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E.L. 1/77

GEOPEKO
 PROGRESS REPORT ON GEOPHYSICS
 GRANVILLE EAST
 ROCKY CAPE, TASMANIA
 J. D. H. SUMPTON
 NOVEMBER 1982

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1. INTRODUCTION

This report discusses geophysical exploration techniques used on the Granville East magnetite/pyrrhotite-tin prospect, and in particular covering the period since the last reporting in June 1982.

The Granville East aeromagnetic anomaly was originally chosen for further examination on the grounds that it may be related to tin bearing skarn mineralization, given its discrete nature and proximity to the Heemskirk Granite. Tin mineralization in such a case would be associated with either magnetite or pyrrhotite. Hence the geophysical character of such bodies would be that they were:

- a. anomalous in their magnetic susceptibility.
- b. anomalously conductive if the mineralization was concentrated in massive pyrrhotite.

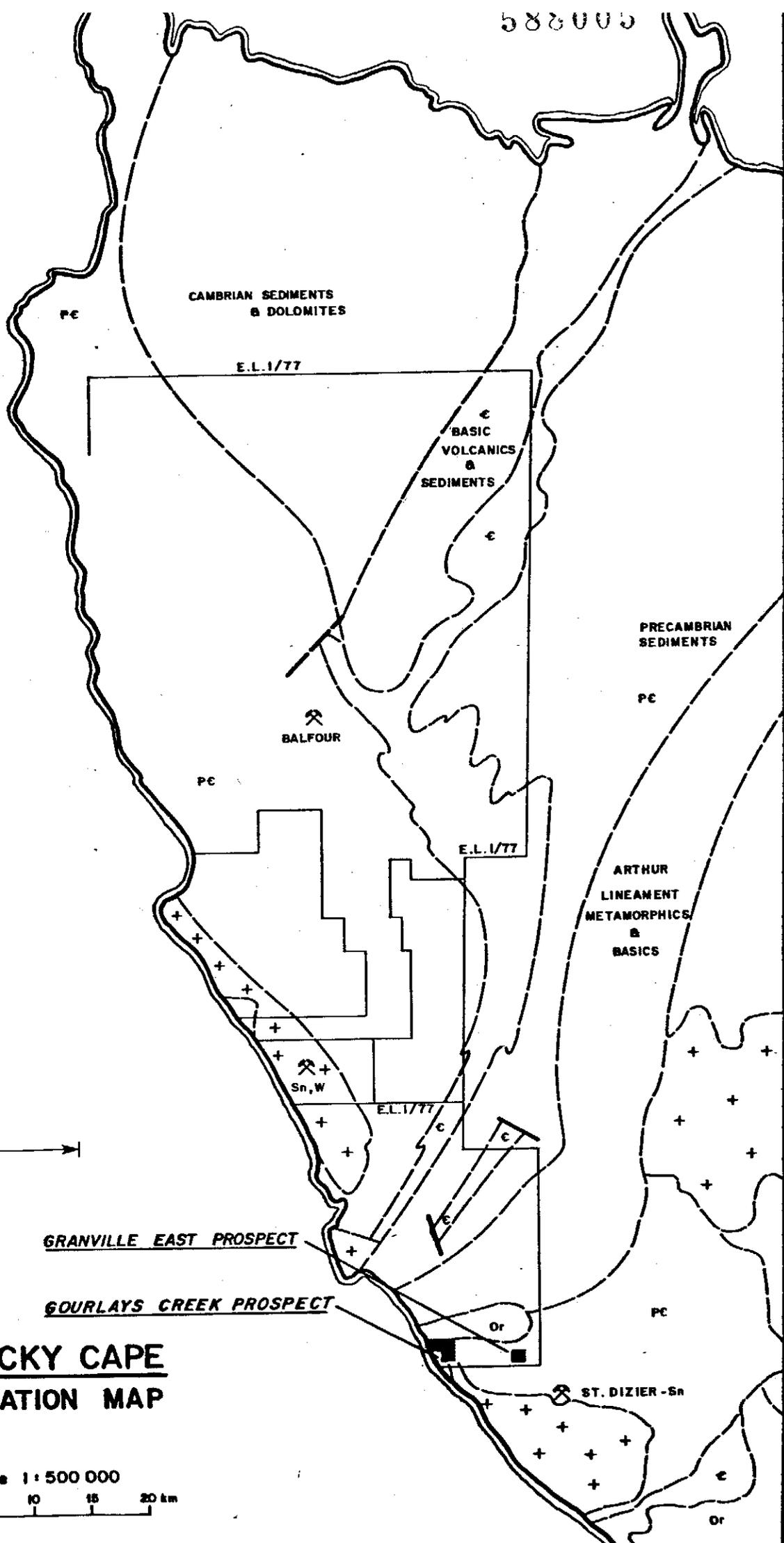
Also there is evidence that the style of mineralization expected at Granville East would be closely related to black shale sequences. These in turn would be expected to have a conductivity contrast with other rock types in the area.

From these considerations geophysical methods were chosen which would respond to these anomalous physical properties, i.e. the measurement of total magnetic intensity, self potential and SIROTEM. The timing of these various techniques is presented in the table below.

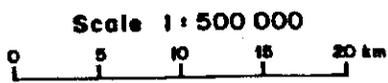
Airborne Magnetometer Survey	August 1981
Reconnaissance Ground Magnetics	September 1981
Detailed Ground Magnetics	November 1981
Self Potential	June 1982
Infill Ground Magnetics	August 1982
SIROTEM Survey	October 1982

In addition the 5 diamond drill holes have been logged for magnetic susceptibility.

Detailed descriptions of the surveys not covered in this report can be found in Heithersay and Sumpton (1982) and Sumpton (1982).



**E.L.1/77 ROCKY CAPE
PROJECT LOCATION MAP**



2. MAGNETICS

As well as providing the lead in to the area, magnetometry has provided the primary geophysical tool in the search for concentrations of magnetite or pyrrhotite, hopefully carrying tin. From the first it was recognised that the magnetic picture was complex, the magnetic intensity being a composite of the combined affects of numerous magnetic sources of widely varying size, shape and magnetic properties. Subsequent drilling and testing of magnetic properties from surface and drill core have confirmed this. The magnetic properties which characterise the various rock types present have been determined to be as follows:

Quartzites and Siltstones

Containing very little magnetic material, for practical purposes may be regarded as non magnetic.

Black Shales and Mudstones

Often containing varying concentrations of disseminated pyrrhotite, and with that concentration varying from weakly magnetic to moderately magnetic.

Unaltered Carbonates

May be considered to be non magnetic.

Banded Calcsilicates

These horizons may be unmineralized or maybe replaced by increasing percentages of magnetite or pyrrhotite. When barren they may be treated as non magnetic, whilst their susceptibility increases with increasing concentrations of magnetite or pyrrhotite until they are strongly magnetic when containing significant amounts of magnetite.

Remnant Magnetism

Seven samples have so far been sent to the C.S.I.R.O. for magnetic analysis. Their report of the results of this analysis is appended. The samples comprised 2 samples from surface costeans, 5 from drill holes. 4 of the samples (including the 2 from surface) were of pyrrhotite and/or magnetite bearing potential ore material, whilst the remaining 3 consisted of pyrrhotite bearing black shale. Without regard to composition or rock type, the samples show high and variable values of Koenigsberger ratio and large variations in NRM directions. The mean NRM direction has a declination of 166° and an inclination of $+3^{\circ}$ with a 'cone of confidence' of 23° . In addition to this stable component there is a magnetically soft component which would in situ be expected to be aligned roughly parallel with the current field direction.

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The variation in the NRM properties makes it impossible to reliably ascribe a resultant magnetization to any theoretical body, which makes reliable modelling extremely difficult, and weakens any correlation between magnetic mineral content and resultant magnetization.

The conflict of dip that has arisen from magnetic interpretation and geological evidence can most likely be explained in the light of measured NRM characteristics. Such a large disparity between the NRM directions observed and the present field would be expected to distort the shape of the magnetic profile in such a way as to give rise to an erroneous estimates of dip.

It should be noted that there is considerable doubt concerning the reliability of the orientation of some of the samples, and this taken with the small number of samples analysed to date raises the possibility that the NRM characteristics may not be as scattered as they currently appear. More sampling is required to establish this.

Infill Magnetics

Subsequent to the last report the bulk of the grid has had magnetic intensity read on 50m line spacings. The infill data has confirmed the complexity of the magnetic field, particularly south of line 10100N. It has however brought out the continuity of several trends and better defined the existing anomalies. The more significant responses are discussed in detail below. The following interpretation refers to Plan 25.

Zone A is a zone of near surface spikey anomalies adjacent to the quartzite contact. This has been shown to correspond to a tin bearing magnetite-pyrrhotite unit.

Zone B sits adjacent to the quartzite contact in a position similar to that of Zone A to the north, with which it is most likely continuous being folded with the contact around 9850N. This is also likely to be attributable to magnetic skarn material with or without pyrrhotite bearing black shales. Here the source of the response seems deeper than the source of Zone A producing broader anomalies.

Zone C this trend parallels Zone B some 200m to the west and shows some evidence of similar folding around 9850N. From the evidence of DDH 2 it would appear that it is caused by pyrrhotite bearing black shales interbedded with narrow units of banded pyrrhotite serpentine skarn.

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Zone D is a less well developed trend once again more or less parallel to Zone B and Zone C and further to the west. Its source is also likely to be pyrrhotitic black shales with or without skarn material.

Zone E this anomaly lies in a similar position with respect to the quartzite contact to Zone A, and is also similar in showing evidence of near surface magnetic material. Therefore it seems likely that it too is caused by a narrow near surface magnetite/pyrrhotite unit, possibly carrying tin.

Zone F is a broad continuous anomaly sitting in a similar relationship to the quartzite contact as Zone A etc. From the evidence of DDH 3 it appears that around 10200N the anomaly has as its source pyrrhotite rich black shales. The foregoing does not rule out however, the possibility that elsewhere this anomaly is at least partly attributable to skarn material.

Drilling

Drill Holes DDH 1, DDH2 and DDH3 have at least partly been drilled to test magnetic anomalies. DDH1 clearly intersected the narrow magnetic unit whose near surface expression gave rise to the spike anomaly on line 10000N. Hole DDH5 was sited to intersect this horizon at depth, which it was successful in doing. DDH 2 and DDH3 both intersected sufficient magnetic material (taking remnance into account) to generate the magnetic anomaly at the surface, though the bulk of the material in each case was, as mentioned above pyrrhotite bearing black shale. DDH 2 and DDH3, both drilled on line 9700N, both showed considerably higher measured susceptibilities over their length than the other drill holes. This raises the possibility that the large, broad anomaly in this area has as its source a considerable thickness of moderately magnetic black shale material.

An illustration of the difficulty involved in reliable interpretation of magnetic anomalies in this area comes from the sample taken from DDH3 sent to the C.S.I.R.O. for magnetic analysis. The measured magnetic susceptibility is 300×10^{-6} c.g.s. units (about 0.004 SI), a typical figure for pyrrhotitic black shales in this area. However the measured value of the Koenigsberger ratio is 32, and the stable NRM direction some 83° different in declination and 101° different in inclination from the present field. Hence the resultant magnetization is quite large and in a direction completely different from the induced component. If these figures were typical of the drilled section a sizeable anomaly would be developed over the black shale unit, if they were atypical then a very different anomaly would emerge

Susceptibility logs of the five drill holes are presented in Figures 11 through 15.

Conclusion

From drilling and subsequent magnetic analysis of the rock types intersected it has become clear that broadly there are two major sources of magnetic anomalies within the area, pyrrhotitic black shales and pyrrhotite/magnetite skarn material. The susceptibility of the former is affected by the concentration of pyrrhotite and of the latter by this and the percentage of magnetite present. Also the magnetization of both is affected by a highly variable remnant vector. This means that, with the possible exception of narrow near surface horizons of skarn material, it is not possible to distinguish between these two on the evidence of magnetics alone. Nevertheless several horizons favourable for the occurrence of magnetic skarn with or without pyrrhotite bearing black shale have been indentified.

3. SIROTEM

The bulk of the Granville East grid (excluding the north-east corner bounded by 10000N, 10000E) was covered by the SIROTEM transient electromagnetic method. A total of 8.4 line kms were covered using 100m coincident loops with 50% overlap. The more significant responses were detailed using 50m loops, again with 50% overlap. Profiles of transient response are shown in Section 7 of this report. Contours of transient response for delay times of 2.6mS and 15.8mS are presented on Plans 26 and 27.

The response on all profiles shows clearly the difference in conductivity between the black shales to the west and the quartzites to the east. Superimposed on this however are a series of anomalous responses adjacent to or coincident with the contact between the two rock types, and distinct from the response attributable to the contact alone. They are largely coincident with and are certainly related to the magnetic horizons which occupy a similar position with respect to the contact. In order to better define the character of this trend three profiles were retraversed using a smaller 50m coincident loop. This data was subjected to a detailed interpretation which is set out below.

10400N

The response on this line is typical of the northern part of the grid when traversed with 100m loops. It is more or less coincident with the magnetic anomaly designated Zone F. The 50m loop traverse, which has its centres on 10375N, shows the anomaly to be double peaked. Comparison with curves derived from C.S.I.R.O. model studies shows that a possible source for this anomaly is a steeply dipping dyke, or some approximation thereof, which is quite shallow and of the order of 10m wide, centred under 9725E. The detail data confirms that the SIROTEM response and the magnetic anomaly share a common or very closely related source. See figure 1.

10000N

The data gathered using 100m loops on this line shows a response close to the costean exposed mineralization and the related spiky magnetic anomaly. The 50m loop data (centred on 10025N) shows a sharp spike centred over the magnetite gossan at 9750E. This response may be attributable to magnetite mineralization rather than a conductor (see Figure 6 for decay curve). To the west of this spike there is a more conventional response peaking around 9675E. It is this response that is largely responsible for the anomaly resolved from the 100m loop data. Although the proximity of the adjacent sharp spike makes it difficult to reliably determine the shape of this anomaly, it appears likely that it has as its source a dyke like body dipping to the east with top buried around 75m near 9600E (see Figure 2).

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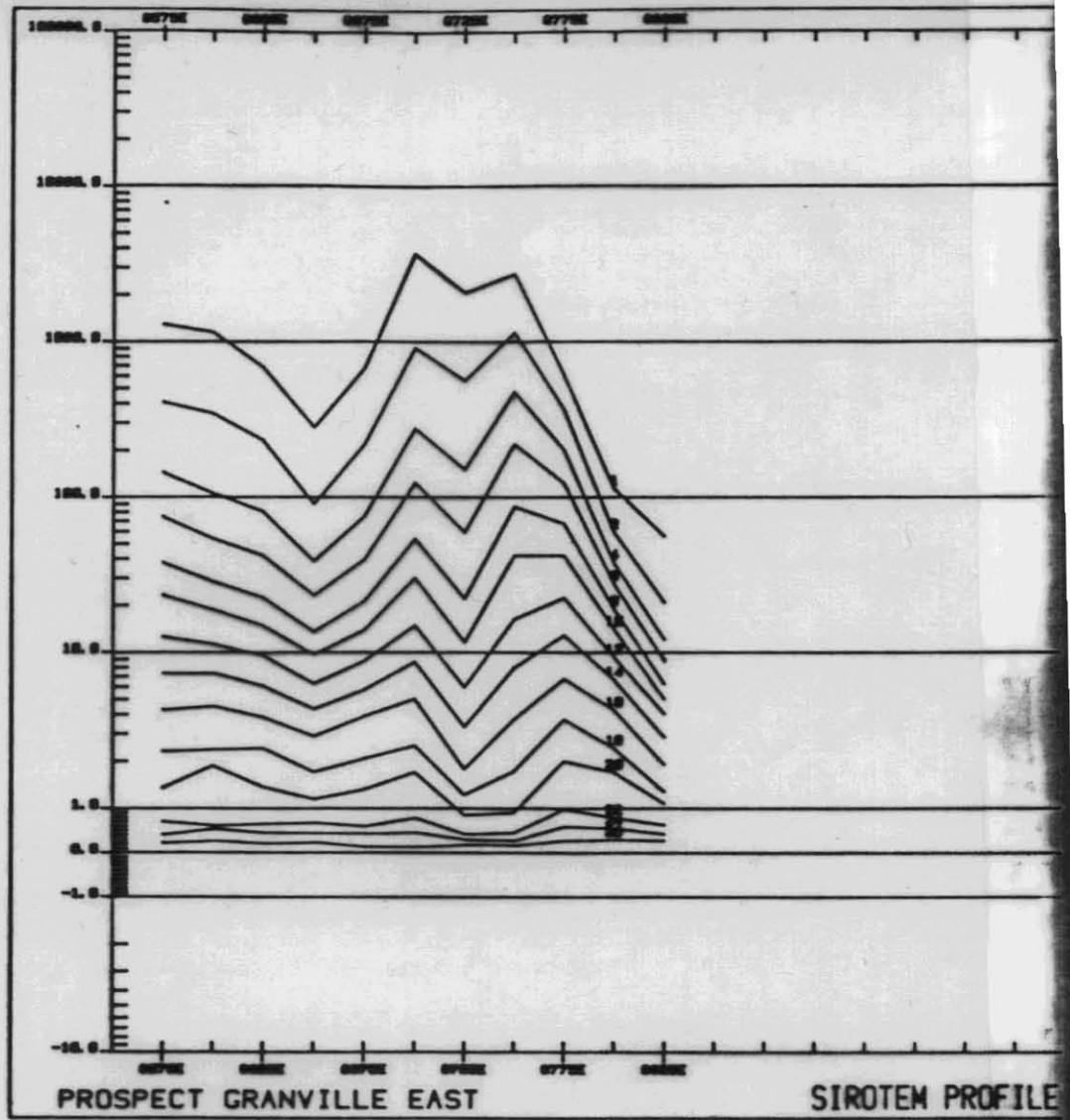
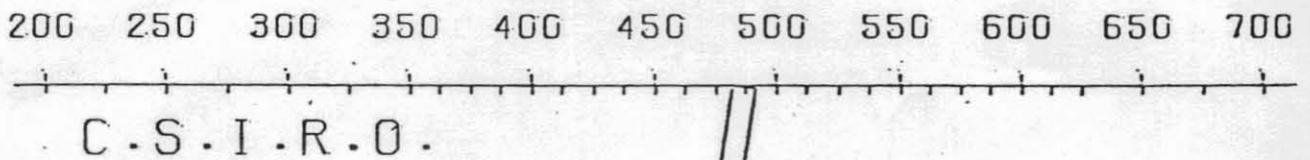
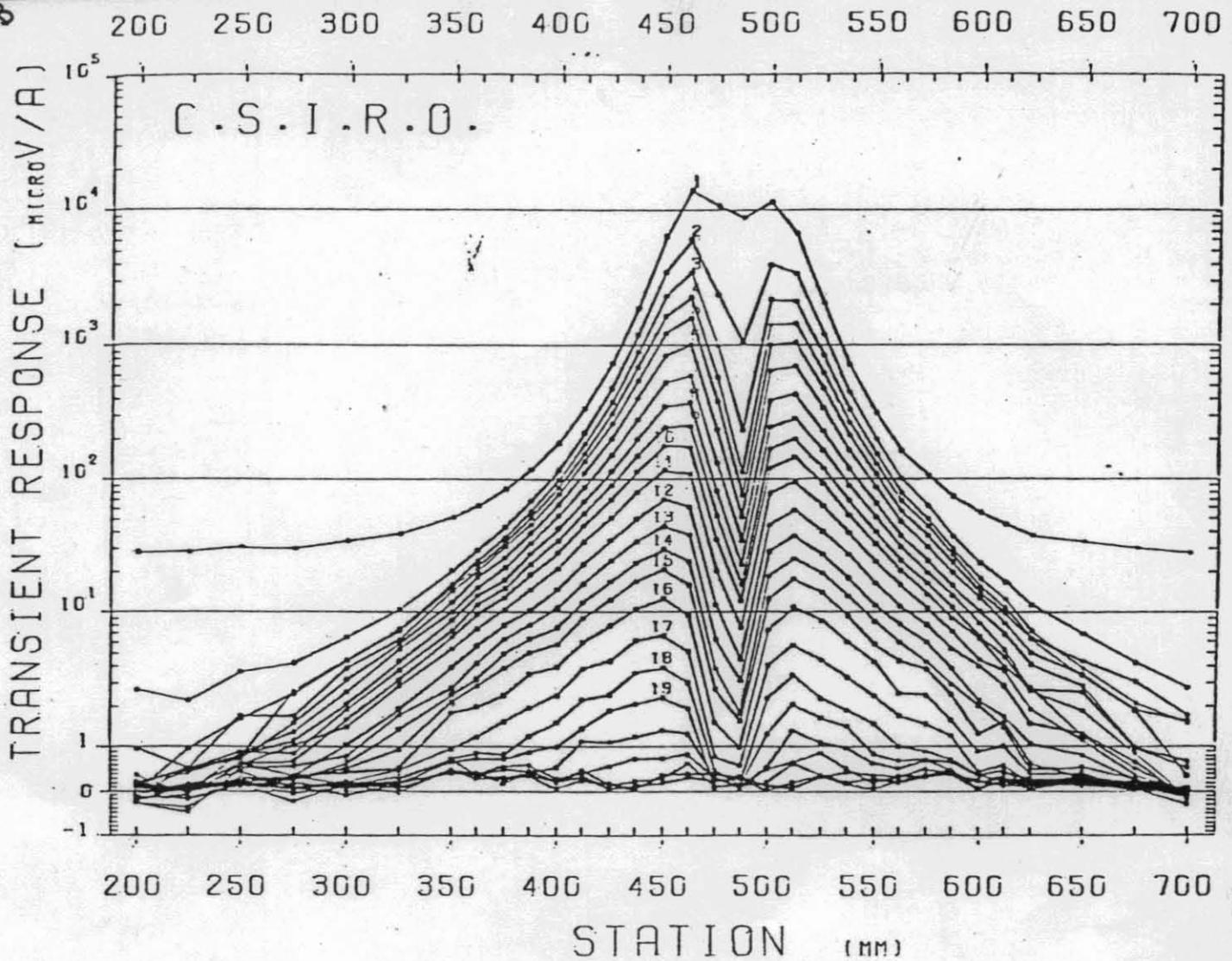


FIGURE 1

TRAVERSE 10375N
TRANSIENT RESPONSE

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LOOP CONFIGURATION:	CL	LOOP SIDE:	5G (MM)
LOOP SEPARATION:	G (MM)	SEPARATION/LOOP SIDE:	G
TRANSMITTER LOOP TURNS:	108	RECEIVER LOOP TURNS:	97
DIP:	82 (DEG)	STRIKE:	G (DEG)
LOOP ELEVATION:	G (MM)	BODY CONDUCTIVITY:	.17E+08 S.M ⁻¹
BODY WIDTH:	1G (MM)	HOST CONDUCTIVITY:	.00E+00 S.M ⁻¹
BODY DEPTH:	G.G (MM)	OVERBURDEN CONDUCTIVITY:	.00E+00 S.M ⁻¹

1101

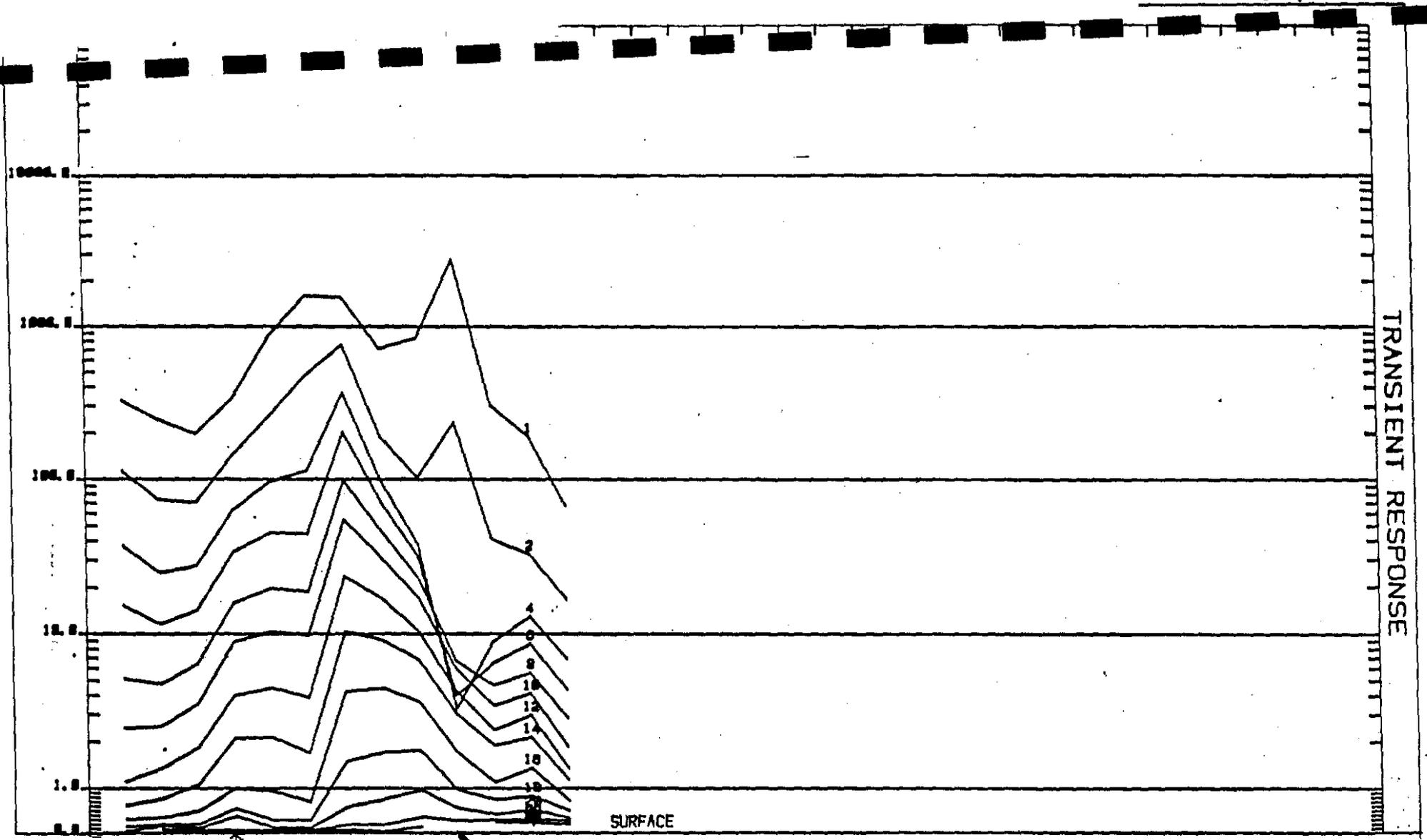


FIGURE 2
INTERPRETED SOURCES
OF SIROTEM RESPONSE-LINE 10025N

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This estimate was obtained through comparison with published scale model curves (Case No. 2.1.33).

The transient response decay curves for station 9750E using a 100m loop, and stations 9725E and 9700E using 50m loops were analysed using the following procedure.

1. The response due to a conducting half space was removed by fitting a power curve to the data with a power constant approximating $-5/2$ i.e.

$$\frac{E(t)}{I} = At^{-5/2}$$

2. The residual thus obtained is theoretically due to the response from an anomalous conductor, which should have the form

$$Ae^{-\frac{t}{\tau}}$$

where tau is the decay constant, which is related to the conductivity and size of the body.

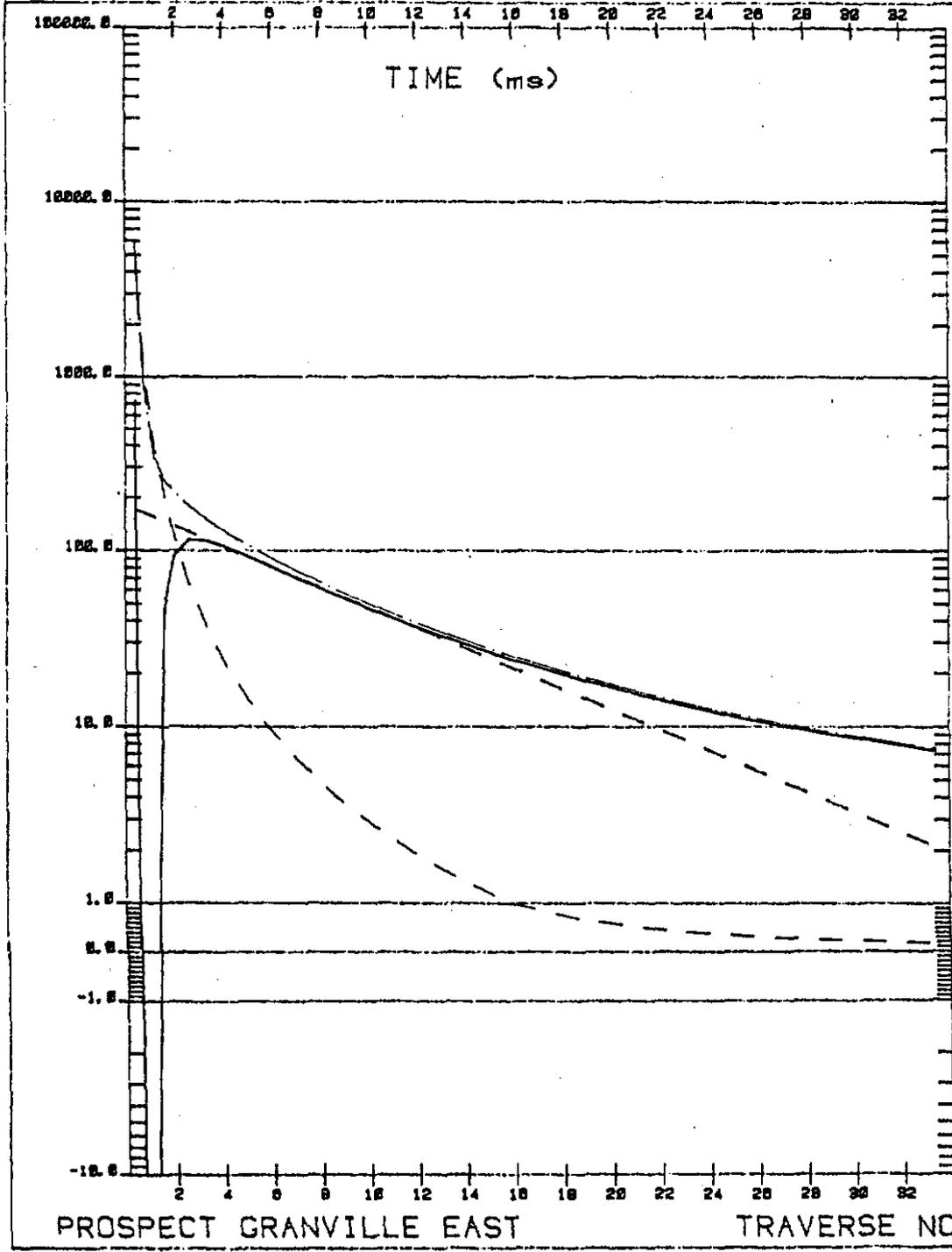
From the decay curves chosen for analysis the following decay constants were obtained for the body causing the anomalous response:

Station 9750E (100m loop) tau=7.5
 Station 9700E (50 m loop) tau=4.8
 Station 9725E (50. m loop) tau=5.7

These values would imply that the anomaly has a sulphide source. It is likely that the major contribution to the anomalous response seen in the decay curves is made by the western source, however the affect of the sharp spike to the east cannot be discounted. The analyses are presented in graphical form in Figures 3, 4 and 5.

9500N

A conductive response was interpreted to be centred around 10100E from the 100m loop data. This line was chosen for follow up rather than 9600N, which has a similar character, as the response on 9500N lies close to a sharp magnetic anomaly (anomaly E). Two traverses were run whose plotting points lie on 9475N and 9525N. On line 9475N there is a sharp response at 10050E which possibly relates to a shallow magnetite source similar to that producing the spike on line 10025N. Its correlation with the magnetic peak is also precise. The response on line 9525N may be attributable to an easterly dipping source (possibly the black shale/quartzite contact) near 10025E, however the decay curves show little which is anomalous.



SIROTEM RESIDUAL ANALYSIS

STATION 9750E _____ $\sigma(t)/I$ (micro V/A)
 STATION 9750E - - - - - $V = 812.050 \cdot \text{TIME}^{-2.3242}$
 STATION 9750E _____ RESIDUAL
 STATION 9750E - - - - - $V = 181.880 \cdot \text{EXP}(-.1934 \cdot \text{TIME})$

TAU=7.52

PROSPECT GRANVILLE EAST
 TRAVERSE NO. 10000N
 STATION 9750E
 CALCULATED TIMES .4 - 1.6

FUNCTION $V = \text{AMPLITUDE} \cdot \text{TIME}^{-A}$
 WHERE
 AMPLITUDE = 612.950386409
 A = 2.32424079851
 COEFFICIENT OF DETERMINATION = .980100131539
 COEFFICIENT OF CORRELATION = .990000066434

PROSPECT GRANVILLE EAST
 TRAVERSE NO. 10000N
 STATION 9750E
 CALCULATED TIMES 3 - 12

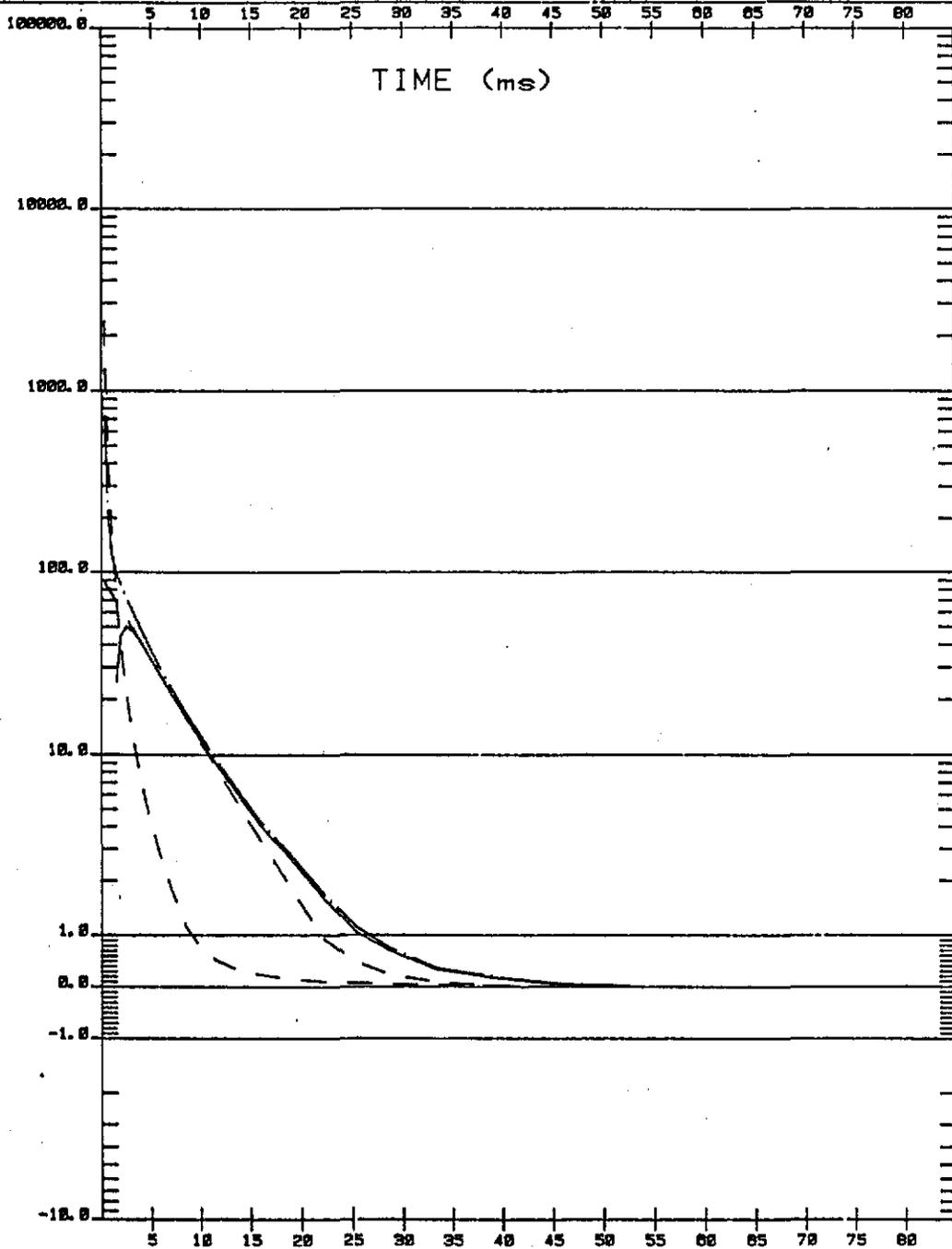
FUNCTION
 $V = \text{AMPLITUDE} \cdot \text{EXP}(-A \cdot \text{TIME})$ $\tau = 7.5 \text{ms}$
 WHERE
 AMPLITUDE = 181.6795541
 A = .133371297745
 COEFFICIENT OF DETERMINATION = .999567321062
 COEFFICIENT OF CORRELATION = .99977863663

TIME	RESPONSE	FUNCTION	RESIDUAL
.4	5871.00	5156.25	714.75
.6	838.70	1029.60	-190.90
1.0	351.80	401.23	-49.43
1.2	252.80	285.59	47.21
1.4	216.00	122.39	93.61
1.6	182.40	66.52	115.88
1.8	149.90	35.66	114.24
2.0	126.40	21.82	104.58
2.2	108.50	14.55	93.95
2.4	94.52	10.30	84.22
2.6	77.96	6.66	71.30
2.8	61.30	4.13	57.17
3.0	49.01	2.77	46.24
3.2	39.99	1.98	38.01
3.4	33.16	1.47	31.69
3.6	25.63	1.06	24.57
3.8	18.96	.65	18.31
4.0	14.56	.46	14.10
4.2	11.55	.33	11.22
4.4	9.52	.25	9.26
4.6	7.54	.18	7.36
4.8	5.78	.12	5.67
5.0	4.73	.08	4.65
5.2	4.11	.06	4.05

TIME	RESPONSE	FUNCTION	RESIDUAL
4	714.75	172.24	542.51
6	-190.90	163.29	-354.19
8	-49.43	154.01	-203.44
10	47.21	146.77	-99.56
12	93.61	139.14	-45.54
14	115.88	128.44	-12.56
16	114.24	115.44	-1.20
18	104.58	103.76	1.82
20	93.95	93.06	1.89
22	84.22	83.00	1.22
24	71.30	71.42	1.88
26	57.17	57.70	1.47
28	46.24	46.61	1.63
30	38.01	37.60	1.41
32	31.69	30.43	1.26
34	24.57	22.09	2.48
36	18.31	14.41	3.90
38	14.10	9.41	4.69
40	11.22	6.14	5.08
42	9.26	4.01	5.25
44	7.36	2.11	5.25
46	5.67	.96	4.71
48	4.65	.38	4.27
50	4.05	.16	3.89

LOOP SIZE=100m

FIGURE 3



SIROTEM RESIDUAL ANALYSIS

STATION 9700E _____ $v(t)/I$ (micro V/A)
 STATION 9700E - - - - - $V = 239.119 \cdot \text{TIME}^{-2.5000}$
 STATION 9700E _____ RESIDUAL
 STATION 9700E - - - - - $V = 95.528 \cdot \text{EXP}(-.2086 \cdot \text{TIME})$

TAU=4.79

PROSPECT GRANVILLE EAST
 TRAVERSE NO. 10025N
 STATION 9700E
 CALCULATED TIMES .4 - 2.6

FUNCTION $V = \text{AMPLITUDE} \cdot \text{TIME}^{-A}$
 WHERE
 AMPLITUDE = 239.113294223
 A = 2.5
 'A' INPUT BY OPERATOR

PROSPECT GRANVILLE EAST
 TRAVERSE NO. 10025N
 STATION 9700E
 CALCULATED TIMES 5 - 10

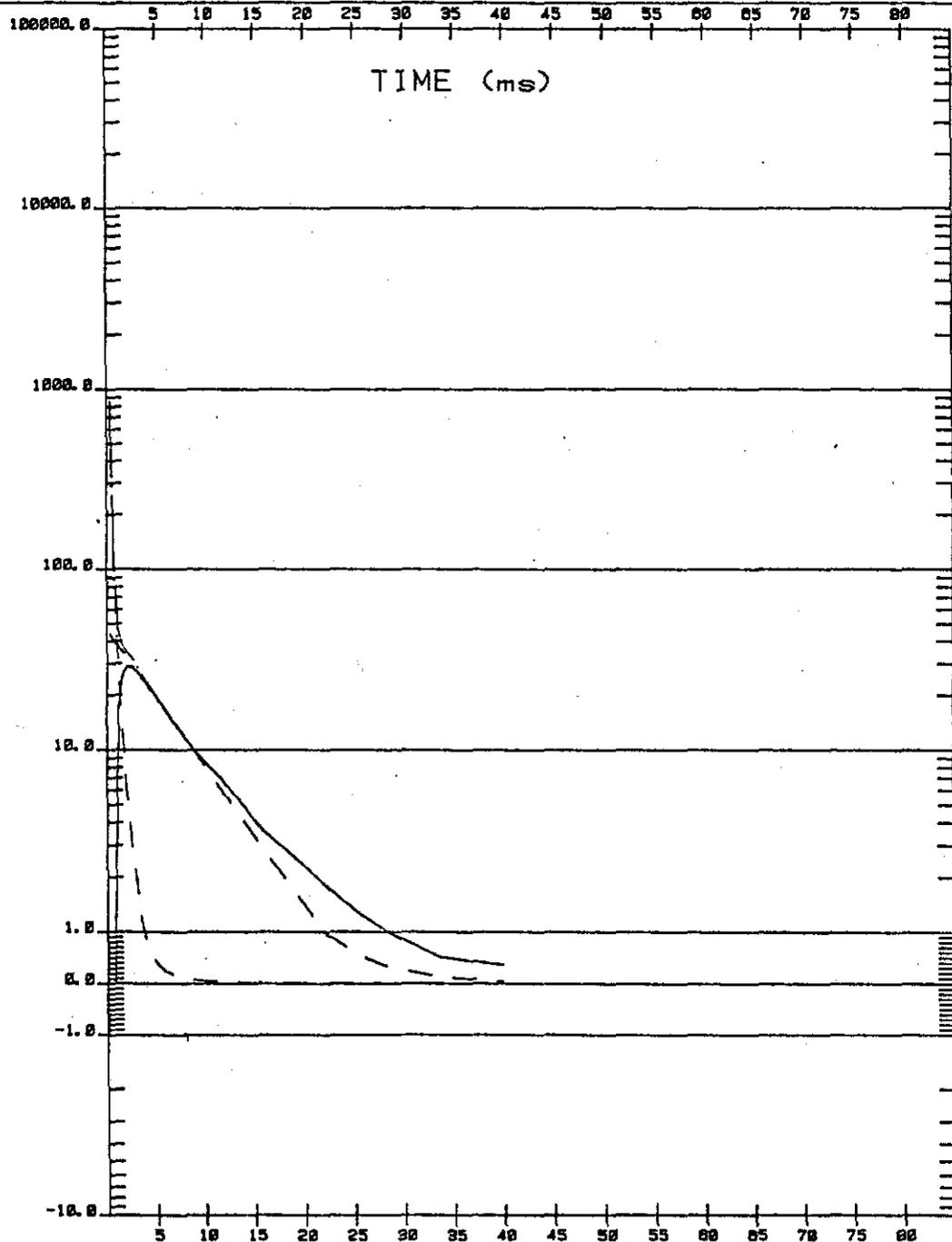
FUNCTION
 $V = \text{AMPLITUDE} \cdot \text{EXP}(-A \cdot \text{TIME})$
 WHERE
 AMPLITUDE = 95.5264270115
 A = .208575083234
 COEFFICIENT OF DETERMINATION
 = .999918254093
 COEFFICIENT OF CORRELATION
 = .999959126211

TIME	RESPONSE	FUNCTION	RESIDUAL	TIME	RESPONSE	FUNCTION	RESIDUAL
.4	720.15	2362.95	-1642.80	.4	-1642.80	87.88	-1730.68
.8	190.33	417.71	-227.39	.8	-227.39	80.85	-308.23
1.2	121.08	151.58	-30.51	1.2	-30.51	74.37	-104.88
1.6	98.85	73.84	25.01	1.6	25.01	68.42	-43.41
2.0	86.44	42.27	44.17	2.0	44.17	62.94	-19.78
2.6	72.25	21.94	50.31	2.6	50.31	55.54	-5.23
3.4	57.65	11.22	46.43	3.4	46.43	47.00	-1.57
4.2	46.71	6.61	40.09	4.2	40.09	39.78	.31
5.0	38.05	4.28	33.77	5.0	33.77	33.67	.10
5.8	31.38	2.95	28.43	5.8	28.43	28.49	-.06
7.0	23.97	1.84	22.12	7.0	22.12	22.18	-.06
8.6	17.03	1.10	15.92	8.6	15.92	15.89	.03
10.2	12.52	.72	11.00	10.2	11.00	11.38	-.42
11.8	9.16	.50	8.66	11.8	8.66	8.15	.50
13.4	6.90	.36	6.53	13.4	6.53	5.84	.69
15.0	4.49	.24	4.25	15.0	4.25	3.54	.71
19.0	2.79	.15	2.64	19.0	2.64	1.62	.92
22.2	1.71	.10	1.61	22.2	1.61	.93	.68
25.4	1.11	.07	1.04	25.4	1.04	.48	.56
28.6	.76	.05	.71	28.6	.71	.25	.46
33.4	.37	.04	.33	33.4	.33	.09	.24
39.0	.18	.02	.16	39.0	.16	.02	.13
46.2	.06	.02	.05	46.2	.05	.01	.04
52.6	.03	.01	.01	52.6	.01	.00	.01

LOOP SIZE=50m
 FIGURE 4

PROSPECT GRANVILLE EAST TRAVERSE NO. 10025N

588016



PROSPECT GRANVILLE EAST

TRAVERSE NO. 10025N

SIROTEM RESIDUAL ANALYSIS

STATION 9725E _____ $a(t)/I$ (micro V/A)
 STATION 9725E _____ $V = 52.100 \cdot \text{TIME}^{-3.0328}$
 STATION 9725E _____ RESIDUAL
 STATION 9725E _____ $V = 46.916 \cdot \text{EXP}(-.1757 \cdot \text{TIME})$

TAU=5.69

PROSPECT GRANVILLE EAST
 TRAVERSE NO. 10025N
 STATION 9725E
 CALCULATED TIMES 4 - 8

FUNCTION $V = \text{AMPLITUDE} \cdot \text{TIME}^{-A}$
 WHERE
 AMPLITUDE = 52.1988131286
 A = 3.03281163778
 COEFFICIENT OF DETERMINATION = 1.00000000005
 COEFFICIENT OF CORRELATION = 1.00000000002

PROSPECT GRANVILLE EAST
 TRAVERSE NO. 10025N
 STATION 9725E
 CALCULATED TIMES 5 - 10

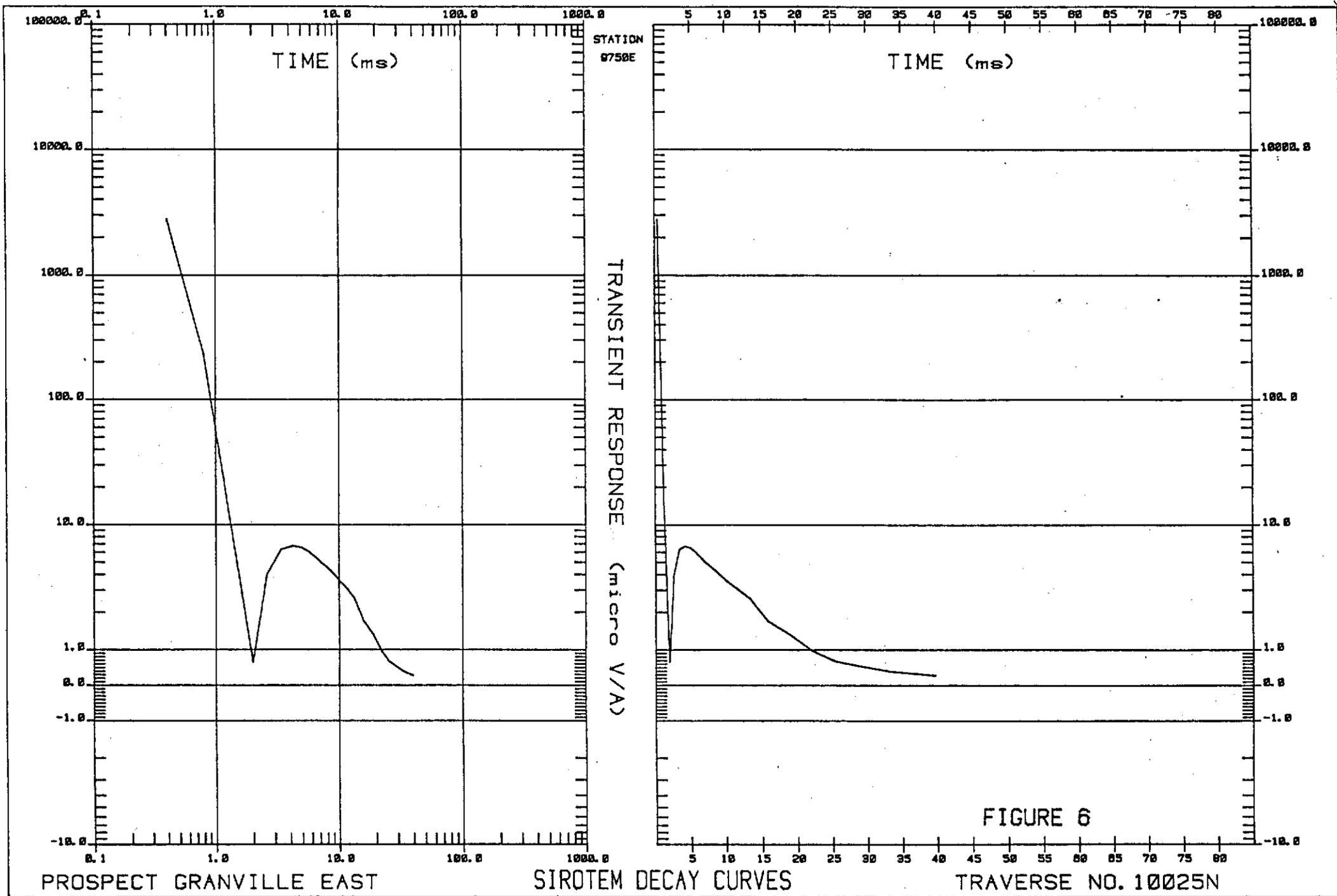
FUNCTION
 $V = \text{AMPLITUDE} \cdot \text{EXP}(-A \cdot \text{TIME})$
 WHERE
 AMPLITUDE = 46.9159421067
 A = .175682380611
 COEFFICIENT OF DETERMINATION = .999930564231
 COEFFICIENT OF CORRELATION = .999965281513

TIME	RESPONSE	FUNCTION	RESIDUAL
4	840.50	840.50	0.00
6	102.76	102.70	0.06
1.2	46.62	30.03	16.59
1.6	38.30	12.55	25.75
2.0	35.18	6.38	28.80
2.6	31.68	2.88	28.80
3.4	27.00	1.28	25.72
4.2	23.11	.67	22.43
5.0	19.87	.40	19.47
6.0	17.18	.25	16.93
7.0	13.91	.14	13.76
8.0	10.41	.08	10.34
10.0	8.35	.05	7.82
11.0	6.82	.03	6.79
13.4	5.33	.02	5.31
15.0	3.63	.01	3.62
19.0	2.59	.01	2.58
22.0	1.77	.00	1.76
25.4	1.27	.00	1.26
28.0	.97	.00	.96
33.4	.51	.00	.51
39.0	.36	.00	.36

TIME	RESPONSE	FUNCTION	RESIDUAL
4	0.00	43.73	-43.73
6	-0.00	40.76	-40.76
1.2	16.59	38.00	-21.41
1.6	25.75	35.42	-9.67
2.0	28.80	33.02	-4.22
2.6	28.80	29.71	-.92
3.4	25.72	25.82	-.09
4.2	22.43	22.43	.00
5.0	19.47	19.49	-.02
6.0	16.93	16.94	-.01
7.0	13.76	13.72	.05
8.0	10.34	10.36	-.02
10.0	8.31	7.82	.49
11.0	6.79	5.90	.89
13.4	5.31	4.46	.85
15.0	3.62	2.92	.70
19.0	2.58	1.67	.92
22.0	1.76	.95	.81
25.4	1.26	.54	.72
28.0	.96	.31	.65
33.4	.51	.13	.38
39.0	.36	.04	.32

LOOP SIZE=50m
 FIGURE 5

016



07000

Summary

The SIROTEM data reflects the known geology, particularly with respect to the quartzite/black shale contact. The survey has resolved a number of anomalies that may be related to tin bearing conductive mineralization. Line 9475N shows a response which has a great similarity to that already shown to be attributable to mineralization on line 10025N. Line 10025N shows evidence of a conductive body adjacent to the costean exposed mineralization which does not give rise to a magnetic anomaly (the implied depth to top is consistent with this). Line 10375N also shows evidence of a body which may be conducting pyrrhotite. It is relevant here to note that line 10200N produced a similar response to that on line 10400N, both using 100m loops. The subsurface under line 10200N has been tested by DDH3 and it is likely that this anomaly has as its source pyrrhotitic black shales. Whilst it is therefore quite possible that the anomaly on line 10375N has a similar source (a decay curve analysis similar such as that used on 10025N revealed similar decay constants for both anomalous responses), experience here has shown that data collected with 100m loops is not altogether adequate in assessing such similarities.

4. CONCLUSIONS

The geophysical techniques used at Granville East are responding to pyrrhotitic black shales and to magnetic skarn mineralization. It has not been unambiguously possible to distinguish between the two potential sources, however a number of targets have been developed which are likely to comprise the most conductive and/or magnetic horizons without regard to the nature of the source. The most significant of these are as follows:

1. The magnetic and conducting horizon adjacent to the quartzite contact, in particular line 9475N, 10050E.
2. The possible repetition of this sequence designated magnetic Zones C and D.
3. The SIROTEM response at 9600E on line 10025N, this is possibly an along strike extension of magnetic zone C.

Additional evidence for near surface conducting material is given by the self potential data (see Heithersay and Sumpton 1982), however only the SP anomaly to the north and south of line 10000N around 9725E, the anomaly on 9700N and 9600N around 10000E, and that on line 9500N around 10050E show any significant SIROTEM response using 100m loops.

Much has been learnt about the geophysical and geological nature of the subsurface within the prospect, which has had and will have significant impact on this and subsequent interpretations. Remnant magnetism has been shown to be a very important factor in assessing magnetic anomaly patterns, and it is planned to increase the number of samples to clarify this aspect.

5. REFERENCES

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- Sumpton J. Report on Magnetometer Survey Granville
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- Buselli G. and Thorburn M. SIROTEM Models. C.S.I.R.O. Report
March 1981 and updates.

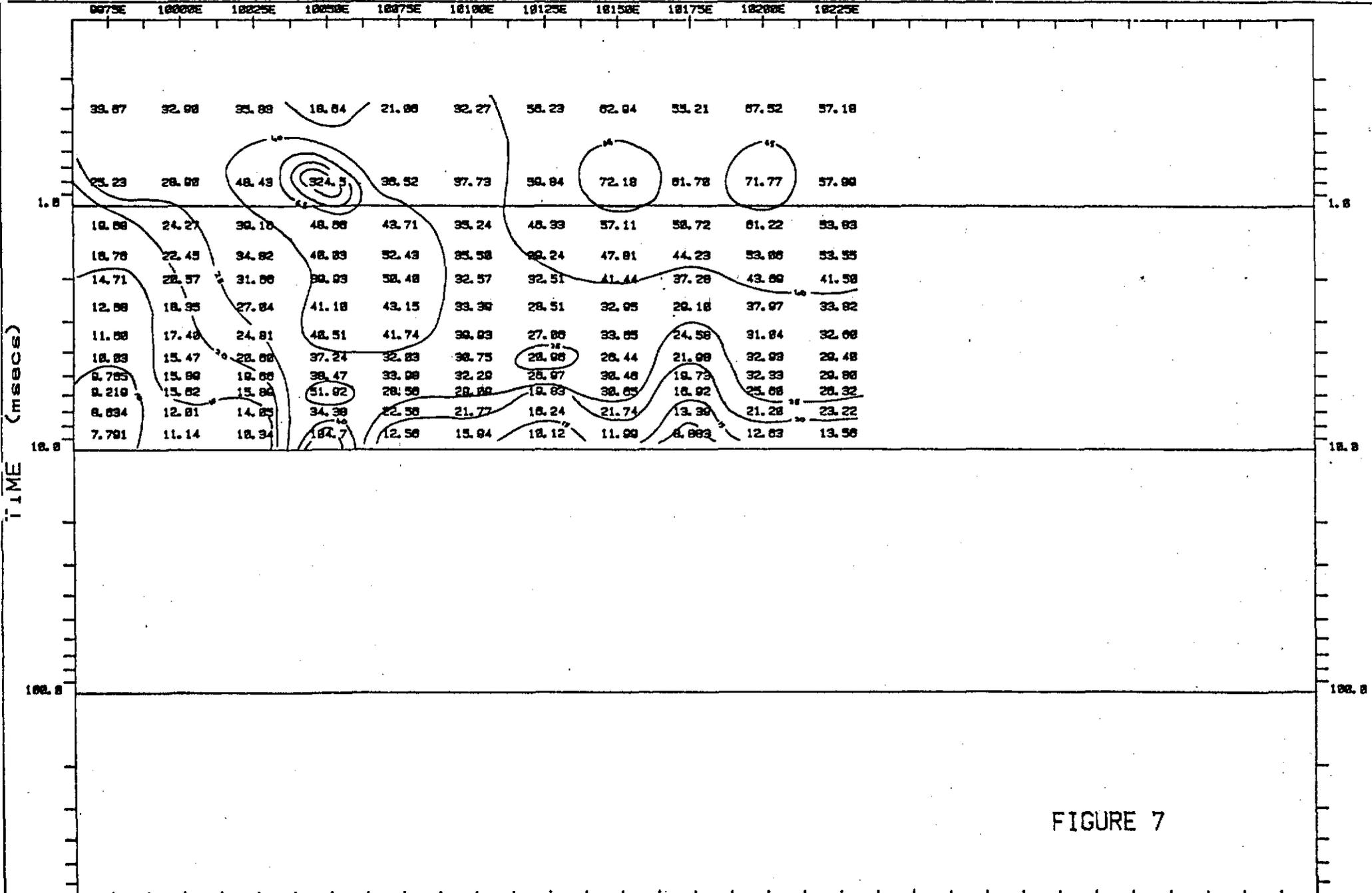
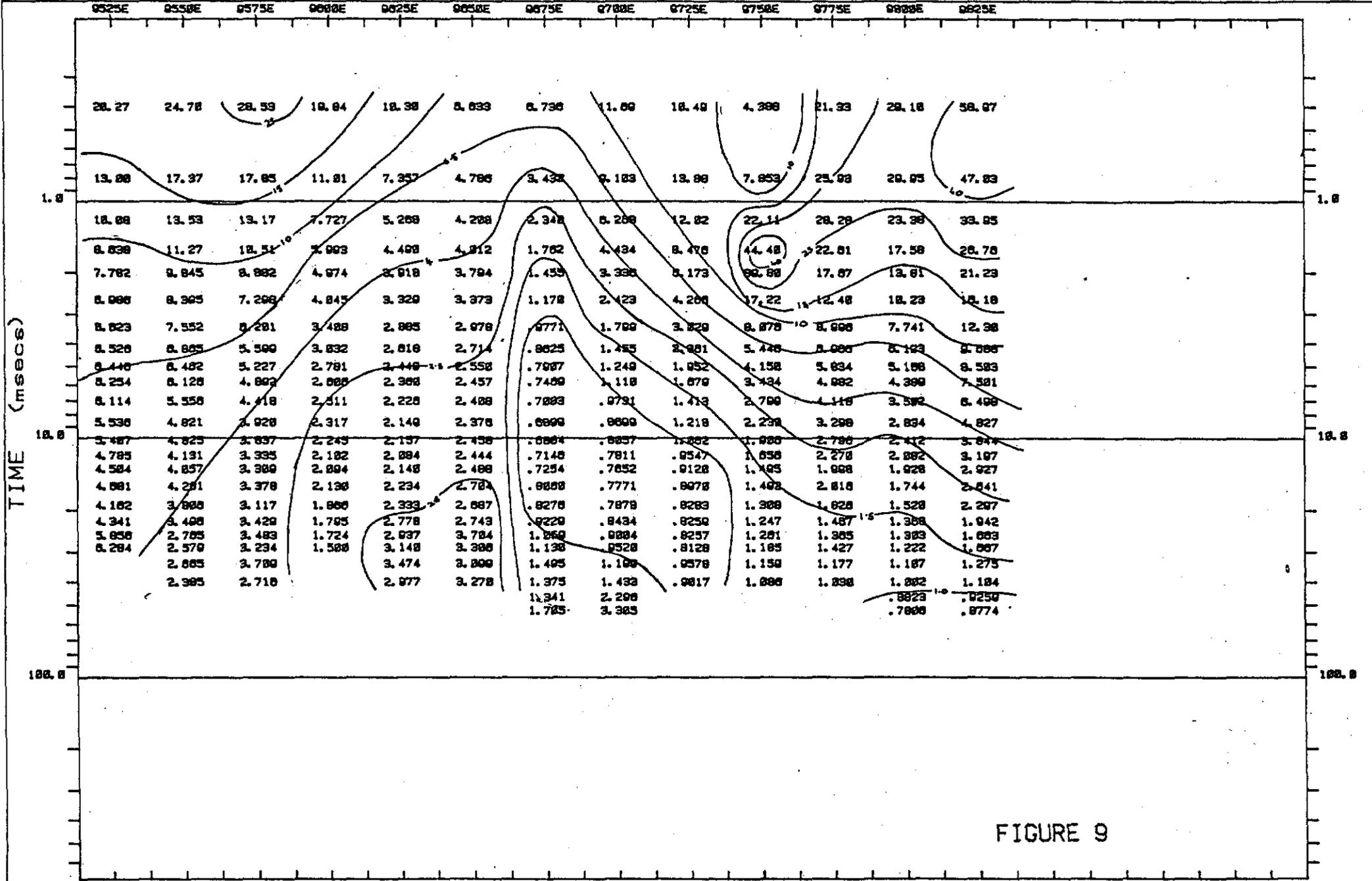
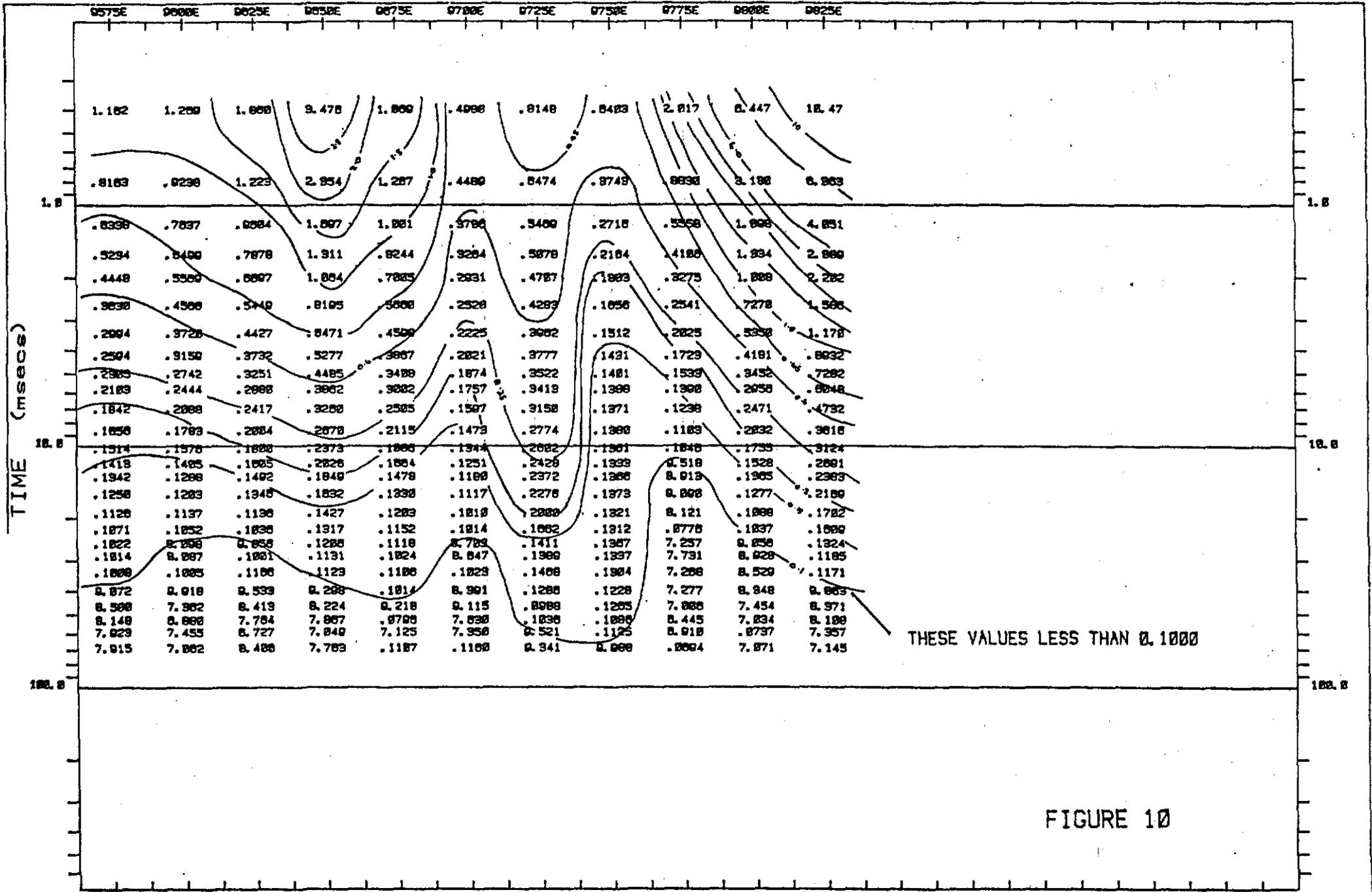


FIGURE 7



PROSPECT GRANVILLE EAST APPARENT RESISTIVITY PSEUDOSECTIONS TRAVERSE NO. 10025N

582024



THESE VALUES LESS THAN 0.1000

FIGURE 10

GRANVILLE EAST DDH 1 SUSCEPTIBILITY IN SI UNITS

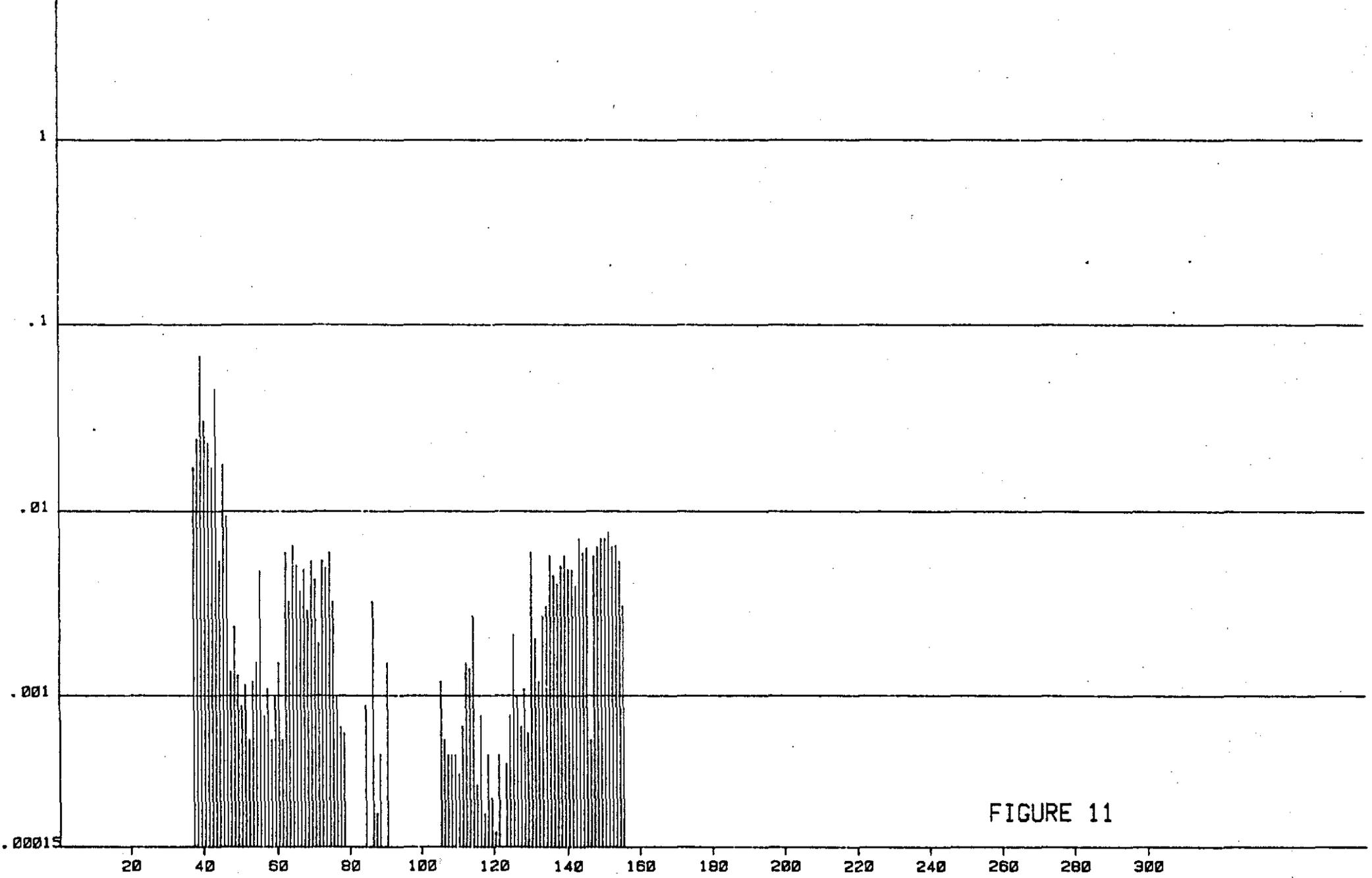


FIGURE 11

GRANVILLE EAST DDH 2 SUSCEPTIBILITY IN SI UNITS

025

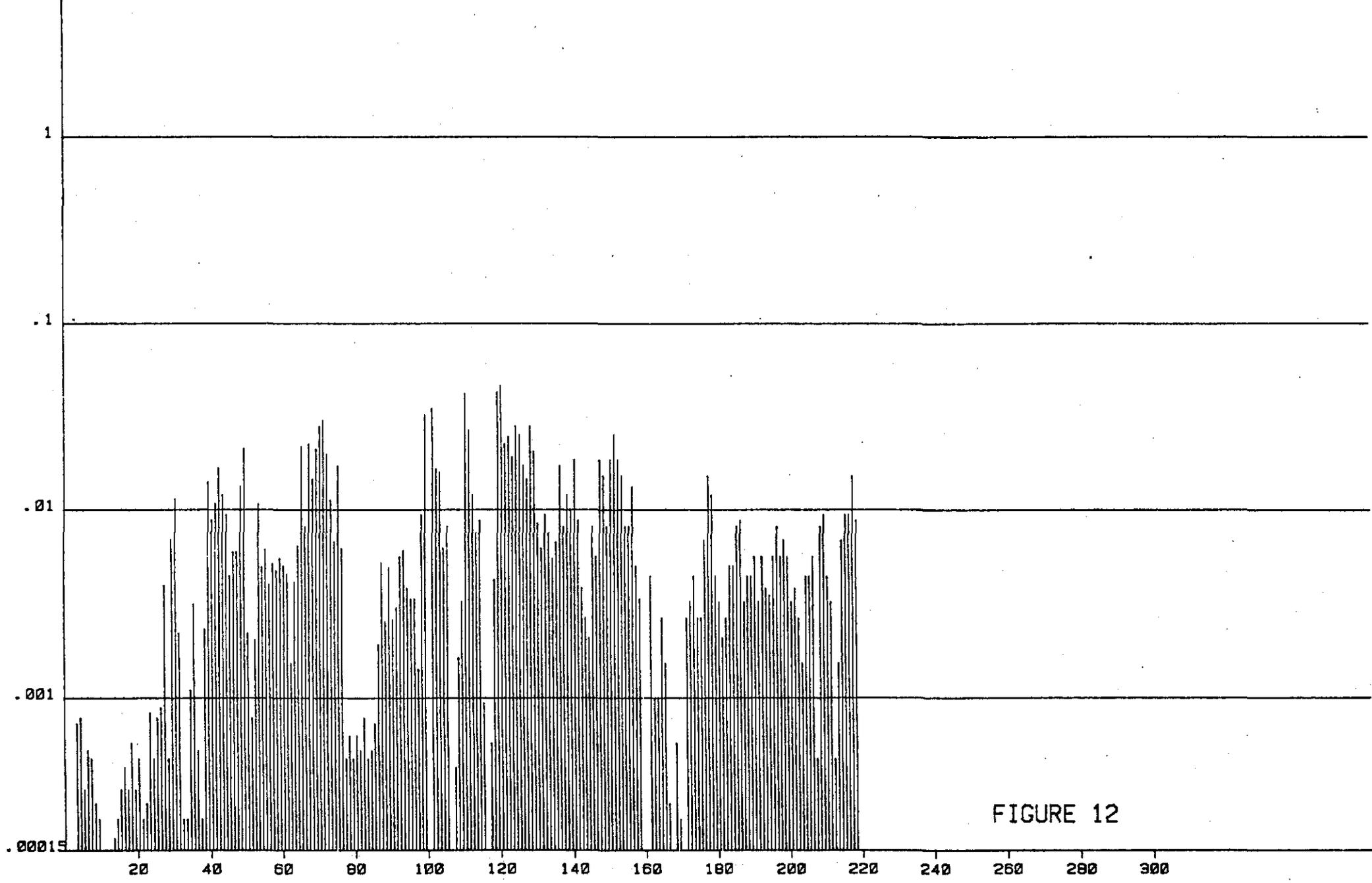


FIGURE 12

588027

GRANVILLE EAST DDH 3 SUSCEPTIBILITY IN SI UNITS

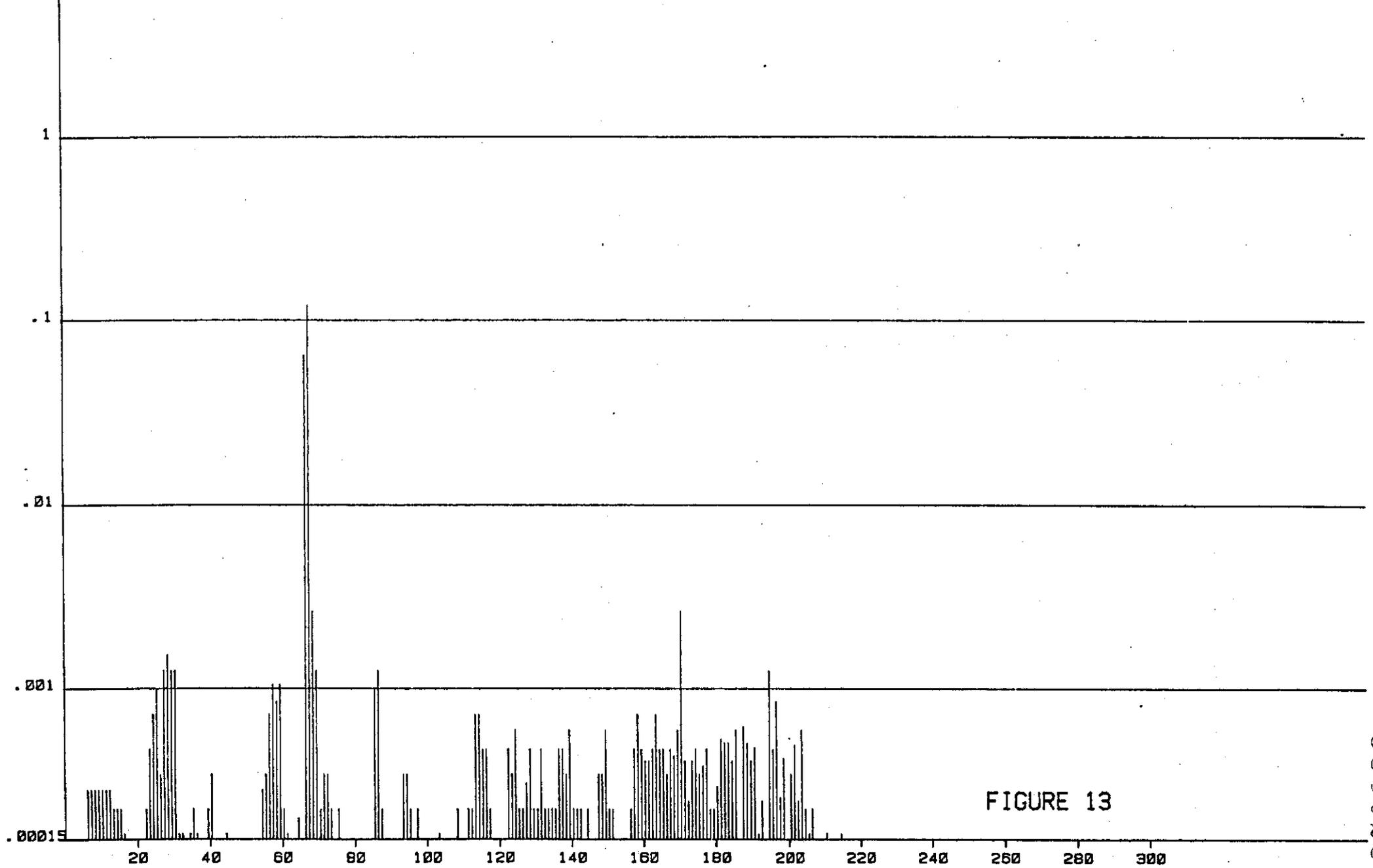


FIGURE 13

GRANVILLE EAST DDH 4 SUSCEPTIBILITY IN SI UNITS

027

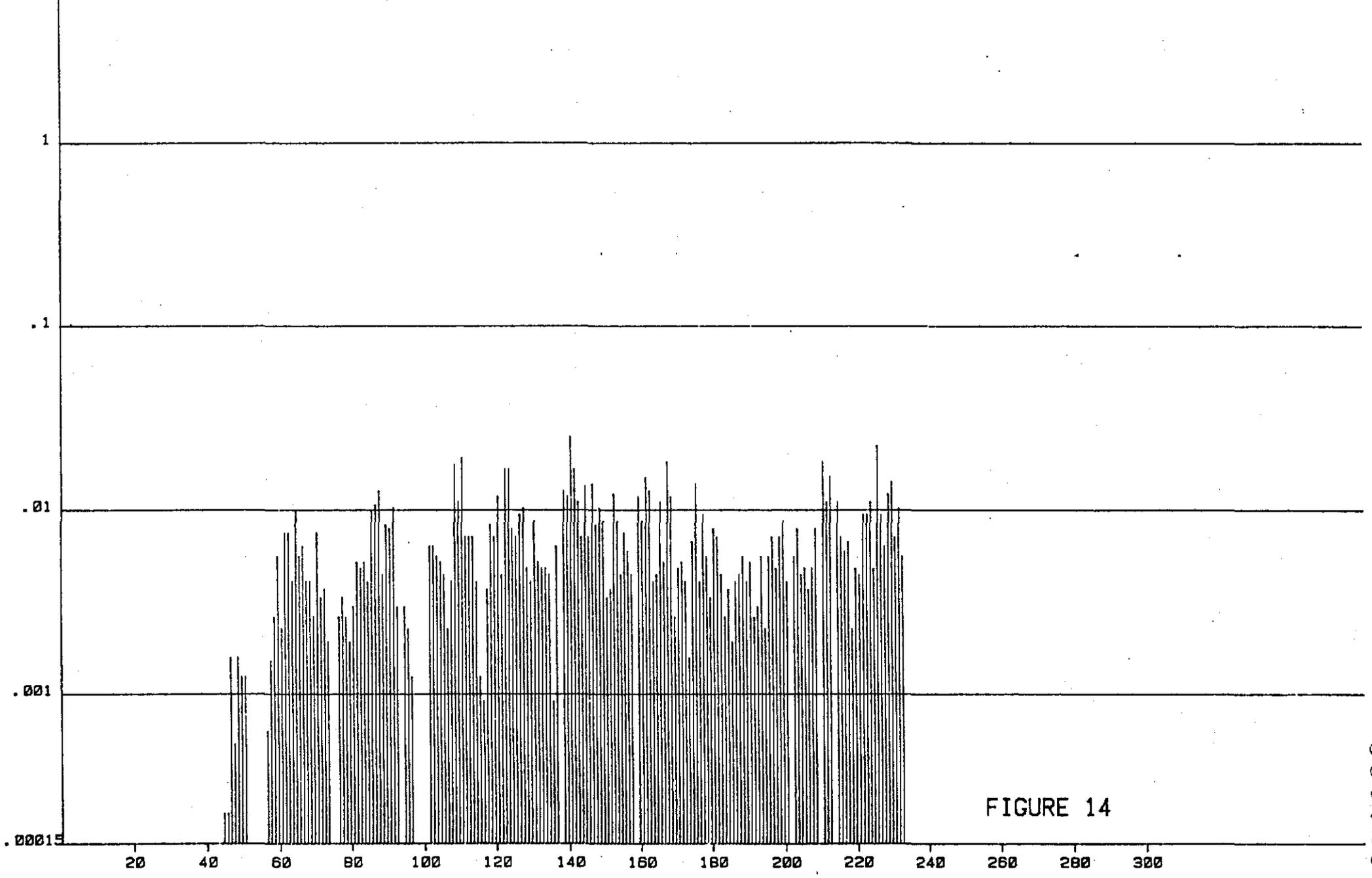


FIGURE 14

588029

GRANVILLE EAST DDH 5 SUSCEPTIBILITY IN SI UNITS

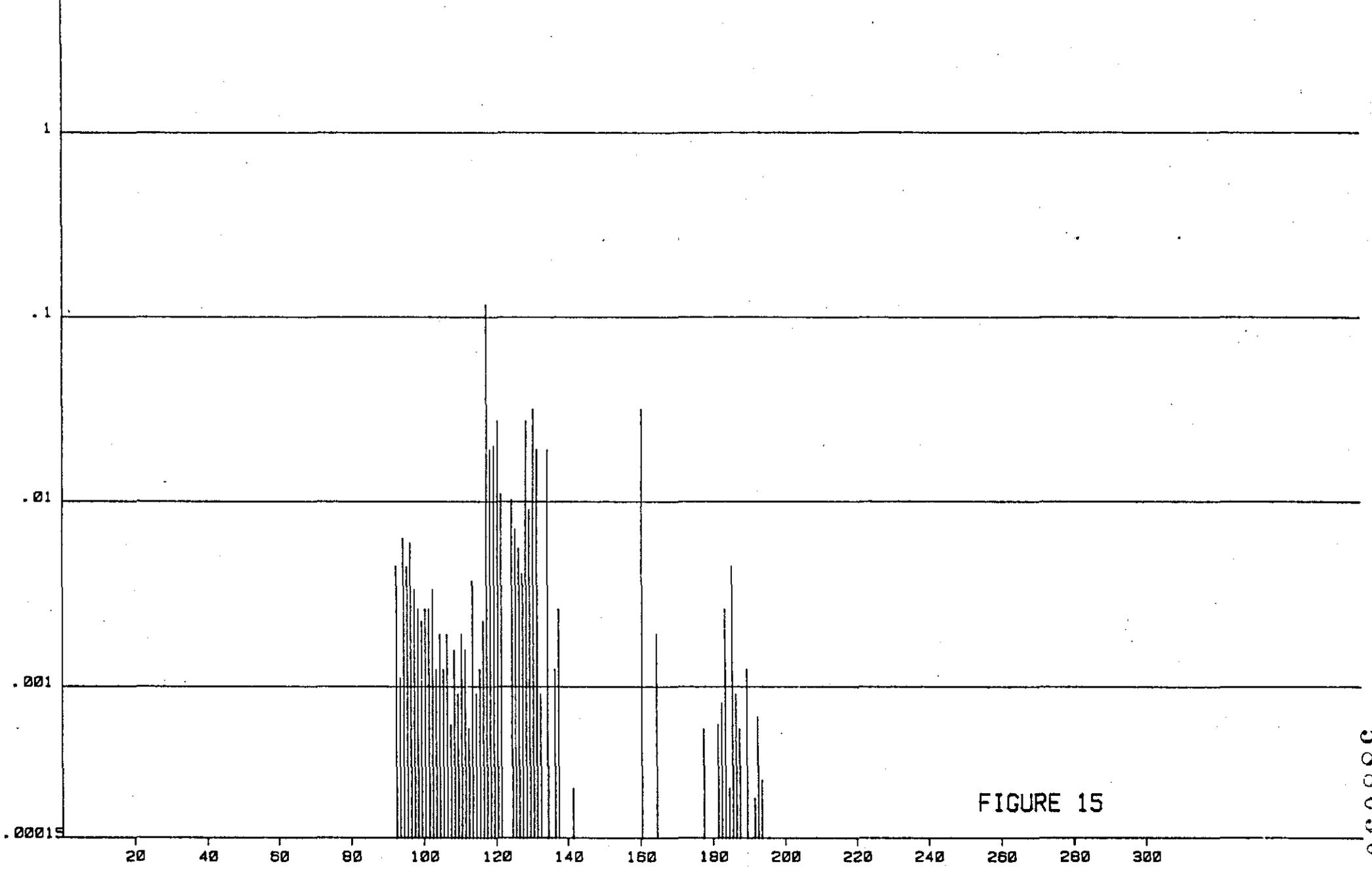


FIGURE 15

029

588031

APPENDIX

REPORT BY C. S. I. R. O. ON MAGNETIC PROPERTIES

DISCUSSION OF RESULTS

The bulk susceptibilities, NRM intensities, Koenigsberger ratios susceptibility anisotropy ratios and NRM directions of the seven samples are given in the accompanying table.

Remanent magnetization appears to be important in this rock unit, but the picture is complicated by the scattered nature of NRM directions. There is an indication in the NRM directions that both polarities of magnetization are present as the directions tend to be either north- or south-directed with shallow inclination. This is confirmed by palaeomagnetic cleaning.

The samples fall into two groups:

- (i) KR11460 - 11464 which are magnetite-bearing and appear to have no pyrrhotite whatsoever. Thermomagnetic analysis of KR1164 showed the presence of pure magnetite with a Curie temperature of $\sim 580^{\circ}\text{C}$. After heating to 600°C a small amount of hexagonal pyrrhotite was detected, possibly produced by reaction of magnetite with pyrite. The gossan sample also contained pure magnetite. The remanence of this sample is extremely hard -10% of NRM still remaining after AF demagnetization in 3000 Oersteds. This indicates that the bulk of the remanence is carried by very fine (sub-micron_ acicular magnetite grains which are probably invisible under a microscope.
- (ii) KR5977 - 5979 which probably contain monoclinic pyrrhotite. This is suggested by the rapid decay of remanence on heating above 300°C (the Curie temperature of pyrrhotite is $\sim 320^{\circ}\text{C}$).

The magnetite-bearing samples are more magnetic than the pyrrhotite-bearing rocks, but the NRM directions and Q values are not demonstrably different. However the susceptibility anisotropy of the pyrrhotite-bearing rocks tends to be somewhat greater.

Analysis of Remanence Components

Most of the samples do not behave well on AF or thermal cleaning, tending to show unstable behaviour. It appears that the NRMs reflect the presence of substantial amounts of palaeomagnetic noise carried by very magnetically soft grains, accounting for the scatter of NRM directions.

031

Although these soft components of magnetization are readily removed during initial cleaning, and the overall trend of the stable components is then apparent, these soft grains continually pick up random components of magnetization during standard laboratory procedures, in spite of efforts to minimise exposure of the specimens to stray fields. Demagnetization plots are therefore rather noisy. Examples of three extremes of behaviour are given in the enclosed vector diagrams.

The diagrams are projections of remanence vector end-points onto two orthogonal planes. The crosses represent projection onto the horizontal plane, the circles onto a vertical plane. Successive points represent remanence vectors after successive demagnetization steps. Linear segments indicate removal of a single component of magnetization over the corresponding demagnetization range. Curved segments indicate the presence of two or more components which have overlapped stability spectra. The most stable component of magnetization is resolved by cleaning only if the segment joining the last few points extrapolates linearly to the origin.

- A. A single component of magnetization is revealed by AF cleaning. The magnetization is SE with shallow upward inclination.
- B. Two components are indicated. The softer component is west directed with downward inclination. The more stable component is not fully resolved, but is probably S-SE directed with downward inclination.
- C. Again two components are indicated, but the signal is masked by substantial noise. A soft component, roughly W and down, and a harder component, S horizontal, are indicated.

After examination of the demagnetization plots and computer analysis for linear segments, it was concluded that the magnetization of these rocks consists of a very soft component, which in situ is probably aligned roughly with the present field, and a substantial S to SE or N-NW shallow component of moderate to high stability. Although both polarities are present, the S-directed magnetization is more common and probably represents the predominant component.

The mean direction of stable remanence, without regard to polarity, is $(166^{\circ}, +3^{\circ})$, $\alpha_{95} = 23^{\circ}$.

The high Q values in the table will overestimate the average Q of the rock body because the susceptibility should be somewhat enhanced by viscous magnetization carried by soft grains, and because the remanence is not all of one polarity. However it is probable that the overall NRM intensity is still several times larger than the induced magnetization.

Magnetic Fabric

The magnetite-bearing samples do not have a clearly defined magnetic fabric. The pyrrhotite-bearing samples (KR5977 - 5979), however, exhibit a planar parallel fabric with a well-defined magnetic foliation plane dipping shallowly to the west. Within this plane magnetic lineations plunge shallowly to the NW. The most probable interpretation of this data is that the magnetic foliation represents alignment of pyrrhotite grains in the cleavage. Within this W-dipping cleavage plane the magnetic lineation may represent the axis of folding.

.....

033
 TABLE 1. MAGNETIC PROPERTIES OF GRANVILLE EAST SAMPLES

Sample	k	J	Q	NRM Direction	A
KR11462	5,820	25,700	7.0	(195°, -48°)	1.22
KR11463	960	7,080	11.7	(189°, +28°)	1.18
KR11464	2,780	20,700	11.8	(86°, +40°)	1.05
KR11460	39,600	80,600	3.2	(301°, -27°)	1.61
KR5977	100	250	4.0	(185°, -46°)	1.77
KR5978	700	360	0.8	(335°, -11°)	1.46
KR5979	300	6,040	32	(277°, +38°)	1.29

k = emu susceptibility $\times 10^6$

J = NRM intensity (microgauss)

Q = Koenigsberger ratio J/kH where $H = 0.63$ Oersteds

NRM = direction is given in form (dec, inc), where declination is positive clockwise from TN, inclination is positive downwards

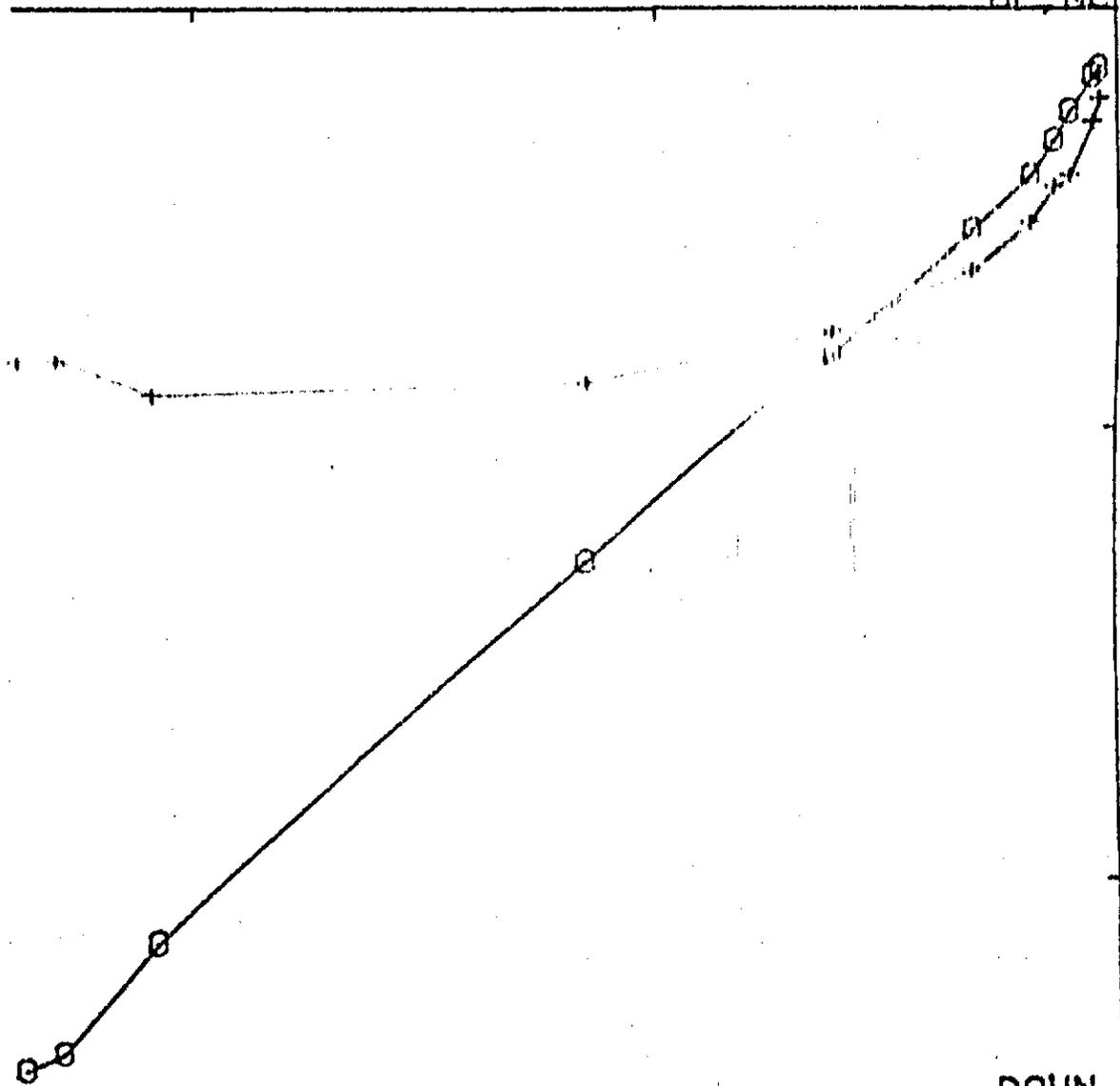
A = susceptibility anisotropy = $\frac{\text{maximum susceptibility}}{\text{minimum susceptibility}}$

WEST

KR5979
UP, NORTH

3471

034



DOWN, SOUTH

588036

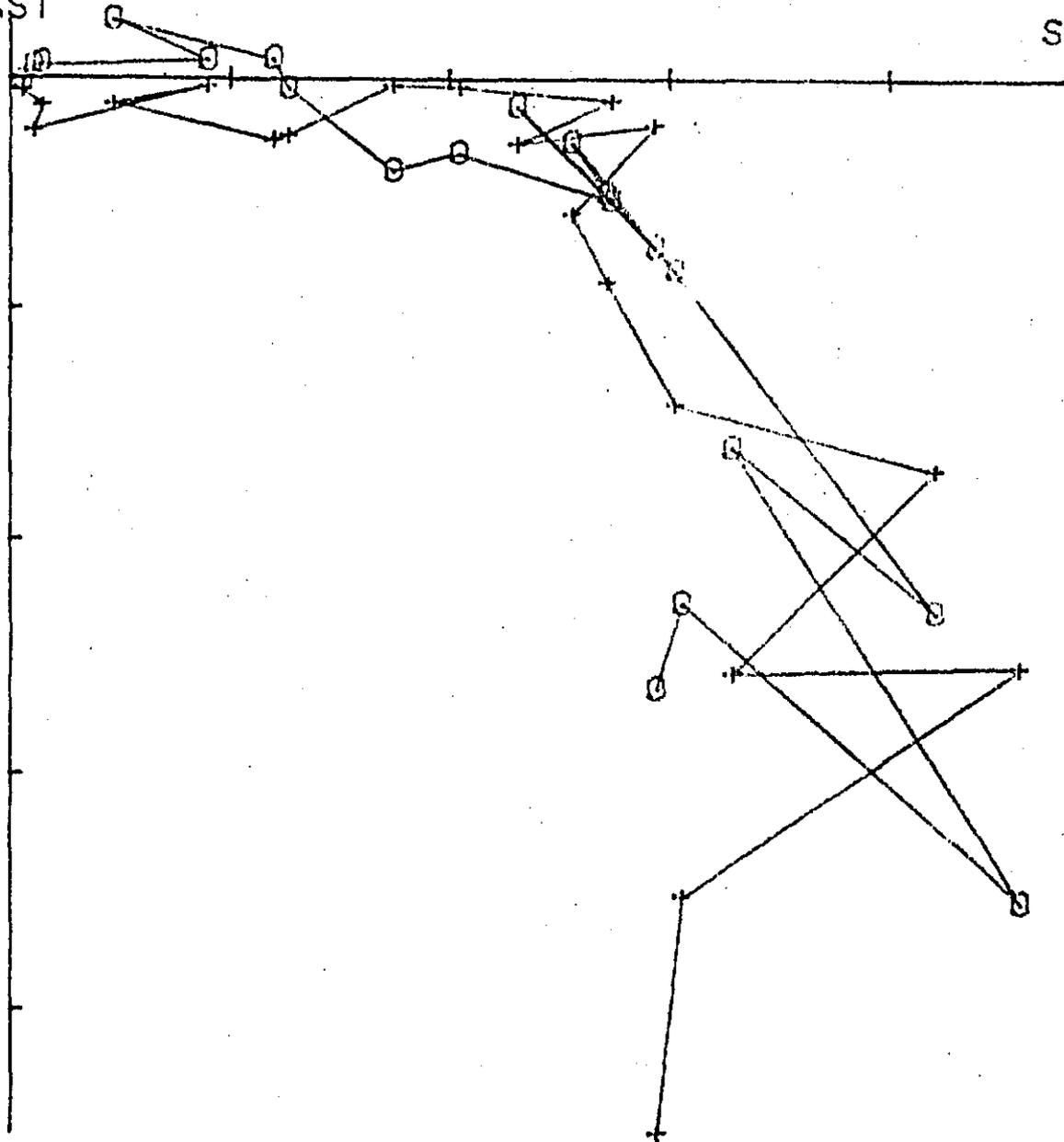
KR11463BNRM
UP EAST
NORTH

601

SOUTH

035

DOWN, WEST



588037

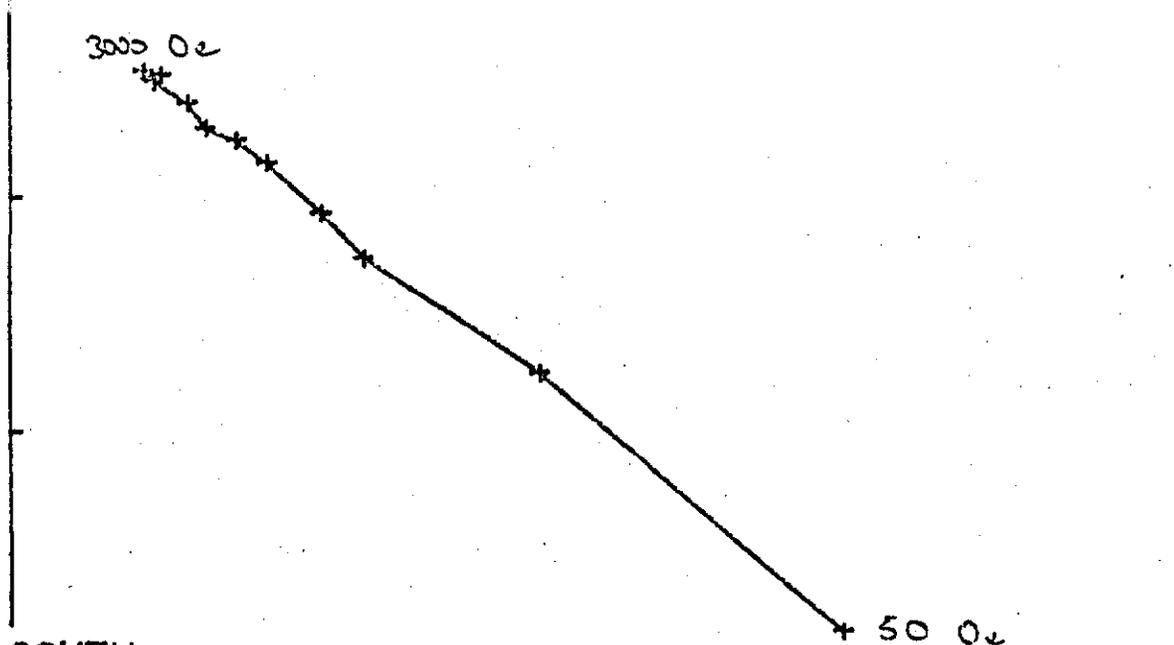
WEST

WEST



3000 Oe

DOWN, SOUTH

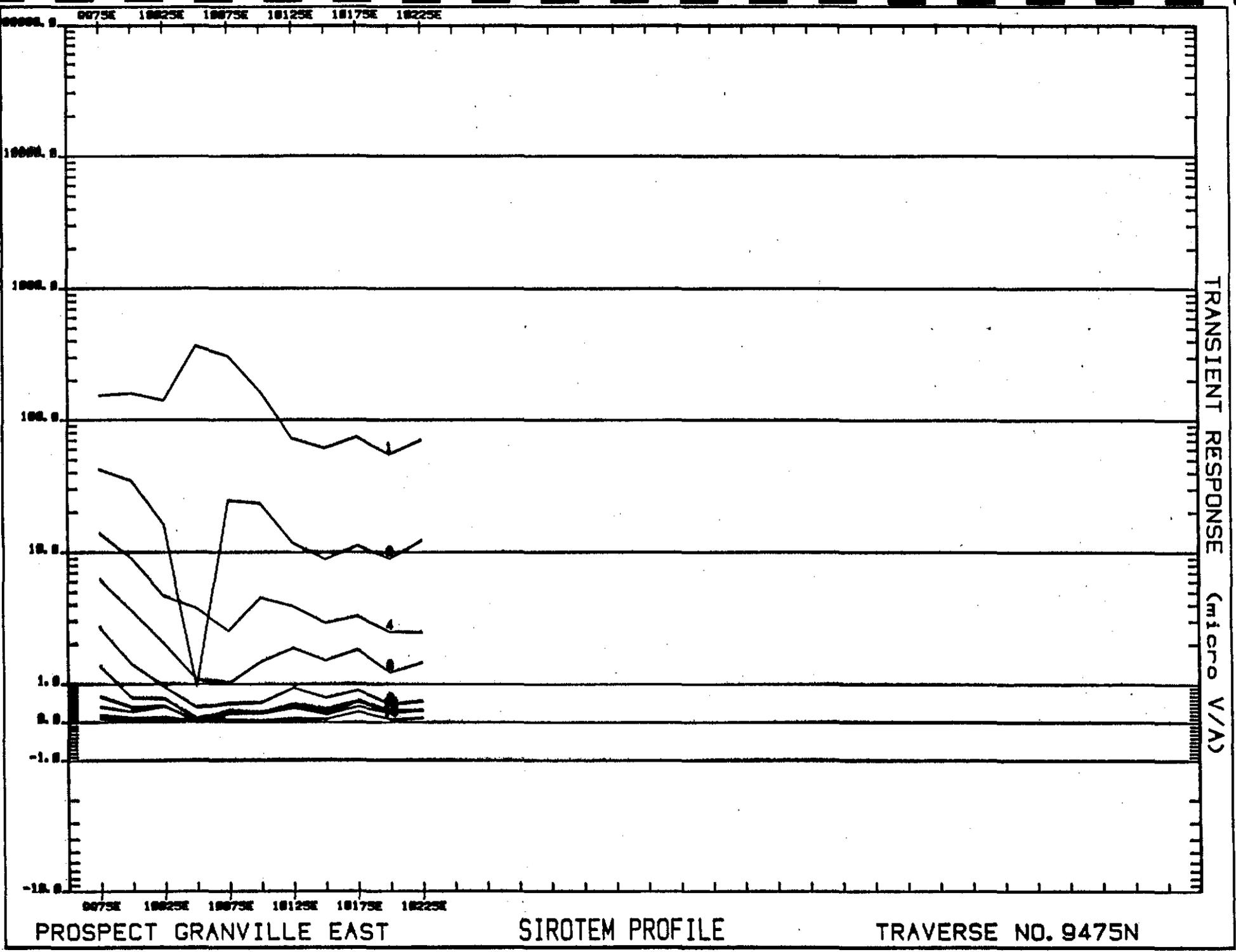


+ 50 Oe

Section 7

SIROTEM PROFILES

038



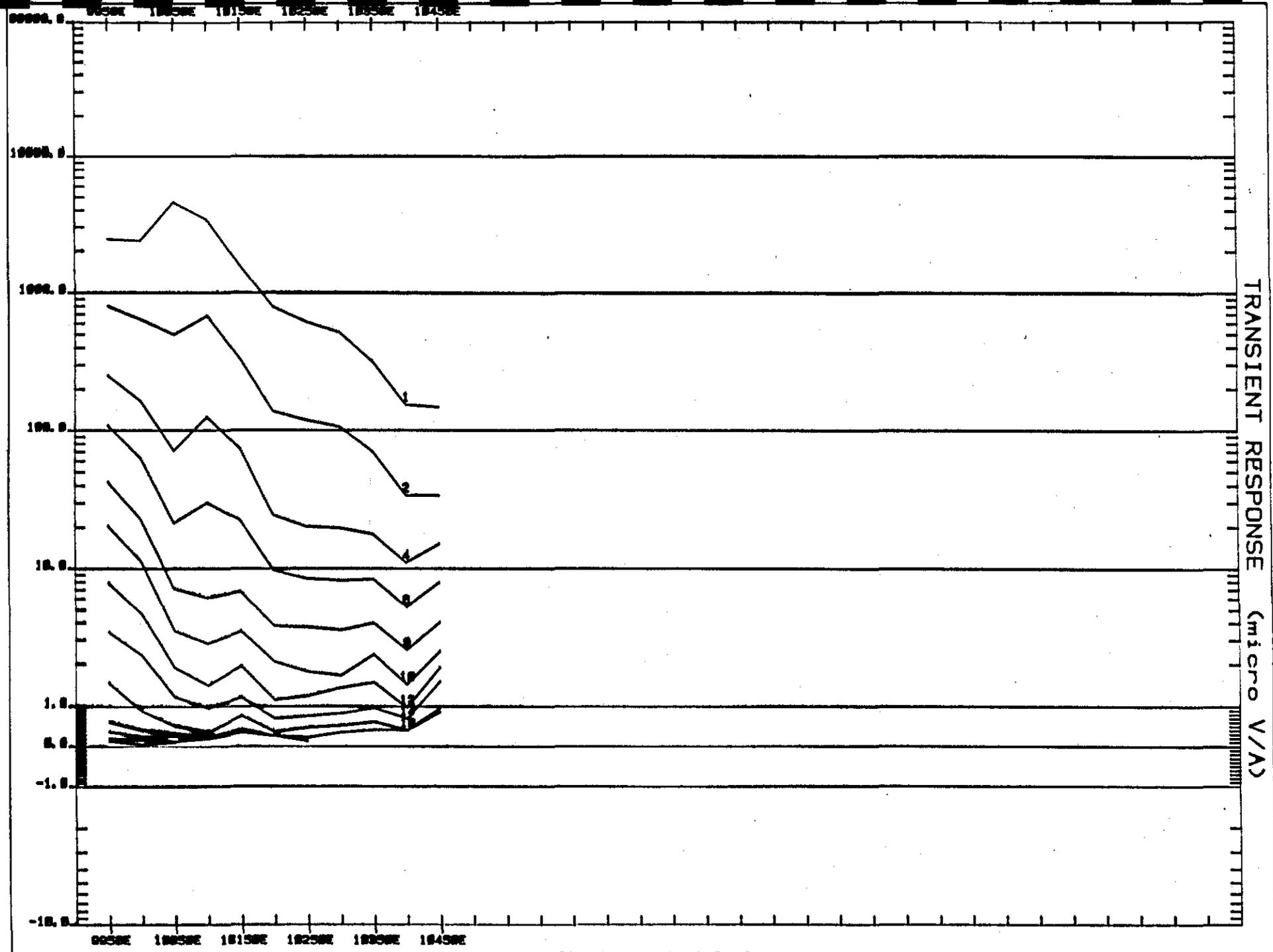
588040

PROSPECT GRANVILLE EAST

SIROTEM PROFILE

TRAVERSE NO. 9475N

039



TRANSIENT RESPONSE (micro V/A)

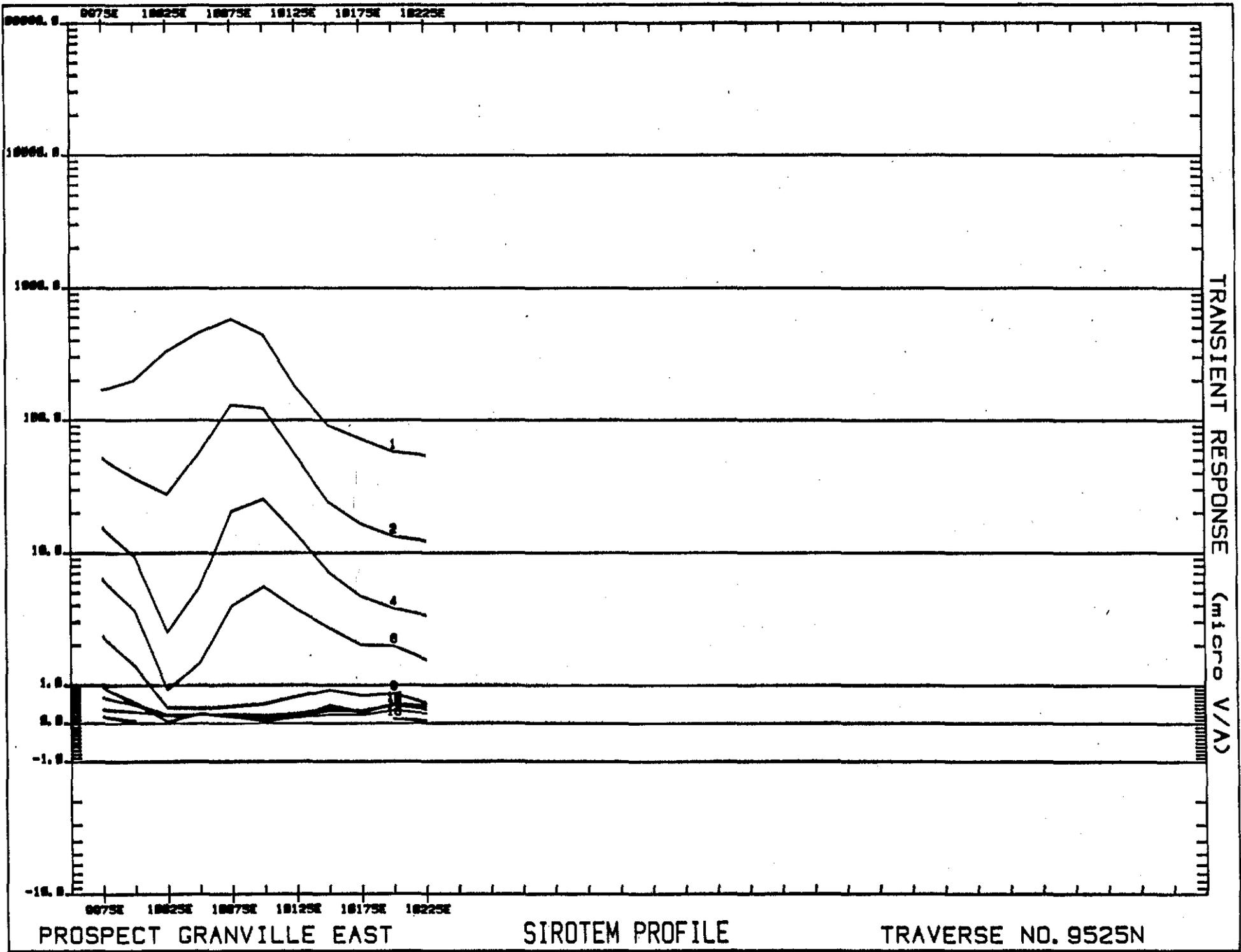
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SIROTEM PROFILE

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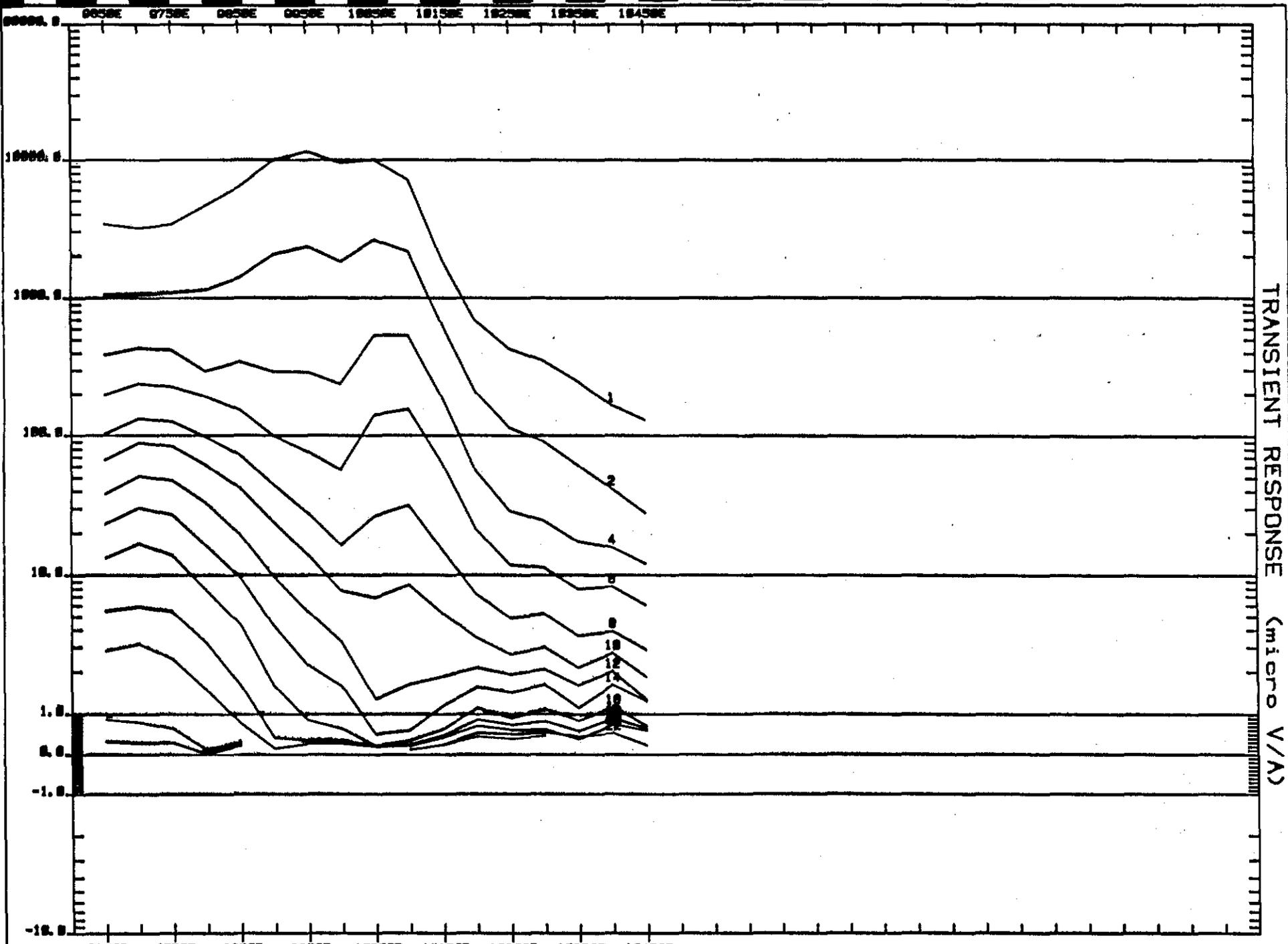
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040



588042

041



TRANSIENT RESPONSE (micro V/A)

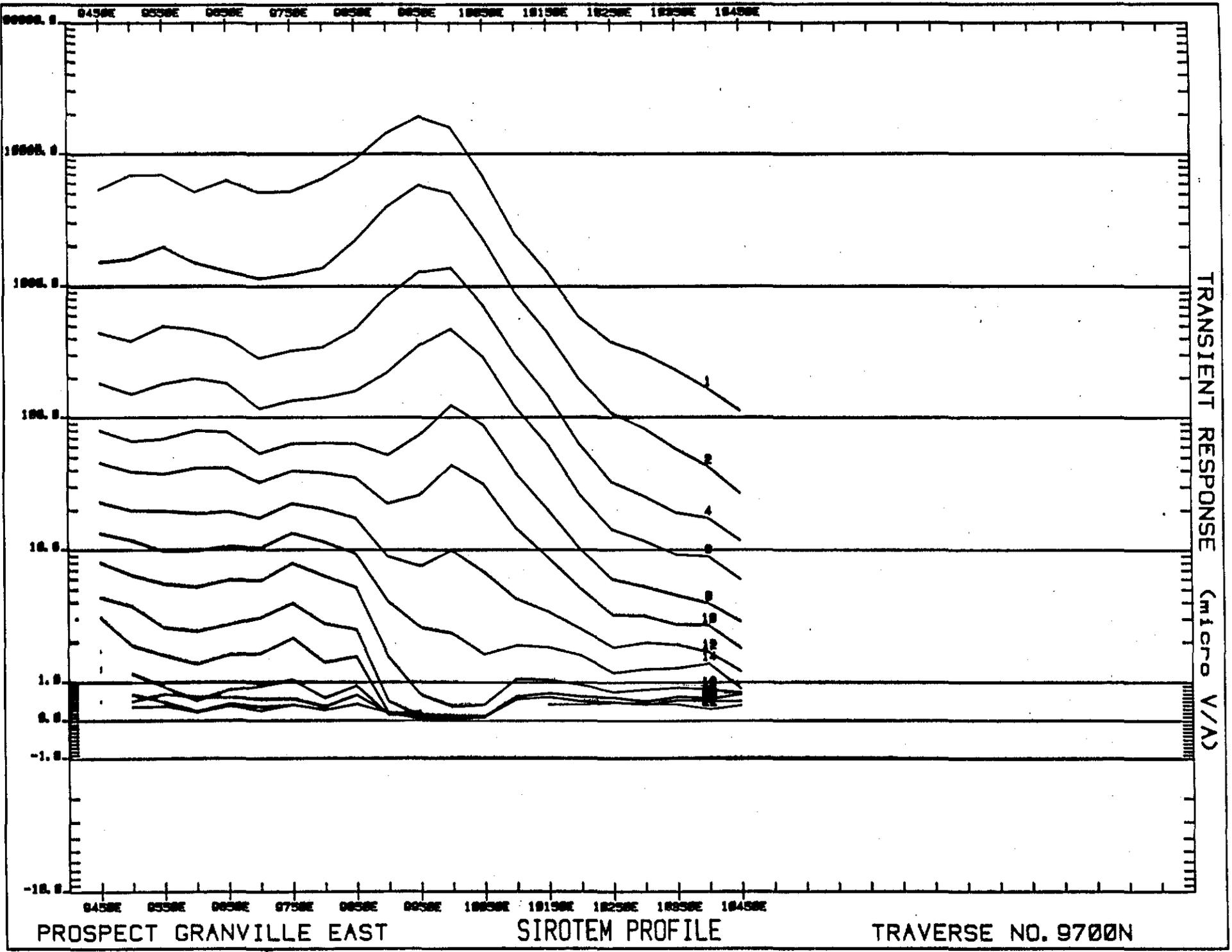
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SIROTEM PROFILE

TRAVERSE NO. 9600N

588043

042



TRANSIENT RESPONSE (micro V/A)

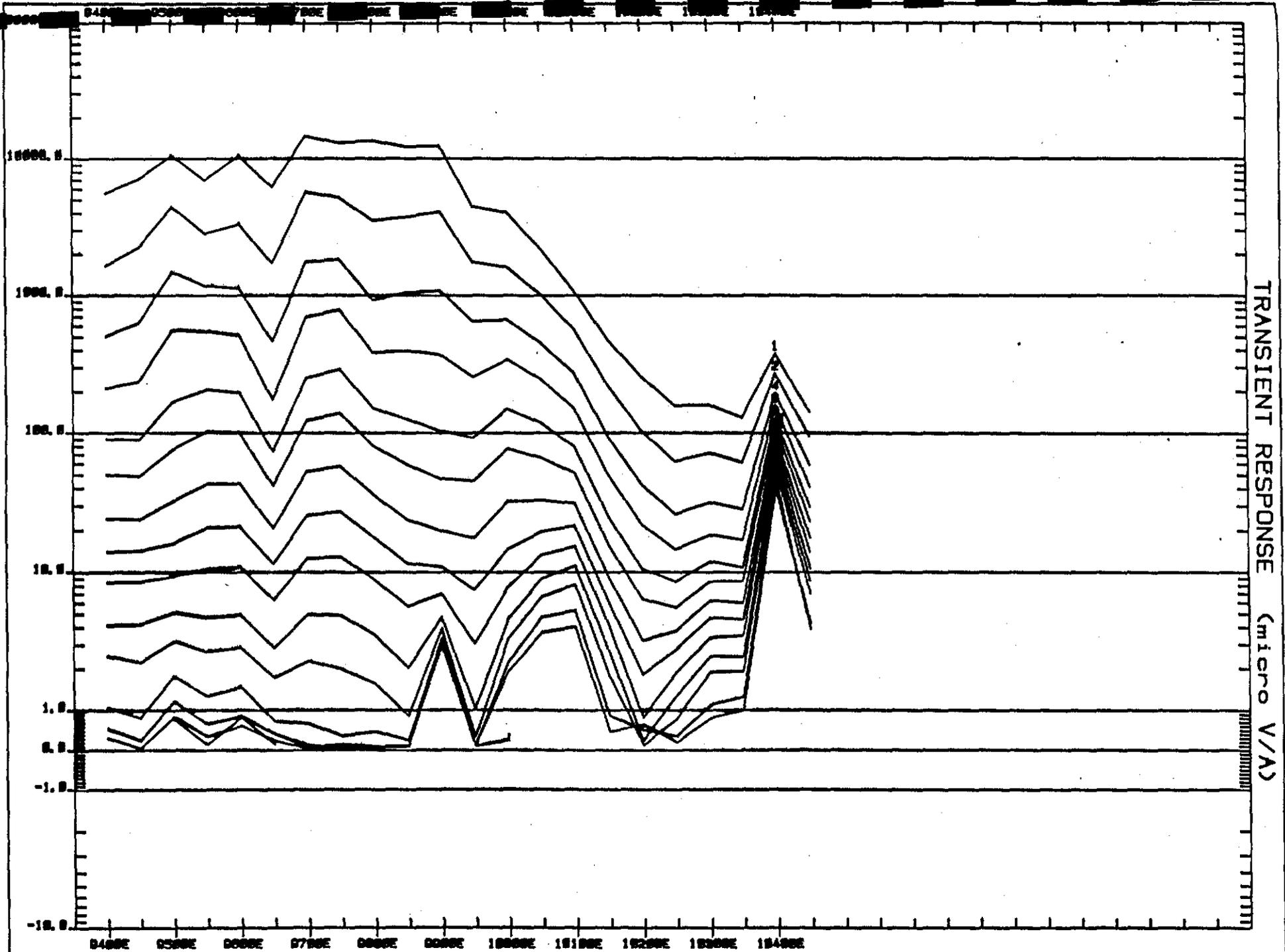
PROSPECT GRANVILLE EAST

SIROTEM PROFILE

TRAVERSE NO. 9700N

588044

043



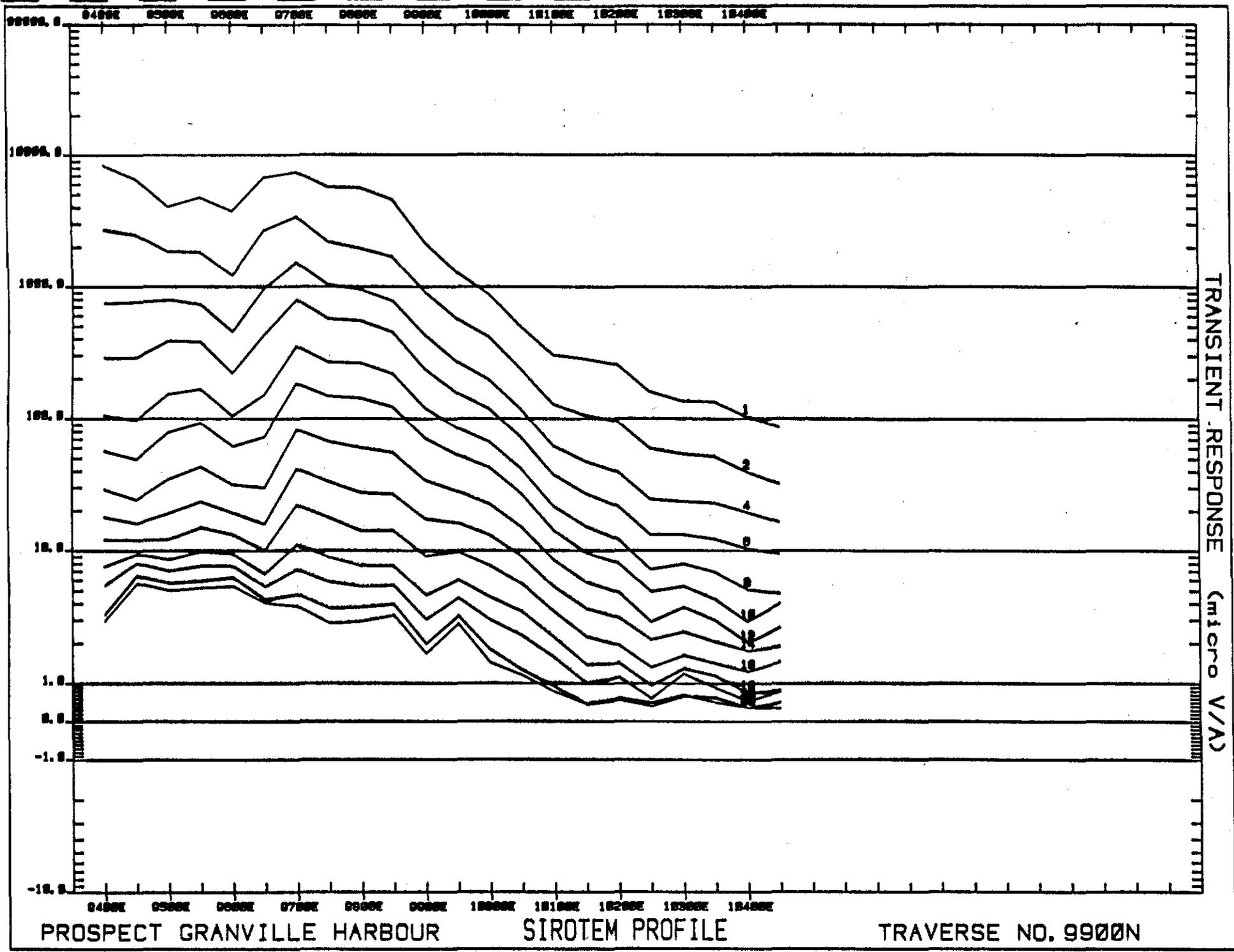
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SIROTEM PROFILE

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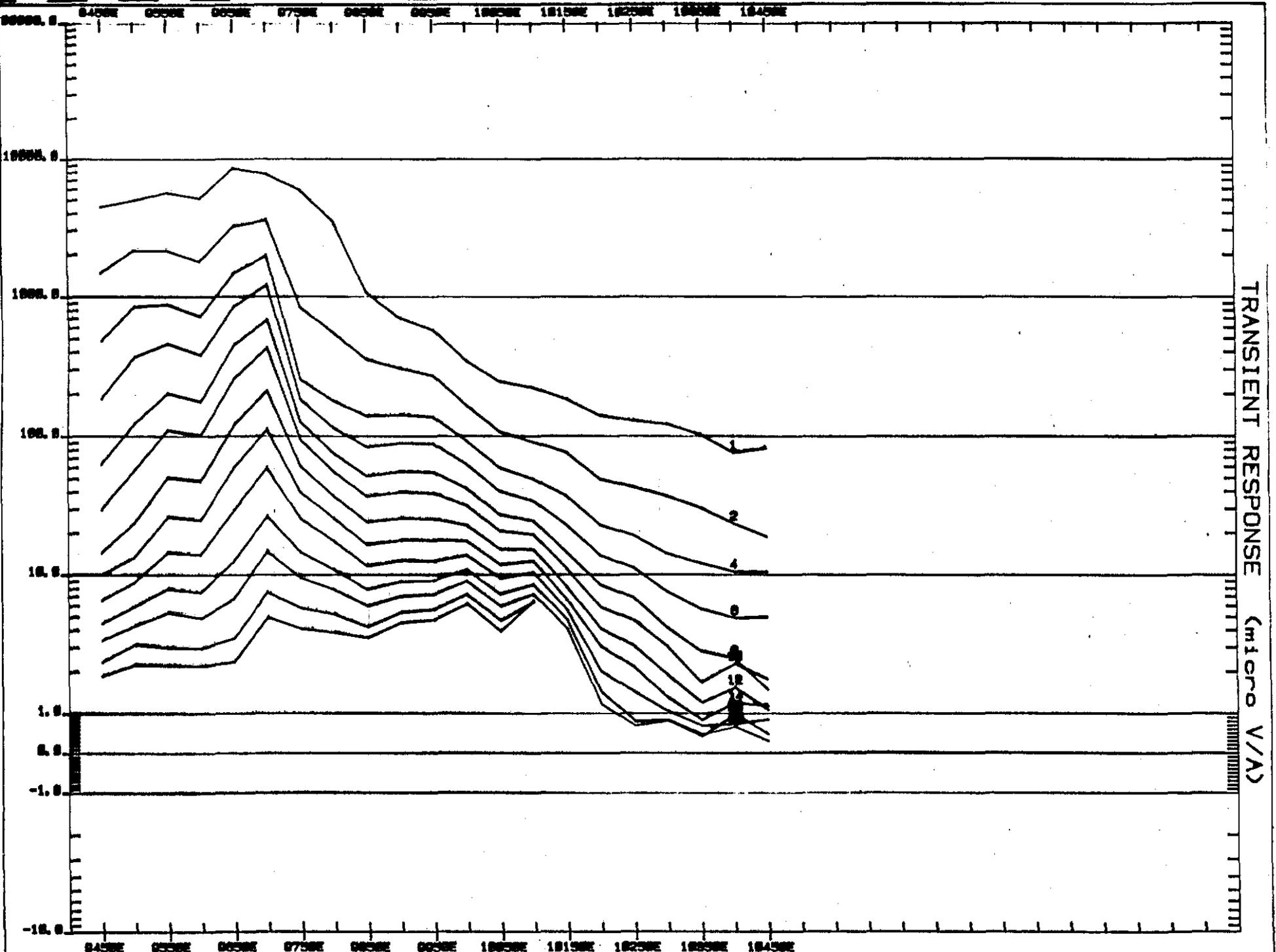
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04A



588046

045



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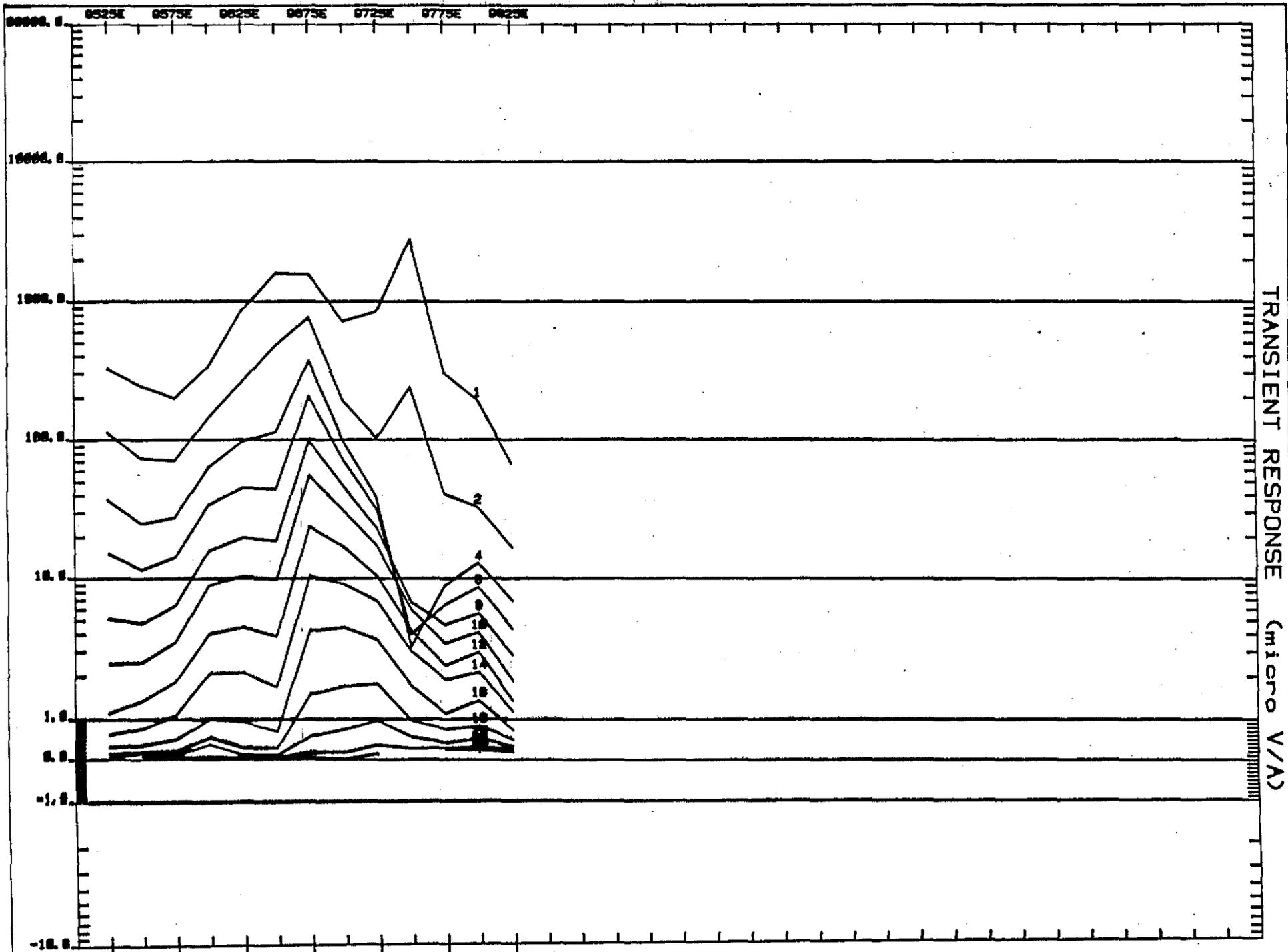
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PROSPECT GRANVILLE EAST

SIROTEM PROFILE

TRAVERSE NO. 10000N

046



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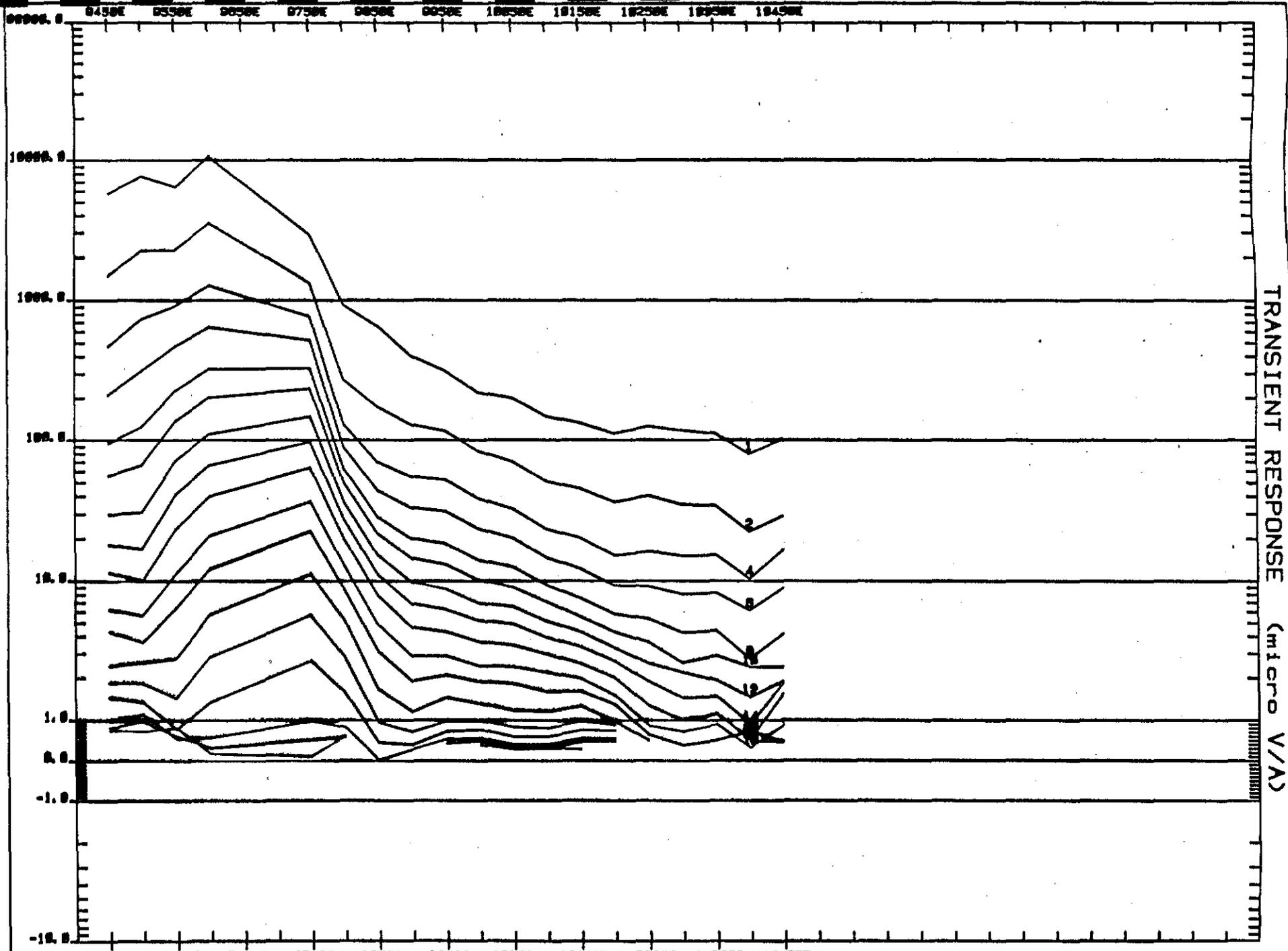
PROSPECT GRANVILLE EAST

SIROTEM PROFILE

TRAVERSE NO. 10025N

588048

041



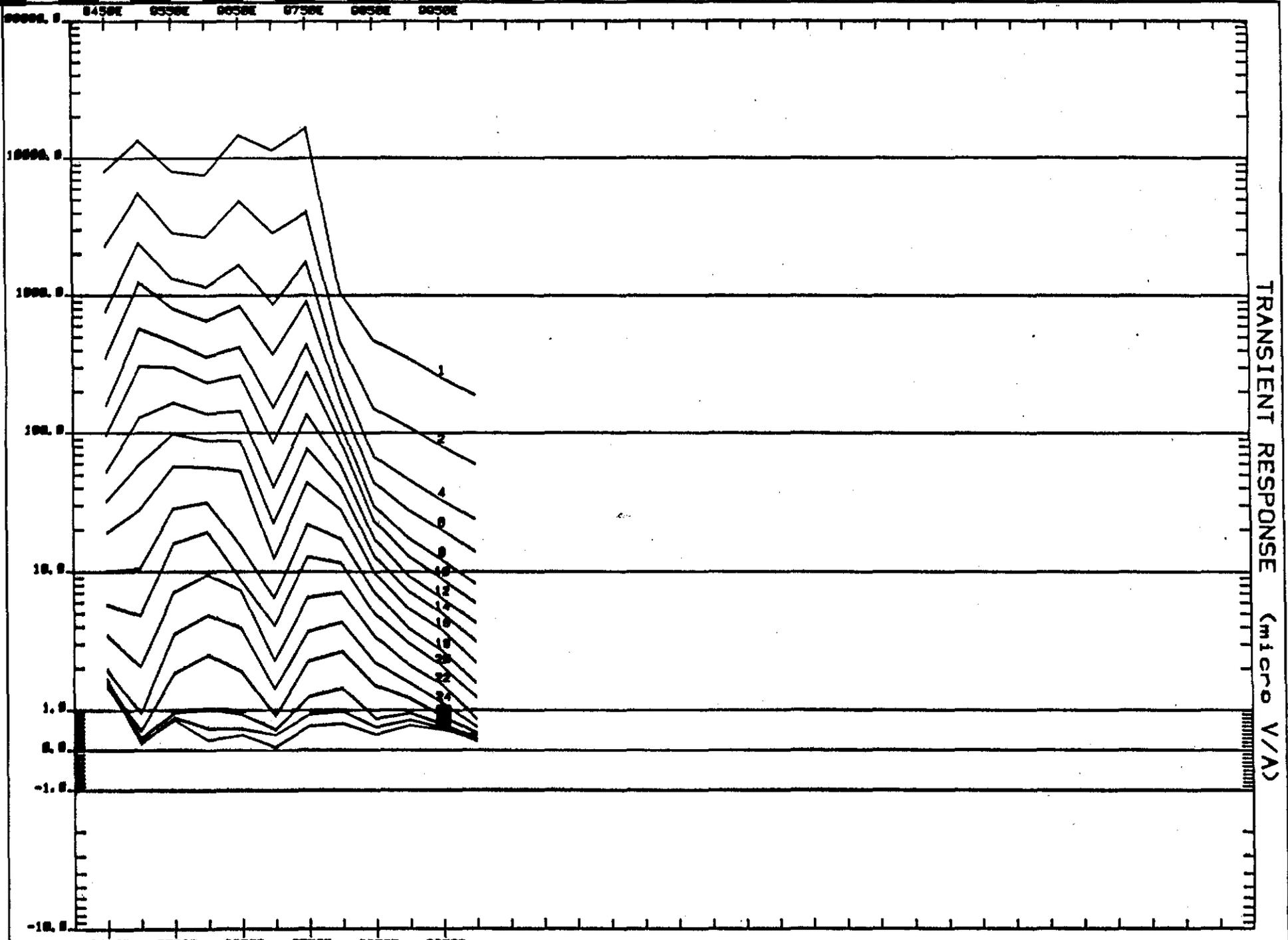
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PROSPECT GRANVILLE EAST

SIROTEM PROFILE

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588049



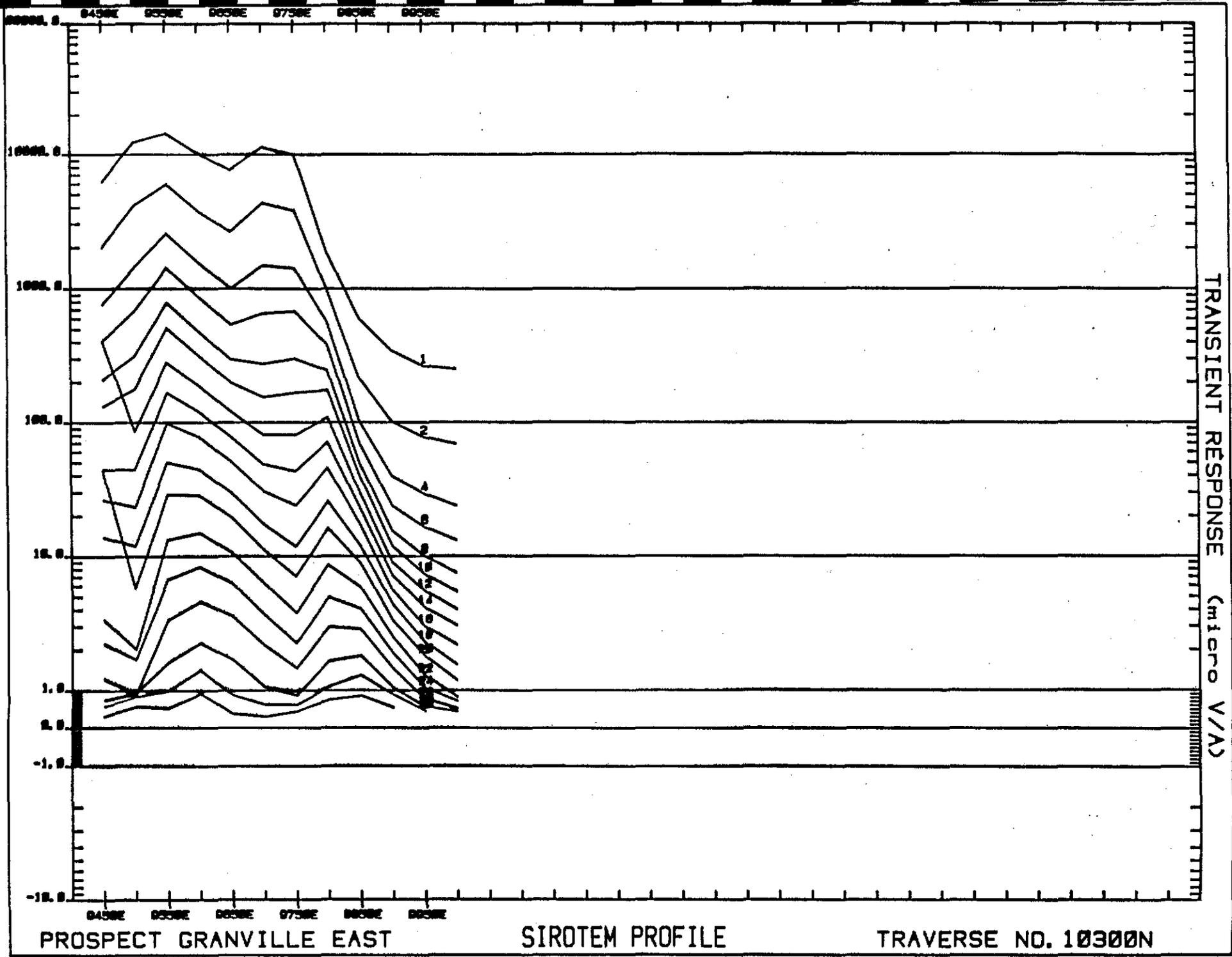
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SIROTEM PROFILE

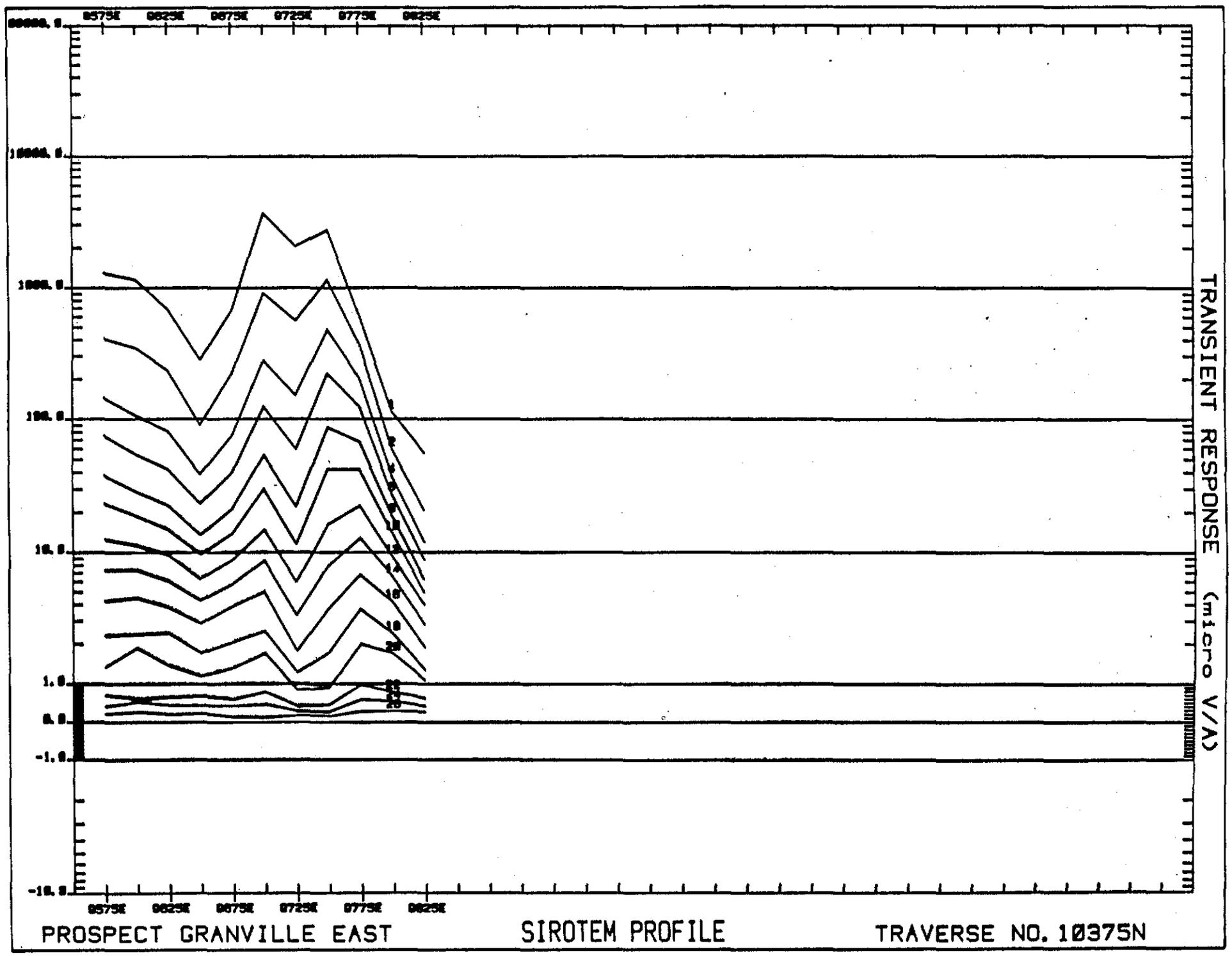
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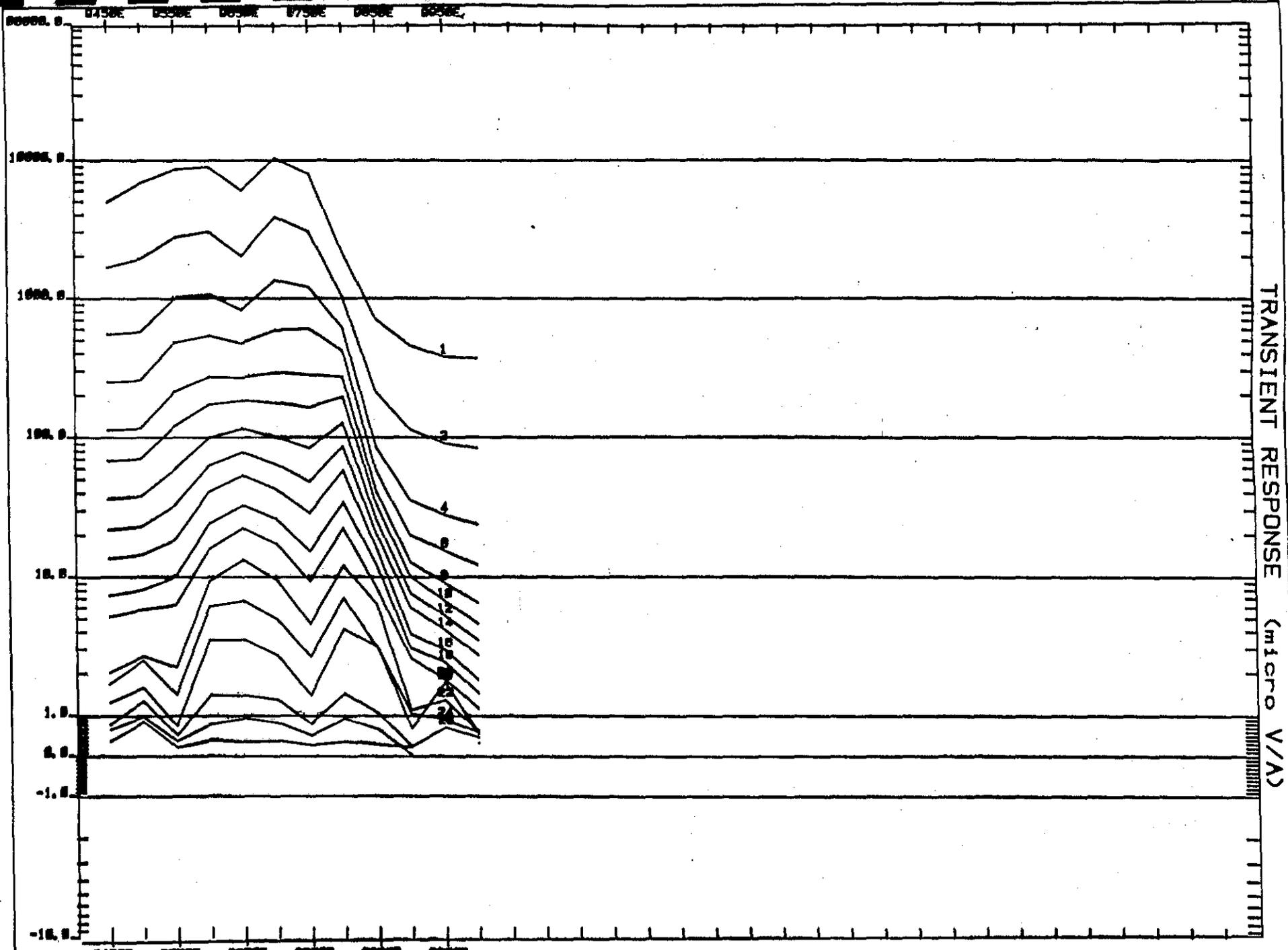
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050



588052

052



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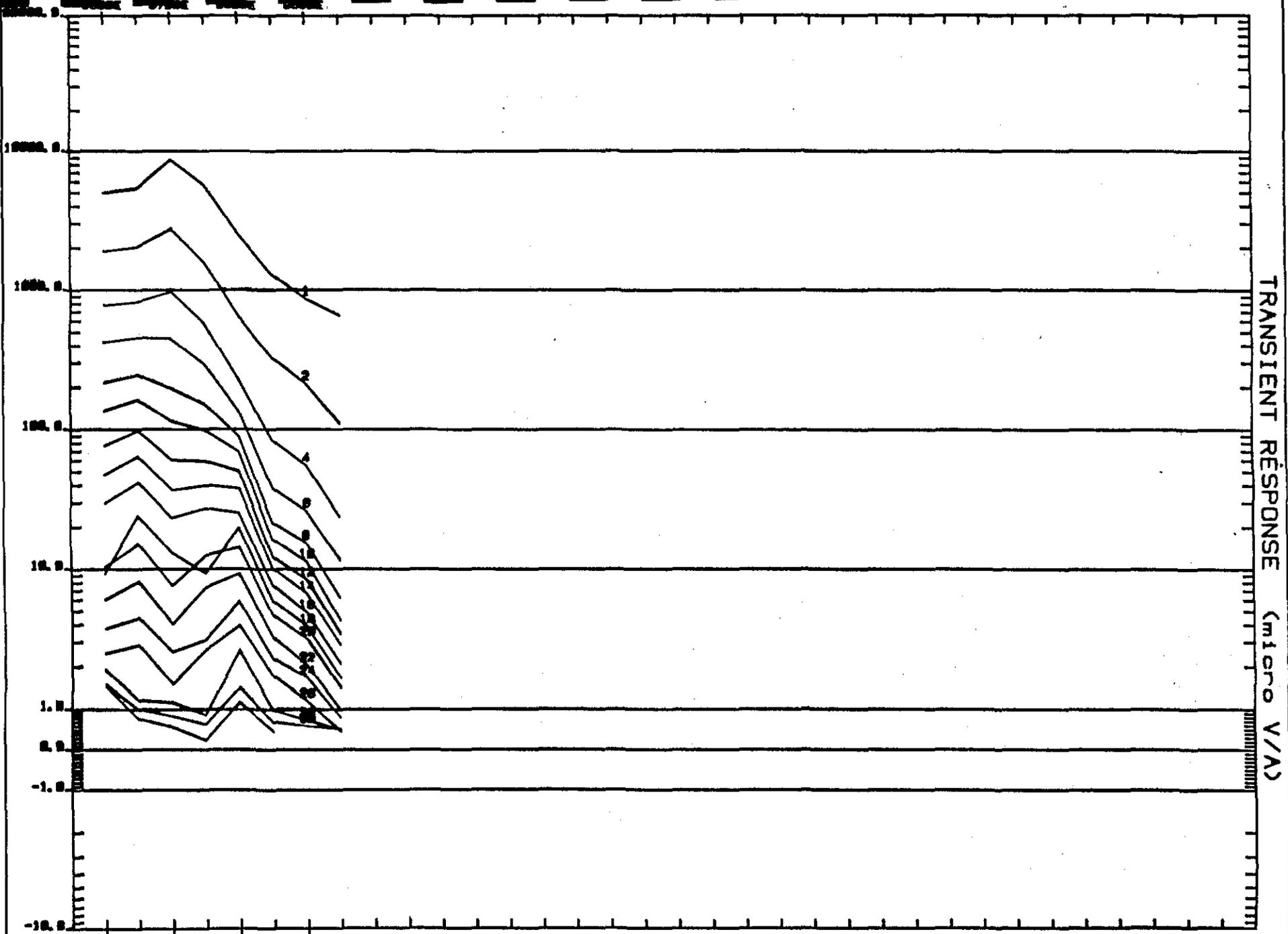
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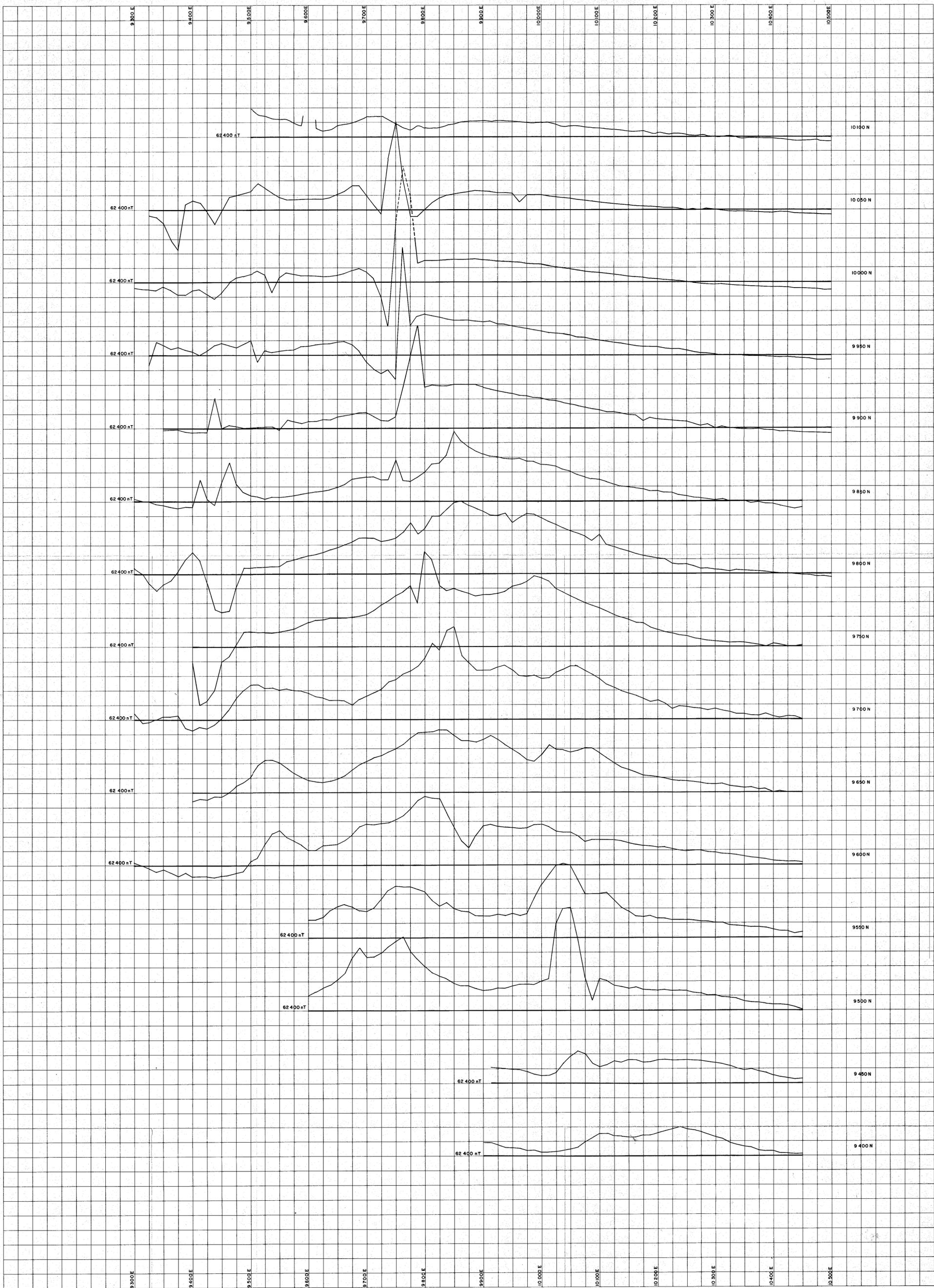


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SIROTEM PROFILE

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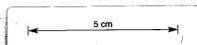
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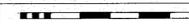
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 BASE PEG :- 10 000 E, 9 400 N.
 Revised August '82



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 GEOPH : J. S.
 DRAWN : J. R. M.
 CHECKED :



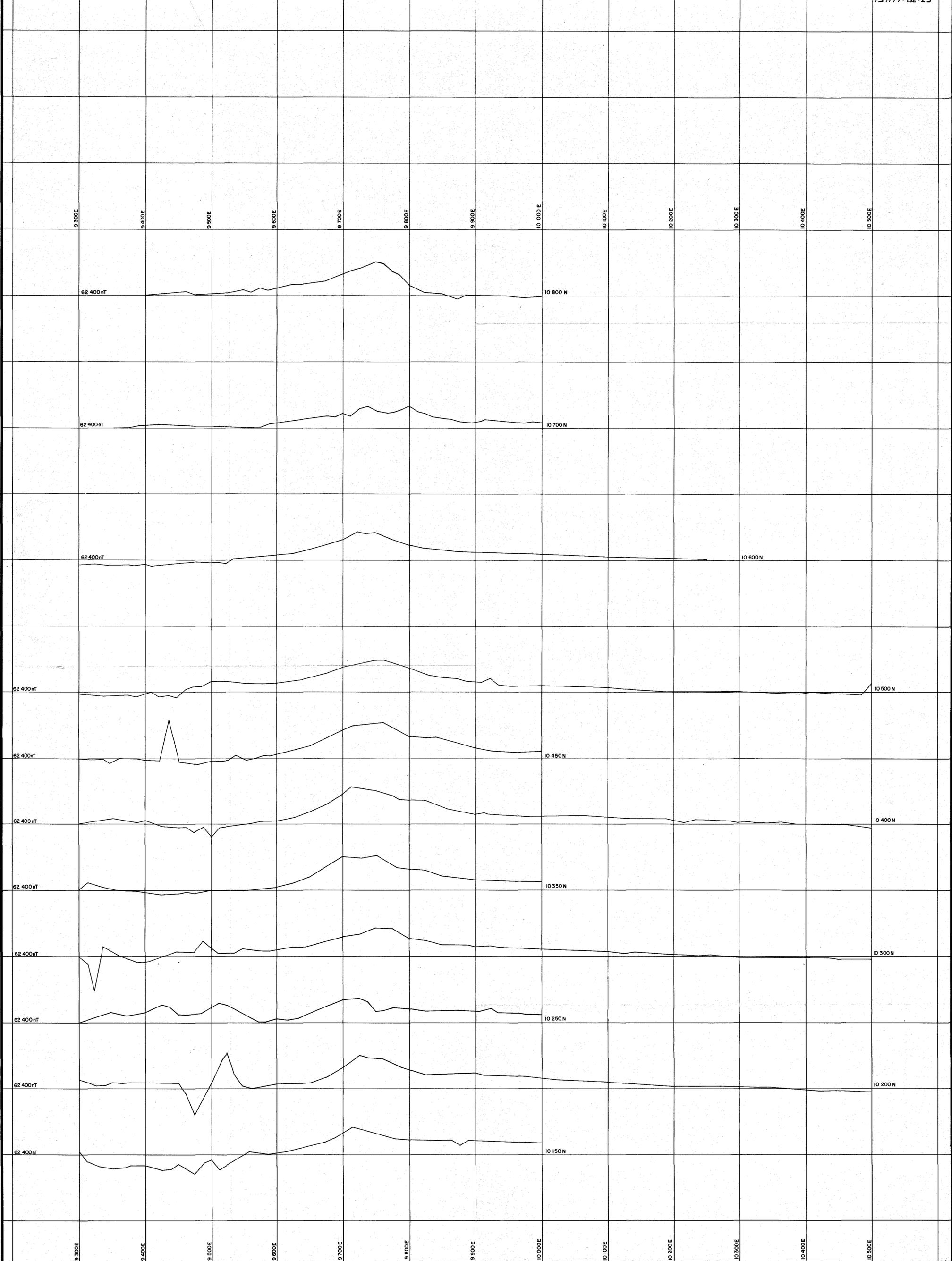
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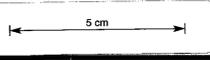
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 83-1962
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GE-22

7111



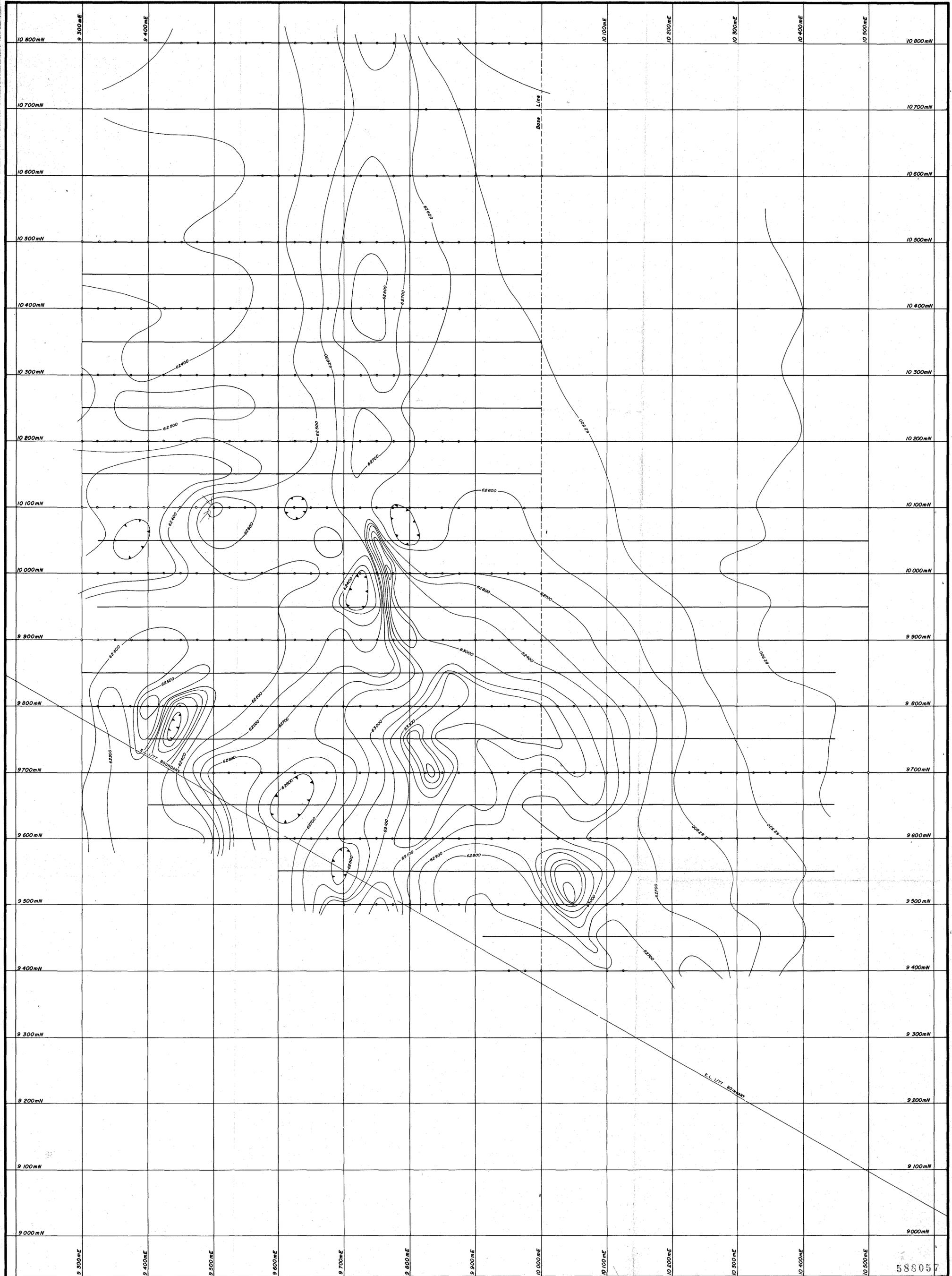
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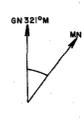
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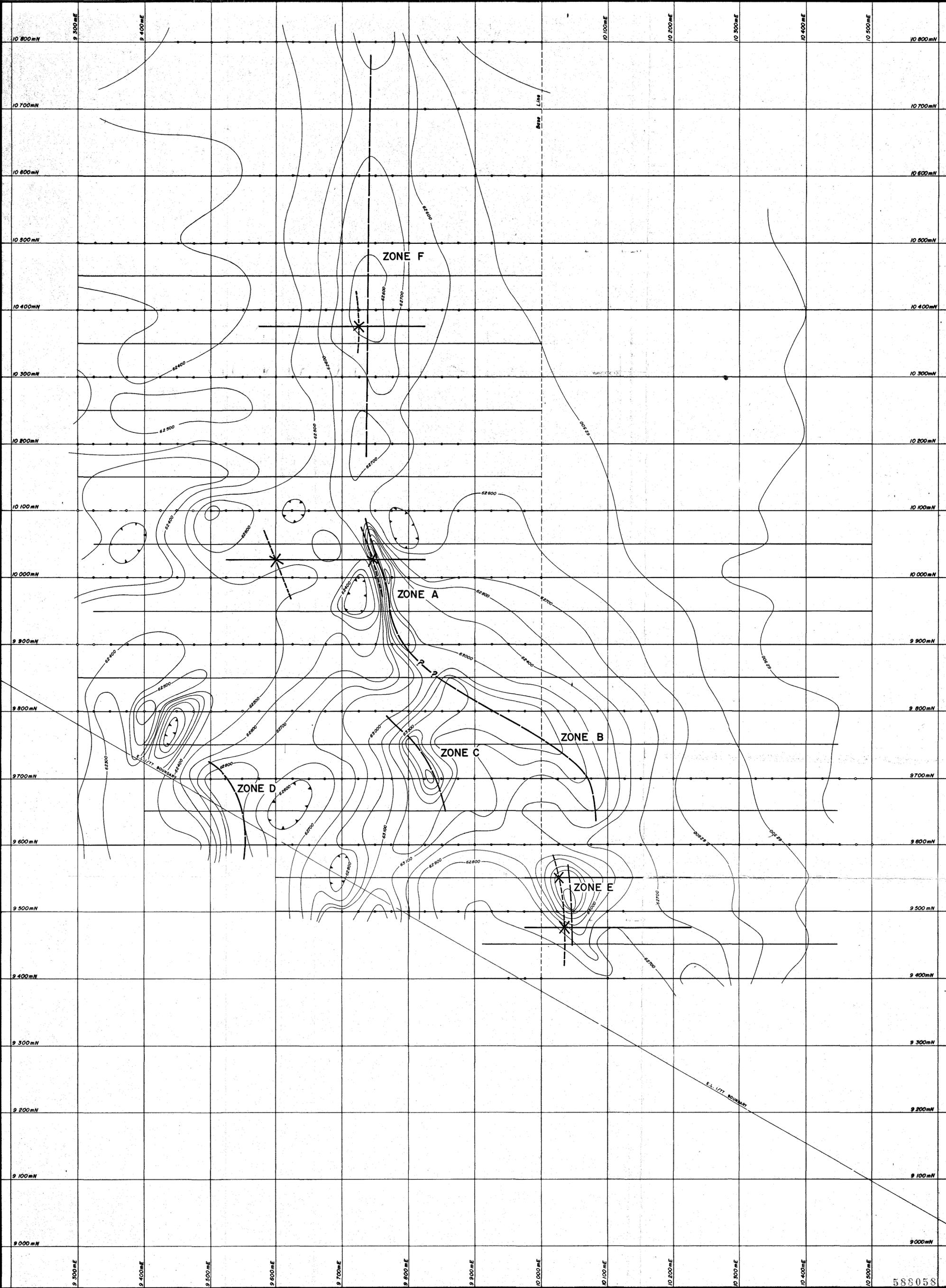
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 OBS: N. Lang., R. Out., J. Sum.



DATE 16/11/82
 GEOL. J.S.
 DRAWN R. Toz
 CHECKED

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GRANVILLE EAST
 CONTOURS OF TOTAL MAGNETIC INTENSITY



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- MAGNETIC TREND
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- X — SIROTEM 50m LOOP COVERAGE
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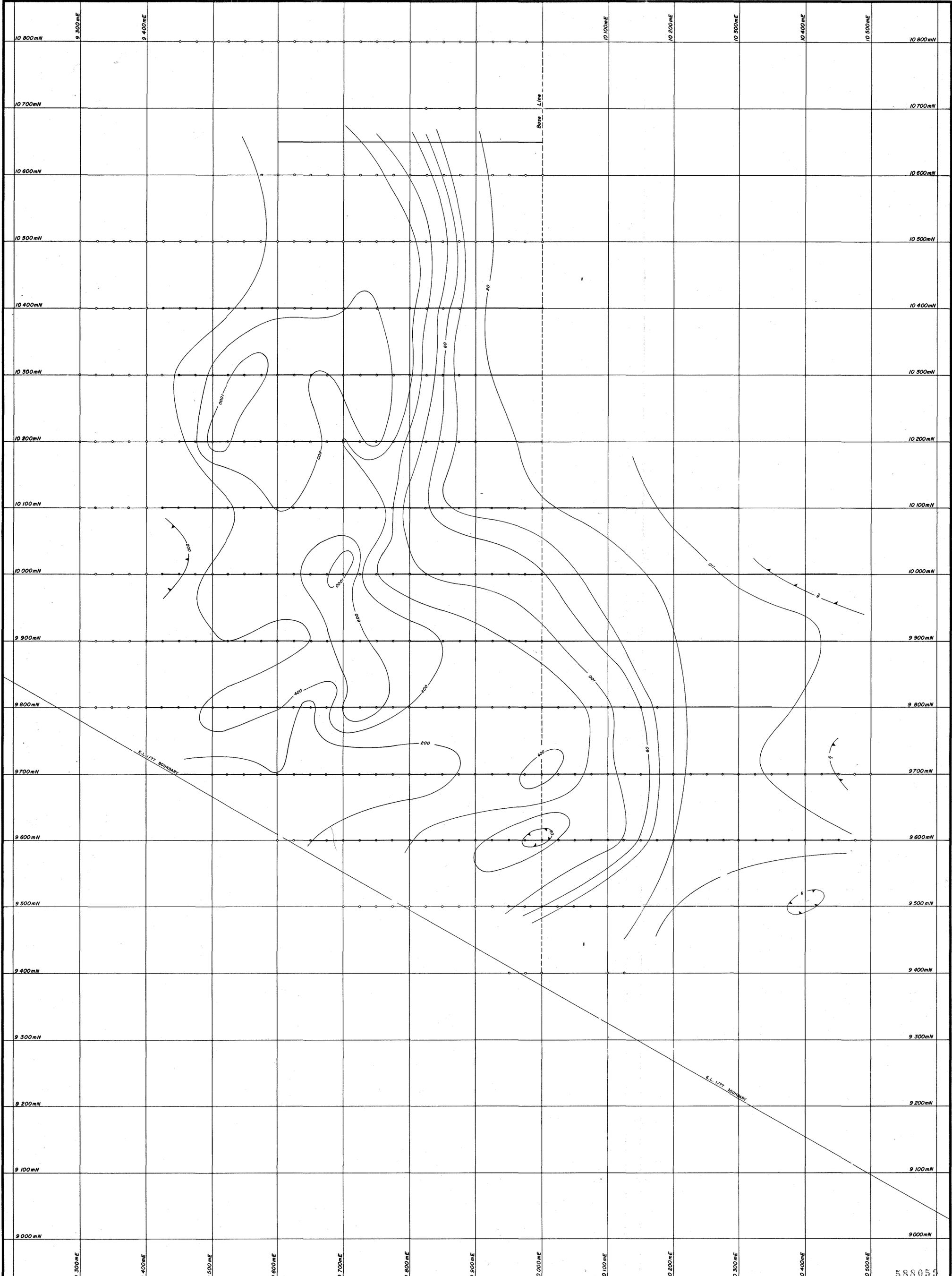
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GNS 321°M

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GEOLOGIST J. Sum.
DRAWN R. Tag
CHECKED

588058



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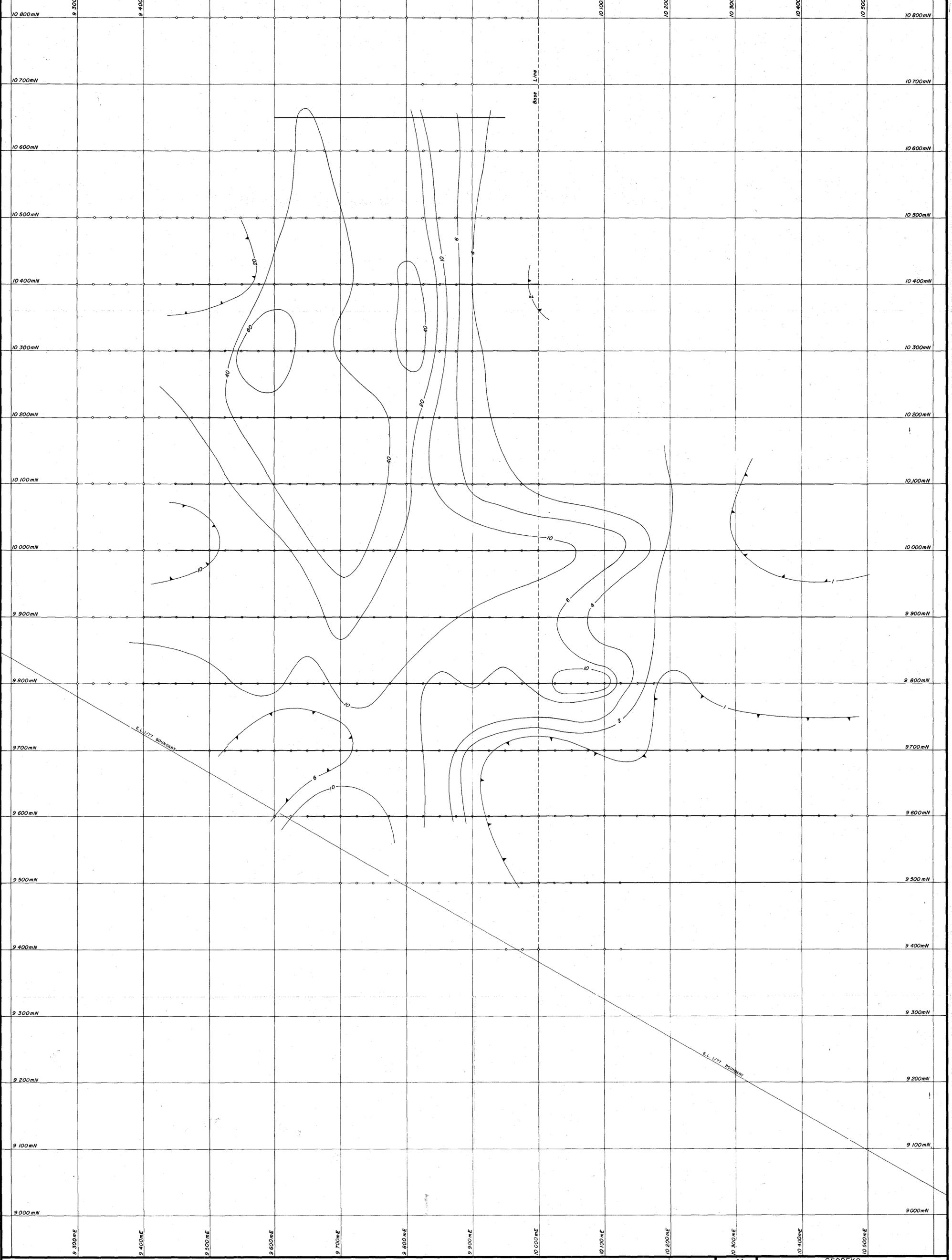
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5 cm

GN 321°M
 MN

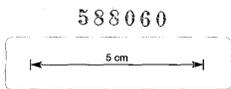
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 GRANVILLE EAST
 Contours of e(t)/l Channel 6 (2.6mS)

88059



LEGEND:
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DATE: October 1982
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 INSTRUMENT: Sirotem MK. II
 OBS. P.M.



GN 321°M
 DATE 16/11/82
 GEOL. J.S.
 DRAWN: R.T.G.
 CHECKED:

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E.L. 1/77 ROCKY CAPE, TASMANIA
GRANVILLE EAST 7116
 Contours of $e(t)/I$ Channel 16 (15.8 mS)