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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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CHEWTON-CASTLEMAINE INDUCED POLARISATION TEST SURVEY,

VICTORIA 1965

by

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ILLUSTRATIONS

SUMMARY

An I.P. test survey was conducted by the Bureau at the Chewton - Castlemaine Gold field in late October, 1965. The survey was undertaken to see if the gold bearing reefs could be detected by geophysical methods. This was considered doubtful due to the low sulphide content.

Small yet well defined anomalies were recorded over the Wattle Gully Mine and seem related to the gold and pyrite lodes of the "leather jacket formation". Anomalies recorded over the Eureka and Eureka Vineyards are less prominent and similar anomalies may be hard to recognise. An interesting I.P. anomaly near the Mona Reef warrants further attention.

A geophysical survey of the area is recommended, but a combination of electrical and electromagnetic methods is advised.

1. INTRODUCTION

A geophysical survey over auriferous quartz reefs in the Chewton - Castlemaine area was requested by the Eureka Gold Mining Syndicate and supported by the Victorian Mines Department. In particular, the Syndicate was interested in testing the Induced Polarisation (I.P.) method, as it was thought that this would be the most applicable method in the area because of the low sulphide content of the lodes. The area is about 78 miles north west of Melbourne (Plate 1). The gold is known to occur in various types of quartz deposits and is usually accompanied by small amounts of sulphides. The gold cannot be detected directly by geophysical methods. To determine whether the accompanying sulphides are present in sufficient amounts to be located by the I.P. method, the Bureau conducted a short test survey from the 18th to the 21st October, 1965. Personnel on the survey were geophysicists J.P. Williams and E.C. Sedmik, geophysical assistant N.A. Ashmore and one field hand.

The lease held by the Eureka Syndicate comprises the area outlined in Plate 1, with the exception of a small lease over the Wattle Gully Mine. This mine is currently being worked by Wattle Gully Mines N.L. who expressed willingness to allow test traverses to be observed over known sections of the lode. The location of the test traverses is shown in Plate 1. 400 S and the eastern part of 700 N are over the Wattle Gully mine; the western part of 700 N and Eureka traverse (2300S) are over the Eureka Vineyard and Eureka lodes respectively.

The ready assistance and co-operation of the Eureka Gold Mining Syndicate and the Wattle Gully Gold Mines N.L. Company is gratefully acknowledged.

2. GEOLOGY

The dominant lithologies of the surveyed area are Lower Ordovician slates and sandstones. These are tightly folded along north south axes which are generally about 600 feet apart. The folding is asymmetrical and the eastern limbs of the anticlines are nearly vertical and sometimes even overturned while the western limbs have a more gentle dip. The folds are intersected by numerous strike faults which dip either east or west at about 45^{o}.

These faults commence in the bedding, cut across the axes of the anticlines and, when they cross the adjacent synclinal axes, they steepen and become bedded again. This gives rise to the so called "leather jacket formations" of the field. Th Wattle Gully lode lies in this type of formation. In the Wattle Gully area, the western dipping shears are stronger than the eastern ones. Where they cut nearly vertical easterly dipping beds, they give ideal conditions for the formation of quartz reefs.

The gold is generally associated with quartz deposits which occur as "leather jacket formations", saddle reefs, fissure reefs and sometimes as irregular spurs. The Eureka lodes are largely in fissure and saddle reefs. The lodes are accompanied by varying amounts of sulphides. Up to 3% pyrite has been recorded at the Wattle Gully Mine. Some pyrite is also known to occur in otherwise barren slates.

The geological sections presented in Plates 2 and 3 are based partly on accurate information provided by the Wattle Gully Gold Mines N.L. Co. and are partly inferred from the mapping of Baragwanath (1903) and Thomas (1939). The surface position of axial planes is known with some certainty, but the form lines of strata are purely diagrammatic.

3. DISCUSSION OF RESULTS

The I.P. survey was carried out using the dipole-dipole configuration with transmitting frequencies of 5.0 c/s and 0.3 c/s. Detailed descriptions of the method are to be found in recent geophysical literature. For most purposes, the description given by Forwood and Roberts (1965) is quite adequate.

Traverse 400 S and the eastern part of traverse 700 N were selected to cover the Wattle Gully lode. 200 foot dipoles were used because the lode is about 500 feet below the surface. As I.P. anomalies were outlined with this spacing, 200 foot dipoles were used throughout the survey.

The I.P. anomaly on 400 S is characterised by low resistivities and moderate frequency effects and, consequently, high metal factors. The frequency effects are of the order of 5% which, in some areas, would be considered low, but, at Wattle Gully, appear significant. The anomaly source appears to be fairly deep and to coincide with the position of the lode but it is not possible to determine the shape of the source. The most likely cause of this anomaly is sulphide mineralisation as there is no graphite present. However because this section of the mine is virtually worked out, the pyrite present may be solely in the fill material in the stopes.

Several I.P. anomalies were recorded on traverse 700 N. These are similar in character to the anomaly on 400 S. The anomalies are best defined by the metal factor values (Plate 2). The anomaly between 200 W and 800 W has two shallow branches which join and continue at depth.

The West Wattle Gully reef, Phillips reef and the Wattle Gully lode are in a favourable location for the source of this anomaly. Assuming they all contain pyrite they have probably contributed to the composite nature of the I.P. anomaly.

The anomaly at 700 E was not completely covered by the survey and may continue east. No known mineralisation is present here, but the Chewton anticlinal axis at 700 E presents a favourable location for mineralisation.

A fairly prominent I.P. anomaly with frequency effects as great as 9% was recorded between 1100 W and 1500 W on traverse 700 N. This anomaly coincides with the projected position of the Mona Reef, but is about 400 feet south of the known reef. It is the strongest recorded anomaly in the area and suggests that a higher percentage of sulphide mineralisation may be present.

The I.P. anomalies recorded over the Eureka and Eureka Vineyard lodes have different characteristics to the anomalies in the eastern part of the area. Metal factor anomalies approximately coincide with the axial planes and the lodes but are fairly weak. The highest frequency effects lie to the east and west of the metal factor anomalies, but are accompanied by high resistivities and, hence, low metal factors. The lodes here are fissure and saddle reef lodes, but little is known of their extent and sulphide content.

4. CONCLUSIONS AND RECOMMENDATIONS

The I.P. anomalies recorded at Chewton, in part, appear related to the mineralisation.

Over the Wattle Gully Mine the anomalies seem to be due to the "leather jacket formations". This suggests that the I.P. method would detect similar mineralisation elsewhere in the area.

The type of mineralisation at the Eureka and Eureka Vineyard is different and the I.P. anomalies are not as well defined. It may be possible to recognise these deposits by the low resistivities and medium metal factors even though the frequency effects are low.

The anomaly near the Mona Reef is interesting and more work is warranted. At this stage it is not practical to recommend a drill site, but this should be possible after more detailed work is carried out. This also applies to the anomaly at 700 E/700 N.

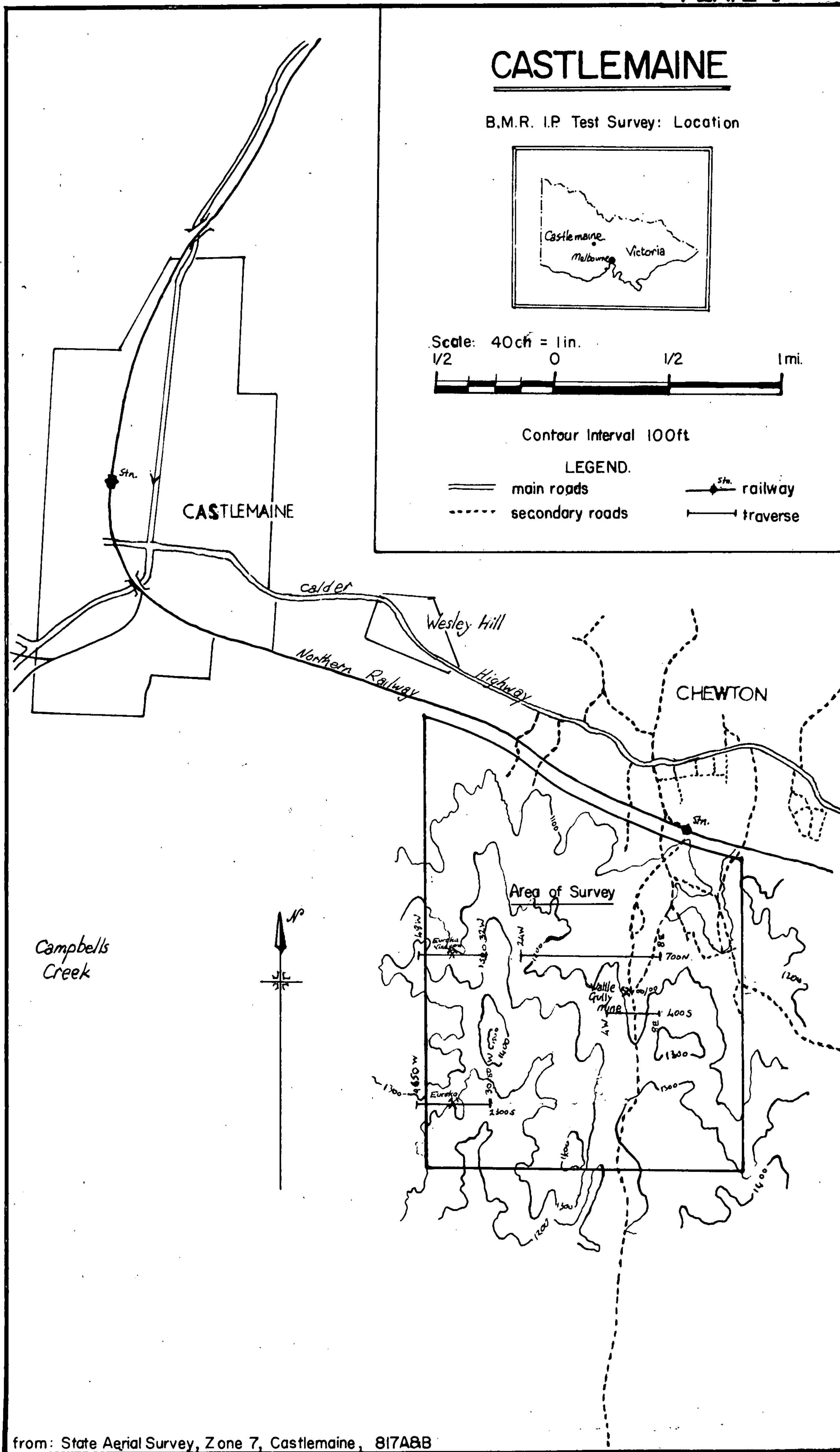
It is recommended that further geophysical work be conducted in the area, but it is not considered advisable to rely solely on the I.P. method. An electromagnetic method such as Turam may assist in locating the shear zones. The use of the Potential - Drop - Ratio method may also elucidate structure by outlining the quartz masses.

It is emphasised that a survey carried out in this way can only outline the presence of the quartz masses and pyrite, and the gold content can only be assessed by drilling. It is worthy of note that most I.P. anomalies coincide with anticlinal crests. If the slates have a bed containing pyrite stronger anomalies would be recorded over anticlines and these anomalies may be entirely unrelated to gold content. This could only be determined after a careful correlation of detailed geological and geophysical work is carried out.

5. REFERENCES

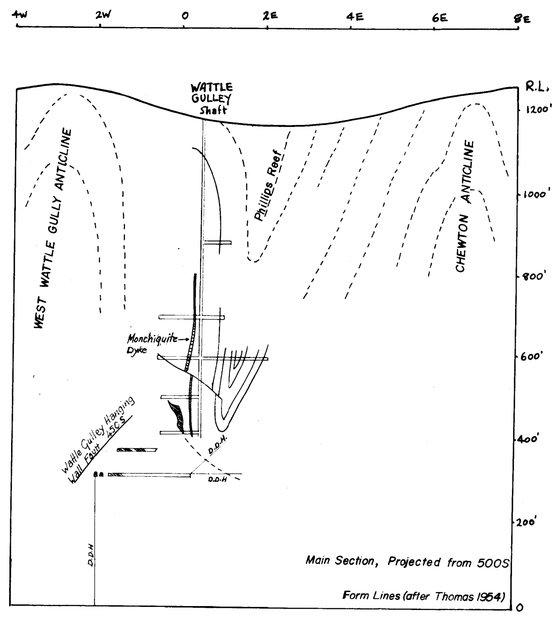
Baragwanath W.	1903	The Castlemaine Goldfield. Geol. Surv. Vic. Mem.Z.
Forwood P.S. and Roberts J.B.	1965	The application of induced polarisation in the geophysical exploration for metals in Australia. Eighth Comm. Min. & Met. Cong. Vol. 2 Exploration and Mining Geology.
Thomas D.E.	1939	Survey map. Dept. Mines Vic.
	1955	The Chewton - Castlemaine - Fryerstown Goldfield. Fifth Comm. Min. & Met. Cong. Vol. 1 Ch. 12 Ore Deposits Victoria and Tasmania.

PLATE I



from: State Aerial Survey, Zone 7, Castlemaine, 817A&B

TRAVERSE 400 S



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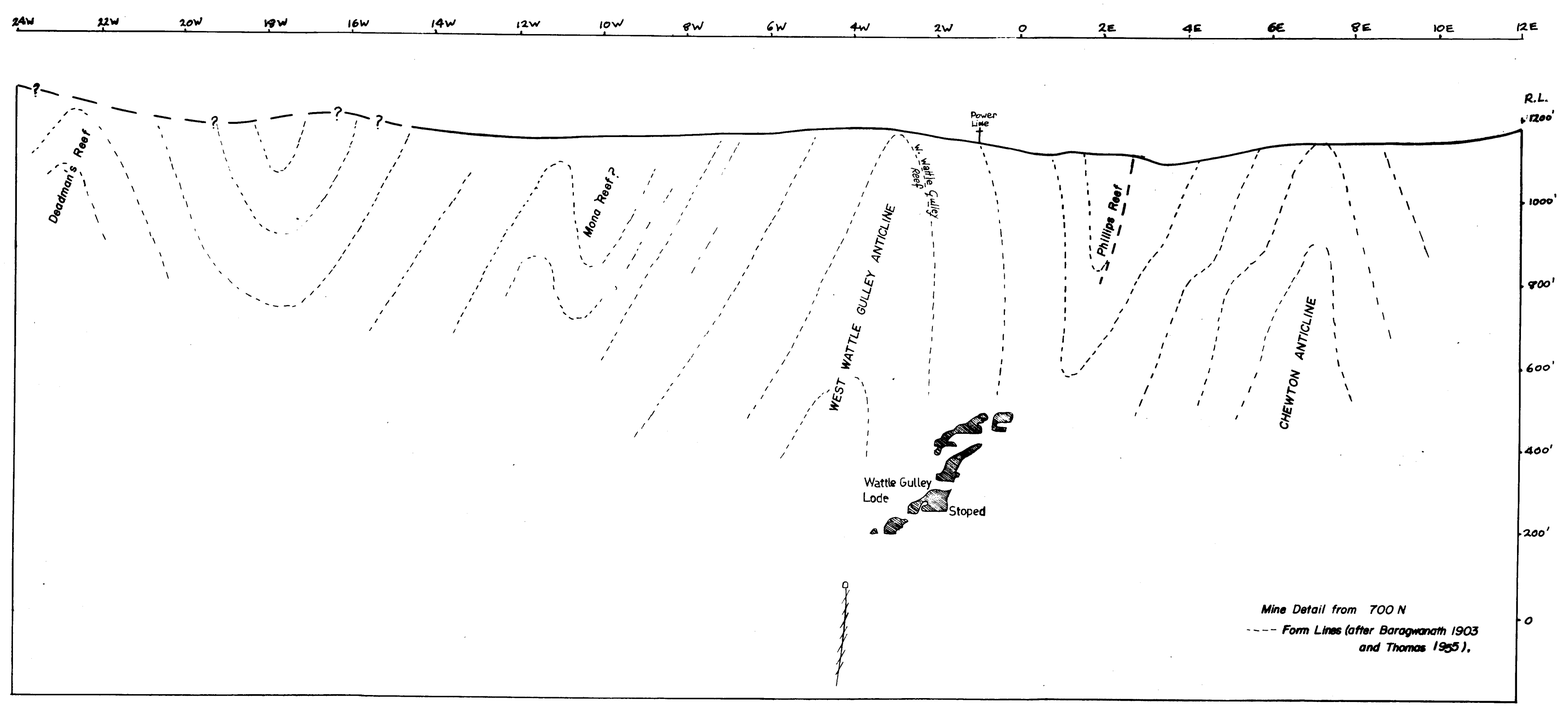
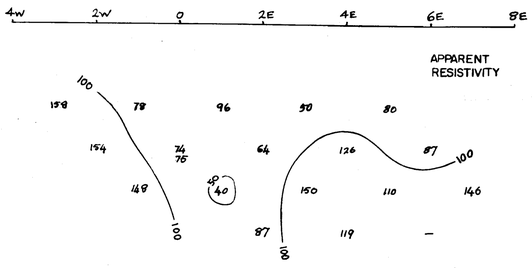
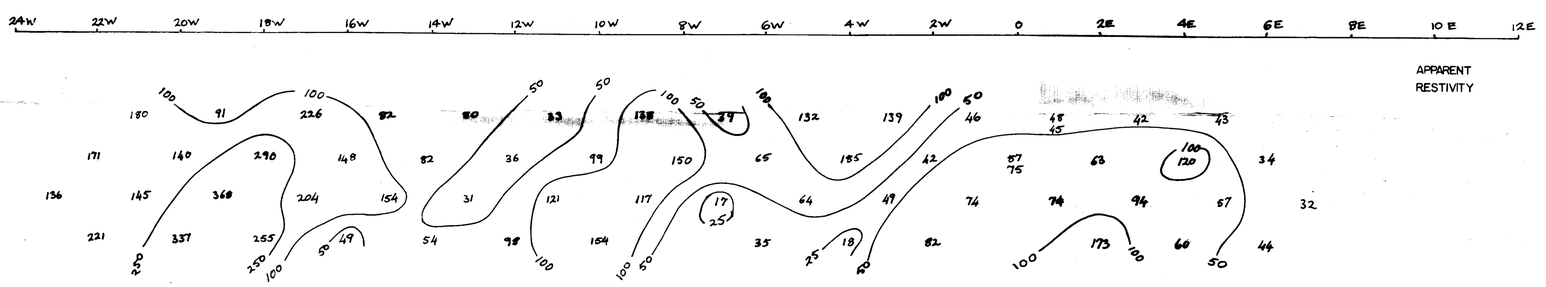
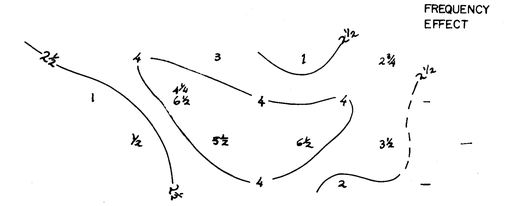
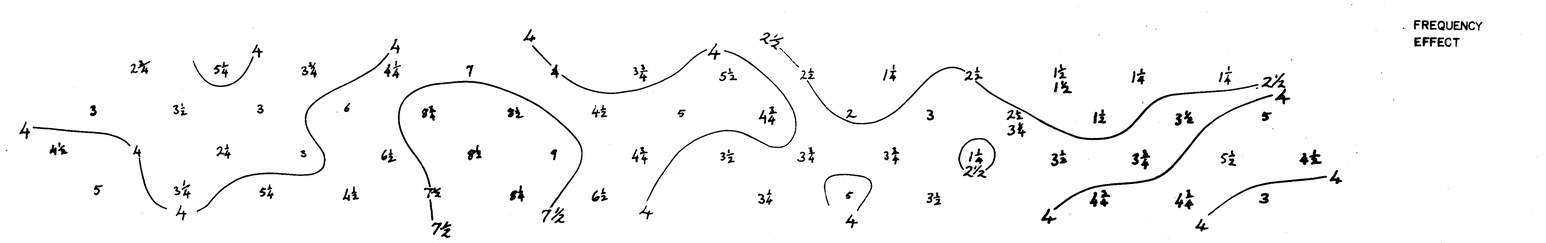
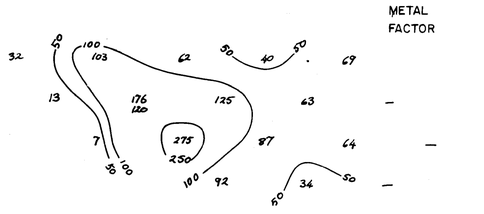


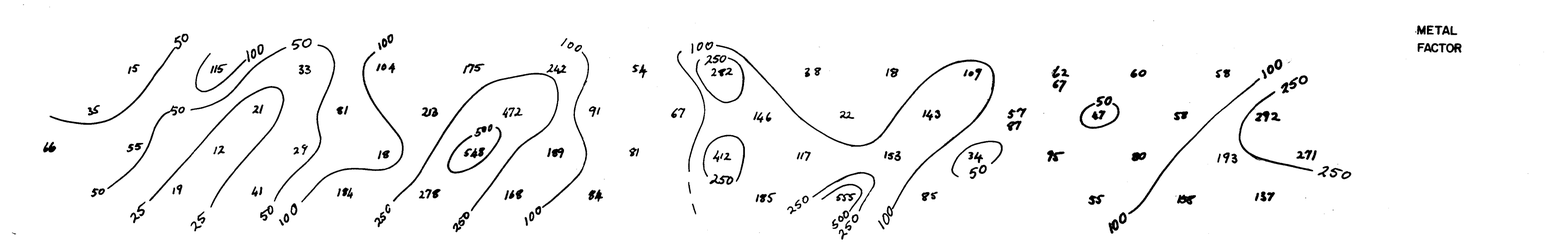




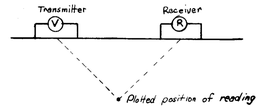








DIPOLE - DIPOLE Configuration



Transmitting Frequencies 5·0 and 0·3 c.p.s.

Dipole length 200ft (const.)

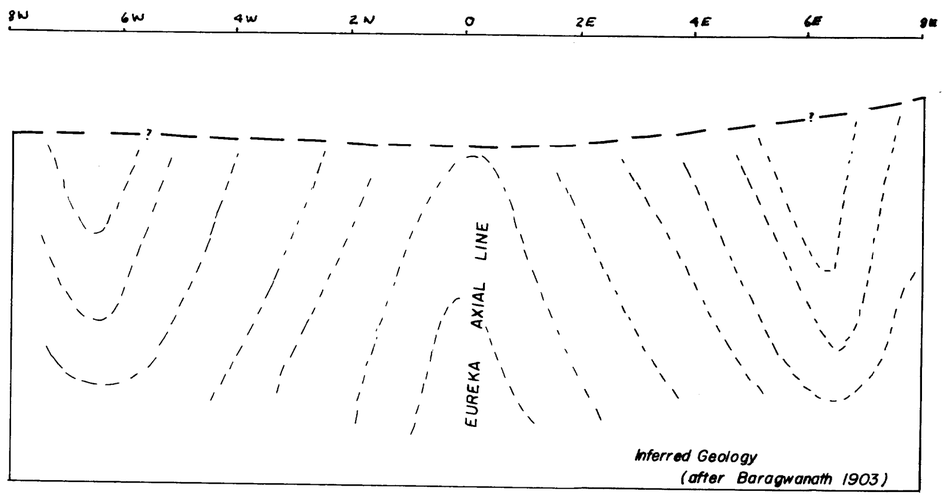
INDUCED POLARISATION TEST SURVEY OF THE CHEWTON-CASTLEMAINE GOLDFIELD.

Comparison of I.P. Profiles and Known Geology over the WATTLE GULLEY Mine.

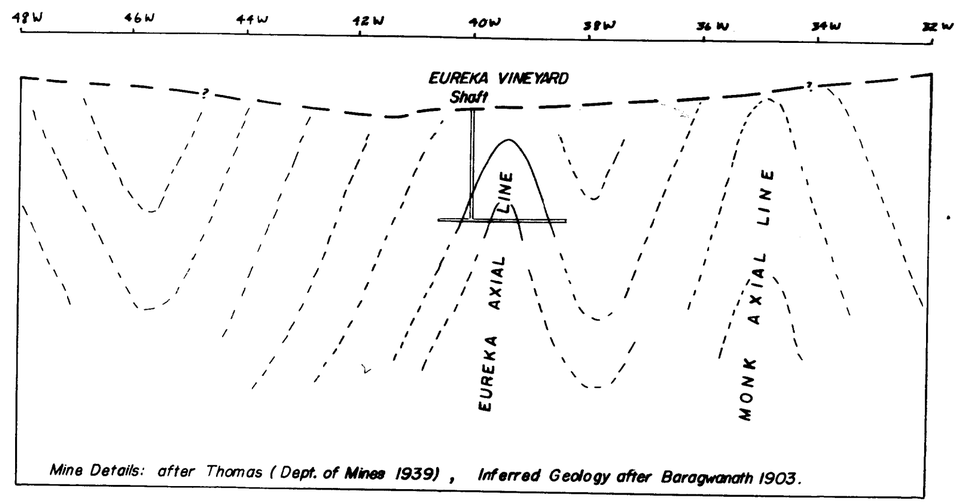
SCALE: 200 feet to 1 inch.

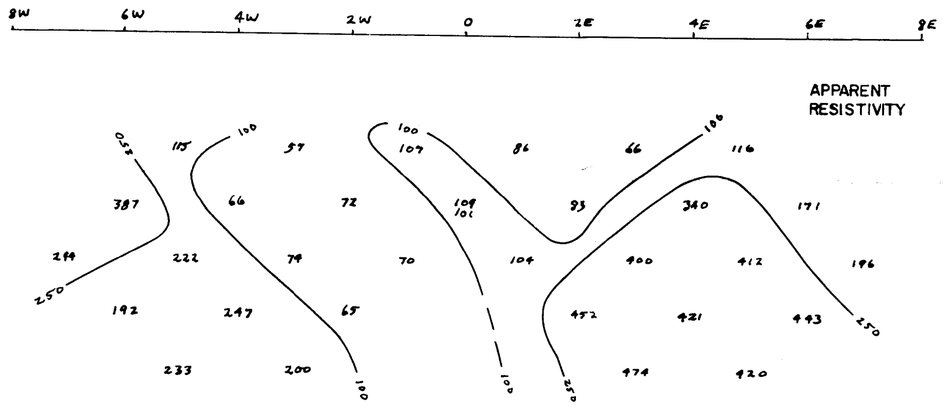
PLATE 3.

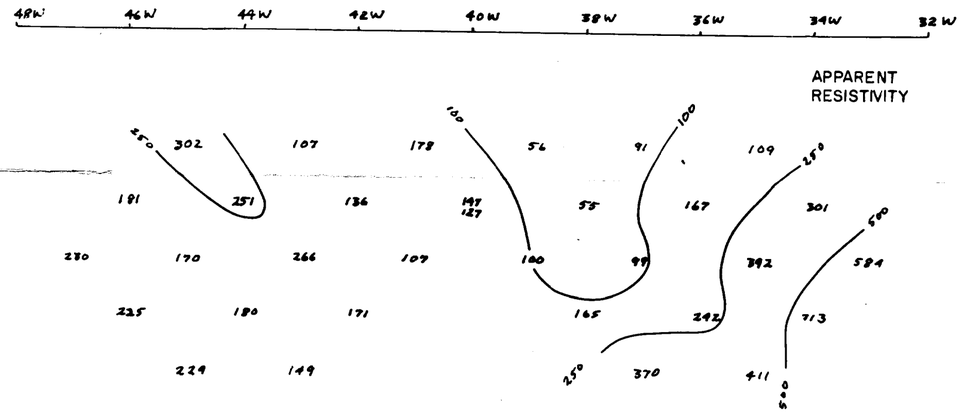
EUREKA TRAVERSE

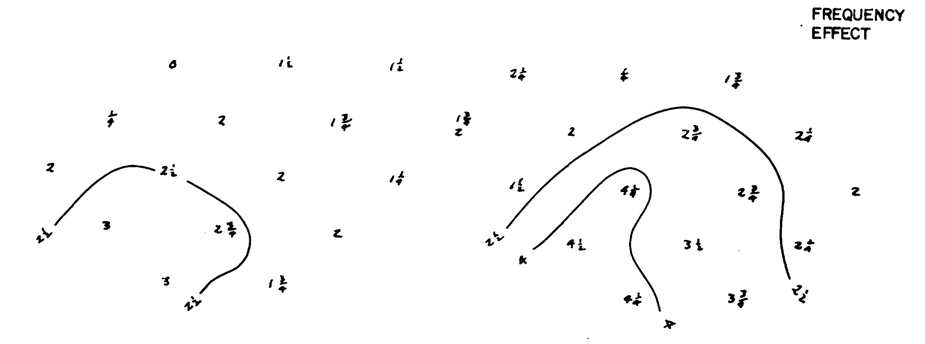


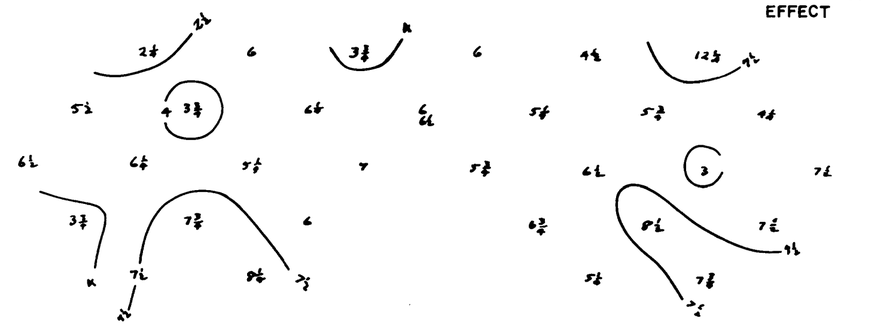
TRAVERSE 700N

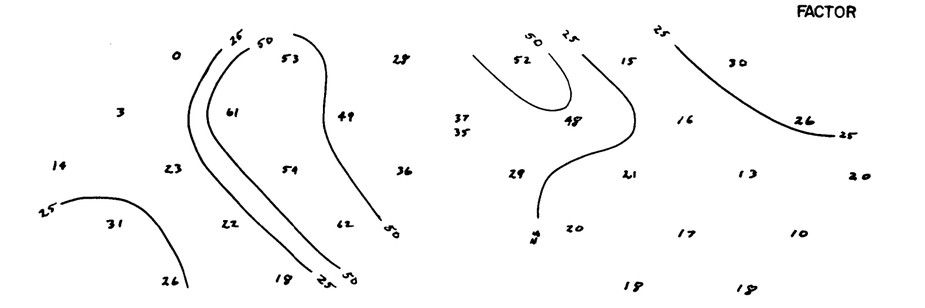


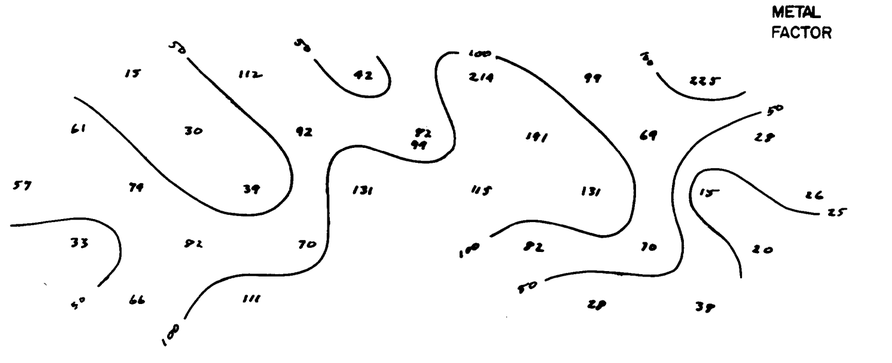












I.P. DETAILS: The dipole-dipole configuration was used with a dipole length of 200 ft. Transmitting frequencies were 5·0 and 0·3 c.p.s.
Two-dimensional plots as in PLATE 2.

SCALE: 200 feet to 1 inch.

ft 200 0 200 400 600 800 feet

Grid Details: Traverse 700N is based on mine grid co-ordinates.

EUREKA Traverse is on an arbitrary system. The zero point is approximately 3850W/2300S

INDUCED POLARISATION TEST SURVEY OF THE CHEWTON-CASTLEMAINE GOLDFIELD. Comparison of I.P. Profiles and Known Geology over the EUREKA and EUREKA VINEYARD Mines.