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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

RECORDS

1959 No. 150.

GEOPHYSICAL SURVEY OF THE

BLACK SNAKE COPPER MINE, TUBBUT, VICTORIA.

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ABSTRACT.

The Black Snake Copper Mine area, situated near Accommodation Creek in East Gippsland, Victoria, was surveyed using self-potential and electromagnetic methods.

Strong self-potential and relatively weak electromagnetic anomalies were discovered over the mine workings and were shown to extend over a length of about 800 feet along the line of lode.

In the northern part of the surveyed area a strong self-potential anomaly was revealed, extending for at least 1,000 feet along a contact between granodiorite and quartzites.

Six drilling targets were selected, four in the mine area to test for extension in depth and strike of the known mineralisation, and two in the northern self-potential anomaly to test for new mineralisation.

1. INTRODUCTION.

At the request of the syndicate operating the Black Snake Copper Mine near Accommodation Creek in East Gippsland, the Commonwealth Bureau of Mineral Resources conducted a geophysical survey of the mine and adjacent area.

The Department of Mines supported the syndicate's request and made available a Senior Geologist, R. G. Whiting, to assist in the investigation. Mr. Whiting made a geological survey of the area and was responsible for the layout of traverses required for the geophysical work.

The geophysical survey was carried out by the author during September, 1959. During the field operations considerable assistance was received from the syndicate members, Mr. J. Say and Mr. K. Michelson.

As shown in the locality map on Plate 1, the mine is situated near the junction of the Deddick and Snowy Rivers, and can be reached from Lakes Entrance via Buchan and McKillop's Bridge or from Orbost via Bonang. The mine area appears on aerial photographs Bendock, Run 4, No. 1090 and Run 3, No. 1046.

2. GEOLOGY.

In an unpublished report prepared shortly before the present survey, Whiting (1959) summarised the available information concerning the copper occurrence and referred to earlier reports by Dunn, Baragwanath and Grieve. However, it was not until the present survey that the geology of the area was mapped in detail.

The main geological boundaries are shown in Plate 1. The western part of the geophysical survey area consists of granodiorite with occasional outcrops of overlying porphyry. The eastern part of the area consists of Ordovician quartzites and hornfels. This part of the area is very rugged owing to the gorge of Accommodation Creek and the sharp ridges and peaks formed by the bands of hornfels. A major change in strike and dip of the quartzites gives evidence of a fault in the position marked on the map.

The known ore occurrences are along the hanging wall of the lode formation (Whiting, 1959), which strikes about 315° magnetic. They appear to be east-west shoots terminated on the east by the hanging wall. The mineralisation consists almost exclusively of chalcopyrite with a gangue of barytes, calcite and quartz. The mine has a small output of high grade ore which is at present milled by a stamp battery and concentrated by Wilfley tables to give a concentrate containing 25% to 30% copper.

3. OUTLINE OF OPERATIONS.

The information available at the time of the request for a geophysical survey supported the recommendation by Whiting (1959) that electrical prospecting methods could be used. J. Horvath, Senior Geophysicist, inspected the mine and reported

that prospecting with the Turam electromagnetic method should detect ore-bodies of the type examined, but that the indications would probably be weak. It was considered that the self-potential method also should be tried, although doubts were held as to its suitability in this area, because active oxidation of sulphides appeared to be negligible.

A base line bearing 315°M was selected and traverses were laid out at right angles to it and cutting the hanging wall at about 800 feet from the base line. The traverses were surveyed using two-frequency Turam equipment and self-potential equipment. The results of the Turam and self-potential surveys are shown on the plan in Plate 2. Representative profiles along selected traverses appear in Plate 3. Magnetic readings were made along one traverse only.

4. TURAM SURVEY.

The Turam method of electromagnetic prospecting has been described by Hedstrom (1940). In the present survey the primary cable was laid along the base line and was grounded at both ends. Observations were made at intervals of 50 feet along all traverses using the frequency of 440 cycles per second and a coil separation of 50 feet. Where anomalies were observed, the corresponding parts of the traverses were surveyed at 25 feet intervals using both frequencies, 440 and 880 cycles per second, in order to confirm the anomalies and to show them in greater detail. This was considered necessary because of the small dimensions of the known ore-shoots.

The positions of the observed anomalies are listed below:-

Traverse	0	:	425 E, 575 E, 725 E.
"	2.5 S	:	625 E
"	4 S	:	625 E, 825 E
"	5 S	:	500 E, 625 E
"	8 S	:	260 E
"	9 S	:	775 E
"	10 S	:	200 E (approx.), 750 E.
"	11 S	:	440 E, 750 E.
"	12 S	:	475 E, 765 E.
"	13 S	:	625 E, 790 E.
"	14 S	:	825 E.
"	15 S	:	700 E, 810 E.
"	16 S	:	675 E, 820 E.
"	17 S	:	825 E.
"	18 S	:	825 E.

Where the anomalies appear to fall along definite lines, these have been marked on the plan in Plate 2. The anomalies have been classified arbitrarily as strong, medium or weak according to whether the phase anomalies with the 880 cycle frequency exceeded

6 degrees, was between 2 and 6 degrees or was less than 2 degrees.

The anomalies recorded were mostly weak anomalies but in general were well defined. The strongest anomaly is positioned near 10 S/200 E. It occurred close to the primary cable line and would require the cable line to be placed further to the west to enable it to be adequately observed. The anomaly is situated at the contact between the granodiorite and the quartzites and might be connected with the weak anomaly at 8 S/260 E. Both anomalies lie near the southern end of the self-potential anomaly, which is referred to below.

The most persistent line of anomalies is that extending from traverse 18 S to traverse 9 S and coinciding with the known mine workings at 12 S/765 E and 15 S/810 E. The weakest anomalies along this line are on traverses 14 S and 10 S, the most pronounced are on traverses 12 S, 13 S and 15 S.

The other anomalies shown on Plate 2 are considered to be of minor importance except the one at 2.5 S/625 E which occurs near the portal of an abandoned tunnel.

5. SELF-POTENTIAL SURVEY.

Self-potential observations using a Cambridge PH Meter as a millivoltmeter were made at intervals of 50 feet along all traverses except 7 S. The accuracy of observations at any point was about ± 10 millivolts.

The survey revealed two well-defined anomalies which are shown by the self-potential contours in Plate 2. The maximum potential difference measured at each anomaly was 225 millivolts. One anomaly is situated along the line of the known lode between traverses 10 S and 15 S. The other is in the quartzites adjacent to the granodiorite contact between traverses 0 and 9 S. The second or northern anomaly is still present on the most northerly traverse and may extend beyond it.

6. MAGNETIC SURVEY.

The Accommodation Creek area lies in the Deddick 1-mile military map area, which has been surveyed by the Bureau with an airborne magnetometer, along flight lines spaced one mile apart. The Bureau map No. G.269-3 shows the results of the airborne survey. One flight line crossed the present survey area approximately along traverse 20 S. No airborne anomalies were recorded in the Accommodation Creek area.

Ground magnetometer readings using a Watts vertical force variometer No. 68630 were made along one traverse, 12 S, during the present survey. An anomaly of about 250 gammas was observed at 12 S/250 E near the granodiorite contact and another smaller anomaly of about 50 gammas, at 12 S/775 E over the mine. The smaller anomaly is probably due to the presence of rails and trucks in the tunnel.

7. INTERPRETATION.

Electromagnetic and self-potential anomalies have been obtained over the known mineralisation in the mine workings at 12 S/765 E and the open cut at 15 S/810 E. There is close agreement between the results of the two methods between traverses 16 S and 10 S but on traverses 17 S and 9 S no self-potential anomalies were recorded. It is possible that each of these traverses, the upper part of the ore shoots, the source of the self-potential effects, has been removed by the action of rock slip and soil creep.

The self-potential and electromagnetic anomalies in the area of the present mine workings indicate that mineralisation is likely to be present over a length of 700 to 800 feet. From the electromagnetic results the most promising parts of the lode line are considered to be between 11.5 S/750 E and 13.5 S/800 E, between 14.5 S/820 E and 15.5 S/810 E and between 16.5 S/840 E and 17.5 S/825 E. However, the electromagnetic effects are relatively weak and could be caused by short narrow veins only. The known ore-shoots strike at 45° to the line of lode and it is possible that the conducting bodies producing the electromagnetic effects are short shoots arranged en echelon along the line of lode. It is not possible from the electromagnetic or self-potential results to predict the depth extent of mineralisation.

The northern self-potential anomaly extends for a distance of about 1,000 feet in the quartzites along the granodiorite contact and may continue beyond the northern limit of the surveyed area. It occurs in a part of the area where the detailed surface geology is mainly obscured by either alluvium or talus on the slopes of a hornfels ridge. The only evidence of prospecting is the tunnel extending from about 2.5 S/625 E to about 4 S/600 E, in which sparse copper mineralisation has been observed. The tunnel was driven along a fissure. It was not taken far enough to test the area where the strongest self-potential anomaly occurs.

At 2.5 S/625 E, where the creek has cut through the hornfels ridge, an electromagnetic anomaly coincides with the self-potential anomaly but apart from this there is little correlation between the results of the two methods. The weak electromagnetic anomaly at 8 S/260 E and the strong one at 10 S/200E are situated near the southern end of the self-potential anomaly and fall approximately in the line with the axis of the self-potential anomaly.

In the workings of the Black Snake Mine, Whiting (1959) observed that the oxidized zone does not extend for more than a few feet below the surface. If the northern self-potential anomaly is due to the oxidation of sulphide minerals, these must be present close to the surface and would be expected to produce stronger electromagnetic effects than were actually observed. The absence of a persistent electromagnetic anomaly suggests that if mineralisation is associated with the self-potential anomaly, the mineralisation does not mainly occur as definite fissure veins. Fissure veins may occur where the self-potential anomaly is narrow at 2.5 S/625 E and disseminated mineralisation, not necessarily rich in copper, may occur to the south where the anomaly is broader. Test drilling will be required to determine if this interpretation is correct.

Several local minor anomalies, both self-potential and electromagnetic, were observed and have been marked on the map (Plate 2). At the present stage, they can be neglected until a geological examination is made at the points where they occur. Any testing by costean should be done along the traverses only, as interpolation of the small anomalies between traverses could be erroneous.

8. RECOMMENDATIONS.

Six drilling targets, whose positions in plan are given below, have been selected as an initial test of the geophysical results. It is advisable to have the drilling targets on or close to traverses so that the drilling results may be compared with the actual observed geophysical profiles. As any mineralisation present is expected to occur at relatively shallow depths, it is considered that the depths of the targets should be taken as 100 feet or less.

Target.	Traverse.	Coordinate.	Purpose.
No. 1	6 S	450 E	Test centre of northern S.P. anomaly for disseminated mineralisation.
No. 2	2.5 S	625 E	Test northern S.P. anomaly for vein mineralisation.
No. 3	11 S	750 E	Test Black Snake Mine extension to North.
No. 4	12 S	765 E)	Test Black Snake Mine at depth.
No. 5	13 S	775 E)	
No. 6	15 S	810 E	Test Black Snake extension to South.

An extension of the geophysical survey to the north with surveys of selected areas along the granodiorite contact may warrant consideration if the drilling of the northern anomaly discloses an orebody.

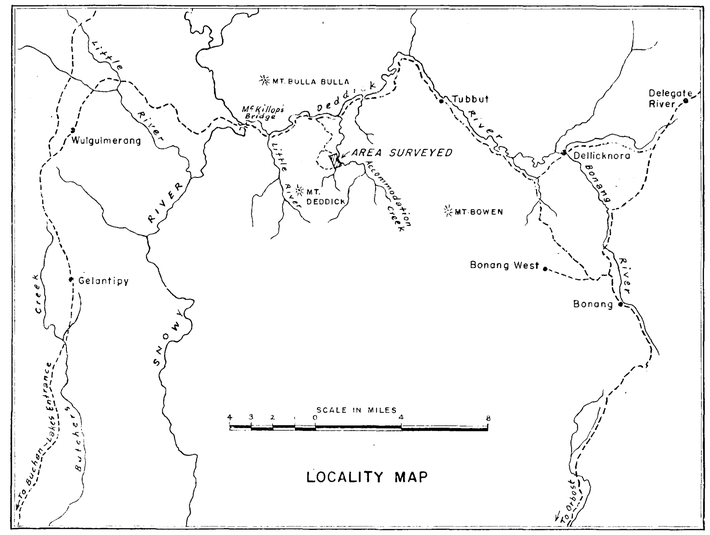
10. REFERENCES.

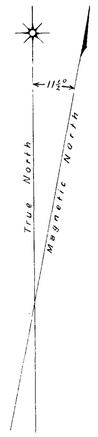
HEDSTROM, H. 1940 - Phase Measurements in Electrical Prospecting. Trans. A.I.M.M.E. 138.

WHITING, R.G. 1959 - The Black Snake Copper Mine, Accommodation Creek. Department of Mines, Victoria. Unpublished Report No. 22/59.

WHITING, R.G. 1959 - The Black Snake Copper Mine (in preparation).

PLATE I





LEGEND

- TRAVERSE
- ROAD
- CREEK
- FENCE
- BUILDING
- SURVEY PEG (Peg)
- CONTOURS (20FT. Interval) (2000 / 2020)
- COSTEAN
- TUNNEL
- WINZE
- SHAFT
- GEOLOGICAL BOUNDARY
- FAULT
- INFERRED FAULT
- STRIKE AND DIP (40°)
- QUARTZITE
- GRANODIORITE
- PORPHYRY
- ALLUVIUM

SCALE IN FEET
100 50 0 100 200 300

GEOPHYSICAL SURVEY AT BLACK SNAKE COPPER MINE, TUBBUT, VICTORIA

GEOPHYSICAL TRAVERSES, GEOLOGY AND TOPOGRAPHY

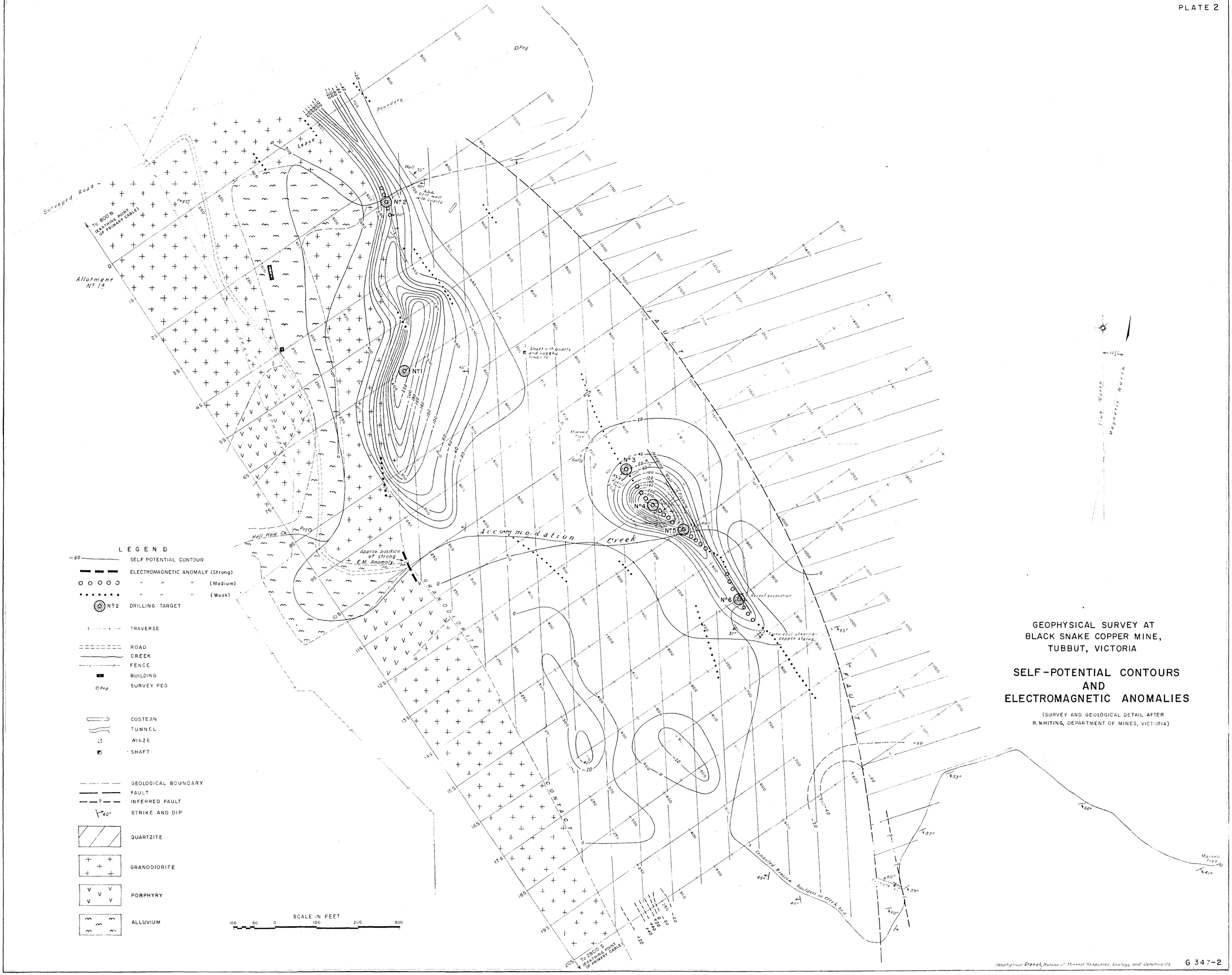
(AFTER R.WHITING SEN.GEOL. DEPARTMENT OF MINES, VIC.)

(LEVEL DATUM ARBITRARY)

Geophysical Branch, Bureau of Mineral Resources Geology and Geophysics

G 347-1

To Accompany Records 1959 No 150



GEOPHYSICAL SURVEY AT BLACK SNAKE COPPER MINE, TUBBUT, VICTORIA

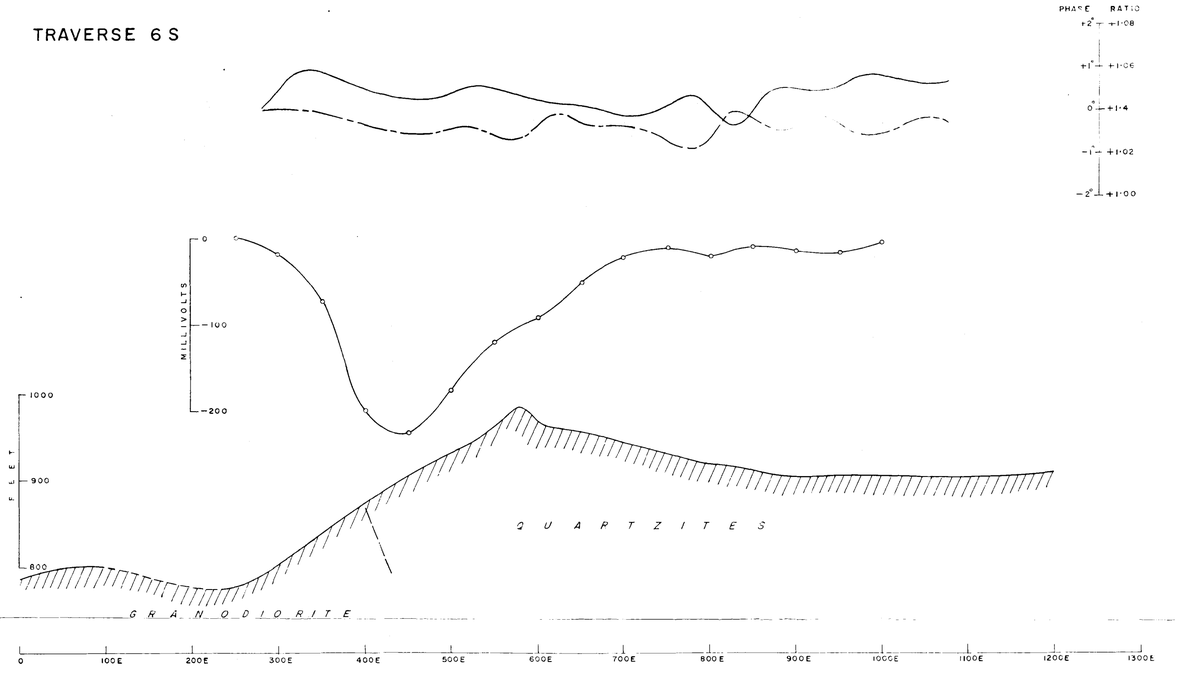
SELF-POTENTIAL CONTOURS AND ELECTROMAGNETIC ANOMALIES

(SURVEY AND GEOLOGICAL DETAIL AFTER R. WHITING, DEPARTMENT OF MINES, VICTORIA)

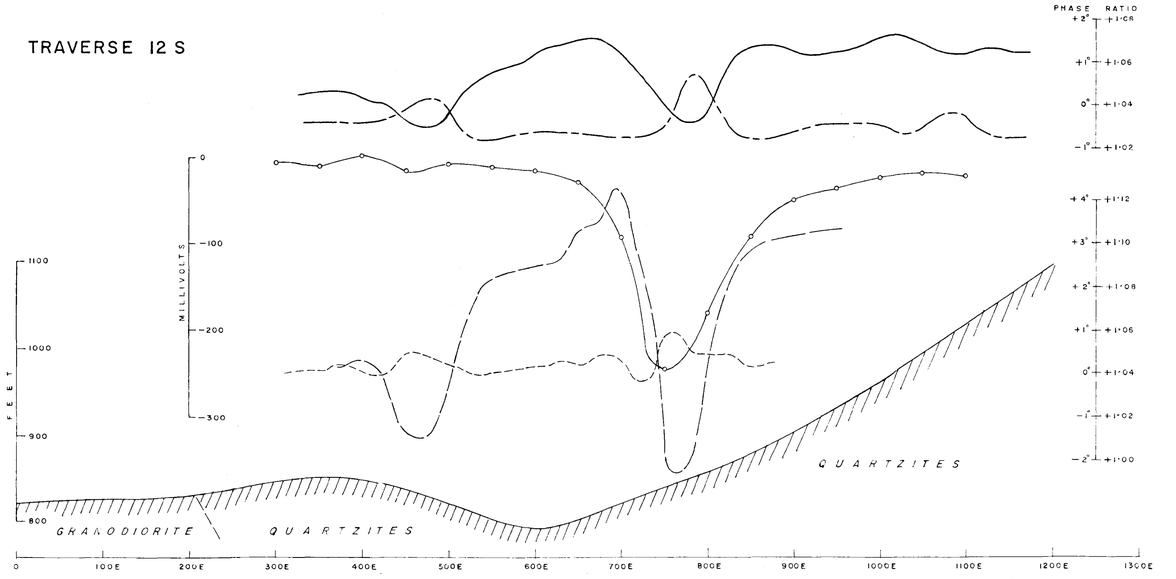
Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G 347-2

To Accompany Records 1959, No 150

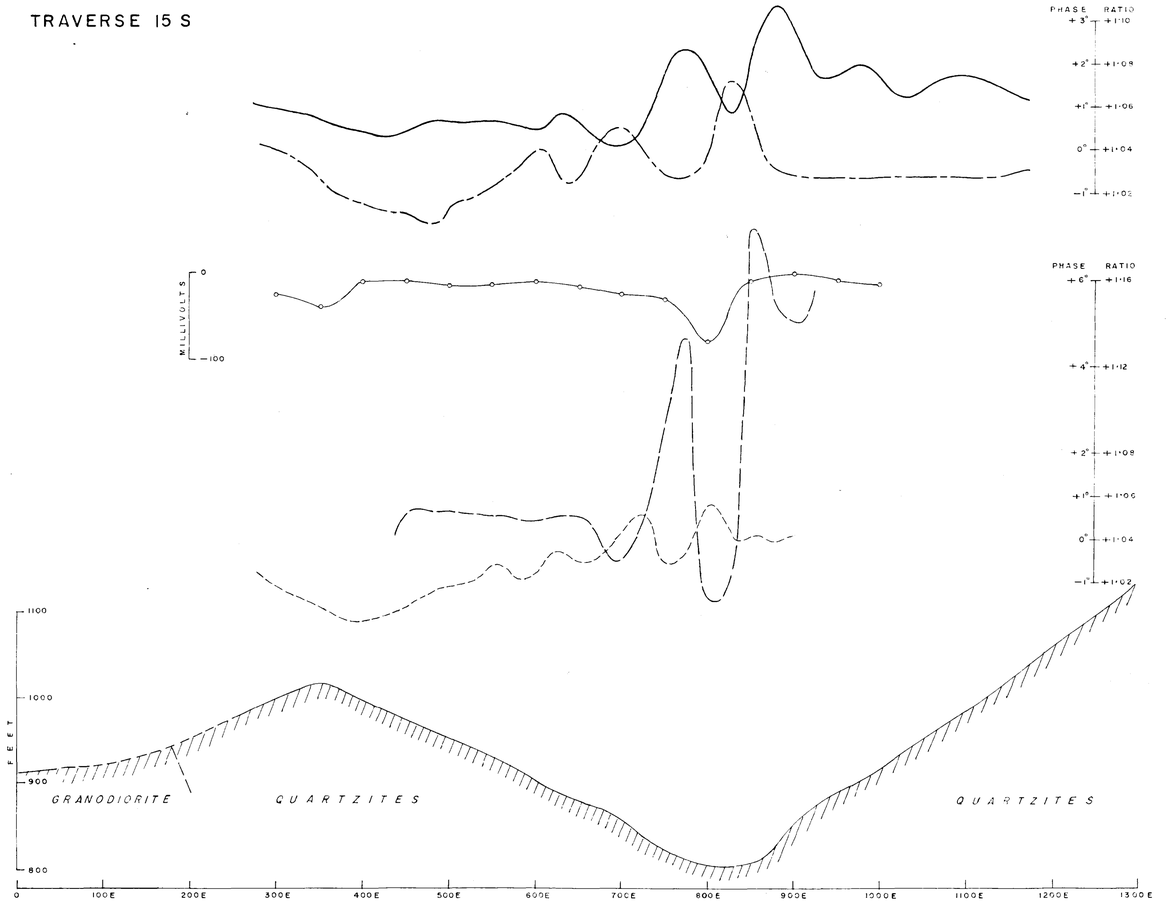
TRAVERSE 6 S



TRAVERSE 12 S



TRAVERSE 15 S



LEGEND

- 440 c/s TURAM PHASE
- 880 c/s TURAM PHASE
- 440 c/s TURAM RATIO
- 880 c/s TURAM RATIO
- SELF POTENTIAL

HORIZONTAL SCALE IN FEET
100 50 0 100 200 300
VERTICAL SCALES AS SHOWN

GEOPHYSICAL SURVEY AT
BLACK SNAKE COPPER MINE,
TUBBUT, VICTORIA

SELECTED SECTIONS SHOWING
TURAM ELECTROMAGNETIC
AND SELF POTENTIAL PROFILES

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. G 347-3

To Accompany Records 1959, No 150