COMMONWEALTH OF AUSTRALIA

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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD NO. 1967/151

TENNANT CREEK DETAILED AEROMAGNETIC SURVEY,

NORTHERN TERRITORY 1967

by

E.P. SHELLEY and P.J. BROWNE - COOPER

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CONTENTS

		Page
	SUMMARY	
1.	INTRODUCTION	1
2.	GEOLOGY	1
3.	RESULTS AND INTERPRETATION	3
4.	CONCLUSIONS AND RECOMMENDATIONS	7
5.	REFERENCES	8
APPENDIX 1.	Results of analyses of individual anomalies	11
APPENDIX 2.	Operational details	12

ILLUSTRATIONS

Plate 1.	Locality map	(Drawing No. E53/B1-35)
Plate 2.	Total magnetic intensity contours, geophysical interpretation, and geology - Area A	(E53/B1-53)
Plate 3.	Total magnetic intensity contours, geophysical interpretation, and geology - Area B	(E53/B1-54)
Plate 4.	Total magnetic intensity contours, geophysical interpretation, and geology - Area C	(E53/B1-55)

SUMMARY

During March and April 1967, a detailed aeromagnetic survey of three areas in the Tennant Creek mineral field was made by the Bureau of Mineral Resources. The survey was made as an aid to geological mapping and mineral exploration and the three areas had been selected as being of particular interest. The aeromagnetic data were interpreted in terms of geological structure and rock type.

The survey delineated a WNW-striking magnetic 'ridge' in the area 24 miles north-east of Tennant Creek. This is thought to be due to a belt of sediments of the Warramunga Group. Areas of low magnetic relief to the west and north of this 'ridge' were interpreted as representing granitic rocks and Cambrian sedimentation respectively.

In the area 25 miles north-west of Tennant Creek the contours have a general westerly trend which is intersected by a southerly trend in the western half. Several prominent positive and negative lineations have been interpreted. A strong anomaly was recorded over the Warrego mine.

The southern part of the area 9 miles west of Tennant Creek is thought to be underlain by a porphyry mass, and several small anomalies near the margins of this mass have been interpreted as being due to ironstone bodies. A prominent west striking magnetic 'ridge' was delineated in the north, and the magnetic data suggest that the source is faulted twice within the survey area.

Individual anomalies of interest were recorded in each of the three areas. Analysis of the anomalies suggests that several of them are worth further investigation.

1. INTRODUCTION

A detailed aeromagnetic survey of three areas in the Tennant Creek gold and copper field was carried out during March and April 1967. The three areas as indicated on Plate 1 were chosen in collaboration with the BMR Geological Branch after consideration of the interpreted structure and the positions of known orebodies.

Copper and gold mineralisation at Tennant Creek is almost invariably associated with ironstone bodies which consist mainly of quartz-magnetite below the water table. Consequently the magnetic method of prospecting has been used with considerable success.

Much ground magnetic surveying has taken place in the Tennant Creek area. Surveys carried out prior to the Second World War by the Aerial, Geological and Geophysical Survey of Northern Australia are described by Daly (1957), and recent surveys by the BMR are described by Daly (1959a and b), Douglas (1962; 1964a and b) O'Connor and Daly (1958; 1962), and O'Connor, Goodchild, and Daly (1959). These, together with various surveys by private companies, have covered many of the more interesting anomalies.

The Tennant Creek 1:250,000 map area was surveyed by the aeromagnetic method in 1956 and 1960 (BMR, 1958; Spence, 1962). On these surveys, a D.C.3 aircraft was flown at 500 ft above ground level along Shoran-controlled arcs approximately one-fifth of a mile apart. From the results, small areas were selected for detailed aeromagnetic surveying. These were flown in 1964 (Milsom and Finney, 1965) and 1966 (Finney, 1967). The survey described in this Record was the third of this type.

2. GEOLOGY

The geology of the Tennant Creek mineral field has been the subject of a comprehensive study by Ivanac (1954), which includes all the known geology up to 1950. Further work is described by Crohn, Ryan, and Oldershaw (1959); Crohn (1963); Crohn and Oldershaw (1965); Dunnett (1965); Dunnett and Harding (1965); and Harding (1965). Geological work has also been carried out by Geopeko Ltd and Australian Development N.L. but the results are not generally available.

The Tennant Creek mineral field is in a geosynclinal fold belt that has been stable since the close of the Lower Proterozoic apart from limited volcanic activity during the Cambrian. The Warramunga Geosyncline developed early in the Proterozoic about an axis trending north-west and passing to the south of the Tennant Creek township. During this phase, a thick sedimentary sequence was laid down. Orogenic movements followed and the Warramunga Group sediments were uplifted, deformed, and intruded by granites. The sediments were probably affected by later orogenic movements associated with the Davenport Geosyncline to the south. These were the last major tectonic movements in the area and the present land surface results from the dissection of a Tertiary peneplain some 200 ft above the general present level.

Sedimentary rocks

Archaean rocks do not crop out in the Tennant Creek 1:250,000 map area but are thought to occur in a magnetically disturbed area twenty miles WSW of Tennant Creek beneath about 80 ft of unconsolidated grit and sandstone. Diamond-drill cores taken from this area consist of a complex of gneiss and amphibolite, containing magnetite-rich bands associated with gabbroic and granite intrusions. The observed magnetic anomalies are caused by this magnetite and are not associated with mineralisation.

Most of the rocks that crop out in the Tennant Creek area belong to the Lower Proterozoic Warramunga Group, which contains all the known mineral deposits. The group consists of greywacke, tuffaceous greywacke, siltstone, and shale, with some grit and pebble beds.

Metamorphism of the Warramunga Group is intense only at the margins of the igneous intrusions and in the numerous shear zones, where chlorite, sericite, and talc have been formed. Two distinct classes of shears and faults have been recognised, the more widespread of which is characterised by a main north-westerly trend with associated north-easterly shears, and by quartz infillings which now give rise to prominent ridges. The largest of these shears extends from Quartz Hill to Rocky Range (Plate 1) dividing the Warramunga Group into two units. To the south and west of the shear the sediments are sharply folded and dips are generally steep and occasionally vertical, but to the north, folding is less intense and dips rarely exceed 45°. Smaller but more numerous shears post-date the quartz-filled type, differing from them in strike direction and in being infilled with ironstone.

Cambrian rocks crop out in the southern part of Area 'A'. These belong to the Helen Springs Volcanics and Gum Ridge Formation, and unconformably overlie the Warramunga Formation. The Helen Springs Volcanics consist of basalts, grits, and breccias and the Gum Ridge Formation of calcareous sandstone, shale, and chert.

Igneous rocks

Igneous rocks intrude the sediments of the Warramunga Group. These include massive foliated granite and adamellite, quartz porphyry and quartz-feldspar porphyry dykes and plugs, and ignimbrites filling volcanic pipes. The presence of ignimbrites shows that these are high level intrusions and this is borne out by the relatively slight contact metamorphism which has been produced. These contact metamorphic effects are generally represented by silicification of a few favourable beds and breccia zones, giving rise to prominent jasper bars.

The porphyry bodies are small, the maximum size being about 3 miles by 1 mile. They are generally elongated east-west, parallel to the dominant strike of the Warramunga Group, and may show shearing in this direction. Most of the granites and porphyries are conformable with the country rock, but local variations exist on a small scale.

Other igneous rocks present in the Tennant Creek area are uralitised diorites, dolerite dykes in the granite complexes, some serpentinite, and many lamprophyre plugs and dykes.

Mineralisation

Most of the known gold and copper mineralisation is associated with ironstone lodes. These ironstones are of a similar nature throughout the Tennant Creek mineral field, being largely quartz-magnetite bodies, oxidised to quartz-haematite above the water table. Throughout most of the field favourable beds (mudstone, shale, haematite shale) and favourable structure (shear and brecciation zones) have controlled mineralisation.

An important feature of the mineralisation is the repetition of ore-shoots, which may occur down-pitch from an outcropping quartz-haematite lens. Gold is found in the ironstone or in the adjacent brecciated sediments and is invariably more plentiful in the oxidised zone, owing to secondary enrichment. Very few gold deposits have been worked in the primary zone, where the gold is more finely divided and may be associated with sulphides.

The copper ore occurs mainly within the ironstone bodies. The primary sulphide mineral is chalcopyrite with associated pyrite, arsenopyrite and the quartz-magnetite of the ironstone. Native copper, cuprite, and carbonates occur in the oxidised zone. Copper bodies are also known to occur in porphyries and phyllites but these are usually of low grade. Small lead-zinc ore bodies also occur in the ironstones.

Mining takes place at a relatively shallow depth, the deepest level being 1200 ft at the Peko mine. The other important copper mines at Tennant Creek are Orlando and Ivanhoe. The two important gold producers are the Nobles Nob and Juno mines. A number of other prospects in the area are currently under investigation.

3. RESULTS AND INTERPRETATION

The aeromagnetic contours for each of the three areas, A, B, and C, are shown superimposed on known geology in Plates 2, 3, and 4 respectively. Qualitative geophysical interpretation is also shown in these plates. This involves the delineation of positive and negative trends and interpreted faults.

Numbered anomalies in the plates refer to those which have been analysed quantitatively by one or more methods. In all cases profiles on which the analyses were done were constructed from the magnetic contours.

Several different interpretation methods were used depending on the assumed shape of the anomaly source. Circular anomalies which had a minimum south of the maximum were assumed to be due to sources of a spherical nature and were analysed by the method of Daly (1957).

Elongated anomalies were assumed to be caused by tabular bodies. Profiles were constructed normal to the assumed strike of the body and analysed by the curve-fitting method of Gay (1963). Preliminary depths to these bodies were generally obtained by the half-maximum-slope method of Peters (1949). Other methods used were those of Henderson and Zeitz (1948) and Moo (1965).

Area A

The pattern of the aeromagnetic contours in this area (Plate 2) is in general agreement with the results obtained in the earlier D.C.3 survey (BMR, 1958). The known geology consists of some small outcrops of Warramunga Group sediments in the south-east of the area and just outside the north-west corner. Hence there is no direct correlation possible between the magnetic results and geology.

The main feature in the area is a magnetic 'ridge' with an average amplitude of 350 gammas striking WNW from the south-east corner. This ridge is thought to be caused by a belt of Warramunga sediments. Five anomalies on the 'ridge' have been analysed assuming their sources to be of tabular shape. A3, A4, and A6 all give depths of over 1000 ft and all dip to the south. A1 yields a depth of 750 ft and A5 a depth of only 50 ft. The latter anomaly is just to the north of a mapped outcrop of Warramunga Group sediments containing quartz dykes and veins.

The steep magnetic gradient on the northern flank of the 'ridge' coincides with a photo-interpreted lineament and has been interpreted as a fault. A smaller fault about $1\frac{3}{4}$ miles long has been interpreted along the southern edge of the ridge and is also found to correspond well with photo-interpreted lineaments. However, no other lineaments are reflected in the magnetic pattern and no magnetic evidence is apparent for the mapped faults around the outcrops in the south-east of the area.

The low magnetic relief in the western part probably is associated with a block of the Tennant Creek Granite Complex, which has been inferred as lying outside the western margin of the area. A small anomaly (A2) of amplitude 65 gammas occurs in this region. Analysed as a tabular body, the anomaly gives a depth of 400 ft to the source and a dip of 60° to the north. A calculated susceptibility of 7.68×10^{-4} c.g.s. suggests a body of intermediate to basic composition.

Depths calculated in Area A range from near-surface to 2000 ft, and magnetic susceptibilities from 7.68×10^{-4} to 3.04×10^{-3} c.g.s. Appendix 1 gives the results of analyses of the anomalies.

Area B

As with Area A, the magnetic contour pattern in Area B (Plate 3) is broadly similar to that of the earlier D.C.3 survey (BMR, 1958). There is a general east-west trend in the contours, particularly prominent in the east of the area, which is intersected by an approximately north-south trend at the western end.

7

The geology is obscured over most of the area by sand and alluvium; that shown in Plate 3 has been obtained from recent mapping of the Marion Ross 1-mile map area by the Northern Territory Administration Resident Geologist at Tennant Creek (B. Tapp, pers. comm.). In the south-east of the area, the rocks are Warramunga Group sediments with small bodies of porphyry. This is possibly the pattern over the whole of the area.

A line of porphyry intrusives has been inferred from the geological mapping. It starts about 0.7 mile north of the Great Western mine, east of the survey area, trends west for about 3.5 miles, south-west for 1.4 miles, north-west for 1.0 mile and then west towards the Warrego mine. This line of intrusives appears to be broadly reflected by the magnetic contours at the eastern end, but there is a divergence to the west at longitude 133°55'E. If the magnetic contours are associated with the intrusives, the latter are more likely to trend WSW at this point towards the centre of the southern boundary of the survey area. Two small porphyry bodies have been mapped in this locality.

No correlation is obvious between the Warramunga Group sediments and the magnetic contour pattern.

The only mine in the area is the Warrego mine, which has recently been commenced by Peko Mines N.L. An anomaly of 910 gammas (B2) occurs over this mine. It is roughly circular with a prominent minimum to the south and if it is assumed to have a spherical source, a depth of 1450 ft to its centre is obtained by the method of Daly (1957). As the anomaly has two maxima, however, the source probably has a complex shape and hence the assumption of a spherical source might not be correct. The depth to the top of the orebody is known to be about 500 ft and it extends to at least 1600 ft below ground level.

Two other anomalies, B1 and B6, were also analysed. Spherical sources were assumed for these, as they had circular or sub-circular patterns. B1 has an amplitude of 120 gammas and a depth to the centre of the source of 1050 ft. In the case of B6, these values are 150 gammas and 600 ft respectively. They are probably small ironstone bodies within sedimentary rocks of the Warramunga Group.

Three other anomalies, B3, B4, and B5, were analysed assuming tabular sources and gave depths of 400, 1200, and 1500 ft respectively. They are probably due to bodies of an intermediate to basic rock type such as dolerite.

Numerous other magnetic anomalies are present in the area but mutual interference has rendered them unsuitable for detailed analysis.

Several positive and negative lineations have been interpreted in the area. In the south-eastern part they trend strongly east-west while in the north-west they trend approximately north-south. The strong NNW negative lineations which were apparent in the earlier survey (BMR, 1958) are not prominent in this detailed survey, only one being particularly obvious. There is no magnetic expression of the mapped faults and dykes in the area and their relationship to the interpreted lineations is obscure.

Area C

The general magnetic pattern in this area (Plate 4) is very similar to the magnetic contours of the earlier D.C.3 survey (BMR, 1958). There is also a good match of the contours with those of Area 2 of the 1966 detailed survey (Finney, 1967).

As most of the area is covered by sand and alluvium, little direct correlation can be made between the magnetic pattern and the geology. In the southern half of the area, outcrops of porphyry coincide with an area of low magnetic relief; hence it is suggested that porphyry may underlie much of the southern part of the area. Three small anomalies (C11, C12, and C13) occur along the southern edge of this interpreted porphyry mass. These are thought to be ironstone bodies because of the limited extent of their anomalies and also because it is common for ironstones to be intruded near the edges of porphyry bodies.

The Jubilee mine near the centre of the eastern survey boundary is located on the flank of a small elongated anomaly (C7). This anomaly has an amplitude of 100 gammas and is probably caused by the prominent east-west striking dyke of quartz-haematite-magnetite on which the mine is located. Analysis of the anomaly indicates that the dyke dips to the south at 70° and that the top of the unoxidised part is at a depth of 250 ft.

There is no anomaly which can be associated with The Extension mine near the centre of the southern survey boundary.

A prominent feature in the aeromagnetic contours is an east-west striking 'ridge' in the northern part of the area. This 'ridge' is offset twice to the south before swinging around slightly to strike WNW. The D.C.3 contours (BMR, 1958) indicate that the 'ridge' extends about a mile beyond the western edge of the survey area. The average amplitude of the 'ridge' is about 400 gammas and at its eastern end the source was calculated to be at a depth of at least 2000 ft. Analysis of anomaly C4 on the western end of the 'ridge' yielded a depth of 1500 ft indicating that the source may become shallower westwards.

The source of the magnetic 'ridge' appears to be a block of igneous or metamorphic material, possibly Archaean, faulted into the sediments of the Warramunga Group. The offsets mentioned in the previous paragraph are interpreted as faults within this feature.

Another prominent feature in the area is the large circular anomaly (C5), about $\frac{3}{4}$ mile across, which occurs 3 miles NNW of The Extension mine. This has an amplitude of 270 gammas and is thought to be due to a long cylindrical body dipping south because of its rather vague minimum. Analysis of this anomaly by the method of

9

Henderson and Zeitz (1948) gave a depth of 2000 ft to the top of the body. This anomaly could be important as it lies along a line of copper mines trending WNW through Golden Forty, Wheal Doria, and Peter Pan (Plate 1).

Five anomalies with circular contours (C6, C8, C11, C12, and C13) were analysed assuming the sources to be roughly spherical. C6 is located 0.9 mile NNW of the Jubilee mine near a quartz-haematite-magnetite dyke and shear zone. Analysis of this anomaly suggests a source at a depth of 500 ft below ground level. Anomaly C8 occurs over an area of Warramunga Group sediments and quartz veins about 0.7 mile SSE of the Jubilee mine. The source of this anomaly is approximately 750 ft below ground level. The three other circular anomalies lie along the southern edge of the postulated prophyry mass as described previously. All are thought to be due to ironstone bodies.

Several other anomalies were analysed assuming tabular sources. Source depths ranged from 300 to 1950 ft and dips were mainly to the south. Susceptibility calculations on these bodies gave values ranging from 4.75×10^{-4} to 7.80×10^{-3} c.g.s. These values suggest that the sources are of a basic rock type, although not as magnetic as quartz-magnetite.

The results of the analyses of all the anomalies are shown more fully in Appendix 1.

4. CONCLUSIONS AND RECOMMENDATIONS

The interpreted belt of Warramunga Group sediments in Area A is probably the only one in the north-east part of the Tennant Creek mineral field which is close to the surface. The Cambrian sediments thicken eastwards and any anomalies from magnetic rocks in the Precambrian units below them will probably be too small to be detected. Some aeromagnetic traverses eastwards from Area A would provide a means of testing this hypothesis. In Area A, only anomaly A5 would appear to warrant further investigation and drilling.

In Area B, anomalies B1 and B6 are the only two recommended for ground investigation. Further detailed aeromagnetic surveying north of this area is recommended to ascertain the extent and significance of the north-trending lineations.

The detailed aeromagnetic method has been particularly useful in Area C in delineating an area of probable porphyry intrusion, especially as a number of small anomalies have been detected along the edges of this body. Anomalies C6, C8, C11, C12, and C13 are all possible drilling targets. Useful information would also be obtained from drilling C5 even though its source is quite deep.

Detailed aeromagnetic coverage is recommended for the region between Area C and the Tennant Creek township. This region contains several old mines and would link Area C with Areas 1 and 2 of the 1966 survey (Finney, 1967) and with the 'Aeromagnetic Ridge' area of the 1964 survey (Milsom and Finney, 1965).

10

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APPENDIX 1

Results of analyses of individual anomalies

Anomaly No.	Depth to top (ft b.g.l.)	Dip (degrees)	Thickness (ft)	K (c.g.s.)	Source
A1	750				Tabular
A2	400	60N	550	7.68×10^{-4}	"
A3	2000	70S		1.65×10^{-3}	"
A4	1000	0		1.81×10^{-3}	"
A5	50				"
A6	1500	60S		3.04×10^{-3}	"
A7	1150				"
B1	750			*1.00×10^{-2}	Spherical
B2	1000			*5.00×10^{-2}	"
B3	400	40SE	1100		Tabular
B4	1200	80N	1000		"
B5	1500	40N	1200		"
B6	450			*1.00×10^{-2}	Spherical
C1	1350	80S	1600	3.66×10^{-3}	Tabular
C2	1200	70S	1400	5.52×10^{-3}	"
C3	300	Steep			"
C4	1500	35S	950	7.80×10^{-3}	"
C5	2000				Dipping cylinder
C6	500			*1.00×10^{-2}	Spherical
C7	250	70S	700	4.75×10^{-4}	Tabular
C8	750			*5.00×10^{-2}	Spherical
C9	500	65NE	900	3.19×10^{-3}	Tabular
C10	1950	50S	1600	2.58×10^{-3}	"
C11	500			*1.00×10^{-2}	Spherical
C12	500			*1.00×10^{-2}	"
C13	750			*5.00×10^{-2}	"

*Susceptibility value assumed for calculation of depth to top of source.

APPENDIX 2

Operational details

Staff

BMR	E.P. Shelley	:	Party leader
	P.J. Browne-Cooper	:	Geophysicist
	W.R.D. Buckley	:	Drafting Officer
	P. Evans	:	Senior Technician (Radio)
	B.M. Tregellas	:	Geophysical Assistant
	P.S. Moffat	:	Drafting Assistant
TAA	First Officer G.E. Brown		

Equipment

Aircraft	:	Cessna 180, VH-GEO.
Magnetometers	:	BMR MNS-1 (prototype) proton precession with towed bird detector, output to two Moseley Autograf recorders. BMR MNS-1 proton precession, base station monitor, output to Esterline-Angus recorder.
Radio altimeter	:	AN/APN-1.
Camera	:	Modified Vinten, 35mm single frame with wide-angle lens.

Survey Specifications

Altitude	:	Nominally 280 ft above ground level with detector at 250 ft above ground level.
Line spacing	:	Nominally one-tenth mile.
Line direction	:	East-west.
Recorder sensitivities	:	Moseley recorders - 100 and 1000 gammas f.s.d. Esterline-Angus recorder - 1000 gammas f.s.d.

Operations

Survey party arrived Tennant Creek	:	3rd and 4th March
Flying commenced	:	7th March
Flying concluded	:	15th April
Survey party departed for Batchelor	:	26th April

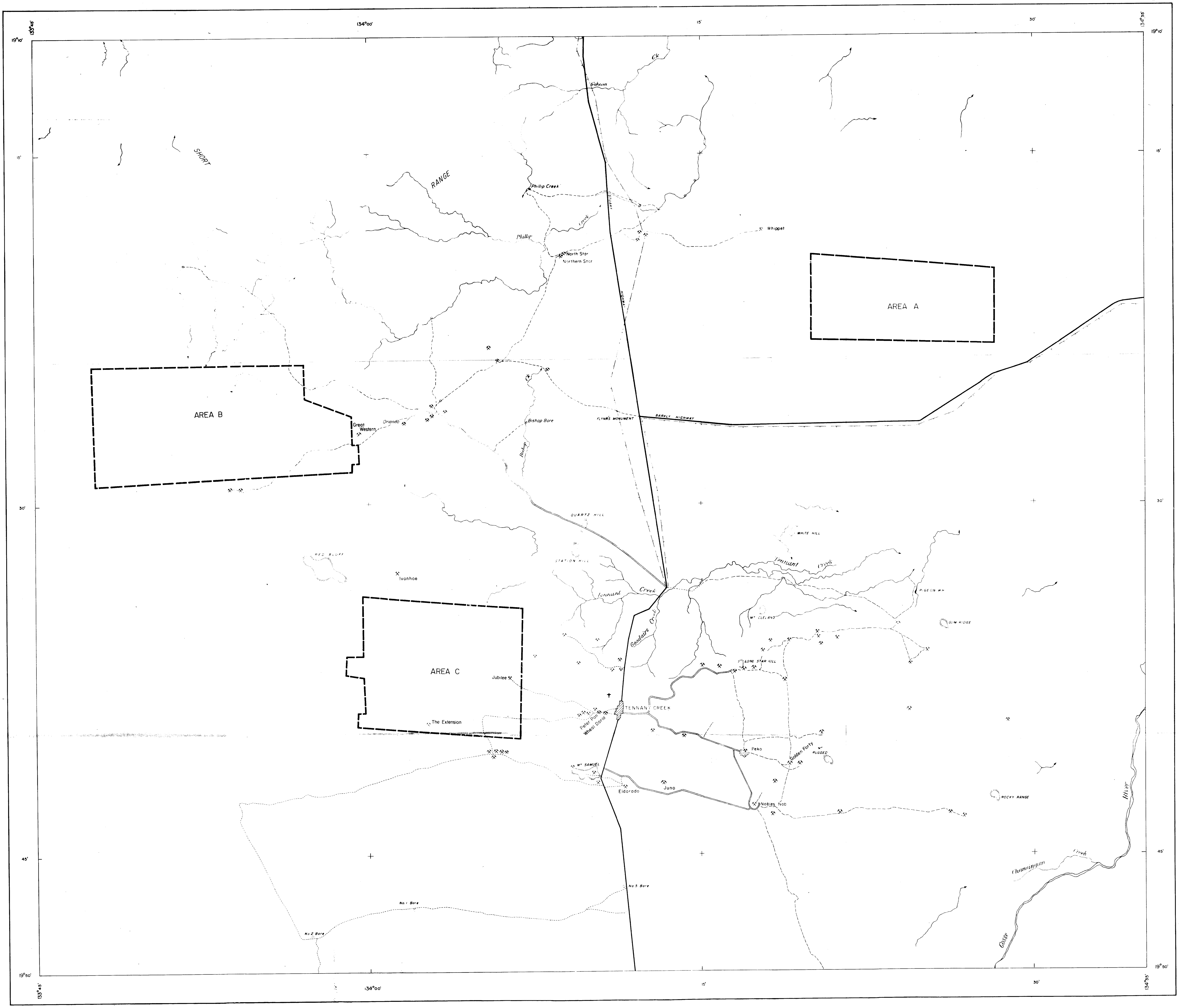
15

Diurnal variation

Two methods were used to remove the effects of the diurnal variations of the Earth's magnetic field from the survey records. The first method involved the flying of a baseline before and after each flight. The baseline was chosen for its ease of reflying and low magnetic relief. The correction was made assuming a linear variation of the magnetic field between the times the two baselines were flown.

The second method involved the use of the record from the base-station magnetometer, which was operated continuously throughout the flight. This gave a more accurate diurnal correction.

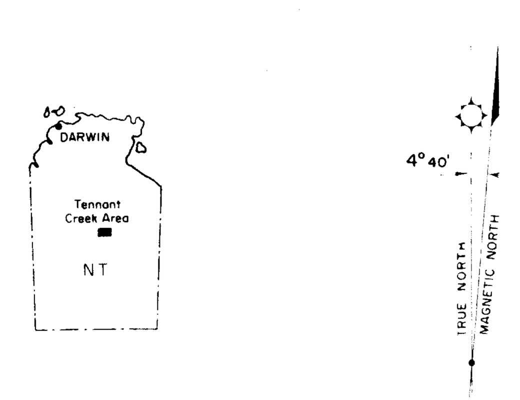
Both methods were used for one particular flight so that they could be related to each other.



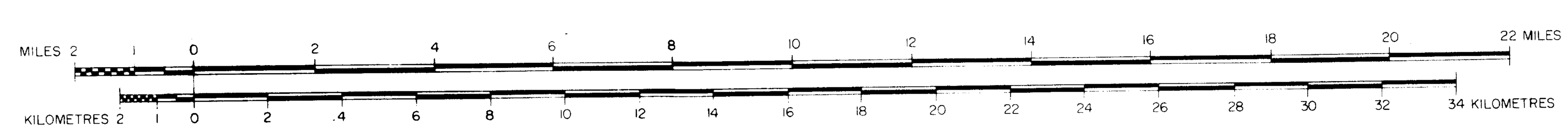
BASED ON G237/11-14, E53/B0-46

DETAILED AEROMAGNETIC SURVEY, TENNANT CREEK NT, 1967

LOCATION DIAGRAM



LOCALITY MAP



TOPOGRAPHICAL LEGEND

- River or creek
- Highway or main road
- Secondary road
- Road or track
- Bore
- Mine
- Aerodrome or landing ground
- Hill feature
- Approximate boundary of survey area

AREA A

TOTAL MAGNETIC INTENSITY CONTOURS GEOPHYSICAL INTERPRETATION AND GEOLOGY

MAGNETIC CONTOUR INTERVAL 10 GAMMAS

NOTES

THE MAGNETIC DATA HAVE NOT BEEN CORRECTED FOR THE REGIONAL MAGNETIC GRADIENT

GEOLOGY AFTER D. DUNNET AND R. R. HARDING,(1965)

THE GEOGRAPHICALS SHOWN ARE APPROXIMATE

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS. E53/BI-53

To Accompany Record No. 1967/151

PLATE 3

BASED ON E53/B0-48, E53/B0-51, E53/B1-48

AREA B

TOTAL MAGNETIC INTENSITY CONTOURS
GEOPHYSICAL INTERPRETATION
AND
GEOLOGY

MAGNETIC CONTOUR INTERVAL 10 GAMMAS

GEOLOGICAL LEGEND

CAINOZOIC

Cz — Sand, gravel, silt, alluvium, 'bulldust'

PRECAMBRIAN
LOWER PROTEROZOIC

- Quartz
- Quartz - feldspar - porphyry intrusives
- Line of quartz - feldspar - porphyry intrusive, exact boundaries unknown
- Numerous quartz - haematite - magnetite lenses
- Quartz - haematite - magnetite

WARRAMUNGA GROUP

- Undifferentiated greywacke-shale sequences. Minor sandstone, siltstone and volcanics
- Undifferentiated greywacke-shale sequences. Minor sandstone, siltstone and volcanics (?)
- Ironstone (intrusives)?

- Geological boundary
- Fault, position accurate
- Established fault, position approximate
- Inferred fault
- Quartz - filled fault
- Strike and dip of strata
- Generalised strike and dip of undulating strata
- Trend of bedding showing direction of dip
- Anticline, position accurate, showing plunge
- Shear zone

MILES 1 0 1 2 3 MILES

KILOMETRES 1 0 1 2 3 4 KILOMETRES

TRUE NORTH
MAGNETIC NORTH
4°30'

NOTES

THE MAGNETIC DATA HAVE NOT BEEN CORRECTED FOR THE REGIONAL MAGNETIC GRADIENT

GEOLOGY AFTER B.A. TAPP, RESIDENT GEOLOGIST'S OFFICE, TENNANT CREEK, 1967

THE GEOGRAPHICALS SHOWN ARE APPROXIMATE

TOPOGRAPHICAL LEGEND

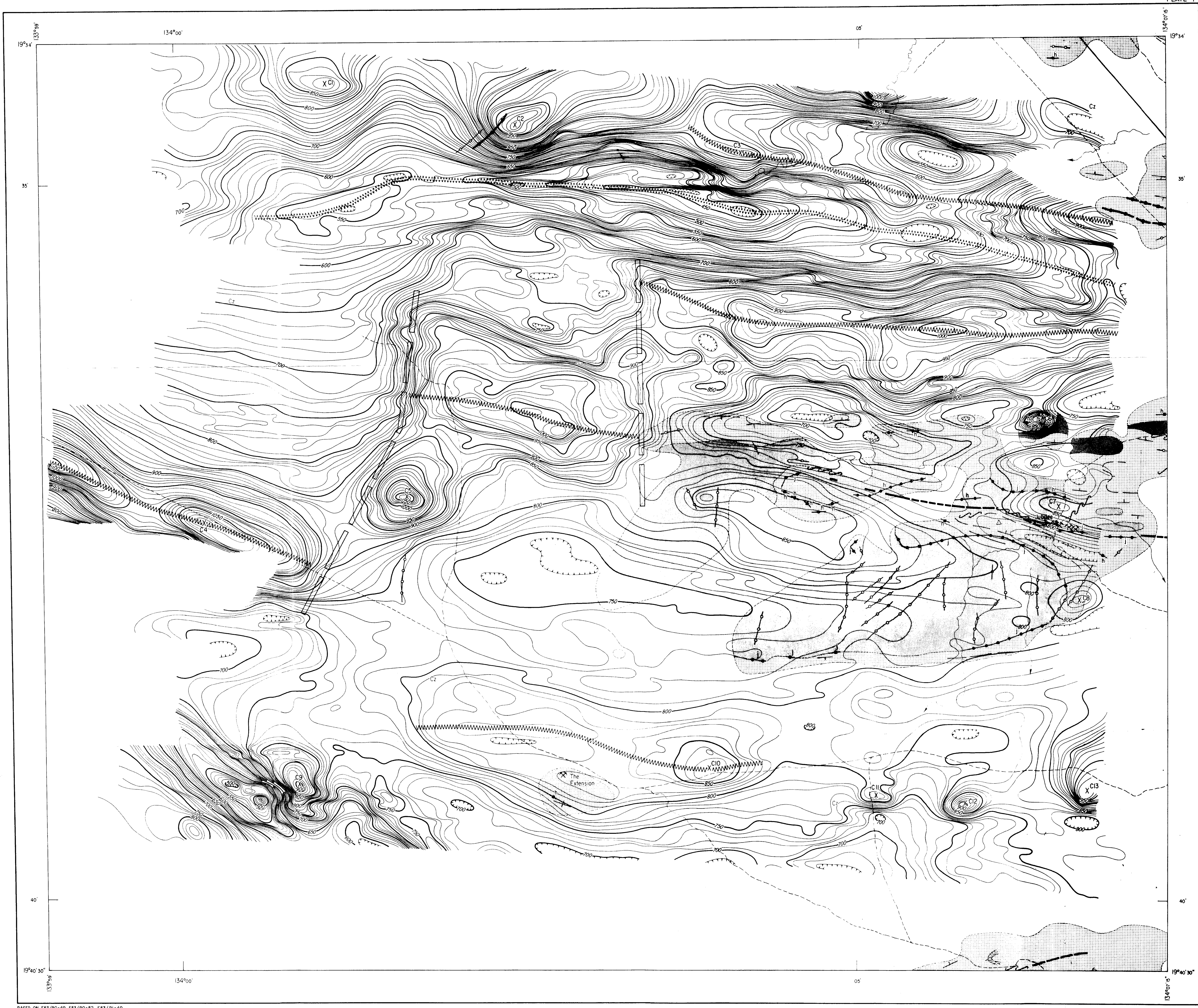
- River or creek
- Road or track
- Mine or prospect

GEOPHYSICAL LEGEND

- 1750 1700 Magnetic contours
- Magnetic 'low'
- Positive magnetic trend
- Negative magnetic trend
- XB2 Anomaly numbered for reference

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS E53/B1-54
To Accompany Record No 1967/151

PLATE 4



BASED ON E53/B0-49, E53/B0-52, E53/B1-49

GEOLOGICAL LEGEND

CAINOZOIC

Cz — *Gravel, sand, silt, clay*

PRECAMBRIAN

UPPER AND LOWER PROTEROZOIC

Quartz

LOWER PROTEROZOIC

h — *Quartz - haematite - magnetite*

j — *Haematite - jasper*

Quartz - feldspar porphyry

Quartz - baveno - feldspar porphyry

WARRAMUNGA GROUP

Greywacke, shale

Haematite shale

Geological boundary

Fault, position accurate

Established fault, position approximate

Fault, concealed

Quartz - filled fault

Vertical strata

Strike and dip of strata

Trend of bedding showing direction of dip

Shear zone

AREA C

TOTAL MAGNETIC INTENSITY CONTOURS GEOPHYSICAL INTERPRETATION AND GEOLOGY

MILES 1 0 2 MILES

KILOMETRES 1 0 1 2 3 KILOMETRES

MAGNETIC CONTOUR INTERVAL 10 GAMMAS

NOTES

THE MAGNETIC DATA HAVE NOT BEEN CORRECTED FOR THE REGIONAL MAGNETIC GRADIENT

GEOLOGY AFTER P.W. CROHN AND W. OLDERSHAW, 1963

THE GEOGRAPHICALS SHOWN ARE APPROXIMATE

4°40'

TRUE NORTH

MAGNETIC NORTH

TOPOGRAPHICAL LEGEND

Highway or sealed road

Road or track

River or creek

Mine or prospect

Trigonometrical station

GEOPHYSICAL LEGEND

750 700 — *Magnetic contours*

Magnetic 'low'

Interpreted fault

Positive magnetic trend

Negative magnetic trend

XC6 — *Anomaly numbered for reference*

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS. E53/B1-55

To Accompany Record No. 1967/151