COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES.
GEOLOGY AND GEOPHYSICS

RECORDS 1954, No. 3

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by

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ABSTRACT

This report describes a geophysical survey made in May 1952 and August 1953 at the Silver Valley mine workings, near Inverell, N.S.W. From the workings there is evidence of mineralisation along a well-defined fissure and one ore shoot has already been partly developed. The survey was made in an attempt to locate other ore shoots of sufficient size to warrant mining operations. Self-potential, magnetic and electromagnetic methods were used in the survey.

The self-potential method showed a well-defined anomaly on the eastern extension of the fissure, indicating that a small body of sulphides may exist there with its centre about 300 feet east of the known ore shoot. The magnetic and electromagnetic results showed no pronounced anomalies which could be correlated with any defined ore shoot.

Recommendations are made as to how the self-potential anomaly could best be tested. These comprise sinking a shaft at the centre of the anomaly, extending an existing adit, or driving a new adit from a point nearer the anomaly.

1. INTRODUCTION

The Silver Valley mine workings are situated in the Parish of Mayo, County of Hardinge and comprise leases P.M.L.10 and P.M.L.12. The mine is approximately sixteen miles from Inverell via the village of Copeton and approximately eighteen miles from Inverell via the village of Howell. The town of Inverell is the nearest commercial centre and is more than 400 miles from Sydney by road and railway (see Locality Map, Plate 1).

The country in which the mine is situated is rugged, being the slopes of the broad valley of the Gwydir river. Vegetation consists mainly of pine scrub and the area is of very limited value for grazing. Most of the area is more than 2,000 feet above sea level.

As the result of an application by Mr. Grunberg, the representative of a syndicate interested in the area, a geophysical survey was carried out in an attempt to locate a mineral deposit of sufficient size to warrant the start of mining and treatment operations.

2. GEOLOGY

The surface formation is composed mainly of granites, which, because of their resistance to erosion, are responsible for the rugged topography of the Copeton-Howell area. L.A. Cotton (1910) has shown the approximate boundaries of the two granite masses in the area and their relation to sedimentary rocks and basalts. The Tingha granite, which is the major formation, is intruded by a large tongue of acid granite which trends south-west across the area.

Above the granites, to the immediate north-west of the Silver Valley mine, is a roof pendant of sediments. Further to the north-west there are several outcrops of basalt which have covered old stream deposits containing gem minerals such as diamond. The contact between the two granites is somewhere beneath the overlying basalt and sediments. Within the acid granite there is evidence of mineralisation along a well-defined major fissure, which strikes about 113^{o} magnetic. One small shoot of silver, lead, zinc and copper ore has been opened up. The syndicate interested in the mine believed that the roof pendant of sedimentary rocks would provide a suitable environment for ore deposition at the time of mineralisation of the fissure, and that ore shoots additional to that already partly developed in the acid granite could be found.

3. OPERATIONS

In May 1952, a field party from the Geophysical Section of the Bureau of Mineral Resources, visited the area to do electromagnetic, self-potential and magnetic surveys. K.H. Tate and A.F. Alle made the surveys, and were assisted by two field-hands engaged by the syndicate. The work was supervised by Dr. J. Horvath, Senior Geophysicist.

Surveying of the geophysical grid was done at first by the field party and later by a surveyor(P.O'Reilly) of the Department of the Interior, Sydney. The base-line was laid at a magnetic bearing of 113.5°, approximately along the line of strike of the fissure referred to in section (2). In the central part of the area traverses at right angles to the base-line were spaced at 100 ft. intervals, this spacing being increased to 150 ft. and 200 ft. at the north-western and south-eastern ends of the grid. Observation points were pegged at 50 ft. intervals along each traverse. The lay-out of the grid and its relationship to the Silver Valley mine workings and to the topography are shown on Plate 2.

In August, 1953, some repetition work was done by K.H. Tate and M.J. O'Connor, and in addition four shorter traverses (350.E, 450.E, 575.E and 725.E) were surveyed in the area where pronounced self-potential anomalies had been recorded during the first survey. This report records the work done both in May, 1952 and August, 1953.

In areas which are thought to contain only small ore shoots, it is considered desirable to verify the results obtained with one geophysical method by the application of another and to correlate the two sets of results. In an attempt to obtain confirmation of the evidence obtained by the self-potential survey, electromagnetic and magnetic methods were used, but these proved unsuitable for this area.

4. SELF-POTENTIAL SURVEY

(a) Method.

Sulphide ore bodies which are enclosed in barren country rock, and which project from the zone of groundwater-saturated rocks into the zone of weathering, are subject to oxidation processes accompanied by electrochemical activity. This produces electric currents which pass from the ore body into the surrounding rock and back to the ore body. At the ground surface a resultant electric potential distribution occurs and differences in potential can be measured between any two points. Mapping of such measurements provides a clear picture of the potential distribution. The presence of a centre of negative potential on the surface is often indicative of a buried sulphide ore body undergoing oxidation.

One fixed rear station was maintained as a reference point and at every other station, at intervals of 25 feet along the grid, a reading was taken of the potential difference relative to the fixed station. At each point, two measurements were taken and in most cases the value plotted in the profiles on Plate 3 is the mean value of the observations.

However, at one point on each traverse, usually at the station on or near co-ordinate 500.E, several check observations were made in the course of the survey to determine the reliability of individual readings. The separate values obtained at these stations are shown on Plate 3 in order to give some idea of the overall reliability of the results. It is significant that in the areas of pronounced negative anomaly the reliability of the results is quite good.

(b) Results.

The profiles of the potentials along each traverse are shown on Plate 3, and from these profiles a contour map (Plate 4) has been drawn. This shows, by means of self-potential contours, the major features of the potential distribution.

The outstanding feature on Plate 4 is a well-defined negative centre at 500.S on traverse 400.E. This anomaly is situated on the eastern extension of the fissure disclosed in the mine. It is very well defined, and as can be seen from the self-potential profile of traverse 400.E, has a maximum departure of approximately -120 millivolts from the mean value. It could arise from a shallow-seated, sulphide ore body of length less than 175 feet.

A minor negative anomaly with a departure of approximately -40 millivolts from the mean value occurs at 400.S on traverse 00. This is probably an effect related to the granite-sediment contact.

There is no evidence in the self-potential results to suggest that ore deposition occurred west of the granite-sediment contact on traverse 00, as profiles 100.W to 600.W showed no defined anomalies. The self-potential profiles between 500.E and 1,000.E are somewhat erratic and there is no clear evidence that any important ore shoots occur along the fissure in that area. Some small negative anomalies are shown in the north-east of the area, but these are considered to be of no importance.

5. ELECTROMAGNETIC SURVEY

(a) Method.

An alternating-current field was propagated in the area to be surveyed by passing a 500-cycle current through a large rectangular loop of cable (3,600 feet by 1,800 feet) laid out on the ground with its long side parallel to the line of lode and displaced 500 feet from it. Measurements of the field components were made at 25 feet intervals along the traverses laid out for the self-potential survey. These measurements were compared with calculated components of an undisturbed field, to determine if there were any residual effects which might be caused by secondary fields arising in good-conducting formations such as sulphide ore bodies. It was expected that the silver-lead ore shoot would act as a good conductor, and that the enclosing granite would be sufficiently non-conducting to provide a distinct electrical contrast.

Work was greatly impeded by the steep terrain, which caused slow progress and prevented easy access to parts of the lay-out.

(b) Results.

No significant anomaly in the components of the electromagnetic field was observed over the known small shoot of ore or in any other part of the area surveyed. Further, observations over known ore shoots at the nearby Conrad Mine, where similar geological conditions exist, did not show any clearly defined electrical indications. Based on these two sets of observations, it is concluded that the electromagnetic method is not suitable for prospecting in this area.

6. MAGNETIC SURVEY

(a) Method.

At all stations on the surveyed grid a Watts magnetic vertical force variometer was set up and measurements were made of the vertical component of the earth's magnetic field, relative to an established base-station.

(b) Results.

The profiles of the magnetic observations are shown on Plate 5.

Although irregular departures from the normal value of the earth's magnetic field can be seen on the profiles, they cannot be correlated with any known ore body. It is believed that the anomalies recorded were caused by irregularly distributed concentrations of accessory minerals such as magnetite, ilmenite and biotite, in the enclosing granite. As it is improbable that any relationship exists between the distribution of these magnetic minerals and the sulphide mineralisation, it is unlikely that the magnetic anomalies observed carry any significance in the detection of the sulphide ore shoots.

Some of the profiles on Plate 5 exhibit small vertical breaks of some ten or twenty gammas. These discontinuities occur only at some points at which there was a halt in the observations, usually between one afternoon and the next morning. The existence of the breaks suggests that the instrument was not completely adjusted for temperature compensation. The small magnitude of the discontinuities is a measure of the slight extent to which the magnetic results are unreliable.

7. CONCLUSIONS AND RECOMMENDATIONS

The electromagnetic and magnetic methods are not suitable for a survey of the Silver Valley Lode.

The results of the self-potential survey, as shown on Plate 4, suggest that a small body of sulphides may exist between traverses 300.E and 475.E, with its centre about 300 feet east of the known shoot. This appears to be a new discovery, because no mine openings exist in that area. Testing is essential to determine if any ore is present. The partly eroded fissure has been covered at this point by talus debris from the slope above, and any outcrop would therefore be hidden.

The anomaly could be easily tested, because a shallow pit should be sufficient to expose any evidence of mineralisation and any formation thus revealed could be followed down by means of a prospecting shaft.

Alternatively, the present adit at about 100.E on traverse 500.S could be extended towards the centre of the anomaly.

A second alternative, and probably a less costly one, would be to drive an adit towards the centre of the anomaly from a point about 270.E/500.S (see Plate 4).

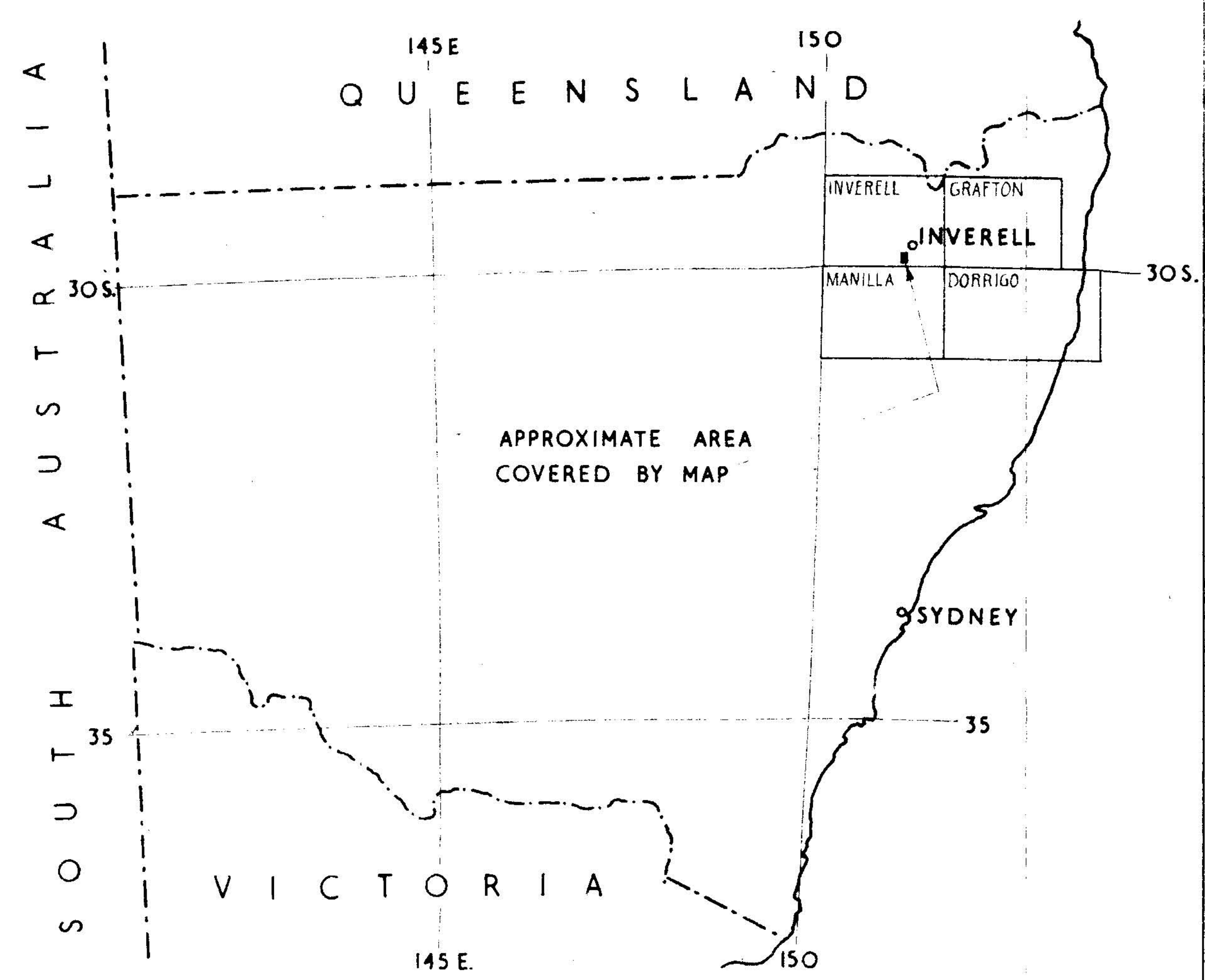
8. REFERENCE

Cotton, L.A., 1910 - The Ore Deposits of Borah Creek, New England District, N.S.W., Proc.Linn. Soc. N.S.W., Pt.II, p.502.

(K. H. TATE)
Geophysicist.

Melbourne,
21st May, 1954.

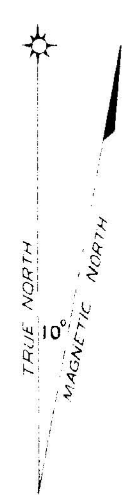
PLATE I

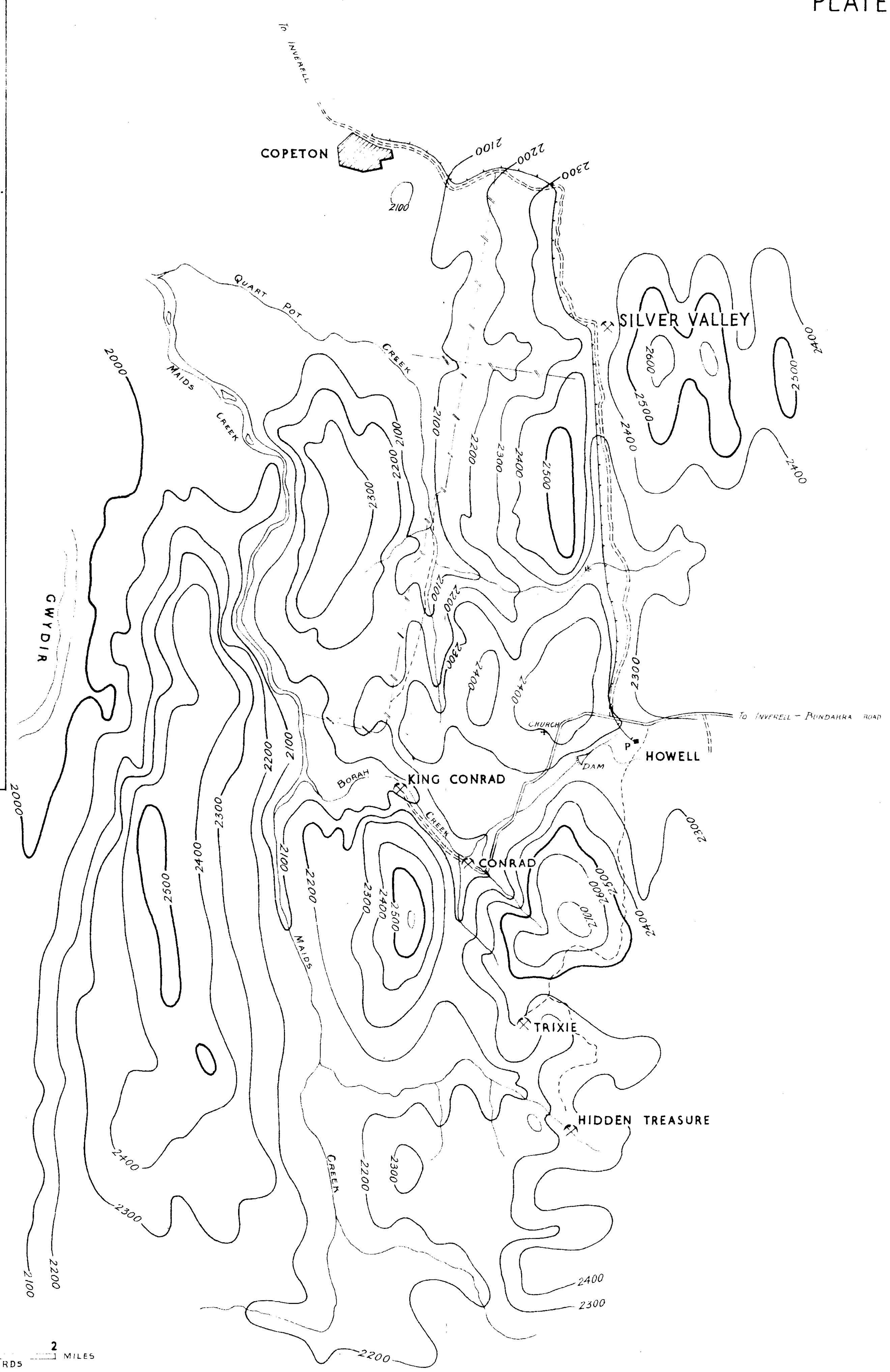


POSITION OF AREA DEALT WITH IN REPORT AND REFERENCE TO AUSTRALIAN 4 MILE MAP SERIES

SCALE OF MILES

50 0 100 200 300





SCALES

MILE 1 ½ 0 1 2 MILES

YARDS 1000 500 0 1000 2000 3000 YARDS

LEGEND

2000 SURFACE CONTOURS (INTERVAL 100')

FENCE

ROAD

VEHICULAR TRACK

TRACK

TELEGRAPH LINE

MINES

DATUM LEVEL BY BAROMETRIC DETERMINATION AT CONRAD MINE BY PROPERTY AND SURVEY BRANCH DEPT. OF INTERIOR 1953

CONTOURS BY PHOTO-INTERPRETATION

GEOPHYSICAL SURVEY AT SILVER VALLEY

COPETON, N.S.W.

LOCALITY MAP

L. G. Sute

GEOPHYSICIST

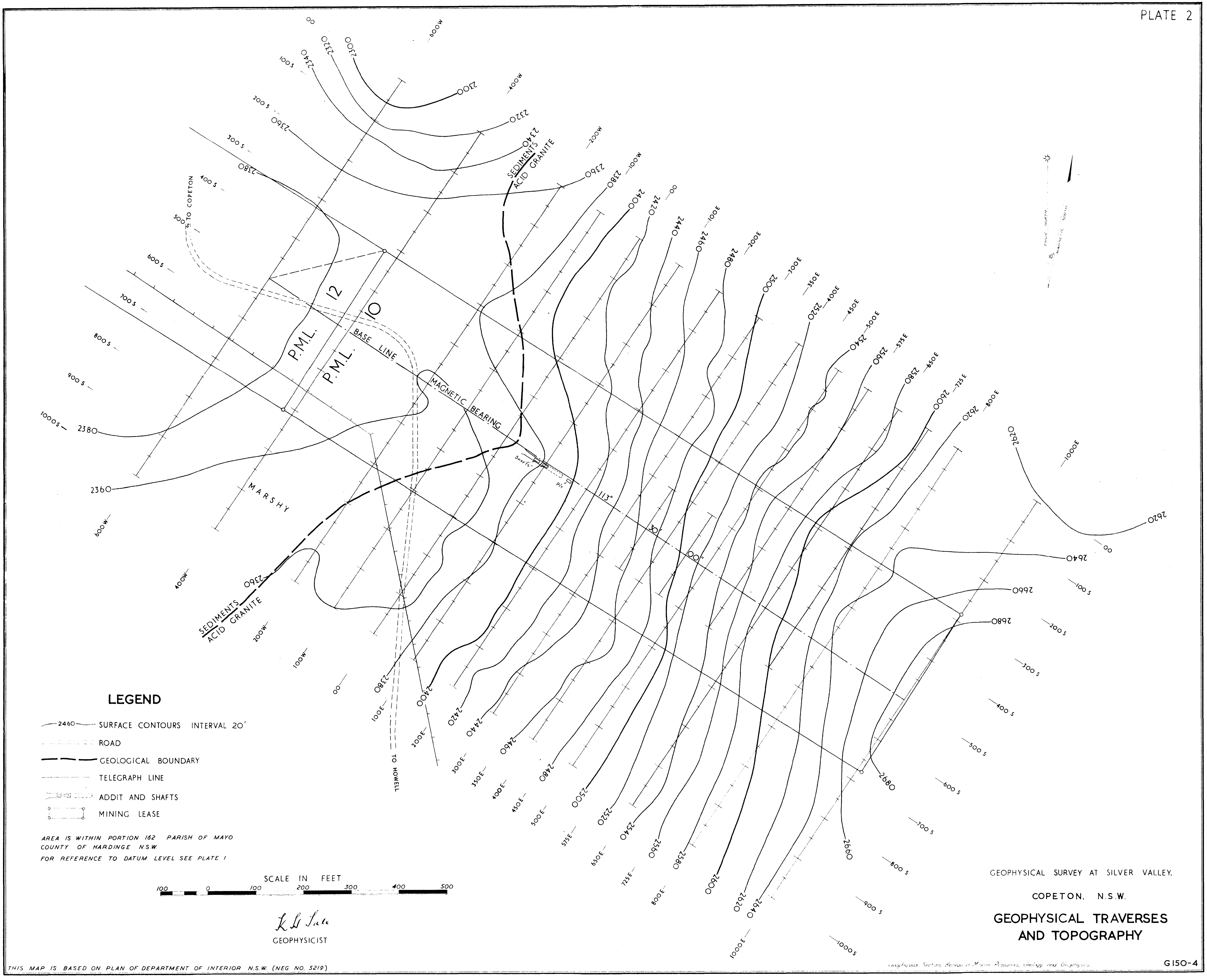
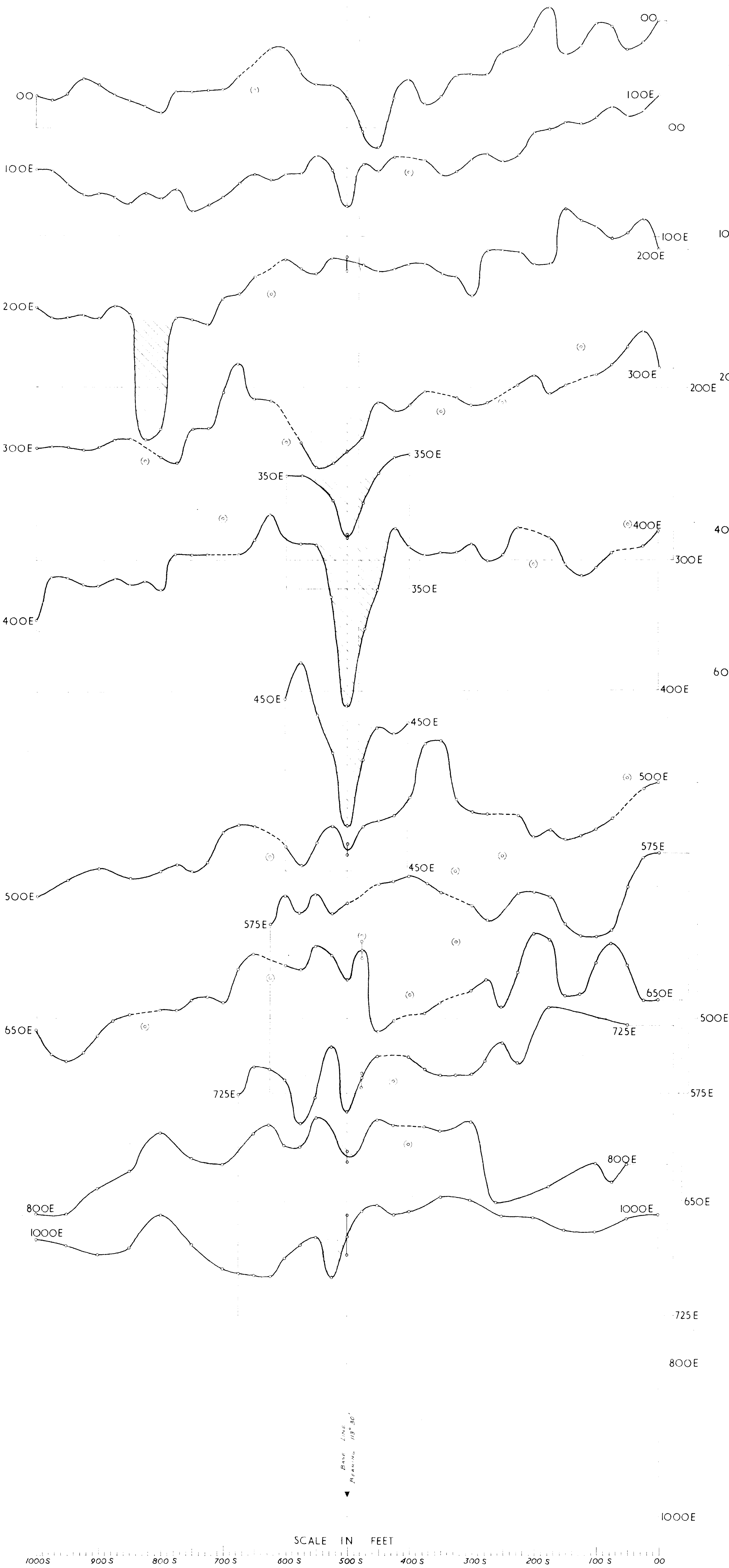
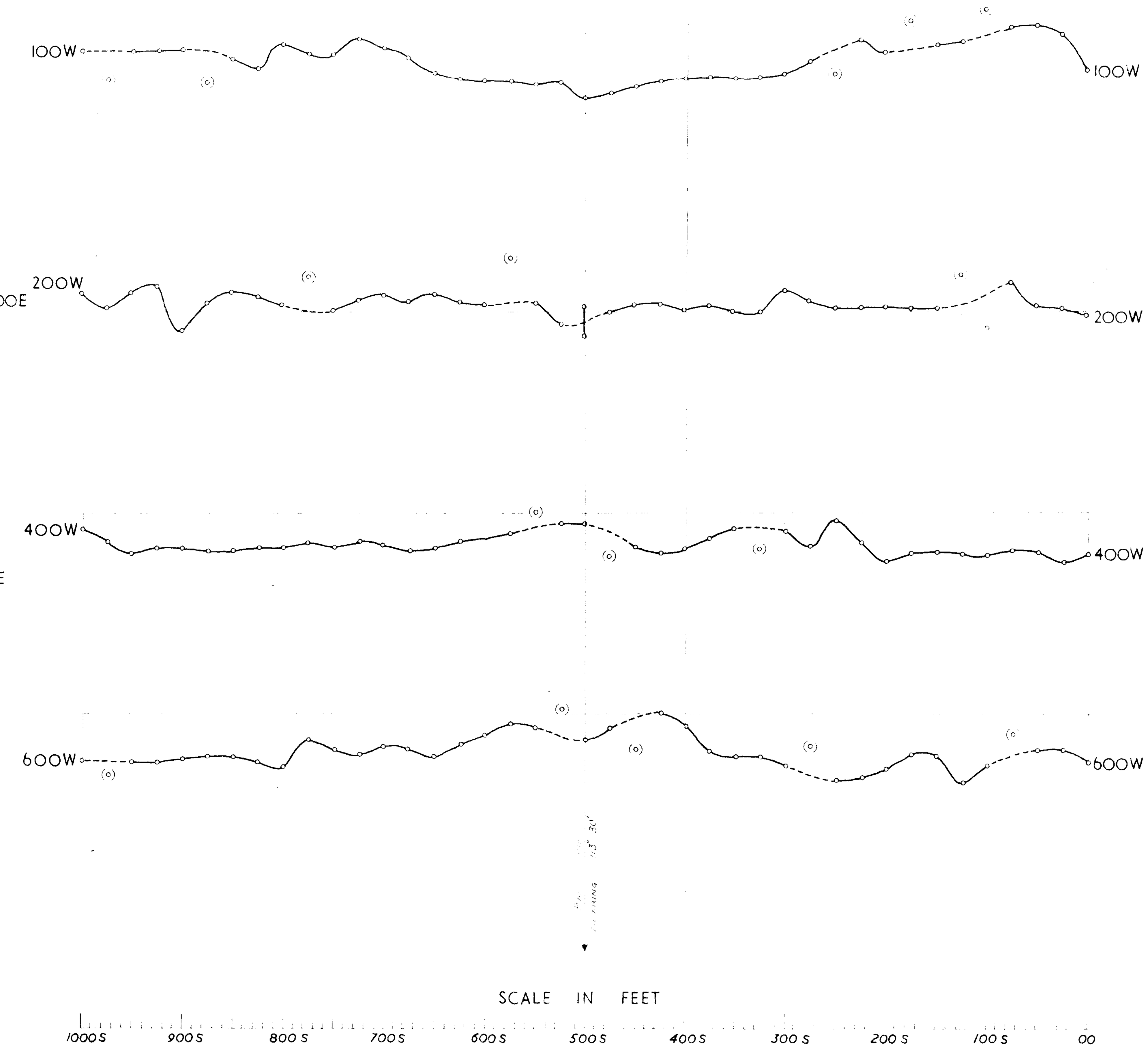


PLATE 2
LEGEND
2460 SURFACE CONTOURS INTERVAL 20'
ROAD
GEOLOGICAL BOUNDARY
TELEGRAPH LINE
ADDIT AND SHAFTS
MINING LEASE
AREA IS WITHIN PORTION 162 PARISH OF MAYO
COUNTY OF HARDINGE N.S.W.
FOR REFERENCE TO DATUM LEVEL SEE PLATE 1
SCALE IN FEET
100 0 100 200 300 400 500
GEOPHYSICIST
THIS MAP IS BASED ON PLAN OF DEPARTMENT OF INTERIOR N.S.W. (NEG NO. 5219)
GEOPHYSICAL SURVEY AT SILVER VALLEY,
COPETON, N.S.W.
GEOPHYSICAL TRAVERSES
AND TOPOGRAPHY
G150-4
P.M.L. 12
P.M.L. 10
BASE LINE
MAGNETIC BEARING
113° 30' 00"
SEDIMENTS
ACID GRANITE
MARSHY
TO COPETON
TO HOWELL
SHAFTS
PIT

PLATE 3





GEOPHYSICAL SURVEY AT SILVER VALLEY,

COPETON, N.S.W.

SELF-POTENTIAL PROFILES

VERTICAL SPACING OF PROFILES NOT TO SCALE

VERTICAL SCALE 1" = 50 MV
THE ZERO LINE FOR EACH PROFILE
REPRESENTS A VALUE OF -100 MILLIVOLTS

K. G. Sute
GEOPHYSICIST

G150-1

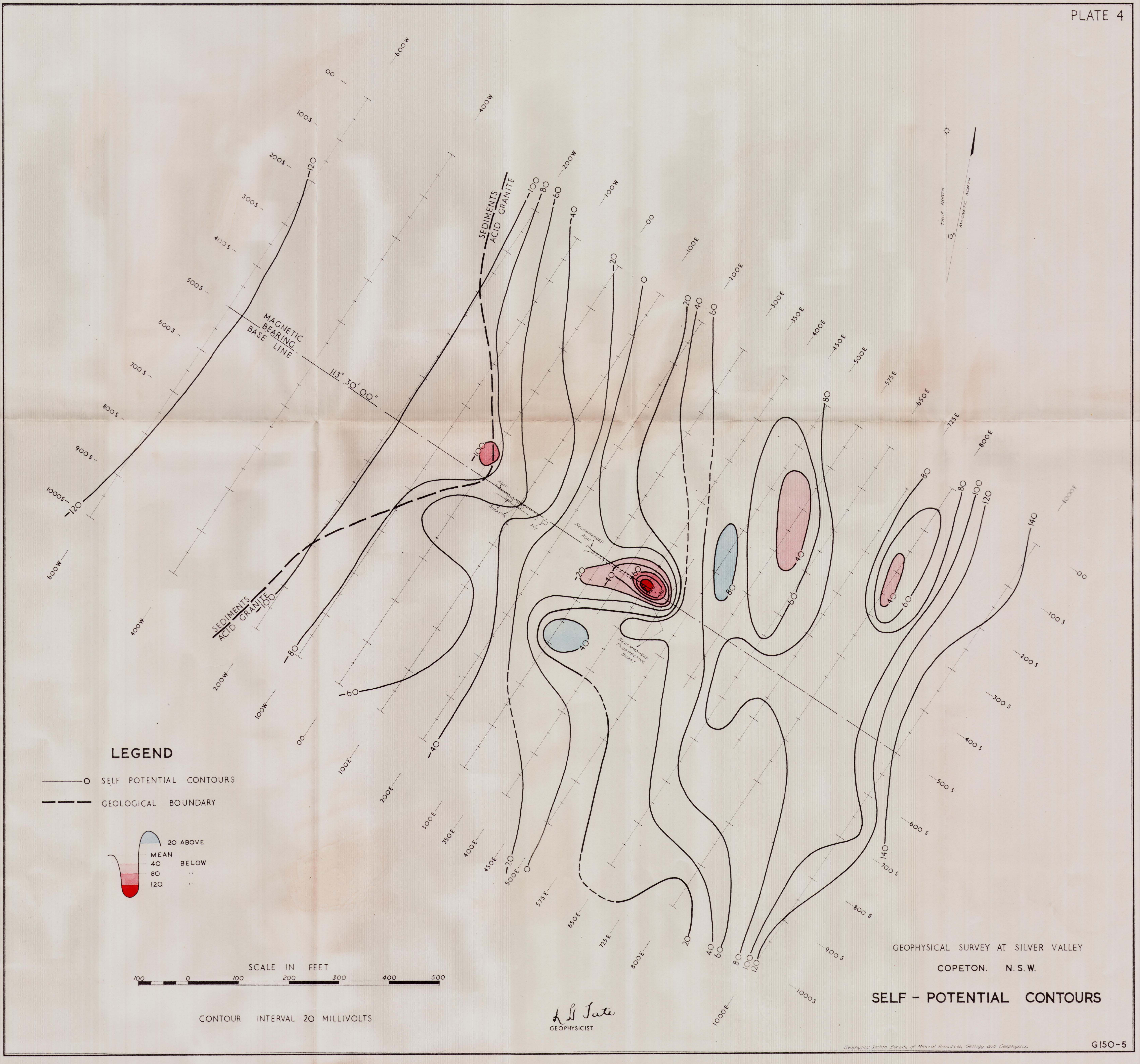
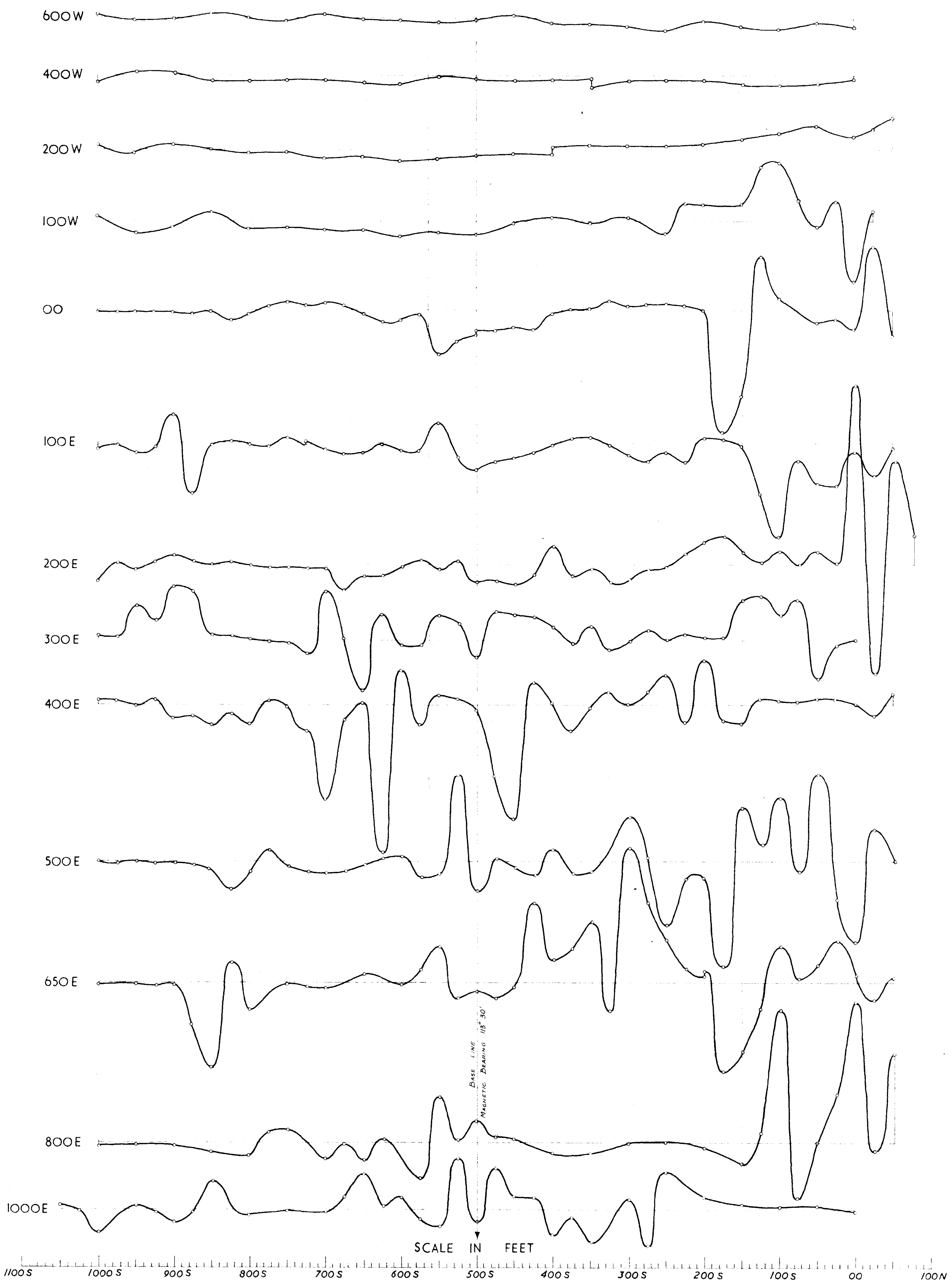


PLATE 4
MAGNETIC BEARING BASE LINE
113° 30' 00"
SEDIMENTS
ACID GRANITE
TRUE NORTH
MAGNETIC NORTH
ADIT
SHAFT
PIT
RECOMMENDED ADIT
RECOMMENDED PROSPECTING SHAFT
LEGEND
SELF POTENTIAL CONTOURS
GEOLOGICAL BOUNDARY
20 ABOVE
MEAN
40 BELOW
80 ..
120 ..
SCALE IN FEET
100 0 100 200 300 400 500
CONTOUR INTERVAL 20 MILLIVOLTS
GEOPHYSICIST
GEOPHYSICAL SURVEY AT SILVER VALLEY
COPETON. N.S.W.
SELF - POTENTIAL CONTOURS
G150-5

PLATE 5



GEOPHYSICAL SURVEY AT SILVER VALLEY

COPETON, N.S.W.

VERTICAL MAGNETIC FORCE PROFILES

VERTICAL SCALE 1" = 200 GAMMAS

VERTICAL SPACING OF PROFILES NOT TO SCALE

GEOPHYSICIST

GEOPHYSICAL SECTION BUREAU OF MINERAL RESOURCES

G 150 2