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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

RECORDS 1955, No. 88

GEOPHYSICAL SURVEY AT
MT. BROWN COPPER MINE,
KARANGI, N.S.W.

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by

D. L. ROWSTON

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ABSTRACT

A geophysical test survey was made at the Mt. Brown Copper Mine, Karangi, N.S.W. in October, 1954.

The survey was undertaken by the Bureau of Mineral Resources at the request of the Mt. Brown Copper Mining Company, supported by the New South Wales Department of Mines, to assist in prospecting the leases for additional ore reserves. Reopening and developing the present workings is uneconomical without further prospects.

Self-potential, electromagnetic, magnetic and radioactive methods were used in the survey. The magnetic results show a distinct pattern, but this appears to be unrelated to the known deposit and cannot be interpreted satisfactorily until a regional geological survey of the area has been made. It is recommended that this be done.

No self-potential anomalies or electromagnetic indications which could be caused by an ore body, were obtained in the surveyed area. Parts of the area were unsuitable for electromagnetic work because of the effects of electric power lines. The very weak variations observed in the self-potential values are accounted for by small local surface effects.

Random radioactive readings over the area gave no indications of radioactivity above background level.

1. INTRODUCTION

The Mt. Brown Copper Mine is situated on lease PGL2, Parish of Coff, County of Fitzroy, New South Wales. The mine is three-quarters of a mile south of Karangi railway siding, and a first-class road links the mine with Coffs Harbour, a deep sea port, 5½ miles to the south-east (Plate 1). Leases PGL2 and PGL10 (Plate 2) are held by the Company, with right of entry to adjoining leases PGL4 and PML5. The Mt. Brown Copper Mining Co. Pty. Ltd., in August, 1953, submitted a request to the Bureau of Mineral Resources, Geology and Geophysics for a geophysical survey to assist in prospecting the leases for additional ore reserves. Without further prospects, the reserves as then known did not warrant re-opening and operating the mine. The request was supported by the Department of Mines, New South Wales, but owing to the shortage of staff, the Bureau was unable to undertake the survey until October, 1954.

The area near the mine is hilly, with dense rain forest to the west. Heavy rain during the survey impeded operations and for a time prevented access to the leases.

2. GEOLOGY

The geological map of New South Wales, issued by the Department of Mines, and the geological map of Australia and New Guinea, prepared by the Bureau, show the Karangi district as lying in a large area of undifferentiated Palaeozoic sedimentary rocks. The area has not been mapped in detail. Several references to the mine itself occur in reports of Inspectors of Mines, and available information is summarised and assessed in a report to the Company by Mott (1953). The following notes are extracted from Mott's report:-

> Mineralisation occurs in an east-west shear in shale with a steep dip to the north. Chalcopyrite and pyrite, with considerable quartz, are concentrated as fissure fillings forming tabular lenses which make and fade. Silicification and metamorphism of the shales suggest the proximity of an intrusive mass but there is no evidence of it or its possible relationship to the late Palaeozoic granites which crop out at Coramba, about 5 miles to the north.
>
> The mine has been developed at the 122 and 185-foot levels. Stopes above the upper level have been worked out and the only known ore is a rich shoot east of the main shaft between the 122 and 185-foot levels, approximately 15 feet long and 2 feet wide. At the eastern end of the lower level there is a fault and the level terminates in barren jointed slates. Extensive cross-cutting failed to locate the continuation of the ore body. Owing to the lack of regional geological information, the only prospect of interpreting geophysical results would have been on the basis of indications obtained from the known ore bodies.

3. OPERATIONS

No geophysical work had been done previously in the locality.

The survey was made in October, 1954, by D.L. Rowston, Geophysicist of the Bureau, assisted by three field hands provided by the company. Surveying and levelling were done by Mr. P.O'Reilly of the Department of the Interior, Sydney.

The geophysical grid (Plate 2) was surveyed using a baseline on a magnetic bearing of 73°40' at a distance of 500 feet north of the mine shaft. The grid extended from 500 feet east of the mine shaft to 600 feet west of it. The direction of the baseline was chosen approximately parallel to the strike of the known mineralisation. Traverses were laid out at right angles to the baseline at intervals of 100 feet, and observations were made at intervals of 25 feet along each traverse. This close spacing was chosen because any ore bodies present could be expected to be of limited size.

4. METHODS AND RESULTS

(a) General

The methods used were:-

(i) Self-potential - to measure electrochemical potentials caused by the oxidation of sulphides at the groundwater table, the known mineralisation being sulphidic.

(ii) Electromagnetic - to locate zones of high electrical conductivity produced by ore bodies or other geological features.

(iii) Magnetic - to determine thelocal variations in the vertical intensity component of the earth's magnetic field due to magnetic mineral concentrations.

(iv) Radioactive - as a matter of interest and because of the possibility of radioactive minerals being associated with the copper.

(b) Self-potential

(i) Method

In the self-potential method, the distribution of naturally occurring potentials is measured over the surface of the ground. These potentials are due to the electrochemical action of ground waters on conducting bodies, and can arise from various geological formations. In general, it is impossible to assign a specific cause to self-potential anomalies. However, it is found that sulphide bodies which lie partly below and partly above ground-water level are frequently efficient generators of such potentials. Negative potential anomalies of a characteristic type may be associated with such bodies, and the presence of such an anomaly may indicate the presence of a sulphide body.

At Mt. Brown, observations were made with a Cambridge pH millivoltmeter. The rear electrode was the stationary reference point and two readings were taken with the front electrode at each observation point in order to minimise surface influences. No self-potential observations were made on traverse 600W.

(ii) Results

The readings were reduced and plotted as profiles (Plate 3). The indications recorded were weak, and did not warrant the compilation of a contour map.

The small positive anomaly which appears on traverses 500W to 100E coincides with the course of a stream, and is probably due to ion concentration differences between the stream and normal ground water. Two small negative indications on traverses 00 and 100W are probably due to local surface effects associated with the mine dump.

The failure of the self-potential method may be attributed to either the absence of sizeable ore bodies or the absence of oxidation. The latter could be due to the high level of the water-table in the area. Standing water in the mine is at 60 feet, and most of theore which has been produced was recovered from below this level. Under such conditions oxidation is limited and the resultant potentials are small.

(c) Electromagnetic.

(i) Method

A primary electromagnetic field was induced over the area of the survey by passing a 500-cycle alternating current through a large rectangular loop of insulated cable laid out on the ground. The loop measured 3,000 x 2,000 feet. One side of the loop extended from 1500W to 1500E along the baseline and the other side was 2,000 feet north of it. Measurements of the horizontal and vertical components of the field intensity were made using Electromagnetic Compensator No.6.

Departure from a calculated primary field attentuation curve indicates the presence of secondary fields originating in zones of high conductivity. Profiles were obtained by applying primary field reductions and terrain corrections. Any anomalies remaining after these corrections are made indicate the presence of secondary fields.

(ii) Results

Electromagnetic results proved useless on the western traverses, mainly because of the extraneous fields caused by high-tension transmission lines crossing the leases (Plate 2). On the eastern traverses, interference from the railway telegraph and anomalous readings due to fences were the only indications recorded. In the area not disturbed by these factors no electromagnetic indications were obtained. The method is of little value in the immediate neighbourhood of the mine shaft because of the disturbance factors mentioned above, but would probably be more successful if applied to other parts of the area.

(iii) Experimental

Some experimental work was undertaken using a prototype Turam equipment. This method compares field intensity and phase displacement of the primary electromagnetic field at two points on the grid. Two search coils were calibrated in a uniform field. Then, with a constant separation of 50 feet, they were placed at different distances from the primary loop. Observed departures from normal values indicate variations in ground conductivities. The only indication recorded was due to the mine power supply. Interference from power lines limited observations to traverse 100W.

(d) Magnetic

(i) Method

Magnetic observations were made on traverses 600W to 100E and 400E using a Watts Vertical Force Variometer (No.61939). Readings were taken relative to a selected base station, namely 100S on traverse 00. Several checks were made to obtain a diurnal variation correction.

(ii) Results

The reduced results were plotted as profiles (Plate 4) and contours (Plate 5).

Interpretation of the magnetic results would be purely conjectural, without the results of a thorough geological survey, together with some petrological analyses of rock types.

No large magnetic indication coincides with the present known deposit, and no basis is therefore available for associating the observed anomalies with possible mineralisation.

(e) Radioactive

Radioactive readings were taken at random over the area, using an Austronic ratemeter, type PRM200. No increase above a weak background count was noted.

5. CONCLUSIONS AND RECOMMENDATIONS

No indications were obtained from the known ore bodies, either by self-potential or electromagnetic methods. This result is not unexpected, considering the very limited dimensions of the ore bodies already worked.

Magnetic results show the presence of anomalous conditions, which cannot be correlated with the ore-bodies, but which might be of assistance in elucidating structure, if detailed geological information were available.

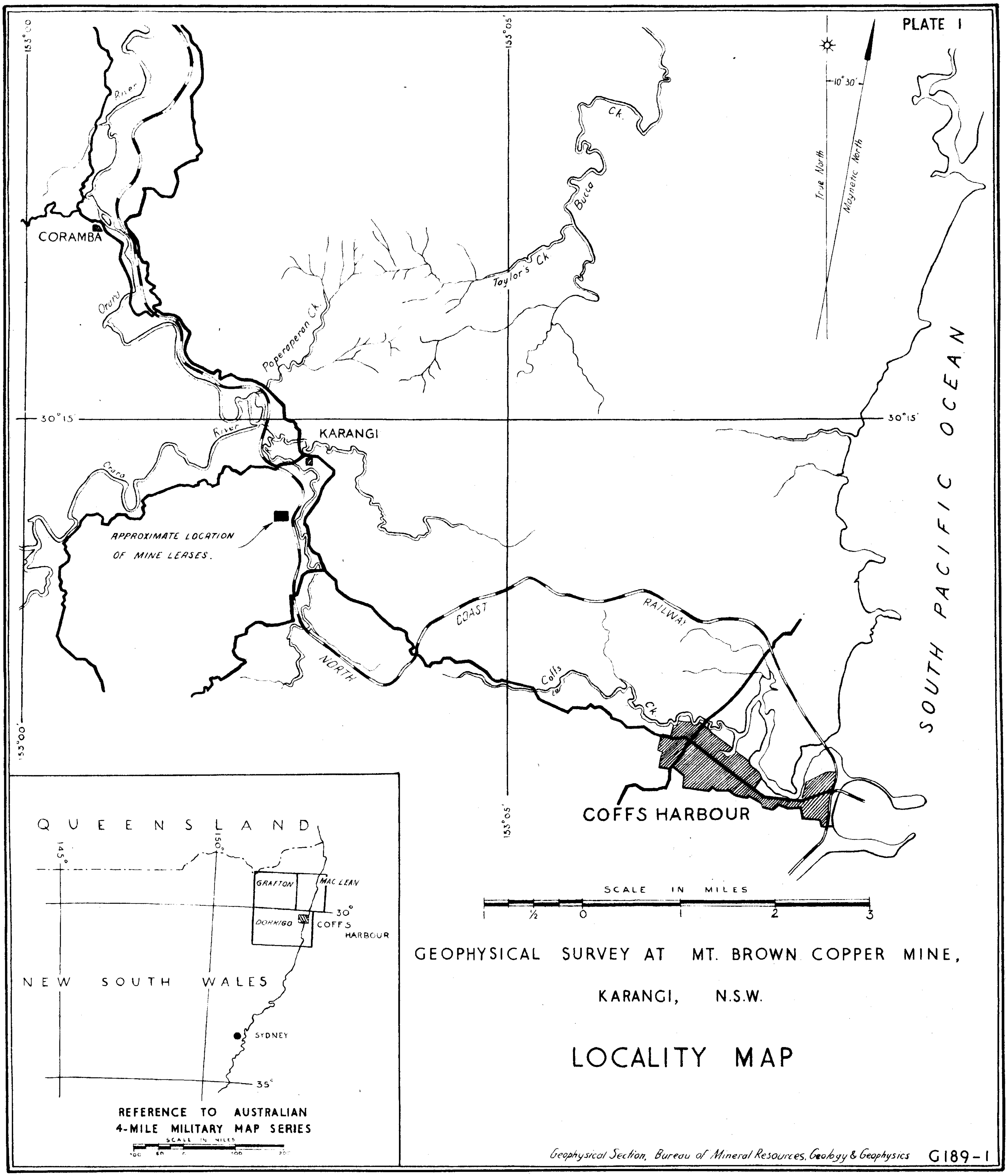
It is apparent that new ore bodies of the dimensions of those mined, if any exist, would not be detectable by the geophysical methods used, and there is no reason to suppose that further geophysical work would give results of any value. In the event of a regional geological survey establishing structural controls which might lead to the presence of mineralisation on a larger scale, the question of further geophysical work could be re-examined.

6. ACKNOWLEDGEMENTS

The co-operation of Mr. K. Burns, general manager of the company and Mr. P. O'Reilly, surveyor of the Department of the Interior, Sydney, was greatly appreciated.

7. REFERENCES

Mott, D.W., 1953 - Mt. Brown Copper Mine, Coramba Division, New South Wales (Unpublished).



GEOPHYSICAL SURVEY AT MT. BROWN COPPER MINE,

KARANGI, N.S.W.

LOCALITY MAP

Geophysical Section, Bureau of Mineral Resources, Geology & Geophysics G189-1

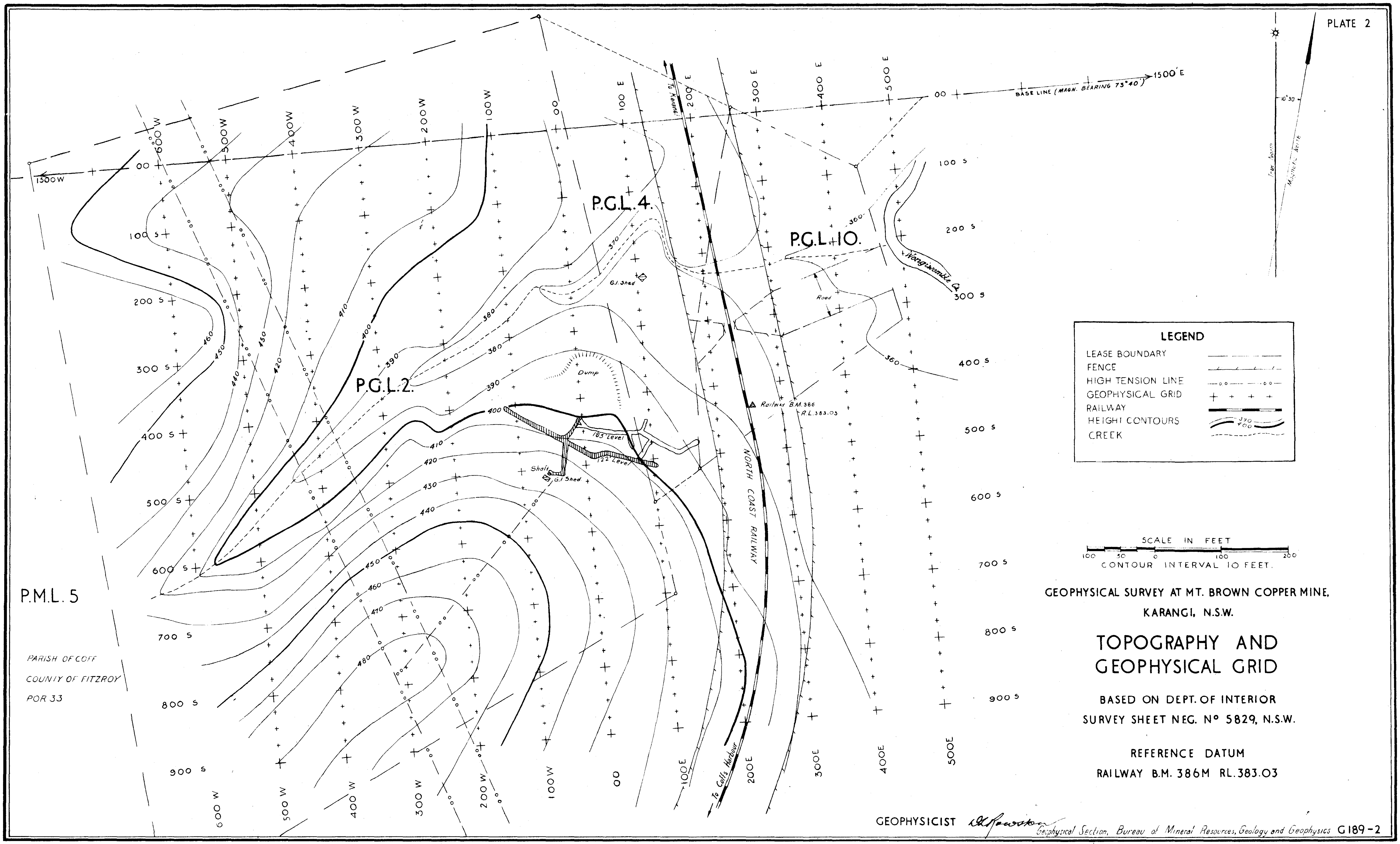
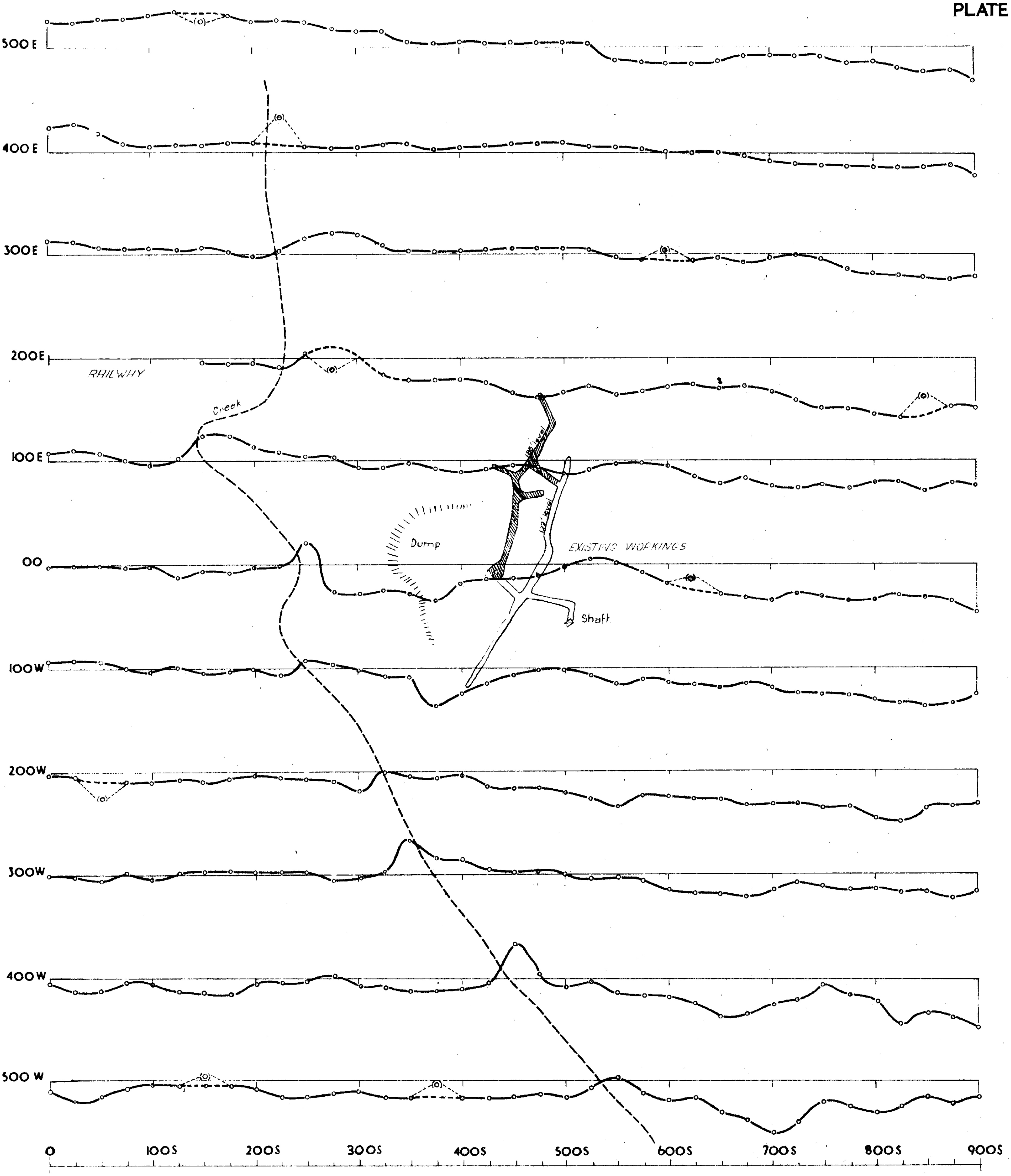


PLATE 2
GEOPHYSICAL SURVEY AT MT. BROWN COPPER MINE, KARANGI, N.S.W.
TOPOGRAPHY AND GEOPHYSICAL GRID
BASED ON DEPT. OF INTERIOR SURVEY SHEET NEG. Nº 5829, N.S.W.
REFERENCE DATUM
RAILWAY B.M. 386M RL.383.03
LEGEND
LEASE BOUNDARY
FENCE
HIGH TENSION LINE
GEOPHYSICAL GRID
RAILWAY
HEIGHT CONTOURS
CREEK
SCALE IN FEET
100 50 0 100 200
CONTOUR INTERVAL 10 FEET.
BASE LINE (MAGN. BEARING 73°40')
1500'E
1500W
P.G.L.4.
P.G.L.10.
P.G.L.2.
P.M.L. 5
PARISH OF COFF
COUNTY OF FITZROY
POR 33
NORTH COAST RAILWAY
To Kempsey
To Coffs Harbour
Railway B.M. 386
R.L. 383.03
G.I. Shed
Shaft
Dump
185' Level
122' Level
Road
Nongiwombe Ck.
True North
Magnetic North
10°30
GEOPHYSICIST
Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics G189-2

PLATE 3



SCALES

HORIZONTAL SCALE 100 0 100 200 300 FEET

VERTICAL SCALE 100 0 100 200 300 MILLIVOLTS

GEOPHYSICIST D.K. Rowston

GEOPHYSICAL SURVEY AT

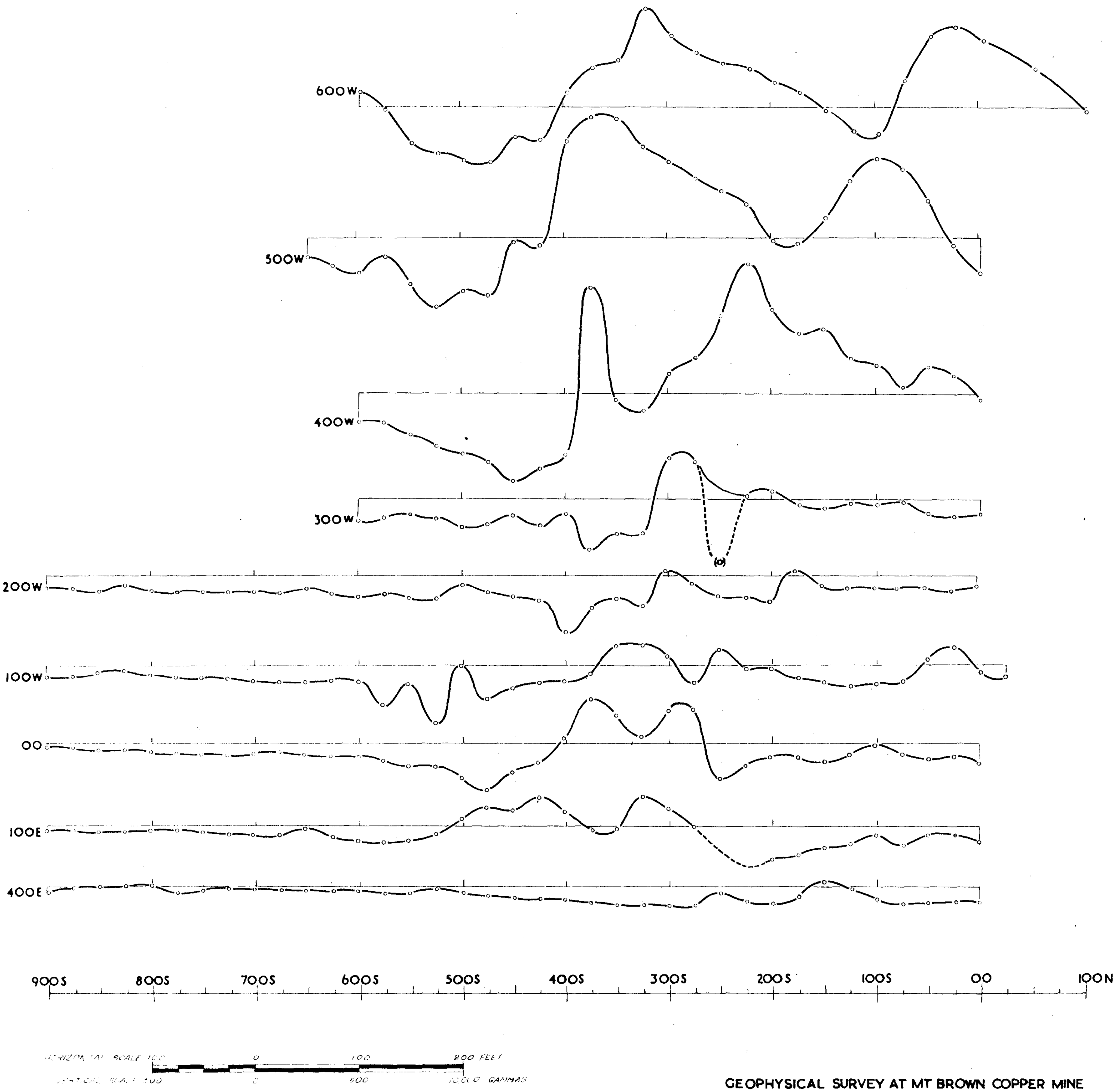
MT BROWN COPPER MINE, KARANGI, N.S.W.

SELF POTENTIAL PROFILES

G 189-3

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics.

PLATE 4



GEOPHYSICAL SURVEY AT MT BROWN COPPER MINE

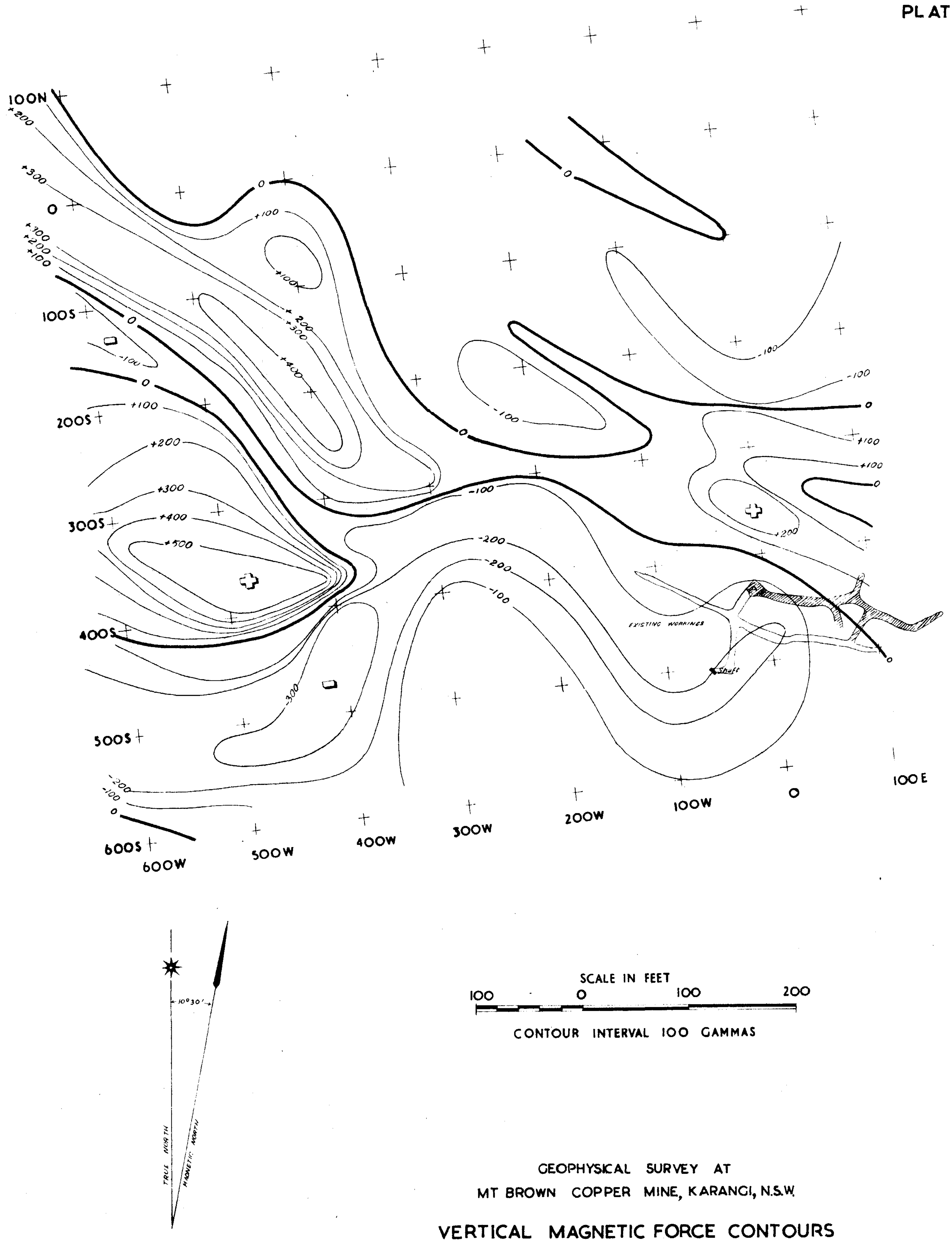
KARANGI N.S.W.

VERTICAL MAGNETIC FORCE PROFILES

GEOPHYSICIST D.F. Rowston

GEOPHYSICAL SECTION, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

G189-4



GEOPHYSICAL SURVEY AT
MT BROWN COPPER MINE, KARANGI, N.S.W.

VERTICAL MAGNETIC FORCE CONTOURS

Geophysicist

GEOPHYSICAL SECTION, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS G 189-5