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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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Geophysical Surveys of the Rum Jungle Complex, Northern Territory, 1968

by

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GEOPHYSICAL SURVEYS OF THE RUM JUNGLE COMPLEX, NORTHERN TERRITORY 1968

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SUMMARY

Slingram and resistivity test surveys were made on the Rum Jungle Complex to locate faults with no surface expression. These are of interest as possible zones of uranium concentration. The Giants Reef Fault produced Slingram and resistivity anomalies, and several other anomalous zones were found in the Complex. Both the Slingram and resistivity methods appear capable of detecting faults and shears in the Complex. The Slingram method is preferred to the resistivity method because it is quicker and more efficient.

A surface radiometric survey across the Complex did not find any significant anomalies either on the faults located in the Slingram and resistivity surveys or elsewhere.

A gravity survey was made to study the western boundary of the Complex. The results show that the western edge has a steep dip. Depth to basement under the metasediments west of the Complex is estimated at about 900 metres.

No magnetic contrast was found between the Complex and the metasediments west of it.

1. INTRODUCTION

Test surveys were made in 1968 by the Bureau of Mineral Resources, Geology & Geophysics (BMR) to find a suitable method for locating fault zones in the Rum Jungle Complex, particularly fault zones with no surface expression. This work arose from a suggestion by Territory Enterprises Pty Ltd that the Complex should be investigated for possible occurrence of uranium deposits similar to those in the Massif Central of France, where supergene concentrations occur in fault zones in a granite similar to the Rum Jungle Complex.

An east-west traverse (120S, of the Rum Jungle East grid) had already been pegged across the Complex for a gravity survey, and this was used to test the Slingram and resistivity methods over the Complex. A number of anomalies were found and the strike directions of two selected anomalous zones were determined by surveying two short traverses 800 feet north of 120S. A surface radiometric survey was also made on Traverse 120S.

The gravity survey made in 1967 (Williams, 1970) to investigate the eastern boundary of the Complex, was extended west on Traverse 120S, to study the western boundary of the Complex. A magnetic survey was also made across this boundary.

2. GEOLOGY

The geology of the Rum Jungle Complex, after Rhodes (1965) is shown in Plate 2. Rhodes describes The Succession as a granitic complex which occupies the core of an eroded dome of low-grade metasediments. He distinguished six major units in the Complex: these are, in order of decreasing age, schists and gneisses, granite gneiss, metadiorite, coarse granite, large feldspar granite, and leucocratic granite. Quartz-tourmaline veins and veins and dykes of pegmatite and amphibolite are also present. The metasediments rest unconformably on the eroded surface of the Complex. During a later period of folding and low-grade metamorphism the metasediments were domed around the granitic basement.

3. METHODS

The methods used in the surveys across the Complex were Slingram, resistivity, radiometric, gravity, and magnetic. The gravity and magnetic surveys were extended west over metasediments. Gravity and magnetic readings were 200 feet apart; all other readings were 100 feet apart.

The Slingram is a conventional electromagnetic method which uses a moving transmitter, moving receiver, and horizontal loop. Coil spacing was 200 feet and frequency was 1760 Hz.

In the resistivity survey, an ABEM Terrameter was used; this uses a 4-Hz current and a Wenner configuration. Electrode spacing was 200 feet; choice of this spacing was based on the Slingram results which indicated anomalies due to near-surface features.

The radiometric survey was made with Harwell Type 1368A ratemeters (geiger counters). The magnetic survey was made with an Askania vertical-component torsion magnetometer and the gravity survey with the Sharpe No. 145 gravity meter (scale value: 0.1065 milligals per scale division).

4. RESULTS

Slingram and resistivity

The Slingram and resistivity results on Traverse 120S are shown in Plate 3. The traverse crosses a number of units within the Complex (Plate 2). The Slingram results show a number of weak anomalies, mainly in the imaginary component. Some of these anomalies are over or close to creeks or swamps. The creeks and swamps may be caused by weathering effects caused in turn by fault zones. The Slingram anomalies increase in number going from west to east along the traverse, i.e. towards the Giants Reef Fault. This fault zone stands out clearly in the Slingram profiles between 96W and 106W.

The Slingram anomaly at the extreme western end of the traverse is Slingram anomaly A (Ashley, 1965) and is due to a shear on the Coomalie Dolomite/Crater Formation boundary. The boundary between the Crater Formation and the Complex is at about 528W. The anomalous zone between 250W and 266W is associated with outcrops of banded iron formation.

The resistivity profile is closely related to the Slingram profile, and all Slingram anomalies have accompanying resistivity anomalies of the order of 100 ohm-metres, with a few readings lower. The Giants Reef Fault stands out very clearly, with resistivities as low as 10 ohm-metres.

The resistivity high between 490W and 506W is associated with granite outcrop which is shattered and may represent a non-conducting fault zone.

Much of the resistivity profile is disturbed, probably by near-surface effects or electrode grounding effects. However, the anomalous zones stand out from the noise.

Two Slingram-resistivity anomalies were selected, and a traverse 800 feet north (112S) was pegged and surveyed with Slingram and resistivity methods to determine strikes of the anomalies. The two anomalies selected were at 343W and between 168W and 182W. (The profiles are reproduced in Plate 4; they show that the anomalies at 343W strike north, and the anomalies between 168W and 182W strike ENE).

Radiometric

Surface radiometric readings were made across the Complex on Traverse 120S at every 100 feet and on outcrop near the traverse. The results (Plate 3) show that the granite is everywhere radioactive, as was expected. The most radioactive part of the Complex along Traverse 120S is on the outcrop immediately west of the Giants Reef Fault, from 113 W to 150W. This radioactivity is definitely on massive outcrop, mapped by Rhodes (1965) as leucocratic granite, and is not associated with fault zones. Only the eastern part of the leucocratic granite is anomalously radioactive. No significant anomalies were found on anomalies located in the Slingram and resistivity surveys.

Gravity

The gravity results are shown in Plate 5. The 1967 gravity survey (Williams, 1970) included readings on Traverse 120S from east of the Rum Jungle Complex and the Giants Reef Fault to 220W. The 1968 survey continued west from 220W across the Complex and the metasediments west of the Complex, and finished at 642W. From 610W to 642W Traverse 116S was used instead of 120S to avoid the Finniss River.

Reductions were made using the same corrections and density (2.6 g/cm^3) as was used by Williams (1970). The same datum (BM51 on the Stuart Highway) was used as in the previous survey.

A comparison between the gravity profile and the geological map shows that density variations occur within the Rum Jungle Complex. The largest variation shown in the profile across the Complex is the low east of 340W. Outcrop within this low is sparse; the main outcrop is banded iron formation about 262W, and this causes a high within the low. Rhodes (1965, p. 9) believes that this banded iron formation is in a down-folded or faulted block, and the whole gravity low under discussion may be associated with Archaean sediments in down-folded or faulted blocks.

Plate 6 shows observed and computed gravity profiles over the western boundary of the Complex. The surface position of the boundary is inferred from geological evidence north and south of the traverse to be at about 528W; no outcrop occurs on the traverse itself. The steep gravity gradient between 534W and 551W is not directly related to the sediment/Complex boundary. The gentle gradient between 516W and 534W is associated with this near-surface density contrast, and the steep gradient is due to a density contrast extending much deeper and lying west of the surface contact. Theoretical gravity profiles were obtained using the computer programme for simulation of gravity anomalies described by Haigh, and Williams, and Pollard (in preparation). Measurements made on diamond-drill cores indicate a density contrast of 0.13 g/cm^3 between the Complex and the metasediments. A boundary dipping 70° west with its surface at 543W gave a curve which fitted reasonably well with the observed gravity. The gravity profile was then computed for various boundaries with a shallow dip from the surface at about 528W to the 70° boundary. The best fit obtained is shown in Plate 6. This is a boundary which dips at five degrees west from the surface to 150 feet (46 metres) vertical depth, and then dips 70° west. The observed gravity is not a smooth curve, indicating that the Complex boundary is irregular. The gravity results indicate that the boundary is roughly dome-shaped. The depth of the metasediments on the western end of the traverse is estimated at 3000 feet (900 metres).

<u>Magnetic</u>

A magnetic survey was made across the boundary of the Complex between 492W and 632W. No magnetic contrast was found between the Complex and the metasediments. Variations in the magnetic profile (Plate 5) are localized, near-surface effects.

5. CONCLUSIONS

The Slingram and resistivity surveys across the Rum Jungle Complex found a number of anomalies which can be interpreted as due to faults. The Slingram and resistivity results are complementary, and the conclusion reached is that Slingram is the preferred method to use for locating faults in the Complex because it is quicker and more efficient. Resistivity would be useful as a check.

The surface radiometric survey across the Complex found no significant anomalies. Hence there was no evidence to suggest that the fault zones inferred from the Slingram and resistivity results were associated with above-normal radioactivity.

The gravity survey indicated a steep dip on the western boundary of the Rum Jungle Complex. The depth to basement under the metasediments west of the Complex is estimated to be about 900 metres.

No magnetic contrast was found between the Complex and the metasediments west of it.

6. REFERENCES

ASHLEY, J., 1965 - Rum Jungle area geophysical surveys, Northern Territory 1963. Bur. Min. Resour. Aust. Rec. 1965/3 (unpubl.).

HAIGH, J.E., WILLIAMS, J.P., and POLLARD, P.C., - Simulation of gravity and magnetic anomalies. Bur. Min. Resour. Aust. Rec. (in prep.).

RHODES, J.M., 1965 - The geological relationships of the Rum Jungle Complex, Northern Territory. Bur. Min. Resour. Aust. Rep. 89.

WILLIAMS, J.P., 1970 - Geophysical investigation of the eastern margin of the Rum Jungle Complex, Northern Territory 1967. Bur. Min. Resour. Aust. Rec. 1970/1 (unpubl.).

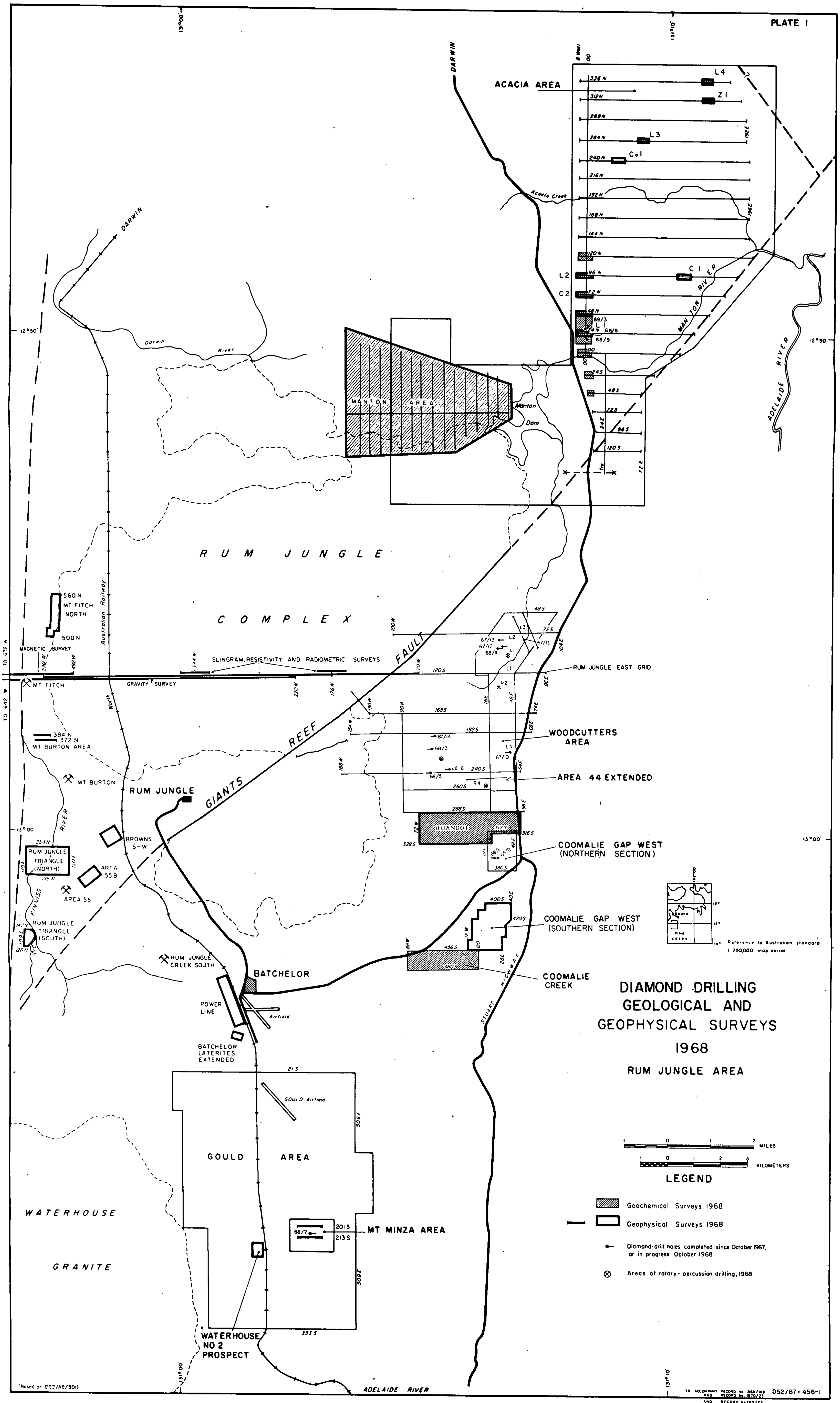


PLATE I
DIAMOND DRILLING
GEOLOGICAL AND
GEOPHYSICAL SURVEYS
1968
RUM JUNGLE AREA
ACACIA AREA
MANTON AREA
RUM JUNGLE
COMPLEX
GIANTS REEF FAULT
SLINGRAM, RESISTIVITY AND RADIOMETRIC SURVEYS
RUM JUNGLE EAST GRID
WOODCUTTERS AREA
AREA 44 EXTENDED
HUANDOT
COOMALIE GAP WEST (NORTHERN SECTION)
COOMALIE GAP WEST (SOUTHERN SECTION)
COOMALIE CREEK
MT FITCH NORTH
MAGNETIC SURVEY
GRAVITY SURVEY
MT FITCH
MT BURTON AREA
MT BURTON
RUM JUNGLE
BROWNS S-W
RUM JUNGLE TRIANGLE (NORTH)
AREA 55 B
AREA 55
RUM JUNGLE TRIANGLE (SOUTH)
RUM JUNGLE CREEK SOUTH
BATCHELOR
POWER LINE
BATCHELOR LATERITES EXTENDED
GOULD AREA
MT MINZA AREA
WATERHOUSE GRANITE
WATERHOUSE NO 2 PROSPECT
ADELAIDE RIVER
MANTON RIVER
STUART HIGHWAY
DARWIN
Australian Railway
MILES
KILOMETERS
LEGEND
Geochemical Surveys 1968
Geophysical Surveys 1968
Diamond-drill holes completed since October 1967, or in progress October 1968
Areas of rotary- percussion drilling, 1968
Reference to Australian standard 1:250,000 map series
(Based on D52/A8/301)
TO ACCOMPANY RECORD No. 1969/149 AND RECORD No. 1970/23 AND RECORD No. 1971/23 AND RECORD No. 1971/20
D52/B7-456-1

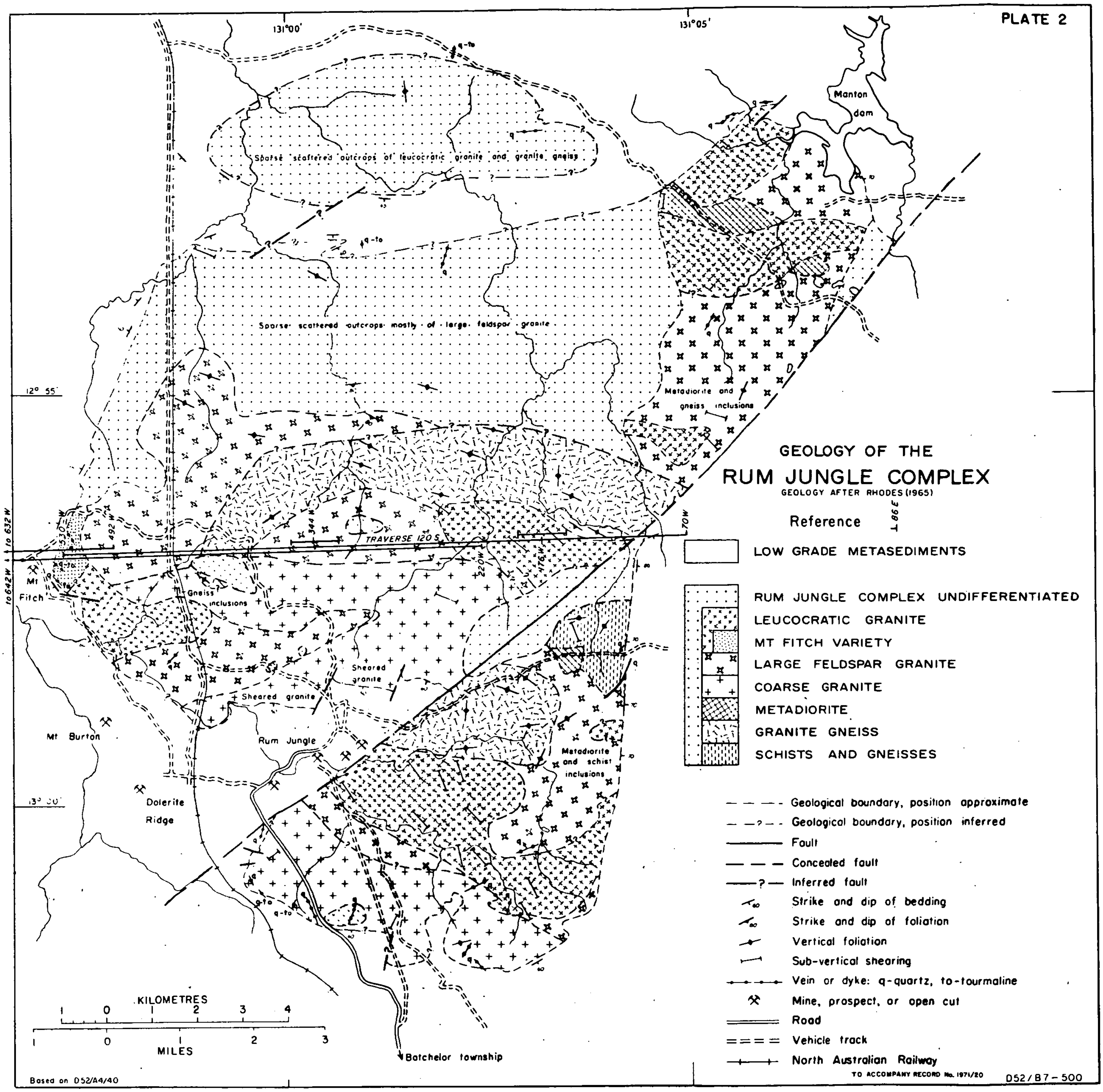
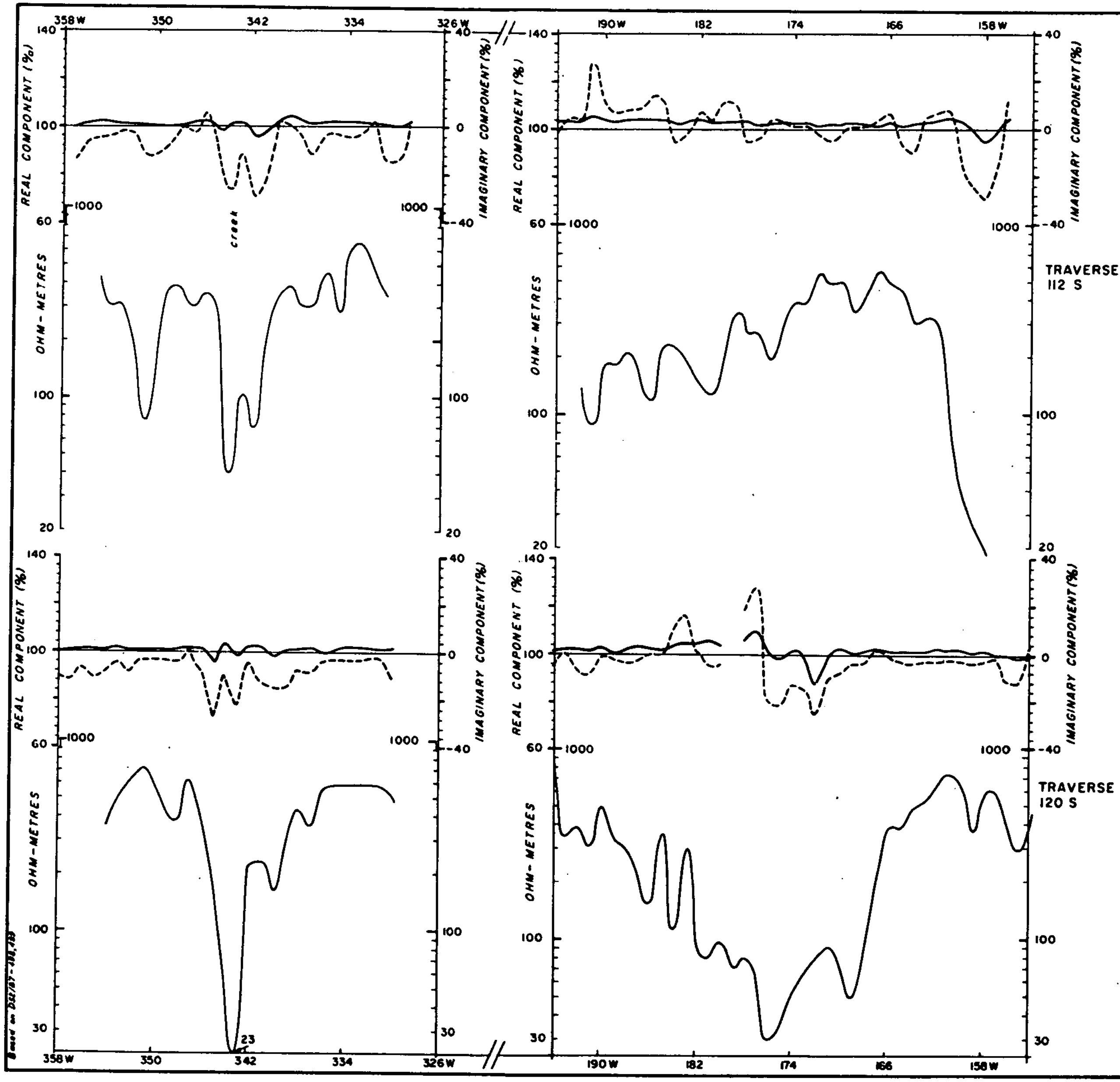


PLATE 2
131°00'
131°05'
12° 55'
13° 00'
Manton dam
Sparse scattered outcrops of leucocratic granite and granite gneiss
Sparse scattered outcrops mostly of large feldspar granite
Metadiorite and gneiss inclusions
Metadiorite and schist inclusions
TRAVERSE 120 S
Gneiss inclusions
Sheared granite
Mt Fitch
Mt Burton
Rum Jungle
Dolerite Ridge
Batchelor township
KILOMETRES
1 0 1 2 3 4
MILES
1 0 1 2 3
GEOLOGY OF THE
RUM JUNGLE COMPLEX
GEOLOGY AFTER RHODES (1965)
Reference
LOW GRADE METASEDIMENTS
RUM JUNGLE COMPLEX UNDIFFERENTIATED
LEUCOCRATIC GRANITE
MT FITCH VARIETY
LARGE FELDSPAR GRANITE
COARSE GRANITE
METADIORITE
GRANITE GNEISS
SCHISTS AND GNEISSES
Geological boundary, position approximate
Geological boundary, position inferred
Fault
Concealed fault
Inferred fault
Strike and dip of bedding
Strike and dip of foliation
Vertical foliation
Sub-vertical shearing
Vein or dyke: q-quartz, to-tourmaline
Mine, prospect, or open cut
Road
Vehicle track
North Australian Railway
Based on D52/A4/40
TO ACCOMPANY RECORD No. 1971/20
D52/B7-500

SLINGRAM, RESISTIVITY, AND SURFACE RADIOMETRIC PROFILES
TRAVERSE 120S

D52/B7-463

PLATE 4



COMPARISON OF SLINGRAM AND RESISTIVITY RESULTS ALONG TRAVERSES 112 S AND 120 S

RUM JUNGLE COMPLEX N.T. 1968

TO ACCOMPANY RECORD No. 1971/20

D52/B7-501

PLATE 5

GRAVITY AND MAGNETIC PROFILES
TRAVERSE 116S/120S

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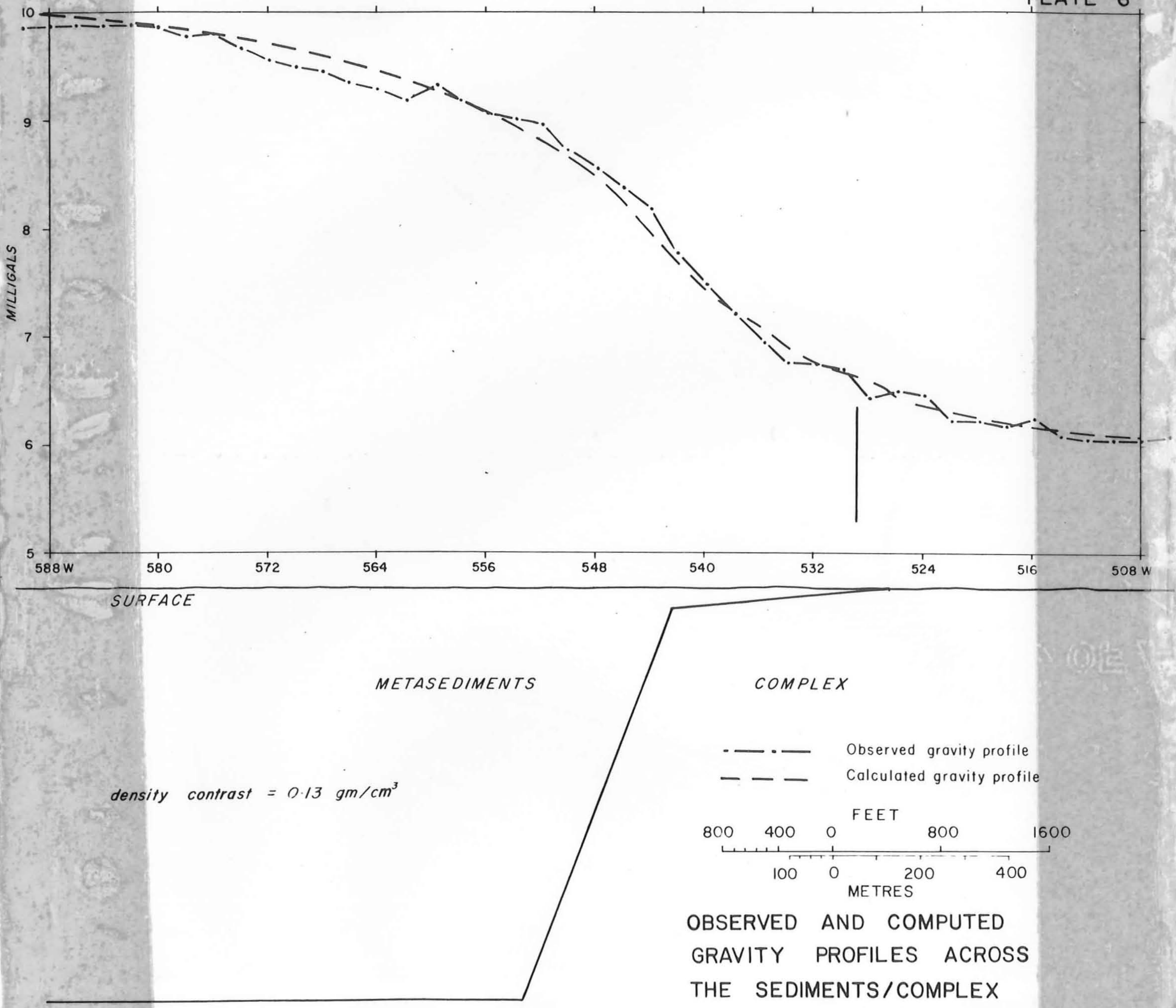
D52/B7—464

RUM JUNGLE 1968

PLATE 6



OBSERVED AND COMPUTED GRAVITY PROFILES ACROSS THE SEDIMENTS/COMPLEX BOUNDARY

TO ACCOMPANY RECORD No. 1971/20

D52/B7-465