COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

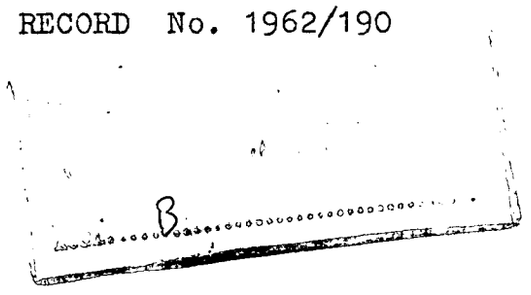
RECORD No. 1962/190

TENNANT CREEK MAGNETIC SURVEY, NT 1961

by

A. Douglas

RECORD No. 1962/190



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CONTENTS

ILLUSTRATIONS

SUMMARY

In March 1961 some measurements were made of the horizontal component of magnetic intensity along the centre-lines of some magnetic anomalies near Tennant Creek, NT.

Calculated and observed curves of horizontal and vertical components are compared, and estimates are given of the locations, depths, and radii of the bodies causing the magnetic anomalies.

1. INTRODUCTION

During March 1961, at the request of Australian Development N.L., measurements were made of the variations in the horizontal magnetic force along the centre-lines of a series of magnetic anomalies located close to Tennant Creek, Northern Territory. These anomalies had already been investigated by the staff of Australian Development N.L. using a vertical-force magnetometer, and the horizontal-force surveys were carried out to supplement this work and aid in the interpretation of the results. The horizontal-magnetometer surveys were made by A. Douglas of the Bureau of Mineral Resources, assisted by Australian Development N.L. staff.

2. DESCRIPTION OF AREAS SURVEYED

Red Bluff area

This area lies about 30 miles west of Tennant Creek and close to the Red Bluff Trig. Point. A grid, with traverses in the true north direction, had been surveyed over the area by the staff of Australian Development N.L. The approximate position of the Red Bluff Trig. Point on this grid is 18.20E/1.50N. The magnetic anomalies in the area have been numbered 1 to 12. The centre-lines of Anomalies 1A, 4, 7A, 7B, 7C, 12A, and 12B were surveyed with the horizontal-force magnetometer.

BMR Area No.3

This area has been described by O'Connor and Daly (1962) and by Daly (1959). Horizontal force measurements were made along the centre-line of Anomaly No. 2.

Nobles Nob North

A very broad anomaly lying east of Nobles Nob mine was located during the 1935-37 survey by the Aerial, Geological and Geophysical Survey of Northern Australia (AGGSNA) and is described by Daly (1957) as part of the Rising Sun area. This anomaly has been renamed Nobles Nob North. An approximate relation between the AGGSNA grid and the Australian Development N.L. grid used for the 1961 survey is: 10S/26E on the AGGSNA grid is equivalent to 13N/116E on the Australian Development N.L. grid. The Australian Development N.L. traverses run true north.

Cabbage Gum No. 1

No information on the exact location of this area is available. The approximate position is five miles south of Nobles Nob mine.

Golden Forty

This area was also covered by the AGGSNA and is described by Daly (1957). The point 11.68E/8S on the AGGSNA grid is equivalent to 0E/0N on the Australian Development N.L. grid. The Australian Development N.L. traverses run true north.

Golden Kangaroo

The survey grid for this area is an extension of the Australian Development N.L. grid for the Golden Forty.

3. INTERPRETATION OF RESULTS

The method of interpretation used for the results is that described by Daly (1957), which is based on the assumption that the anomalies are caused by spherical bodies polarised by induction in the present direction of the Earth's magnetic field. The method and its limitations have been fully described by Daly and will not be discussed here.

Using Daly's method, estimates have been made of the depth and position of the centres of the bodies and their radii. Daly's values for the constants of the magnetic field at Tennant Creek (0.5 gauss for the total force and $48^{\circ}50'$ for the inclination) have been used for these calculations. The radii of the bodies have been estimated assuming a susceptibility of 10^{-1} c.g.s. units. These estimates are given below.

Area	Anomaly	Traverse	Calculated body causing anomaly: Centre	Depth to Centre (ft)	Radius (ft)
Red Bluff	1A	19E	12.97N	534	130
	4	108W	6.85N	1145	290
	12A	276W	239.26S	632	170
	12B	276W	223.16S	486	110
	7A	177.7W	93.60S	582	160
	7B	176W	84.60S	924	220
	7C	166W	71.60S	874	205
BMR Area No. 3	2	196W	45.15N	418	110
Nobles Nob North		116E	18.82N	3205	650
Cabbage Gum No. 1		176E	125.03S	534	170
Golden Forty		9E	13.31S	505	180
		1E	11.11S	505	170
		1E	2.98S	262	100
		1E	3.23S	97	45
		0E	10.41S	505	170
		0E	2.98S	262	100
Golden Kangaroo		41.5E	8.65N	310	110
		41.5E	13.13N	194	40
		39E	10.34N	486	115
		39E	12.60N	214	55

Red Bluff area (Plate 2)

Anomaly 1A. The calculated and observed horizontal profiles are in good agreement over their central portions, but diverge markedly towards the ends of the traverse.

The calculated and observed vertical-component profiles have similar shapes but the maximum of the calculated profile lies about 100 ft north of the observed maximum. Daly (1957) suggests that such a discrepancy could be attributed to the effects of dip but that this hypothesis must be treated with caution.

Anomaly 4. The fit of the horizontal-component profile is good except at the northern end.

The vertical-component curves also show fair agreement and their maxima occur at roughly the same point.

Anomalies 12A and 12B. The horizontal-component curves show good agreement except towards the southern end of the traverse.

Although the calculated and observed vertical-component curves have their maxima at the same point, the gradients of the observed vertical profiles are steeper, suggesting a shallower depth for the body than that estimated from the horizontal profile. The most marked difference is at the southern end of the traverse.

Anomalies 7A and 7B. The bodies causing these anomalies are close together and interpretation of the observed profiles is more difficult.

It was assumed that the magnitude and the position of the maximum and minimum of Anomaly 7A (vertical-component profile) on Traverse 177.7W are little affected by the proximity of the body causing Anomaly 7B. An estimate of the depth and position of the body causing Anomaly 7A was then made. It was then assumed that the body causing Anomaly 7A has the same effect on the magnetic profile along Traverse 176W as on the profile along Traverse 177.7W, and this effect was then subtracted from the observed profiles along Traverse 176W. The profile remaining was then regarded as being due solely to Anomaly 7B and an estimate of the depth and position of a body causing this anomaly was made. The computed and observed curves for Traverse 176W agree very well, which indicates that the depth estimates may be considered to be reliable.

Anomaly 7C. Although there is evidence of another body lying south of that causing Anomaly 7C, it is not close enough to have a marked affect on the observed magnetic profiles near Anomaly 7C. A good fit has been obtained for the central portion of the observed and calculated horizontal and vertical-component profiles.

BMR Area No. 3 (Plate 3)

Agreement is good over the central portion of the traverse but towards the ends of the traverse the observed and calculated profiles diverge considerably.

Nobles Nob North (Plate 3)

The observed profiles along the traverse are very erratic and estimates of the position of maxima and minima are accordingly difficult. However, the calculated curves agree fairly closely and suggest that the depth estimates are reliable.

Cabbage Gum No. 1 (Plate 3)

The calculated and observed profiles along Traverse 176E are in good agreement, apart from slight discrepancies towards the ends of the traverse.

The observed profile for Traverse 170E is too erratic to allow a close fit to be made. The calculated horizontal profile along Traverse 176E roughly fits the observed profile along Traverse 170E.

Golden Forty (Plate 4)

Three traverses, viz. OE, 1E, and 9E, were read over this area. The interpretation of the profiles has been made assuming the following:

(a) Profiles along Traverse 9E indicate a single body

(b) " " " 1E " three bodies

(c) " " " OE " two bodies

All profiles indicate a body at a depth of 505 ft and the profiles along Traverses 1E and OE both indicate a body at a depth of 262 ft. The third body detected on Traverse 1E is at a very shallow depth and is probably an iron blow whose upper limit is close to the surface.

Golden Kangaroo (Plate 4)

The observed profiles for the two traverses surveyed across this area appear to indicate two bodies in both cases. The calculated profiles based on this assumption agree fairly well with the observed profiles.

4. ACKNOWLEDGEMENT

The author expresses his appreciation of the co-operation and willing assistance of the staff of Australian Development N.L.

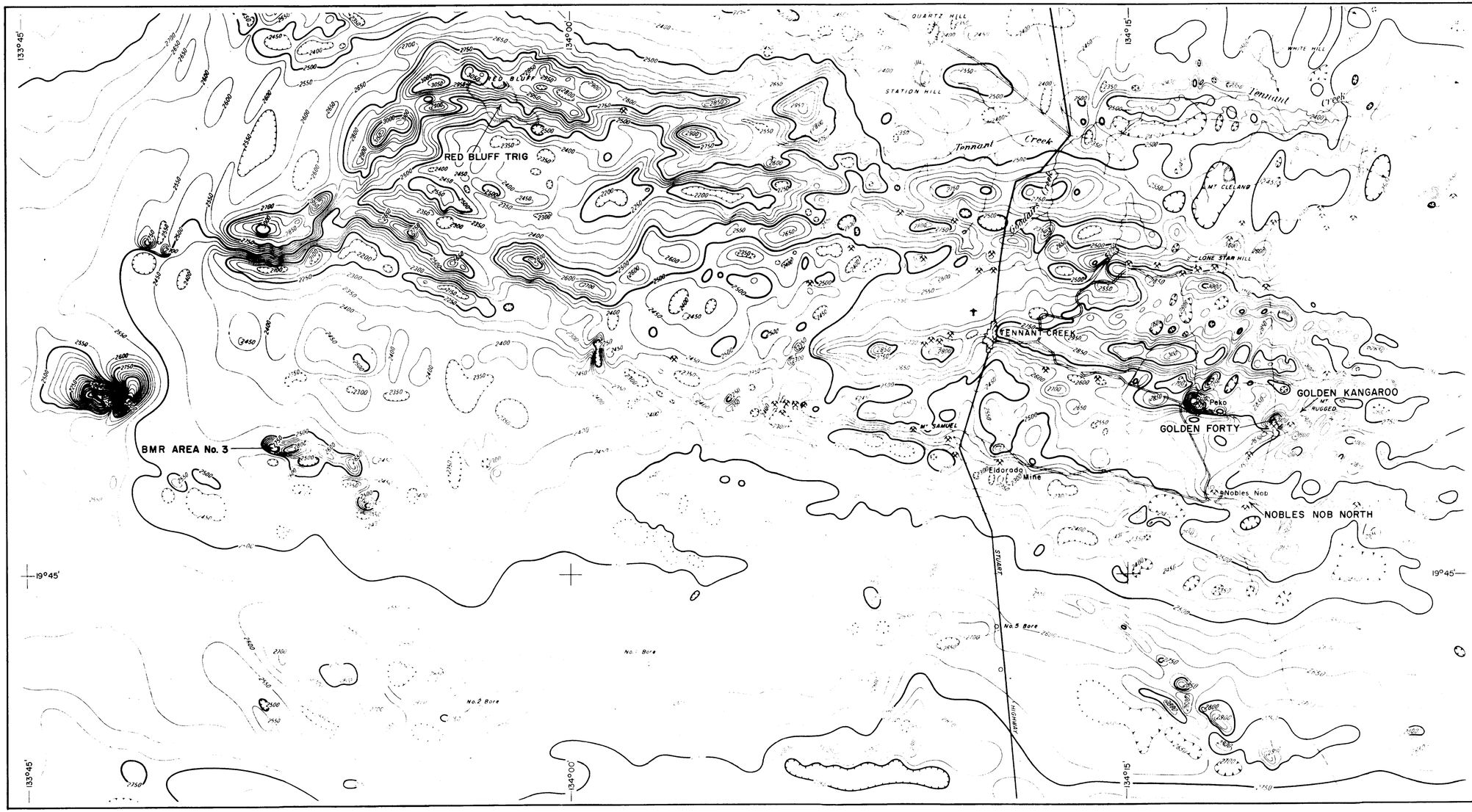
5. REFERENCES

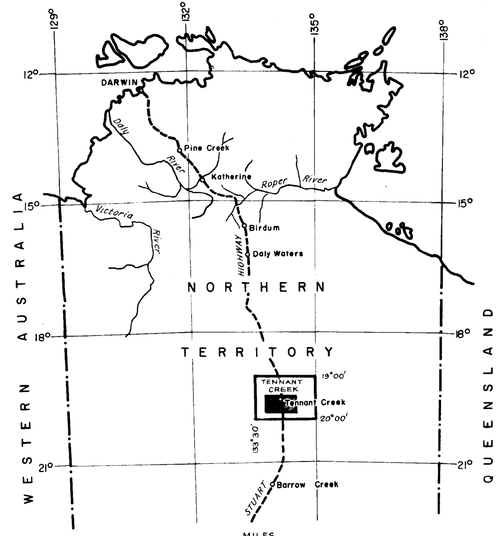
DALY, J. 1957 Magnetic prospecting at Tennant Creek, Northern Territory, 1935-37. Bur. Min. Resour. Aust. Bull. 44.

DALY, J. 1959 Recommendations for diamond drilling at Tennant Creek, NT. Bur. Min. Resour. Aust. Rec. 1959/45 (unpubl.).

O'CONNOR, M.J. and DALY, J. 1962 Tennant Creek ground magnetic survey, NT 1958. Bur. Min. Resour. Aust. Rec. 1962/148 (unpubl.).

PLATE I





TENNANT CREEK, NT
GROUND MAGNETIC SURVEY, 1961

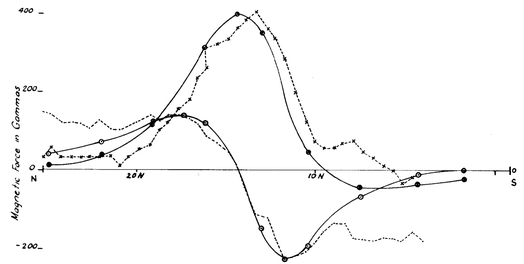
LOCALITY MAP
SHOWING
TOTAL MAGNETIC INTENSITY
MEASURED BY AIRBORNE MAGNETOMETER

MILES

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. E 53/B7-1

TO ACCOMPANY RECORD No. 1962/190

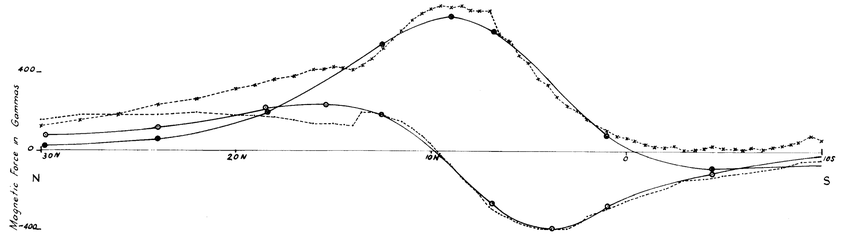
PLATE 2



RED BLUFF ANOMALY 1A

Traverse 19E

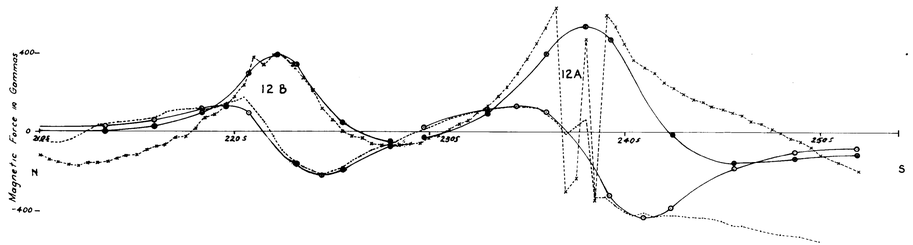
Centre of Body 1297 N
Depth of Centre 534 ft



RED BLUFF ANOMALY 4

Traverse 108 W

Centre of Body 685 N
Depth of Centre 1145 ft

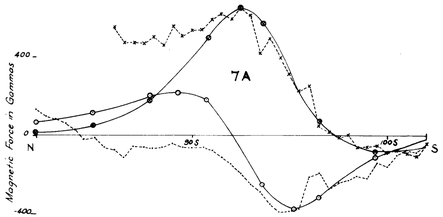


RED BLUFF ANOMALIES 12A & 12B

Traverse 276 W

Centre of Body 12A 23926 S
12B 22316 S

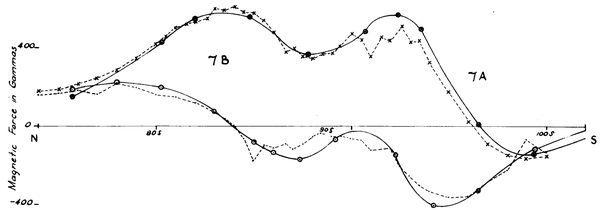
Depth of Centre 12A 632 ft
12B 486 ft



RED BLUFF ANOMALY 7A

Traverse 177·7 W

Centre of Body 9360 S
Depth of Centre 582 ft

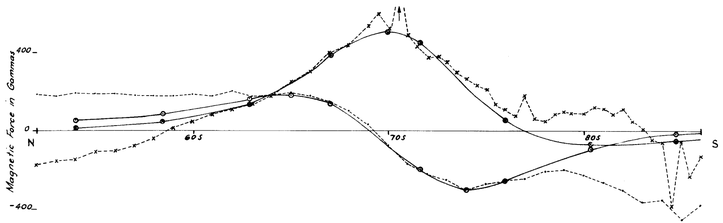


RED BLUFF ANOMALY 7B & 7A

Traverse 176 W

Centre of Body 7A 9360 S
7B 8460 S

Depth of Centre 7A 582 ft
7B 924 ft



RED BLUFF ANOMALY 7C

Traverse 166 W

Centre of Body 7160 S
Depth of Centre 874 ft

Reference

Observed horizontal-component variations.

Observed vertical-component variations.

Calculated horizontal-component variations.

Calculated vertical-component variations.

Vertical Magnetic Force Results after Australian Development N.L.

MAGNETIC SURVEY AT TENNANT CREEK
MARCH 1961

COMPARISON OF OBSERVED AND CALCULATED PROFILES.

Horiz. Scale

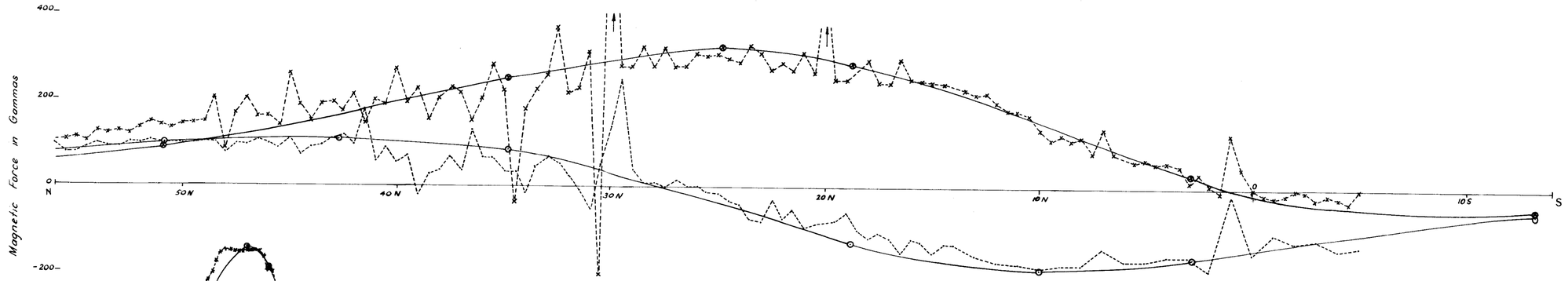
400 0 400 800 FT

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

E 53/87-2

To Accompany Record No 1962/190

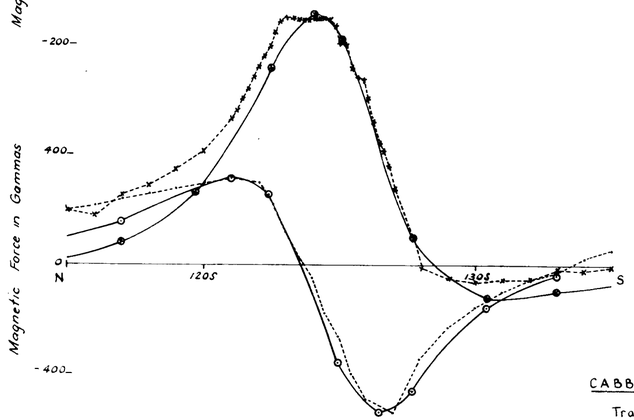
PLATE 3



NOBLES NOB NORTH

Traverse 116 E

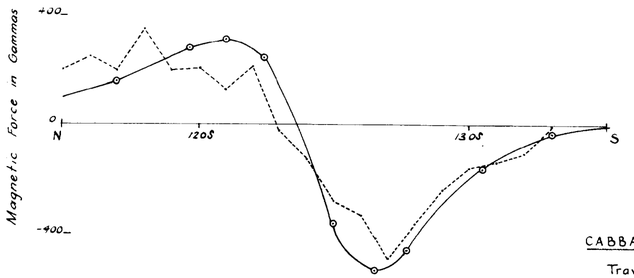
Centre of Body 1882 N.
Depth of Centre 3205 ft



CABBAGE GUM No 1

Traverse 176 E

Centre of Body 12,503 S.
Depth of Centre 534 ft



CABBAGE GUM No 1

Traverse 170 E

Centre of Body 12·50 S.
Depth of Centre 534 ft

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

Reference

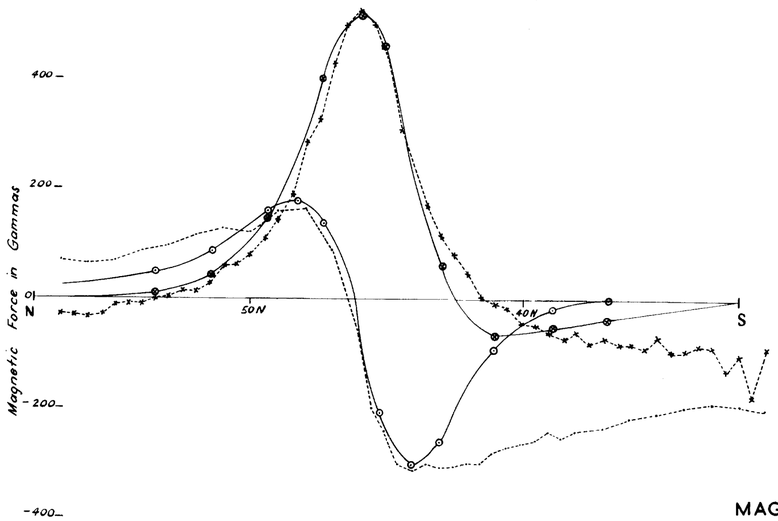
Observed horizontal-component variations.

Observed vertical-component variations.

Calculated horizontal-component variations.

Calculated vertical-component variations.

Vertical Magnetic Force Results after Australian Development N.L.



BMR AREA No. 3

ANOMALY No 2

Traverse 196 W

Centre of Body 46·15 N
Depth of Centre 418 ft

MAGNETIC SURVEY AT TENNANT CREEK
MARCH 1961

COMPARISON OF OBSERVED AND CALCULATED PROFILES

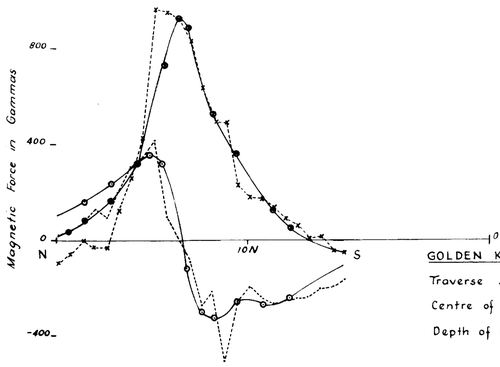
Horiz. Scale

400 0 400 800 FT

E 53/B7-3

To Accompany Record No 1962/190

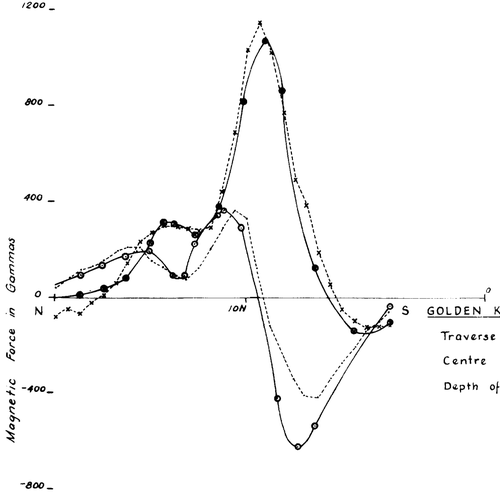
PLATE 4



GOLDEN KANGAROO

Traverse 39 E

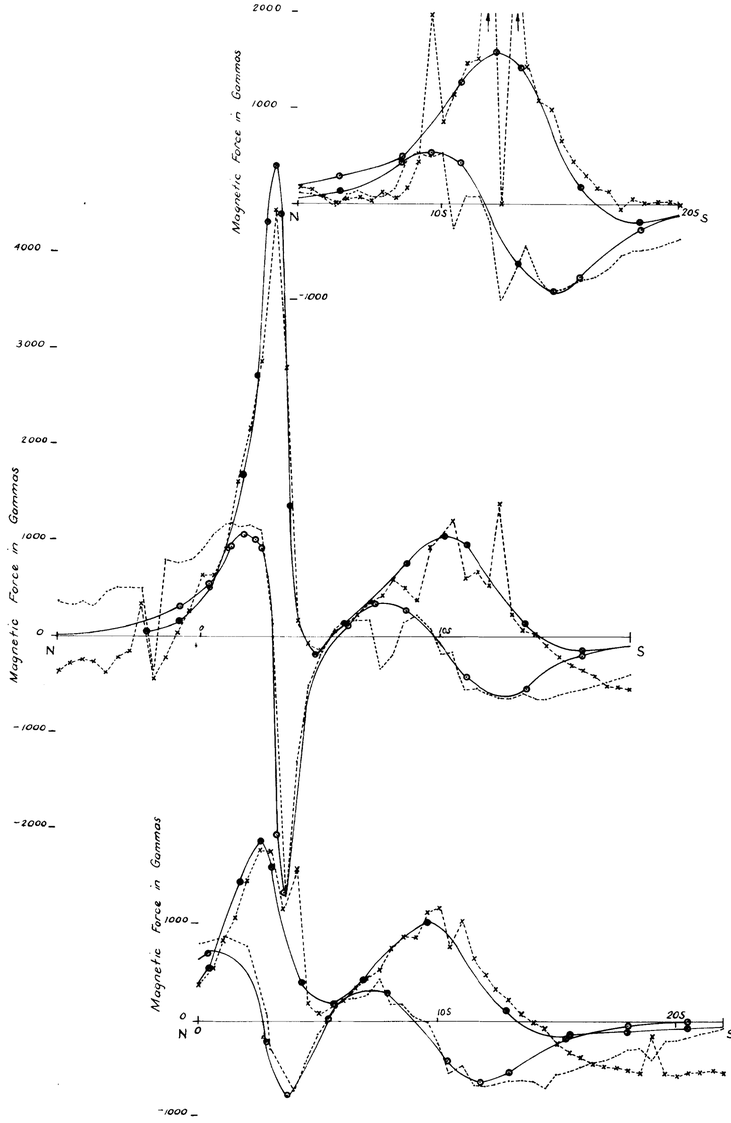
Centre of Body	12·60 N	10·34 N
Depth of Centre	214 ft	486 ft



GOLDEN KANGAROO

Traverse 41·5 E

Centre of Body	8·65 N	13·13 N
Depth of Centre	310 ft	194 ft



GOLDEN FORTY

Traverse 9E

Centre of Body	13·31 S
Depth of Centre	505 ft

GOLDEN FORTY

Traverse 1 E

Centre of Body	1·11 S	3·23 S	2·98 S
Depth of Centre	505 ft.	97 ft	262 ft

GOLDEN FORTY

Traverse 0E

Centre of Body	10·41 S	2·98 S
Depth of Centre	505 ft	262 ft

Reference

Observed horizontal-component variations

Observed vertical-component variations

Calculated horizontal-component variations

Calculated vertical-component variations

Vertical Magnetic Force Results after Australian Development N.L.

MAGNETIC SURVEY AT TENNANT CREEK MARCH 1961

COMPARISON OF OBSERVED AND CALCULATED PROFILES.

Horiz. Scale

400 0 400 800 FT

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

E 53/87-4

To Accompany Record No 1962/190