357001
Q72

MICROFILMED

LYELL E.Z. EXPLORATIONS

Queenstown

Report on

MOORES VALLEY

GEOPHYSICAL SURVEYS

59-285

Geophysical Surveys. Moore's Valley L.E.Z. June '59.

Report No. G 96

June '59

357

000 OURS

357002 696.

16th June, 9

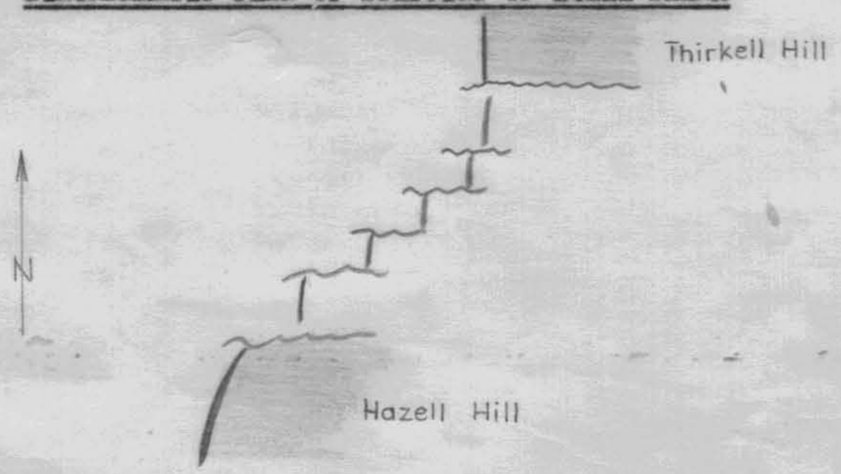
To: Mr. G.F. Hudspeth

Geophysical Surveys in Moore's Valley, S.W. Tasmania

Attached is the report by J.B. Boniwell on the geophysical work carried out in Moore's Valley prior to April, 1959.

A major point requires clarification in this report in view of the statement that the Lyell Shear is considered to be displaced some indeterminate distance to the east of the existing grid. The collation of the I.P. work (metal factors and apparent resistivities), gravimetric and magnetic surveys with the projection of geological features from the south and north edges of the Valley, has provided a reasonable basis for a working hypothesis of the basement geology. Broadly, the best interpretation of this information is that the Lyell Shear crosses from Hazell Hill to Thirkell Hill in a series of easterly steps. This stepping effect is caused by east-west faulting which is considered to trend through the area and which has displaced the Shear in a right handed sense, consequently although these faulted portions strike north-south, the overall structure trends NE-SW.

DIAGRAMMATIC PLAN OF STEPPING OF LYELL SHEAR



The first east-west fault is thought to lie near the south edge of I.P. anomaly 'C', this displaces the Shear some 1500 feet to the east. From here it trends north-south through 'C' at about line 15E and along or near the western edge of 'A'. Some 400 feet north of 'A' it is again stepped to the east. The best geophysical evidence of the existence of a fault lies at the northern end of 'A' where the gravimetric, magnetic and apparent resistivity trends occur together. Geologically there is no reason to expect a large gravimetric contrast on east-west traverses across the Lyell Shear. This can be seen by comparing the effects that would be obtained if the Linda Valley and Tharsis Ridge were flat and the valley filled with gravel and sand. A gravity traverse north-south from Gormanston to Mt. Lyell (across the N. Lyell Fault) would provide a marked contrast owing to the rapid decrease in the depth of Tertiary sediments northwards across the Fault. However, an east-west traverse across the Lyell Shear could be expected to show very little contrast owing to the constant depth of Tertiary sediments. In addition, the physical contrast in the basement rock types on either side of the Shear would be reduced below that which exists on the N. Lyell Fault owing to the higher degree of shearing and alteration which occurs with the former zone. These factors must also be considered in the Moore's Valley area.

Drilling Programme

On the basis of the present geophysical information, only a limited drilling programme of two holes each 1000' in length should be considered: both drilled in the western part of anomaly 'A' (co-ordinates 12000N, 12200E: 11500N, 12100E). Before further drilling is considered it is essential that additional geophysical information is obtained.

Geophysical Programme

It would considerably assist the investigation of the Moore's Valley area if a limited geophysical programme were completed prior to the beginning of the field season on 1st November. Details of this programme are given in Appendix II. Briefly the programme would consist of a gravimetric and a magnetic investigation covering the assumed extensions of the I.P. anomalies to the east, and the edge of the Valley across the Hazell Fault. It would involve the employment of four bushmen for 7 weeks and one instrument operator for four weeks. An estimated length of 31,550 feet of traverse is involved, 9,250 feet is already prepared with 22,300 feet remaining. The bushmen would prepare these lines prior to the arrival of the geophysical instruments and after their completion one of these men would act as surveyor (stadia survey) and instrument operator for the magnetometer with the other three acting as assistants where required. All personnel would walk in to Moore's Valley from Birch, with a staging camp established about halfway. Use can be made of the food and equipment which is already stored in the Valley with additional gear being dropped from fixed wing aircraft. After the party is established it need only be supplied by air once a week.

Personnel for Programme

(a) Bushmen

R. Martin, T. Burrell, P. Russell and D. Rudsell have indicated that they would work on this project if it materialises.

(b) Instrument Operator/Surveyor

T. Burrell is already trained in the use of the magnetometer and during the summer he acted as surveyor (levelling only) with the geophysical crew. He would find no difficulty in learning the technique of stadia survey.

J. Gillie could be trained as operator for the gravitymeter. He has indicated his willingness to undertake this work.

(c) Interpretation of Data

A consultant geophysicist can be obtained from the mainland who would be able to complete the interpretation of the data and train Gillie to operate the meter.

(d) Gravitymeter

Two possible sources exist: Rio Tinto Australian Exploration Pty. Ltd. and Western Mining Corporation. The instrument would be required from 25th August to 26th September in Queenstown.

(e) Supervision

Most of the surveys are self-checking but I would visit the locality at the beginning of the instrument surveys.

Dates of Programme

Bushmen commence on 8th August. Instrument operator goes in 29th August, remains until 26th September.

The gravitymeter would be required in Queenstown on 25th August and consultant geophysicist for 26th and 27th August. The geophysicist would also be required over the period 5th October-8th October inclusive.

35C044

Chief Geologist, L.E.E.

003

357005

25th May, 9

GEOPHYSICAL SURVEYS IN MOORE'S VALLEY, S.W. TASMANIA

(Up to April, 1959)

Introduction

Under a Tertiary cover of unconsolidated gravels and clays, several hundreds of feet thick, there occurs, in the regional sense, a most important structural setting for sulphide incidence so far as is known in South-West Tasmania. Because of the cover, the detection of metalliferous ores, if present, is largely a geophysical function.

Over a period of nearly 15 months, quite a suite of geophysical methods has been applied to the Moore's Valley area: airborne magnetic, electromagnetic, and radiometric, ground magnetic, electromagnetic (Afmag, Turam, vertical loop), self-potential, induced polarisation, and gravimetric, some of them, it is true, applied in the course of wider surveys, but all providing some perspective to the setting and to themselves.

Airborne Coverage

Moore's Valley was flown concurrently with em., total intensity magnetometer and scintillometer as a side-product of the AH117 project of Adastra Huntings in 1957-58.

Although AEM anomalies were recorded in the valley, they, by reason of the depth of cover, of the near-horizontal clay layers within the cover, and of the "shore-line" effects from the edges, do not and could not, arise from bedrock causes. The aeromagnetic data reveal no determinative contrasts to allow a resolute interpretation of the structural trends. The scintillometer profiles are featureless.

Ground Magnetic

Three early traverses run with the vertical intensity magnetometer across a grid in the valley floor can be largely discounted as they represented too small a sampling, and as the results themselves were seen to contain inherent errors and uncertainties.

Subsequent accurate coverage by the Bureau of Mineral Resources (Des. Rowston) showed that susceptibility contrasts in the valley were very small, and that no conclusive structural inferences could be drawn. This, of course, merely confirms the airborne conclusion.

However, it is possible to detect trends in the magnetic profiles that are divorced from apparent topographic relationships. In turn, these may reflect structural trends, but such can not be presumed with conviction. Such trends as recognised bear grid NW, most of them west of the BL, one to the east between lines 60 and 68N.

Ground Electromagnetic

(a) Afmag

Reconnaissance surveying with this tool by McPhar Geophysics Ltd. was severely handicapped by weak field strengths during the period of trial. Moreover, the results did not at first appear to be of any great value. However, projection of the data upon a hypothetical grid 45 degrees to that occupied revealed a consistency in the tilt angle indications that finally led to the actual observation of a "cross-over" on a BL traverse (at BL/11N), and a dip pattern commensurate with its repetition on strike grid NW.

This sole anomaly, the first attributable to a bedrock source, became the focus for subsequent geophysical effort.

(b) Turam and Vertical Loop

In short orientation surveys, the Afmag anomaly was subjected to specific testing by the more standard electromagnetic methods, Turam and vertical loop. Neither method was successful in obtaining in correlation a compatible response and neither, in consequence, can be considered suitable for future exploration in the valley.

On line 12N, the Turam survey disclosed a small phase shift near the BL, an anomaly, however, which did not close off to the west. Moreover, this effect was shown to repeat consistently on lines north independent of the Afmag (and later IP) strike, yet, quite patently, in some parallel relationship with topography and drainage. This precluded its identification with the Afmag expression.

The BL was traversed by the vertical loop receiver, with the transmitter located (at 12N/12W) to provide near-optimum conditions of coupling and depth of field. The resultant dip angle profile was virtually featureless.

Self Potential

A short survey with self-potential was sufficient to demonstrate that the method is quite inapplicable to the valley conditions of a rapidly changing surface relief to which, by reason of the nature of the Tertiary material, it was particularly sensitive.

Induced Polarisation

A reconnaissance traversing of the BL by induced polarisation strikingly disclosed a zone about 11N anomalous in conductivities and "metal" content. This notable correlation with the Afmag indication immediately projected an IP coverage that sought to resolve and otherwise define the initial expression and its extensions.

All this work was carried out by McPhar Geophysics Ltd. and has been reported on separately. However, the salient features need to be discussed and re-emphasised here:

1. Three anomalous "zones", labelled A, B and C, have been postulated as a result of the interpretation of the metal factor values. They apparently strike grid NW, dip grid SW and are of considerable depth extent.

2. None of the zones have been closed off. The apparent closure of zone A on line 10W could well be simulated, as is pointed out, by an increasing depth factor; and in this regard, it is pertinent that a vertical rise in elevation of over 100' occurs between lines 5W and 10W. That is, the Tertiary cover almost undoubtedly thickens by this amount.

3. Again, it is pointed out, the zones, particularly to the east, may well be related to one anomalous region with metalliferous material disseminated variably throughout, a region, therefore, still to be considered open both ends.

4. No mention is made of graphite. It is not likely that graphite is the sole cause of either the Afmag or IP expressions, yet, it is an electronic conductor, and quite capable, it is known, of producing polarisation effects. Although the very manner of operation seeks to minimise its effect, graphite, in discussions with Dr. Hallof, is still regarded as very much an unknown quantity. Thus, it is conceivable that, should graphite exist in association with sulphides, it could be adding to the degree of polarisation.

5. Any test drilling of the IP region as it stands must be reconciled to a programme of at least two or three holes. This is important.

It is interesting to note that the general bearing of the major IP trend conforms to that observed in the magnetic data; in fact, a magnetic axis, consistent with a SW dipping fault structure, can be centred along the IP zone A. Albeit the magnetic control needs be treated with great caution, this added evidence of a sheared conductor source strengthens that possibility.

The high resistivities obtained to the south of the grid area are almost certainly characteristic to the Owen conglomerate. Their abrupt manner of appearance, and their identification in the McPhar report as a different rock-type rather implies that the Owen is faulted off circa 24S/BL, 24S/5E, 22S/10E, and that it does not appear to the north in the valley proper as a base-rock beneath the Tertiaries. In which case, even if the Ordovician sequence is represented there by the Gordon limestone, the throw of the fault must be large, of the order of several thousands of feet. Such a major structure might considerably affect the incidence of mineralisation in the valley; and it is in this regard that the IP zone C, with a strike near-normal to the BL and parallelling that of the fault, might hold its greatest significance. Thus, the indicated coalescence of the three IP zones east may well provide that critical area of maximum interest.

Gravimetric

A fairly extensive gravimetric coverage sought to provide some detail of the IP zones, and of the bedrock relief.

The observed data have been reduced on the assumption of 1.87 gms./cc for the near surface density, a figure that, in view of the thickness and relative homogeneity of the cover, may be considered representative of the Tertiary mantle. The resulting Bouguer profiles are marked by very steep gradients, increasing to the south and west at remarkably linear rates. Nonetheless, sufficiently consistent variants exist to postulate some local structure.

The grid area, it must be presumed, is being dominated by major, deep-seated rock movements. One of these has already been indicated, the Owen fault boundary at the valley's edge; another must be the Lyell Shear itself. Unfortunately within the limits of the coverage, neither of these contacts have been clearly resolved, although their sum-effect, quite patently, is a downthrowing of the area to the north and east. There is some gravity evidence to suggest that the Lyell Shear is appreciably displaced an indeterminate distance to the east. This, it is pointed out, is quite compatible with post-Owen cross-structures, and with the strike behaviour of the shear contact at the southern outcrop end.

Locally, two relatively minor structural axes have been recognised, and are shown in plan with postulated movements. These conform to the trends across the grid area previously noted, and, in fact, are distinctly related to the IP zones A and B. Nonetheless, they are not considered to be unique, but rather simplifications of a complex structural setting.

There exist also in the Bouguer profiles several sharp breaks, e.g. at 9N/5E, 18N/10E, that occur spasmodically, and for which there appear no satisfactory relationships. As intrinsically, they can not be of a deep-seated origin, i.e. a bedrock effect, their cause is either near-surface, or more probably a jump in instrument characteristics (or an error in elevations). However, they do not materially affect the following considerations; on the other hand, their inherent uncertainties do mitigate against a useful plan of residual gravity.

It is manifest that no striking positive correlations exist with the IP. An apparent residual anomaly peaks at the BL on line 12N, and over the IP zone A. However, this expression is not a genuine correlation, but an integral part of a gravity system that extends to line 16N, possibly to 20N, in faithful association with a topographic ridge along the BL. That this is so is best seen in the BL gravity profile which has resolved no positive expression as it crosses the IP zone. The implication is that the surface feature here actually reflects a basement high, itself not necessarily unrelated to some structural element. Further, it could be expected that any marked change in the bedrock relief would, in turn, cause some change in the physical conditions of the overburden, e.g. by differential compaction; and in this regard, it is pertinent to note that the Turam results have already presumed such a circumstance across the BL.

This, nonetheless, is the only clear case of a bedrock to topography inter-relationship. Assuming a basement density of 2.70 gms./cc., a bedrock "hill" 250' high peaking 300' below surface would account for the gravity expression on line 12N. Although some basal relief is implicit elsewhere within the grid area, it evidently is not of the same proportion, or is more deeply buried.

The lack of correlations with the IP renders desirable the drawing of a range of theoretical ceilings corresponding to a range of possible sulphide bodies that could exist, yet be beyond gravimetric discrimination. For this purpose, a detectable level has been taken as 0.2 mgal. residual anomaly, a fairly large magnitude. Thus, assuming a depth of cover of 300', and a country rock density of 2.70 gms./cc., then for a body 400' wide, the total sulphide content must be less than 5%; for a body 200' wide, less than 10%; for a body 100' wide, less than 20%; et seq. In all cases, the bodies have been assumed to be of at least 400' strike length, to be dipping 70° west, and to be semi-infinite in depth, i.e. beyond 1000' down-dip.

To consider any combinations of these bodies, as might be expected in fact, then the individual gravity effects must be added. Thus, a semi-massive body of, say, 20% sulphides, with a disseminated halo, must be contracted in dimensions to escape detection.

Conclusions and Recommendations

The interest in Moore's Valley to this date is necessarily centred on the IP anomalies. These are almost certainly located in shear zones which, themselves, as has been shown in one case, are separately conducting, i.e. conduction is arising from more than sulphides. In view of this fact, the apparent homogeneity of the various IP indications, and the lack of gravimetric expression, the total percentage of actual sulphides present can not be considered large. Yet sulphides almost undoubtedly occur.

Thus, it is recommended that further IP coverage should concentrate initially on the extension of the present zones to their limits east. It is hoped in this way that the Lyell Shear boundary may be recognised, allowing the systematic projection of further coverage along its locus. Failing this, surveying could recommence at the northern outcrop end, working south according to the findings. The use of the gravimeter as a complementary tool should be continued, if possible.

It has been proposed to test drill the IP zones as they stand to determine conclusively the nature of the anomalous material. This needs to be looked at closely.

Drilling in the Moore's Valley environment is no simple matter, but a difficult, and perforce, an expensive operation. Costs are expected to approach £10 per foot. It is considered, therefore, that economics allow only two alternatives: scout drilling or drilling of geophysical targets.

The former, even if not impractical, is certainly an unrealistic basis for exploration in this setting. The latter implies a complete geophysical evaluation of the entire area of interest, the costs for which necessarily being offset by the restriction of drilling to the best one or two targets. But how can it be known that the existing IP anomalies constitute an optimum target without the completion of the geophysical coverage? Remember that only a small fraction of Moore's Valley has yet been covered, and that further geophysical work has already been contracted for; remember that the present IP anomalies remain open both ends and could improve (or deteriorate) on strike; consider the unencouraging gravimetric implications. Consider also, that to effectively test drill this IP target, 2-3 holes at least 1000' long are required, i.e. approximately £30,000.

Thus, to drill as proposed presumes that no further IP anomalies will be discovered, or that the existing ones will prove to be the best (in which case no further geophysics is necessary). Both suppositions are unreasonable, particularly as it is believed that the present grid area is still west of the Lyell Shear.

It is strongly recommended, therefore, that any drilling action be postponed until the completion of whatever further geophysical coverage is contemplated.

Zeehan, Tas. J.B. BONIWELL

APPENDIX I

GEOPHYSICAL COVER IN MOORE'S VALLEY TO 30th APRIL, 1959

Airborne Survey (Magnetic, Electromagnetic and Radiometric)

Flight lines 556 to 578 inclusive carried out by Adastra Hunting Geophysics Pty. Ltd. (AH 117).

Ground Magnetic

B.M.R.

Line 12N	8E to 11W	Line 48N	20E to 20W
20N	20E to 20W	52N	20E to 20W
24N	20E to 20W	56N	20E to 20W
28N	20E to 20W	60N	20E to 20W
32N	20E to 20W	68N	BL to 23E
36N	20E to 20W	72N	BL to 16E
40aN	20E to 20W	76N	20W to 36E
44N	20E to 20W	84N	BL to 40E

Readings every 100 feet.

Ground Electromagnetic

(a) Afmag

Line 20N	20E to 30W	Line 36N	20E to 20W
24N	20E to 20W	44N	20E to 20W
28N	20E to 20W	BL	2N to 22N
32N	20E to 20W		

Readings every 100 feet.

(b) Vertical Loop

Transmitter at 12N/12W, receiver at BL from 00 to 24N.

(c) Turam

Final report not yet received from B.M.R. but the transmitting cable was placed along 12W with traverses run to the east, towards and over the base-line.

(d) Self Potential

Final report not yet received from B.M.R. but in the general area of BL/12N.

Induced Polarisation

BL	100N to 52S (800' spread)	Line 5W	40N to 16S (400' spread)
BL	40N to 40S (400' spread)	10W	40N to 16S (400' spread)
BL	22N to 6S (200' spread)	5E	40N to 40S (400' spread)
Line 44N	16E to 12W (400' spread)	10E	40N to 40S (400' spread)
12N	20E to 20W (400' spread)	15E	40N to 18S (400' spread)

Gravimetric

BL	24N to 19S	Line 10W	24N to 8S
Line 20N	15E to 20W	5E	20N to 15S
16N	~~16E to 20W~~ 16W → 18E	10E	28N to ~~11S~~ 16S
12N	~~19E + 50 to 19W~~ 14W → 21E	15E	24N to 00
5W	24N to 11S + 50		

Readings every 100 feet.

APPENDIX II

1. **GRAVITY SURVEY**

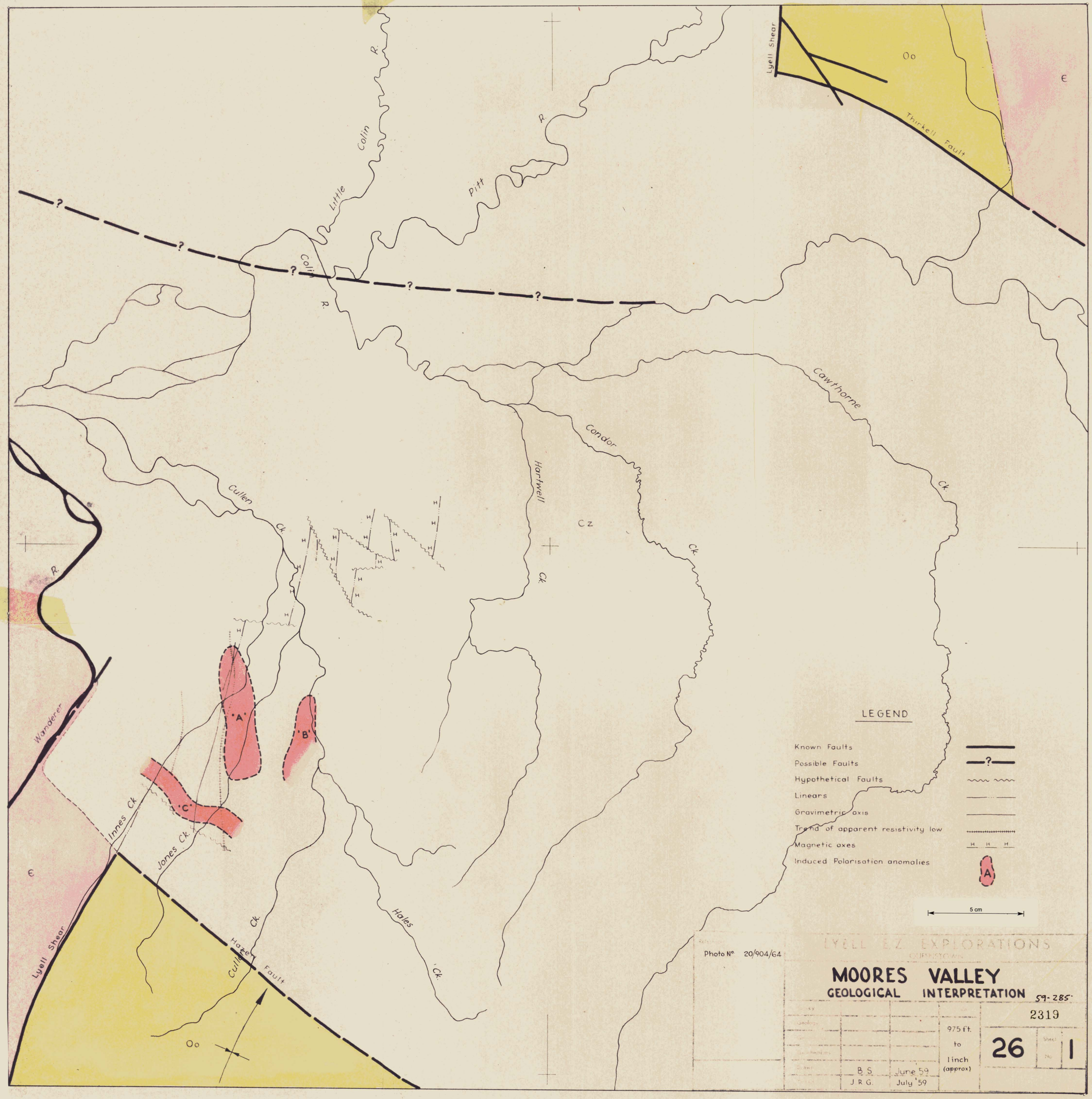
		Existing	Extension
B.L.	40S to 19S	Complete	-
5W	11S + 50 to 20S	Complete	-
10W	8S to 40S	8S to 16S	16S to 40S
10E	11S to 40S	Complete	-
15E	00 to 26S	Complete	-
20E	20N to 40S	-	20N to 40S
30E	12N to 20S	-	12N to 20S
40E	12N to 40S	-	12N to 40S
12N	40W to 20W	-	40W to 20W
	~~3~~20E to 55E	-	20E to 55E
	31,550	9,250	22,300

With stations at every 100 ft. this involves 317 stations. The gravimetric survey during March-April here was 328 stations. At least 17,900 feet of the new/extended lines will be required for the IP survey later this year.

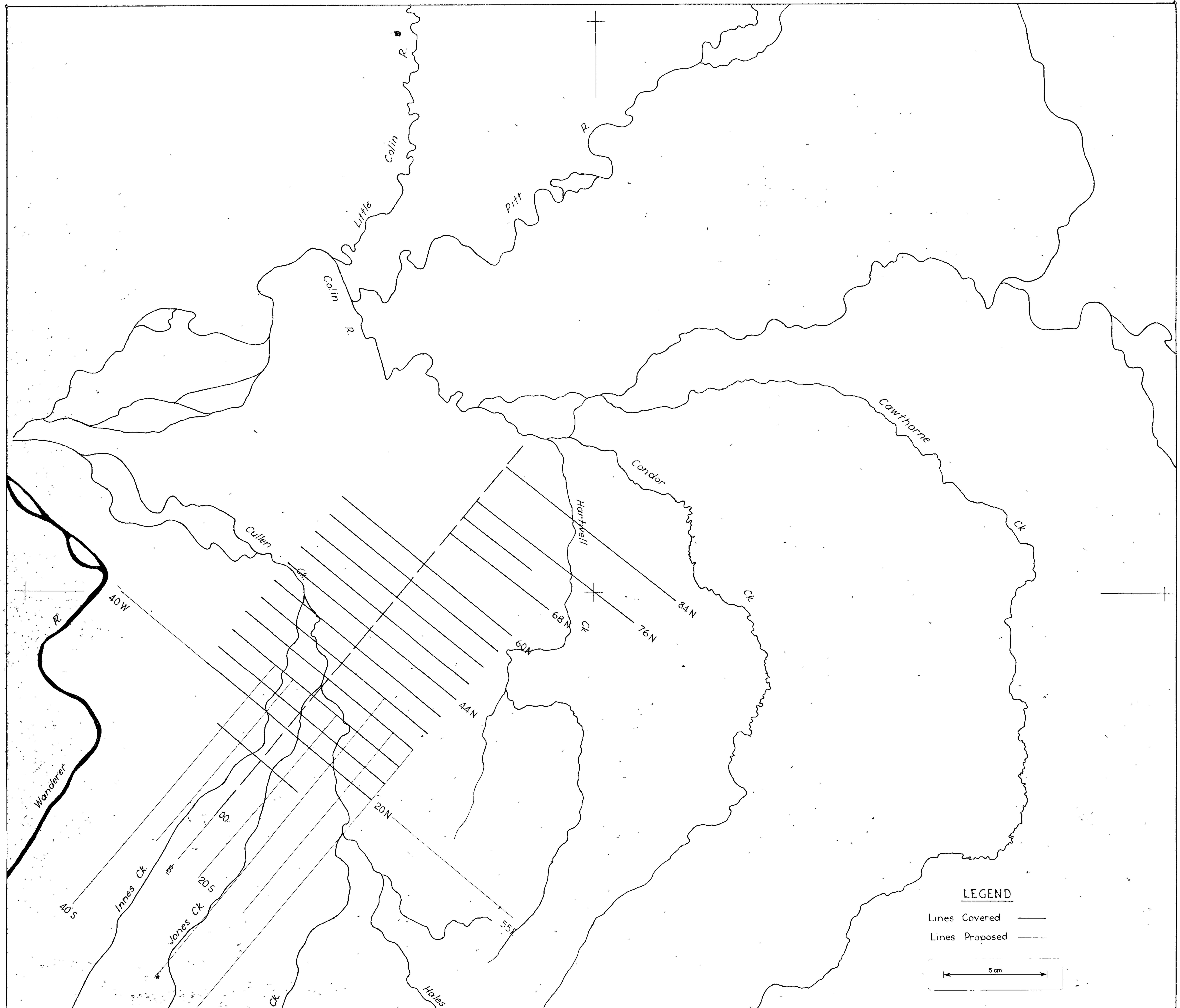
2. **MAGNETIC SURVEY**

~~12~~10N	40W to 55E
10W	20N to 40S
5W	20N to 20S
B.L.	20N to 20S
5E	20N to 20S
10E	28N to 40S
15E	24N to 20S
20E	24N to 40S

Readings every 100 ft., equals 452 stations


Lyell Shear
Oo
€
Thirkell Fault
Little Colin R.
Pitt R.
Colin R.
?
Cawthorne Ck
Condor Ck
Hartwell Ck
Cz
Cullen Ck
R.
Wanderer
'A'
'B'
'C'
Innes Ck
Jones Ck
Hales Ck
Cullen Ck
Hazel Fault
LEGEND
Known Faults
Possible Faults
Hypothetical Faults
Linears
Gravimetric axis
Trend of apparent resistivity low
Magnetic axes
Induced Polarisation anomalies
5 cm
LYELL E.Z. EXPLORATIONS
Photo N° 20/904/64
MOORES VALLEY
GEOLOGICAL INTERPRETATION
59-285.
2319
975 ft. to 1 inch (approx)
B.S. June 59
J.R.G. July '59
26
Sheet No 1

357015



Reference	LYELL E.Z EXPLORATIONS QUEENSTOWN 59-285				
Photo N° 20/904/64	MOORES VALLEY MAGNETIC				
	Survey			Scale	2320
	Geology			975 ft to 1inch (approx)	26 Sheet No 3
	Geophysics				
	Geochemistry				
	Drawn				
		J R G	July '59		

357016

LYELL E.Z. EXPLORATIONS
QUEENSTOWN

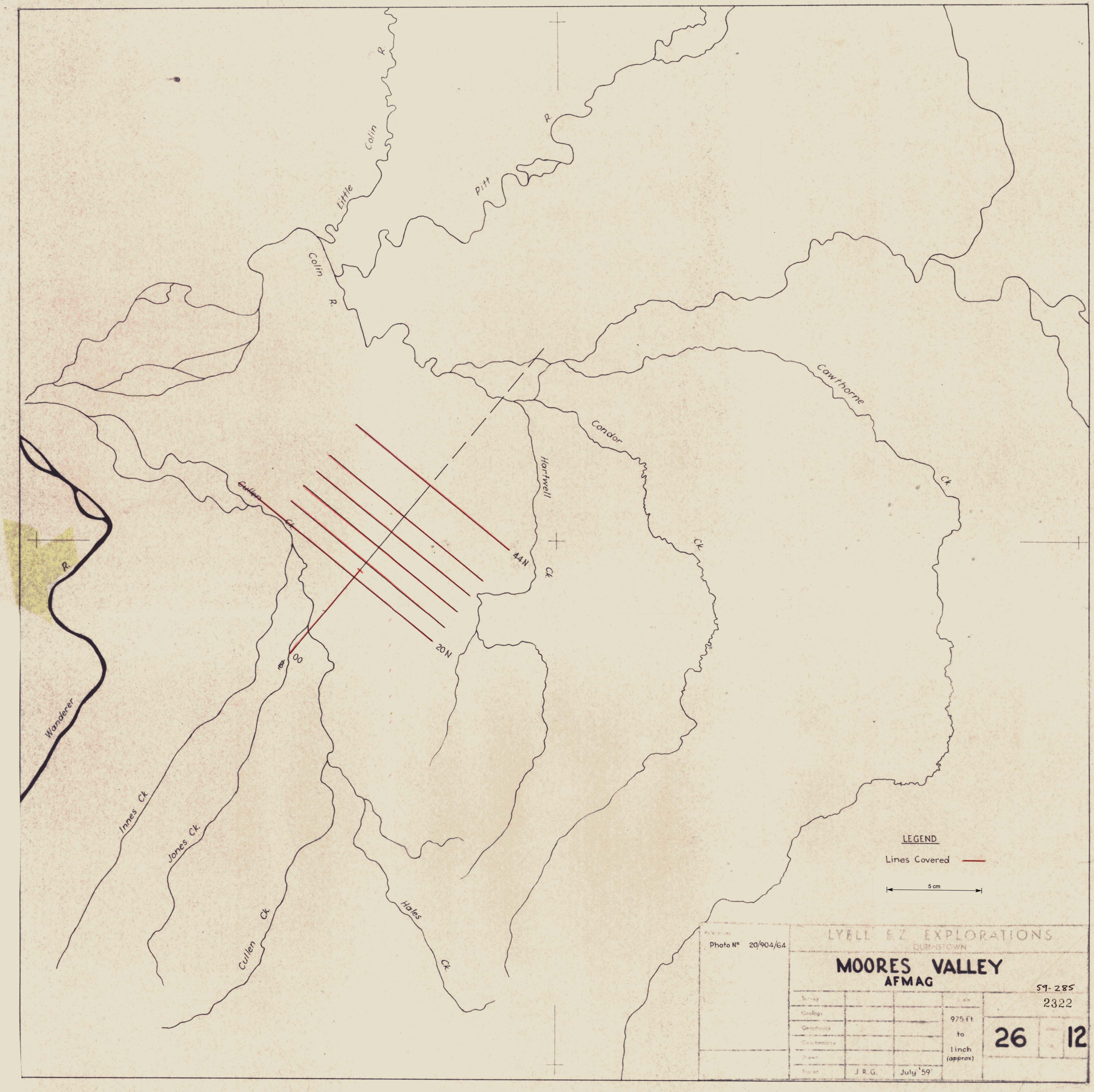
MOORES VALLEY
BOUGUER GRAVITY

59-285

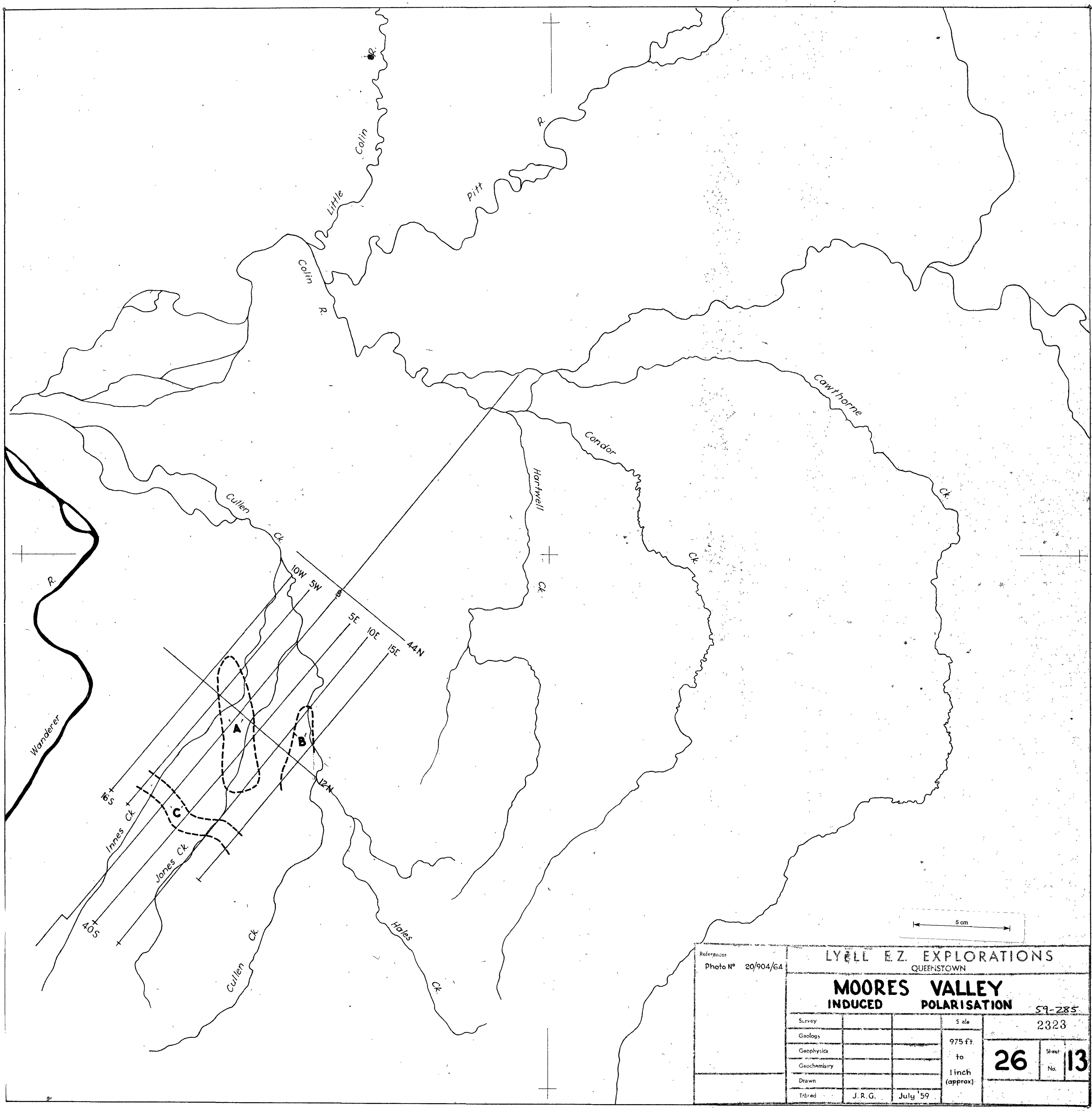
Photo Nº 20/904/64

Drawn			Scale: 975 ft. to 1 inch (approx)	2321
Traced	J.R.G.	July '59		26 — No. 4

357017


Little Colin R.
Pitt R.
Colin R.
Cawthorne Ck.
Condor Ck.
Hartwell Ck.
Cullen Ck.
44N
20N
00
R.
Wanderer
Innes Ck.
Jones Ck.
Cullen Ck.
Hales Ck.
LEGEND
Lines Covered
5 cm
Photo No. 20/904/64
LYELL E.Z. EXPLORATIONS
MOORES VALLEY
AFMAG
59-285
2322
Survey
Geology
Geophysics
Geochemistry
Drawn
Traced J.R.G. July '59
975 ft. to 1 inch (approx)
26
12

357018


Little Colin R.
Pitt R.
Colin R.
Cawthorne Ck.
Condor Ck.
Hartwell Ck.
Cullen Ck.
Wanderer R.
10W
5W
5E
10E
15E
44N
12N
16S
40S
A
B
C
Innes Ck.
Jones Ck.
Cullen Ck.
Hales Ck.
5 cm
References
Photo No 20/904/64
LYELL E.Z. EXPLORATIONS
QUEENSTOWN
MOORES VALLEY
INDUCED POLARISATION
59-285
Survey
Geology
Geophysics
Geochemistry
Drawn
Traced J.R.G. July '59
Scale
975 ft. to 1 inch (approx)
2323
26
Sheet No. 13

357019