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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1966/140

QUEENSTOWN (BLOCKS AREA) INDUCED POLARISATION TEST,

TASMANIA 1965

by

J.P. WILLIAMS

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1966/140

SUMMARY

The induced polarisation method was used on a test traverse in the Blocks area near Queenstown, Tasmania, to determine if the method could detect the small amounts of native copper present in ferruginous clays in the Gordon Limestone.

Although the results show some correlation with the geological section based on drilling data, it is doubtful whether any of the induced polarisation effects observed are due to the known copper clay deposits. It is considered that a more detailed investigation would be required to test the method conclusively.

1. INTRODUCTION

During the Bureau of Mineral Resources (BMR) geophysical survey at Comstock in the Mount Lyell district of Tasmania in 1965, the Mount Lyell Mining and Railway Company requested an induced polarisation (IP) test traverse over the copper clay deposits of the Blocks area. The Blocks area is north-west of Linda and on the southern slopes of Mount Lyell (Plate 1). Traverse 1270E (Plate 2) was selected for the test because good geological control was available from six holes previously drilled along this traverse. A geological section based on the results of this drilling is shown in Plate 3.

The IP method has been used successfully elsewhere for locating small amounts of disseminated sulphide mineralisation and it was hoped that similar results would be produced by the native copper in the copper clays.

In 1948 the BMR made a geophysical survey in the Gormanston area south-west of the test traverse (Webb, 1958). An anomalous zone revealed by the equipotential line method was drilled and copper clay deposits were encountered in the holes.

In 1962, McPhar Geophysics Pty Ltd surveyed an area north of the 1965 traverse with the IP method. Plate 2 shows the relationship of the closest traverses to traverse 1270E. Drill hole LB 2 was drilled on line 14 to test the results, but no copper was found.

A description of the IP method as used in this survey has been given by Williams (1966). The dipole length used for the Block traverse was 100 feet and the transmitting frequencies were 10 c/s and 0.3 c/s.

2. GEOLOGY

Detailed descriptions of the geology of the Mount Lyell area are given by Wade and Solomon (1958) and Solomon and Elms (1965). The brief description given here is derived largely from these sources.

The copper clay deposits are confined to a narrow belt between North Lyell and Linda on the eastern side of the Mount Lyell/Mount Owen divide. The mineralisation lies conformably on the Owen Conglomerate Series and below siliceous shales of the Gordon Limestone. Both the Owen Conglomerate Series and the Gordon Limestone are Ordovician in age. The clay deposits contain native copper. Cuprite, siderite, and goethite are also present. Wade and Solomon suggested that hydrothermal solutions altered shales of the Gordon Limestone to ferruginous clays carrying native copper.

Later (Solomon & Elms, 1965), this theory of ore genesis was modified. It is now suggested that the copper and goethite are partly due to indigenous oxidation of pre-existing sulphides formed during the Tabberabberan Orogeny and partly to deposition from acid meteoric waters draining the outcropping sulphides on the divide. Solomon suggests that these processes occurred during the Mesozoic and early Cainozoic eras. In either case the mineralisation appears to be stratigraphically controlled and confined to a favourable bed of the Gordon Limestone.

The geology of the test area is shown as a plan in Plate 2 and as a cross-section along traverse 1270E in Plate 3. The Pioneer beds are the youngest member of the Upper Owen Conglomerate Series. The Owen Conglomerate shown in Plate 2 is older than the Pioneer beds. In this text, however, the term 'conglomerate' refers to all members of the Series unless stated otherwise. The clays and sands of Plates 2 and 3 are presumably altered Gordon Limestone, as Wade and Solomon (1958) state that all copper clay deposits are in shales of the Gordon Limestone. The contact between these sediments and the conglomerate illustrates the type of folding in the area.

3. DISCUSSION OF RESULTS

The IP results are presented in the conventional form of a two-dimensional plot in Plate 3. A geological section is included for comparison.

The apparent resistivity results are characterised by a broad zone of low resistivities (less than 250 ohm-metres) between 300 N and 600 N. This zone is surrounded by higher resistivities which are mostly greater than 1000 ohm-metres.

There is a frequency effect anomaly between 200 N and 500 N. This anomaly is broad and has a maximum value of 8%. A smaller frequency effect anomaly occurs between 700 N and 800 N, with a maximum value of 6½%. However, these anomalies are seen to be very weak when the background frequency effects, which are as high as 4%, are taken into account.

The metal factor values show an anomaly between 300 N and 550 N. The anomaly appears to be due mainly to the low resistivities, as the high frequency effects which are associated with the higher resistivities do not give a distinct metal factor anomaly.

4. INTERPRETATION

The high apparent resistivities seem to be broadly related to the conglomerate and the low resistivities to the clays and sands filling the valleys. However, it is difficult to distinguish the two valleys from these results. This is probably because the length of the dipoles used (100 feet) was too large.

The frequency effects do not appear to have a direct correlation with the position of the copper clays. The mineralisation is in a bed of ferruginous clays, which may produce an IP effect. The conglomerate contains small concentrations of haematite, limonite, and chromite, and these minerals can also produce IP effects. The anomaly at 700 N is similar to one at Gormanston, which is also characterised by high resistivities and high frequency effects, and was interpreted as being caused by haematitic conglomerate (Williams, 1965).

The metal factor anomaly between 300 N and 500 N does not agree in position with the copper clay deposits. At first glance this anomaly might appear to be related to the copper clay in drill hole LB12, but there is no metal factor anomaly at 700 N over the much larger copper zone that was intersected by drill hole LB18.

If a drill hole had been recommended from these metal factor results it would have been sited at 475 N with a target depth of approximately 200 feet. Such a hole would have encountered conglomerate at a very shallow depth.

The IP survey conducted by McPhar Geophysics Pty Ltd immediately north of traverse 1270E used a dipole length of 100 feet and frequencies of 2¼ and ¼ c/s. A drill hole recommended on line 14 did not give any positive results.

5. CONCLUSIONS AND RECOMMENDATIONS

It is not possible to state definitely whether the observed IP effects are due to the copper clay deposits. The large resistivity 'low' seems to be due to the combined effects of the two valleys. Other resistivity variations are probably due to inhomogeneities in the conglomerate. The frequency effects may be influenced by variations in the mineral content of the conglomerate as well as the presence of copper. The apparent displacement of the metal factor anomaly from the expected position may be due to its greater dependence on low resistivities. The inconclusive nature of the results may also be attributed to some extent to the insufficient resolving power of the 100-ft dipoles.

The absence of any anomaly at 700 N suggests that the IP results may bear no relation to the copper clays at all. However, as only one traverse was surveyed by the method and the dipole length was not varied, it cannot be stated definitely that the IP method is inapplicable to the search for such deposits. If further IP work is done in the area, the use of smaller dipoles, say 25 feet, may clarify the problem.

The successful location of copper clay deposits by the equipotential line method (Webb, 1958) may have been due to the larger extent of the deposits. However, the electromagnetic methods may be more precise in locating such mineralisation. A series of observations along traverse 1270E with the E.M. Gun would test this possibility.

6. REFERENCES

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WADE M. L. and SOLOMON M.	1958	Geology of the Mount Lyell mines, Tasmania. Econ. Geol. 53(4), 367-416.
WEBB J. E.	1958	Geophysical survey at Mount Lyell, Queenstown, Tasmania 1948-9. Bur. Min. Resour. Aust. Rec. 1958/111.
WILLIAMS J. P.	1965	Queenstown geophysical survey, Tasmania 1964. Bur. Min. Resour. Aust. Rec. 1965/94.
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LEGEND

SEDIMENTARY ROCKS

QUATERNARY
- Q — Talus, alluvium, etc.
- Qp — Moraine with varved clays

PERMIAN
- Pt — Tillite of Mt Sedgwick

ELDON GROUP — SILURIAN
- Sc, s — Crotty Quartzite:– grey, medium to coarse-grained, locally split by shales

JUNEE GROUP — ORDOVICIAN
- Og — Gordon Limestone, dark blue-grey, argillaceous
- Oo — Oou — Upper Owen Conglomerate
- Oo — Oom — Middle Owen Conglomerate
- Oo — Ool — Lower Owen Conglomerate

DUNDAS GROUP — CAMBRIAN
- €, c — Greywacke Conglomerate
- €, s — Miners Slate:– finely banded siltstones
- €, €jc — Jukes Conglomerate very coarse greywacke conglomerate

METAMORPHIC ROCKS

(ex Dundas Group)
- qp — Quartz feldspar porphyry

IGNEOUS ROCKS

- lam — Lamprophyre (kersantite?) dykes (post-Permian)
- dl — Dolerite of Mt Sedgwick (post-Permian)

GEOLOGICAL BOUNDARIES

- Observed
- Approximate
- ? Doubtful

FAULTS

- Observed
- Approximate

BEDDING

- Strike and Dip
- Vertical
- Horizontal
- Overturned
- Pitch
- Schistosity
- Cleavage
- Syncline
- Anticline

- Main Road
- Vehicular Track
- Foot Track
- River or Creek
- Δ Triangulation Station
- Quarry
- Mine for Copper
- Au Unless Marked — Gold
- H Haematite
- Geophysical traverses of previous surveys
- Geophysical traverses 1965
- Outline of areas covered by equipotential survey in 1934-38 by Blazey & Douglas (Richardson, 1949) and in 1948 by Webb (1958)

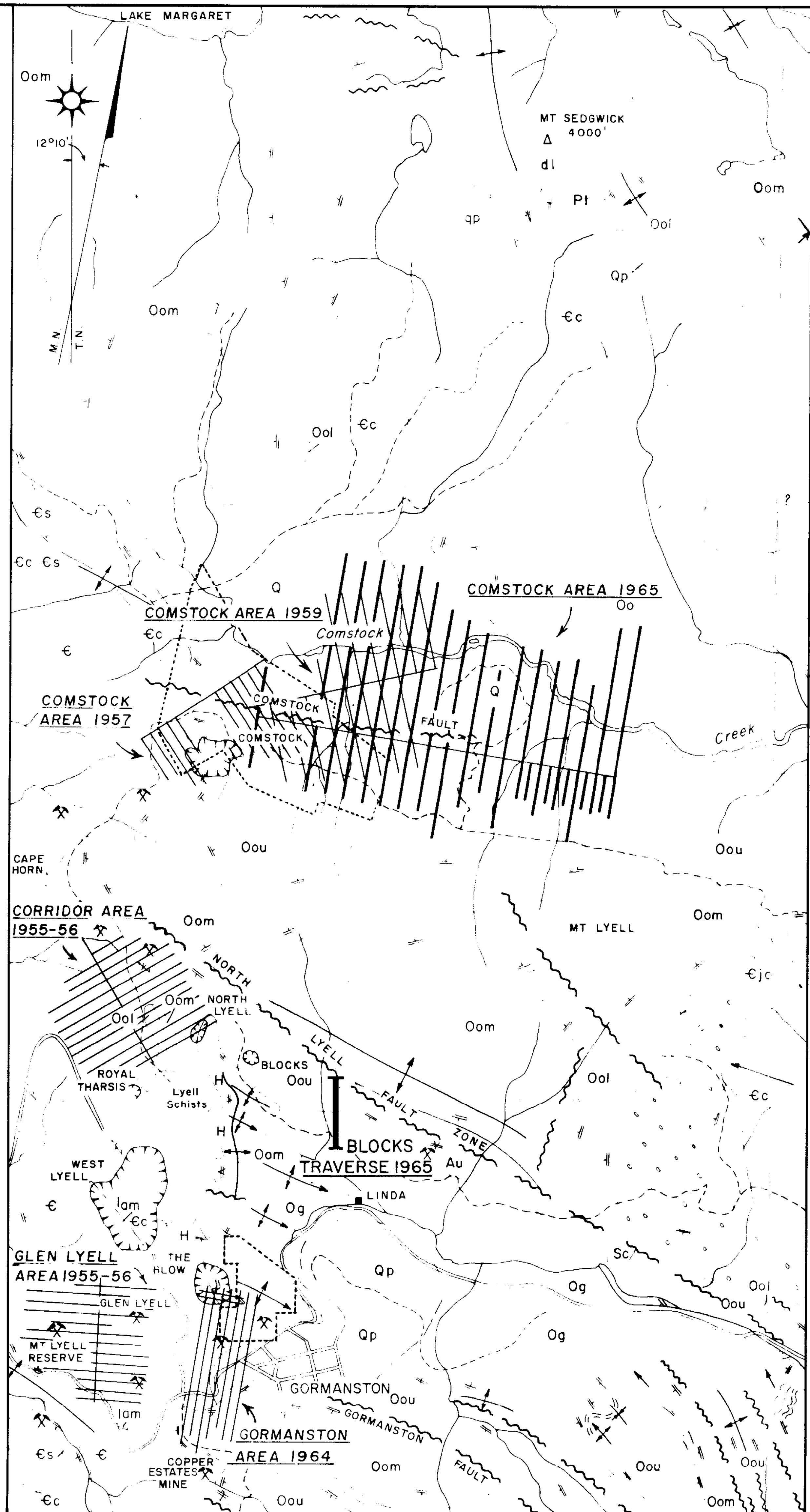
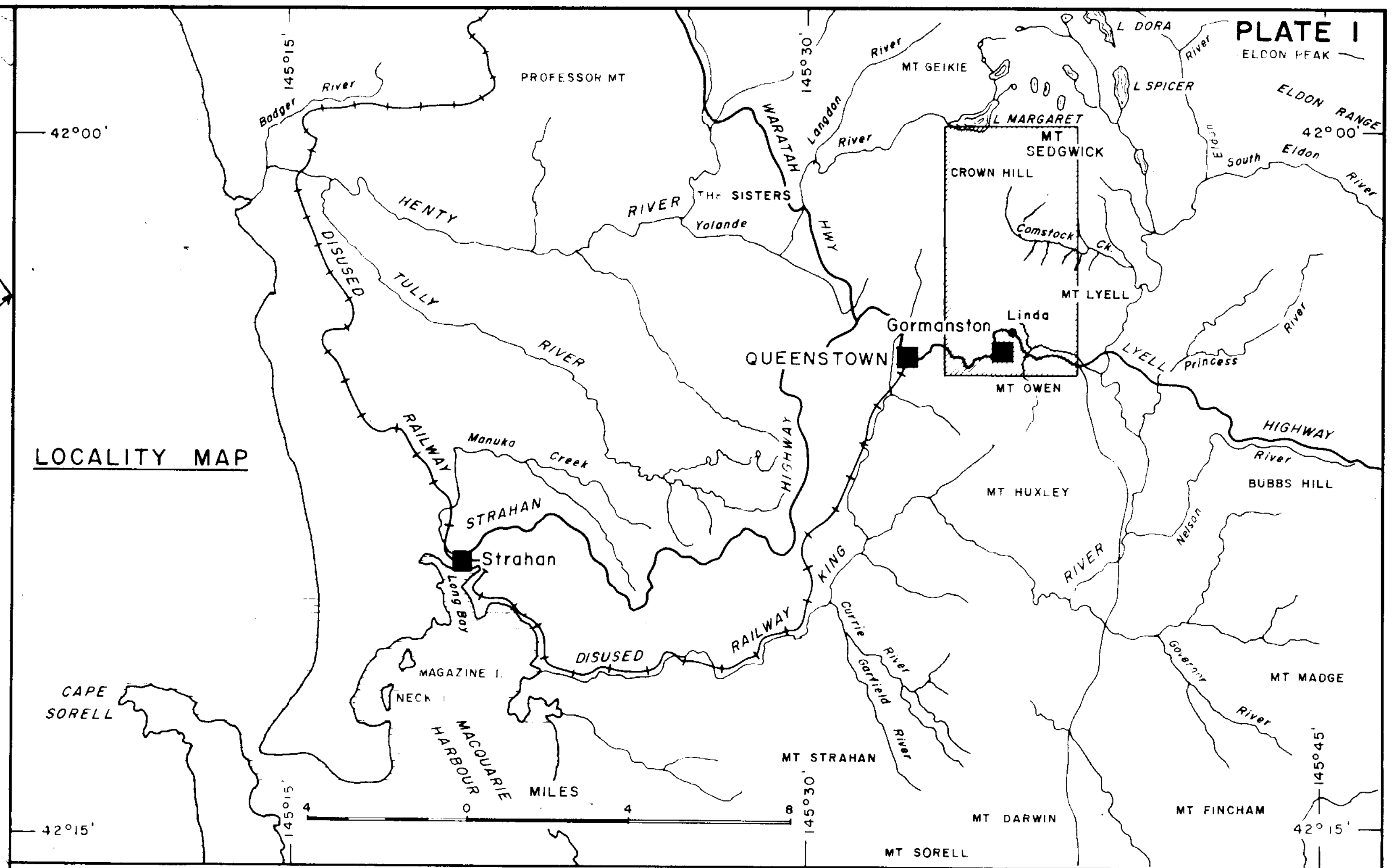
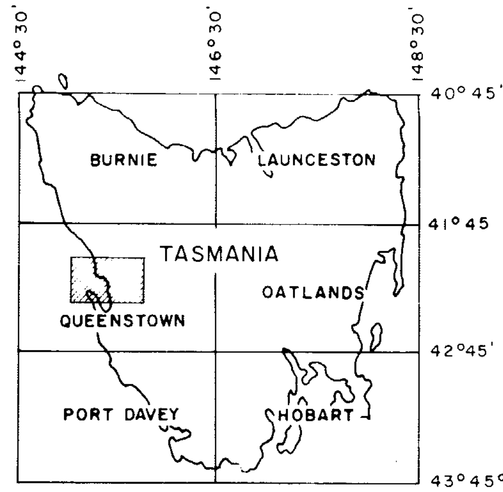


PLATE I

LOCALITY MAP





REFERENCE TO AUSTRALIA STANDARD 1:250,000 MAP SERIES: QUEENSTOWN

BLOCKS AREA I.P. TEST
QUEENSTOWN, TASMANIA, 1965

LOCALITY AND REGIONAL GEOLOGICAL MAP

MILES

1 0 1 2

AFTER MT LYELL M and R CO LTD, QUEENSTOWN AREA GEOLOGICAL MAP

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To accompany Record No. 1966/140

PLATE 2

I.P. TEST SURVEY
BLOCKS AREA, QUEENSTOWN, TAS
GEOLOGICAL AND SURVEY MAP, 1965

GEOLOGY AFTER MT LYELL M. & R. Co. Ltd.

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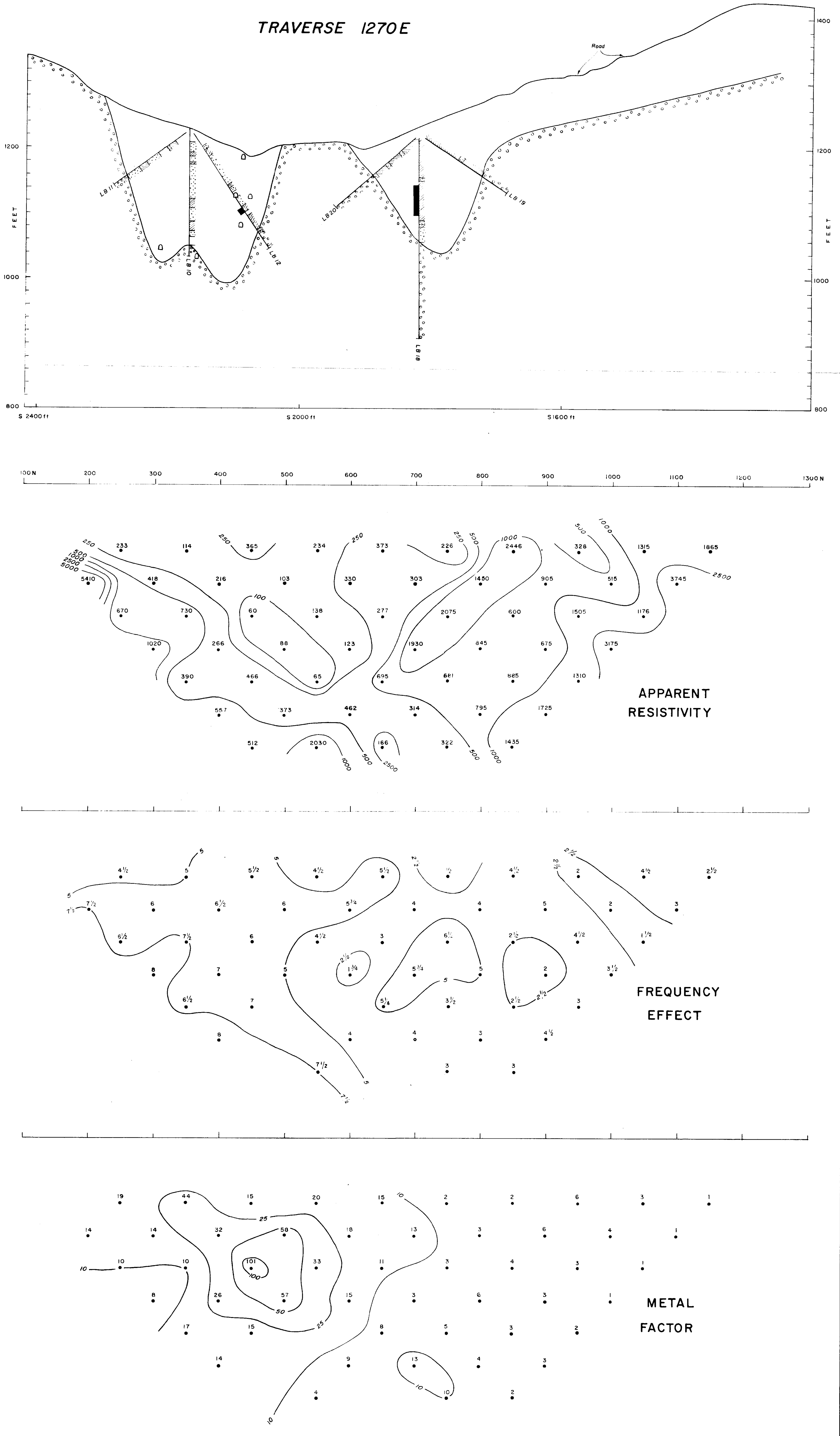
PLATE 3



LEGEND

Drill hole with log

" " " copper clay

Drive

Undifferentiated clay

Unconsolidated sand

Pioneer beds

20 Plotted position of IP reading (Dipole - dipole configuration)

Dipole length 100 feet Transmitted frequences 10·0 and 0·3 c/s

BLOCKS AREA, QUEENSTOWN, TAS.

INDUCED POLARISATION TEST SURVEY, 1965

GEOLOGY AFTER MT LYELL M. & R. Co Ltd.

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics K55/B7-123

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