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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORDS 1958, No. 15

GEOPHYSICAL INVESTIGATION (1956-1957), COPPER-NICKEL DEPOSITS, NORTH DUNDAS FIELD, TASMANIA

by

J. HORVATH and M. J. O'CONNOR

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ABSTRACT.

Geophysical investigations have been made in the North Dundas copper-nickel field near Zeehan, Tasmania, over a number of periods since 1928. In 1928, a survey was made by the Imperial Geophysical Experimental Survey and subsequent testing revealed a copper-nickel deposit in the northern part of the field. Surveys were made by the Bureau of Mineral Resources, Geology and Geophysics from May to June, 1952, and December, 1952, to March, 1953. Testing which followed these surveys revealed further deposits of copper-nickel ore. Further surveys using the self-potential and magnetic methods were made by the Bureau in October, 1956, and from March to May, 1957, and the results are described herein.

Several self-potential anomalies were disclosed by the survey. Two of large areal extent were tested by trenching which revealed graphitic slate. It seems likely that the anomalies tested are due to potentials associated with the graphitic slate and are of no economic interest. Some of the self-potential anomalies not yet tested may be due to sulphide mineralisation of economic importance and testing is recommended.

Two strong magnetic anomalies were found in the southern part of the field in an area occupied by serpentine. The strongest was tested by surface trenching and by a diamond drill hole. Low grade nickel-chromium mineralisation associated with magnetite was revealed by the testing. Further investigation of the serpentine belt is recommended.

1. INTRODUCTION.

The North Dundas copper-nickel field is situated about 5 miles north-east of Zeehan, Tasmania. Access to the area may be gained by the Emu Bay Railway from Zeehan and by a road made on an old tram track branching to the west off the road from Zeehan to Renison Bell (see Plate 1).

Mining and prospecting work have been carried out in the area at intervals during the past sixty years. Nine separate ore-bodies have been found over a length of 1¾ miles. Each ore-body was comparatively short and narrow and was proved only to shallow depths. Some of the ore-bodies had a high copper-nickel content. Several small lead ore-bodies have also been found in the North Dundas field.

In 1928, the central and northern parts of the area were surveyed by the Imperial Geophysical Experimental Survey, as part of a programme to test various geophysical methods. Following this survey, trenching and diamond-drilling were done to test the geophysical indications and the success of this work contributed to the renewed activity in the northern part of the field during the succeeding years.

In 1950, Montana Silver Lead N.L. became the holder of all mining leases in the Cuni area and Eagle Metals and Industrial Products Pty. Ltd. secured an option over the field from Montana Silver Lead N.L. for a limited period. The renewed interest in the field resulted in the preparation by the Department of Mines, Tasmania, of a Summary Report (Dept. Mines, Tas., 1952) concerning the earlier mining activities and drilling results. This was followed by an application to the Bureau of Mineral Resources, Geology and Geophysics for a geophysical investigation over an area approximately 7,000 feet from the Emu Bay Railway to the north and 1,000 feet from east to west. This work was done in two periods, i.e. May to June, 1952 and December, 1952 to March, 1953. The work done during these two periods has been described by Keunecke (1952, 1953).

In 1953, Eagle Metals and Industrial Products Pty. Ltd. relinquished the option after some drill holes had been put down to test the geophysical results. Drilling was resumed in 1955 by Montana Silver Lead N.L. Application was made to the Bureau of Mineral Resources by Montana Silver Lead N.L. for a further geophysical survey over an area approximately 2,000 feet by 1,800 feet to the south of the area covered by the 1952 and 1953 surveys.

This work, as well as the easterly extensions of seven traverses of the 1952 and 1953 surveys, was done in October, 1956, by Dr. J. Horvath and in March-May, 1957, by M. J. O'Connor. The surveying was done by E. Sedmik, geophysicist of the Bureau of Mineral Resources. Field assistants were provided by Montana Silver Lead N.L.

2. GEOLOGY.

The geology of the area has been described elsewhere (see Dept. Mines, Tas., 1952, Taylor & Burger, 1952 and Keunecke, 1952) and reference should be made to these reports.

3. METHODS.

The methods used in this survey were self-potential and magnetic, which have been described by Keunecke (1953) and by Edge and Laby (1931).

Previous experience has shown that the most suitable geophysical methods of detecting the copper-nickel ore of this area are the electromagnetic methods (Keunecke, 1953), but self-potential methods were also effective. Electromagnetic work was not done on this survey because suitable equipment was not available at the time, and the work was restricted to self-potential and magnetic methods.

Self-potential work was done with a Cambridge pH-meter using non-polarising electrodes. A Watts vertical force variometer was used for the magnetic work.

4. WORK DONE.

(a) Southern Area.

Self-potential work was done along nineteen traverses, of length from 2000 to 2700 feet, spaced 100 feet apart. At the northern end of the area (HF to 500S) six intermediate traverses of length 400 to 1000 feet were added. Readings were taken every 25 feet along the traverses. The traverses are shown on Plate 2.

Magnetic readings were taken, generally at 50-foot intervals, along traverses 300S, 350S and 700S to 1400S.

(b) Eastern Extensions.

Self-potential work was done at 25-foot intervals from approx. 800E to 2800E along traverses HC, HD, N, O, AC, AX and AY and from approx. 1400E to 2000E along traverses L, M, P and Q (see Plate 1).

Magnetic readings were taken, generally at 50-foot intervals, along traverses O and AX and at 25-foot intervals along traverse AC.

5. RESULTS OF SURVEY.

(a) Southern Area.

(i) Self Potential.

The self-potential contours are shown on Plate 2. The main features to be noted are -

1. The large, well-defined negative anomaly on the western side of the area extending from traverses 300S to 1400S. This anomaly strikes approx. north, which is the predominant strike of the anomalies found in the northern area in the 1952 and 1953 surveys.

The soil in the vicinity of 700S/250W to 150W and 1100S/150W to 50W was removed by a bulldozer and graphitic slate was exposed in both sections.

2. The relatively narrow, negative anomaly between traverses 250S and 400S from 200E to 1100E. This anomaly is quite intense (approx. 600 millivolts) and is the only self-potential anomaly recorded in the copper-nickel area with an easterly strike.

3. The small narrow anomaly striking north between traverses 200S and 00 in the vicinity of 600E and the strike changing to north-west between traverses 00 and HF. This north-west striking anomaly lines up with an anomaly of the same strike near the Nickel Reward shaft, which is about 400 feet north-west of HF/425E.

4. A small north-striking negative anomaly centred on traverse 500S at 1300E

The remainder of the area surveyed shows no marked self-potential anomalies. There is a slight positive gradient in the self-potential values with a maximum in a south-easterly direction.

(ii) <u>Magnetic</u>.

A magnetic contour plan of the anomalies in the southern area between traverses 900S and 1300S is shown on Plate 3.

There are two magnetic anomalies which are roughly parallel, striking north-north-east; the smaller anomaly with a maximum of approx. 1,500 gamma at 1200S/1775E; the larger one with a maximum of approx. 4,000 gamma at 1200S/1850E. These are the only anomalies of magnitude greater than about 300 gamma that have been detected in the copper-nickel area. No significant self-potential anomalies were found at the location of these two magnetic anomalies.

The magnetic work in other parts of the southern area showed that there is a positive gradient in a westerly direction of approx. 100 gamma per 100 feet. A small anomaly (approx. 100 gamma) was found on traverse 300S with a maximum about 1025E-1050E and a minimum about 925E.

(b) <u>Eastern Extension</u>.

(i) <u>Self Potential</u>.

The self-potential profiles are shown on Plate 4 for the eastern extension of selected traverses of the 1952-53 surveys.

A negative anomaly of the order of 200 millivolts was measured on traverses HC and HD which are 100 feet apart. The anomaly is smooth in shape and extends from 200 feet to 300 feet along the traverses. The minima are centred about 1600E-1625E and 1575E on traverses HC and HD respectively.

The most intense self-potential anomalies so far measured in the copper-nickel area were found in the vicinity of the abandoned McKimmie's mine, along traverses L, M, N, O, P and Q. Along these traverses, between approx. 1500E and 2000E there are two negative anomalies which strike roughly north. These anomalies are shown also on the self-potential contour plan on Plate 5. Two other anomalies with negative centres at 2175E, 2275E and 2200E, 2260E respectively were observed on traverses N and O (see Plate 4).

Along traverse AC there are three well-defined negative anomalies; the largest (of order 650 millivolts) is centred about 1950E, and two smaller ones are centred about 1475E and 2475E respectively.

The self-potential values along traverses AX and AY are much disturbed, especially between 1300E and 2000E.

Discussion of Results.

Self Potential Results.

Southern Area.

Four anomalies numbered 1 to 4 have been described in the preceding section and will be considered in that order.

Anomaly No. 1 has been tested to a limited extent by a bulldozer on traverses 700S and 1100S. The anomaly is extensive and it seems likely that it is due to potentials associated with graphitic slate similar to that revealed by the bulldozer.

The other three anomalies (2 to 4) have not been tested. Anomalies 2 and 3 are long and narrow and the features giving rise to them are evidently of similar form. They may be due to sulphide bodies but this can be determined only by testing. Anomaly 4 is of restricted size but limited testing may be warranted; it may be due to sulphide mineralisation.

Eastern Extension.

The large anomalies on traverses L to Q between 1500E and 2000E occur in the Dundas sediments. Trenching carried out on traverse N between 1800E and 1900E showed only graphitic slate with no visible sulphide mineralisation. It is likely that these self-potential anomalies are caused by graphitic slate with which may be associated local sulphide mineralisation. Soil samples have been taken over the area but have not been analysed yet. If the assays reveal significant amounts of lead or copper further testing may be warranted. The strong self-potential anomalies on traverse AC and on traverses AX and AY to the north suggest geological conditions similar to those at McKimmie's Prospect and may be due to lead mineralisation in Dundas sediments; possibly a southern extension of the Lead Blocks deposit. This, however, can be determined only by suitable testing.

Magnetic Results.

Two strong magnetic anomalies in the southern area (Plate 3) are of particular interest. A trench dug at 1850E on traverse 1200S revealed limonitic and siliceous material in strongly weathered serpentine. Six soil samples taken over the area of the magnetic anomalies and a sample from the trench gave relatively high nickel values on analysis. The results of the magnetic survey and the assays of the soil samples were given to the Company, which decided to test the more intense of the two magnetic anomalies by diamond drilling. The drill hole (M23) on traverse 1200S at approximately 1900E was drilled to the west in the direction of the traverse (262° magnetic) at an angle of depression of 45°.

The drill hole showed a different type of nickel mineralisation from that in the known deposits. The nickel is not associated with copper-sulphides in or adjacent to a dolerite dyke, but with magnetite in serpentine. The nickel content is low, ranging up to only 0.36 percent. Two samples of core were assayed for chromium and the chromium content is somewhat higher than the nickel. The nickel and chromium seem to be closely associated with magnetite and bodies rich in magnetite can be detected readily by a magnetic survey.

Although the nickel mineralisation revealed by drill hole M23 is not of economic grade, the magnetite-rich body in which it is found is of relatively large dimensions. It is believed that the discovery is important because it indicates the possibility that similar bodies rich in magnetite but with a higher nickel content may exist within the serpentine belt and that these might be detected by a magnetic survey.

After the drilling had revealed the close association of magnetite and nickel in this deposit, samples were taken from several places in the serpentine belt; especially from limonitic outcrops. The samples assayed by the Mines Department Laboratory, Launceston, revealed fairly wide-spread nickel mineralisation, values ranging from 0.10 percent to 0.40 percent.

In the light of this evidence it would seem that further prospecting for nickel in the Serpentine belt by geological, geophysical and geochemical methods would be warranted to determine whether ore bodies of payable grade and quantity can be found.

6. CONCLUSIONS AND RECOMMENDATIONS.

The geophysical survey revealed several self-potential anomalies and two intense magnetic anomalies. Two of the self-potential anomalies have been tested by trenching. The trenching revealed graphitic slate which is believed to be the cause of the anomalies tested. It is possible that some of the self-potential anomalies not yet tested may be due to graphitic slate possibly with associated lead and pyrite mineralisation. Some may, however, be due to sulphide deposits of economic importance but this can be determined only by testing.

It is recommended that the remaining self-potential anomalies be tested in the first place by trenching and if warranted by the result of this testing, by diamond drilling.

Testing of the most intense magnetic anomaly by trenching and a diamond drill hole revealed extensive low-grade nickel and chromium mineralisation in close association with magnetite in serpentine. This type of mineralisation was not previously known in this area. A limited amount of surface sampling indicates that nickel mineralisation is widespread in the serpentine belt and in view of the ease with which magnetite-rich bodies can be detected by magnetic methods it is considered that further magnetic surveys would be warranted. A geological survey would be needed in the first place to outline the most favourable areas for a magnetic survey.

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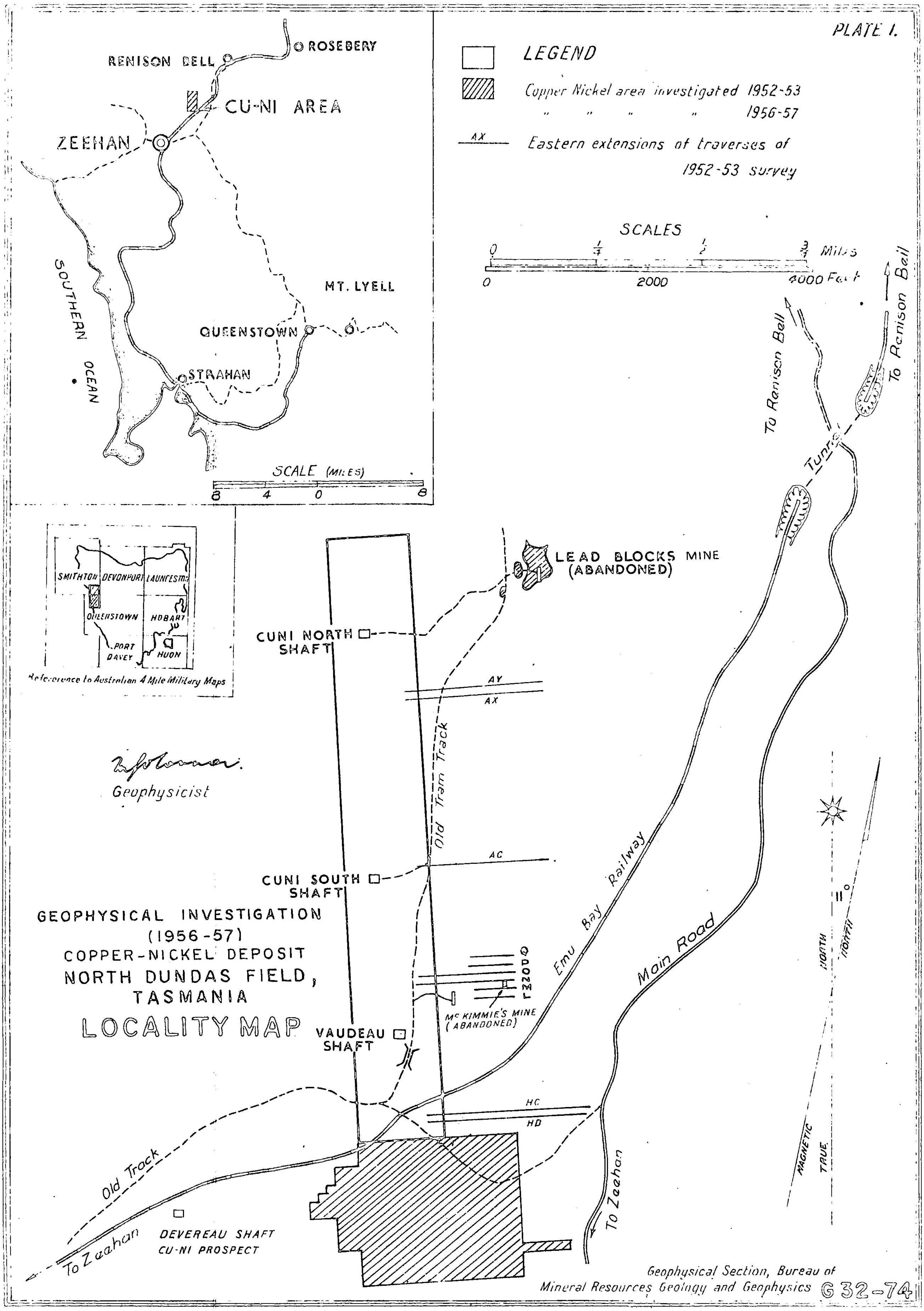


PLATE I.
LEGEND
Copper Nickel area investigated 1952-53
" " " " 1956-57
AX
Eastern extensions of traverses of 1952-53 survey
SCALES
0 1/4 1/2 3/4 Miles
0 2000 4000 Feet
RENISON BELL
ROSEBERY
CU-NI AREA
ZEEHAN
SOUTHERN OCEAN
MT. LYELL
QUEENSTOWN
STRAHAN
SCALE (MILES)
8 4 0 8
SMITHTON
DEVONPORT
LAUNCESTON
QUEENSTOWN
HOBART
PORT DAVEY
HUON
Reference to Australian 4 Mile Military Maps
To Renison Bell
To Renison Bell
Tunnel
LEAD BLOCKS MINE (ABANDONED)
CUNI NORTH SHAFT
AY
AX
Old Tram Track
Geophysicist
AC
CUNI SOUTH SHAFT
Emu Bay Railway
Main Road
GEOPHYSICAL INVESTIGATION (1956-57)
COPPER-NICKEL DEPOSIT
NORTH DUNDAS FIELD, TASMANIA
LOCALITY MAP
McKIMMIE'S MINE (ABANDONED)
VAUDEAU SHAFT
HC
HD
11°
NORTH
NORTH
MAGNETIC
TRUE
Old Track
To Zeehan
To Zeehan
DEVEREAU SHAFT
CU-NI PROSPECT
Geophysical Section, Bureau of Mineral Resources Geology and Geophysics
G 32-74

GEOPHYSICAL INVESTIGATION (1956-57), COPPER-NICKEL DEPOSIT,
NORTH DUNDAS FIELD, TASMANIA

(SOUTHERN AREA)

SELF-POTENTIAL CONTOURS

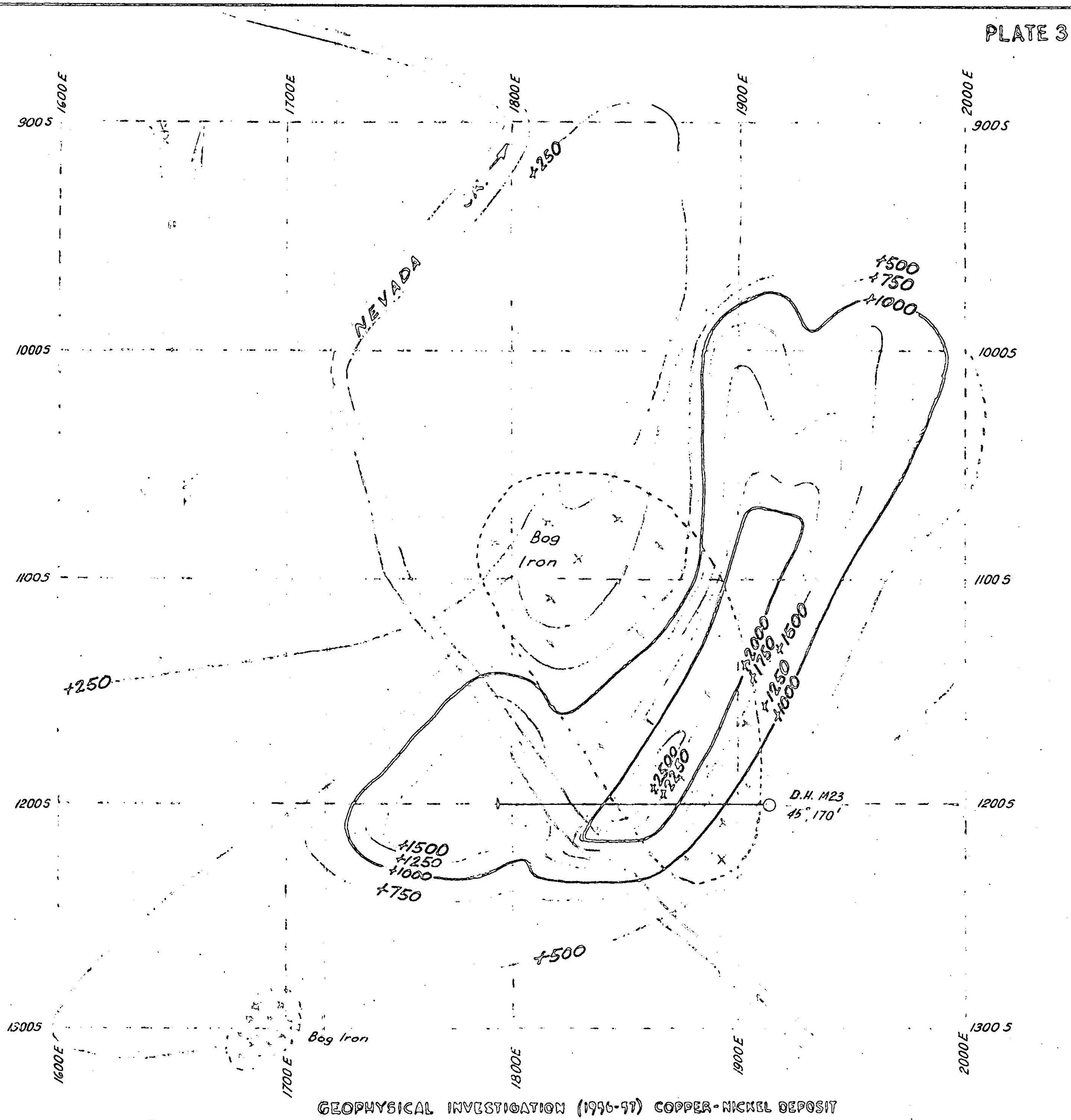
CONTOUR INTERVAL 50 MILLIVOLTS

SCALE IN FEET

GEOPHYSICIST

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics G32-78

PLATE 3



GEOPHYSICAL INVESTIGATION (1956-57) COPPER-NICKEL DEPOSIT
NORTH DUNDAS FIELD, TASMANIA

MAGNETIC CONTOURS

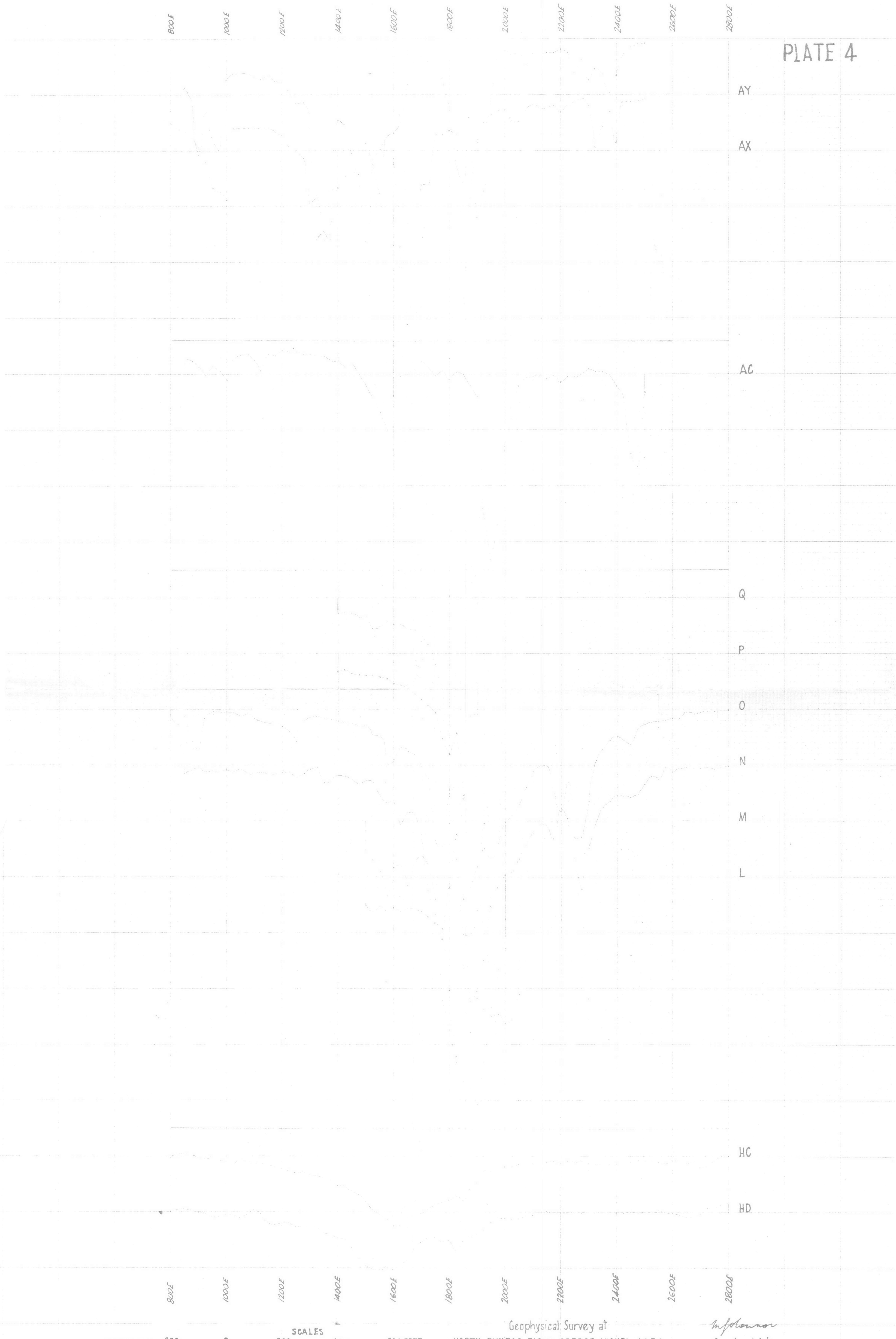
GEOPHYSICIST

CONTOUR INTERVAL 250 GAMMA

SCALE OF FEET

50 25 0 50 100 150

Geophysical Section, Bureau of Mineral Resources. G32-76



SCALES

HORIZONTAL 200 0 200 400 600 FEET
VERTICAL 200 0 200 400 600 MILLIVOLTS

TRAVERSE SEPARATION SCALE: 100 FEET TO 1 INCH.

Geophysical Survey at
NORTH DUNDAS FIELD COPPER-NICKEL AREA,
Near Zeehan, Tasmania

SELF-POTENTIAL PROFILES.

Geophysicist.

G32-79

GEOPHYSICAL INVESTIGATION (1956-57) COPPER-NICKEL DEPOSIT

NORTH DUNDAS FIELD, TASMANIA

SELF-POTENTIAL CONTOURS

(M^c KIMMIE'S AREA)

GEOPHYSICIST

CONTOUR INTERVAL 50 MILLIVOLTS

Geophysical Section, Bureau of Mineral Resources Geology and Geophysics