

SCINTREX

MICROFILMS

321001

OPEN FILE

A REPORT ON A
GRADIENT ARRAY ELECTRICAL INDUCED POLARIZATION
AND TOTAL MAGNETIC FIELD SURVEY
OVER THE CLARK RIVER GRID, NEAR QUEENSTOWN, TASMANIA
ON BEHALF OF
THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

FORM	A.G.	C.G.	E.O.	DATE
G. DIR.	2 OCT 1984			REGISTERED
	DEPT. OF MINES			E & IL
	FILE No. 10,076/84			

SCINTREX

PRIVATE AND CONFIDENTIAL

A REPORT ON A
GRADIENT ARRAY ELECTRICAL INDUCED POLARIZATION
AND TOTAL MAGNETIC FIELD SURVEY
OVER THE CLARK RIVER GRID, NEAR QUEENSTOWN, TASMANIA
ON BEHALF OF
THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

BY

A.W. HOWLAND-ROSE
MSc, DIC, AMAusIMM, FGS.
GEOPHYSICIST

SYDNEY, N.S.W.

APRIL, 1978

TAS-054D

CONTENTS

Summary

Introduction Page 1

Equipment and Modus Operandi Page 2

Data Presentation Page 2

Discussion of Results Page 3

Contour Interpretations Page 13

General Conclusions Page 17

Detailed Conclusions Page 19

Data Profiles

Plate 1 - Chargeability Contour Plan

Plate 2 - Resistivity Contour Plan

Plate 3 - Total Magnetic Field Contour Plan

Plate 4 - Interpretation Plan

**SCINTREX PTY. LTD.**

GEOPHYSICAL CONSULTANTS AND CONTRACTORS

SUMMARY

An electrical induced polarization gradient array reconnaissance survey over the Clark River grid has revealed a series of approximately grid north south trending induced polarization anomalies. Zones 'C', 'I' (28N), 'L₁' and 'M' are considered of primary interest, Zones 'D', 'G', 'I' (20N & 24N), 'J', 'K', 'L₂' and 'L₃', 'N' and 'P' are of secondary interest, while Zones 'A', 'B', 'E', 'F', 'H' and 'O' are of tertiary geophysical interest.

The magnetic field, resistivity and chargeability data have been compiled into a physical property interpretation plan which summarises the characteristics of the underlying rocks, and is therefore a geophysical representation of the underlying geological units.

SCINTREX

A REPORT ON A
GRADIENT ARRAY ELECTRICAL INDUCED POLARIZATION
AND TOTAL MAGNETIC FIELD SURVEY
OVER THE CLARK RIVER GRID, NEAR QUEENSTOWN, TASMANIA
ON BEHALF OF
THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

INTRODUCTION

At the request of Mr. K. Reid, Chief Geologist for the Mount Lyell Mining & Railway Company Ltd., Scintrex Pty. Ltd. undertook electrical induced polarization reconnaissance surveys using the gradient array, and total magnetic field surveys over the twelve 400 metres spaced lines making up the Clark River Grid.

The crew consisted of Senior Operator, Mr. B. Ekstrom, Second Operator, Mr. R. Sims and three assistants supplied by Scintrex. The crew was camped in the Clark River camp and supplied by helicopter. The geological supervision and direction was carried out by Senior Exploration Geologist Mr. R. Mears, while the author supplied such additional supervision as was necessary.

The work was carried out over 4½ single operator and 8 double operator days between 23rd January and 8th February, 1978.

SCINTREX*EQUIPMENT AND MODUS OPERANDI*

The energising unit consisted of a Scintrex 10/15 kilowatt time domain induced polarization transmitter powered by a trailer mounted Volkswagen industrial engine. This unit was stationed on a ridge overlooking the Clark River Valley and the lines run out from the unit on both sides of the valley. The unit was attended by J. Dart who travelled by four wheel drive vehicle from Queenstown daily, and communication between the transmitter and the reading crews was by radio. The resultant primary and secondary fields were investigated using two Scintrex IPR-8 units utilising a three slice, 2 second programme.

The magnetic field survey was carried out using a stationary base magnetometer (Geometrics 801) read every two to five minutes with two Scintrex MP-2 units read on line. The resultant data was corrected for base station variation and each individual field reading is considered to be within ± 3 gamma of any other. (Except in areas of high gradient).

DATA PRESENTATION

The data profiles of electrical induced polarization, apparent resistivity and (separately) total magnetic field are displayed at the scale of 1:2500. Resistivity is shown on a 10 centimetre log cycle and expressed in ohm-metres, while apparent chargeability is shown in millivolts/volt at the scale of 1 centimetre = 2 millivolts/volt.

SCINTREX

Page - three

While three slices (M_1 , M_3 and M_5) were measured and recorded, only M_3 was plotted. Also, as the decay form was invariably normal (+) when normalised for amplitude, no ΔM data was required to be plotted.

The magnetic field data is shown at two scales as follows:-
1 centimetre = 50 gamma and, in areas of steep gradient, 1 centimetre = 500 gamma.

All three parameters, resistivity, chargeability and total magnetic field, are shown in contour format at the scale of 1:6000. The three physical properties have been combined in a physical property interpretation plan, again at the scale of 1:6000.

DISCUSSION OF RESULTS

Chargeability The range in chargeability values recorded in the area varies from less than 10 millivolts/volt to in excess of 70 millivolts/volt. However, the background lies in the range 14 \pm 4 millivolts/volt in the north and increases to the south to about 17 \pm 2 millivolts/volt. Individual anomalies relative to the backgrounds are mostly seen on one line only, and rarely over two or more lines. The strike length therefore probably ranges between less than 400 metres to over 400 metres but rarely to 800 metres.

SCINTREX

Page - four

Apparent Resistivity The range in apparent resistivity recorded was from less than 1500 ohm-metres to in excess of 20,000 ohm-metres. The background can be considered to be about 5000 \pm 2000 ohm-metres in the north-east which increases west and south to become about 7000 \pm 2000 ohm-metres in the south-west. The bulk of the resistivities recorded, however, lie in the range 3000 to 10,000 ohm-metres

Magnetic Field On the eastern sections of lines 0 to 20, the magnetic field remains about 62,300 gamma to 62,600 gamma. In the south-eastern section of the grid, fields rise from 1000 to 10,000 gamma above this level. This section obviously marks a major rock type difference from the remainder of the grid area.

For all three physical properties, the strike of all significant features varies about grid north-south.

The significant induced polarization responses are discussed on a line by line basis below.

LINE 00 - ZONE 'A' An 8 millivolts/volt response situated at 3125E from host rocks whose resistivity is a high 5000 to 6000 ohm-metres. A disseminated source at a maximum depth of 50 metres is estimated.

007

SCINTREX

LINE 04N - ZONE 'B' At 3670E an 18 millivolts/volt response above a 16 millivolts/volt background was recorded. The host rock resistivity is about 10,000 ohm-metres as against the background of about 4000 ohm-metres. Also the anomaly occurs close to the western flank of a highly magnetic unit which was recorded from about 3650E to 3910E. While the source will undoubtedly contain magnetite, the chargeability is considered to be disseminated sulphides within a highly resistive rock unit. The maximum depth to source is estimated to be about 50 to 60 metres and the dip *perhaps* to the east. A normal/slow decay form infers a normal grain size to the source. There is no clear correlative of this zone either to the north or south.

LINE 08N - ZONE 'C' A most significant anomaly was recorded on this line between about 3330E to 3400E where the chargeabilities reach over 50 millivolts/volt as against a background of about 12 millivolts/volt. The resistivities are significantly reduced over this response to about 2500 ohm-metres from 7000 to 8000 ohm-metres to the east and west. The chargeable source therefore is either disseminated or weakly interconnected, and lies within a host less resistive than the enclosing rocks. The maximum depth to this *wide* source is less than 25 to 30 metres. The decay form is normal. There is a 100 gamma depression in the total magnetic field over this zone. Thus, either remnant magnetism is present within the magnetite in the source, or perhaps pyrrhotite may contribute to the source. It is possible that the lower resistivities recorded at 3425E (+50 metres) on line 12N could relate

to this host rock.

LINE 12N - ZONE 'D' A 14 to 15 millivolts/volt response was recorded at 2775E whose maximum depth is estimated to be about 40 metres. This response occurs within broadly lower resistivities of 5000 ohm-metres as against twice this to both the east and west. A smaller peak at 2850E may also be related. This anomaly is of secondary interest.

LINE 12N - ZONE 'E' A broad zone of 10 millivolts/volt against the 16 millivolts/volt background was recorded between 3700E and 3975E which has two broad peaks (E and E') at 3775E and 3925E, the maximum depths of which are estimated to be about 50 to 60 metres. The 4000 ohm-metres resistivities show a disseminated source while lack of distortion in the magnetic field indicates that the source must either be sulphide or graphite in origin.

LINE 12N - ZONE 'F' At 4500E a substantial 30 millivolts/volt response against a low 4 millivolts/volt(+) background is considered in large degree to be due to distortions in the equipotential field due to the angle of the current flow across the lines. As such the legitimising of this response is suspect.

LINE 16N - ZONE 'G' Two significant anomalies of about 15 to 16 millivolts/volt above the 16 to 18 millivolts/volt background were recorded at about 3925E and 4000E, both accompanied by a 60%

SCINTREX

to 70% decrease in the apparent resistivity to about 2500 ohm-metres. The maximum depth of each source is estimated at 25 to 35 metres. In both cases substantial increases in magnetic field were recorded which indicate magnetite contributes to the source material, however it is not possible to say whether it is the *sole source*.

LINE 16N - MINOR ZONES OF INTEREST Zones of 8 millivolts/volt above background were recorded at 2675E, 2912E and 3000E within highly resistive 7000 to 18,000 ohm-metres. The maximum depth to source of these responses is estimated to be 25 metres. All are of relatively minor interest.

LINE 16N - ZONE 'H' Broad high chargeabilities of 28 millivolts/volt were noted between 4150E and 4300E and are coincident with a 1000 gamma \pm increase in the magnetic field. The source is considered at least in part, to be due to associated magnetite and thus of little economic interest.

LINE 16N - ZONE 'P' A sharp 10 millivolts/volt response was recorded on this line at 3562E against a background of 16 millivolts/volt. A coincident 50% depression in the high 8000 to 4000 ohm-metres resistivity infers the source to be of a disseminated nature. The maximum depth to source is interpreted to be less than 25 metres and the width also less than 25 metres. This zone is considered of better than secondary interest, and *may* trend into a somewhat wider zone on line 20N at 3662E.

010

SCINTREX

LINE 20N - ZONE 'I' A significant 20 millivolts/volt above the 14 millivolts/volt background was observed centred at 4112E coincident with a sharp 50%+ reduction in apparent resistivity to 2000 ohm-metres. The maximum depth to the chargeable source is estimated at 40 metres. Coincident increases in magnetic field of up to 10,000 gamma above background are also recorded. Therefore, the source is in part (or in whole) magnetite. Nevertheless the source is of secondary to primary interest as magnetite as a chargeability source is difficult to quantify. This response can be traced north across lines 24N and 28N.

All other responses on this line are of minor interest only.

LINE 24N - ZONE 'I' The chargeability response is again about 20 millivolts/volt above background, and is situated at 4140E, but unlike Zone 'I' on line 20N, there is no significant decrease in the apparent resistivity and therefore the source must be wholly disseminated in nature. The maximum depth to source is estimated to be 30 metres. Unlike line 20N, the zone on this line is associated with an increase in magnetic field of only a few hundred gamma at the most. Therefore the source cannot be magnetite, but sulphides (or graphite). This zone is of secondary interest.

LINE 24N - ZONE 'J' Within a broad *relative* depression in the higher background resistivities of 6000 to 7000 ohm-metres down to 4500 ohm-metres, a broad induced polarization response of up to 12 millivolts/volt above the 10 to 12 millivolts/volt

011

SCINTREX

background, was recorded between 3280E to 3375E centred at 3312E. The maximum depth to source at the latter co-ordinate is about 50 metres. The source is interpreted as being disseminated sulphides (and/or graphite) but contains some magnetite (or pyrrhotite) as a local coincident increase of about 100 gamma was recorded over this zone.

LINE 28N - ZONE 'I' This zone reaches its greatest interest on this line with a 74 millivolts/volt anomaly being recorded coincident with a 1500 ohm-metres low in resistivity as against a 6000 ohm-metres background. The decay form observed was normal, and there was no distortion in the accompanying magnetic field. The maximum depth to source at 4112E is estimated at 25-30 metres.

LINE 32N Only minor responses were recorded on this line, the most notable of which were:-

(i) An 8 millivolts/volt response on a 16 millivolts/volt background at 4187E which *may* represent the most northerly extension of Zone 'I', and

(ii) A broad zone of from 4 to 8 millivolts/volt between 3350E and 3500E from within high apparent resistivities of 6000 to 8000 ohm-metres which may relate to a similar zone on line 36N (see below).

LINE 36N Low amplitude increases in chargeability of about 6 +2 millivolts/volt were recorded between 3100E and 3200E,

SCINTREX

between 3375E and 3480E, and a single peak at 3937E and are considered of minor interest only.

LINE 36N - ZONE 'K' Two narrow sharp peaks at 3637E and 3688E occur either side of a 60%+ decrease in apparent resistivity at 3675E to 2000 ohm-metres. The maximum depth to these sources is about 35 metres. The causative material is disseminated sulphides (or perhaps graphite) on the flanks of a more conductive host.

LINE 36N - ZONE 'L' (?) An 8 millivolts/volt response on line 36N at 4212E from within high 5000 ohm-metres resistivities and no distortion in the local magnetic field, infer a disseminated sulphide or graphite source, the maximum depth of which is inferred to be about 25 to 30 metres. This may represent the most southerly extension of Zone 'L' (see below).

LINE 40N - ZONE 'L' A series of significant chargeability responses of 43 millivolts/volt (peak), 26 millivolts/volt (shoulder) and 26 millivolts/volt (peak) at 4212E, 4250E and 4312E are all coincident with significant lowering of the apparent resistivity to 1200 ohm-metres, 1600 ohm-metres and 1600 ohm-metres from 3000 ohm-metres plus. The maximum depth to source in all cases is estimated to be about 30 metres. The absence of significant magnetic responses clearly indicates the absence of magnetite or significant pyrrhotite from the source. Thus weakly interconnected or disseminated sulphides (or graphite) within a host less resistive

than the enclosing rocks is the interpreted source.

LINE 40N - ZONE 'M' An increase in chargeability from a 12 to 13 millivolts/volt background to a maximum of 22 millivolts/volt at 4050E was recorded between 3975E and 4075E. This response coincides with a relative depression in the apparent resistivity to 1800 ohm-metres from over 7000 ohm-metres 50 metres to the east, and 3500 ohm-metres 100 metres to the west. A similar depression in resistivity at 3910E on line 36N and accompanied by a 7 millivolts/volt chargeability response may correlate with this zone. On line 40N the maximum depth at 4050E is about 60 metres. The zone is flanked by an increase of 120 to 150 gamma in the magnetic field, inferring the presence of magnetite bearing units either side of the host to the disseminated chargeable material.

LINE 44N - ZONE 'M' A most significant and substantial induced polarization response was recorded between 3975E and 4100E. A peak of 42 millivolts/volt and a shoulder of 28 millivolts/volt were recorded at 4012E and 4075E inferring sources at both these sites. These anomalies occur within a change in resistivity from over 5000 ohm-metres to the west of 3950E and 1500 ohm-metres to the east of 4100E. The maximum depth to source of the two sources, interpreted as being disseminated in nature, is 70 metres and 50 metres respectively. The absence of material increases in the magnetic field indicate the absence of magnetite within the source.

014

SCINTREX

LINE 44N - ZONE 'N' A sharp 8 to 10 millivolts/volt above background response centred at 4162E *may* be related to a resistivity low of 1250 ohm-metres at 4188E. The source is interpreted to be narrow (i.e. less than the 25 metres dipole used), and the maximum depth to the disseminated source is about 25 metres. This zone *may* be a northerly extension of Zone 'L'.

LINE 44N - ZONE 'O' A normally significant 18 to 20 millivolts/volt chargeability response above the 18 millivolts/volt background was centred at 4437E. However, as the line was angled to the field (see Plates 1 to 3) over the response, it is likely a distortion caused by the shallow angle the potential dipole made to the current flow direction between the two current poles (electrodes). Assuming normal criteria over the site, apparent resistivity falls over this section to about 1500 ohm-metres from 2500 ohm-metres to the immediate west. The maximum depth to source is estimated at 70 metres. The source is disseminated or weakly interconnected sulphides (or graphite), with only very minor magnetite present. A second minor "shoulder" response of 6 millivolts/volt above background was recorded at 4375E within more resistive rocks and *may* represent a disseminated halo effect. The magnetic field increases about 100 gamma over this zone which infers that magnetite is present within the source, but not wholly responsible for the observed chargeability reading. This anomaly should receive some follow-up attention, however, extreme caution is necessary due to the angle of the line.

015

SCINTREX

LINE 44N - MINOR ANOMALIES Some four minor chargeable sources having chargeabilities of about 5 to 6 millivolts/volt were noted centred at 3488E, 3588E, 3737E and 3788E. In all cases the high resistivities (5000 ohm-metres+) associated with these anomalies indicate a disseminated source, while the profile form indicates a shallow 25 metres depth to that source.

CONTOUR INTERPRETATIONS

The general strike of all three physical properties varied about grid north south. In the south-eastern section the strike tends to be just east of grid north, while in the north it is just west of grid north. The *main features* of each physical property show parallel trends.

The resistivity data:- The resistivity data shows a range from in excess of 20,000 ohm-metres to less than 1500 ohm-metres. The highest apparent resistivities were recorded within 400 metres of the baseline, and generally decrease to the east, particularly east of about 3800E on lines north of 28N, and east of about 4200E on lines south of 20N. This general increase in resistivity from east to west infers a gradual but variable change in composition across strike. The increase in resistivity *may* for instance, infer more acidic rocks to the west. The 400 metre spacing between lines precludes detailed interline correlation, and significant events rarely extend over more than two lines.

SCINTREX

A number of more resistive units were defined in the western section as follows:-

Lines 28N and 32N west of about 3100E the resistivity rises to over 18,000 ohm-metres and is accompanied by low background chargeabilities of 12+ millivolts/volt, and no distinct change in magnetic field. A resistive rock, low in mafic minerals is the source, e.g. silicified acid volcanic.

Line 20N at 3200E +25 metres, and line 16N between 3100E and 3200E where resistivities reach about 20,000 ohm-metres, while background chargeabilities remain about 17 millivolts/volt to 10 millivolts/volt. Broadly lower than background magnetic fields by about 100 gamma were recorded over this area. The source is again resistive rock low in mafic mineral content, probably silicified acid volcanics.

Line 12N centred at about 2650E +25 metres where 15,000 ohm-metres resistivities are accompanied by low 11 to 12 millivolts/volt chargeabilities. Again, rocks low in mafic minerals are considered to be the source.

Highly resistive 15,000 to 17,000 ohm-metres resistivities between about 2800E and 2900E on line 16N were, unlike the three resistive zones above, accompanied by *higher* chargeabilities of 20 to 23 millivolts/volt. No significant change in the magnetic field was recorded over this unit. The source is resistive but carries an increased non-magnetic mafic mineral content and/or sulphides also. It is fundamentally different to the three units described above.

017

SCINTREX

On the whole, the more resistive the area, the lower the accompanying chargeability and the lower the magnetic field.

The most significant low resistivity feature was recorded on lines 36N and 32N centred at 4400E and 4225E where resistivities as low as 1100 ohm-metres were located. Slightly higher magnetic fields and slightly lower than background chargeabilities of 16 millivolts/volt were noted over this zone, but northwards, along the strike the chargeability increases to 43 millivolts/volt at 4210E on line 40N.

Other resistivity lows on lines 44N and 40N at 4100E and 4025E, and on line 28N at 4100E, and line 36N at 3900E, are all accompanied by significant increases in chargeability. Thus, either the host to the causative mineralisation is less resistive than the enclosing rocks, or (and) the chargeable material itself may show some inter-connection. This zone *may* extend over an appreciable strike length, and may be "formational" in origin.

The "moderately" resistive units have been noted on Plate 4. The eastern margin often shows a dextral displacement 100 to 150 metres, but does not give the appearance of being a fault. Lateral changes in resistivity seem more likely (facies change along strike?).

On the magnetic field data the most interesting feature is an area east of 3800E on 20N, 3675E on 16N, 3550E on line 12N, 3400E on 8N, 3300E on 4N and 3200E on 00, which shows extremely high magnetic

018

SCINTREX

relief. Although the boundary described above has a grid N20°E strike, the individual magnetic units (and the associated chargeability and resistivity data also), have a near grid north south trend near the boundary. North of line 20N this zone is not present. Individual magnetic units are generally accompanied by lower apparent resistivities (but still a resistive 3000+ ohm-metres in absolute terms), while some of these maxima are accompanied by an increase in chargeability (e.g. GW). Some of the magnetic anomalies have no increase in chargeability (e.g. at 4200E on 12N). This infers the magnetic sources are not necessarily chargeable. Thus were they magnetic material coincident with chargeability anomalies, the source of the two may not be the same. In similar sequences on the West Coast, graphitic shales carrying magnetite have been recorded. This is a possibility here.

The apparent angular junction with the enclosing sediments may infer a facies change, hinge fault, disconformity or folding, which is not clearly discernible from the data.

West of this contact, and north of line 20N the magnetic field rarely exceeds 62,500 \pm 200 gamma. A zone of relatively low magnetic level of 62,500 \pm 25 gamma in the north to 62,450 \pm 50 gamma in the south was recorded on and to the west of the baseline. (See Plate 4). In common with the moderately resistive units, this unit shows apparent dextral displacements of up to 200 metres between lines 24N and 28N and between lines 8N and 12N. Faults are not the suspected cause, perhaps this too is due to change in physical properties

019

SCINTREX

along strike.

The chargeability background shows an increase in chargeability from west to east, across strike, and from north to south. The most significant induced polarization highs were recorded on the eastern quarter of the area. In this section these anomalies are generally accompanied by lower apparent resistivities, although the absolute levels are generally a higher 1500 to 3000 ohm-metres.

The substantial chargeability responses east of the boundary of high magnetic relief (see Plate 4), where magnetite may make some contribution to the high chargeabilities located (such as zone EW and GW), magnetite alone is not considered the source. Graphite and/or pyrite certainly also make a contribution. The significant anomalies appear to be semi-continuous along strike in the west.

The form of the chargeability anomalies do not infer dislocation by faulting.

GENERAL CONCLUSIONS

- 1 - All three physical properties show an approximate grid north south trend, subject always to the 400 metres distance between lines being able to give a realistic correlation between significant features. Should the causative zones have strike lengths less than the spacing (say 300 metres), and should an "en-echelon" pattern be present, such as observed in many other volcanogenic sequences similarly mapped, then the strike direction

020

SCINTREX

could vary somewhat to that suggested by the data recorded at the 400 metres line spacing.

- 2 - The magnetic field data shows substantial increases to 10,000 gamma above background in the south-eastern section of the grid (as defined below). The boundary between this zone and the zone of much more subdued magnetic relief to the west, is about grid N20°E. However, the strike of individual magnetic features within this zone is approximately grid north-south. The explanation for this boundary is not known, and may be a fault, disconformity, or perhaps a "facies change".

- 3 - While a number of the chargeable zones defined have associated magnetic signatures, not all substantial magnetic anomalies have associated significant chargeability responses. Generally, grain size being equal, it takes five times to ten times the volume of magnetite to produce the equivalent anomalies. A study of the substantial magnetic field increases seen, indicates that on the whole, the magnetite is not chargeable, and further infers that in those zones where substantial magnetic field increases and significant induced polarization responses coincide, the source contains sulphides as well as magnetite.

- 4 - The chargeability data was all acquired on the three slice, M₁, M₃, M₅ programme. A study of the data shows that when the magnitude of M₃ is taken into account, the decay forms over both background and anomalous zones showed normal to near normal decay

021

SCINTREX

forms. Thus this data has not been plotted separately.

5 - In general the resistivity background falls from west to east and from north to south. The physical property map delineates the highly resistive and moderately resistive sections. From north to south there does not seem to be a "dextral stepping" of the more resistive western section into the less resistive eastern section. No clear indication of faulting or folding can be seen in any of the physical properties to explain this phenomenon. It may merely represent facies change along strike.

6 - The induced polarization anomalies have been examined and the detailed conclusions are set out below. Their relative merit has been wholly judged on geophysical grounds. While none are truly conductive in nature, most have sources which either are themselves weakly conductive, or are contained within host rocks which are less resistive than the enclosing rocks. As such, the causative mineralisation is considered to be disseminated, or if "massive" electrically discontinuous over appreciable lengths (i.e. scores of metres).

7 - The maximum depths to source range from less than the potential dipole employed (i.e. 25 metres) to 70 metres.

DETAILED CONCLUSIONS

The most substantial responses were Zone 'B' (Line 4N), Zone 'C' (Line ~~20N~~⁰⁸), Zone 'I' (Lines 20N to 28N), Zone 'L' (Line 40N) and

022

SCINTREX

Zone 'M' (Line 44N). The details are as follows:-

ZONE 'A' - 00/3125EAn 8 millivolts/volt response from a disseminated source whose maximum depth is about 50 metres. This response is considered of *TERTIARY INTEREST ONLY*.

ZONE 'B' - 04N/3670E An 18 millivolts/volt response from a most resistive host (10,000 versus 4000 ohm-metres background). is interpreted to be caused by a disseminated sulphide source at a maximum depth of 50 to 60 metres. The source is contained within the western flank of a magnetite bearing zone, but is not caused by magnetite.

Such anomalies in the Mt. Lyell field have not generally been found to be of any merit. *OF TERTIARY INTEREST.*

ZONE 'C' -08N/3330E-3400E A significant four to five times background response was recorded coincident with a 65% fall in apparent resistivity to 2500 ohm-metres and is interpreted as being due to disseminated sulphides within a host less resistive than the enclosing rocks and is at a depth of 25 to 30 metres. A fall in the magnetic field may indicate presence of pyrrhotite as a contributive sulphide. This response is of *PRIMARY GEOPHYSICAL INTEREST.*

ZONE 'D' - 12N/2775E A disseminated source at a maximum depth of about 40 metres is considered of *SECONDARY INTEREST ONLY.*

023

SCINTREX

ZONE 'E' - 12N/3775E & 3925E Disseminated sulphide sources are inferred at maximum depths of 50 to 60 metres for +25 metres either side of the co-ordinates. This response is of *TERTIARY INTEREST ONLY*.

ZONE 'F' -12N/4500E This substantial response may be due to distortions in the secondary potential field caused by the angle of current flow, and as such may be of little or no significance.

ZONES 'GW' & 'GE' - 16N/3925E & 4000E 15 millivolts/volt above background responses coincident with 60%-70% falls in apparent resistivity to 2500 ohm-metres AND substantial increases in magnetic field, infer magnetite (and perhaps sulphides) to be the source at a maximum depth of 25 to 35 metres. *OF SECONDARY TO PRIMARY INTEREST.*

ZONE 'H' - 16N/4150E-4300E Higher magnetic fields of over 1000 gamma infer the source of this 50% above background chargeability to be disseminated magnetite and thus of *LITTLE POTENTIAL ECONOMIC INTEREST.*

ZONE 'I' - 20N/4112E A sharp narrow chargeability response of 20 millivolts/volt above background from within a source which is less resistive than the enclosing rocks is also coincident with a substantial increase in magnetic field. The source is considered to be due to disseminated magnetite which may include sulphides. The response is considered of *SECONDARY TO TERTIARY INTEREST* on this line.

SCINTREX

024

ZONE 'I' - 24N/4140E On this line, Zone 'I' is identical in form and magnitude to line 20N, but is not accompanied by the substantial increase in magnetic field or decrease in apparent resistivity. The maximum depth to source is estimated at 30 metres. The source is of *SECONDARY INTEREST ONLY*.

ZONE 'I' - 28N/4112E This is perhaps the most significant chargeability response located on the grid. A 74 millivolts/volt anomaly at 4112E is coincident with a 75% fall in apparent resistivity to 1500 ohm-metres. No distortion in the magnetic field indicates either a sulphide and/or graphite source. Maximum depth is estimated at 35 metres. *OF PRIMARY GEOPHYSICAL INTEREST*.

ZONE 'J' - 24N/3280E-3375E Disseminated sulphides (and/or graphite) with some minor pyrrhotite and/or magnetite are the interpreted source for this anomaly. The maximum depth to source at 3312E is about 50 metres. The anomaly is considered of *SECONDARY INTEREST AT BEST*.

ZONE 'K' - 36N/3737E & 3688E Two distinct chargeability peaks either side of a resistivity low of 2000 ohm-metres (as against 5000 ohm-metres to east and west) indicate a disseminated source at a maximum depth of 35 metres below each chargeability maxima. *OF SECONDARY INTEREST ONLY*.

ZONE 'L' - 40N/4212E, 4250E and 4312E Three separate narrow zones, L₁, L₂, L₃, all of which show significant increases in

025

SCINTREX

chargeability and a depression in the apparent resistivity, are interpreted as sulphides (or graphite) within a host less resistive than the enclosing rocks. The maximum depths are 35 metres. *OF PRIMARY INTEREST, L₁; OF SECONDARY INTEREST, L₂ & L₃.*

ZONE 'M' - 36N/3937E Within a broad resistivity low which reaches 1800 ohm-metres at 3912E as against 6000 to 7000 ohm-metres to the east and west, a relatively minor 7 millivolts/volt chargeability response was recorded from a source interpreted to be disseminated and at a maximum depth of 50 metres below 3937E. *OF SECONDARY INTEREST AT BEST.*

ZONE 'M' - 40N/4050E An 8 millivolts/volt anomaly within a broad apparent resistivity low to 1800 ohm-metres (versus 4000 to 7000 ohm-metres to west and east) is interpreted as being due to disseminated sulphides (or graphite) within a less resistive host rock at a maximum depth of 50 metres. The enclosing rocks to the east and west contain some magnetite as inferred by the 100 gamma+ maxima at 4000E and at 4100E.

ZONE 'M' - 44N/⁴⁰¹²~~4102E~~ A substantial 28 millivolts/volt above background response at 4012E is interpreted as being caused by disseminated sulphides (or graphite) within a rock type change. A very slight depression in the resistivity infers some weak conduction within the host rocks. This anomaly is of *PRIMARY GEOPHYSICAL INTEREST.*

SCINTREX

026

ZONE 'N' - 44N/4162E A small 8 to 10 millivolts/volt response is accompanied by lower than average resistivities of the order of 1500+ ohm-metres, and is interpreted as coming from a disseminated source whose width and depth are less than the 25 metres potential dipole employed. This response is of *SECONDARY INTEREST*.

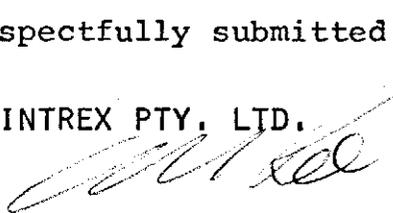
ZONE 'O' - 44N/4437E A normally significant response was observed centred at co-ordinate 4437E. However, the line was at a sharp angle to the normal traverse (see Plates) and therefore this response is suspect, and of dubious priority.

ZONE 'P' - 16N/3562E, 20N/3662E A narrow source less than the 25 metres dipole wide and deep, was located on line 16N and as a somewhat broader zone on line 20N. The interpreted source is disseminated sulphides (or graphite) within a host less resistive by 50% than the enclosing rocks. The geophysical interest is rated *BETTER THAN SECONDARY*.

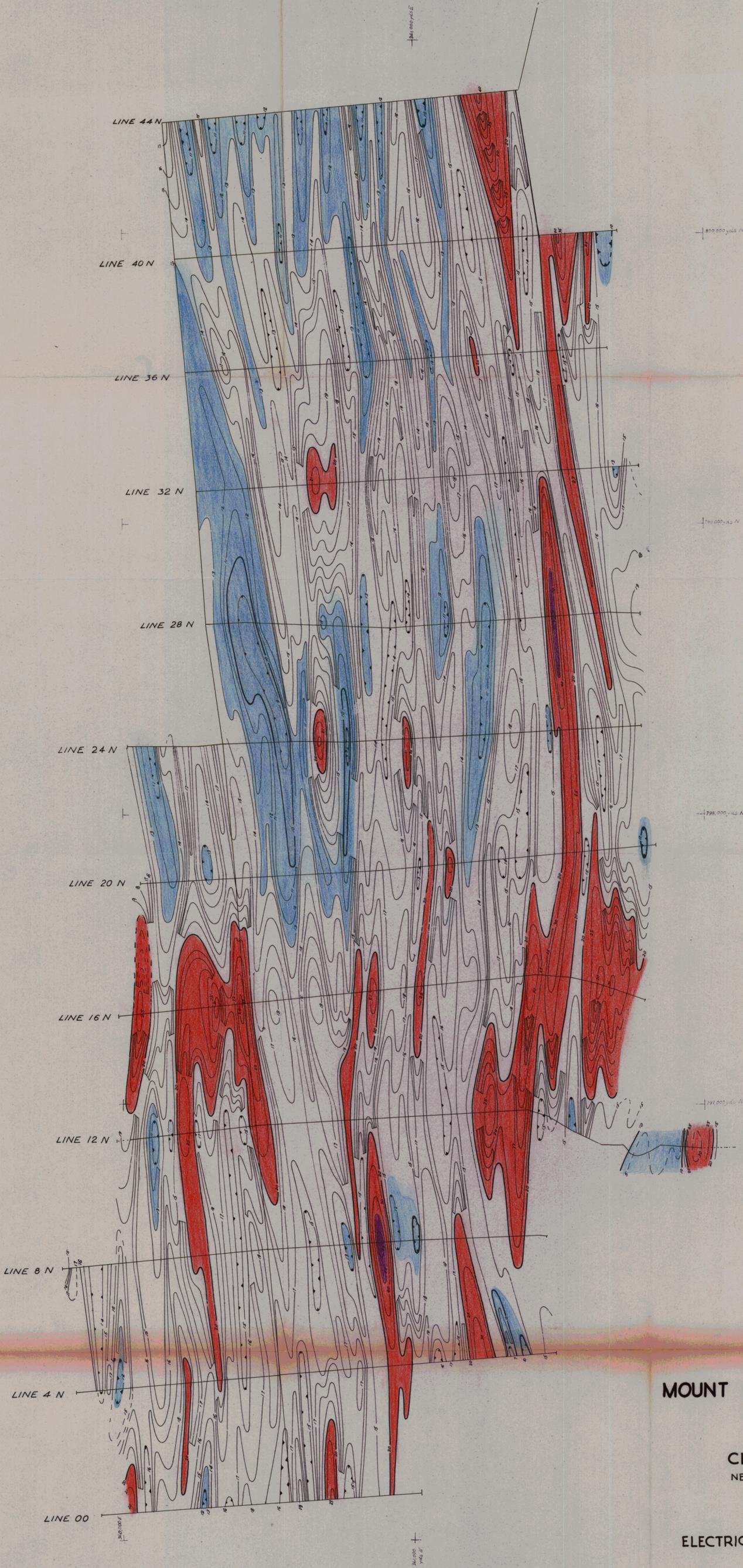
The author looks forward to discussing these results with Mt. Lyell in the near future.

Respectfully submitted on behalf of:

SCINTREX PTY, LTD.


A.W. HOWLAND-ROSE, MSc, DIC, AMAusIMM, FGS.

GEOPHYSICIST



- Below average background
- Above average background
- Very high chargeability

**MOUNT LYELL MINING & RAILWAY
COMPANY LTD.**

CLARK RIVER GRID
NEAR QUEENSTOWN - TASMANIA

GRADIENT ARRAY
ELECTRICAL INDUCED POLARIZATION
SURVEY

**CHARGEABILITY
CONTOUR PLAN**

SURVEYED & COMPILED BY
SCINTREX



JANUARY - FEBRUARY 1978

321029

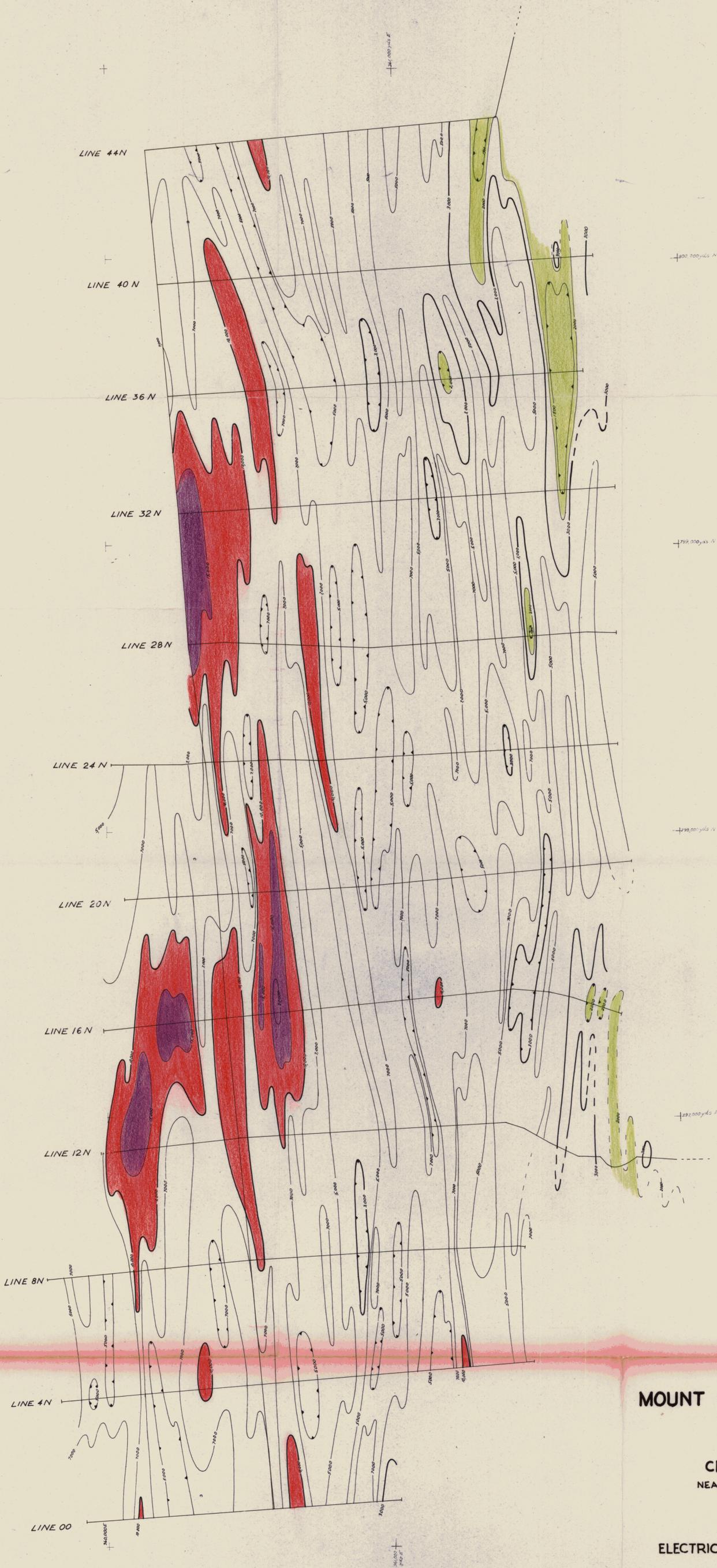
SCALE 1:6000



Job N° TAS-054-D Sheet 1 of 1 PLATE 1.

027

84-2239 vol 112



**MOUNT LYELL MINING & RAILWAY
COMPANY LTD.**

**CLARK RIVER GRID
NEAR QUEENSTOWN - TASMANIA**

**GRADIENT ARRAY
ELECTRICAL INDUCED POLARIZATION
SURVEY**

**RESISTIVITY
CONTOUR PLAN**

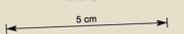
SURVEYED & COMPILED BY
SCINTREX



JANUARY - FEBRUARY 1978

321030

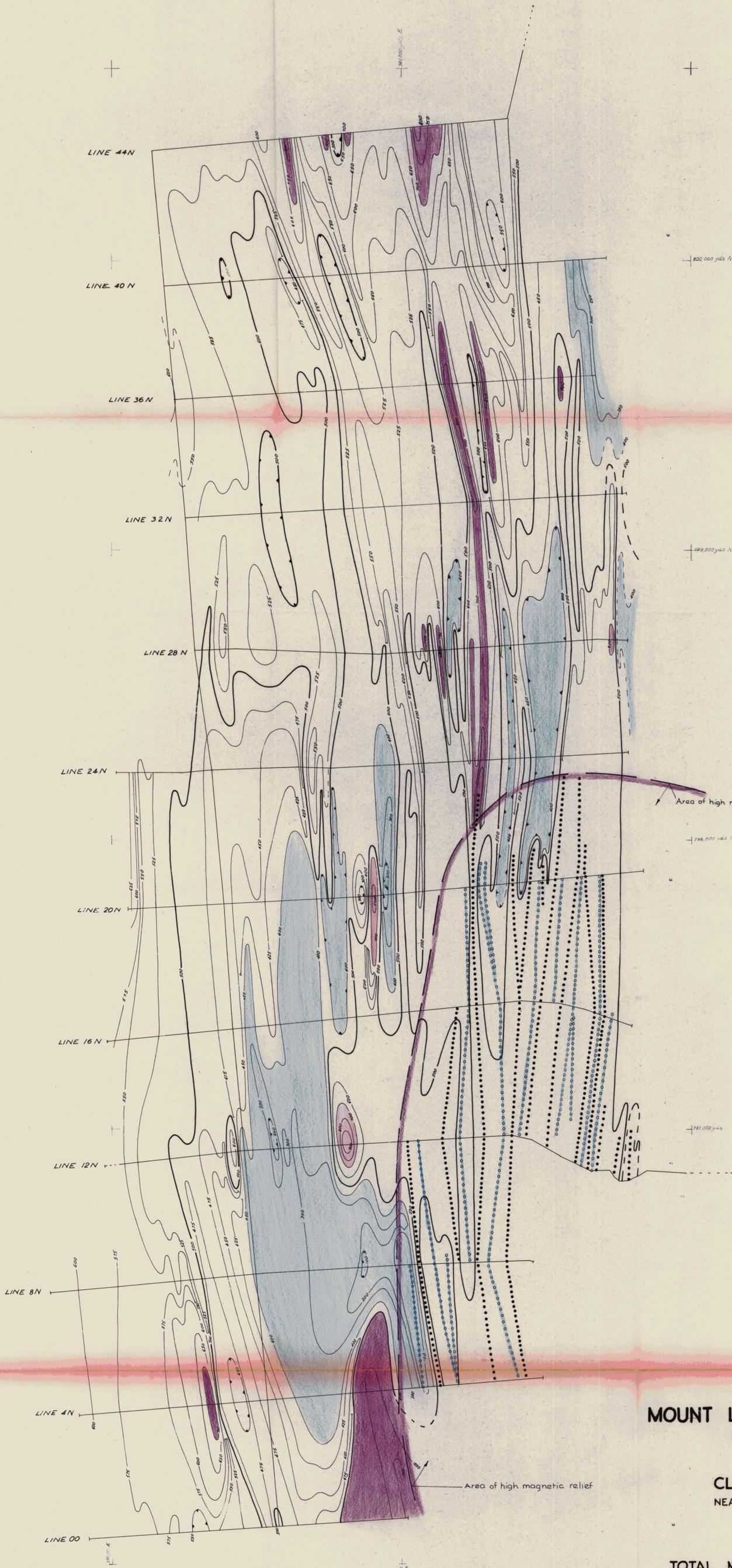
SCALE 1:6000



Job N° TAS-054-D Sheet 1 of 1 **PLATE 2.**

028

84-2239 vol 1/2



Legend

- (1) ●●●● Magnetic high $\approx >1000g$
- (2) ○○○○ Magnetic low $\approx <400g$
- (3) Add 62,000g to all values.

**MOUNT LYELL MINING & RAILWAY
COMPANY LTD.**

CLARK RIVER GRID
NEAR QUEENSTOWN - TASMANIA

TOTAL MAGNETIC FIELD SURVEY

CONTOUR PLAN

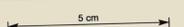
SURVEYED & COMPILED BY
SCINTREX



JANUARY - FEBRUARY 1978

321031

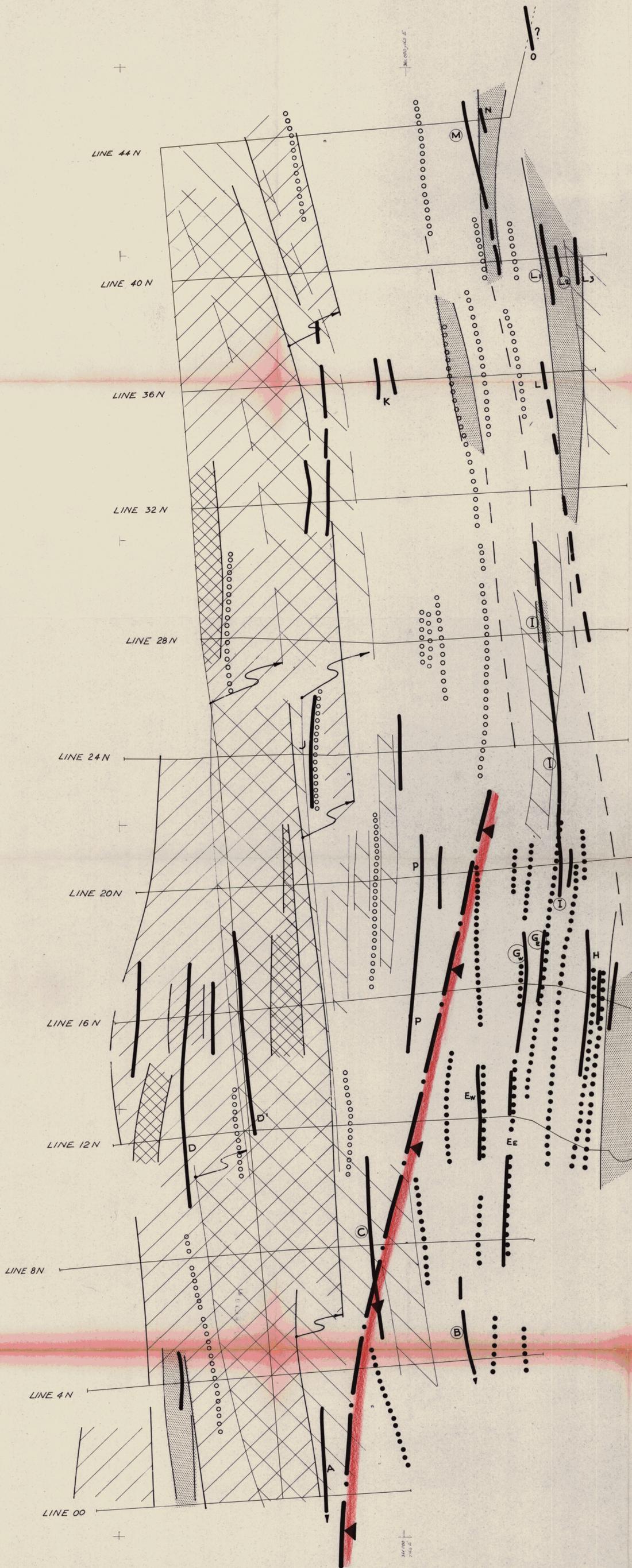
SCALE 1:6000



Job No. TAS-054-D Sheet 1 of 1 PLATE 3

029

84-2239 vol 1/2



- Legend**
- Boundary of area of high magnetic field.
 - Major magnetic field axis (1000 g+)
 - Low-amplitude magnetic highs (100-300 g)
 - Areas of low magnetic field
 - Low resistivity - less 1000 $\Omega\cdot m$.
 - Areas of moderate to high resistivity
 - Areas of high resistivity (15,000 $\Omega\cdot m$)
 - Low background chargeability within high apparent resistivities
 - Induced polarization highs - primary interest.
 - Induced polarization highs - secondary / tertiary interest.
 - Apparent 'sidestep' - facies change?
- F* (SEE REPORT)

MOUNT LYELL MINING & RAILWAY COMPANY LTD.

CLARK RIVER GRID
NEAR QUEENSTOWN TASMANIA

**GRADIENT ARRAY
ELECTRICAL INDUCED POLARIZATION
&
TOTAL MAGNETIC FIELD SURVEY**

INTERPRETATION PLAN

SURVEYED & COMPILED BY
SCINTREX



JANUARY - FEBRUARY 1978

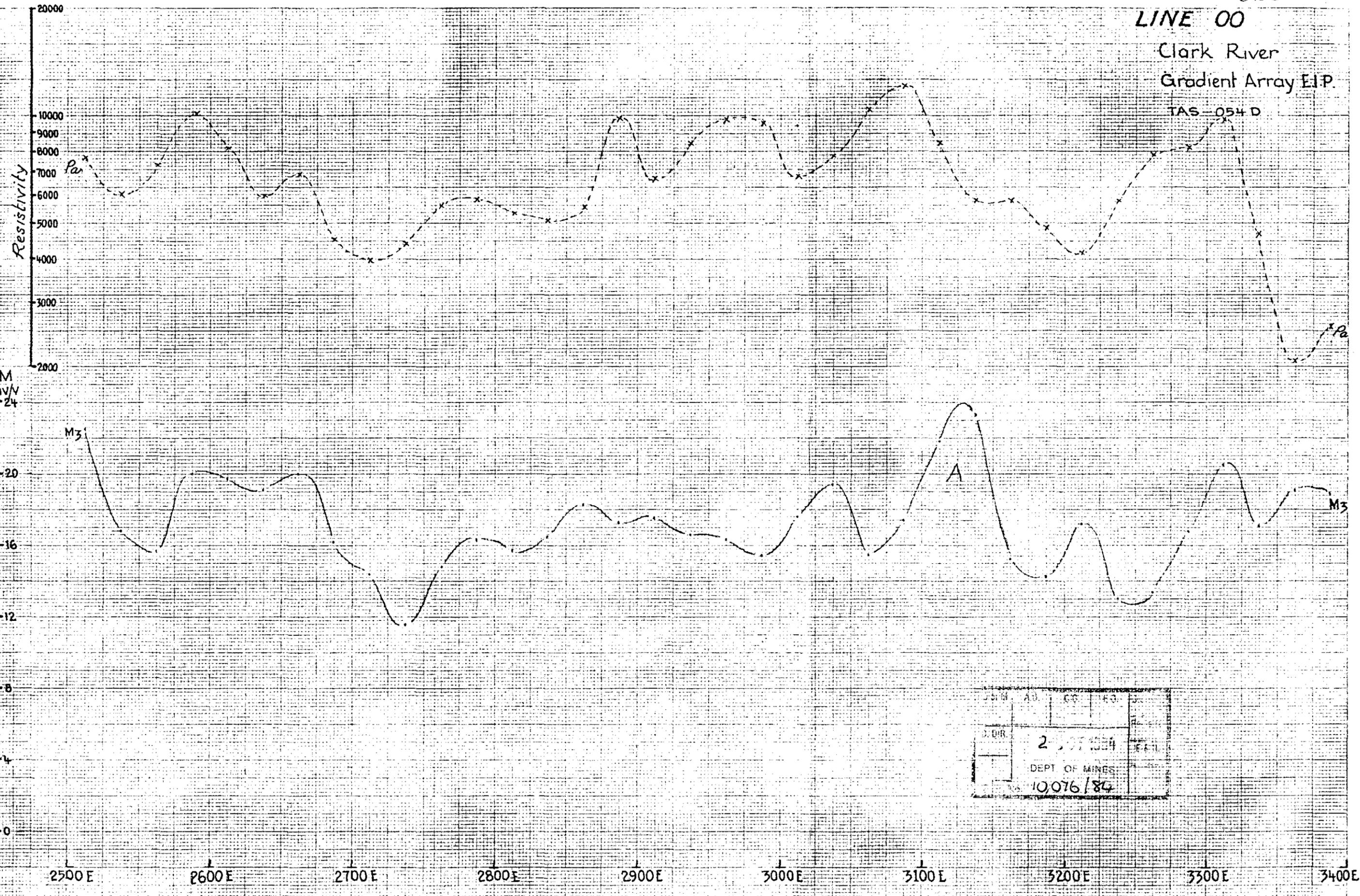
321032

SCALE - 1:6000



LINE 00
Clark River
Gradient Array EIP

TAS-054 D



031

FILE NO. 10 X 10 TO THE CENTIMETER 10 X 10 CM

11 12 13

032

321034

LINE 04 N
Clark River
Gradient Array E.I.P.
TAS-054 D



UNIVERSITY OF TORONTO LIBRARY

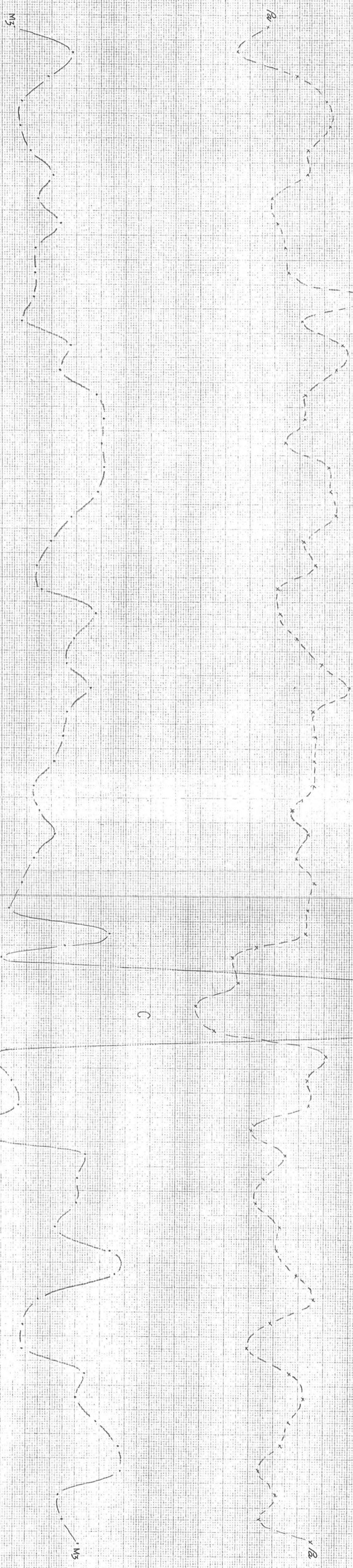
U101 7A

Chargeability

Resistivity

M
mV/k
20000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000

2500 E
2400 E
2500 E
2600 E
2700 E
2800 E
2900 E
3000 E
3100 E
3200 E
3300 E
3400 E
3500 E
3600 E
3700 E
3800 E
3900 E



321035

LINE 8 N
Clark River
Gradient Array E.I.P.
TAS-054 D

035

321037

LINE 16 N

Clark River

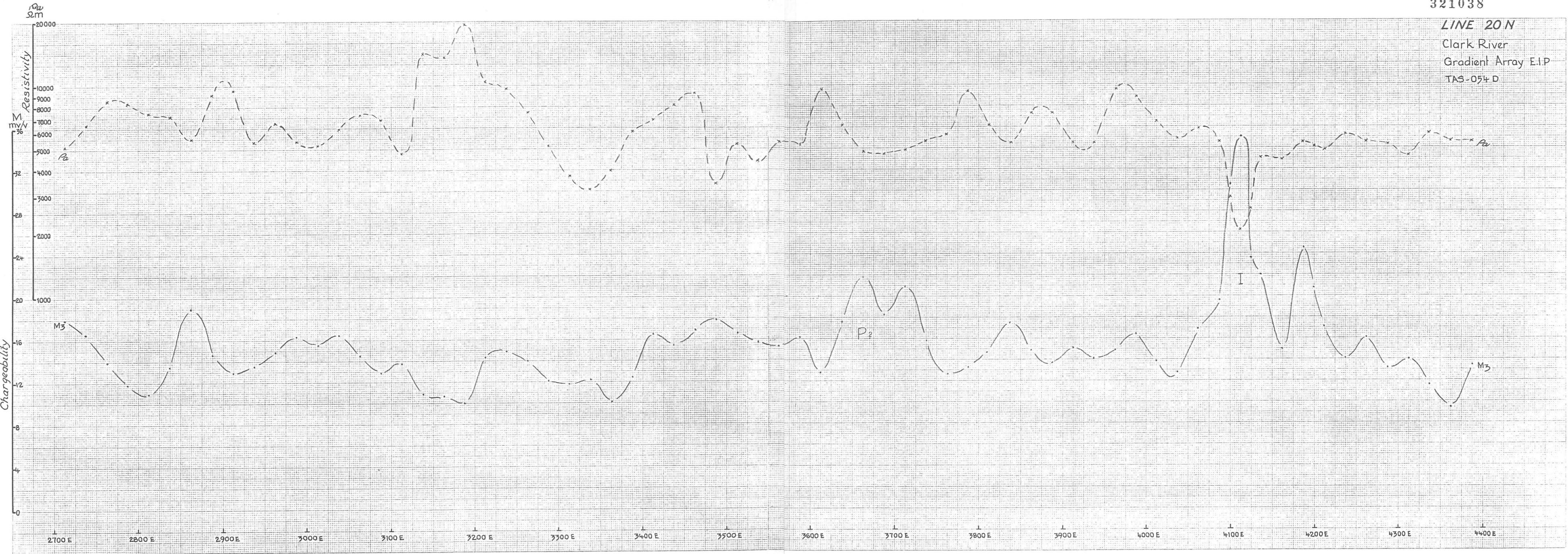
Gradient Array E.I.P

TAS-054 D



LINE 20 N
Clark River
Gradient Array E.I.P
TAS-054 D

036



100 ft. x 100 ft. grid. 100 ft. x 100 ft. grid. 100 ft. x 100 ft. grid.

131 111

321039

LINE 24 N

Clark River

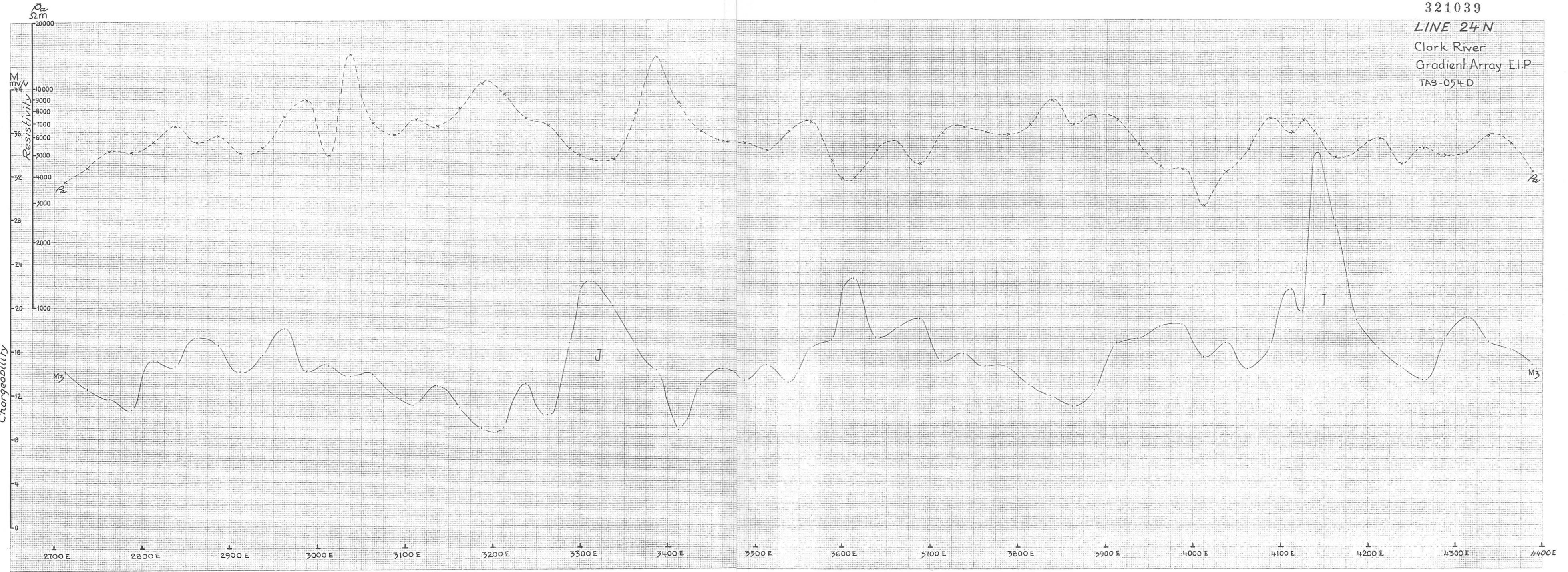
Gradient Array E.I.P

TAS-054D

037

WATSON & PERRY CO. 1000 S. 10th St. SPOKANE, IDAHO

NA 1213



LINE 28 N
Clark River
Gradient Array E.I.P
TAS-054 D

038

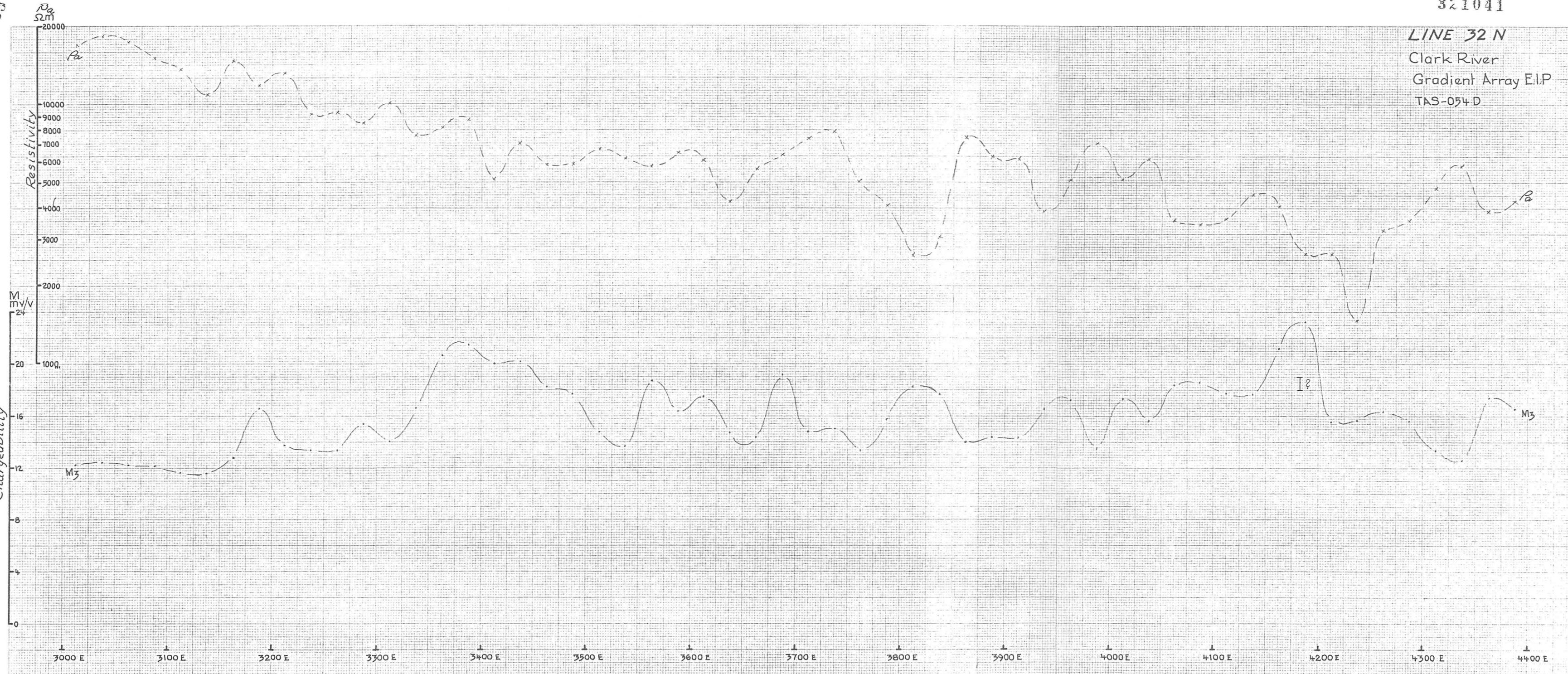


LINE 32 N
Clark River
Gradient Array E.I.P
TAS-054 D

039

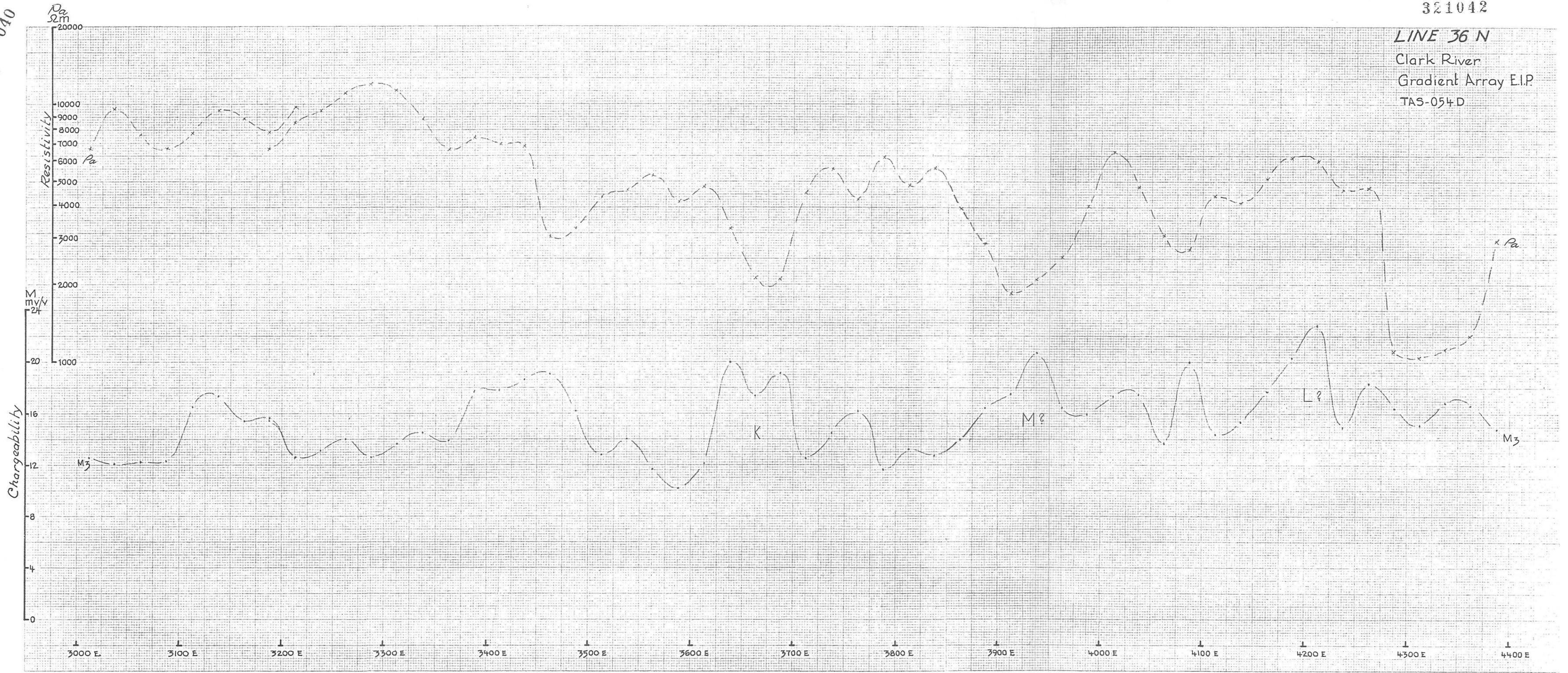
MO X CAPACITIVITY
RESISTIVITY
MVA

VIET VA

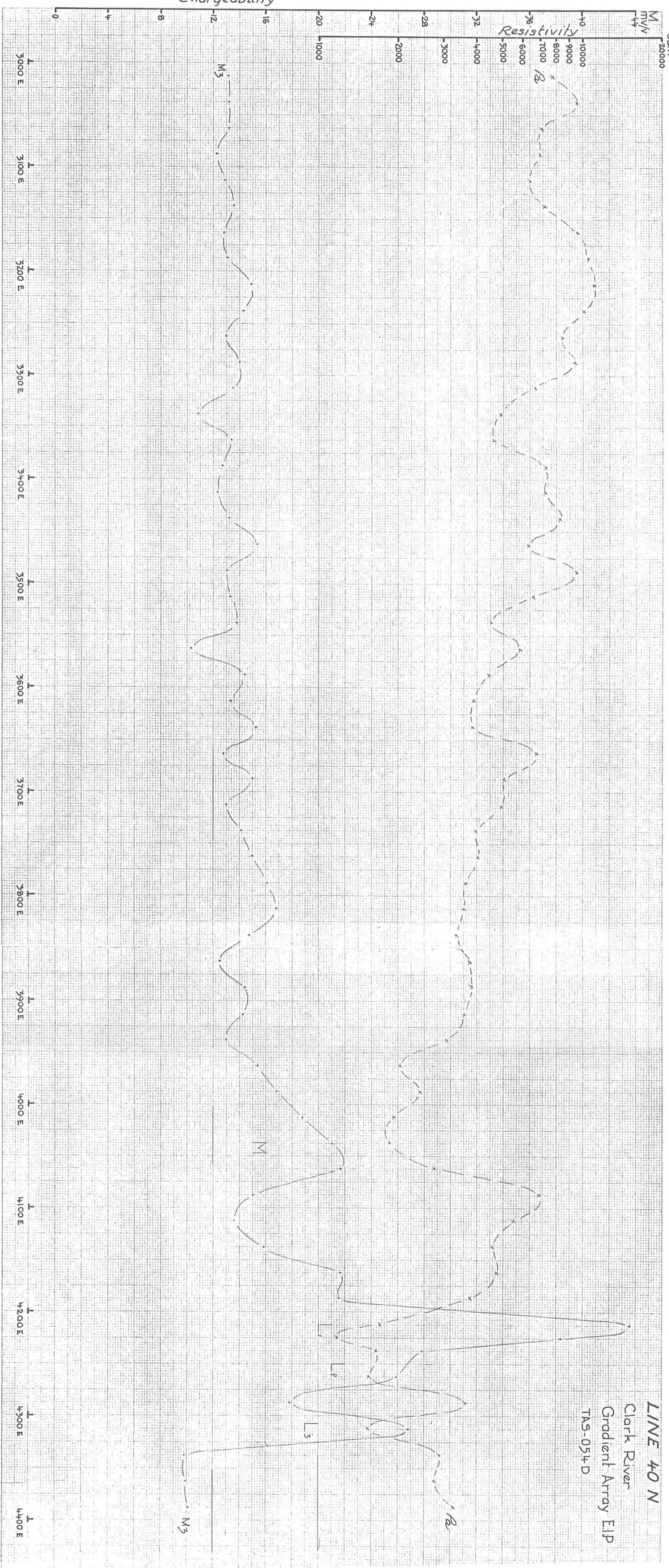


LINE 36 N
Clark River
Gradient Array E.I.P.
TAS-054D

040



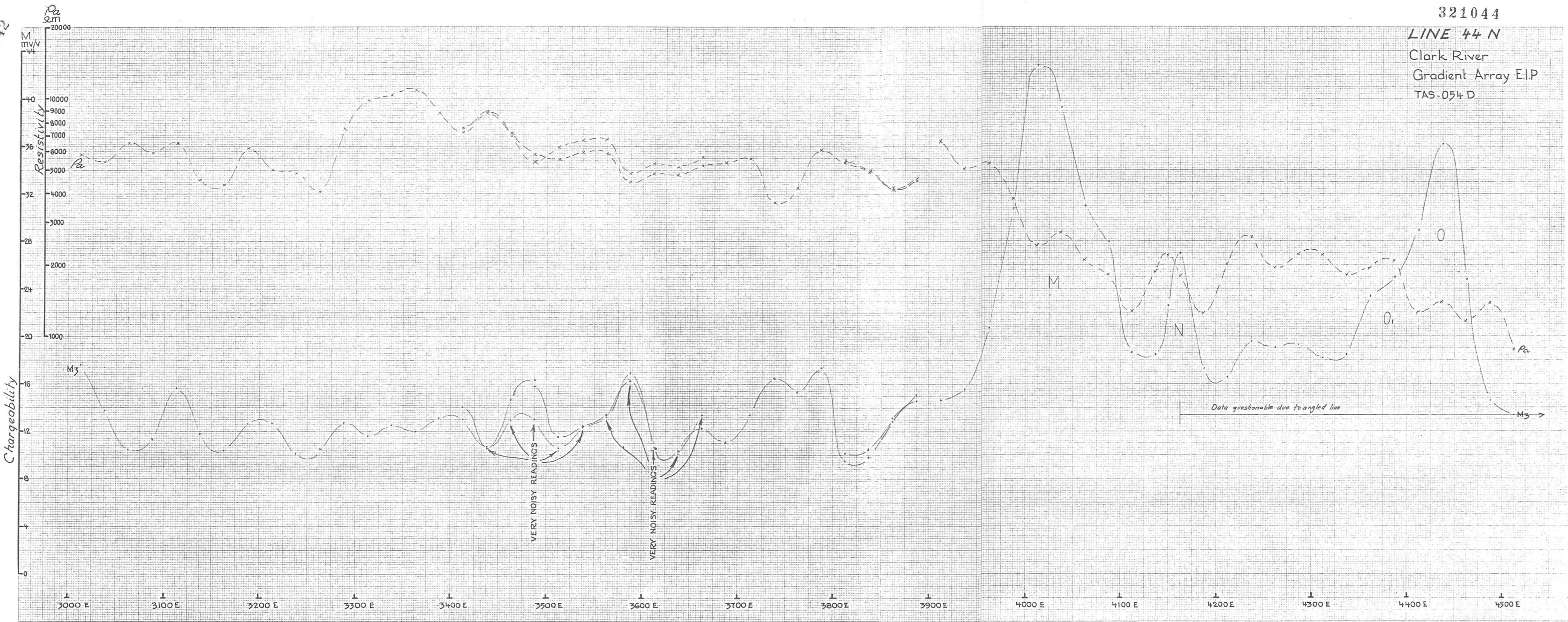
LINE 40 N
Clark River
Gradient Array EIP
TAS-054 D



042

321044

LINE 44 N
Clark River
Gradient Array E.I.P
TAS-054 D



043

321045

636 TT

LINE OON

Clark River
Magnetics

TAS-054-D

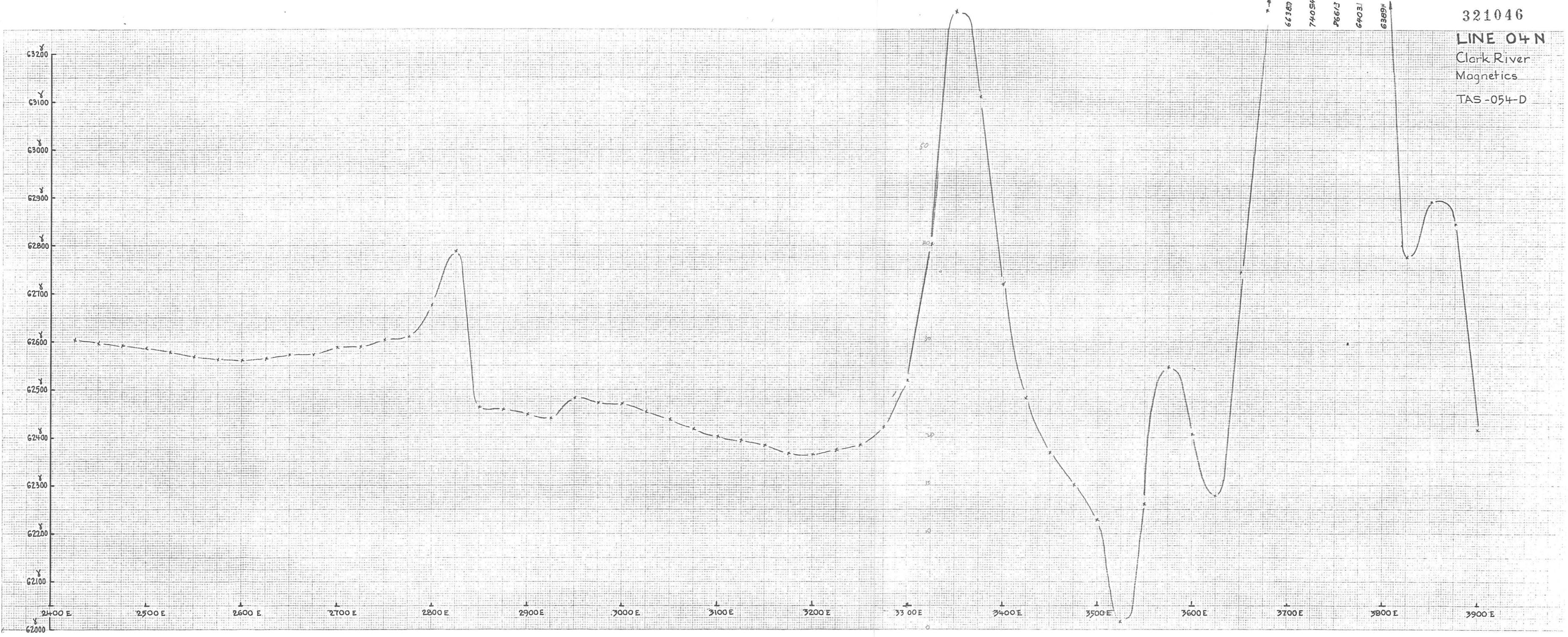


REPRODUCED FROM THE ORIGINAL BY THE U.S. GEOLOGICAL SURVEY

41 121 A

044

U.S. GEOLOGICAL SURVEY



321046

LINE 04 N
Clark River
Magnetics
TAS-054-D

Y
63200
63100
63000
62900
62800
62700
62600
62500
62400
62300
62200
62100
6200

50
40
30
20
15
10
0

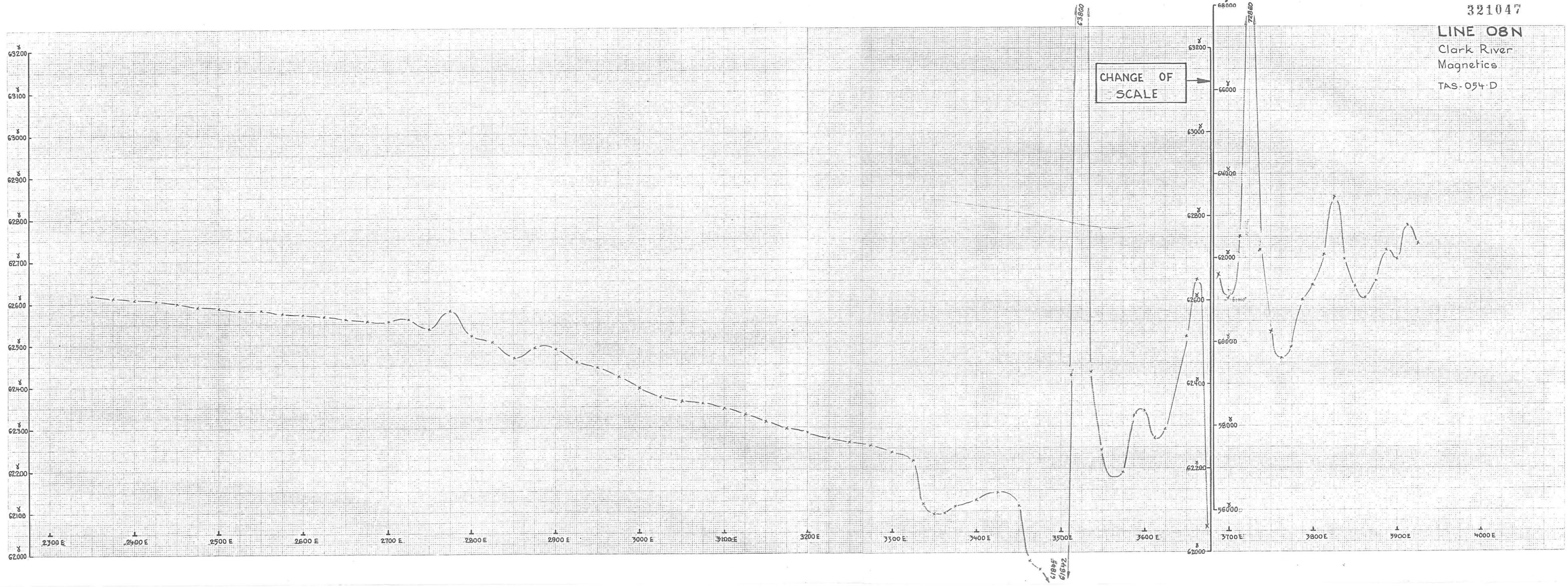
66787
74054
96613
64031
6389N

2400 E 2500 E 2600 E 2700 E 2800 E 2900 E 3000 E 3100 E 3200 E 3300 E 3400 E 3500 E 3600 E 3700 E 3800 E 3900 E

045

U.S. GEOLOGICAL SURVEY

WATER RESOURCES DIVISION



321047

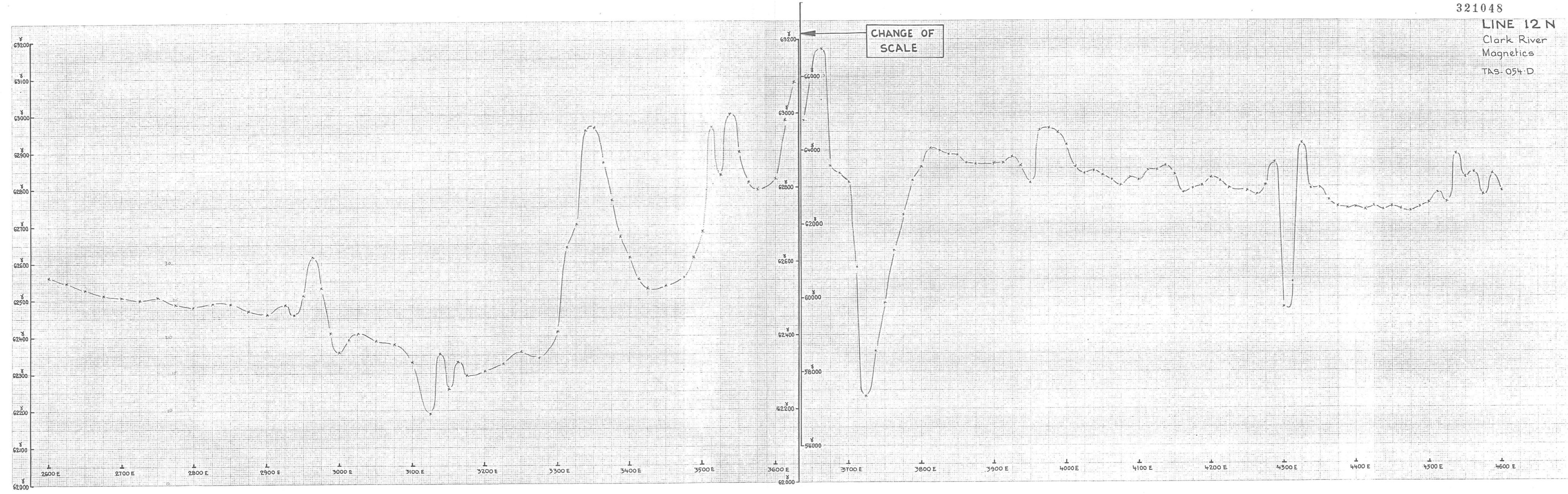
LINE 08N
Clark River
Magnetics
TAS-054-D

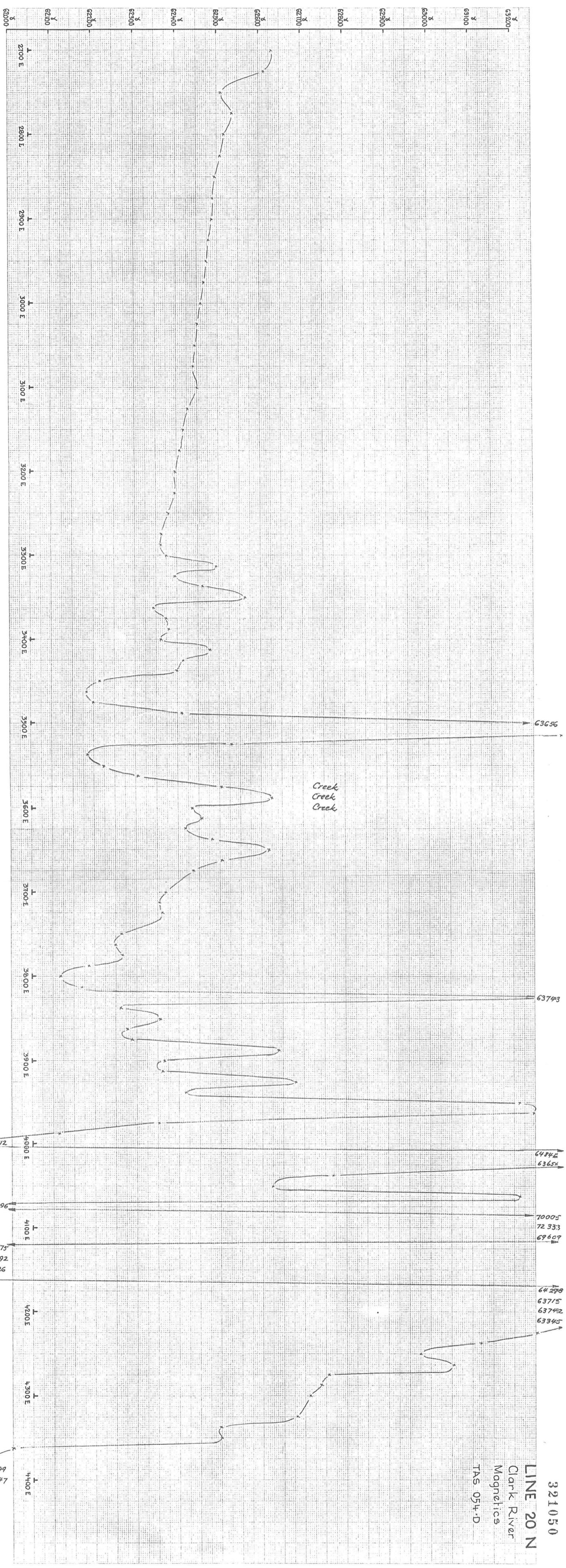
CHANGE OF SCALE

61845
61842

046

U.S. GEOLOGICAL SURVEY
BULLETIN 1211-A
MAGNETIC INTENSITY OF THE CLARK RIVER





321050

LINE 20 N

Clark River

Magnetics

TAS 054-D

63656

63743

64846
63654

70005
72333
69609

64298
63715
63742
63345

61812

57096

58575
60492
61326

61649
61547

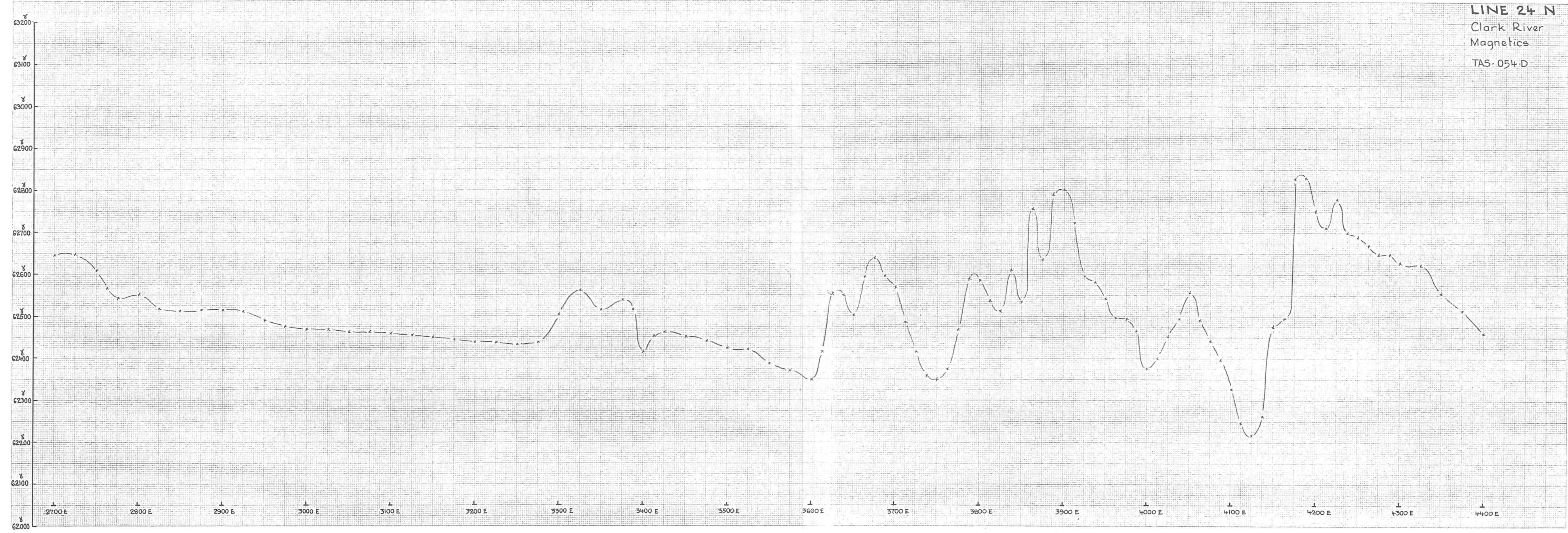
049

321051

LINE 24 N
Clark River
Magnetics
TAS-054-D

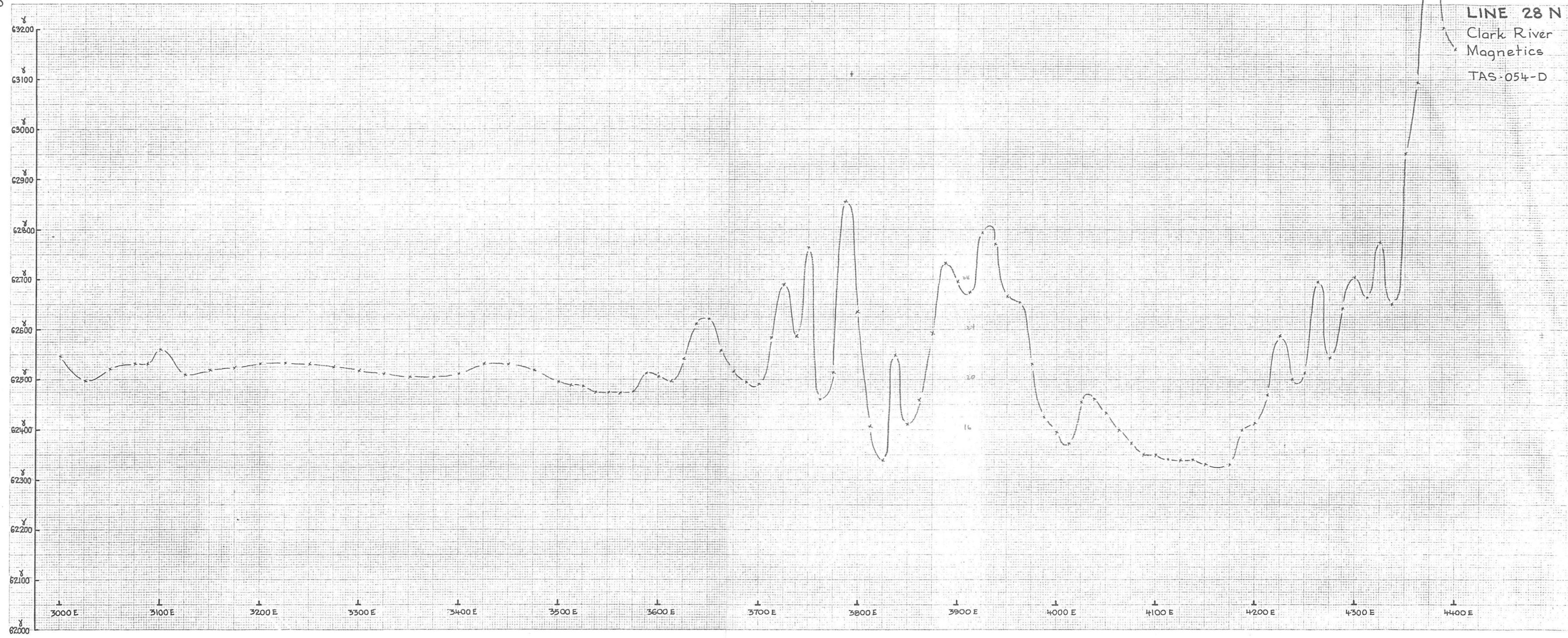
PROF. G. L. FISHER, JR.
U.S. GEOLOGICAL SURVEY
WASHINGTON, D.C.

43 1213



050

321052
LINE 28 N
Clark River
Magnetics
TAS-054-D



KODAK SAFETY FILM

41 121 A

LINE 32 N
Clark River
Magnetics
TAS-054-D

051

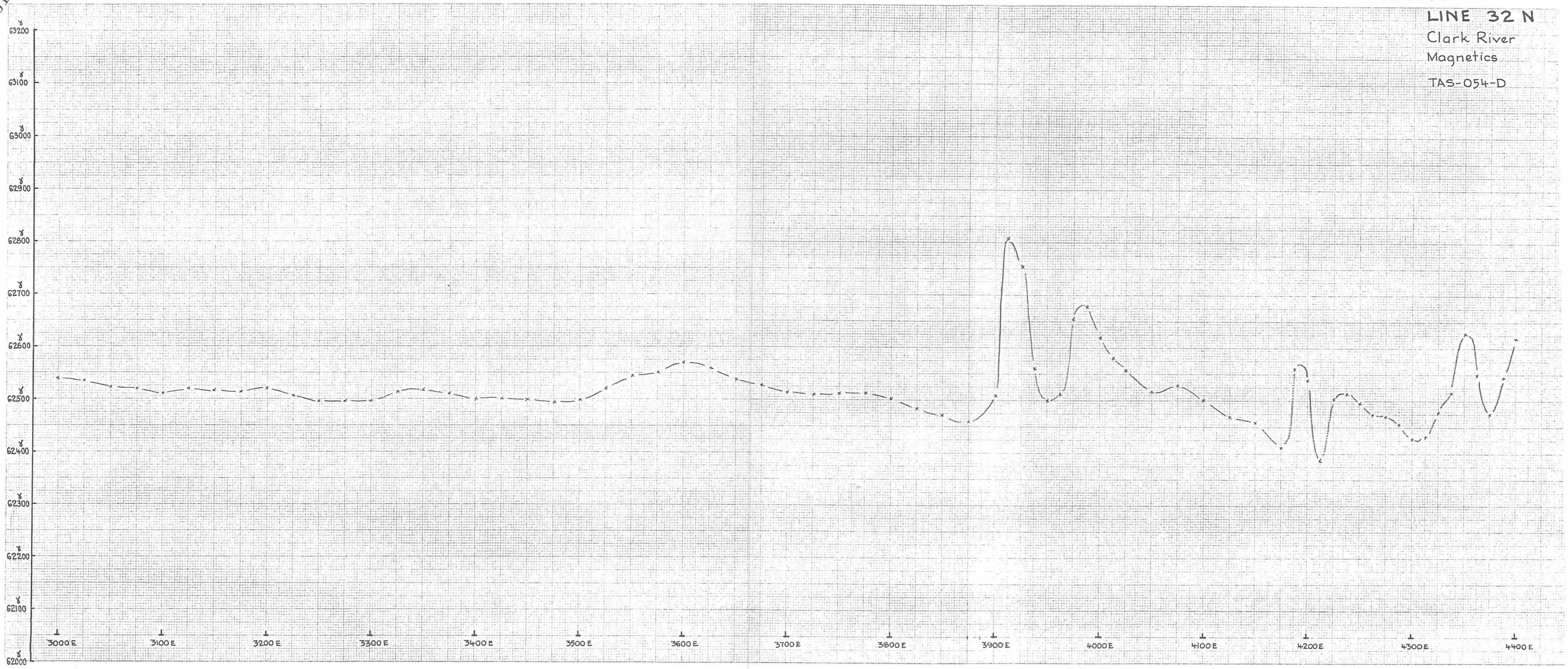
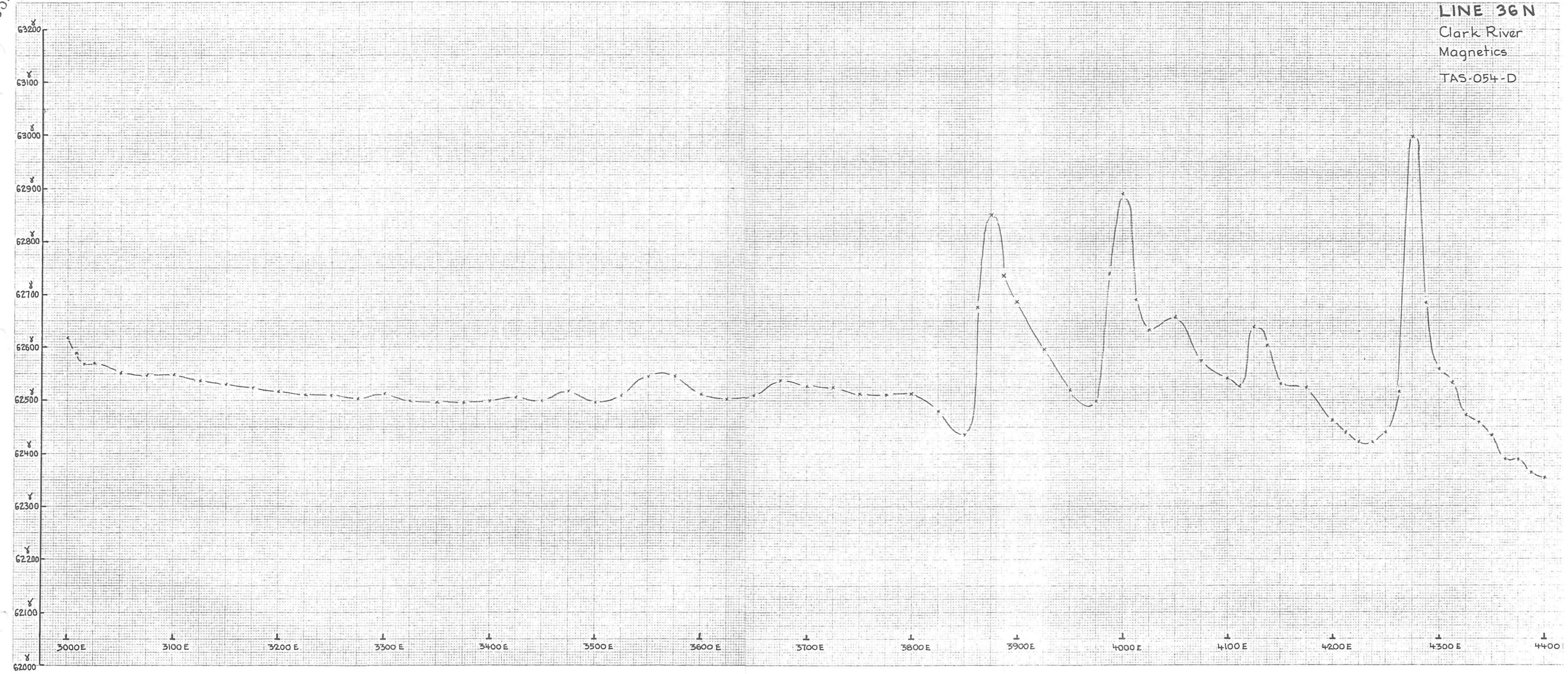


FIG 174

052

321054

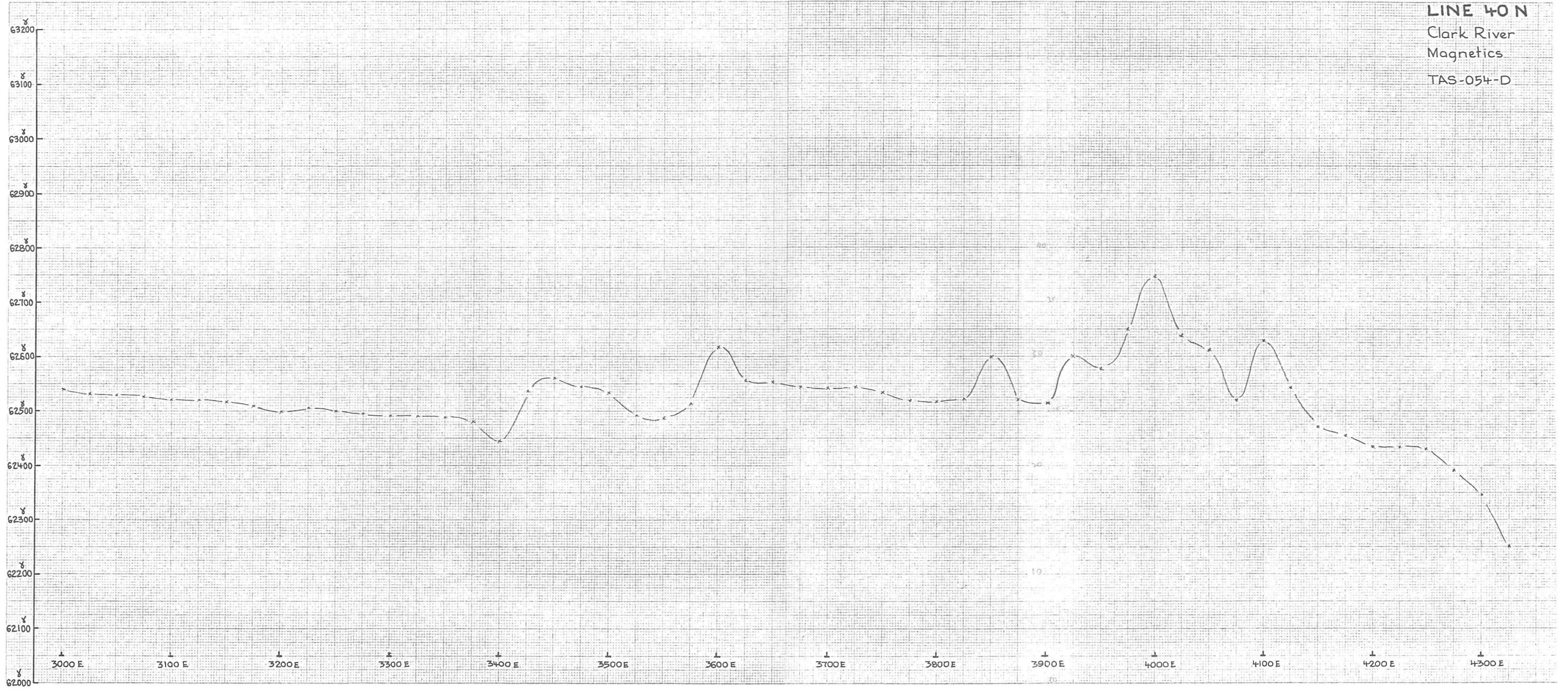
LINE 36 N
Clark River
Magnetics
TAS-054-D



053

321055

LINE 40 N
Clark River
Magnetics
TAS-054-D



054

321056

LINE 44N
Clark River
Magnetics
TAS-054-D

