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RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

MELBOURNE, AUSTRALIA

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GEOPHYSICAL SURVEYS
IN THE
STIRLING VALLEY, TASMANIA

by

J. B. Boniwell

Geophysical Surveys in the Stirling Valley by J B Boniwell 6/4/59

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GEOPHYSICAL SURVEYS IN THE STERLING VALLEY, TASMANIA.

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J. B. Boniwell

C O N T E N T S

P L A N S

No.	T.515	Electromagnetic Profile, Sterling Valley	1" to 400'
"	T.516	Bouguer Gravity Profile, " "	1" to 400'
"	T.518	Regional Gravity Gradients " "	1" to 400'
"	T.513	Residual Gravity Contours " "	1" to 400'
"	T.517	Topographic Contours " "	1" to 400'
"	T.514	Vertical Intensity Contours " "	1" to 400'
"	T.525	Gravity Traverse on Sterling Mine	1" to 400'
"	T.527	Spontaneous Potential Contours Sterling Valley	1" to 400'

A band of Cambrian sediments enclosed by members of the Dundas volcanic assemblage forms the floor of the Sterling Valley. Interest in this belt is brought into focus by the Tullah lead-zinc mineralization in the North, and the heavy pyritisation at the old Sterling Mine in the South. Schistosities in the Sterling Valley slates apparently link up the two occurrences to the one shear structure.

GEOPHYSICAL COVERAGE

An extensive coverage of the valley South from the Murchison River to the S.P.L. boundary was provided for by a grid of lines cut at 400' intervals, pegged at 100' stations, and controlled from a base-line bearing 17 degrees azimuth. Primary electromagnetic surveying was undertaken with a vertical loop excited at 1000 cps. by a motor-generator unit. Auxiliary gravimetric and magnetic coverage provided detail on the anomalous indications of the primary phase.

DISCUSSION OF RESULTS

(a) Electromagnetic (Plan T.515)

One major electrical horizon dominates the grid area, crossing from North to South with but one apparent discontinuity. Between lines 16S and 48S, strengths of the secondary field reach their maximum level, and show uniform field patterns consistent with a steeply dipping, viz. about 75 degrees West, conducting sheet of appreciable dip extent under a shallow cover, circa 10'-20'. To the North of line 16S, although resolved with decreasing amplitudes, this horizon has been traced with certainty to line 20N, and there is evidence that it may continue beneath the alluvial cover right to the Murchison River. However, in this sector, a parallel conducting horizon has been defined in the East, weakening from the Murchison South to line 16N. As the strikes implicit to these geophysical horizons are significantly dissociated from bedding strikes, it is virtually certain that they represent trends in schistosities. Thus, in this event, the weakening North of one and the strengthening North of the other rather suggests that, despite the influence of cover, exaggerated en echelon shearing occurs across the grid area.

In addition, two comparatively minor conductors of finite length have been established in the central part of the grid. Neither are particularly well resolved nor of marked quality, but both are distinguished by differing geologic settings. The more westerly, whilst part under alluvium, can be presumed to be arising from bedded members of the sedimentary series (tuffs?); the easterly from a significantly conducting segment of the slate-volcanics contact.

(b) Gravimetric

Observed gravity data have been reduced to the Bouguer values on the assumption of a near-surface density of 2.67 gms/cc. Profiles of Bouguer gravity are shown in Plan T.516. Regional gravity effects have been removed empirically in a series of curve-fits (depicted in Plan T.518) to provide the residual data. The latter have been contoured (see Plan T.513) only to the extent of emphasising major departures from a zero datum as it is felt that the accuracy of the actual field observations may have suffered in the swampy ground conditions of the valley floor.

Several patently interesting gravity situations emerge from this breakdown:-

(a) A lenticular region of high gravity in correlation with the conductor-cum-shear in the extreme South. The likelihood that the increased densities so implied here are due to mineralization is heightened by the fact that the Sterling Mine appears on immediate strike, and that the electrical disturbance identified with the shear intensifies just in this region. Just how important this zone could be would be best gauged by a gravimeter check of the Sterling Mine mineralization. However, drilling by the E.Z. Co. of the latter, and the relatively narrow widths intersected there, of the order of 20', rather suggest a gravity expression smaller in magnitude and extent than those obtained in the gravity region under discussion. Thus, it would seem that more massive and/or more widespread mineralization exists here.

(b) A broader region of high gravity peaking on the CL West of the BL. Pertinent conductive effects exist, but are vague and show no consistent correlation with the gravity anomaly. However, the peak magnitude of the residual closure is of an order and character to allow the presence of 10% sulphides in a bedded horizon.

(c) A high gravity closure peaking near the CL East of the BL. Correlating electromagnetic effects are definitely indicated here, although amplitudes are not large. (It should be noted, however, that amplitudes have been suppressed, in comparison with the primary survey, by the use of traverses spaced 400' from the transmitter position). This anomaly assumes importance largely by virtue of its geologic setting (see above), and of a prospect trench at 4E on line 4S in which massive pyrite occurs. It is seen that the local gravity expression at the latter point is minor only, and that the parent gravity system centres at least 400' North where it is of added stature by reason of a coincident magnetic high of over 500 gammas. Thus, it can be presumed that greater amounts of more varied mineralization occur on the CL.

(d) An axis of gravity low immediately North of (c) and striking into the grid area from the SE. There is regional evidence to suppose that this is the axis of a cross-structure, presumably a fault, whose immediate import lies in its possible implications to (c) and to (e).

(e) A distorted region of gravity high North again of (d). Apparent electromagnetic correlations exist on lines 16N and 20N, but not on line 24N. As the gravity closure occurs, apparently, entirely in volcanics through which the conductor axis passes virtually unchanged into other rock-types North, no ready association of gravity with mineralization can be made in this case.

(f) An axis of gravity low striking NE into the grid area across lines 24N to 36N inclusive. It is thought, again, that this feature represents a structural axis whose presence may be of import to subsequent findings.

(g) Two small areas of positive gravity centred on 16S/4E and 40N/BL. Both these are marked by magnetic correlations of a character to presume, at least, the incidence of minor mineralization. Neither, however, possess electrical correlations.

It should be noted that, apart from the above individual considerations, any evaluation of a zone of residual gravity high must take into account the possible influence of bed-rock topography on anomaly resolution. As surface land forms so often reflect bed-rock behaviour, topographic contours have been compiled in Plate T.517 to allow comparison. It is seen at once that anomaly (e) above is remarkably accounted for by such a surface relief bedrock combination, but elsewhere, on anomalies (a), (b) and (c), the effect, whilst present, is either not clear or inconsistent. It is considered, therefore, that these latter anomalies must largely stand as genuine expressions of excess masses in situ.

(c) Magnetic

Coverage by the vertical intensity variometer has disclosed a number of highly localised magnetic centres, but has revealed virtually no trends in the regional sense (see Plate T.514). Features in the coverage are:-

(a) the magnetic centre at CL/4E (see above).

(b) 200 gamma correlation with positive gravity centres at 16S/4E, and at ¼CN/BL (see above).

(c) indications of magnetic mineralization in the gravity-inferred structure between lines 8N and 16N. These appear spasmodic and of an order to suggest only the minor dissemination of magnetic pyrrhotite.

(d) two large centres on line 16N. Unsupported by other geophysical evidence, these anomalies are of minor interest only, and probably indicate nothing further than the localisation of small amounts of free magnetite, i.e. less than 1%.

PREVIOUS WORK

Self potential surveys of the southern portion of the valley down to the Sterling Mine were carried out in 1957. Unfortunately, the surveys grid cannot be located on the ground, and there is no way of accurately tieing this previous work to the present coverage from the existing plans.

Nonetheless, it would appear that negative centres of self-potential were obtained in discrete zones along the shear North of the Sterling Mine up to about line 24S. Although SP. coverage apparently extended further North up to about line 4S, it was virtually all West of the present BL and quite a substantial proportion West of the Sterling River. Thus, another line of SP. anomalies evidently occurs West of the present grid area circa lines 28S - 8S.

RECOMMENDATIONS

Although the history of the Sterling Valley mineralization bespeaks semi-massive pyritisation with little or no grade values, it is felt that the series of geophysical anomalies now outlined should not go untested. Therefore, it is recommended that drilling or trenching should be undertaken with the following initial targets in view:-

(1) The "contact" anomaly at CL/4E. Drill site: 180' chained West along line of traverse from station 4E on CL, depression -45 degrees, bearing East along line of sight of traverse, estimated length 400'.

Gravity inferred tonnages, however, are not large, being of the order of 450,000 tons of 30% sulphides conservative estimate, and therefore, must even be considered smaller if more massive concentrations are expected. Therefore, widths would be of the same order as the Sterling Mine, that is, circa 20'.

(2) The "shear" anomaly at the South of the grid. Drill site: 200' chained West along line of traverse from station 2W on line 32S, depression -45 degrees, bearing East along line of sight of traverse, estimated length 550'.

Tonnages indicated on line 32S are 600,000 tons and for the zone, 2.2 million tons of 30% sulphides.

(3) The "bedded" anomaly at 6W/CL. Drill site: 240 chained West along line of traverse from station 6W on line CL, depression -45 degrees, bearing East along line of sight of traverse, estimated length 500'.

Drilling of these holes should be conditional on subsequent findings, e.g. the gravimetric check of the Sterling Mine mineralisation itself, geological and geochemical conclusions, and in the case of DDH. No. 3, on the results of the first two holes. Experience at Gooseneck has shown that the density of a slate rock-type at depth is substantially higher than at surface, and given the inclusion of even minor amounts of sulphide mineralization, densities climb to a detectable level above the volcanic country rock. Broad gravity anomalies result, and it appears probable that the gravity target of DDH. No. 3 may fall in this category. It is because of this effect that trenching is allowed as a possible preferred alternative to drilling, at lease on this zone.

1st March, 1959
Zeehan, Tasmania.

J.B. Bonwell,
Geophysicist.

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STERLING VALLEY GEOPHYSICAL SURVEYS

ADDENDUM I

A short gravimetric check of the Sterling Mine mineralization was made on the 4th March, 1959. The base point of the single line traverse was placed 100'N. of the old mine shaft. The profile is shown on plan No. T.525.

The reduced profile is remarkable for its smoothness, in fact, the only departure is a small 0.15 mgal. positive anomaly at station 2W. The underground workings are all East, approximately 60', of the shaft; and whilst the exact collar positions of the seven holes drilled by the E.Z. Co. in 1949 are not known, they all fall within an area 700' along strike by 300' across strike, and, by reason of the short hole lengths, 150' or less, are all obviously grouped to explore the mine lode channel at a shallow depth. Thus, two things are clear: one, the lode itself is situated at about 1E on the gravimeter traverse and has given rise to no gravimetric expression; two, the one-station anomaly at 2W, whatever its pertinence, has not been drilled.

DDH. No. St.P.75 appears to provide the closest correlation with the gravity traverse. This hole intersected variably pyritised slates and tuffs throughout, and a 25' width of semi-massive pyrite (30%) at 120'-145' downhole. As it is fairly certain that the gravimeter traversed into the porphyries to the West, the lack of a marked contact expression precludes that the density contrast between these mineralised slates and the volcanics is of an appreciable order.

Therefore, in the light of the evidence from this one traverse, the anomalous gravity systems to the North are enhanced insofar as they do not appear to represent a mere slate-porphyry contrast, or mineralization of the order as that at the Sterling Mine. Sulphide bodies of much greater widths and tonnages are indicated. However, the effects of topography, that is, bedrock relief, still remain largely unresolved, as it is seen that the terrain on this traverse, at least in profile, is remarkably regular. This in itself confirms that bedrock effects exist to the North, but provides no clue as to degree and character.

In consequence of the above, drilling recommendations in the Sterling Valley sited on geophysical evidence still warrant implementation.

15th March, 1959.
Zeehan, Tasmania.

J.B. Boniwell,
Geophysicist.

STERLING VALLEY GEOPHYSICAL SURVEYS

ADDENDUM II

A report on geophysical work in the Sterling Valley area was written by J. Boniwell. Since that report was written the following work has been undertaken: (1) testing of Afmag equipment (2) the relocation of old S.P. grid in relation to present grid. This will be described briefly.

Electrolytic Zinc kindly consented to having tests made of Afmag equipment on R.T.A.E. ground. On March 7th the Afmag equipment and operator P. Hallof were available for tests at Sterling Valley and in the Chester area. Short tests were made on two grid lines, namely lines 40S and 24N in the Sterling Valley area. On line 40S the Afmag confirmed the presence of a conductor near the base line where the Sharpe vertical loop equipment showed a strong conductor and indicated the presence of a conductor approximately 300 feet east of the base line. On line 24 north the activating field was not sufficiently strong to give any conclusive readings over an area where the Sharpe equipment indicated a conductor of weaker quality than was recorded on line 40S. Operator P. Hallof pointed out that the Afmag activating field is much weaker around noon at the time the tests were made on line 24N.

Spontaneous Potential work was conducted in the Sterling Valley in March 1957. The position of the old S.P. grid can now be located with respect to the present grid. A plan T.527 attached shows the S.P. contours in relation to the new base line. It will be seen that a number of S.P. anomalies form a line along the new base line which corresponds to the position of the conductor indicated by the Sharpe method from grid line 48S to line 12S. The S.P. anomaly is not continuous along the conductor line. The reason for this could be that conditions favourable for active electrochemical action responsible for the S.P. indications do not exist for the entire length of the conductor. The breaks in line of S.P. anomalies correspond with the lower lying ground where the water table is close to the surface of the ground, allowing for no zone of active oxidation.

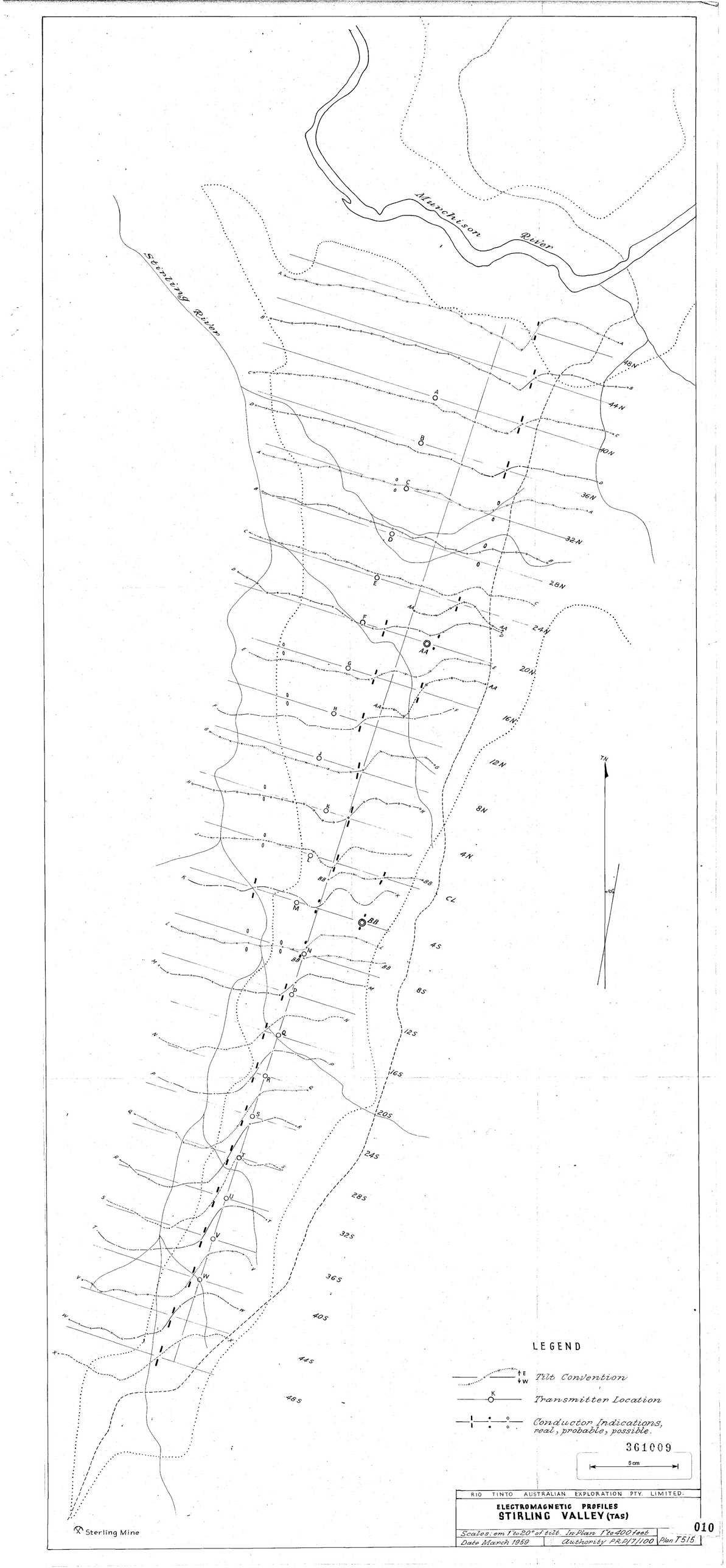
There are two other zones of S.P. indications; one centered at 4800N, 1100W (old grid) and a second centered at 6800N, 1000W. The first of these strikes in a N-S direction and it is interesting to note that if the line were continued 300 feet southward it would cross line 40S (new grid) at the position of the second conductor indicated by the Afmag equipment on this line.

The S.P. anomaly at 6800N, 1000W corresponds approximately with a magnetic high and a small gravity high on line 16S, also there is some evidence on the electromagnetic profiles to suggest the presence of a conductor zone. All these indications are near the eastern limit of the area surveyed and no conclusions can be made about this zone until the surveys are extended further in an easterly direction.

The above does not materially affect the recommendations made in report by J. Boniwell for the drilling of geophysical indications, although it is now evident that there are two conducting zones on line 32S. The hole recommended by Boniwell on line 32S would check the stronger western zone. Further drilling in the area would be dependent upon the results obtained from this hole.

6th April, 1959.

E. McCarthy,
Senior Geophysicist.



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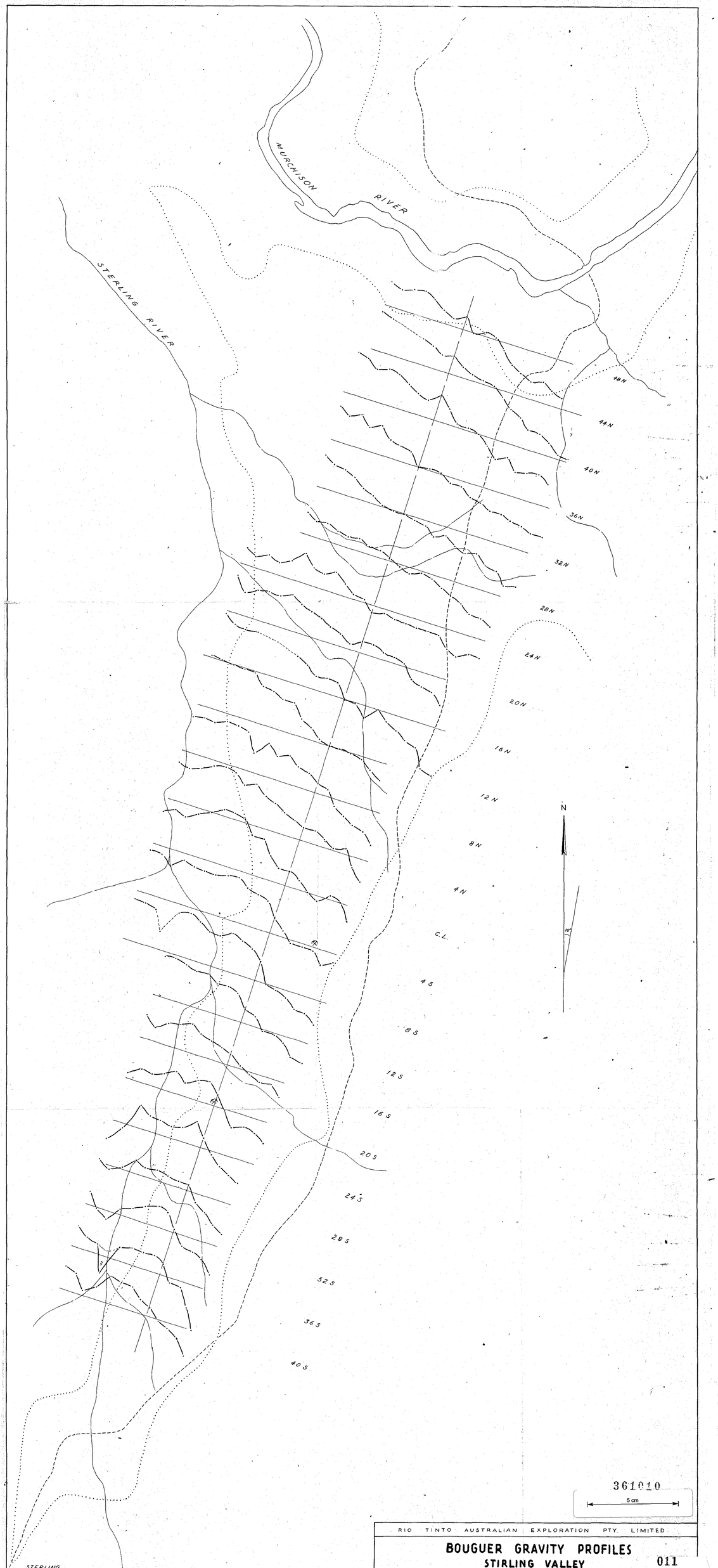
ELECTROMAGNETIC PROFILES

STIRLING VALLEY (TAS)

Scales: cm 1"to 20° of tilt. In Plan 1"to 400 feet.

Date March 1959 | Authority PRP/7/100 | Plan T515

010



361010

5 cm

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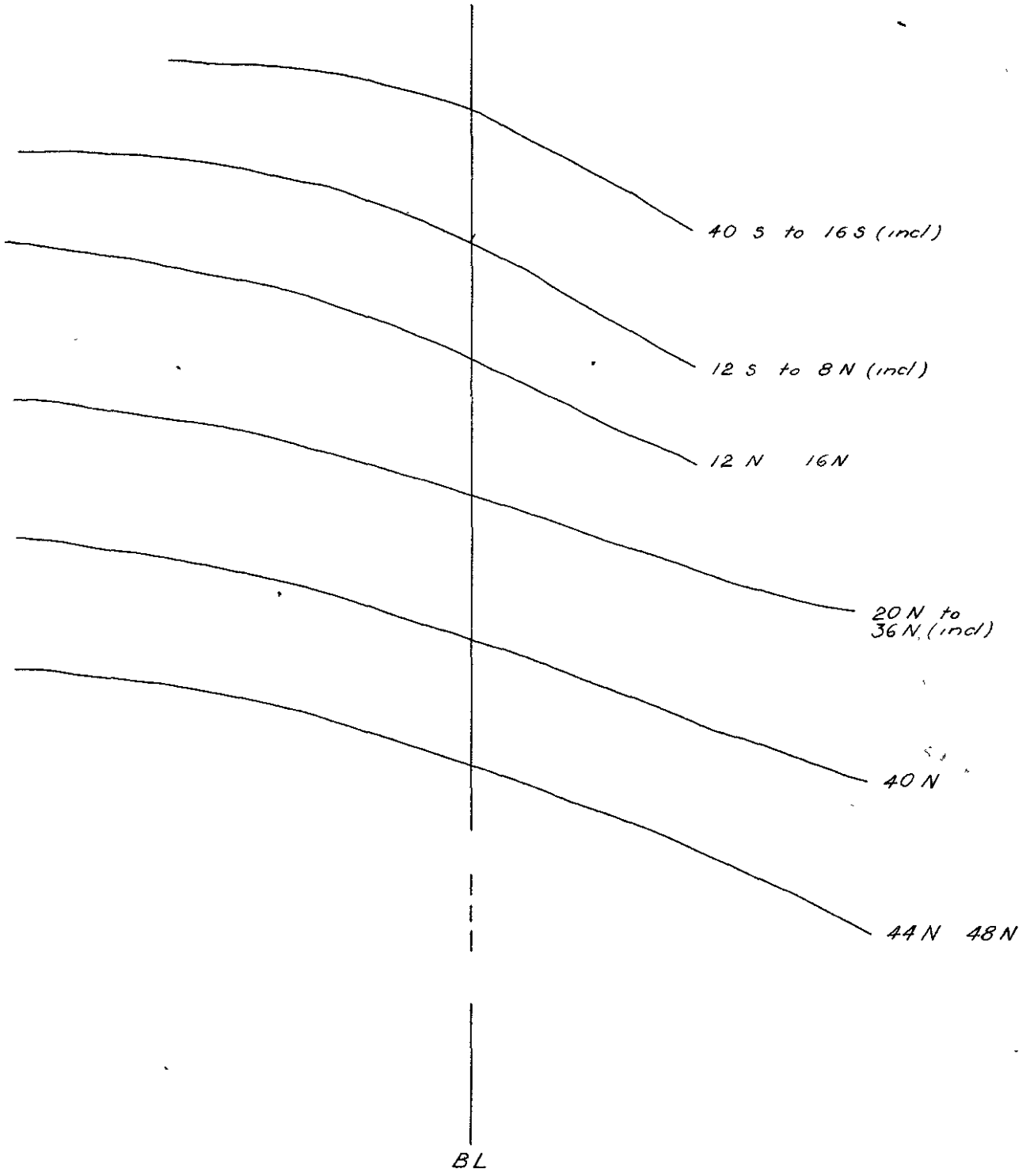
BOUGUER GRAVITY PROFILES

STIRLING VALLEY

TASMANIA

011

18.3.1959.	SCALES: 40 : 1inch = 1.0mgal in Plan : 1inch = 400 Feet	PRP17/100	Plan No T 516



361011

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REGIONAL GRAVITY GRADIENTS

STIRLING VALLEY, TAS

012

5 cm

March 1959	HORIZONTAL SCALE 1 inch = 400 feet	PRP/7/100	Plan No T 518

361012

5 cm

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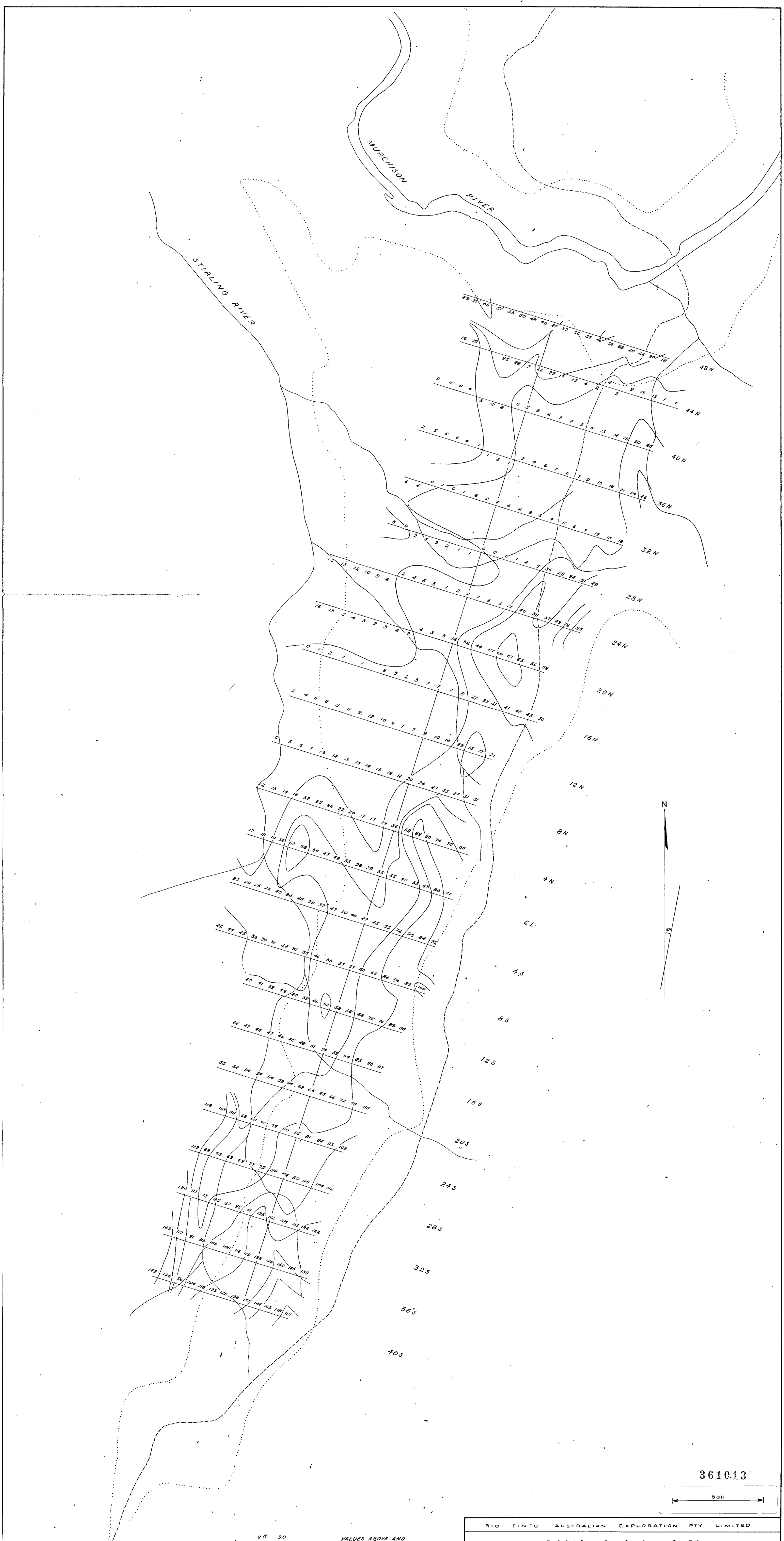
RESIDUAL GRAVITY CONTOURS

STIRLING VALLEY, TASMANIA

Also showing changes in regional gravity along B.L. Section. Interpreted axes marked.

20th March 1959	SCALE in plan: 1 in. = 400 Ft. Contour interval = 0.10 mgal.	PRP/7/100	Plan No T 513

013



3610-13

5 cm

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TOPOGRAPHIC CONTOURS

STIRLING VALLEY

TASMANIA

014

23rd March 1959	SCALE in plan 1in.=400ft Contour Interval 20 feet	PRP/7/100	Plan No T 517

Murchison River

Stirling River

HIGH

LOW

48N

44N

40N

36N

32N

28N

24N

20N

16N

12N

8N

4N

CL

4S

8S

12S

16S

20S

24S

28S

32S

36S

40S

N

10°

Values above and Below a common Datum

Stirling Mine

361014

5 cm

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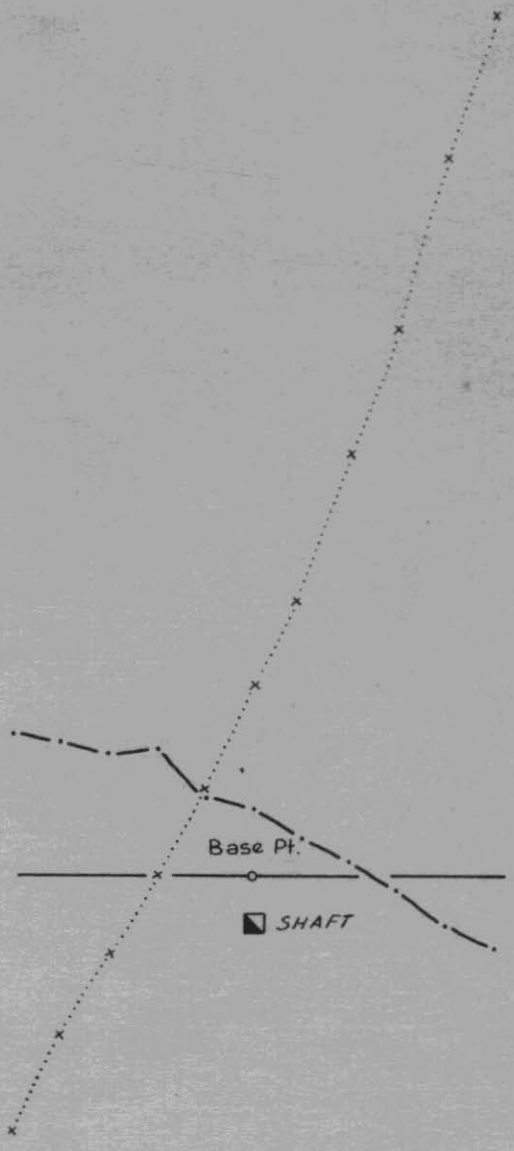
VERTICAL INTENSITY CONTOURS
STIRLING VALLEY

Date April 1959 | Scale: in plan 400 feet to 1 inch

Authority PRP/7/100 | Plan No T 514

015



4W 00 4E

361015

5 cm

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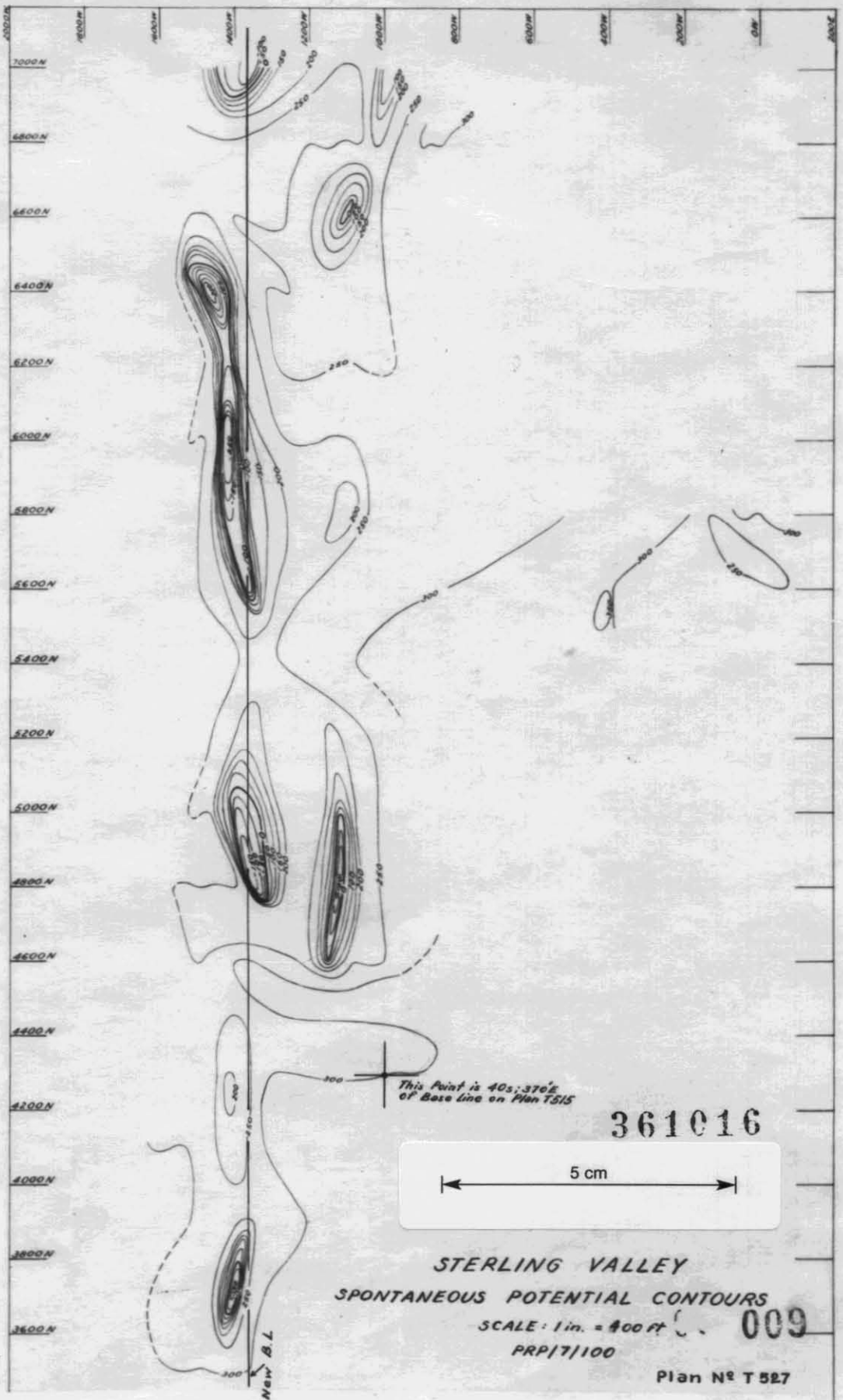
GRAVITY TRAVERSE ON STIRLING MINE
STIRLING VALLEY
TASMANIA

008

18th March 1959	SCALES: Gg: 1 in. = 1.0 mgal in Plan: 1 in. = 400 Ft. topogr.: 1 in. = 20 Ft.	PRP/7/100	Plan Nº T525


7000N
6800N
6600N
6400N
6200N
6000N
5800N
5600N
5400N
5200N
5000N
4800N
4600N
4400N
4200N
4000N
3800N
3600N
New B.L.
This Point is 40s; 370'E of Base Line on Plan T515
361016
5 cm
STERLING VALLEY
SPONTANEOUS POTENTIAL CONTOURS
SCALE: 1 in. = 400 ft.
PRP/7/100
009
Plan Nº T 527