COMMONWEALTH OF AUSTRALIA

# DEPARTMENT OF NATIONAL DEVELOPMENT

# BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS



RECORD No. 1962 / 124

## AREA 55 GEOPHYSICAL SURVEY, RUM JUNGLE DISTRICT, N.T. 1960



by

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# SUMMARY


A geophysical survey using electromagnetic (Turam), self-potential, magnetic, and radiometric methods was carried out over the known radioactive and geochemical anomalies at Area 55 in an attempt to locate any deposits of sulphides and associated uranium that these known anomalies might indicate.

The main geophysical anomalies outlined appear to be related to geological boundaries and fault zones rather than to zones of mineralisation. The radiometric results confirmed the previous work of Territory Enterprises Pty Ltd and showed that the radio-activity is restricted to a band of chloritic schist. The magnetic work detected no large anomalies but outlined several zones of marked magnetic disturbance. The significance of the self-potential results is not clear but again these appear to be related to lithology and structure rather than to mineralisation. This is also true of the electromagnetic results. However, it is recommended that two of the electromagnetic anomalies be further investigated by drilling.


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## 1. INTRODUCTION

During July 1960, a geophysical survey was carried out over Area 55 by the Bureau of Mineral Resources as part of the 1960 programme of uranium prospecting in the Rum Jungle Uranium Field. Area 55 lies about $1\frac{3}{4}$ miles west of Rum Jungle Siding (see Plate 1). The area has little relief and is accessible by a track from Rum Jungle Siding.

The 1960 survey was carried out by geophysicists D.L. Rowston and A. Douglas and the laboratory staff of the Darwin Uranium Group of the Bureau of Mineral Resources.

## 2. HISTORY AND GEOLOGY

The discovery in 1952 of a radioactive anomaly over Area 55 during the Bureau's high-level scintillograph survey (Wood and McCarthy, 1952) first drew attention to Area 55 as an area that might contain uranium minerals. The anomaly was confirmed by low-level airborne surveys by Territory Enterprises Pty Ltd (TEP) in 1956 and by the Bureau in 1957, and was outlined in detail by a ground radiometric survey carried out by TEP geologists in 1953-54.

Geological mapping revealed a marked similarity between Area 55 and the known areas of uranium mineralisation in the Rum Jungle Uranium Field. The rocks of all the areas belong to the Golden Dyke Formation of the Brocks Creek Group, and all the areas lie on, or close to, a limestone/slate contact.

A broad outline of the geology of Area 55 (after TEP) is shown on Plate 2. Three major rock types occur in the area, viz. limestone, chloritic schist, and black slate. The chloritic schist outcrop varies in width and lies between the limestone and black slate. The rocks strike approximately 035 degrees and dip towards the west. In the north-western corner of the area the junction between chloritic schist and black slate is marked by a fault which is approximately parallel to the strike.

During 1958 the Bureau of Mineral Resources made a geochemical survey over Area 55, the results of which (Haldane and Debnam, 1959) revealed extensive copper and lead anomalies (Plate 2). A nickel anomaly was also outlined extending from 4S to 18S approximately along the line of the limestone/chloritic schist junction. These anomalies are believed to indicate sulphides of base metals. Uranium mineralisation has been found associated with base metal mineralisation in other parts of the Rum Jungle Uranium Field and the geochemical work is regarded as further evidence for possible uranium mineralisation within Area 55.

The previous radiometric, geological, and geochemical evidence has all suggested that deposits of sulphides and associated uranium minerals are likely to occur in Area 55. The objects of the 1960 geophysical survey were to locate sulphide deposits and thus, indirectly, to locate associated uranium orebodies.

## 3. GEOPHYSICAL METHODS

Four geophysical methods, viz. electromagnetic (Turam), self-potential, magnetic, and radiometric, were used during the survey of Area 55. The descriptions of these methods and their application to the search for uranium have been given by Daly (1962).

## 4. GEOPHYSICAL RESULTS AND INTERPRETATION

Geophysical measurements were taken at 25-ft intervals along 17 traverses which were spaced 200 ft apart. The layout of these traverses and their relation to the Hundred of Goyder co-ordinates are shown on Plate 2. The Turam electromagnetic surveys were made using a frequency of 440 c/s and a coil separation of 50 ft. The main features of the results are described below.

### Electromagnetic

The most outstanding features of the electromagnetic results (see Plates 3 and 4) are two elongate anomalies named Anomalies A and B, which are well defined by both phase and ratio results. However, Anomaly A has larger ratio values than Anomaly B.

Anomaly A extends from Traverse 12S to Traverse 27S at 12W, and has two points of measured maximum intensity, one on Traverse 18S and the other on Traverse 24S. Anomaly B extends northwards from Traverse 8S and is still well defined at the northern limit of the survey area. To the north, the axis of the anomaly bifurcates; the main branch swings slightly eastward and crosses Traverse 0 at about 11W.

A slightly anomalous zone crosses the whole of the area between 5W and 8W. The phase readings are negative over this section. On the ratio results the zone is poorly marked. A complex pattern of anomalies occurs at the southern limit of the area surveyed.

### Self-potential (S-P)

The S-P measurements were very erratic and it was impossible to plot a contour plan directly from the field sheets. Therefore the S-P irregularities were smoothed by plotting the mean readings for adjacent points halfway between these points and joining up these mean values. The S-P contour plan shown on Plate 5 was made from these smoothed profiles.

The contour plan shows a zone of relatively positive potentials to the north of 11S and a narrow zone extending southwards at about 7W. A zone of relatively negative readings extends from 11S to about 30S. The axis of this negative zone lies at about 11.5W between 11S and 26S, but south of 28S the axis bends sharply eastwards. On Traverse 30S the axis lies at 10W. Three areas of maximum measured negative intensity occur within this zone, with centres near 13S/11.5W, 24S/11.25W, and 28S/9.75W. Another negative anomaly occurs centred near 17S/4.5W.

Magnetic

The whole of the area was surveyed using a Hilger and Watts vertical-force variometer (No. 69106). The results for much of the area are erratic and no major anomalies were located. However, results along most of the traverses indicate a slight regional gradient, the vertical magnetic force decreasing towards the eastern ends of the traverses.

Two zones of extreme magnetic disturbance can be delineated, one stretching from 0 to 6S and lying west of 11W, the other stretching from 14S to the southern limit of the area and also lying west of 11W. Along Traverse 32S the magnetic profile is disturbed for its whole length.

Radiometric

The 1961 survey was made with Harwell type 1368A ratemeters. The results (Plate 6) in general confirm those of the previous ground radiometric survey carried out by TEP if due allowance is made for localised 'highs' over disturbed ground around costeans. The main zone of radioactivity lies north of Traverse 10S, but a narrow zone extends south at about 7W to Traverse 18S. There is also an area of high radioactivity stretching from about 26S to 30S at 7W. Anomalous readings were observed along the western part of Traverse 32S.

## 5. DISCUSSION OF RESULTS

All the geophysical results for Area 55 appear to indicate the geological formations of the area rather than zones of extensive mineralisation with the formations. Thus the radiometric and S-P results give strong indications of the chloritic schist outcrops which are characterised by two to four times background radioactivity and by positive S-P readings.

To a lesser extent the Turam results also indicate the chloritic schist. The zone of slightly-negative phase anomalies crossing the area at about 7W is probably related to outcrop of this rock. The absence of any notable ratio anomalies accompanying these phase anomalies shows that the chloritic schist is a relatively poor conductor.

Turam Anomaly B appears to be related to the fracture zone that marks the north-western boundary of the chloritic schist outcrop. Along this line of dislocation the chloritic schist abuts black slate, and it seems likely that movement along the fracture would have aligned any graphite in the adjacent rocks in a direction parallel to the fault plane, thereby increasing the conductivity. As Anomaly B lies south of the position of the geological boundary, the Turam anomaly probably indicates minor branches of the fracture lying entirely within the chloritic schist. The low conductivity of the feature causing Anomaly B, as indicated by the relative magnitude of the phase and ratio results, is compatible with this suggestion.

No fracture zone has been recognised in the vicinity of Turam Anomaly A but the similarity in strike of Anomalies A and B suggests they may have a similar origin. The high conductivity of the feature causing Anomaly A, as indicated by the high ratio readings, is to be expected as Anomaly A overlies a region of black slate in which the percentage of carbonaceous material is probably greater than in chloritic slate.

The above hypotheses seem to account for the Turam anomalies satisfactorily although other features, e.g. presence of sulphides, could cause similar anomalies. There is little evidence, however, to support such a suggestion and the simpler explanations of faulting appear to be the more likely.

The negative S-P readings extending from 10S to 30S and west of 10W appear to be associated with the chloritic schist/black slate junction. A line of zero potential parallels this boundary for a considerable distance. The origin of the strongly-developed negative centres along this generally negative zone, however, is not clear. The negative centres at 24S/11.25W and 28S/9.75W appear to coincide with Turam anomalies, and the increased intensity of the S-P anomalies may be the combined effect of the chloritic schist/black slate boundary and the fracture suggested to be responsible for the Turam Anomaly A. However, there is no obvious correlation between the S-P anomaly centred near 13S/11.5W and the maximum of Turam Anomaly A on Traverse 18S. Therefore no definite conclusion can be reached as to the origin of the negative centres; they may indicate mineralisation close to, or at, the chloritic schist/black slate contact, but there is little evidence to support this. It seems likely that, at least in part, these anomalies are associated directly with the chloritic schist/black slate boundary.

The intense local S-P anomaly centred near 17S/5W lies close to the limestone/chloritic schist boundary and is probably associated with this junction. This anomaly may also indicate mineralisation along the contact; the nickel anomaly that is indicated by the geochemical survey as coinciding with this contact over much of its length tends to support this suggestion. However, if mineralisation is appreciable and is due to some nickel-bearing sulphide, e.g. pyrrhotite, a zone of conductivity (disclosed by a Turam anomaly) would be expected coinciding with the S-P anomaly. No Turam anomaly was found and the hypothesis of mineralisation must therefore be regarded with caution.

The geochemical evidence regarding the distribution of copper and lead over Area 55 seems to be of little help in the interpretation of the geophysical results. These geochemical anomalies are very broad and they have no obvious association with the geophysical anomalies. The general form of the geochemical anomalies suggests that the copper and lead occur disseminated through the chloritic schist as does the uranium. There is no real evidence of concentrations of the sulphides of these metals in Area 55.

## 6. CONCLUSIONS AND RECOMMENDATIONS

All the geophysical anomalies outlined appear to be related to lithology and structure rather than to mineralisation. However, the electromagnetic Anomalies A and B, although probably related to a fracture zone, might indicate mineralisation. Drill holes to a vertical depth of 150 ft are recommended at 2S/12.5W, 2S/13.25W, 18S/12W, and 25S/12W to test these anomalies.

## 7. REFERENCES


| | | |
|---|---|---|
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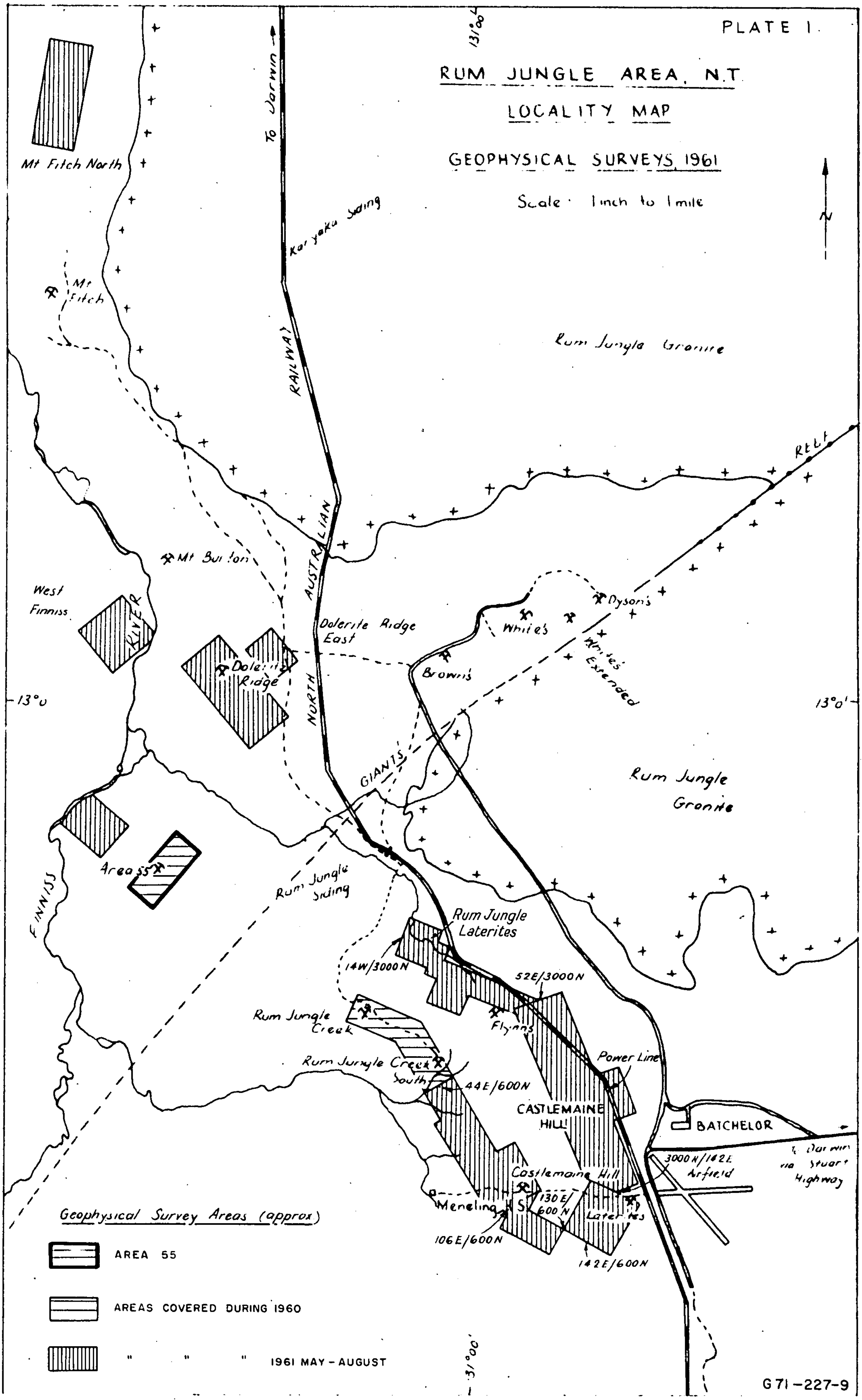
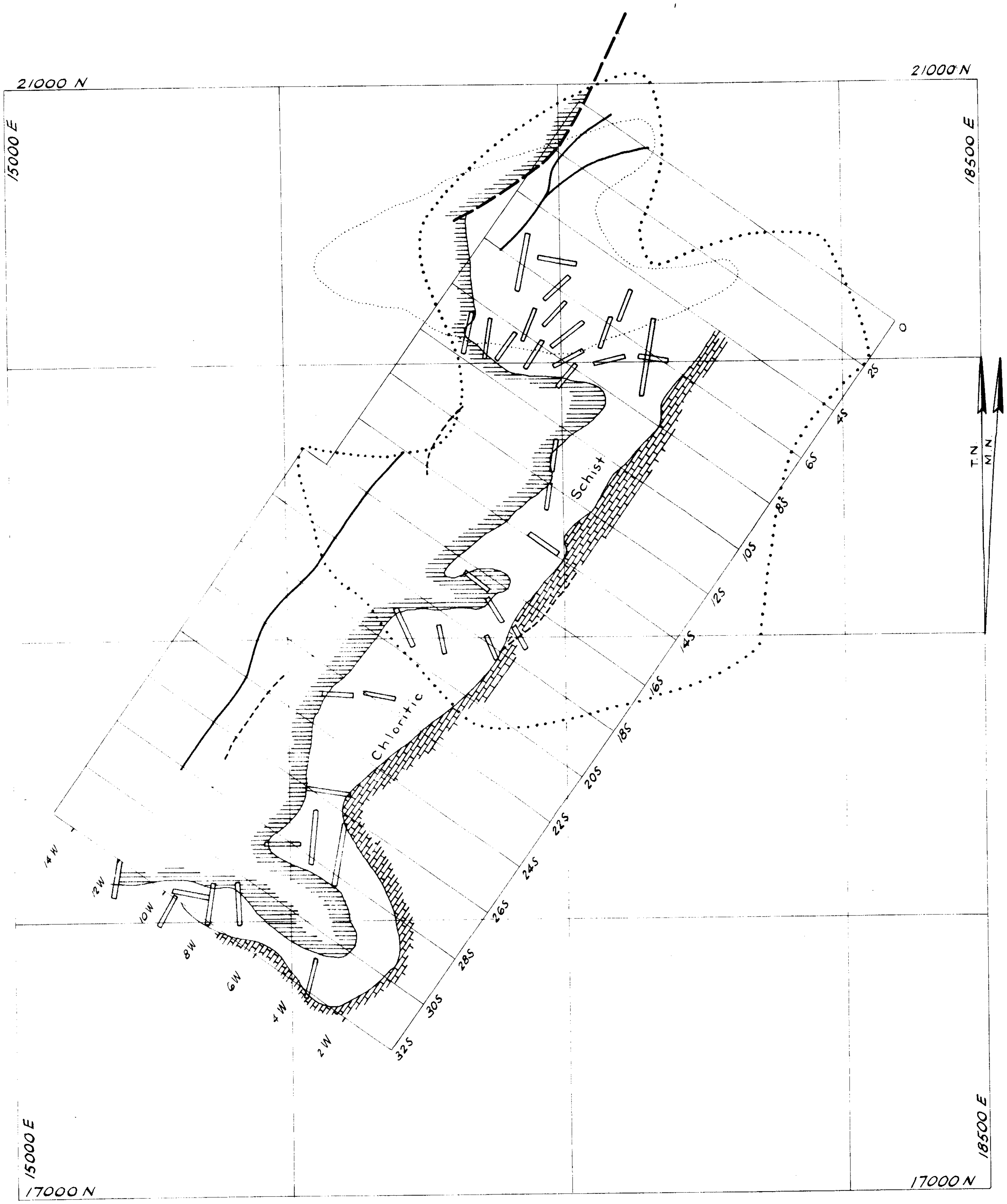
| HALDANE, A.D. and DEBNAM, A.H. | 1959 | Geochemical prospecting survey, Rum Jungle, N.T. 1958. <u>Bur. Min. Resour. Aust. Record</u> C.1959/3. |
| WOOD, F.W. and McCARTHY, E. | 1952 | Scintillometer-airborne surveys over the Rum Jungle area and other portions of the Northern Territory. <u>Bur. Min. Resour. Aust. Record</u> 1952/79. |




To accompany Record No. 1962/124

# PLATE 2




Reference

- Black slate
- Limestone
- Main Turam indication (axis)
- Main S-P anomaly (axis)
- +250 ppm copper contour
- +100 ppm lead contour
- Geological boundary
- Fault
- Costean

## GEOPHYSICAL GRID AND INDICATIONS, GEOCHEMICAL ANOMALIES AND GEOLOGY
## AREA 55

GEOPHYSICAL SURVEY IN RUM JUNGLE AREA, N.T. 1960

Scale

400 0 400 800 FT

Bureau of Mineral Resources, Geology and Geophysics,
Darwin February 1961.

G 71-222

To accompany Record No 1962/124

S69-GP

PLATE 3


# TURAM PHASE CONTOURS

AREA 55

GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA N.T. 1960

| | |
|---|---|
| COIL SEPARATION | 50 FEET |
| FREQUENCY | 440 c/s |
| CONTOUR INTERVAL | 2·5 DEGREES |

T.N.
M.N.

Scale

100 0 100 200 FT

Bureau of Mineral Resources Geology and Geophysics
Darwin N.T. December 1960

G 71-223

To accompany Record No.1962/124

S70-GP

PLATE 4


# TURAM RATIO CONTOURS

AREA 55

GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA, N.T. 1960.

T.N.
M.N.

| | |
|---|---|
| COIL SEPARATION | 50 FEET |
| FREQUENCY | 440 c/s |
| CONTOUR INTERVAL | 0·02 |

Scale

100 50 0 100 200 FT

Bureau of Mineral Resources Geology and Geophysics
Darwin November 1960

G 71–224

To accompany Record No. 1962/124


# SELF-POTENTIAL CONTOURS

AREA 55

GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA, N.T. 1960

Contour Interval : 50 mV

Scale

100 50 0 100 200 300 FT

*Bureau of Mineral Resources, Geology and Geophysics.*
*Darwin February 1961*

G 71-225

To accompany Record No. 1962/124

S72-GP

PLATE 6

# RADIOMETRIC CONTOURS

AREA 55

GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA, N.T. 1960

Contour Interval ·01 mr/hr

Scale

100 0 100 200 FT

Bureau of Mineral Resources, Geology and Geophysics.
Darwin February 1961

G 71-226

To accompany Record No 1962/124

S73-GP