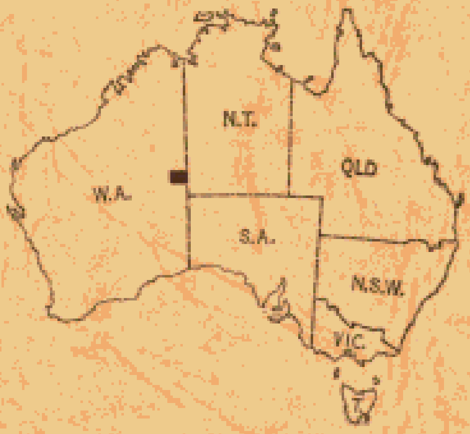
1 : 250,000

GEOLOGICAL SERIES

EXPLANATORY NOTES

RAWLINSON, W.A.



Sheet SG/52-2

International Index

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

1 : 250,000 GEOLOGICAL SERIES

EXPLANATORY NOTES

RAWLINSON, W.A.

Sheet SG/52—2 International Index

Compiled by D. J. Forman

Issued under the authority of the Hon. David Fairbairn,
Minister for National Development

1965

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

MINISTER: THE HON. DAVID FAIRBAIRN, D.F.C., M.P.

SECRETARY: R. W. BOSWELL

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

DIRECTOR: J. M. RAYNER

THESE NOTES WERE PREPARED IN THE GEOLOGICAL BRANCH

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Canberra A.C.T.

Explanatory Notes on the Rawlinson Geological Sheet

Compiled by D. J. Forman

The Rawlinson 1 : 250,000 Sheet area occupies the south-west portion of the Amadeus Basin within Western Australia. It lies adjacent to the Northern Territory border between longitudes 127° 30′ E. and 19° E. and latitudes 24° S. and 25° S.

The area is covered by air-photographs at a scale of 1 : 40,000. In 1959 the Department of Lands and Survey, Western Australia, produced, at a scale of approximately 1 : 63,360, uncontrolled photo-mosaics of tne 12 one-mile areas with the Sheet area. In 1960 the Department produced planimetric base maps at photo-scale of the one-mile areas from air-photographs, with astrofixes for control, and in 1961 an uncontrolled photo-mosaic of the Sheet area at a scale of 1 : 253,440.

The area lies within an aboriginal reserve, but there are no permanent inhabitants. Access is by the graded road which runs from Giles through the area to Alice Springs (Fig. 1). The area is undeveloped except at the Pass of the Abencerrages, where several bores have been drilled for water.

The climate is arid, with an annual rainfall of less than 10 inches. The winter months of May to September inclusive are cool and the climate is pleasant, but the summer months, particularly December and January, are hot and unpleasant. Humidity is low and dew occurs only after rain.

Geological Investigations

Many exploring and prospecting expeditions have traversed the area since Ernest Giles in 1873 (Giles, 1889), but very few of these contributed substantially to geological knowledge. In 1905 F. R. George (George & Murray, 1907) led a government prospecting expedition into the south-west corner of the Northern Territory and described rocks exposed along the eastern margin of the Rawlinson Sheet. In 1936, H. A. Ellis (1937) accompanied an expedition searching for 'Lasseter's reef' and penetrated as far as the Wallace Hills. In 1951 G. F. Joklik (1952) accompanied a similar expedition which crossed the Western Australian border north of the Kathleen Range and then traversed around 'Mount Ant' and part of the Walter James Range. Frome Broken Hill Co. Pty Ltd (Gillespie, 1959) made the first real attempt to study the geology of the area in 1958. They measured about 12 sections and traversed throughout the eastern half of the Rawlinson area. In 1960 and 1963 the area was mapped by Bureau of Mineral Resources geologists as part of the regional survey of the Amadeus Basin (Wells, Forman, & Ranford, 1965; Forman, 1965).

During October 1960 the Bureau of Mineral Resources flew aeromagnetic traverses from Giles (Goodeve, 1961) and in 1962 a helicopter gravity party covered the area as part of a larger reconnaissance gravity survey (Lonsdale & Flavelle, 1963).

DRAINAGE AND TOPOGRAPHY

The area is one of sandy desert broken by high mountain ranges and hills and low ridges and hills. Such defined drainage as exists is internal, and Rebecca Creek and the Docker River drain northwards towards Lake Hopkins (see Fig. 1).

The mountain ranges and hills, in the southern half of the Sheet area, include the Rawlinson Range, Schwerin Mural Crescent, Walter James Range, and Robert Range. Ridges and hills occur farther north in the Wallace Hills/Carnegie Range area.

The sandy desert contains innumerable long east-west sand dunes standing up to 60 feet above the level of the sand plain. The sand is fixed by a sparse to dense cover of spinifex and other small shrubs.

Lake Hopkins is a large salt lake, about 1450 feet above sea level, which forms a centre of internal drainage. The drainage is mostly subsurface and the lake is usually dry. Christopher Lake on the western margin is a smaller lake of the same type.

STRATIGRAPHY

Precambrian, Palaeozoic, Tertiary(?), and Quaternary sediments are preserved in the Rawlinson area, which is in the south-western part of the Amadeus Basin. The rocks contain no diagnostic fossils, and the ages have been assigned to them on the basis of stratigraphical position and lithological correlation.

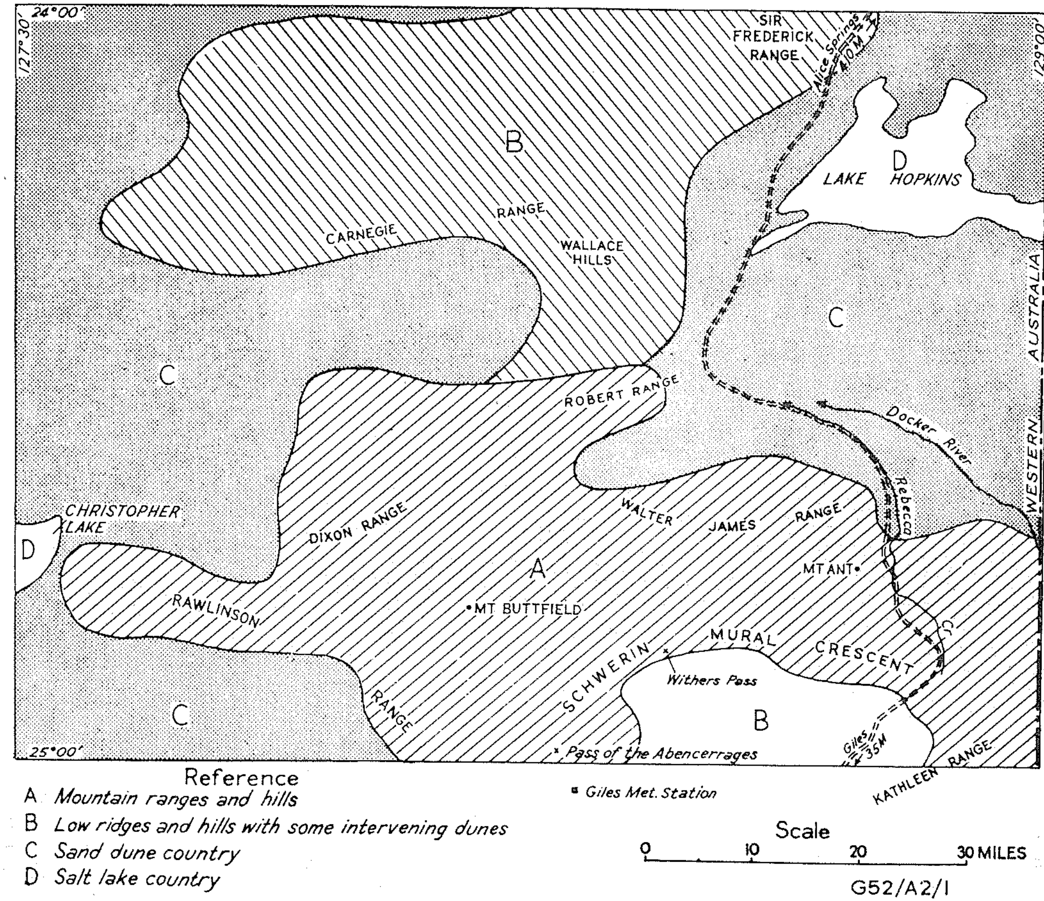
PRECAMBRIAN

The basal formation of the Amadeus Basin succession on the Rawlinson Sheet area is the Dean Quartzite of Upper Proterozoic age: the rocks stratigraphically beneath it are of unknown age, though they are, obviously, Precambrian. They crop out on the southern half of the Rawlinson Sheet area, where the Dean Quartzite and Bitter Springs Formation of Upper Proterozoic age have been infolded with them.

TABLE 1—STRATIGRAPHY OF RAWLINSON SHEET AREA

	Age	Rock Unit and Symbol	Thickness (feet)	Lithology	Remarks
Cainozoic	Quaternary	Qs Qa Qt Ql		Aeolian sand. Alluvium. Evaporites Travertine.	Salt lake deposit.
	Tertiary?	Tc		Conglomerate, sandstone.	Piedmont deposits.
Palaeozoic and Precambrian	Permian	Buck Formation	Up to 100	Coarse sandstone, siltstone, conglomerate with tillitic texture.	Continental fluvioglacial deposit.
				—UNCONFORMITY—	
	Ordovician-Devonian	Mereenie Sandstone Pzm	30 +	White fine-grained cross-bedded quartz sandstone.	Probably continental.
	Ordovician	O	20 +	Red limestone and calcarenite.	Marine, top and bottom not exposed.
				—? UNCONFORMITY—	
	Cambrian to Upper Proterozoic	Maurice Formation Pza	6000 +	Quartz sandstone, quartz greywacke, micaceous siltstone and micaceous sandstone.	Deltaic or paralic red beds.
		Sir Frederick Conglomerate Pzs	Variable 1200 +	Boulder, cobble and pebble conglomerate. Lenses of sandstone.	Laterally equivalent to Ellis Sandstone. Continental.
		Ellis Sandstone Pze	2000	Cross-bedded quartz sandstone and pebbly sandstone, some interbedded calcareous sandstone, and siltstone.	Laterally equivalent to Sir Frederick Conglomerate. ? Continental.
				—UNCONFORMITY—	
	Upper Proterozoic	Carnegie Formation Buc	4000 +	Quartz greywacke, sandstone, siltstone and shale.	Deltaic or paralic 'red beds'.
		Bitter Springs Formation Bub	?	Dolomite, limestone, calcilutite and siltstone. Stromatolites.	May contain an evaporite sequence. Possible source beds for petroleum.
		Dean Quartzite Bud	3900	Fine to coarse quartzite, sandstone, minor conglomerate, sericite-quartz schist, schistose, sericitic quartzite, sericitic quartzite. ?	Grade of metamorphism varies with amount of infolding and subsequent depth of tectonic burial.
	Undifferentiated	Dixon Range Beds pCd	? 6000	Quartz sandstone, siltstone, shale, arkose, feldspathic sandstone, fine conglomerate. Some quartz -mica schist.	Apparently conformable beneath Dean Quartzite.
		pC		Quartzite, quartz-sericite schist, sericite-quartz schist, quartz-feldspar-sericite schist, slate, phyllite, brown and grey feldspar porphyry, sheared basalt.	May be laterally equivalent to Dixon Range Beds.
		pCp		Brown and grey feldspar porphyry.	

Fig. 1 Physiographic divisions—Rawlinson 1 : 250,000 Sheet.



South of the Schwerin Mural Crescent and the Rawlinson Range the rocks are quartzite, quartz-sericite schist, sericite-quartz schist, quartz-feldspar-sericite schist, slate, pyhllite, brown and grey feldspar porphyry, and sheared basalt. They were probbaly part of a volcanic succession with interbedded sediments which has been metamorphosed. South of the Kathleen Range, on the Scott Sheet area, similar rocks are intruded by and in gradational contact with granite.

In the Schwerin Mural Crescent the metamorphosed Dean Quartzite rests without visible unconformity on these rocks and in the Walter James Range the Dean Quartzite rests with no visible unconformity on the little-altered sediments of the Dixon Range Beds.

The Dixon Range Beds are a sequence of quartz sandstone, siltstone, shale, arkose, feldspathic sandstone, fine conglomerate, greywacke, and some quartz-mica schist which are probably equivalent to the rocks south of the Kathleen Range. The base of the unit is not exposed and the succession is repeated by thrusting, but it may be over 6000 feet thick.

Upper Proterozoic

The Upper Proterozoic sediments at the base of the Amadeus Basin succession are the Dean Quartzite, Bitter Springs Formation, and Carnegie Formation.

The Dean Quartzite crops out in the southern half of the Sheet area, where it is infolded with the older Precambrian rocks and has been metamorphosed to a degree that varies according to the degree of infolding. The sequence of fine to coarse quartzite, sandstone, and minor conglomerate, and in places sericite-quartz schist, schistose sericitic quartzite, and sericitic quartzite, is 3900 feet thick at the Robert Range.

Included in the mapped unit, at the top, are siltstone, shale, slate, and calcareous siltstone which are probably equivalent to the Bitter Springs Formation.

On the northern half of the Sheet area the Bitter Springs Formation is the oldest formation exposed. It is overlain conformably by the Carnegie Formation, which is a sequence of sandstone, quartz greywacke, siltstone, and minor shale over 4000 feet thick.

Upper Proterozoic Cambrian

The Ellis Sandstone, its lateral equivalent the Sir Frederick Conglomerate, and the Maurice Formation form a thick conformable sequence of unfossiliferous clastic sediments deposited unconformably on the Carnegie Formation after or during the Petermann Ranges Orogeny (Forman, 1965). The Sir Frederick Conglomerate contains phenoclasts derived from the underlying Upper Proterozoic Formations and from the south-west margin of the Amadeus Basin.

The age of the sequence is doubtful; but the Ellis Sandstone and Sir Frederick Conglomerate are probably equivalent to the Mount Currie Conglomerate on the Bloods Range Sheet, which is rather tentatively assigned to the uppermost Precambrian, and the Maurice Formation to the Cleland Sandstone, which is Cambrian.

Ordovician

Red limestone and calcarenite of probable Ordovician age crops out east of Lake Hopkins. No fossils were found in these sediments, but they dip at a low angle to the north beneath an isolated outcrop of the Mereenie Sandstone.

Ordovician-Devonian

The Mereenie Sandstone crops out east of Lake Hopkins as a low inconspicuous ridge in which about 30 feet of white fine-grained quartz sandstone is exposed.

Permian

Outcrops of Buck Formation are common on the western side of the area, where they occur as continental fluvioglacial outliers from the Permian in the Canning Basin. The deposits contain faceted and striated pebbles, cobbles, and boulders in a matrix of both sandstone and siltstone.

Tertiary

Piedmont conglomerate crops out near the high mountain ranges and hills in the south of the area.

Quaternary

Quaternary sediments cover approximately three-quarters of the Rawlinson Sheet area. Travertine and evaporites occur in and around Lake Hopkins; travertine also occurs over outcrops of the Bitter Springs Formation, the Carnegie Formation, and the Ellis Sandstone. Alluvium and aeolian sand cover the remainder of the area.

STRUCTURE AND GEOLOGICAL HISTORY

The older Precambrian sediments were laid down during a period of volcanic activity and were gently folded, but not metamorphosed, before the Upper Proterozoic sediments were deposited.

The Dean Quartzite and Bitter Springs Formation were laid down in an Upper Proterozoic sea during a period of comparative tectonic calm. Later in the Upper Proterozoic tectonic activity increased near the south of the

Rawlinson Sheet area and clastic 'red beds' of the Carnegie Formation were deposited. The Carnegie Formation was probably deposited in a paralic enrivonment.

After the Carnegie Formation had been laid down, tectonic activity in the south reached a climax, and the Dean Quartzite, Bitter Springs Formation, and older Precambrian sediments were folded into a large-scale recumbent fold and metamorphosed in the most deeply buried areas. The orogeny produced a mountain range in the south, and the Sir Frederick Conglomerate, Ellis Sandstone, and Maurice Formation were deposited in the near-shore areas with gentle unconformity over the Carnegie Formation. All these formations were probably folded during the final stages of the orogeny, which is known as the Petermann Ranges Orogeny. The sedimentary formations overlying the Bitter Springs Formation were folded over a décollement surface within the Formation.

In the Ordovician, thin marine sediments were deposited in the north-east of the Rawlinson area. Late in the Ordovician the area was uplifted and remained a land mass throughout the Silurian and Devonian. The Mereenie Sandstone was deposited in a predominantly continental environment during this period. After its deposition the whole mass was gently folded. In the Permian the area was glaciated and the continental, fluvio-glacial deposits of the Buck Formation were deposited in the west.

Subsequent weathering and erosion have produced the widespread Tertiary and Quaternary deposits.

ECONOMIC GEOLOGY

Underground Water

The only water bores in the area are at Giles to the south of the Pass of the Abencerrages, where good water is obtained from alluvium overlying Precambrian porphyroblastic schist.

Water could also occur at shallow depth in the alluvial basin of Rebecca Creek in the area south of the Schwerin Mural Crescent, or south of Withers Pass.

Petroleum Prospects

The Bitter Springs Formation is a possible source rock for petroleum and the overlying Carnegie Formation may contain cap and reservoir rocks.

The northerly trending anticline between the Carnegie Range and the Sir Frederick Range contains a core of Carnegie Formation and may be a suitable site for a shallow test of the area's petroleum prospects. However, as both potential source and reservoir rocks are of Upper Proterozoic age the petroleum prospects of the area are rated as poor.

Evaporites

The Bitter Springs Formation is known to contain evaporite deposits in the central and eastern parts of the Amadeus Basin. Evaporites probably occur in the Bitter Springs Formation on the Rawlinson Sheet area and a test hole for oil or gas could be extended into the Bitter Springs Formation to test whether the evaporites contain potash or other economic deposits.

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T. J. HUGHES, Government Printer, Tasmania.

RAWLINSON

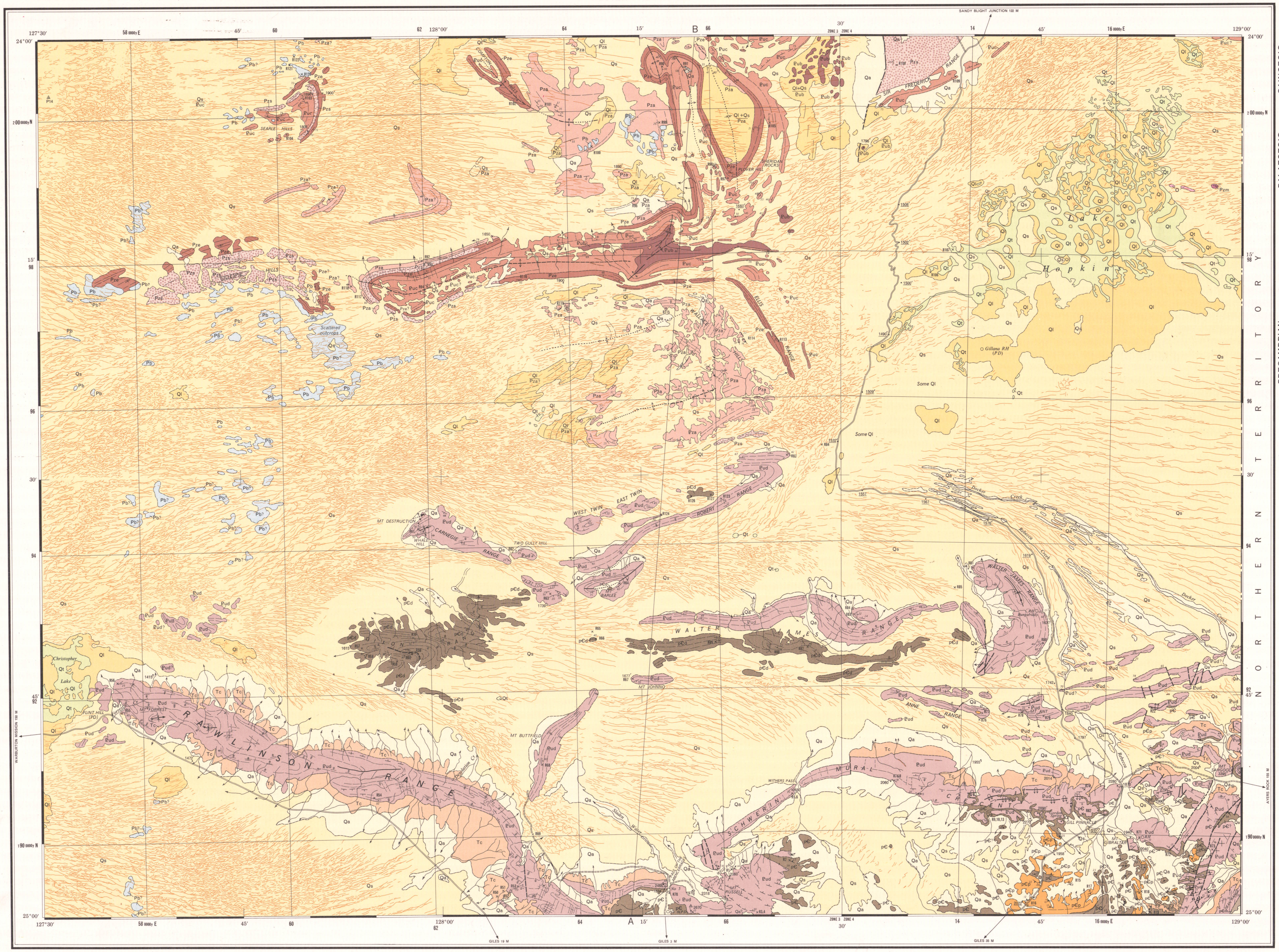
WESTERN AUSTRALIA

AUSTRALIA 1:250,000 GEOLOGICAL SERIES

SHEET SG 52-2

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

FIRST EDITION 1966



Reference

CAINOZOIC	QUATERNARY		Qs	Sand
			Qa	Alluvium
			Qt	Evaporites
			Ql	Travertine
	TERTIARY ?		Tc	Conglomerate, sandstone
PALAEOZOIC	PERMIAN	Buck Formation	Pb	Coarse sandstone, siltstone, conglomerate with tillitic texture
	ORDOVICIAN —DEVONIAN	Mereenie Sandstone	Pzm	Fine, white, cross-bedded quartz sandstone
	ORDOVICIAN		O	Red limestone and calcarenite
	UPPER PROTEROZOIC —CAMBRIAN	Maurice Formation	Pza	Quartz sandstone, quartz greywacke, micaceous siltstone, micaceous sandstone,
		Sir Frederick Conglomerate	Pzs	Boulder, cobble and pebble conglomerate. Lenses of sandstone
		Ellis Sandstone	Pze	Cross-bedded and pebbly sandstone, quartz sandstone, siltstone, some interbedded calcareous sandstone
PRECAMBRIAN	UPPER PROTEROZOIC	Carnegie Formation	Puc	Quartz greywacke, sandstone, siltstone, shale
		Bitter Springs Formation	Pub	Dolomite, limestone, calcilutite, siltstone. Stromatolites
		Dean Quartzite	Pud	Fine to coarse quartzite, sandstone, some conglomerate and sericite-quartz schist, schistose sericitic quartzite and sericitic quartzite
	UNDIFFERENTIATED	Dixon Range Beds	p€d	Quartz sandstone, siltstone, fine conglomerate, shale arkose, feldspathic sandstone, greywacke, some quartz-mica schist
			p€	Quartzite, quartz-sericite schist, sericite-quartz schist quartz-feldspar-sericite schist, slate, phyllite, sheared basalt
			p€m	Porphyroblastic schist, quartz-feldspar porphyry
			p€p	Quartz-feldspar porphyry
			p€g	Granite (section only)

Geological boundary

Anticline, showing plunge

Overturned anticline

Syncline, 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 strata

Prevailing dip

Vertical strata

Horizontal strata

Overturned strata

Dip < 15°

Dip 15° – 45°

Dip > 45°

Trend lines

Joint pattern

} air photo interpretation

Strike and dip of foliation

Vertical foliation

Plunge of lineation

Macrofossil locality

× R21 Text reference to specimen locality

Water bore

Spring

RH Rock hole

Sand dune

Road

Track

Trigonometrical station

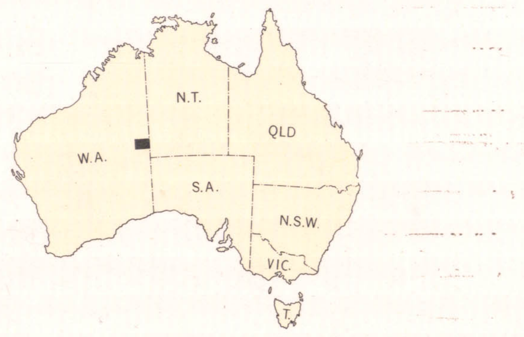
•1710′ Height in feet, instrument levelled

•1624′ Height in feet, barometric

} datum mean sea level Port Augusta

(PD) Position doubtful

Compiled and published by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. Issued under the authority of the Hon. David Fairbairn, Minister for National Development. Base map compiled from controlled air-photo mosaics supplied by the Western Australian Department of Lands and Surveys. Aerial photography by the Royal Australian Air Force; complete vertical coverage at 1:40,000 scale.
Transverse Mercator Projection.



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MORRIS SF 51-16	RYAN SF 52-13	MACDONALD SF 52-14	MOUNT RENNIE SF 52-15	MOUNT LIEBIG SF 52-16
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2°30′E 3°E 4°E 3°30′E

ANNUAL CHANGE 1′E

Scale 1:250,000

5 0 5 10 15 MILES

5 0 5 10 15 20 25 KILOMETRES

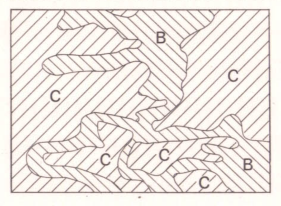
BLACK NUMBERED LINES INDICATE THE 20,000 YARD TRANSVERSE MERCATOR GRID, ZONES 3 AND 4 (AUSTRALIA SERIES)

Section

Cainozoic sediments omitted from section

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

GEOLOGICAL RELIABILITY DIAGRAM



B Reconnaissance—traverses and air-photo interpretation

C Sketchy: air-photo interpretation

Geology and compilation, 1962, by: A. T. Wells, D. J. Forman, L. C. Ranford
Geology, 1963, by: D. J. Forman, P. M. Hancock
Recompiled, 1964, by: A. T. Wells, D. J. Forman
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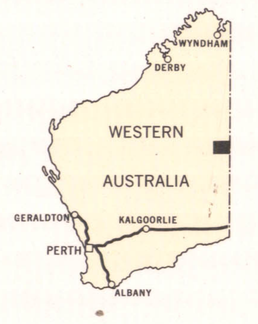
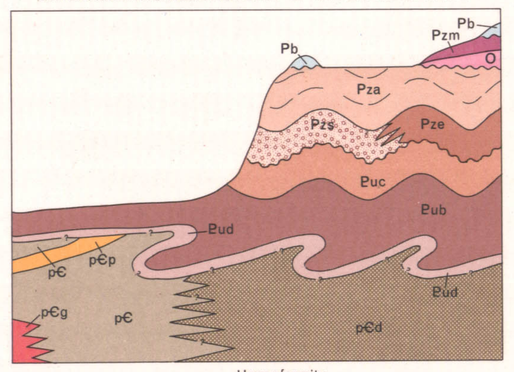
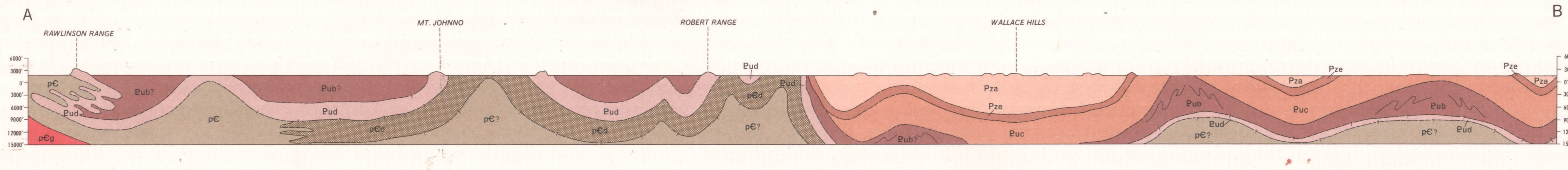
Drawn by: Mercury Press Pty. Ltd., Hobart



DIAGRAMMATIC RELATIONSHIP OF MAJOR ROCK UNITS



Unconformity



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RAWLINSON

SHEET SG 52-2

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