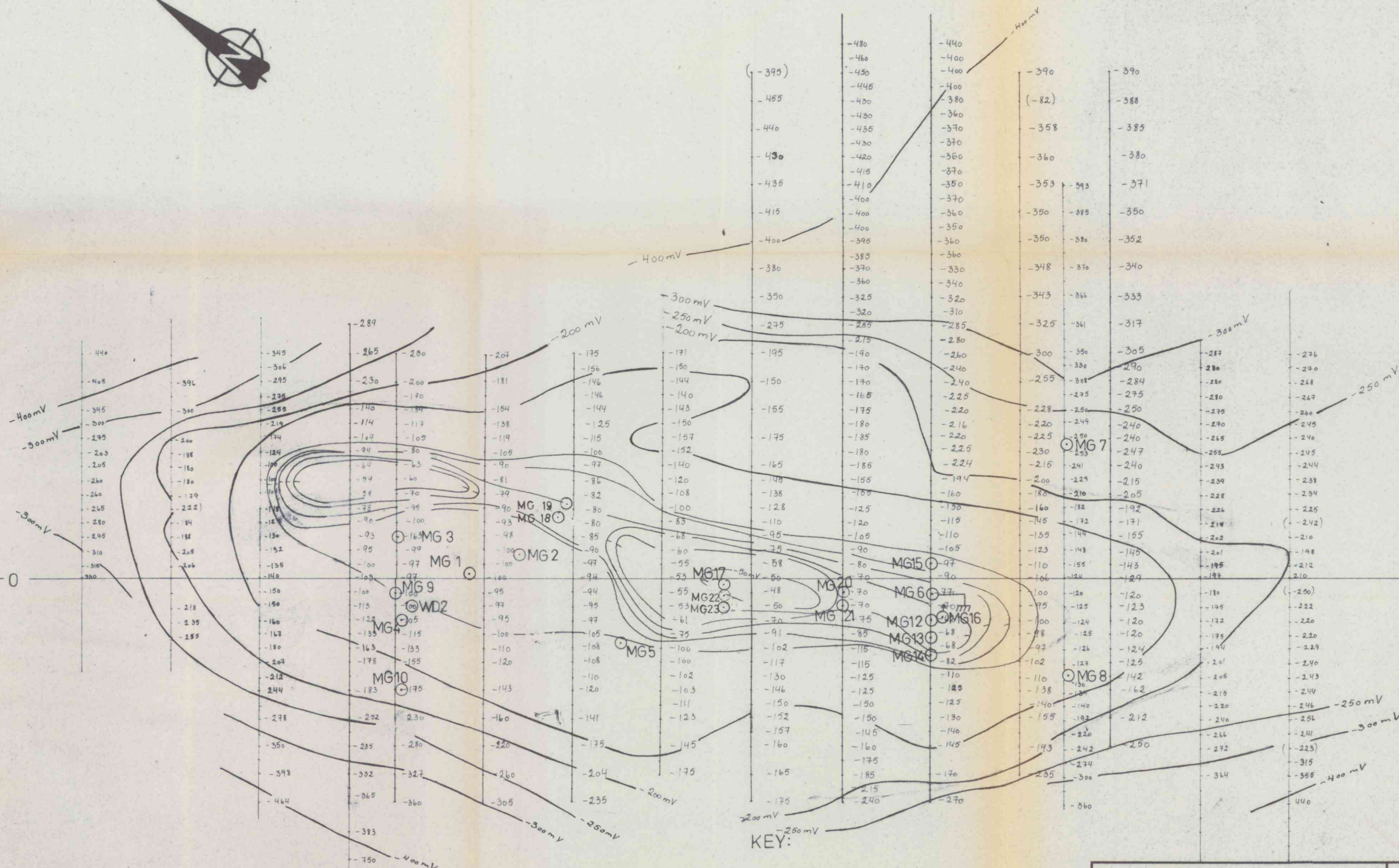
SCALE	OBS. MR	6-7/76
1:2500	DRAW. MR	7/76
	TRAC. DE	3/77
	CHK.	

MAP NO.

ENCLOSURE 3

MAP SHEET

160N 80N 0 40s 120s 200s 280s 360s 440s 520s 600s 680s 760 840s



MEGRUNDTJERN, ESPEDALEN.
MG-6 Zone.
Mise à la masse measurements.

SCALE	OBS. FiH	6-76
1:2500	DRAW. FiH	6-76
	TRAC. BB	6-76
	CHK. MS	6-76

1/2 SULFIDMALM

MAP NO.

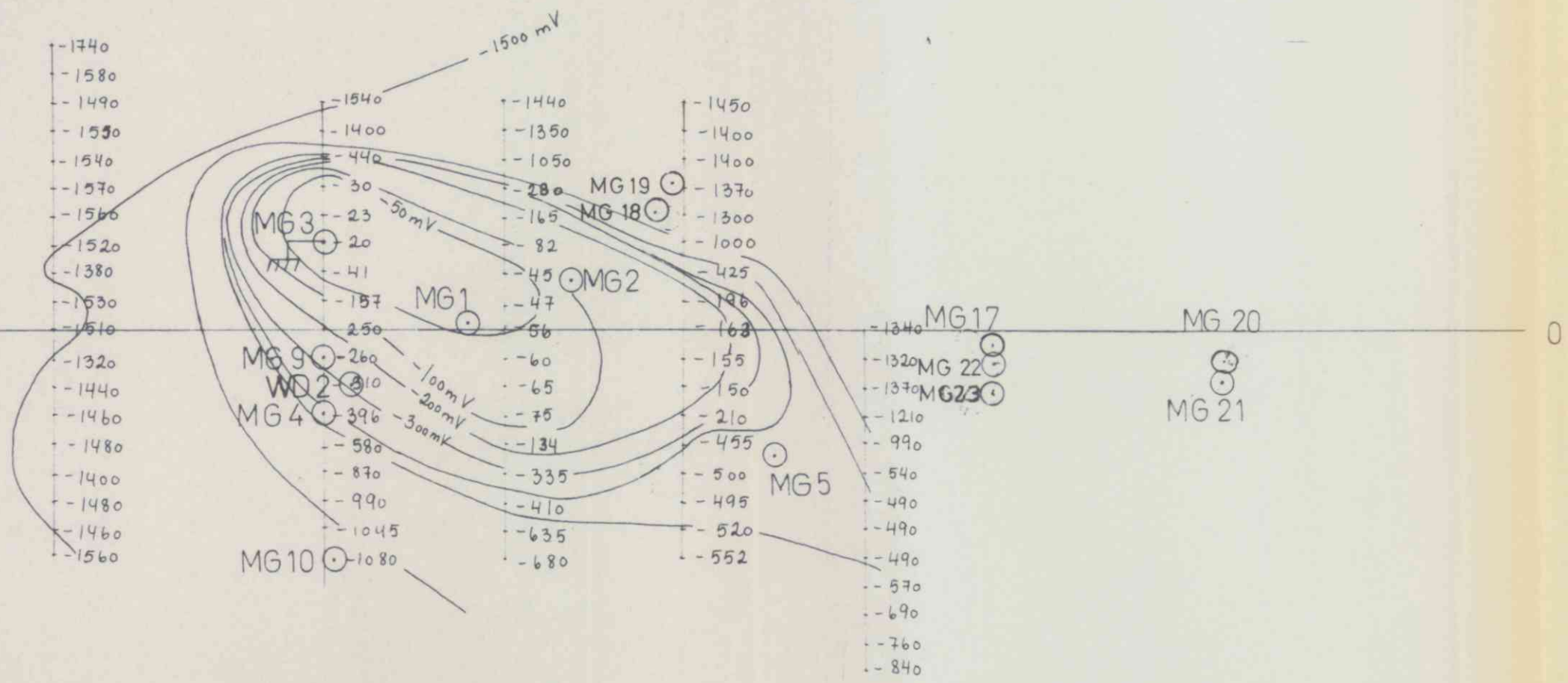
ENCLOSURE 4

MAP SHEET

80 N 0 40 s 120 s 200 s 280 s



100 E
50 E
0
50 W
100 W

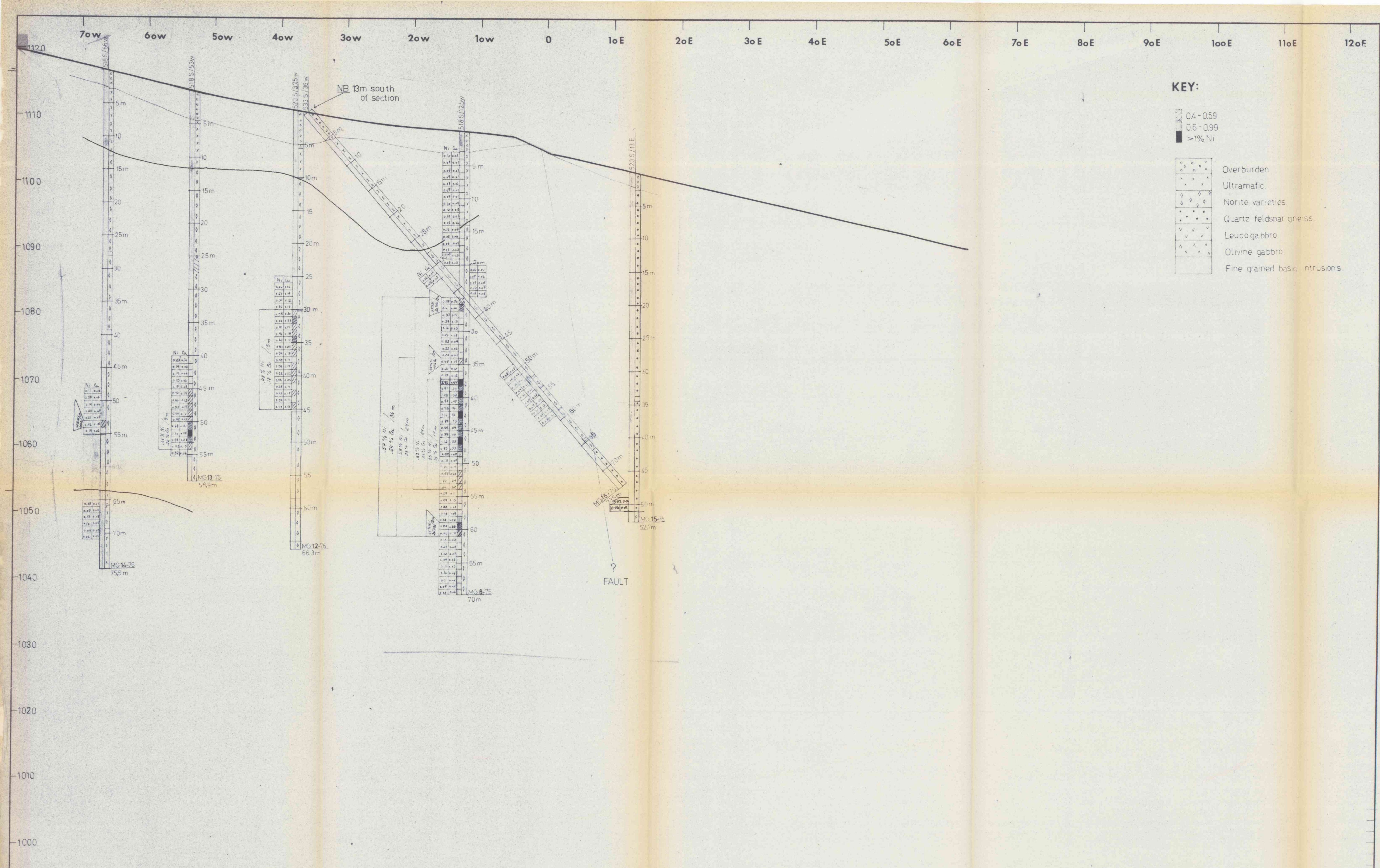


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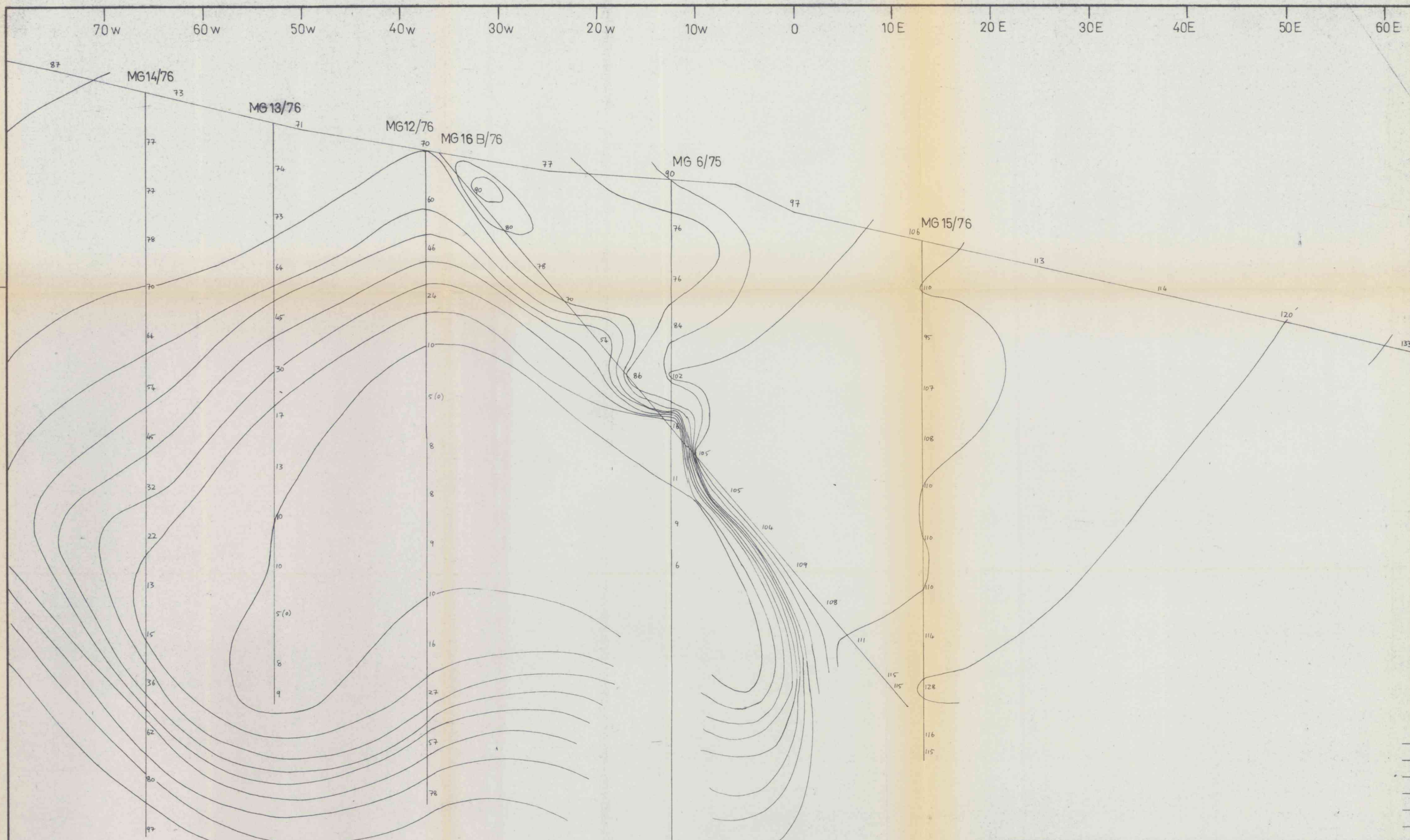
MG3 Active electrode in
DDH MG3 (10m down hole)

All values in -mV.

MEGRUNDTJERN, ESPEDALEN. MG-3 Zone. Mise à la masse measurements.	SCALE	OBS. FiH	6-7
	1:2500	DRAW. FiH	6-76
TRAC. BB		10-76	
CHK. 987		10/76	
1/5 SULFIDMALM	MAP NO.		
	ENCLOSURE 5		
MAP SHEET			

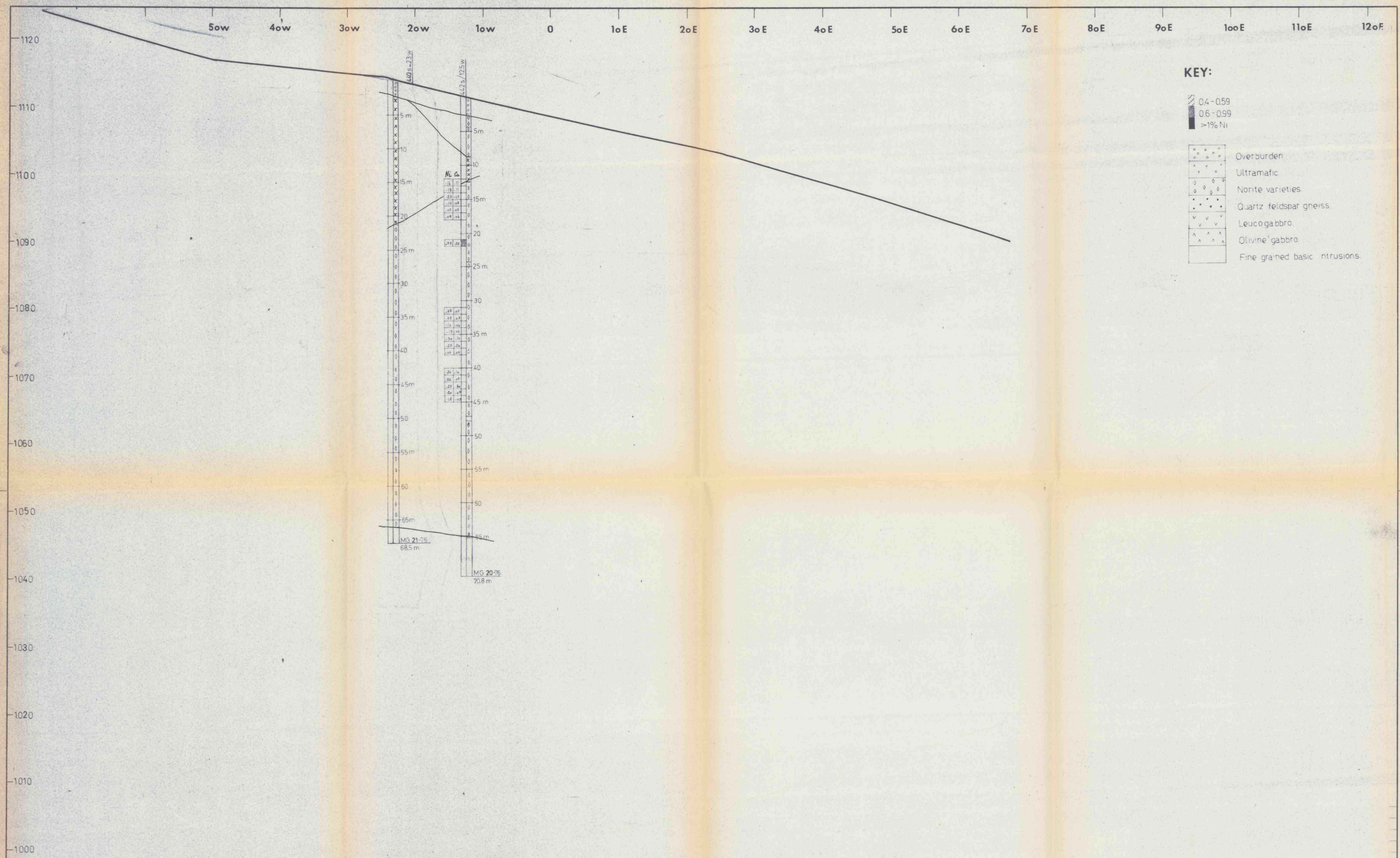


MEGRUNDSTJERN, ESPEDALEN.	1:250	SCALE	OBS. DE	1975-76
			DRAW. DE	1976
			TRAC. BB	---
			CHK.	
Profile 520 s.				
1/8 SULFIDMALM		MAP NO.		
		ENCLOSURE 6		
		MAP SHEET		

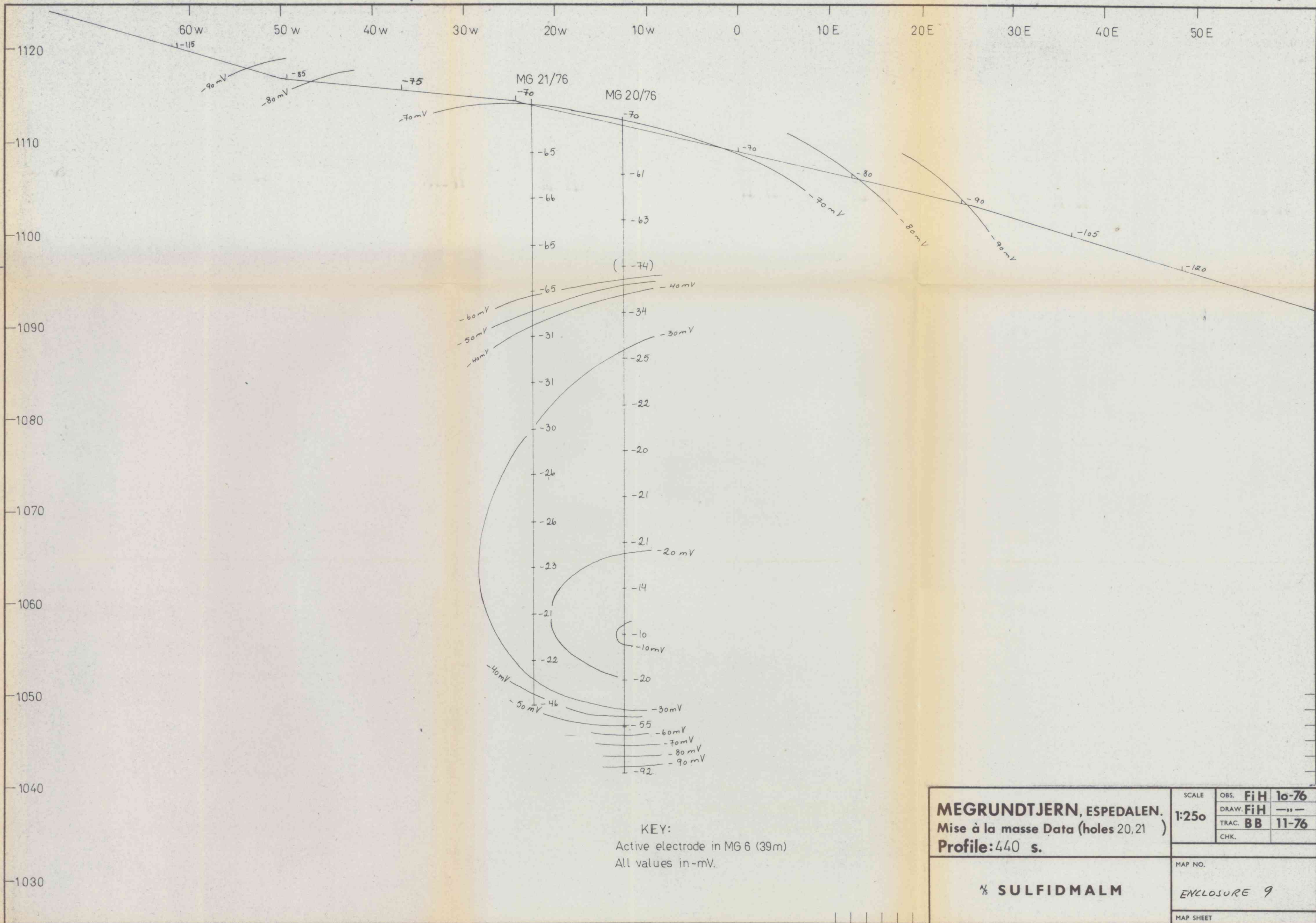


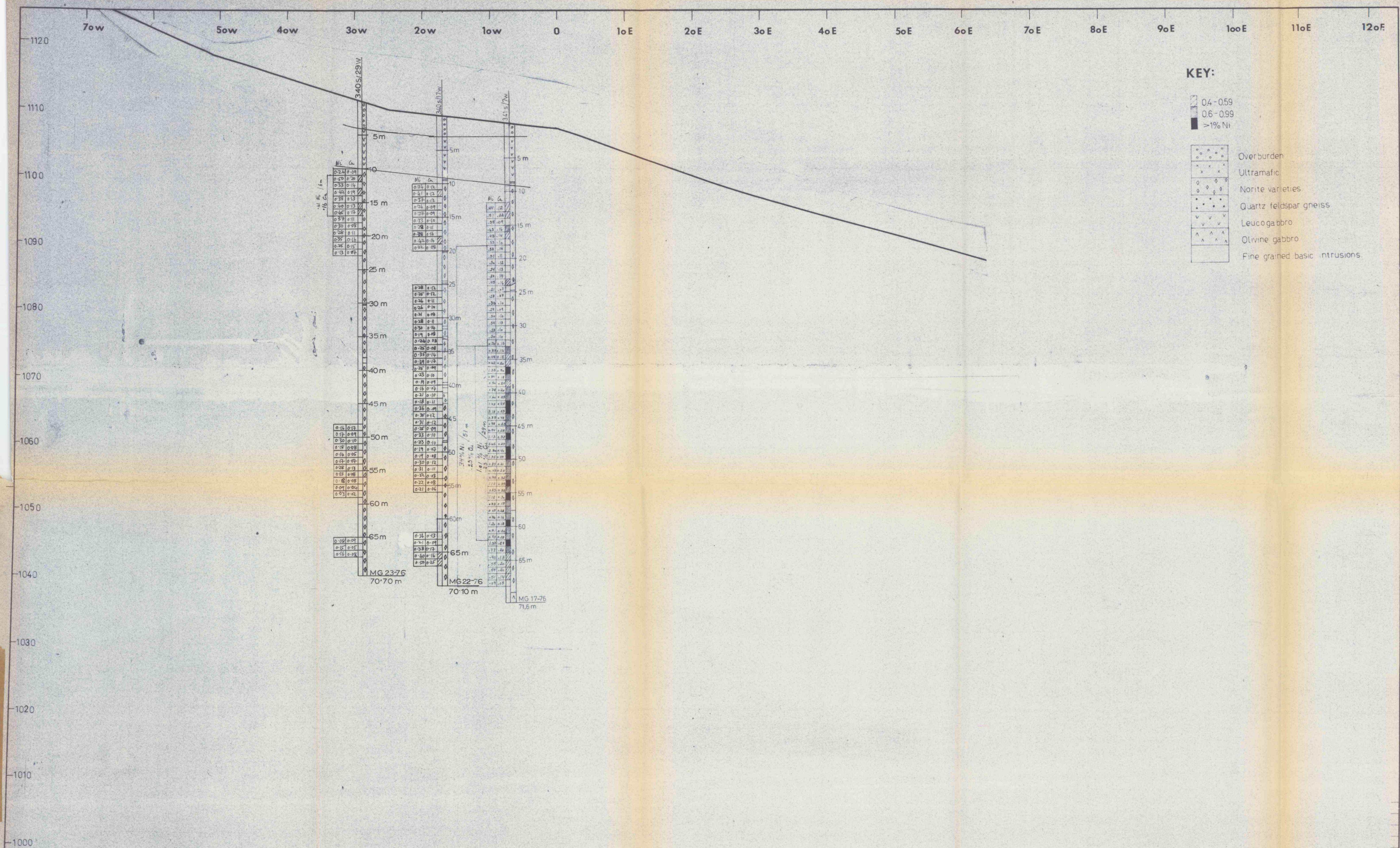
KEY:
Active electrode in MG 6 (39m)
All values in -mV.

MEGRUNDTJERN, ESPEDALEN. Mise à la masse Data (holes 6, 12 - 16) Profile: 520 s.		SCALE	OBS.	Fi H	10-76
		1:250	DRAW.	DE	—
1/2 SULFIDMALM		TRAC.	BB	11-76	
		CHK.			
MAP NO.		ENCLOSURE 7			
		MAP SHEET			

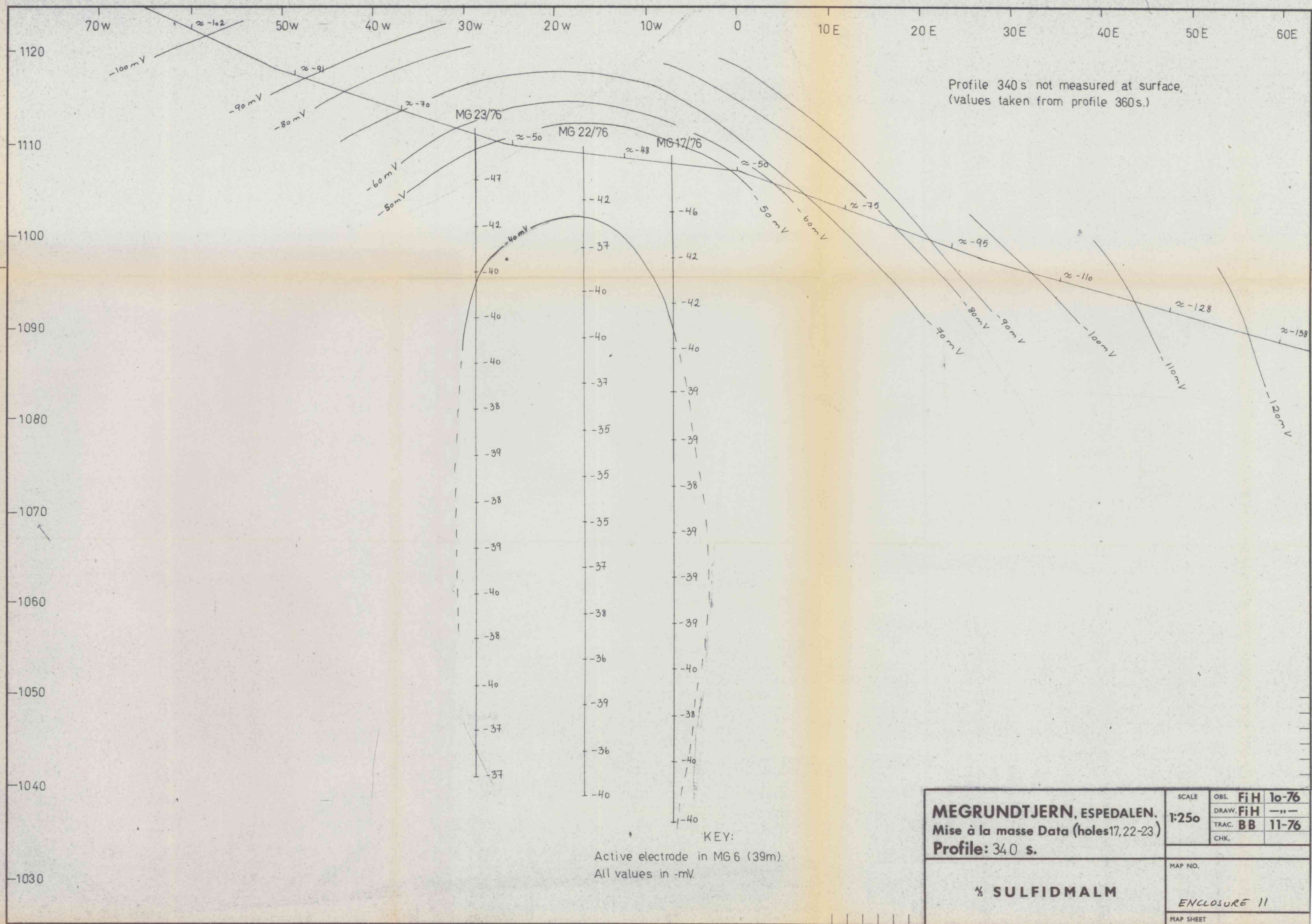


MEGRUNDSTJERN, ESPEDALEN. Profile 440 s.	SCALE	OBS. DE	9-76
	1:250	DRAW. BB	10-76
		TRAC. BB	—
		CHK.	
1/2 SULFIDMALM	MAP NO.	ENCLOSURE 8	
	MAP SHEET		

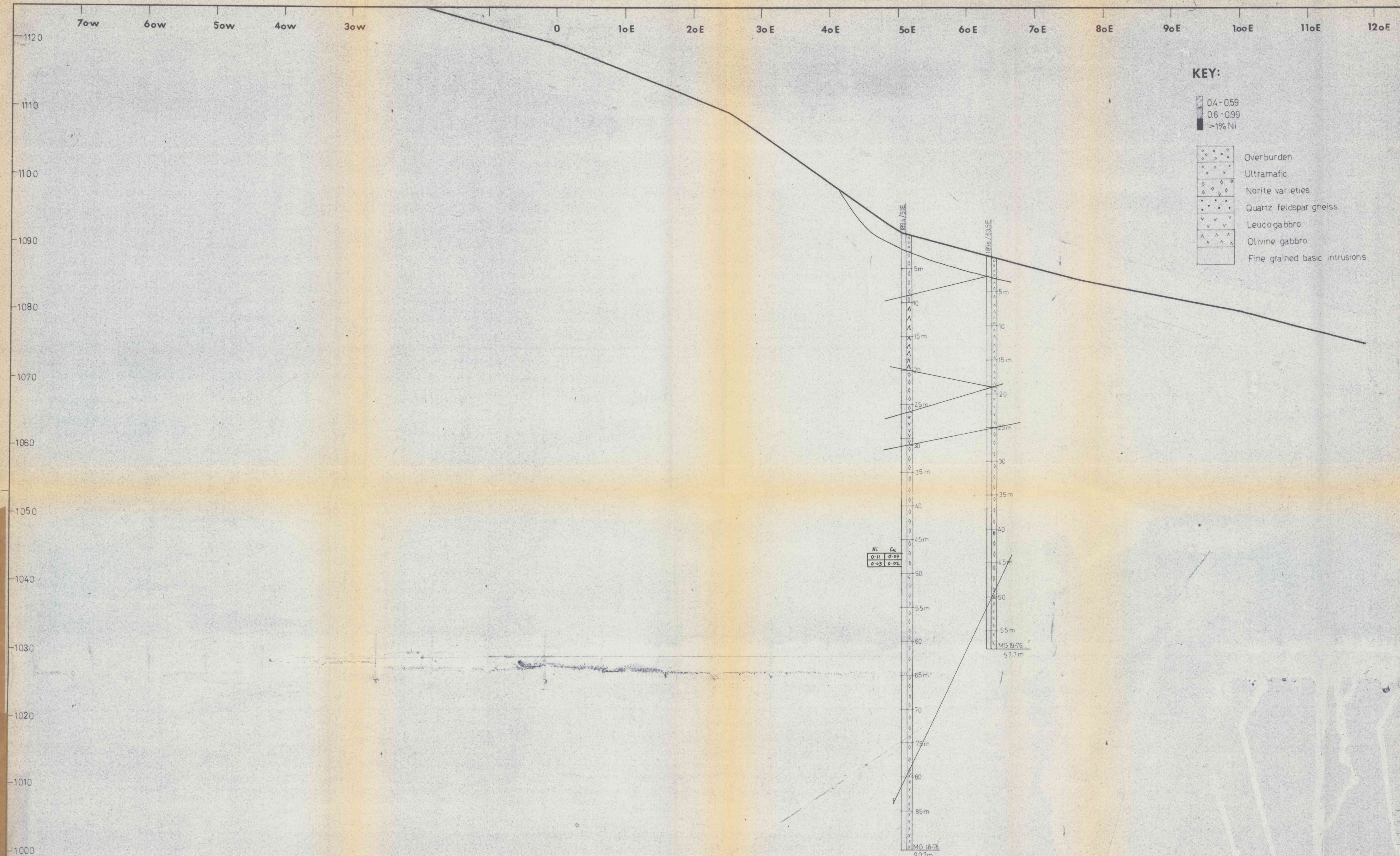




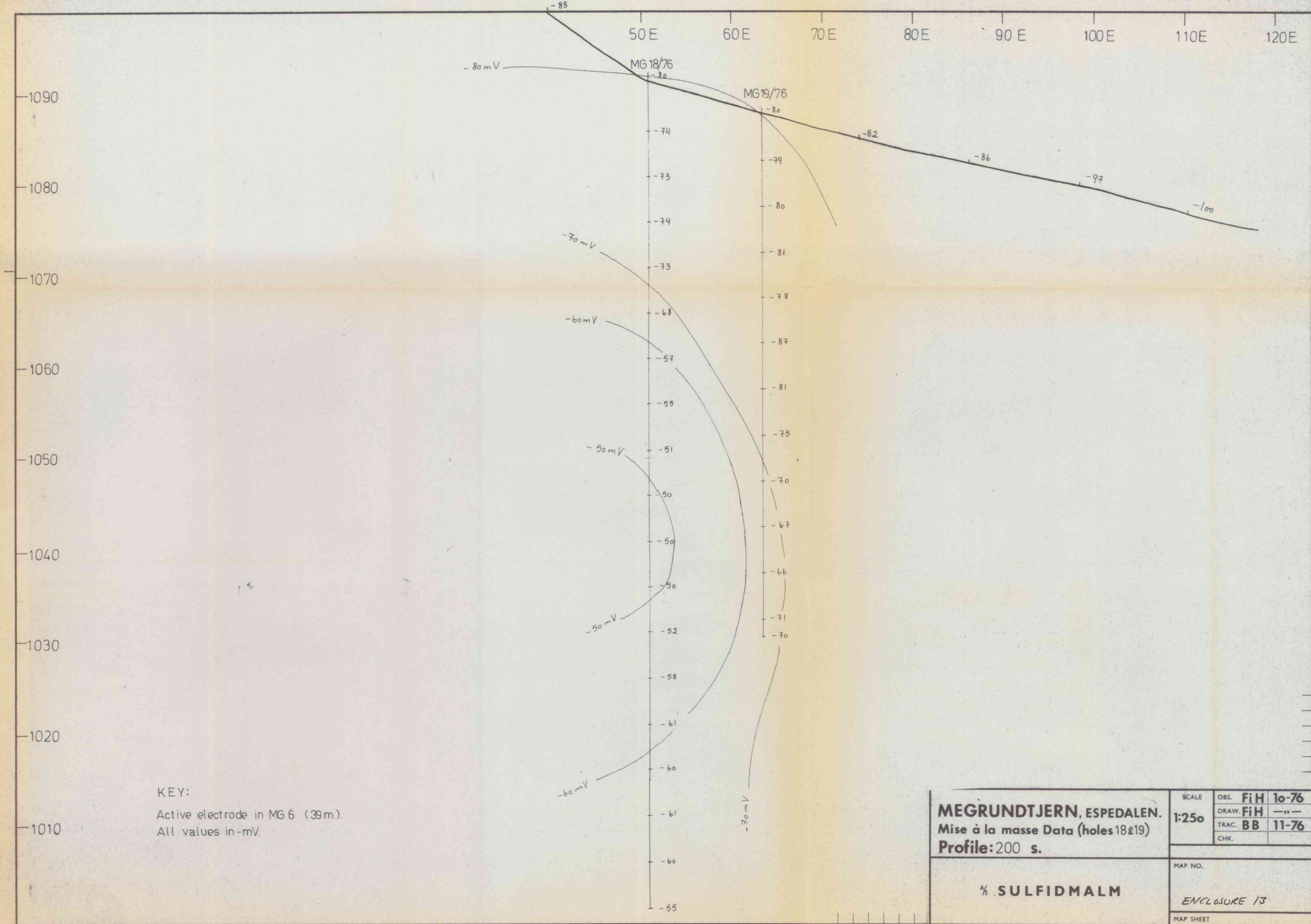
MEGRUNDSTJERN, ESPEDALEN.	SCALE			OBS.	DE	1976
	1:250			DRAW.	DE	
				TRAC.	BB	
				CHK.		
Profile 340s		MAP NO.				
SULFIDMALM		ENCLOSURE 10				
		MAP SHEET				



MEGRUNDTJERN, ESPEDALEN. Mise à la masse Data (holes 17, 22-23) Profile: 340 s.	SCALE	OBS. FiH	10-76
	1:250	DRAW. FiH	— — —
		TRAC. BB	11-76
		CHK.	
$\frac{1}{8}$ SULFIDMALM	MAP NO.		
	ENCLOSURE 11		
	MAP SHEET		



MEGRUNDSTJERN, ESPEDALEN. Profile 200s	SCALE	OBS. DE 9-76
	1:250	DRAWN. DE 10-76
	CHK. BB	
1/2 SULFIDMALM	MAP NO.	ENCLOSURE 12
	MAP SHEET	



KEY:
Active electrode in MG 6 (39m).
All values in -mV.

MEGRUNDTJERN, ESPEDALEN. Mise à la masse Data (holes 18&19) Profile: 200 s.	SCALE	OBS.	FiH	10-76
	1:250	DRAW.	FiH	—
		TRAC.	BB	11-76
		CHK.		
MAP NO.		ENCLOSURE 13		
MAP SHEET				