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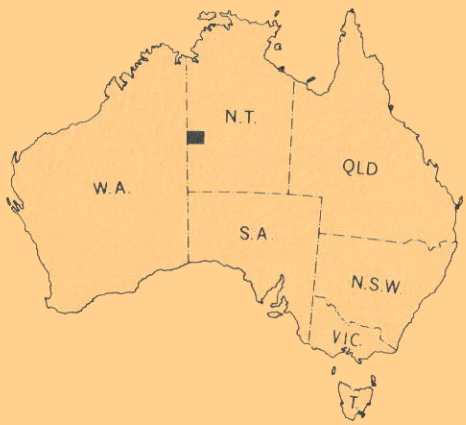
HIGHLAND ROCKS

NORTHERN TERRITORY



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DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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COMPILED BY I. M. HODGSON

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Explanatory Notes on the Highland Rocks Geological Sheet

Compiled by I. M. Hodgson

The Highland Rocks 1:250 000 Sheet area is bounded by latitudes 21° and 22°S and longitudes 129° and 130°30′E; its western boundary is the Northern Territory/Western Australia border.

The area lies southwest of the road connecting Alice Springs and Halls Creek, and forms part of the Lake Mackay Aboriginal Reserve. It is uninhabited, and the only track known in the area is in the southeast; from a few kilometres west of Mount Farewell (22°00S, 130°16′E) it leads to Vaughan Springs homestead in Mount Doreen Sheet area to the southeast. Travel across country is slow and difficult because of the absence of tracks, innumerable sand dunes, and navigation problems caused by the general low relief and lack of prominent landmarks.

The climate is semi-desert, and the annual rainfall averages about 200 mm. The rain falls mostly in the summer, but the amount and distribution, both annual and seasonal, are variable. Maximum summer temperatures are about 40°C, and frosts occur in winter.

The vegetation is sparse, and consists mainly of spinifex, small shrubs, and scattered trees.

The Sheet area was mapped by the Bureau of Mineral Resources (BMR) in 1972 and 1973 as part of a geological reconnaissance of The Granites-Tanami region. Because access on the ground was so difficult, the area was mapped wholly by helicopter traverses. In 1973, when the main part of the area was mapped, about 50 hours were flown in 11 days, and up to 40 landings a day were made.

Aerial photographs used for mapping are at a nominal scale of 1:80 000, and were flown in 1971 and 1972 (copies are available from the Division of National Mapping, Canberra).

Previous investigations

The first recorded exploration in Highland Rocks Sheet area was by Warburton, who crossed the area from southeast to northwest in 1873 (Warburton, 1875; Feeken, Feeken, & Spate, 1970). He named Mount Farewell on about 13 June 1873, and reached Lake White, which he named after his cook, on about 6 August. He described the area as 'a most hopeless country indeed'.

Sixty years later, in 1933, Terry traversed the area, naming False Mount Russell and Wickhams Well (Terry, 1937).

No systematic geological work was done in the Sheet area until the 1973 survey, although Mount Farewell and the McEwin Hills were visited by BMR geologists in 1969, during mapping of Lake Mackay Sheet area (Nicholas, 1972).

In 1967, Highland Rocks Sheet area was included in a reconnaissance gravity survey of parts of the Northern Territory and Western Australia (Whitworth, 1970). The Bouguer anomaly contours are shown on the accompanying map.

TOPOGRAPHY AND DRAINAGE

Highland Rocks Sheet area ranges in altitude from about 550 m above sea level in the southeast to about 330 m in the northwest, where Lake White forms part of a centre of inland drainage. Part of Lake Mackay, a large salt lake covering much of Webb and Lake Mackay Sheet areas, extends northward into the southwest corner of the Sheet area. Its floor is about 360 m above sea level.

Like the surrounding region, the area is mostly an undulating sand plain from which rise residual hills, such as False Mount Russell in the northwest, cuestas, ridges, and mounds. Much of the area is crossed by east-trending longitudinal sand dunes. There are no significant surface drainage channels.

A series of laterite rises in the central part of the area is named Highland Rocks.

GEOLOGY

The stratigraphy is summarized in Table 1. A general account of the regional geology is given in Blake & Hodgson (1975) and a detailed account is in preparation (Blake, Hodgson, & Muhling, in prep.). A more detailed account of the geology of the Highland Rocks Sheet area is in Hodgson (1974). The geology of adjoining Sheet areas is described in the above reference, Blake & Yeates (1976), Nicholas (1972), Hodgson (1976), and Stewart (1976).

STRUCTURE

The Highland Rocks Sheet area forms part of two tectonic units, the *Arunta Block* and the *Birrindudu Basin* (see Structural and Tectonic Sketch). The Arunta Block is made up of metamorphic rocks of the Arunta Complex and granite, which is possibly Carpentarian. No major folds have been mapped within the Arunta Block, because outcrops are discontinuous, and exposures poor. Where quartzite and schist are seen together, the bedding of the quartzite and the schistosity of the schist are roughly parallel and, like the foliation of the gneiss and granite, are steep to vertical, and trend generally east.

The sediments in the Birrindudu Basin, which belong to the Redcliff Pound Group, are strongly unconformable on the Arunta Block. They appear to have been folded into a number of anticlines and synclines, whose steeply dipping axes trend northeast in the south, and east in the north, and may also have been faulted.

Non-marine Palaeozoic sediments in the northwest and south may have been deposited in two separate basins. The southern boundary of the northern basin is at least partly bounded by a fault, and in the southern basin the sediments have been folded into a tight east-trending syncline.

Whitworth (1970) has divided the Sheet area into three regional gravity units. A large area of metamorphic rocks corresponds to the *Willowra Regional Gravity Ridge;* the southeast part of the Sheet area lies in the *Yuendumu Regional Gravity Low;* and the northwest is part of the *Pedestal Gravity Low,* which includes part of a Palaeozoic basin.

TABLE 1. SUMMARY OF STRATIGRAPHY

Age		Unit and map symbol	Estimated max. thickness (m)	Rock types	Stratigraphic relations	Remarks
CAINOZOIC	QUATERNARY	Qa	?	Sand, silt, clay; minor halite, gypsum	Superficial veneer on older units	Alluvial, lacustrine, and evaporitic; occupies claypans and ephemeral lakes near Lake White
		Qe	?	Halite, gypsum, sand, silt, clay	Superficial veneer on older units	Evaporitic sediments restricted to salt lakes; distinguished from Qa by white salt crust visible on aerial photographs
		Qs	?	Sand, silt	Superficial veneer on older units	Alluvial and aeolian; occupies barely perceptible drainage depressions
		Qz	?	Sand; minor gravel and rubble	Superficial veneer on older units	Aeolian; piedmont gravel and rubble on slopes flanking residual hills
		Qm	?	Sand, halite, gypsum, calcrete	Superficial veneer on older units	Aeolian and evaporitic; forms islands in the Lake White comlex and banks on W margins of saltpans
		Qr	?	Red silt and clay	Superficial veneer on older units	Red soil in SE corner of Sheet area; colluvial and alluvial outwash lateritized rocks
		Czq	?	Vein quartz rubble	Superficial veneer on Arunta Complex	Residue from weathering of quartz-veined metamorphic rocks and granite; commonly shows contorted trends on aerial photographs, reflecting trends in underlying rocks
	TERTIARY	Tt	?	Calcrete: white, pink, and grey inorganic limestone; partly silicified.	Superficial veneer on older units	Forms low rises in broad shallow depressions; probably a subsurface deposit formed in Tertiary drainage depressions
		Ts	1	Silcrete: pale buff to grey; angular quartz grains in fine siliceous matrix.	Superficial veneer on ?Cretaceous, Palaeozoic, and Proterozoic rocks	Commonly developed on quartz-rich rocks, but most occurrences too small to show on map
		(stipple)	7	Laterite	Veneer on pre-Tertiary units	Pisolitic upper part of lateritic weathering profile; caps most metamorphics and granite in sheet area. Remnants of Tennant Creek erosion surface (Hays, 1967)

TABLE 1. SUMMARY OF STRATIGRAPHY—(*continued*)

Age	*Unit and map symbol*	*Estimated max. thickness (m)*	*Rock types*	*Stratigraphic relations*	*Remarks*
MESOZOIC ?CRETACEOUS	K?	3	Quartzose sandstone, conglomerate; abundant clay matrix	Unconformable on granite and Arunta Complex	May be correlated with Larranganni Beds to north and Hazlett Beds to W (Blake et al., in prep.); non-marine
			UNCONFORMITY		
PALAEOZOIC	Pedestal Beds Pzs	500	Clayey quartzose sandstone; minor conglomerate, siltstone, shale	Unconformable on Arunta Complex, and granite; inferred to be unconformable on Munyu Sandstone and Lucas Formation	N and S edges of Sheet area. No fossils found; probably fluvial
			UNCONFORMITY		
	Lucas Formation Pzl	1000	Calcareous and non-calcareous sandstone, siltstone, mudstone; minor limestone	Inferred to be unconformable on Erica Sandstone	In NW corner of Sheet area only; gently dipping to flat-lying. No fossils found; probably fluvial and lacustrine
			MAJOR UNCONFORMITY		
PROTEROZOIC ADELAIDEAN REDCLIFF POUND GROUP	Erica Sandstone Ᵽre	800	Sublithic arenite; minor quartz arenite; clayey matrix, medium to fine-grained, mainly medium-bedded, cross-bedding and ripple marks common	Inferred to be overlain unconformably by Lucas Formation; inferred to be conformable on Marraba Formation	W edge of Sheet area only
	Murraba Formation Ᵽrb	500	Chert-granule conglomerate, sublithic arenite, quartz arenite mainly fine-grained, mainly thin-bedded, but conglomerate up to 2 m thick; cross-bedding and ripple marks common	Inferred to be conformable on Munyu Sandstone	Crops out in syncline NE of Sydney Margaret Range in NW of Sheet area
	Munyu Sandstone Ᵽru	300	Quartz arenite, sublithic arenite, conglomerate; arenite medium to coarse-grained, cross-bedded, medium to thin-bedded	Unconformably overlies granite and Arunta Complex; Inferred to be overlain unconformably by Pedestal Beds. Correlated with Lewis Range and Muriel Range Sandstones to north	Forms NE-trending strike ridges in W of Sheet area

TABLE 1. SUMMARY OF STRATIGRAPHY—(*continued*)

Age	*Unit and map symbol*	*Estimated max. thickness (m)*	*Rock types*	*Stratigraphic relations*	*Remarks*
			MAJOR UNCONFORMITY		
PROTERO-ZOIC CARPEN-TARIAN	Ꝑg		Biotite granite (sensu lato), muscovite-biotite adamellite, biotite granodiorite; minor aplite and pegmatite	Intrudes Arunta Complex; overlain by Munyu Sandstone, Pedestal Beds, and ?Cretaceous sediments	Most outcrops strongly lateritized; in places difficult to distinguish from gneiss and schist. Probably similar in age to dated granites from other parts of The Granites-Tanami region
?ARCHAEAN	Arunta Complex Aa, Aag, Aas Aaq	?	Gneiss, schist, quartzite	Intruded by granite; overlain unconformably by Munyu Sandstone, Pedestal Beds, and ?Cretaceous. Correlated with Tanami complex to north	Strongly lateritized; mostly exposed in breakaways. Rock types commonly interbedded, and cannot everywhere be mapped separately

GEOLOGICAL HISTORY

The oldest rocks in the area are the metamorphics of the Arunta Block. These were originally sediments, which may have been deposited during the Archaean. After being folded and regionally metamorphosed, they were intruded by granite, probably early in the Carpentarian.

For the remainder of the Carpentarian the area may have been part of a landmass. Certainly, any sediment deposited during this period was eroded before the oldest unit of the Redcliff Pound Group, the Munyu Sandstone, was laid down. The Birrindudu Basin sediments were later folded, faulted, and uplifted, perhaps during the Petermann Ranges Orogeny near the end of the Adelaidean, forming a landmass which has persisted probably throughout the Phanerozoic.

During the Palaeozoic, fluvial and lacustrine sediments of the Lucas Formation and Pedestal Beds were laid down in shallow basins in the northwest and south. Subsequently, those in the south were folded into a tight east-trending syncline, and those in the northwest were faulted along their southern edge.

Non-marine Mesozoic sediments are represented by patches of quartzose sandstone and conglomerate.

Subaerial erosion and weathering throughout at least the Cainozoic have formed a widespread sand plain with dunes and scattered residual hills of bedrock, and produced a lateritic weathering profile, the last being evidence that the climate was wet for some of this time.

ECONOMIC POTENTIAL

No mineralization of any kind is known in the Sheet area, but very little prospecting has been done. The metamorphics, which are the most likely host rocks for mineralization, are poorly exposed, as over most of the area they are either capped by laterite or concealed by sand. Where they are exposed they are generally deeply weathered.

Water

There are no watercourses in the area. Rainwater may last a few days in the claypan complexes around Lake White in the northwest and the northern tip of Lake Mackay in the southwest. Other occurrences of surface water are a soak named Wickhams Well (lat. 21°16′10″S, long. 129°36′10″E), and two small rockholes 50 and 95 km east of False Mount Russell. Both rockholes are quite exposed and therefore probably short-lived.

There is no information available on subsurface water, as there are no bores in the Sheet area. However, judging from data on bores in The Granites Sheet area to the north and the Mount Theo Sheet area to the east, water of variable quality and quantity is probably present at shallow depth beneath calcrete.

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