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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

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PRELIMINARY REPORT ON A GEOPHYSICAL SURVEY AT RUDDYGORE COPPER DEPOSIT, CHILLAGOE, NORTH QUEENSLAND

by

J. HORVATH

B.M.R. RECORDS.

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ABSTRACT.

A geophysical survey of the area of the Ruddygore Copper Deposit, near Chillagoe, Queensland, was conducted in July and August, 1959.

Magnetic and self-potential methods proved unsuitable, but the electromagnetic method gave indications of medium strength over the known deposit and several weaker indications in the area immediately to the east. About 3,000 feet west of the known deposit, the electromagnetic survey revealed an extensive zone of relatively strong indications, which are probably due to mineralisation.

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1. INTRODUCTION.

A programme of geophysical surveys of selected areas in the Chillagoe Mineral Field was started by the Bureau of Mineral Resources in July, 1959.

The area of the Ruddygore Copper Deposit, situated two miles north-east of Chillagoe township was selected as the first area to be investigated because of its geological significance. The Ruddygore deposit consists of disseminated copper ores in granite. No previous geophysical surveys had been carried out on this type of deposit in the Chillagoe Field, the earlier surveys by the Imperial Geophysical Experimental Survey (Edge and Laby, 1931) and the Bureau (Langron, 1957) having been done in the sedimentary belt.

The survey of the Ruddygore area was commenced on 8th. July, 1959 and lasted, with interruptions for surveys in other parts of the Field, until 24th. August, 1959. The geophysical party comprised M. O'Connor (party leader), R. Stubbs (geophysicist) and three field assistants. The geophysical grid was surveyed and pegged by surveyor W. Darch of the Department of the Interior. The locality of the survey area is shown in Plate 1.

2. GEOLOGY.

The Ruddygore copper deposit is situated on a low range of hills with Mt. Coonbeta just to the northeast of the town being the most prominent one. The hills are surrounded by rather extensive alluvial flats.

An area of many square miles, consisting of several varieties of rocks of granodioritic composition, extends mainly to the east and north of the Chillagoe township. These granitic intrusive rocks comprise granite, granite porphyry, aplite and monzonite. A geological map, taken from Broadhurst (1949), of

the area near the Ruddygore deposit is shown in Plate 1. A more detailed geological map of the Ruddygore area is being prepared by C. Branch of the Bureau's Geological Section, but is not yet available.

According to Broadhurst (1949) the ore deposit is associated with metasomatic alteration of the monzonite. Normal granodiorite is the most common rock type while the monzonite seems to be a local basic variation of the granodiorite. The monzonite is characterised by a decrease in the amount of silica and a smaller grain size of the rock constituents. The monzonite has undergone metasomatic alteration in varying degrees but most intensely at the ore deposit. In the most intensely altered monzonite the ferromagnesian minerals have been converted to chlorite and epidote.

The mineralisation consists of a network of quartz veins with chalcopyrite and bornite following the aureole structure of the monzonite plug. Aplite has intruded the area north of the opencut and seems also to form the innermost core of the plug. The ore deposit was worked mainly between 1903 and 1909 and produced about 30,000 tons of ore with a copper content of 3.9% copper in the handpicked material from the open cut. Three levels were opened up from the main shaft but contributed little to the production as the average copper content was only 0.5 to 1.5% copper. Later two lines of churn drill holes were drilled across the deposit but gave low values of only about 0.5% copper and showed that poor zones existed in the ore body. The project was abandoned because of the low values encountered in these holes, although the overall copper content of the deposit is probably somewhat higher.

3. GEOPHYSICAL METHODS & RESULTS.

Tests were made over the known ore deposit with electromagnetic, self-potential and magnetic methods.

The magnetic method was tried because it was thought that the intense alteration of the monzonite and its more basic composition would produce some slight magnetic anomalies. No correlation, however, could be found between the very weak magnetic variations and the known geology, and it was decided not to persevere with the magnetic method.

It was also considered possible that self-potential anomalies would be obtained due to oxidation of the copper sulphides. No clear self-potential anomaly was found over the known copper deposit and consequently this method also was abandoned.

Both the Turam method, using a long grounded cable for the primary layout, and the Slingram method, using a portable small transmitter coil at constant distance from the receiver coil, were tried over the known orebody. Both methods gave indications corresponding to the known copper deposit. It was decided to continue only with the Turam method as this method gave more pronounced indications and in general requires no terrain corrections and consequently no levelling.

A plan showing the geophysical grid and positions of the Turam indications is given in Plate 2. Selected Ratio-phase diagrams and Turam profiles are shown in Plates 3 and 4 respectively.

When it was found that clear indications were obtained over the known ore deposit, the Turam survey was extended to cover a larger area east of the base line. With the cable line along 00, observations were made every 50 feet along traverses 200 feet apart, between 1600 N and 1600 S and extending to 2400 E. In a few places of special interest, intermediate traverses were laid.

Some weak to medium indications were found between 300 N and 400 S at about 950 E corresponding in position with the ore of the main open cut. They became weaker further to the north and south and gradually disappeared. The electromagnetic results indicate that the conducting body is not of very large dimensions, that the conductivity is best where the open cut is situated and gradually diminishes away from the open cut. Only a very weak indication was found at the No. 2 opencut.

Other indications obtained in the area east of the cable line were the following:-

1) north of the open cut between 800 N/1250 E and 1400 N/1270 E

2) 800 N/1800 E to 1400 N/1900 E

3) from 200 N/1525 E to 1000 S/1300 E

These three indications are distinct but weaker than the indication at the open cut. Indication 3 becomes very weak in its southern portion.

4) A rather extensive zone of good conductivity is found between 1200 S/1800 E to 200 S/2050 E and then continuing from 200 N/1960 E to 800 N/2350 E. This indication is particularly well defined in its northern part.

Between the indications in the area of the opencut and those further north, there is a zone mainly on traverses 400 N and 600 N practically devoid of any indications. This may be due to an unfavourable barren rock formation.

Following completion of the survey east of the base line, three reconnaissance traverses were surveyed to the west of the cable line. These traverses were laid out along 800 N, 200 S and 1200 S and were extended to 2000 W.

On traverse 1200 S a strong indication was found at 1800 W. This indication was stronger than the one over the open cut and was considered to be of potential interest. A more detailed investigation was therefore started in this western area and traverses were laid every 200 feet between 200 N and 2200 S. As the indications showed a striking direction to the northwest, the traverses became too long for a survey from the cable line at 00 and the cable was relaid on line 1000 W. On the southern traverses observations were made up to 2550 W but from 500 S northwards the lines were extended to about 3000 W.

An extensive zone of indications was found extending from 2200 S/1800 W to 200 N/3020 W. North of traverse 1400 S the indications are mostly stronger than in the area east of the cable line. The zone of good conductivity changes its strike direction several times and shows some rather irregular features, especially between traverses 600 S and 200 S. This area lies

in the wide soil covered flats west of the low range of hills but is still within the boundary of monzonite as shown on the geological map. As outcrops are rare and geological conditions are favourable it should be of interest to follow up the geophysical survey with some trenching and diamond drilling.

The indication is still quite strong on traverse 200 N and the good conductor may extend further than shown on the map (Plate 2). As the whole surveyed area lies within the belt of granodiorite north of Chillagoe it is likely that this extensive indication is caused by mineralisation.

4. CONCLUSIONS & RECOMMENDATIONS.

Distinct indications were obtained using the Turam electromagnetic method over the copper deposit worked in the open cut. The indications however are not very extensive and gradually decrease from the maximum over the open cut in both north and south directions. Other indications were obtained mainly east of the open cut but they are weaker than the ones over the open cut and it is therefore assumed that if the indications are due to mineralisation this would probably be poorer than the mineralisation in the open cut.

An extensive line of indications was found nearly 3000 feet west of the open cut in soil covered flats. These indications are stronger and more extensive than those near the open cut and could be of economic importance if they are due to mineralisation.

It is recommended that further investigation should first be concentrated on the indications between 1400 S/1680 W and 200 N/3020 W, by trenching - if the overburden is not too thick - and by diamond drilling. These indications, like those near the open cut, show no pronounced dip of the conductor, perhaps because no defined foot or hanging wall exists. If the dip cannot be ascertained on geological grounds it is suggested that test holes should be depressed at an angle not exceeding 45 degrees and drilled from sites about 150 feet from the indications.

Should the drillholes strike mineralisation of interest then the indications east of the opencut should be investigated by drilling. If mineralisation is proved on the western line of indications an electromagnetic survey covering the whole area occupied by monzonite and aplite and especially the soil covered flats may be warranted.

5. REFERENCES.

BROADHURST, E., 1949 - Geology of the Ruddygore Copper Mine, Chillagoe, Proc. Aus. Inst. Min. Met. 154-155.

EDGE, A.B. and LABY, T.H., 1931 - The Principles and Practice of Geophysical Prospecting. Cambridge Univ. Press, London.

LANGRON, W.J., 1957 - Geophysical Survey in the Chillagoe-Mungana District, Qld. Cwth. Bur. Min. Resour. Rec. 1957/39.

PLATE I

METAL HILLS
(GRANODIORITE
OUTCROPS)

MAG. NTH.

Metal Ck.

Station Ck.

SLAUGHTER
YARDS

RUDDYGORE
MINE

AREA OF 1959
GEOPHYSICAL SURVEY

SLAG DUMP

SMELTERS

MOUNT
COOMBETA

Rail to MUNGANA

Railway Station

CHILLAGOE
TOWN AREA

TO ALMA-DEN

TO TITREE

Rail to CAIRNS

CHRISTMAS
GIFT MINE

THO
MINE

GRANODIORITE

MONZONITE

APLITE

GRANITE PORPHYRY

LIMESTONE

CHERTS

SANDSTONE

PACIFIC OCEAN

Mitchell R.

MT MULLIGAN

Walsh R.

MAREEBA

CAIRNS

17°00'

MUNGANA

CHILLAGOE

ALMADEN

ATHERTON

HERBERTON

INNISFAIL

145°30'

SCALE IN MILES
10 0 10 20 30 40

Cooktown

Mossman Cairns

Atherton Innisfail

REFERENCE TO AUSTRALIAN 4
MILE MILITARY MAP SERIES

ELECTROMAGNETIC SURVEY AT RUDDYGORE COPPER DEPOSIT,
CHILLAGOE MINERAL FIELD, NORTH Q'LD.

GEOLOGICAL AND LOCALITY MAPS

GEOLOGY AFTER E. BROADHURST. PROCEEDINGS A.I.M.M. NEW SERIES No. 154-5, 1949

SCALE IN FEET
1200 0 1200 2400 3600

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G84-19

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PLATE 2

3200 W 2800 W 2400 W 2000 W 1600 W 1200 W 800 W 400 W 0 400 E 800 E 1200 E 1600 E 2000 E 2400 E

TRUE NORTH
MAG. NORTH
10° 15'

1600 N
1200 N
800 N
400 N
0
400 S
800 S
1200 S
1600 S
2000 S
2200 S

CABLELINE 2
CABLELINE 1

SHAFT No. 3
MAIN SHAFT
No. 1 OPEN CUT
No. 2 OPEN CUT
SHAFT

3000 W 2000 W 1200 W 800 W 0 1000 E 2000 E 2400 E

LEGEND

STRONG
MEDIUM
WEAK
VERY WEAK
} ELECTROMAGNETIC INDICATIONS

△ PERMANENT IRON PEGS

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CHILLAGOE MINERAL FIELD, NORTH Q'LD.

MAP OF GEOPHYSICAL GRID AND INDICATIONS

SCALE IN FEET
200 0 200 400 600

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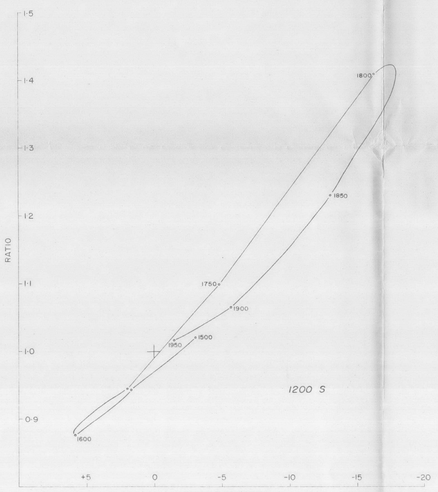
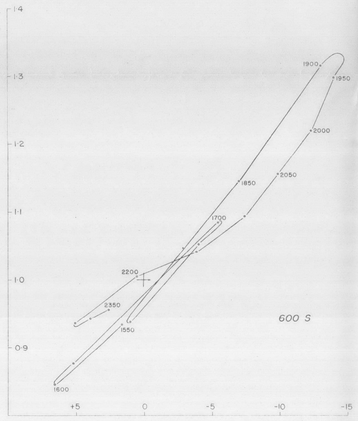
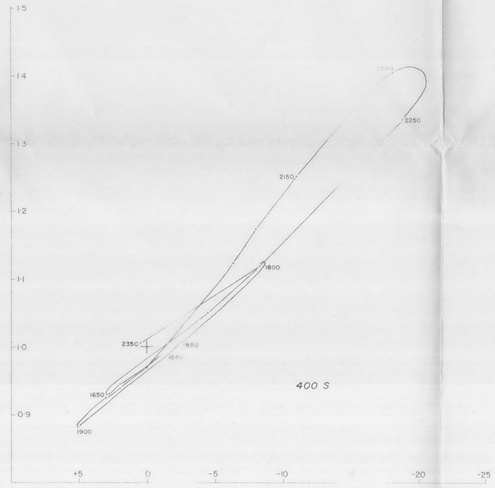
PLATE 3

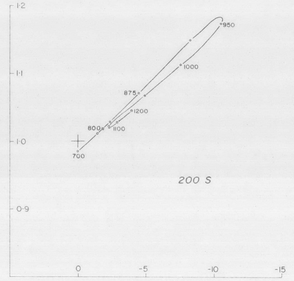
SELECTED INDICATIONS WEST OF CABLELINE

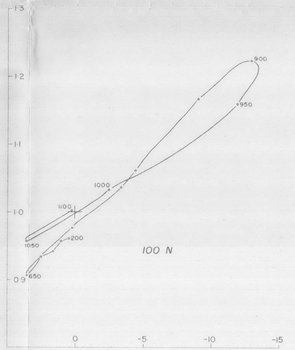


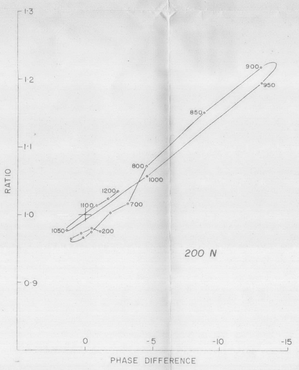


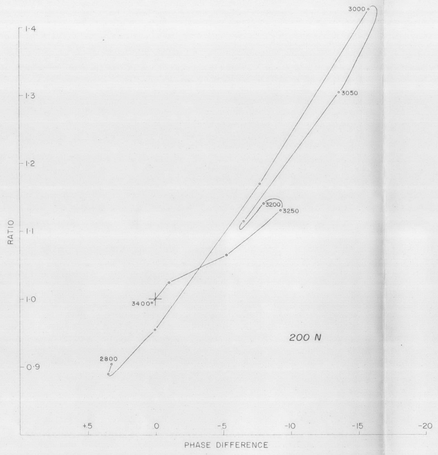


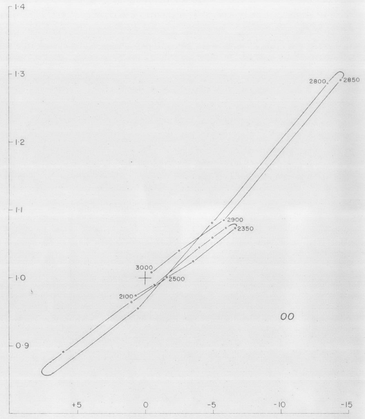
SELECTED INDICATIONS EAST OF CABLELINE

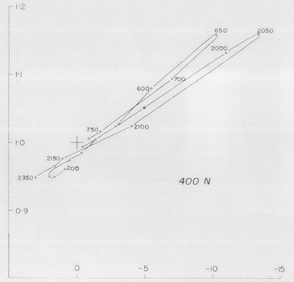


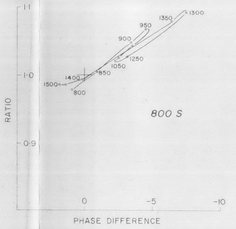












ELECTROMAGNETIC SURVEY AT RUDDYGORE COPPER DEPOSIT,
CHILLAGOE MINERAL FIELD, NORTH Q'LD.

TURAM RATIO-PHASE DIAGRAMS

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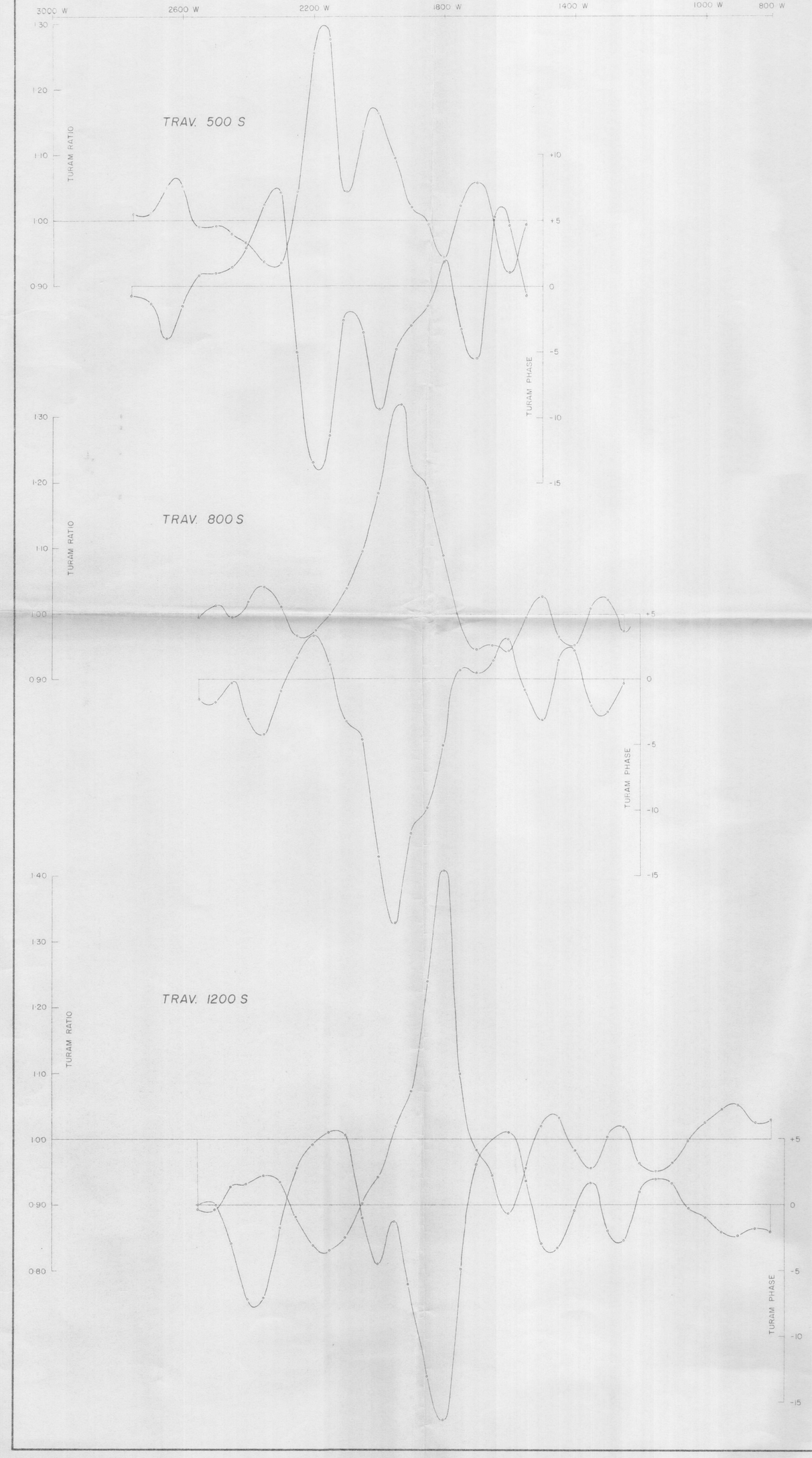
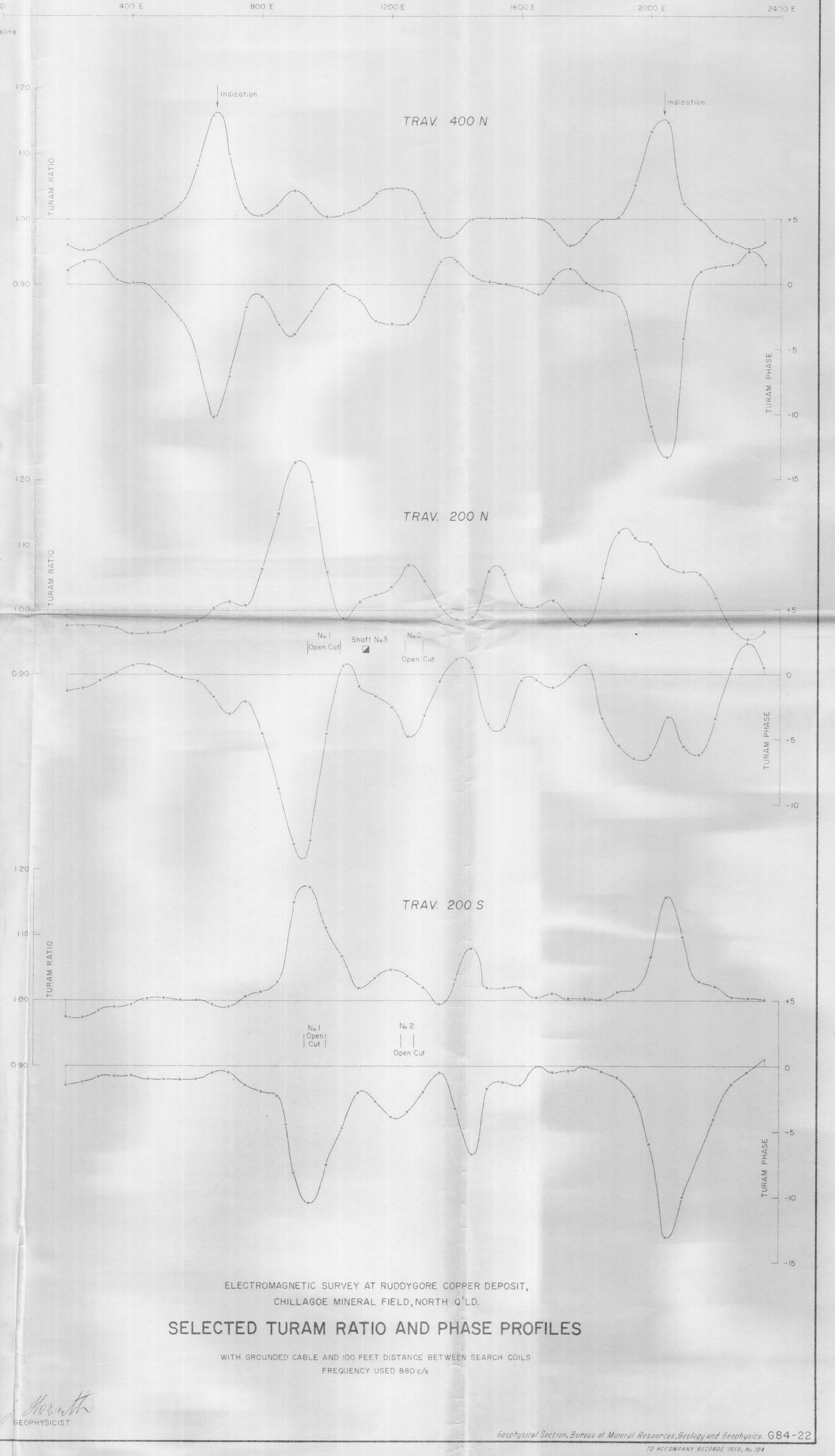
PLATE 4





ELECTROMAGNETIC SURVEY AT RUDDYGORE COPPER DEPOSIT,
CHILLAGOE MINERAL FIELD, NORTH Q'LD.

SELECTED TURAM RATIO AND PHASE PROFILES

WITH GROUNDED CABLE AND 100 FEET DISTANCE BETWEEN SEARCH COILS
FREQUENCY USED 880 c/s

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