1962/102
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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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RECORD No. 1962/102

RUM JUNGLE CREEK SOUTH TO CASTLEMAINE HILL GEOPHYSICAL SURVEY,

NORTHERN TERRITORY 1961

by

D. L. ROWSTON

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ILLUSTRATIONS

SUMMARY

Radiometric and electromagnetic surveys were made over an area from Rum Jungle Creek South to Castlemaine Hill. This work was carried out with the approval of the Australian Atomic Energy Commission as part of the Bureau of Mineral Resources' 1961 programme of uranium prospecting in the Rum Jungle area, Northern Territory.

The electromagnetic method outlined many anomalies lying in a distinct conducting zone. It is suggested that this zone is caused by a bed of chloritic or graphitic rocks, the more intense anomalies within this zone being ascribed to an increase in conductivity due either to sulphide or graphitic concentrations or to local shearing. As uranium is associated with sulphides in several places in the Rum Jungle area, it is recommended that these anomalies be tested by drilling.

The radiometric results confirm previous work but appear to be unrelated to any economic deposits of uranium.

1. INTRODUCTION

This Record describes in detail the geophysical survey over one section of an extensive area that was investigated in the Rum Jungle Uranium Field by the Bureau of Mineral Resources during 1961. The whole area extends (Plate 1) from the Rum Jungle Creek South (RJCS) orebody around the western, southern, and eastern margins of a prominent quartzite breccia ridge to the Rum Jungle Laterites, and has been briefly discussed in toto by Daly (1962).

The relevant section of the area, viz. from the RJCS orebody to the Castlemaine radiometric anomaly, is situated on the western flank of the breccia outcrop about two miles west of the Batchelor township. Access is possible in all seasons. An open vegetation predominates; mainly eucalypts with some pandanus palms in the swampier localities. The area is heavily grassed during the wet season and the early part of the dry season.

2. METHODS AND RESULTS

The 1960 RJCS geophysical grid (Daly and Rowston, 1962) was extended in 1961 from Traverse 44E to 130E, the baseline bearing 146° 30' (true) from 44E to 106E and 116° 30' (true) from 106E to 130E. Traverses ranging in length from 1200 ft to 2500 ft were pegged at right angles to the baselines. The traverses were spaced 200 ft apart and were pegged at 50-ft intervals. It should be noted that the geophysical co-ordinates do not refer to true directions nor to the local grid established by Territory Enterprises Pty Ltd. The relative position of the geophysical and 'Hundred of Goyder' grids are shown by Daly (1962, Plate 2). Daly also describes the principles and limitations of the various geophysical methods employed during the survey.

The entire layout was surveyed with the electromagnetic (Slingram) and radiometric methods. Also, the traverses from 44E to 80E and from 102E to 130E were investigated with the Turam electromagnetic equipment to establish a relation between the results of the different electromagnetic techniques. This relation is demonstrated by the selected profiles shown on Plate 2. The profiles also show the effect on the Slingram real component caused by differences in height between the transmitting and receiving coils when approaching the quartzite breccia. Level corrections have not been applied and this should be borne in mind when the real component contour plan (Plate 4) is studied. The effect is only appreciable at the breccia/slate contact where there are no significant secondary fields.

All the geophysical results are presented as contour plans except for the selected profiles on Plate 2.

3. INTERPRETATION OF RESULTS

Radiometric

The radiometric contours (Plate 3) confirm the Castlemaine anomaly outlined by earlier investigators, and define some areas with radioactivity higher than background. General background for the locality is accepted as about 0.015 mr/hr and since radioactivity in the areas does not exceed 0.030 mr/hr, these areas are considered insignificant. The Castlemaine anomaly has been tested by both Territory Enterprises Pty Ltd and a geochemical party from the Bureau (Ruxton, in preparation) and does not appear to indicate an economic uranium deposit.

Although the radiometric anomaly appears to be completely dis-associated from electromagnetic anomalies obtained in the Castlemaine area, a possible connexion will be discussed below.

Electromagnetic

Most of the discussion of the electromagnetic results will be centred on Plate 5 which contains the Slingram imaginary component contours. The electromagnetic anomalies are more clearly defined in Plate 5 than in the real component contours of Plate 4; also, elevation differences between the coils will necessitate corrections being made to real component values, but no similar corrections are needed for imaginary component values. Reference will be made to the Turam results where necessary (Plates 6, 7, 8, and 9).

Many anomalies were detected by electromagnetic methods, and these anomalies were restricted to a distinct conducting zone extending over the length of this area and probably through the Batchelor Laterites to the Power Line area. Further geophysical work is recommended to check this probability.

The geological section J-K on the Bureau's Rum Jungle District Special sheet (1 : 63,360) shows that the dominant structure is a syncline in the Lower Proterozoic rocks with the Upper Proterozoic quartzite breccia lying unconformably along its axis. A conducting bed in the Lower Proterozoic sequence could give rise to the anomalous zone defined by the electromagnetic method. This is the most likely interpretation of the geophysical feature, but local shearing and folding in certain portions of the zone are also indicated.

In the Castlemaine area, the anomalous zone is about 400 ft wide, and is attributed to a stratigraphic feature such as a bed of chloritic schist or black slate. This anomaly is less clearly defined south-west from Meneling Creek because of the incomplete geophysical coverage and because of the apparent lower electrical conductivity. Elsewhere, the conductivity of the zone is also variable and the anomalies, arbitarily taken as being outlined by the minus-20-per-cent contour, show the presence of lenticular maxima within it.

It is considered that anomalies in the section 44E to 90E (Plate 5) are important, particularly as the conducting zone is a continuation of that associated with the RJCS pyritic uranium orebody. In 1961 an attempt was made to determine whether the origin of the increased conductivity of the ore material is due to the presence of sulphides or graphite or to mineralised solutions in shears. All three agencies are present, and the results of assays by Australian Mineral Development Laboratories on selected core samples did nothing to resolve the indeterminacy. The assays show that the orebody contains about 1 percent graphite and 3 percent pyrite with no preferred areal distribution or fixed ratio of either component to the quantity of uranium or to each other. Sampling was necessarily restricted to the orebody, and the amount of sulphides or graphite elsewhere in the general conducting zone is therefore unknown. However, the association of the anomaly with the uranium deposit is distinct, and it is reasonable to assume that electromagnetic anomalies in the same environment and of the same magnitude may indicate a repetition of mineralisation. Therefore, any pronounced anomaly in the conducting zone should be investigated further.

For instance, the broad Slingram anomaly extending from 44E to 56E with its axis at about 250N could be due to a body of similar characteristics to the RJCS orebody but at greater depth. Open-cut operations precluded a more detailed overlap of the 1960 and 1961 surveys and in the section 40E to 44E the continuation of contours is somewhat uncertain. A fold or cross-fault may occur in this locality.

The lenticular anomaly, which extends from 56E to 64E and is roughly centred about 525N/60E, indicates a narrow, comparatively shallow conductor. It exhibits the same sharp boundary towards the quartzite breccia as in the RJCS area. This boundary is well defined as far as Traverse 90E, but thereafter it is less apparent.

Between 78E and 90E, the Slingram imaginary component contours show a marked disruption in the normal trend of the conducting zone. This deviation is due probably to a cross-fault which moved the north block to the west. Alternatively, the marker horizon could have been subject to a tight flexure or fold in this locality. The fault interpretation is preferred but there is at present no conclusive geological evidence to support it. The fault zone, other than where it crosses the main conductor, is apparently non-conducting. However, it is of interest to note that the radiometric anomaly (Plate 3) is elongated in the same strike direction (defined by the axis of the Slingram 25-degree contour about 175N/88E) and lies directly in line with the postulated fault. Furthermore, if the fault is projected eastwards it crosses the Batchelor Laterites radiometric anomaly and the marker horizon again where the Slingram contours are displaced. The three anomalies located about 50N/80E, 250S/80E, and 200N/88E constitute worth-while drilling targets, particularly as uranium mineralisation commonly occurs along the bedding planes of carbonaceous or graphitic slate and is localised by shearing or tight folding.

From 92E the normal trend of the main conductor is resumed but is not delineated as clearly as in the area discussed above. A minor north-striking fault, with west block movement to the north, may pass through 200N/98E. Two narrow anomalies, indicating a wide horizontal conductor, were detected between 98E and Meneling Creek at 106E, and geochemical testing during 1961 outlined a restricted copper anomaly in this locality.

Between 106E and 130E the Slingram results contain no indications of apparent significance but suggest another possible north-trending fault through the point 00/118E. Movement indicated is again the west block to the north. On the Turam contours (Plates 8 and 9) the 1.20 ratio contours between 102E and 118E suggest a general increase in conductivity, which may be related to the swampy alluvium in the area.

Although in general there is good correlation between the real and imaginary components of the secondary fields, several features require comment. At about 500S on Traverses 78E to 84E the real component contours (Plate 4) show a distinct anomaly which has no counterpart in the imaginary component. As the combination of both components define the same secondary field, the contour configurations should correspond even though their magnitudes may differ considerably. There is no topographic feature present that could account for the anomaly. The nearest imaginary component contour (the minus-20-per-cent contour about 300S/82E) to which the real component contours may be related is displaced about 200 ft. No satisfactory theoretical reason can be given for the displacement, but it is worthy of note that a similar displacement was obtained between the Turam components of the secondary field near the uranium orebody at RJCS in 1960.

Elsewhere along the line of the suggested fault, the strong anomalies in the imaginary component are not complemented by real component minima of any magnitude.

4. CONCLUSIONS AND RECOMMENDATIONS

The electromagnetic anomalies observed in the Castlemaine area are ascribed to a bed of chloritic or graphitic rocks. The increased conductivity of certain sections of the bed may be due either to sulphide or graphitic concentrations or to local shearing. Drilling is needed to determine the origin of the anomalies and whether or not they indicate worth-while mineralisation.

It is considered that the zones of anomaly obtained at the adjacent Batchelor Laterites and Power Line areas are the continuation of the zone that extends south from Rum Jungle Creek to Castlemaine Hill. Geophysical work to link the Castlemaine and Batchelor Laterites grids and check this probability is recommended.

Of the area between RJCS and the Castlemaine anomaly, the section 44E to 90E contains electromagnetic anomalies that warrant further investigation and testing. Geochemical analyses for base metals, and costeans trenched to expose the bedding, could be advantageous in planning a drilling programme. It is highly probable that the sources of the geophysical anomalies are at or near the base of weathering; therefore drill holes should be sited to intersect the targets at about 70 to 120 ft vertical depth. Although specific sites are given, each anomaly will probably require a line of shallow vertical holes across it for thorough testing, because it is not certain whether these anomalies indicate one wide conductor or two narrow ones at the edges of the main zone.

In particular a strong recommendation is made that the anomalies detailed below be given a high priority for testing:

(a) The group of anomalies outlined by the Slingram minus-20-per-cent imaginary contours about the points 50N/80E, 175N/88E, and 225S/80E and by the 95-per-cent real component contour about 500S/80E.

(b) The Slingram anomaly centred near 250N/50E.

(c) The Slingram anomaly centred near 520N/60E.

Other minor anomalies were detected but it is considered unlikely that these indicate mineralisation of economic importance.

Although there are no surface radiometric anomalies associated with the electromagnetic anomalies, except perhaps indirectly along the postulated fault (Group (a) electromagnetic anomalies with the Castlemaine radiometric anomaly), it has been found that this is not a prerequisite for a uranium orebody at depth (cf RJCS, Daly & Rowston, 1962). Current geochemical investigations into the problems of the migration and dispersion of uranium and the possible relation between surface radiometric anomalies and uranium deposits in the local environment may, when complete, enable positive correlations to be made.

The recommendations are based solely on the electromagnetic results and on the established evidence from RJCS.

Specific sites for vertical shallow drill holes are nominated. These are:

Traverse 50E at 525N, 400N, 300N, 200N
" 60E at 700N, 600N, 500N, 200N
" 80E at 100N, 50N, 220S
" 86E at 50N.
" 87E at 100N.
" 88E at 200N.

where the co-ordinate underlined indicates first preference.

5. REFERENCES

DALY, J. 1962 Rum Jungle district, Northern Territory, introductory report on geophysical surveys 1960-61 Bur. Min. Resour. Aust. Record 1962/27.

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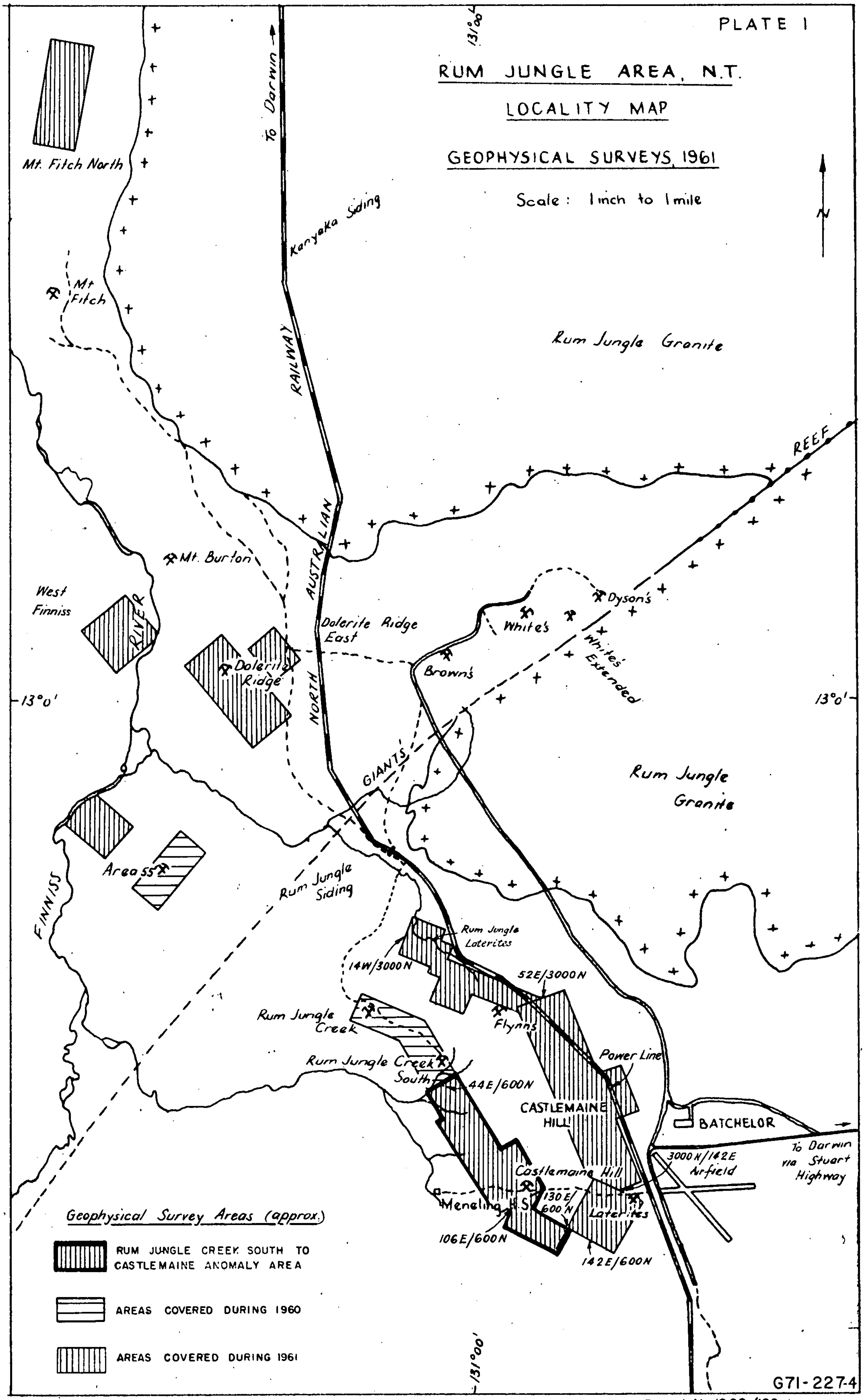
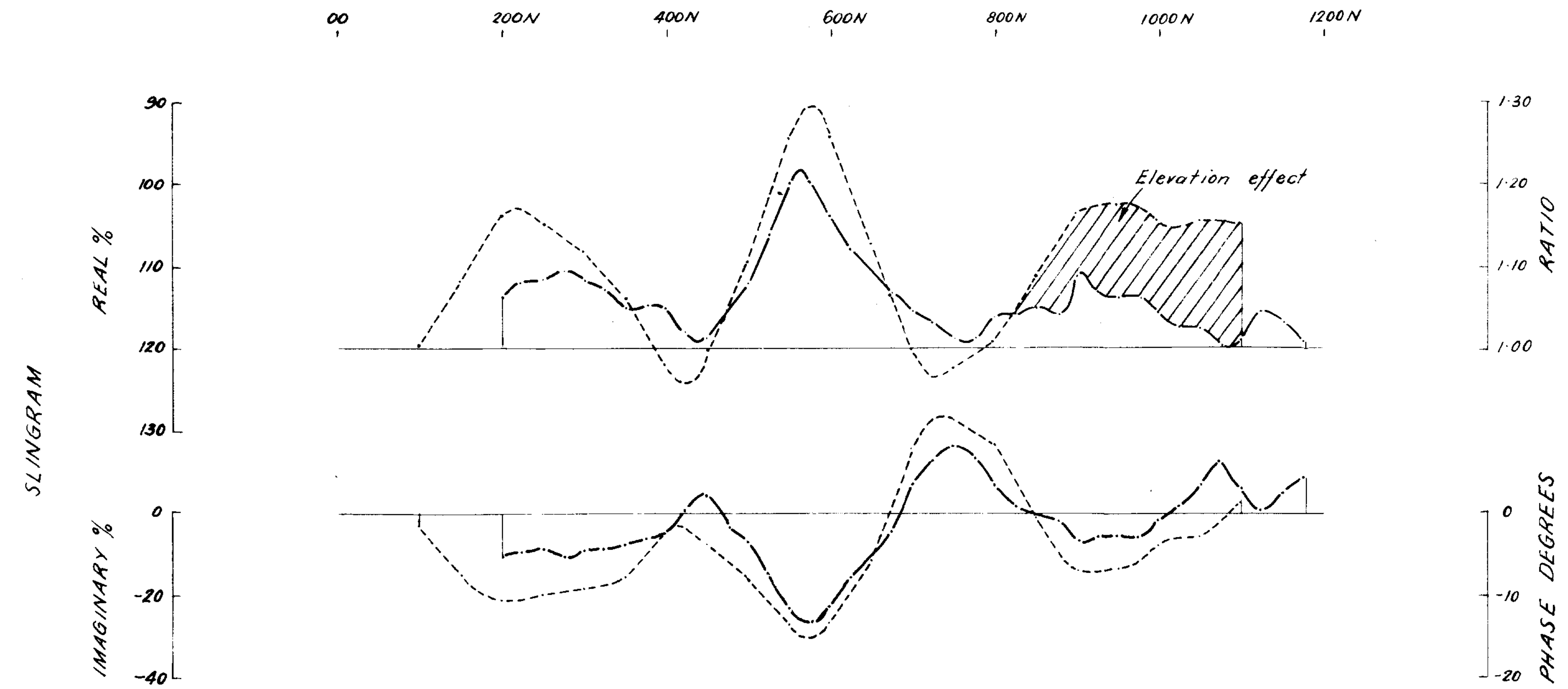
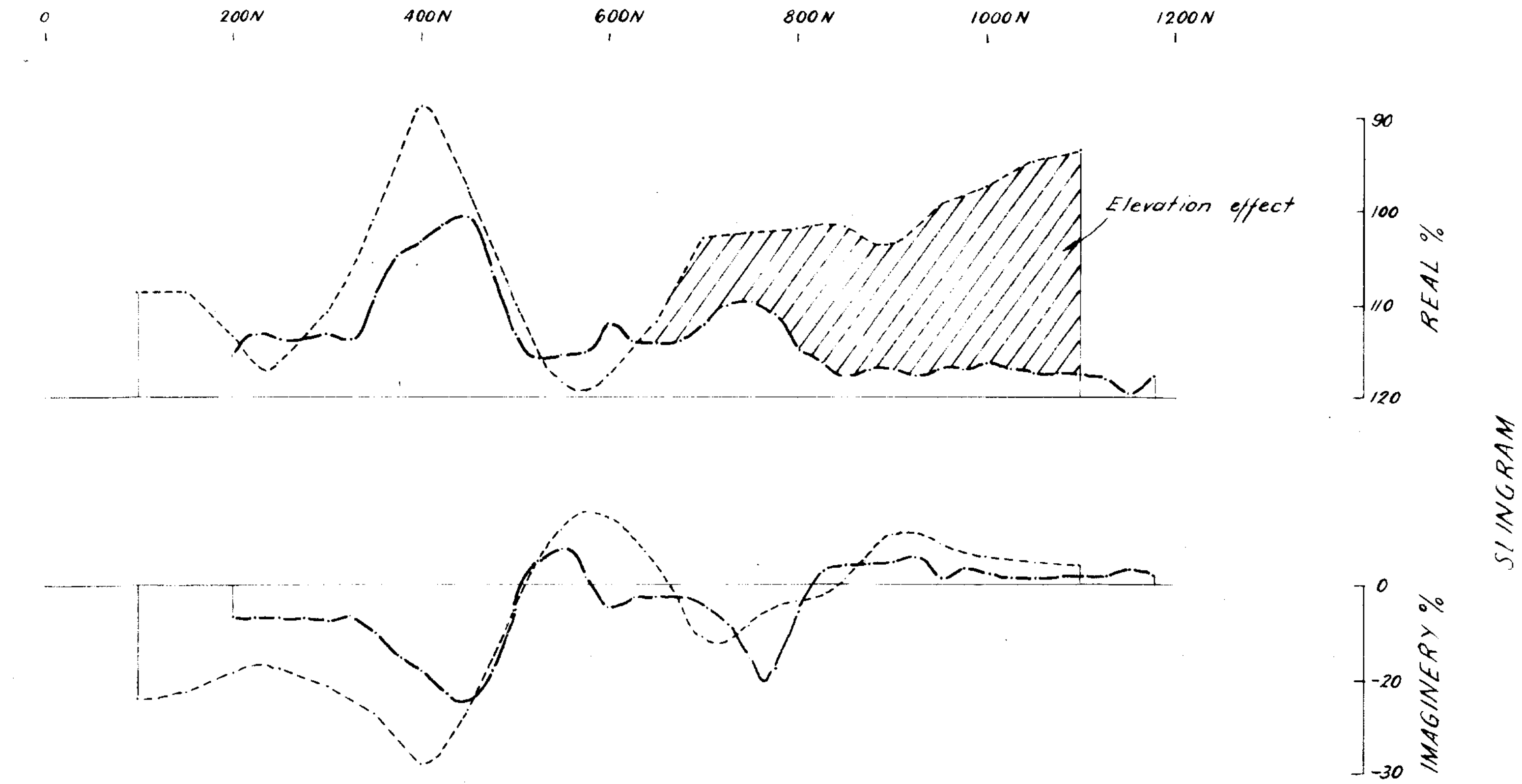
RUXTON, B.P., and SHIELDS, J.W. — Geochemical and radiometric surveys Rum Jungle, Northern Territory 1961. Bur. Min. Resour. Aust. Record (in preparation).



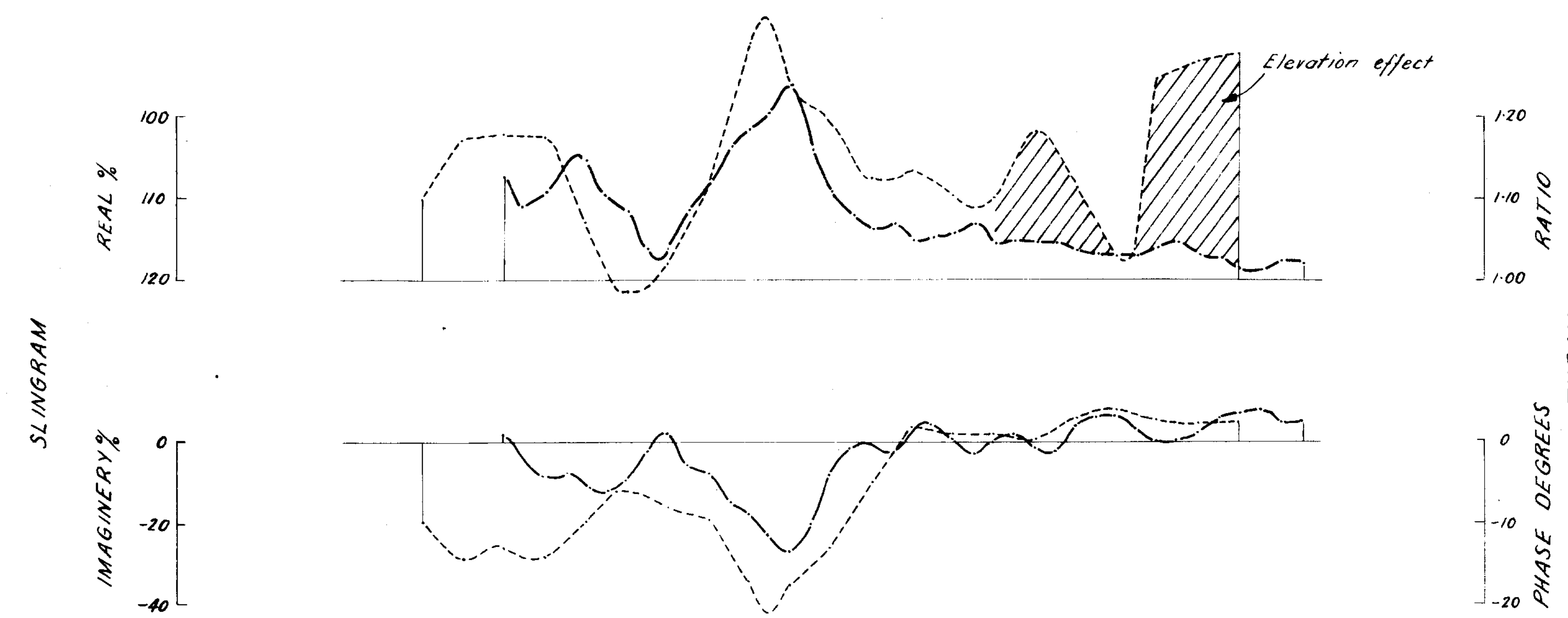
To Accompany Record No 1962/102



TRAVERSE 58E



TRAVERSE 62E



TRAVERSE 60E

SLINGRAM, FREQUENCY	1760 CPS,	COIL SEPARATION	200 FEET
TURAM, "	440 CPS,	" "	50 FEET

GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA N.T., 1961

RUM JUNGLE CREEK SOUTH TO CASTLEMAINE HILL
COMPARISON OF SLINGRAM & TURAM MAGNITUDES

Geophysicist: A. Douglas.

Bureau of Mineral Resources, Geology and Geophysics
Darwin, N.T. March 1962.

G 71-239

To Accompany Record No 1962/102 S111-GP

GEOPHYSICAL SURVEY AT RUM JUNGLE 1961

RUM JUNGLE CREEK SOUTH TO CASTLEMAINE HILL

RADIOMETRIC CONTOURS

Background 0·015 mR/hr. (approx)
Contour Interval 0·005 mR/hr.

Scale
200 0 200 400 FT.

Geophysicist: A. Douglas

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

G71-240 S77-GP

To Accompany Record No 1962/102

GEOPHYSICAL SURVEY AT RUM JUNGLE 1961

RUM JUNGLE CREEK SOUTH TO CASTLEMAINE HILL

SLINGRAM REAL COMPONENT CONTOURS

Frequency 1760 c.p.s
Coil Separation 200 feet
Contour Interval 5%

Scale
200 0 200 400 FT

Geophysicist A Douglas

Bureau of Mineral Resources, Geology and Geophysics, Darwin, July 1961

G71-241 S78-GP

To Accompany Record No 1962/102

GEOPHYSICAL SURVEY AT RUM JUNGLE 1961

RUM JUNGLE CREEK SOUTH TO CASTLEMAINE HILL

SLINGRAM IMAGINARY COMPONENT CONTOURS

Frequency 1760 c.p.s.
Coil Separation 200 feet
Contour Interval 5%

Anomalies defined by -20% contour

Scale 200 0 200 400 FT.

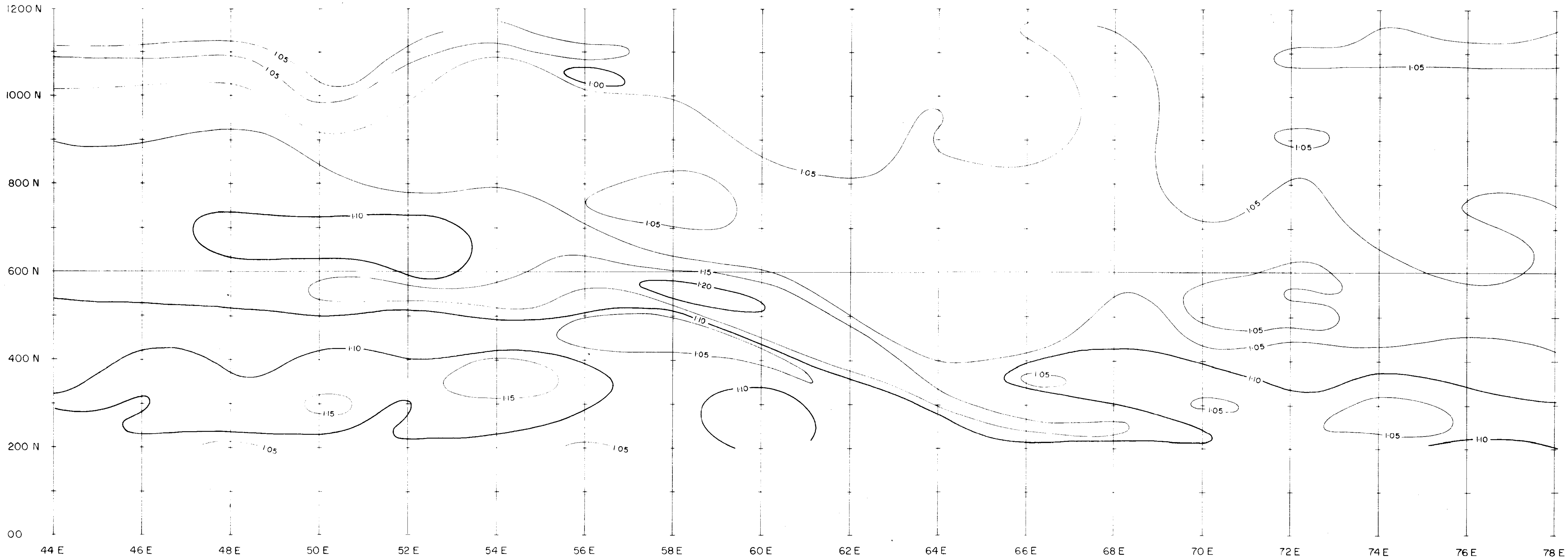
Geophysicist: A. Douglas

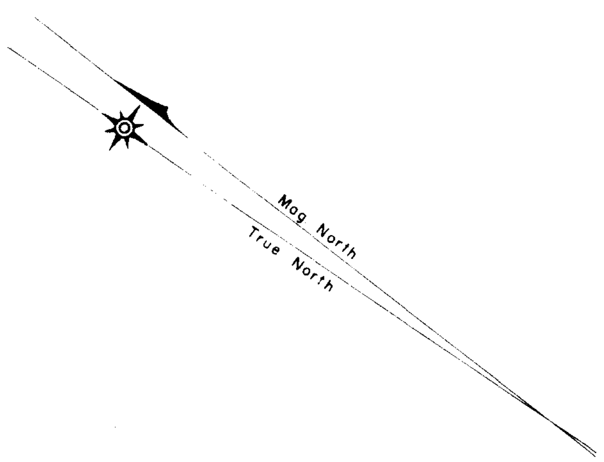
Bureau of Mineral Resources, Geology and Geophysics, Darwin. July 1961

G71-242 S76-GP

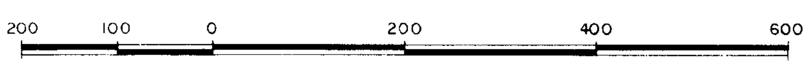
To Accompany Record No 1962/102

PLATE 6





SCALE IN FEET



GEOPHYSICIST: A Douglas

GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA, N.T., 1961

RUM JUNGLE CREEK SOUTH TO CASTLEMAINE HILL

(TRAVERSES 44 E TO 78 E)

TURAM RATIO CONTOURS

FREQUENCY 440 CPS COIL SEPARATION 50'

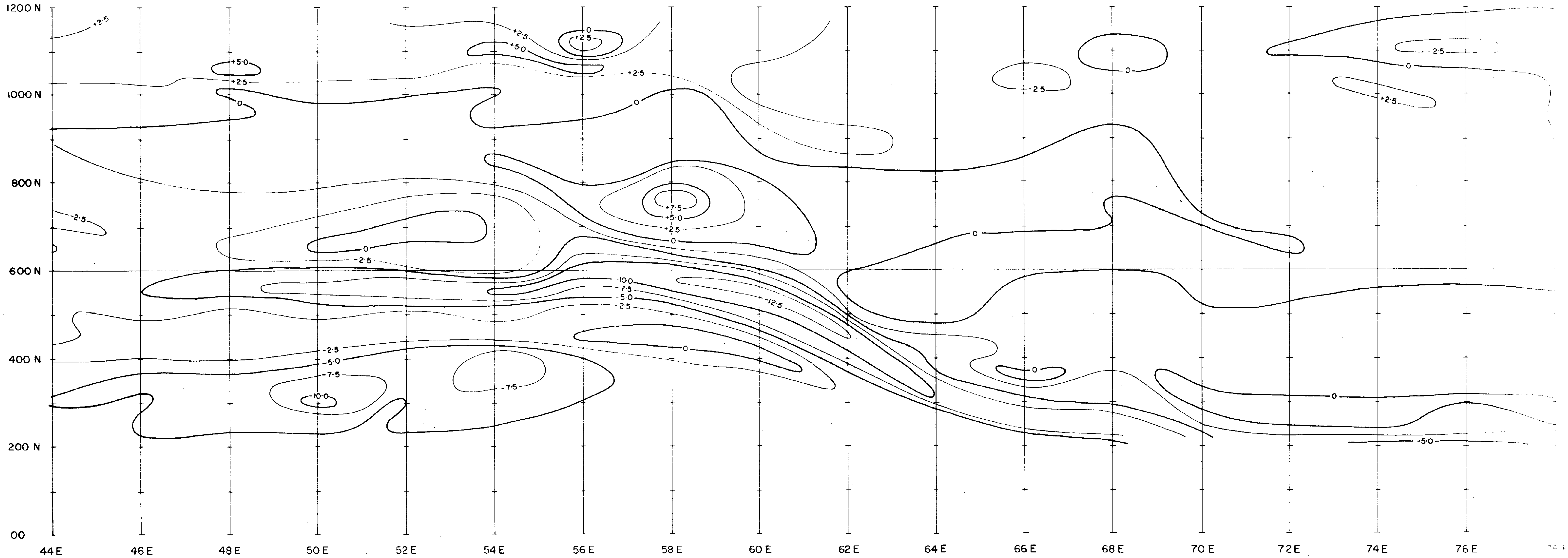
CONTOUR INTERVAL 0·05

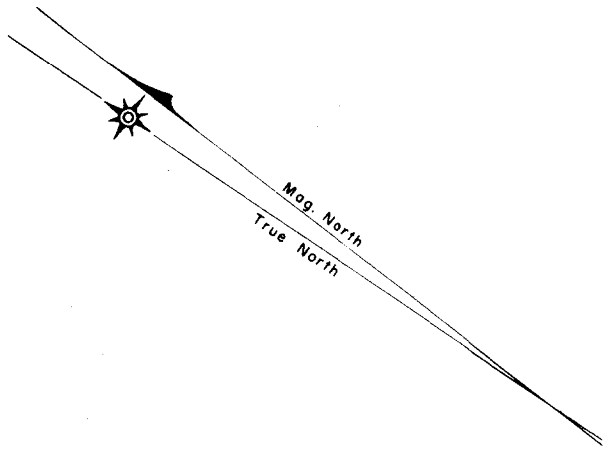
Bureau of Mineral Resources, Geology and Geophysics, Darwin, N.T., December 1961

G71-243

To Accompany Record No 1962/102 S86 · GP

PLATE 7





GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA, N.T., 1961

RUM JUNGLE CREEK SOUTH TO CASTLEMAINE HILL

(TRAVERSES 44 E TO 78 E)

TURAM PHASE CONTOURS

FREQUENCY 440 CPS COIL SEPARATION 50'

CONTOUR INTERVAL 2.5°

SCALE IN FEET

200 100 0 200 400 600

GEOPHYSICIST: A. Douglas

Bureau of Mineral Resources, Geology and Geophysics, Darwin, N.T., December 1961

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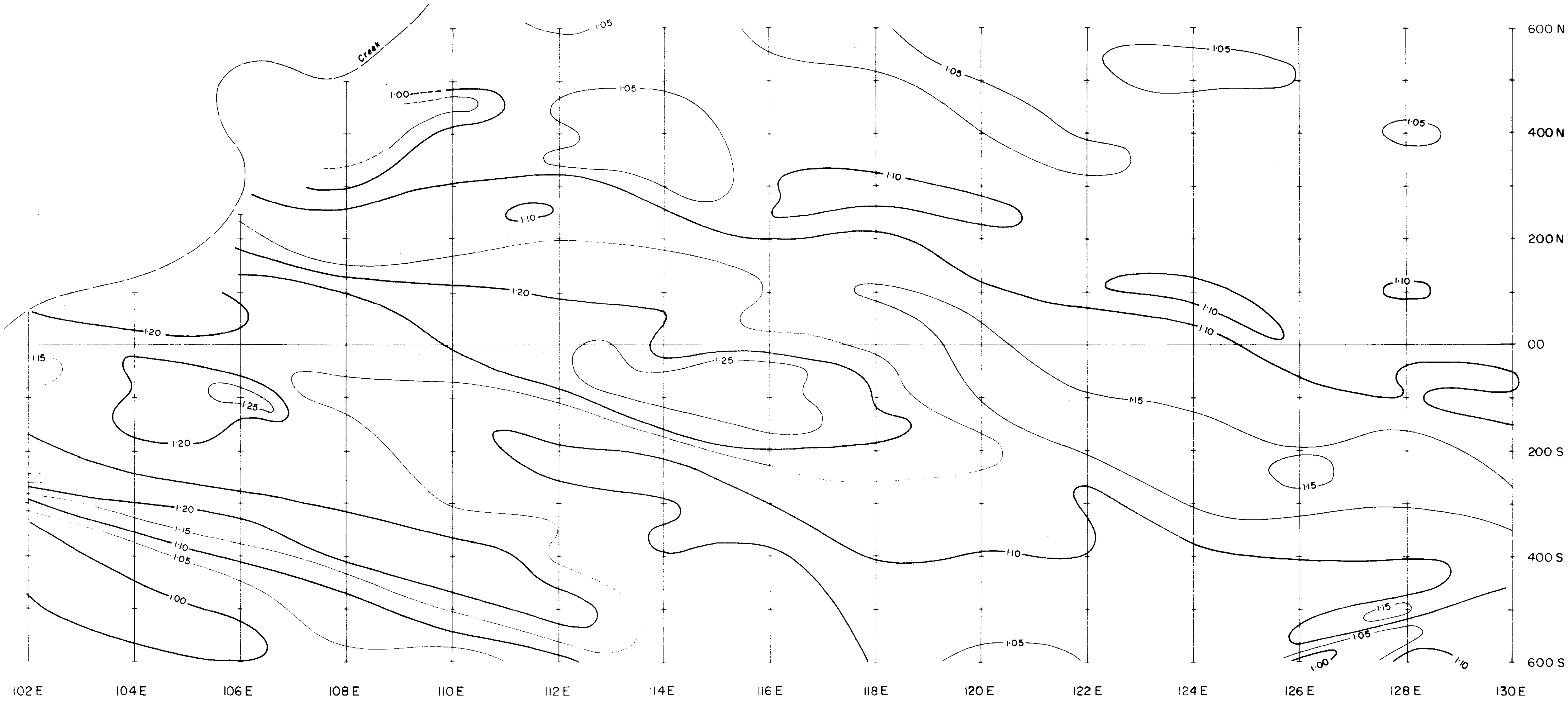
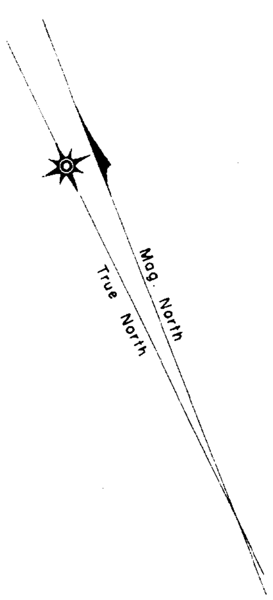
To Accompany Record No 1962/102 [illegible]





GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA, N.T., 1961

RUM JUNGLE CREEK SOUTH TO CASTLEMAINE HILL

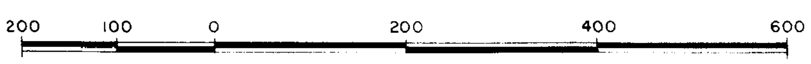
(TRAVERSES 102 E TO 130 E)

TURAM RATIO CONTOURS

FREQUENCY 440 CPS COIL SEPARATION 50'

CONTOUR INTERVAL 0·05

SCALE IN FEET



GEOPHYSICIST: A. Douglas

Bureau of Mineral Resources, Geology and Geophysics, Darwin, N.T., December 1961

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To Accompany Record No 1962/102

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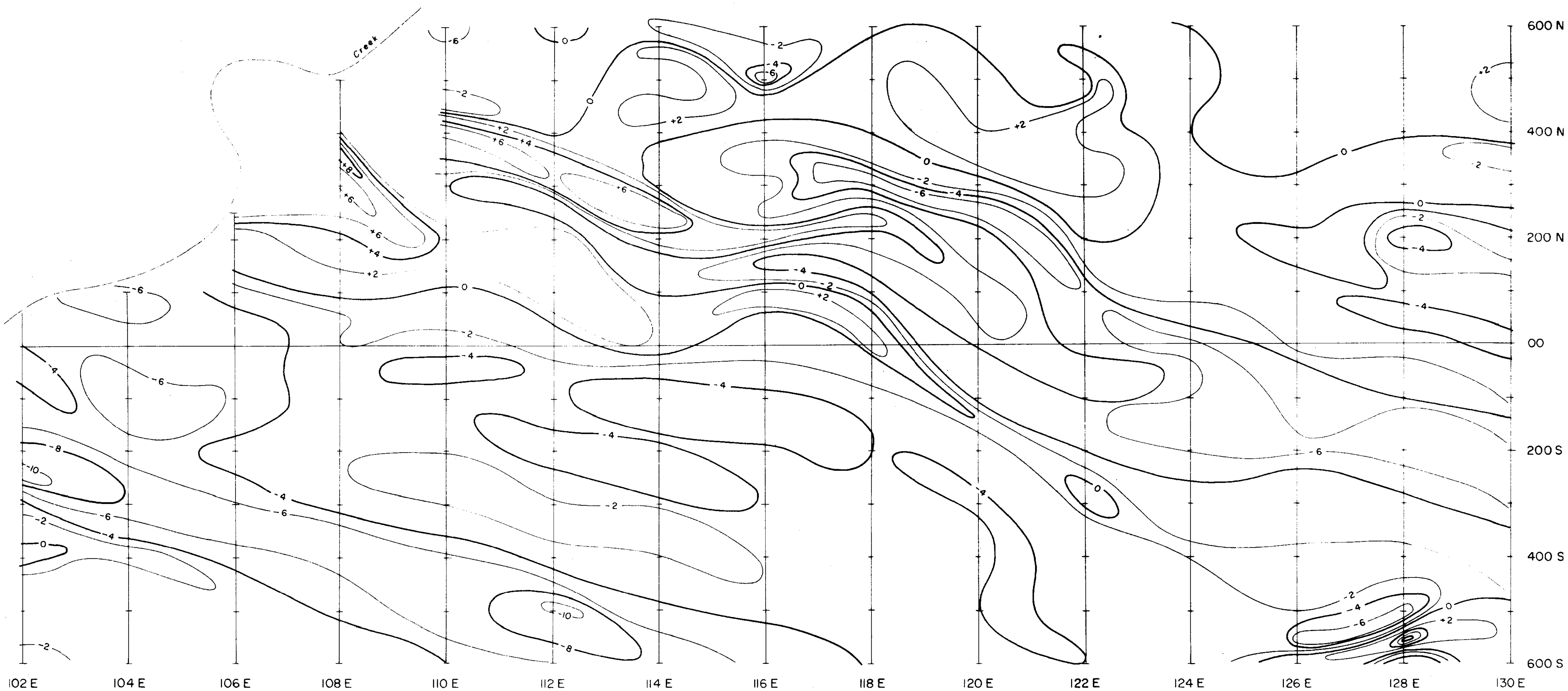

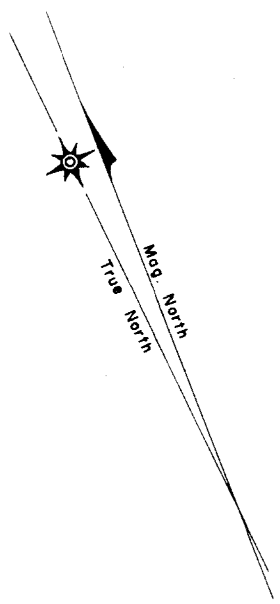

SCALE IN FEET

200 100 0 200 400 600

GEOPHYSICIST: A. Douglas

GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA, N.T., 1961

RUM JUNGLE CREEK SOUTH TO CASTLEMAINE HILL

(TRAVERSES 102 E TO 130 E)

TURAM PHASE CONTOURS

FREQUENCY 440 CPS COIL SEPARATION 50'

CONTOUR INTERVAL 2°

Bureau of Mineral Resources, Geology and Geophysics, Darwin, N.T., December 1961

G 71-246

To Accompany Record No 1962/102 S87-GP