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Geophysical surveys on the "Birkeland Test Grid", Evje-Iveland area, 1972

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Sammendrag

BV 3766

A/S SULFIDMALM

INTER-OFFICE MEMORANDUM

Date: 11th January, 1973

To: Falconbridge Nikkelverk A/S

cc: A.M.Clarke/D.B. Sutherland, D.R. Lochhead, F. Hansen, F. Nixon

From: J. B. Gammon

Subject:

905-7, Birkeland Test Grid, Evje-Iveland area (Report no. 204/72/7).

Please find attached Hansen's report on the use of various geophysical methods on our "test grid" in the Evje-Iveland area. He concludes that Slingram gives superiour results to the Crone shootback system whereas the VLF equipment also picks up tectonic zones in addition to the conductors detected by the conventional EM equipment.

We hope to put a hole into this target early in 1973 using our Winkie drill equipment.

J. B. Gammon

ARK
554 04.21

BV-3766
204-72-7

Oslo

FOR FALCONBRIDGE NIKKELVERK A/S

A/S SULFIDMALM

PROJECT 905-7

GEOPHYSICAL SURVEYS ON THE "BIRKELAND TEST GRID", EVJE-IVELAND AREA, NORWAY, 1972.

by

F. HANSEN

INTRODUCTION.

The following cases are from the Bekken area, which has been chosen as a test area for the various geophysical systems that Sulfidmalm has at its disposal:

ABEM (slingram) various frequencies.

CRONE, horisontal and coaxial shootback various frequencies. Vertical loop, broadside tecnique and fixed transmitter.

GEONIC's VLF and magnetics have been carried out.

LOCATION.

The test site is located in Iveland kommune, South Norway and is the northernmost part of the Orreknappen grid, reported on by F. Nixon (Report No. 142-71-7). The reader is referred to Nixon's report for details on the geology and mineralization in this area.

GEOPHYSICS.

All of the geophysical methods tested, indicate an anomaly striking WNW - ESE roughly parallel to a strong EW tectonic zone. The anomaly seems to be interrupted along line 75 W by something which could be a fault. The survey was done in two directions, perpendicular to each other.

No. 1. Direction of traverse N-S and normal to the geological strike.

No. 2. Direction of traverse E-W and parallel to geological strike.

Maps obtained from No. 1 direction give the best results for interpretation, because the traverses are at an angle with the geological strike.

Maps obtained form No. 2 direction also show the clear anomalies having approximately the same strike

../2

and length. But these curves are not so easy to do interpretation on. This must be because the direction of traverse is almost parallel to the strike direction.

MAGNETOMETER SURVEY.

Instrument Mc Phar M 700 fluxgate magnetometer measuring the vertical intensity of the earth's magnetic field. Map no. 7/72/101.

Background values are about 1000 - 2000 p. A magnetic high appears over the two Paascheskjerp S. (B), about 10000 p on one reading (450N/37,5W). This high seems to coinside with the easternmost EM-conductor. The westerly one does not show up too well on the magnetic picture.

In general the magnetic picture conforms with the strike direction. Unfortunately it does not show the trend of the EM-conductor. (A magnetic anomaly does not appear too well on the Orreknappen grid magnetic map either, obs. grids not 100% identical in Orreknappen report 142-71-7 (Map no. 07/72/7).

ELECTROMAGNETIC METHODS.

A) Low frequency EM.

1) ABEM, slingram, two frequencies (440 Hz and 1760 Hz), in phase and out of phase, measuring the secondary field in percent of the primary field.

2) CRONE horizontal shootback method tiltangle (in phase only), three frequencies, 390, 1830 and 5010 Hz.

3) A few selected profiles have also been surveyed using the CRONE instrument as a vertical loop, broadside technique and fixed transmitter station.

4) Coaxial shootback was also tested using the Crone equipment.

B) High frequency EM.

GEONICS VLF EM 16 using the stations GBR (Rugby) 16,0 kHz, NAA (Cutler Maine) 17,8 kHz and UMS (Moscow) 17,1 kHz. The instrument is measuring the secondary field vertical component (tilt angle) in phase and out of phase.

THE ABEM GUN (Slingram).

It is a moving source inductive method consisting of transmitter and receiver linked together with a referance cable. A fixed referance voltage is taken from the transmitter and fed into the compensator of the receiver, through the referance cable. The voltage picked up in the receiver is decomposed into two components, one in phase and the other 900 (one quarter period) out of phase, with the referance voltage. The magneticle of each are determined by comparison with the reference voltage.

The field operation of the slingram is that the transmitter and receiver are held a fixed distance apart and moved together in the direction of their line. The reference cable is also used to keep the distance between the coils constant.

After having selected the transmitter - receiver distance, and the system placed on neutral ground, we calibrate the compensator to read 100% for the in phase component and 0% for the out of phase component. This means that the primary field has been compensated.

It shall be noted that we might produce spurious anomalies on the in phase component due to changes in the coil separation. The magnetic field varies inversely as the cube of the distance from the coils. (I.e. a 1% change in the transmitter - receiver distance gives a spurious anomaly of 3%). The elevation difference between transmitter and receiver coils must also be recorded, so that afterwards a correction can be added to the in phase component. Neither of these corrections are needed for the out of phase component, which is a purely secondary phenomenon representing only a time difference between the primary and resultant fields and is not dependant upon the irregularities in the strength of the primary field.

Map no: 7/72/102 shows the imaginary component, high frequency contoured, with the direction of traverse perpendicular to the conductor. The easternmost conductor shows up very well on lines 25W and 50W. On line 25W it is difficult to do an accurate interpretation. The EM anomalies sits on a very strong magnetic anomaly, which is interpretate as causing the strong reversed anomaly next to it (i.e. possibly magnetic). The lop is at ≈ 420N the magnetic anomaly is 40 m further N. Conductor must be very good and probably shallow. Line 50W is much more straight forward to interpret it gives a depth of about 8 m, dip 70° S, lop at 450W, it is a good conductor. Line 75W does not show anything on the imaginary component. The real component give possible indications of two narrow conductors. On line 100W the westernmost conductor appears. On the real component it stands out as two thin almost vertical conductors about 60 m apart. The southernmost is about 16 m deep and the northernmost about 9 m deep. This is also a good conductor. Map no. 7/72/103 also shows the imaginary component, high frequency, contoured, but here the direction of traverse is almost parallel to the conductor. But even here the conductor and the trend of it shows very well. The two sections plotted have not been interpreted in detail.

CRONE HORISONTAL SHOOTBACK.

In order to minish errors due to irregular terrain. (a. elevation differences between the transmitter and receiver, b. misalignment of the relative orientation of transmitter and receiver, c. variation in the separation between transmitter and receiver.) Crone developed a new ground electromagnetic prospecting method. It is known as the Crone Shootback Method. In this new system two identical coils are used to transmit and/or receive alternately.

The field operation of the shootback method is that of a moving source inductive system. Both the transmitter and receiver are moved and kept at constant separation. At every station two measurements are made. For the first, the transmitter coil is held with the coil axis at an angle of 90° to the horizontal. The receiving coil is used to determine the angle ($\alpha 1$) at which the field tilts away from the vertical. The roles of the transmitter and receiver are then interchanged, and another tilt angle is measured ($\alpha 2$). The sum of these two readings is the resultant tilt angle (αR), and will be the measure of the true anomaly at the midpoint between the two coils. ($\alpha R = \alpha 1 + \alpha 2$).

Map no. 7/72/104 shows contours of tilt angles, the direction of traverse is perpendicular to the conductor. In this case with an almost vertical conductor the lop is located under the positives. The easternmost conductor shows up very well on lines 25W and 50W. In general the conductor is about 15 m deep dipping steeply to the S. (ca. 60°). The trend is WNW-ESE. Line 75W is blank. On line 100W again we pick up an anomaly, this is the most western one. This conductor is interpreted as beeing shallow, about 6 m deep, and being almost vertical (ca. 80° N). Individual plots se map no. 7/72/105 - 106 - 107. Map no. 7/72/108 is also showing contours of tilt angle data, but here the direction of traverse is almost parallel to the conductor. The contours still show the conductor and the trend of it. The sections are not so easy to do interpretation on, and it is probably due to the direction of the survey.

CONDUCTIVITY INTERPRETATION.

By using two operating frequencies Crone draws the following unsubstantiated and subjective conclusions concerning the conductivity of sources detected by the system:

Ratio of: $\frac{\alpha \text{ max low freq.}}{\alpha \text{ max high freq.}}$	conductivity interpretation
1.0 - 0.6	1) Massive sulphide.
0.8-0.4	2) Fracture filling sulphides.
0.7 - 0.2	3) Disseminated sulphides, carbonaceous sediments and graphite.
0.3 - 0.1	4) Conductive sediments.

In our case the ratio αmax low/ αmax high is approximately 0.7. This could be interpretated as a no. 1, 2 or 3 type of conductor. (see table above).

VLF-EM (Geonics EM 16).

The VLF transmitting stations operating for communication with submarines have a vertical antenna. The antenna current is thus vertical, creating a concentric horizontal magnetic field around them. When these magnetic fields meet conductive bodies in the ground these will be secondary fields radiating from these bodies. The equipment measures the vertical in phase components of these secondary fields (tangent of the tilt angle of the polarization ellipsoid). By means of electromic devices in the instrument we can also read the out of phase component.

Map no. 7/72/109 shows the tilt angle in phase and out of phase plotted as sections. The station is Moscow, and the surveying direction is perpendicular to the strike. Taking the inflection points from these sections and plotting them as conductors on a separate map no. 7/72/110, we get a clearer picture. The strong conductor I interpretate as being the easternmost EM conductor, the moderate one the westernmost EM conductor. The weak conductor joining the strong conductor must be the Birkeland stream E-W strong tectonic zone. (see Geology by F.N.) Map no. 7/72/111 is the FRASER computed data from map no. 7/72/109. It seems to agree with the above mentioned interpretation.

Map no. 7/72/112 shows the whole test grid. Two VLF stations are plotted as sections (Cutler Maine/Rugby). Surveying direction is perpendicular to strike. The anomaly picture here also confirms that there are to EM-conductors plus the anomaly caused by the tectonic zone.

Map no. 7/72/113 - 114 - 115 - 116 are VLF survey with the traverses almost parallel to strike. They do not present a very clear picture, due to the direction of the traverses. This just confirms that the survey line should perpendiculare to strike direction.

Map no. 7/72/117 is equivalent to map no. 7/72/112, but just showing the one station (GBR) in the most important part of the grid. The readings were also taken on another day by another operator. The tilt angle picture is pretty much the same, but for one reading on line 25W/425N in phase (real). This could be a "false" reading. Map no. 7/72/118 is the FRASER computed data from map no. 7/72/117. The easternmost conductor is here set off to the S on line 25W. This is due to the "false" reading mentioned above.

VERTICAL LOOP BROADSIDE TECHNIQUE.

The Broadside or parallel line procedure has been developed to provide rapid coverage of an area with short range portable dip angle systems. The transmitter and receiver are advanced simultaneously along two of the grid lines. The coil separation was 50 m and the frequencis 1830 Hz. Instrument: CRONE Shootback EM. Four lines surveyed, 0, 25W, 50W and 75W. The maine anomaly zone is clearly indicated (see map no. 7/72/119).

VERTICAL LOOP "FIXED TRANSMITTER" STATION (Const. sep.).

In this method a series of lines are surveyed from a fixed transmitter location. The transmitting coil is oriented to successive receiver positions to eliminate the effects of topographic changes. In this case the coil separation was kept constant at 100 m. Transmitter position was in the center of the grid at 425N. The transmitter was moved up simultaneously with the receiver. Instrument was CRONE shootback EM frequency 1830 Hz. Six lines surveyed: 0, 25W, 50W, 75W, 100W and 125W. The easternmost anomaly zone shows up very well on line 0.25W and 50W. (See map no. 7/72/120).

CRONE COAXIAL SHOOTBACK (Map no. 7/72/121).

This method is identical to the horizontal shootback method, but for the position of the Tx coil (Tx vertical instead of horizontal). Two lines were surveyed: 25W and 50 W. Sections very similar to those obtained with horizontal shootback, but for amplitude. Individual interpretation (CSB/HSB 1830 Hz) gives similar results. (See map no. 7/72/122, 7/72/123).

CONCLUSIONS.

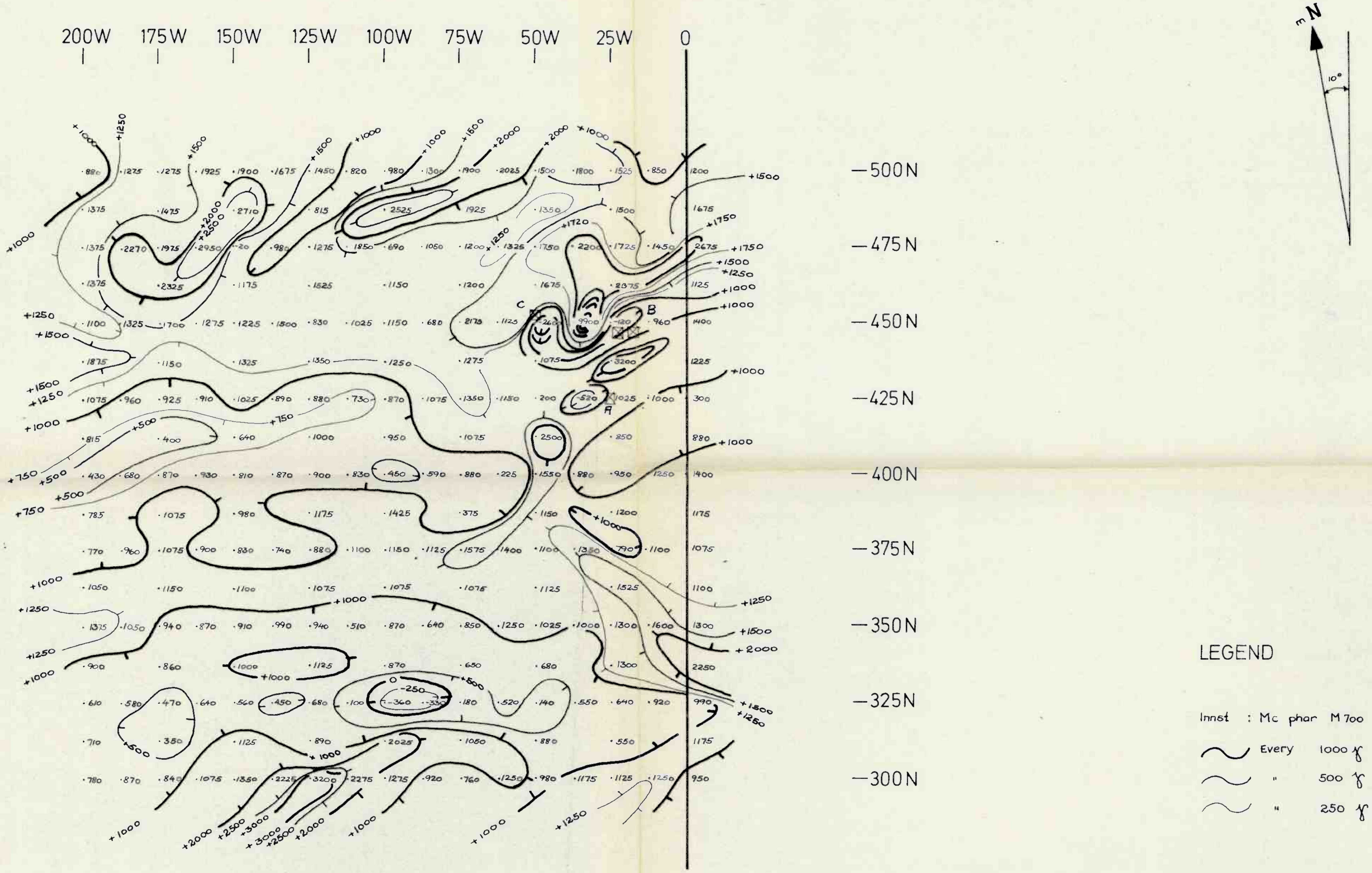
All the various geophysical systems tested outlined the main conductor with satisfaction. This conductor has a strike length of approx. 100 m and trend WNW/ESE.

Low frequency E.M. seems to pick up the main conductive zone only, where as high frequency E.M. also responds to the major tectonic zones.

The Crone instrument shows one conductive source in all methods used, on some profiles high frequency ABEM indicates that the main conductive zone is composed of 2 or more narrow parallel conductors fairly closely spaced. In this respect the ABEM gun seems to be superior to the CRONE in that it is more sensitive to closely spaced, similar conductive sources.

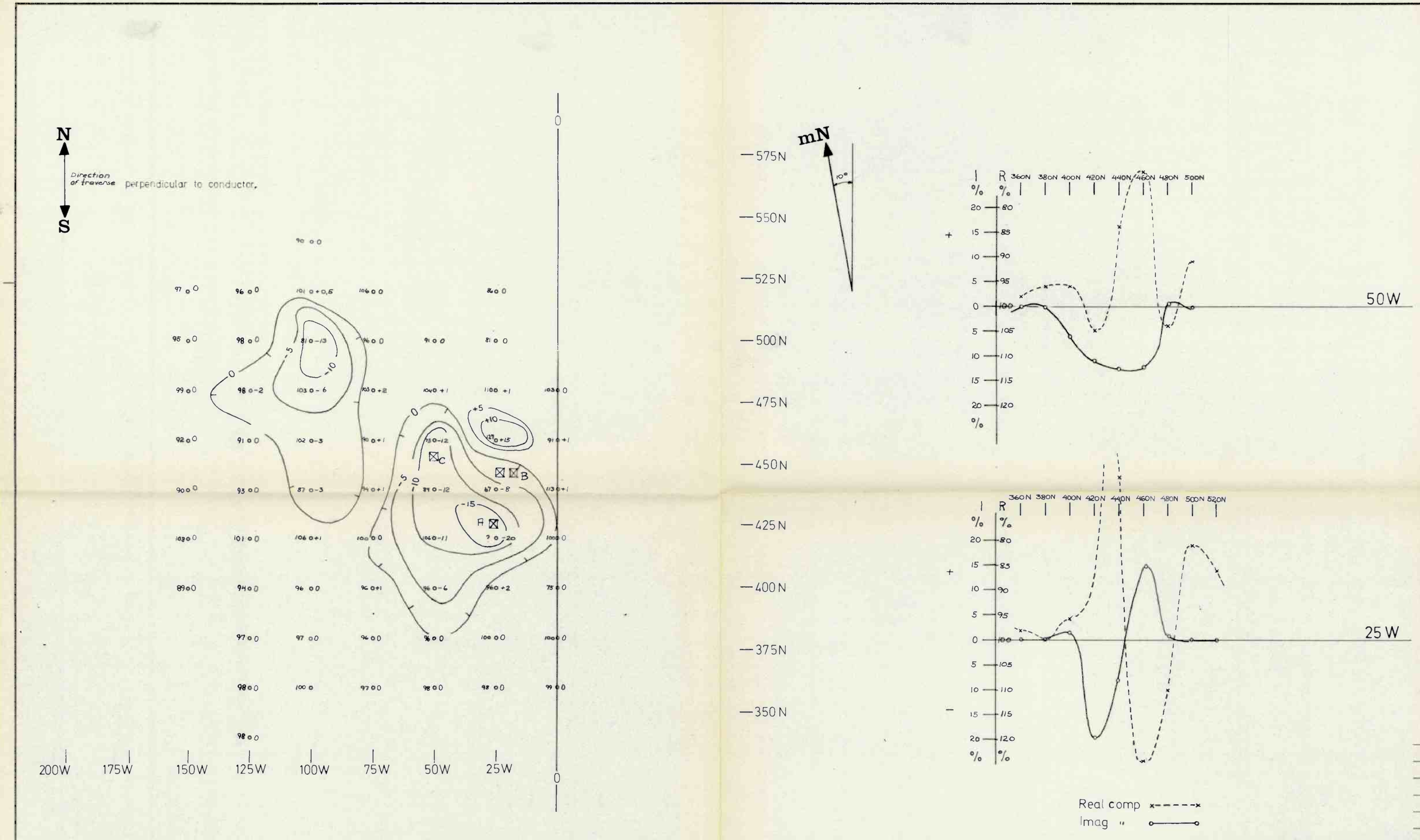
IP (frequensy type of IP/resistivity) have not been tested on this grid. This is an another tool which the Sulfidmalm staff is familiar with. Hopefully we will have the chance another time to test it out here and compare.

I look forward to seeing this target tested with the Winkie drill.



Birkeland test grid Magnetic anomalies	SCALE 1:1000	OBS. FIH 2-72 DRAW. FIH 2-72 TRAC. UT 4-72 CHK. FIH 10-72
A/S SULFIDMALM	MAP NO. 7/72/101	
	MAP SHEET	

A.s Terrkopi. 2000. A 2. E 9 gl. 10-71. Sentrum Trykkeri.



BIRKELAND TEST GRID
ABEM gun. Highfreq. 1760 Hz
Imag. comp. Contour interval 5%

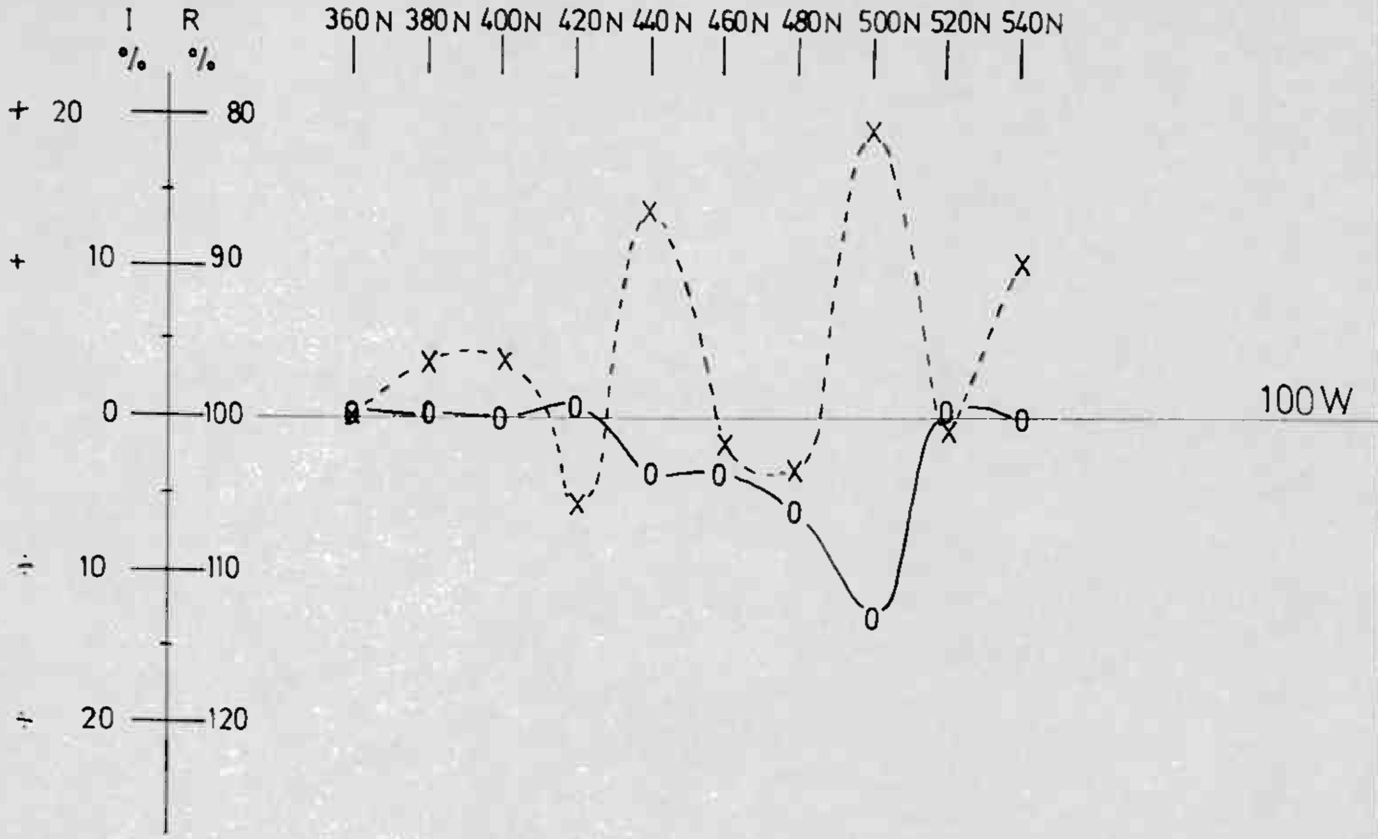
SCALE 1:1000	OBS. FIH	2-72
	DRAW. F.I.H.	2-72
	TRAC. U.T	4-72
	CHK. FIH	10-72

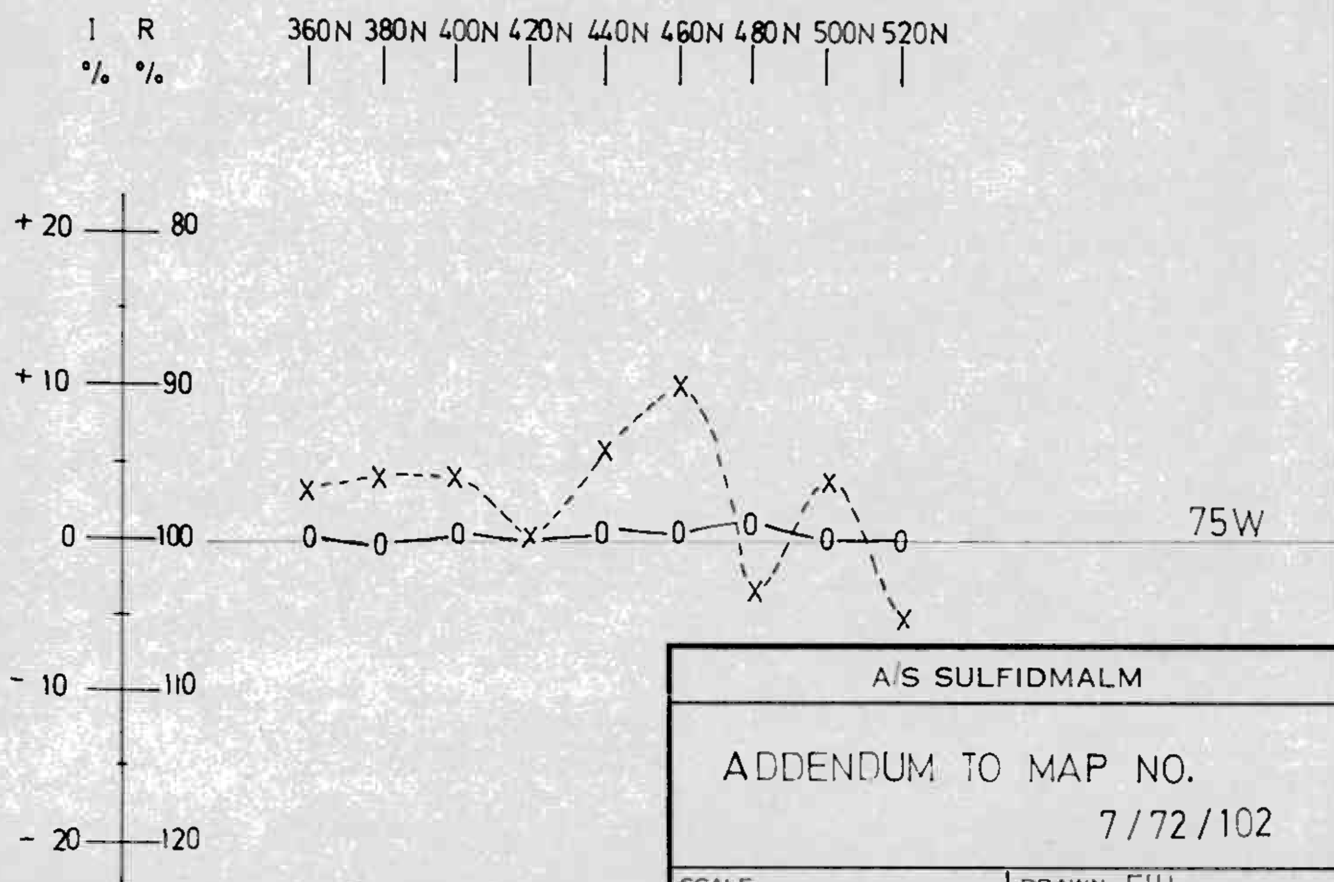
A/S SULFIDMALM

MAP NO. 7/72/102

MAP SHEET

A.s Tørrkopi. 2000. A 2. E 9 gl. 10-71. Sentrum Trykkeri.

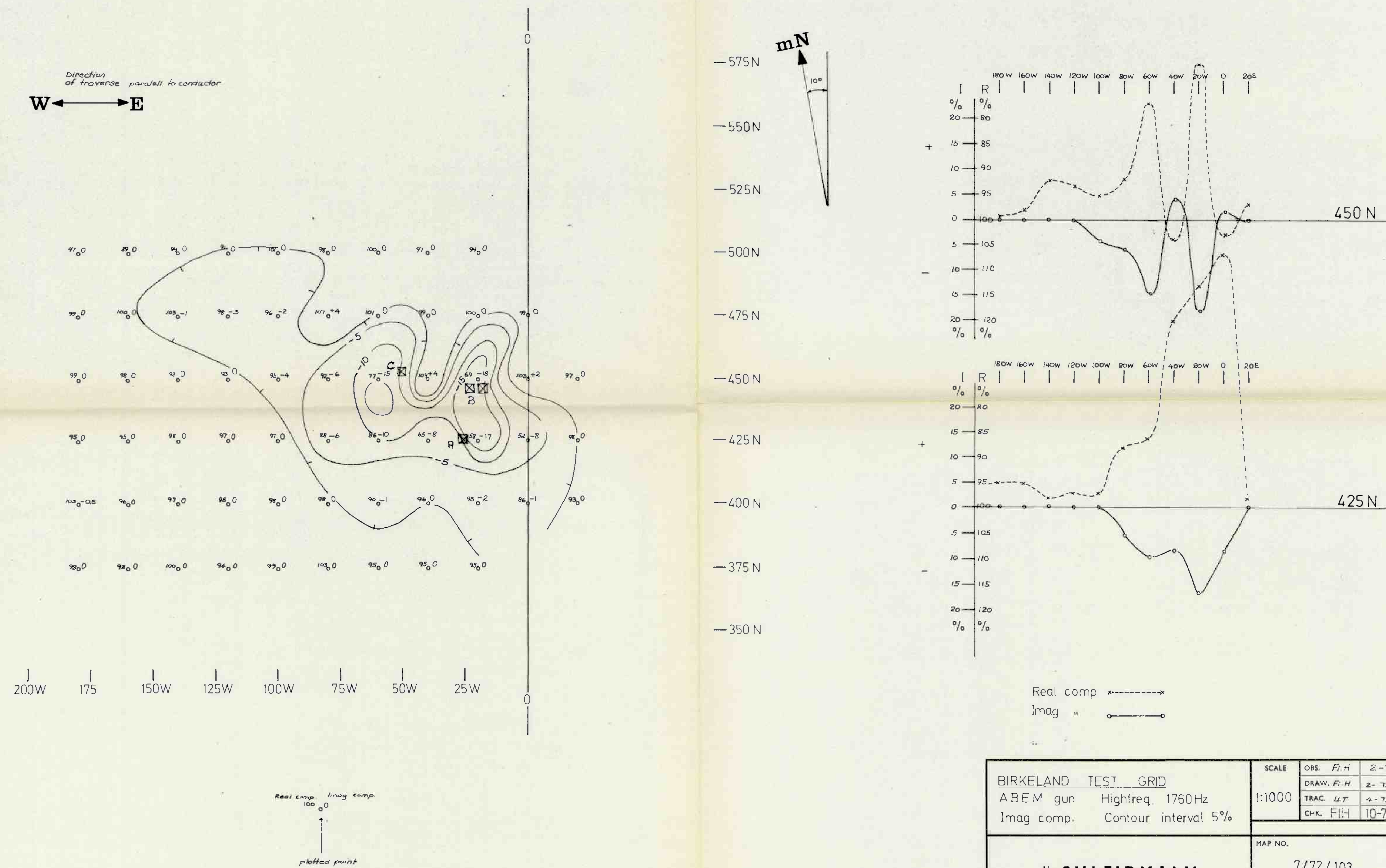




A/S SULFIDMALM

ADDENDUM TO MAP NO.
7 / 72 / 102

SCALE	DRAWN FIH
DATE 2-72	TRACED BL



BIRKELAND TEST GRID
ABEM gun Highfreq. 1760 Hz
Imag comp. Contour interval 5%

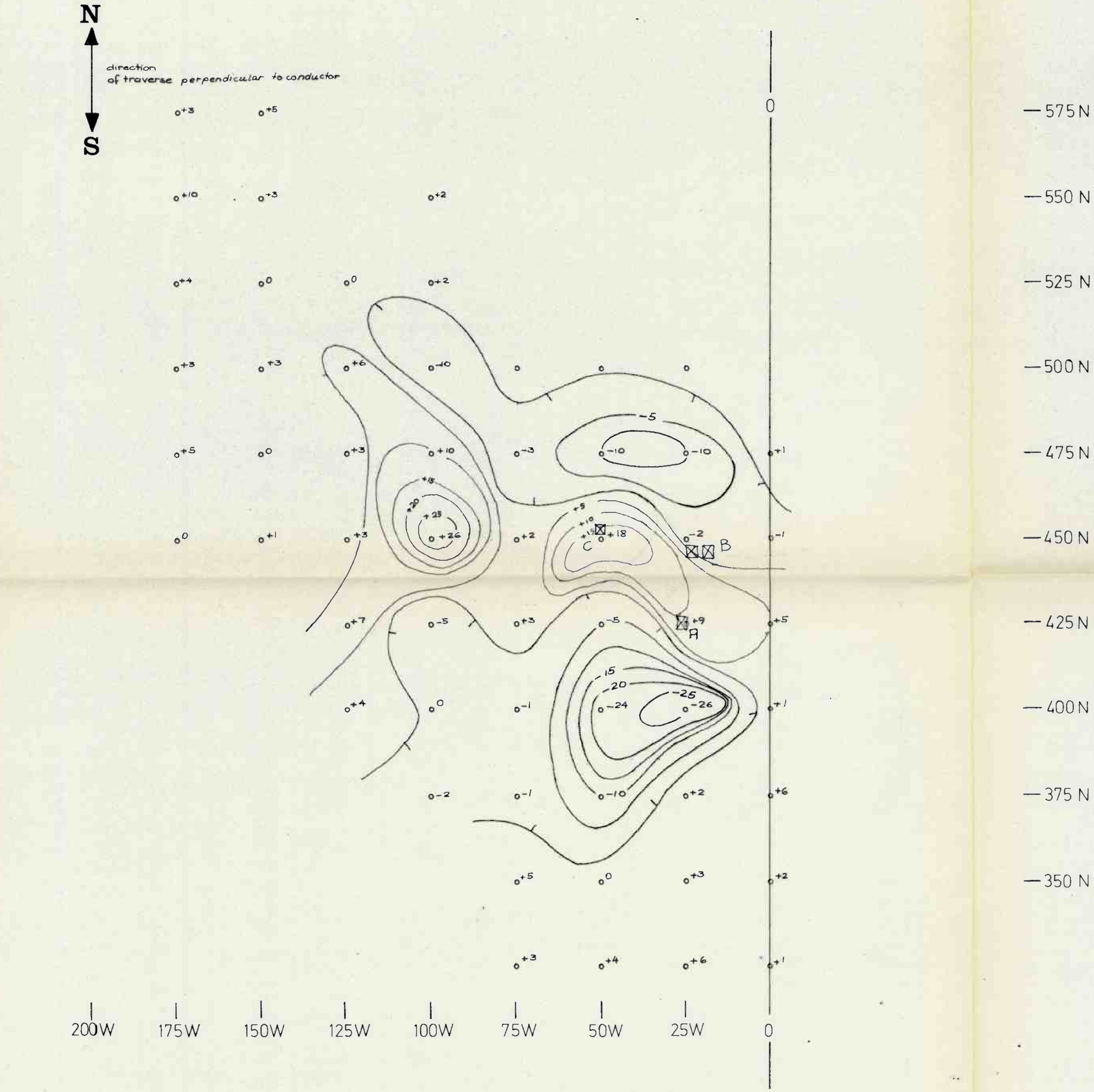
SCALE	OBS. Fi.H	2-72
1:1000	DRAW. Fi.H	2-72
	TRAC. U.T	4-72
	CHK. FIH	10-72

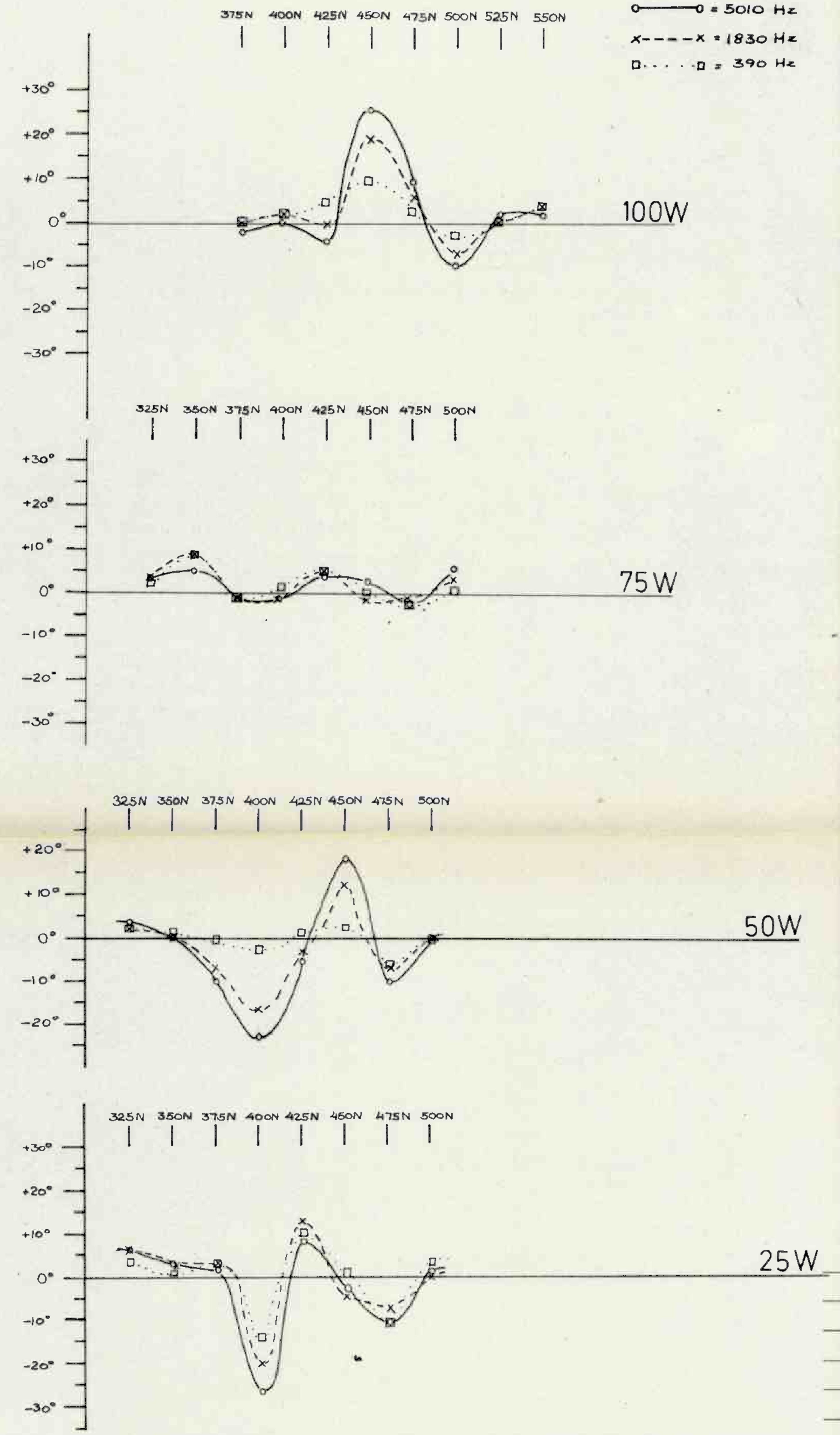
A/S SULFIDMALM

MAP NO. 7/72/103

MAP SHEET

A.s Tarrkopi. 2000. A 2. E 9 gl. 10-71. Sentrum Trykkeri.





BIRKELAND TEST GRID
CRONE horizontal shootback
high freq. 5010 Hz coil sep 50 m
Top of conductor under positives
contour interval=5°

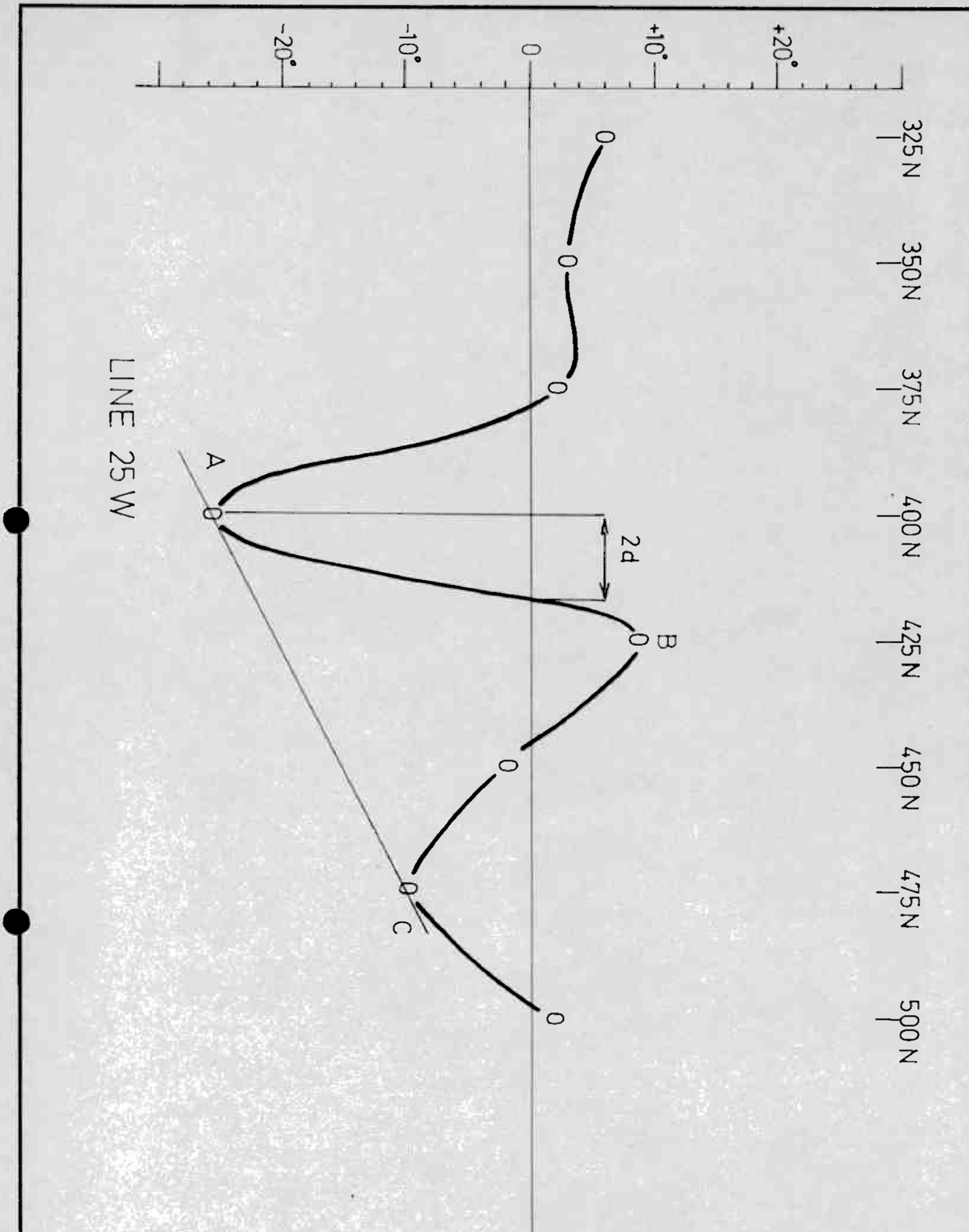
SCALE		
1:1000	OBS. FIH	2-72
	DRAW. Fi. H	2-72
	TRAC. U. T	4-72
	CHK. FIH	10-72

A/S SULFIDMALM

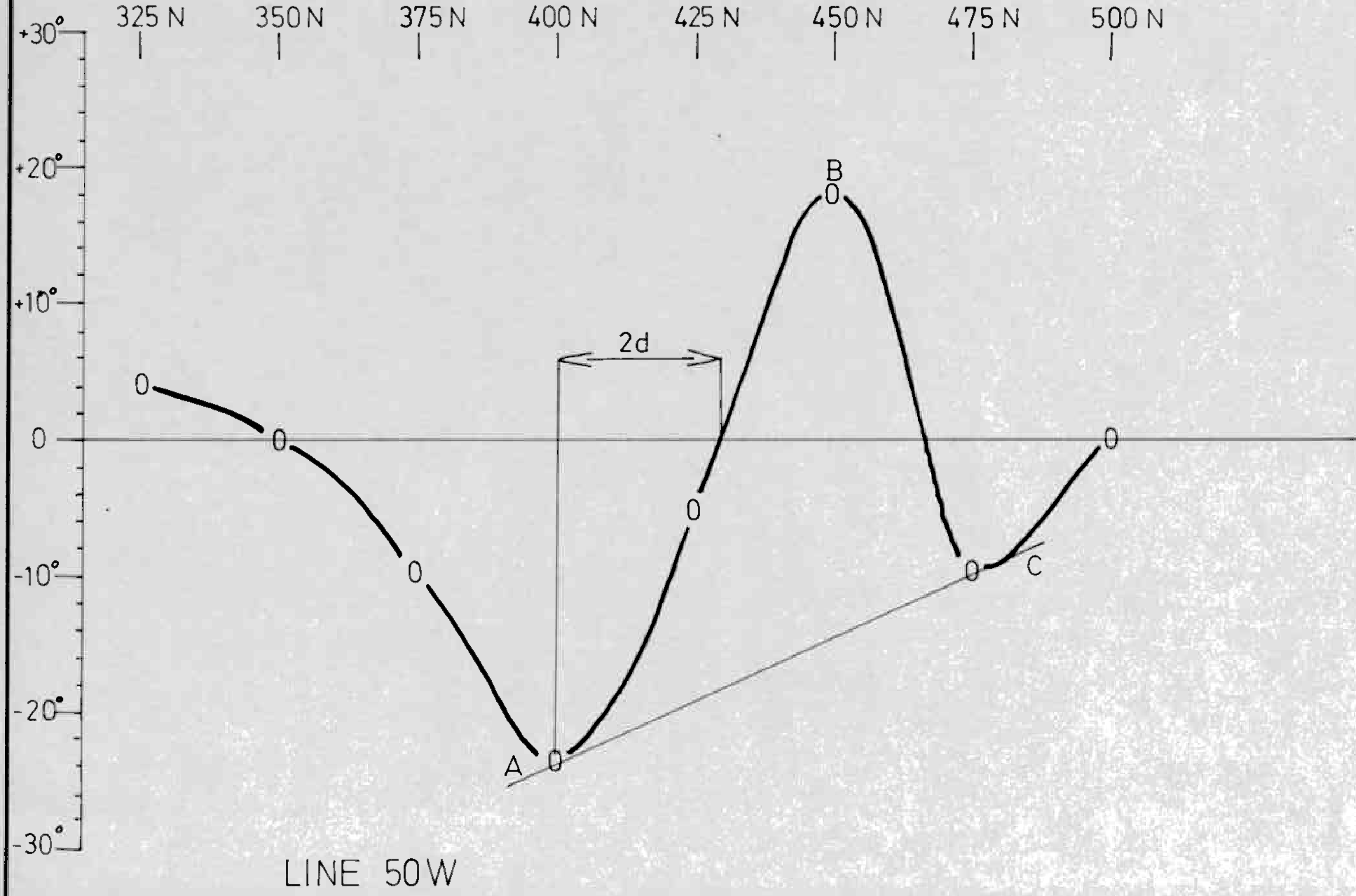
MAP NO. 7/72 /104

MAP SHEET

A.s Tørrkopi. 2000 A 2. E 9 gl. 10-71. Sentrum Trykkeri.



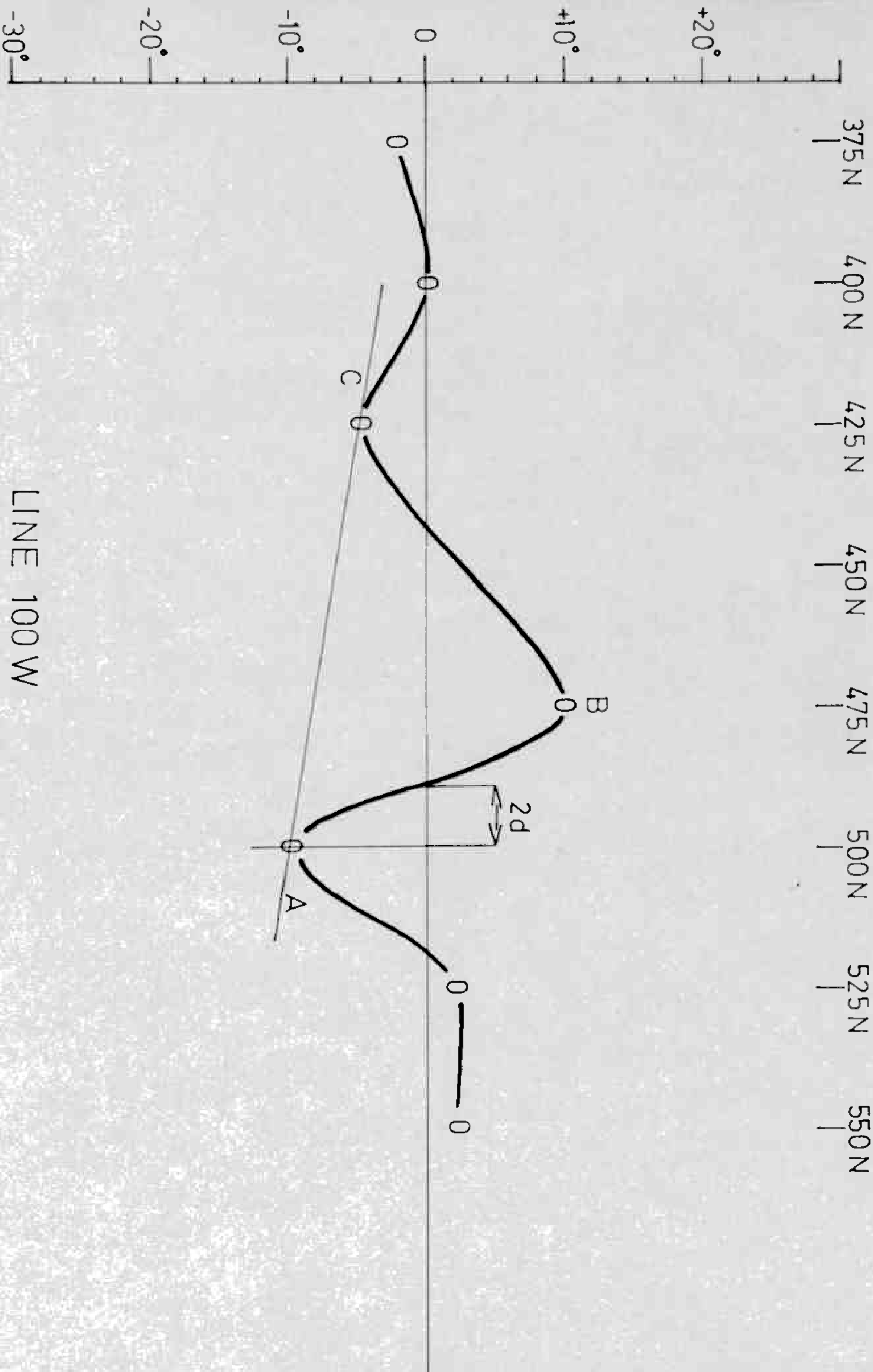
A/S SULFIDMALM	
BIRKELAND TEST GRID CHS, 5010 Hz Top of conductor ≈ 425 N Depth ≈ 2d = 17m ⊃: d = $\frac{17}{2}$ = 8,5 m Dip ≈ 62° S	
SCALE 1:1000	DRAWN FIH
map 7/72/105	TRACED BL



A/S SULFIDMALM

BIRKELAND TEST GRID
CHS, 5010 Hz
Top of conductor ≈ 450 N
Depth ≈ 2d = 29 d= $\frac{29}{2}$ = 14,5m Dip ≈ 65° S

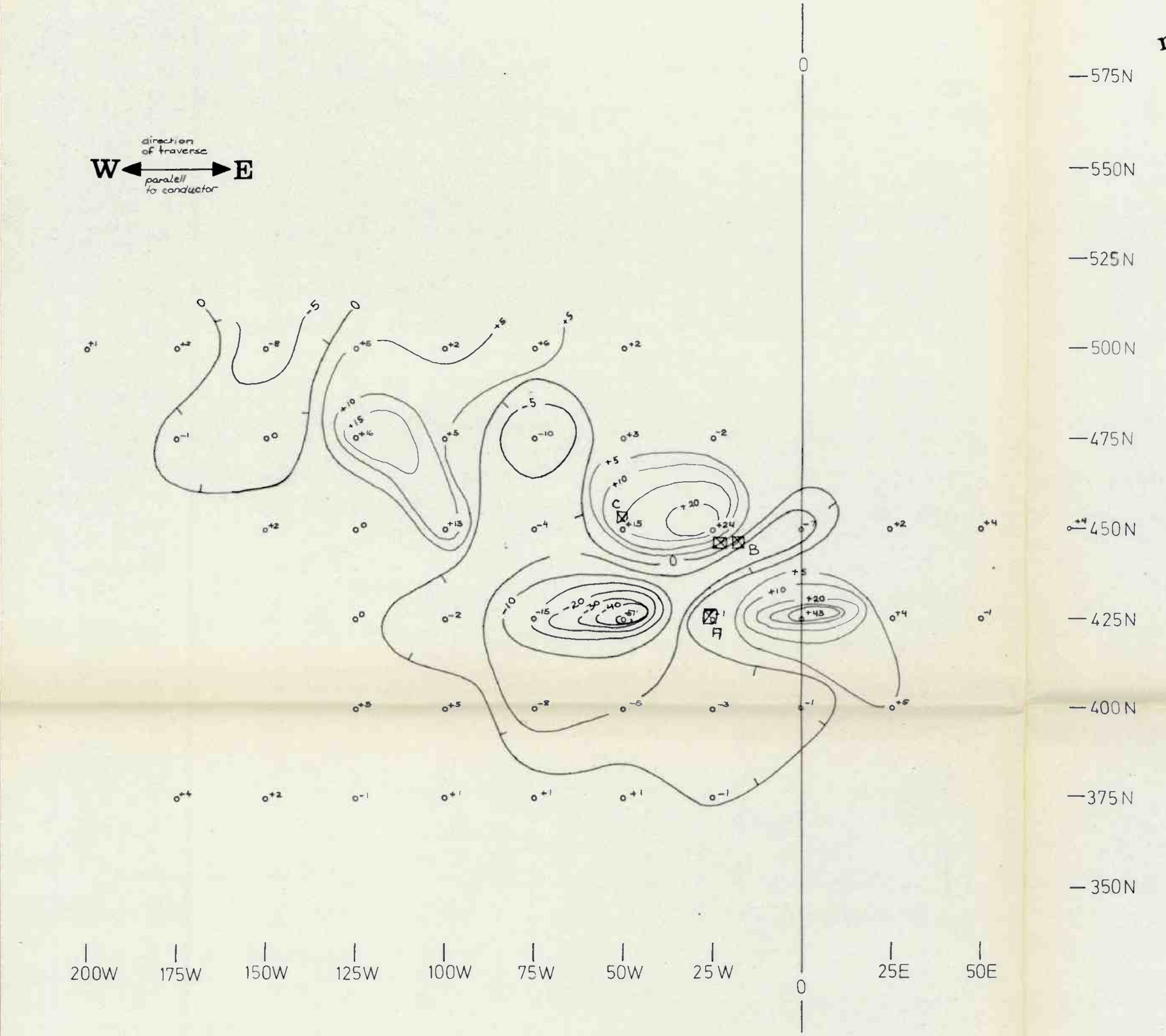
SCALE	1:1000	DRAWN FIH
map	7/72/106	TRACED BL

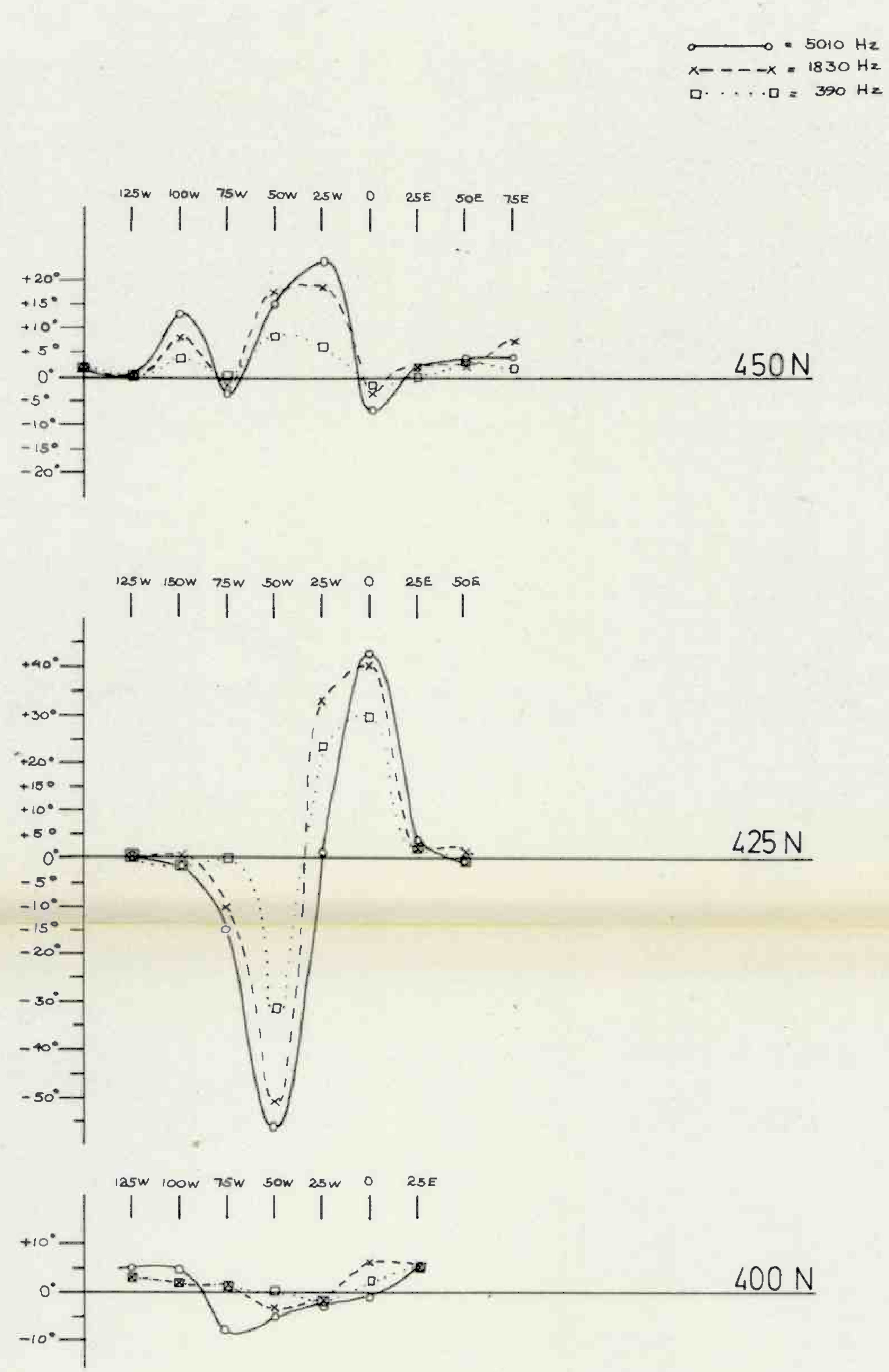


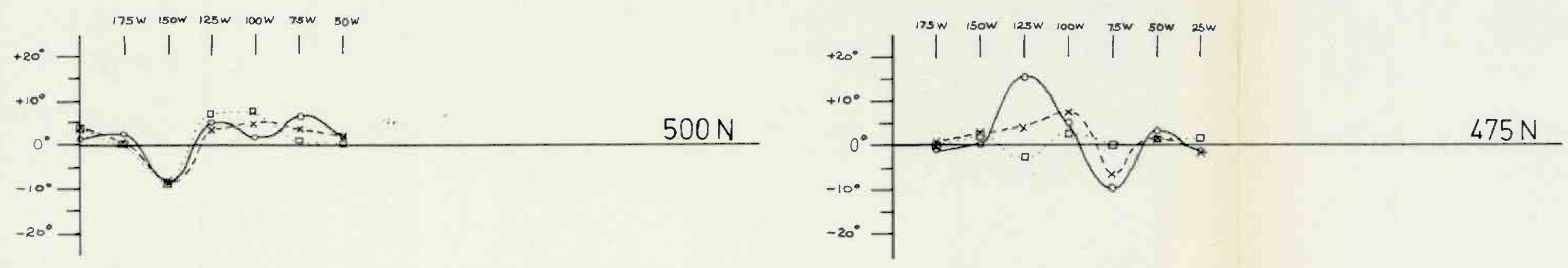
A/S SULFIDMALM

BIRKELAND TEST GRID
CHS, 5010 Hz
Top of conductor ≈ 475 N
Depth ≈ 2d = 11m ⊃: d = $\frac{11}{2}$ = 5,5 m   Dip ≈ 81° N

SCALE 1:1000	DRAWN FIH
map 7/72/107	TRACED BL

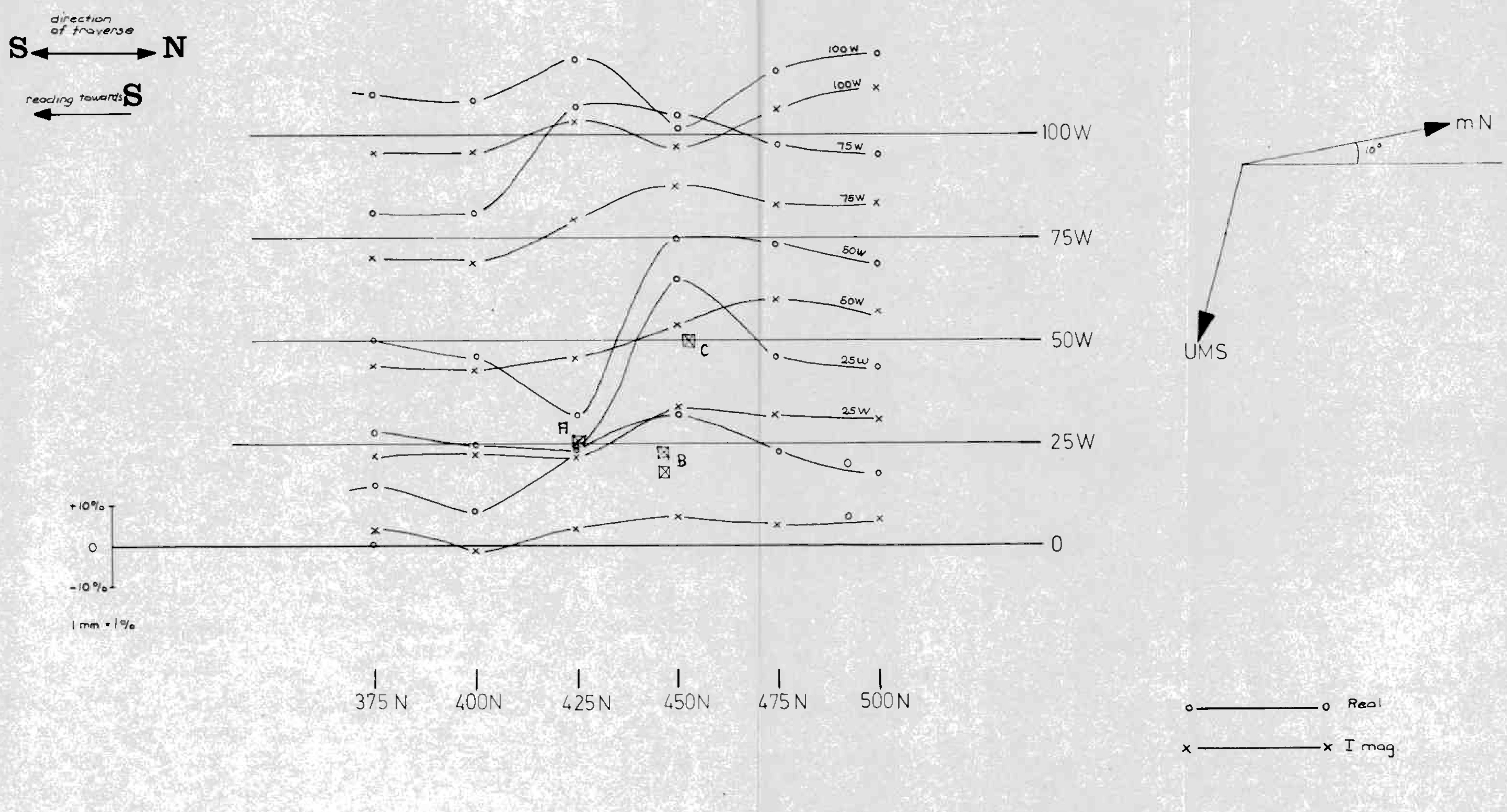






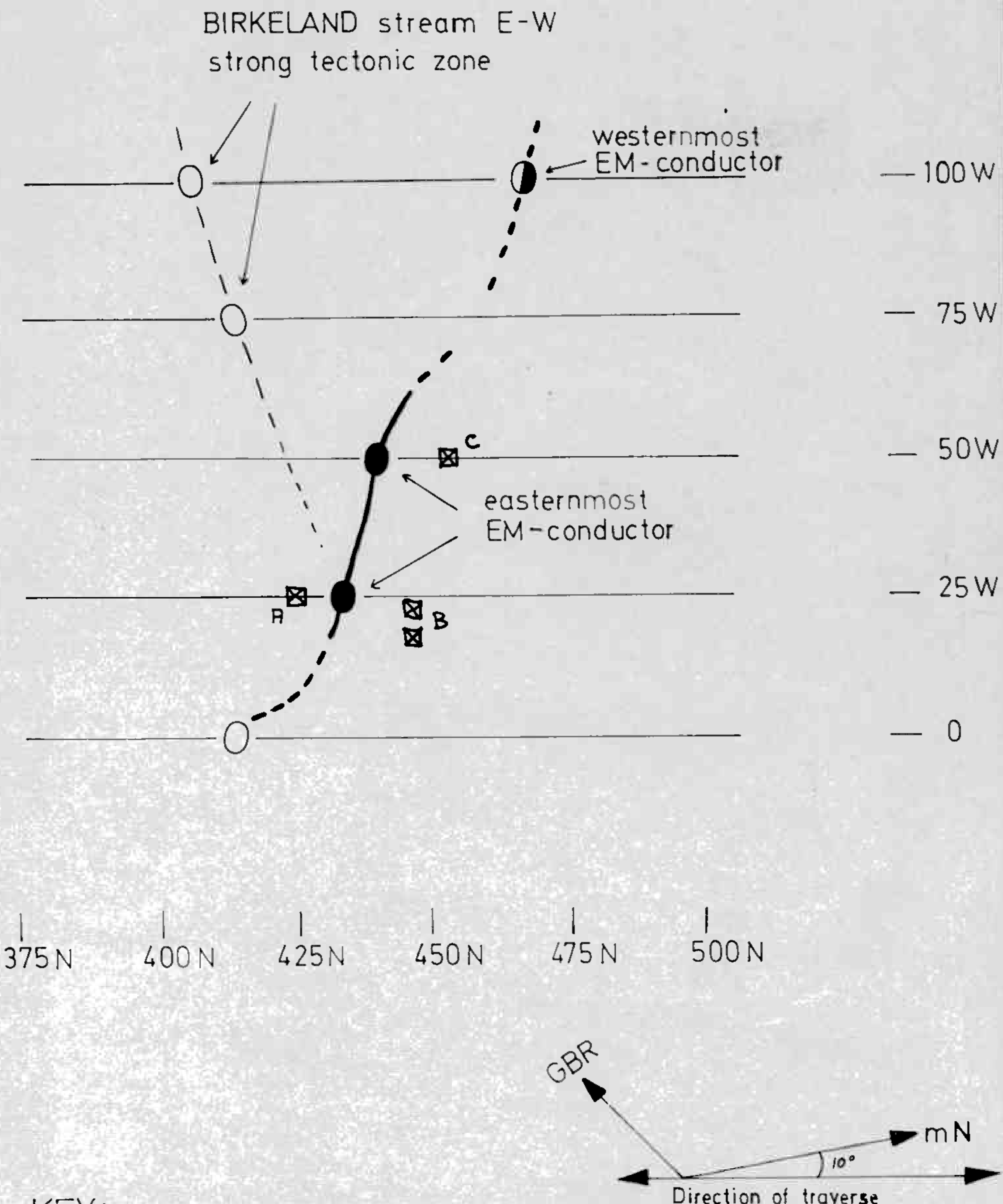
BIRKELAND TEST GRID CRONE horizontal shootback high freq. 5010Hz coil sep. 50m Top of conductor under positives contour interval = 5°	SCALE 1:1000	OBS. FIH	2-72
		DRAW. Fi. H.	2-72
		TRAC. U.T.	4-72
		CHK. FIH	10-72
A/S SULFIDMALM	MAP NO. 7/72/108		
	MAP SHEET		

A.s Tørrkopi. 2000. A 2. E 9 gl. 10-71. Sentrum Trykkeri.



BIRKELAND TEST GRID Geonics EM 16 VLF Station (Moscow) 17,1 kHz	SCALE 1:1000	OBS. FIH	2-72
		DRAW. FI. H	2 · 72
		TRAC. U.T	4 · 72
		CHK. FIH	10-72
A/S SULFIDMALM	MAP NO. 7/72/109		
	MAP SHEET		

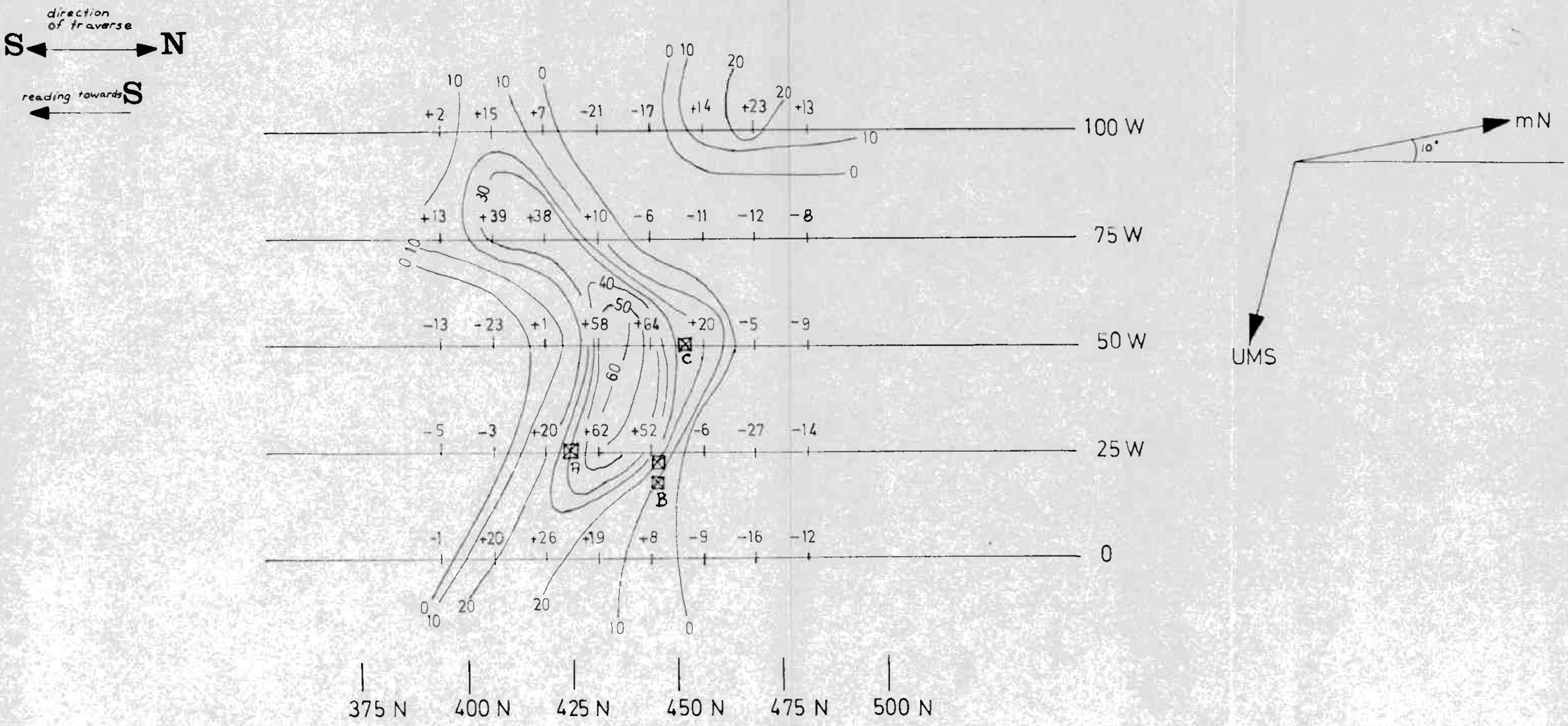
A.s Tørrkopi. 1000. A 3. E 9 gl. 10-71. Sentrum Trykkeri.



KEY:

- ● STRONG CONDUCTOR
- ◐ MODERATE "
- ○ WEAK "

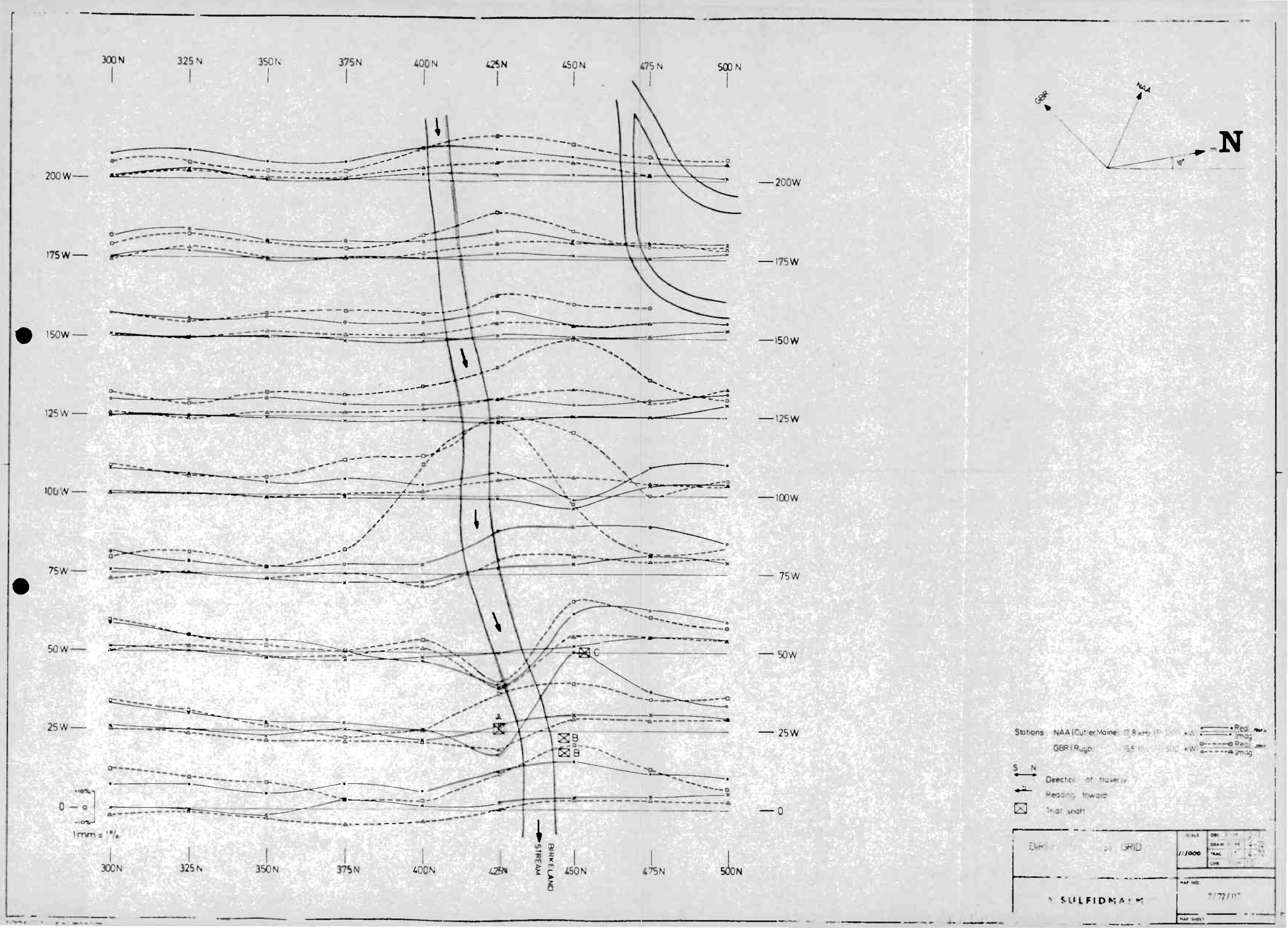
A/S SULFIDMALM	
BIRKELAND TEST GRID Interpretation of map no 7/72/109	
	Map no 7/72/110
SCALE 1:1000	DRAWN FIH
DATE 10-72	TRACED BL



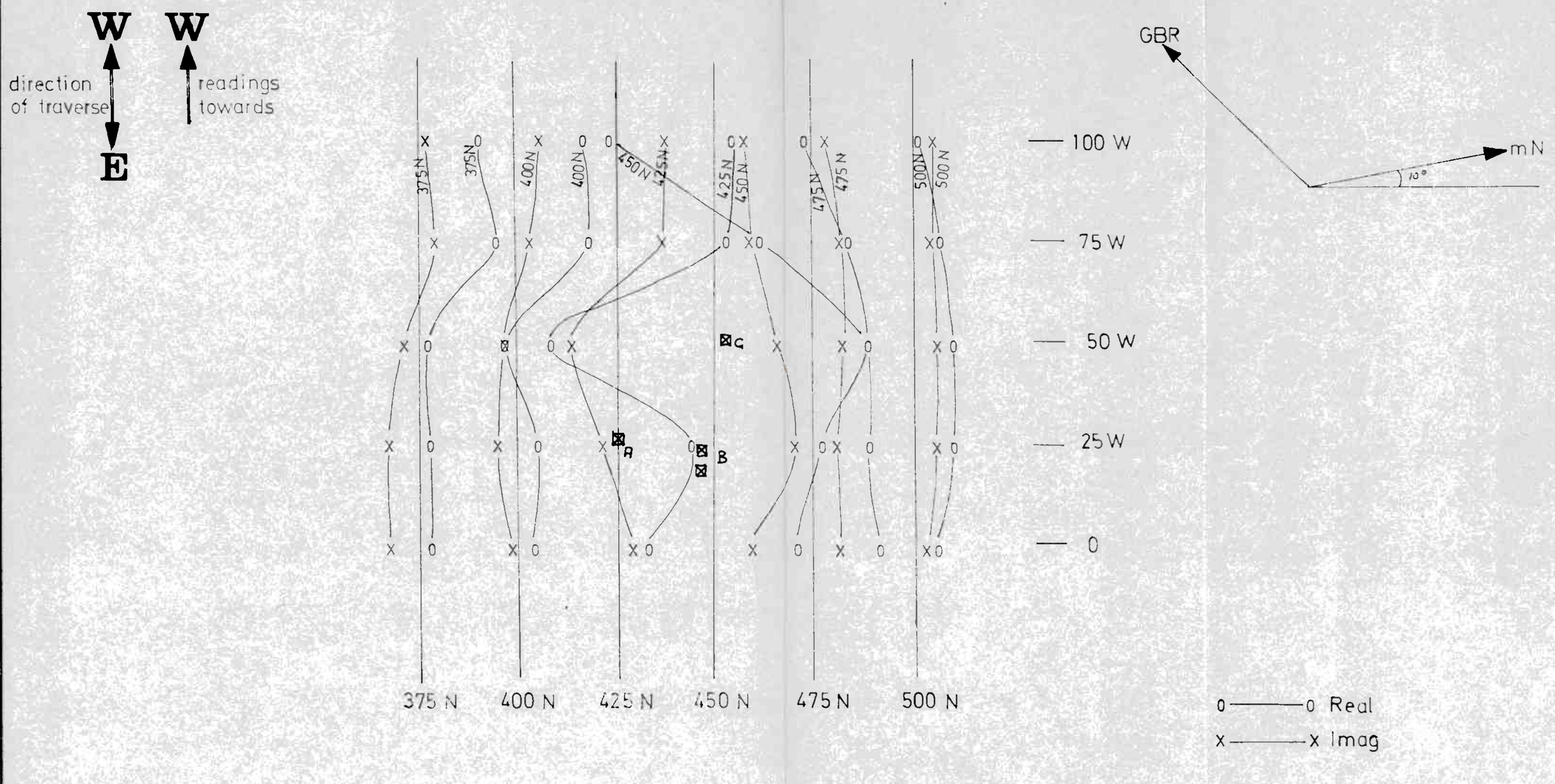
FRASER data computed from tilt angle in phase data countour interval every 10 (negatives ignored.)

BIRKELAND TEST GRID	SCALE	OBS. FIH	2-72
Geonics EM 16 VLF	1:1000	DRAW. FIH	9-72
Station (Moscow) 17,1 kHz		TRAC. BL	9-72
Contouring of FRASER computed data.		CHK. FIH	10-72
A/S SULFIDMALM	MAP NO. 7/72 / 111		
	MAP SHEET		

A.s Tørrkopi. 1000. A 3. E 9 gl. 10-71. Sentrum Trykkeri.

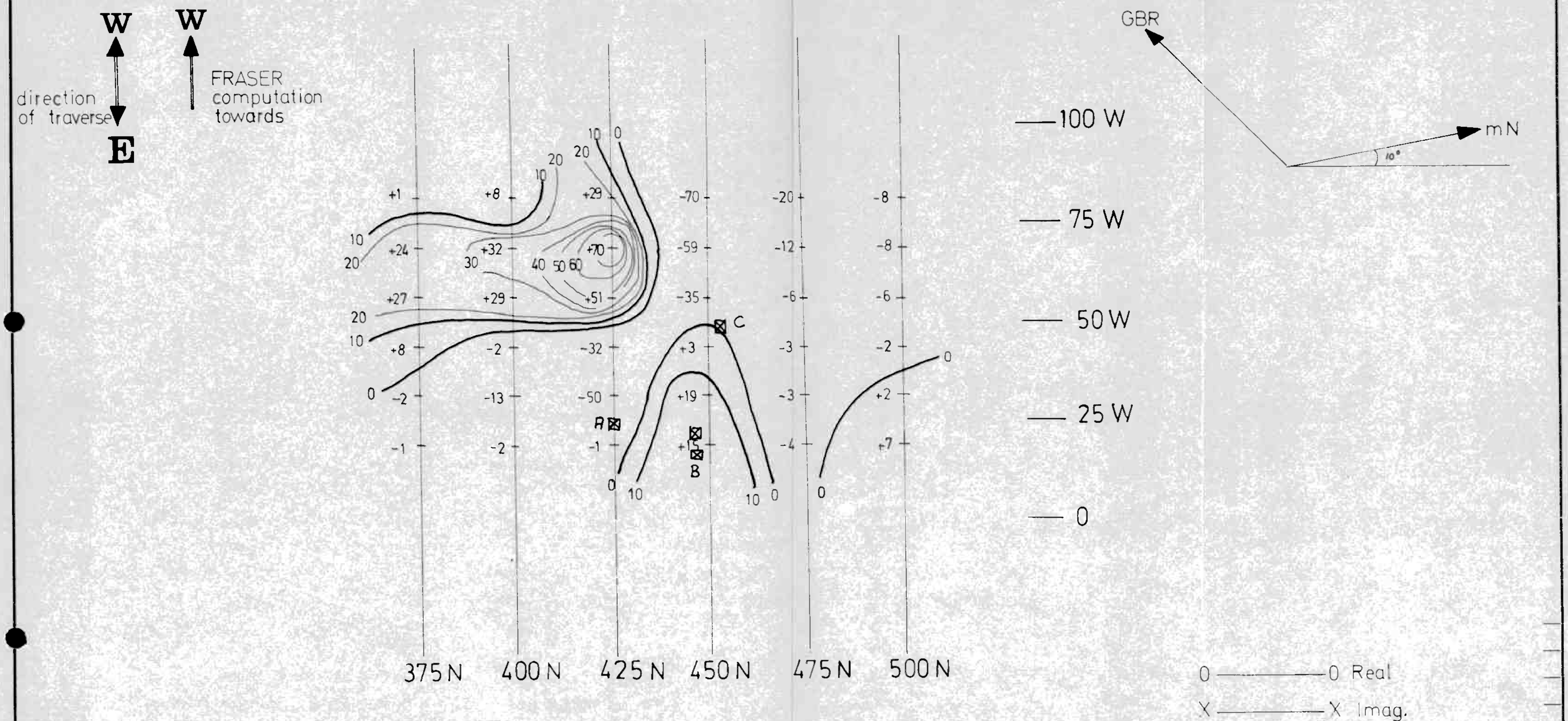


300 N
325 N
350 N
375 N
400 N
425 N
450 N
475 N
500 N
200 W
175 W
150 W
125 W
100 W
75 W
50 W
25 W
0
1 mm = 1%
GBR
NAA
N
C
B
BIRKELAND STREAM
Stations
Real
Imag
S
N
SCALE
1:1000
SULFIDMALM



BIRKELAND TEST GRID Geonics EM 16 VLF Station (Rugby) 16,0 kHz	SCALE 1:1000	OBS. FIH	2-72
		DRAW. FIH	9-72
		TRAC. BL	10-72
		CHK. FIH	10-72
A/S SULFIDMALM	MAP NO. 7/72/113		
	MAP SHEET		

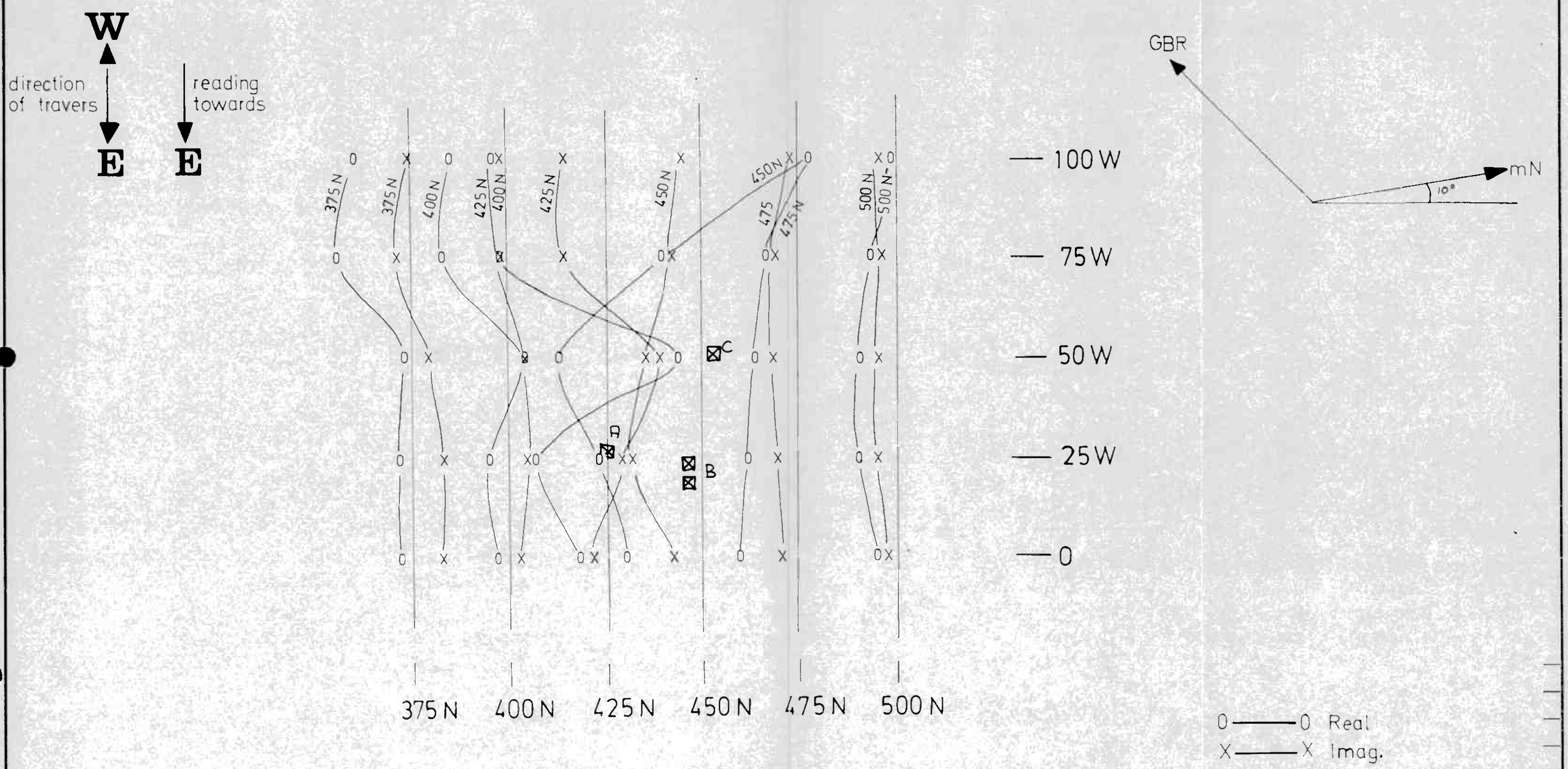
A.s Tørrkopi. 1000. A 3. E 9 gl. 10-71. Sentrum Trykkeri.



FRASER data computed from tilt angle in phase data
contour interval every 10 (negatives ignored)

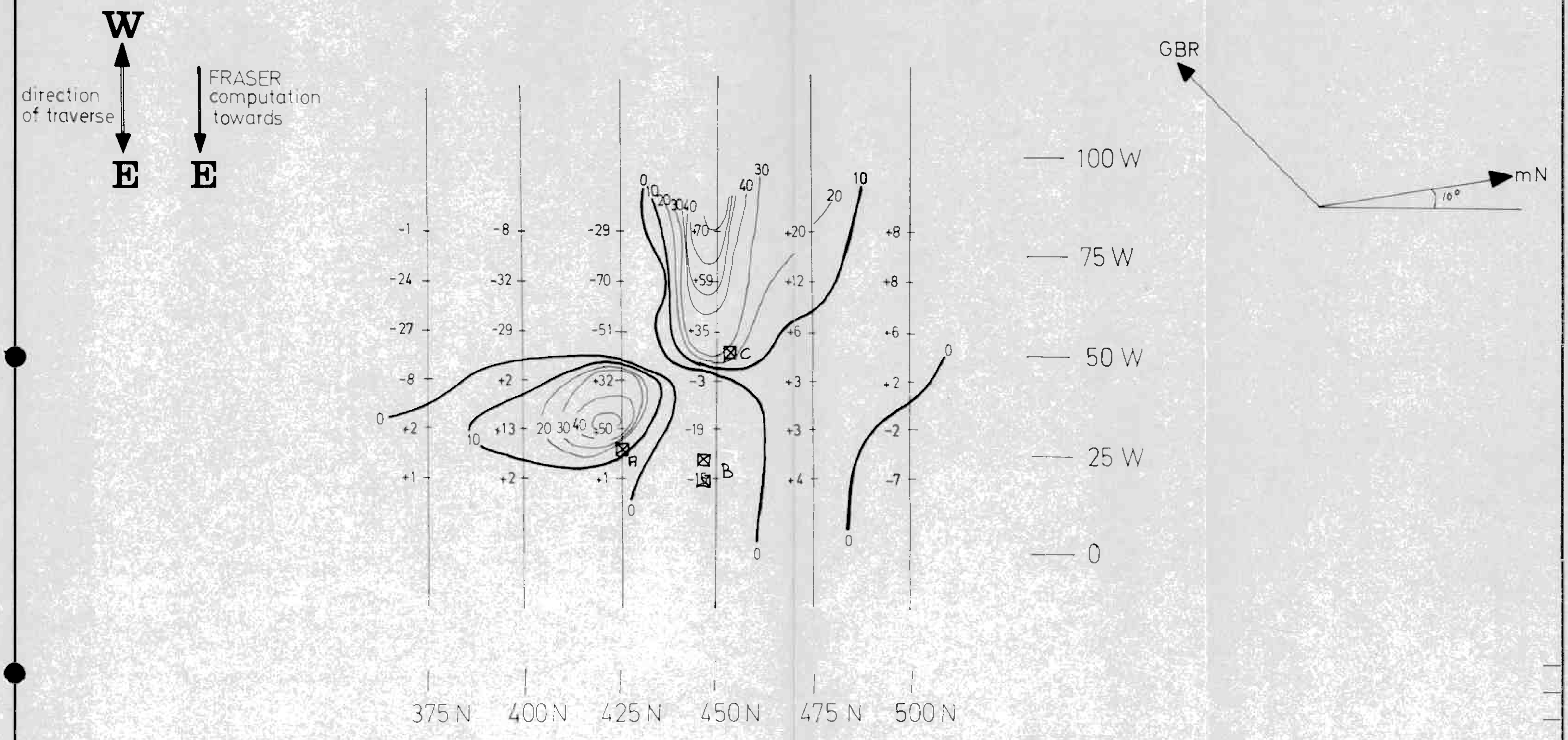
BIRKELAND TEST GRID Geonics EM 16 VLF Contouring of FRASER computed data	SCALE 1:1000	OBS. FIH	2-72
		DRAW. FIH	9-72
		TRAC. BL	10-72
		CHK. FIH	10-72
A/S **SULFIDMALM**	MAP NO. 7/72/114		
	MAP SHEET		

A.s Tørrkopi. 1000. A 3. E 9 gl. 10-71. Sentrum Trykkeri.



BIRKELAND TEST GRID Geonics EM 16 VLF Station (Rugby) 16,0 kHz	SCALE 1:1000	OBS. FIH DRAW. FIH TRAC. BL CHK. FIH	2-72 9-72 10-72 10 - 72
A/S SULFIDMALM	MAP NO. 7/72/115		
	MAP SHEET		

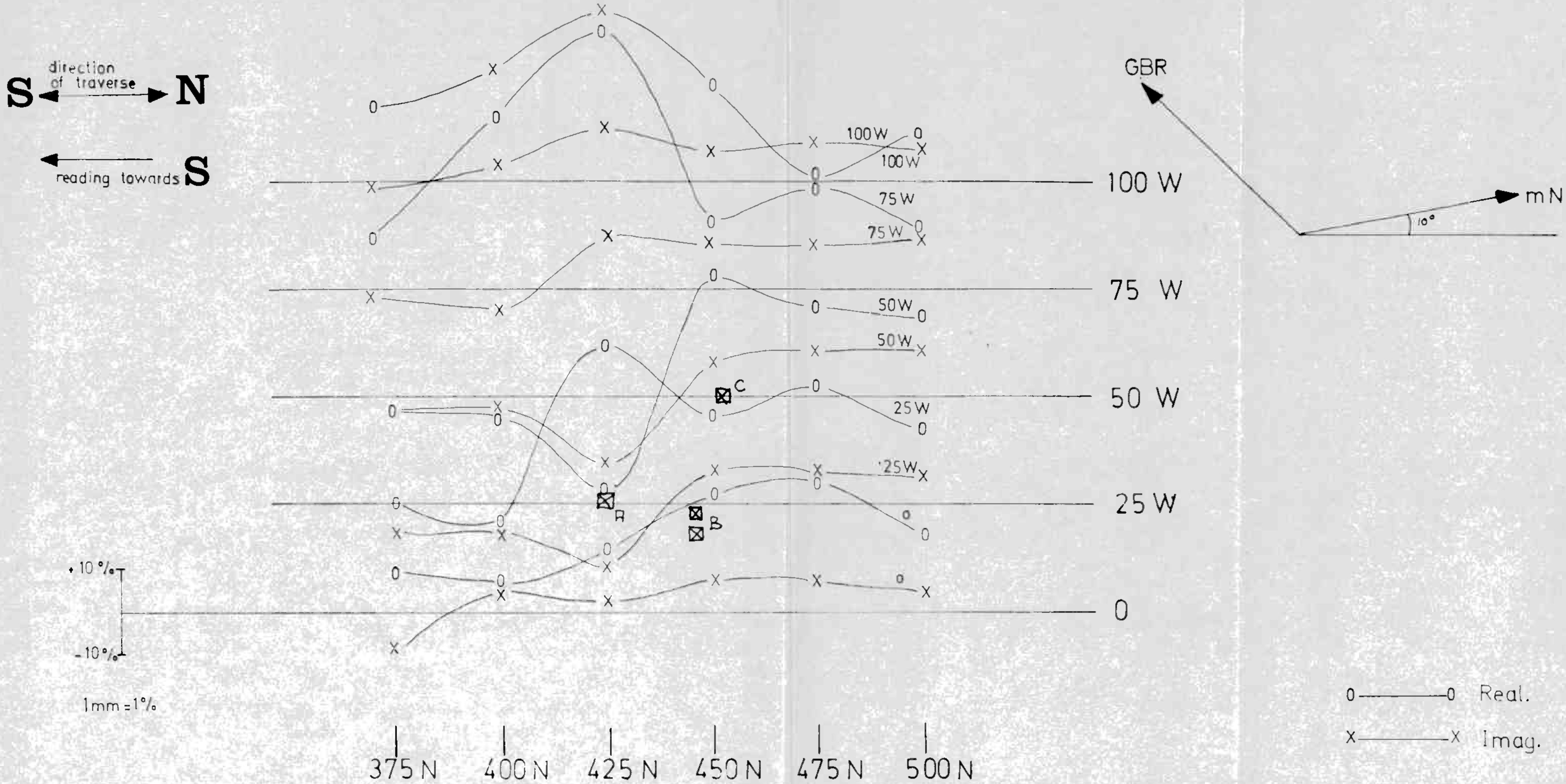
A.s Terrkopi. 1000. A 3. E 9 gl. 10-71. Sentrum Trykkeri.



FRASER data computed from tilt angle in phase data
contour interval every 10 (negatives ignored)

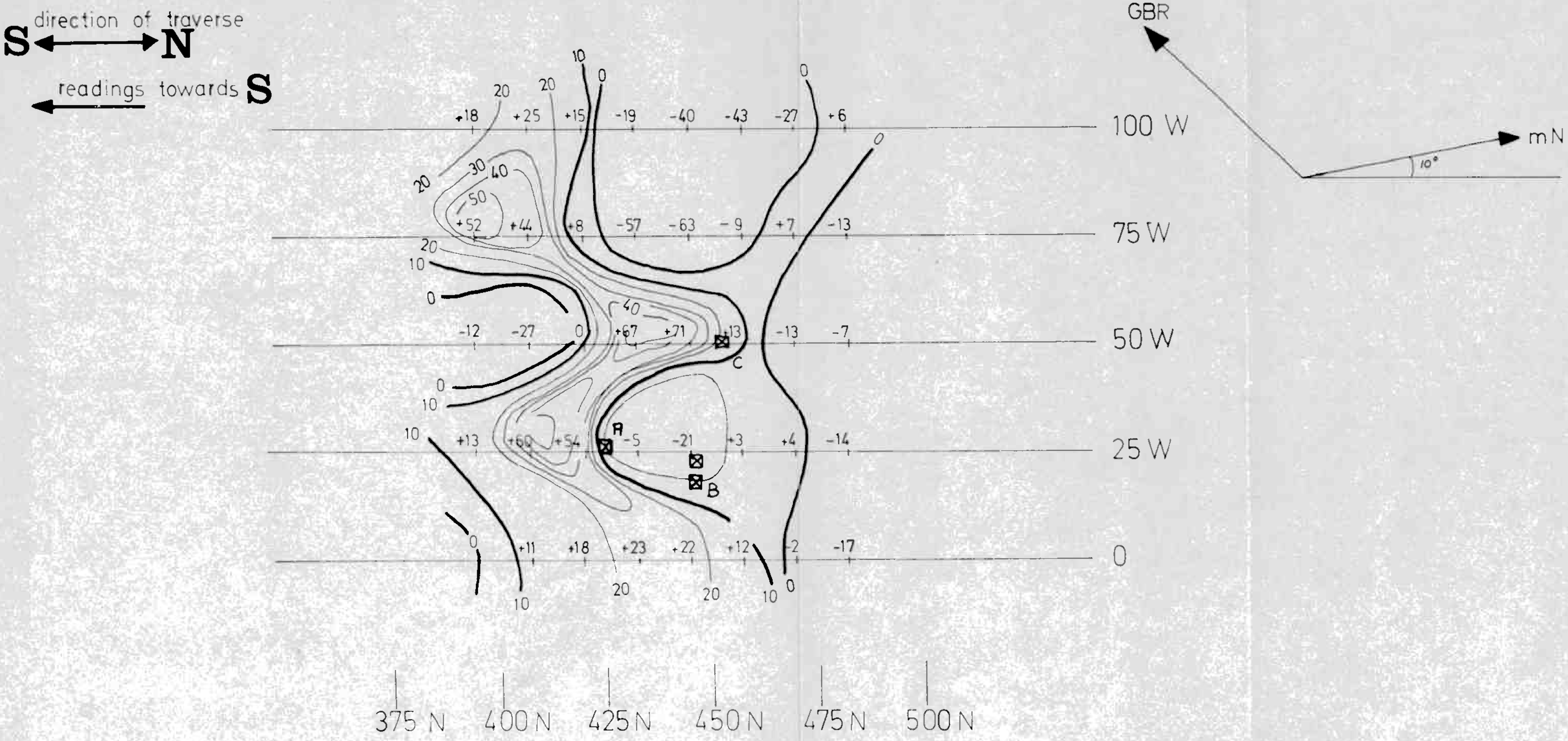
BIRKELAND TEST GRID Geonics EM 16 VLF Station (Rugby) 16,0 kHz Contouring of FRASER computed data	SCALE 1:1000	OBS. FIH 2-72 DRAW. FIH 9-72 TRAC. BL 10-72 CHK. FIH 10-72
A/S **SULFIDMALM**	MAP NO. 7/72/116	MAP SHEET

A.s Terrkopi. 1000. A 3. E 9 gl. 10-71. Sentrum Trykkeri.



BIRKELAND TEST GRID Geonics EM 16 VLF Station (Rugby) 16,0 kHz	SCALE 1:1000	OBS. FIH	2-72
		DRAW. FIH	9-72
		TRAC. BL	9-72
		CHK. FIH	10-72
A/S **SULFIDMALM**	MAP NO. 7/72/117		
	MAP SHEET		

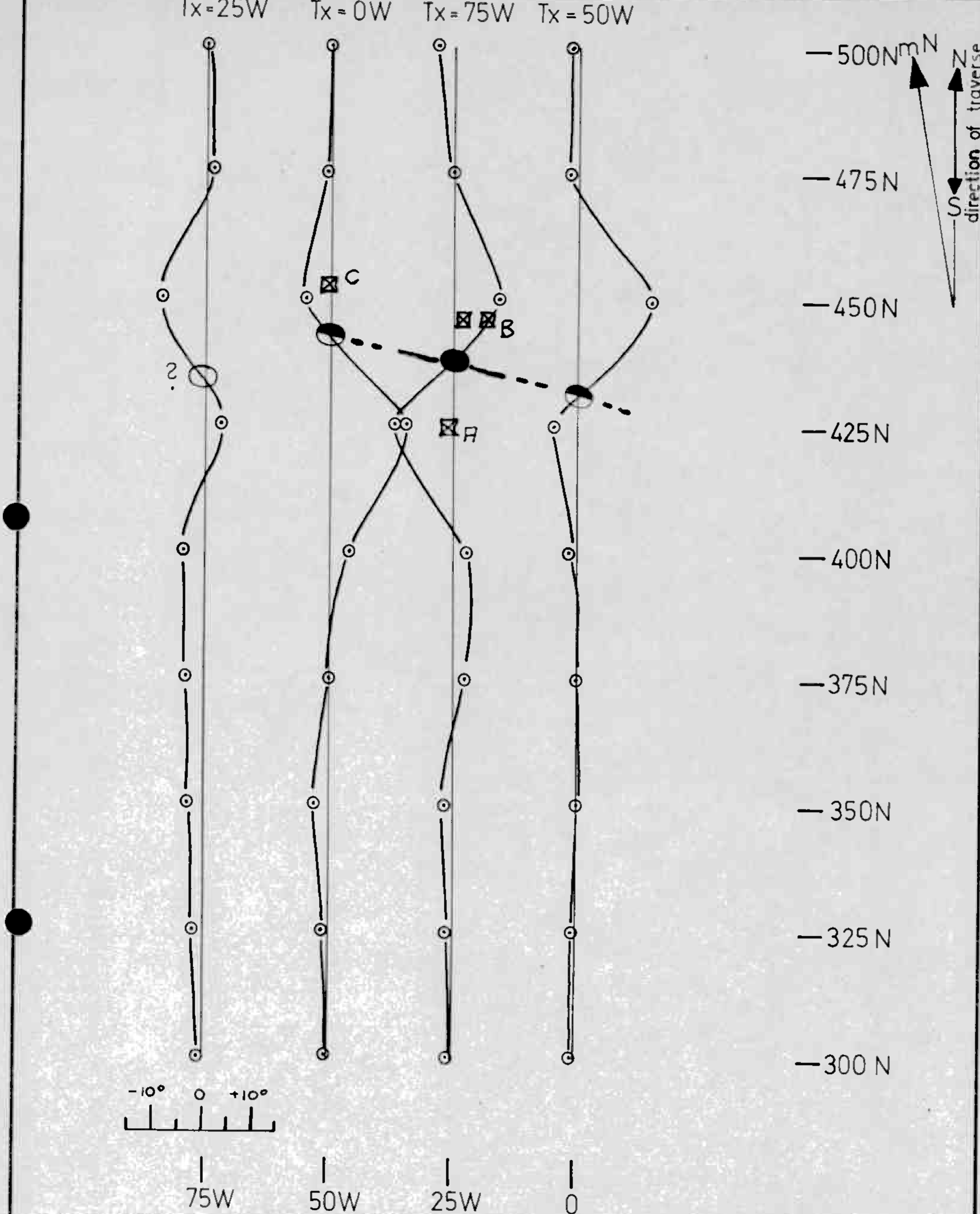
A.s Tegnekopi. 1000. A 3. E 9 gl. 10-71. Sentrum Trykkeri.



FRASER data computed from tilt angle in phase data
contour interval every 10 (negatives ignored)

BIRKELAND TEST GRID Geonics EM 16 VLF Station (rugby) 16,0 kHz Contouring of FRASER computed data.	SCALE 1:1000	OBS. FIH	2-72
		DRAW. FIH	9-72
		TRAC. BL	10-72
		CHK. FIH	10-72
A/S SULFIDMALM	MAP NO. 7/72/118		
	MAP SHEET		

A.s Terrkopi. 1000. A 3. E 9 gl. 10-71. Sentrum Trykkeri.



KEY:

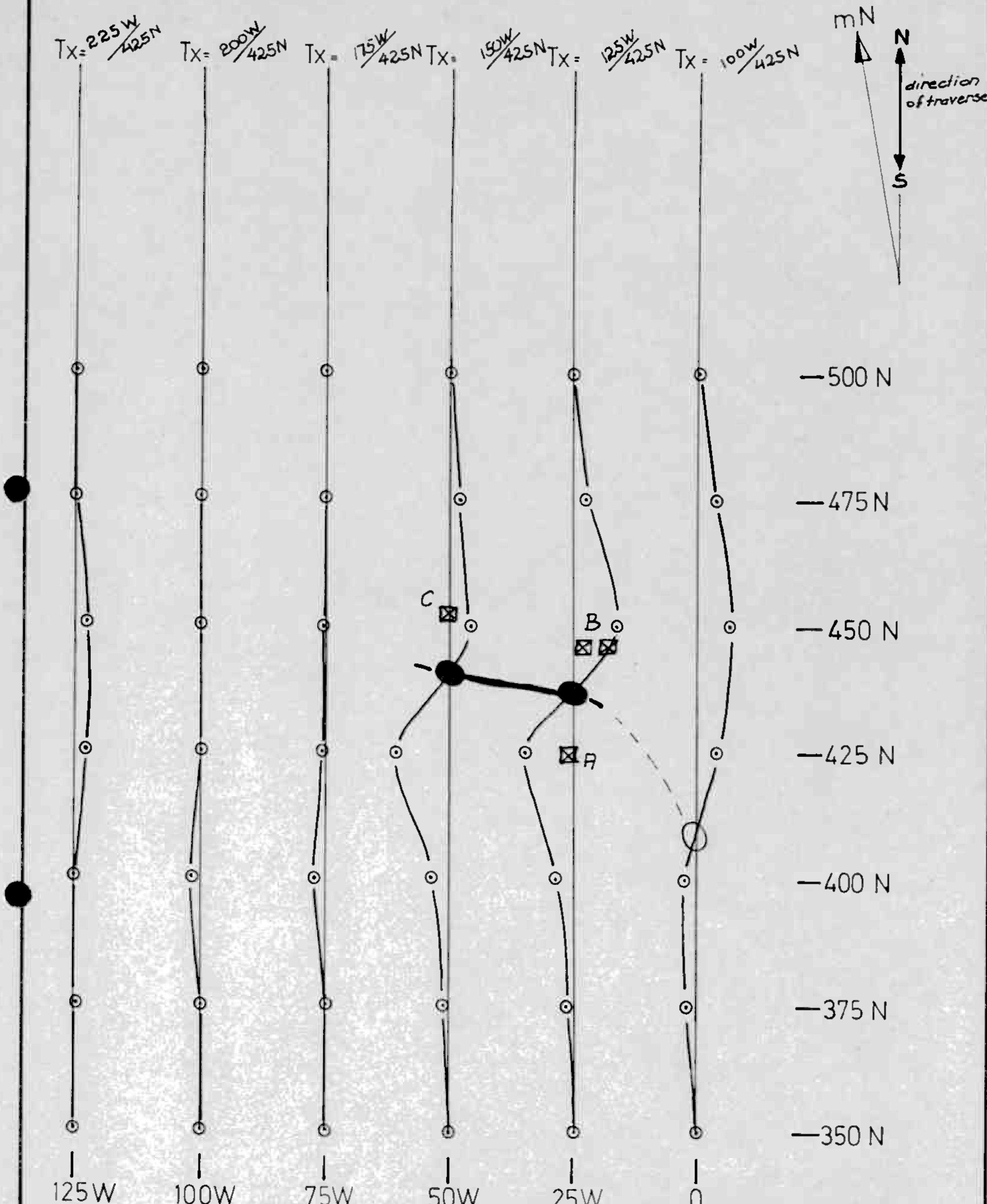
- STRONG CONDUCTOR
- MODERATE 〃
- WEAK 〃

A/S SULFIDMALM

BIRKELAND TEST GRID

Crone vertical loop
broadside technique
freq = 1830 Hz

SCALE	1:1000	DRAWN	FIH
map	7/72/119	TRACED	UT



KEY :

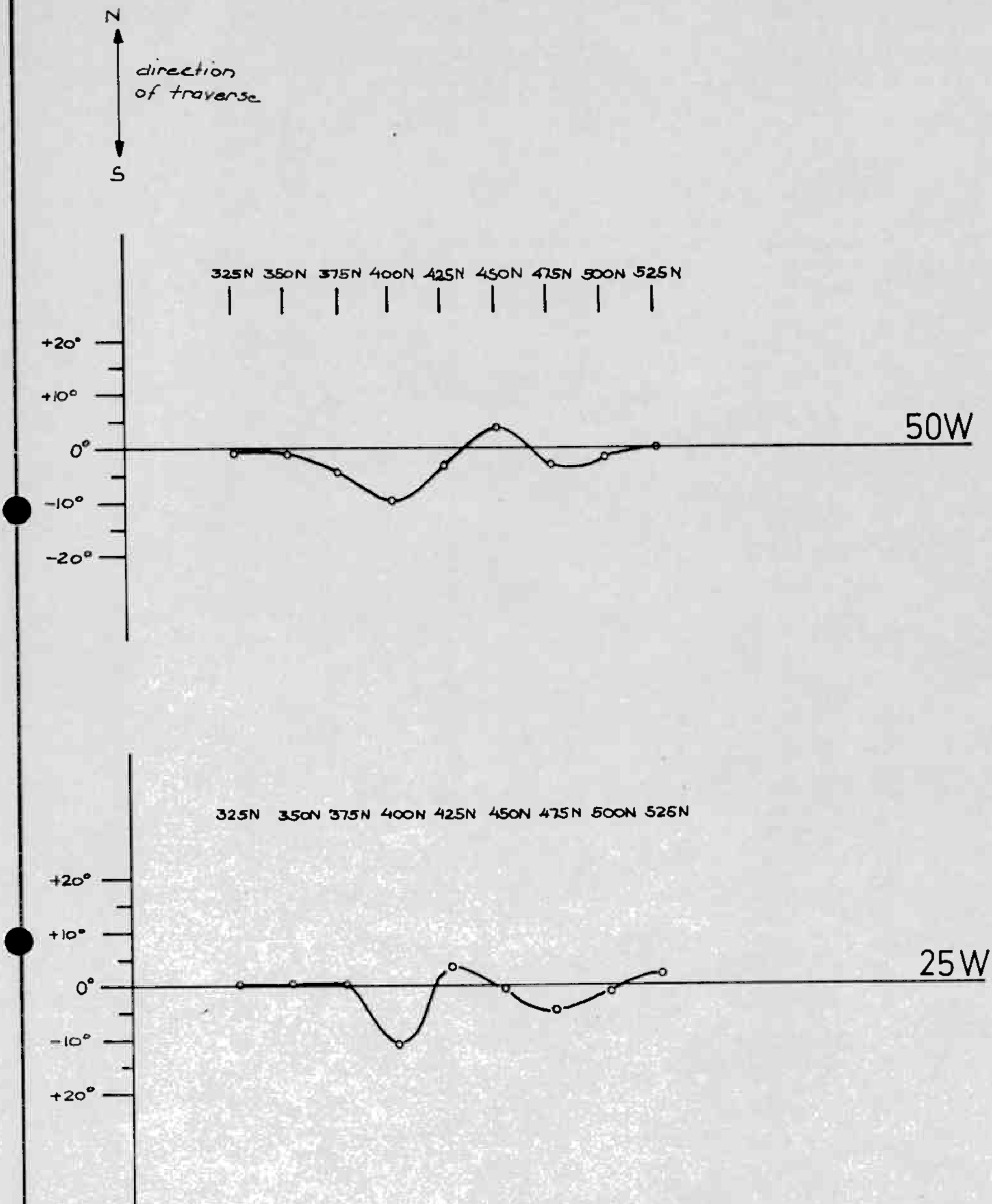
- STRONG CONDUCTOR
- MODERATE "
- WEAK "

A/S SULFIDMALM

BIRKELAND TEST GRID

Crone vertical loop
fixed transmitter station
freq 1830 Hz

SCALE	1:1000	DRAWN	Fi. H.
map	7/72/120	TRACED	U. T.

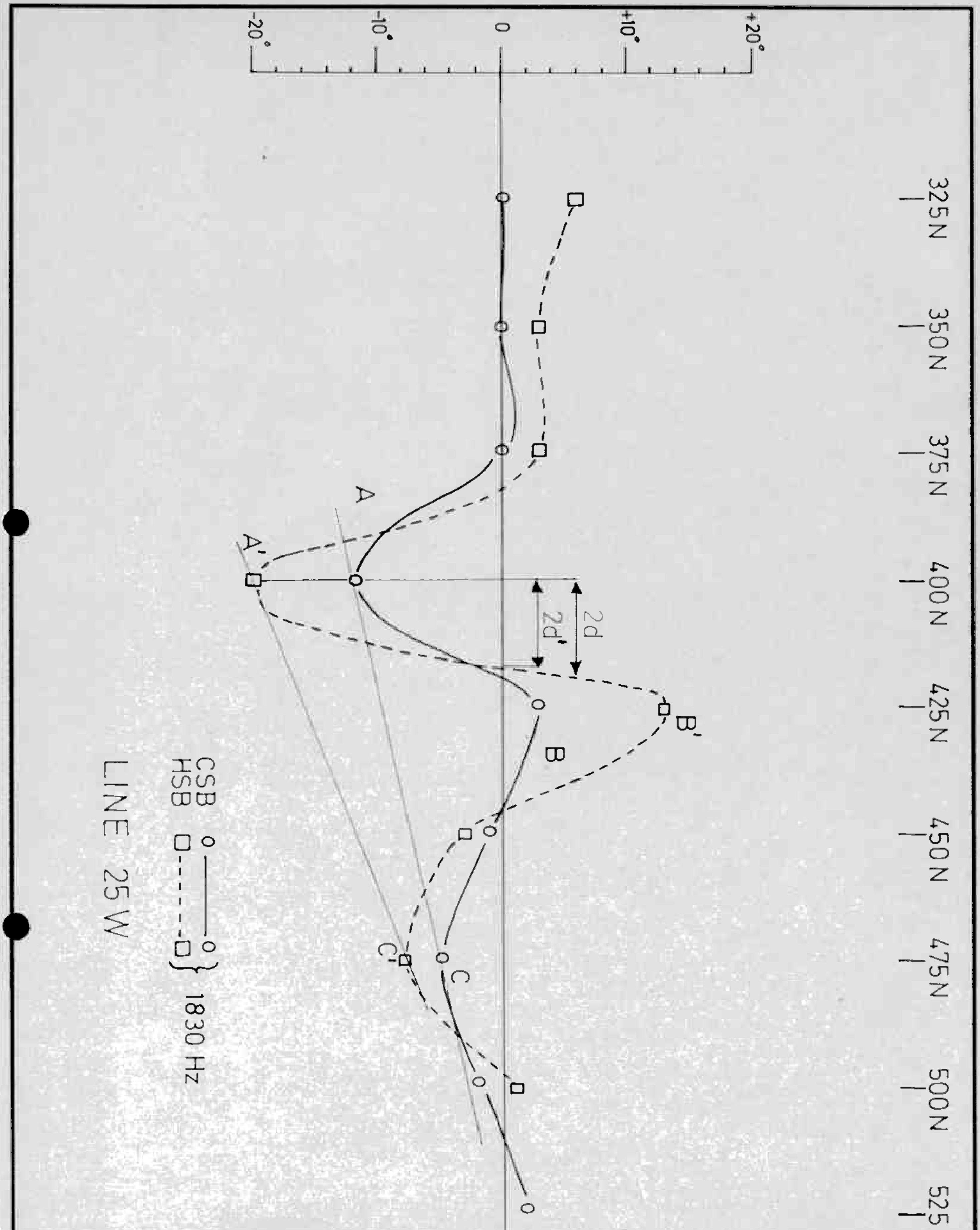


A/S SULFIDMALM

BIRKELAND TEST GRID

Crone coaxial shootback
Freq = 1830 Hz

SCALE	1:2500	DRAWN	Fi. H.
map	7/72/121	TRACED	U. T

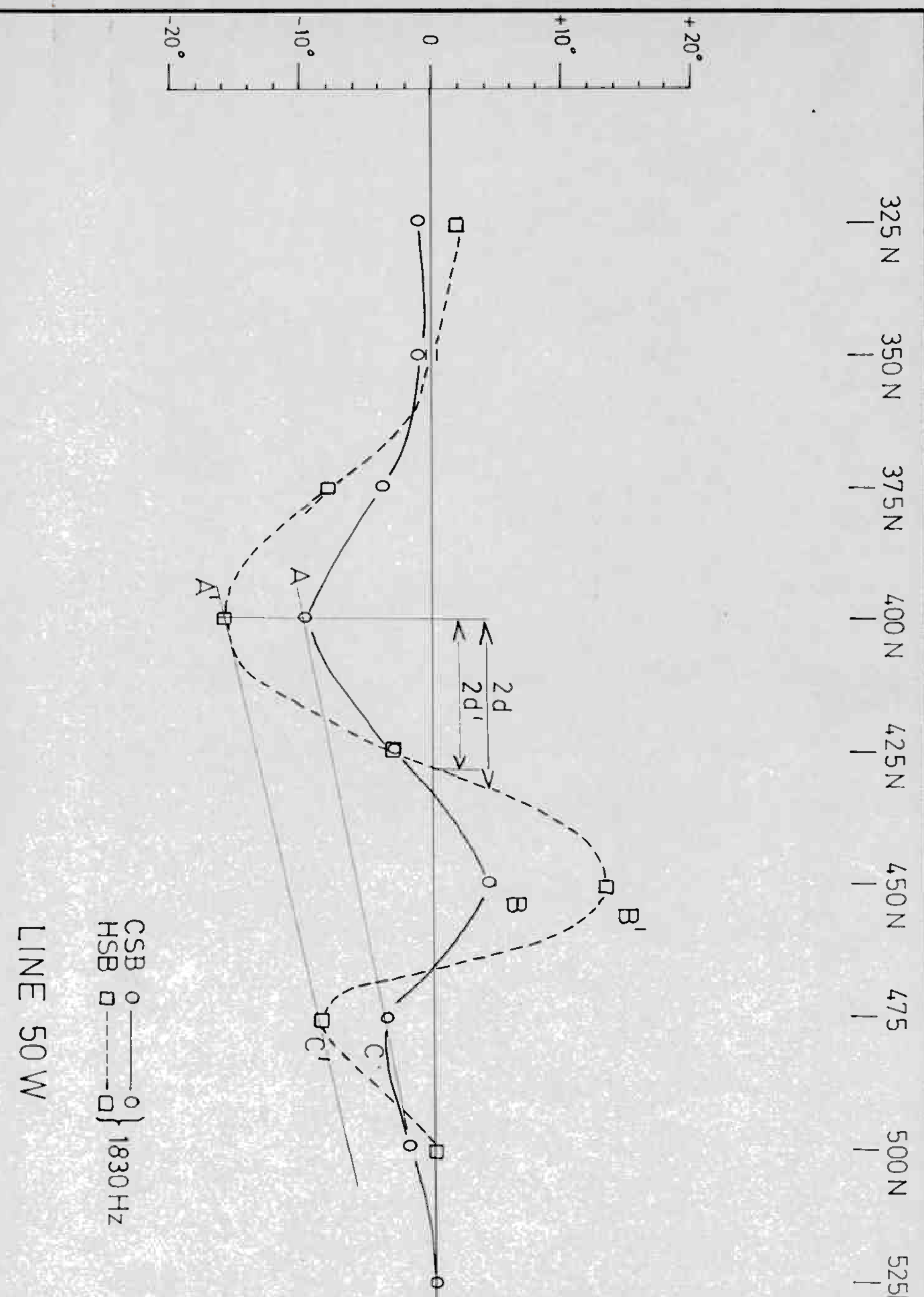


Constructed interpret.	CSB	HSB
Top of conductor	425 N	425 N
Depth	10m	9m
Dip	77°S	68°S

A/S SULFIDMALM

BIRKELAND TEST GRID

SCALE	1:1000	DRAWN	FIH
map	7/72/122	TRACED	BL



Constructed interpret.	CSB	HSB
Top of conductor	450 N	450 N
Depth	16 m	14,5 m
Dip	78°S	77°S

A/S SULFIDMALM

BIRKELAND TEST GRID

SCALE 1:1000	DRAWN FIH
map 7/72/123	TRACED BL

FALCONBRIDGE
LABORATORIERAPPORT

Geol.avd.

554.04 21

Dato 26.2.1973

Analyse-konto		Ni	Co	Cu	Fe	S			(New file – Birkeland)
	Hull no. 1 pr 1, 1.5-2 m Birkeland	0.14	0.17			2.6			
	" " 1 pr 2, 3-4 m "	0.40	0.45			9.6			
	" " 1 pr 3, 4-5 m "	0.14	0.18			3.0			
	" " 1 pr 4, 5-6 m "	0.17	0.15			3.2			
	" " 1 pr 5, 6-6.5 m "	0.18	0.20			3.3			
	" " 1 pr 6.5-7 m "	0.09	0.11			0.7			
	Hull no. 2 pr 1, 1.5-2 m Birkeland	0.11	0.12			1.5			
	" " 2 pr 2, 3.5-4 m "	0.29	0.19			7.5			
	" " 2 pr 3, 4-5 m "	0.43	0.28			10.5			
	" " 2 pr 4, 5-6 m "	0.16	0.15			3.0			
	" " 2 pr 5, 6-6.5 m "	0.14	0.12			2.5			
	" " 2 pr 6, 6.5-7 m "	0.09	0.12			1.4			
	" " 2 pr 7, 7-7.5 m "	0.07	0.10			1.6			
	" " 2 pr 8, 7.5-8 m "	0.07	0.15			1.9			

[illegible]

Bl. 21.03

FALCONBRIDGE
LABORATORIERAPPORT

Geol.avd.

Dato 26.2.1973

Analyse-konto		Ni	Cu	~~Cu~~	Fe	S			
	Hull no. 1 pr 1, 1.5-2 m Birkeland	0.14	0.17			2.6			Fig 3
	" " 1 pr 2, 3-4 m "	0.40	0.45			9.6			
	" " 1 pr 3, 4-5 m "	0.14	0.18			3.0			
	" " 1 pr 4, 5-6 m "	0.17	0.15			3.2			
	" " 1 pr 5, 6-6.5 m "	0.18	0.20			3.3			
	" " 1 pr 6.5-7 m "	0.09	0.11			0.7			
	Hull no. 2 pr 1, 1.5-2 m Birkeland	0.11	0.12			1.5			
	" " 2 pr 2, 3.5-4 m "	0.29	0.19			7.5			
	" " 2 pr 3, 4-5 m "	0.43	0.28			10.5			
	" " 2 pr 4, 5-6 m "	0.16	0.15			3.0			
	" " 2 pr 5, 6-6.5 m "	0.14	0.12			2.5			
	" " 2 pr 6, 6.5-7 m "	0.09	0.12			1.4			
	" " 2 pr 7, 7-7.5 m "	0.07	0.10			1.6			
	" " 2 pr 8, 7.5-8 m "	0.07	0.15			1.9			

Bl. 21.03