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COMMONWEALTH OF AUSTRALIA
MINISTRY OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

RECORDS 1950, No. 41

PROGRESS REPORT OF THE GEOPHYSICAL SURVEY OF RENISON BELL TIN FIELD, TASMANIA

by

L.W. WILLIAMS

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1. INTRODUCTION.

The Renison Bell township is in the West Coast region of Tasmania. It is connected by rail and road with Zeehan, and by rail with the seaports of Burnie and Strahan.

The country is of very high relief and is dissected by numerous rivers and creeks. The rainfall is slightly greater than 100 inches per annum, and occurs mainly during the winter months. As this survey was carried out between the beginning of April and the end of June, little time was lost because of bad weather, until towards the end of the survey.

Tin ore was first discovered on the field in 1890, and in 1901 the sluicing of detrital ore commenced. It was some years later (1909) before batteries were erected to treat the oxidised ore. At that time, the companies had no way of treating the sulphides, and mining was restricted to the oxidised ore. The result was that this ore was eventually worked out and it was not until 1935 that Renison Associated Tin Mines N.L. started treating the sulphides. The future development of the field will probably depend mainly on the working of sulphide ores. Up to 1949, 2,560 tons of metallic tin were contained in the concentrates produced from the Renison Bell field.

The request for the geophysical survey was made by Renison Associated Tin Mines N.L. through the Director of the Tasmanian Mines Department. The purpose of the survey was to explore for additional ore-bodies within an area of interest, occupying approximately 9½ square miles. The present work was confined to an area near the Renison Bell main lode and situated on the northern slope of the Renison Bell Hill. Its purpose was to test the magnetic and self-potential methods over known ore-bodies and to apply these methods in the search for further bodies in the immediate vicinity.

The party consisted of Messrs. L.W. Williams and A.J. Barlow, geophysicists, and Mr. K.S. Swan, assistant. Most of the surveying was done by Mr. B.L. Taylor of the Tasmanian Mines Department, and his assistance was greatly appreciated.

Thanks are also due to Renison Associated Tin Mines N.L. for supplying a field assistant for part of the time, and to their staff for helping the geophysical party in many ways.

11. GEOLOGY.

The Renison Bell area is part of the North Dundas tin field, the geology of which has been described by Ward (1909), Conder (1918) and Reid (1925). The particular area around Renison Bell has been described by Fisher (1943).

The principal rocks of the North Dundas field are sediments known as the Dundas slates. They are probably of Cambro-Ordovician age and consist predominantly of slates and tuffs but also include sandstones, grits and conglomerates. The dip is not uniform but is generally to the north-east at a low angle.

The Dundas slates have been intruded by a series of basic igneous rocks ranging from gabbro to serpentine, and later by quartz-porphyries. The quartz-porphyries are considered to have been directly associated with the source of the mineral bearing solutions.

-/There are

There are two main types of lode formation:-

1. Narrow fissure lodes, which dip steeply and in general strike roughly north-west. Some of these lodes can be traced continuously for considerable distances. "The tendency-- is for a set of fissures to be developed roughly in line or en echelon, often with lesser sub-parallel or branching fissures". (Fisher, 1943).

2. Massive flat-lying sill-like bodies referred to locally as "floors". These bodies appear to be intruded between the bedding planes of the sediments and may occur on either the footwall or hanging wall sides of the fissure lodes.

In general, the lodes are massive sulphidic bodies, in which the most abundant minerals are pyrite, pyrrhotite, quartz and carbonates of iron, manganese and magnesium. The relative proportions of these minerals vary considerably. The tin ore is cassiterite. The distribution of cassiterite in the lodes is irregular. In places, rich veins and pockets occur but the conditions governing their occurrence are not known. The cassiterite is grey, fine grained and seldom visible to the naked eye except where it occurs in rich shoots in the sulphides.

111. METHODS.

General:

A survey was carried out in the vicinity of the Cable and Old Mill Workings by the Imperial Geophysical Experimental Survey (Edge and Laby, 1931). In the course of this survey four different methods were used. These were the electromagnetic, equipotential line, self-potential and magnetic methods. Of these methods, the magnetic was found to be the most useful, and the self-potential gave very valuable confirmation of the results. In view of this, these were the two methods decided on for the present survey. A brief description of these methods follows.

Magnetic method:

Conditions at Renison Bell are very favourable for the application of the magnetic method because the ore-bodies consist mostly of pyrrhotite, which has a high magnetic susceptibility. The experience of the I.G.E.S. showed that the bodies were of sufficient size to produce intense anomalies in the magnetic field at the surface.

In the present work, the magnetic survey consisted in the measurement of variations in the vertical component of the magnetic field. The instrument used was a Watts vertical force variometer.

Self-potential method:

The most general application of this method is for the detection of sulphide ore-bodies which are undergoing oxidation. In an oxidising sulphide body, a difference of electrical potential is produced between the upper part of the body and the part below the oxidation zone. As a result of this "spontaneous polarisation" a current flow takes place in the body and is completed through the surrounding rocks. The current flow is investigated by making potential measurements at the ground surface and is of such a nature that a potential minimum or "negative centre" is produced over the top of the ore-body.

-/The previous

The previous work at Renison Bell by the I.G.R.S. showed that the ore-bodies produced very intense self-potential effects as a result of the active nature of the oxidation, the high pyrite content and the proximity of the bodies to the surface.

IV. RESULTS AND INTERPRETATION.

General:

The results of the self-potential and magnetic measurements, given in the form of contours in plates 2 (magnetic) and 3 (self-potential), show that with each method there have been observed a number of intense anomalies, providing strong indications of mineralisation. In general, there is agreement in position between the self-potential and magnetic anomalies and it has been possible to recognise thirteen principal and more or less separate "anomalous areas". Rather than discuss the methods separately, it is considered preferable to deal with each "anomalous area" in turn. For convenience in referring to these areas of interest, they have been numbered 1 to X11 as shown in plates 2 and 3.

Tests over known ore-bodies:

An examination will first be made of the geophysical results which can be correlated with ore-bodies already known from surface exposures and mine workings. The positions of the known ore-bodies are shown in plate 1, but it should be pointed out that, as the mining in the past has been mainly limited to the oxidised ores, the information available as to the full extent of these bodies is far from complete. The rather irregular form of the contour patterns of both the self-potential and magnetic anomalies may be attributed to the complex shape of the ore-bodies themselves as well as to the effects of topography, and these factors have made it impossible to apply any satisfactory theoretical treatment to the observed results.

Geophysical anomalies which appear to be related to known ore-bodies occur on "anomalous areas" 1 to V1:-

1. Both the self-potential and magnetic anomalies lie on the line of the Renison Bell main lode and occur over a massive pyrrhotite body, which is exposed on the surface and continues south to the Glory Hole. A floor which has been worked just south-east of the Glory Hole is probably a continuation of this mineralisation and would account for the south-easterly extensions of both the self-potential and magnetic anomalies.

11. The anomalies here occur over the Lower Blow Lode. The magnetic maximum (> 4000 gammas) is localised and occurs on traverse 800S. The self-potential contours show an elongated "negative centre" (-400 millivolts) extending from 800S to 900S. There is a good agreement between the axis of each anomaly and the strike of the lode.

The self-potential contours show that there is a well-marked anomaly axis connecting the "negative centres" of areas 1 and 11. This axis appears to be related to the mineralisation of the Lower Blow Lode between 400S and 700S and is no doubt due to the continuation of this mineralisation through to the main Renison Bell lode. The same self-potential axis extends south to area 111, and there is a suggestion of a similarly placed but less defined elongation of the magnetic contours.

-/111.

111. Both the magnetic maximum and the self-potential "negative centre" occur on 1500S and coincide with the northern part of the Upper Blow lode. In each case the form of the anomaly is such as would be caused by a narrow steeply-dipping body such as a fissure lode.

1V. In this area the geophysical results show strong anomalies corresponding to the Upper Blow lode between 1790S and 1990S and the pyrrhotite floor exposed in the No.5 Workings. A large amount of pyrrhotite ore has been uncovered and the complex nature of the contour patterns may be largely due to variations in thickness of the overburden. From the magnetic results there is evidence that the floor exposed in the No.5 Workings extends to approximately 300E on traverses 1790S and 1890S.

V. The self-potential and magnetic anomalies correspond to a lode known as the Cross lode. A large irregular oxidised floor is associated with a cross fissure. From the magnetic and self-potential anomalies, it would appear that the ore-body, as mapped by Fisher (1943) from exposures on the surface and in the open cut, represents only the northern portion of a more extensive body, and that there is a substantial extension to the south and particularly to the south-east of the previously known limits. In the latter direction the self-potential anomaly is particularly intense with a "negative centre" of -500 millivolts at 875E/1100S.

V1. A fairly strong localised self-potential anomaly is present here, but without any appreciable magnetic anomaly. A fissure lode and a floor occur just east of the centre of the self-potential anomaly.

Applicability of the methods:

From the foregoing results it will be seen that, in the area covered by the present survey, the known ore-bodies produce, almost without exception, strong magnetic and self-potential anomalies showing that the two methods used would be applicable to the search for other ore-bodies in the Renison Bell area.

In general, there is a good agreement in position between the indications from the two methods and it should be possible to locate the positions of ore-bodies with considerable certainty. However, it is apparent that, in regard to the detailed features of the anomalies, the self-potential and magnetic results do not always show a close correspondence with one another. This is probably only to be expected when it is considered that the bodies, consisting of combinations of floors and fissures, are very irregular in shape, and the pyrrhotite and pyrite contents of the lodes are by no means uniform. Furthermore the self-potential effects will be influenced by the depth of the oxidation zone, which although generally shallow, is subject to variations throughout the area. As measured at the surface both the magnetic and self-potential anomalies produced by an ore-body are also likely to be affected by the irregular topography. For these reasons it will probably be difficult to deduce with certainty the exact boundaries and structures of the ore-bodies from the geophysical results. It should be stressed that the geophysical anomalies give no idea of the tin content of the ore-bodies from which they arise.

Interpretation of results:

The magnetic and self-potential results obtained on those parts of the area where mineralisation was previously

-/unknown

unknown will now be considered. There are seven "anomalous areas" (numbered Vll to Xlll, and shown in plates 2 and 3), where the results appear to be significant.

Vll. In this area, the positions of the magnetic and self-potential anomalies are in close agreement; the anomalies are intense and suggest that the mineralisation persists for a distance of about 700 feet. The most likely interpretation is a fissure lode with a west-north-west strike, extending from the "negative centre" on 1000S along the self-potential anomaly axis towards the "negative centre" of area Xl. There is also the possibility of "floors" being associated with such a fissure lode.

Vlll. The strong magnetic anomaly probably indicates an isolated pyrrhotite body, probably a fissure lode, nearly 200 feet in length. The self-potential anomaly observed over the same area is relatively weak.

lX. In this area the magnetic and self-potential contours do not match very well and although there is definite evidence of mineralisation, it is difficult to form any conclusions regarding the extent and strike of the ore-body.

X. In this area there is a magnetic anomaly only. As the area is close to the Renison Bell Creek it is possible that the sulphide body does not extend above the ground water level, in which case oxidation would not be taking place and no self-potential effect would be expected. The magnetic indication is persistent in length and as it continues to the north-west as far as line 00 it is probably due to an ore shoot forming part of the Renison Bell main lode system.

Xl. The geophysical anomalies here are complex and it is difficult to see the relationship between the results of the two methods. The magnetic "high" occurs mainly to the east of the self-potential "negative centre". At 1690S 950E, where the indications coincide, a "floor" has been exposed by shallow workings. The self-potential anomaly is intense (reaching values of less than -500 millivolts) and shows several radiating axes, suggesting fairly extensive sulphide mineralisation. The most pronounced of these axes is in the line of the probable fissure lode of area Vll and it is considered that a very reasonable interpretation would be a fissure lode with an associated "floor" of considerable extent. It is clear that the observations should be extended further to the east to obtain a more complete picture of this "anomalous area".

Xll and Xlll. Only self-potential anomalies have been observed on these areas. On the first, there are two "negative centres" suggesting a subsidiary fissure branching from the Blow lode; on the second, the anomaly covers an appreciable area and appears to indicate an occurrence of mineralisation isolated from the main Blow lode system.

V. DRILLING RECOMMENDATIONS.

The recommended drill holes listed below are intended for the purpose of testing the geophysical anomalies which appear to indicate hitherto undiscovered ore-bodies. The difficulty in determining the structure and attitude of the bodies from the geophysical results has been pointed out, and it is considered that the recommended drill holes, while proving the existence or

-/otherwise

otherwise of ore-bodies associated with the geophysical indications, will also provide a basis for a more complete interpretation of the results of the present survey and of further surveys which may be made in the Renison Bell area.

Recommended Drill Holes.

Hole No.	Co-ordinates of Collar	Area to be tested	True Bearing of hole	Depression of hole
G1	1050S, 180E	V11	Vertical	-
G2	1200S, 475E	V11	247	30
G3	1400S, 575E	V11	187	45
G4	1400S, 225E	V111	202	45
G5	1790S, 275E	1V	Vertical	-
G6	1890S, 600E	1X	247	45
G7	1650S, 960E	X1	187	45
G8	800S, 400W	X111	277	60
G9	500S, 775E	X	202	45
G10	1000S, 900E	V	187	30
G11	500S, 40W	X11	247	60

(Note: Owing to an error in the surveying, on several traverses the pegs were incorrectly marked. The following is a list of corrections to the peg markings:-

Traverse 2000S should read 1990S
Traverse 1900S should read 1890S
Traverse 1800S should read 1790S
Traverse 1700S should read 1690S
Traverse 1600S should read 1605S.

The corrected values have been used for the co-ordinates of the proposed drill holes: e.g. G.5 whose co-ordinates are 1790S, 275E will have its collar at peg marked 1800S, 275E).

A few words of explanation are needed with regard to the selection of some of the drill hole sites given above.

On area V11, holes G.1, G.2 and G.3 would test both the self-potential and magnetic indications. The vertical hole G.1 is mainly intended to test for a possible "floor" and the inclined holes G.2 and G.3 for a fissure lode. If continued far enough, G.2 will test the ground below the secondary magnetic "high" at not too great a depth.

The purpose of G.5 is to show to what extent the magnetic anomaly of area 1V is indicative of an easterly extension of the mineralisation occurring in the No.5 Workings.

On area 1X it should be possible to test, with only one fairly shallow hole such as G.6, the conditions below both the magnetic "high" and the self-potential "negative centre".

The holes G.8, G.9 and G.11 should provide information useful in explaining why an indication may be observed with one method (either magnetic or self-potential) unaccompanied by any effect observed with the other method.

-/V1.

VI. SUMMARY AND CONCLUSIONS.

During the three months that the party was in the field an area of approximately 1/10 of a square mile was covered using the magnetic and self-potential methods.

The purpose of the survey was to test these methods over known ore-bodies and to investigate the possibility of other bodies in the immediate vicinity. The results of the survey have established that the magnetic and self-potential methods are capable of locating with considerable certainty the type of sulphide body which occurs at Renison Bell. Several significant indications have been observed in parts of the area where ore-bodies had not been known previously.

Eleven drill holes have been recommended to test what appear to be indications of undiscovered ore-bodies. Such drilling would add considerably to the value of the present survey by giving information which would be useful in the interpretation of the results of any future magnetic and self-potential investigations in the Renison Bell field.

The results which have been obtained justify an extension of the survey beyond the limits of the area covered by the present work. In particular, it will be desirable to extend the survey to the south and south-east to trace completely the anomalies which have been observed near the southern limit and in the south-eastern corner of the area.

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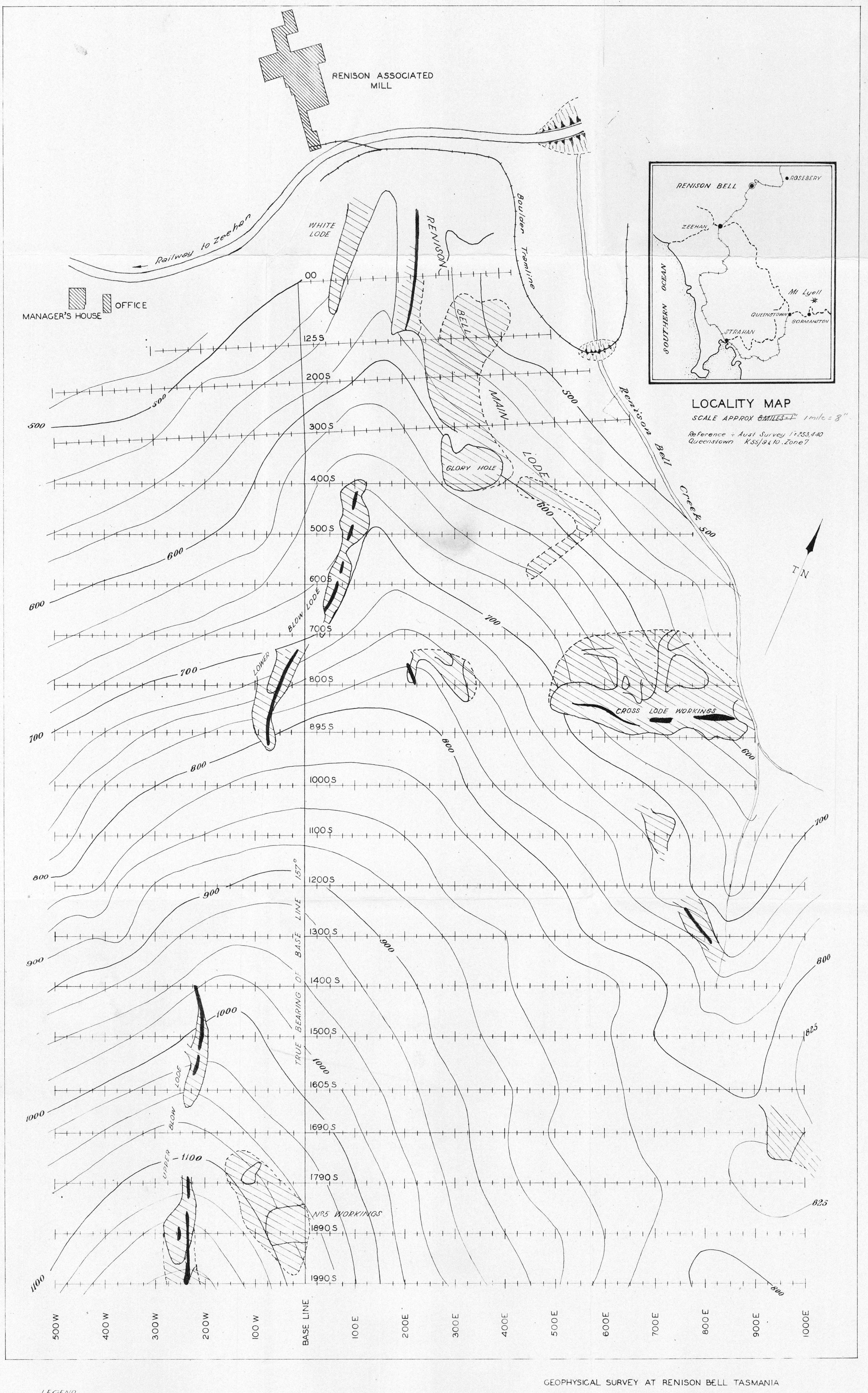
(L. W. WILLIAMS)
Geophysicist.
6/3/1951.

PLATE I



LEGEND

Fissure Lodes

Floors exposed at surface or in workings.

SCALE

100 0 100 200 300 Feet

Contour interval 25'

Datum: Peg 00, B.L. taken as 500'

Geophysicist

11-50

GEOPHYSICAL SURVEY AT RENISON BELL TASMANIA

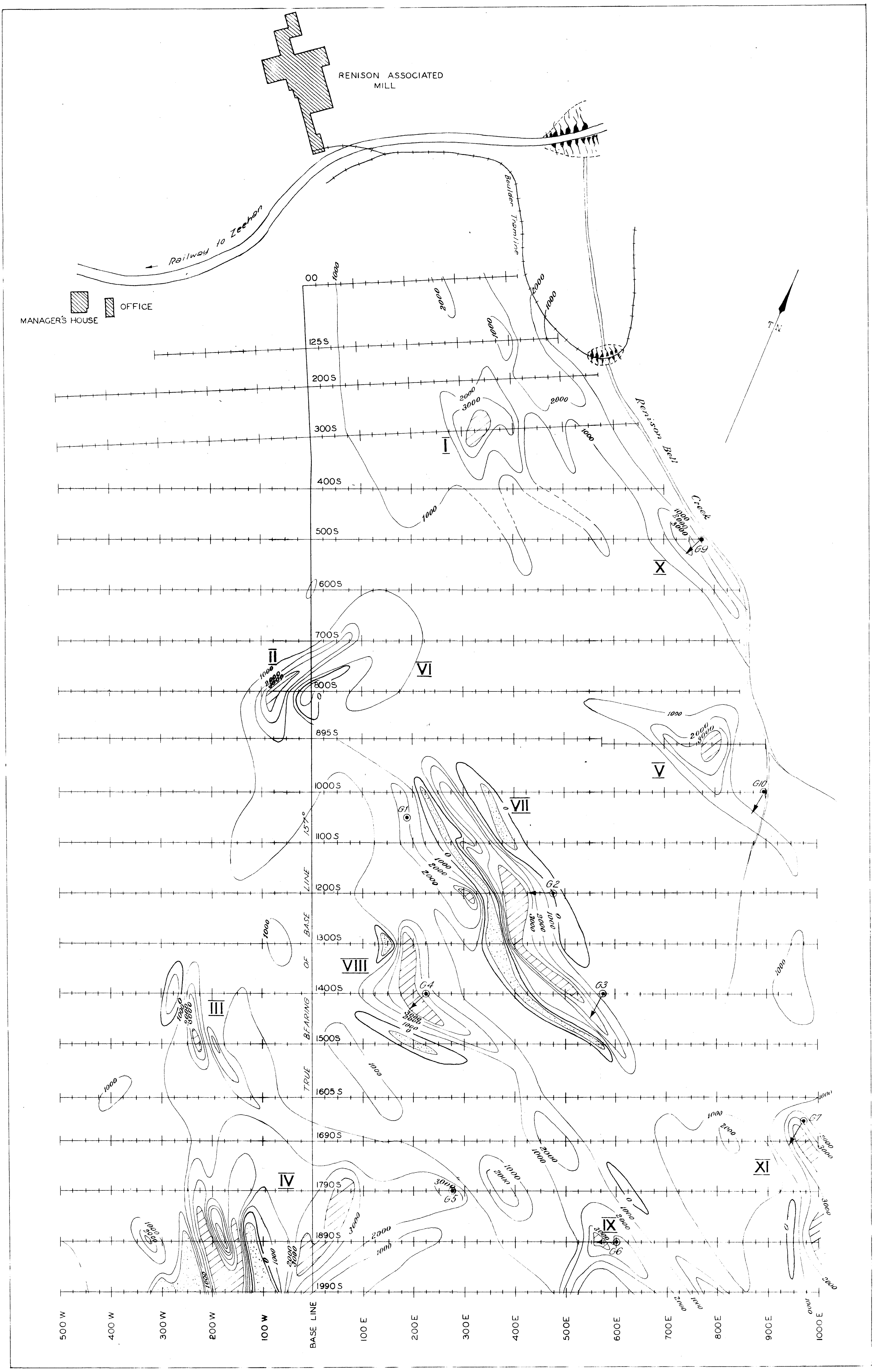
SURFACE PLAN SHOWING GEOPHYSICAL GRID, SURFACE CONTOURS & KNOWN ORE-BODIES

Geology taken from Fisher (1943)

G 86-1

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics

PLATE 2



GEOPHYSICAL SURVEY AT RENISON BELL, TASMANIA.

MAGNETIC VERTICAL FORCE CONTOURS

LEGEND

- Gre[illegible] than 4,000 Gammas
- Less than -1,000 Gammas
- Anomalous Areas shown thus IV
- Recommended Drill Holes... ⦿

SCALE

100 0 100 200 300 Feet

Contour [illegible] 000 Gammas

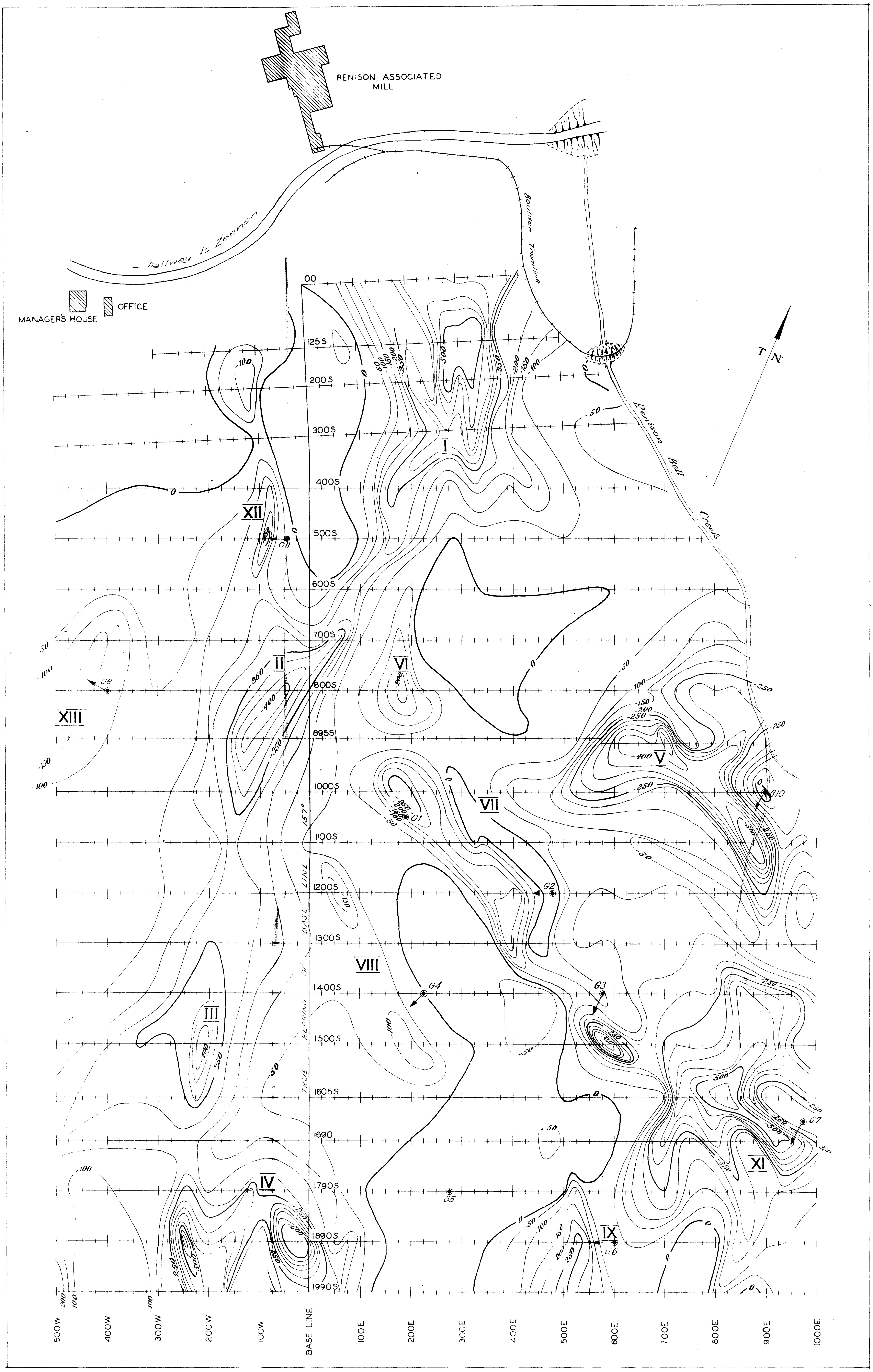
[signature] L. W. Williams

[illegible]

G 86-2

Geophysical Section, Bureau of Mineral Resources Ge[illegible] Geophy[illegible]

PLATE 3



GEOPHYSICAL SURVEY AT RENISON BELL, TASMANIA.

SCALE

100 0 100 200 300 Feet

SELF POTENTIAL CONTOURS

Contour interval 50 Millivolts

Anomalous Areas shown thus VI

Recommended Drill Holes ⊙

[signature] Williams
Geophysicist
6. 11. 31

G86-3

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics.