Bergvesenet
Postboks 3021, N-7441 Trondheim

Rapportarkivet

Bergvesenet rapport nr	Intern Journal nr	Internt arkiv nr	Rapport lokalisering	Gradering
5720				

Kommer fra ..arkiv	Ekstern rapport nr	Oversendt fra	Fortrolig pga	Fortrolig fra dato:
Grong Gruber AS		Grong Gruber a.s.		

Tittel
Malmgeofysiske undersøkelser ved Renselvann, i Nord-Trondelag. Bilag

Forfatter	Dato	År	Bedrift (oppdragsgiver og/eller oppdragstaker)
Mauring, Eirik	13.12	1984	Grong Gruber A/S

Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad
Røyrvik	Nord-Trondelag		1924 1	Grong

Fagområde	Dokument type	Forekomster (forekomst, gruvefelt, undersøkelsesfelt)
Geofysikk Geologi		Rennselvann skjerp

Råstoffgruppe	Råstofftype
Malm/metall	Cu, Zn

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse
Bilag til Hovedoppgave for NTH

MALMGEOFYSISKE UNDERSØKELSER
VED RENSELVANN, I NORD-TRØNDELAG

av

Eirik Mauring

NTH

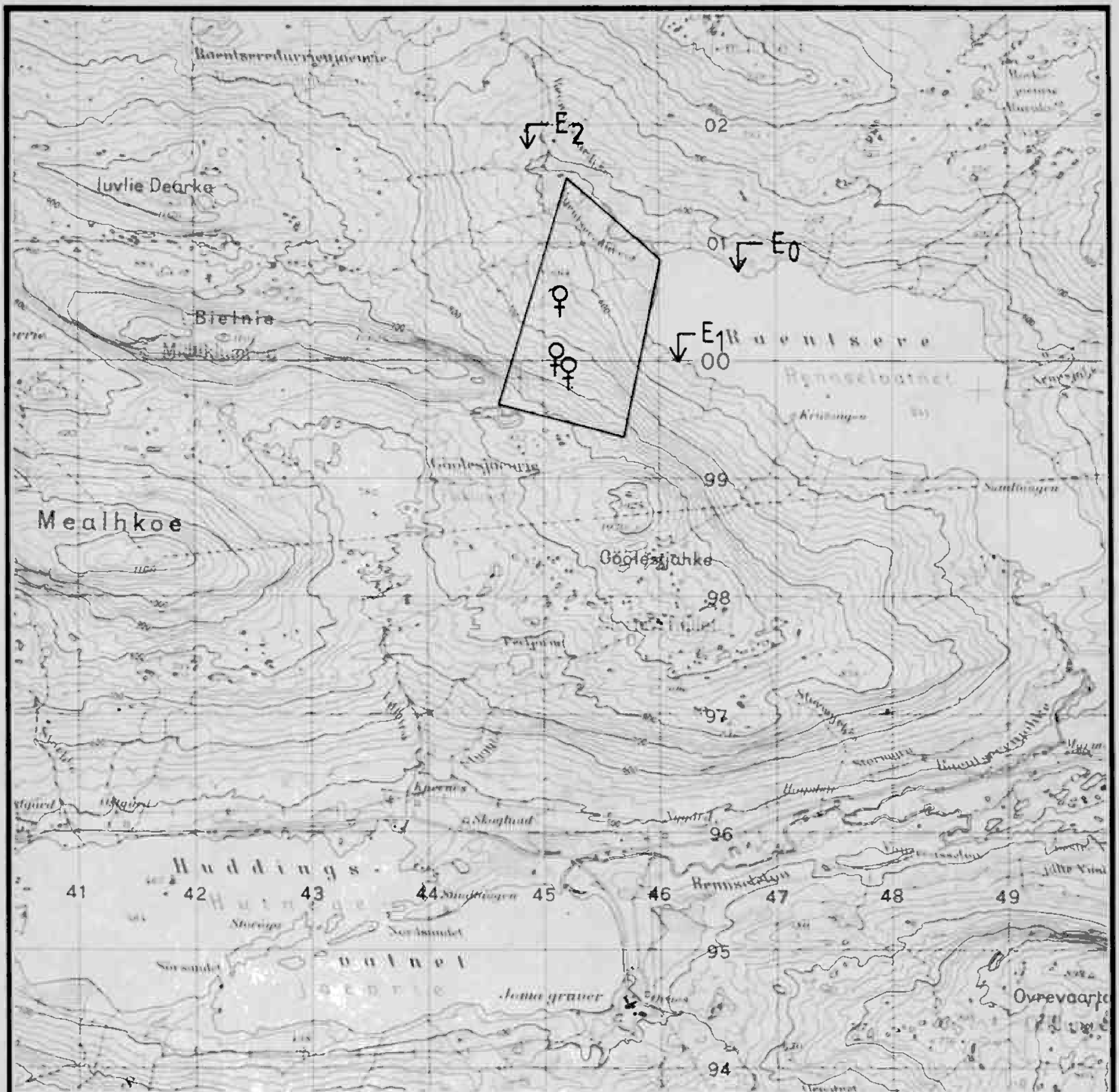
Institutt for petroleumsteknologi
og anvendt geofysikk

1984

Bilag

BILAG

1. Regionalt kartblad med målefeltet inntegnet
2. Oversikt over stikningsnettet
3. Geologisk kart over området
3a. Samlet tolkningskart
4. Konturkart for CP-målingenes jording I
5. Konturkart for CP-målingenes jording II
6. Konturkart for CP-målingenes jording III
7. Konturkart for Fraser-filtrert SP
8. Konturkart for IP
9. Konturkart for ledningsevne
10. Schlumberger dybdesonderingskurve
11. Gravimetrisk profil og tolkninger
12. Dobbel Wenner dybdesonderingskurver
13. CP-profilkurver for jording I
14. CP-profilkurver for jording III
15. SP-profilkurver
16. IP- og σ_a-profilkurver
17. VLF-kurver
17a. VLF og APEX
18. Utledninger av elektrodekonfigurasjoner
20. Måleverdier og feilberegninger for dobbel Wenner dybdesonderinger
21. Egenvekter og andre gravimetriske data
22. Måleverdier for magnetisk susceptibilitet
23. Måling av spesifikk motstand på prøvestykker
24. Oversikt over prøvestykker



TEGNFORKLARING

♀ RØSK / SKJERP

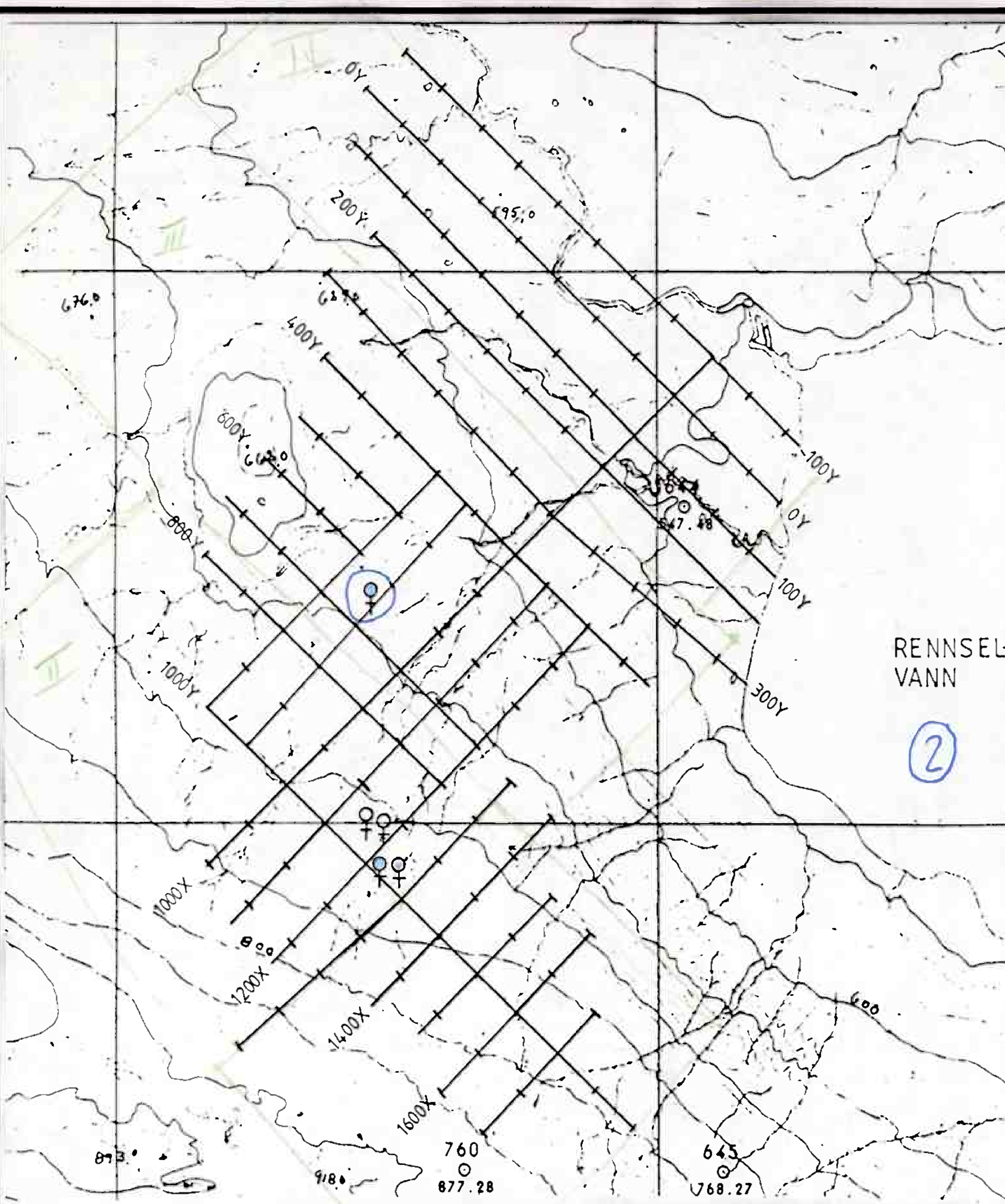
E_0: FJERNSTRØMELEKTRODE VED CP-MÅLINGER

$E_{1,2}$: STRØMELEKTRODER VED IP-σ-MÅLINGER

MÅLEFELT

1

GRONG GRUBER A/S OVERSIKTSKART RENSELVANN NV RØYRVIK, NORD-TRØNDELAG	MÅLESTOKK 1:50000	MÅLT JSR	AUG - 84
		TEGN JSR	OKT. - 84
		TRAC	
		KFR. JSR	NOV. - 84
NORGES GEOLOGISKE UNDERSØKELSE TRONDHEIM	TEGNING NR. 84.132-01	KARTBLAD NR. 1924 I	



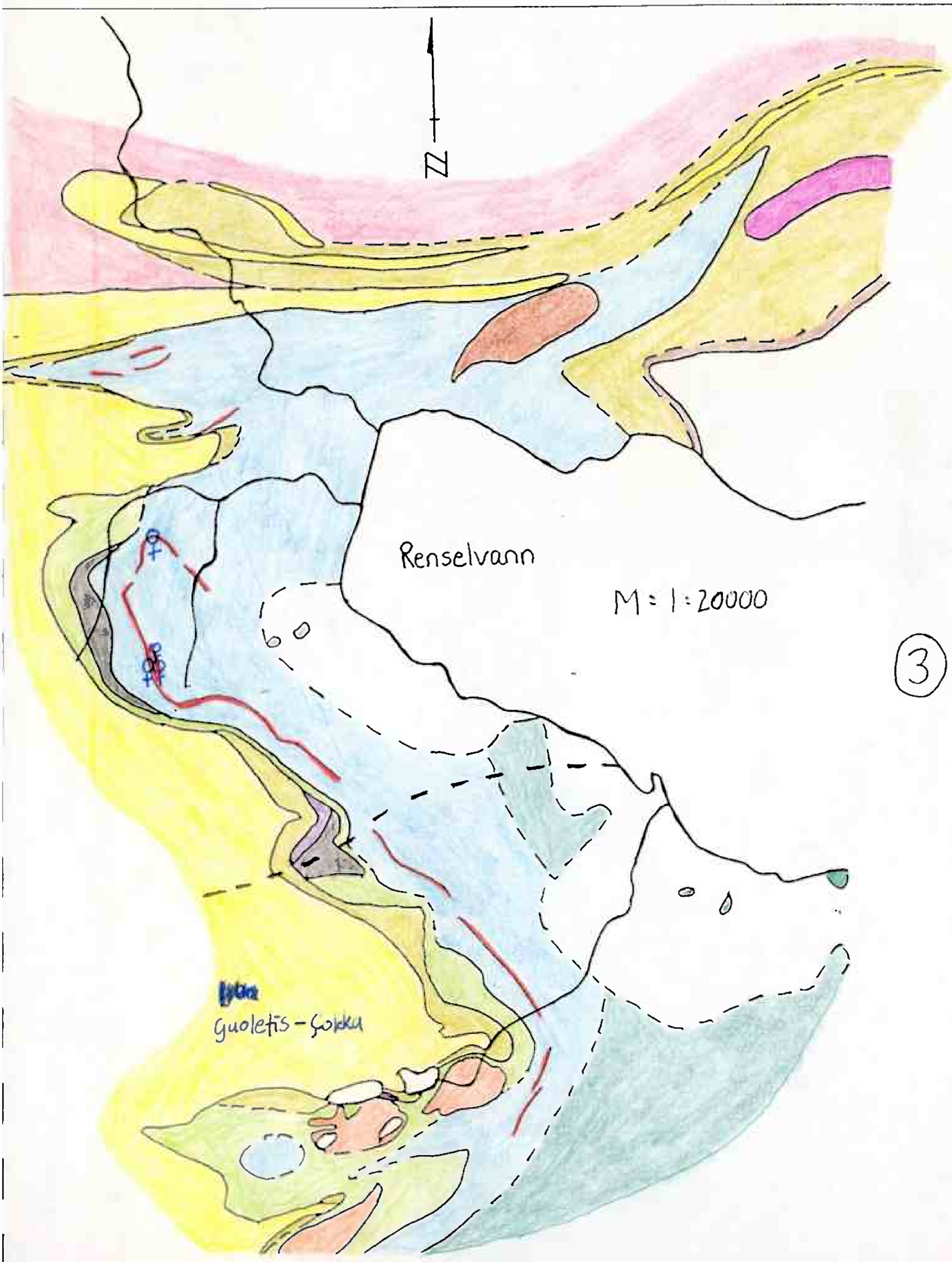
TEGNFORKLARING:

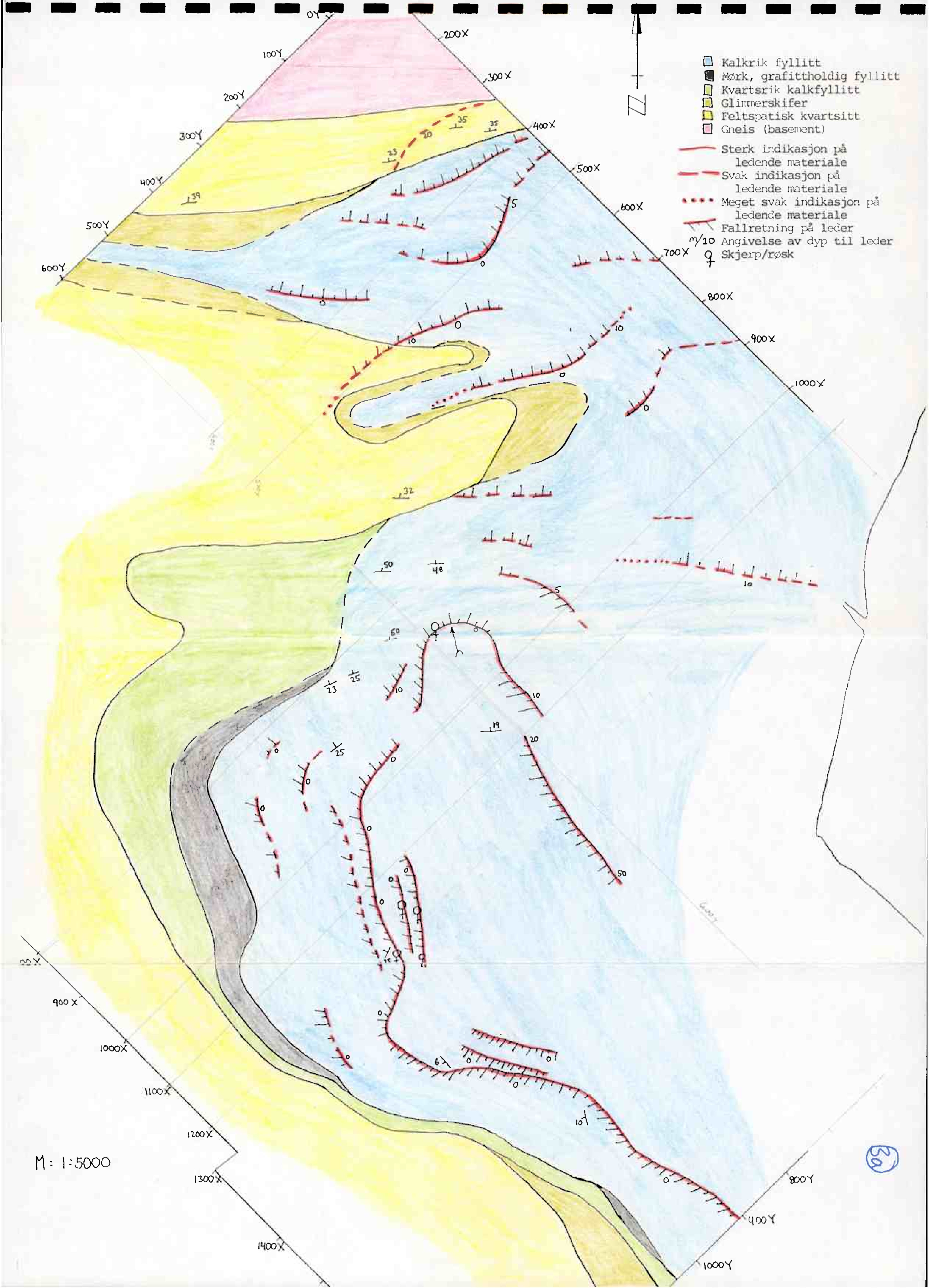
♀ SKJERP/RØSK

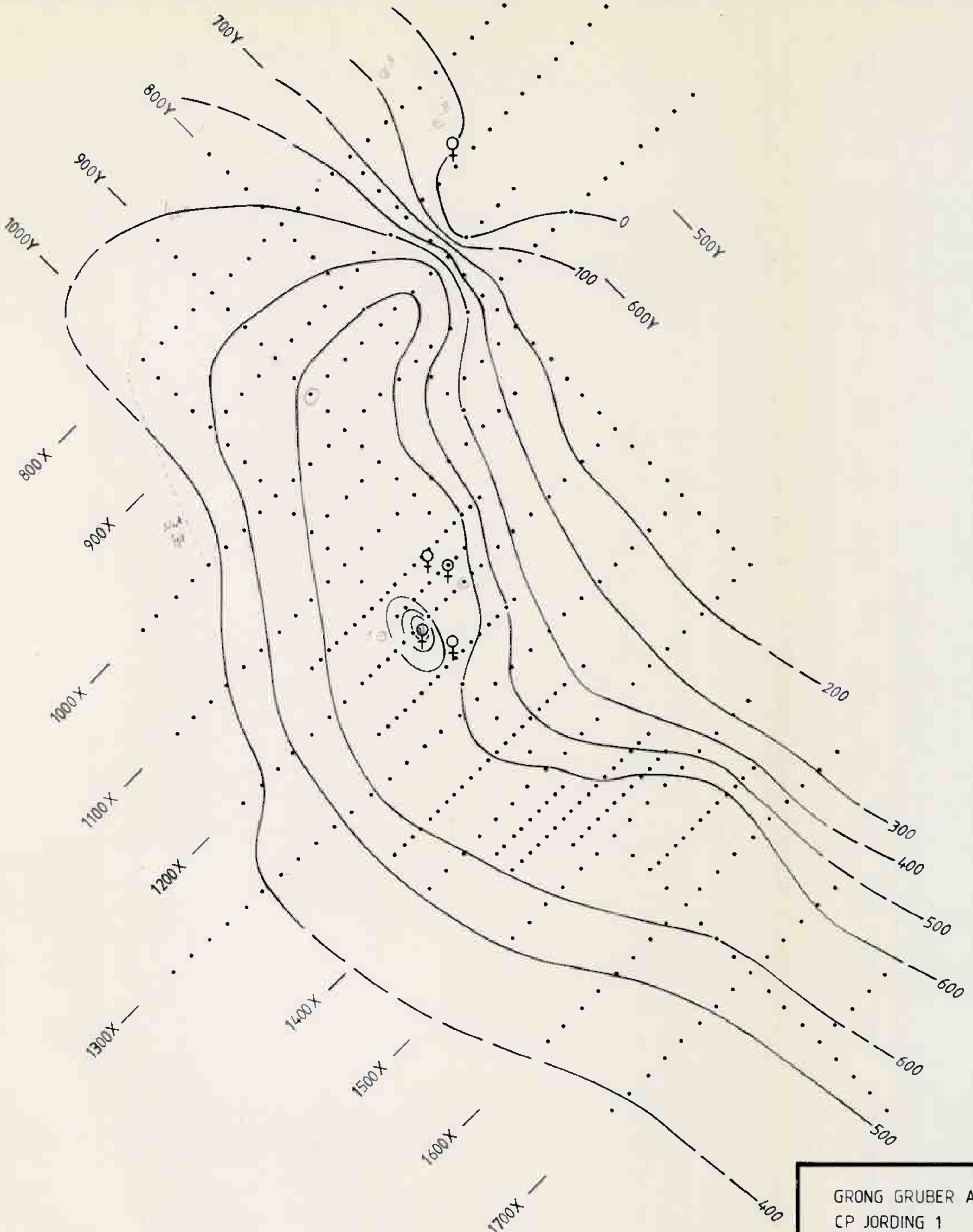
○ Interessesenter

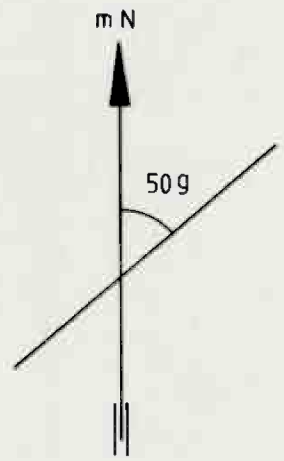
GRONG GRUBER A/S MÅLTE PROFILER RENSELVANN NV RØYRVIK, NORD-TRØNDELAG	MÅLESTOKK 1:[illegible]000 10	MÅLT JSR	AUG.-84
		TEGN JSR	OKT.-84
		TRAC	
		KFR. JSR	NOV.-84
NORGES GEOLOGISKE UNDERSØKELSE TRONDHEIM	TEGNING NR. 84.132-02	KARTBLAD NR. 1924 I	

Kvartsrik kalkfyllitt (yngre)
Kalkrik fyllitt
Båndet metasandstein/fyllitt
Mørk, grafittholdig fyllitt
Kvartsrik kalkfyllitt (eldre)
Amfibolitt, keratofyr, klorittskifer
Glimmerskifer
Feltspatisk kvartsitt
Gneis
Gabbro
Serpentinitt
Mineralisering
Overdekt




Kalkrik fyllitt
Mørk, grafittholdig fyllitt
Kvartsrik kalkfyllitt
Glimmerskifer
Feltspatisk kvartsitt
Gneis (basement)
Sterk indikasjon på ledende materiale
Svak indikasjon på ledende materiale
Meget svak indikasjon på ledende materiale
Fallretning på leder
m/10 Angivelse av dyp til leder
Skjerp/røsk
M: 1:5000
50





4

TEGNFORKLARING:

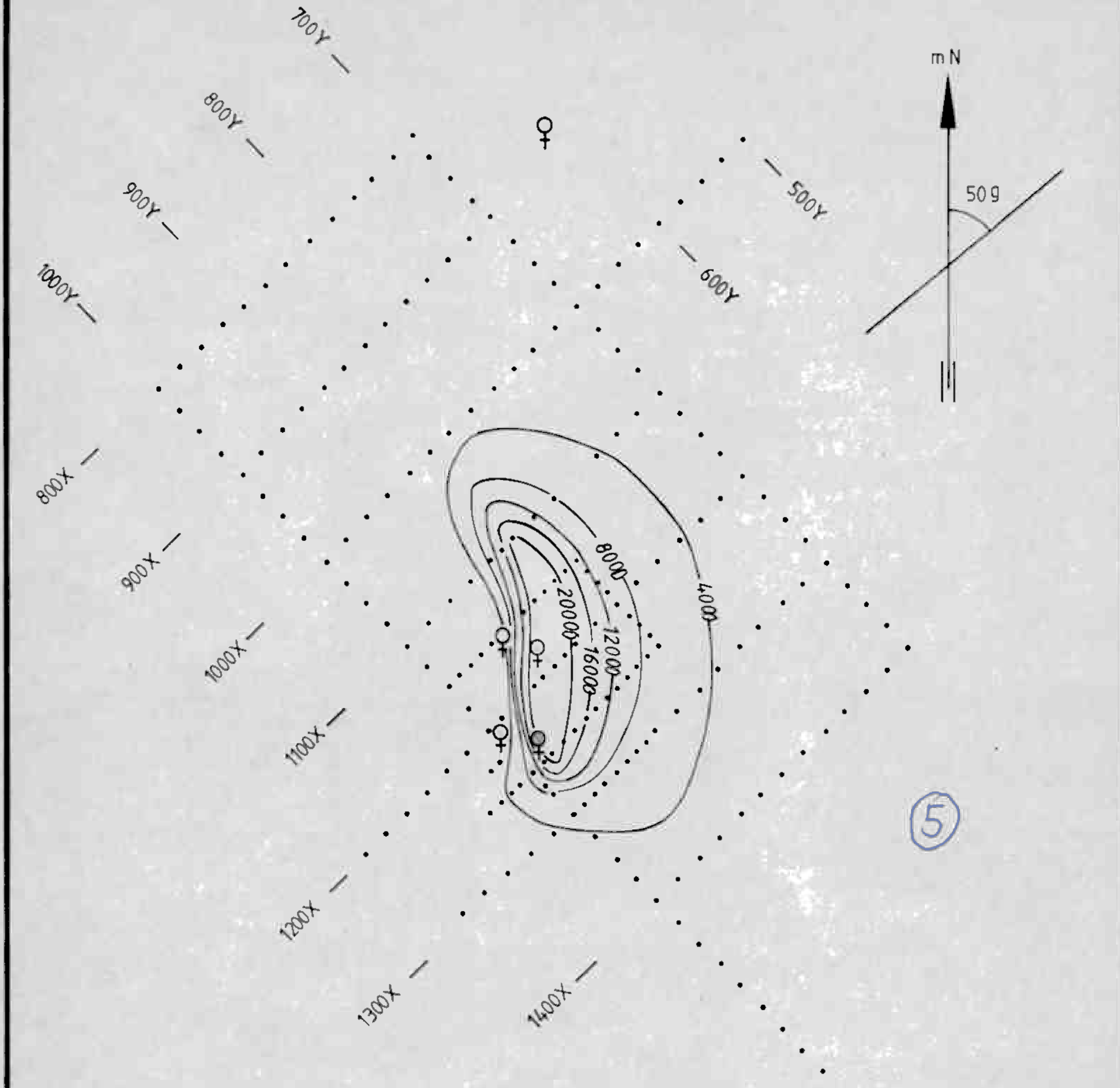
♀ SKJERP/RØSK

· · · MÅLEPUNKTER

KONTURAVSTAND 100 mV

JORDING I SKJERP, 1210X - 988Y

GRONG GRUBER A/S CP JORDING 1 RENSELVANN NV RØYRVIK, NORD-TRØNDELAG	MÅLESTOKK 1:5000	MÅLT JSR	AUG. -84
		TEGN EM	SEPT. -84
		TRAC	
		KFR. JS R	NOV. -84
NORGES GEOLOGISKE UNDERSØKELSE TRONDHEIM	TEGNING NR. 84.132-03	KARTBLAD NR. 1924 I	



TEGNFORKLARING:

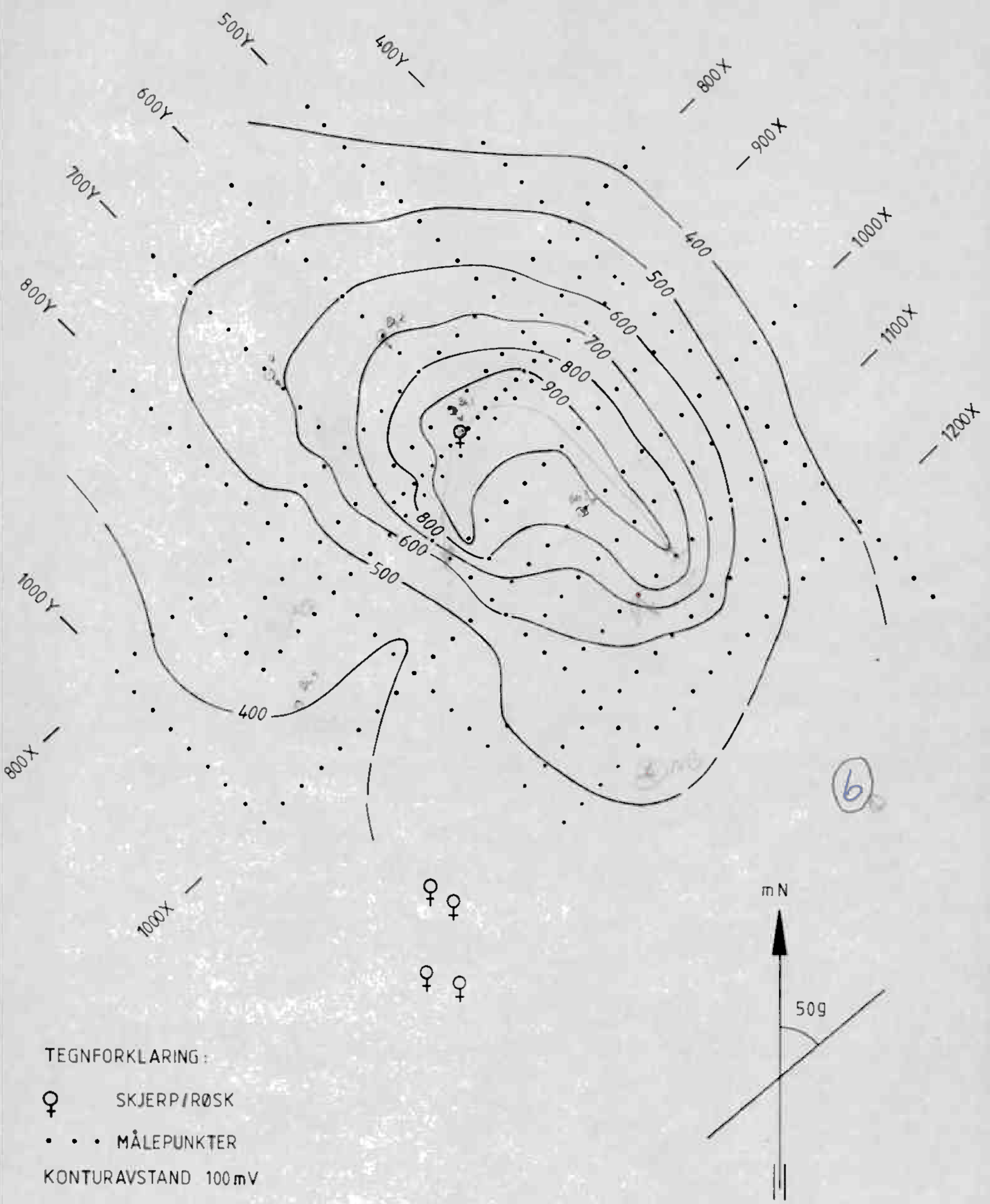
♀ SKJERP/RØSK

• • • MÅLEPUNKTER

KONTURAVSTAND 400mV

JORDING I SKJERP, 1235X - 975Y

GRONG GRUBER A/S CP JORDING II RENSELVANN NV RØYRVIK, NORD - TRØNDELAG	MÅLESTOKK 1: 5000	MÅLT JSR TEGN JSR TRAC KFR. JSR	AUG - 84 OKT - 84 NOV - 84
NORGES GEOLOGISKE UNDERSØKELSE TRONDHEIM		TEGNING NR. 84.132-04	KARTBLAD NR. 1924 I



TEGNFORKLARING:

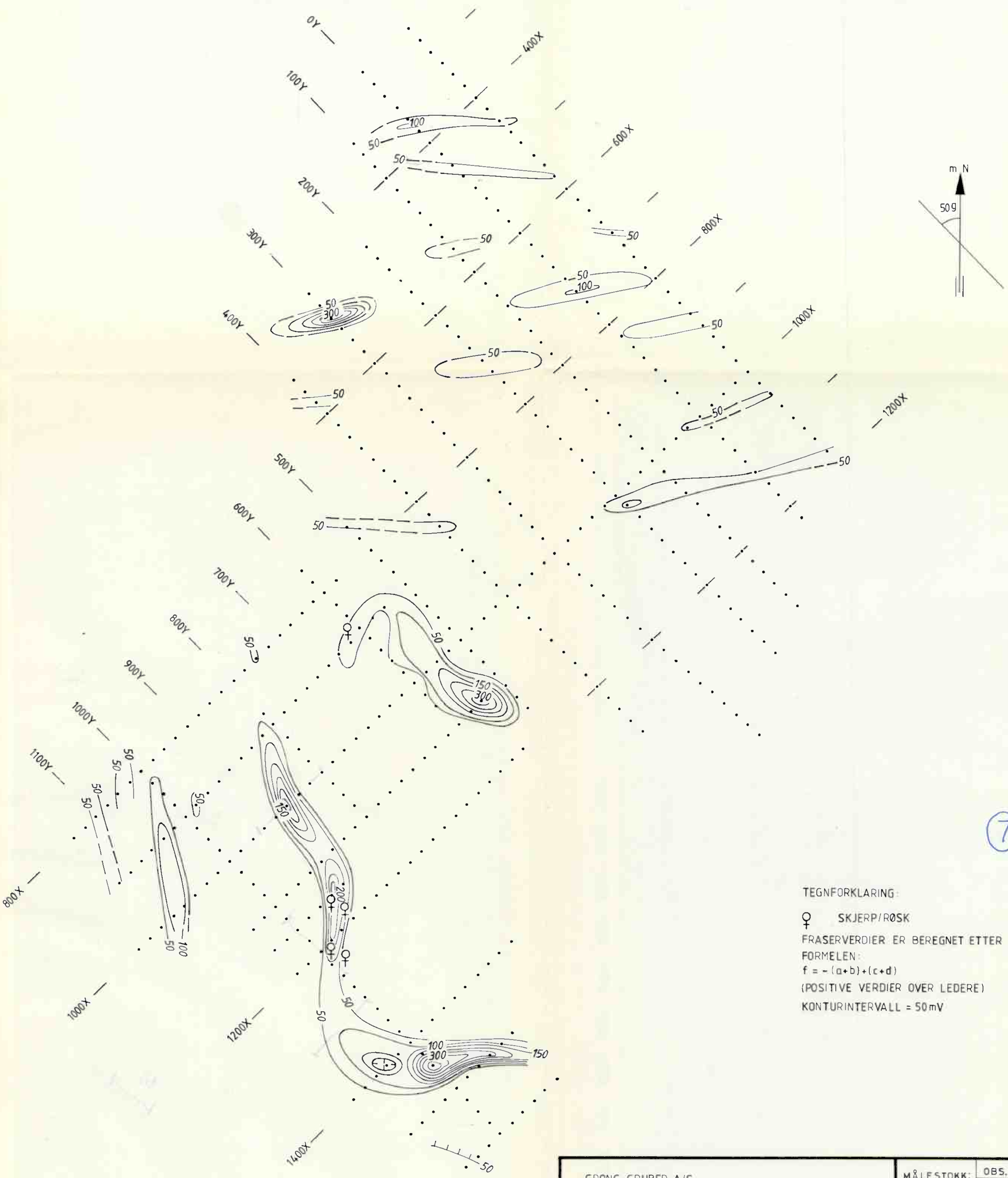
♀ SKJERP/RØSK

• • • MÅLEPUNKTER

KONTURAVSTAND 100 mV

JORDING I RØSK 878X-616Y

GRONG GRUBER A/S CP JORDING III **RENSELVANN** RØYRVIK, NORD-TRØNDELAG	MÅLESTOKK 1:5000	MÅLT JSR	AUG.-84
		TEGN EM	SEPT.-84
		TRAC	
		KFR. JSR	NOV.-84
NORGES GEOLOGISKE UNDERSØKELSE TRONDHEIM		TEGNING NR. 84.132-05	KARTBLAD NR. 1924 I



7

TEGNFORKLARING:

♀ SKJERP/RØSK

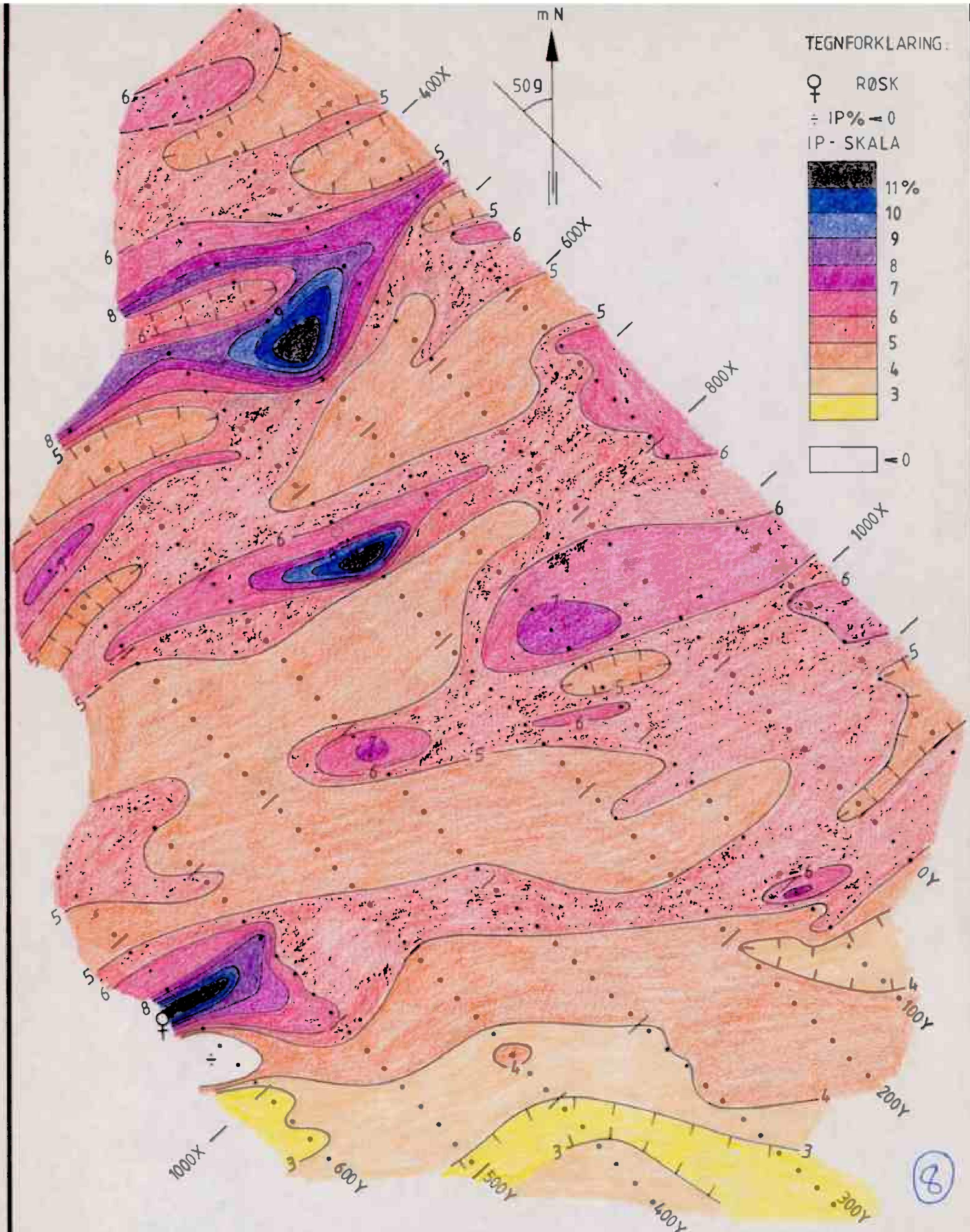
FRASERVERDIER ER BEREGNET ETTER FORMELEN:

$f = -(a+b)+(c+d)$

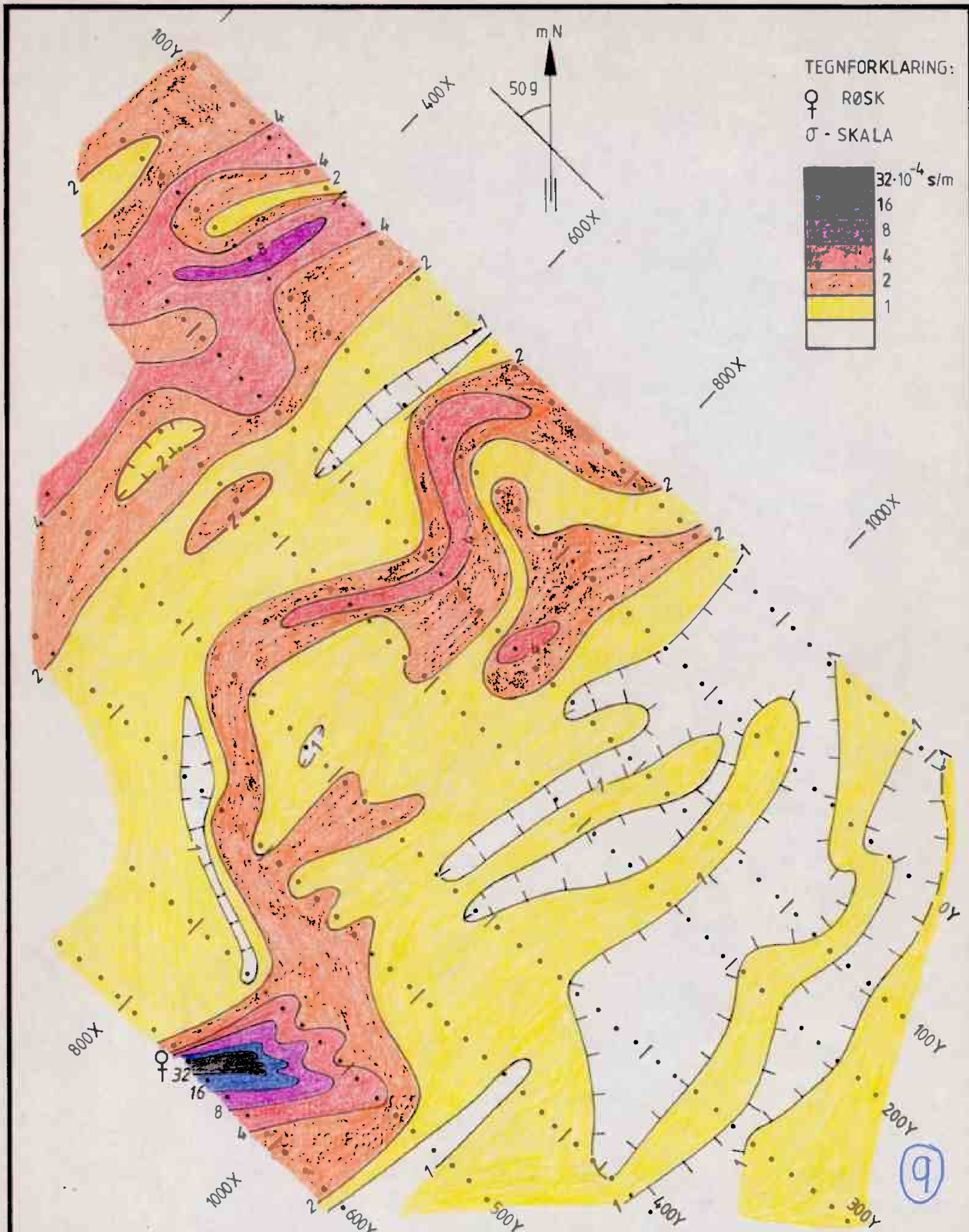
(POSITIVE VERDIER OVER LEDERE)

KONTURINTERVALL = 50mV

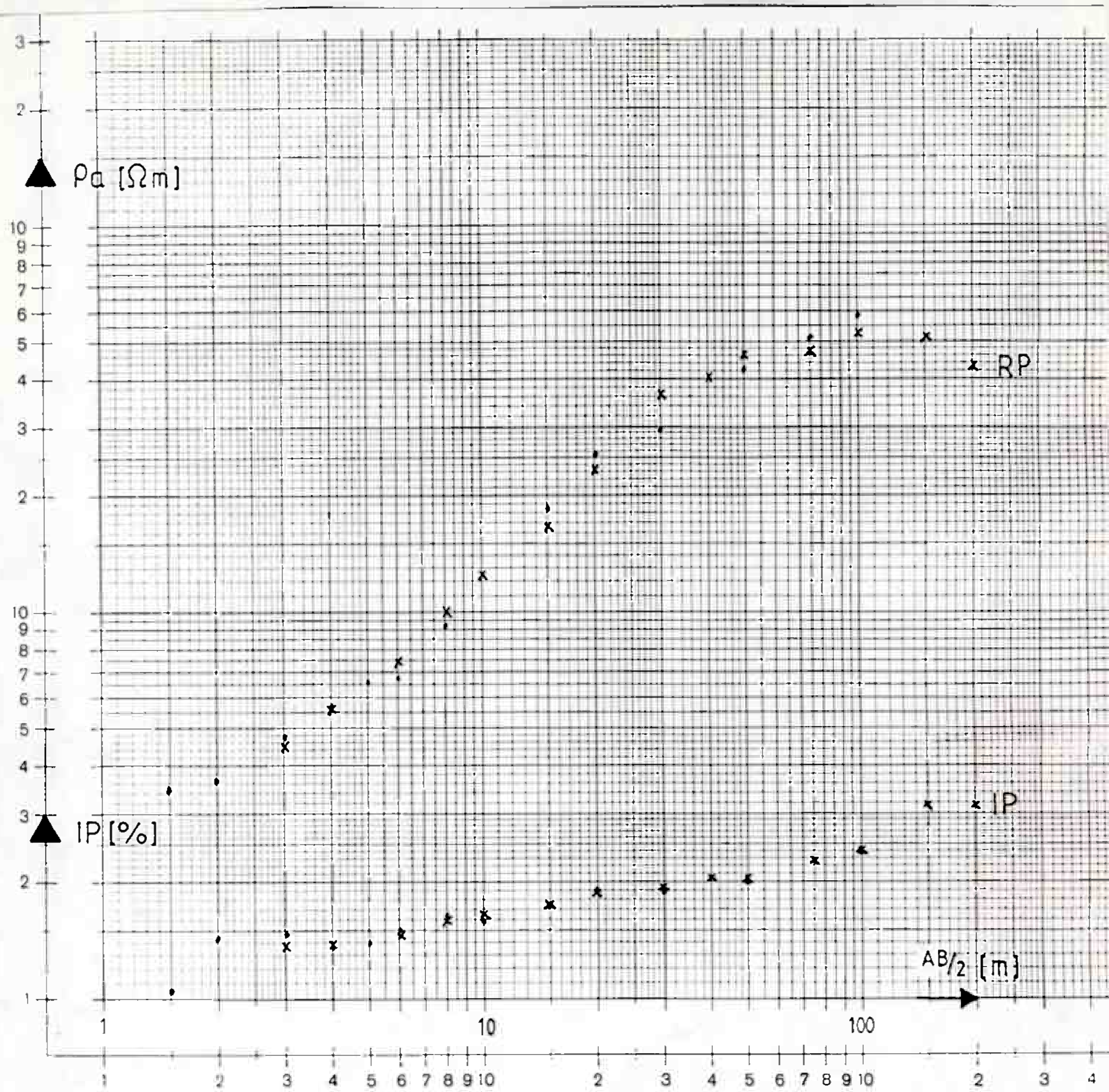
GRONG GRUBER A/S SP, FRASERFILTRERT RENSELVANN NV RØYRVIK, NORD-TRØNDELAG	MÅLESTOKK: 1:5000	OBS. JSR/EM	AUG - 84
		TEGN EM	SEPT - 84
		TRAC.	
		KFR. JSR	NOV. - 84
NORGES GEOLOGISKE UNDERSØKELSE TRONDHEIM	TEGNING NR. 84.132 - 08	KARTBLAD NR. 1924 I	



GRONG GRUBER A/S IP GRADIENTMÅLINGER **RENSELVANN NV** RØYRVIK, NORD-TRØNDELAG	MÅLESTOKK 1:5000	MÅLT JSR	AUG - 84
		TEGN EM	SEPT - 84
		TRAC	
		KFR. JSR	NOV - 84
NORGES GEOLOGISKE UNDERSØKELSE TRONDHEIM		TEGNING NR. 84.132-06	KARTBLAD NR. 1924 I



GRONG GRUBER A/S σ - GRADIENTMÅLINGER RENSELVANN NV RØYRVIK, NORD-TRØNDELAG	MÅLESTOKK 1:5000	MÅLT JSR	AUG.-84
		TEGN EM	SEPT.-84
		TRAC	
		KFR. JSR	NOV-84
NORGES GEOLOGISKE UNDERSØKELSE TRONDHEIM	TEGNING NR. 84.132-07	KARTBLAD NR. 1924 I	



TEGNFORKLARING:

I P: INDUSERT POLARISASJON

RP: RESESTIVITET (ELEKTRISK MOTSTAND)

AB: AVSTAND MELLOM STRØMELEKTRODER

SCHLUMBERGER ELEKTRODEKONFIGURASJON

10

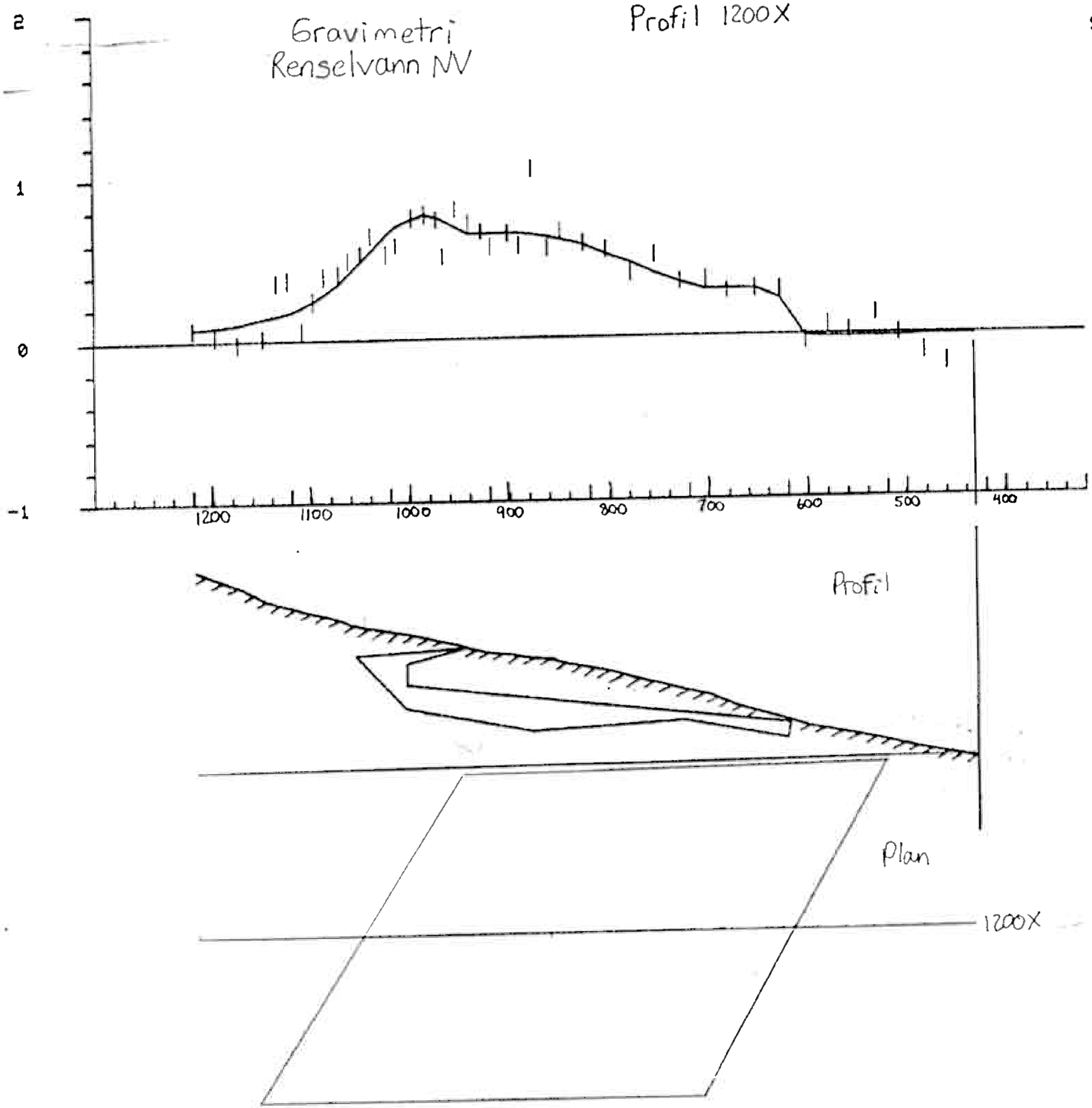
GRONG GRUBER A/S IP-RP DYBESONDERING, 1000X - 100Y RENSELVANN NV RØYRVIK, NORD-TRØNDELAG	MÅLESTOKK	MÅLT JSR	AUG. - 84
		TEGN JSR	OKT. - 84
		TRAC	
		KFR. JSR	NOV. - 84
NORGES GEOLOGISKE UNDERSØKELSE TRONDHEIM	TEGNING NR. 84.132-09	KARTBLAD NR. 1924 I	

SD= 1.097

SUROUNDING DENSITY: 2700.00
ALL DISTANCES ARE TO BE GIVEN IN METERS
BODY(1)
ANGLE OF BODY 35.0
ANOMALOUS DENSITY 800.00

YMIN	-200.00 YMAX	200.00
1	271.43	-708.57
2	161.43	-701.43
3	211.43	-647.14
4	340.00	-622.86
5	491.43	-631.43
6	595.71	-611.43
7	598.57	-627.14
8	212.86	-671.43
9	212.86	-692.86

ANOMALOUS MASS= 3.215 MTON
TOTAL MASS= 14.066 MTON



SUROUNDING DENSITY: 2700.00
ALL DISTANCES ARE TO BE GIVEN IN METERS
BODY(1)
ANGLE OF BODY 30.0
ANOMALOUS DENSITY 800.00
YMIN -100.00 YMAX 100.00

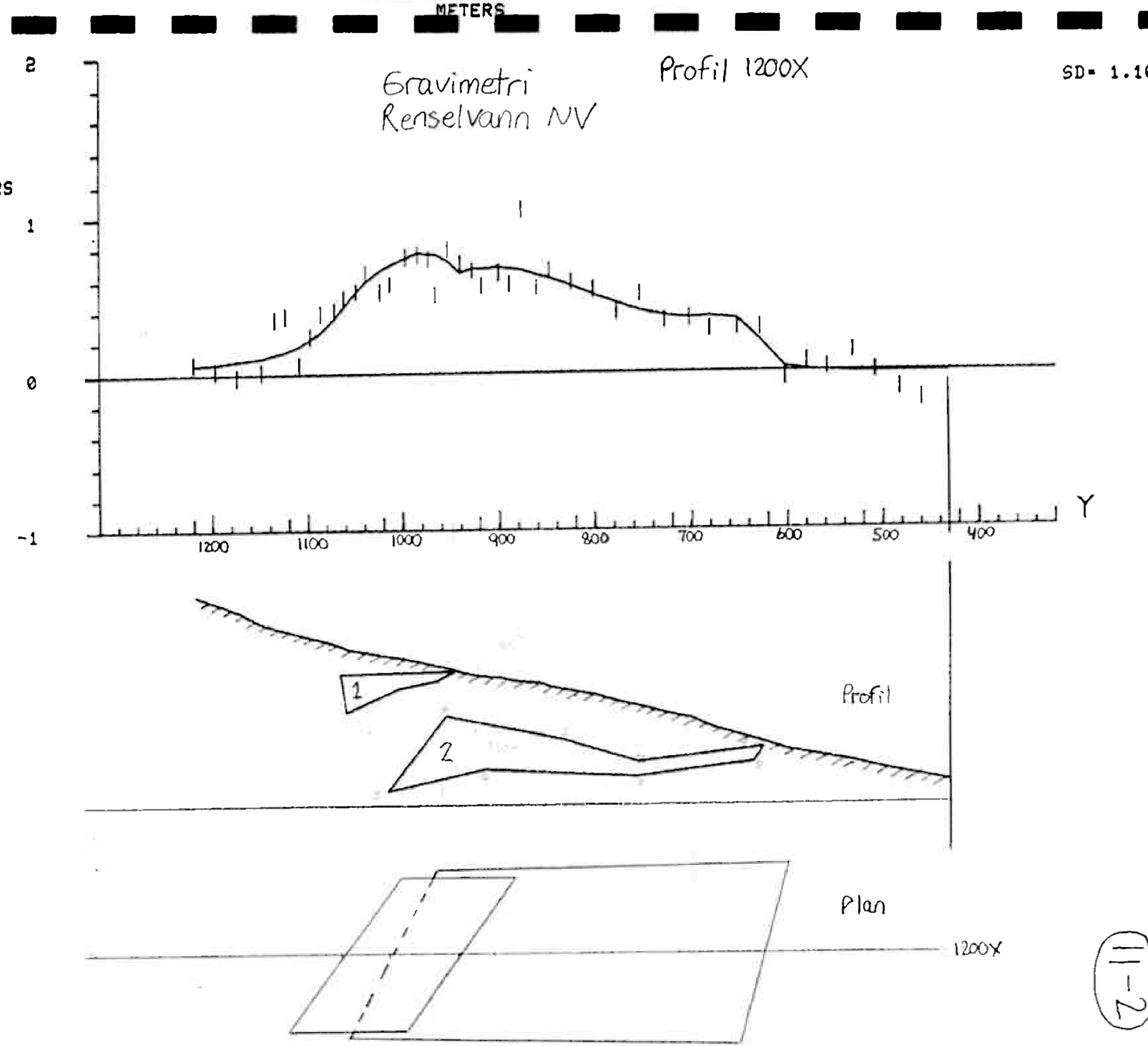
1	271.43	-708.57
2	151.43	-705.71
3	157.14	-665.71
4	211.43	-690.00
5	252.86	-698.57

ANOMALOUS MASS= .370 MTON
TOTAL MASS= 1.618 MTON

BODY(2)
ANGLE OF BODY 10.0
ANOMALOUS DENSITY 800.00
YMIN -100.00 YMAX 100.00

1	592.86	-625.71
2	461.43	-611.43
3	384.29	-635.71
4	261.43	-661.43
5	200.00	-581.43
6	301.43	-604.29
7	460.00	-595.71
8	582.86	-610.00

ANOMALOUS MASS= 1.878 MTON
TOTAL MASS= 8.216 MTON



11-2

SUROUNDING DENSITY: 2700.00
ALL DISTANCES ARE TO BE GIVEN IN METERS

BODY(1)
ANGLE OF BODY 35.0
ANOMALOUS DENSITY 800.00

YMIN	-200.00	YMAX 200.00
1	265.71	-710.00
2	170.00	-695.71
3	151.43	-627.14
4	207.14	-671.43
5	245.71	-688.57

ANOMALOUS MASS= 1.014 MTON
TOTAL MASS= 4.436 MTON

BODY(2)
ANGLE OF BODY 20.0
ANOMALOUS DENSITY 800.00

YMIN	-100.00	YMAX 100.00
1	367.14	-680.00
2	264.29	-662.86
3	231.43	-630.00
4	335.71	-651.43

ANOMALOUS MASS= .410 MTON
TOTAL MASS= 1.793 MTON

BODY(3)
ANGLE OF BODY 20.0
ANOMALOUS DENSITY 800.00

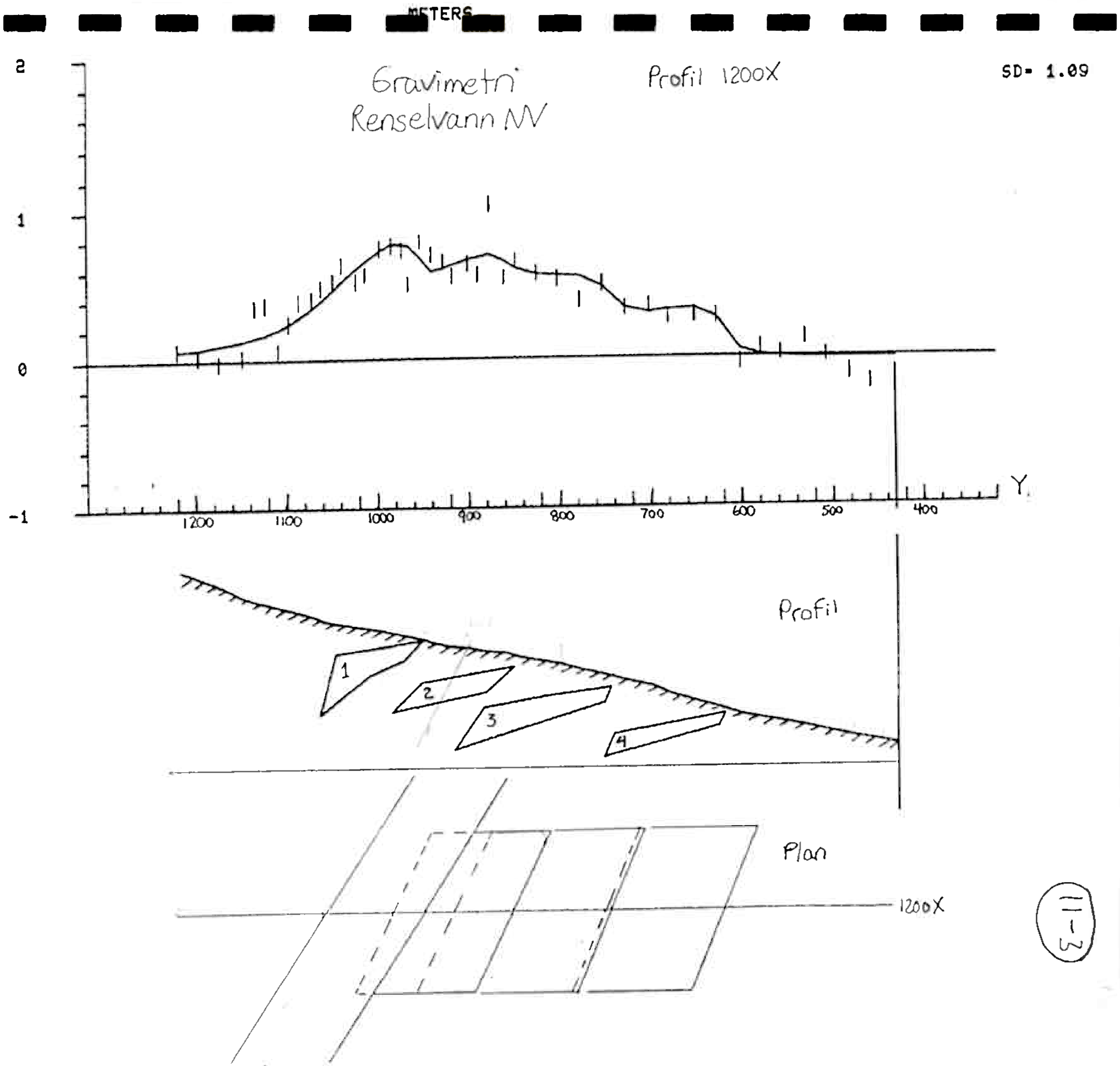
YMIN	-100.00	YMAX 100.00
1	472.86	-655.71
2	405.71	-647.14
3	332.86	-634.29
4	300.00	-587.14
5	465.71	-638.57

ANOMALOUS MASS= .689 MTON
TOTAL MASS= 3.013 MTON

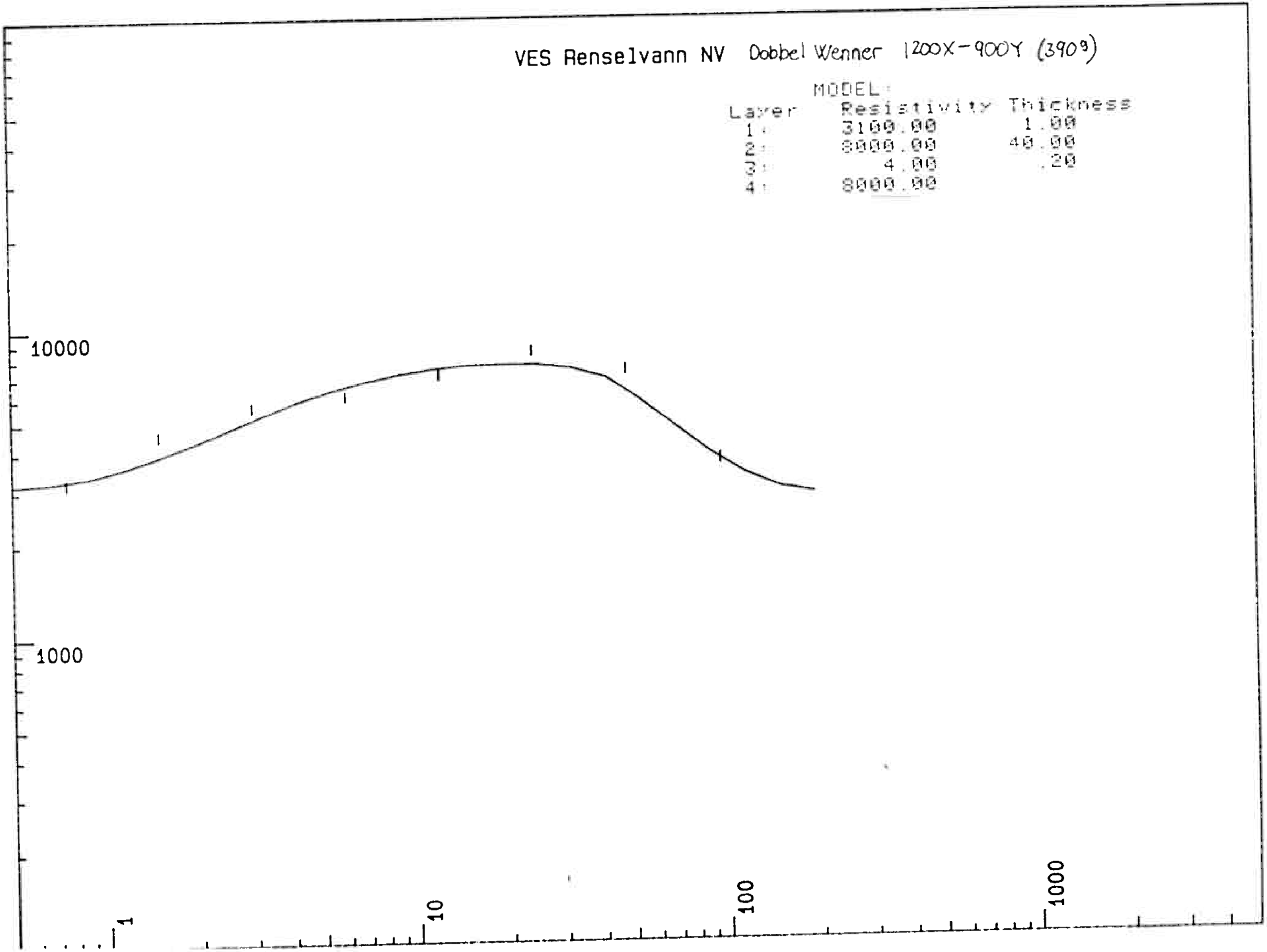
BODY(4)
ANGLE OF BODY 20.0
ANOMALOUS DENSITY 800.00

YMIN	-100.00	YMAX 100.00
1	598.57	-624.29
2	475.71	-602.86
3	464.29	-577.14
4	591.43	-610.00

ANOMALOUS MASS= .360 MTON
TOTAL MASS= 1.574 MTON

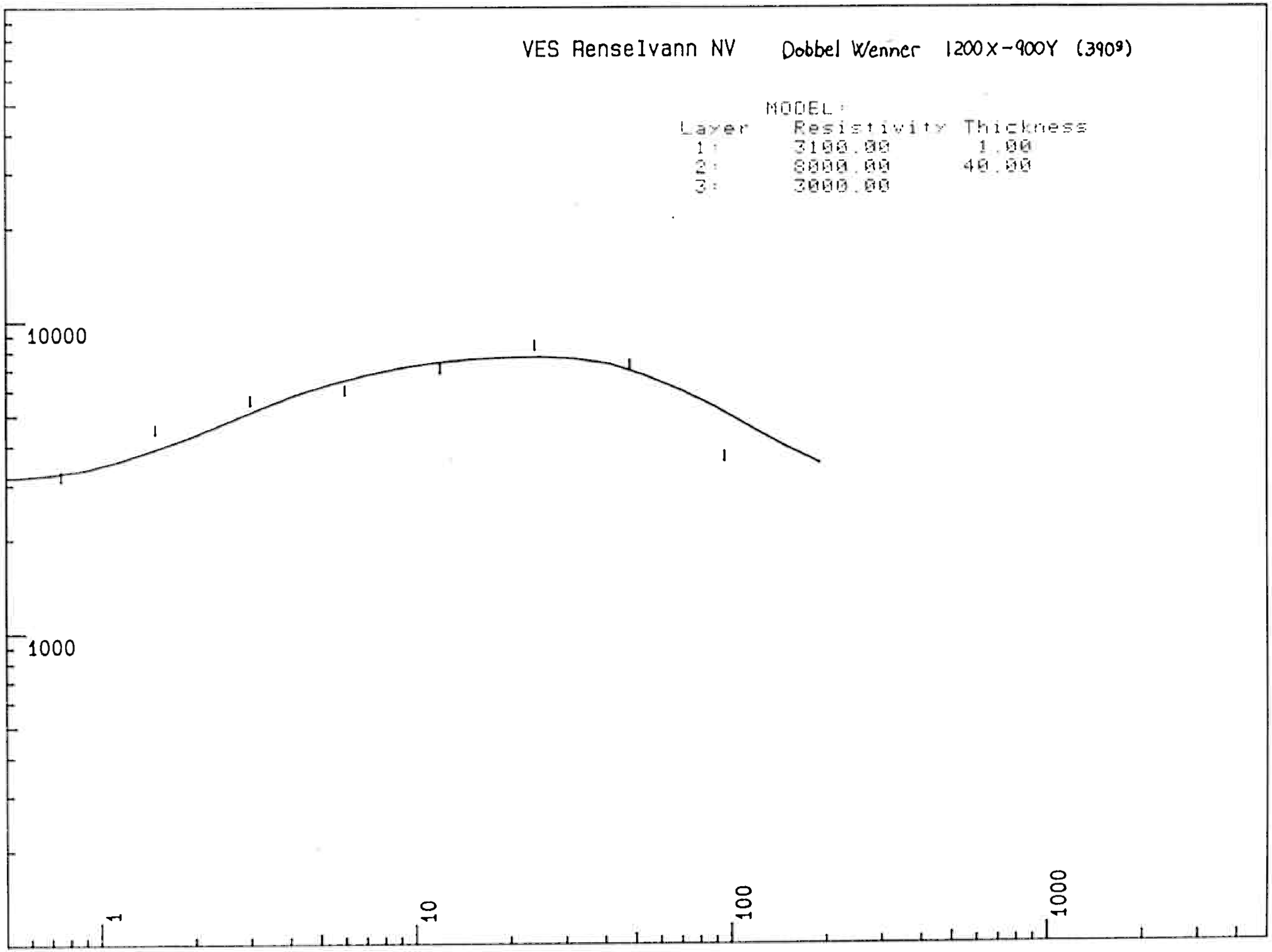


II-3



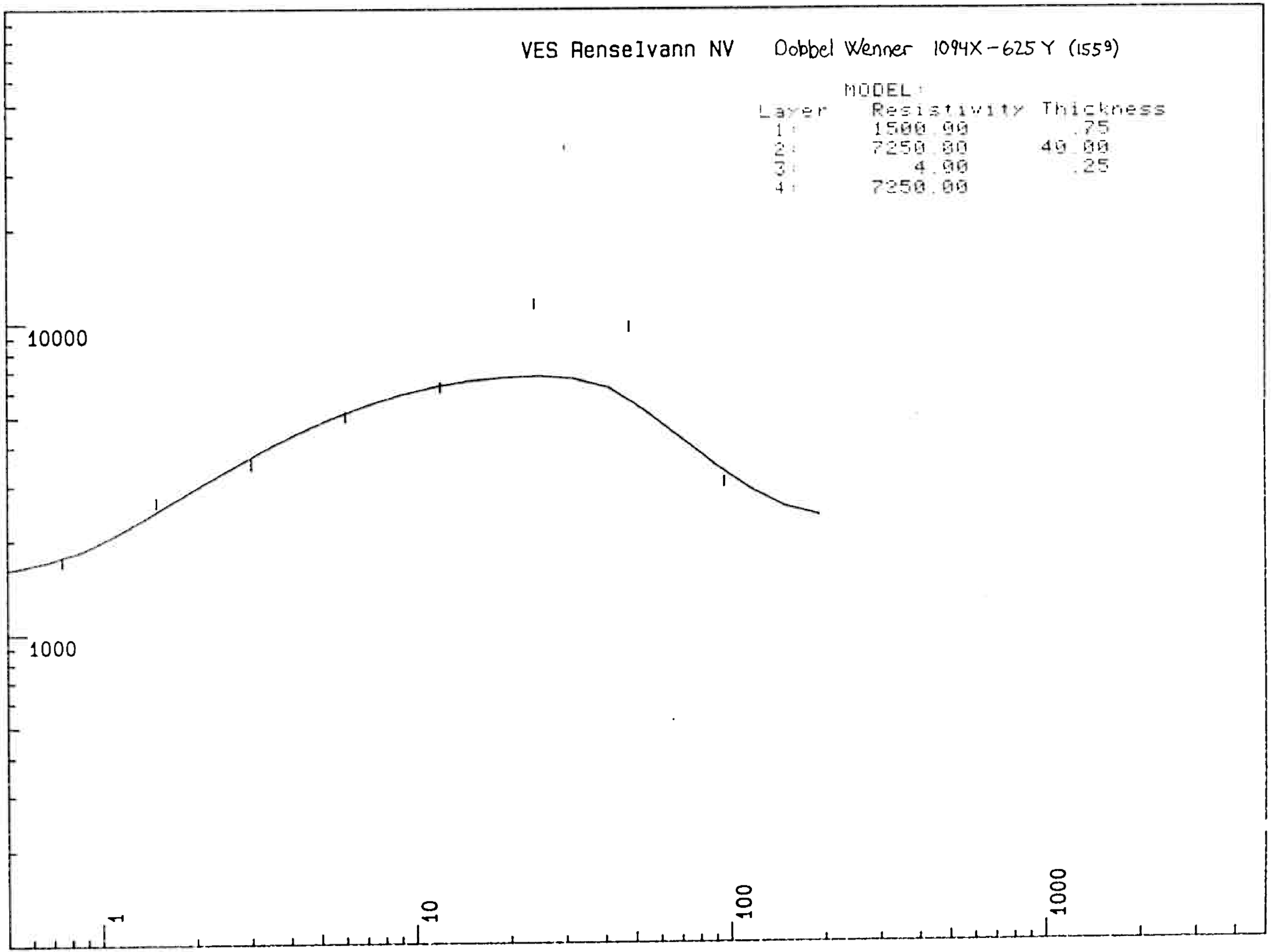
VES Renselvann NV Dobbel Wenner 1200X-900Y (390°)
MODEL:
Layer Resistivity Thickness
1: 3100.00 1.00
2: 8000.00 40.00
3: 4.00 .20
4: 8000.00
10000
1000
1
10
100
1000

12-1

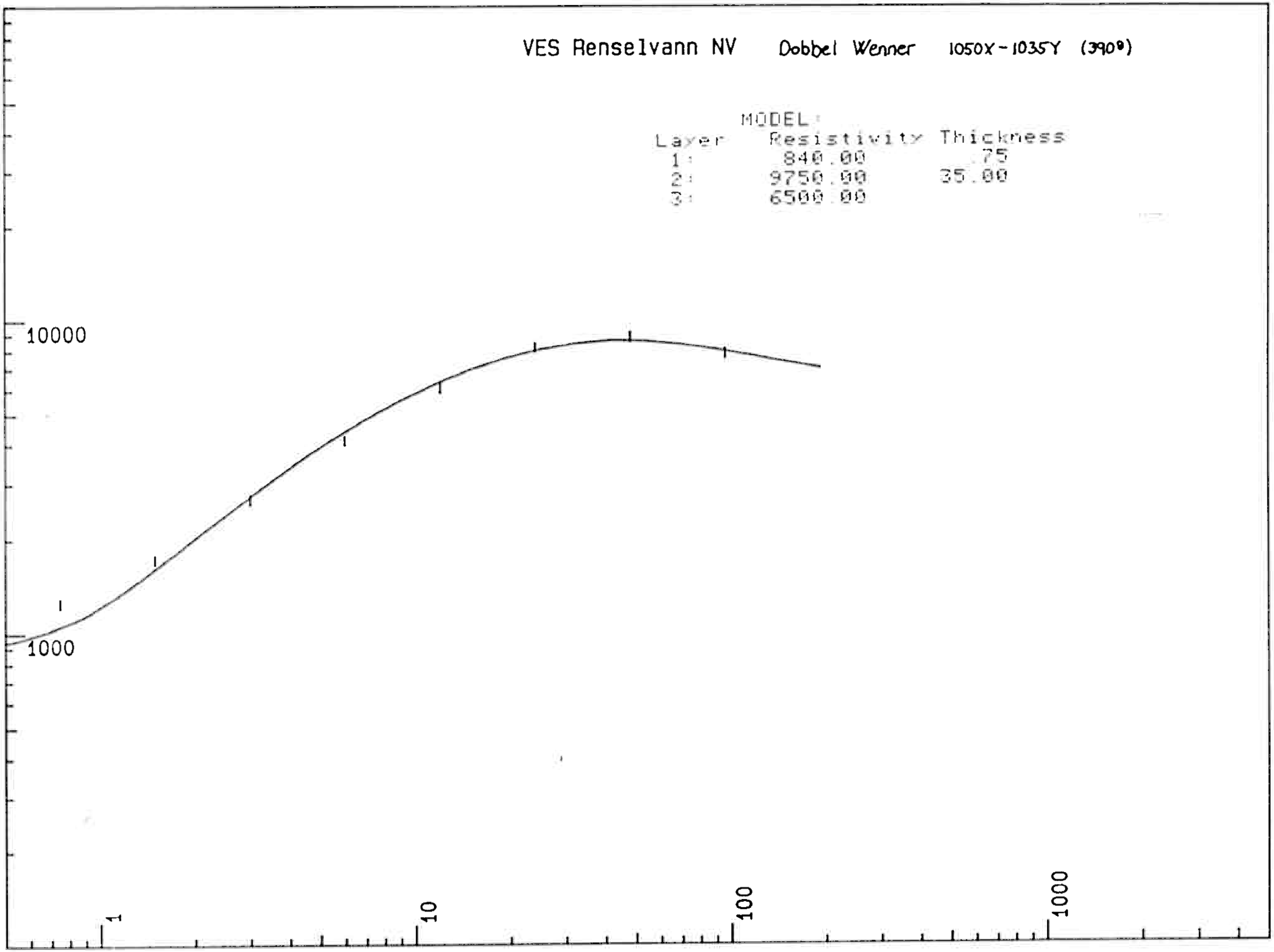


VES Renselvann NV Dobbel Wenner 1200X-900Y (3909)
MODEL:
Layer Resistivity Thickness
1: 3100.00 1.00
2: 8000.00 40.00
3: 3000.00
10000
1000
1
10
100
1000

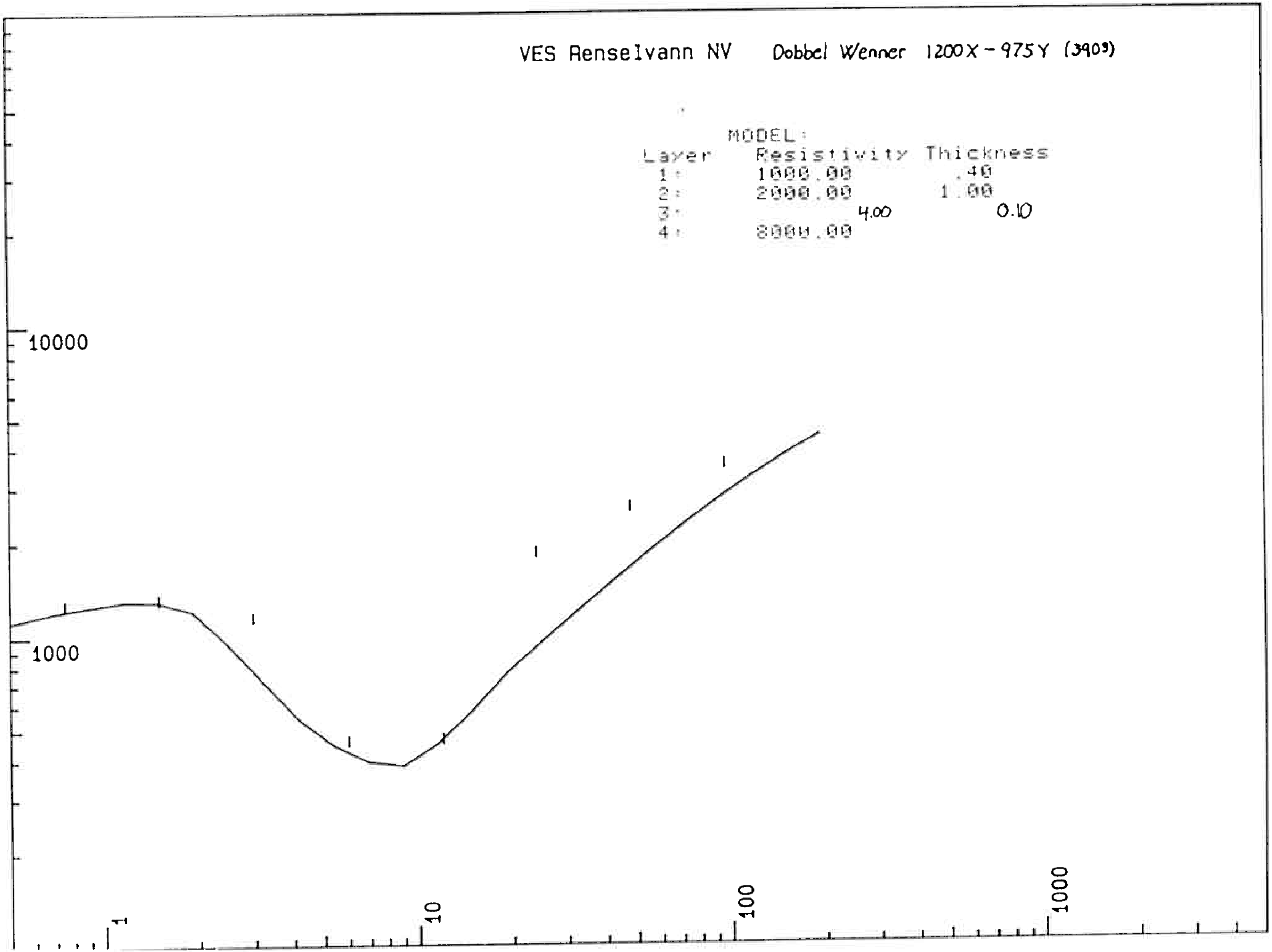
12-2


VES Renselvann NV
Dobbel Wenner 1094X-625Y (1559)
MODEL:
Layer Resistivity Thickness
1: 1500.00 .75
2: 7250.00 40.00
3: 4.00 .25
4: 7250.00
10000
1000
1
10
100
1000

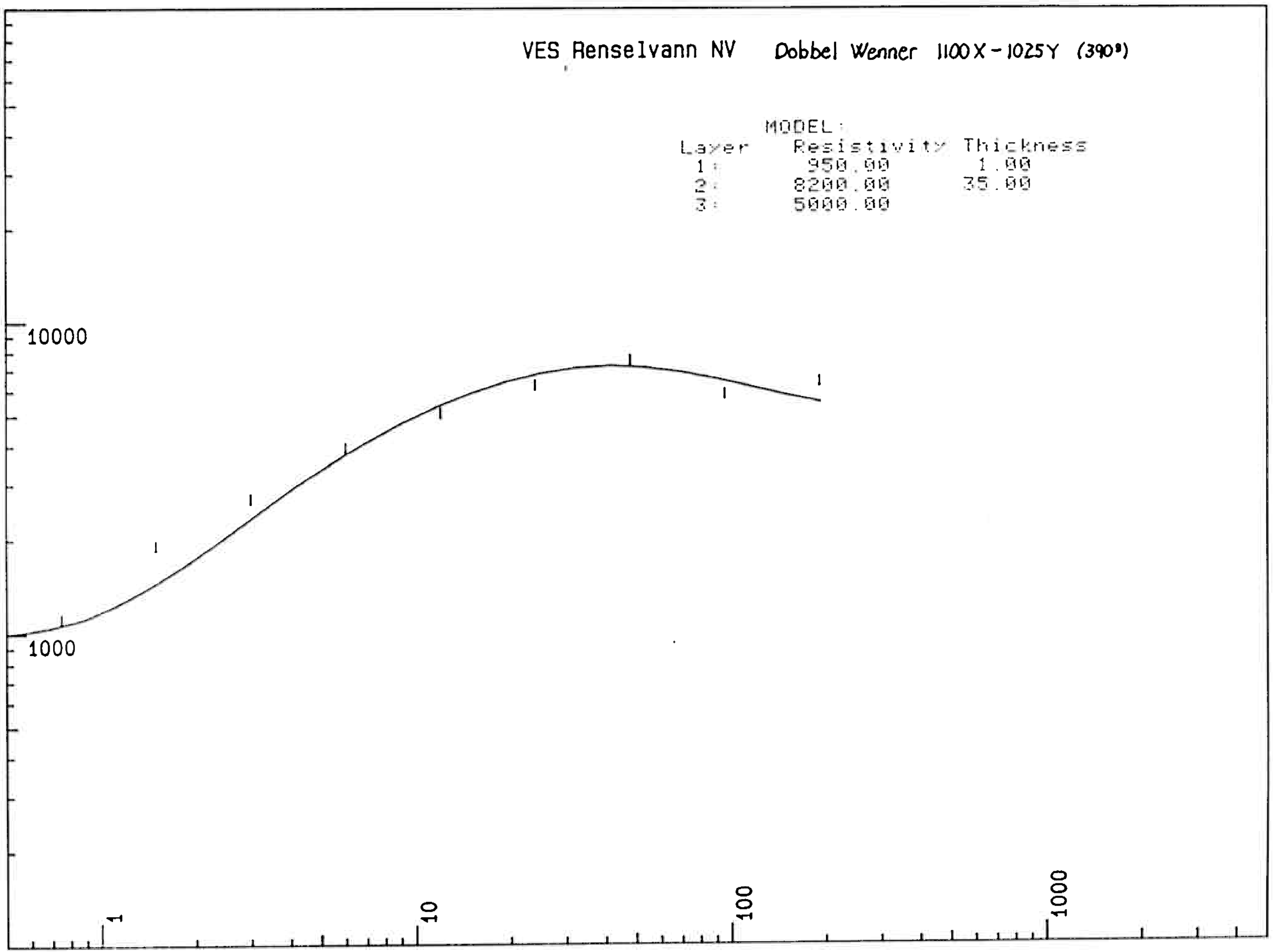
12-3


VES Renselvann NV Dobbel Wenner 1050X-1035Y (3909)
MODEL:
Layer Resistivity Thickness
1: 840.00 .75
2: 9750.00 35.00
3: 6500.00
10000
1000
1
10
100
1000

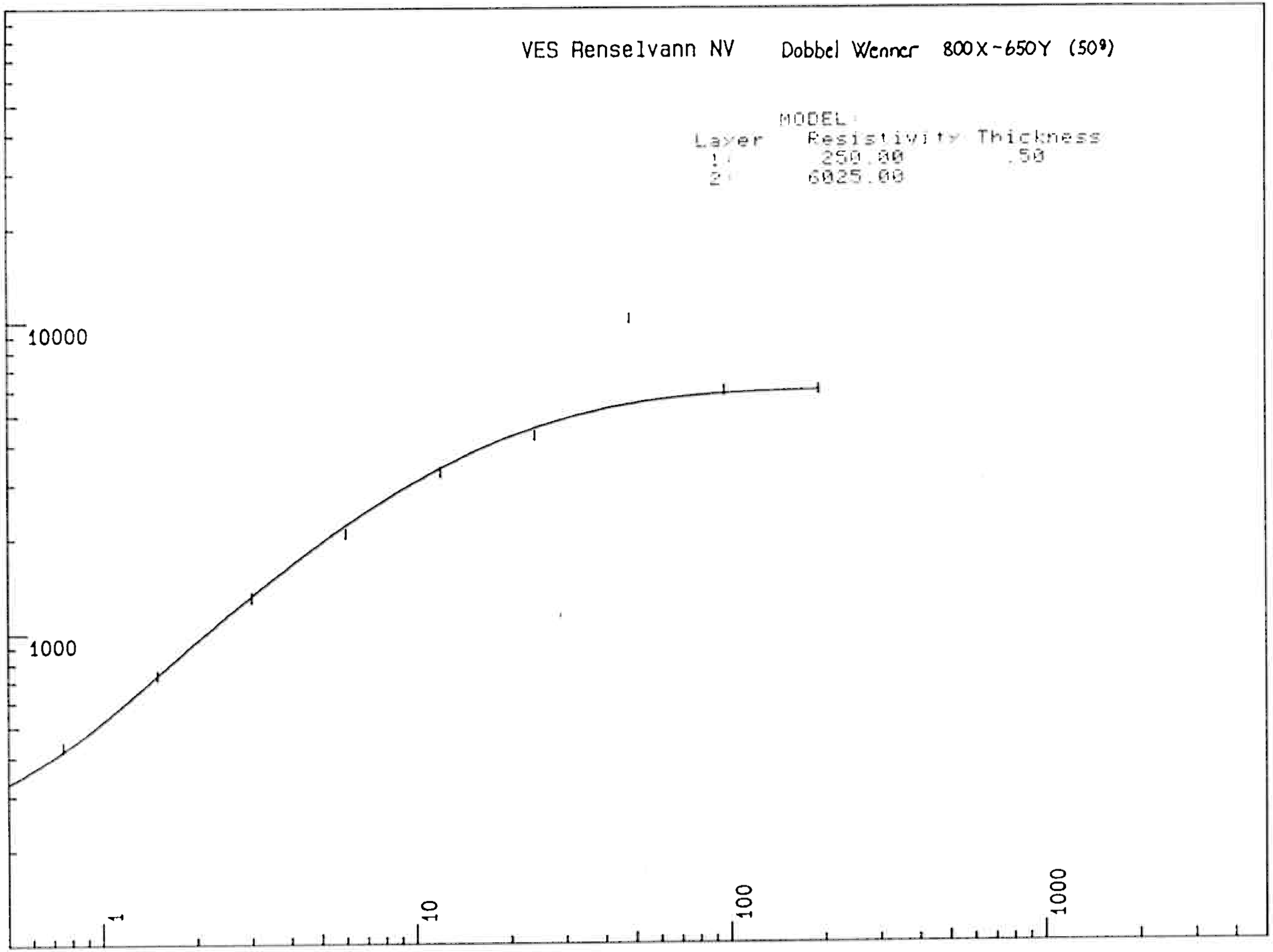
12-4


VES Renselvann NV Dobbel Wenner 1200X - 975Y (3903)
MODEL:
Layer Resistivity Thickness
1: 1000.00 .40
2: 2000.00 1.00
3: 4.00 0.10
4: 8000.00
10000
1000
1
10
100
1000

12-5

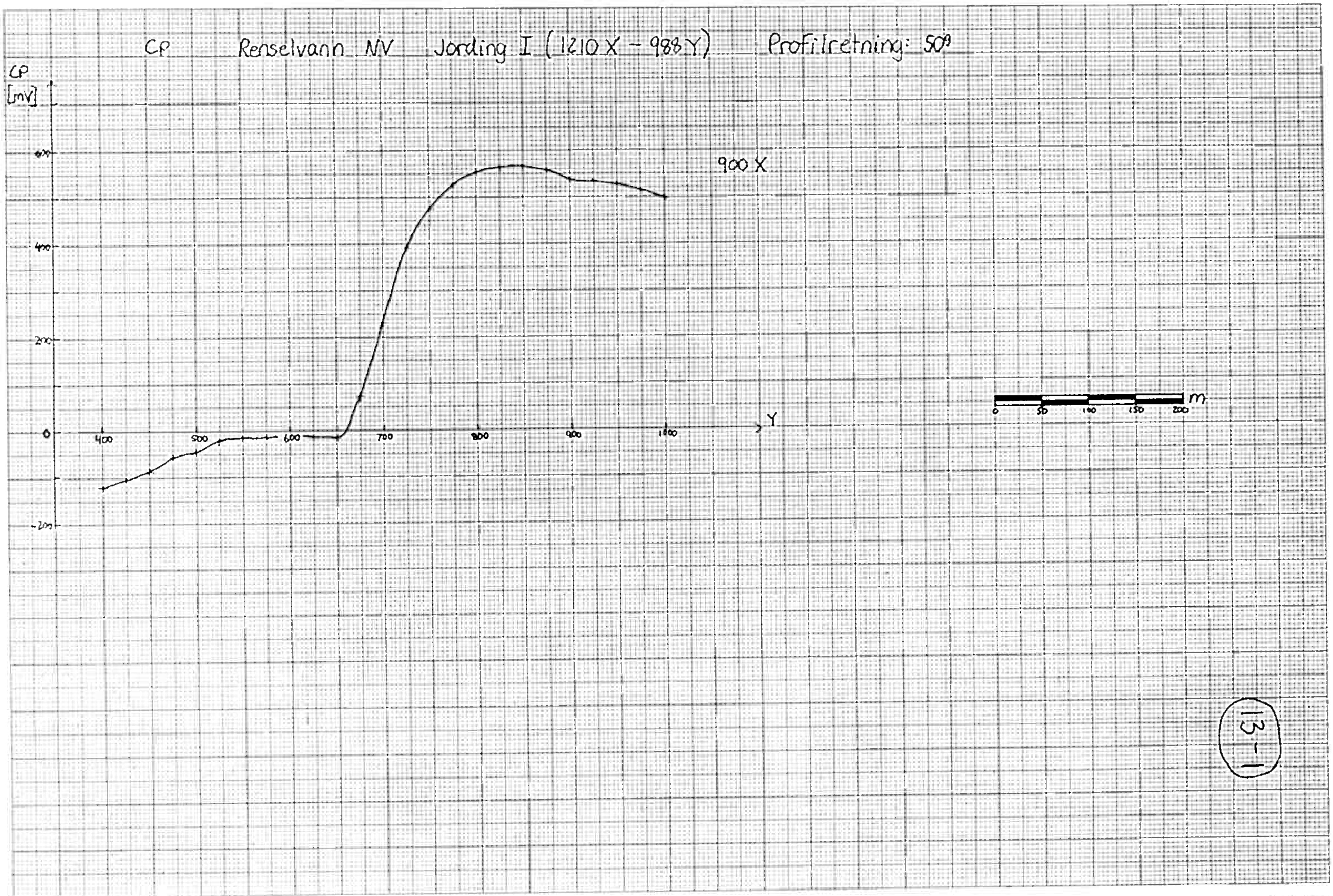

VES Renselvann NV Dobbel Wenner 1100X - 1025Y (390°)
MODEL:
Layer Resistivity Thickness
1: 950.00 1.00
2: 8200.00 35.00
3: 5000.00
10000
1000
1
10
100
1000

12-6



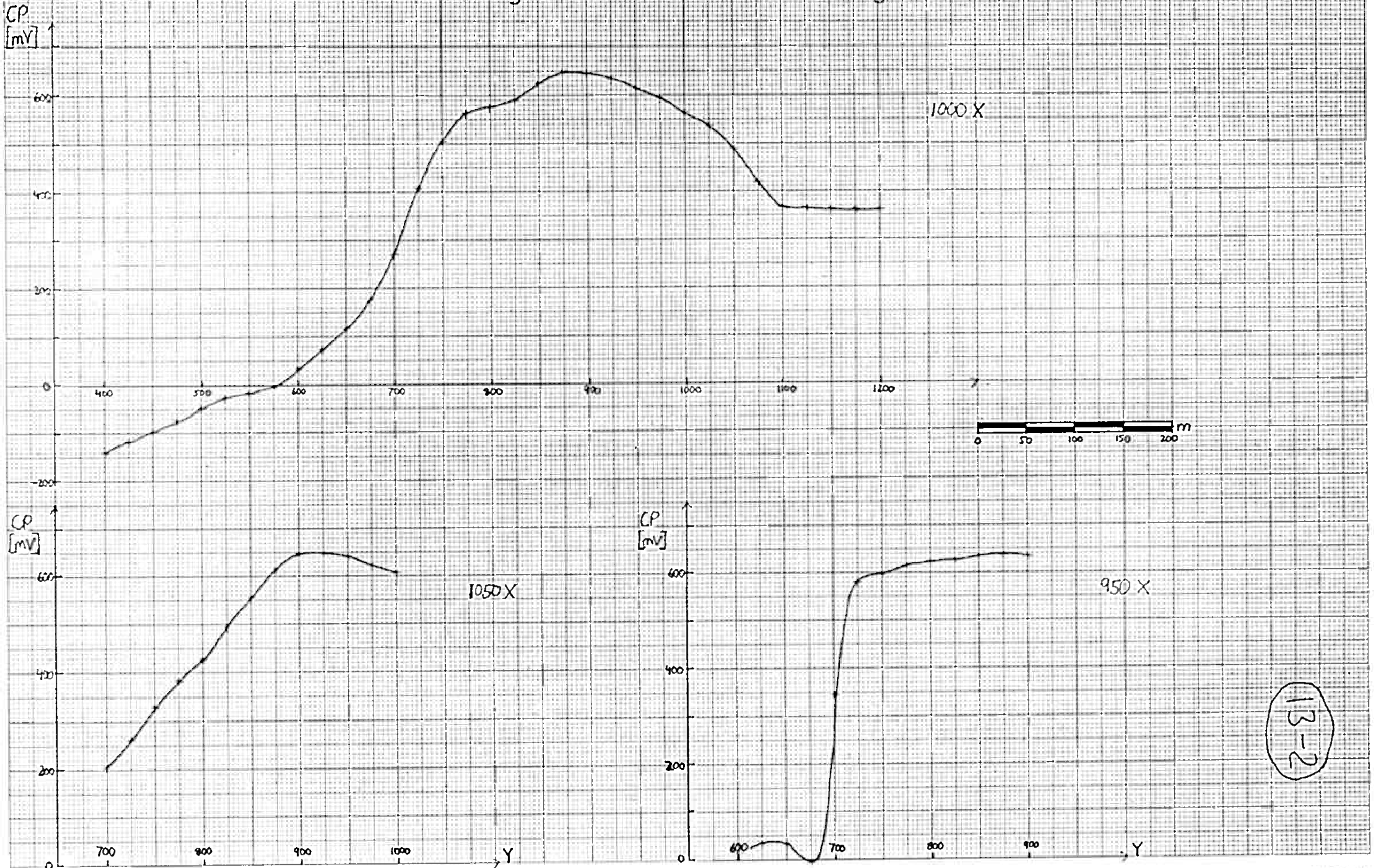
VES Renselvann NV Dobbel Wenner 800X-650Y (509)
MODEL:
Layer Resistivity Thickness
1: 250.00 .50
2: 6025.00
10000
1000
1
10
100
1000

12-7



Vare nr. 03102

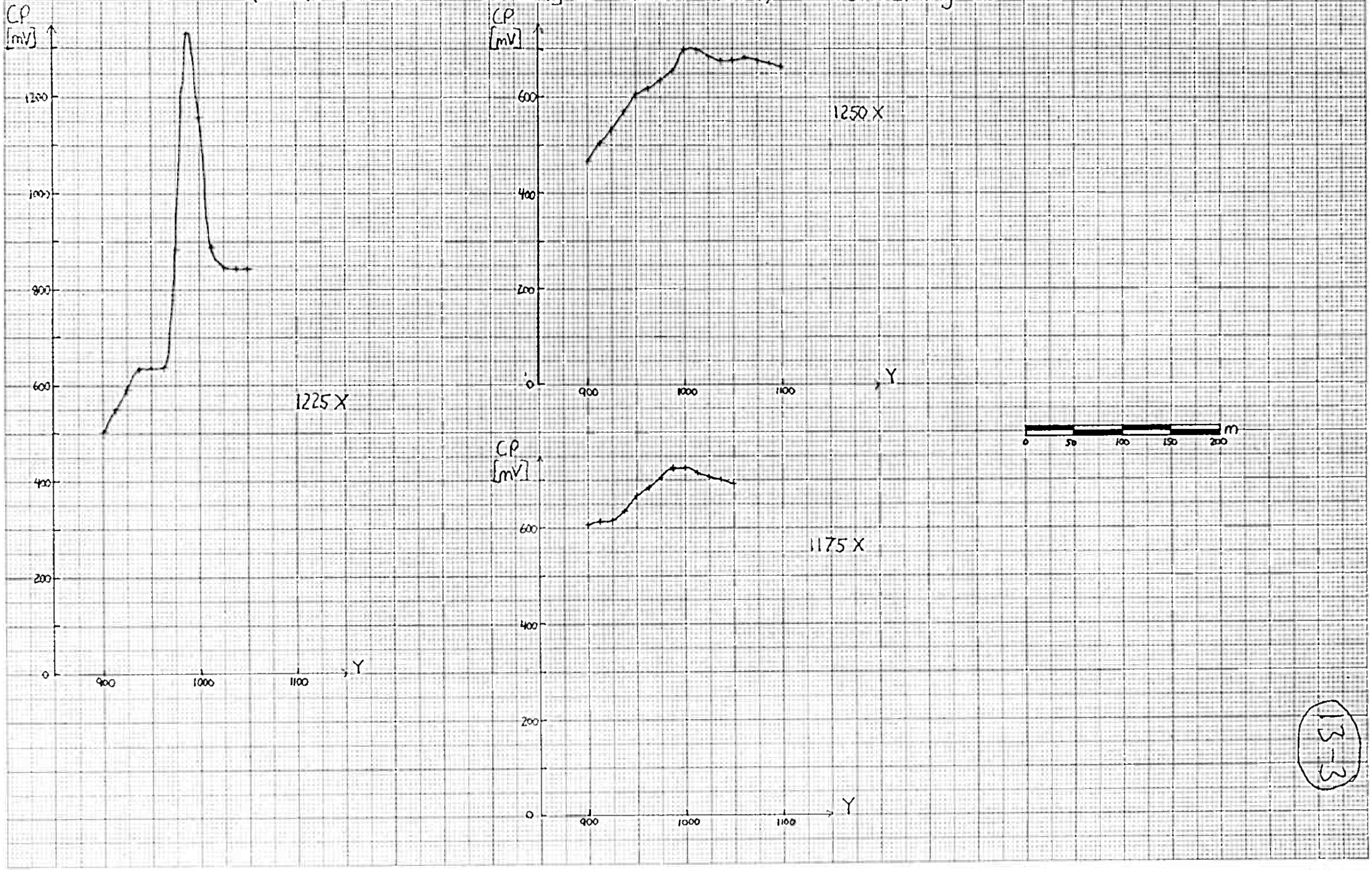
CP Renselvann NV Jording I (1210X - 988Y) Profilretning: 50g



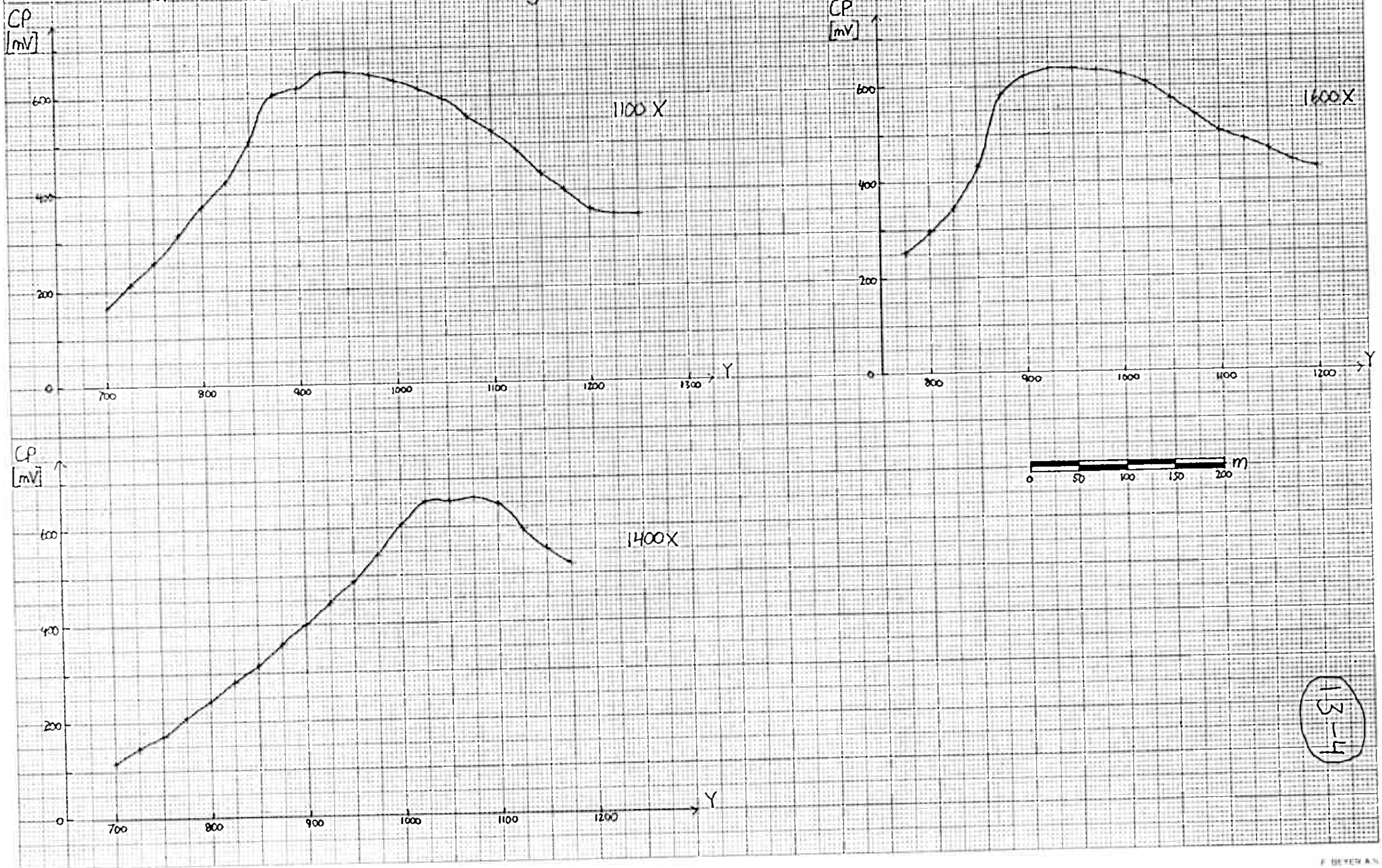
Vare nr. 03102

F. BEYER A.S.

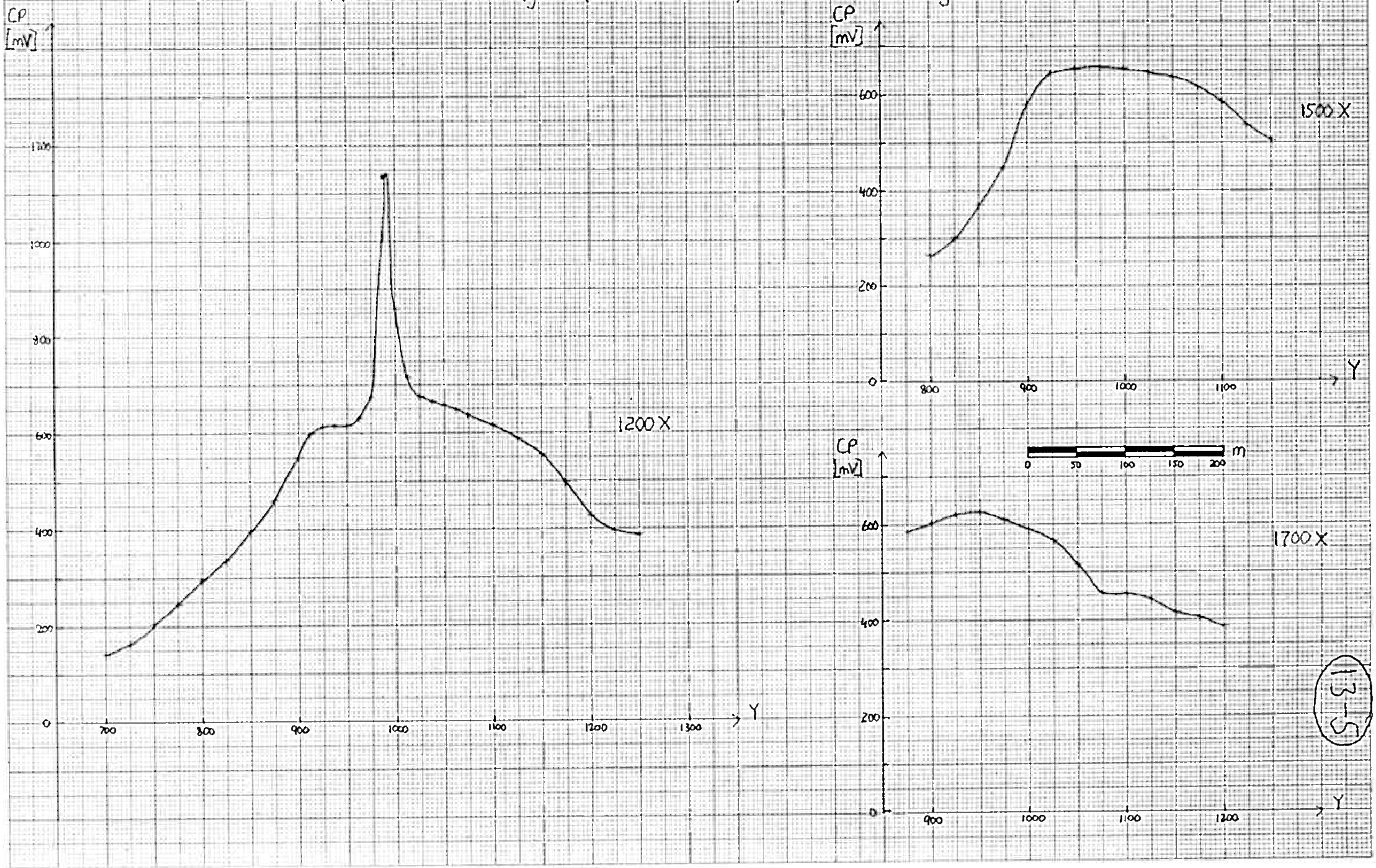
CP Renselvann NV Jording I (1210X – 988Y) Profilretning: 50g



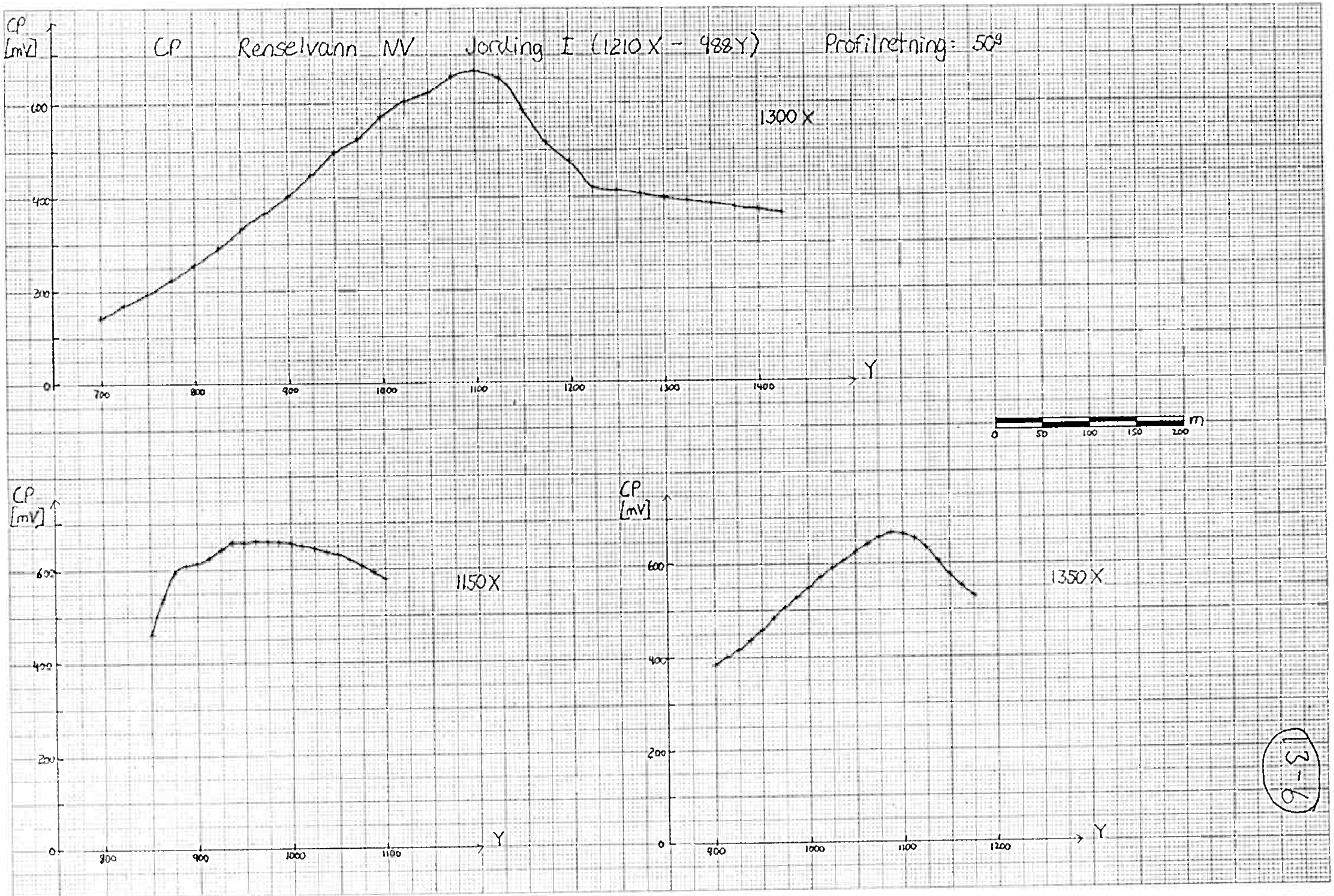
CP Renselvann NV Jording I (1210X – 988Y) Profilretning: 50g



CP Renselvann NV Jording I (1210X - 988Y) Profilretning: 50⁹

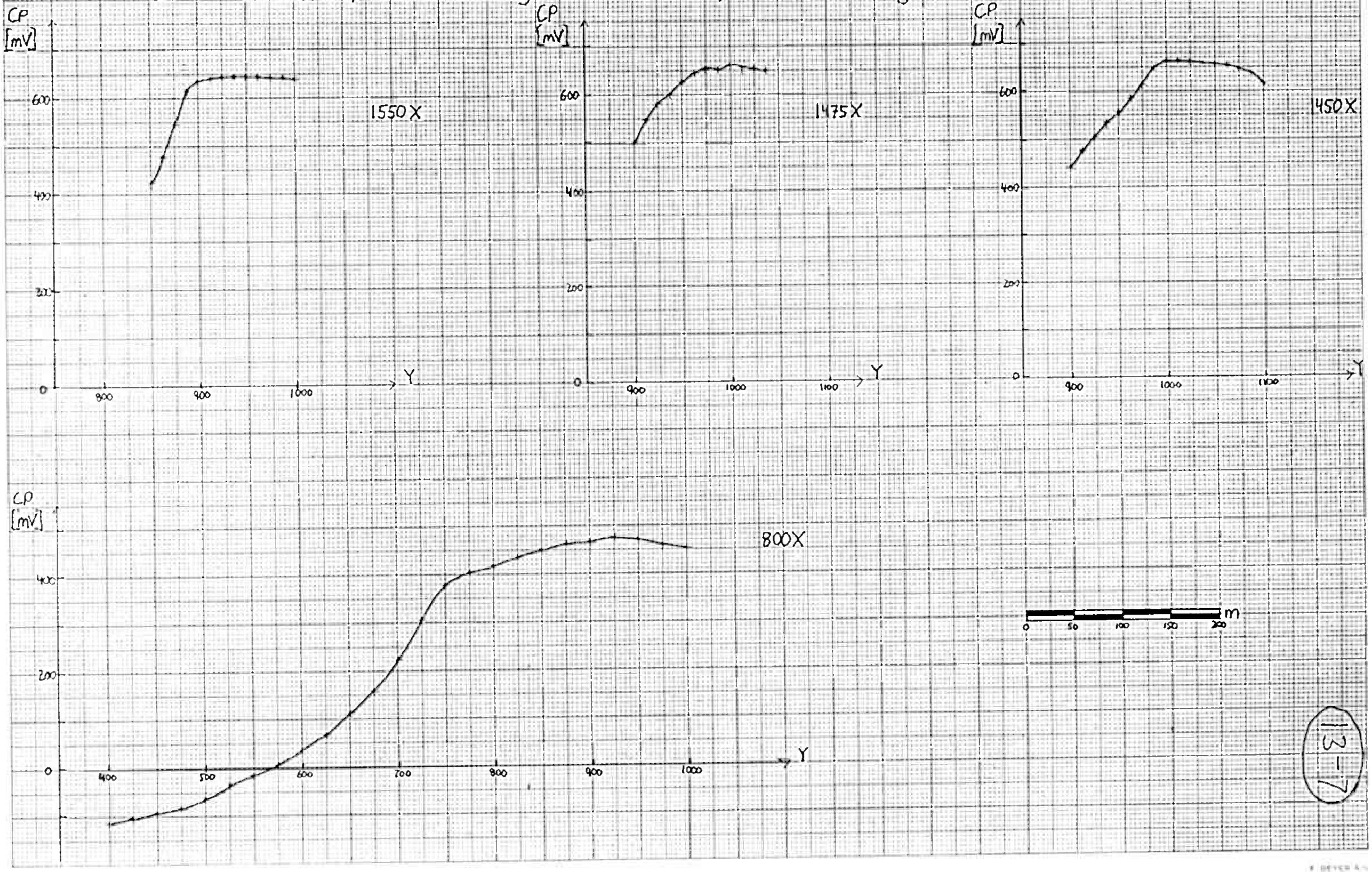


Vare nr. 03102



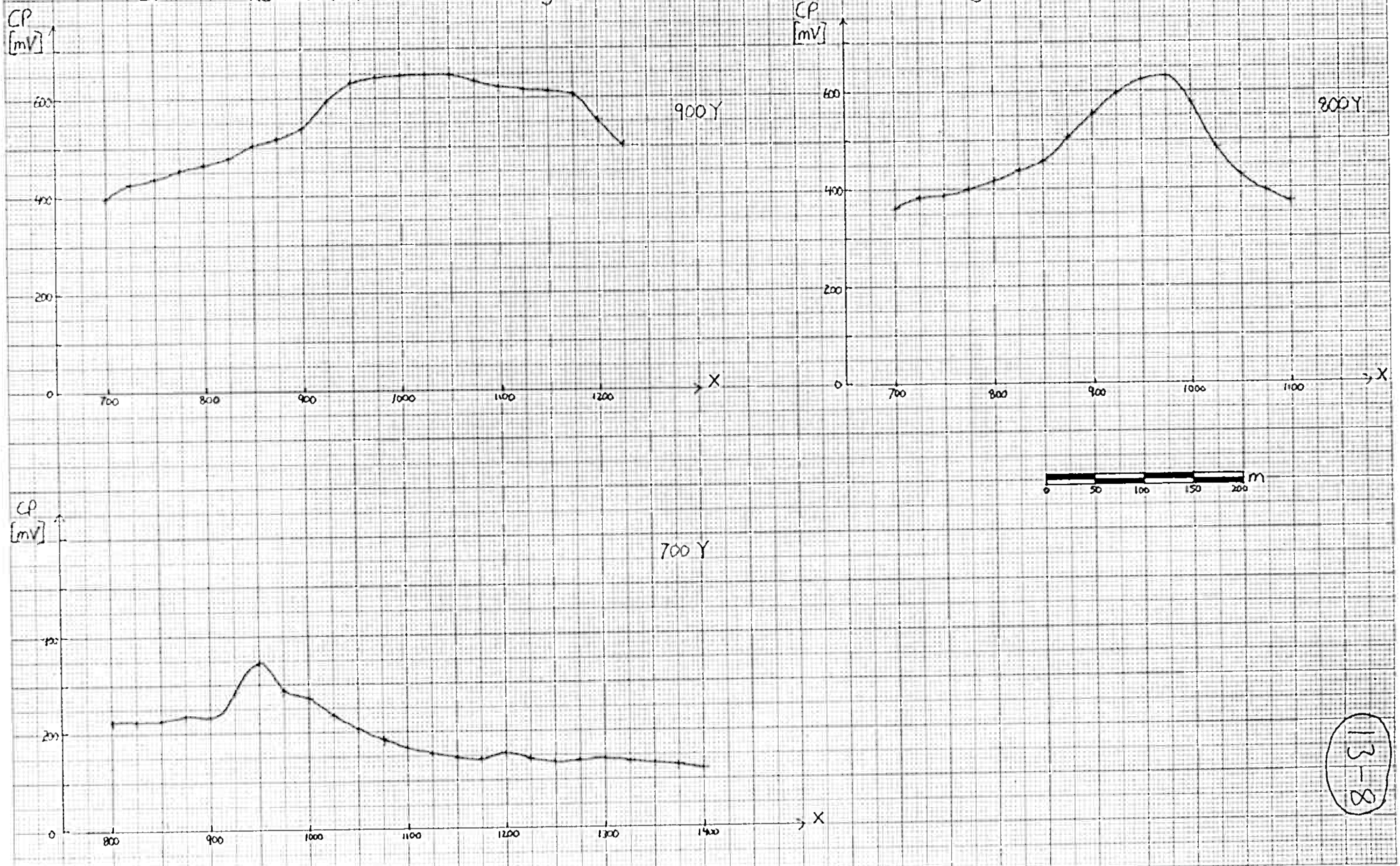
Vare nr. 03102

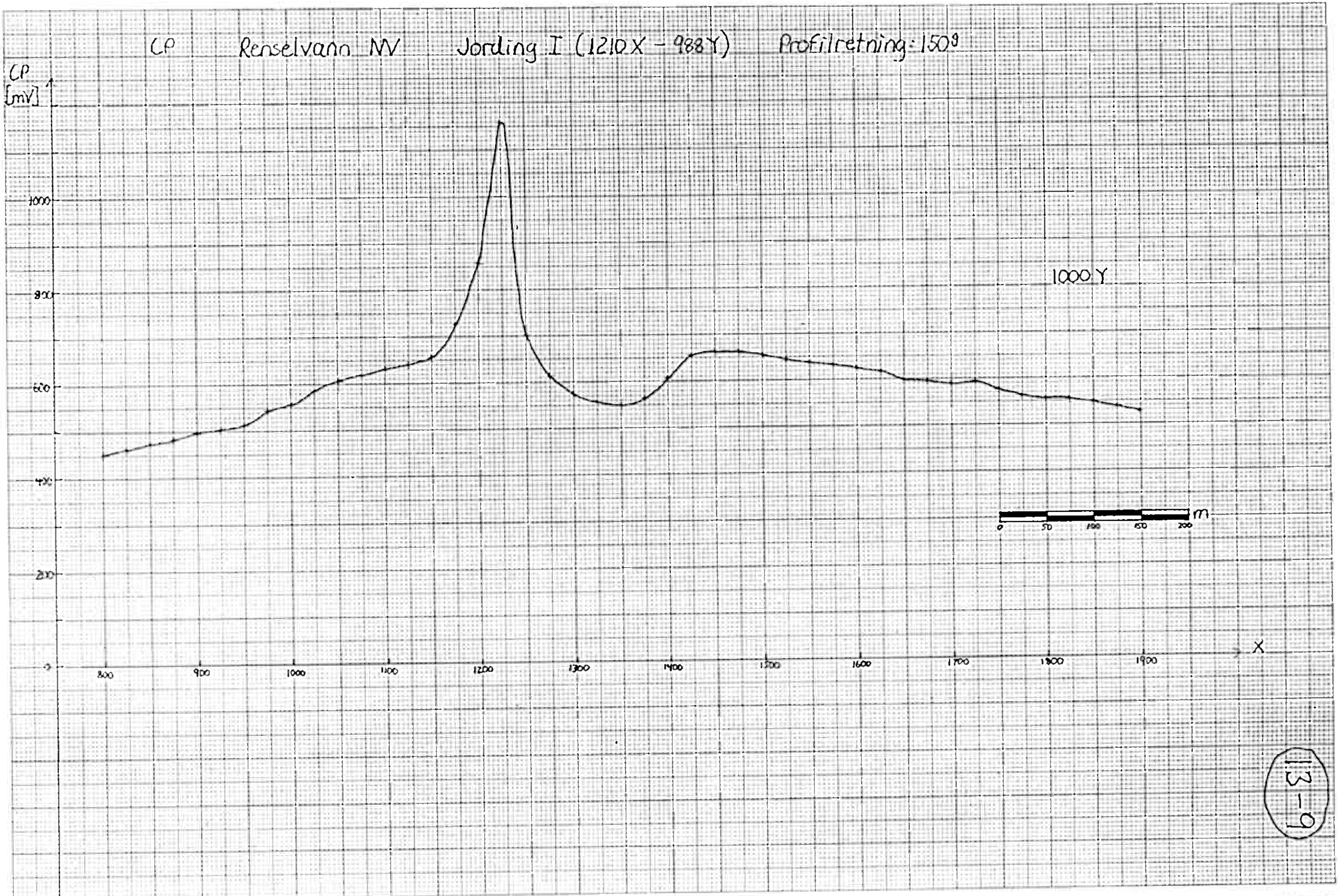
CP Renselvann NV Jording I (1210X - 988Y) Profilretning: 50ᵍ



13-7

CP Renselvann NV Jording I (1210 X – 988Y) Profilretning: 150^g

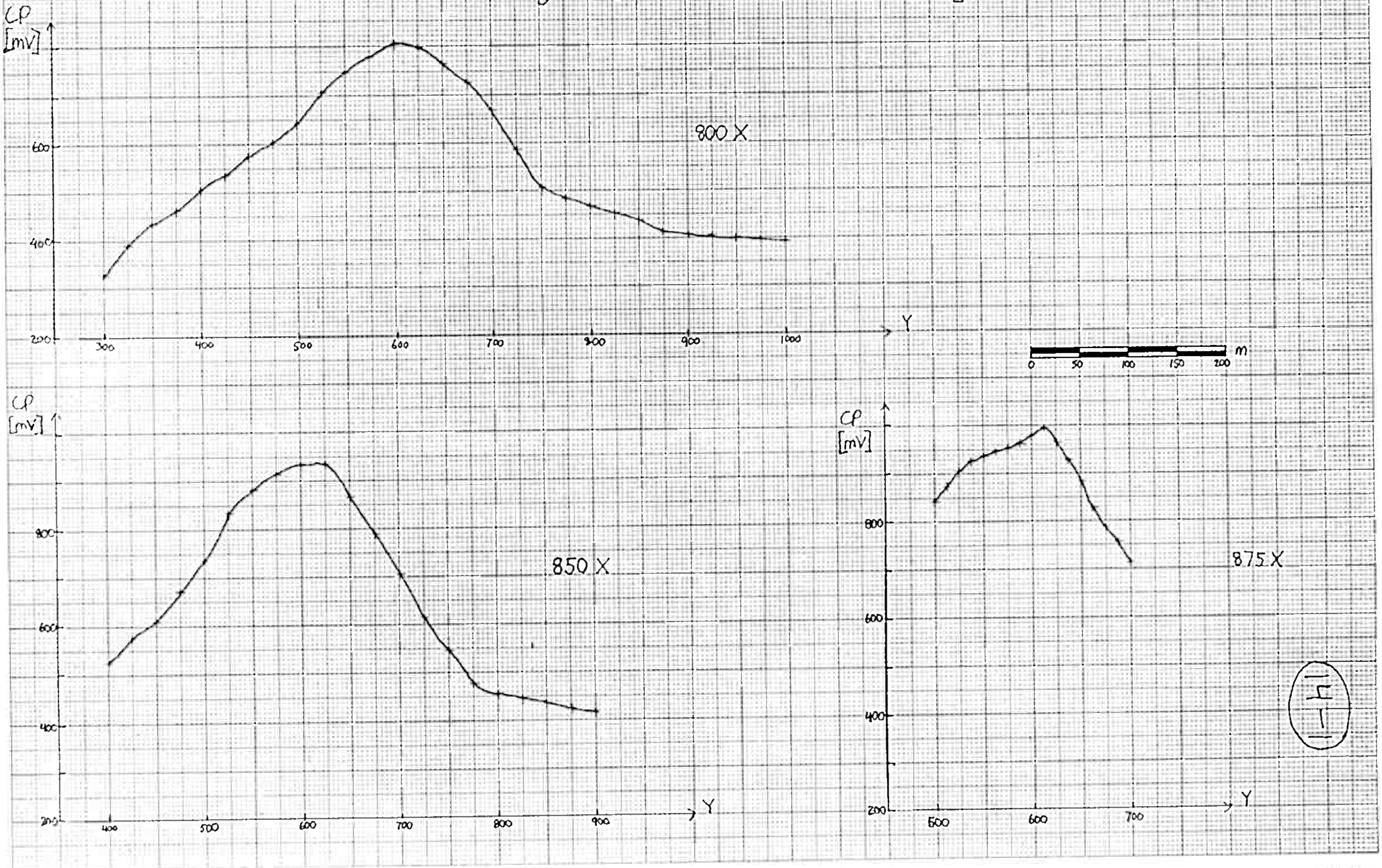




Vare nr. 03102

T. BEYER A.S

CP Renselvann NV Jording III (878X - 616Y) Profilretning: 50g



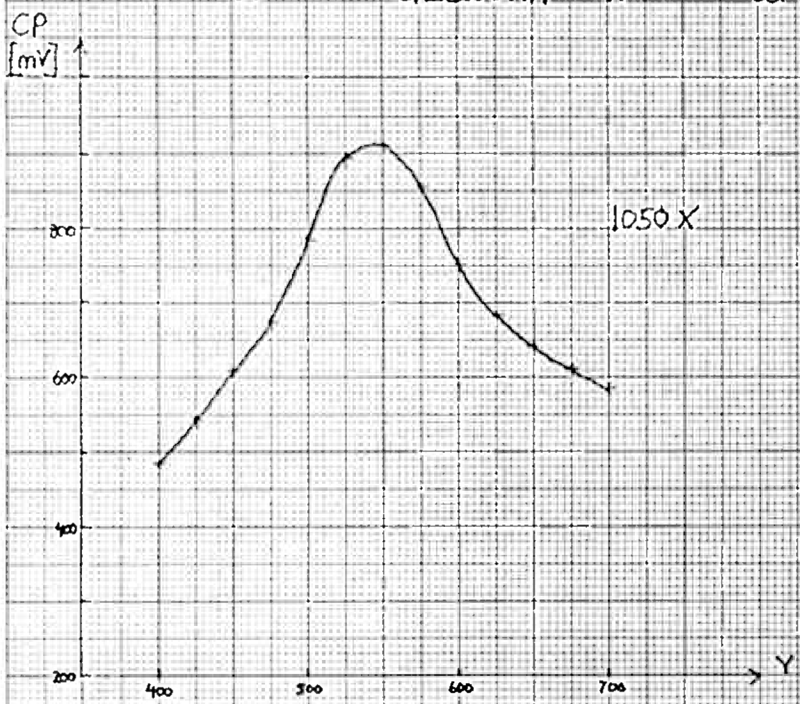
CP Renselvann NV Jording III (878 X – 616 Y) Profilretning: 50^g

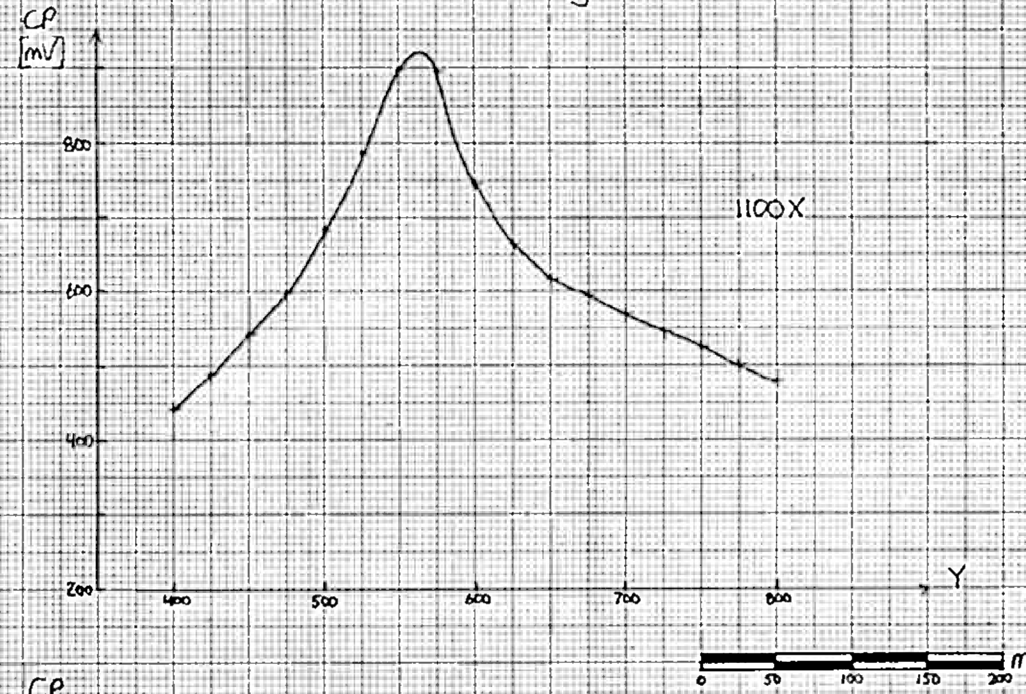
II-2

Vare nr. 03102

F. BEYER A.S

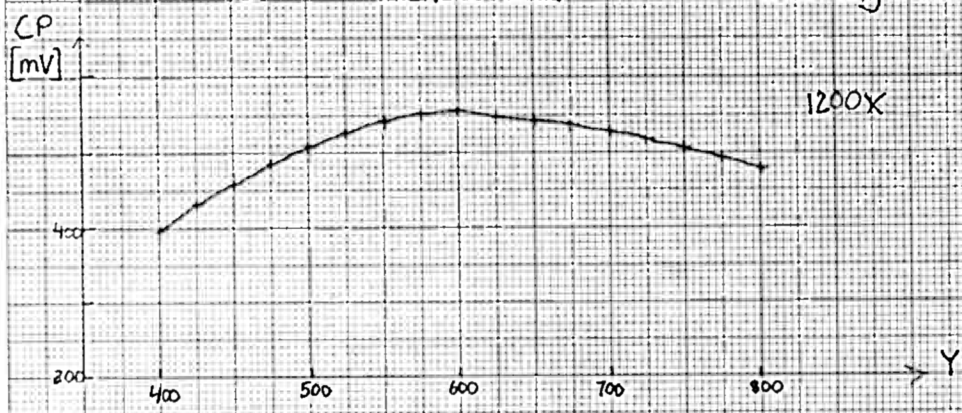
CP Renselvann NV Jording III (878X - 616Y) Profilretning: 50^g

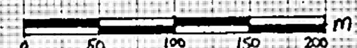




14-13

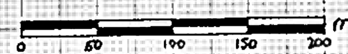
CP Renselvann NV Jording III (878X - 616Y) Profilretning: 50g

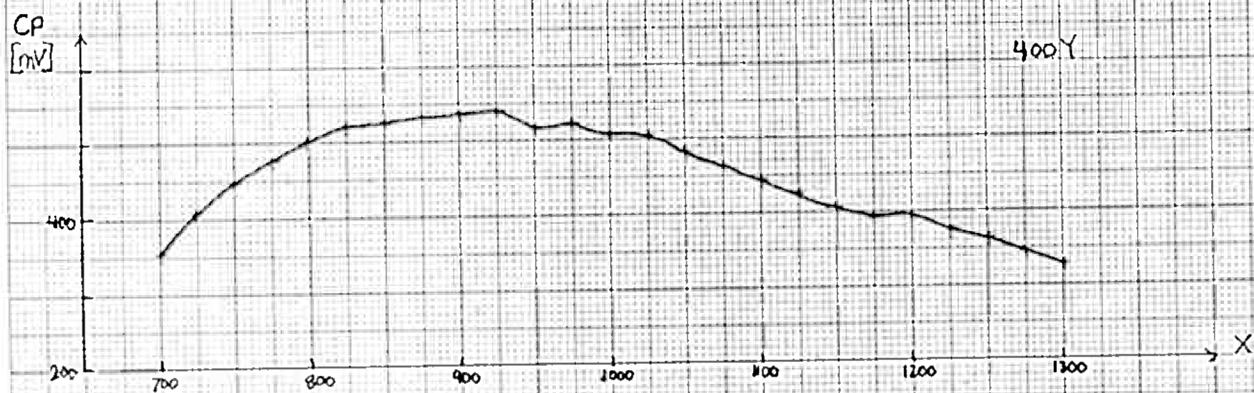




14-4

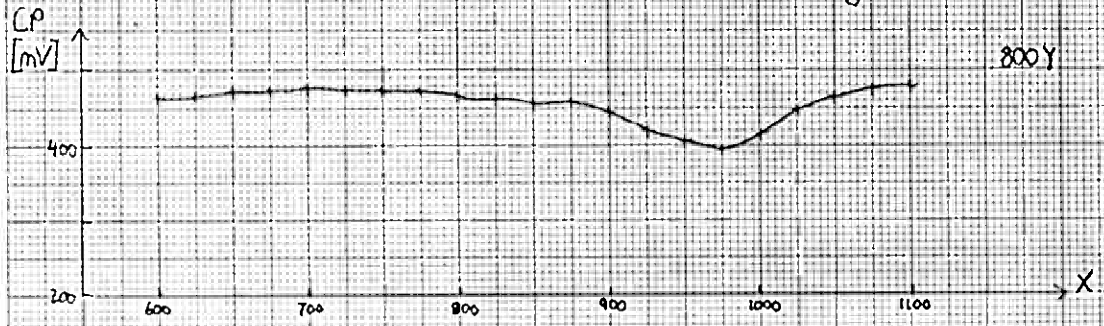
CP Renselvann NV Jording III (878X - 616Y) Profilretning: 150°





14-5

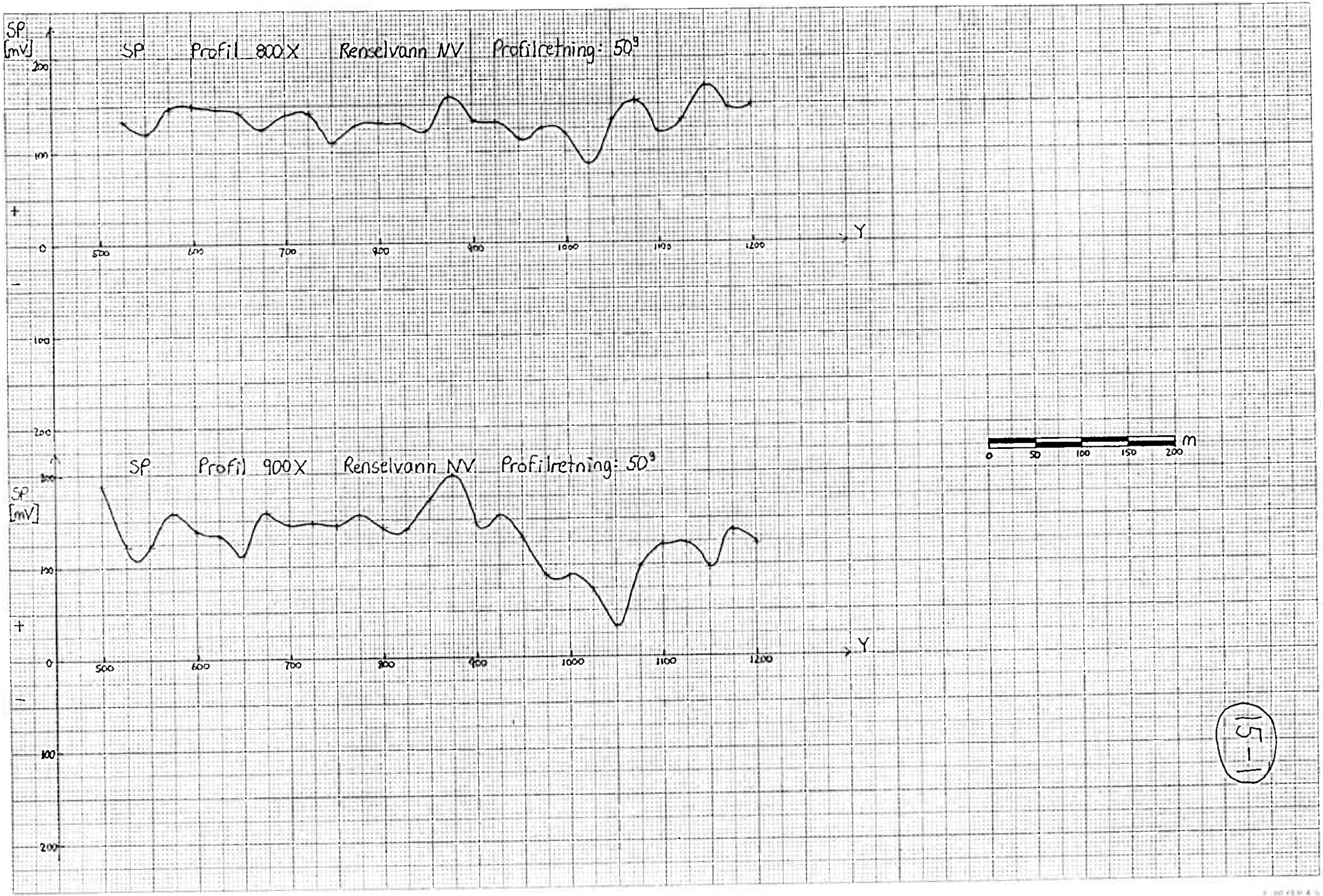
CP Renselvann NV Jording III (878X - 616Y) Profilretning: 150°



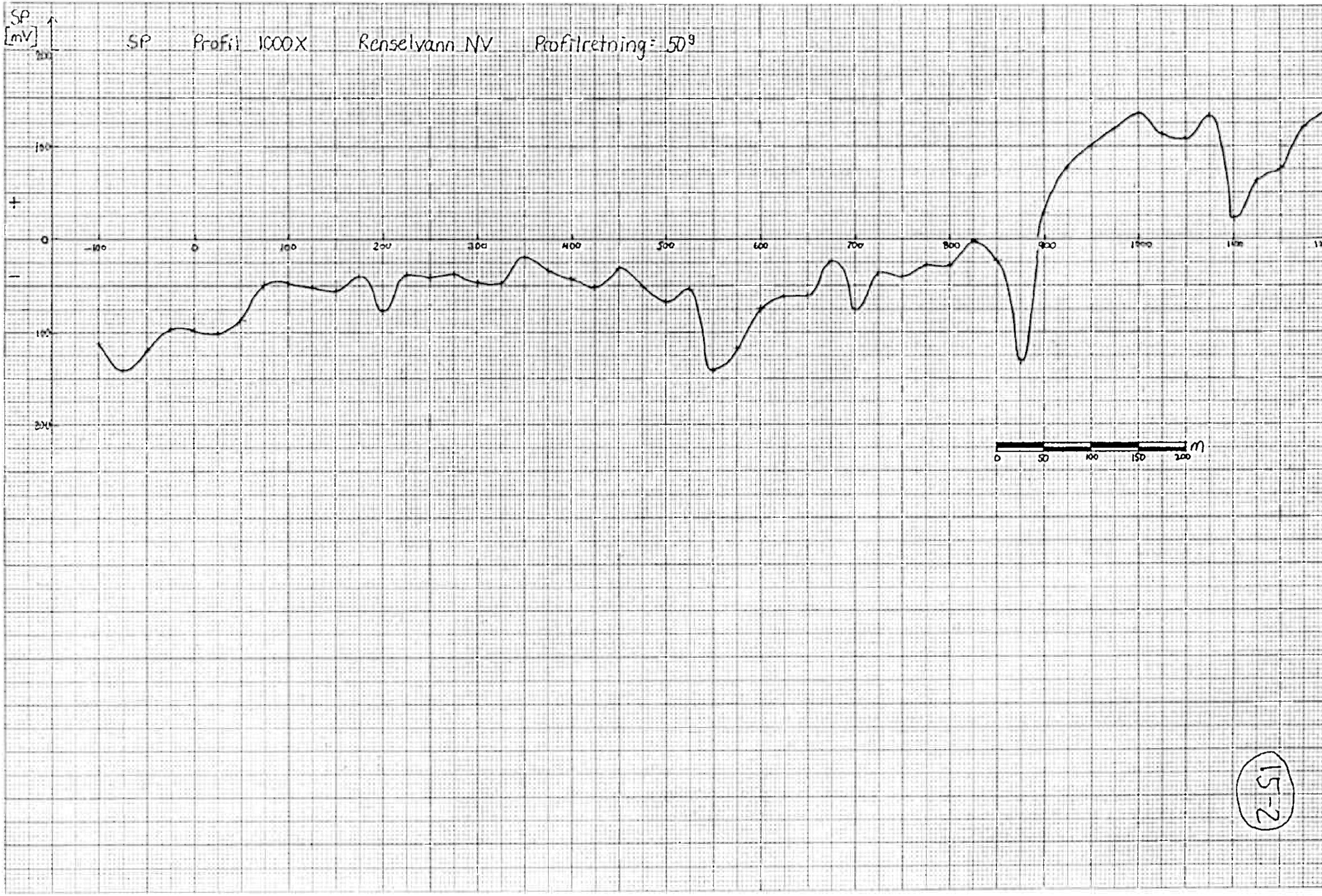
14-9

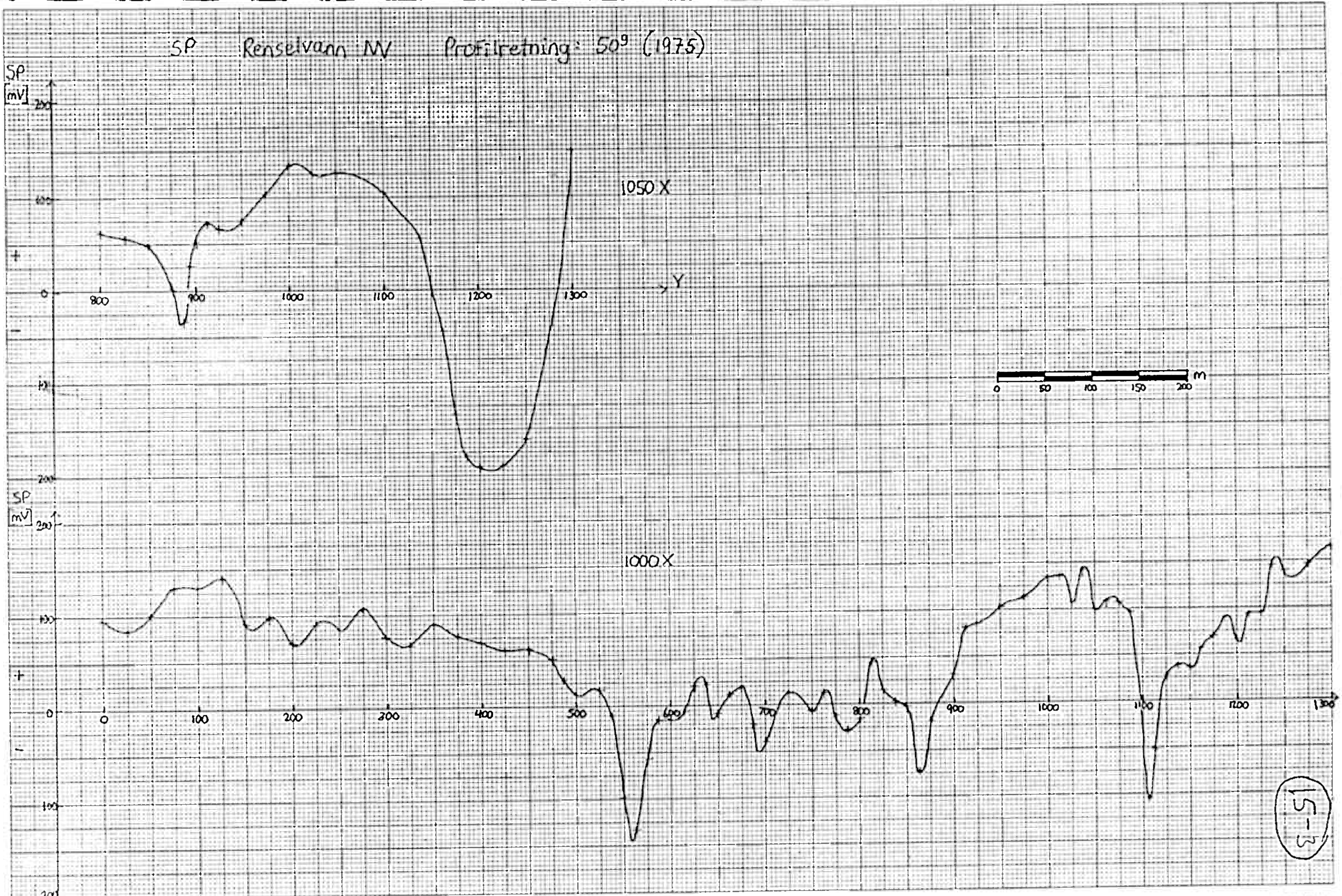
Vare nr. 03102

F. BEYER A.S.

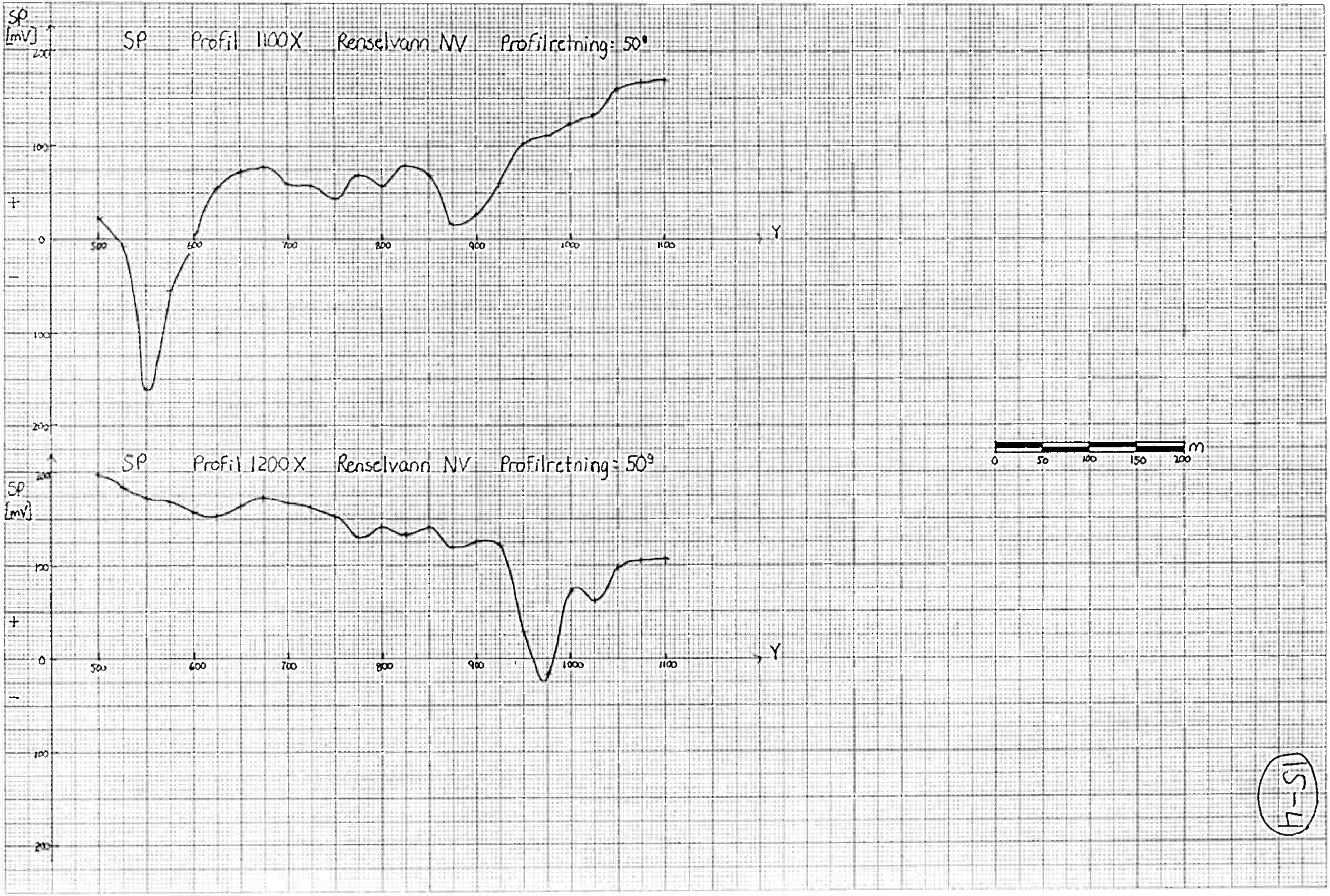


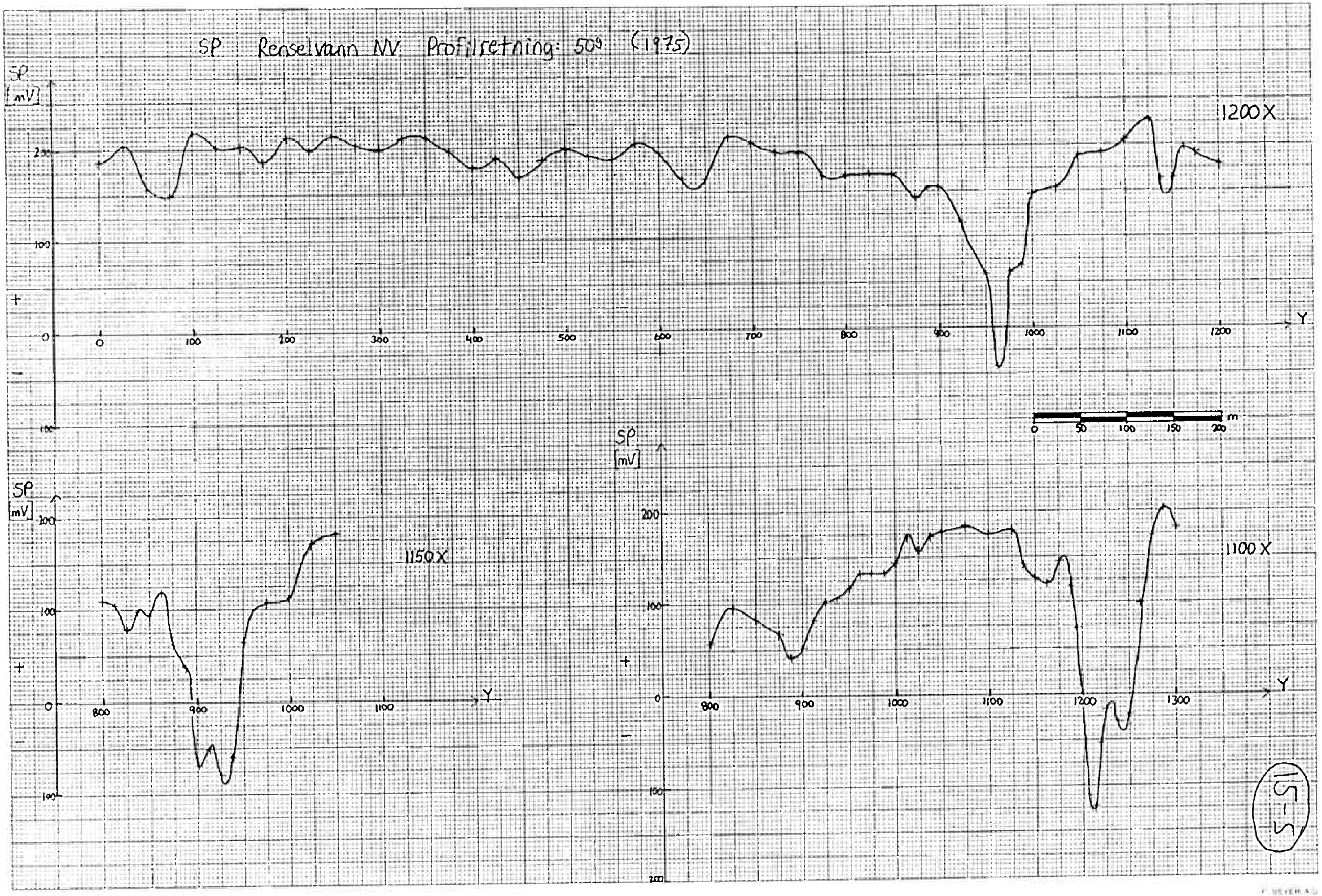
Vare nr. 03107


SP [mV]
SP Profil 1000X Renselvann NV Profilretning: 50g
100
0
100
200
-100 0 100 200 300 400 500 600 700 800 900 1000 1100 1200
Y
0 50 100 150 200 m
15-2



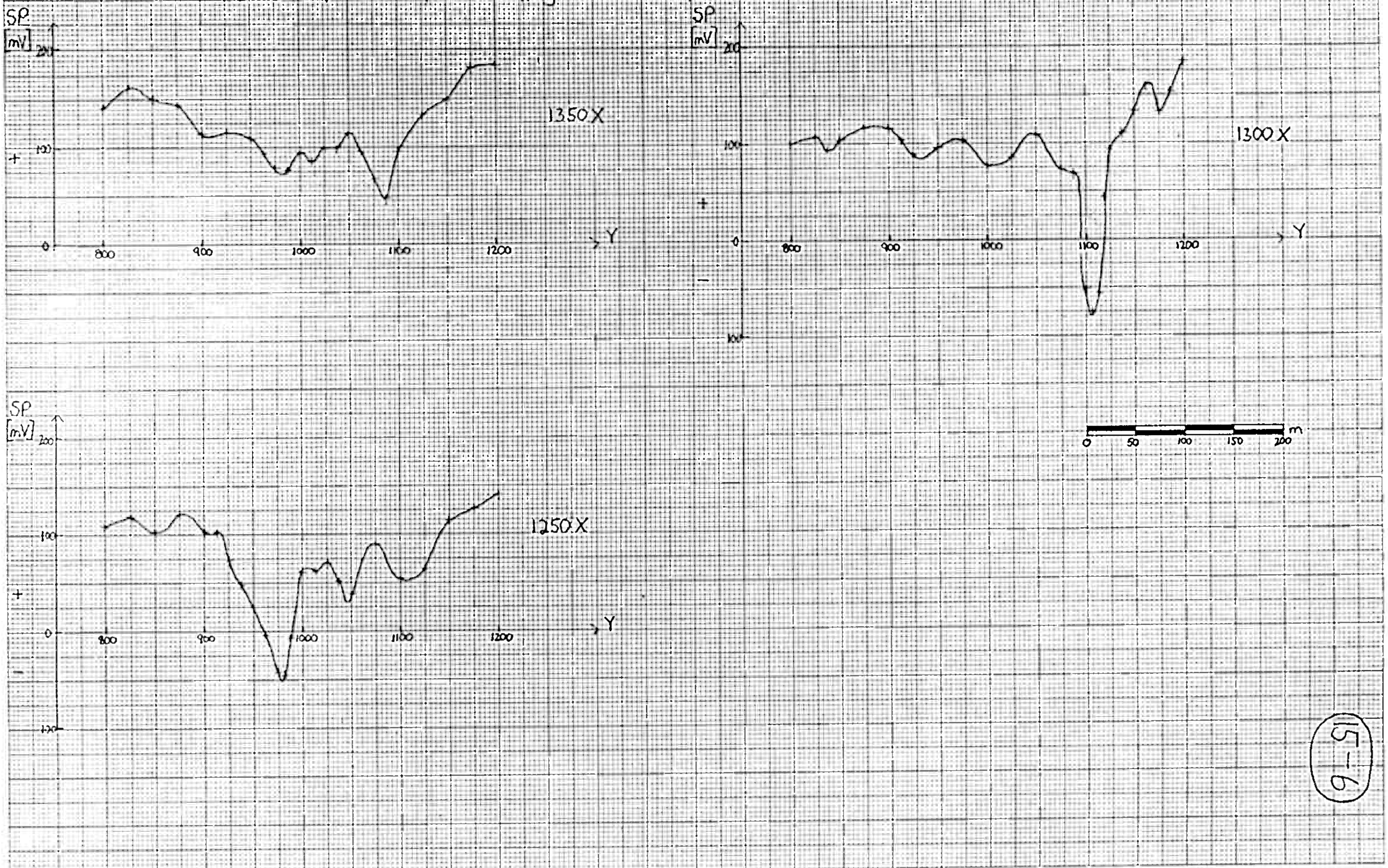
Vare nr. 03102


SP [mV]
SP Profil 1100X Renselvann NV Profilretning: 50°
200
100
+
0
−
100
200
500
600
700
800
900
1000
1100
Y
SP Profil 1200X Renselvann NV Profilretning: 50°
SP [mV]
0 50 100 150 200 m
15-4

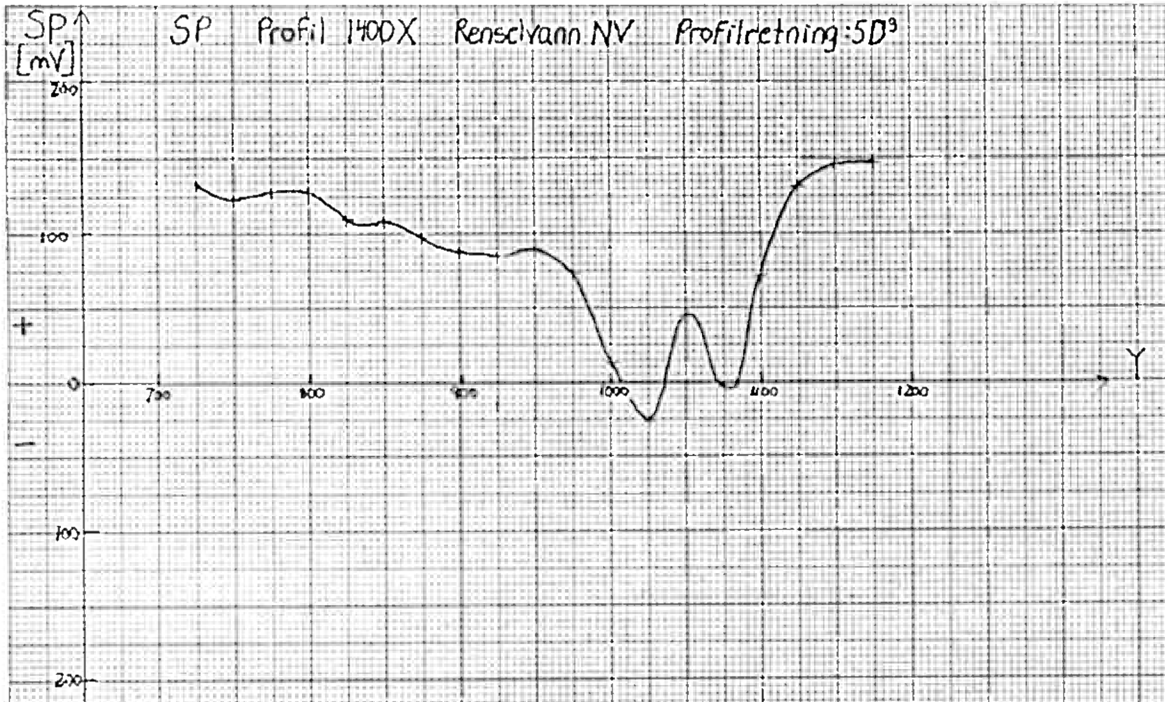


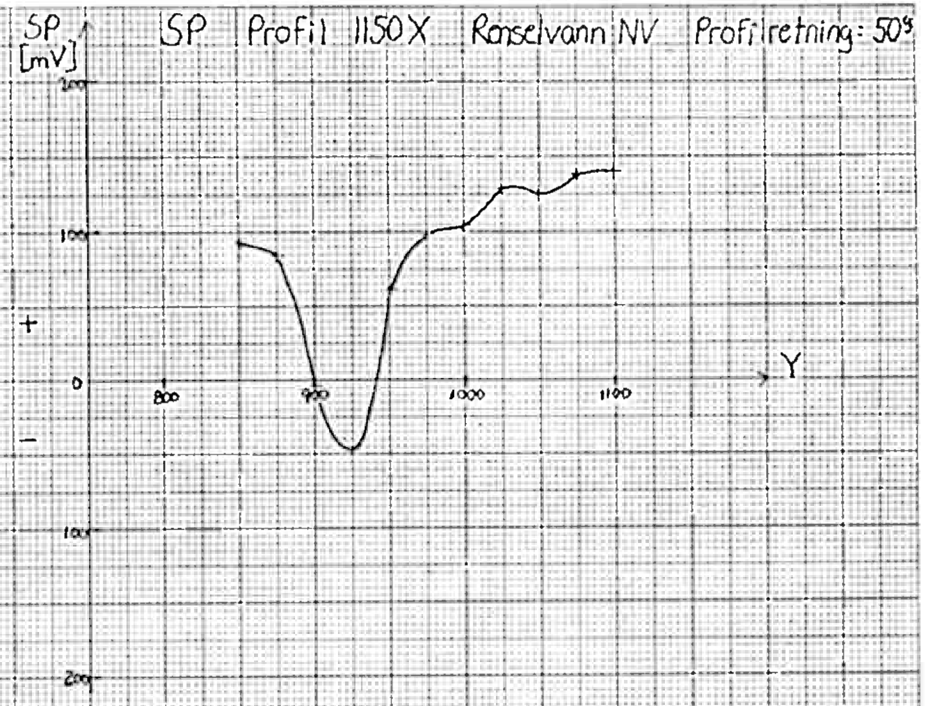
Vare nr. 03102

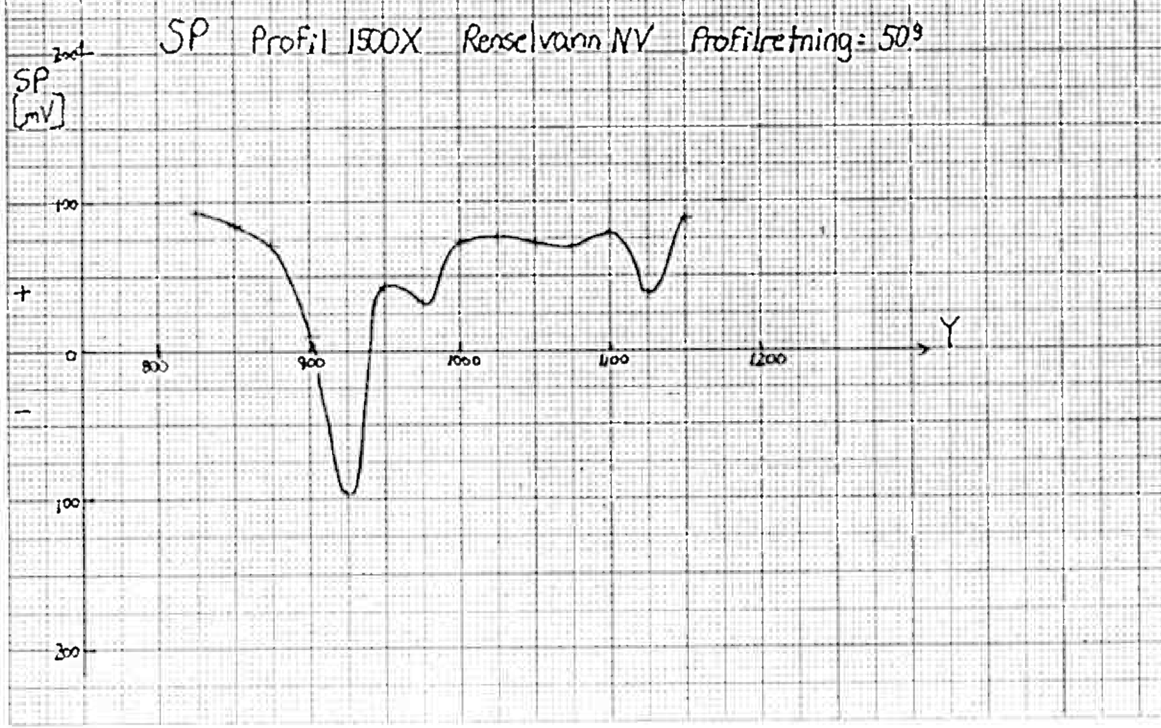
SP Renselvann NV Profilretning - 50° (1975)

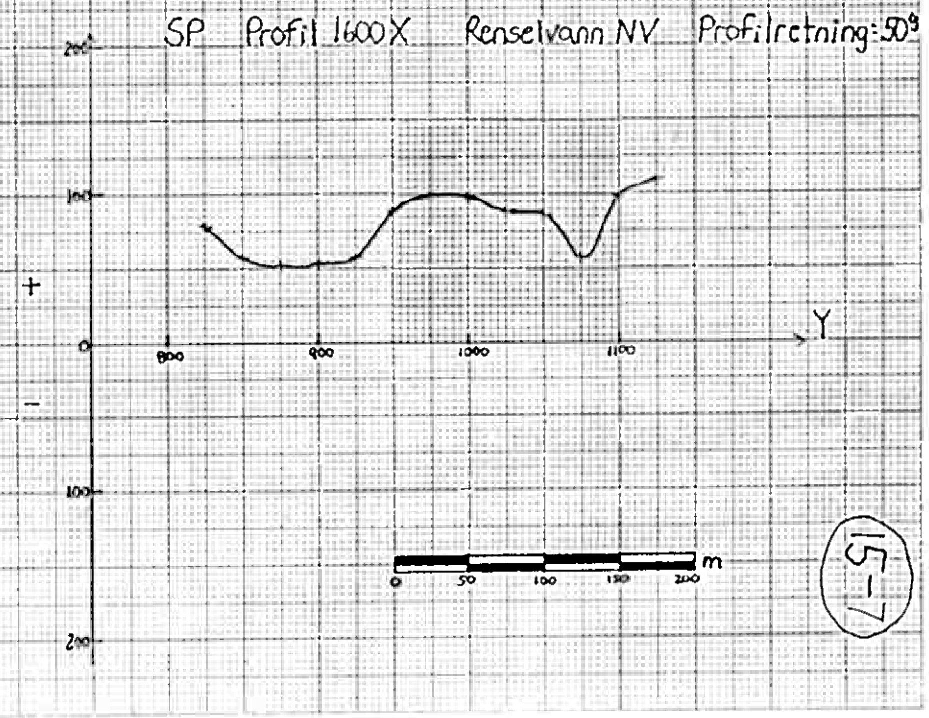


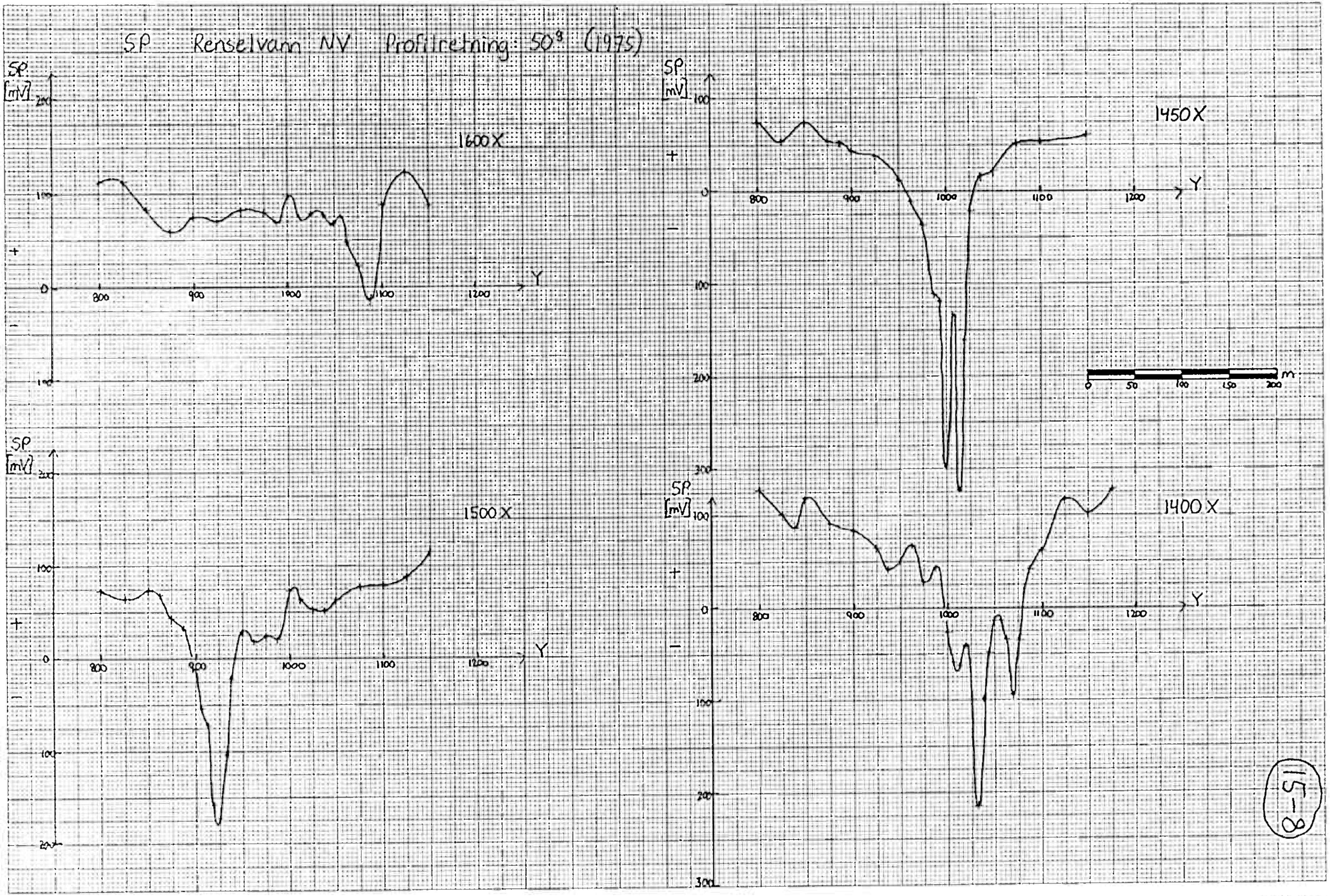
Vare nr. 03102


SP Profil 1400X Renselvann NV Profilretning: 50g
SP [mV]
200
100
+
0
−
100
200
700
800
900
1000
1100
1200
Y

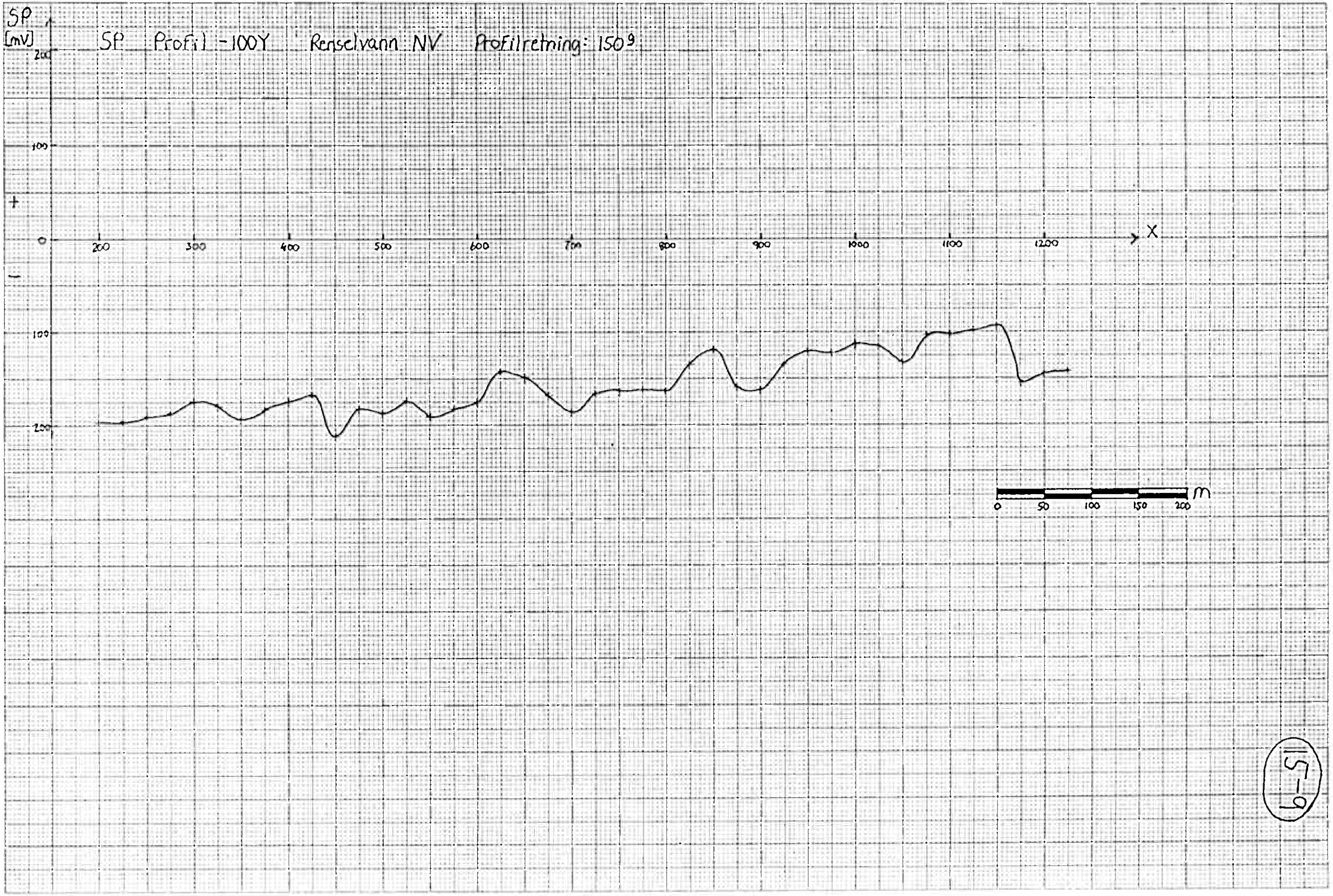

SP Profil 1150X Renselvann NV Profilretning: 50g
SP [mV]
200
100
+
0
−
100
200
800
900
1000
1100
Y

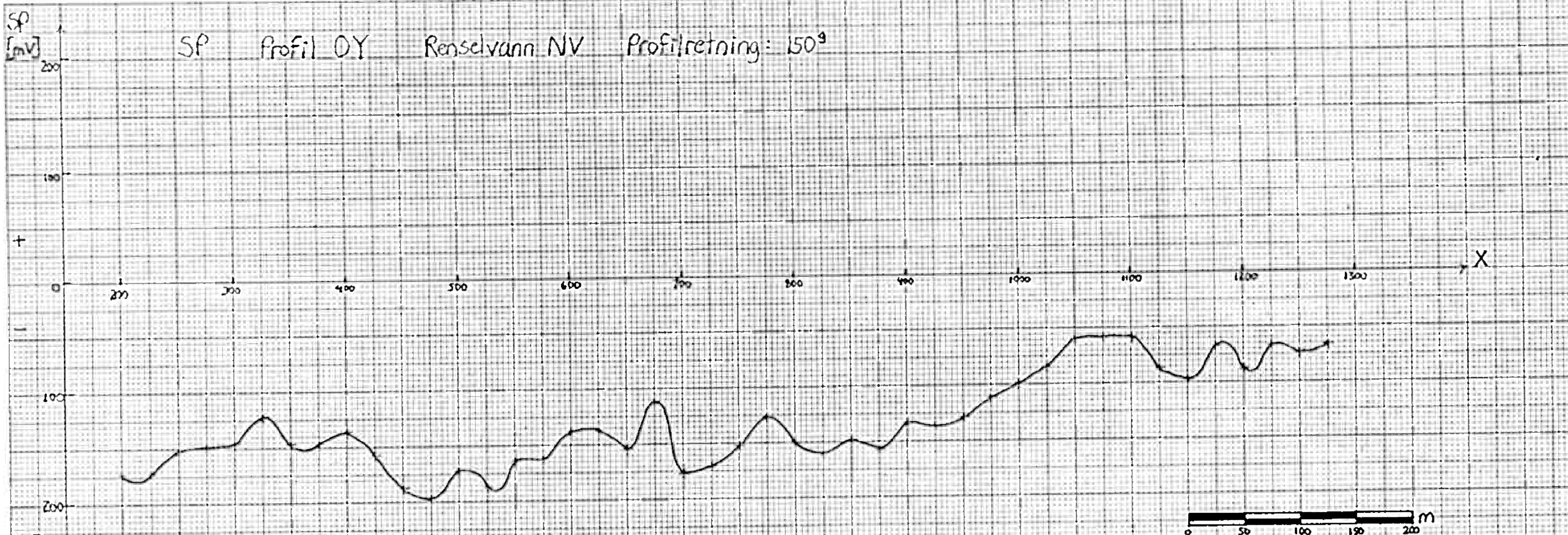

SP Profil 1500X Renselvann NV Profilretning: 50g
SP [mV]
200
100
+
0
−
100
200
800
900
1000
1100
1200
Y

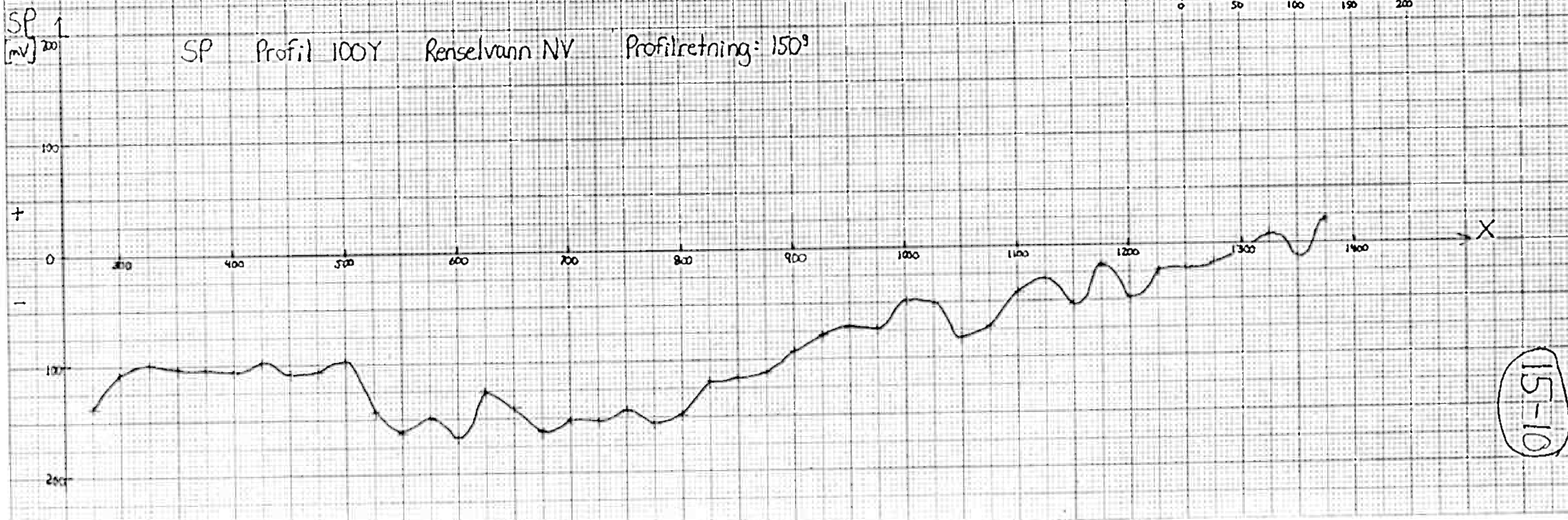

SP Profil 1600X Renselvann NV Profilretning: 50g
200
100
+
0
−
100
200
800
900
1000
1100
Y
0
50
100
150
200
m
15-7



Vare nr. 03102

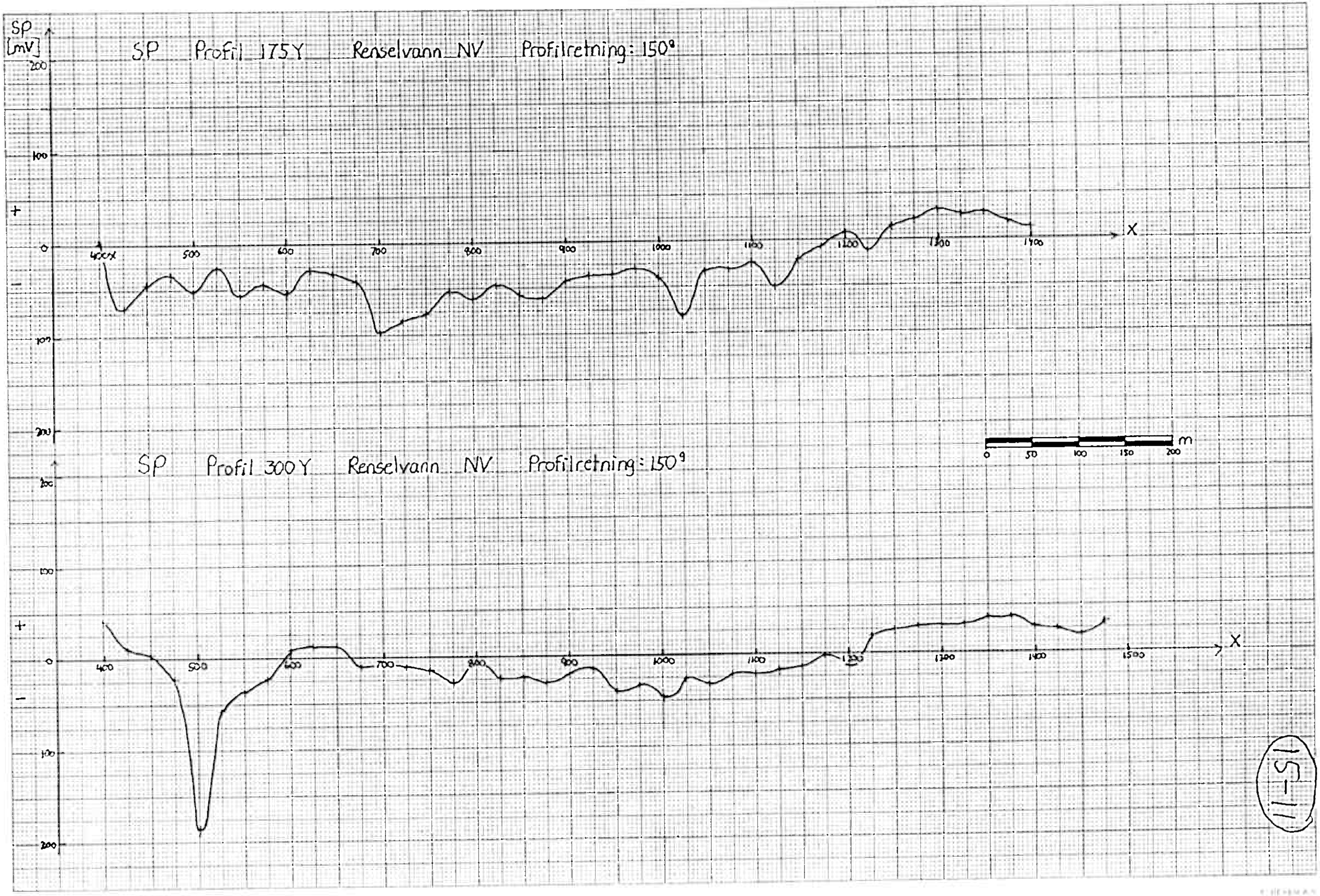

SP [mV]
SP Profil -100Y Renselvann NV Profilretning: 150g
200
100
+
0
-
100
200
200
300
400
500
600
700
800
900
1000
1100
1200
X
m
0
50
100
150
200
15-9



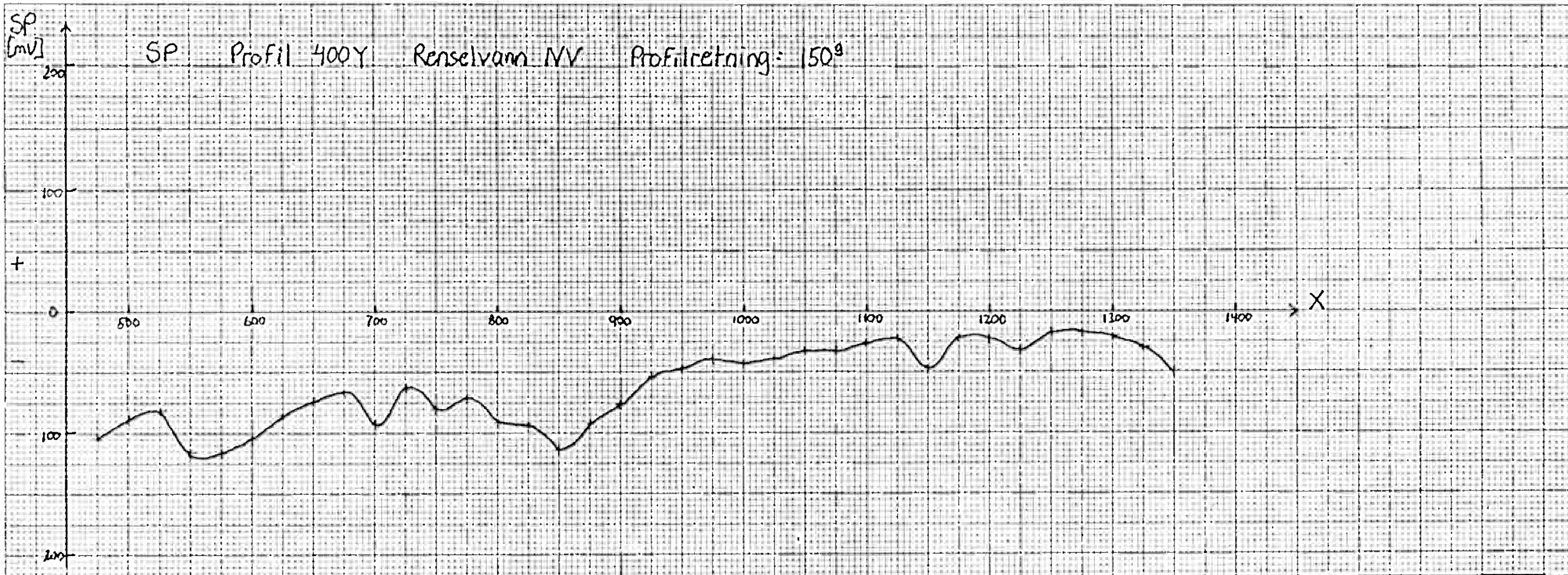


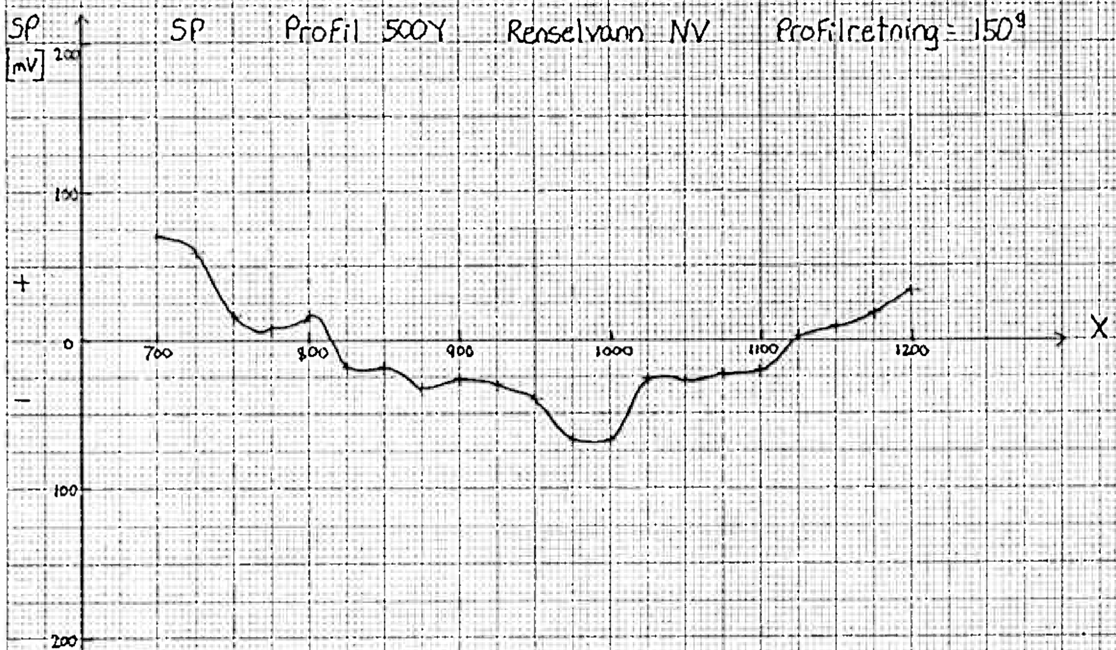
15-10

Mønt nr. 03102

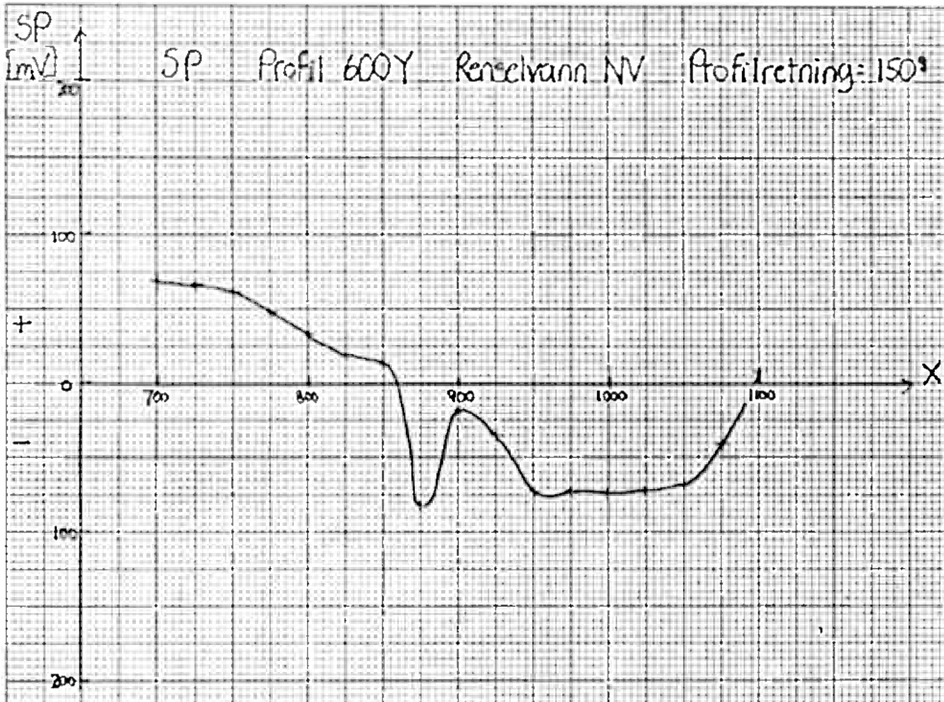


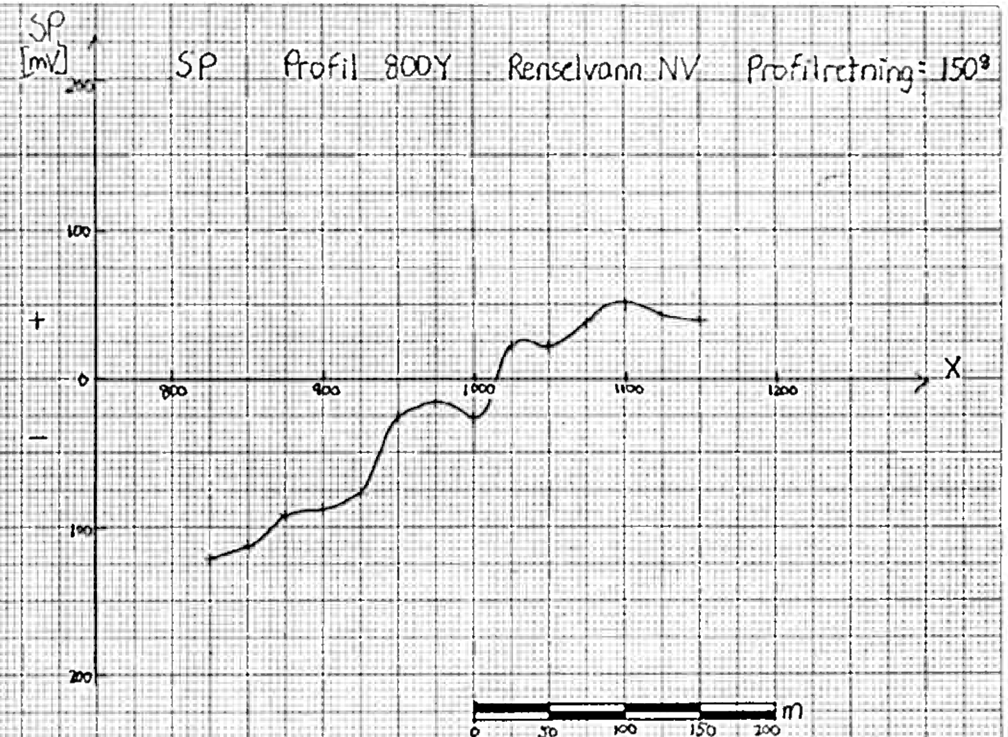
Vare nr. 03102

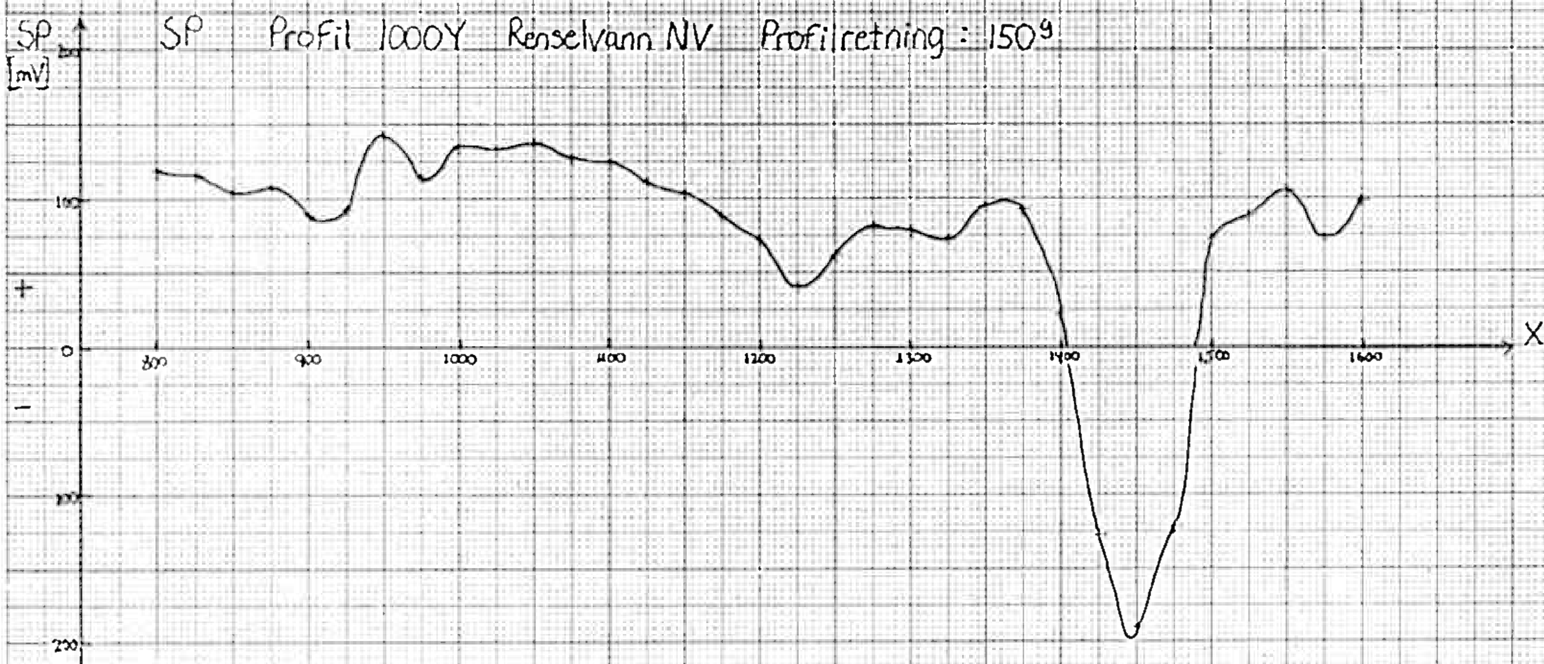

SP [mV]
SP Profil 400Y Renselvann NV Profilretning: 150g
200
100
+
0
-
100
200
500
600
700
800
900
1000
1100
1200
1300
1400
X
m
0
50
100
150
200


SP [mV]
SP Profil 500Y Renselvann NV Profilretning: 150g
200
100
+
0
-
100
200
700
800
900
1000
1100
1200
X

15-12



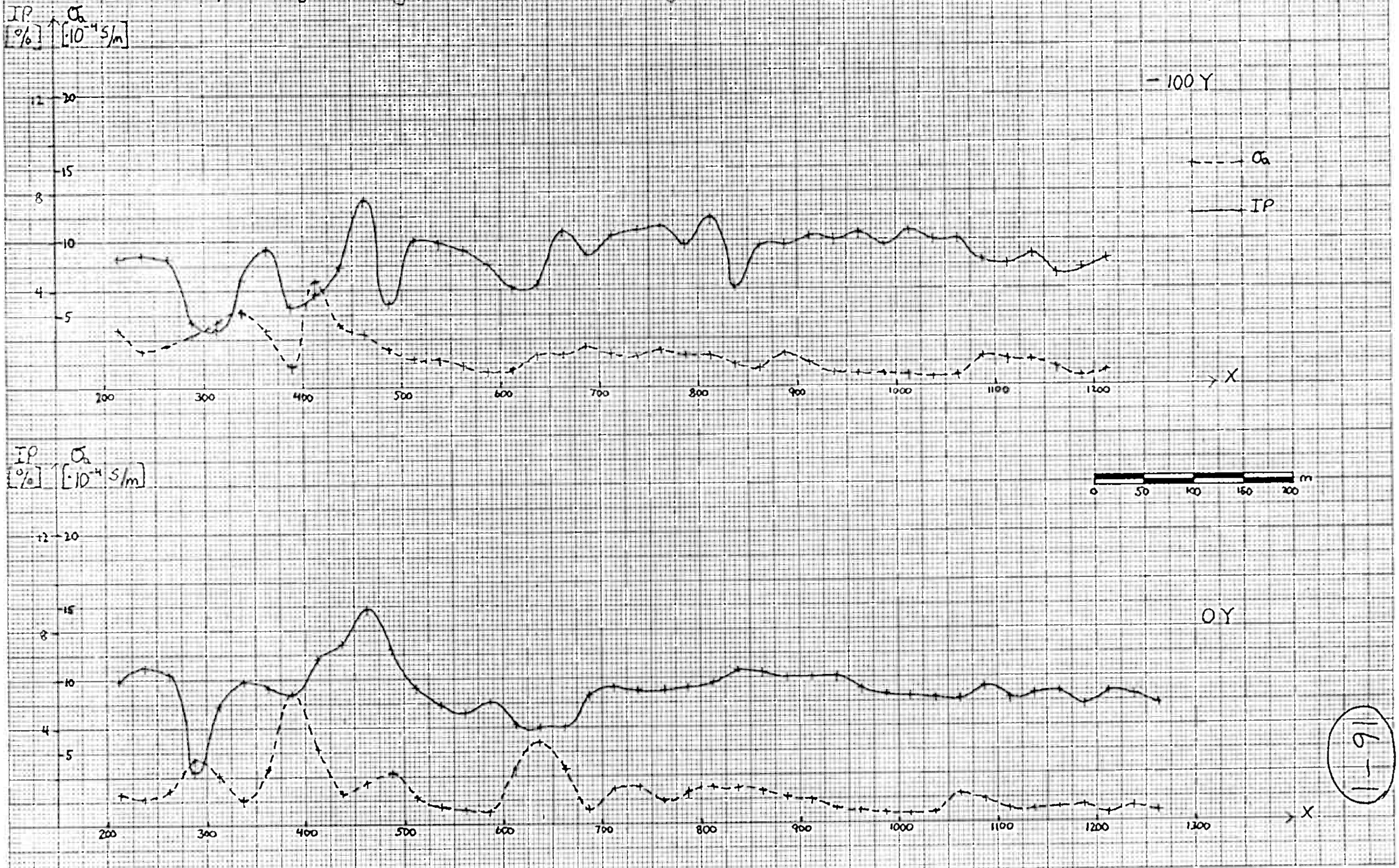




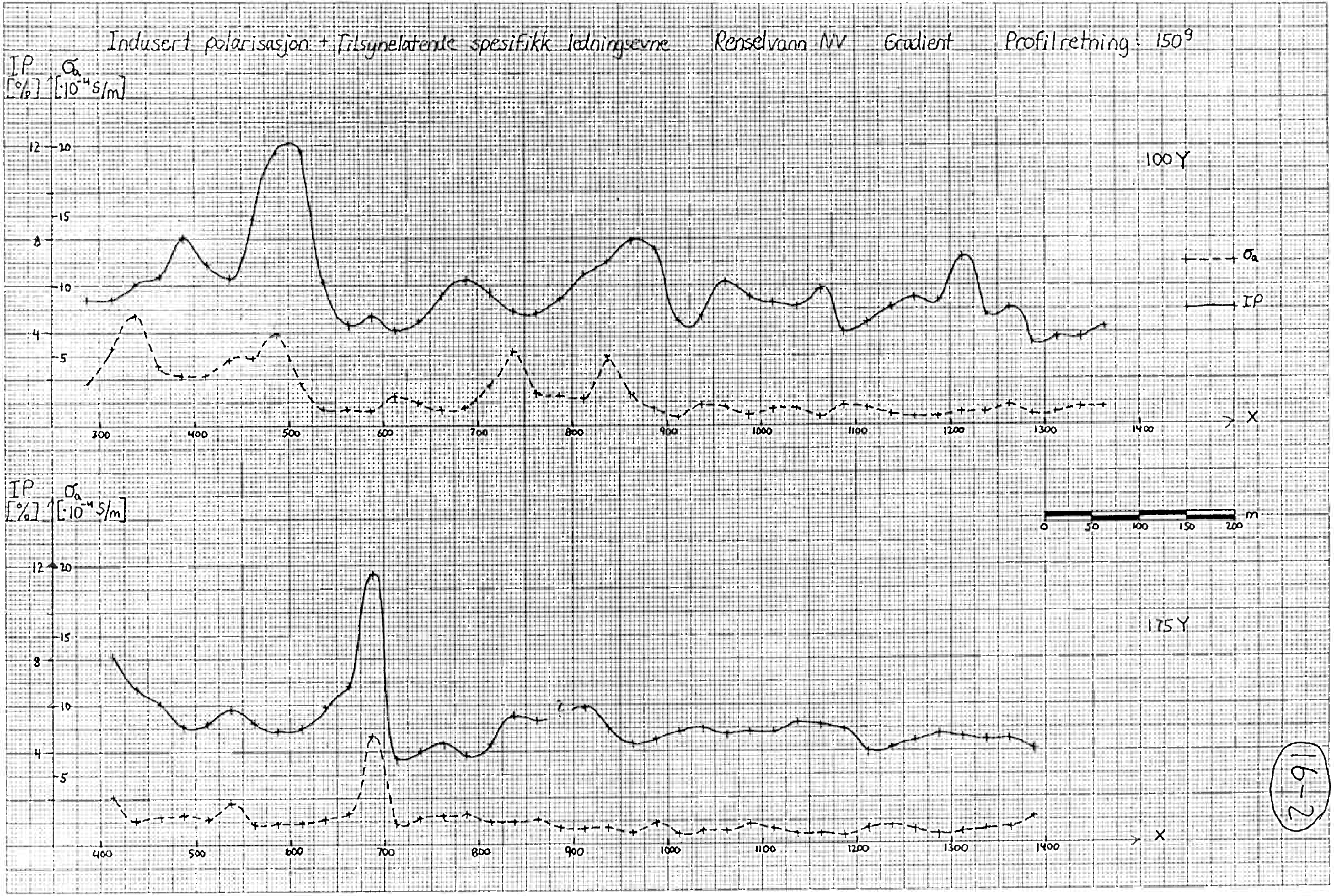
15-13

Vare nr. 03102

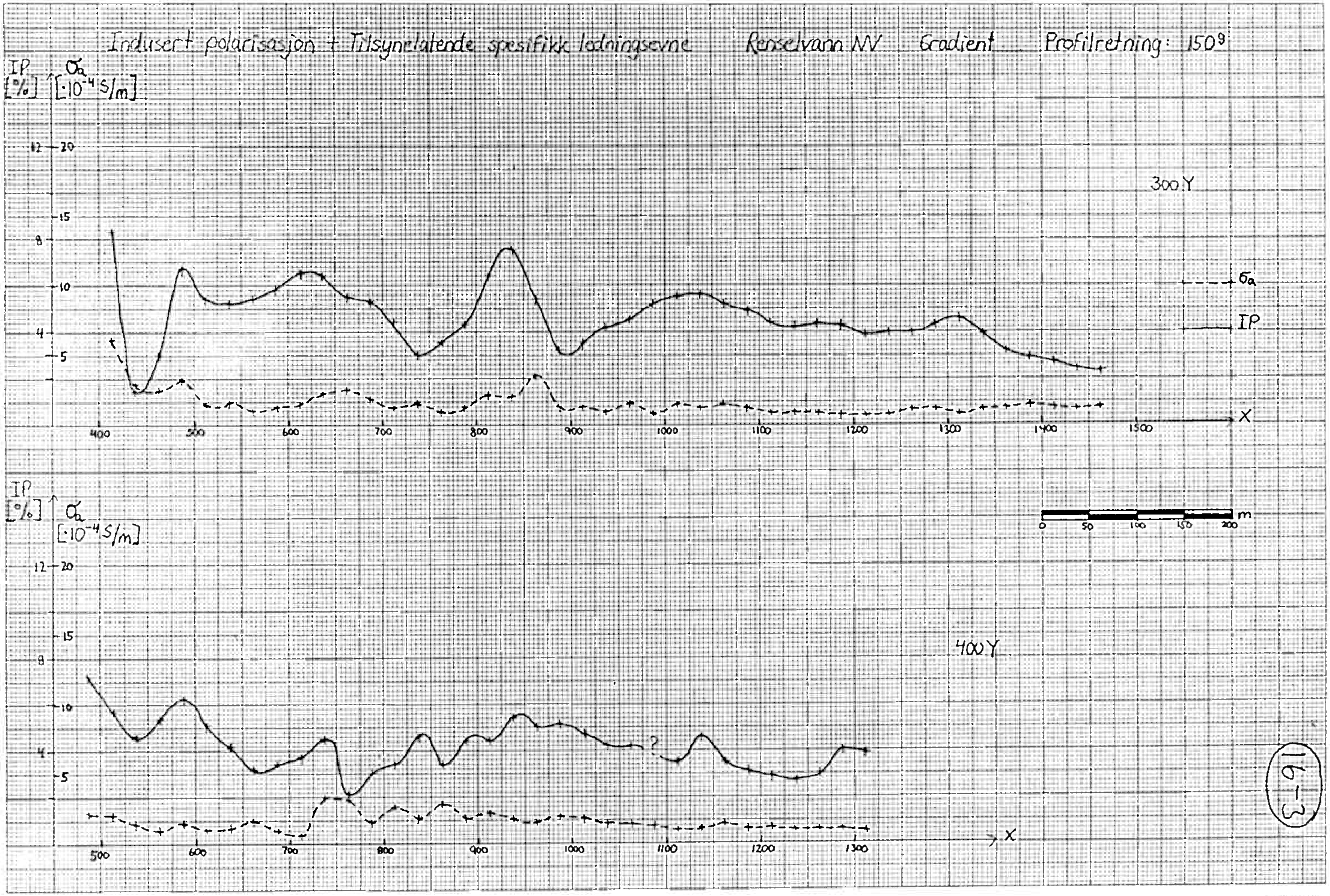
Indusert polarisasjon + Tilsynelatende spesifikk ledningsevne   Renselvann NV   Gradient   Profilretning: 150g



Vare nr. 03102

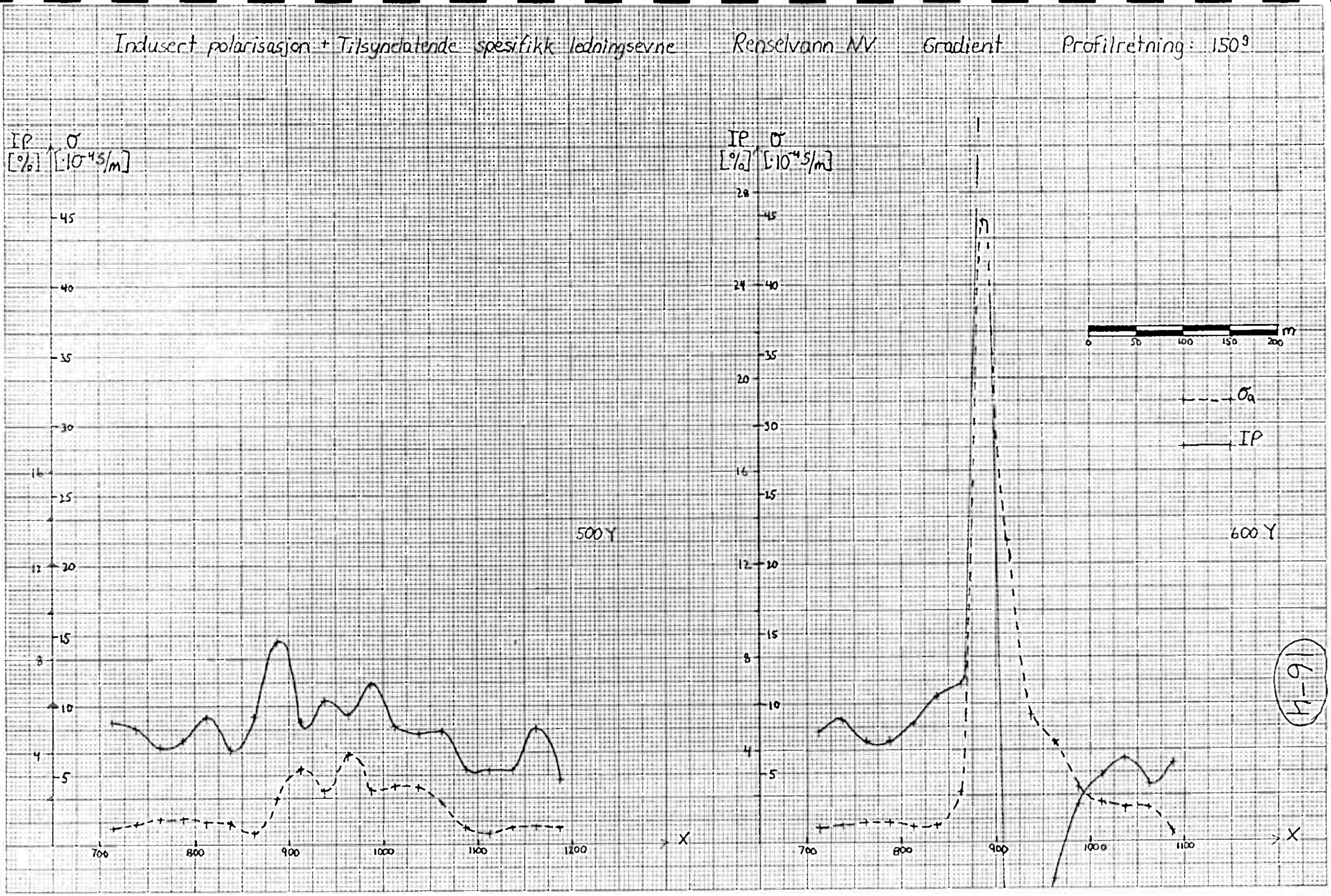


Vare nr. 03102



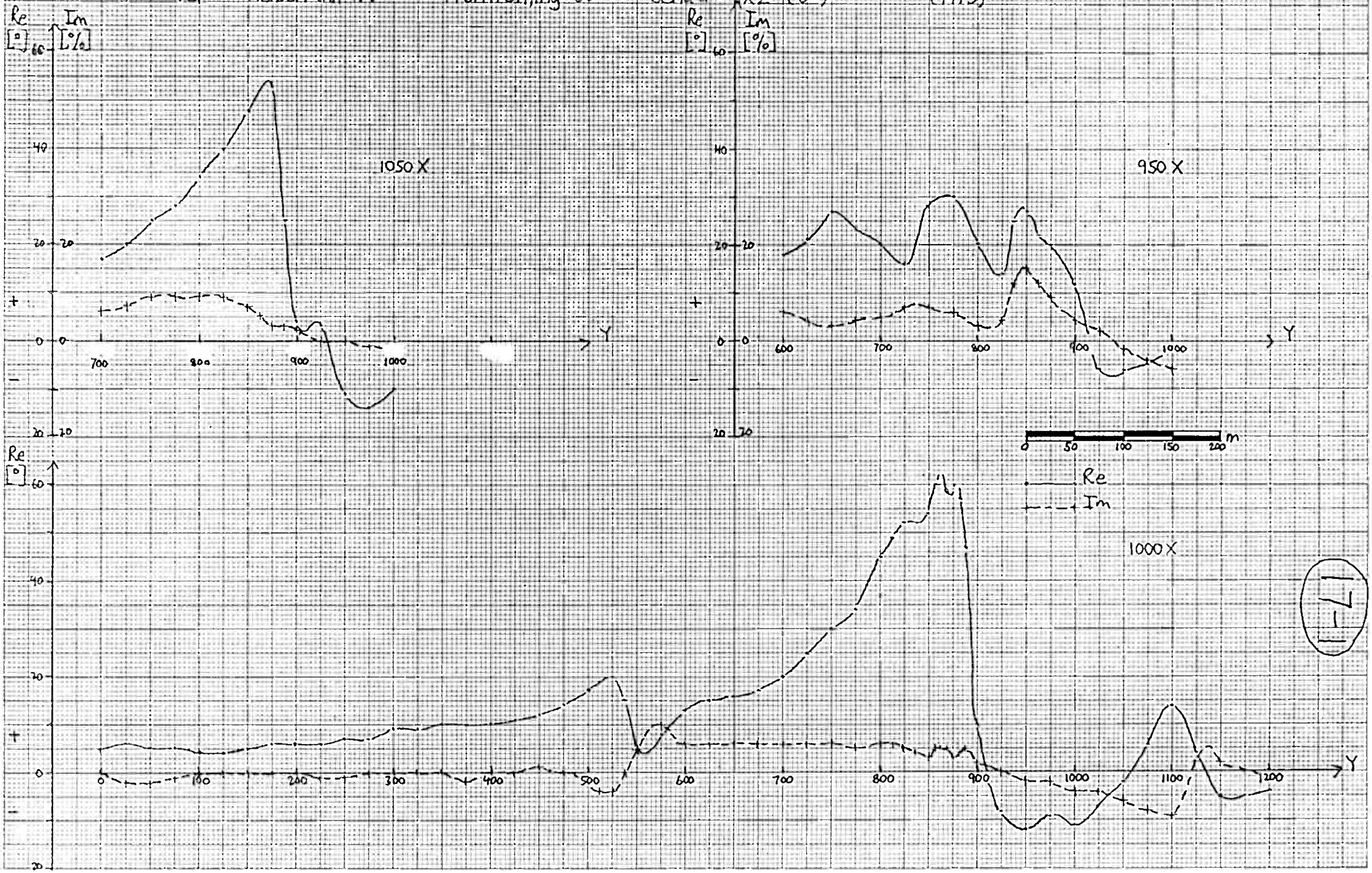
Vare nr. 03102

F. BEYER A.S

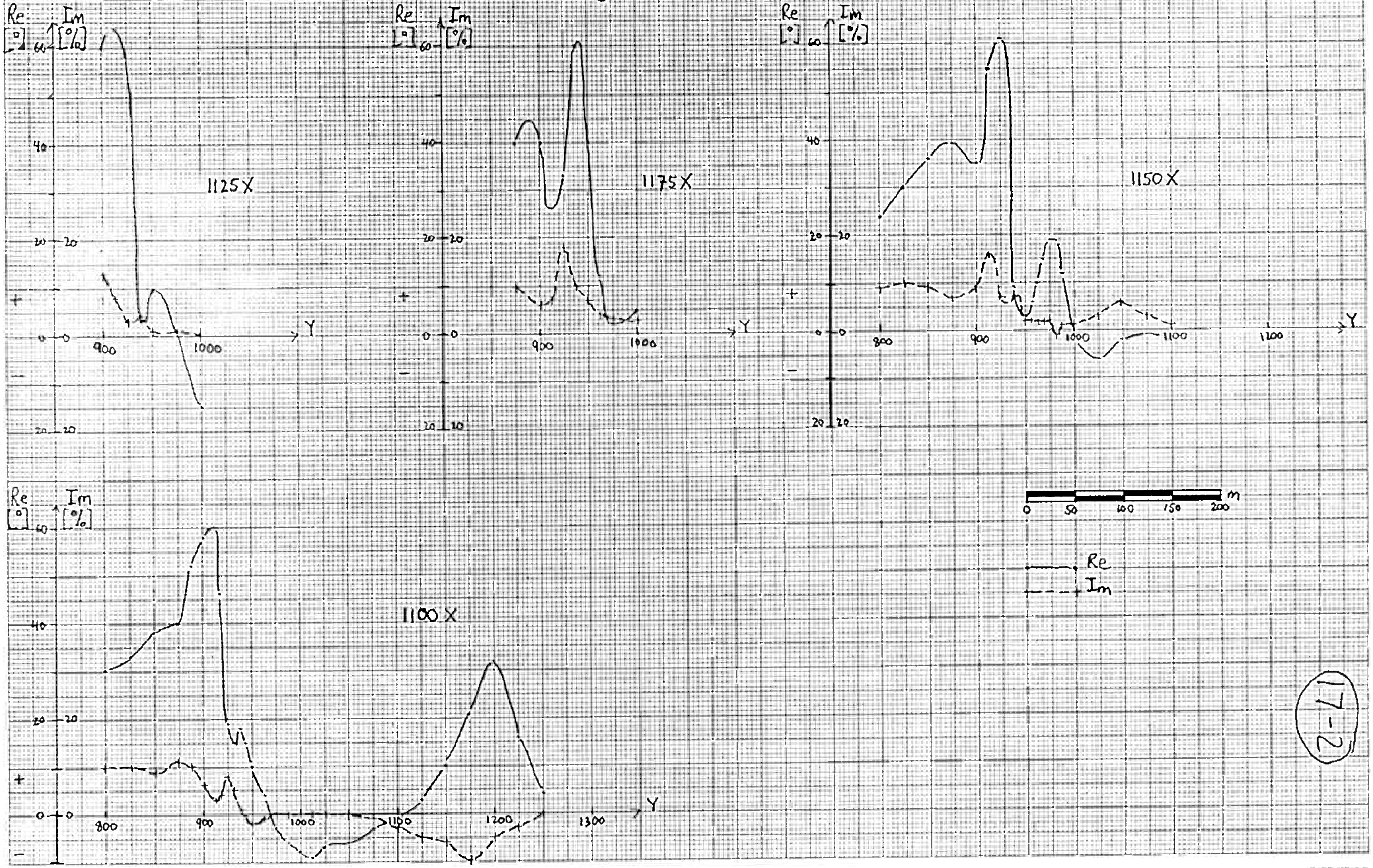


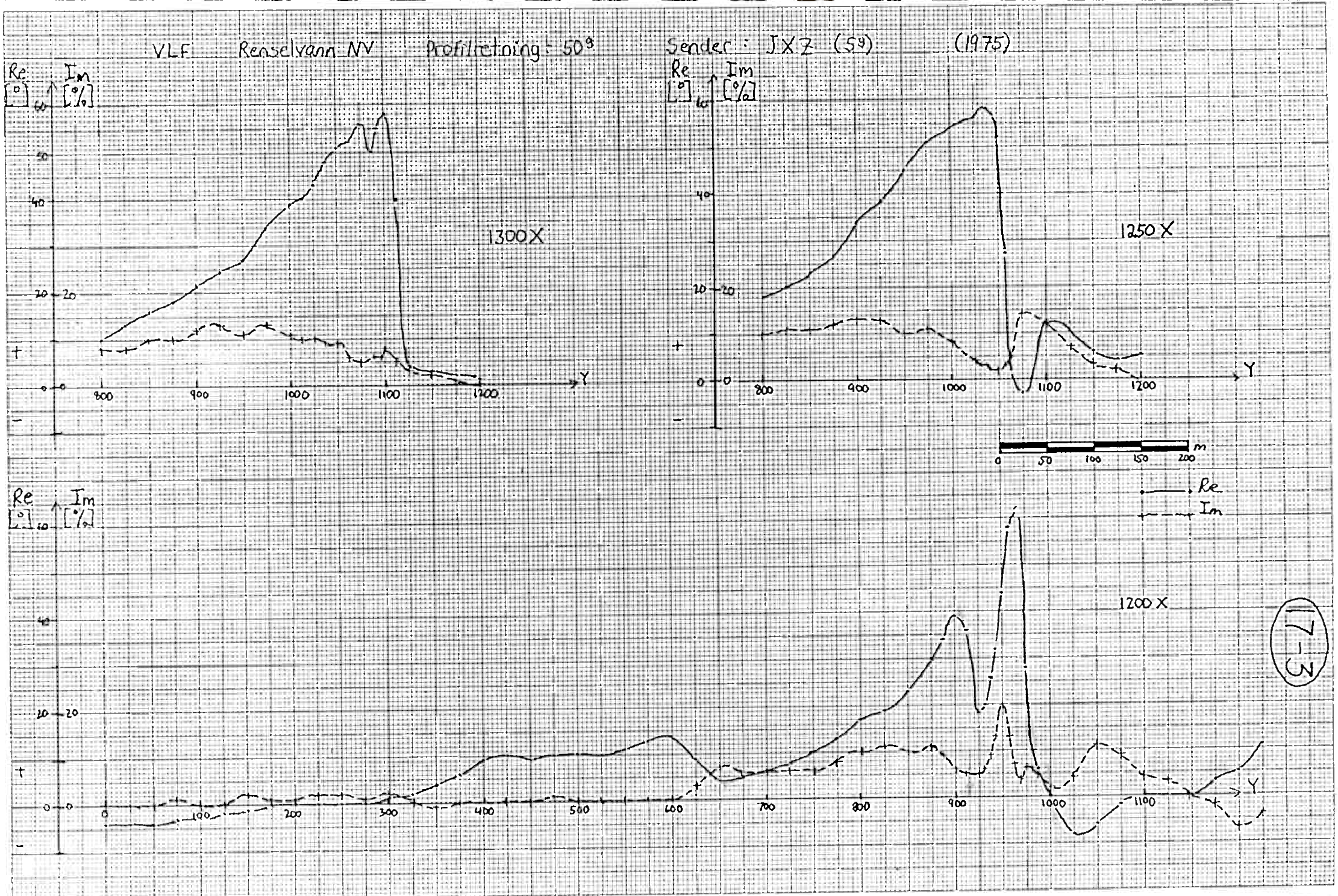
Vare nr. 03102

VLF Renselvann NV Profilretning: 50g Sender: XZ (5g) (1975)



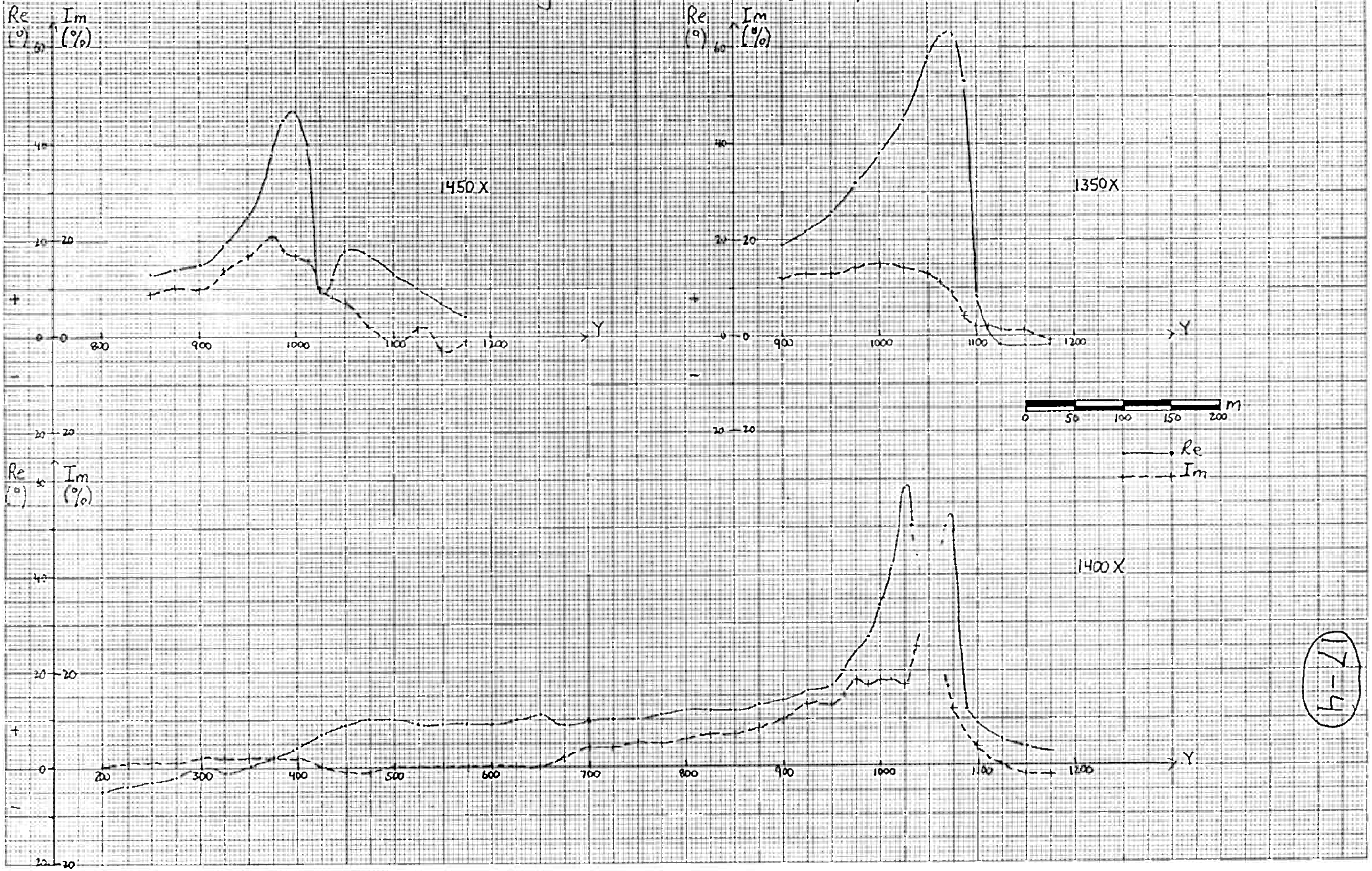
VLF Renselvann NV Profilretning: 50g Sender: JXZ (5g) (1975)





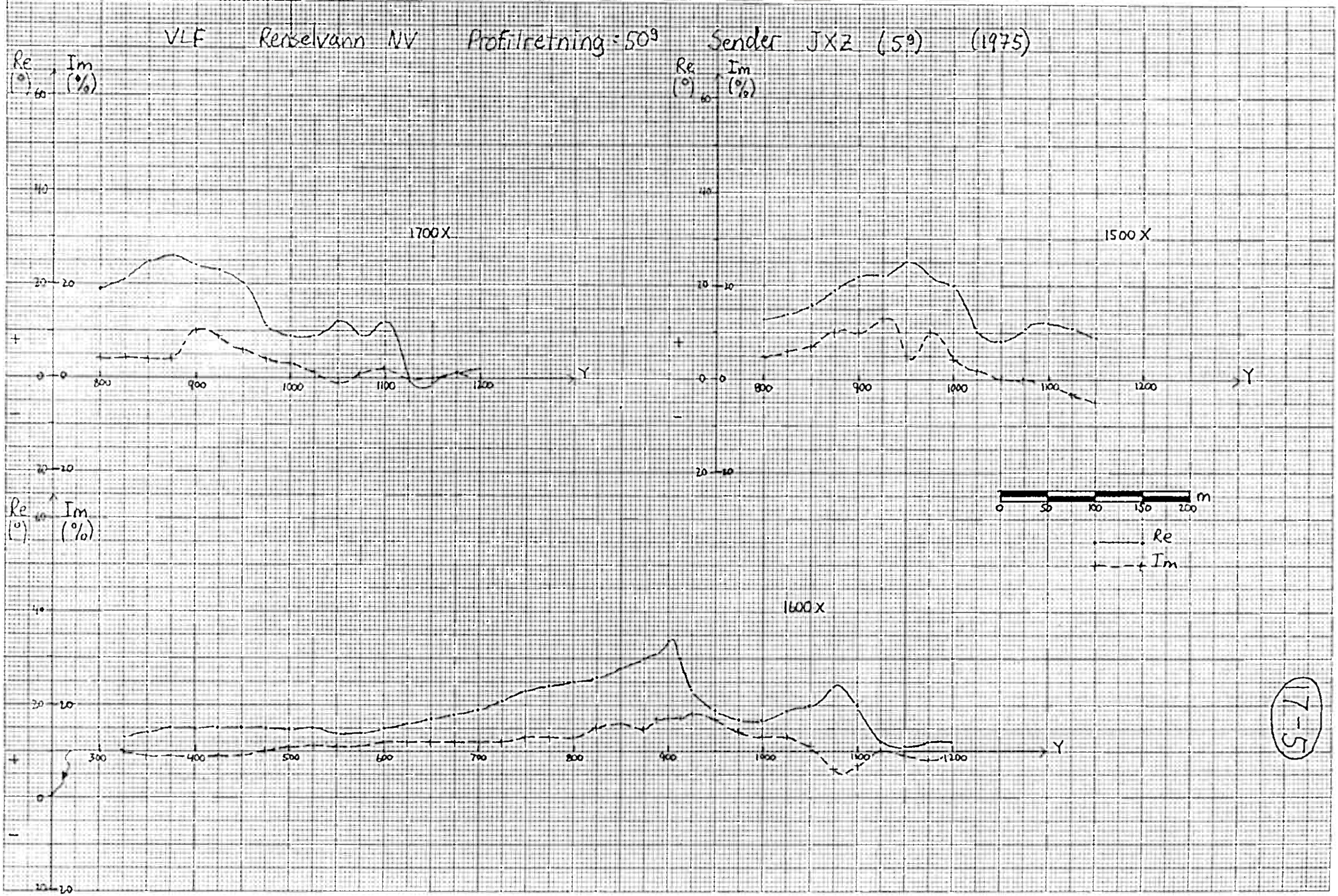
Vare nr. 03102

VLF Renselvann NV Profilretning: 50° Sender: JXZ (59) (1975)



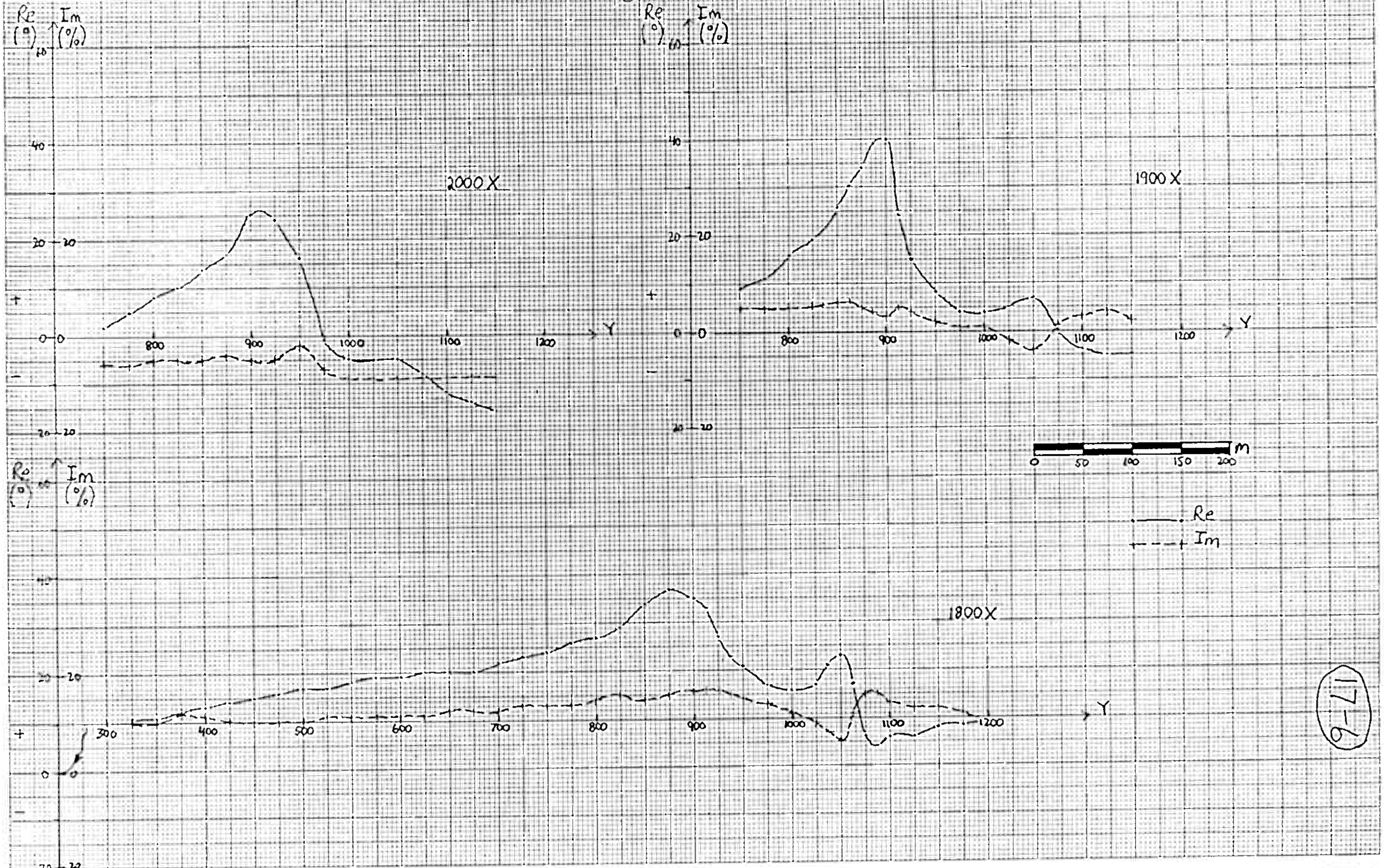
Vare nr. 03102

F. BEYER A.S.



VLF Renselvann NV Profilretning: 50g Sender JXZ (5g) (1975)
Re (°) Im (%)
1700 X
1500 X
1600 X
Y
m
0 50 100 150 200
Re
Im
17-5

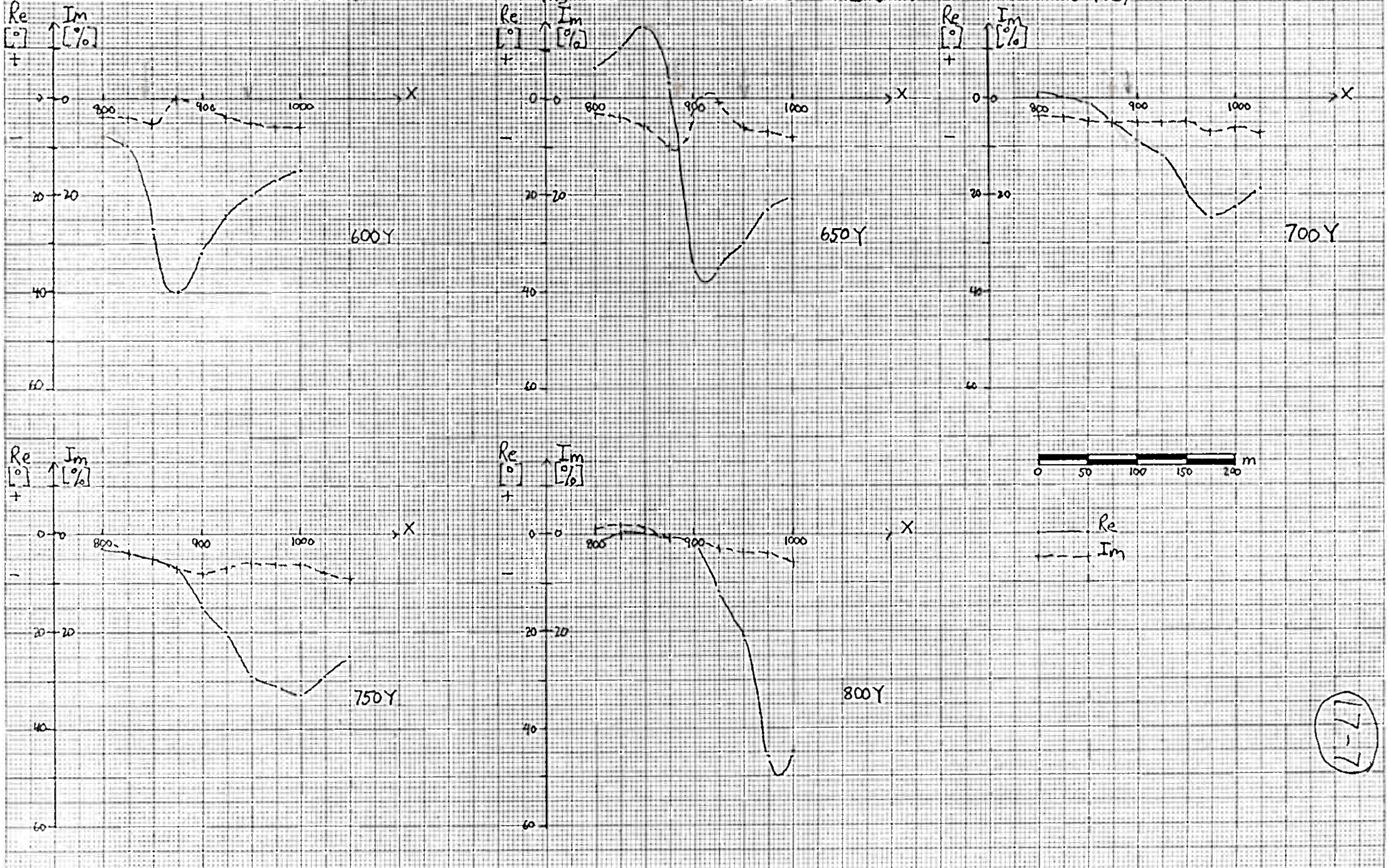
VLF Renselvann NV Profilretning: 50g Sender: JXZ (5g) (1975)



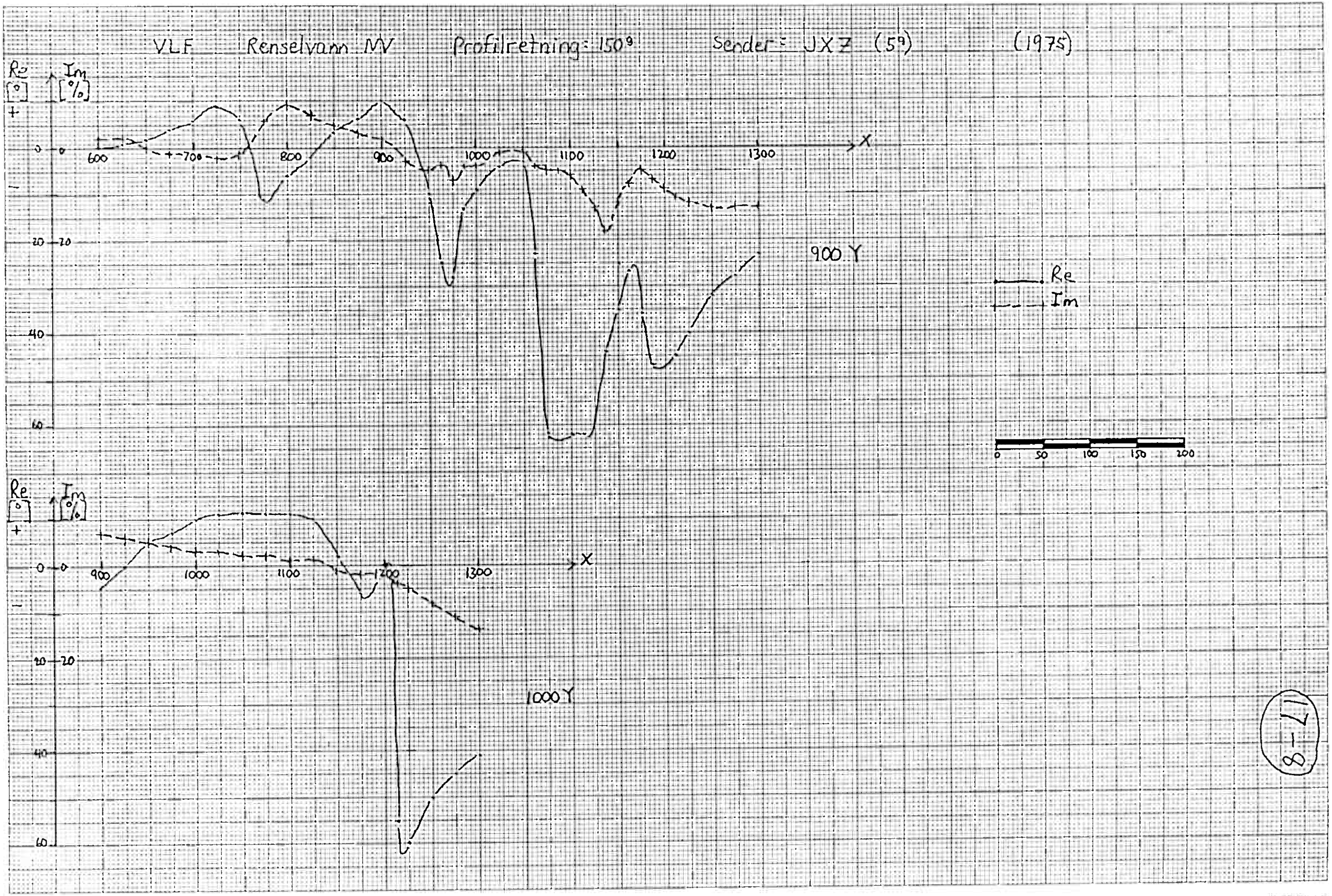
Vare nr. 03102

F. BEYER A.S

VLF Renselvann NV Profilretning: 150° Sender: JXZ (5°) (1975)

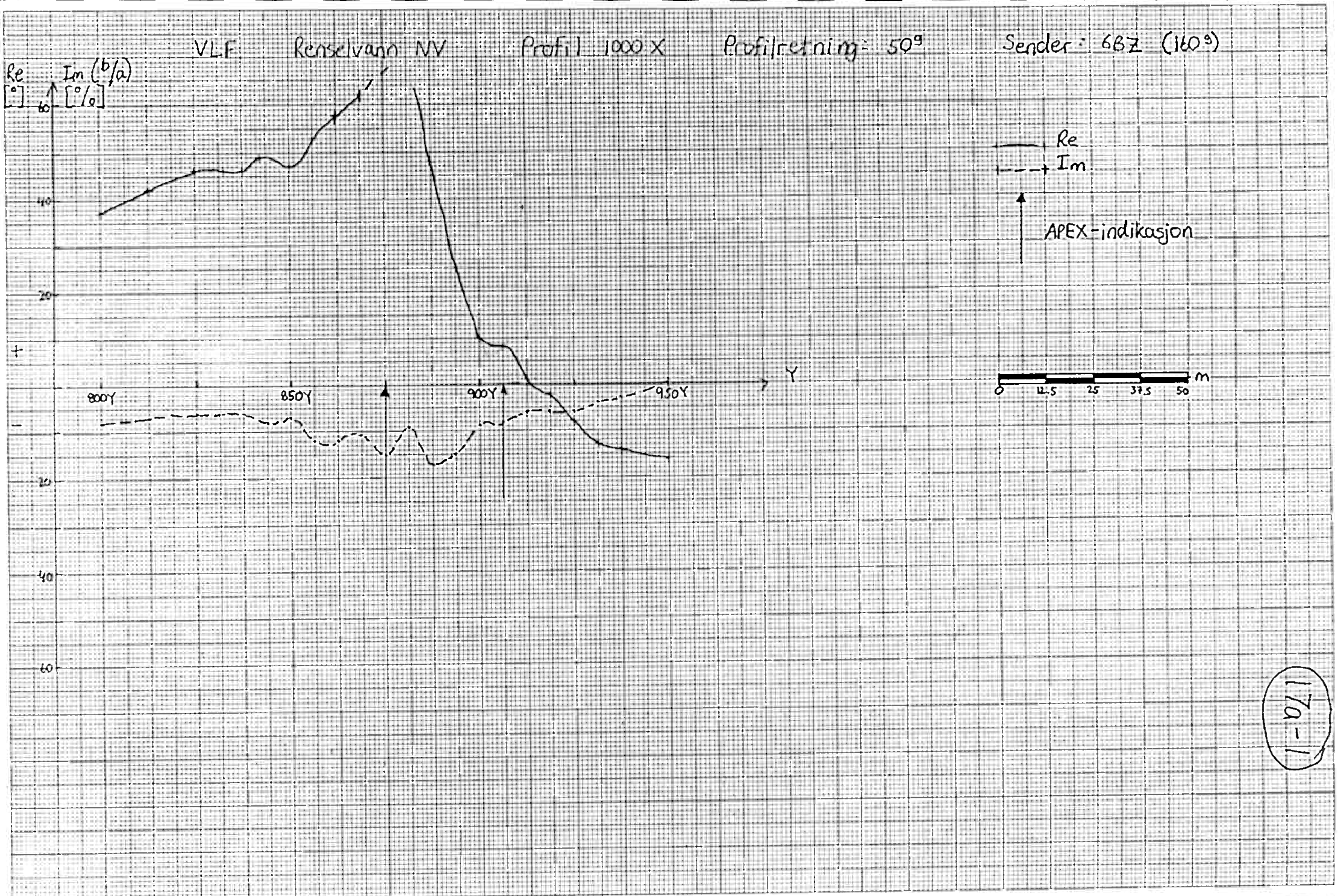


Vare nr. 03102

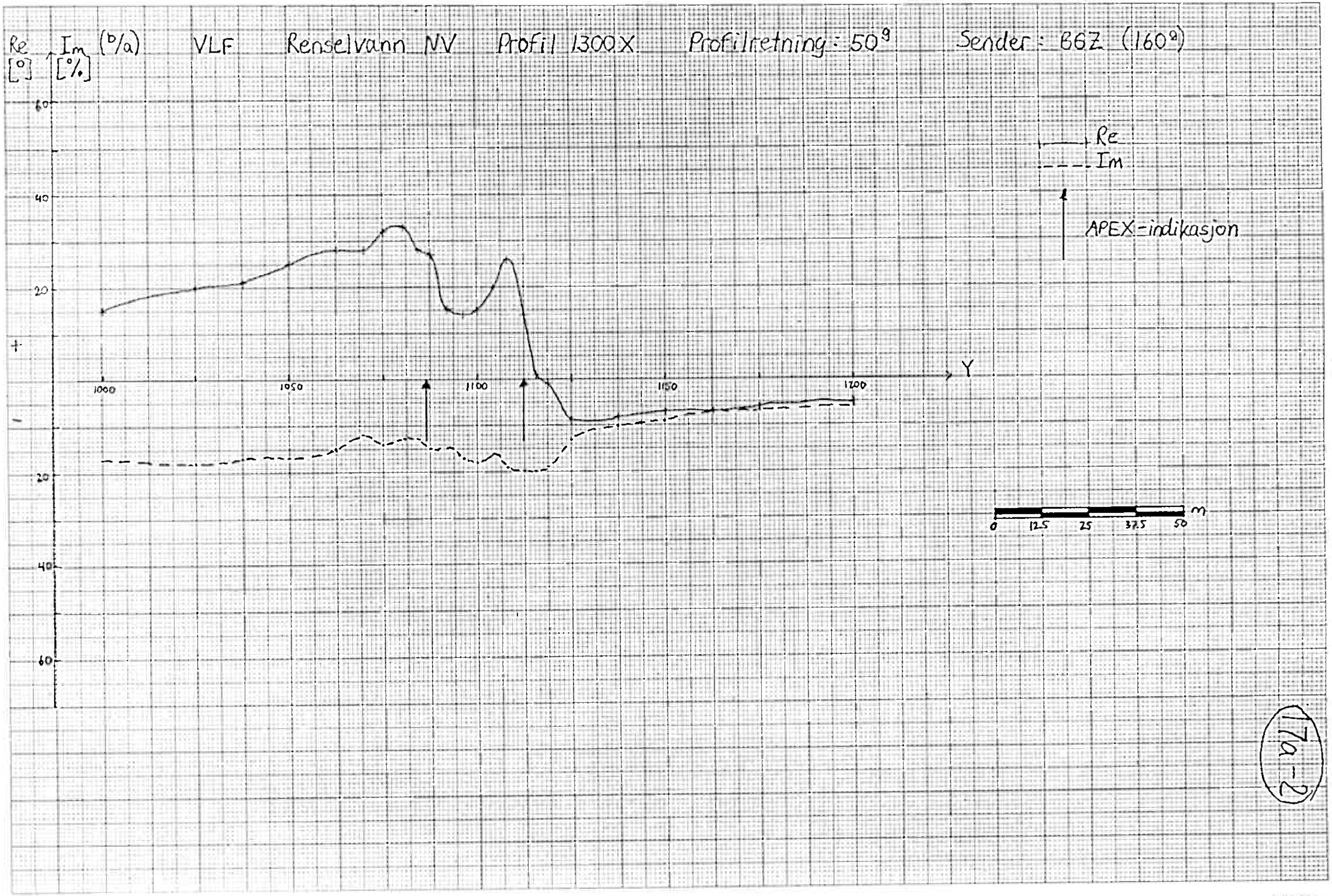


Vare nr. 03102

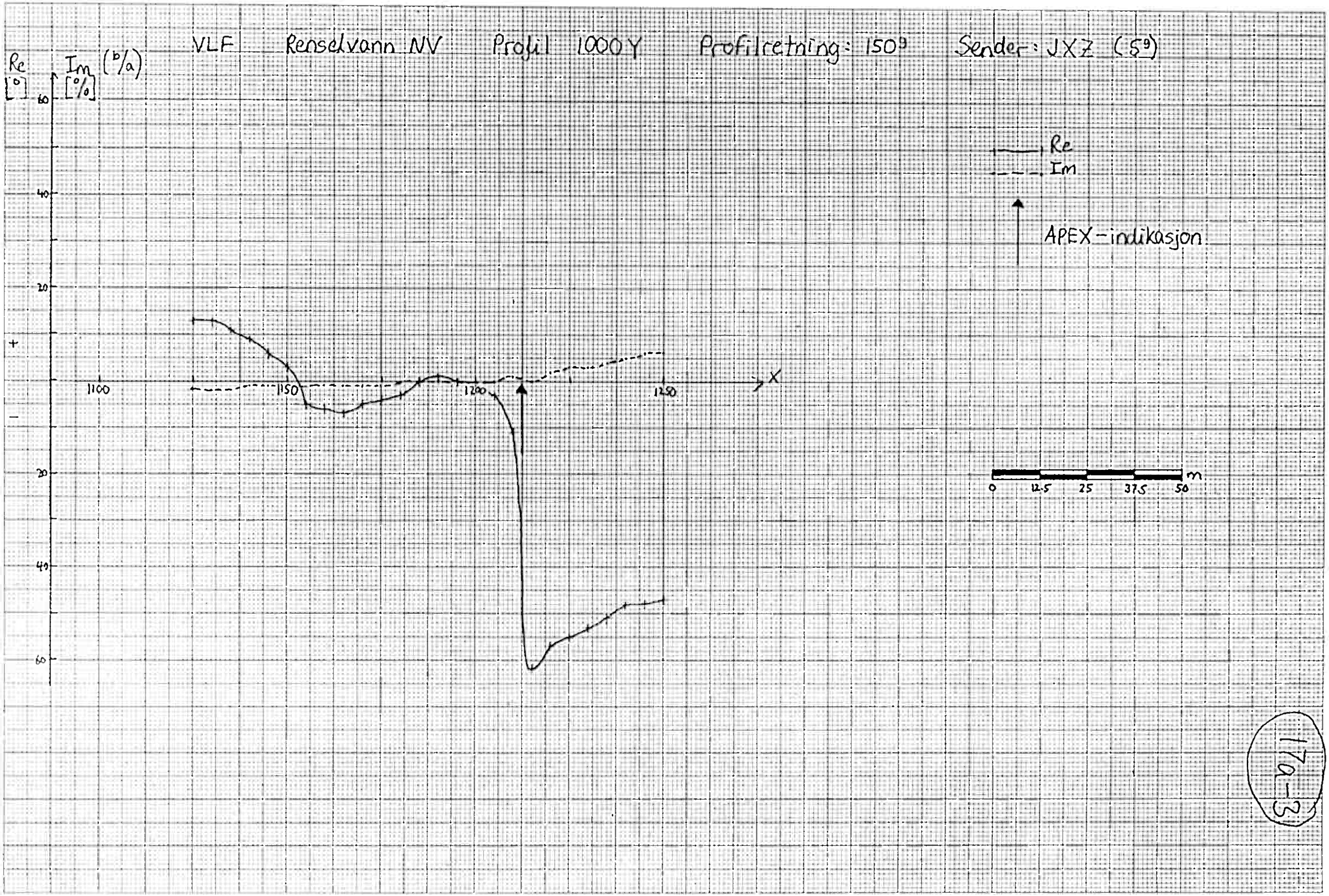
F. BEYER A.S



Vare nr. 03102



Vare nr. 03102



VLF
Renselvann NV
Profil 1000Y
Profilretning: 150g
Sender: JXZ (5g)
Re [°]
Im [%]
(b/a)
60
40
20
+
1100
1150
1200
1250
X
−
20
40
60
Re
Im
APEX-indikasjon
0
12.5
25
37.5
50
m
17a-3

UTLEDNINGER AV ELEKTRODEKONFIGURASJONER

Utgangspunkt: potensialet på overflaten i avstand "r" fra strømelektrode;

$$V = \frac{\rho I}{2\pi r}$$

samt superposisjonsprinsippet. Figurene tilhørende de forskjellige konfigurasjonene er skissert under teoridelen om elektrodekonfigurasjoner.

V_{P1E1} leses: potensialet i potensialelektrode P1 på grunn av strømelektrode E1.

Gradient

$$V_{P1E1} = \frac{\rho I}{2\pi r_1} \qquad V_{P2E1} = \frac{\rho I}{2\pi r_2} \qquad V_{P1E2} = \frac{-\rho I}{2\pi r_3} \qquad V_{P2E2} = \frac{-\rho I}{2\pi r_4}$$

$$\Delta V = P_1 - P_2 = \frac{\rho I}{2\pi r_1} - \frac{\rho I}{2\pi r_3} - \left(\frac{\rho I}{2\pi r_2} - \frac{\rho I}{2\pi r_4}\right)$$

$$\Rightarrow \underline{\rho_a = \frac{\Delta V}{I} 2\pi \left(\frac{1}{r_1} - \frac{1}{r_2} - \frac{1}{r_3} + \frac{1}{r_4}\right)^{-1}}$$

Wenner

$$V_{P1E1} = \frac{\rho I}{2\pi a} \qquad V_{P1E2} = \frac{-\rho I}{4\pi a} \qquad V_{P2E1} = \frac{\rho I}{4\pi a} \qquad V_{P2E2} = \frac{-\rho I}{2\pi a}$$

$$\Delta V = P_1 - P_2 = \frac{\rho I}{2\pi}\left(\frac{1}{a} - \frac{1}{2a} - \frac{1}{2a} + \frac{1}{a}\right)$$

$$\Rightarrow \underline{\rho_a = \frac{\Delta V}{I} 2\pi a}$$

R_A

$$V_{P1E1} = \frac{\rho I}{2\pi a} \qquad V_{P1E2} = \frac{-\rho I}{2\pi (n+1)a} \qquad V_{P2E1} = \frac{\rho I}{2\pi (n+1)a} \qquad V_{P2E2} = \frac{-\rho I}{2\pi a}$$

$$\Delta V = P_1 - P_2 \qquad = \frac{\rho I}{2\pi}\left(\frac{1}{a} - \frac{1}{(n+1)a} - \frac{1}{(n+1)a} + \frac{1}{a}\right)$$

$$\Rightarrow \Delta V = \frac{\rho I}{2\pi}\left(\frac{2}{a} - \frac{2}{(n+1)a}\right) = \frac{\rho I}{\pi a}\left(1 - \frac{1}{n+1}\right)$$

$$\Rightarrow \underline{\rho_a = \frac{\Delta V}{I}\pi a \left(1 - \frac{1}{n+1}\right)^{-1}} \qquad n=1 \text{ gir Wenner}$$

Dipol-dipol

$$V_{P1E1} = \frac{\rho I}{2\pi (n+2)a} \qquad V_{P1E2} = \frac{-\rho I}{2\pi (n+1)a} \qquad V_{P2E1} = \frac{\rho I}{2\pi (n+1)a} \qquad V_{P2E2} = \frac{-\rho I}{2\pi n a}$$

$$\Delta V = P_1 - P_2 = \frac{\rho I}{2\pi a}\left(\frac{-1}{n+1} + \frac{1}{n} + \frac{1}{n+2} - \frac{1}{n+1}\right) = \frac{\rho I}{2\pi a}\left(\frac{-2}{n+1} + \frac{1}{n} + \frac{1}{n+2}\right)$$

$$= \frac{\rho I}{2\pi a}\left(\frac{-2n(n+2) + (n+1)(n+2) + n(n+1)}{n(n+1)(n+2)}\right) = \frac{\rho I}{2\pi a}\left(\frac{-2n^2-4n+n^2+3n+2+n^2+n}{n(n+1)(n+2)}\right)$$

$$= \frac{\rho I}{\pi a}\left(\frac{1}{n(n+1)(n+2)}\right)$$

$$\Rightarrow \underline{\rho_a = \frac{\Delta V}{I}\pi a n(n+1)(n+2)}$$

$\underline{R_C}$

$$V_{P1E1} = \frac{\rho I}{2\pi a} \qquad V_{P1E2} = \frac{-\rho I}{2\pi n a} \qquad V_{P2E1} = \frac{\rho I}{2\pi (n+2) a} \qquad V_{P2E2} = \frac{-\rho I}{2\pi a}$$

$$\Delta V = P_1 - P_2 = \frac{\rho I}{2\pi a}\left(1 - \frac{1}{n} - \frac{1}{n+2} + 1\right)$$

$$\Delta V = \frac{\rho I}{2\pi a}\left(2 - \frac{1}{n} - \frac{1}{n+2}\right)$$

$$\Rightarrow \rho_a = \frac{\Delta V}{I} 2\pi a \left(2 - \frac{1}{n} - \frac{1}{n+2}\right)^{-1}$$

Schlumberger

$$\underbrace{V_{MA} = \frac{\rho I}{2\pi\left(\frac{AB}{2} - \frac{MN}{2}\right)} \qquad V_{MB} = \frac{-\rho I}{2\pi\left(\frac{AB}{2} + \frac{MN}{2}\right)}}_{1} \qquad \underbrace{V_{NA} = \frac{\rho I}{2\pi\left(\frac{AB}{2} + \frac{MN}{2}\right)} \qquad V_{NB} = \frac{-\rho I}{2\pi\left(\frac{AB}{2} - \frac{MN}{2}\right)}}_{2}$$

$$\Delta V = V_1 - V_2$$

$$\Delta V = \rho I \left(\frac{1}{2\pi\left(\frac{AB}{2} - \frac{MN}{2}\right)} - \frac{1}{2\pi\left(\frac{AB}{2} + \frac{MN}{2}\right)} - \frac{1}{2\pi\left(\frac{AB}{2} + \frac{MN}{2}\right)} + \frac{1}{2\pi\left(\frac{AB}{2} - \frac{MN}{2}\right)}\right)$$

$$\Delta V = \frac{\rho I}{\pi}\left(\frac{1}{\frac{AB}{2} - \frac{MN}{2}} - \frac{1}{\frac{AB}{2} + \frac{MN}{2}}\right)$$

$$\Rightarrow \rho_a = \frac{\pi\left(AB^2 - MN^2\right)}{4MN}\frac{\Delta V}{I}$$

20-1

FEILBEREGNINGER FOR VES MED DOBBEL WENNER ELEKTRODEUTLEGG OG BGS-KABEL

Observasjonsfeil: $$e_{obs} = \frac{R_A(a) - [R_B(a) + R_C(a)]}{R_A(a)} \cdot 100\%$$

Lateral feil: $$e_l(a) = \frac{R_D(2a) - 2[R_C(a) - R_D(a)]}{R_D(2a)} \cdot 100\%$$

Offset-feil: $$e_f(a) = \frac{R_{D1}(a) - R_{D2}(a)}{R_D(a)} \cdot 100\%$$

Punkt 1200X-900Y

a (m)	R_A (Ω)	R_B (Ω)	R_C (Ω)	R_{D1} (Ω)	R_{D2} (Ω)	ρ_a (Ωm)	e_f (%)	e_l (%)	e_{obs} (%)
0.5	1560	87.8	1472	943	1096	3202.9	-15.01	-25.6	0.01
1	1022	65.3	956	705	736	4527	-4.30	-5.8	0.07
2	592	40.2	554	409	481	5592	-16.18	9.0	-0.37
4	333	16.3	316	220	259	6019.3	-16.28	-8.8	0.21
8	205	11.75	189.7	139.5	141.7	7067.3	-1.56	-18.02	1.73
16	118.5	5.54	116.6	83.3	83.1	8364.2	0.24	-85.6	-3.07
32	51.8	1.154	52.3	33.6	38.4	7238.2	-13.33	-257.3	-3.19
64	25.5	3.51	21.5	14.20	4.05	3669.4	111.23		1.921

Punkt 1094X-625Y

a (m)	R_A (Ω)	R_B (Ω)	R_C (Ω)	R_{D1} (Ω)	R_{D2} (Ω)	ρ_a (Ωm)	e_f (%)	e_l (%)	e_{obs} (%)
0.5	820	42.5	773	586	506	1715.3	14.65	-7.6	0.55
1	633	38.5	598	440	404	2651.5	8.53	-25.7	-0.55
2	381	31.8	353	320	240	3518.6	28.57	26.7	-1.00
4	310	12.4	300	175.2	223	5003.9	-24.01	-63.5	-0.77
8	194	15.4	179	117.9	128.9	6202.8	-8.91	1.9	-0.21
16	194	5.64	185	166.1	60.6	11395	93.07	-200.1	1.73
32	70.9	4.47	67.5	62.7	32.8	9600.7	62.62	-419.4	-1.51
64	31.7	7.62	32.0	9.34	5.87	3058.2	45.63		-24.98

20-2

Punkt 1050X-1035Y

a (m)	R_A (Ω)	R_B (Ω)	R_C (Ω)	R_{D1} (Ω)	R_{D2} (Ω)	ρ_a (Ωm)	e_f (%)	e_1 (%)	e_{obs} (%)
0.5	623	18.17	606	344	453	1251.9	-27.35	-51.2	-0.19
1	431	14.42	414	256	293	1724.7	-13.48	-30.7	0.60
2	325	20.5	305	231	196	2682.9	16.39	-11.4	-0.15
4	229	20.3	209	165.5	163	4128.1	1.52	26.1	-0.13
8	170.1	11.98	158.1	113.8	128.4	6087.2	-12.06	9.1	0.01
16	116.9	6.96	110.1	80.0	82.9	8188.3	-3.56	-30.4	-0.14
32	56.5	4.71	51.7	43.0	44.9	8836.7	-4.32	20.2	0.16
64	29.8	1.53	27.1	19.06	19.80	7813.3	-3.81		3.94

Punkt 1100X-500Y

a (m)	R_A (Ω)	R_B (Ω)	R_C (Ω)	R_{D1} (Ω)	R_{D2} (Ω)	ρ_a (Ωm)	e_f (%)	e_1 (%)	e_{obs} (%)
0.5	577	18.68	562	300	450	1178.1	-40.0	-39.6	-0.64
1	420	16.74	402	233	303	1683.9	-26.12	-40.6	0.30
2	280	16.75	264	177.2	204	2395.2	-14.06	-12.0	-0.27
4	190.5	10.25	180.7	136.5	125.7	3294.9	8.24	-20.2	-0.24
8	113.0	8.45	104.2	71.5	93.5	4146.9	-26.67	21.1	0.31
16	75.2	5.78	68.7	52.0	58.0	5529.2	-10.91	28.2	0.96
32	60.0	1.93	57.4	42.1	34.2	7670.5	20.71	-143.5	1.12
64	20.4	1.247	19.22	19.58	12.04	6357.6	47.69		-0.33

Punkt 1200X-975Y

a (m)	R_A (Ω)	R_B (Ω)	R_C (Ω)	R_{D1} (Ω)	R_{D2} (Ω)	ρ_a (Ωm)	e_f (%)	e_1 (%)	e_{obs} (%)
0.5	635	27.8	607	370	438	1269.2	-16.83	-93.6	0.03
1	245	34.9	208	228	191.5	1317.9	17.40	103.8	0.86
2	116.1	3.81	112.4	49.3	133.6	1149.2	-92.81	-129.7	-0.09
4	24.9	0.114	25.1	20.9	15.59	458.6	29.10	-48.0	-1.26
8	16.72	-0.45	17.19	9.47	9.06	465.7	4.43	13.3	-0.12
16	37.6	-0.098	37.6	4.88	31.7	1838.7	-146.6	-203.4	0.26
32	26.4	0.025	26.2	6.06	19.40	2560.5	-104.8	-208.6	0.66
64	16.60	-1.342	18.74	5.76	11.70	3510.5	-68.0		-4.81

Punkt 1100X-1025Y

a (m)	R_A (Ω)	R_B (Ω)	R_C (Ω)	R_{D1} (Ω)	R_{D2} (Ω)	ρ_a (Ωm)	e_f (%)	e_1 (%)	e_{obs} (%)
0.5	561	27.7	532	357	352	1113.7	1.41	-16.6	0.23
1	475	20.1	454	276	333	1913.2	-18.72	-39.0	0.19
2	304	20.5	284	232	198.2	2703.0	15.71	12.0	-0.16
4	229	12.25	217	141.5	171.7	3935.8	-19.28	-19.6	-0.11
8	141	8.96	131.5	105.0	97.0	5076.8	7.92	1.37	0.38
16	88.2	5.25	82.5	61.8	61.9	6217.8	-0.16	-10.9	0.51
32	52.6	3.03	49.1	37.5	37.0	7489.6	1.34	-64.0	0.89
64	19.83	1.172	18.41	14.89	14.01	5810.7	6.09		1.25

Punkt 800X-650Y

a (m)	R_A (Ω)	R_B (Ω)	R_C (Ω)	R_{D1} (Ω)	R_{D2} (Ω)	ρ_a (Ωm)	e_f (%)	e_1 (%)	e_{obs} (%)
0.5	218	7.46	210	127.2	148.5	433.07	-15.45	-23.6	0.25
1	186	9.34	175.9	117.2	116.3	733.6	0.77	-14.3	0.41
2	149.7	13.40	136.5	104.1	102.9	1300.6	1.16	20.1	0.13
4	117.8	8.37	109.5	91.4	73.9	2077.2	21.17	17.8	-0.06
8	101.8	3.99	97.8	64.4	66.2	3282.3	-2.76	-52.6	0
16	60.0	3.90	58.8	47.5	37.7	4282.6	23.00	36.2	-4.50
32	79.0	3.34	79.0	71.1	30.4	10204	80.20	-280.6	-4.23
64	19.7	1.128	18.58	12.39	17.30	5969.5	-33.08		-0.04

21

EGENVEKTER OG ANDRE GRAVIMETRISKE DATA

Prøve nr.	vekt i luft (g)	vekt i vann (g)	sp.vekt (g/cm^3)
EM-3a	825.2	533.2	2.83
EM-9	609.1	386.5	2.74
EM-7	601.6	373.4	2.64
EM-5	242.1	155.5	2.80
EM-3	238.6	152.2	2.76
Ic	466.8	319.5	3.17
EM-2	924.8	578.7	2.67
EM-1	701.9	489.9	3.31
II	902.6	635.7	3.38
III	822.3	570.6	3.27
EM-4	290.1	183.5	2.72
EM-8	329.7	205.8	2.66
EM-6	497.9	328.8	2.94

Gjennomsnittlig tyngde av kalkfyllitten: $2.70 \pm 0.04 g/cm^3$

Gjennomsnittlig tyngde av kis i jording I: $3.24 \pm 0.10 g/cm^3$

Gjennomsnittlig tyngde av kis i jording II: $3.16 \pm 0.31 g/cm^3$

Tyngde av kis i jording III: $3.27 g/cm^3$

MÅLEVERDIER FOR MAGNETISK SUSCEPTIBILITET

Prøve nr.	1(γ)	2(γ)	3(γ)	4(γ)	5(γ)	6(γ)	V (cm^3)	k
EM-9	0.3	0.4	0.3	0.3	0.1	0.3	222.6	$2.37 \cdot 10^{-5}$
Ic	0.9	0.7	0.7	0.9	1.9	0.3	147.3	$1.14 \cdot 10^{-4}$
III	1.1	1.1	1.1	0.9	0.3	1.1	251.8	$6.89 \cdot 10^{-5}$
II	6.0	6.0	6.2	6.0	0.3	5.2	266.9	$3.45 \cdot 10^{-4}$
EM-6	1.5	1.4	1.2	1.4	1.1	1.1	169.1	$1.41 \cdot 10^{-4}$
EM-8	0.3	0.1	0.1	0.1	0.0	0.0	123.9	$1.50 \cdot 10^{-5}$
EM-3a	0.7	0.7	0.6	0.4	0.3	0.6	292.1	$3.50 \cdot 10^{-5}$
EM-5	0.6	0.3	0.4	0.4	0.3	0.3	86.6	$8.23 \cdot 10^{-5}$
EM-1	0.3	0.1	0.1	0.1	2.0	0.0	212.0	$3.80 \cdot 10^{-5}$
EM-2	0.7	0.7	0.7	0.7	0.6	0.4	346.1	$3.40 \cdot 10^{-5}$
EM-7	0.3	0.3	0.1	0.1	0.1	0.0	228.3	$1.22 \cdot 10^{-5}$
EM-3	0.3	0.1	0.1	0.1	0.1	0.0	86.5	$2.51 \cdot 10^{-5}$
EM-4	0.1	0.1	0.3	0.1	0.1	0.0	106.7	$2.03 \cdot 10^{-5}$

MÅLING AV SPESIFIKK MOTSTAND PÅ PRØVESTYKKER

Prøve nr.	Spesifikk motstand (Ωm)
EM-2	4498
III	3.0
EM-1	2.1
II	4.0
EM-9	1808
EM-4	1229

OVERSIKT OVER PRØVESTYKKER

I (a,b,c): Kis i jording I

II: Kis i jording II

III: Kis i jording III

EM-1: Kis i jording I

EM-2: Fra sidebergets heng i jording I

EM-3,a: Kis i jording III

EM-4: Bergarts-ligg i jording III

EM-5: Mineralisert sone i jording II

EM-6: Mineralisert sone i jording II

EM-7: Prøve tatt fra kvartsitt-enheten

EM-8: Kalkfyllitt

EM-9: Kalkfyllitt