



Bergvesenet rapport nr 7197	Intern Journal nr	Internt arkiv nr	Rapport lokalisering	Gradering
Kommer fra ..arkiv Ni & Ol A/S	Ekstern rapport nr	Oversendt fra Ni & Ol A/S	Fortrolig pga	Fortrolig fra dato:

Tittel

Geophysical Surveys at Nikkel og Olivin in Ballangen, NORWAY

Forfatter

Laurila, Tero

Dato År

04.09 1996

Bedrift (Oppdragsgiver og/eller oppdragstaker)

Soumen Malmi OY

Kommune Ballangen	Fyke Nordland	Bergdistrikt	1: 50 000 kartblad 1331 1	1: 250 000 kartblad Narvik
-----------------------------	-------------------------	---------------------	-------------------------------------	--------------------------------------

Fagområde

Geofysikk

Dokument type**Forekomster (forekomst, gruvefelt, undersøkelsesfelt)**

Bruvannsfeltet
Råna

Råstoffgruppe

Malm/metall

Råstofftype

Cu, Ni

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

Rapporten beskriver magnetiske-, slingram Max-Min målinger, borhullsmåling med 3-komponent magnetiske målinger, misse-a -la-masse og til slutt Protem-målinger. Måleresultatene er overlevert som kart uten kommentar.

Det er vedlagt diskett med måleresultater

NIKKEL OG OLIVIN MINE

GEOPHYSICAL SURVEYS AT NIKKEL OG OLIVIN IN BALLANGEN, NORWAY

ESPOO 04, September 1996



Box 10, FIN - 02921 ESPOO

**Tel + 358-0-8524 010
Fax + 358-0-8524 0123**

GEOPHYSICAL SURVEYS AT NIKKEL OG OLIVIN IN BALLANGEN, NORWAY

I N D E X

1. GENERAL
2. SURVEY AREA
3. LINE STAKING
4. MAGNETIC SURVEY
5. SLINGRAM SURVEY
6. 3 - COMPONENT MAGNETIC SURVEY
7. MISE-À-LA-MASSE SURVEY
8. PROTEM SURVEY
9. APPENDICES

1. GENERAL

This report describes geophysical surveys at Nikkel og Olivin Mine in Ballangen, Norway. The surveys were carried out on behalf of Nikkel og Olivin AS (the Corporation) by Suomen Malmi Oy (the Contractor) during the period 6.8-17.8.1996.

The aim of the surveys was to delineate the geological structures.

The work consisted of geophysical surveys according to the tender 221/96017 and 221/96017b (Smoy) and order dated on 12 July 1996 (OMR). The survey plan was made by the Corporation. The field crew consisted of one foreman and two observers. The duration of the field work was 12 days.

2. SURVEY AREA

The survey area is located at Nikkel og Olivin Mine in Ballangen about 35 km west of the city of Narvik in northern Norway. The size of the area where slingram and magnetic surveys were carried out is about 1,25 km x 0,5 km. 3-component magnetic survey, Protom and mise-à-la-masse survey were made at the area of the lake Bruvann.

3. LINE STAKING

The line staking was made by utilising a Topcon theodolite and measuring tape. The survey lines were orientated by using compass. Totally 5450 m of base line were staked.

4. MAGNETIC SURVEY

An automatically reading Scintrex Envi-Mag proton magnetometer was used in the survey. As a base station a Scintrex MP-2 magnetometer equipped with a KTP data logger was used.

A standard procedure for magnetic total field survey was applied. The station interval was 10 m and the line spacing was 50 m. Totally 1403 points were measured.

The results are presented as a total field magnetic profile map and as a color map in appendices 14 and 15. Digital field data on a data diskette in Geosoft format is enclosed with this report.

5. SLINGRAM SURVEY

An APEX Max Min I ground EM system was used in the survey. Measuring frequencies were 220 Hz, 1760 Hz and 7040 Hz and the coil separation was 100 meters.

The station interval was 20 m and the line spacing was 50 m. Totally 691 points were measured.

The results are presented as profile maps and color maps in appendices 2-13. Digital field data on data diskette in Geosoft format is enclosed with this report.

6. 3 - COMPONENT MAGNETIC SURVEY

In the 3-component magnetic survey, an OMS-logg borehole logging system equipped with MAG-D-30 sensor was used.

The survey interval for 3-component magnetic survey was 5 m. The logging was made in two holes (BAL-P1 and BAL-235). Totally 610 m were logged.

Based on the magnetic data the borehole deviation was calculated. The results are presented in appendices 16 - 19. Digital field data on a data diskette is enclosed with this report.

7. MISE-À-LA-MASSE SURVEY

For mise-à-la-masse (MAM) measurements, a Terrameter SAS system made by Abem Ab was used.

The field work was done according to the corporation's instructions. The results are presented as profiles in appendices 20 and 21. Digital field data on a diskette is enclosed with this report.

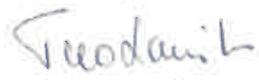
8. PROTEM SURVEY

In the Protem survey, an Geonics Protem receiver, EM-37 transmitter, BH43-3 borehole sensor and an three component ground sensor were used.

In the borehole survey the transmitter loop size was 400 x 600 m and the survey interval was either 5m or 10 m. The logging was made in one hole (P1). Totally 195 m were logged. On the ground one profile (X=1 200 Y=2 050 - Y=2 800) was measured using the same transmitter loop as in the borehole survey.

The results are presented in appendices 22 and 23. Digital field data on a data diskette is enclosed with this report.

Espoo, 4 September, 1996


Tero Laurila, Eng.
Suomen Malmi Oy
Geophysics

9. APPENDICES

1. SURVEY AREA

- 1.1 Location map of the magnetic and slingram survey area 1:10 000

2. MAGNETIC SURVEY

- 2.1 Magnetic profile map total field 1: 5 000
2.2 Magnetic color map total field 1: 5 000

3. SLINGRAM SURVEY

- 3.1 Slingram profile map f = 220 Hz Re - component 1: 5 000
3.2 Slingram profile map f = 220 Hz Im - component 1: 5 000
3.3 Slingram profile map f = 1760 Hz Re - component 1: 5 000
3.4 Slingram profile map f = 1760 Hz Im - component 1: 5 000
3.5 Slingram profile map f = 7040 Hz Re - component 1: 5 000
3.6 Slingram profile map f = 7040 Hz Im - component 1: 5 000
3.7 Slingram color map f = 220 Hz Re - component 1: 5 000
3.8 Slingram color map f = 220 Hz Im - component 1: 5 000
3.9 Slingram color map f = 1760 Hz Re - component 1: 5 000
3.10 Slingram color map f = 1760 Hz Im - component 1: 5 000
3.11 Slingram color map f = 7040 Hz Re - component 1: 5 000
3.12 Slingram color map f = 7040 Hz Im - component 1: 5 000

4. 3 - COMPONENT MAGNETIC SURVEY

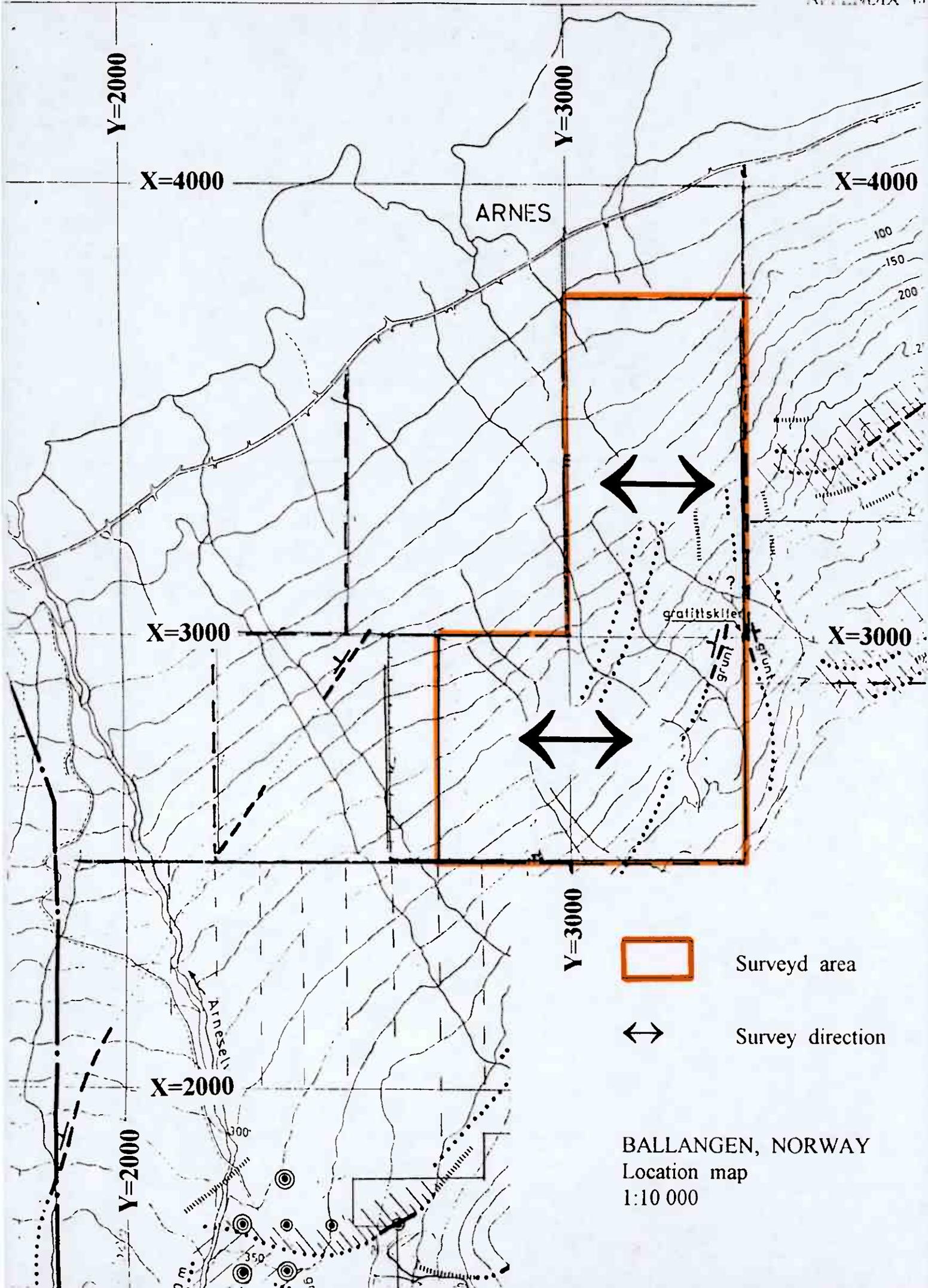
- 4.1 3 - component magnetic hole BAL-P1 1: 2 000
4.2 Deviation hole BAL-P1 1: 2 000
4.3 3 - component magnetic hole BAL-235 1: 2 000
4.4 Deviation hole BAL-235 1: 2 000

5. MISE-À-LA-MASSE SURVEY

- 5.1 Mise-à-la-masse survey ground profiles 1: 5 000
5.2 Mise-à-la-masse survey hole profiles 1: 2 000

6. PROTEM SURVEY

- 6.1 Protem hole BAL-235 1: 2 000
6.2 Protem line X = 1 200 1: 5 000

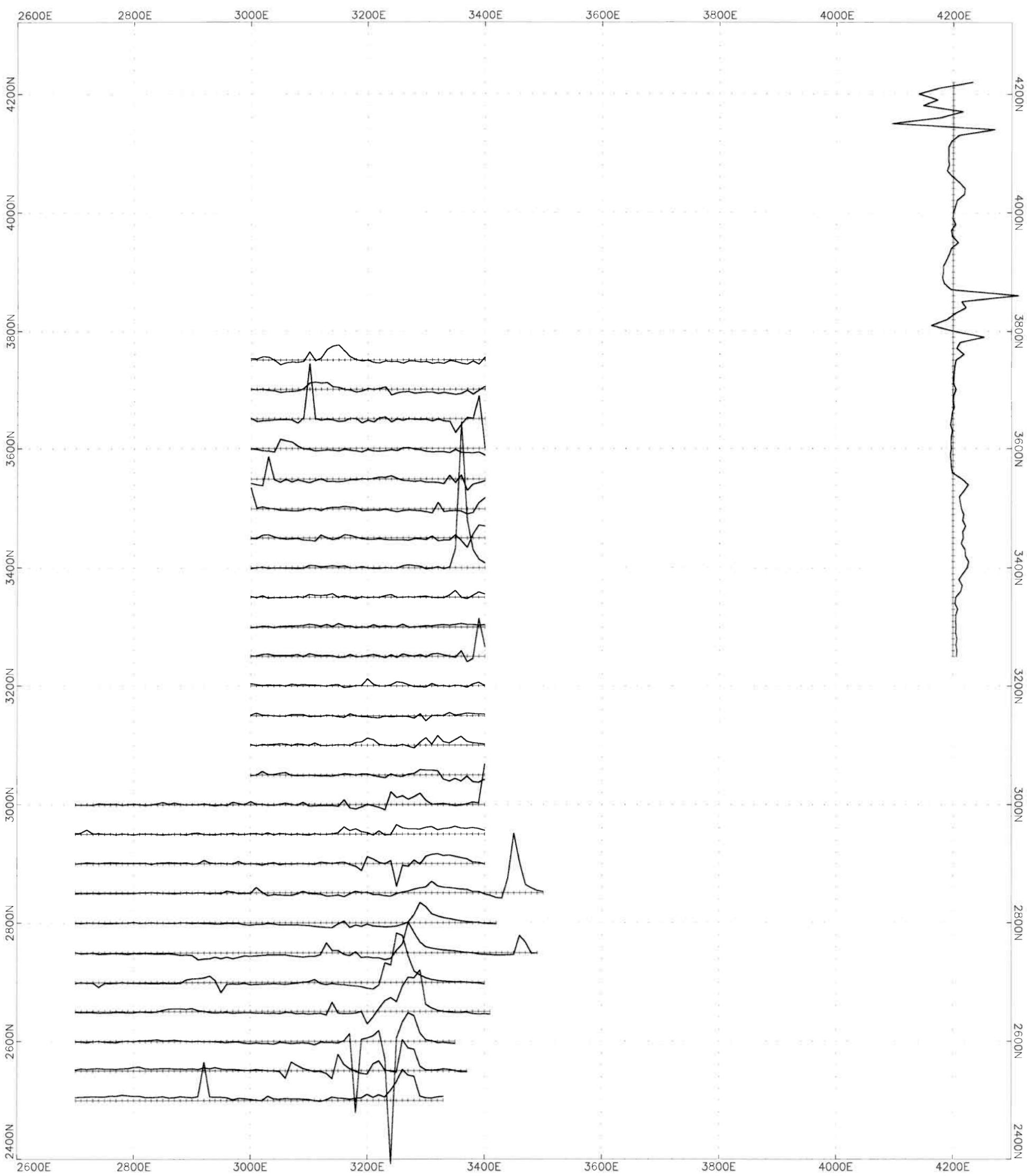


Surveyd area

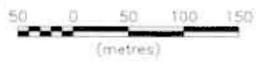


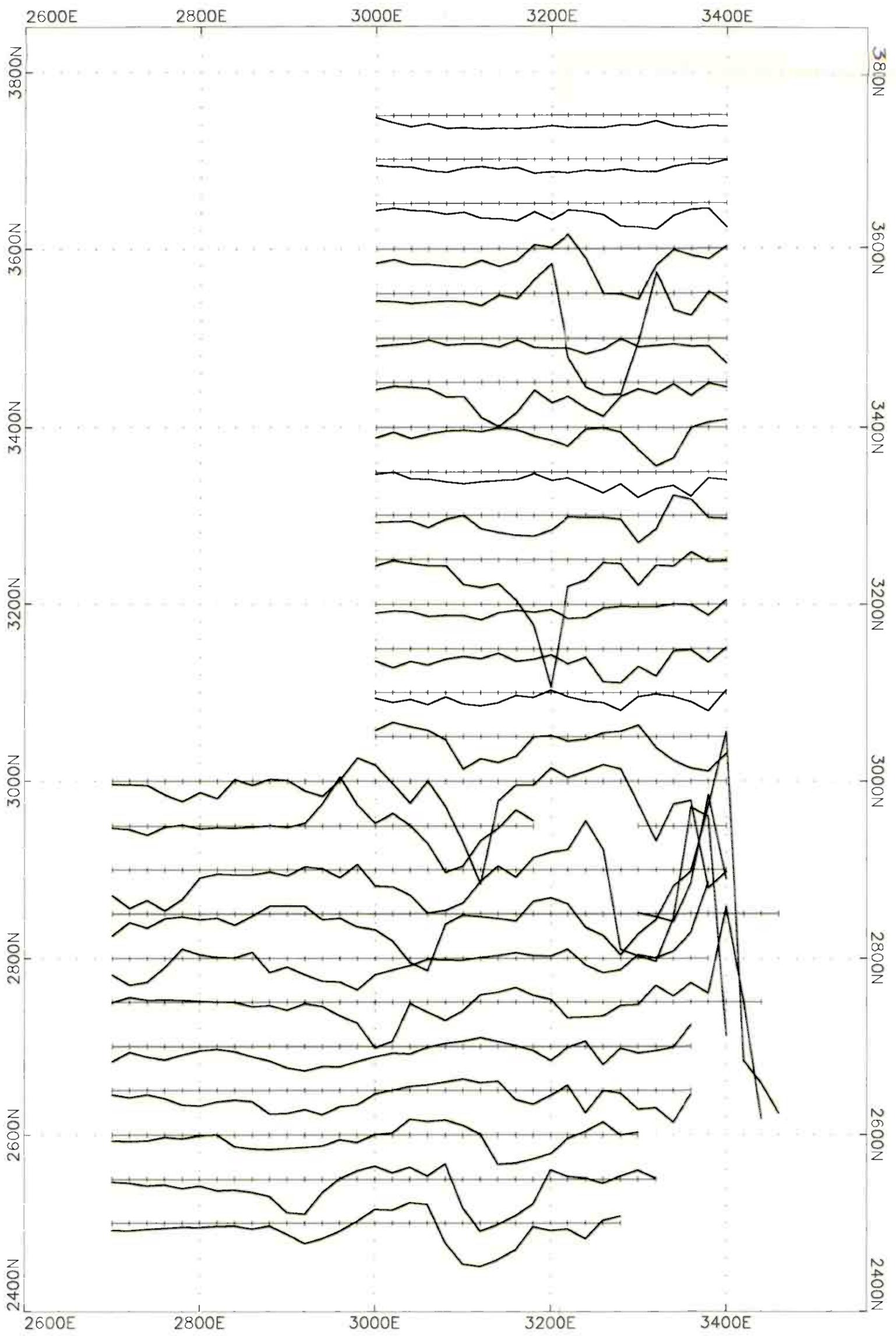
Survey direction

BALLANGEN, NORWAY
 Location map
 1:10 000



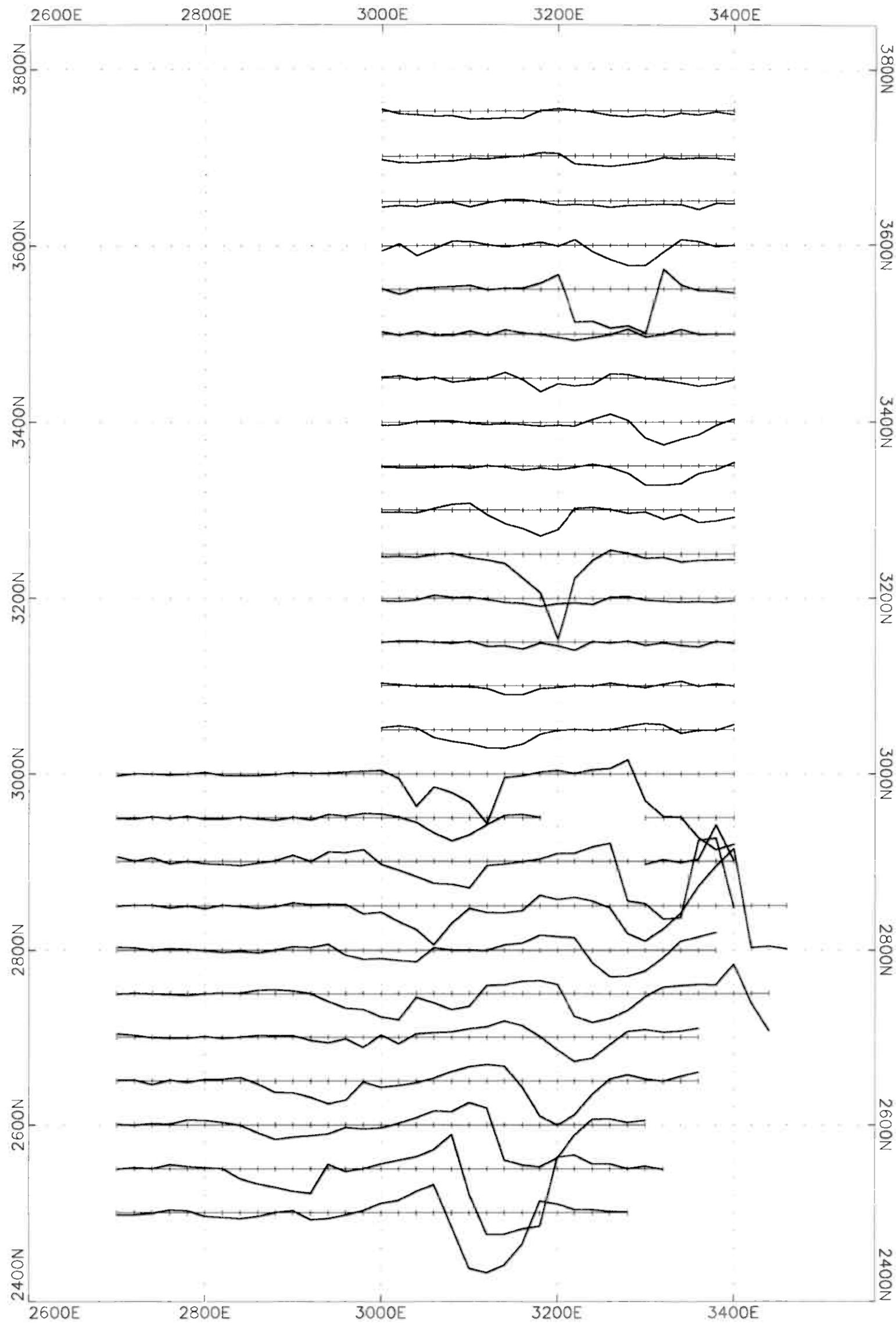
MAGNETIC SURVEY
Ballangen Norway
Nikkel og Olivin AS
52130 \pm 200 nT/cm
August 1996 SMOY
1: 5 000





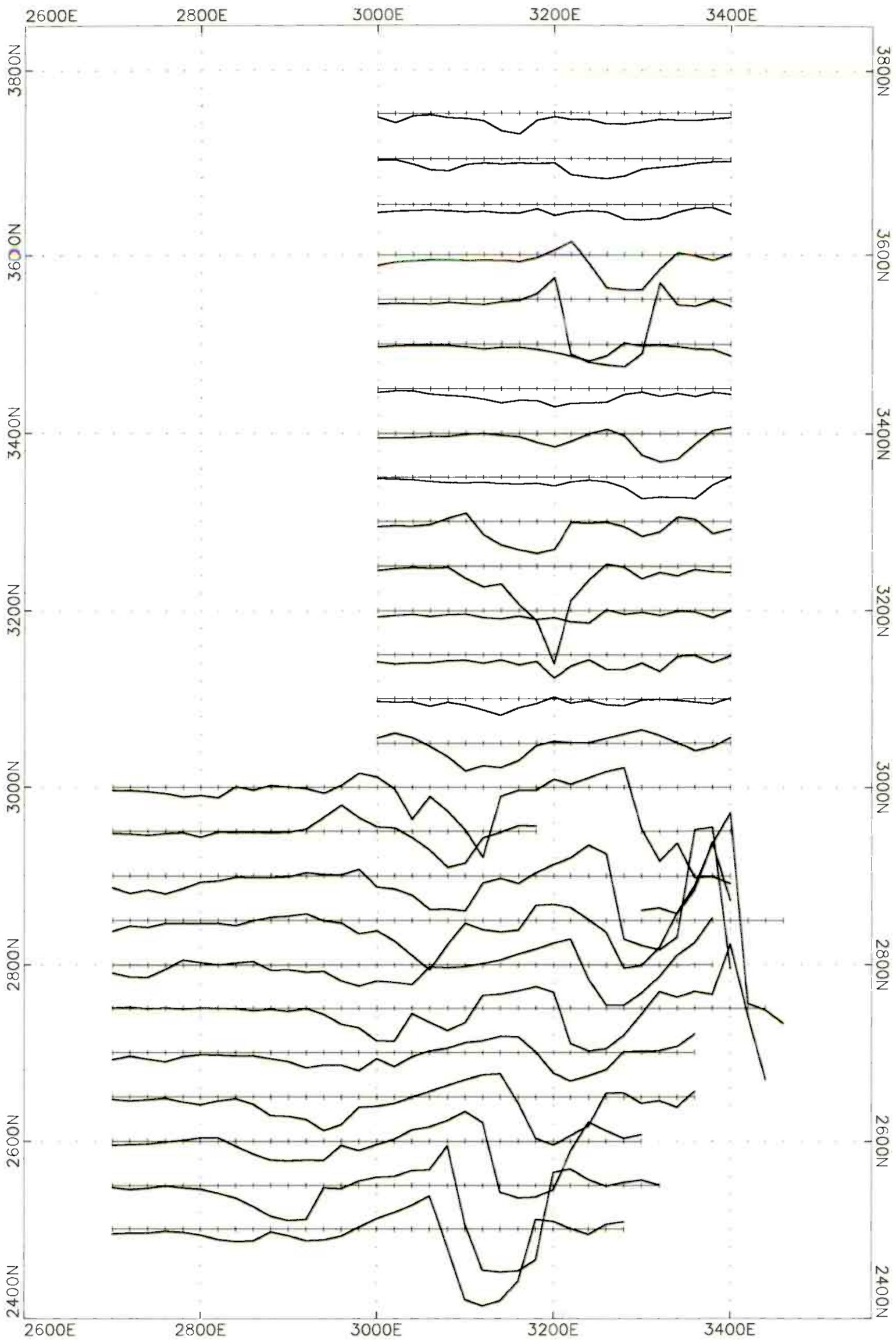
ELECTROMAGNETIC SURVEY
Ballangen Norway
Nikkel og Olivin AS
Re 220 Hz 0+-10 %/cm
August 1996 SMOY
1: 5 000





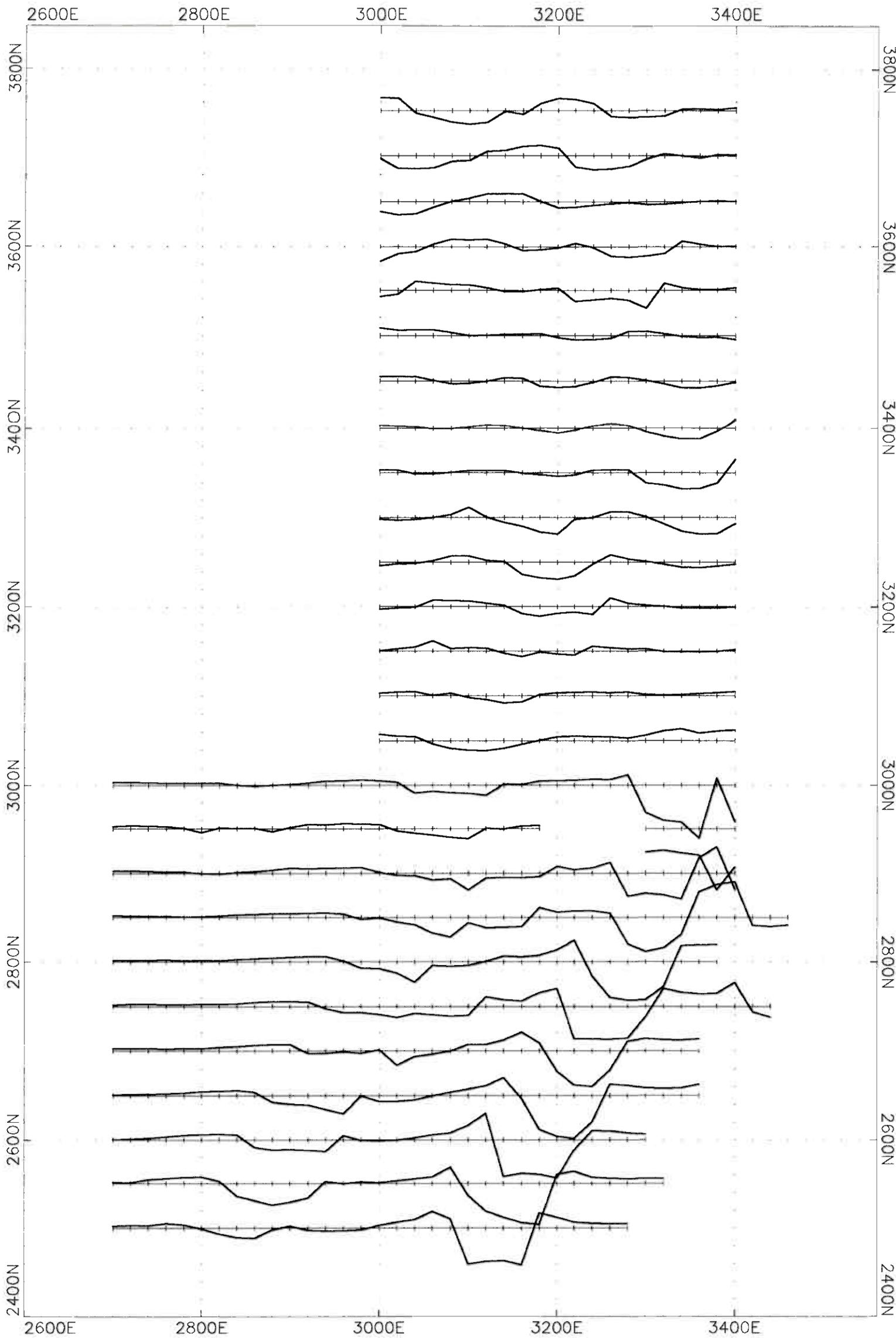
ELECTROMAGNETIC SURVEY
Ballangen Norway
Nikkel og Olivin AS
Im 220 Hz 0+-10 %/cm
August 1996 SMOY
1: 5 000





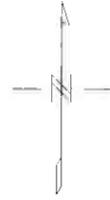
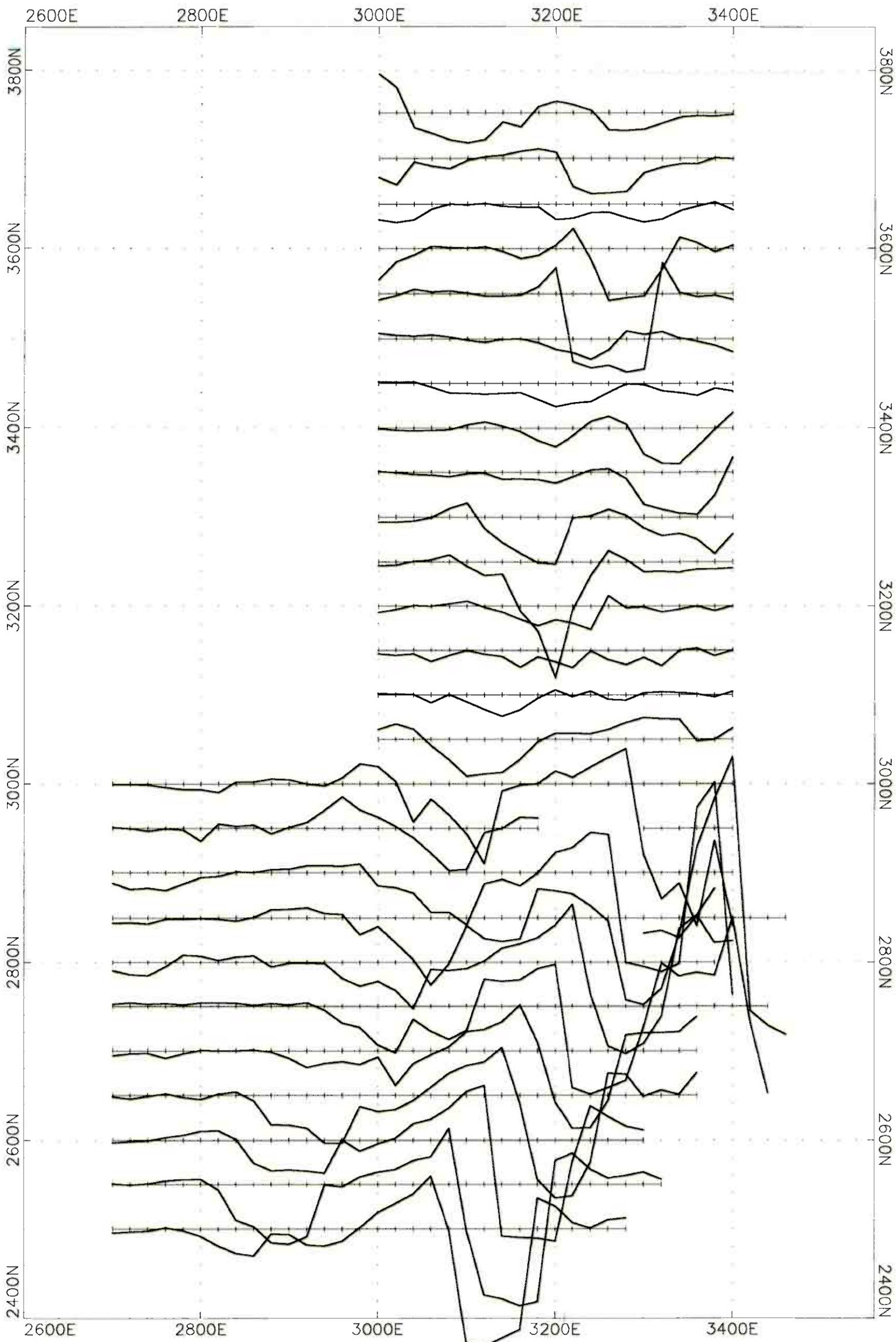
ELECTROMAGNETIC SURVEY
Ballangen Norway
Nikkel og Olivin AS
Re 1760 Hz 0+-20 %/cm
August 1996 SMOY
1: 5 000





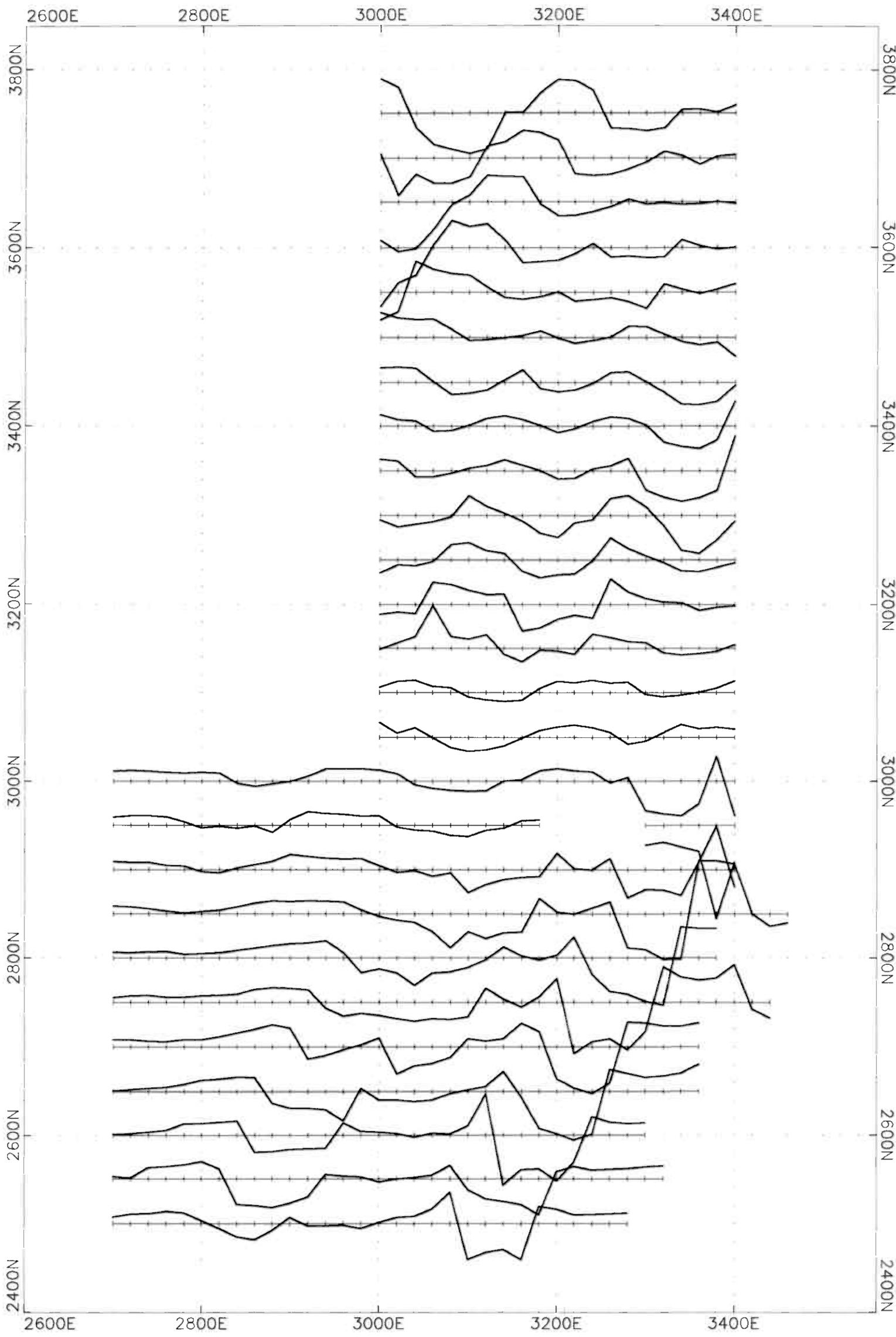
ELECTROMAGNETIC SURVEY
Ballangen Norway
Nikkel og Olivin AS
Im 1760 Hz 0+-20 %/cm
August 1996 SMOY
1: 5 000





ELECTROMAGNETIC SURVEY
Ballangen Norway
Nikkel og Olivin AS
Re 7040 Hz 0+-20 %/cm
August 1996 SMOY
1: 5 000

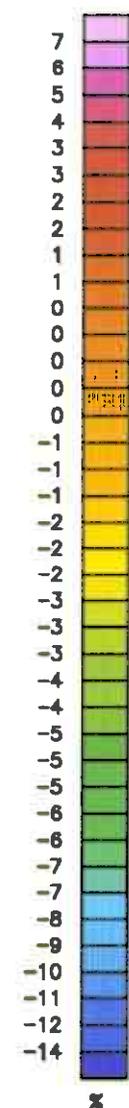
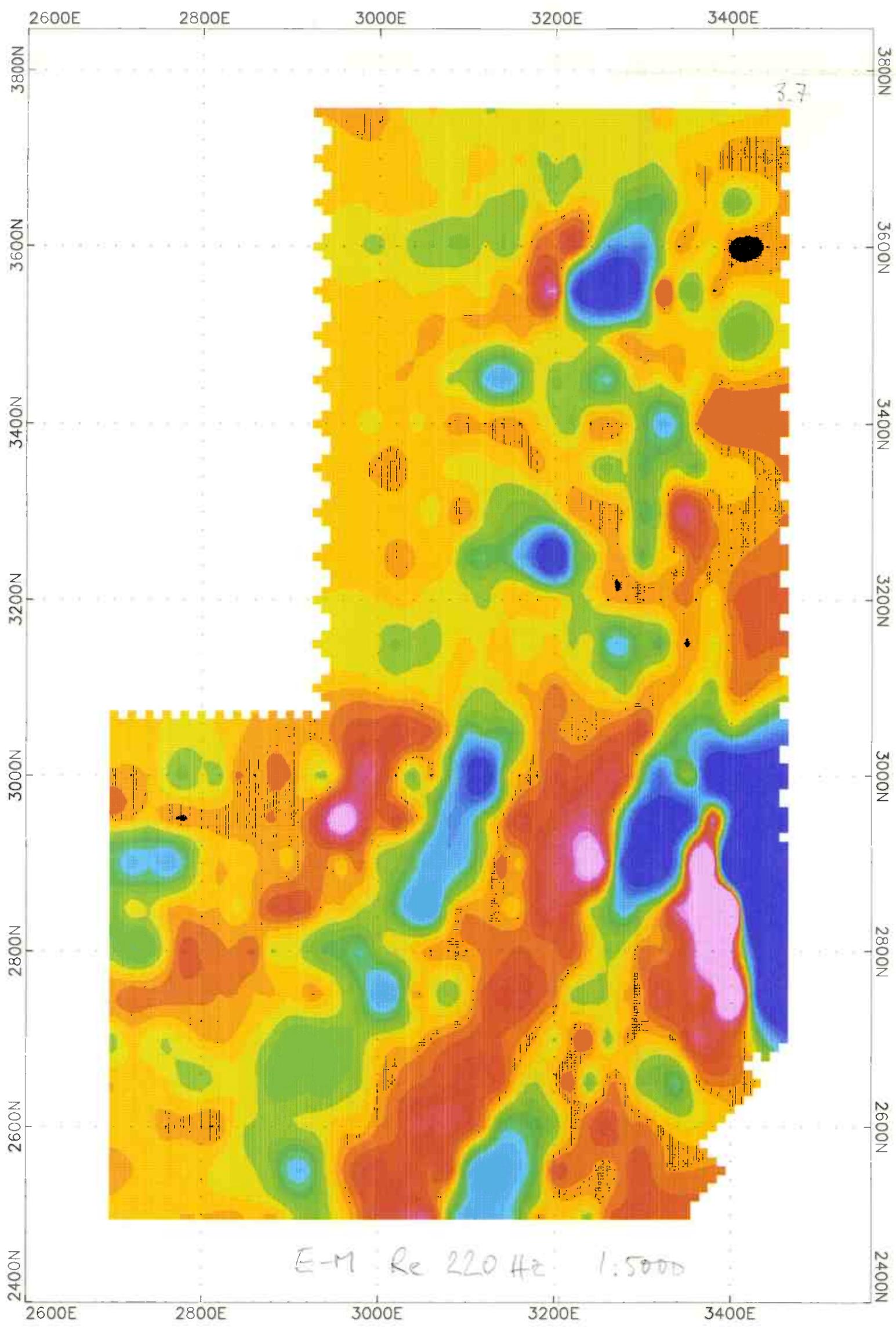




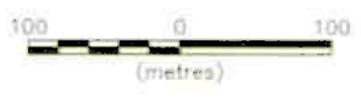
ELECTROMAGNETIC SURVEY
Ballangen Norway
Nikkel og Olivin AS
Im 7040 Hz 0+-20 %/cm
August 1996 SMOY
1:5 000



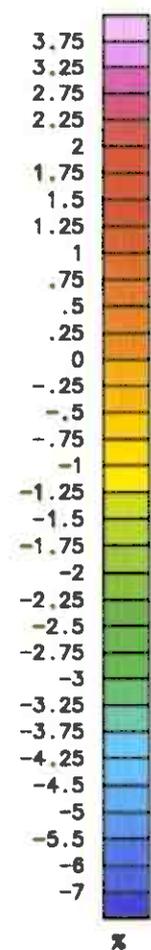
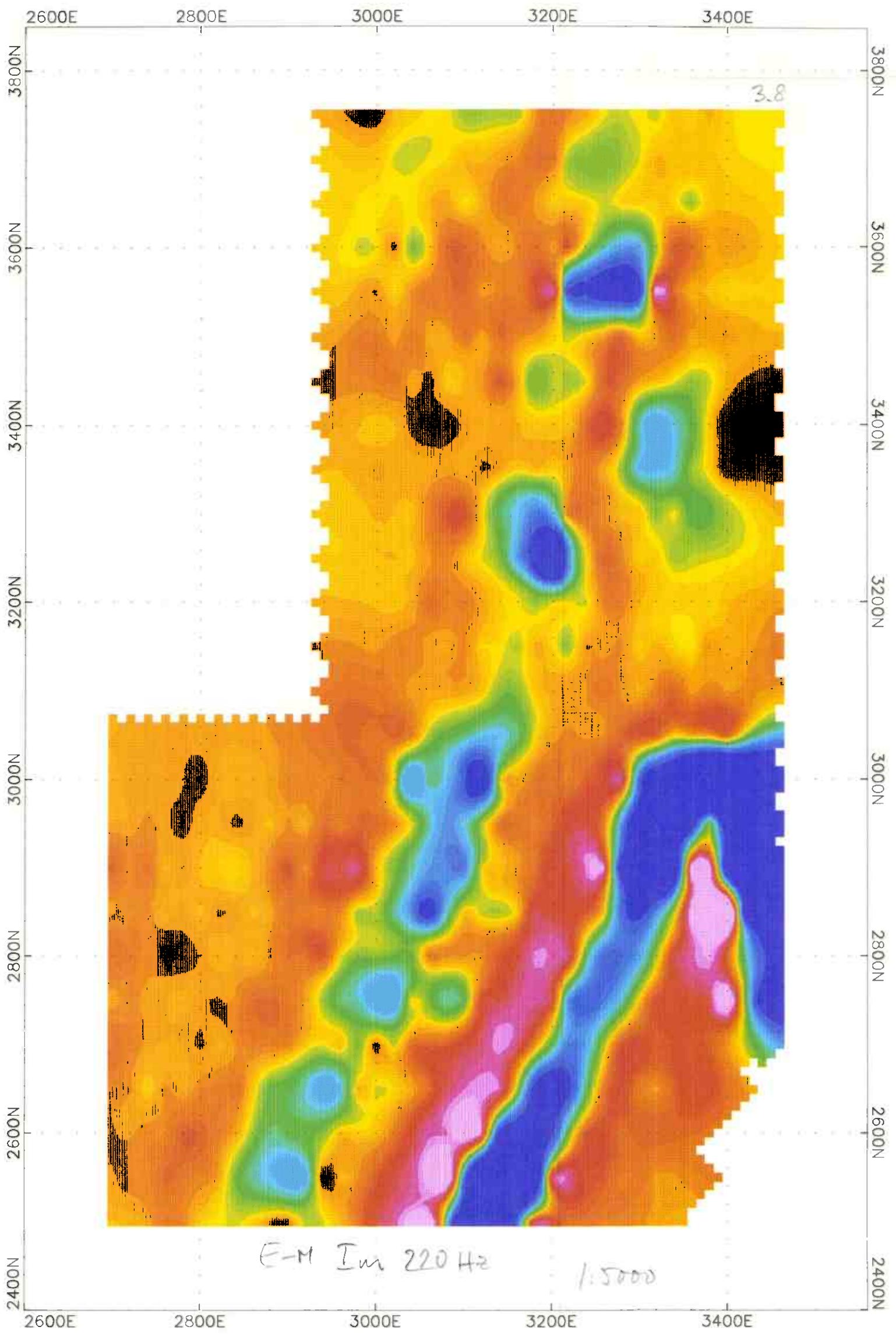
3.7



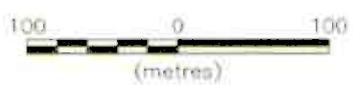
ELECTROMAGNETIC SURVEY
 Ballangen Norway
 Nikkel og Olivin AS
 Re 220 Hz
 August 1996 SMOY
 1: 5 000

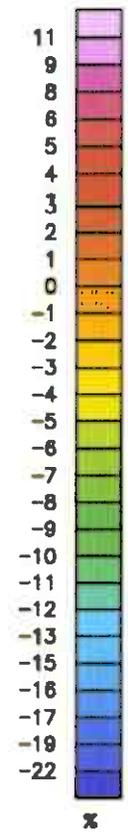
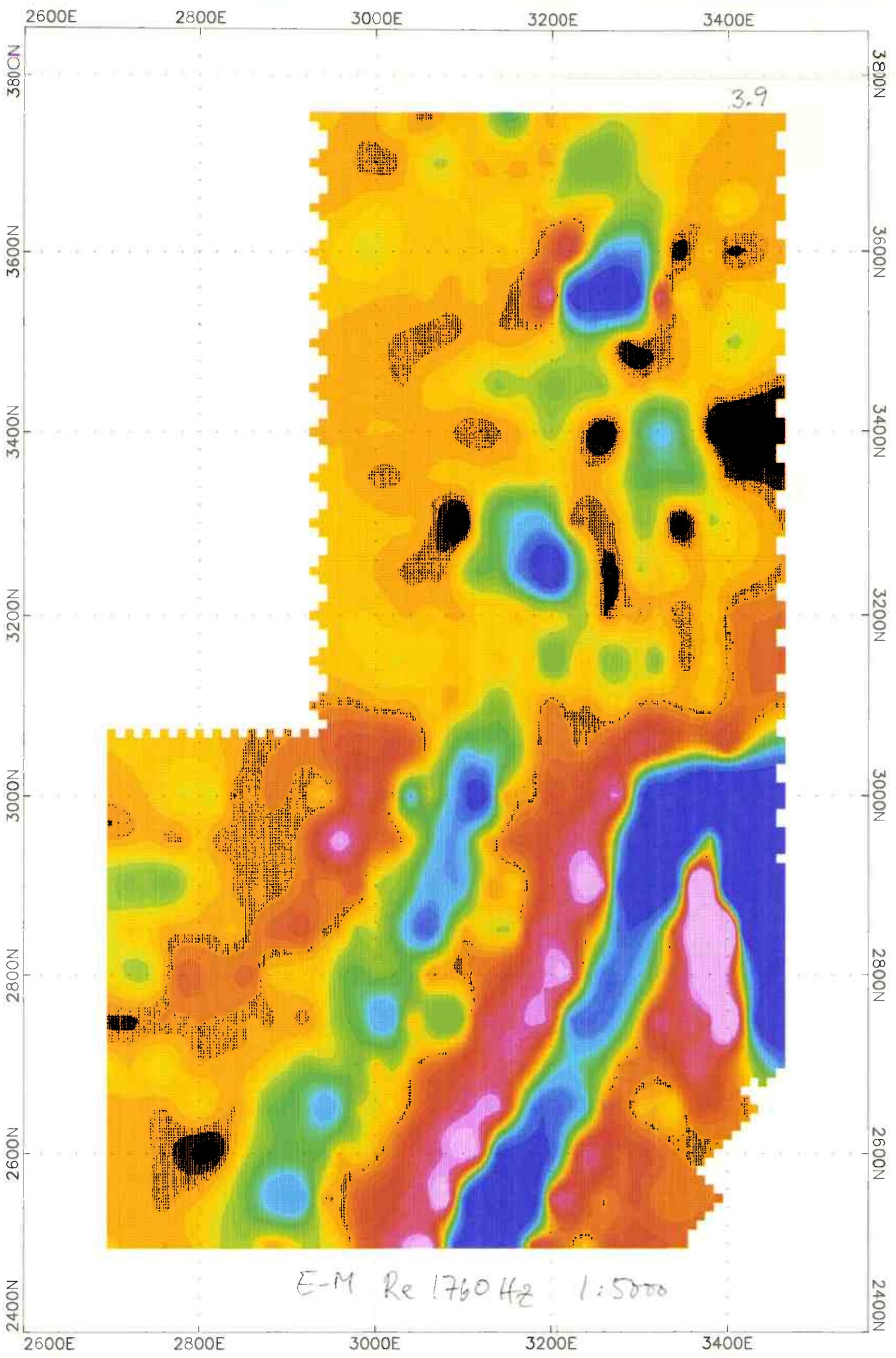


E-M Re 220 Hz 1:5000



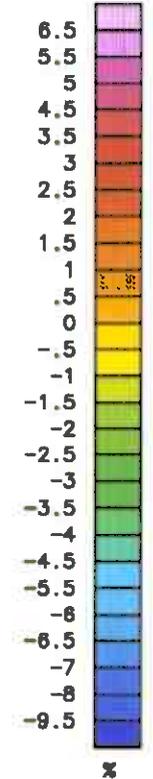
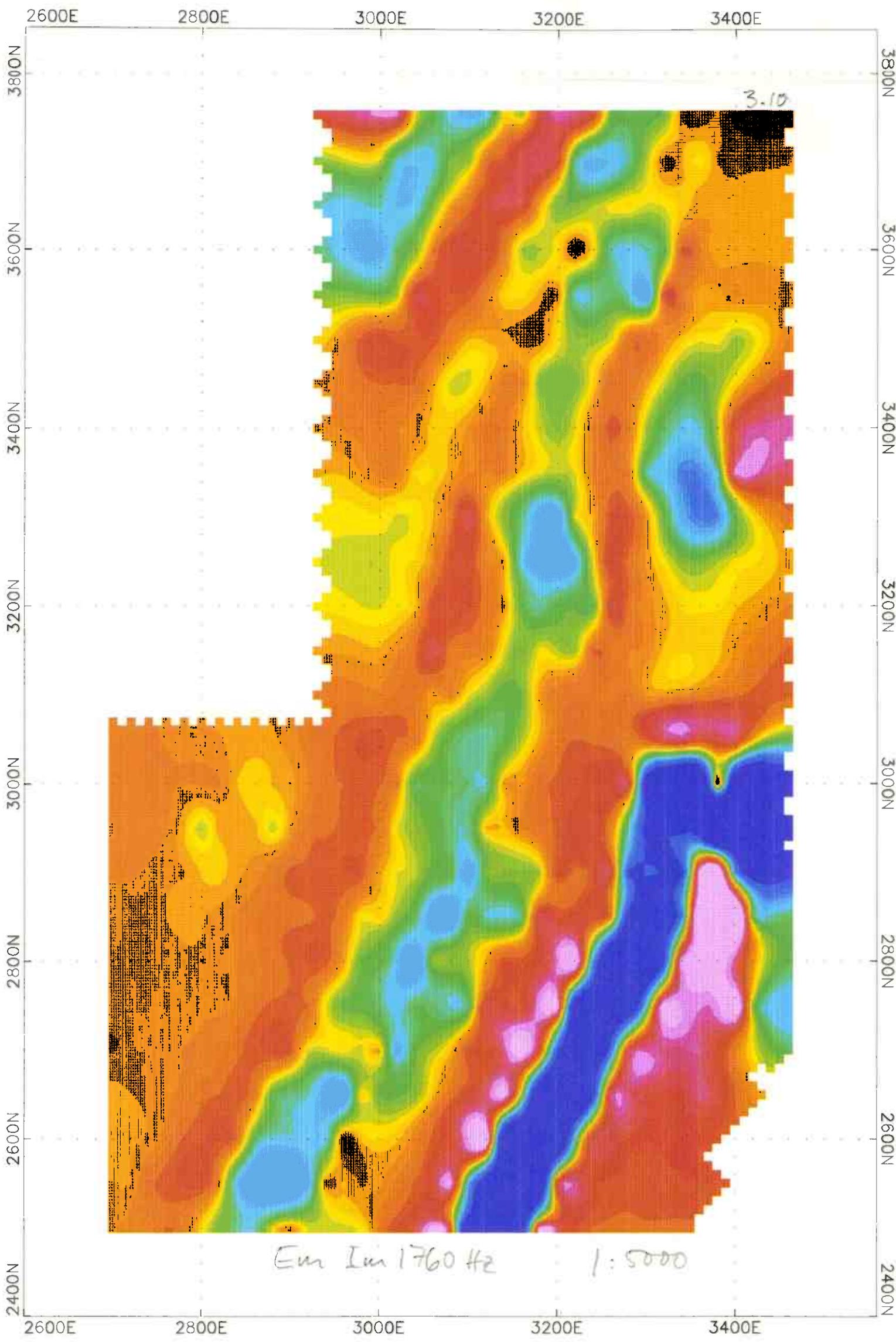
ELECTROMAGNETIC SURVEY
Ballangen Norway
Nikkel og Olivin AS
Im 220 Hz
August 1996 SMOY
1: 5 000



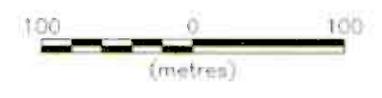


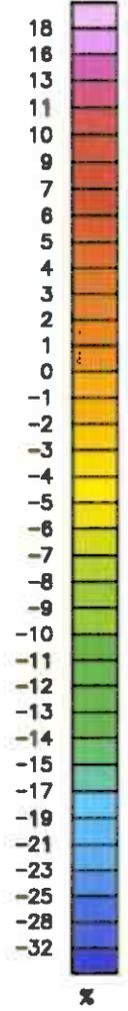
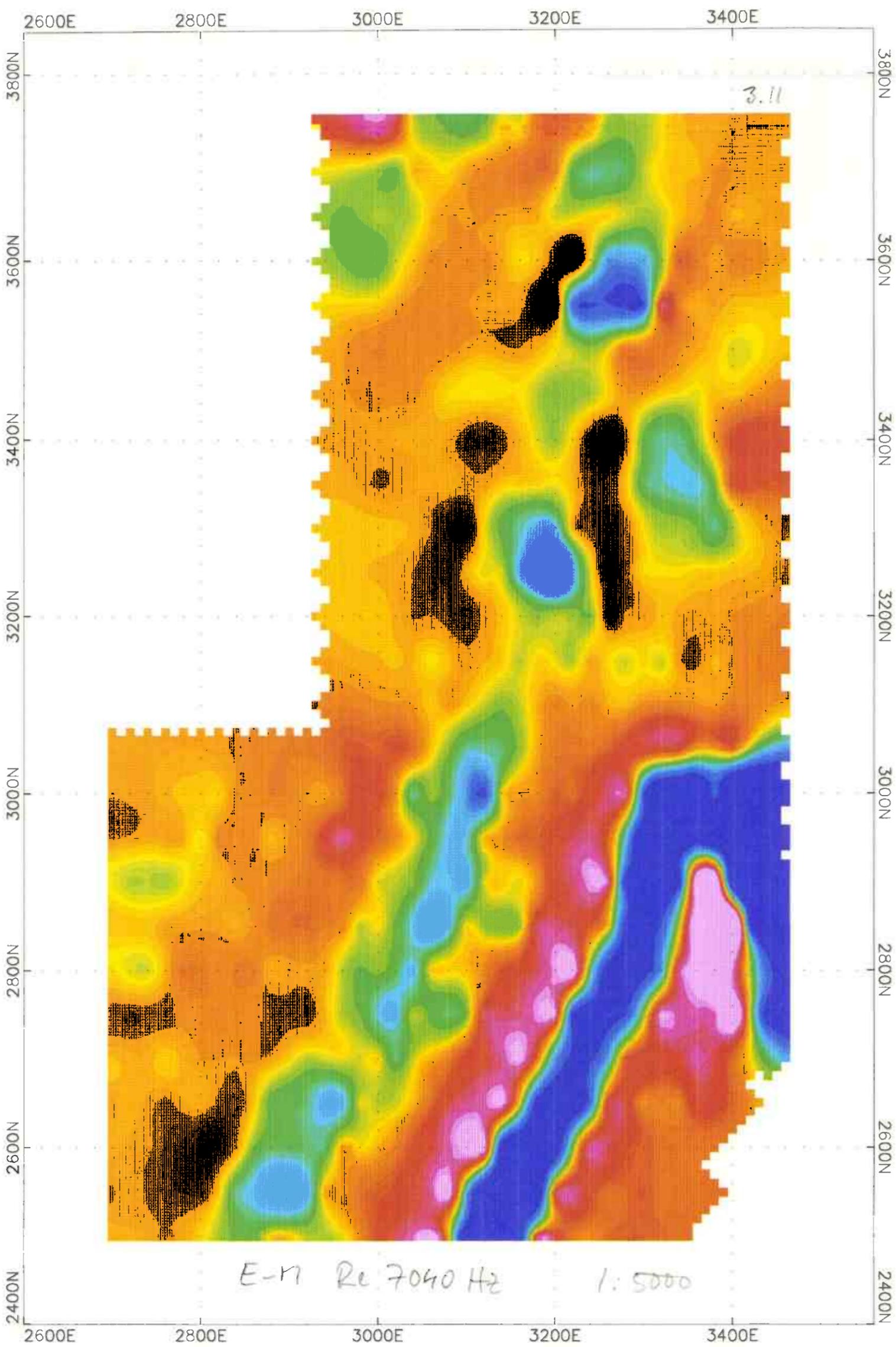
ELECTROMAGNETIC SURVEY
Ballangen Norway
Nikkel og Olivin AS
Re 1760 Hz
August 1996 SMOY
1: 5 000



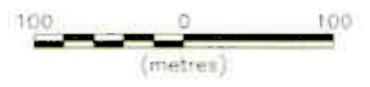


ELECTROMAGNETIC SURVEY
Ballangen Norway
Nikkel og Olivin AS
Im 1760 Hz
August 1996 SMOY
1: 5 000



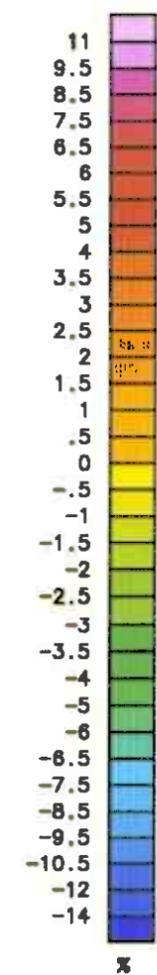
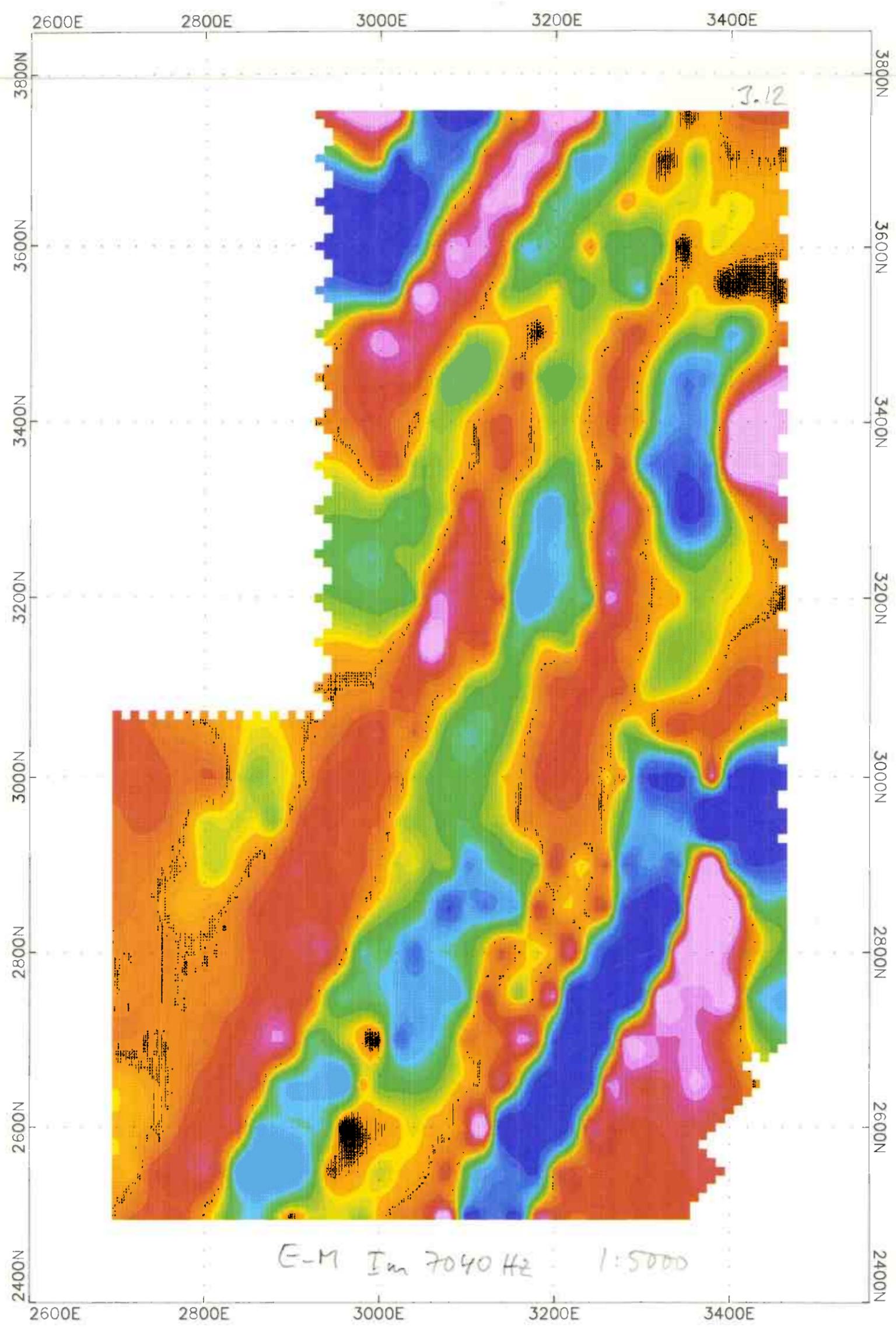


ELECTROMAGNETIC SURVEY
Ballangen Norway
Nikkel og Olivin AS
Re 7040 Hz
August 1996 SMOY
1: 5 000

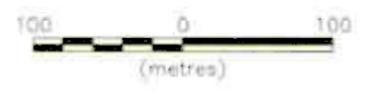


E-n Re 7040 Hz 1:5000

3.11

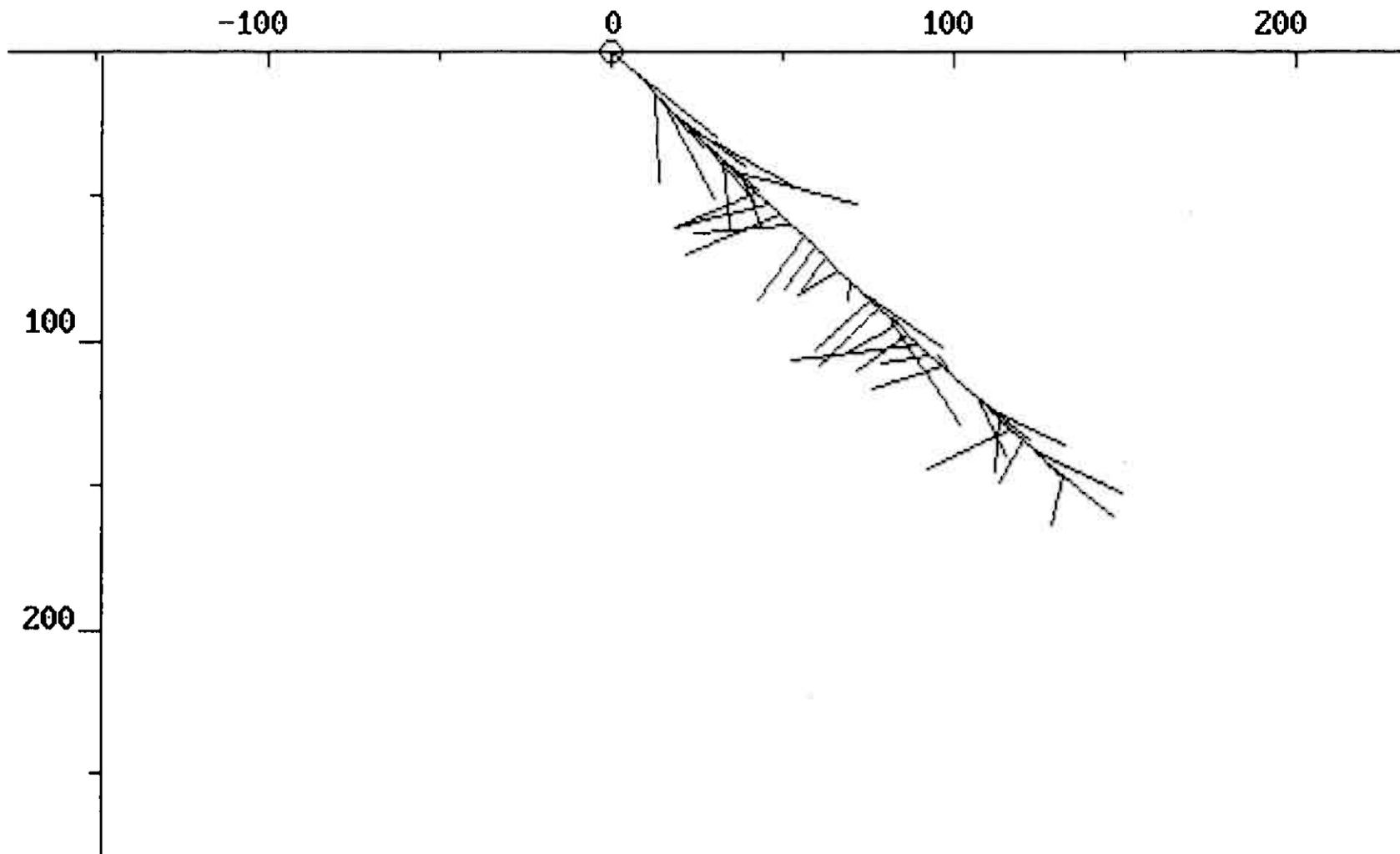


ELECTROMAGNETIC SURVEY
 Ballangen Norway
 Nikkel og Olivin AS
 Im 7040 Hz
 August 1996 SMOY
 1: 5 000



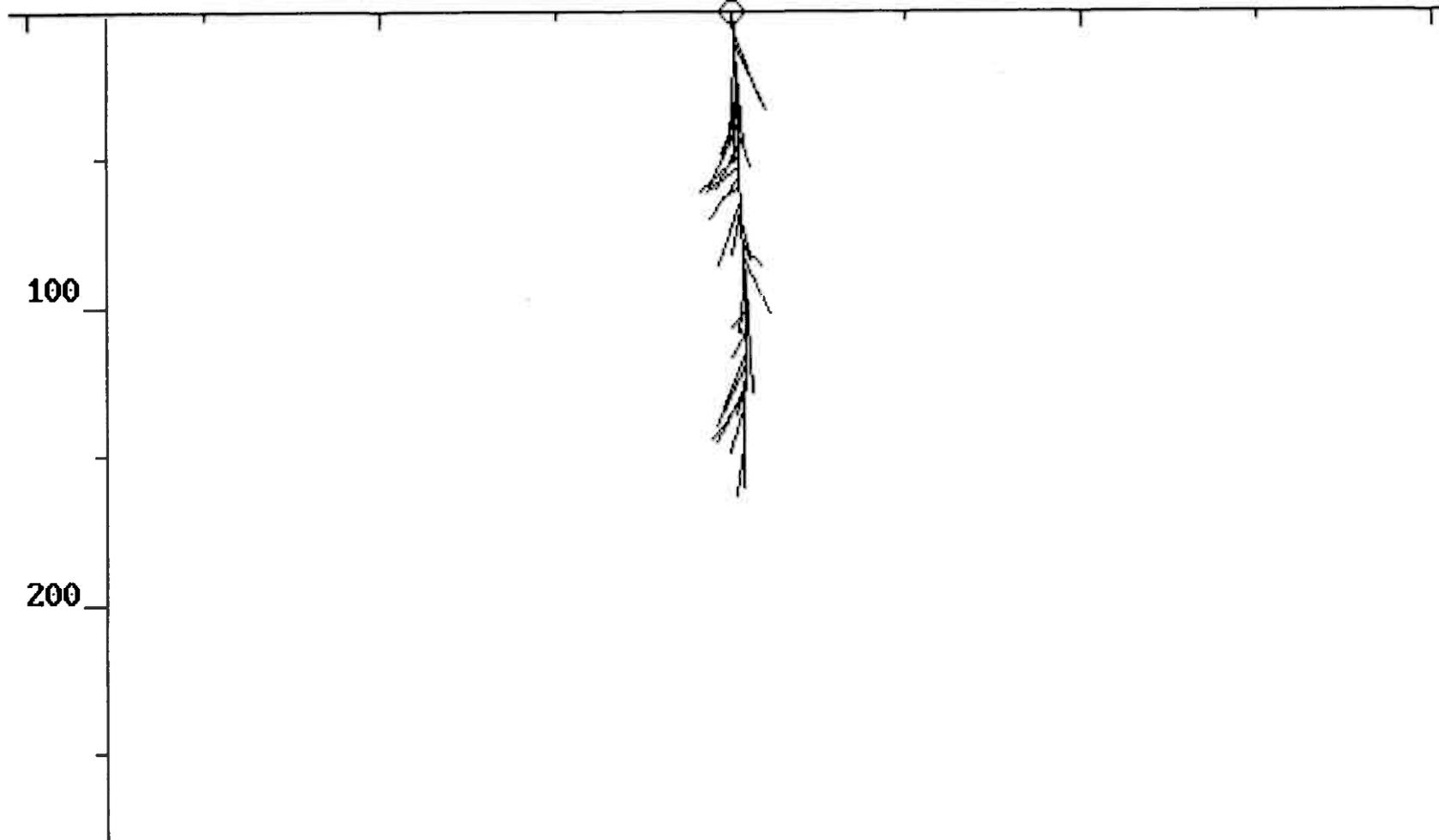
P1 BALLANGEN
Sivukuva

DIP=47.5° DEG= 98.8° 1: 2000 100 nT/cm
Normaalikenttä 52600 nT DIP=78.3° DEG= 0.0°
200



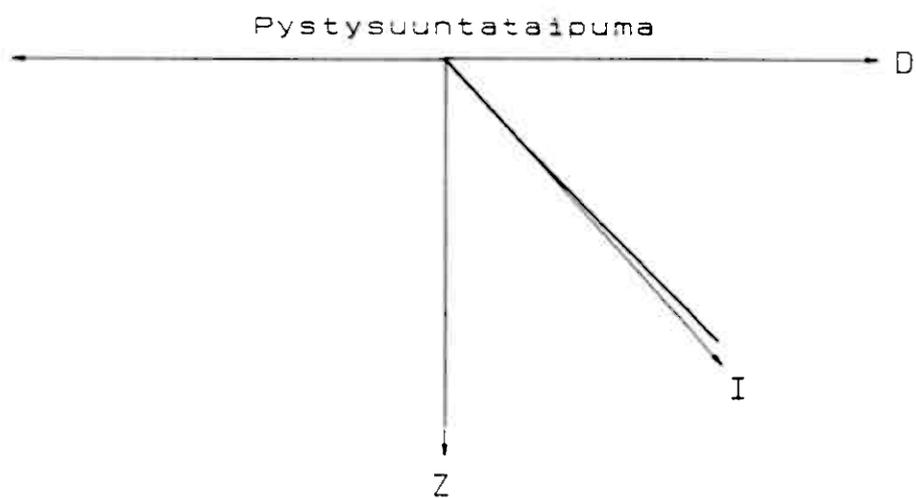
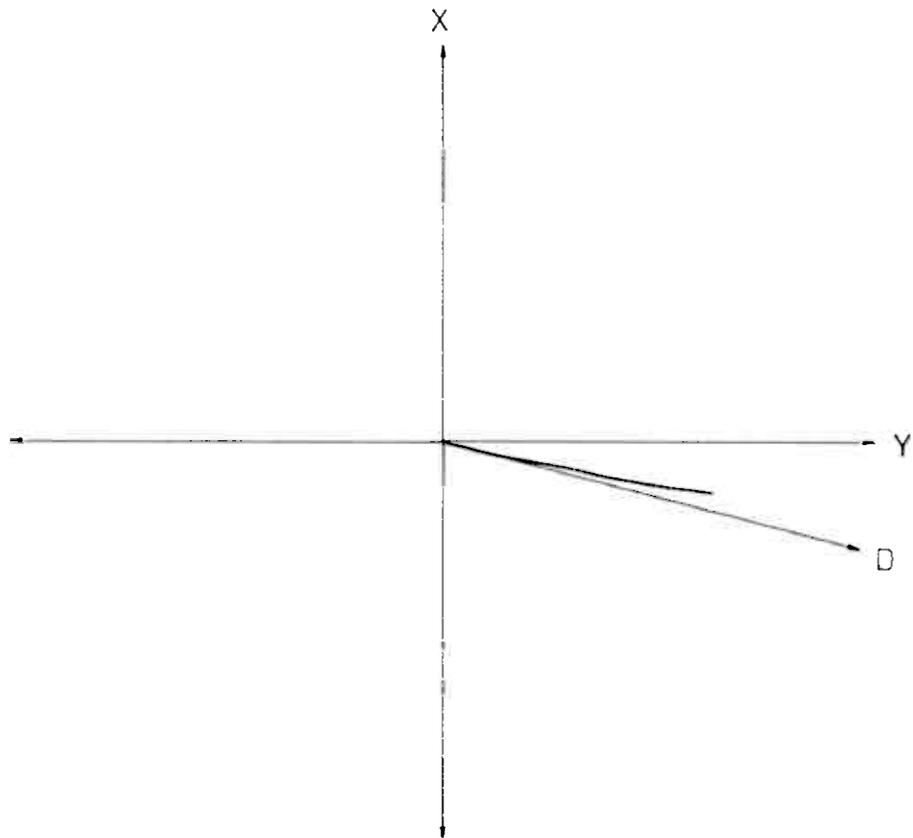
P1 BALLANGEN
Katsoja reiän takana
-100

DIP=47.5° DEG= 98.8° 1: 2000 100 nT/cm
Normaalikenttä 52600 nT DIP=78.3° DEG= 0.0°
100



BAL-P1

Sivusuuntataipuman maanpintaprojektio
valtakunnallisessa koordinaatistossa



3D-MAG-TAIPUMAMITTAUS

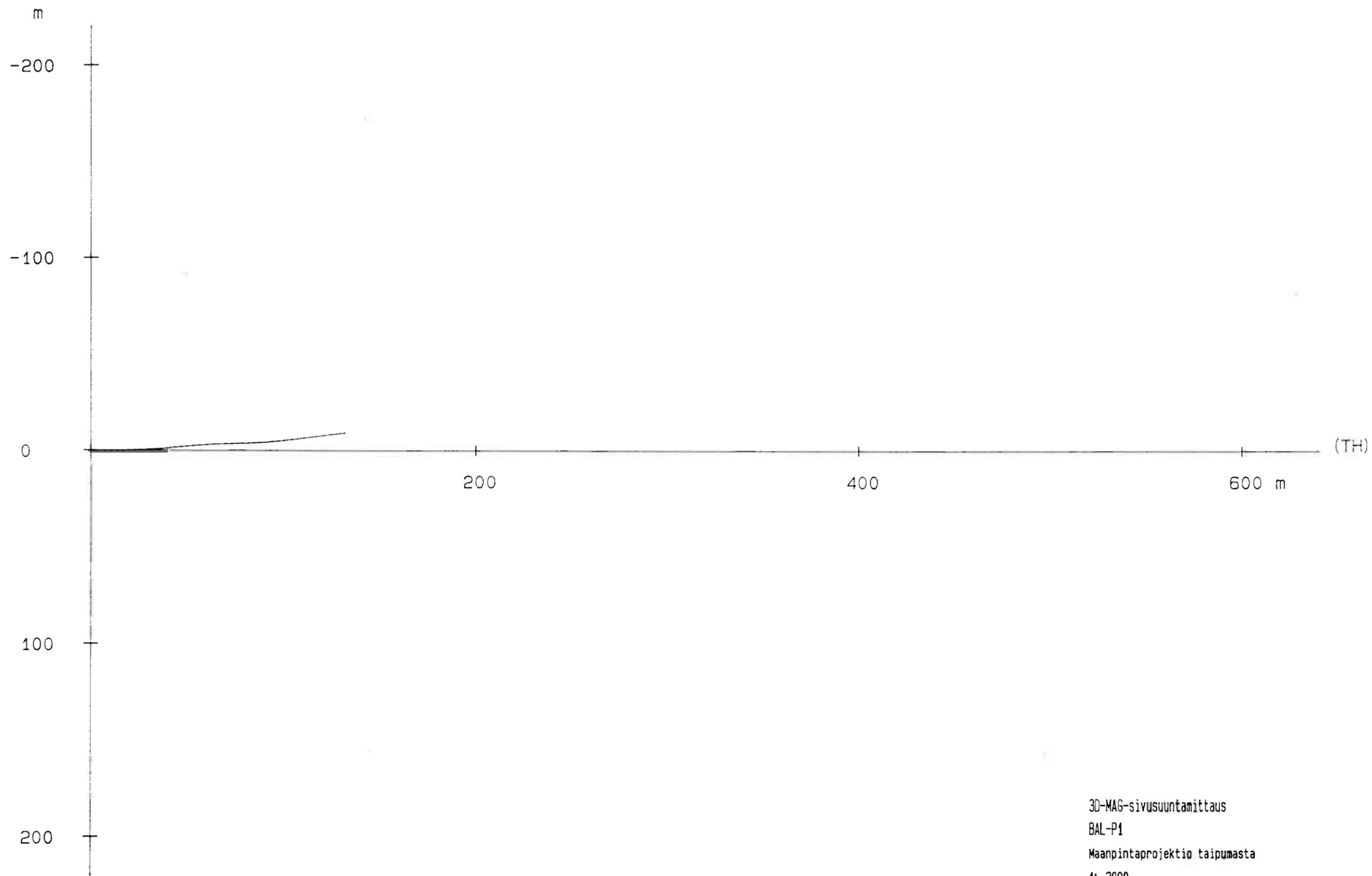
Alkusuunta D = 105.6 astetta

Alkukaltevuus I = 50.1 astetta

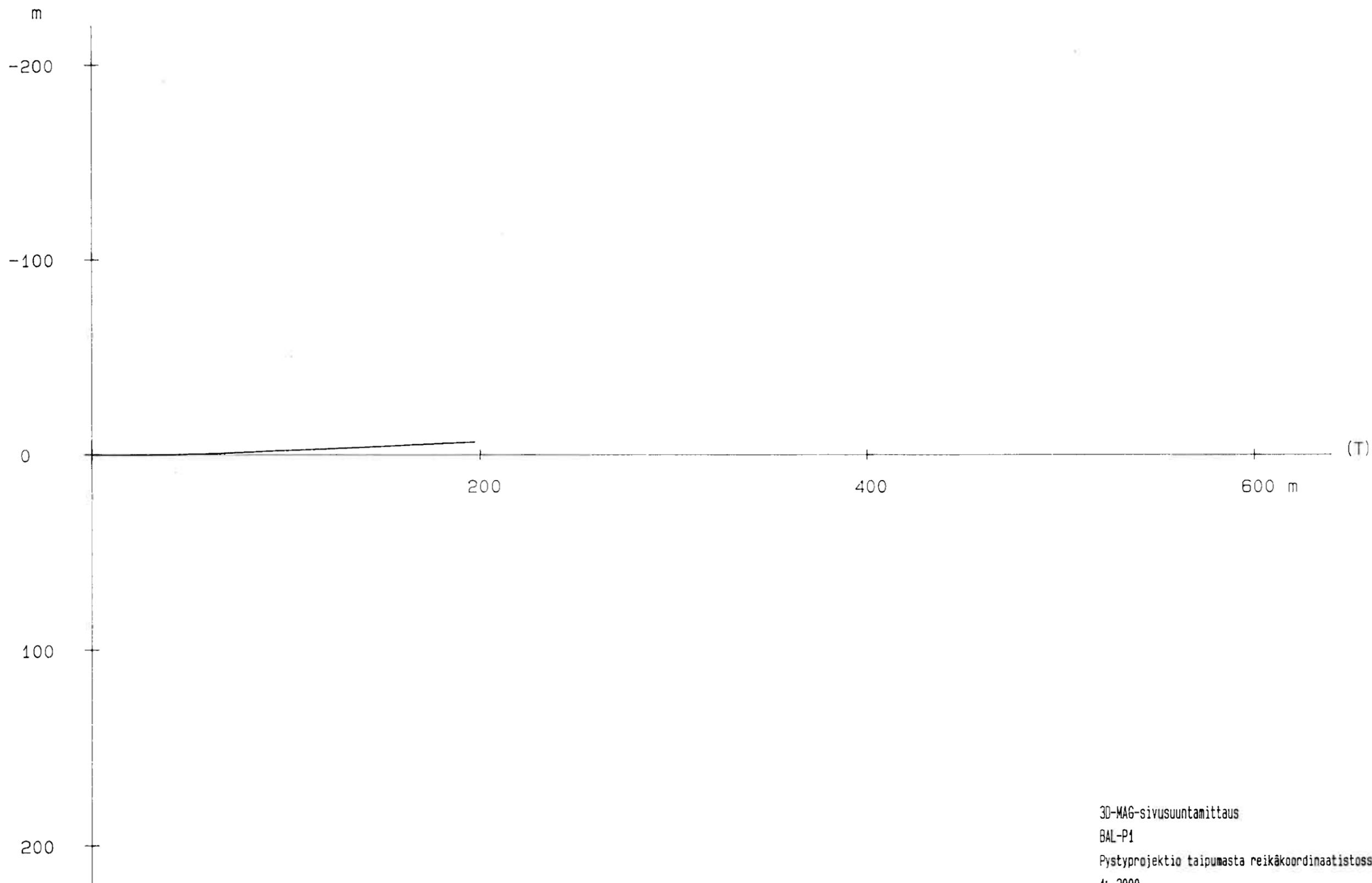
Kokonaispituus = 197.6 m

SMOY

04-09-1996



3D-MAG-sivusuuntamittaus
BAL-P1
Maanpintaprojektio taipumasta
1: 2000
SMOY 04-09-1996



3D-MAG-sivusuuntamittaus
BAL-P1
Pystyprojektio taipumasta reikäkoordinaatistossa
1: 2000
SMOY 04-09-1996

Suomen Malmi Oy

09-04-1996

 * 3D-MAG-SIVUSUUNTAMITTAUS *

Työn otsikko: BAL-P1

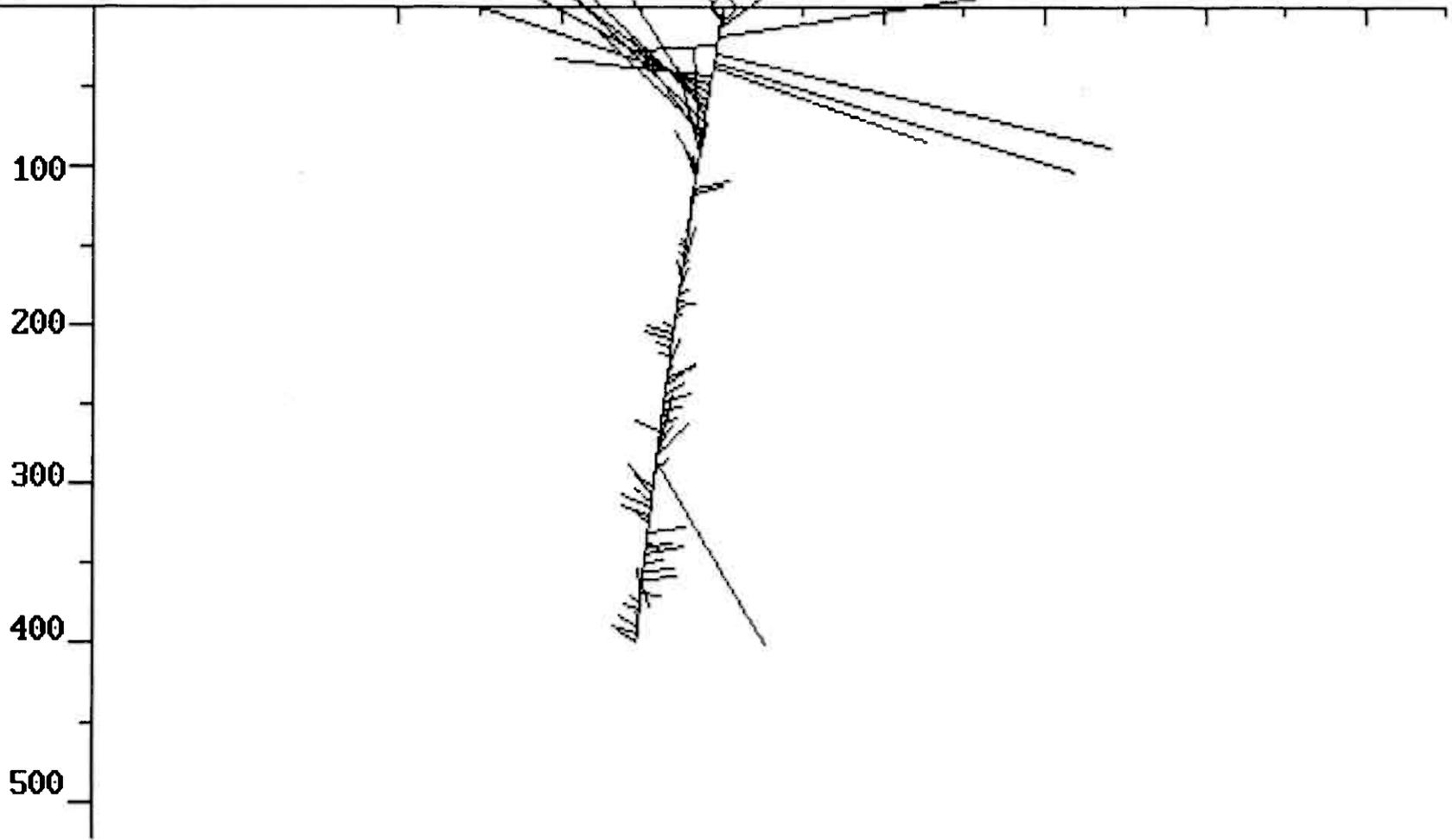
Alkusuunta = 105.6 astetta
 Alkukaltevuus = 50.1 astetta

Piste	pituus	X	Y	Z	suunta	kaade
1	0.0	0.0	0.0	0.0	105.6	50.1
2	10.4	-1.8	6.4	-8.0	105.6	50.1
3	15.4	-2.7	9.5	-11.8	105.4	50.1
4	20.4	-3.5	12.6	-15.7	105.3	50.0
5	25.4	-4.3	15.7	-19.5	104.9	49.9
6	30.4	-5.2	18.8	-23.3	104.4	49.7
7	35.4	-5.9	22.0	-27.1	103.7	49.5
8	40.4	-6.7	25.2	-30.9	103.0	49.2
9	45.4	-7.4	28.4	-34.7	102.3	48.9
10	50.4	-8.1	31.6	-38.4	101.6	48.6
11	55.4	-8.7	34.8	-42.2	100.9	48.3
12	60.4	-9.4	38.1	-45.9	100.4	47.9
13	65.4	-10.0	41.4	-49.6	100.0	47.6
14	70.4	-10.5	44.8	-53.3	99.9	47.4
15	75.4	-11.1	48.1	-57.0	100.1	47.3
16	80.4	-11.7	51.4	-60.6	100.6	47.3
17	85.4	-12.4	54.8	-64.3	101.3	47.3
18	90.4	-13.1	58.1	-68.0	102.0	47.4
19	95.4	-13.8	61.4	-71.7	102.7	47.6
20	100.4	-14.5	64.7	-75.4	103.3	47.7
21	105.4	-15.3	67.9	-79.1	103.8	47.8
22	110.4	-16.1	71.2	-82.8	104.0	47.8
23	114.4	-16.8	73.8	-85.7	104.0	47.8
24	118.4	-17.4	76.4	-88.7	103.8	47.7
25	122.4	-18.1	79.0	-91.7	103.4	47.6
26	126.4	-18.7	81.6	-94.6	102.8	47.5
27	130.4	-19.3	84.3	-97.6	102.1	47.4
28	135.4	-20.0	87.6	-101.2	101.3	47.3
29	140.4	-20.6	90.9	-104.9	100.5	47.2
30	145.4	-21.2	94.3	-108.6	99.7	47.1
31	150.4	-21.8	97.6	-112.2	99.4	47.1
32	155.4	-22.3	101.0	-115.9	99.1	47.1
33	160.4	-22.8	104.4	-119.6	98.6	47.1
34	165.4	-23.3	107.7	-123.2	98.2	47.1
35	170.4	-23.8	111.1	-126.9	98.0	47.1
36	175.4	-24.3	114.5	-130.6	98.0	47.2
37	180.4	-24.8	117.8	-134.2	98.2	47.3
38	185.4	-25.2	121.2	-137.9	98.5	47.3
39	190.4	-25.8	124.5	-141.6	98.7	47.4
40	197.6	-26.5	129.3	-146.9	98.8	47.5

235_120 BALLANGEN
Katsoja reiän takana

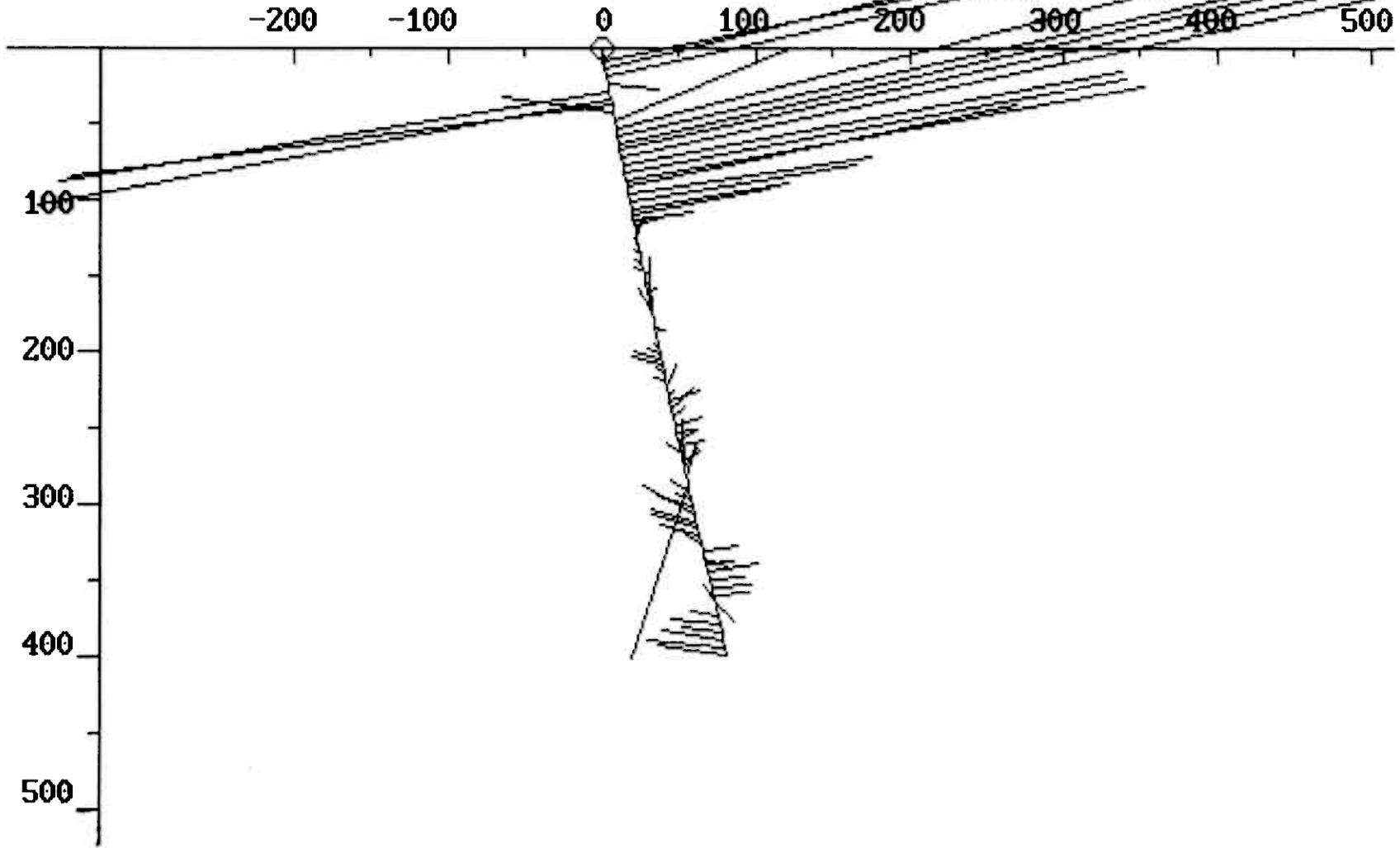
DIP=76.3° DEG= 80.4° 1: 4000 400 nT/cm
Normaalikenttä 52600 nT DIP=77.8° DEG= 0.0°

-200 -100 0 100 200 300 400



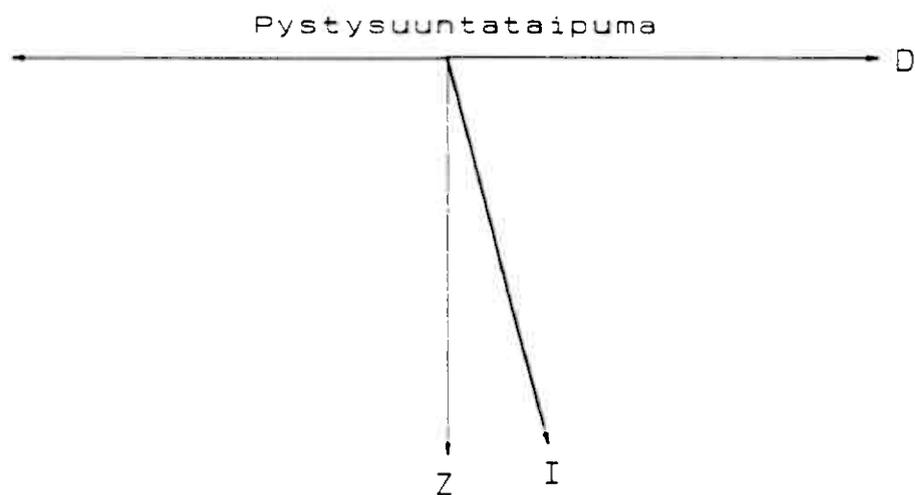
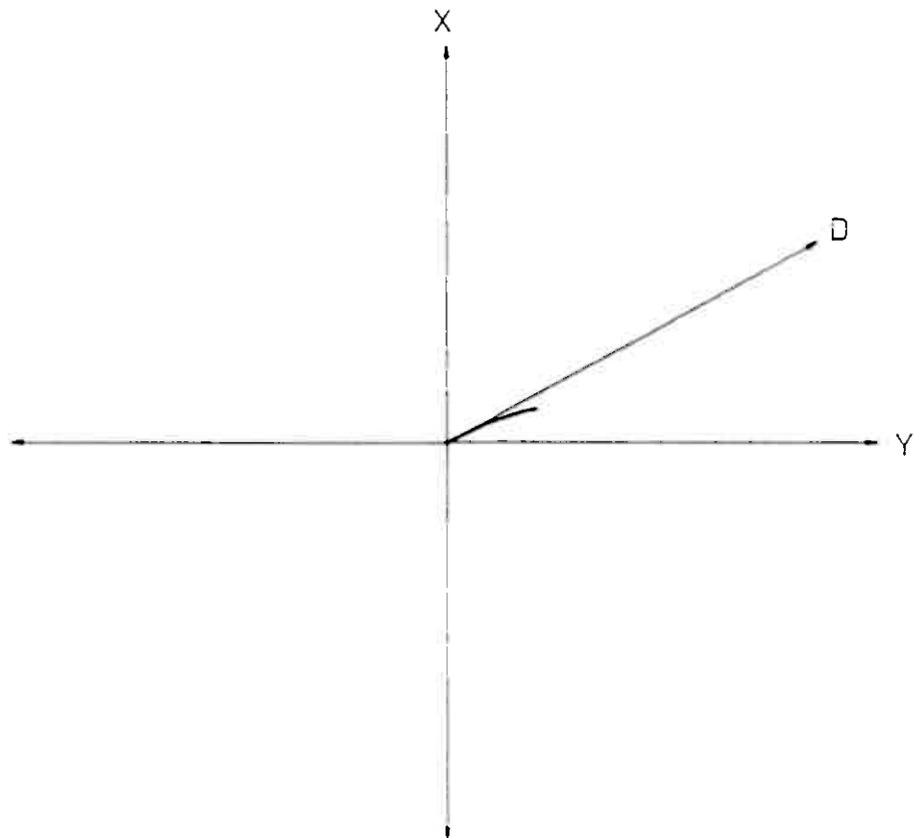
235_120 BALLANGEN
Sivukuva

DIP=76.3° DEG= 80.4° 1: 4000 400 nT/cm
Normaalikenttä 52600 nT DIP=77.8° DEG= 0.0°



BAL-235

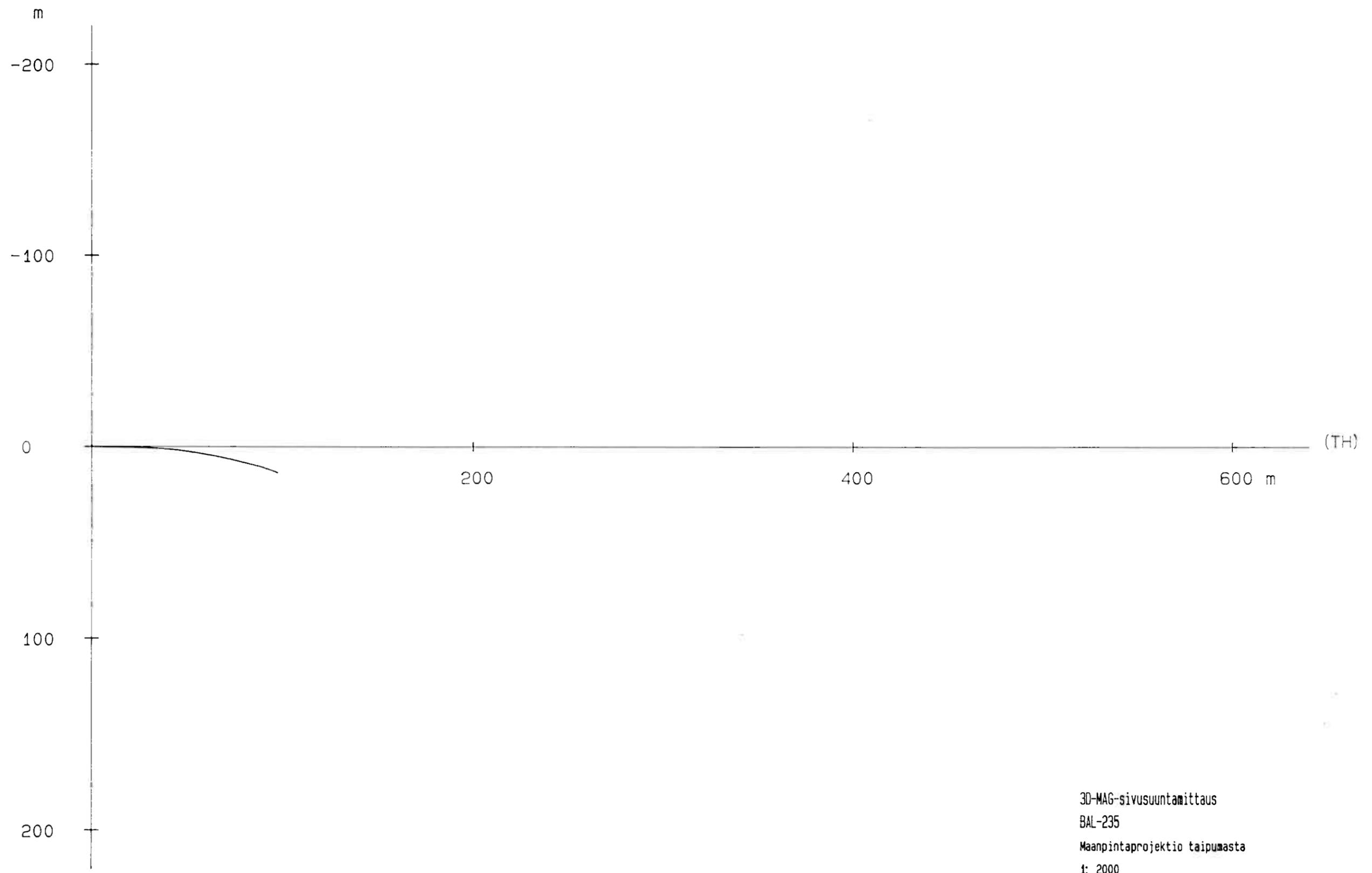
Sivusuuntataipuman maanpintaprojektio
valtakunnallisessa koordinaatistossa



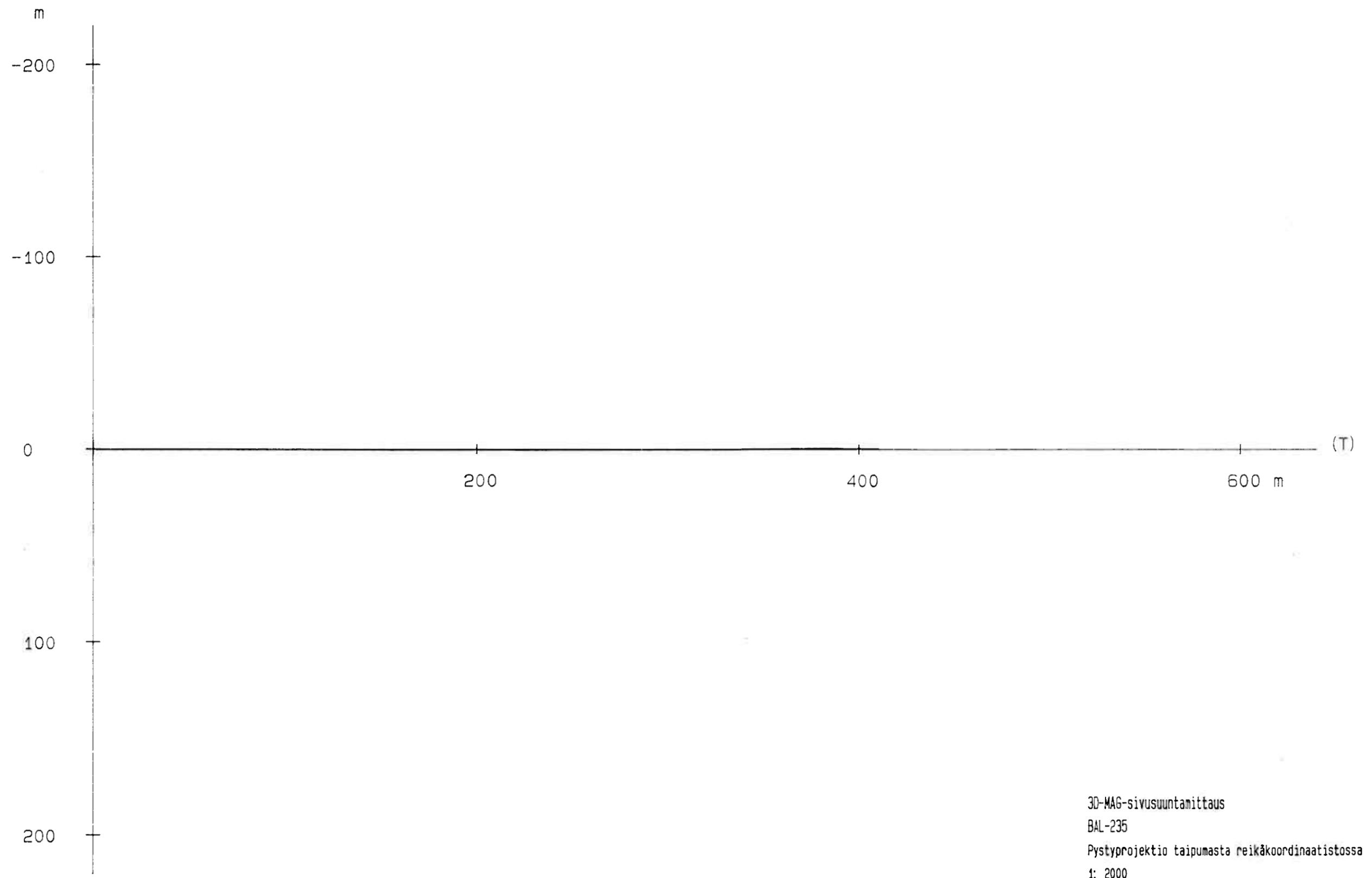
3D-MAG-TAIPUMAMITTAUS

Alkusuunta D = 59.3 astetta
Alkukaltevuus I = 76.4 astetta
Kokonaispituus = 410.7 m

SMOY
04-09-1996



3D-MAG-sivusuuntamittaus
BAL-235
Maanpintaprojektio taipumasta
1: 2000
SMOY 04-09-1996



30-MAG-sivusuuntamittaus
BAL-235
Pystyprojektio taipumasta reikäkoordinaatistossa
1: 2000
SMOY 04-09-1996

Suomen Malmi Oy

09-04-1996

 * 3D-MAG-SIVUSUUNTAMITTAUS *

Työn otsikko: BAL-235

Alkusuunta = 59.3 astetta
 Alkukaltevuus = 76.4 astetta

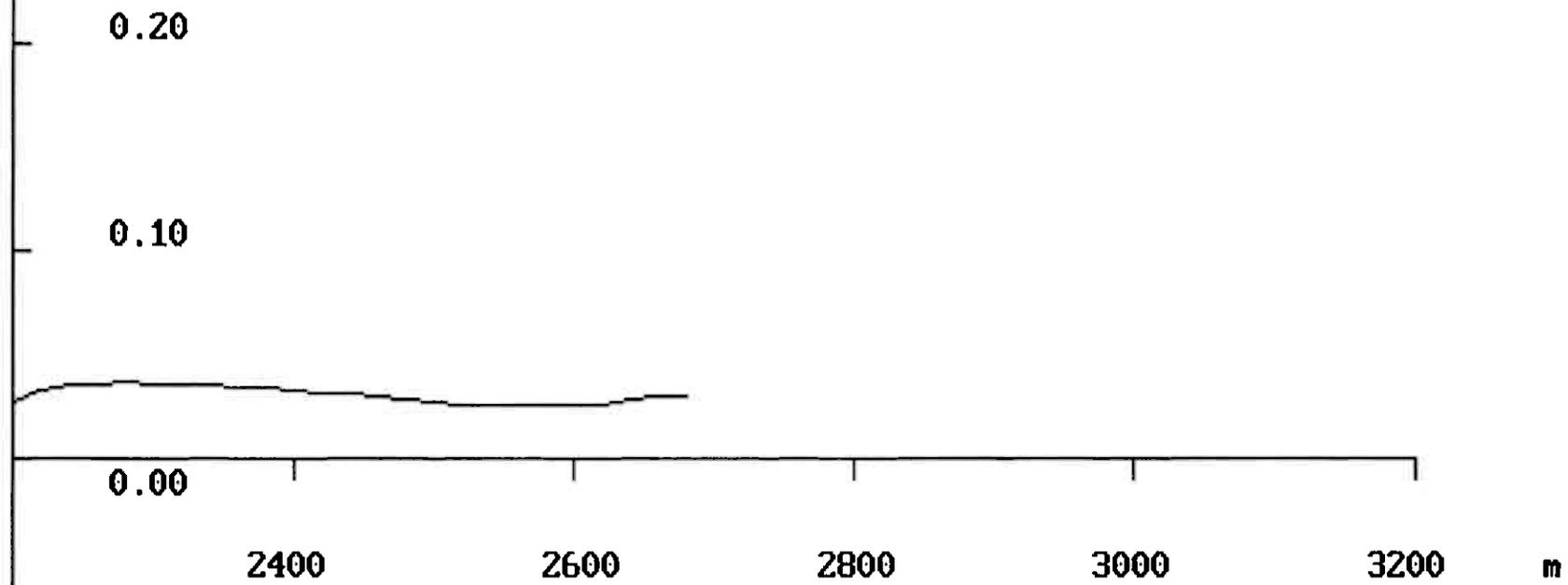
Piste	pituus	X	Y	Z	suunta	kaade
1	0.0	0.0	0.0	0.0	59.3	76.4
2	10.3	1.2	2.1	-10.0	59.3	76.4
3	15.3	1.8	3.1	-14.9	59.5	76.4
4	20.3	2.4	4.1	-19.7	59.8	76.4
5	25.3	3.0	5.1	-24.6	60.1	76.4
6	30.3	3.6	6.2	-29.5	60.3	76.4
7	35.3	4.2	7.2	-34.3	60.3	76.4
8	40.3	4.8	8.2	-39.2	60.3	76.4
9	45.3	5.4	9.2	-44.0	60.3	76.4
10	50.3	5.9	10.2	-48.9	60.4	76.4
11	55.3	6.5	11.3	-53.8	60.4	76.4
12	60.3	7.1	12.3	-58.6	60.4	76.4
13	65.3	7.7	13.3	-63.5	60.4	76.4
14	70.3	8.3	14.3	-68.3	60.4	76.4
15	75.3	8.8	15.3	-73.2	60.5	76.4
16	80.3	9.4	16.4	-78.1	60.6	76.4
17	85.3	10.0	17.4	-82.9	60.6	76.4
18	90.3	10.6	18.4	-87.8	60.7	76.4
19	95.3	11.1	19.4	-92.6	60.8	76.4
20	100.3	11.7	20.5	-97.5	60.8	76.4
21	105.3	12.3	21.5	-102.4	60.9	76.4
22	110.3	12.9	22.5	-107.2	61.1	76.4
23	113.6	13.2	23.2	-110.4	61.2	76.4
24	117.0	13.6	23.9	-113.7	61.4	76.4
25	120.3	14.0	24.6	-116.9	61.6	76.4
26	125.3	14.5	25.6	-121.8	61.9	76.4
27	130.3	15.1	26.7	-126.7	62.2	76.4
28	135.3	15.6	27.7	-131.5	62.5	76.5
29	140.3	16.2	28.7	-136.4	62.8	76.5
30	145.3	16.7	29.8	-141.2	63.1	76.5
31	150.3	17.2	30.8	-146.1	63.5	76.5
32	155.3	17.8	31.9	-151.0	63.8	76.4
33	160.3	18.3	32.9	-155.8	64.1	76.4
34	165.3	18.8	34.0	-160.7	64.4	76.4
35	170.3	19.3	35.0	-165.5	64.6	76.4
36	175.3	19.8	36.1	-170.4	64.7	76.4
37	180.3	20.3	37.2	-175.3	65.1	76.4
38	185.3	20.8	38.2	-180.1	65.4	76.4
39	190.3	21.3	39.3	-185.0	65.8	76.4
40	195.3	21.7	40.4	-189.8	66.2	76.4

BAL-235

Sivu 2

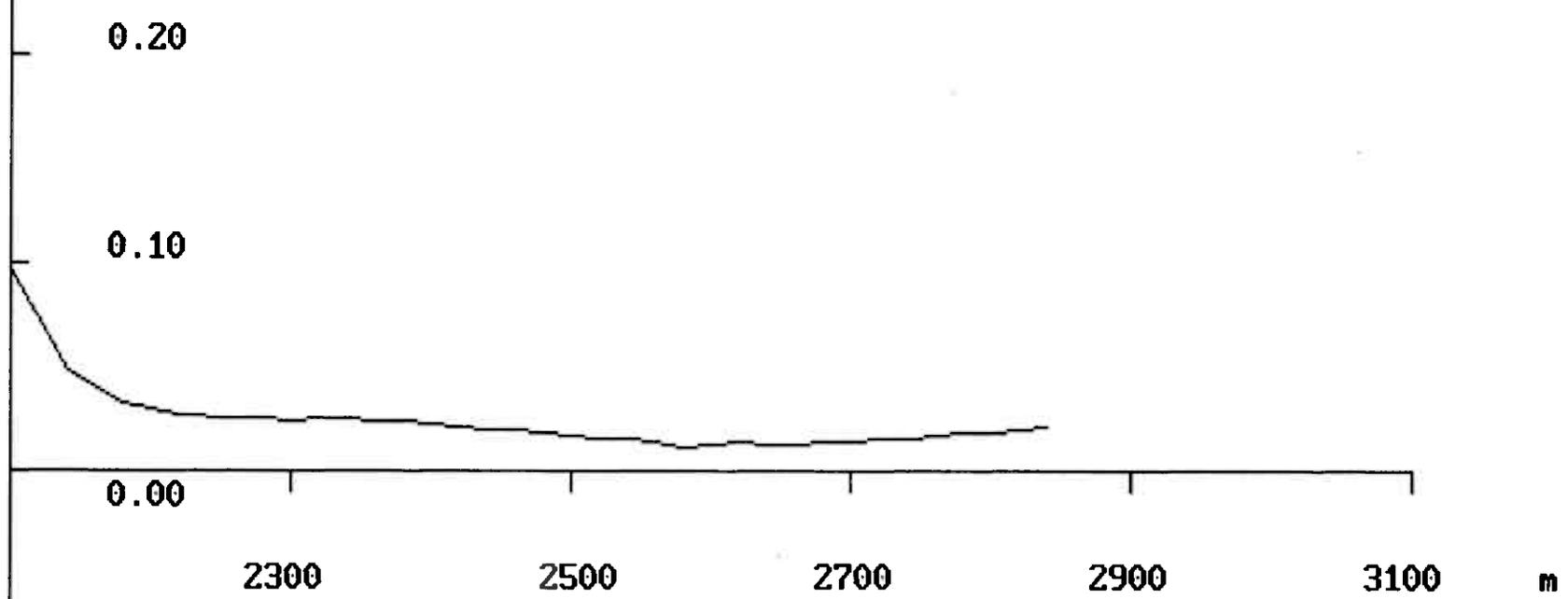
41	200.3	22.2	41.5	-194.7	66.6	76.4
42	203.6	22.5	42.2	-197.9	66.9	76.4
43	207.0	22.8	42.9	-201.2	67.3	76.4
44	210.3	23.1	43.6	-204.4	67.6	76.4
45	215.3	23.6	44.7	-209.3	67.8	76.4
46	220.3	24.0	45.8	-214.1	68.0	76.3
47	225.3	24.5	46.9	-219.0	68.1	76.3
48	230.3	24.9	48.0	-223.8	68.2	76.2
49	235.3	25.3	49.1	-228.7	68.3	76.2
50	240.3	25.8	50.2	-233.6	68.4	76.1
51	245.3	26.2	51.4	-238.4	68.5	76.1
52	250.3	26.7	52.5	-243.3	68.6	76.1
53	255.3	27.1	53.6	-248.1	68.8	76.0
54	260.3	27.5	54.7	-253.0	69.1	76.0
55	265.3	28.0	55.9	-257.8	69.4	75.9
56	270.3	28.4	57.0	-262.7	69.9	75.9
57	275.3	28.8	58.1	-267.5	70.3	75.9
58	280.3	29.2	59.3	-272.4	70.8	75.9
59	283.6	29.5	60.1	-275.6	71.3	75.9
60	287.0	29.7	60.8	-278.8	71.4	75.9
61	290.3	30.0	61.6	-282.1	71.5	75.9
62	295.3	30.4	62.8	-286.9	71.6	75.9
63	300.3	30.8	63.9	-291.8	71.8	75.9
64	305.3	31.1	65.1	-296.6	72.2	75.8
65	310.3	31.5	66.2	-301.5	72.5	75.8
66	315.3	31.9	67.4	-306.3	72.6	75.8
67	320.3	32.2	68.6	-311.2	72.7	75.8
68	325.3	32.6	69.8	-316.0	72.9	75.7
69	330.3	33.0	70.9	-320.8	72.9	75.6
70	335.3	33.3	72.1	-325.7	72.9	75.5
71	340.3	33.7	73.3	-330.5	72.9	75.4
72	345.3	34.1	74.5	-335.4	73.0	75.3
73	350.3	34.5	75.8	-340.2	73.1	75.3
74	355.3	34.8	77.0	-345.0	73.4	75.2
75	360.3	35.2	78.2	-349.9	73.9	75.2
76	365.3	35.5	79.4	-354.7	74.5	75.3
77	370.3	35.8	80.7	-359.5	75.3	75.4
78	373.6	36.1	81.5	-362.8	75.7	75.4
79	377.0	36.3	82.3	-366.0	76.2	75.5
80	380.3	36.5	83.1	-369.2	77.1	75.7
81	385.3	36.7	84.3	-374.1	78.1	75.8
82	390.3	37.0	85.5	-378.9	78.9	76.0
83	395.3	37.2	86.7	-383.8	79.6	76.1
84	400.3	37.4	87.8	-388.6	80.1	76.2
85	405.5	37.6	89.1	-393.7	80.3	76.3
86	410.7	37.8	90.3	-398.8	80.4	76.3

ohm CP-pot : BALLANGEN : X= 900 Y = 2200 - 2680 m
Laite : SAS300C : 1: 5000 P160896A.CPM
— KAIUOS

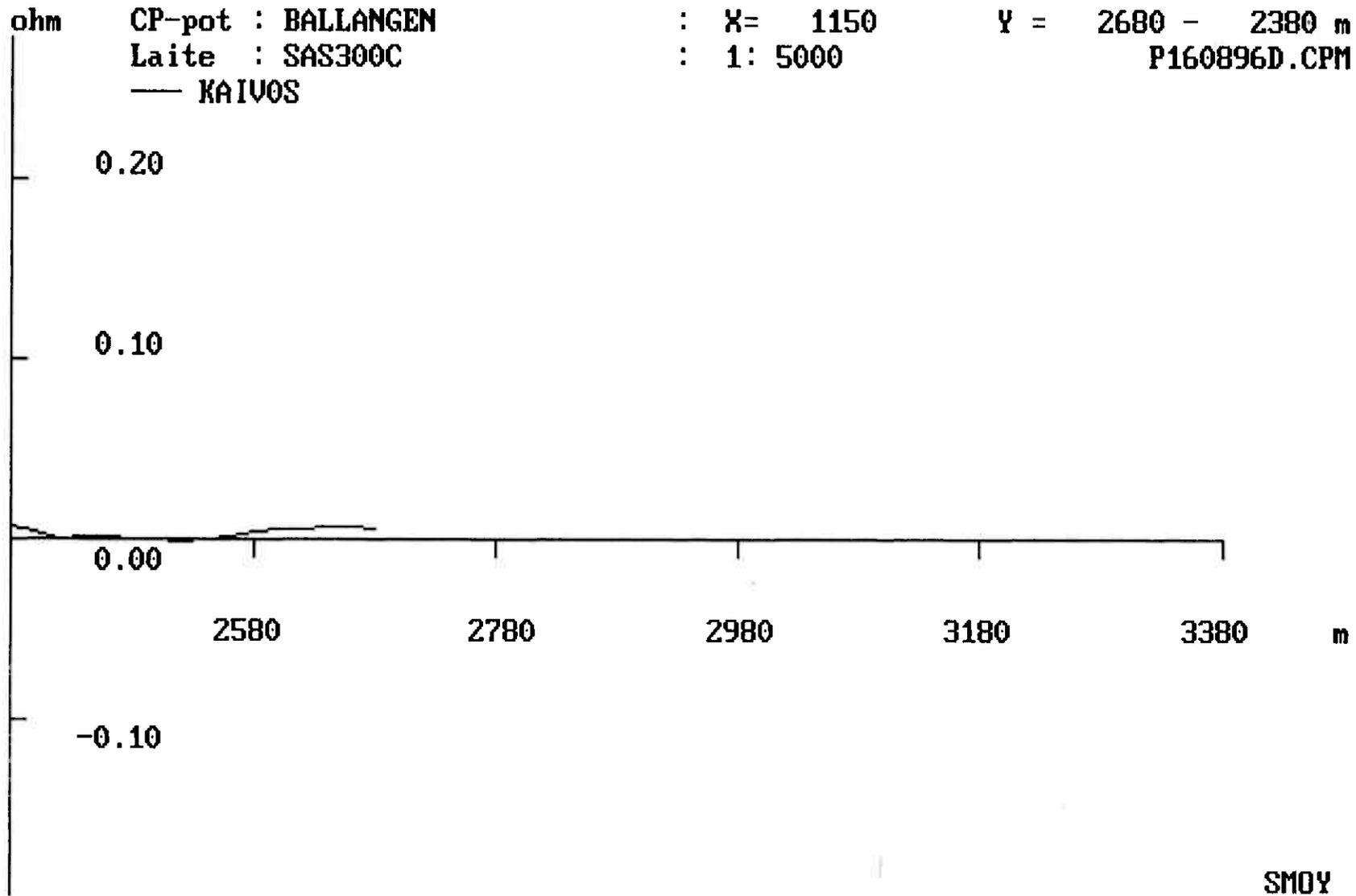


SMOY

ohm CP-pot : BALLANGEN : X= 1000 Y = 2100 - 2840 m
Laite : SAS300C : 1: 5000 P160896B.CPM
— KAIUOS

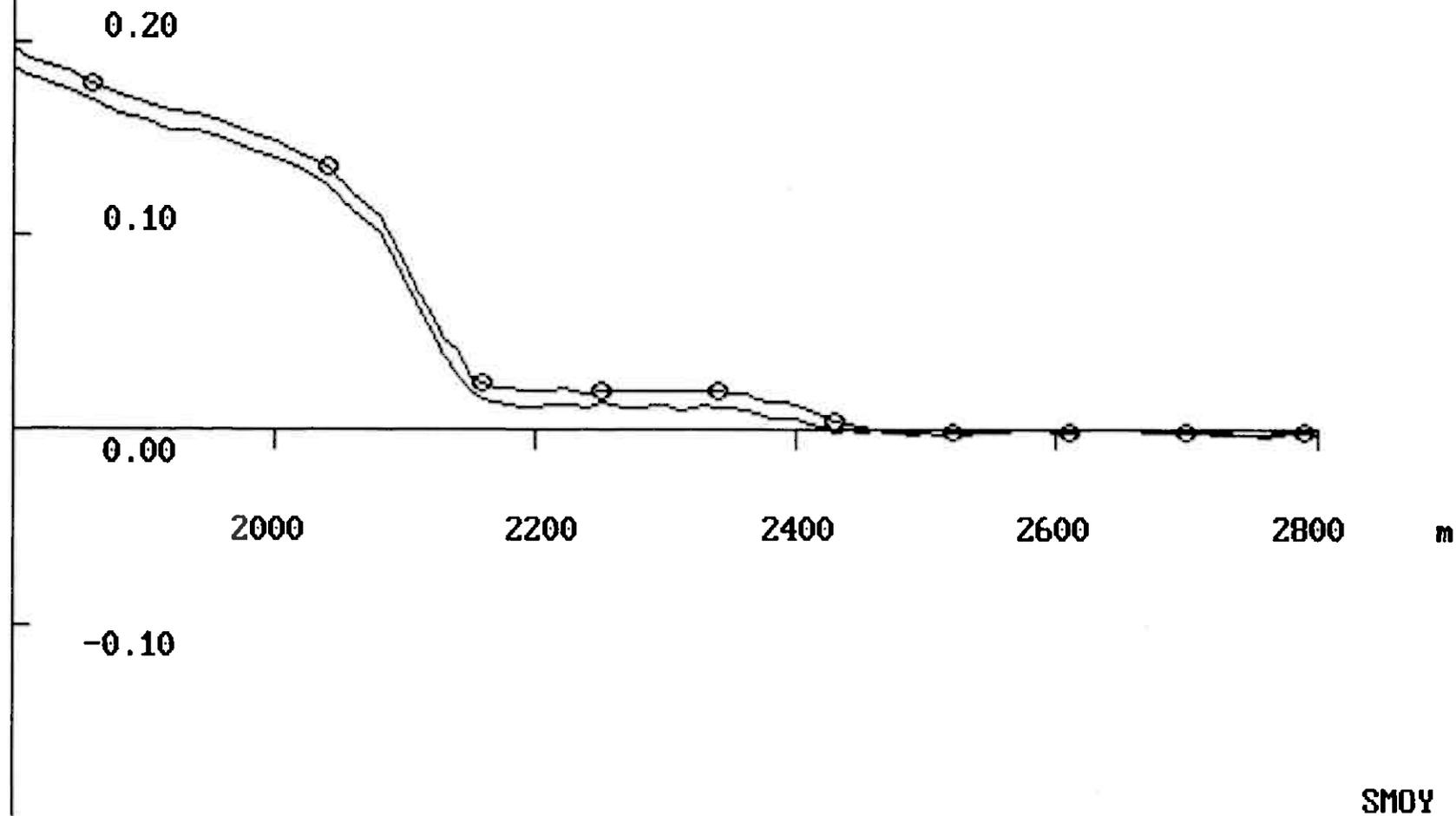


SMOY



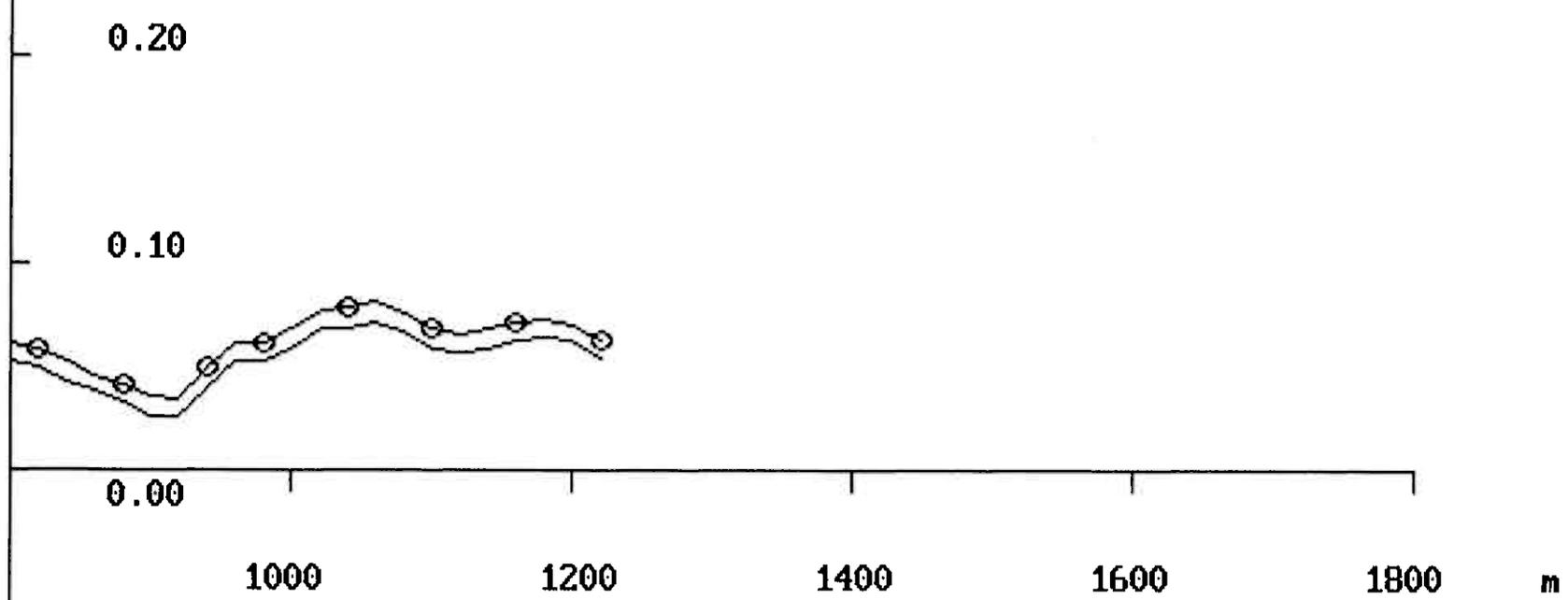
SMOY

ohm CP-pot : BALLANGEN : X= 1200 Y = 1800 - 2800 m
Laite : SAS300C : 1: 5000 P090896B.CPM
— KAIUOS -o- P2450



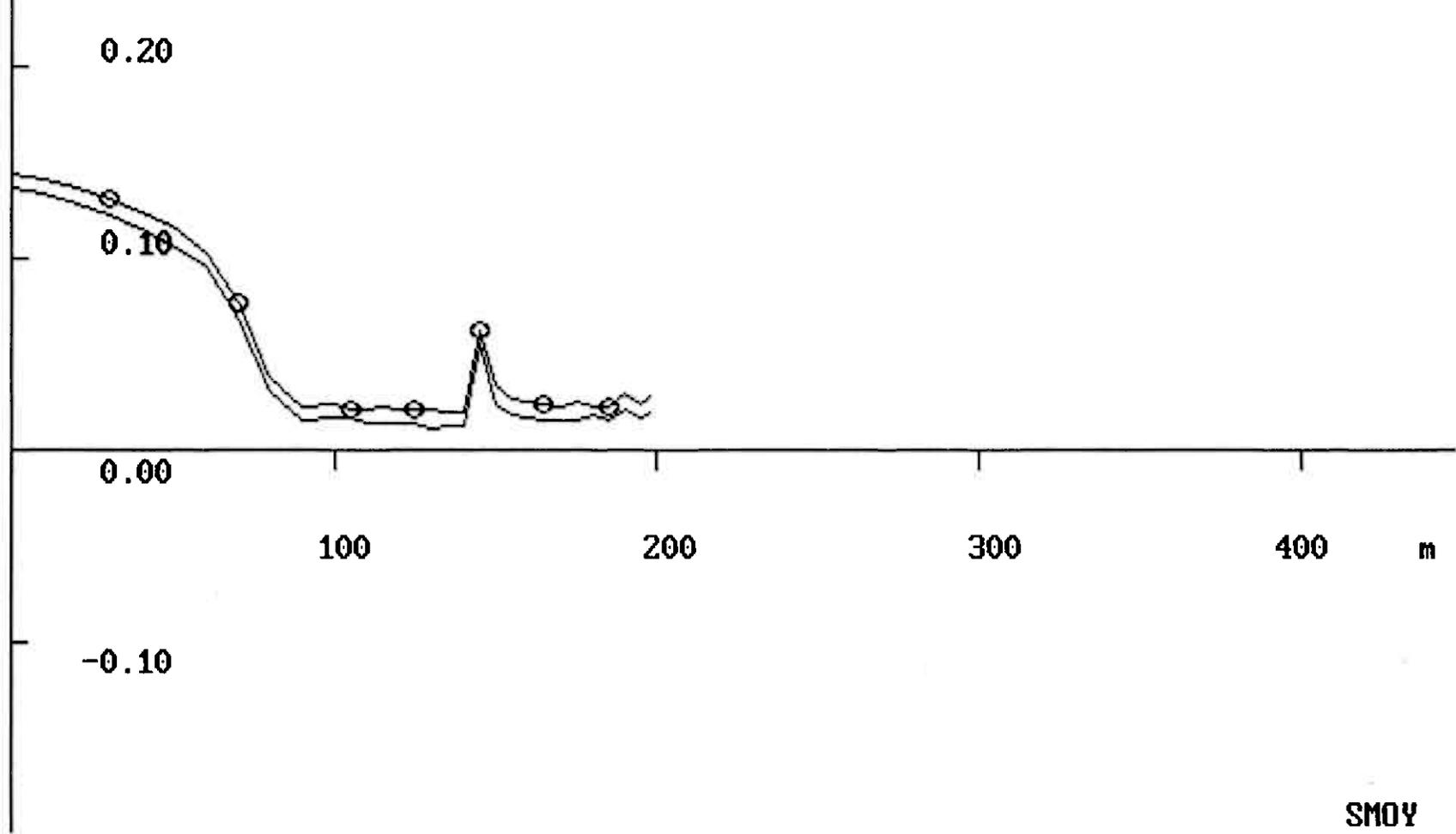
SMOY

ohm CP-pot : BALLANGEN : y= 2120 x = 800 - 1220 m
Laite : SAS300C : 1: 5000 P090896A.CPM
— KAIUOS -o- P2450



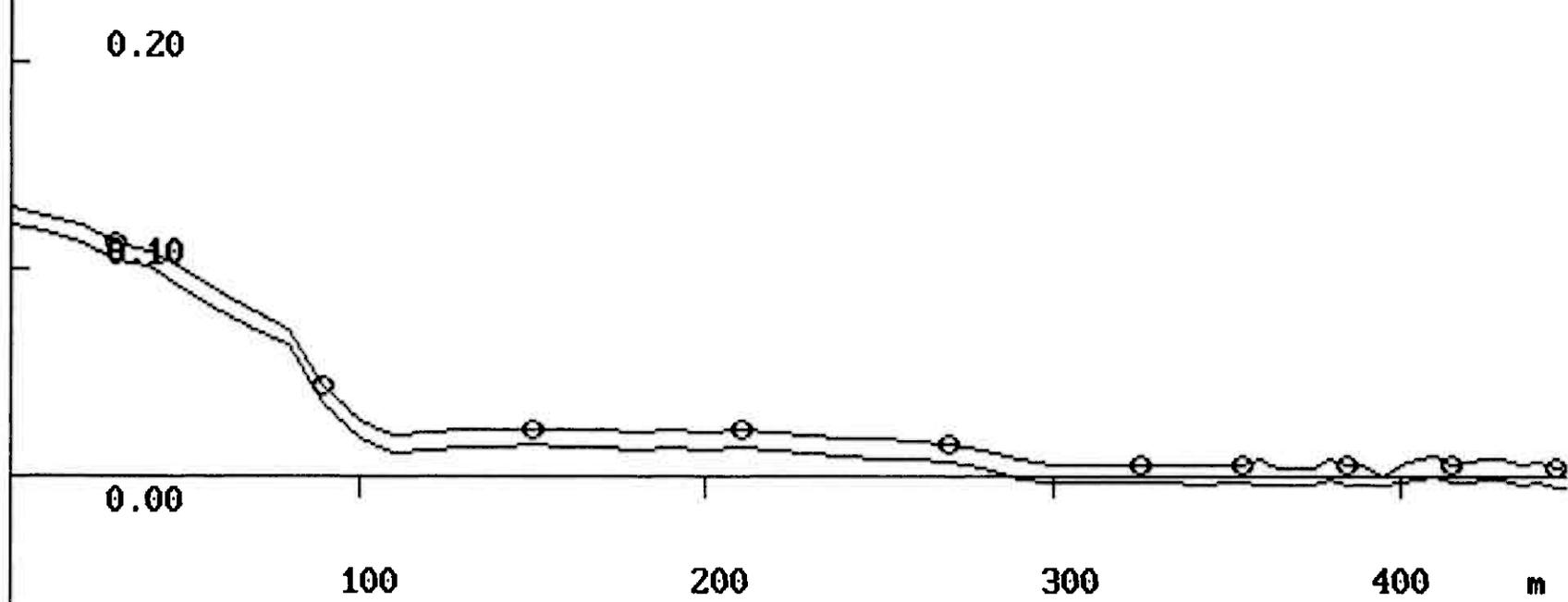
SMOY

ohm CP-pot : BALLANGEN : P1 S = 0 - 198 m
 Laite : SAS300C : 1: 2000 P080996A.CPR
 — KAIUOS -o- P2450



SMOY

ohm CP-pot : BALLANGEN : P5 S = 0 - 450 m
Laite : SAS300C : 1: 2000 P080896B.CPR
— KAIUOS -o- P2450



SMOY

