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AMADEUS BASIN AIRBORNE MAGNETIC AND RADIOMETRIC SURVEY,

NORTHERN TERRITORY 1965

by

G.A. YOUNG and E.P. SHELLEY

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CONTENTS

ILLUSTRATIONS

Note: This Record supersedes Record No. 1966/64

SUMMARY

An airborne magnetic and radiometric survey of the greater part of the Amadeus Basin in the Northern Territory was flown during 1965.

The general structure of the Basin interpreted from the magnetic results shows good agreement with gravity data. The magnetic basement attains a maximum depth of 38,000 ft below sea level in the Amadeus Gravity Depression in the Mount Liebig 1:250,000 map area. Numerous basement high and low features resolved from the magnetic data have their gravity counterparts. In addition, seismic data are in good agreement with basement form determined in the Gosses Bluff and Ooraminna localities.

The magnetic data reveal that the strong Bouguer anomaly gradients to the north and south-west of the Basin are produced by changes in basement rock type. In areas of basement outcrop magnetic anomaly trends are in general ill-defined. Trends to the north of the Basin are oriented east-west contrasting with those in the Basin, which are approximately north-south.

Numerous small magnetic anomalies located in the south-west part of the Amadeus Basin suggest that volcanic activity was widespread in this region during the Proterozoic era.

A contour presentation of the radiometric data reveals a correlation between radioactive 'highs' and sediments of the Larapinta and Pertaoorrta Groups. Although a definite correlation has not yet been established between gamma radiation and phosphorites in the Amadeus Basin, a radioactive 'high' associated with the Johnny Creek anticline suggests that this is the most promising area for further search for phosphate deposits.

1. INTRODUCTION

An airborne magnetic and radiometric survey was flown over the greater part of the Amadeus Basin and the surrounding Precambrian basement during the period May to November 1965. The area surveyed is enclosed by latitudes 23°S to 26°S and longitudes 129°E to 135°E and includes the MOUNT RENNIE, BLOODS RANGE, PETERMANN RANGES, MOUNT LIEBIG, LAKE AMADEUS, AYERS ROCK, HERMANNSBURG, and ALICE SPRINGS 1:250,000 map areas and parts of the HENBURY, KULGERA, and RODINGA 1:250,000 map areas as shown in Plate 1. The petreoleum tenements that are wholly or partly contained within the survey area are also shown on this plate.

The survey was designed primarily to provide the magnetic data needed to determine the basement structure within the sedimentary basin in order to aid oil exploration and geological mapping. The radiometric data were required to test the suitability of the airborne radiometric method in the exploration for phosphate deposits in the Ordovician sediments.

In recent years field parties from the Geological Branch of the Bureau of Mineral Resources have been engaged in the programme of geological mapping of the map areas listed above. Geological maps at a scale of 1:250,000 have been published for these areas in editions ranging from preliminary to final coloured. In addition, photo-interpretation maps of selected areas were prepared for the Bureau of Mineral Resources (BMR) by the Institut Francais du Petrole (Scanvic, 1961). Geological maps of the survey area at smaller scales have been compiled by Quinlan (1962), Barrie (1964), and Forman (1964).

The main features of the Amadeus Basin are the thick pile of sedimentary rocks extending in age from Upper Proterozoic to Middle Palaeozoic which range in thickness to over 30,000 ft, and the development within the sediments of great anticlinal structures that parallel the Basin edges and extend over great distances.

The favourable assessment of the economic petroleum prospects of the Amadeus region made by Magellan Petroleum (N.T.) Pty Ltd attracted Exoil N.L. to enter into an exploration partnership with the former company in 1962. The first well drilled by Exoil N.L. south-east of Alice Springs (Ooraminna No. 1) encountered combustible hydrocarbon gas in the Upper Proterozoic Areyonga Formation. Subsequent wells established the presence of free oil and substantial petroliferous gas flows in the lower Palaeozoic sediments, as shown in Appendix B.

Phosphorite deposits were first noted in the Amadeus Basin in 1961 (Wells, Forman and Ranford, 1962). These occur as thin phosphate-rich beds in the Ordovician Larapinta Group. All four formations of the Larapinta Group are phosphatic but with the exception of the Stairway Sandstone the phosphate content is very low. During 1963, drill tests were made on the Stairway Sandstone to determine the thickness, distribution, and grade of the phosphorite beds. The most significant indication of phosphate was obtained in DDH/AP4 (Plate 19). This drill hole was located near a gravity 'high' on the Angas Downs Gravity Ridge (Plate 17). Barrie (1964) considers that, as phosphate may be controlled by topographic highs on the sea-floor and as the Angas Downs Gravity Ridge was probably a reflection of a topographic ridge on the Ordovician sea-floor, there may be a correlation between phosphate distribution and gravity ridges.

Gravity coverage of the entire survey area has been made by helicopter-borne surveys of the Bureau of Mineral Resources. The eastern part of the Amadeus Basin was included in a survey in 1961 (Langron, 1962) and the western part in a 1962 survey (Lonsdale & Flavelle, 1963). The Bouguer anomaly map produced for the area is shown in Plate 17. This map reveals extensive structural information concerning the geology of the Basin and the underlying Precambrian basement. This information is correlated with the magnetic data later in this Record in the section dealing with the interpretation of the magnetic results.

Magnetic surveys previously flown in, or adjacent to, the present survey area included two reconnaissance traverses flown from Alice Springs to the Tomkinson Ranges and to Giles by the Bureau of Mineral Resources (Goodeve, 1961). A series of four traverses were flown in BLOODS RANGE and MOUNT RENNIE by Aero Service Ltd for Roset Pty Ltd in 1963. In the same year Aero Service Ltd also flew a more detailed survey for Exoil (N.S.W.) Pty Ltd. This survey covered FINKE and parts of RODINGA, HENBURY, KULGERA, and AYERS ROCK. During July 1965, Adastra Hunting Geophysics Pty Ltd flew an aeromagnetic survey of Davenport Hills for Reef Exploration Pty Ltd. This survey was within MOUNT RENNIE and BLOODS RANGE, duplicating to some extent the aeromagnetic coverage of this region. Flight-line orientation was north-west and the survey altitude 3000 ft above sea level. The interpretation of these recent surveys is commented upon in Chapter 3.

In recent years the Bureau of Mineral Resources has made three seismic surveys (Plate 17) for oil exploration within the Amadeus Basin (Turpie & Moss, 1963; Moss, 1964 & 1966). Results from the first of these surveys showed that the Palm Valley anticlinal structure exists at depth and includes at least 18,000 ft of sediments.

In the locality three miles east of Hermannsburg Mission, good reflections were obtained from depths in excess of 26,000 ft (Turpie & Moss, 1963).

The second seismic survey revealed that the Missionary Plain Syncline contained 26,000 ft of sediments at Gardiner Range Fault and 33,000 ft at a locality 25 miles further north. Gosses Bluff was shown to be a sedimentary feature and not an expression of basement relief. This result supported the theory that Gosses Bluff is a diapiric structure of the salt-dome type, with the Bitter Springs Formation providing the necessary mobile material. The nature of the Archaean/sediment contact was not resolved owing to poor reflections (Moss, 1964).

The seismic traverse made from Alice Springs to Deep Well across the Ooraminna Anticline in 1962 indicated that the sediments attain a thickness of approximately 20,000 ft to the north and south of the anticline and thin to about 16,000 ft over the anticline (Moss, 1966).

Seismic surveys have recently been made by Geophysical Associates International for Magellan Petroleum (N.T.) Pty Ltd (1966) in the Missionary Plain area, and by Namco International Inc. for Exoil (N.S.W.) Pty Ltd (1966) in KULGERA. The results from this work have recently been released and are dealt with later in this record.

2. GEOLOGY

The Amadeus Basin is an intracratonic structure in which sedimentary rocks from Upper Proterozoic to Upper Palaeozoic age have been deposited. The maximum sedimentary thickness developed is thought to be between 30,000 and 35,000 ft (BMR, 1962).

Forman and Hancock (1964) state that the sediments within the Amadeus Basin are defined at the northern margin of the Basin where the Upper Proterozoic Heavitree Quartzite and younger formations rest unconformably on the eroded surface of the Arunta Complex gneiss, granite, and schist. The southern margin of the Basin is not marked by this unconformity between an igneous and metamorphic basement and a basal quartzite. Instead, the Dean Quartzite, which is believed to be equivalent to the Heavitree Quartzite, lies with regional unconformity on a sequence of Precambrian volcanic and sedimentary rocks.

Two major orogenic events have deformed the sedimentary sequence. The first occurred at the close of the Upper Proterozoic and produced isoclinal and recumbent folding in the south of the Basin. The second event, of Upper Devonian age, caused most of the structures now obvious at the surface and is termed the "Alice Springs Orogeny" (Forman & Milligan, 1965). At the southern boundary of the Basin the recumbent folding is believed to have produced a thick sedimentary section overlain by basement rocks. Recumbent folding is also known along the northern boundary where several nappe structures are developed.

Stratigraphy

The general stratigraphy of the Amadeus Basin, subdivided into the northern and southern sectors, is shown in Appendix A. This is primarily based on Ranneft (1963) and Forman and Hancock (1964). The following brief notes on the broad stratigraphic divisions are derived from the sources indicated.

Precambrian (Archaean?) and undifferentiated Precambrian. These rocks are exposed in the north of the area to form the MacDonnell and Harts Ranges and in the south to form the Mann and Musgrave Ranges. There are also extensive outcrops in BLOODS RANGE and PETERMANN RANGES.

The MacDonnell and Harts Ranges consist of gneisses and schists, which were probably developed from sedimentary rocks with interbeds of volcanics. These rocks were strongly folded and metamorphosed and subsequently intruded by granite, granodiorite, gabbro, dolerite, and amphibolite (Quinlan, 1962).

The Mann and Musgrave Ranges consist of strongly metamorphosed sedimentary rocks intruded by granite, granodiorite, and swarms of dolerite dykes (Quinlan, 1962).

In BLOODS RANGE and PETERMANN RANGES, the undifferentiated Precambrian has been divided into two units. The lowest unit exposed in the Mount Harris Basalt, which is followed by the Bloods Range Beds. The latter unit consists of a sequence of sandstone and quartzite, schists, porphyry, and slate with interbedded basic extrusive rocks (Forman, 1963; Forman & Hancock, 1964). As a result of regional folding these two units have been metamorphosed to schist, amphibolite, gneiss, and granite. Forman and Hancock (1964) suggest that the Mount Harris Basalt may be of Lower Proterozoic age and the Bloods Range Beds of either Lower or Upper Proterozoic age.

Upper Proterozoic. In the northern part of the area the Heavitree Quartzite is the basal unit of the Upper Proterozoic section. This is correlated in the south with the Dean Quartzite, which rests with regional unconformity on the Bloods Range Beds and Mount Harris Basalt. Overlying the basal unit in the north is the Bitter Springs Formation. Thick evaporite beds occur in the Bitter Springs Formation and in addition spilitic lavas have been recorded within this formation in ALICE SPRINGS. The Pinyinna Beds are the southern equivalent of the Bitter Springs Formation.

Disconformably overlying the Bitter Springs Formation are the Areyonga Formation and the Pertatataka Formation. The former consists of pebble and cobble conglomerates and boulder beds of glacial origin with thin bands of limestone. The Pertatataka Formation consists of thick beds of sandstone, shale, and quartz-greywacke.

In the south of the area the Inindia Beds are correlated with the Areyonga Formation and consist of a sequence of siltstone, sandstone, chert, chert breccia, and thin interbeds of dolomite (Wells, Ranford, & Cook, 1963). Correlated with the Pertatataka Formation are the Winnall Beds, which comprise a sequence of siltstone, sandstone, and pebbly sandstone.

At Ellery Creek, 50 miles west of Alice Springs, the total thickness of Upper Proterozoic sediments is about 6000 ft. The thickness and lithology of the formations are known to vary considerably from west to east along the MacDonnell Ranges (Quinlan, 1962). In the southern part of LAKE AMADEUS the section is 10,000 ft thick and decreases northwards to 2600 ft (Wells et al, 1963).

Sills and dykes of quartz-dolerite crop out in the southern part of AYERS ROCK and in some parts of PETERMANN RANGES. Most of the dolerite bodies occur in the gneisses which were formed by metamorphism of the older Precambrian rocks. It is thought that they may have been injected shortly after the folding in the late Upper Proterozoic or Lower Cambrian.

Lower Palaeozoic. In the north of the area a sequence of Cambrian and Ordovician rocks conformably overlie the Pertatataka Formation indicating continuous deposition from Upper Proterozoic to Lower Palaeozoic times. The Pertaoorrta Group (Cambrian) has a maximum thickness of 13,000 ft and the Larapinta Group (Ordovician) about 8000 ft. Both groups consist of thickly interbedded shale, sandstone and quartz-greywacke, limestone, and shale with thin limestones. The Pertaoorrta Group increases in thickness both southward and westward from Alice Springs with an accompanying decrease in carbonate content. The Larapinta Group is 4200 ft thick at Ellery Creek and 8000 ft at Stokes Pass (110 miles west of Alice Springs). The limestone and shale formations thicken more than the arenaceous formations. The thickening is not accompanied, however, by marked changes in lithology (Quinlan, 1962).

In the west and south-west of the Lower Palaeozoic sediments rest unconformably on the Upper Proterozoic rocks. The Mount Currie Conglomerate crops out in BLOODS RANGE and AYERS ROCK. This is a sequence of pebble, cobble, and boulder conglomerate with a minimum thickness of 2000 ft (Forman & Hancock, 1964). The Ayers Rock Arkose has a minimum thickness of 8000 ft and was probably deposited at the same time as the Mount Currie Conglomerate. These two units are regarded as Cambrian and are thought to be wedges of sediment deposited adjacent to a tectonically active area to the south (Forman & Hancock, 1964). The Cleland Sandstone crops out in LAKE AMADEUS and BLOODS RANGE and is laterally equivalent to part of the Cambrian Pertaoorrta Group (Wells et al, 1963). It overlies the Winnall Beds with strong angular unconformity.

In the south of the area the Larapinta Group sediments occur as thin, flat-lying outliers.

Upper Palaeozoic. Sedimentary rocks of Upper Palaeozoic age range in thickness from 2000 to 10,000 ft and are subdivided into the Mereenie Sandstone and the Pertnjara Formation. These rocks unconformably overlie both the Lower Palaeozoic and Upper Proterozoic units and crop out over all of the area except the south-west.

The Mereenie Sandstone consists of medium-grained sandstone and silty sandstone which attains a maximum thickness of 3200 ft (Ranneft, 1963). It is thought to have an age in the range Upper Ordovician to Middle Devonian.

The Pertnjara Formation lies both conformably and unconformably on the Mereenie Sandstone. It has a maximum thickness of 10,000 ft (Quinlan, 1962) and consists of conglomerate, sandstone, siltstone, and calcareous sandstone. The basal siltstone unit has been dated as late Middle Devonian or early Upper Devonian (Hodgson, 1964) and the formation is thought to range in age up to Upper Carboniferous.

Mesozoic to Recent. Small areas of Mesozoic sediments occur in the south-eastern and north-eastern parts of the area. These were evidently formed in small basins during a transgression of the sea at the time of deposition of the Great Artesian Basin sediments. The sediments range in thickness from 100 to 1000 ft and consist of claystone, sandy siltstone, and siltstone.

Post-Mesozoic weathering and erosion have produced grey-billy profiles on parent rocks with a low iron content and laterites on parent rocks with a high iron content.

Superficial deposits of Tertiary sandstone and conglomerate have been laid down in some parts and Quaternary sands, gravels, evaporites, and alluvium now cover large parts of the area.

Structure

At least two orogenies are evident in the area of the north-east margin of the Amadeus Basin (Forman & Milligan, 1965). The older, the Arunta Orogeny, is defined as the orogeny which folded and metamorphosed the Arunta Complex before the Heavitree Quartzite was deposited. During the orogeny the Arunta Complex was isoclinally folded about north-south axes.

The Alice Springs Orogeny accompanied and followed the deposition of the Pertnjara Formation. It occurred in the Devonian causing recumbent folding of the Bitter Springs Formation and older rocks along the northern margin of the Amadeus Basin and decollement sliding and folding of the sediments over the Bitter Springs Formation. The regional trend of the fold axes is west in the eastern and central parts of the Amadeus Basin and north-west in the western part.

This orogeny caused the development of at least two nappe complexes: the Ormiston and the Arltunga Nappe Complexes in HERMANNSBURG and ALICE SPRINGS, respectively. These developed after the deposition of the Upper Proterozoic, Cambrian, and Ordovician sediments. The sediments younger than the Bitter Springs Formation were squeezed out of the nappes and forced southwards over a decollement surface within it (Forman & Milligan, 1965). Further nappe structures are thought to be present along the northern margin of the Basin. Elsewhere along the margin the sediment/basement contact is steep to overturned.

A period of orogenesis has been recognised in the south-west of the Basin where recumbent and isoclinal folding of the sediments below the Bitter Springs Formation and the Pinyinna Beds has been produced. This occurred during the late Upper Proterozoic or early Lower Cambrian and is referred to as the "Lake Neale Folding" (Forman, 1963) or the "Petermann Ranges Folding" (Forman

& Hancock, 1964). The isoclinal folding is tight in the south but dies out northwards away from the orogenic area. The overlying Inindia and Winnall Beds slid northwards on a decollement surface in the Pinyinna Beds and Bitter Springs Formation. The Mount Harris Basalt, Bloods Range Beds, and Dean Quartzite were regionally folded into a recumbent fold which extends at least 200 miles in an east-west direction and which is overturned for a distance of about 35 miles across the strike (Forman & Hancock, 1964). Granite, gneisses, and schists were produced during this period of deformation.

Within the Basin, minor folding and warping during the Upper Proterozoic and Lower Palaeozoic deformed the sediments to produce local unconformities and disconformities in the sediments below the Pertnjara Formation.

The folding within the Amadeus Basin as a result of the Alice Springs Orogeny is the "Amadeus Basin Folding" of Forman (1963). The fold structures are characterised by broad synclines and relatively sharp anticlines (Wells et al, 1963). Numerous fractures occur parallel and close to the anticlinal crests and these die out in the nose area. In the cores of many of these anticlines are found carbonate and gypsum, which are correlated with the Bitter Springs Formation. The fold axes trend north-west to west-north-west and there are minor cross-folds.

There is widespread faulting in the Precambrian basement rocks where they are exposed in the north and south of the area. Within the basin there are two main fault types: NNW-trending faults and strike faults. In general these faults are only local. Two major fault zones have been mapped in the north-west of the Basin (Wells et al, 1962). The Haast Bluff/Mount Liebig fault zone (Plate 3) consists of moderately dipping thrust faults and the Mount Rennie/Ligertwood Cliffs zone (Plate 2) is marked by sparse outcrops of quartz veins, considerable displacement of the Heavitree Quartzite, and by a faulted contact between the Bitter Springs Formation and the basement. These zones have a west to west-south-west trend.

A number of probably diapiric structures have been mapped in the Basin particularly in MOUNT RENNIE, HERMANNSBURG, and LAKE AMADEUS (Wells et al, 1963; Pritchard & Quinlan, 1962; Forman, 1963). They are thought to have originated in the Bitter Springs Limestone. Evidence suggests that the intrusions developed before the "Amadeus Basin Folding". However, during this folding the incompetent evaporites may have been squeezed into the cores of anticlines and later they may have initiated diapirs (Wells et al, 1962).

Economic geology

Petroleum. Drilling for petroleum in the northern part of the Amadeus Basin has been in progress since early 1963. Nineteen wells have been drilled to date (31st December 1966), of which five have been completed as gas or gas-condensate producers. Most of the flows have come from the Ordovician Larapinta Group, particularly from the Pacoota Formation. The locations of the wells are shown in Plate 17 and details appear in Appendix B.

The prospects for further significant accumulations of hydrocarbons in this part of the Basin are very good. There are many potential source, reservoir, and cap rocks present in the sedimentary sequence.

Near the southern margin of the Basin the Pinyinna and Inindia Beds offer potential source rocks. Suitable reservoir rocks may be found in the Inindia and Winnall Beds but at present no structural traps are obvious from surface structure (Forman & Hancock, 1964).

The recognition of diapirs in the Amadeus Basin has great economic significance because they are potential traps for oil. The evaporites in the sequence provide a cap-rock for oil accumulation and several analyses of samples from the Bitter Springs Formation indicate residual hydrocarbons.

Phosphate. The presence of phosphorites in the Amadeus Basin was first mentioned briefly by Wells et al (1962), who found isolated outcrops of thin phosphate-rich beds in the Ordovician Stairway Sandstone in MOUNT LIEBIG. During 1962 a more detailed study of the phosphorites was made in LAKE AMADEUS and parts of HENBURY.

Phosphorites are confined to the Larapinta Group. All four formations are phosphatic but, with the exception of the Stairway Sandstone, the phosphate content is very low.

Phosphatic material occurs in a finely divided form throughout much of the Stairway Sandstone. It occurs most commonly as pellets or nodules which contain the highest percentage of P_2O_5; the pellets are either sparsely scattered through the sandstone or limestone beds (5% to 10% of P_2O_5) or, more normally, form beds one to four inches thick composed almost entirely of phosphorite pellets in a sandy matrix. These pellet beds have the highest P_2O_5 content; generally between 10% and 22%.

In 1963 a drilling programme was carried out to test the phosphate occurrences in the Stairway Sandstone (Barrie, 1964). Four holes were drilled in LAKE AMADEUS and HENBURY (see Plate 9). In all holes some cores gave a positive reaction to a field test for phosphate and numerous pellet bands were observed.

Miscellaneous. Small shows of copper and silver-lead-gold mineralisation have been recorded in the Mount Harris Basalt and Bloods Range Beds in BLOODS RANGE (Forman, 1963) but these are not economic. Some small sedimentary copper deposits are known within the Basin sediments.

Evaporites are present in diapirs and salt pans throughout the area. The bulk of these evaporites are gypsum with minor amounts of halite. The diapirs are also potential sources of potassium nitrate.

3. MAGNETIC RESULTS AND INTERPRETATION

The magnetic profiles have been reduced from the original charts to a scale of 1:250,000 for all flight lines and ties within the survey area. To simplify the data presentation at a scale of 1:250,000 in this Record, a selection of magnetic profiles has been made. Plates 2 to 12 show the profiles obtained from flight lines spaced at 4-mile intervals superimposed on the current editions of the BMR 1:250,000 Geological Maps. The profiles in the northern part of the survey area are accurately positioned near longitudes 129°00'E, 130°30'E, 132°00'E, 133°30'E, and 135°00'E, and those in the southern part of the area near longitudes 129°00'E, 130°30'E, 132°00'E, and 133°10'E. The maximum probable error at intermediate locations is ±1 mile east-west.

Plates 13 and 14 show composite magnetic profiles for flight lines oriented east-west and north-south, respectively, over the entire survey area at a scale of 1:500,000.

Plate 15 shows magnetic profiles at a scale of 1:500,000 recorded on flights made at a height of 11,000 ft above sea level. Comparison with the magnetic data in Plate 13 shows that the profiles in Plate 15 provide greater resolution of some of the major deep-seated magnetic sources, thereby improving the reliability of their interpretation.

The interpretation of magnetic data shown in Plate 16 is quantitative within the sedimentary basin but only qualitative in areas of basement outcrop to the north and south. The magnetic basement surface is indicated within the sedimentary basin by 'depth to magnetic basement' contours at intervals of 2000 ft. The probable error of the depth estimates controlling these contours is ± 10%.

In both the northern and southern areas of basement outcrop, zones have been defined with reference to the prominent magnetic characteristics as listed below.

Northern basement

Zone	Magnetic character
A	Magnetic anomalies mainly less than 50 gammas
B	Magnetic anomalies mainly in the range 50-250 gammas
C	Magnetic anomalies mainly in the range 250-1000 gammas

Southern basement

Zone	Magnetic character
A	Magnetic anomalies mainly less than 25 gammas
B	Magnetic anomalies mainly in the range 25-125 gammas
C	Magnetic anomalies mainly in the range 125-500 gammas

The use of the same zone classifications in the northern and southern areas of basement outcrop is not intended to indicate the equivalence of rock types between these two regions, although such may exist.

In general, basement rocks are thought to have an increasing basic content progressing from zone A to zone C. It is to be expected therefore that the zones and their boundaries will show correlation with geological and other geophysical features.

The geological significance of the zones is discussed later in dealing with magnetic and radiometric interpretation.

Northern basement outcrop

The aeromagnetic data shown in Plates 13 and 14 reveal an abrupt change in magnetic character near the centres of MOUNT RENNIE, MOUNT LIEBIG, HERMANNSBURG, and ALICE SPRINGS. This is indicative of the abutment of the sedimentary rocks of the Amadeus Basin against the metamorphic-igneous rocks of the Arunta Complex. In general, the magnetically inferred boundary between these two units is in close agreement with that geologically mapped.

Inspection of magnetic profiles in Plate 13 yields little evidence for northerly trends in the magnetic data in the area of basement outcrop. The more widely spaced magnetic profiles of Plate 14 do, however, reveal anomalies with east-west trends particularly in HERMANNSBURG. These anomalies are not of simple form although they do bear resemblance to 'dyke' type sources. This limited assessment of magnetic trends indicates that magnetic strike is predominantly oriented east-west, parallelling surface geological trends.

The east-west trend is further reflected by the boundary between zones B and C (Plate 16). This is approximately coincident with the line of the maximum gravity gradient to the north of the Amadeus Basin (Plate 17). The increase in magnetic disturbance to the north of this boundary is interpreted as evidence for an increase in the basic nature of the basement rocks. This change in rock type would be compatible with the form of the Bouguer anomaly, as, in general, an increase in the basic nature of rocks is associated with an increase in their density.

In HERMANNSBURG and ALICE SPRINGS, zones of type A appear to correlate with the Ormiston and Arltunga Nappe Complexes (Plate 16). This magnetic character is interpreted as evidence for acidic basement rocks in these localities, which would support the hypothesis of Forman and Milligan (1965) that less dense basement rocks form the cores of the nappes.

The A-type zone in the west of MOUNT LIEBIG (Plate 16) correlates with a major granite outcrop. The westerly continuation of this geological unit into MOUNT RENNIE, as indicated on the Amadeus Basin Tectonic map (Forman, 1964), is not supported by the magnetic data. The MOUNT RENNIE geological sheet (Plate 2) shows this unit to be gneissic granite; however, zone B suggests a more basic rock type and this is supported by the fact that the outcrop of basalt in the west of MOUNT RENNIE is included in the same zone.

In the north-east of MOUNT RENNIE a major magnetic anomaly trending 070° is coincident with a major gravity 'high' and is interpreted as evidence for the presence of a basic or ultra-basic igneous body.

Intense magnetic disturbance is confined to ALICE SPRINGS (Plate 5), where anomaly amplitudes frequently exceed 2000 gammas. Iron and copper mineralisation is known to be present in the neighbourhood of some of these anomalies (I. Youles, pers. comm.). An anomaly at latitude 23°03'S/longitude 133°46'E was indicated by a detailed aeromagnetic survey directed towards the search for copper orebodies (Tipper, 1966). The source of this anomaly does, however, correspond to an outcrop of quartz-garnet-magnetite rock.

Southern basement outcrop

The contact between the sedimentary rocks of the Amadeus Basin and the basement rocks is shown by the aeromagnetic data in Plates 13 and 14 to pass through the south of BLOODS RANGE, the west and south of AYERS ROCK, and the south of KULGERA. The southern boundary of the Basin is not so well defined by the magnetic data as the northern boundary, owing to the presence of minor magnetic anomalies within the Basin. Throughout AYERS ROCK, there are magnetic anomalies which are caused by sources near to surface level. Of these anomalies, those which occur within the area of sedimentation suggest the presence of dyke swarms or volcanic rocks.

Correlation between the magnetically inferred southern boundary of the Amadeus Basin and that mapped geologically is only possible in BLOODS RANGE, where there is good agreement. Elsewhere the inferred boundary is invariably to the north of basement exposures.

Inspection of the magnetic profiles in Plates 13 and 14 indicates that in PETERMANN RANGES, AYERS ROCK, and KULGERA, magnetic anomalies have predominant northerly trends, although these are in general ill-defined. There is little evidence for east-west magnetic trends in these areas; however, the distance between the north-south profiles (Plate 14) makes resolution difficult.

The most clearly resolved northerly trends occur in the north-east of PETERMANN RANGES. There is no immediate geological correlation with these trends, but it is possible that they result from interbedded basaltic lavas or faulting. In BLOODS RANGE two series of magnetic trends have been resolved. These are oriented 080° and 100°, the former group being the better defined. The cross-section included in the BLOODS RANGE 1:250,000 geological map (Plate 6) indicates that the source of the magnetic anomalies with trends of 080° is the Mount Harris Basalt. Groups of two closely spaced anomalies are interpreted as inclusions of Mount Harris Basalt in folds. The poor resolution of the magnetic anomalies does not allow a detailed analysis to be made of the attitude of the limbs of these folds.

In the southern basement outcrop area the zone boundaries show a predominant trend of 110°, which is similar to some gravity trends. In addition the zones show a high degree of correlation with Bouguer gravity anomalies (Plates 16 and 17). In particular the gravity shelf on the north-east margin of the Mount Davies Gravity High (Lonsdale & Flavelle, 1963) is clearly associated with a C-type zone. The Katamala Gravity Embayment to the north-east corresponds to a C-type zone. The suggestion by Lonsdale and Flavelle that this feature results from low density Lower Proterozoic or Archaean rocks which include numerous granitic intrusions is supported by the magnetic data; however, the presence of shallow magnetic sources would not support the alternative interpretation of a narrow trough of Proterozoic sediments of thickness 2000 to 4000 ft or more.

The A-type zone that extends northwards from PETERMANN RANGES into BLOODS RANGE broadly corresponds to a region of Lower Palaeozoic sedimentation. It is deduced that the magnetic disturbance characteristic of basement type B has been suppressed by burial of Lower Proterozoic rocks beneath minor Lower Palaeozoic sedimentation. Magnetic profiles shown in Plates 13 and 15 illustrate the effect of increased 'depth of burial' on the magnetic character of basement type B in BLOODS RANGE.

Little correlation is apparent between the Ayers Rock Gravity Depression and the magnetic character of the basement rocks that crop out to the south. The distribution of zones in the south of AYERS ROCK would give limited support for the presence of intermediate type basement rocks immediately to the north of latitude 25°55'S and more basic, denser, rocks to the south. On the north-west flank of the gravity depression, the C-type zone trending 290° has an associated Bouguer anomaly 'ridge' of approximately 10 milligals relief. Within AYERS ROCK the magnetic basement at the boundary of the Basin appears to be donw-faulted to the north by approximately 10,000 ft. The magnetic data could, however, support an easterly continuation of the Petermann Range Nappe structure as shown in the diagrammatic section in Plate 16. The boundary of the Basin cuts across the gravity depression and either structural interpretation appears to contradict the gravity data.

In the north of PETERMANN RANGES the C-type zone is collinear with a similar zone in AYERS ROCK. There is a moderate degree of parallelism between these two zones and the C-type zone shown in the south-west and south of PETERMANN RANGES and the south of AYERS ROCK, suggestive of a structural relationship.

The B-type zone in BLOODS RANGE includes the near east-west trending magnetic lineations previously mentioned. After removal of these lineations little disturbance remains. It is not possible to obtain a direct correlation between the magnetic character of this zone and the Bloods Range Gravity High. It does seem reasonable, however, to conclude that the Bloods Range Gravity High and the Angas Downs Gravity Ridge are caused by Lower Proterozoic basement rocks, which include metasediments, granite, and thick basalt (Scanvic, 1961; Forman, 1962), on the basis that the amplitude of the magnetic disturbance apparent in the former area is typical of basic volcanics or granitic rocks. The general absence of magnetic disturbance in the north of AYERS ROCK other than that attributed to dykes may easily be explained by the burial of the Lower Proterozoic rocks beneath 5000 ft of Upper Proterozoic sediments of the Amadeus Basin.

Amadeus Basin

The aeromagnetic data shown in Plates 13 and 14 reveal major basement susceptibility contrasts within the Basin. These are oriented predominantly between 330° and 030°. Analysis of selected anomalies indicates that the susceptibility contrasts have values in the range 0.5 to 5.0×10^{-3} c.g.s. units. These basement trends are oriented in a markedly different direction from those evident in areas of basement outcrop. The range of susceptibility contrasts and the magnetic lineations indicate that the magnetic basement underlying the Basin represents plutonic bodies within or at the surface of the Arunta Complex.

The general form of the magnetic basement surface as shown in Plate 16 bears a high degree of similarity to that indicated by gravity data. The correspondence between the magnetic and gravity data is very high in terms of both major and minor features of basement relief. However, some disparity exists in the structure at the sediment/basement boundary as determined by the two methods.

Regional magnetic profiles obtained from the tie-lines (Plate 14) commonly show a low susceptibility contrast at the Basin's northern margin. A much larger susceptibility contrast is associated with the contact between zones B and C in the outcropping basement to the north, as shown in Plate 16. It is apparent that a much greater northerly increase in the magnetic mineral content and, therefore, rock density is present at the contact between zones B and C than at the boundary of the Basin. This would explain the apparent disagreement between the magnetic and gravity data.

It is not possible at present to determine fully the nature of the northern sediment/basement contact. The magnetic anomalies shown at the Basin's boundary on ties 8, 9, 18, 20, and 21 are interpreted as being caused by near-vertical 'dyke-like' sources. These may be readily produced along faulted contacts or very steep unconformities between the sediments and the basement.

Within the area of basement outcrop in BLOODS RANGE and AYERS ROCK south of the Basin boundary, the magnetic data show some evidence for the presence of a deep magnetic basement. This is probably Archaean and underlies the exposed or near-surface rocks, which are Lower Proterozoic or older. The magnetic basement contours shown in Plate 16 of areas of basement outcrop refer to the lower magnetic horizon.

The use of residual and derivative techniques in the reinterpretation of both the magnetic and gravity data would probably assist the determination of the structure of the sediment/basement contact.

The axis defined by the deepest parts of the magnetic basement lies in the southern parts of MOUNT RENNIE, MOUNT LIEBIG, HERMANNSBURG, and ALICE SPRINGS. This is collinear with the axis of thickest sedimentary sections as indicated by gravity data. The deepest parts of the Basin are shown by the 36,000-ft and 34,000-ft contours in the east and west, respectively, of MOUNT LIEBIG. These depths are in approximate agreement with the quoted estimate of maximum thickness of sedimentary rocks (BMR, 1962).

Basement depth contours in Plate 16 illustrate the presence of a number of high and low features and associated basement gradients. These are briefly described in the following paragraphs. Section thicknesses have been obtained by assuming an average surface level of 1000 ft above mean sea level.

L1. This is a basement depression along the axis of the Amadeus Basin. The magnetic data indicate that the maximum possible sedimentary thickness contained in this structure is 29,000 ft. However, as this interpretation is controlled by only a few isolated depth estimates, the reliability of this figure is not high. This depression in the magnetic basement corresponds to an extension of the comparatively thick sediments of the Amadeus Basin (Lonsdale & Flavelle, 1963).

The interpretation of aeromagnetic data obtained by Adastra Hunting Geophysics Pty Ltd in this area indicated a maximum depth to magnetic basement of 20,000 ft below sea level (Reef Exploration Pty Ltd, 1965). It is most unlikely that their interpretation is any more reliable than that contained in this record, as in both cases similar interpretation problems were encountered. The rapid southerly rise of magnetic basement in BLOODS RANGE shown by Adastra Hunting Geophysics Pty Ltd is most probably caused by the recognition of only one magnetic horizon, whereas the current interpretation indicates two.

L2 and L3. These are the most prominent magnetic basement depressions resolved from the magnetic data and indicate the axis of the deepest part of the Amadeus Basin. These depressions are coincident with the regions of maximum sedimentary thickness indicated by the Amadeus Gravity Depression. The maximum possible sedimentary thicknesses determined in these two depressions are 35,000 ft and 37,000 ft, respectively.

It is possible that the crystalline basement is shallower than the magnetic basement in the region of L2, as the granite basement that crops out to the north shows little associated magnetic disturbance. Such an interpretation would assume that the acidic rocks of the Arunta Complex are intruded at depth by a basic plutonic body.

Conflicting depth estimates obtained in the east of L3, about Gosses Bluff, are interpreted as caused by the interaction of two deep-seated magnetic anomalies. The shallower depths obtained in the range of 23,000 to 28,000 ft below sea level are considered unreliable even though they are consistent in themselves. Accepted depth estimates in L3 are in the range of 31,000 to 39,000 ft below sea level.

L4. This is a magnetic basement depression south of Alice Springs, which contains a maximum possible sedimentary thickness of 23,000 ft. Gravity data confirm the presence of a basement depression and, in addition, a seismic traverse made by the Bureau of Mineral Resources across the Ooraminna Anticline (Moss, 1966) closely supports the structure inferred from the magnetic data as shown in Plate 16.

L5. This magnetic basement depression is elongated in a north-westerly direction and attains a maximum depth of 34,000 ft below sea level. Gravity data do not support the presence of this basement feature and in view of the few depth estimates controlling the inferred structure, the interpretation must be given a low reliability.

L6. A southerly extension of the basement depression L3 gives rise to a subsidiary basement depression L6, which is associated with a gravity 'low'. The gravity data show little evidence for elongation of this basement feature although the magnetic data indicate that L6 has a similar north-westerly trend to L5.

L7. A possible basement fault G5 in the south-east of HENBURY is interpreted as giving rise to the basement depression L7, in which the maximum possible sedimentary thickness is 23,000 ft. Gravity data support the south-east elongation of the depression and the presence of a medium basement ridge.

L8. This basement depression in the centre of RODINGA corresponds to the western end of the East Rodinga Gravity Low. The extension of this feature to the east is only marginally apparent by the slight embayment of the 6000-ft magnetic basement contour. Lonsdale and Flavelle (1963) correlated the gravity 'low' with a small basin of Palaeozoic sediments. The magnetic data indicate that crystalline basement underlying this structure is within 10,000 ft of sea level.

L9. A basement 'low' with a relief of approximately 6000 ft is superimposed on a northerly dipping basement surface. Deep-seated magnetic anomalies were unresolvable over the central and western parts of this basement feature, thereby limiting depth control mainly to the north and east flanks. No corresponding feature is indicated by the gravity data.

H1. This uplift in the magnetic basement surface forms a south-trending ridge of approximately 6000 ft relief that protrudes into the Amadeus Gravity Depression in MOUNT RENNIE. The magnetic basement contours north and south of G1 indicate that the feature H1 was originally continuous to the north, but was probably affected later by major faulting. Gravity data show limited evidence for the presence of this basement ridge. However, the resolution is poor.

H2, H6, and H7. These three 'highs' form a major ridge in the magnetic basement extending from the east of LAKE AMADEUS to the centre of southern MOUNT LIEBIG. The major basement 'high', H7, has a relief of approximately 10,000 ft with respect to the general basement level. Feature H6 is a small associated 'high' to the west-north-west of H7, and H2 forms a broad ridge which extends northwards into the Amadeus Gravity Depression separating the two major magnetic basement depressions, L2 and L3. All of these magnetic basement features have high gravity correlation as shown by Plates 16 and 17.

The apparent lineaments produced by the magnetic basement contours between L5 and H6 and H7 and between L6 and H6 and H7 are interpreted as evidence for possible major basement faulting. The trend of these lineaments is north-west, which is intermediate between the trends of surface structural fold axes and faulting.

<u>H3</u>. The magnetic basement depression associated with the eastern extremity of the Amadeus Gravity Depression is subdivided by a west-trending ridge, H3, of approximately 2000 ft relief. The Bouguer anomaly contours show some correlation with this basement ridge. A more significant gravity 'high' of 15 mgals to the west, however, has no reflection in the relief of the magnetic basement.

<u>H4 and H5</u>. In the north-east of BLOODS RANGE and north-west of LAKE AMADEUS, two narrow ridges (H4 and H5) in the magnetic basement protrude into the Amadeus Gravity Depression in a north-east direction and have reliefs of approximately 4000 ft and 2000 ft, respectively. The trends of the Bouguer anomaly contours show little agreement with the more pronounced basement ridge, H4, but moderate agreement with H5.

<u>H8</u>. This is a minor 'high' of only 2000 ft relief near the northern boundary of HENBURY. It is elongated in an east-west direction and lies on the south-eastern slope of the major low feature L3. It can be correlated with a minor gravity ridge in the Bouguer contours although some offset between the magnetic and gravity data is apparent. The resolution of the magnetic basement feature H8 is not high, owing to the limited number of depth estimates available.

<u>H9</u>. This forms a prominent 'high' in the magnetic basement near the centre of HENBURY and has an associated west-trending ridge. The relief of H9 is approximately 6000 ft. Little agreement is apparent between the magnetic and gravity data.

<u>H10</u>. This feature forms a significant 'high' in the magnetic basement of approximately 4000 ft relief and 6000 ft depth relative to sea level. The Bouguer contours to the west of the East Rodinga Gravity Low show good correlation with the magnetic basement surface at and about H10.

<u>H11</u>. This magnetic basement feature constitutes a ridge of 2000 to 4000 ft relief trending north-west from KULGERA towards LAKE AMADEUS. It shows some correlation with the Bouguer contours about the eastern extremity of the Angas Downs Gravity Ridge. It is concluded that the gravity feature attributed to shallow Lower Proterozoic rocks is also controlled by upwarping of the Archaean basement.

The depth estimate of 16,400 ft obtained from the anomaly at latitude 25°00'S/longitude 132°00'E is considered to be reliable as it has been confirmed by a high altitude magnetic traverse (Plate 15). Earlier interpretation by Aero Service Ltd (Exoil (N.S.W.) Pty Ltd, 1963) of this anomaly in the north-west of KULGERA yielded a basement depth of 11,300 ft below sea level, which would now appear to be in error.

<u>H12</u>. This minor basement 'high' correlates with a protrusion of the Angas Downs Gravity Ridge. Previous work by Aero Service Ltd indicated a more pronounced 'high' of 5000 ft relief located at a depth of 4000 ft below sea level.

<u>G1</u>. A discontinuity in the magnetic basement contours in the south-west of MOUNT RENNIE produced the trend G1. This trend is interpreted as the result of a fault which strikes east-north-east for approximately 75 miles and which has a throw of about 10,000 ft. A geologically mapped fault zone occurs close to this inferred fault. There is no gravity feature that can be correlated with this structure; however, Bouguer anomaly contours parallel the trend.

<u>G2 and G3</u>. These gradients of the magnetic basement surface occur in east ALICE SPRINGS and in the east and north of RODINGA. The Basin appears to deepen westward initially and thence to the north. The correlation between the Bouguer contours and the magnetic basement depth contours is good and in addition the form of the structure associated with G3 is supported by seismic data (Moss, 1966) as shown in Plate 17.

<u>G4</u>. This trend represents a strong gradient in the south-west quarter of LAKE AMADEUS and is caused by the magnetic basement rising quite rapidly towards the south-west. Although the gravity data show a general shallowing of the Basin to the south, there is a notable difference between the trend of the Bouguer anomaly contours and those of the magnetic basement surface.

<u>G5</u>. This magnetic basement trend is interpreted as resulting from a steep northerly rise in the basement surface in the south-east of HENBURY. The gradient trend is to the north-west and is probably caused by a fault with a throw of approximately 4000 ft. Such a fault is shown in a cross-section included in the HENBURY 1:250,000 Geological Map. In addition, gravity data show general agreement with this fault and the associated depression to the south-west.

<u>G6</u>. The basement escarpment G6 is interpreted as an Archaean basement upwarp continuous with G4 and appears to delineate the southeast margin of the main area of sedimentation. The correlation of this feature with gravity data is not high. The Bouguer contours indicate a more gradual shallowing of the Basin through LAKE AMADEUS, the magnetic basement 'low', L5, having a marked effect on G6.

<u>G7</u>. The easterly continuation of G7 into FINKE has been interpreted as evidence for a fault (Exoil (N.S.W.) Pty Ltd, 1963). Current interpretation would support this deduction.

<u>Correlation of magnetic and seismic data</u>

The interpreted magnetic basement is generally in good agreement with basin structure determined by seismic surveys. Plates 17 and 18 show the locations of seismic surveys that have been made in the area. The depths of the deepest reflectors are included in these plates.

The seismic data obtained by BMR surveys show very good agreement with the general form of the magnetic basement about the eastern part of L3 (Plate 16). The magnetic data do not, however, reveal the minor basement uplift associated with Gosses Bluff as indicated by Moss (1964).

The structure in the Ooraminna area as indicated by seismic data (Moss, 1966) is confirmed by the magnetic interpretation.

The seismic survey in the Missionary Plain locality (Magellan Petroleum (N.T.) Pty Ltd, 1966) indicates that locally the maximum thickness of sediments overlying the Bitter Springs Formation is approximately 28,000 ft immediately to the north-west of Gosses Bluff. This estimate is based on a two-way reflection time of 3.46 seconds and a mean section velocity of 18,000 ft/s. The Bitter Springs Formation and the Heavitree Quartzite probably add 4000 ft to the sedimentary section suggesting a maximum basement depth of approximately 31,000 ft below sea level. This depth and the form of the contours of 'Horizon E' shown in Plate 18 are in good agreement with the magnetic basement contours shown in Plate 16. Resolution of structural features shown by Horizon E is much greater than that interpreted from the magnetic data of the underlying basement.

The rate of shallowing of Horizon E to the south is considerably greater than that of the magnetic basement. Such a configuration of basement and sedimentary surfaces suggests a thickening of the Bitter Springs section across the axis of the Palm Valley Anticline.

Results from the seismic reflection survey in KULGERA (Exoil (N.S.W.) Pty Ltd, 1966) are not in close agreement with the aeromagnetic interpretation. Plate 17 shows the locations of seismic traverses Nos. 2 and 3 and depths to the deepest reflector, which is interpreted as being near the top of the Bitter Springs Formation. Both seismic traverses indicate a tectonically disturbed region. In general, the east-west traverse shows that the depth to the deepest reflector does not exceed 8000 ft below sea level in comparison to the magnetic basement depth of 12,000 ft. This minimum difference in depth of 4000 ft is approximately equal to the section thicknesses of the Bitter Springs Formation and the Heavitree Quartzite, or equivalents (see Appendix A). It does not seem likely, therefore, that any major thickness of Lower Proterozoic rocks underlies the Upper Proterozoic sequence in this locality. The rapid thickening of the sedimentary sequence west or longitude 132°15'E along seismic traverse 2 is in agreement with the magnetic interpretation (L9); however, the general southerly thickening at this longitude along seismic traverse 3 is not supported by the magnetic interpretation.

The differences between the irregular surface mapped as the lowest seismic horizon (Top Salt, Bitter Springs Formation) and the simple form of the underlying magnetic basement along seismic traverse 3 (Plates 16 and 17) suggest that wedges of salt from the Bitter Springs Formation form diapiric structures on the south side of reverse faults.

4. RADIOMETRIC RESULTS AND INTERPRETATION

Profiles showing changes in level of radiometric intensity have been reduced to a scale of 1:250,000 for all flight lines but are not presented in this Record.

Plate 19 shows the composite radiometric contours at a scale of 1:500,000, superimposed on the geological compilation produced by Barrie (1964). Systematic errors revealed by east-west elongation of the radiometric contours are flight-line dependent: they are produced by minor changes in equipment operation or variations in the mean terrain clearance between adjacent flight lines. The contour pattern about latitude 25°S is markedly affected by these errors.

Basement outcrop in MOUNT RENNIE, MOUNT LIEBIG, HERMANNSBURG, and ALICE SPRINGS

The radiometric contours indicate that the regions of granite, gneissic granite, and basalt outcrop in MOUNT RENNIE and MOUNT LIEBIG have similar radioactive mineral content. These regions form a belt of high radioactivity which trends east-west across these two areas. This similarity in radiometric character is in contrast to the magnetic results, which showed variations between two of these three basement rock types.

In general, high radioactivity is associated with exposures of Precambrian basement rocks throughout HERMANNSBURG and ALICE SPRINGS, the latter area being particularly anomalous.

Over the entire area of basement outcrop there is a well defined correlation between high radioactivity and moderate-to-low magnetic disturbance. The abrupt change in basement rock type determined from the magnetic data, which was approximately coincident with the steep gravity gradient, is also shown by the radiometric contours. The zone of basic rocks interpreted from the magnetic data (C-type zone) in general has low radioactivity.

Basement outcrop in BLOODS RANGE, PETERMANN RANGE, AYERS ROCK, and KULGERA

Radioactive anomalies form two distinct belts through PETERMANN RANGES and AYERS ROCK, which are coincident with mapped exposures of undifferentiated Precambrian rocks. These belts have north-west and west trends and may be correlated with the previously mentioned B- and C-type zones, respectively.

The alluvial cover in the region of the C-type zone between the two belts in PETERMANN RANGES probably masks radioactivity from the underlying basement rocks. Even so, it is to be expected that rocks of C-type zone would be less radioactive than those of B-type zone as the former are thought to be more basic.

Well defined easterly trends in south BLOODS RANGE parallel magnetic features resolved in this area. Precambrian basement rocks are again the source of anomalous radioactivity.

Amadeus Basin

Numerous radioactive anomalies have been delineated within the area of sedimentation particularly in LAKE AMADEUS and HENBURY. Plate 19 shows that a high proportion of these anomalies are associated with exposures of the Larapinta and Pertaoorrta Groups in the Watson Range, Ochre Hill, Johnny Creek, Mereenie, Gardiner Range, and James Range anticlines. Two other anomalies in the north-east of AYERS ROCKS and north-centre of KULGERA are also coincident with small exposures of these rocks.

Composite well logs obtained from the Alice No. 1 (Exoil N.L., 1964), East Mereenie No. 1 (Exoil N.L., 1965) and Palm Valley No. 1 (Magellan Petroleum (N.T.) Pty Ltd, 1965) show that considerable gamma radiation is associated with shales of the Pertnjara Formation, Larapinta Group, and Pertaoorrta Group (Plate 20). Sandstone and limestone horizons have little radioactivity, the Mereenie Sandstone in particular showing little response on the gamma ray logs.

The radioactive 'highs' apparent in the north of the Amadeus Basin (Plate 19) are produced by the conglomerate facies of the Pertnjara Formation. This conglomerate contains a large proportion of igneous material (A. T. Wells, pers. comm.), which accounts for the high radioactivity.

In general, few exposures of the phosphate-bearing Larapinta Group appear to be abnormally radioactive when compared to radioactivity exhibited by shales of the Pertaoorrta Group. The anomaly associated with the Johnny Creek anticline is the most significant detected within the sediments of the Amadeus Basin although the contribution of radioactivity from phosphate minerals is locally unknown.

5. CONCLUSIONS AND RECOMMENDATIONS

The interpretation of the magnetic results presented in this Record is based on the original and reduced magnetic profiles. When contour maps become available it would be appropriate to review this interpretation so that it could be amplified and related more closely to the results of the gravity survey.

It is recommended that the digitised magnetic data recorded on all ties and lines spaced at intervals of approximately 16 miles be statistically analysed. Auto-correlation, cross-correlation, and power density analysis should be applied to determine significant geological trends and structure over the entire survey area.

The moderate-to-high degree of correlation of the form of the magnetic basement with the Bouguer anomaly contours suggests that in most of the survey area the magnetic and crystalline basements are identical. The general absence of direct correlation of individual magnetic anomalies with Bouguer anomalies supports this conclusion as it appears that the Bouguer anomalies are primarily dependent upon the density contrast between the sediments and the crystalline basement, whereas magnetic anomalies are produced by intrabasement susceptibility contrasts. The density constrasts associated with the crystalline basement do not generally appear to be significant.

The magnetic basement underlying the Amadeus Basin has been interpreted as being of Arunta age primarily on the assessment of anomaly amplitude and elongation. Some doubt exists as to the validity of this assumption owing to two unusual basement characteristics encountered. The first is the major difference in magnetic trend orientation within the basin as compared to the surrounding basement outcrop. It is possible that the generalised northerly trends found within the Basin result from susceptibility contrasts between ancient crystalline rocks, whereas the more common easterly trends in areas of basement outcrop reflect tectonic activity associated with basin development.

From these two hypotheses it may be concluded that the north-south trends in the Basin, and the east-west trends over the northern basement, result from the Arunta and Alice Springs Orogenies respectively. The absence of east-west trends within the Basin suggest that either the Alice Springs Orogeny had little effect upon basement rocks or the sources are of so limited extent or of such low magnetic susceptibility that they are not recorded at the observation level.

The second unusual characteristic is the rapid change in basement depth near the basin boundary. This severely restricts the recognition of typical magnetic anomalies associated with basement rocks.

The isolated high level magnetic traverses located over basement outcrop yield qualitative information regarding the 'burial' of magnetic basement rocks. In particular Lower Proterozoic rocks appear to produce very little magnetic disturbance when observed from an altitude of 9000 ft above the source. Greater resolution of some magnetic sources in ?Archaean basement rocks is obtained from these traverses, a few critical depth determinations being confirmed.

Well defined easterly magnetic trends detected in BLOODS RANGE have been correlated with exposures of Mount Harris Basalt. It is probable that magnetic data could greatly assist geological mapping in this region with reference to local basement structure. If such information is required it will be necessary to make a more detailed magnetic survey to resolve clearly the form of these magnetic anomalies. Interpretation of such work would take the form of an assessment of the disposition of thin sheet-type sources.

The presence of numerous magnetic anomalies distributed throughout the south-western part of the Basin suggests that widespread volcanic activity accompanied sedimentation in this region. Many magnetic anomalies appear to have the elongation and form typically associated with dykes: however, some detailed flying about Lake Amadeus failed to confirm this impression.

In general, there is fair to good agreement between the interpretation of aeromagnetic data made by Aero Service Ltd (Exoil (N.S.W.) Pty Ltd, 1963), Adastra Hunting Geophysics Pty Ltd (Reef Exploration Pty Ltd, 1965), and that included in this Record. Correlation is best in RODINGA and HENBURY. In KULGERA, similar basement form is shown by the interpretations of Aero Service Ltd and the BMR, although a systematic difference in depth to basement of 30% is apparent, the former interpretation being the shallower. A similar situation exists in BLOODS RANGE and MOUNT RENNIE, where the interpretation by Adastra Hunting Geophysics indicates the shallower magnetic basement. It is possible that re-interpretation of the magnetic data, with the contours of total magnetic intensity available for reference, will produce some shallowing of the magnetic basement shown in Plate 16.

Radiometric results prove that in certain areas considerable radioactivity is associated with rocks of the Larapinta Group and the Pertaoorrta Group. It is now essential that phosphatic rock samples obtained from the Larapinta Group be assayed for radioactive mineral content. If positive results are obtained from such assays it is recommended that a more detailed airborne radiometric survey be flown over the Johnny Creek anticline to assist in the search for economic phosphate deposits. A light aircraft would be required for such work operating at an altitude of 200 ± 20 ft above ground level with an instrument time-constant of one second. This would give much greater resolution of radioactive anomalies and allow targets to be selected for ground geophysical, geological, or geochemical surveys.

The radioactive anomalies constituting a belt coincident with the Pottuyu Hills in PETERMANN RANGES are indicative of granitic type rocks. The decrease in radioactivity and increase in magnetic disturbance over basement rocks to the south is interpreted as evidence for the occurrence of more basic basement rock types. This conclusion is in agreement with gravity data. A similar correlation of radiometric, magnetic, and gravity data is apparent to the north of the Basin, where it is inferred that basement rocks become more basic to the north.

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* Unpublished report on a Commonwealth-subsidised operation

STRATIGRAPHY OF THE AMADEUS BASIN

APPENDIX A

AGE	NORTHERN PART OF BASIN				SOUTHERN PART OF BASIN			REMARKS
		UNIT, FORMATION, ETC.	MAXIMUM THICKNESS (ft.)	LITHOLOGY	UNIT, FORMATION, ETC.	MAXIMUM THICKNESS (ft.)	LITHOLOGY	
QUATERNARY				Gravel, evaporite, clay, sand alluvium				
TERTIARY			100+	Laterite, grey billy, calcareous and gypsiferous silt			Grey billy, conglomerate, breccia	
MESOZOIC			60+	Sandy siltstone, siltstone, grit, linguite, shale, gravel, clay		1,500+	Shale, siltstone, sandstone	
PERMIAN					Crown Point Formation	200	Sandstone, boulder beds, tillites, siltstone, claystone	
UNDIFFERENTIATED PALAEOZOIC					Finke Group	1,500	Sandstone, shale, conglomerates	Possibly equivalent wholly or in part to the Pertnjara Formation
UPPER PALAEOZOIC		Pertnjara Formation	10,000	Sandstone, conglomerate siltstone	Pertnjara Formation	700+	Silty sandstone, Micaceous siltstone, sandstone	Possibly Upper Devonian
UPPER DEVONIAN (?)		Mereenie Sandstone	3,200	Quartz sandstone, silty sandstone	Mereenie Sandstone	340	Kaolinitic sandstone, gypsiferous siltstone	
ORDOVICIAN	LARAPINTA	Stokes Formation	2,000	Silty shale, limestone, sandstone	Stokes Formation	400	Siltstone, shale, dolomite	
		Stairway Sandstone	1,800	Sandstone, siltstone	Stairway Sandstone	350	Sandstone, conglomerate, siltstone, pelletal phosphate	
		Horn Valley Siltstone	1,400	Siltstone, sandstone, limestone shale				
		Pacoota Sandstone	2,700	Sandstone				
CAMBRIAN	PERTAOORRTA	Goyder Formation	2,400	Sandstone, shale, thin limestone	Cleland Sandstone	1,570	Pebbly and micaceous sandstone, siltstone	Equivalent to part of the Pertaoorrta Group
		Jay Creek Limestone	3,500	Limestone, algal limestone, shale				
		Hugh River Shale	1,600	Shale, sandstone, limestone				
		Arumbera Sandstone	4,000	Sandstone				
					Mt. Currie Conglomerate	2,000+	Pebble, cobble and boulder conglomerate, sandstone	Deposited contemporaneously
					Ayers Rock Arkose	8,000+	Arkose, siltstone	
LOWER CAMBRIAN OR UPPER PROTEROZOIC							Sills and dykes of quartz-dolerite	
UPPER PROTEROZOIC		Pertatataka Formation	4,500	Silty shale, algal limestone, thin sandstone, dolomite, conglomerate	Winnall Beds	6,000+	Siltstone, sandstone, pebbly sandstone	
		Areyonga Formation	1,400	Sandstone, conglomerate, minor limestone, glacials	Inindia Beds	7,000	Siltstone, sandstone, chert, chert breccia, dolomite	
		Bitter Springs Formation	2,500	Limestone, algal limestone, shale, salt, gypsum, dolomite, basic volcanics	Pinyinna Beds	2,000?	Crystalline dolomite, limestone, siltstone, slate, phyllite	
		Heavitree Quartzite	1,440	Sandstone, silicified sandstone, quartzite	Dean Quartzite	1,500	Quartzite, sandstone, pebbly sandstone, conglomerate, greywacke	
UNDIFFERENTIATED PRECAMBRIAN					Bloods Range Beds		Sandstone, quartzite, schist, porphyry slate, basic extrusives	Lower or Upper Proterozoic
					Mount Harris Basalt		Arkose, tuff, agglomerate, epidotized amygdaloidal basalt	Possibly Lower Proterozoic
PRECAMBRIAN (ARCHAEAN?)		Arunta Complex		Granite, gneiss, schist, gabbro, dolerite dykes	Musgrave Complex		Igneous/metamorphic complex (Arunta Complex)	

APPENDIX B

AMADEUS BASIN WELL DATA (As at 31st December 1966)

Name	Location	Total Depth (ft)	Remarks
Ooraminna No. 1	24°00'00"S 134°09'50"E F53/14 Alice Springs	6107	Gas show in Areyonga Formation
Alice No. 1	23°54'47"S 133°58'00"E F52/16 Alice Springs	7518	Oil bleeding in Jay Creek Limestone
Mereenie No. 1	23°59'08"S 131°39'10"E F52/16 Mount Liebig	3983	Gas flow 11mcfd from Pacoota Sandstone
East Mereenie No. 1	24°00'31"S 131°33'51"E G52/4 Lake Amadeus	4710	Open hole flow 60 mcfd. Completed as gas producer
East Mereenie No. 2	24°02'47"S 131°38'50"E G52/4 Lake Amadeus	5175	Completed as gas-condensate producer
West Mereenie No. 1	23°56'57"S 131°24'44"E F52/16 Mount Liebig	5504	Completed in Cambrian limestone and sandstone as a gas-condensate producer
Mt. Charlotte No. 1	24°53'41"S 133°59'11"E G53/2 Rodinga	6943	Abandoned in salt (Bitter Springs Formation?)
Palm Valley No. 1	24°00'00"S 132°46'20"E F53/13 Hermannsburg	6658	Completed in Pacoota Formation. Gas flow 14 mcfd from Ham Valley, Pacoota, and Stairway Formations
Waterhouse No. 1	24°01'00"S 133°31'00"E G53/2 Rodinga	3081	Finished in Arumbera Formation
Johnny's Creek No. 1	24°08'46"S 131°29'41"E G52/4 Lake Amadeus	877	Abandoned
Gosses Bluff No. 1	23°49'15"S 132°18'00"E F53/13 Hermannsburg	4534	Abandoned in sandstone

Name	Location	Total Depth (ft)	Remarks
East Johnny's Creek No. 1	24°11'00"S 131°37'55"E G52/4 Lake Amadeus	6344	Plugged and abandoned. No showings of oil or gas
James Range "A" No. 1	24°10'42"S 133°00'40"E G53/1 Henbury	3000	Plugged and abandoned in Bitter Springs Formation
Highway Anticline No. 1	24°20'23"S 133°27'06"E G53/1 Henbury	3770	Plugged and abandoned. No showings of oil or gas
Erldunda No. 1	25°18'30"S 133°11'48"E G53/5 Kulgera	5463	Plugged and abandoned
Ochre Hill No. 1	24°07'58"S 131°23'49"E G52/4 Lake Amadeus	3761	Plugged and abandoned. No showings of oil or gas
West Mereenie No. 2	23°58'49"S 131°32'22"E F52/16 Mount Liebig	4997	Completed in Pacoota Formation as a gas producer (10.6 mmcfd). At 1170 ft oil, and at 280 ft, oil cut mud in DST.
East Mereenie No. 3	24°00'45"S 131°33'10"E G52/4 Lake Amadeus	5215	1400ftoil recovered from Pacoota Formation - not commercial. Plugged and abandoned
Orange No. 1	24°02'34"S 133°46'32"E G53/2 Rodinga	8886	Bottomed in Arumbera Formation. Gas show at 7510ft.

APPENDIX C

METHOD OF DEPTH DETERMINATION

Depth determinations were made by combined application of the half-maximum-slope method (Peters, 1949) and the straight-slope method (Vacquier et al, 1951) using the original charts for computations. The mean determination obtained from the two methods was accepted as the depth to the magnetic source, providing the deviation of this mean from either determination did not exceed 15%.

The horizontal distance between points of half-maximum slope vary from 1.2 times the depth for a thin sheet to 2.0 times the depth for the edge of a semi-infinite block. In most cases a factor of 1.6 was used. This is applicable to a body whose width is equal to about twice its depth. The straight-slope method of interpretation involves the measurement of the horizontal extent of the steepest part of the anomaly curve. In order to use this parameter to obtain the depth to the magnetic source it is necessary to multiply the straight-slope length by a factor within the range 1.0 to 1.8. A factor of 1.5 was used for all determinations.

In general, comparisons between adjacent profiles and orthogonal profiles enable an adjustment to be made for depth determinations influenced by oblique intersections of magnetic contours with flight lines. Depth estimates remain uncorrected if the anomaly cannot be traced across neighbouring profiles, or if the field is too disturbed for a pattern to be seen. As the correction is simply the multiplication by the sine of the angle of intersection, uncorrected depths, which are common in regions of shallow or extremely deep basement, are maximum estimates.

Systematic errors are introduced by the application of standard factors for depth determinations in areas where they are inappropriate. Anomaly interpretation by curve-fitting methods (Gay, 1963) produces more reliable depth estimates providing the anomalies have simple forms. This method of depth determination was used wherever possible to establish control depths and further to provide anomaly analysis for local adjustment of half-slope factors.

The anomalies interpreted by this method are shown in Plate 21 and the various parameters of each are listed in Table 1.

No wells drilled in the Amadeus Basin have bottomed in basement rocks. Absolute control for calibration of depth estimates is therefore not available. Limited seismic information was used where possible to obtain partial calibration of minimum depths to basement.

TABLE 1

Anomaly	Line	Curve parameter (Gay, 1963)		Model parameter				
		Q	R	Depth (ft)	Width (ft)	Strike	Dip	Susceptibility (10^{-3} c.g.s.)
1	41	-360	2.5	34,000	85,000	150°	54° to 240°	1.7
2	41	-360	2.5	31,000	77,500	010°	76° to 100°	1.1
3	62	-270	2	29,900	59,800	030°	35° to 300°	1.6
4	Tie 17	-300	3	18,400	55.200	050°	86° to 320°	0.7
5	Tie 14	-300	1	27,700	27,700	075°	82° to 165°	1.9
6	56	-280	3	28,300	85,200	015°	30° to 285°	0.9
7	63	-270	2	27,900	55,800	030°	35° to 300°	1.6
8	Tie 15	-340	1	33,000	33,000	060°	56° to 150°	3.6
*9	55	-230	4	16,000	64,000	150°	0°	0.4
10	47	-360	3	18,200	54,600	170°	80° to 260°	0.6
11	39	-330	2	27,000	54,000	155°	86° to 245°	0.5
12	65	-350	2	18,400	36,800	170°	84° to 80°	1.2
13	Trav C	-350	1.5	25,600	38,400	170°	84° to 80°	1.0
14	58	-360	.7	31,600	22,100	0°	90°	5.0
15	Trav B	-360	.5	40,600	20,300	0°	90°	5.8
16	55	-370	3	4,800	14,400	0°	80° to 270°	0.6
17	55	-360	2.5	11,000	27,500	175°	86° to 265°	1.1
18	55	-360	2.0	10,000	20,000	17°	70° to 107°	1.3
19	48	-360	0	10,100	THIN	0°	90°	>3.2
20	48	-360	0	10,100	THIN	0°	90°	>3.2
21	48	-37C	2	10,800	21,600	175°	74° to 265°	0.5

The locations of the magnetic anomalies are shown in Plates 13, 14, and 15.

Depths are calculated relative to aircraft height.

* Application of model curve is questionable because of the low dip angle.

APPENDIX D

OPERATIONAL DETAILS

Staff

Geophysicists	: G. A. Young (party leader) E. P. Shelley	
Senior radio technician	: P. B. Turner	
Drafting assistant	: D. P. Lankester	
Geophysical assistants	: K. A. Mort D. Park C. I. Parkinson	
Pilots	: Captain R. Smythe Captain J. Barton Captain D. Allman First Officer D. Spiers	T.A.A.
Aircraft maintenance engineers	: E. Benny J. Cridge W. Briggs P. Derrick	T.A.A.

Equipment

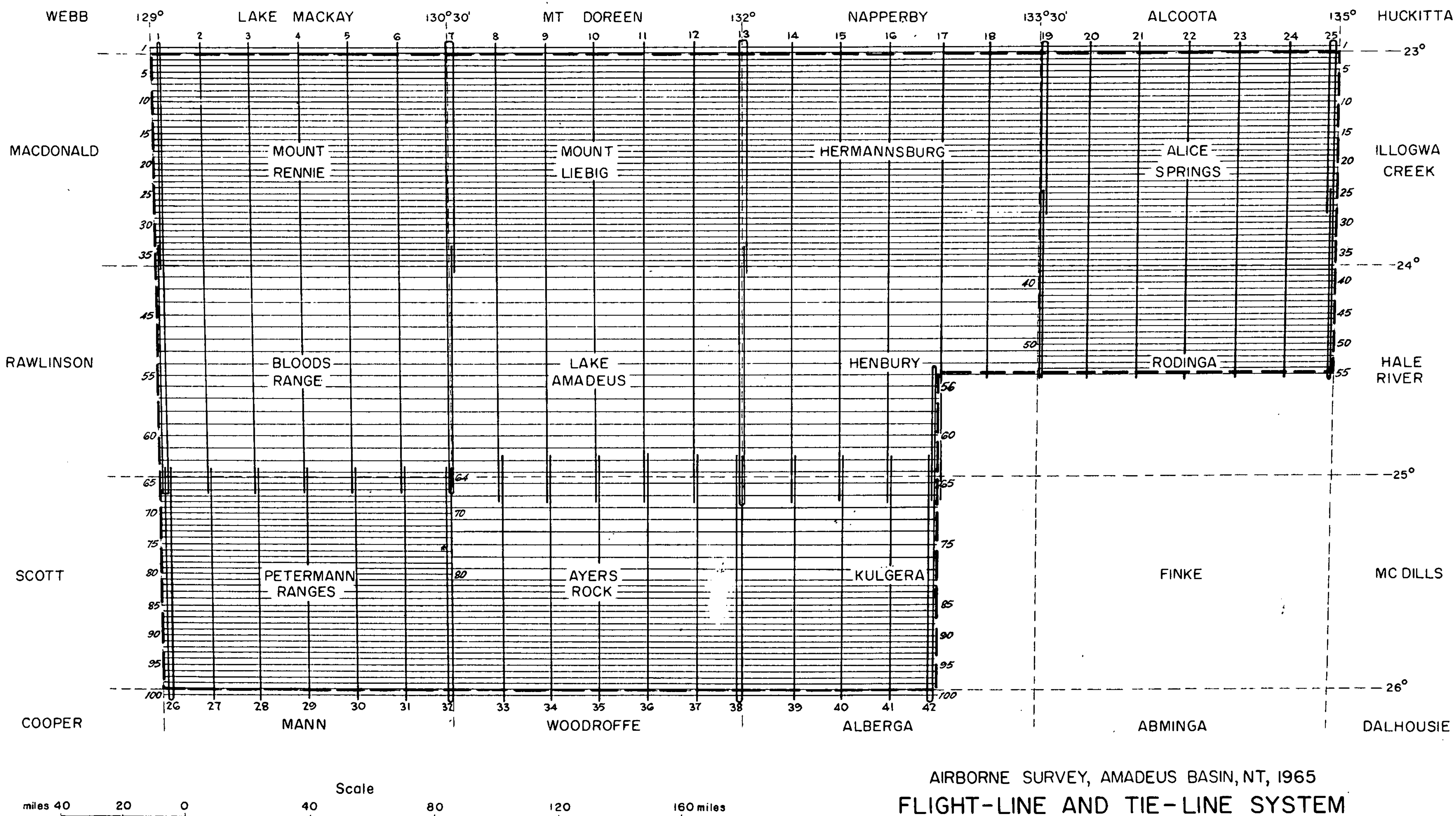
Aircraft	: D.C.3 VH-MIN
Magnetometers	: MFS-5 saturable core fluxgate, tail boom installation coupled to 'Speedomax' and digital recorders. MFD-3 saturable core fluxgate, ground installation for storm warning, coupled to Esterline-Angus recorder.
Scintillographs	: Twin crystal MEL scintillation detector heads inboard and single crystal detector head outboard (the latter suspended from a cable 200 ft below aircraft) Outputs coupled to DeVar recorder
Radio altimeter	: STR30B, frequency-modulated type, output coupled to DeVar recorder
Air position indicator	: Track recorded by DeVar recorder
Camera	: BMR 35-mm strip

Survey Specifications

Altitude	:	800 ft above ground level
Line spacing	:	2 and 4 miles (see Figure 1)
Line orientation	:	East
Tie system	:	Single lines spaced 15 miles apart, double lines at eastern and western boundaries of individual 1:250,000 map areas (see Figure 1)
Navigation control	:	Aerial photographs
Record sensitivity		
MFS-5	:	50 gammas/inch
MFD-3	:	20 gammas/inch
Inboard scintillograph	:	25 c/s/cm
Outboard scintillograph	:	25 c/s/cm
Scintillometer time constants	:	10 seconds

Survey Timetable

Party arrival Alice Springs	:	10th and 11th May
Survey office obtained	:	19th May
Survey flying commenced	:	17th May
Survey flying completed	:	25th October
Survey office vacated	:	1st November
Party departure Alice Springs	:	31st October and 3rd November



AIRBORNE SURVEY, AMADEUS BASIN, NT, 1965

FLIGHT-LINE AND TIE-LINE SYSTEM

FIGURE 1

(To face page 30)

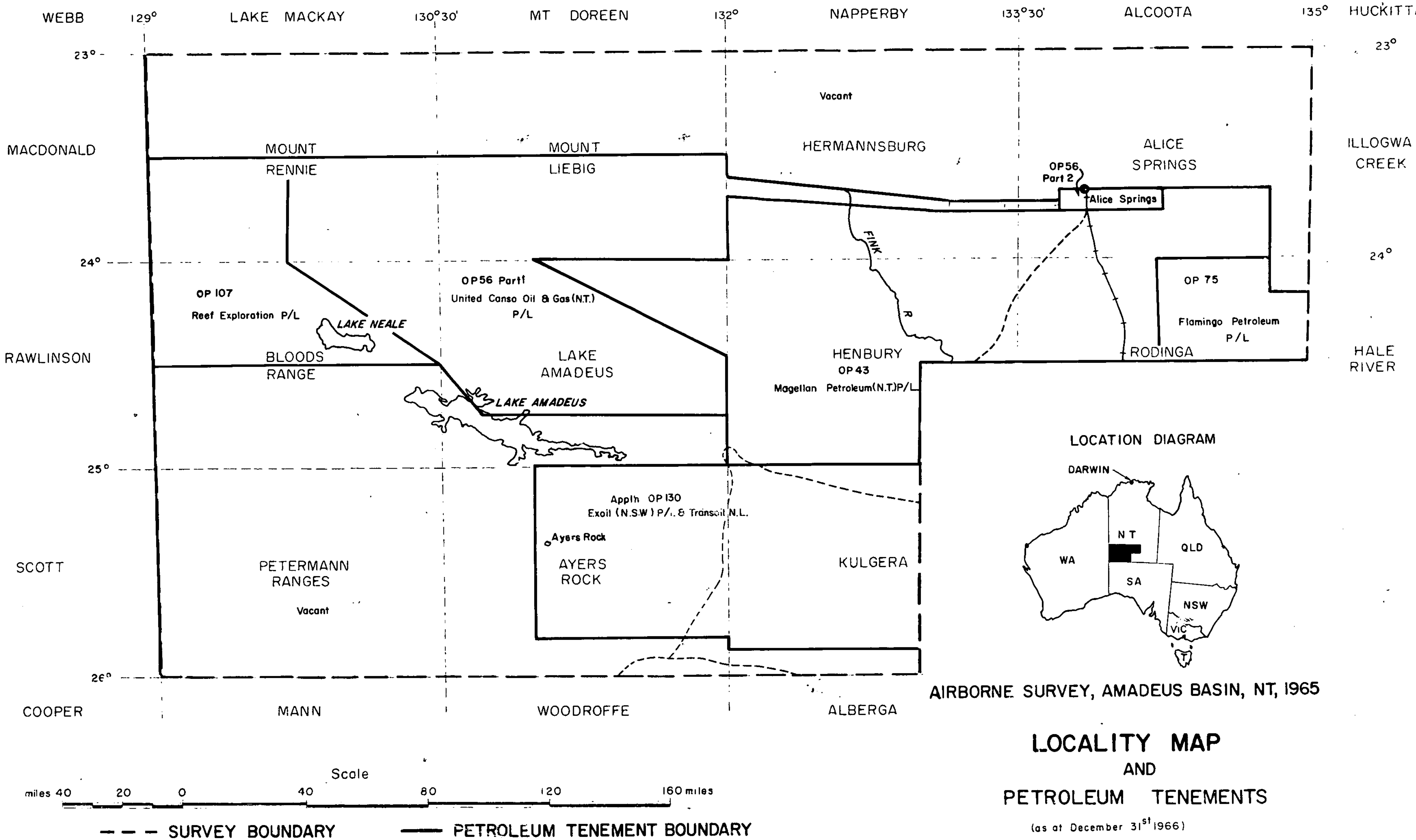
To accompany Record No. 1966/230

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

G 52/B1-7

TO ACCOMPANY RECORD No.1966/230 Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

G 52/B1-16



AIRBORNE SURVEY, AMADEUS BASIN, NT, 1965

LOCALITY MAP AND PETROLEUM TENEMENTS

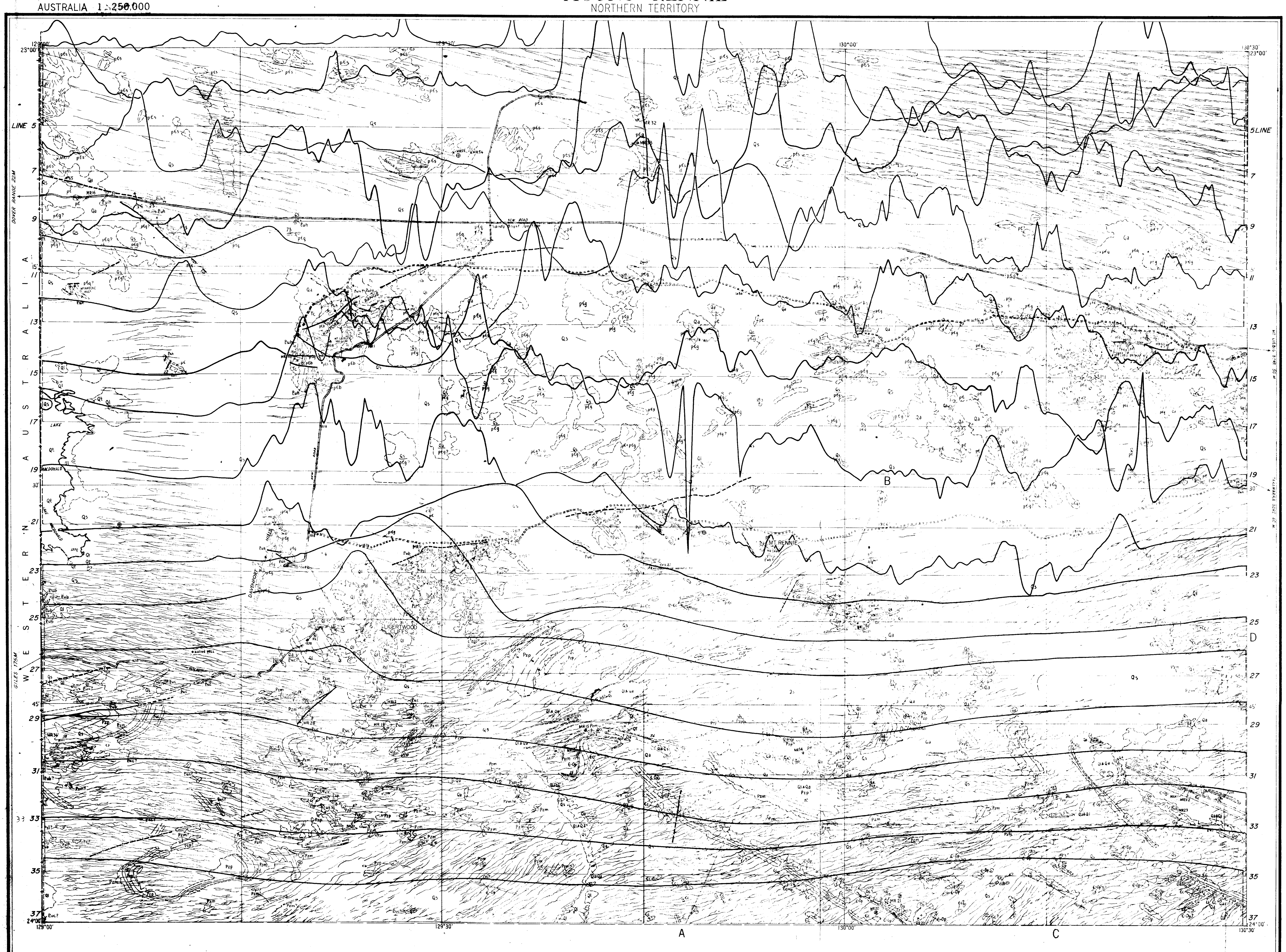
(as at December 31st 1966)

PLATE 1

PLATE 2

AUSTRALIA 1:250,000

MOUNT RENNIE
NORTHERN TERRITORY



Reference

CAINOZOIC	Quaternary	Undifferentiated	Q	(In Section only)
			Qa	Alluvium
			Qs	Sand
			Qt	Evaporites
			Ql	Travertine
	Tertiary		Tc	Conglomerate
PALAEOZOIC			P	Sandstone and micaceous siltstone
		Ligertwood Beds	Pzl	Breccia, sandstone, conglomerate and conglomeratic sandstone
		Pertnjara Formation	Pzp	Calcareous siltstone, siltstone, sandstone and conglomerate
		Mereenie Sandstone	Pzm	Red-brown and white sandstone. Large scale cross bedding
	Ordovician (Larapinta Group)	Undiff	Є-Ol	
		Stairway Sandstone	Os	Sandstone, siltstone and limestone; marine fossils
		Horn Valley Siltstone	Oh	Siltstone and limestone with marine fossils
		Pacoota Sandstone	Є-Op	Sandstone with marine fossils
	Cambrian	Cleland Sandstone	Єc	Sandstone and pebbly sandstone
PRECAMBRIAN	Upper Proterozoic	Carnegie Formation	Ꞓuc	Sandstone, siltstone, pebbly sandstone and conglomerate
		Bitter Springs Limestone	Ꞓub	Crystalline dolomite, crystalline dolomitic limestone, crystalline limestone and siltstone. Stromatolites
			Gp	Gypsum
		Heavitree Quartzite	Ꞓuh	Sandstone, conglomeratic sandstone and siltstone
	Undifferentiated		pЄb	Basalt
			pЄs	Quartz, sericite schist and quartz amphibolite
			pЄg	Gneissic granite
			pЄq	Quartzite
			pЄ	Undifferentiated metamorphic and igneous rocks

Geological boundary

Fault

Where location of boundaries and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries are dotted and faults are shown by short dashes

Strike and dip of strata

Horizontal bedding

Dip < 15° (air-photo interpretation)

Dip 15°-45°

Dip > 45°

Trend of bedding

Joint pattern

Strike and dip of joints

Vertical joints

Strike and dip of foliation

Vertical foliation

Plunge of lineation

Measured section and reference number

Macrofossil locality

× MR 34 Text reference to specimen locality

Dykes or veins { q = quartz, p = pegmatite, d = dolerite }

• 1558' Height in feet - instrument levelled } Datum mean sea level: Port Augusta

• 1558' Height in feet - barometric

Road

Vehicle track

• R.H. Rockhole

Astro station

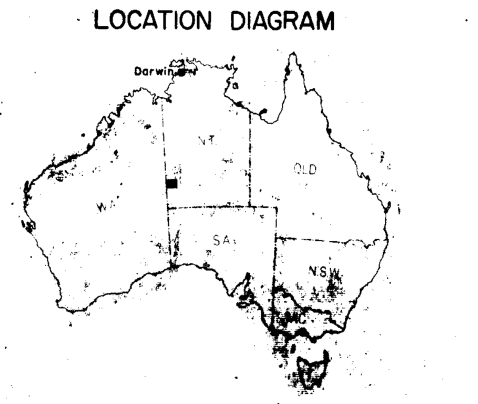
Sand dunes

Scarp

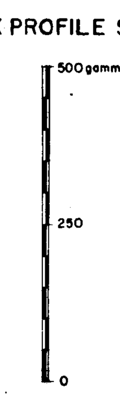
Geological and planimetric mapping from 1:250,000 scale.
Geological Sheet SF 52-15.
Bureau of Mineral Resources, Geology and Geophysics.
Transverse Mercator Projection.

Based on F52/B0-13
Based on F52/B1-17

LOCATION DIAGRAM



APPROX PROFILE SCALE

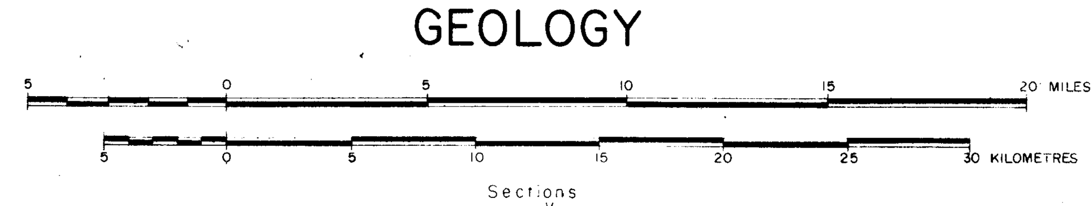


INDEX TO ADJOINING SHEETS
Showing Magnetic Declination

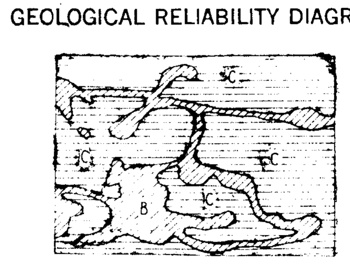
WEBB	LAKE MACKAY	MT DORFEN
MACDONALD	MT RENNIE	MT LIEBIG
RAWLINSON	BLOODS RANGE	LAKE AMADEUS

AIRBORNE SURVEY, AMADEUS BASIN, NT 1965

TOTAL MAGNETIC INTENSITY PROFILES AND GEOLOGY



GEOLOGICAL RELIABILITY DIAGRAM



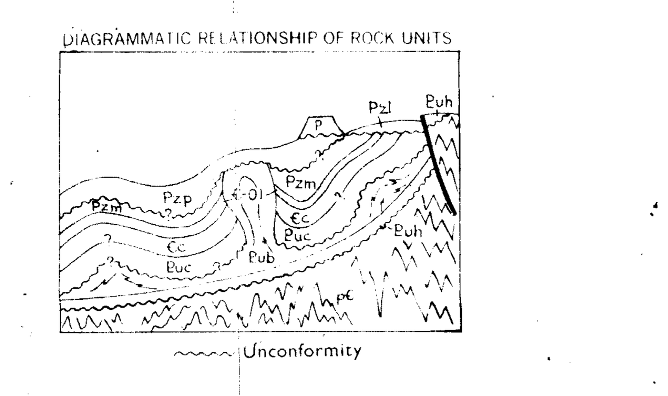
B. Reconnaissance traverses and air-photo interpretation
C. Air-photo interpretation

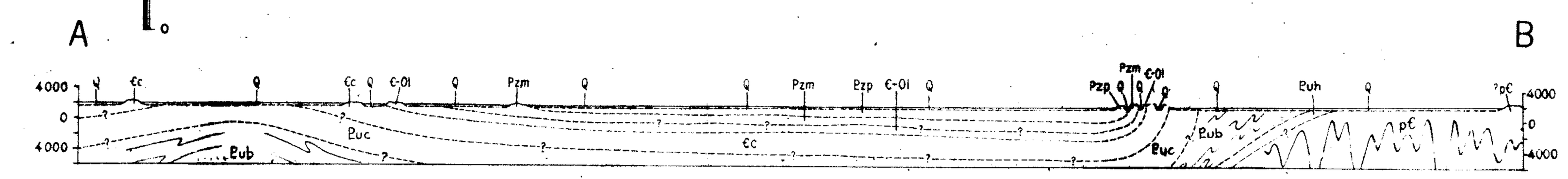
EXPLANATORY NOTES

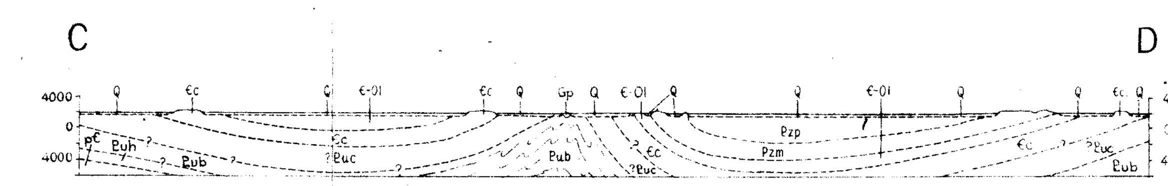
THE SURVEY WAS MADE WITH A DC3 AIRCRAFT AT AN ALTITUDE OF 800 FEET ABOVE GROUND LEVEL ALONG LINES SPACED TWO MILES APART. THE FLIGHT-LINES ARE IDEALISED, AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF ± ¼ MILE.

PROFILES RECORDED AT INTERVALS OF FOUR MILES ARE SHOWN ON THE MAP. THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9.7 GAMMAS PER MILE.

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS







TO ACCOMPANY RECORD No. 1966/230

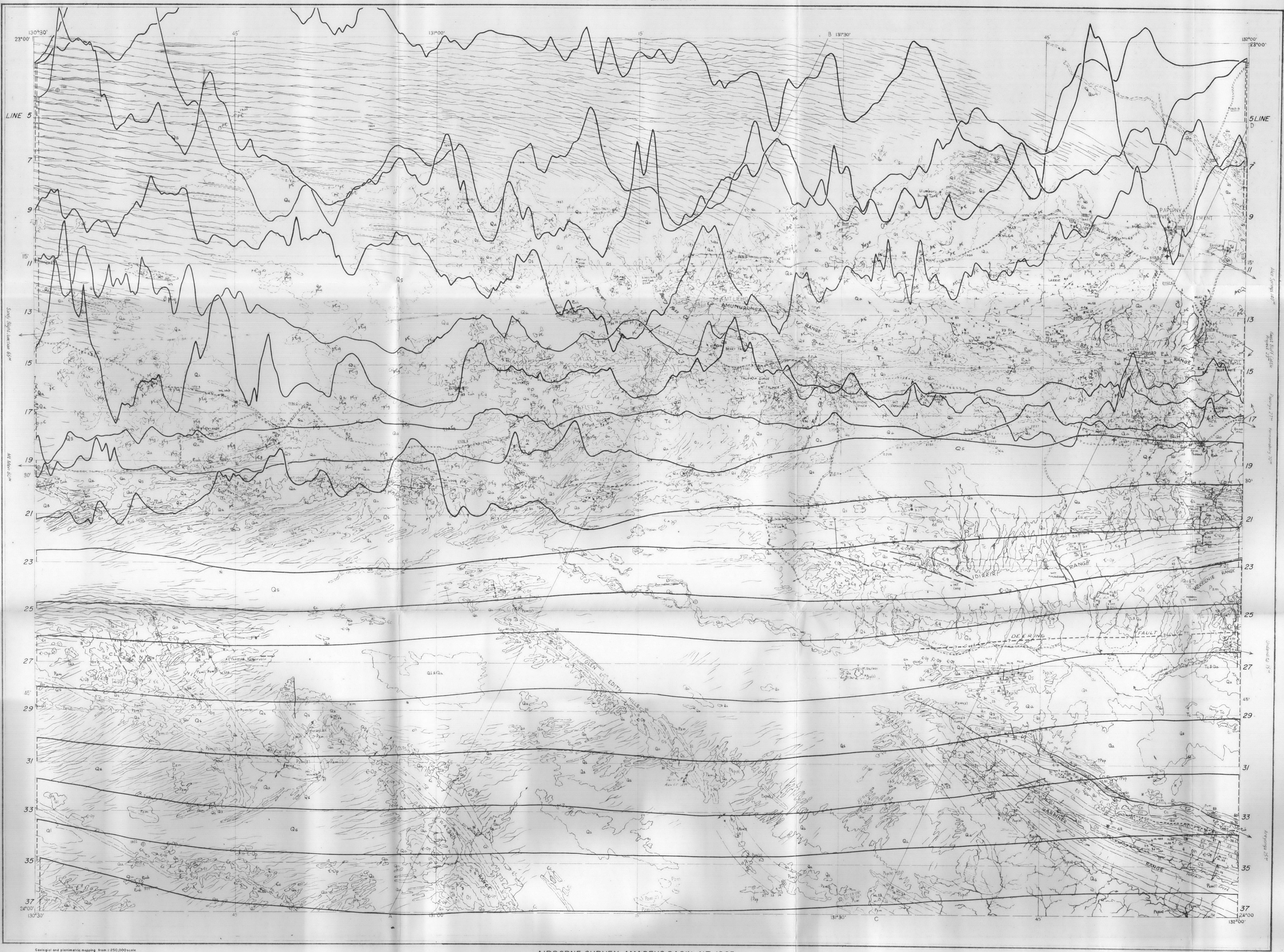
Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics F52/B1-25

AUSTRALIA 1:250,000

MT LIEBIG

NORTHERN TERRITORY

PLATE 3

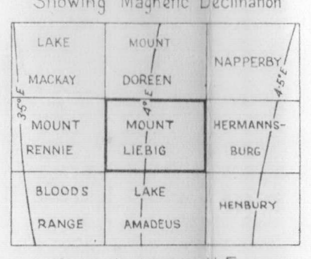


Geologicl and planimetric mapping from 1:250,000 scale
Geological Sheet SF52-16
Bureau of Mineral Resources, Geology and Geophysics.
Transverse Mercator Projection.

Based on F52/B0-14
Based on F52/B1-19

INDEX TO ADJOINING SHEETS

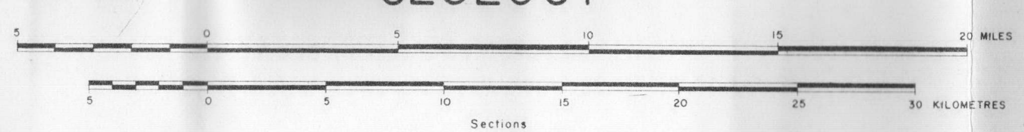
Showing Magnetic Declination



Annual change 1' E

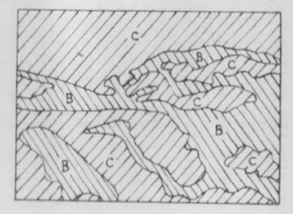
AIRBORNE SURVEY, AMADEUS BASIN, NT 1965

TOTAL MAGNETIC INTENSITY PROFILES AND GEOLOGY



Sections Scale 2 x 1

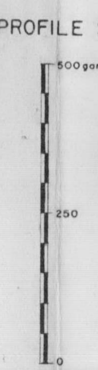
GEOLOGICAL RELIABILITY DIAGRAM



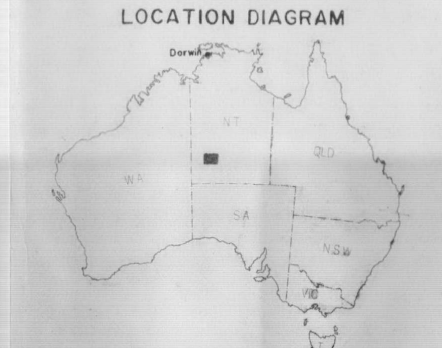
B Reconnaissance, traverses and air-photo interpretation

C Air-photo interpretation

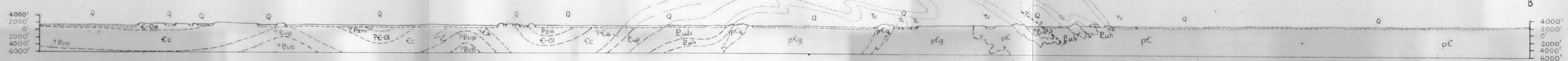
APPROX. PROFILE SCALE



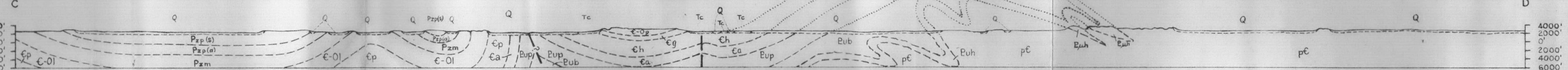
LOCATION DIAGRAM



A - B



C - D



Reference

CAINOZOIC	QUATERNARY	Undifferentiated	Q	Alluvium, sand and travertine (section only)
			Qa	Alluvium
			Qs	Sand
			Ql	Travertine
	? TERTIARY		Tc	Conglomerate
? MESOZOIC			M	Sandstone and siltstone
PALAEOZOIC		Pertnjara Formation	Pzp	Undifferentiated
			Pzp(s)	Sandstone
			Pzp(a)	Siltstone and calcareous siltstone
		Mereenie Sandstone	Pzm	Undifferentiated
			Pzm(2)	White, cross bedded sandstone
			Pzm(1)	Red-brown sandstone
	ORDOVICIAN	Larapinta Group: Undifferentiated	€-Ol	
		Stokes Formation	Ot	Siltstone, shale and limestone. Fossiliferous
		Stairway Sandstone	Os	Sandstone, siltstone and limestone. Fossiliferous
		Horn Valley Siltstone	Oh	Siltstone, shale and limestone. Fossiliferous
		Pacoota Sandstone	€-Op	Sandstone and conglomeratic sandstone. Marine fossils in restricted beds
	CAMBRIAN	Pertaoorrta Formation	€p	Sandstone, siltstone, shale and limestone
		Goyder Member	€g	Sandstone and siltstone; partly calcareous
		Petermann Sandstone Member	€e	Red-brown sandstone and silty sandstone
		Deception Member	€d	Red-brown siltstone and shale
		Illara Sandstone Member	€i	Red-brown sandstone and silty sandstone
		Tempe Member	€t	Siltstone, calcareous sandstone, fossiliferous, glauconitic limestone
		Eninta Sandstone Member	€n	Red-brown sandstone and silty sandstone
		Hugh River Shale Member	€h	Siltstone, shale and silty sandstone
		Arumbera Greywacke Member	€a	Sandstone and siltstone
		Cleland Sandstone	€c	Sandstone, pebbly sandstone
PRECAMBRIAN	UPPER PROTEROZOIC	Pertatataka Formation	Ꝑup	Siltstone, shale, sandstone and limestone
		Bitter Springs Limestone	Ꝑub	Crystalline dolomite, dolomitic limestone, limestone and siltstone. Stromatolites
		Heavitree Quartzite	Ꝑuh	Quartz sandstone, conglomeratic sandstone and siltstone
	UNDIFFERENTIATED		p€g	Granite
			p€q	Quartzite and quartz-sericite schist
			p€	Gneiss, marble; quartzite, schist, granite

Geological boundary

Anticline showing plunge

Fault

Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted; faults are shown by short dashes.

Strike and dip of srata

Vertical strata

Horizontal strata

Overturned strata

Dip < 15° | Dip 15°–45° | Dip > 45° | Trend line | Joint pattern — Air-photo interpretation

Strike an dip of joints

Vertical joints

Strike and dip of foliation

Vertical foliation

Plunge of foliation

Measured section

Fossil locality

• Cu Minor mineral occurence (copper)

× ML9 Text reference to specimen locality

Dyke or vein:
p - pegmatite
q - quartz
d - dolerite

2132·9 Height in feet - instrument levelled
2191 Height in feet - barometric
Datum, mean sea level Port Augusta

Road

Vehicle track

• R.H. Rock hole

Oil well, being drilled

• B Bore

⊗ D Bore, abandoned, dry

Windpump

• T Tank

• S Spring

□ Yd Yard

Homestead

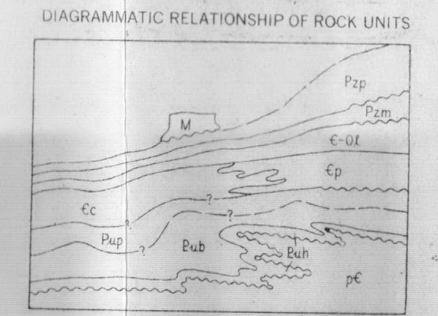
Fence

Landing ground

P.D. Position doubtful

⊕ Astro station

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



Unconformity

EXPLANATORY NOTES

THE SURVEY WAS MADE WITH A DC3 AIRCRAFT AT AN ALTITUDE OF 800 FEET ABOVE GROUND LEVEL ALONG LINES SPACED TWO MILES APART. THE FLIGHT-LINES ARE IDEALISED, AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF ±½ MILE.

PROFILES RECORDED AT INTERVALS OF FOUR MILES ARE SHOWN ON THE MAP. THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9·8 GAMMAS PER MILE.

TO ACCOMPANY RECORD No. 1966/230

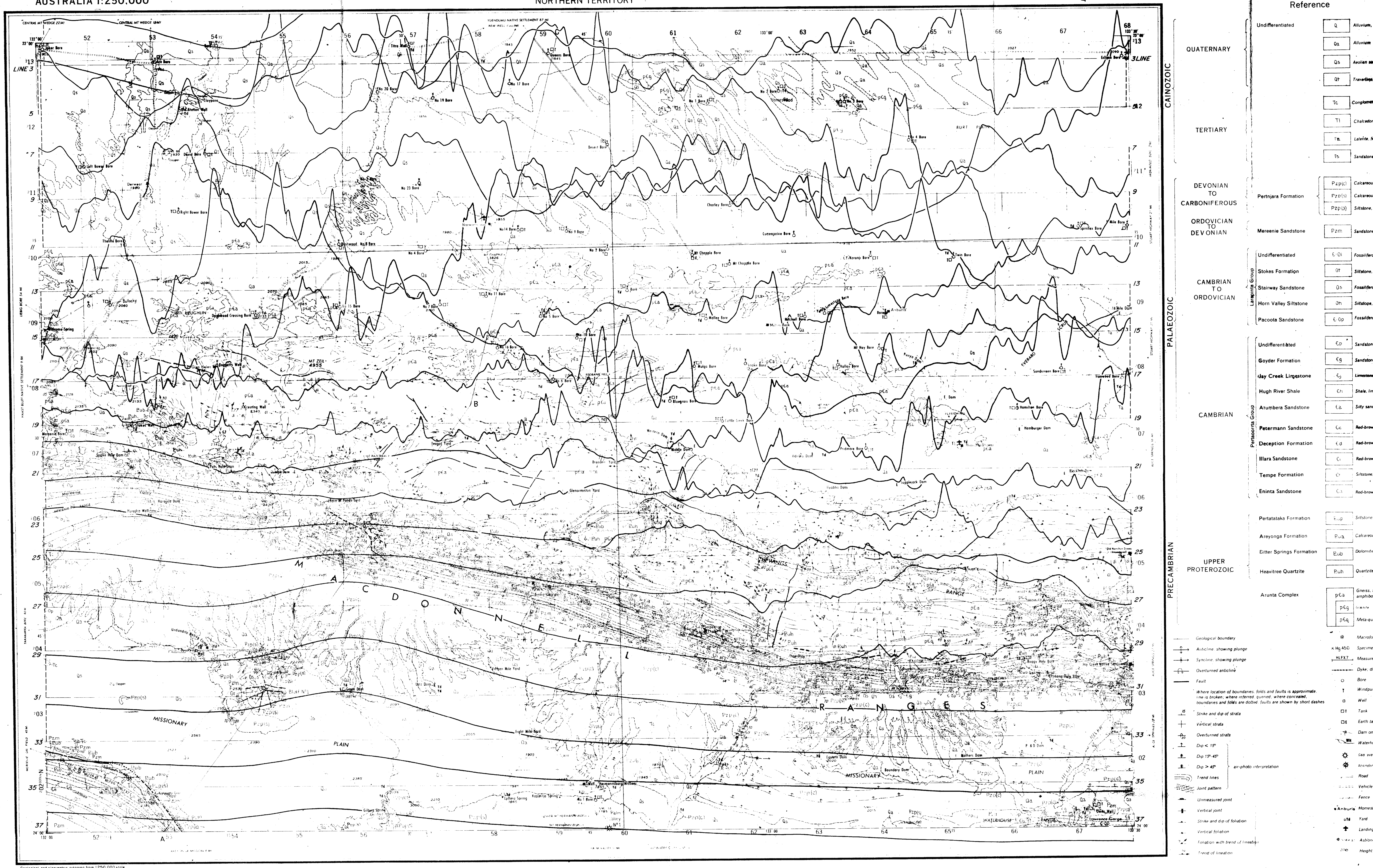
Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. F 52/B1-26

AUSTRALIA 1:250,000

HERMANNSBURG

NORTHERN TERRITORY

PLATE 4



Geological and planimetric mapping from 1:250,000 scale Geological sheet SF53-13 preliminary edition 1965, Bureau of Mineral Resources, Geology and Geophysics
Transverse Mercator Projection

BASED ON F53/B0-25
BASED ON F53/BI-39

Reference

CAINOZOIC	QUATERNARY	Undifferentiated	Q	Alluvium, sand, travertine, conglomerate (section only)
			Qa	Alluvium
			Qs	Aeolian sand
			Qt	Travertine, kunkar
	TERTIARY		Tc	Conglomerate
			Tl	Chalcedonic limestone
			Ta	Laterite, ferricrete
			Ts	Sandstone, conglomeratic sandstone, sandy siltstone, lignite
PALAEOZOIC	DEVONIAN TO CARBONIFEROUS	Pertnjara Formation	Pzp(c)	Calcareous conglomerate
			Pzp(s)	Calcareous sandstone, pebbly sandstone
			Pzp(a)	Siltstone, shale
	ORDOVICIAN TO DEVONIAN	Mereenie Sandstone	Pzm	Sandstone
	CAMBRIAN TO ORDOVICIAN	Larapinta Group: Undifferentiated	Є-Oi	Fossiliferous sandstone, siltstone, shale, limestone
		Stokes Formation	Ot	Siltstone, shale, fossiliferous limestone
		Stairway Sandstone	Os	Fossiliferous sandstone, silty sandstone
		Horn Valley Siltstone	Oh	Siltstone, fossiliferous limestone
		Pacoota Sandstone	Є-Op	Fossiliferous sandstone, silty sandstone
	CAMBRIAN	Pertaoorrta Group: Undifferentiated	Єp	Sandstone, siltstone, shale, dolomite, limestone
		Goyder Formation	Єg	Sandstone, calcareous sandstone
		Jay Creek Limestone	Єj	Limestone, shale, dolomite
		Hugh River Shale	Єh	Shale, limestone, siltstone
		Arumbera Sandstone	Єa	Silty sandstone, siltstone
		Petermann Sandstone	Єe	Red-brown sandstone, silty sandstone
		Deception Formation	Єd	Red-brown siltstone, shale
		Illara Sandstone	Єi	Red-brown sandstone, silty sandstone
		Tempe Formation	Єt	Siltstone, calcareous sandstone, fossiliferous glauconitic limestone
		Eninta Sandstone	Єn	Red-brown sandstone, silty sandstone, siltstone
PRECAMBRIAN	UPPER PROTEROZOIC	Pertatataka Formation	Єup	Siltstone, sandstone, limestone
		Areyonga Formation	Єua	Calcareous sandstone, tillitic siltstone, conglomerate
		Bitter Springs Formation	Єub	Dolomitic limestone, shale, siltstone
		Heavitree Quartzite	Єuh	Quartzite, sandstone
		Arunta Complex	pЄa	Gneiss, schistose gneiss, granite, gneissic granite, schist, amphibolite, sericite-quartz schist, meta-quartzite, pegmatite
			pЄg	Granite
			pЄq	Meta-quartzite, quartz-sericite schist

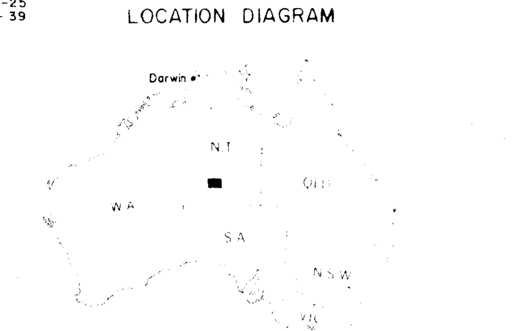
Geological boundary
Anticline, showing plunge
Syncline, showing plunge
Overturned anticline
Fault

Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted, faults are shown by short dashes

Strike and dip of strata
Vertical strata
Overturned strata
Dip < 15°
Dip 15°-45°
Dip > 45°
Trend lines
Joint pattern
} air-photo interpretation
Unmeasured joint
Vertical joint
Strike and dip of foliation
Vertical foliation
Foliation with trend of lineation
Trend of lineation

Macrofossil locality
× Hg 450 Specimen locality. Text reference prefixed by H
HLFX7 Measured section
Dyke; dl—dolerite, p—pegmatite
Bore
Windpump
Well
Tank
Earth tank
Dam on stream
Waterhole
Gas well
Abandoned well with show of gas
Road
Vehicle track
Fence
Anburla Homestead
Yard
Landing ground
Astronomical station
2045 Height in feet, barometric, datum: mean sea level

LOCATION DIAGRAM



INDEX TO ADJOINING SHEETS

Showing Magnetic Declination

HIGHLAND ROCKS SF 52-7	MOUNT THEO SF 52-8	MOUNT PEAKE SF 53-5	BARROW CREEK SF 53-6	ELKEDRA SF 53-7
LAKE MACKAY SF 52-11	MOUNT DOREEN SF 52-12	NAPPERBY SF 53-9	ALCOOTA SF 53-10	HUCKITTA SF 53-11
MOUNT RENNIE SF 52-15	MOUNT LIEBIG SF 52-16	HERMANNSBURG SF 53-13	ALICE SPRINGS SF 53-14	ILLOGWA CREEK SF 53-15
BLOODS RANGE SG 52-3	LAKE AMADEUS SG 52-4	HENBURY SG 53-1	RODINGA SG 53-2	HALE RIVER SG 53-3
PETERMANN RANGES SG 52-7	AYERS ROCK SG 52-8	KULGERA SG 53-5	FINKE SG 53-6	McDILLS SG 53-7

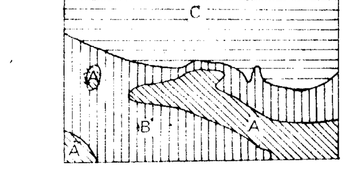
AIRBORNE SURVEY, AMADEUS BASIN, NT 1965

TOTAL MAGNETIC INTENSITY PROFILES AND GEOLOGY

5 0 5 10 15 20 MILES

5 0 5 10 15 20 25 30 KILOMETRES

GEOLOGICAL RELIABILITY DIAGRAM



A Detailed Mapping

B Detailed reconnaissance, general reconnaissance, reconnaissance and air-photo interpretation.

C Air-photo interpretation

EXPLANATORY NOTES

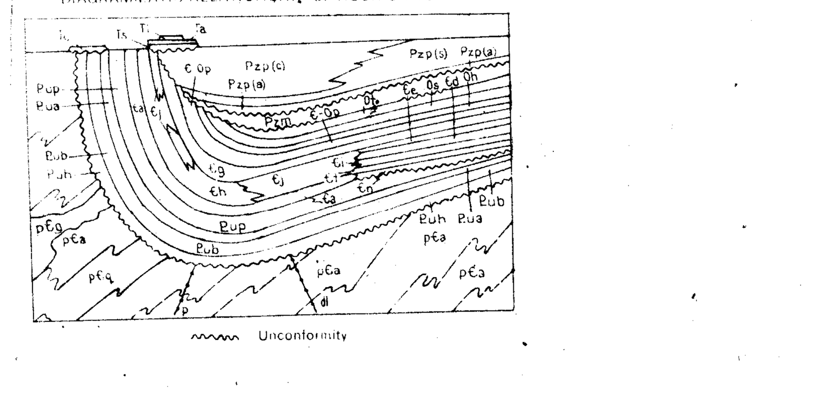
THE SURVEY WAS MADE WITH A DC3 AIRCRAFT AT AN ALTITUDE OF 800 FEET ABOVE GROUND LEVEL ALONG LINES SPACED TWO MILES APART. THE FLIGHT-LINES ARE IDEALISED, AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF ±½ MILE. PROFILES RECORDED AT INTERVALS OF FOUR MILES ARE SHOWN ON THE MAP.

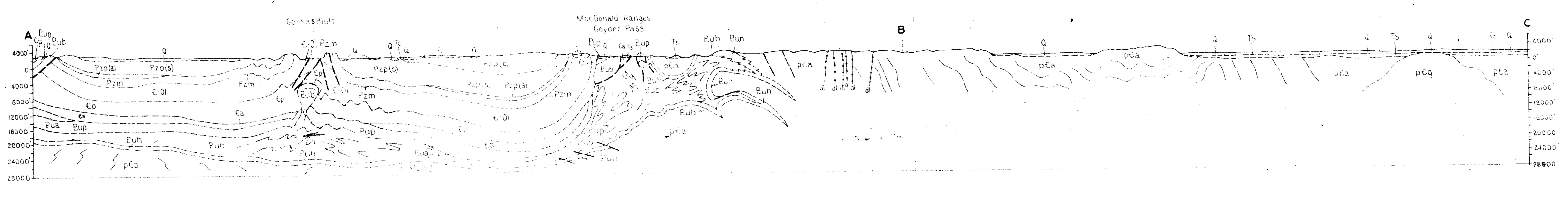
THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9·6 GAMMAS PER MILE.

APPROX. PROFILE SCALE

500 gammas
250
0

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS





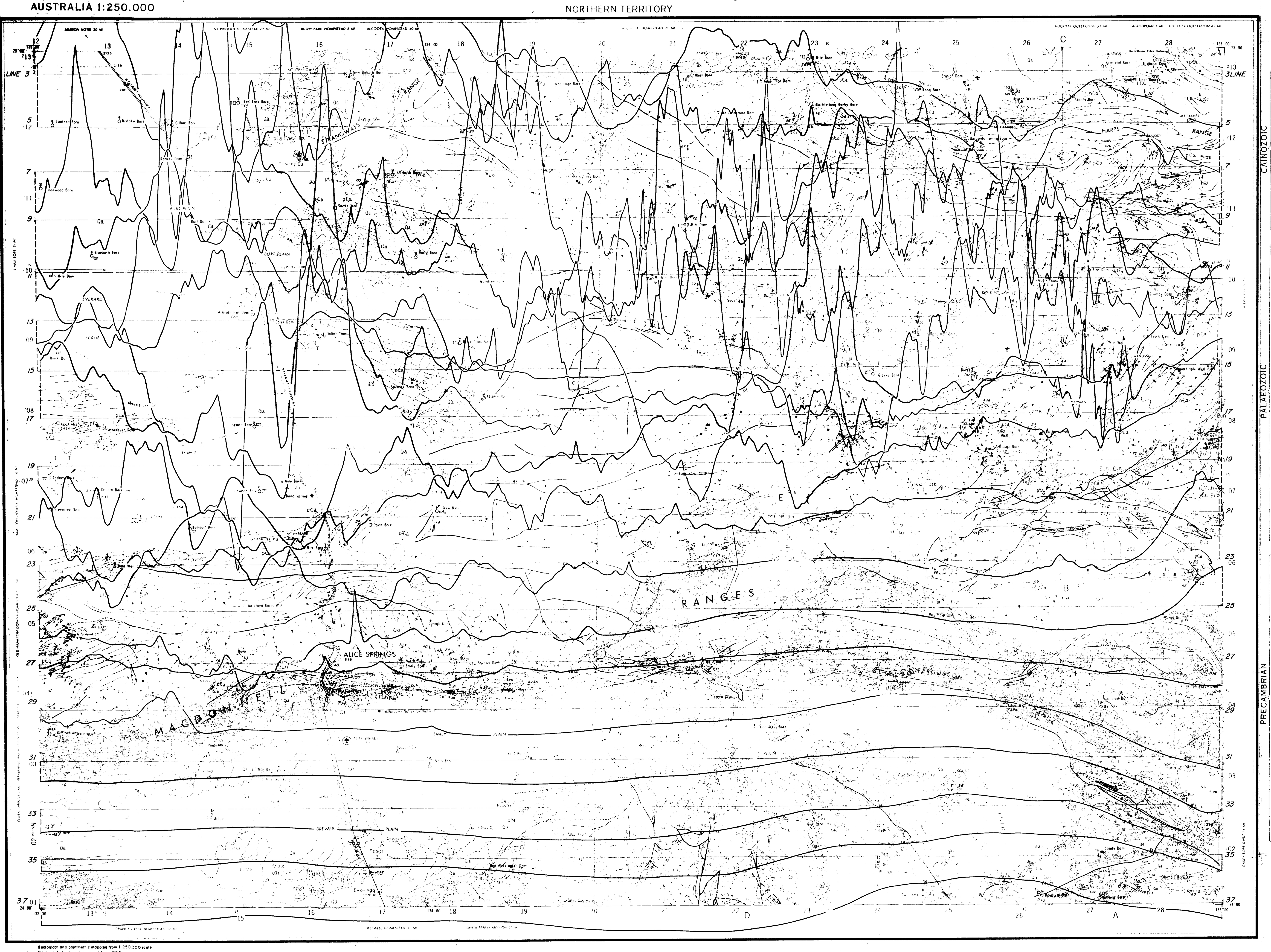
TO ACCOMPANY RECORD No. 1966/230

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. F53/BI-52

ALICE SPRINGS

AUSTRALIA 1:250,000

NORTHERN TERRITORY



Reference

- Geological boundary
- Anticline, showing plunge
- Syncline, showing plunge
- Overturned anticline showing bearing and plunge of axis
- Overturned syncline showing bearing and plunge of axis
- Overturned (downward facing) antiform
- Fault
- Low-angle thrust fault
- High-angle reverse fault

Where location of boundaries, folds and faults is approximate, line is broken, where inferred, queried; where concealed, boundaries and folds are dotted, faults shown by short dashes.

- Strike and dip of strata
- Vertical strata
- Horizontal strata
- Overturned strata
- Dip < 15
- Dip 15 -45
- Dip > 45
- Trend lines
- Joint pattern

(Dip < 15 to Joint pattern: air-photo interpretation)

- Vertical joint
- Strike and dip of foliation
- Vertical foliation
- Foliation with trend of lineation
- Trend of lineation
- Vertical lineation
- Plunge of lineation on vertical foliation
- Macrofossil locality
- Specimen locality. Specimens are marked with prefix AS
- Registered B.M.R. collection number
- Measured section
- Dyke; di-dolerite p-pegmatite
- Sand dunes
- Bore
- Bore with windpump
- Abandoned bore
- Well
- Tank
- Earth tank
- Dam
- Mine
- Minor mineral occurrence
- Silver
- Gold
- Tin
- Niobium
- Kaolin
- Copper
- Gypsum
- Mica
- Lead
- Phosphate
- Tantalum
- Thorium
- Uranium
- Abandoned well with show of oil
- Road
- Vehicle track
- Railway with siding
- Telegraph line
- Fence
- Atnarpa Homestead
- Aerodrome
- Landing ground
- Yd Yard
- Astronomical station
- 1958 Trigonometric station
- 1976 Height in feet, barometric; datum: mean sea level

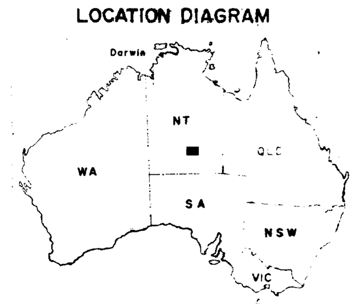
Reference

CAINOZOIC	QUATERNARY	Undifferentiated	Q	Alluvium, sand, travertine, conglomerate (section only)
			Qa	Alluvium, river gravel
			Qs	Aeolian sand
			Qc	Conglomerate, scree
	TERTIARY	Undifferentiated	T	Sandstone, conglomeratic sandstone, calcareous silty sandstone, limestone, travertine, conglomerate, chalcedony
			Tl	Chalcedonic limestone and calcareous sandstone
			Tb	Silcrete (grey billy)
			Ta	Laterite, ferricrete
			Ts	Sandstone, siltstone, some lignite
PALAEOZOIC	DEVONIAN TO CARBONIFEROUS	Pertnjara Formation	Pzp(c)	Conglomerate
			Pzp(s)	Sandstone, pebbly sandstone
	ORDOVICIAN TO DEVONIAN	Mereenie Sandstone	Pzm(2)	White, cross-bedded sandstone
	CAMBRIAN TO ORDOVICIAN	Larapinta Group: Pacoota Sandstone	€-Op	Fossiliferous sandstone and silty sandstone
		N'Dahla Member	On	Purplish-brown sandstone and siltstone
	CAMBRIAN	Pertaoorrta Group: Undifferentiated	€p	Sandstone, siltstone, shale, dolomite, limestone
		Goyder Formation	€g	Silty sandstone, siltstone, limestone, dolomite
		Jay Creek Limestone	€j	Limestone, shale, dolomite
		Hugh River Shale	€h	Siltstone, shale, limestone
		Shannon Formation	€s	Siltstone, shale, limestone, dolomite
		Giles Creek Dolomite	€k	Dolomite, limestone, siltstone, shale
		Chandler Limestone	€l	Limestone and dolomite with chert laminae
		Todd River Dolomite	€r	Pink, fossiliferous dolomite
		Arumbera Sandstone	€a	Red-brown sandstone, silty sandstone, siltstone
			€a3	Sandstone
			€a2	Siltstone, sandstone, some dolomite
			€a1	Sandstone, siltstone, some pebbly sandstone
PRECAMBRIAN	UPPER PROTEROZOIC	Pertatataka Formation	Pup	Siltstone and shale with lenses of sandstone, limestone, conglomerate
		Julie Member	Puj	Dolomite, limestone, lenses of sandstone and calcareous sandstone
		Waldo Pedlar Member	Puw	Siltstone, fine-grained platy sandstone
		Olympic Member	Puf	Conglomerate, siltstone, sandstone, dolomite
		Limbla Member	Pum	Cross-laminated sandstone, sandy calcarenite
		Ringwood Member	Pur	Algal dolomite and calcarenite
		Cyclops Member	Puy	Platy, even-bedded, fine-grained sandstone
		Areyonga Formation	Pua	Sandstone, arkose, siltstone, conglomerate, dolomite
		Bitter Springs Formation	Pub	Dolomite, limestone, siltstone, sandstone, and some basic volcanics
		Loves Creek Member	Pue	Massive, algal dolomite, red siltstone, and sandstone
			Pue1	Basic volcanics
		Gillen Member	Pug	Dolomite, green siltstone, sandstone, gypsum
		Heavitree Quartzite	Puh	Quartzite
		Schaber Hornblende Granite	p€c	Porphyroblastic hornblende oligoclase-microcline granite
		Bungitina Granodiorite	p€t	Biotite-microcline-oligoclase granodiorite
			p€g	Granite
			p€q	Meta-quartzite, quartz-sericite schist
		Arunta Complex	p€a	Mica-quartz-feldspar schist and gneiss, garnet-mica-feldspar gneiss, quartzo-feldspathic gneiss, amphibolite, meta-basic rocks, meta-limestone, quartzite, pegmatite

Geological and planimetric mapping from 1:250,000 scale
Geological sheet, preliminary edition, 1965.
Bureau of Mineral Resources, Geology and Geophysics
Transverse mercator projection

Based on F53/B1-41
Based on F53/B0-26

LOCATION DIAGRAM



INDEX TO ADJOINING SHEETS
Showing Magnetic Declination

MOUNT THEO SF 52-8	MOUNT PEAKE SF 53-5	BARROW CREEK SF 53-6	ELKEDRA SF 53-7	SANDOVER RIVER SF 53-8
MOUNT DOREEN SF 52-12	NAPPERBY SF 53-9	ALCOOTA SF 53-10	HUCKITTA SF 53-11	TOBERMORY SF 53-12
MOUNT LIEBIG SF 52-16	HERMANNSBURG SF 53-13	ALICE SPRINGS SF 53-14	ILLOGWA CREEK SF 53-15	HAY RIVER SF 53-16
LAKE AMADEUS SG 52-4	HENBURY SG 53-1	RODINGA SG 53-2	HALE RIVER SG 53-3	SIMPSON DESERT NORTH SG 53-4
AYERS ROCK SG 52-8	KULGERA SG 53-5	FINKE SG 53-6	McDILLS SG 53-7	SIMPSON DESERT SOUTH SG 53-8

ANNUAL CHANGE 1' 30"E

AIRBORNE SURVEY, AMADEUS BASIN, NT 1965

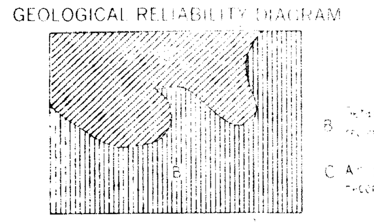
TOTAL MAGNETIC INTENSITY PROFILES AND GEOLOGY

5 0 5 10 15 20 MILES

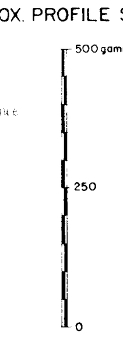
5 0 5 10 15 20 25 30 KILOMETRES

Sections
Cainozoic sediments omitted from section
Scale $\frac{V}{H} = 1$

GEOLOGICAL RELIABILITY DIAGRAM



APPROX PROFILE SCALE

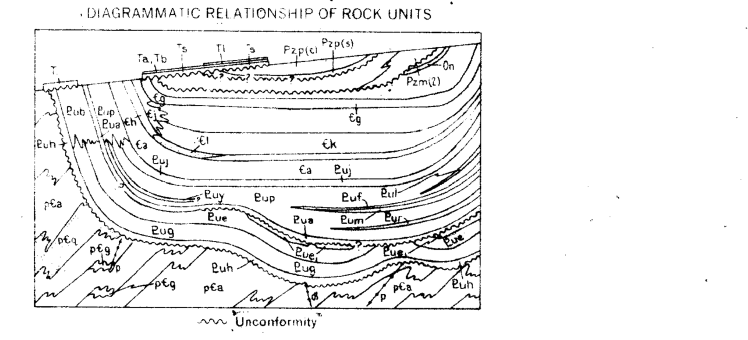


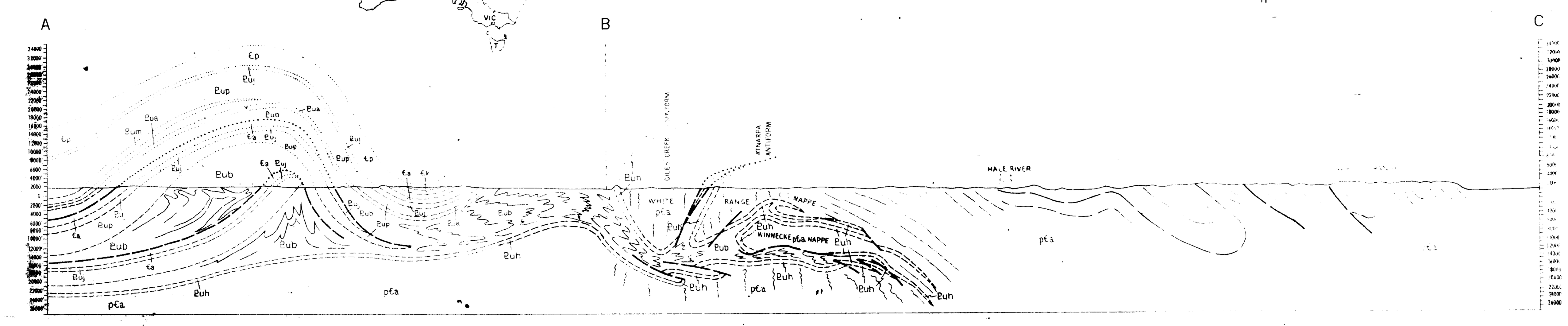
EXPLANATORY NOTES

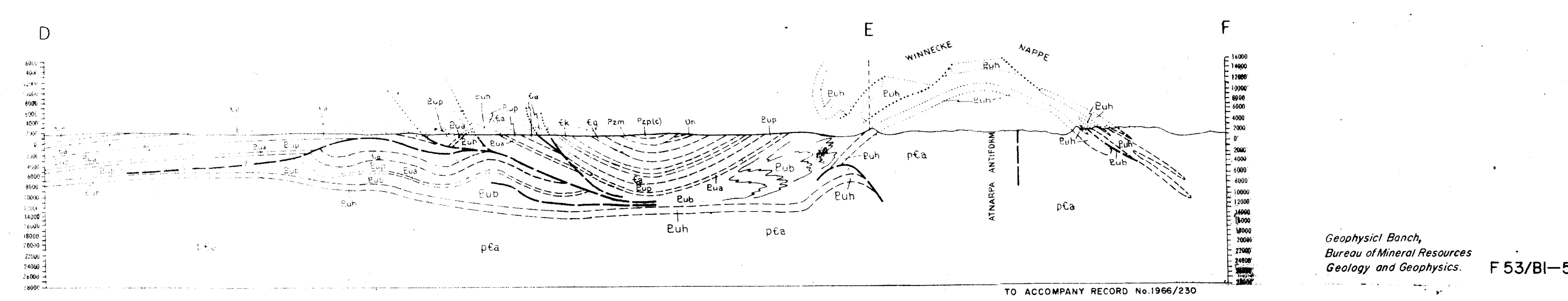
THE SURVEY WAS MADE WITH A DC.3 AIRCRAFT AT AN ALTITUDE OF 800 FEET ABOVE GROUND LEVEL ALONG LINES SPACED TWO MILES APART. THE FLIGHT-LINES ARE IDEALISED, AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF ±½ MILE.

PROFILES RECORDED AT INTERVALS OF FOUR MILES ARE SHOWN ON THE MAP. THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9·6 GAMMAS PER MILE.

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS







TO ACCOMPANY RECORD No. 1966/230

Geophysical Branch,
Bureau of Mineral Resources,
Geology and Geophysics.

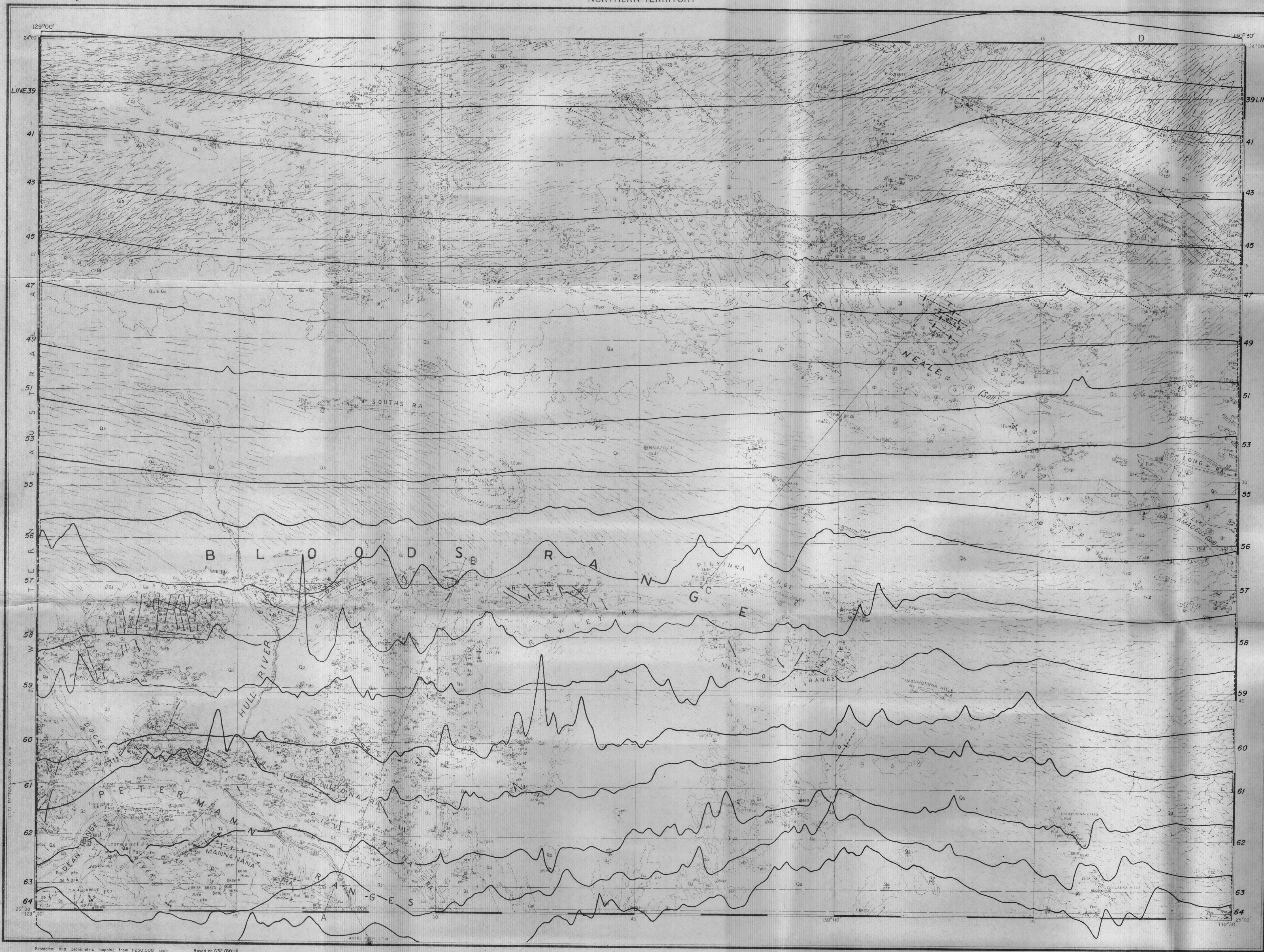
F 53/B1-53

AUSTRALIA 1:250,000

BLOODS RANGE

NORTHERN TERRITORY

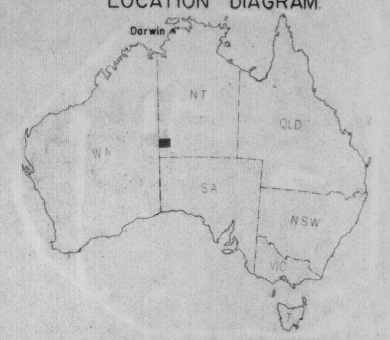
PLATE 6



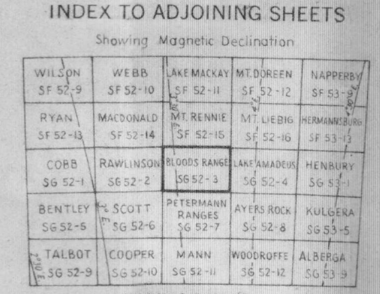
Geological and planimetric mapping from 1:250,000 scale.
Geological sheet SG 52-3 first edition 1965.
Bureau of Mineral Resources, Geology and Geophysics.
Transverse Mercator Projection.

Based on G52/BO-6
Based on G52/BI-9

LOCATION DIAGRAM



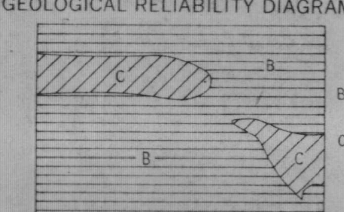
INDEX TO ADJOINING SHEETS



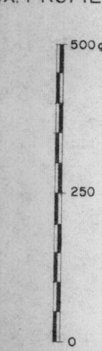
AIRBORNE SURVEY, AMADEUS BASIN, NT 1965

TOTAL MAGNETIC INTENSITY PROFILES AND GEOLOGY

GEOLOGICAL RELIABILITY DIAGRAM



APPROX PROFILE SCALE



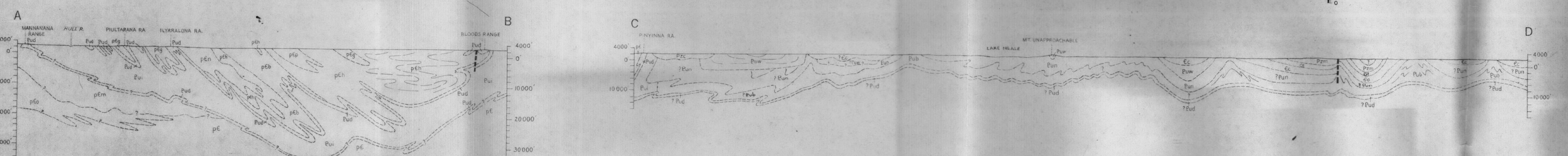
EXPLANATORY NOTES

THE SURVEY WAS MADE WITH A DC3 AIRCRAFT AT AN ALTITUDE OF 800 FEET ABOVE GROUND LEVEL ALONG LINES SPACED FOUR MILES APART. THE FLIGHT-LINES ARE IDEALISED, AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF ±½ MILE.

ALL PROFILES RECORDED ARE SHOWN ON THE MAP.

THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9·8 GAMMAS PER MILE.

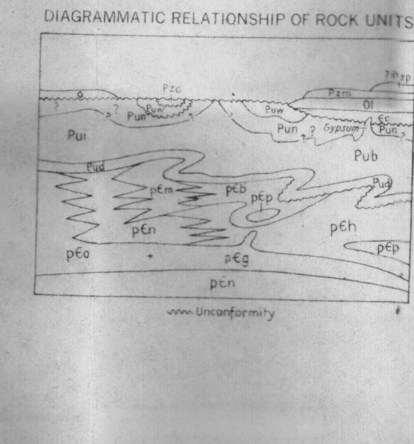
Sections



Reference

CAINOZOIC	QUATERNARY		Qs	Aeolian Sand
			Qa	Alluvium
			Qt	Evaporites
			Ql	Travertine
	TERTIARY ?		Tc	Conglomerate
			T	Sandstone
PALAEOZOIC	CARBONIFEROUS-DEVONIAN	Pertnjara Formation	Pzp	Siltstone
	DEVONIAN-ORDOVICIAN	Mereenie Sandstone	Pzm	Brown and white sandstone. Large scale cross bedding
	ORDOVICIAN	Undifferentiated	O	White sandstone, pipe rock, conglomerate, dolomite, and siltstone, some marine fossils
		Larapinta Group	Ol	Sandstone, siltstone, rare limestone. Marine fossils
	CAMBRIAN	Cleland Sandstone	€c	Crossbedded sandstone and pebbly sandstone, siltstone
		Mt. Currie Conglomerate	Pzc	Conglomerate
PRECAMBRIAN	UPPER PROTEROZOIC	Winnall Beds	Puw	Brown and white sandstone, pebbly sandstone, siltstone
		Inindia Beds	Pun	Red siltstone, dolomite, claystone, shale, chert, chert breccia, dolomite and limestone. Stromatolites.
		Bitter Springs Formation	Pub	Crystalline dolomite, limestone, gypsum. Algal stromatolites
		Pinyinna Beds	Pui	Dolomite, limestone and siltstone Stromatolites
		Dean Quartzite	Pud	Quartzite and conglomeratic quartzite, sandstone
	UNDIFFERENTIATED	Pottoyu Granite Complex	p€o	Very coarse porphyritic granite, fine and medium-grained granite, gneiss, amphibolite, quartz-epidote rock, schist, porphyroblastic schist and quartzite
			p€g	Coarse porphyritic granite and medium-grained granite
		Olia Gneiss	p€n	Fine to medium-grained gneiss, schistose gneiss, porphyroblastic gneiss, granite, schist and quartzite
		Undifferentiated	p€	Granite, schist, gneiss
			p€m	Porphyroblastic schist, quartz-feldspar porphyry
			p€p	Quartz feldspar porphyry
		Bloods Range Beds	p€b	Sandstone siltstone, shale, arkose, tuff, agglomerate, basalt, acid porphyry and metamorphosed equivalents
		Mount Harris Basalt	p€h	Epidotized amygdaloidal basalt, tuff, agglomerate, quartzite

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



TO ACCOMPANY RECORD No. 1966/230

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

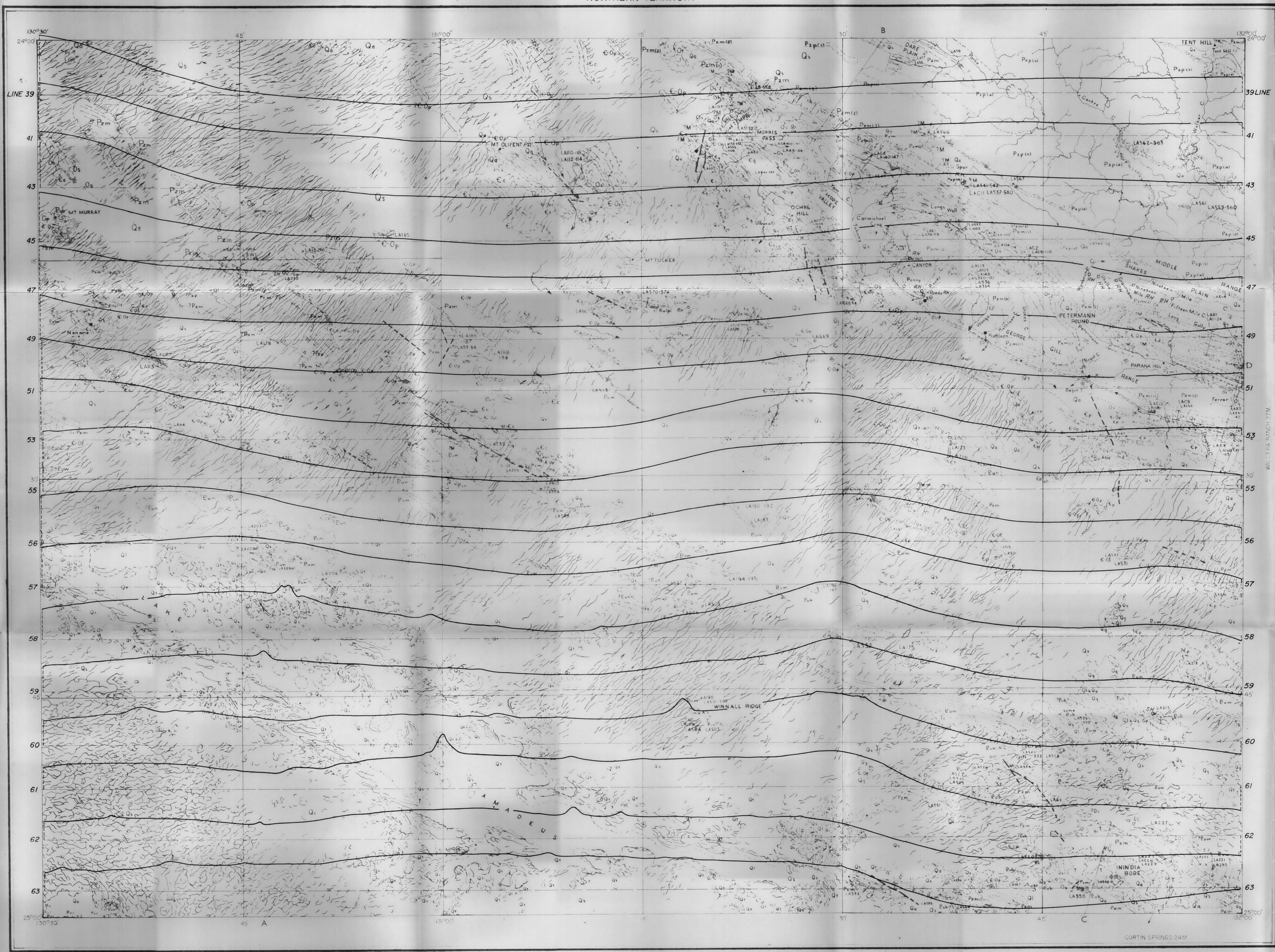
G52/BI-17

AUSTRALIA 1:250,000

LAKE AMADEUS

NORTHERN TERRITORY

PLATE 7



Reference

CAINOZOIC	QUATERNARY		Undifferentiated	Q	Alluvium, sand, travertine, evaporites, conglomerate (Section only)
				Qa	Alluvium, conglomerate
				Qs	Sand
				Ql	Travertine
				Qt	Evaporites in salt lakes
				Qg	Gypsum
	TERTIARY		Undifferentiated	T	Limestone, chert
				Tc	Conglomerate
MESOZOIC			Undifferentiated	M	Sandstone, siltstone
	UNDIFFERENTIATED		Pertnjara Formation	Pzp	Undifferentiated
				Pzp(s)	Red-brown sandstone
				Pzp(a)	Siltstone, calcareous siltstone
			Mereenie Sandstone	Pzm	Undifferentiated
				Pzm(2)	White cross-bedded sandstone
				Pzm(1)	Red-brown silty sandstone, siltstone
			Mount Currie Conglomerate	Pzc	Coarse conglomerate
PALAEOZOIC	ORDOVICIAN -CAMBRIAN	Larapinta Group	Undifferentiated	Є-Ol	
			Stokes Formation	Ot	Siltstone, fossiliferous limestone
			Stairway Sandstone	Os	Fossiliferous sandstone, siltstone, limestone, all in part phosphatic
			Horn Valley Siltstone	Oh	Fossiliferous siltstone, limestone
			Pacoota Sandstone	Є-Op	Fossiliferous sandstone, conglomeratic sandstone, some vertical worm-tubes
	CAMBRIAN		Pertaoorrta Formation	Єp	
			Goyder Member	Єg	Calcareous sandstone, sandy algal limestone
			Petermann Sandstone Member	Єe	Red-brown sandstone and silty sandstone
			Deception Member	Єd	Red-brown siltstone and shale
			Illara Sandstone Member	Єi	Red-brown sandstone and silty sandstone
			Tempe Member	Єt	Siltstone, calcareous sandstone, fossiliferous glauconitic limestone
			Cleland Sandstone	Єc	Brown silty sandstone, pebbly sandstone
PRECAMBRIAN	UPPER PROTEROZOIC		Undifferentiated	Pu	Section only
			Winnall Beds	Puw	White and brown sandstone, white and green siltstone
			Pertatataka Formation	Pup	Section only
			Areyonga Formation	Pua	Siltstone, sandstone, tillite
			Inindia Beds	Pun	Bedded chert, chert breccia, siltstone, thin beds of dolomite
			Bitter Springs Limestone	Pub	Dolomite, dolomitic limestone, limestone, siltstone, sandstone
				Gp	Gypsum

Geological boundary

Fault

Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted, faults are shown by short dashes

Strike and dip of strata

Horizontal strata

Vertical strata

Overturned strata

Dip of bed

Dip < 15°

Dip 15°–45°

Dip > 45°

Air-photo interpretation

Trend lines

Joint pattern

Macrofossil locality

xLA23 Text reference to specimen locality

LAC7 Measured section

Native red ochre mine

W Well

Abandoned well

Abandoned bore with windpump, saline

Waterhole

Rock hole

Soak hole

Spring (permanent)

Spring (intermittent)

Sand dunes

Vehicle track

Fence

Yd Yard

Astro station

Height in feet, instrument levelled } Datum, mean sea level

Height in feet, barometric levelled } Port Augusta

P.D. Position doubtful

EXPLANATORY NOTES

THE SURVEY WAS MADE WITH A DC.3 AIRCRAFT AT AN ALTITUDE OF 800 FEET ABOVE GROUND LEVEL ALONG LINES SPACED FOUR MILES APART. THE FLIGHT-LINES ARE IDEALISED, AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF ± ½ MILE.

ALL PROFILES RECORDED ARE SHOWN ON THE MAP.
THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9·7 GAMMAS PER MILE.

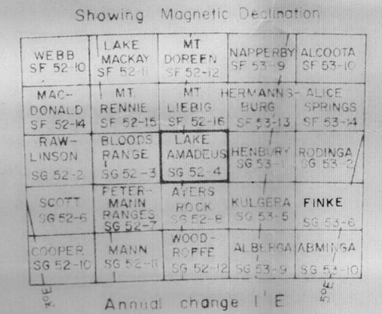
Geological and planimetric mapping from 1:250,000 scale.
Geological sheet SG 52-4 preliminary edition 1963.
Bureau of Mineral Resources, Geology and Geophysics.
Transverse Mercator Projection.

Based on G52/B1-10

Based on G52/B0-7

INDEX TO ADJOINING SHEETS

Showing Magnetic Declination



Annual change 1' E

AIRBORNE SURVEY, AMADEUS BASIN, NT 1965

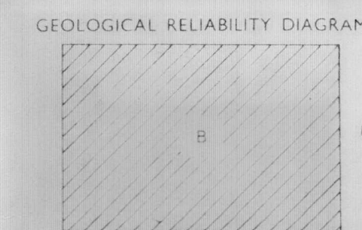
TOTAL MAGNETIC INTENSITY PROFILES AND GEOLOGY

5 0 5 10 15 20 MILES

5 0 5 10 15 20 25 30 KILOMETRES

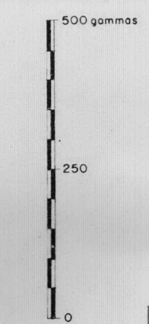
Sections
Scale $\frac{V}{H} = 1$

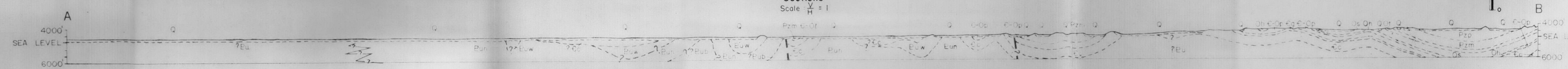
GEOLOGICAL RELIABILITY DIAGRAM



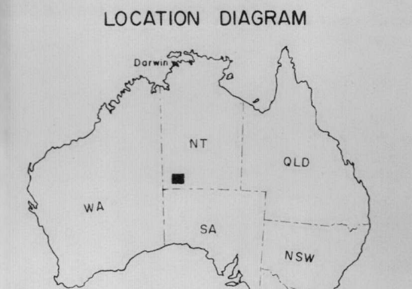
B. Detailed reconnaissance: numerous traverses with air photo interpretation.

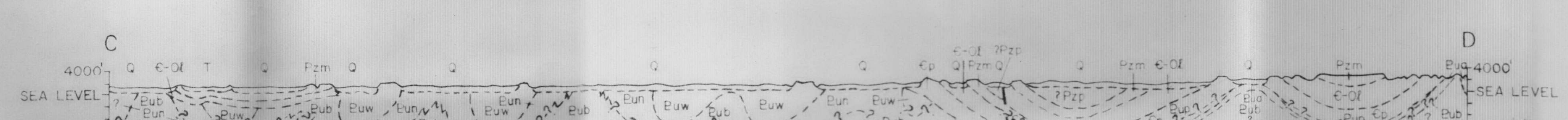
APPROX PROFILE SCALE



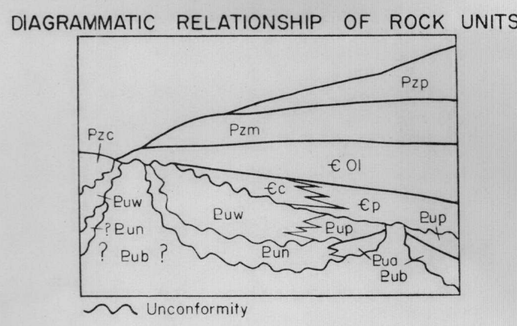


LOCATION DIAGRAM



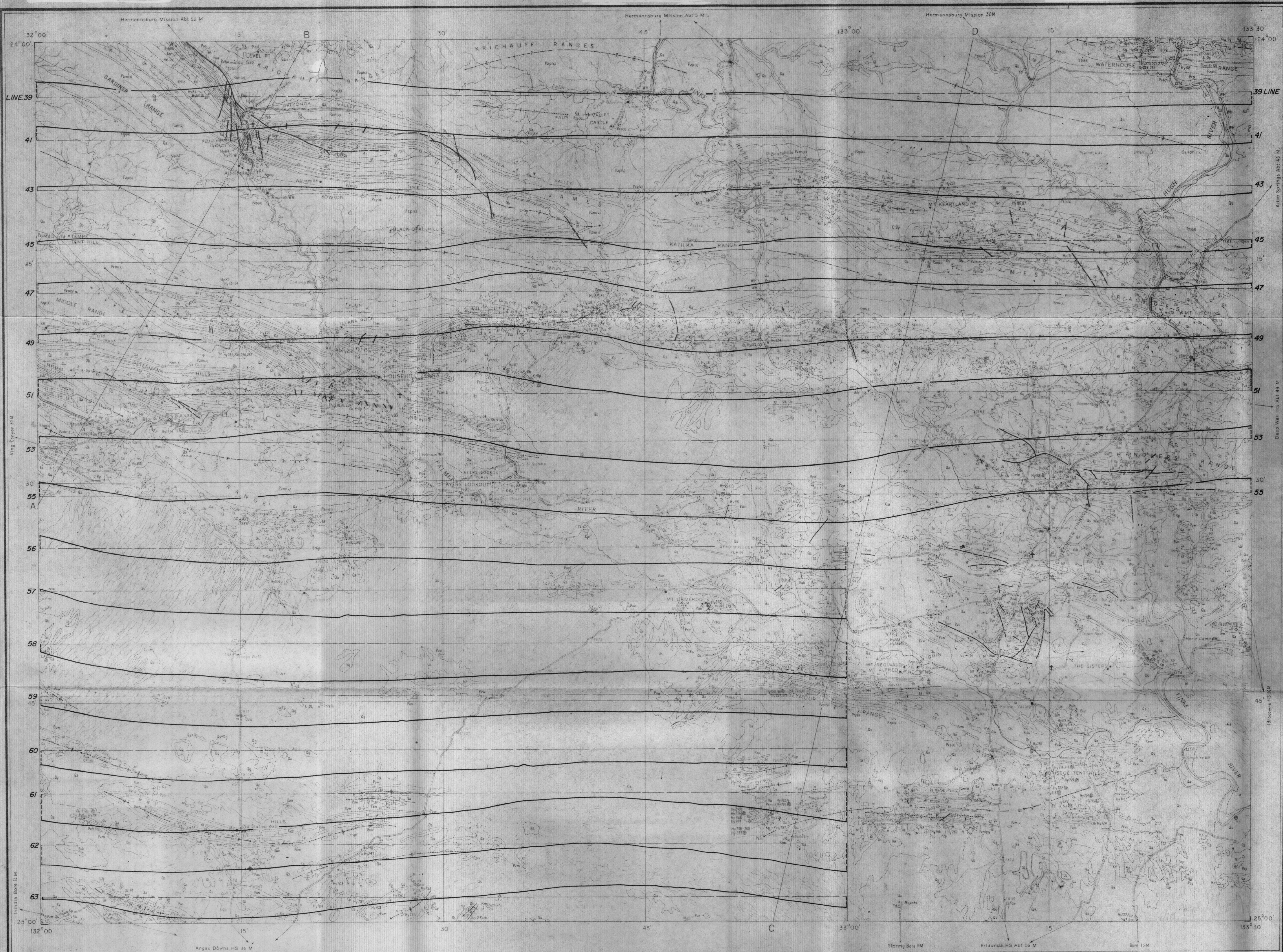


DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



AUSTRALIA 1:250,000

HENBURY
NORTHERN TERRITORY

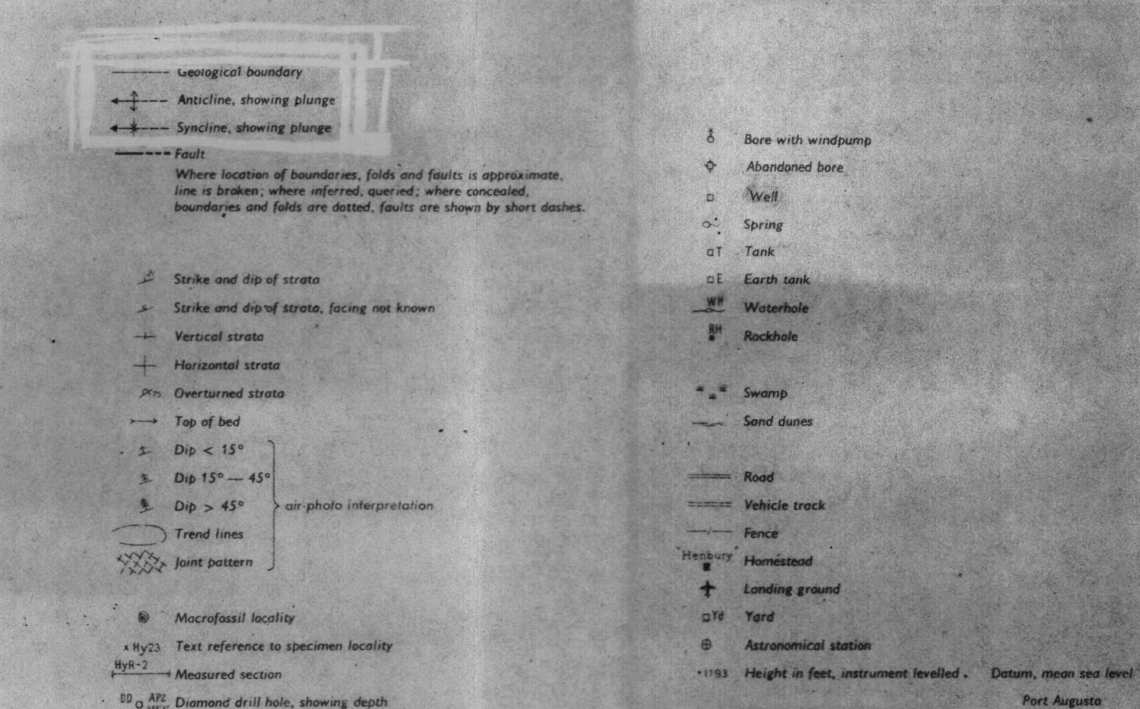


Geological and planimetric mapping from 1:250,000 scale.
Geological sheet SG 53-1 preliminary edition 1964.
Bureau of Mineral Resources, Geology and Geophysics.
Transverse Mercator Projection

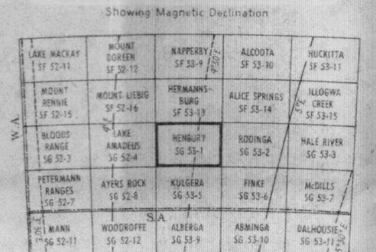
Based on G53/B1-24
Based on G53/B0-6

Reference

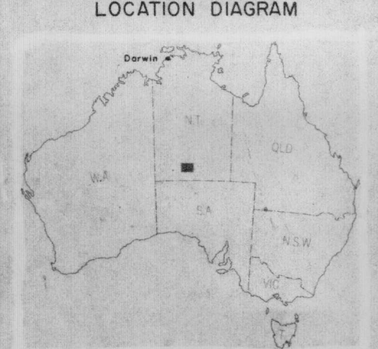
				Reference	
CAINOZOIC	QUATERNARY			Q	Alluvium, sand, travertine, gypsum, conglomerate (section only)
				Qa	Alluvium, river gravel
				Qs	Aeolian sand
				Ql	Travertine
				Qg	Gypsum
				Qc	Conglomerate
	(?)TERTIARY	Undifferentiated		T	Calcareous, silty sandstone, conglomerate, limestone
				Tl	Limestone containing freshwater gastropods
				Tc	Conglomerate
				Tb	"Grey Billy"
				Ta	Laterite, ferricrete
(?)MESOZOIC				M	Kaolinitic sandstone, sandy claystone
PALAEOZOIC	UNDIFFERENTIATED	Pertnjara Formation		Pzp	Sandstone, pebbly sandstone, siltstone
				Pzp(s)	Sandstone, pebbly sandstone
				Pzp(a)	Siltstone, fine silty sandstone
		Mereenie Sandstone		Pzm	Red-brown and white, cross-bedded sandstone
				Pzm(2)	White, cross-bedded sandstone
				Pzm(1)	Red-brown, silty sandstone
	ORDOVICIAN TO CAMBRIAN	Larapinta Group	Undifferentiated	Є-Ol	Fossiliferous sandstone, siltstone and limestone
			Stokes Formation	Ot	Siltstone, shale, fossiliferous limestone
			Stairway Sandstone	Os	Fossiliferous sandstone, silty sandstone, siltstone, limestone
			Horn Valley Siltstone	Oh	Fossiliferous siltstone, limestone
			Pacoota Sandstone	Є-Op	Fossiliferous sandstone, silty sandstone
	CAMBRIAN	Pertaoorrta Formation		Єp	Sandstone, siltstone, shale, limestone
		Goyder Member		Єg	Silty sandstone, sandstone, siltstone, limestone
		Petermann Sandstone Member		Єe	Red-brown sandstone, silty sandstone
		Deception Member		Єd	Red-brown siltstone, shale
		Illara Sandstone Member		Єi	Red-brown sandstone, silty sandstone
		Jay Creek Limestone Member		Єj	Limestone, shale, dolomite
		Tempe Member		Єt	Siltstone, calcareous sandstone, fossiliferous, glauconitic limestone
		Chandler Limestone Member		Єl	Limestone and dolomite with chert laminae
		Eninta Sandstone Member		Єn	Red-brown sandstone, silty sandstone, siltstone
		Quandong Conglomerate Member		Єq	Conglomerate, conglomeratic sandstone
PRECAMBRIAN	UPPER PROTEROZOIC	Winnall Beds		Puw	Sandstone, siltstone
		Pertatataka Formation		Pup	Siltstone, shale, sandstone, limestone
		Areyonga Formation		Pua	Sandstone, claystone, siltstone, minor conglomerate and limestone
		Inindia Beds		Pun	Siltstone, bedded chert, chert breccia, sandstone
		Bitter Springs Limestone		Pub	Dolomite, dolomitic limestone, limestone, siltstone



INDEX TO ADJOINING SHEETS
Showing Magnetic Declination

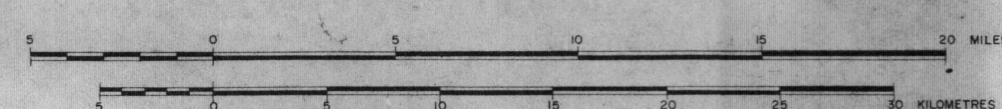


LOCATION DIAGRAM

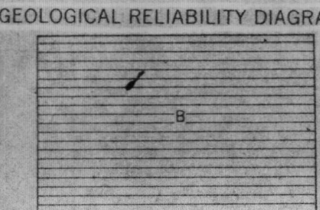


AIRBORNE SURVEY, AMADEUS BASIN, NT 1965

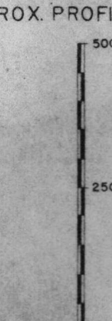
TOTAL MAGNETIC INTENSITY PROFILES AND GEOLOGY



GEOLOGICAL RELIABILITY DIAGRAM



APPROX PROFILE SCALE



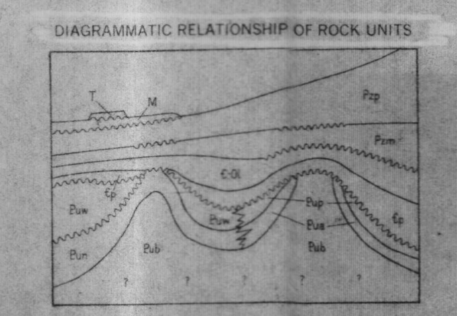
EXPLANATORY NOTES

THE SURVEY WAS MADE WITH A DC.3 AIRCRAFT AT AN ALTITUDE OF 800 FEET ABOVE GROUND LEVEL ALONG LINES SPACED FOUR MILES APART. THE FLIGHT-LINES ARE IDEALISED, AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF ±½ MILE.

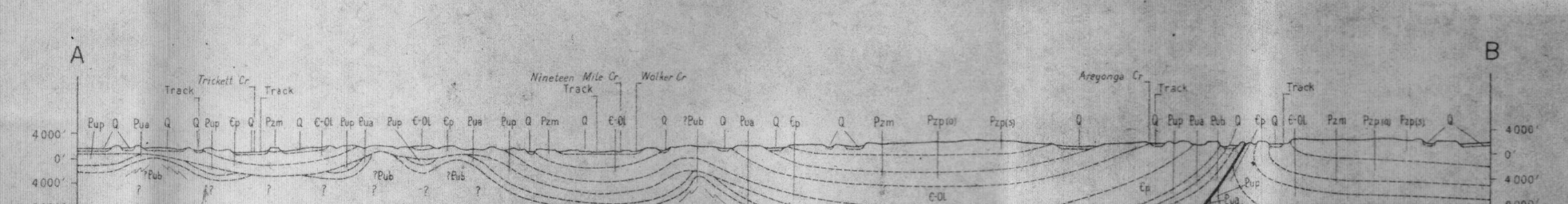
ALL PROFILES RECORDED ARE SHOWN ON THE MAP.

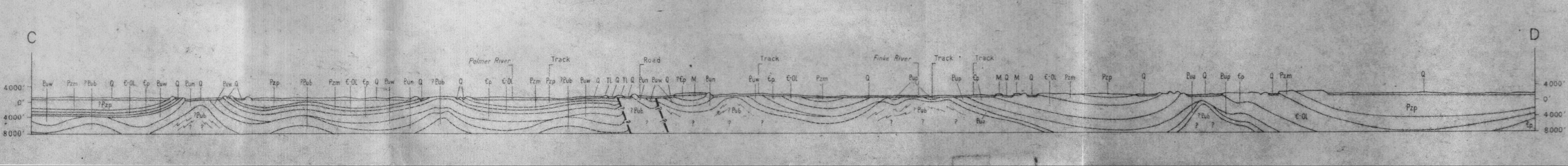
THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9·5 GAMMAS PER MILE.

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



Sections

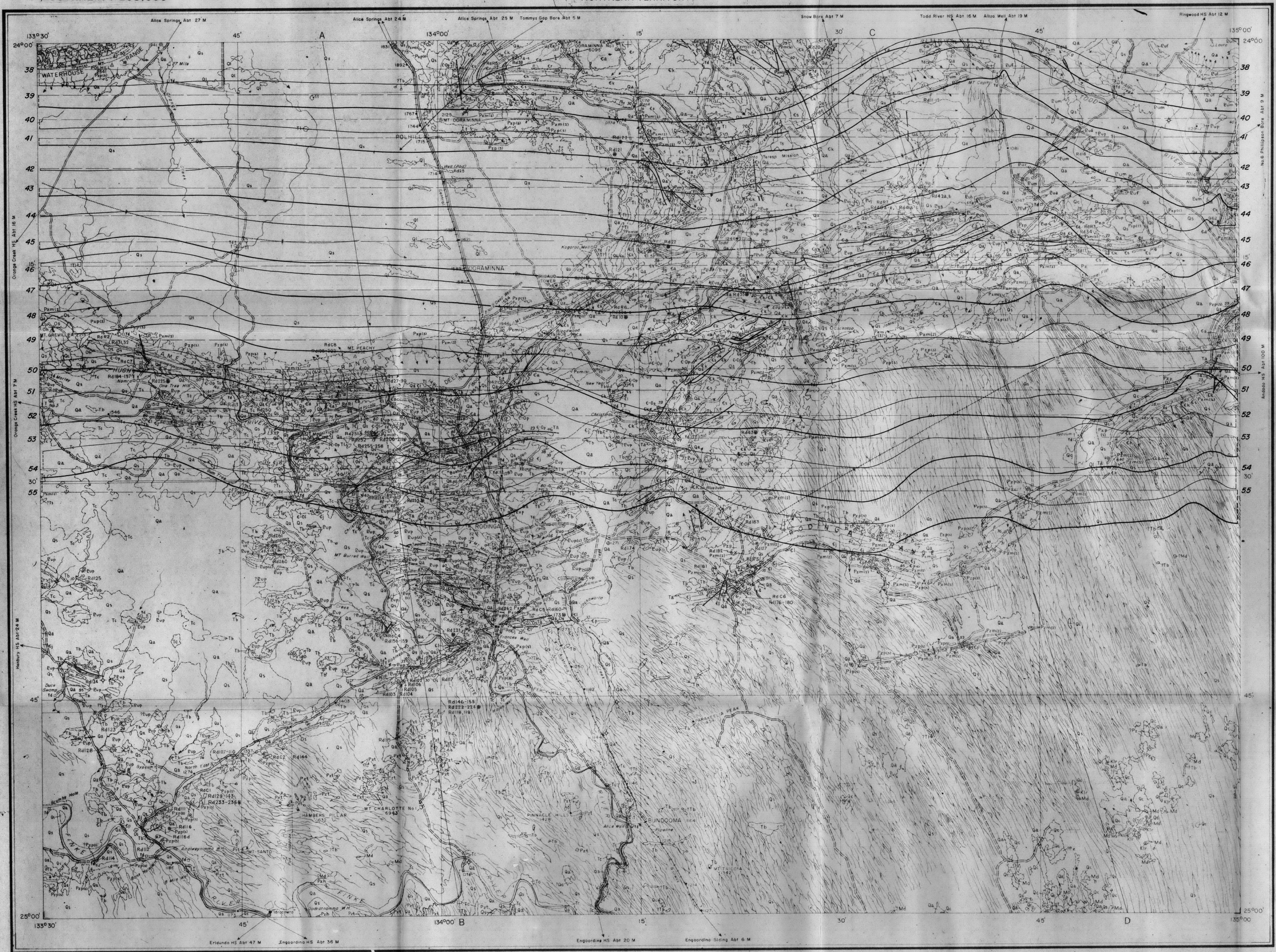




Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

AUSTRALIA 1:250,000

RODINGA
NORTHERN TERRITORY



Geological and planimetric mapping from 1:250,000 scale
Geological sheet SG 53-2 preliminary edition 1965
Bureau of Mineral Resources Geology and Geophysics
Transverse Mercator Projection
BASED ON G53/B0-7
BASED ON G53/B1-30
BASED ON G53/B1-29

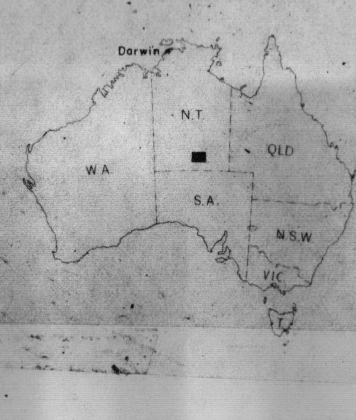
AIRBORNE SURVEY, AMADEUS BASIN, NT 1965

TOTAL MAGNETIC INTENSITY PROFILES AND GEOLOGY

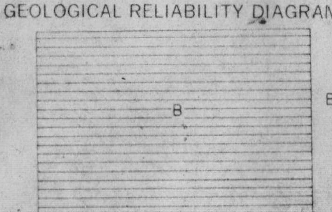
INDEX TO ADJOINING SHEETS
Showing Magnetic Declination

MOUNT DOREEN SF 52-12	NAPPERBY SF 53-9	ALCOOTA SF 53-10	HUCKITTA SF 53-11	TOBERMORY SF 53-12
MOUNT LIEBIG SF 52-16	HERMANNSBURG SF 53-13	ALICE SPRINGS SF 53-14	ILLOGWA CREEK SF 53-15	HAY RIVER SF 53-16
LAKE AMADEUS SG 52-4	HENBURY SG 53-1	RODINGA SG 53-2	HALE RIVER SG 53-3	SIMPSON DESERT NORTH SG 53-4
AYERS ROCK SG 52-8	KULGERA SG 53-5	FINKE SG 53-6	McDILLS SG 53-7	SIMPSON DESERT SOUTH SG 53-8
WOODROFFE SG 52-12	ALBERGA SG 53-9	ABMINGA SG 53-10	DALHOUSIE SG 53-11	POOLOWANNA SG 53-12

LOCATION DIAGRAM



GEOLOGICAL RELIABILITY DIAGRAM

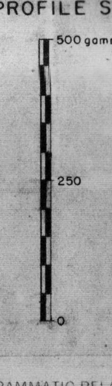


EXPLANATORY NOTES

THE SURVEY WAS MADE WITH A DC3 AIRCRAFT AT AN ALTITUDE OF 800 FEET ABOVE GROUND LEVEL ALONG LINES SPACED TWO MILES APART. THE FLIGHT-LINES ARE IDEALISED AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF ±½ MILE. ALL PROFILES RECORDED ARE SHOWN ON THE MAP.

THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9·4 GAMMAS PER MILE.

APROX. PROFILE SCALE



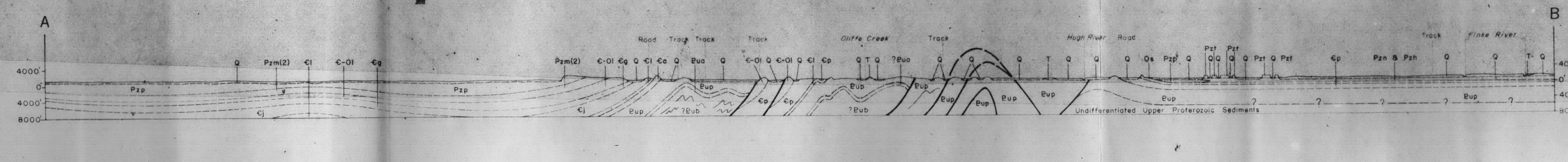
Reference

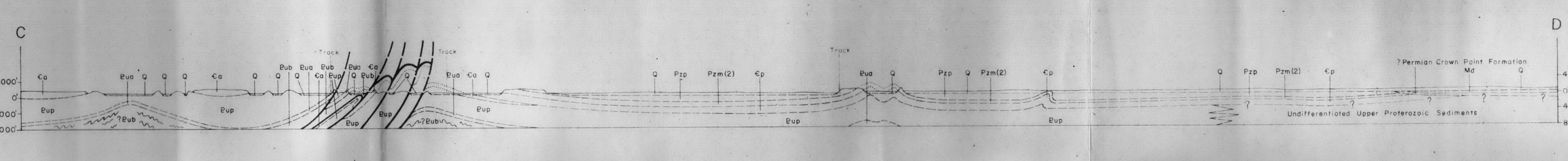
CAINOZOIC	QUATERNARY	Undifferentiated	Q	Alluvium, sand, travertine, gypsum, conglomerate (section only)
			Qa	Alluvium, river gravel
			Qs	Aeolian sand
			Ql	Travertine
			Qg	Gypsum
			Qc	Conglomerate
	? TERTIARY	Undifferentiated	T	Calcareous silty sandstone, conglomerate, limestone
			Tl	Chalcedonic limestone and calcareous sandstone containing freshwater gastropods
			Tc	Conglomerate
			Tb	Silcrete (grey billy)
			Ta	Laterite, ferricrete
			Ts	Sandstone, siltstone, some lignite
MESOZOIC	CRETACEOUS	Rumbalara Shale	Klr	Fossiliferous shale, siltstone, sandstone
	? JURASSIC	De Souza Sandstone	Md	Sandstone, pebbly sandstone, conglomerate
PALAEOZOIC	DEVONIAN TO CARBONIFEROUS	Santo Sandstone	Pzt	Sandstone, pebbly sandstone, minor claystone
		Horseshoe Bend Shale	Pzh	Red-brown biotite shale, grey-green calcareous siltstone
		Langra Formation	Pzn	Sandstone, pebbly sandstone, conglomerate, siltstone
		Pertnjara Formation	Pzp	Sandstone, pebbly sandstone, conglomerate, siltstone
			Pzp(c)	Conglomerate
			Pzp(s)	Sandstone, pebbly sandstone
			Pzp(a)	Siltstone, shale
	ORDOVICIAN TO CARBONIFEROUS		Pz	Sandstone, pebbly sandstone
	ORDOVICIAN TO DEVONIAN	Mereenie Sandstone	Pzm(2)	White cross-bedded sandstone
	ORDOVICIAN TO CAMBRIAN	Larapinta Group: Undifferentiated	€-Ol	Fossiliferous sandstone, siltstone, shale, limestone
		Stokes Formation	Ot	Siltstone, shale, fossiliferous limestone
		Stairway Sandstone	Os	Fossiliferous sandstone, silty sandstone, siltstone, limestone
		Horn Valley Siltstone	Oh	Fossiliferous siltstone and limestone
		Pacoota Sandstone	€-Op	Fossiliferous sandstone and silty sandstone
	CAMBRIAN	Pertaoorrta Group: Undifferentiated	-€p	Sandstone, siltstone, shale, dolomite, limestone
		Goyder Formation	€g	Silty sandstone, siltstone, limestone
		Jay Creek Limestone	€j	Limestone, shale, dolomite
		Shannon Formation	€s	Siltstone, shale, limestone
		Giles Creek Dolomite	€k	Dolomite, limestone, siltstone, shale
		Chandler Limestone	€l	Limestone and dolomite with chert laminae
		Todd River Dolomite	€r	Pink fossiliferous glauconitic dolomite
		Arumbera Sandstone	€a	Red-brown sandstone, silty sandstone, siltstone
PRECAMBRIAN	UPPER PROTEROZOIC	Pertatataka Formation	Pup	Siltstone and shale with lenses of sandstone, limestone and conglomerate
			Pup(c)	Conglomeratic sandstone
		Julie Member	Puj	Dolomite, limestone, lenses of calcareous sandstone
		Waldo-Pedlar Member	Pul	Siltstone, fine grained, thin-bedded sandstone
		Olympic Member	Puf	Conglomerate, siltstone, sandstone
		Limbla Member	Pum	Cross-laminated sandstone, sandy limestone
		Ringwood Member	Pur	Algal dolomite and limestone
		Areyonga Formation	Pua	Conglomeratic siltstone, sandstone; minor dolomite with red chert
		Bitter Springs Formation	Pub	Dolomite, limestone, siltstone, some volcanics

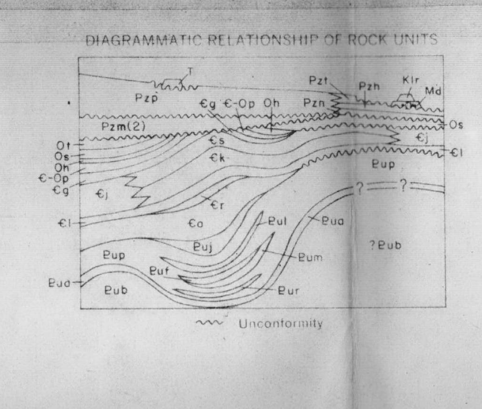
Geological boundary
Anticline, showing plunge
Syncline, showing plunge
Fault

Bore
Abandoned bore
Windpump

Sections
Scale $\frac{H}{V} = 1$



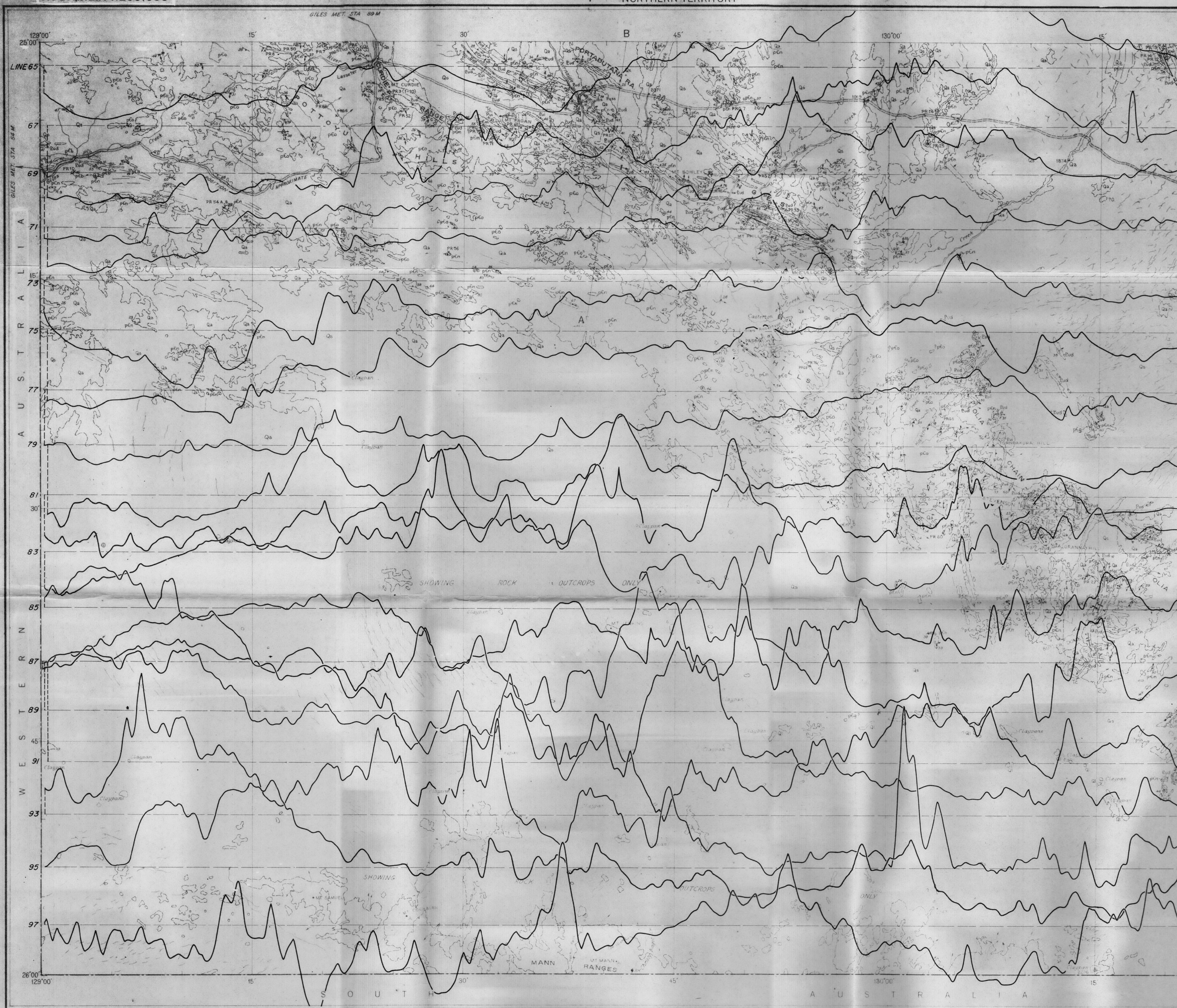




AUSTRALIA 1:250,000

PETERMANN RANGES

NORTHERN TERRITORY



Reference

CAINOZOIC	QUATERNARY		Qs	Sand
			Qa	Alluvium
			Ql	Travertine
	? TERTIARY		Tc	Conglomerate
			T	Sandstone
PALAEOZOIC	ORDOVICIAN		O	White Sandstone
	UNDIFFERENTIATED	Mount Currie Conglomerate	Pzc	Conglomerate
PRECAMBRIAN	UPPER PROTEROZOIC		Ƀu	Sandstone, siltstone
		Pinyinna Beds	Ƀui	Slate, dolomite schist, schist
		Dean Quartzite	Ƀud	Quartzite
	UNDIFFERENTIATED		p€g	Granite
		Pottoyu Granite Complex	p€o	Granite, gneiss, amphibolite, schist
		Olia Gneiss	p€n	Gneiss, porphyroblastic gneiss
			p€m	Porphyroblastic schist, schistose porphyry
		Bloods Range Beds	p€b	Schist, quartzite

- Geological boundary
- Anticline, showing plunge
- Syncline, showing plunge
- Overturned anticline
- Overturned syncline
- Fault

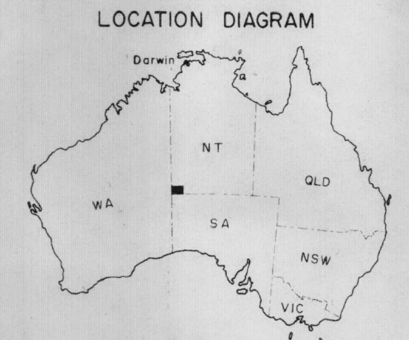
Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted, faults are shown by short dashes

- 40 Strike and dip of strata
- Vertical strata
- Horizontal strata
- 70 Overturned strata
- Dip < 15° (air-photo interpretation)
- Dip 15° — 45° (air-photo interpretation)
- Trend lines (air-photo interpretation)
- Joint pattern (air-photo interpretation)
- Vertical foliation (air-photo interpretation)
- 50 Strike and dip of foliation, with lineation
- 31 Strike and dip of bedding, with lineation
- 26 Direction and plunge of lineation
- Vertical joint
- Macrofossil locality
- x PRG 3 Text reference to specimen locality
- Dyke or vein, q - quartz
- RH Rockhole
- Sand dunes
- Scarp
- Vehicle track
- State boundary
- Astronomical station
- Trigonometrical station
- ·2247 Height in feet, barometric; datum: mean sea level

Geological and planimetric mapping from 1:250,000 scale Geological sheet SG 52—7 preliminary edition 1964. Bureau of Mineral Resources, Geology and Geophysics. Transverse Mercator Projection.

BASED ON G52/BO-8
BASED ON G52/BI-11

LOCATION DIAGRAM



INDEX TO ADJOINING SHEETS

Showing Magnetic Declination

RYAN SF 52-13	MACDONALD SF 52-14	MT RENNIE SF 52-15	MT LEIBIG SF 52-16	HERMANNSBURG SF 53-13
COBB SG 52-1	RAWLINSON SG 52-2	BLOODS RANGE SG 52-3	LAKE AMADEUS SG 52-4	HENBURY SG 53-1
BENTLEY SG 52-5	SCOTT SG 52-6	PETERMANN RANGES SG 52-7	AYERS ROCK SG 52-8	KULGERA SG 53-5
TALBOT SG 52-9	COOPER SG 52-10	MANN SG 52-11	WOODROFFE SG 52-12	ALBERGA SG 53-9
LENNIS SG 52-13	WAIGEN SG 52-14	BIRKSGATE SG 52-15	LINDSAY SG 52-16	EVERARD SG 53-13

ANNUAL CHANGE 1'E

AIRBORNE SURVEY, AMADEUS BASIN, NT 1965

TOTAL MAGNETIC INTENSITY PROFILES AND GEOLOGY

5 0 5 10 15 20 MILES

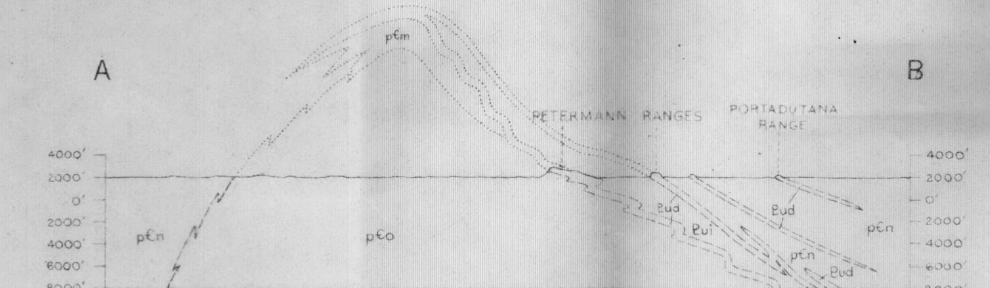
5 0 5 10 15 20 25 30 KILOMETRES

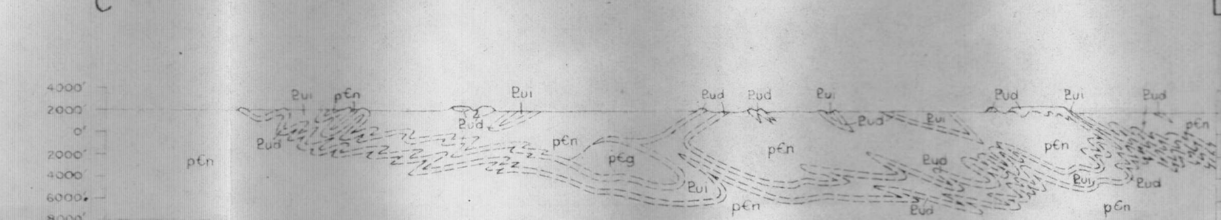
Sections

Scale $\frac{V}{H} = 1$

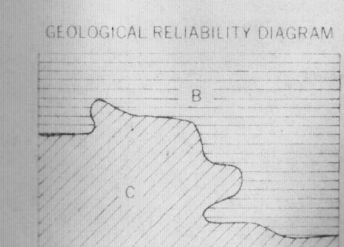
Folding schematic

(Cainozoic units omitted from sections)





GEOLOGICAL RELIABILITY DIAGRAM



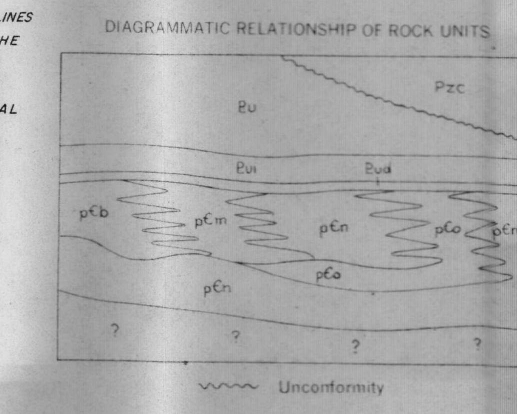
APPROX. PROFILE SCALE

EXPLANATORY NOTES

THE SURVEY WAS MADE WITH A DC.3 AIRCRAFT AT AN ALTITUDE OF 800 FEET ABOVE GROUND LEVEL ALONG LINES SPACED TWO MILES APART. THE FLIGHT-LINES ARE IDEALISED, AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF ± ½ MILE.

PROFILES RECORDED AT INTERVALS OF FOUR MILES ARE SHOWN ON THE MAP. THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9·4 GAMMAS PER MILE.

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



Unconformity

TO ACCOMPANY RECORD No. 1966/230

Geophysical Branch, Bureau of Mineral Resources Geology and Geophysics

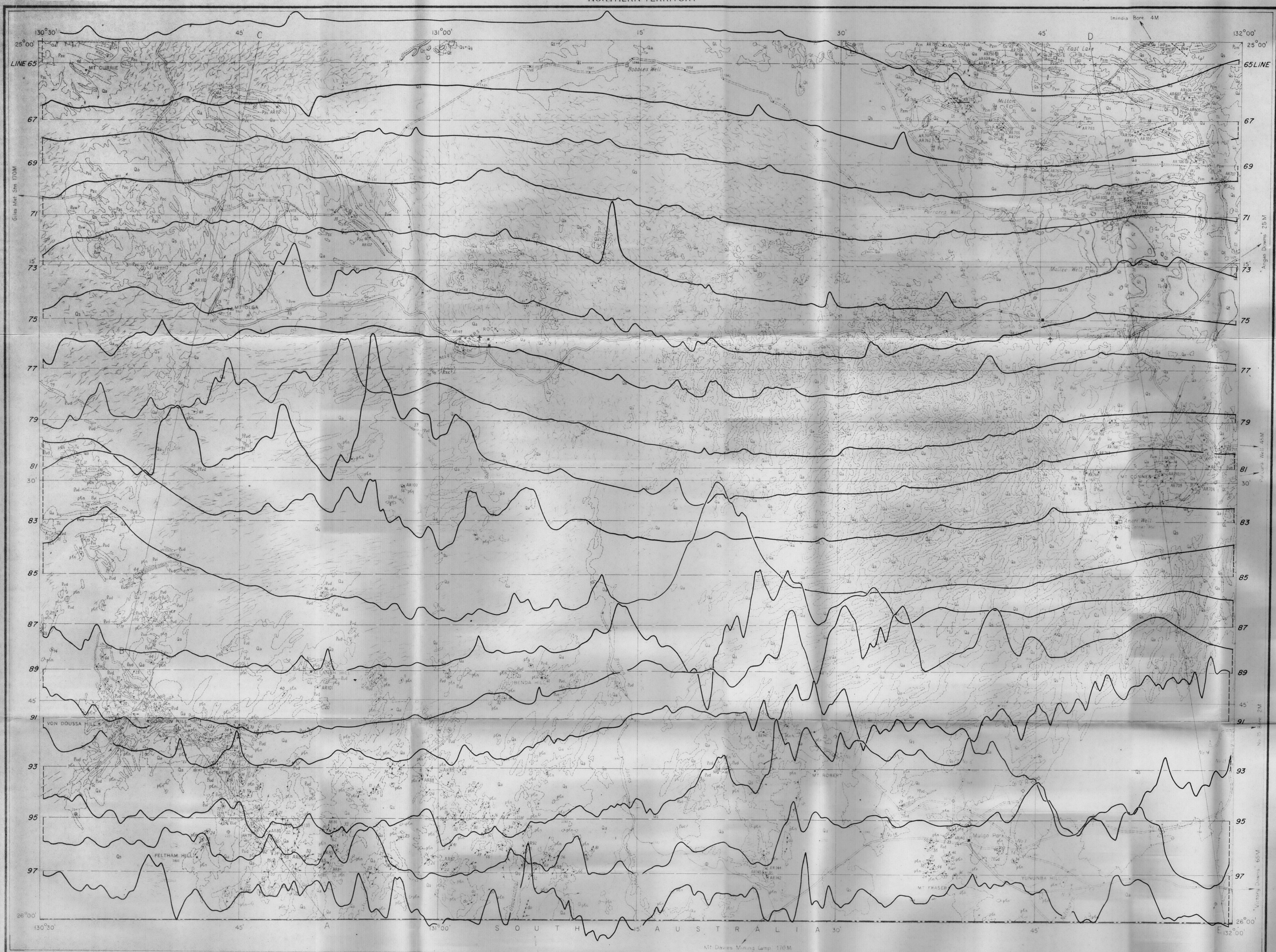
G 52/BI—19

AUSTRALIA 1:250,000

AYERS ROCK

NORTHERN TERRITORY

PLATE 11



Reference

CAINOZOIC	QUATERNARY		Qa	Alluvium
			Qs	Sand
			Qe	Evaporites
			Qt	Travertine
			Qg	Gypsum
	TERTIARY		Tc	Conglomerate
			Tl	Limestone
PALAEOZOIC	ORDOVICIAN-DEVONIAN	Mereenie Sandstone	Pzm	Red-brown silty sandstone and white cross-bedded sandstone
	ORDOVICIAN	Stokes Formation	Ot	Shale and siltstone, some fossiliferous dolomite at base
		Stairway Sandstone	Os	White fine sandstone and kaolinitic sandstone, minor siltstone
	CAMBRIAN	Pertaoorrta Formation	Єp	Pebble conglomerate
		Mount Currie Conglomerate	Єc	Conglomerate; arkose at Ayers Rock possible lithological variant
PRECAMBRIAN	UPPER PROTEROZOIC	Winnall Beds	Puw	Fine siliceous sandstone and dark brown siltstone, minor conglomerate
		Inindia Beds	Pui	Red-brown and white siltstone, chert, sandstone, pebble siltstone, thin beds of dolomite
		Bitter Springs Limestone	Pub	Dark grey dolomite
		Pinyinna Beds	Pup	Grey phyllite, quartz-sericite schist, amphibole schist
		Dean Quartzite	Pud	Schistose quartzite
	UNDIFFERENTIATED	Olia Gneiss	pЄn	Gneiss with schist, porphyroblastic schist, amphibolite migmatite and granite
			pЄg	Granite

Geological boundary
Anticline, showing plunge
Syncline, showing plunge
Overturned anticline
Fault
Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted, faults are shown by short dashes
Strike and dip of strata
Horizontal strata
Overturned strata
Dip < 15° } air-photo interpretation
Dip 15° — 45°
Dip > 45°
Trend lines
Joint pattern
Strike and dip of foliation
Strike and dip of foliation, unmeasured
Vertical foliation
Horizontal foliation
Strike and dip of bedding with trend of lineation
Strike and dip of foliation with trend of lineation
Trend of lineation

Macrofossil locality
×AR70E Specimen locality
KW-8 Measured section
Dyke: do - dolerite

Bore
Abandoned bore
Well
T Tank
E Earth tank
Windpump
Spring
RH Rockhole
Sand dunes

Road
Vehicle track
State boundary
Fence
"Mt. Conner" Homestead
Landing ground
Yd Yard
Astronomical station
Trigonometrical station
1725 Height in feet, instrument levelled } datum: mean sea level
1725 Height in feet, barometric } Port Augusta

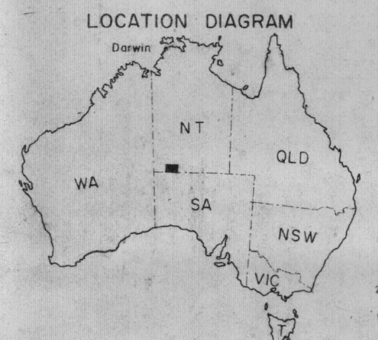
Geological and planimetric mapping from 1:250,000 scale
Geological sheet SG 52-8 preliminary edition 1964
Bureau of Mineral Resources, Geology and Geophysics.
Transverse Mercator Projection.

BASED ON G52/B0-9
BASED ON G52/BI-13

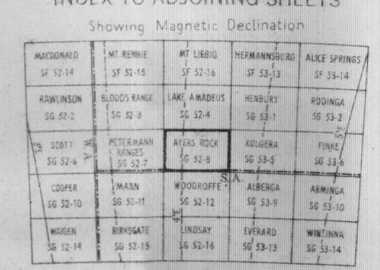
AIRBORNE SURVEY, AMADEUS BASIN, NT 1965

TOTAL MAGNETIC INTENSITY PROFILES AND GEOLOGY

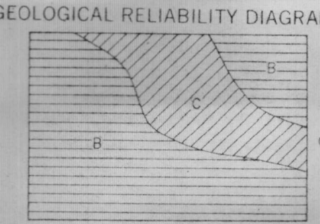
LOCATION DIAGRAM



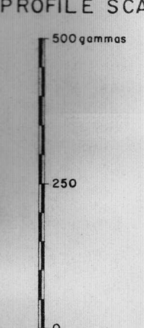
INDEX TO ADJOINING SHEETS



GEOLOGICAL RELIABILITY DIAGRAM



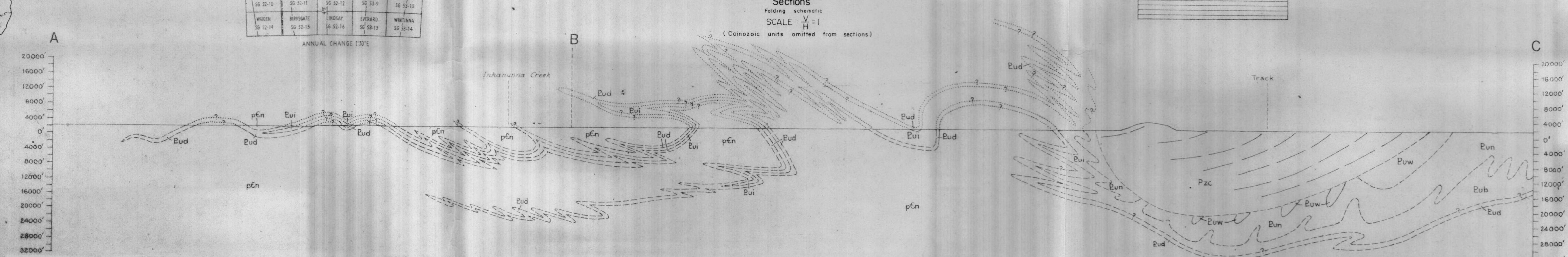
APPROX PROFILE SCALE

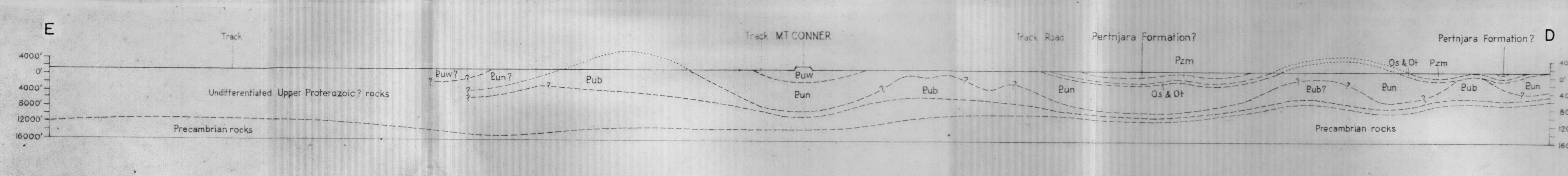


5 0 5 10 15 20 MILES

5 0 5 10 15 20 25 30 KILOMETRES

Sections
Folding schematic
SCALE V/H = 1
(Cainozoic units omitted from sections)



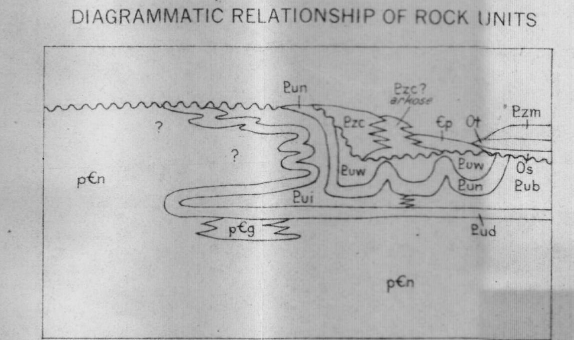


EXPLANATORY NOTES

THE SURVEY WAS MADE WITH A DC3 AIRCRAFT AT AN ALTITUDE OF 600 FEET ABOVE GROUND LEVEL ALONG LINES SPACED TWO AND FOUR MILES APART FOR THE SOUTHERN AND NORTHERN PART OF THE AREA RESPECTIVELY. THE FLIGHT-LINES ARE IDEALISED, AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF 1/4 MILE.

PROFILES RECORDED AT INTERVALS OF FOUR MILES ARE SHOWN ON THE MAP. THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9.4 GAMMAS PER MILE.

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



Unconformity

TO ACCOMPANY RECORD No. 1966/230

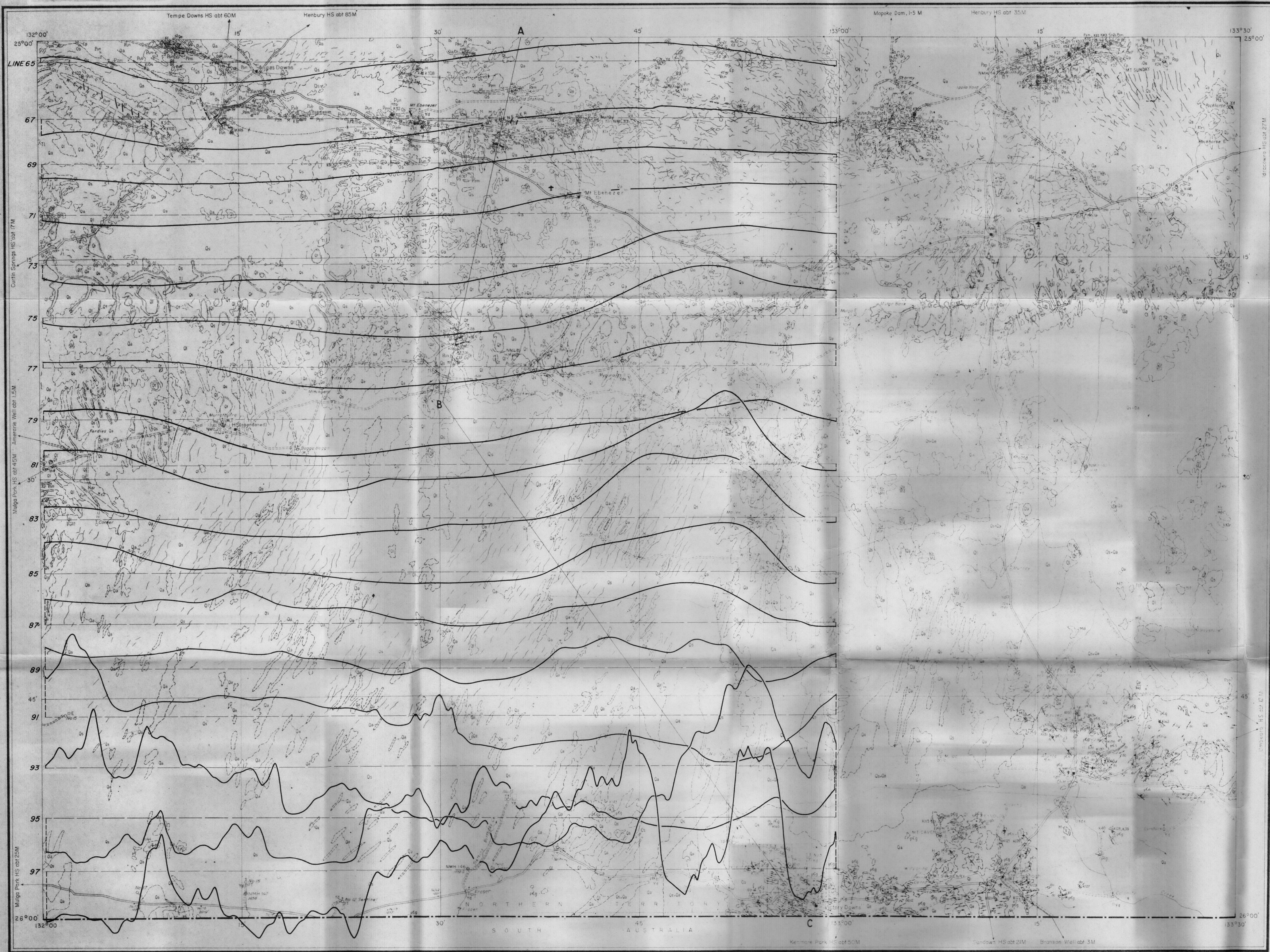
Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics.

G 52/BI-20

AUSTRALIA 1:250.000

KULGERA

NORTHERN TERRITORY



Reference

CAINOZOIC	QUATERNARY		Q	Undifferentiated (Section only)
			Qa	Alluvium, conglomerate
			Qs	Sand
			Ql	Travertine
			Qt	Evaporites
	TERTIARY		Tc	Conglomerate
			Tl	Limestone, calcareous siltstone, siltstone, sandstone
			Tb	"Grey billy", silicified sediments
MESOZOIC			M	Sandstone, siltstone
	LOWER CRETACEOUS	Rumbalara Shale	Klr	Fossiliferous shale and siltstone
	UNDIFFERENTIATED	De Souza Sandstone	Md	Sandstone, pebbly sandstone
PALAEOZOIC	UNDIFFERENTIATED	Finke Group: Idracowra Sandstone	Pzi	White kaolinitic sandstone
		Finke Group: Horseshoe Bend Shale	Pzh	Red-brown biotite shale, some fine sandstone
		Finke Group: Polly Conglomerate	Pzo	Conglomerate
		Pertnjara Formation	Pzp	Red-brown sandstone, siltstone
		Mereenie Sandstone	Pzm	Red-brown kaolinitic sandstone, siltstone
	ORDOVICIAN	Stokes Formation	Ot	Siltstone, silty dolomite
		Stairway Sandstone	Os	Fossiliferous sandstone, phosphorite, conglomerate
	CAMBRIAN	Pertaoorrta Formation	Єp	Sandstone, siltstone, conglomerate
PRECAMBRIAN	UPPER PROTEROZOIC	Winnall Beds	Puw	White and purple-brown sandstone, dark brown siltstone
		Inindia Beds	Pun	Bedded chert, chert breccia, siltstone, dolomite, sandstone, tillite
		Bitter Springs Limestone	Pub	Dolomite, sandstone, chert
			do	Dolerite
			pЄg	Granite, gneiss
			pЄn	Gneiss
			pЄ	Schist

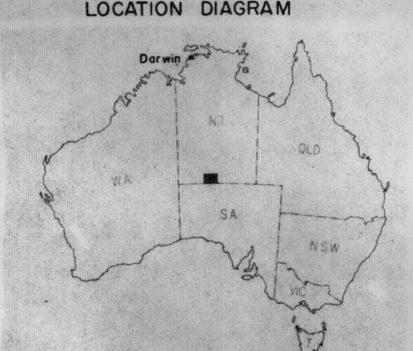
- Geological boundary
- Anticline, showing plunge
- Syncline, showing plunge
- Overturned anticline
- Fault
  Where location of boundaries, folds and faults is approximate, line is broken; where inferred queried; where concealed, boundaries and folds are dotted, faults are shown by short dashes.
- Strike and dip of strata
- Horizontal strata
- Overturned strata
- Dip < 15° (air-photo interpretation)
- Dip 15° — 45° (air-photo interpretation)
- Dip > 45° (air-photo interpretation)
- Trend lines (air-photo interpretation)
- Joint pattern (air-photo interpretation)
- Strike and dip of foliation
- Vertical foliation
- Strike and dip of platy flow structure
- Vertical platy flow structure
- Macrofossil locality
- Specimen locality
- Measured section
- Dyke do, dolerite

- Bore, with windpump
- Abandoned bore
- Well
- Abandoned well
- Spring
- Tank
- Earth tank
- Dam on stream
- Rockhole
- Sand dunes
- Road
- Vehicle track
- Fence
- "Kulgera" Homestead
- Landing ground
- Yard
- Astronomical station
- Height in feet, barometric levelled. Datum, mean sea level. Port Augusta
- Station number

Geological and planimetric mapping from 1:250,000 scale
Geological sheet SG 53-5 Bureau of Mineral Resources, Geology and Geophysics
Transverse Mercator Projection

BASED ON G53/B0-8
BASED ON G53/BI-27

LOCATION DIAGRAM



INDEX TO ADJOINING SHEETS

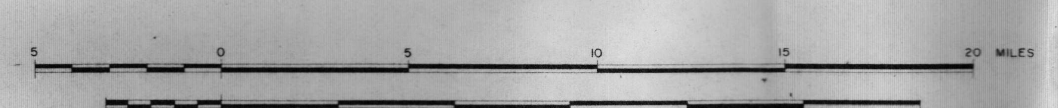
SHOWING MAGNETIC DECLINATION

MT RENNIE SF 52-15	MT LIEBIG SF 52-16	HERMANNSBURG SF 53-13	ALICE SPRINGS SF 53-14	ILLOGWA CREEK SF 53-15
BLOODS RANGE SG 52-3	LAKE AMADEUS SG 52-4	HENBURY SG 53-1	RODINGA SG 53-2	HALE RIVER SG 53-3
PETERMANN RANGES SG 52-7	AYERS ROCK SG 52-8	KULGERA SG 53-5	FINKE SG 53-6	MCDILLS SG 53-7
MANN SG 52-11	WOODROFFE SG 52-12	ALBERGA SG 53-9	ABMINGA SG 53-10	DALHOUSIE SG 53-11
BIRKSGATE SG 52-15	LINDSAY SG 52-16	EVERARD SG 53-13	WINTINNA SG 53-14	OODNADATTA SG 53-15

Annual Change 1°30' E

AIRBORNE SURVEY, AMADEUS BASIN, NT 1965

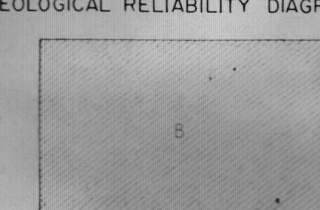
TOTAL MAGNETIC INTENSITY PROFILES AND GEOLOGY



Section

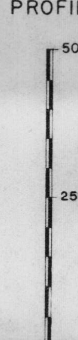
Scale

GEOLOGICAL RELIABILITY DIAGRAM



B Detailed reconnaissance—numerous traverses, with air-photo interpretation

APPROX PROFILE SCALE

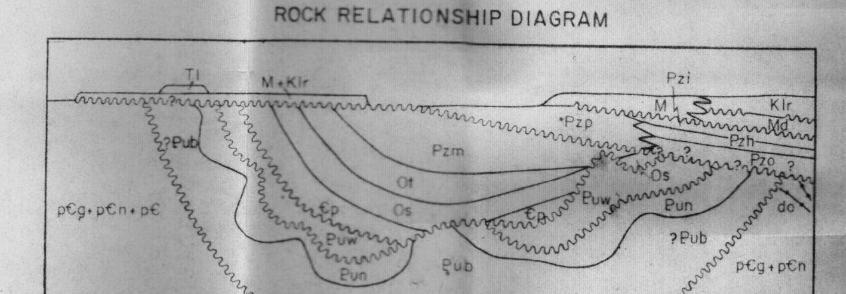


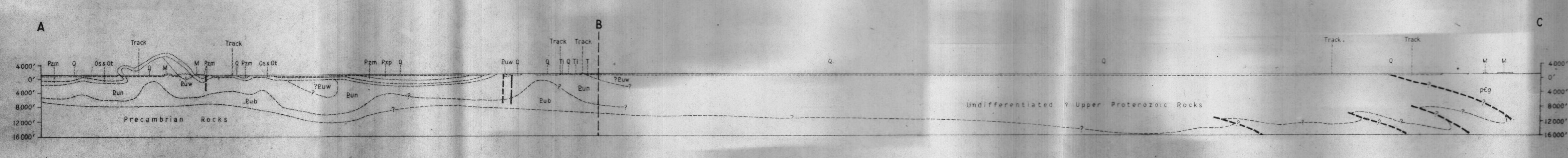
EXPLANATORY NOTES

THE SURVEY WAS MADE WITH A DC.3 AIRCRAFT AT AN ALTITUDE OF 800 FEET ABOVE GROUND LEVEL ALONG LINES SPACED TWO AND FOUR MILES APART FOR THE SOUTHERN AND NORTHERN PART OF THE AREA RESPECTIVELY. THE FLIGHT-LINES ARE IDEALISED, AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF ± ½ MILE.

PROFILES RECORDED AT INTERVALS OF FOUR MILES ARE SHOWN ON THE MAP. THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9·4 GAMMAS PER MILE.

ROCK RELATIONSHIP DIAGRAM





AIRBORNE SURVEY, AMADEUS BASIN, NT, 1965

TOTAL MAGNETIC INTENSITY PROFILES

FLIGHT–LINES ORIENTED EAST – WEST

SCALE

10 0 10 20 30 40 MILES

10 0 10 20 30 40 50 60 KILOMETRES

INDEX TO 1:250,000 SHEETS

MOUNT RENNIE	MOUNT LIEBIG	HERMANNS-BURG	ALICE SPRINGS
BLOODS RANGE	LAKE AMADEUS	HENBURY	RODINGA
PETERMANN RANGES	AYERS ROCK	KULGERA	

LOCATION DIAGRAM

EXPLANATORY NOTES

THE SURVEY WAS MADE WITH A DC.3 AIRCRAFT AT AN ALTITUDE OF 800 FEET ABOVE GROUND LEVEL ALONG EAST – WEST ORIENTED LINES SPACED TWO AND FOUR MILES APART, AND ALONG NORTH – SOUTH LINES SPACED FIFTEEN MILES APART.

THE FLIGHT LINES ARE IDEALISED AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF $\pm \frac{1}{2}$ MILE.

THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9·4 GAMMAS PER MILE.

17 O LOCATION OF SELECTED MAGNETIC ANOMALIES INTERPRETED USING STANDARD CURVES (SEE APPENDIX C)

APPROX. PROFILE SCALE

1000 gammas
500
0

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G52/B1-25

AIRBORNE SURVEY, AMADEUS BASIN, NT, 1965

TOTAL MAGNETIC INTENSITY PROFILES

FLIGHT-LINES ORIENTED NORTH-SOUTH

EXPLANATORY NOTES

THE SURVEY WAS MADE WITH A DC 3 AIRCRAFT AT AN ALTITUDE OF 800 FEET ABOVE GROUND LEVEL ALONG EAST-WEST ORIENTED LINES SPACED TWO AND FOUR MILES APART, AND ALONG NORTH-SOUTH LINES SPACED FIFTEEN MILES APART.

THE FLIGHT LINES ARE IDEALISED AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT PATH WITH A PROBABLE ERROR OF ± 1/2 MILE.

THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 9·4 GAMMAS PER MILE.

THE NORTH-SOUTH LINES ARE NUMBERED FOR TEXT REFERENCE ONLY.

O⁴ LOCATION OF SELECTED MAGNETIC ANOMALIES INTERPRETED USING STANDARD CURVES (SEE APPENDIX C)

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

PLATE 15

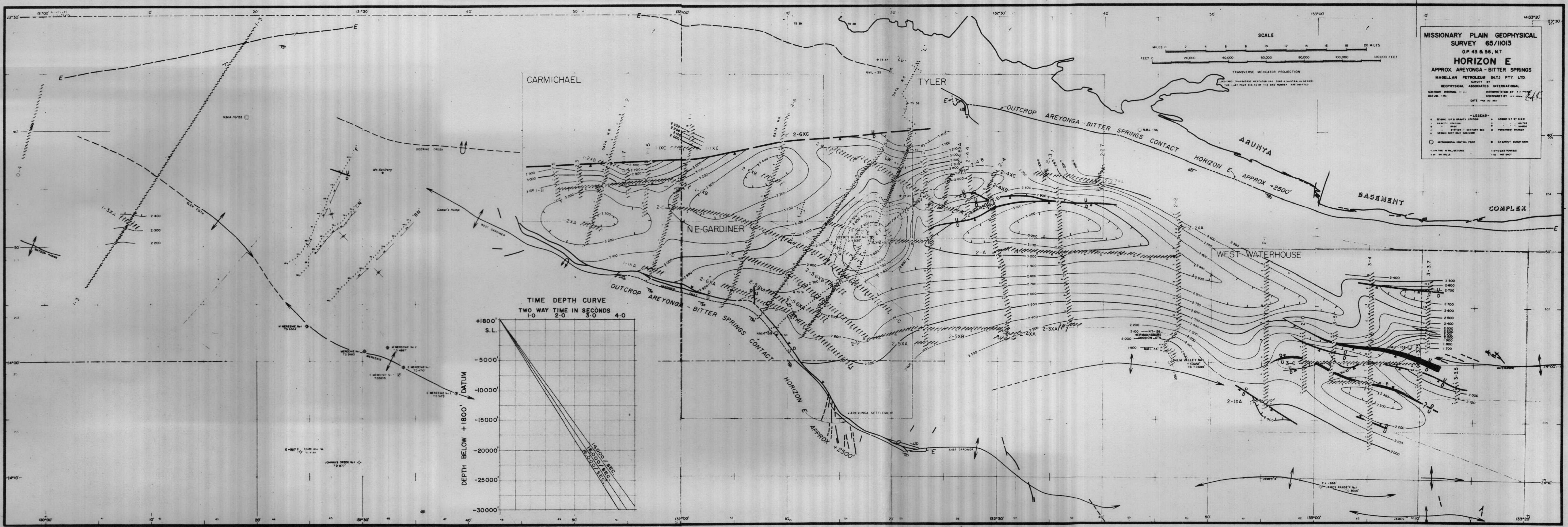
TO ACCOMPANY RECORD No. 1966/230 — *Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics* — G52/B1-27


PLATE 16
AIRBORNE SURVEY, AMADEUS BASIN, NT, 1965
MAGNETIC INTERPRETATION
AND
TECTONIC GEOLOGY
GEOLOGICAL LEGEND
DIAGRAMMATIC RELATIONSHIP OF TIME ROCK UNITS
GEOPHYSICAL LEGEND
SCALE
INDEX TO 1:250,000 SHEETS
LOCATION DIAGRAM
MOUNT RENNIE
MOUNT LIEBIG
HERMANNSBURG
ALICE SPRINGS
ARLTUNGA NAPPE COMPLEX
ORMISTON NAPPE COMPLEX
BLOODS RANGE
LAKE AMADEUS
HENBURY
PETERMANN RANGE
PETERMANN RANGES
AYERS ROCK
KULGERA
G52/B1-28


AIRBORNE SURVEY, AMADEUS BASIN, N.T. 1965
GRAVITY, SEISMIC AND WELL DATA
MOUNT RENNIE
MOUNT LIEBIG
HERMANNSBURG
ALICE SPRINGS
BLOODS RANGE
LAKE AMADEUS
HENBURY
RODINGA
PETERMANN RANGES
AYERS ROCK
KULGERA
SEISMIC SURVEY GOSSES BLUFF
SEISMIC SURVEY PALM VALLEY-HERMANNSBURG
SEISMIC SURVEY OORAMINNA AREA
WEST MEREENIE Nº1
WEST MEREENIE Nº2
MEREENIE Nº1
MEREENIE Nº3
EAST MEREENIE Nº1
EAST MEREENIE Nº2
OCHRE HILL Nº1
JOHNNEYS CREEK Nº1
EAST JOHNNEYS CREEK Nº1
PALM VALLEY Nº2
PALM VALLEY Nº1
JAMES RANGE A Nº1
HIGHWAY ANTICLINE Nº1
WATERHOUSE Nº1
ORANGE Nº1
ALICE Nº1
OORAMINNA Nº1
TRAVERSE 2
INDEX TO 1:250,000 SHEETS
LOCATION DIAGRAM
LEGEND
Gravity contours Interval 5 milligals
Boundary of gravity feature
Gravity feature
Seismic traverse (BMR) with shot point locations
Minimum depth to crystalline basement below sea level
Seismic survey, private company
Well
GRAVITY FEATURES
22 Northern Shelf — Mount Davies Gravity High
23 Katamala Gravity Embayment
24 Ayers Rock Gravity Depression
28 Angas Downs Gravity Ridge
29 Bloods Range Gravity High
30 Mount Liebig Gravity Trough
35 Papunya Gravity Ridge
41 East Rodinga Gravity Low
42 Amadeus Gravity Depression

TO ACCOMPANY RECORD No. 1966/230

HORIZON E
REFLECTION TIME CONTOUR MAP

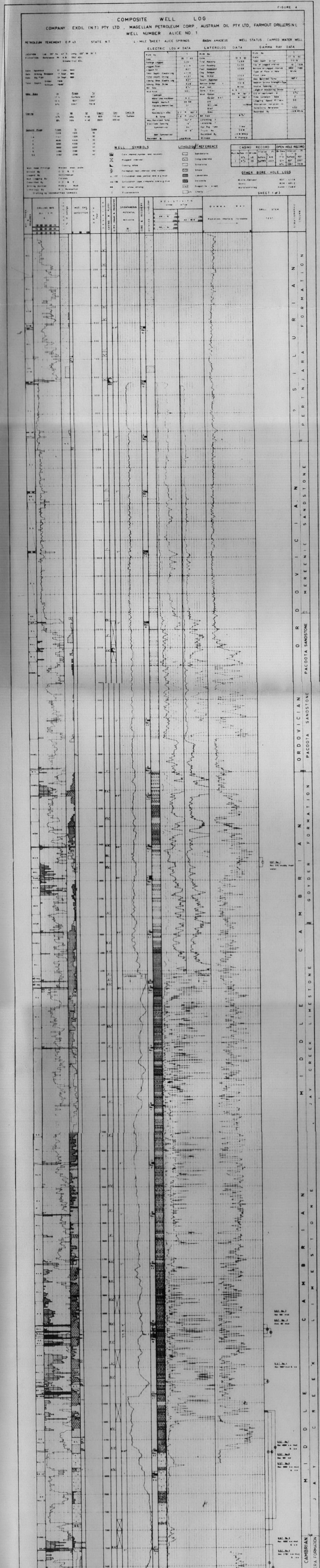


Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. F52/B6-2

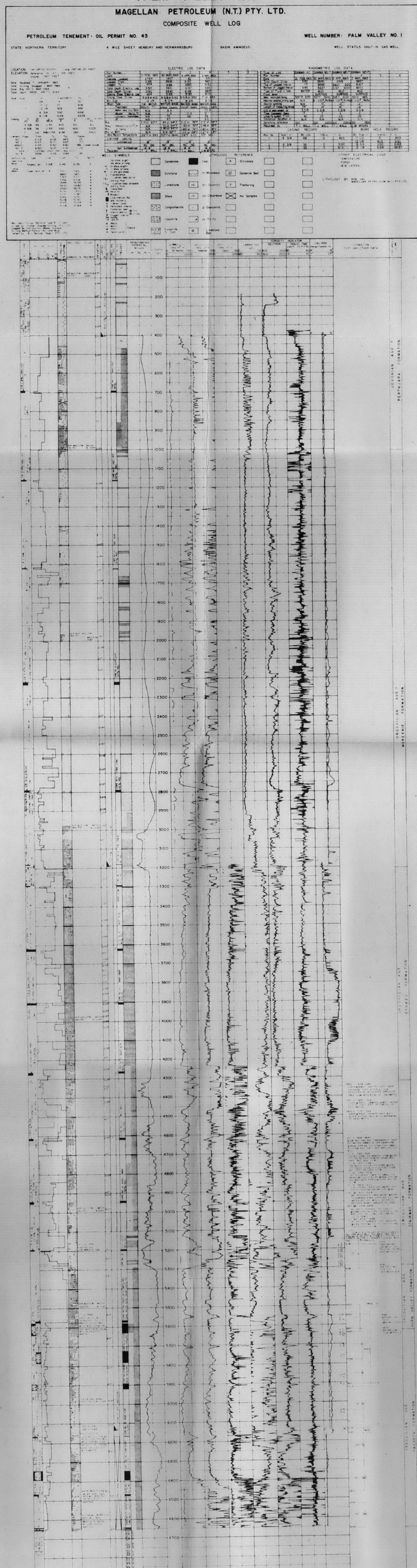
PLATE 18

AIRBORNE SURVEY, AMADEUS BASIN, NT, 1965
RADIOMETRIC CONTOURS
AND
GEOLOGY
GEOLOGICAL LEGEND
Q QUATERNARY
T TERTIARY
M MESOZOIC
PALAEOZOIC
P PERMIAN Undifferentiated Crown Point Formation
Pzu Ligertwood Bed
Pzp Pertnjara Formation, Idracowra Formation, Horseshoe Bend Shale, Langra Formation, Polly Conglomerate
Pzm Mereenie Sandstone
Є-Ol Larapinta Group: Stokes Formation, Stairway Sandstone, Horn Valley Siltstone, Pacoota Sandstone
Є Pertaoorrta Formation, Cleland Sandstone, Mount Currie Conglomerate, Ayers Rock Arkose, Arumbera Greywacke
UPPER PROTEROZOIC
Puc Carnegie Formation
Pup Winnall Beds, Pertatataka Formation
Pua Areyonga Formation, Inindia Beds
Pub Bitter Springs Limestone, Pinyinna Beds
Puh Heavitree Quartzite, Dean Quartzite
AGE UNCERTAIN
pЄ Igneous and metamorphic rocks Undifferentiated
SCALE
40 MILES
60 KILOMETRES
True North
Magnetic North
TOPOGRAPHICAL LEGEND
Geological boundary
Road
Railway
Stream
GEOPHYSICAL LEGEND
Pertnjara Formation with radioactivity in excess of 37·5 cps
Mereenie Sandstone Outcrop with radioactivity in excess of 37·5 cps
Larapinta Group Outcrop with radioactivity in excess of 37·5 cps
Pertaoorrta Formation with radioactivity in excess of 37·5 cps
AP I Diamond drill hole
Radiometric contours
LOCATION DIAGRAM
Darwin
NT
WA
QLD
SA
NSW
INDEX TO 1:250,000 SHEETS
MOUNT RENNIE
MOUNT LIEBIG
HERMANNSBURG
ALICE SPRINGS
BLOODS RANGE
LAKE AMADEUS
HENBURY
RODINGA
PETERMANN RANGES
AYERS ROCK
KULGERA
MOUNT RENNIE
MOUNT LIEBIG
HERMANNSBURG
ALICE SPRINGS
BLOODS RANGE
LAKE AMADEUS
HENBURY
PETERMANN RANGES
AYERS ROCK
KULGERA
LAKE NEALE
LAKE AMADEUS
AP 1
AP 2
AP 3
AP 4
Based on G52/B0-11
Based on G52/B1-32
Geology after Geological Branch, Bureau of Mineral Resources, Geology and Geophysics, Map NT/A78

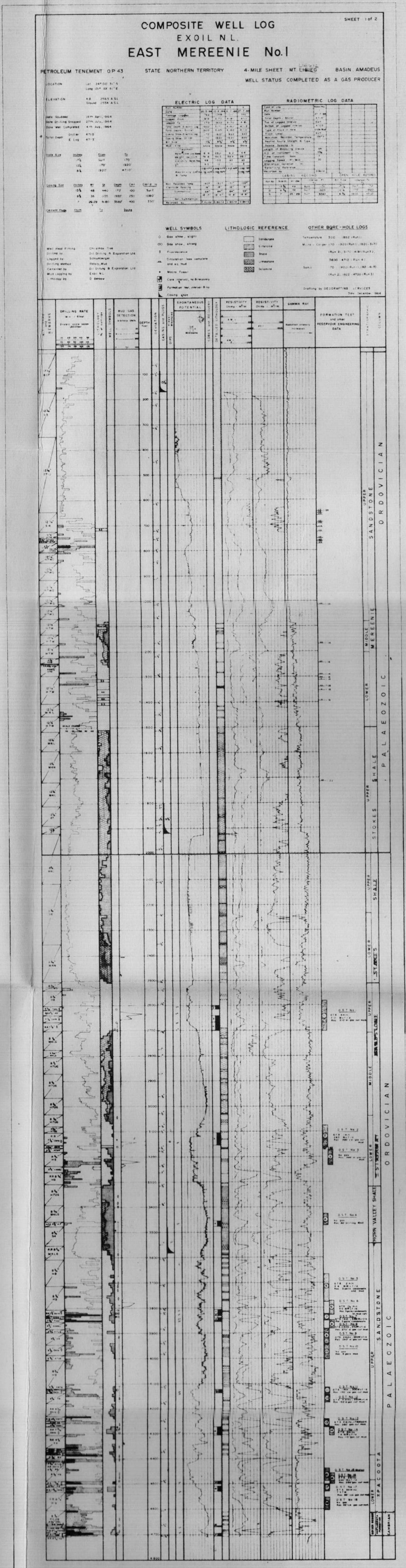
ALICE No. I



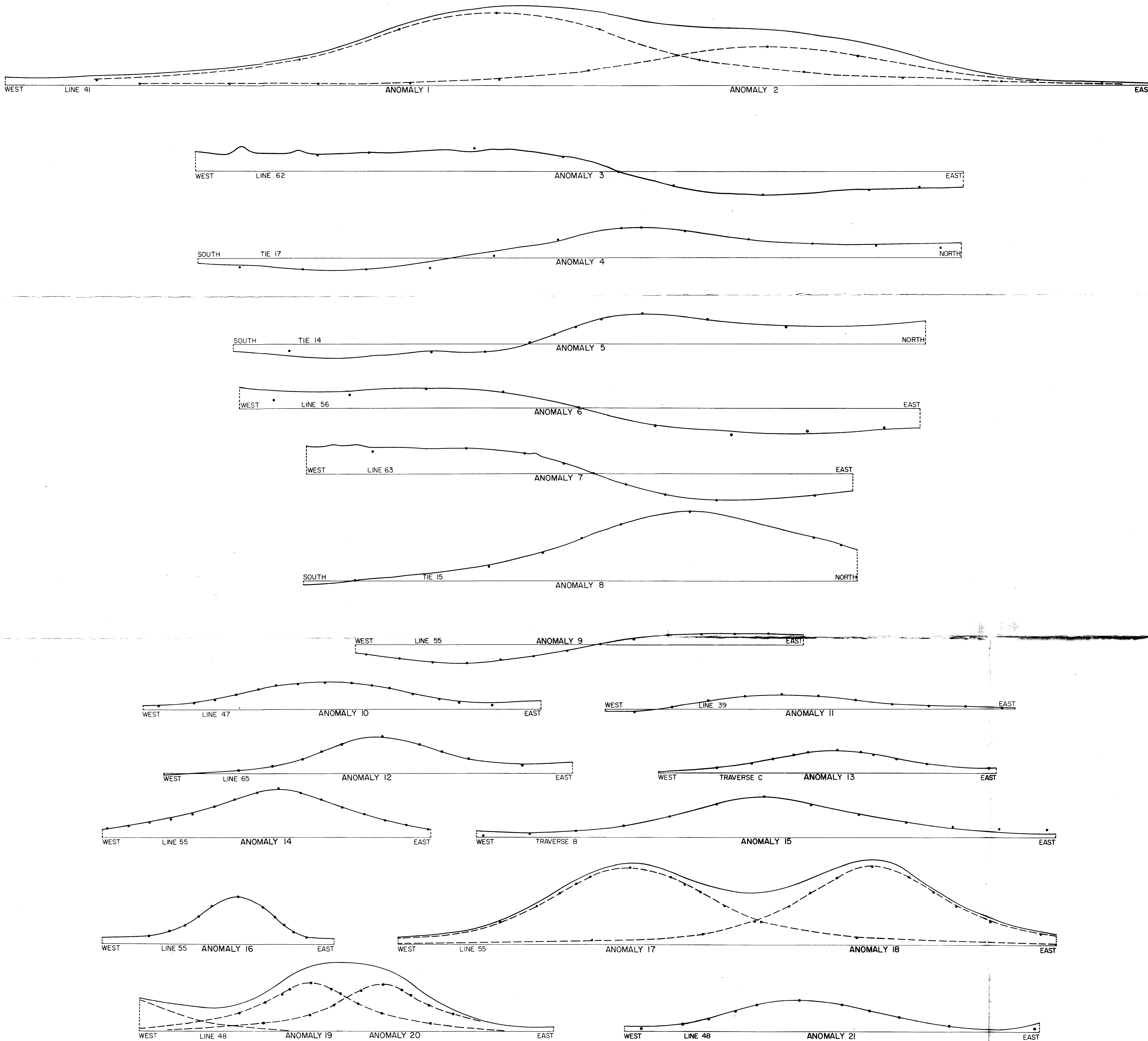
PALM VALLEY No. I



EAST MEREENIE No. I



COMPOSITE WELL LOGS
SHOWING
GAMMA RADIATION, STRATIGRAPHY
AND
LITHOLOGY



LEGEND

Original magnetic profile
Synthesised magnetic profile
Point on standard curve

AIRBORNE SURVEY, AMADEUS BASIN, NT, 1965

INTERPRETATION OF SELECTED ANOMALIES USING STANDARD CURVES

EXPLANATORY NOTES

THE REGIONAL MAGNETIC GRADIENT OF 1 GAMMA PER MILE WEST, AND 9·7 GAMMAS PER MILE SOUTH HAVE BEEN REMOVED FROM THE ORIGINAL MAGNETIC PROFILES.

MODEL PARAMETERS ARE LISTED IN TABLE 1, APPENDIX C