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Geophysical Surveys at Mount Hope, N.S.W.

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C O N T E N T S

LIST OF PLATES

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOPHYSICAL SURVEYS AT MOUNT HOPE, N.S.W.

RECORD 1951, NO.12.

I. INTRODUCTION

Mount Hope, a small town in Central New South Wales, is south of and 101 miles by main road from Cobar, and 11 miles north of the Matakana siding on the Sydney-Broken Hill railway line. (Plate G87-1).

The ores mined in the Mount Hope district have been mainly those of copper, the principal mines being the Mount Hope mine, close to the town, and the Great Central and Comet mines, three miles further south. At present, the only mine in production is the Mount Hope mine, where the leaching process is being used by the Caroline Copper Mines.

At the request of North Broken Hill Ltd., geophysical surveys were carried out on two areas:- (1) the Mount Hope mine area, and (2) the Comet Mine area. The field work was commenced in May, 1950, and occupied three months.

II. GEOLOGY

The following geological summary has been taken mainly from reports by Fisher (1942 a,b).

(1) Mount Hope Mine Area (Plate G87-2)

The Mount Hope Mine is situated close to the town and on the crest of a low ridge, 80 to 100 feet above the general level of the district. The country rock consists of shales, phyllites and sandstones, which, according to Lloyd (1938), are of Silurian age and identical with the Cobar, Canbelego and Nymagee Series. The strike of the beds ranges from 0 to 10 degrees east of north and the dip from 75 degrees west to vertical, except in the immediate vicinity of the ore-body, where steep easterly dips are common.

A strong band of massive sandstone up to 20 feet or more in thickness outcrops along the crest of the ridge on which the mine is situated. A fold in the sandstone band west of the mine indicates that a displacement of the beds has occurred and this movement has apparently caused extensive shearing in the less competent beds of shale and mudstone. The shear zone is visible on the surface for nearly 400 feet north-north-east from the open cut and is characterised by tiny quartz veins filling the fractures and by some iron staining and silicification.

The mineralisation occurs within the mass of sheared country immediately to the east of the sandstone band. The mineralised sections are not in the nature of well-defined lodes and are described by Fisher as aggregations of small veins and streaks occupying fracture, shear and bedding planes. The maximum dimensions of the ore-bearing ground are, vertical thickness 360 feet, length 270 feet and width 90 feet. The primary mineral is almost exclusively chalcopyrite with practically no pyrite or other metallic sulphide. The principal minerals in the oxidised zone are malachite, azurite, chalcanthite and cuprite.

(2) Comet Mine Area (Plate G87-4)

The Comet mine is 3 miles south of Mount Hope township and half a mile west of the main Cobar road, and is situated on a ridge rising 250 feet above the general level of the plain.

As in the Mount Hope mine area, the country rock consists of beds of slates, phyllites and sandstones, which dip steeply and strike north and are probably identical with the Cobar Series. The ridge where the Comet lode outcrops is one of a series of quartz-felspar-porphyry intrusions, which are elongated parallel to the strike of the sedimentary beds and form prominent hills and ridges west of the main road. On the western side of the ridge, rhyolite outcrops and there is a zone of contact breccia between it and the porphyry. The presence of shale inclusions in the breccia suggests that there was originally a contact between the sedimentaries and the rhyolite and that the intrusion by the quartz-porphyry occurred along this contact.

The Comet lode is a fissure vein striking 8 degrees east of north and dipping 80 degrees west to vertical. The lode is generally from 1 to 3 feet wide and is exposed for a length of over 500 feet. It is characterised by the presence of a little shale caught up in the porphyry along the fissure. About 30 feet west of the main lode a short parallel or branch vein is exposed on the surface. Both lodes have been mined in the past.

The Comet shaft has been burnt out and all the levels except the 44 ft. or adit level are now inaccessible. Fisher's description of the workings is mainly based on an old prospectus report, according to which the mining was mainly confined to the oxidised ores, although a sulphide lode 6 feet wide was said to have been exposed in a drive on the 210 ft. level, (the lowest level, now below water). Fisher reports that the minerals observed in the adit are mainly green carbonate minerals and that marcasite and pyrite were identified in a fragment on one of the dumps.

III. GEOPHYSICAL METHODS

The magnetic and self-potential methods were used in the Mount Hope surveys. The choice of these methods was largely based on the experience of previous geophysical surveys, which showed that many of the ore-bodies in the Cobar Region were detectable by reason of associated magnetic and/or self-potential anomalies.

The geophysical layouts on the two areas are shown on Plates G87-2 and G87-4. On the Mount Hope mine area no traverses were read between traverses 144 and 150 owing to the presence of dumps, scrap iron, buildings and an open cut. Readings of the magnetic vertical force were carried out with two Watts variometers and self-potential measurements were made with a modified Cambridge Ph meter. Stations were usually at 50 feet but occasionally at 25 feet intervals.

IV. RESULTS AND INTERPRETATION

(1) Mount Hope Mine Area.

The self-potential and magnetic results are shown in the form of profiles on Plate G87-3. Although readings could not be obtained immediately over the known ore-body, the results from traverses immediately north and south are sufficient to indicate that there are no strong self-potential or magnetic effects due to the ore-body. It is concluded that the ore-body contains little or no magnetic mineral and that, probably owing to a general absence of pyrite, the oxidation of the ore is not sufficiently active to produce appreciable self-potential effects.

The small sporadic peaks on the magnetic profiles are mainly due to scrap iron or ironstone near the surface.

North and south-east of the mine, self-potential anomalies of limited areal extent were observed. These are shown in the plan on Plate G87-2. These anomalies are only of appreciable magnitude along the axes, which are shown marked on the plan. It was noticed that veins of quartz outcrop in and near the areas where the anomalies occur, and the observed effects may be due to oxidising sulphides associated with the quartz veins, but it is clear that the anomalies cannot be taken to indicate mineralisation extending appreciably in depth.

(2) Comet Mine Area.
(a) Magnetic Method.

Results of the survey show that the magnetic field is undisturbed in the vicinity of the Comet lode but that there are two magnetic anomalies in the northern part of the area (Plates G87-5 and G87-7). These anomalies are prominent in an otherwise fairly uniform field and are elongated in a direction approximately parallel to the strike of the sedimentaries. The general form of the anomalies suggest two tabular, steeply dipping magnetic bodies and it seems reasonable to assume the existence of two, more or less separate, fissure veins containing either magnetite or pyrrhotite, and located along the axes of the magnetic anomalies. The western anomaly could be due to a northerly extension of the Comet lode, as the axis of this anomaly is in the line of the axis of the self-potential anomaly (referred to below) associated with the Comet lode.

There is no record of the occurrence of magnetic minerals in the Comet lode. A large number of samples taken from the quartz-porphyry, rhyolite, breccia and sedimentaries were tested for magnetic properties but were all found to be non-magnetic, with the exception of one specimen. This was taken from a dump near two shallow shafts situated at approximately 160, 52 (grid co-ordinates), and may be described as a sandstone inclusion in quartz-porphyry, impregnated with copper carbonate and iron oxides. The results of the tests carried out on the rock samples are useful in that they show that the observed anomalies must be due to well-defined mineralised bodies occurring in otherwise completely non-magnetic rocks.

The observed profiles have been compared with theoretical profiles calculated for thin, vertical, magnetic sheets at different depths, and on this basis it has been estimated that the depths below the surface of the eastern and western magnetic bodies are respectively 100 feet and 200 feet approximately. These are average depths to the upper limits of the bodies and the depths will be less than these figures at the peaks of the anomalies, that is, on line 160 for the eastern anomaly and on line 154 for the western anomaly.

(b) Self-potential Method.

Two self-potential anomalies were observed on the Comet area:- one, in the northern part of the area, of only moderate intensity and small extent and situated between the axes of the two magnetic anomalies, the other, a strong and extensive anomaly apparently associated with the Comet ore-body. (Plates G87-6, G87-7).

The northern self-potential anomaly is probably significant when considered in relation to the magnetic anomalies and may be caused by oxidising sulphides in a branch fissure between the two main fissure veins indicated by the magnetic anomalies.

There is little doubt that the second and more important self-potential anomaly is caused by the oxidation of minerals in the Comet lode. The position of the anomaly and the form of the

contour pattern strongly support this view. Furthermore, it is known that the Comet lode contains pyrite and that therefore conditions should be favourable for the production of self-potential effects. The anomaly extends well beyond the previously known northern limits of the lode and indicates a probable extension of the lode for a distance of 300 to 400 feet north of the Comet shaft.

The observed profiles along the traverses near the centre of the anomaly have been compared with theoretical profiles calculated for a thin, vertical, electrically polarised body at various depths, assuming infinite depth extent and a length of 500 feet. It was concluded that the upper limits of the body causing the anomaly lie between 150 and 200 feet below the level of the collar of the Comet shaft. A depth within these limits would be consistent with the depth of oxidation as indicated approximately by the little information now available on the Comet workings.

The actual centre of the anomaly, as defined by the - 200 millivolt contour lies to the west of the main Comet lode, and its axis coincides with the west branch lode. The contours appear to indicate that this lode extends for another 200 feet north of its previously known limits.

The contour pattern of the whole anomaly appears to be due to the combined effects of a considerable northerly extension of the main Comet lode and a shorter northerly extension of the west branch lode.

V. CONCLUSIONS & RECOMMENDATIONS

On the Mount Hope mine area the magnetic method gave no significant results, and with the self-potential method, only minor anomalies of doubtful significance were observed.

In the Comet mine area, however, strong magnetic and self-potential indications were observed and the results will provide definite targets for any future drilling undertaken in the search for additional ore-bodies in this area. If such drilling is carried out the aim should be to test for the following probable ore occurrences :-

(i) An extension of the main Comet lode northwards along the axes of the main self-potential and the western magnetic anomalies.

(ii) A fissure lode along the axis of the eastern magnetic anomaly.

(iii) A northerly extension of the Comet branch lode.

VI. ACKNOWLEDGMENTS.

The field work at Mount Hope was carried out by the writer with the assistance of J. Quilty (geophysicist) and D. Harris (field assistant). The greater part of the necessary surveying was undertaken by surveyors of North Broken Hill Ltd.

VII. REFERENCES.

Fisher, N. H., 1942 a - Geological Report on the Mount Hope Copper Mine, Mount Hope. Miner. Res. Surv. Rep. 1942/23.

Fisher, N. H., 1942 b - Geological Report on the Great Central Copper Mine, Mount Hope. Miner. Res. Surv. Rep. 1942/21.

Lloyd, A. C., 1938 - Geological Survey of the Cobar District, Annu. Rep. Dep. Min. N.S.W. 1937, 121.

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7/10/51.

Distribution :

1. Under Secretary, Department of Mines, Sydney.
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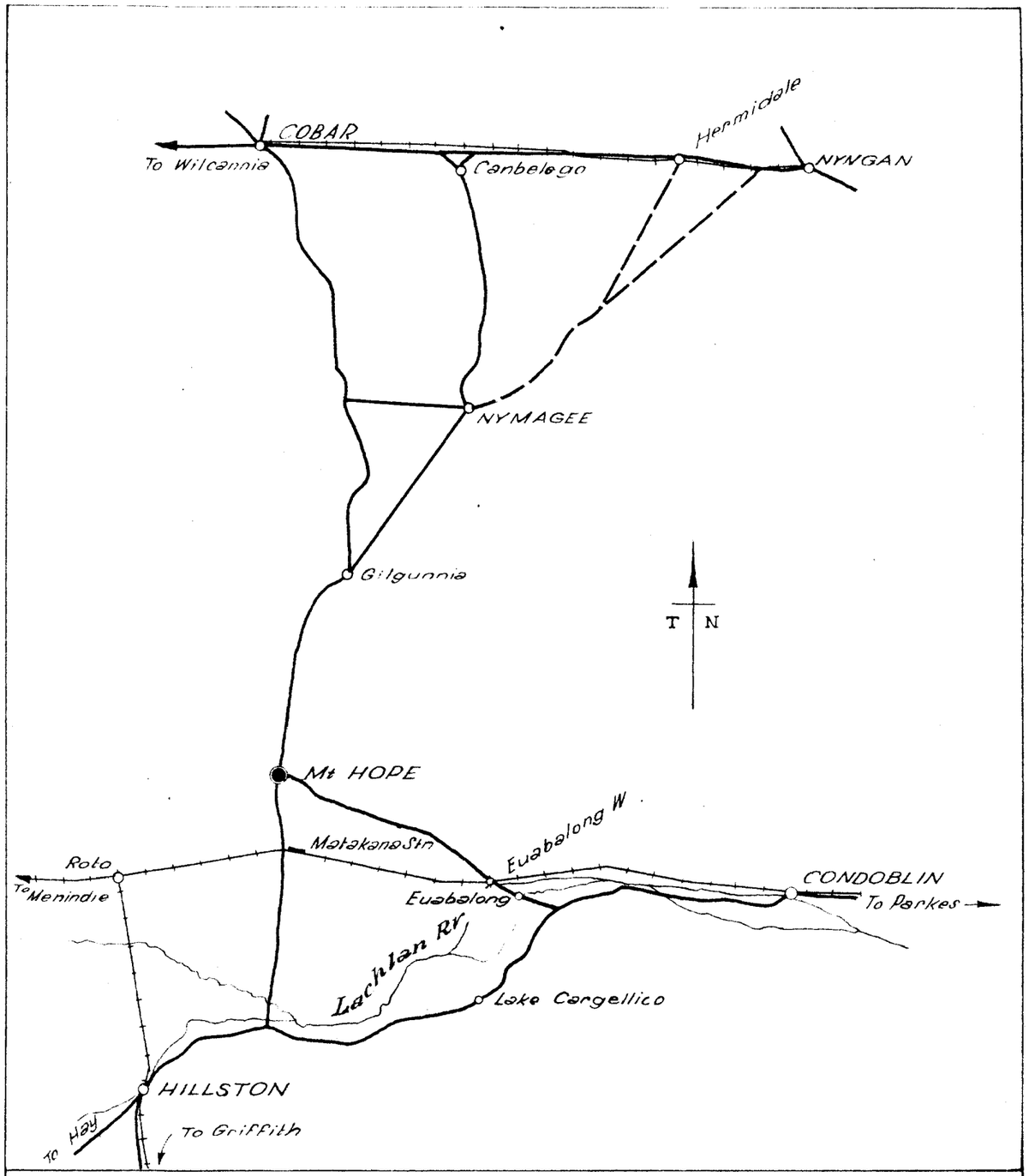
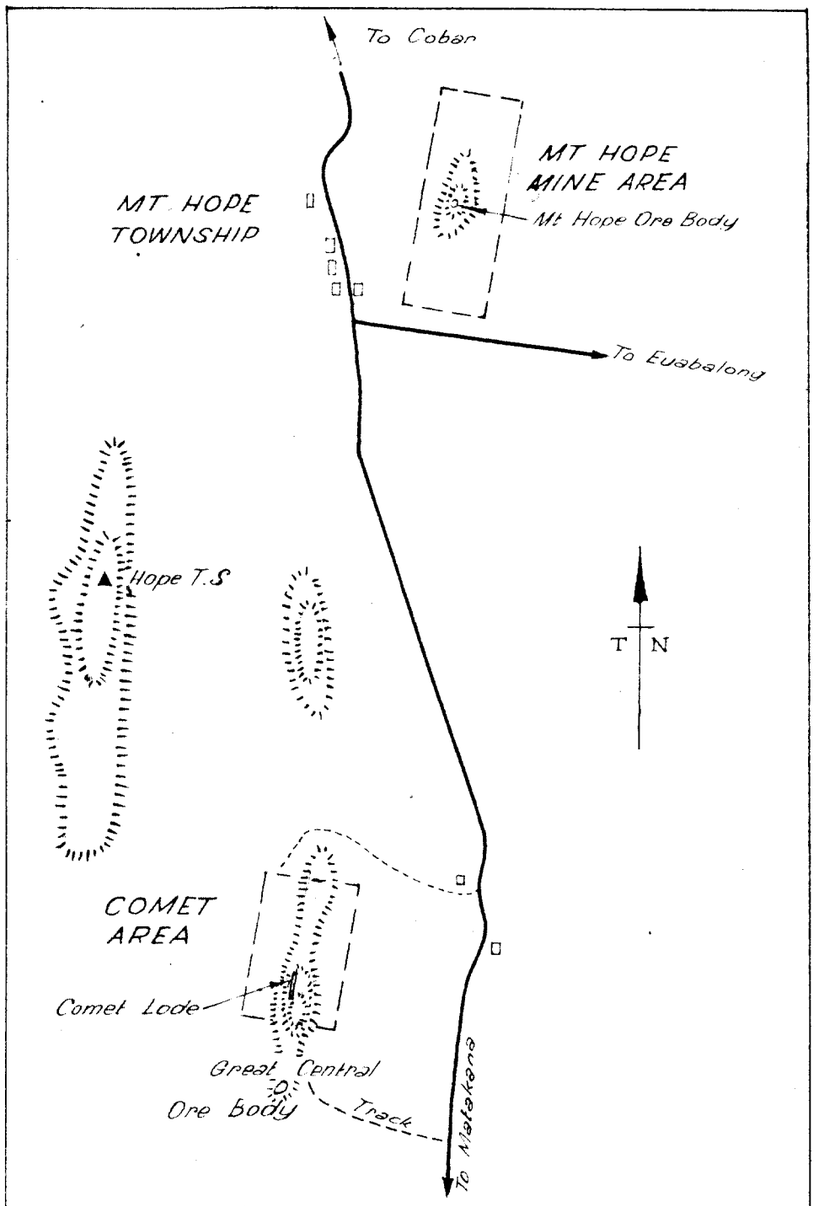


LOCALITY PLAN



SKETCH MAP MT. HOPE DISTRICT

SCALE

1/2 0 1/2 1 MILES

GEOPHYSICAL SURVEY AT MT. HOPE N.S.W.

LOCALITY PLAN & SKETCH MAP MT. HOPE DISTRICT

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G 87 – 1

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43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58

166 164 163 162 161 160 159 158 157 156 154 152 150 144 143 142 141 140 139 138 137 136 134 132 130

PORTION 1
(B Mc. LERNON)

MAIN SHAFT

OPEN CUT

SOUTH SHAFT

T N

LEGEND

- Slates, Phyllites.
- Massive Sandstone
- Shear Zone
- Ore Bearing Area down to 150 level
- Area of small S.P Anomaly with Area of Anomaly

Geology by N.H. Fisher 1942

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Geophysicist

GEOPHYSICAL SURVEY AT MT. HOPE N.S.W

MT. HOPE MINE AREA

SHOWING

GEOLOGY & TRAVERSES

SCALE

100 0 200 400 600 FEET

G87-2

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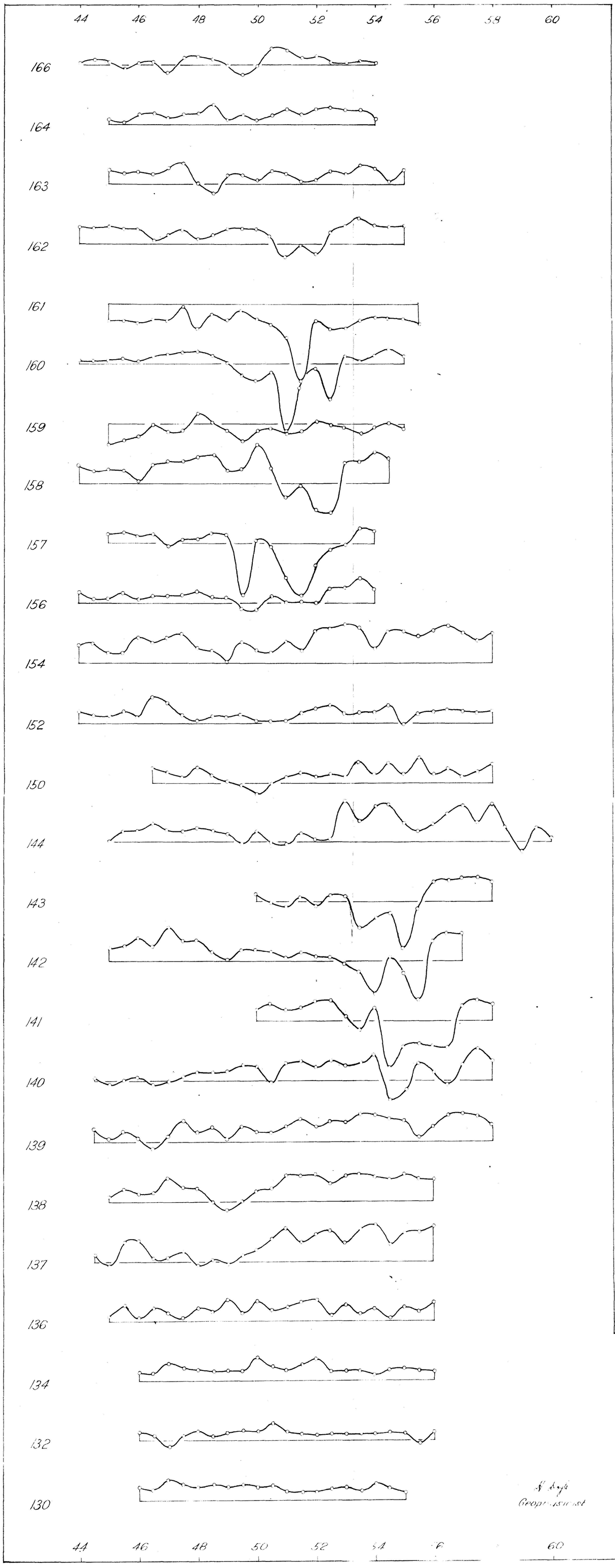

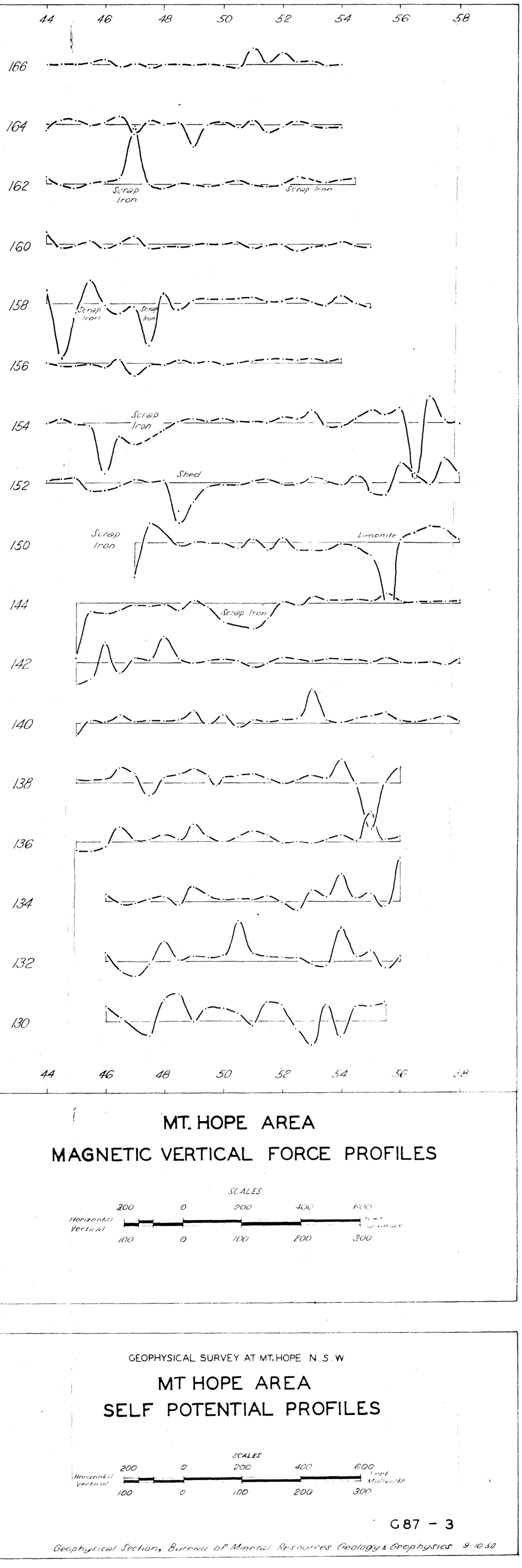

MT. HOPE AREA
MAGNETIC VERTICAL FORCE PROFILES

SCALES

Horizontal 200 0 200 400 600 Feet
Vertical 100 0 100 200 300 Millivolts

GEOPHYSICAL SURVEY AT MT. HOPE N.S.W

MT HOPE AREA
SELF POTENTIAL PROFILES

SCALES

Horizontal 200 0 200 400 600 Feet
Vertical 100 0 100 200 300 Millivolts

G87 - 3

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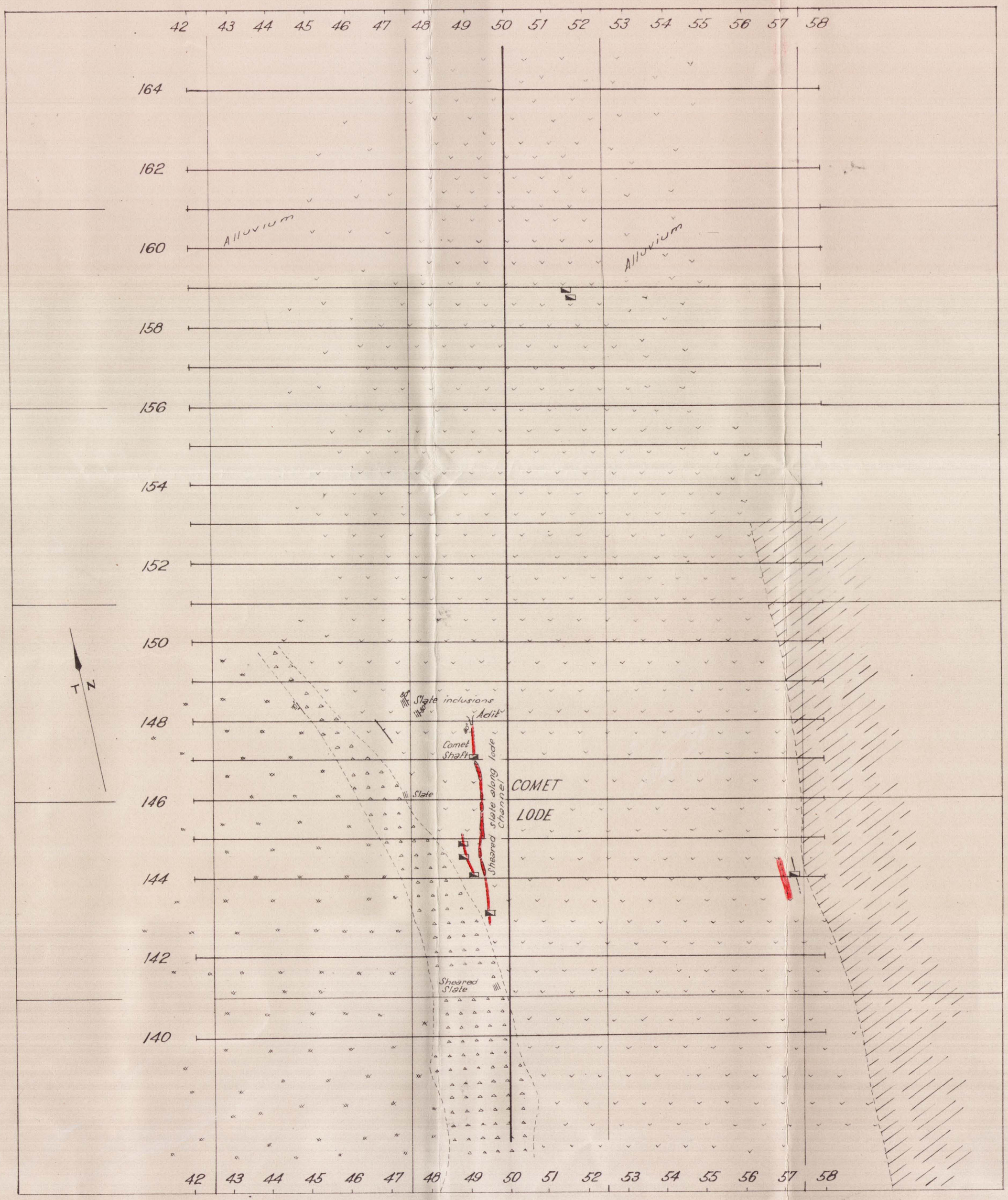

LEGEND

- >2% Cu
- Slates, phyllites
- Quartz porphyry
- Contact Breccia
- Rhyolite

Geology by N. H. Fisher 1942

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GEOPHYSICAL SURVEY AT MT. HOPE N.S.W.

COMET AREA

SHOWING

GEOLOGY & TRAVERSES

200 0 200 400 600 Feet

G87-4

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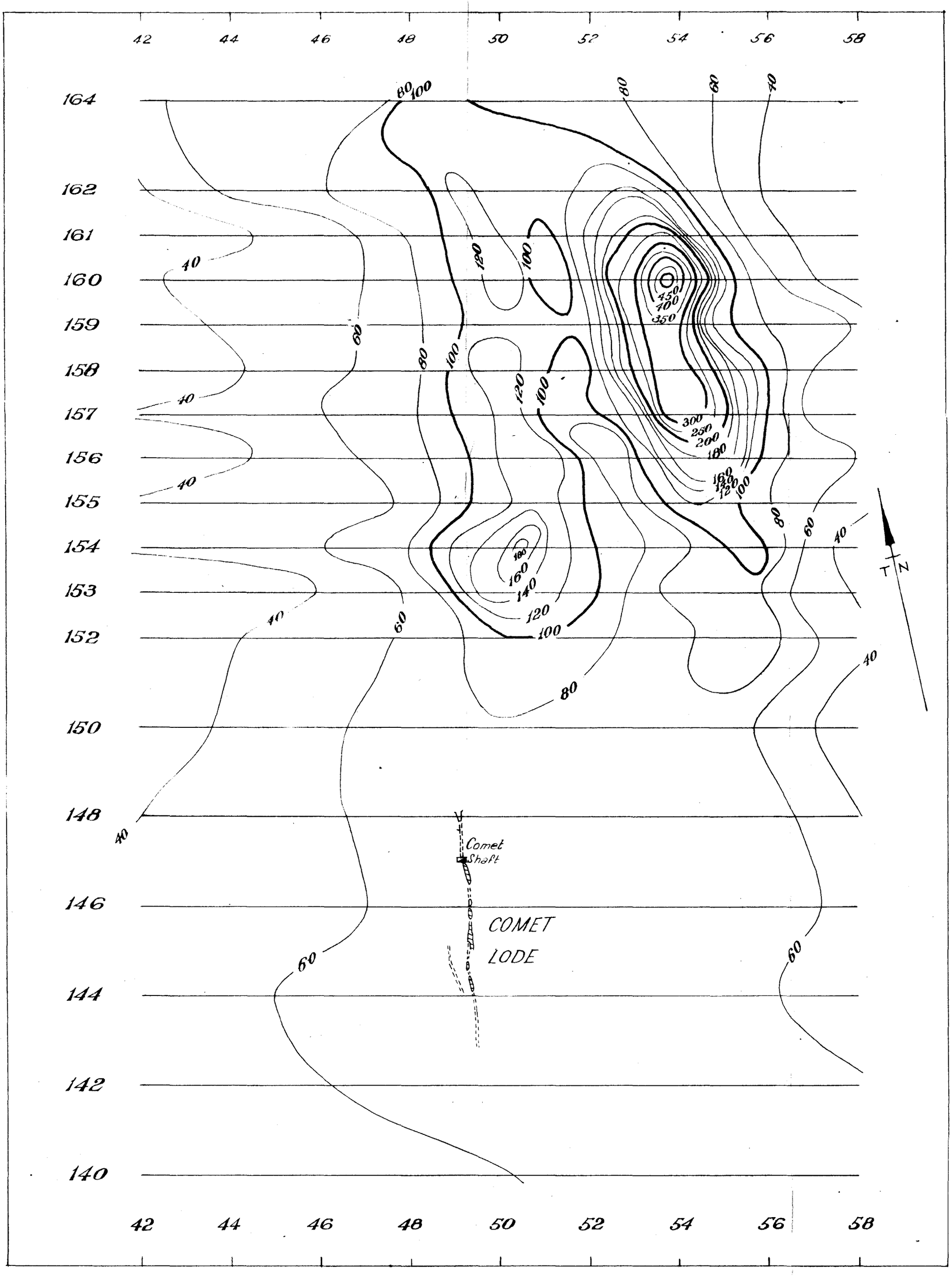
PLATE 4



GEOPHYSICAL SURVEY AT MT. HOPE N.S.W.

COMET AREA

SHOWING

MAGNETIC VERTICAL FORCE CONTOURS

G 87 - 5

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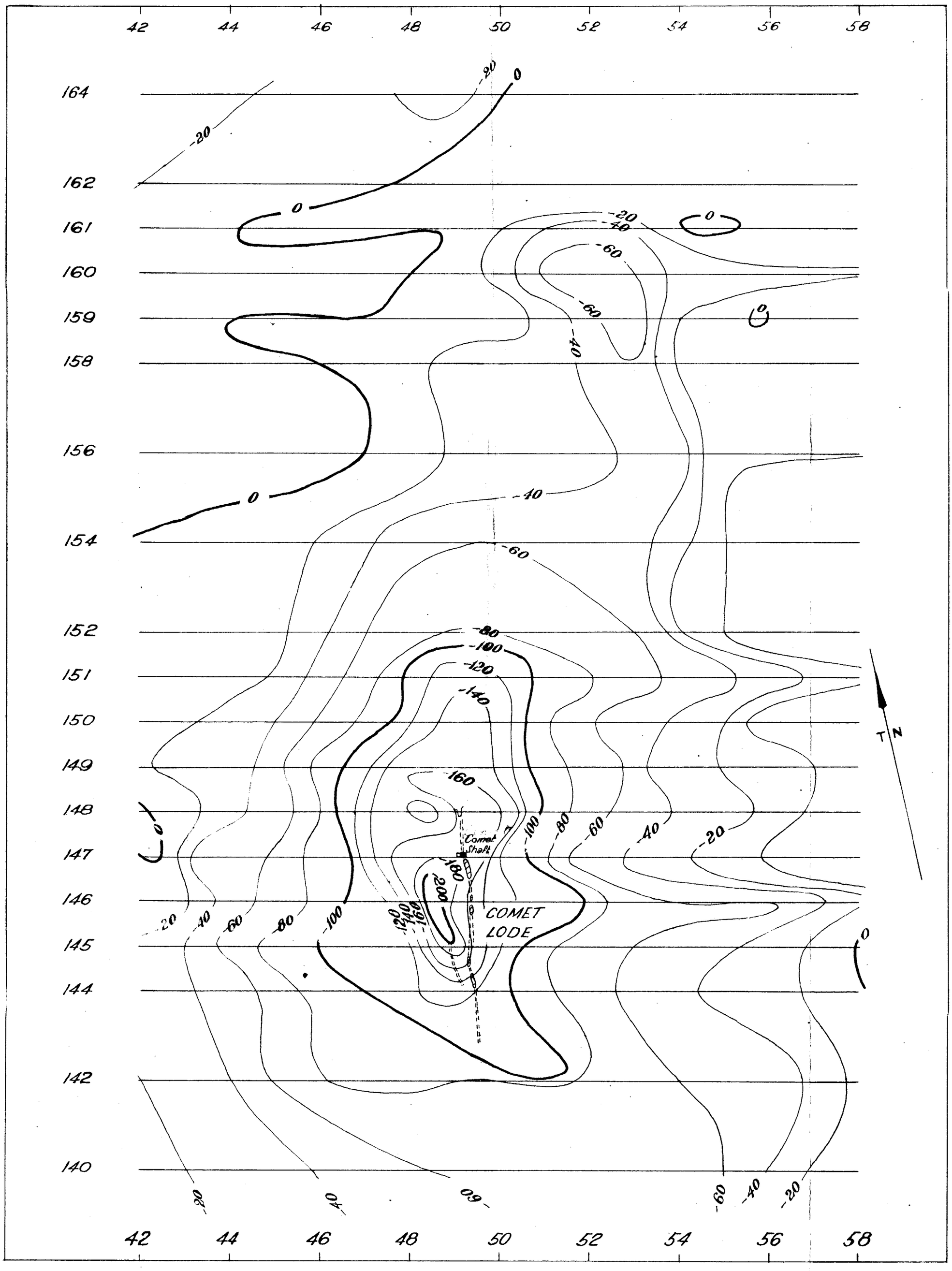
PLATE 5



SCALE

200 0 200 400 feet

Contour interval 20 Millivolts

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Geophysicist

GEOPHYSICAL SURVEY AT MT HOPE N.S.W.

COMET AREA

SHOWING

SELF POTENTIAL CONTOURS

G87-6

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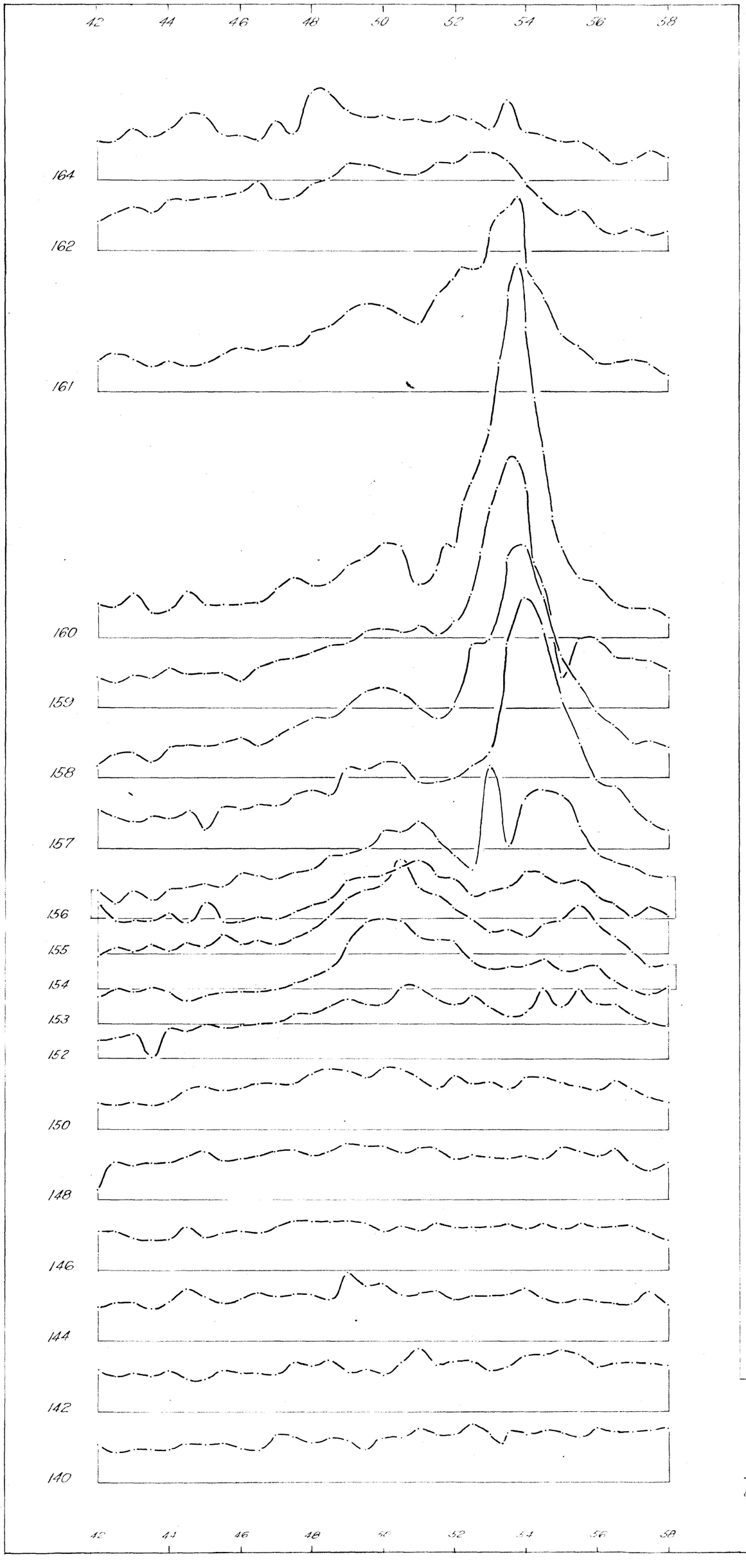
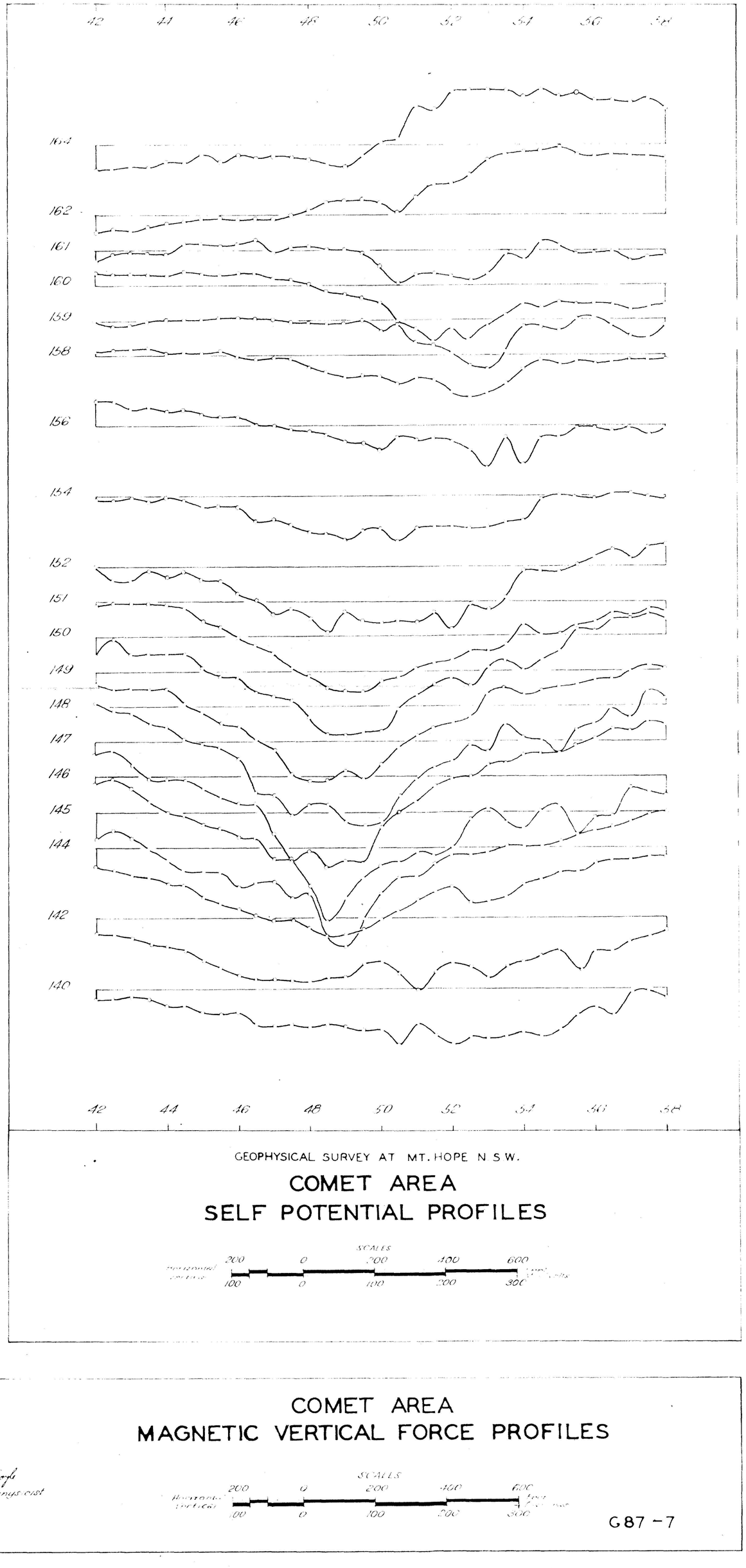
PLATE 6





GEOPHYSICAL SURVEY AT MT. HOPE N.S.W.

COMET AREA
SELF POTENTIAL PROFILES

SCALES

Horizontal 1 inch = 200 feet

Vertical 1 inch = 100 feet

COMET AREA
MAGNETIC VERTICAL FORCE PROFILES

SCALES

Horizontal 1 inch = 200 feet

Vertical 1 inch = 100 feet

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Geophysicist

G87-7

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