1:250 000 GEOLOGICAL SERIES — EXPLANATORY NOTES

MOUNT THEO

NORTHERN TERRITORY

SF/52-8 INTERNATIONAL INDEX

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

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COMPILED BY A. J. STEWART

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Explanatory Notes on the Mount Theo 1:250 000 Geological Sheet

Compiled by A. J. Stewart

The Mount Theo 1:250 000 Sheet area is situated in the southwestern part of the Northern Territory, between latitudes 21°00′ and 22°00′S and longitudes 130°30′ and 132°00′E. The northern three-quarters of the Sheet area is in the Tanami Desert Wildlife Sanctuary; the remainder is occupied by the Chilla Well, Mount Doreen, and Mount Denison pastoral leases, where beef cattle are raised.

The main road in the region is a graded earth road that crosses the western part of the Sheet area and connects Alice Springs with The Granites, a distance of about 550 km. A graded earth road leaves the main road at Refrigerator Well, in the northern part of the Sheet area, and continues northwest for 320 km to Balgo Mission in the Lucas Sheet area. Another earth road joins Floodout Bore in the southern part of the area with Cox's Bore in the adjoining Mount Doreen Sheet area to the south. An unimproved track originating at new Mount Doreen homestead crosses the southwest corner of the area, and continues into the southern part of the Highland Rocks Sheet area to the west. Parts of the old Granites Track, now no longer used, are still visible in the eastern part of the Mount Theo Sheet area.

The average annual rainfall in the area is about 300 mm, but its occurrence is very irregular. Summer temperatures frequently exceed 40°C, and in general temperatures fluctuate markedly, both diurnally and seasonally.

Vertical aerial photographs (K-17) of most of the Mount Theo Sheet area, at a nominal scale of 1:50 000, were flown by the Royal Australian Air Force in 1950; the westernmost part of the Sheet area appears on the Highland Rocks K-17 photographs, and the northern edge, on Run 15 of the Mount Solitaire K-17 set. A photomosaic and topographic map at 1:250 000 scale are available from the Division of National Mapping. A second set of vertical aerial photographs (RC-9) of the entire Mount Theo Sheet area, at a nominal scale of 1:80 000, was flown in 1973.

During the survey by the Bureau of Mineral Resources (BMR), in 1972, members of the Walbiri Tribe from Yuendumu supplied the aboriginal names of many of the topographic features in the area. Where no European names existed, use of the aboriginal names for cartographic purposes was subsequently approved by the Northern Territory Place Names Committee, and the names are recorded on the geological map.

Previous investigations

All known published and unpublished references to the Mount Theo Sheet area are listed in the bibliography. The earliest geological observations in the area were by Maurice & Murray in 1902, who recorded the rock types at Mount Singleton, Sowden Hill, and McDiarmid Hill during their south to north crossing of Australia (Murray, 1904). Kiek (1941) recorded the mining of a small deposit of wolframite at the western end of the Wabudali Range, and Rogers (1954) determined the X-ray powder diffraction data of the rare phosphate mineral, triplite, from the same area.

The most comprehensive surveys of the area have been by CSIRO, who included the Mount Theo Sheet area in their investigation of the lands of the Alice Springs area in 1956-57 (Perry et al., 1962), and BMR, who surveyed a strip along the southern edge of the Mount Theo Sheet area in their magnetic and radiometric survey of the Mount Hardy region in 1958 (Carter, 1960) and included the entire Sheet area in a reconnaissance gravity survey in 1967 (Whitworth, 1970). In 1968, A. T. Wells (BMR) visited the Mount Singleton area during a geological survey of the neighbouring Mount Doreen Sheet area (Wells, Evans, & Nicholas, 1968). In 1972, the author mapped the Mount Theo Sheet area by helicopter, and in the same year a drill party from the BMR Petroleum Technology Section drilled four stratigraphic holes to basement along The Granites-Alice Springs road.

PHYSIOGRAPHY

The Mount Theo Sheet area is largely a flat sandy plain broken by a few isolated hills, ridges, and low cliffs of laterite. Form lines, sketched in Figure 1 from barometric heights supplied by Geophysical Branch, BMR, show that the plain has a very gentle northerly slope of about 0.05°. The Sheet area can be divided into five physiographic regions (Fig. 1):

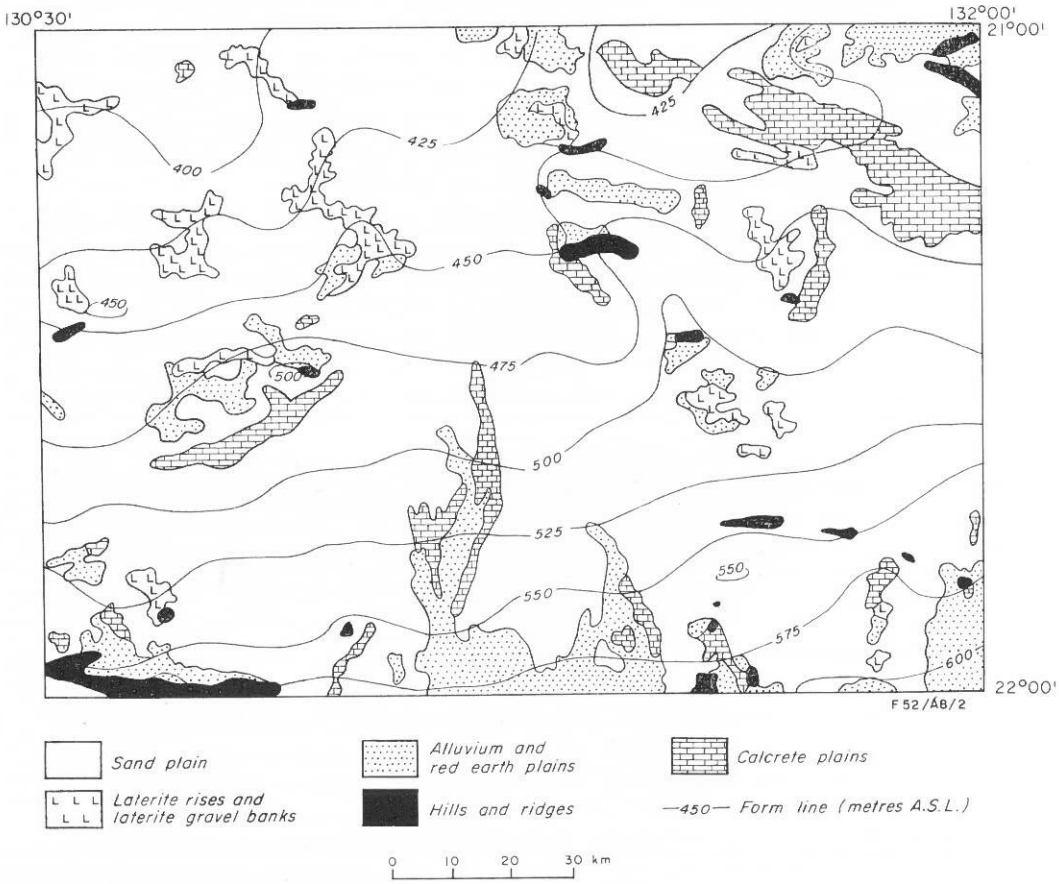

Fig. 1. Physiography.

An extremely flat *sand plain* occupies most of the Sheet area; the sand is generally only 1 m or so thick, and is underlain by up to 5 m of alluvium. Numerous longitudinal dunes, which are the easternmost fringe of the dune field of the Great Sandy Desert of Western Australia, are present in the west of the area and a few other places.

Laterite rises and gravel banks, and *red soil plains* (the latter two being the erosional products of the laterite) are found mainly on the higher parts of the northwest of the Sheet area; smaller areas are present on high ground in the northeast and southwest. The laterite, which forms a gently undulating cuirass on the underlying rocks, has been considerably dissected, and the eroded hollows are filled with alluvium and sand. The red earth in the south of the area is part of the extensive red earth plains in the north of the adjoining Mount Doreen Sheet area.

Calcrete plains have formed in low-lying areas of internal drainage, mainly in the southwest and northeast. Along the southern edge of the Sheet area, calcrete and alluvium have been deposited in the flood-outs of the large streams that flow north from the hills in the Mount Doreen Sheet area.

Hills and ridges are small and isolated. The highest hills are Mount Theo, with a relief of 120 m, and Mount Singleton. Some quartz ridges, about 15 m high, are present in the northeast and southeast.

STRATIGRAPHY

The stratigraphy of the Mount Theo Sheet area is summarized in Table 1, and the relations between the rock units are shown in diagrammatic form in the cross-section and rock relationship diagram. There are two main stratigraphic subdivisions, a basement of Precambrian rocks of the Arunta Block, which forms all the hills and ridges in the area, and a widespread cover of superficial Cainozoic sediments. The basement rocks can be divided into nine lithologic units, whose relations are only partly known.

Precambrian

Schist, gneiss, and quartzite (pЄ). A few low hills in the southeast and southwest are, by analogy with similar outcrops in the adjoining Highland Rocks Sheet area, probably composed of schist and gneiss, and similarly, a single strike ridge near the centre of the western edge of the Mount Theo Sheet area probably consists of thin-bedded quartzite and schist (Hodgson, 1974). None of these exposures was visited during the 1972 survey, and their relations to other units in the Sheet area are unknown.

Granulite (pЄn). Two isolated hills of pelitic granulite are exposed in the southwest, north of the Wabudali Range. The rocks are massive and coarse-grained, and contain cordierite, garnet, sillimanite, biotite, microcline and spinel. Partial alteration of garnet to sericite, and cordierite to pinite shows that slight retrogressive metamorphism has taken place. The relations of the granulites to the other basement rocks in the area are unknown, but they could be the high-grade metamorphic facies of the Lander Rock Beds.

Hornblende amphibolite (pЄb) was intersected at the bottom of stratigraphic hole BMR St 4, and consists of hornblende, andesine, chloritized biotite, quartz, sphene, and accessory apatite and opaque minerals; the hand specimen is fine to medium-grained and schistose. The relations of the amphibolite to other units are unknown.

TABLE 1. STRATIGRAPHY OF MOUNT THEO SHEET AREA

Age		Formation and map symbol	Maximum thickness (m)	Lithology	Topography	Remarks
QUATERNARY		Qc	?1	Colluvium; loose scree and rubble	Talus slopes	Grades into alluvium
		Ql	7.5	White nodular porous calcrete; some chalcedony	Low mounds	Partly concealed by sand
		Qa	5	Red-brown alluvial silty sand; river gravel	Flood-outs, flats	Above water table
		Qs	ca 3	Yellow-brown fine aeolian sand	Plain, some dunes	Dunes are fixed except along crests
		Qr	?1	Red soil	Plains and flats	Partly concealed by sand
QUATERNARY OR TERTIARY		Czc	?10	Fanglomerate; consolidated scree, breccia	Talus slopes	Dissected and bevelled
		Czg	?1	Laterite gravel	Low mounds	Probably passes down into laterite
		Czs	93	Yellow to brown sand, silt, and clay	Subsurface only	Probably old river channel deposits
EARLY TERTIARY		Tlf	3	Red-brown concretionary laterite	Low mesas, rounded hills	Passes down into mottled zone of parent rock
		q	10	Mottled brown and white brecciated vein quartz with limonite and hematite	Sharp ridges	No economic minerals known
PRECAMBRIAN	EARLY PROTEROZOIC REYNOLDS RANGE GROUP	Pg	—	Muscovite and biotite granite	Low hills, tors	Deformed and retrograded
		Pine Hill Formation Prp	400	Clayey sandstone, mudstone, schist	Low strike ridges	Crops out only in Wabudali Range; intruded by granite
		Mount Thomas Quartzite Prt	500	Silicified orthoquartzite, minor schist, and actinolite rock	High strike ridges	Forms isoclinal syncline in Wabudali Range; intruded by granite
		Lander Rock Beds Pll	Unknown	Two-mica schist with minor tourmaline and andalusite: hornfels with cordierite and oligoclase	Low rises	Closely folded, with axial-plane schistosity
		Pla	Unknown	Poorly sorted silty and clayey sandstone and subgreywacke; minor coarse quartzite and slate	Closely dissected hills and short ridges	Closely folded, weakly cleaved and metamorphosed; may be sandy facies of Lander Rock Beds
		pCb	—	Hornblende amphibolite	Subsurface onliy	Probably meta-igneous rock
		pCn	—	Granulite with cordierite, garnet, sillimanite, biotite, spinel	Isolated low rounded hills	Some specimens slightly retrograded
		pC	—	Probably schist, gneiss, and quartzite	Low hills	Not visited

Sandstone (Pla). Low isolated ridges and hills of silty and clayey friable quartz sandstone, subgreywacke, quartzite, and slate, all slightly metamorphosed, crop out in a northwest-trending belt extending from Keyser Hill through Turners dome, Kalga Hills, Ngadiri Hills, Yinabalgu Hills (Mount Theo), to McDiarmid Hill. In the Yinabalgu Hills, especially at Mount Theo itself, the rocks are conspicuously folded. In addition, quartzite forms a structural basin in the central part of the Yinabalgu Hills, and may rest unconformably on the surrounding subgreywacke. If so, it could be correlated with the Mount Thomas Quartzite of the Reynolds Range Group. Similar rocks, though extensively ferruginized, crop out in the southwest of the adjoining Mount Solitaire Sheet area to the north, and in the south of The Granites Sheet area to the northwest, where they are called the Mount Charles Beds (Blake et al., 1973). The rocks may be a sandstone facies of the Lander Rock Beds, but their relations with other units cannot be determined because contacts with other rocks are not exposed.

Lander Rock Beds (Pll). Low rises of brown biotite-muscovite schist with interbeds of feldspathic quartz sandstone and hornfels are exposed in the south of the Sheet area, and at Sowden Hill. The rocks are lithologically identical with the Lander Rock Beds of the Reynolds Range 1:100 000 Sheet area to the southeast (Stewart et al., in prep.). Andalusite forms porphyroblasts in the schist at Gida Gida Hill, and tourmaline is abundant on the southern side of the Kalga Hills, both in the southeast of the Sheet area. From the air, prominent folds are visible in the outcrops. Pegmatite dykes cut across the bedding in places.

Mount Thomas Quartzite (Prt) and *Pine Hill Formation* (Prp). These two units constitute the Reynolds Range Group, and form an isoclinal syncline which unconformably overlies the Lander Rock Beds in the southwest corner of the Sheet area. The Mount Thomas Quartzite is composed mostly of white or grey fine-grained orthoquartzite; in the eastern part of the range it includes an extensive lens of schist with small pods of actinolite amphibolite. Fine clayey sandstone, mudstone, and schist of the Pine Hill Formation conformably overlie the Mount Thomas Quartzite, and have been thermally metamorphosed to andalusite-muscovite hornfels by granite that intrudes the Wabudali Range; the andalusite is retrogressed to muscovite. The amphibolite pods in the Mount Thomas Quartzite also show evidence of retrogression, including aggregates of clinozoisite in the cores of plagioclase crystals, and rims of sphene around ilmenite; these may also be thermal metamorphic effects of the granite intrusion.

Granite (Pg). Tors and boulders of muscovite leucogranite crop out on the flanks of the Wabudali Range, intruding the Lander Rock Beds and both formations of the Reynolds Range Group, and severely deformed and retrogressively metamorphosed granite is exposed in gullies on the northern side of Mount Campbell in the southeast corner of the Sheet area. Retrogressed muscovite granite was cored from the bottom of BMR St 2, on The Granites/Alice Springs road, and granite is recorded in the logs of bores 13, 16, 17, 40, 41, 42, 43, and 44 in the southeast, and in Cattleyard Bore, Renehan Bore, and bores 31, 33, and 36, in the west.

Vein quartz (q). Numerous prominent ridges of brecciated vein quartz occur along major faults in the north of the area; hematite and limonite are minor constituents. Petrographic examination reveals evidence of several episodes of quartz

deposition, brecciation, and recrystallization. No basement rock was observed next to any of the veins in the northeast of the Sheet area, but in the neighbouring Mount Peake 1:250 000 Sheet area to the east, similar veins of brecciated quartz cut basement rocks of the Arunta Block and the unconformably overlying Central Mount Stuart Beds of Late Proterozoic to Early Cambrian age, indicating that faulting and brecciation took place along the veins after Early Cambrian time. However, the faults may have been active before the Central Mount Stewart Beds were deposited, and so no age is assigned to the quartz veins in the Mount Theo Sheet area.

Cainozoic

Superficial Cainozoic sediments cover most of the area. *Laterite* (Tlf) forms small mesas and arcuate cuestas, which are most extensive in the northwest. Small areas of laterite occur around Nungurmanu Hill and north of Karadi Hill. Laterite, directly overlying basement, was intersected in Renehan Bore and in several bores around Chilla Well.

In BMR St 2 and 4, a laterite horizon occurs near the middle of a Cainozoic alluvial sequence, well above weathered basement (Fig. 3). In the drill cuttings the upper laterite appears to be a normal lithified weathering product, but it may be a clastic deposit that formed by erosion of the older laterite from basement highs, followed by deposition and lithification. Banks of *laterite gravel* (Czg), and areas of *red soil* (Qr), have probably formed by erosion of the laterite outcrops.

The most extensive Quaternary deposit is *aeolian sand* (Qs), as sand plain and a few dunes; it is generally only 1 or 2 m thick, and in the Chilla Well area is commonly mixed with silt, clay, or nodules of calcrete. *Alluvium* and *river gravel* (Qa) are extensive in the south of the area, where they have been deposited by streams flowing north from hills in the Mount Doreen Sheet area. Alluvium also surrounds areas of laterite and red earth in the north of the Mount Theo Sheet area. Northwest of Karadi Hill, the boundaries of these units coincide with topographic or soil discontinuities, which reflect faults in the underlying basement; the Cainozoic units are not themselves faulted. Large areas of *calcrete* (Ql) are located along the sides and at the ends of the stream floodouts, and there is more in the low ground in the northeast of the area, and southwest of Chilla Well, on the southern side of a low basement ridge. 7.5 m of calcrete was penetrated in both Refrigerator Bore and Cattleyard Bore.

Beneath the superficial Cainozoic sediments, unconsolidated sand, silt, and clay (Czs) occupy hollows in the underlying basement. The largest of these hollows, referred to here as the Yaloogarrie Basin, is in the middle of the area, near Yaloogarrie and Atlee Creeks (Figs 2 & 3); there are other smaller basins in the northwest and southeast corners of the area. BMR stratigraphic holes 2 and 3 were drilled in the Yaloogarrie Basin. The sediments are probably alluvial river-channel deposits which formed during the Tertiary, when conditions were wetter than now.

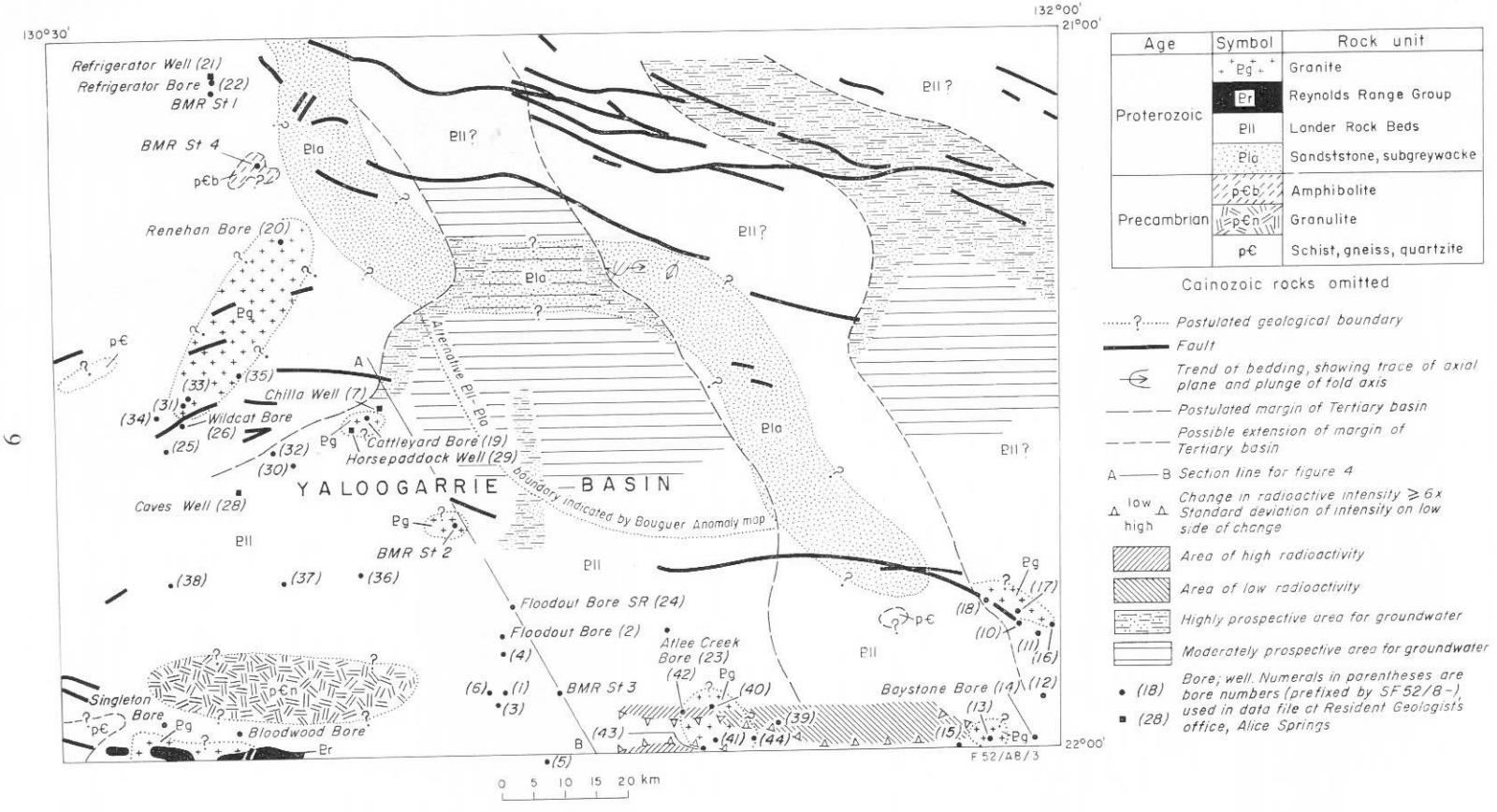

Fig. 2. Structure, Tertiary basins, and radiometric data.

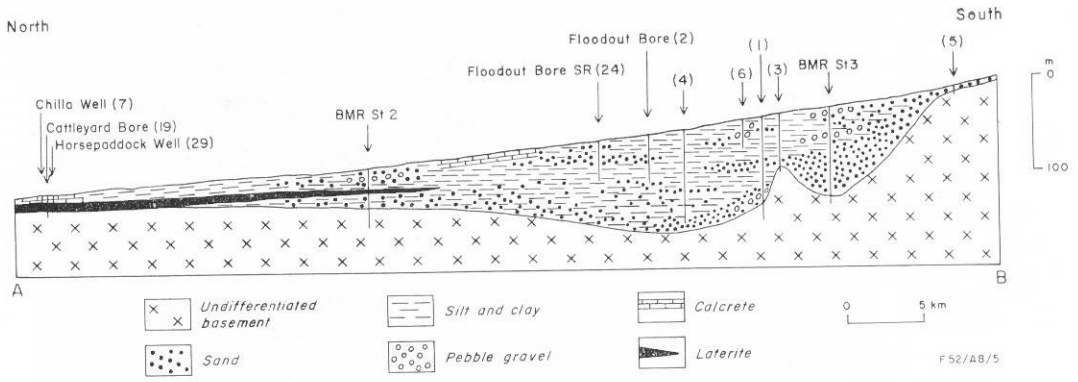

Fig. 3. Cross-section through the Yaloogarrie Basin (Quaternary cover not shown).

STRUCTURE

The geological structure of the Mount Theo Sheet area is shown in Figure 2. Because of the small amount of outcrop, the true configuration and relations of the various basement rock units are not known, and the picture presented in Figure 2 is highly interpretative.

The most prominent and least interpretative structures in the area are the numerous large faults, up to 100 km long, in the east, and the smaller faults in the west. The trend of the large faults is east-southeast, and that of the smaller faults about east-northeast. Masses of brecciated vein quartz are present at many places along the faults, and between these the trace of each fault is commonly expressed as a narrow depression in the Quaternary sediments, in places with a narrow outcrop of laterite or calcrete next to it. Elsewhere, faults filled with quartz pass along strike into prominent lineaments in the vegetation, such as a line of large eucalyptus trees without the usual adjacent watercourse.

In the southwest half of the area, the Lander Rock Beds crop out at several places and are also known at the bottom of several water bores. They thus appear to be the major basement rock unit beneath the superficial cover in this area. Granite was intersected in other water bores in the southwest half of the area, and also in BMR St 2. Thermally metamorphosed hornfels at Sowden Hill and beside Chilla Well landing ground shows that the granite intrudes the Lander Rock Beds. In the Wabudali Range granite intrudes both the Lander Rock Beds and the unconformably overlying Reynolds Range Group. Two exposures of pelitic granulite north of the Wabudali Range suggest the presence of a large mass of high-grade metamorphic rocks. The granulites may be Lander Rock Beds, metamorphosed to a high grade.

Equally uncertain is the large band of sandstone and subgreywacke shown trending southeast across Figure 2. The band contains the known outcrops of these rocks, but it is not at all certain that the outcrops are parts of a single mass.

Nothing is known about the basement rocks in the northeast of the area, because they are not exposed. Granite, and interbedded schist, metasandstone, and quartzite, assigned to the Lander Rock Beds, crop out at Fotheringham Hill

and the Wanabanda Hills in the northwest of the adjoining Mount Peake Sheet area, and are presumed to underlie the superficial cover sediments in the northeast of the Mount Theo Sheet area.

Gravity

Whitworth (1970) discussed the results of a regional gravity survey of the area by BMR in 1967. Figure 4 shows the Bouguer anomalies and gravity features of the Mount Theo and surrounding Sheet areas. The Mount Theo Sheet area coincides with part of the Willowra Regional Gravity Ridge in the north, and part of the Yuendumu Regional Gravity Low in the south. The two gravity minima along the southern edge of the Sheet area correspond with the granite exposed in the Wabudali Range and the granite at the bottom of water bores 40 to 44 (inclusive). The whole of the Yuendumu Regional Gravity Low in the Sheet area coincides with, and thus tends to support the existence of, the postulated area of

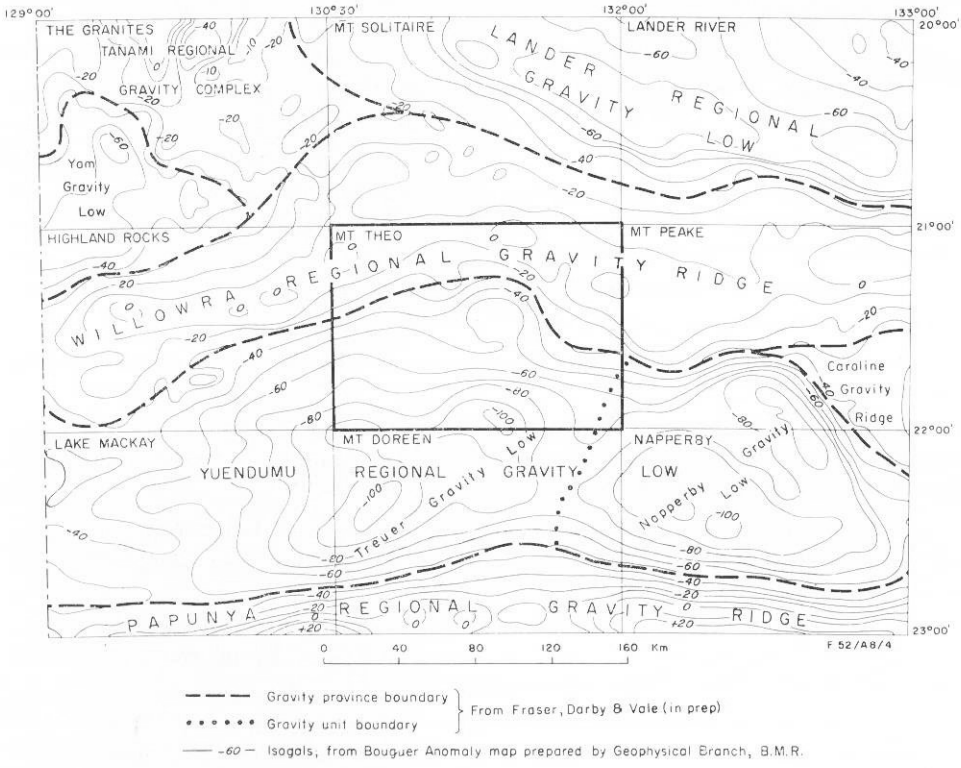

Fig. 4. Bouguer anomalies and gravity features of Mount Theo and surrounding Sheet areas.

Lander Rock Beds and granite intrusions, together with the adjoining belt of sandstone in the northeast. The circular low near the centre of the Sheet area suggests that the sandstone of the Yinabalgu Hills area is much more extensive than is indicated by surface exposures, and an alternative boundary is sketched in Figure 2. Basement rocks are not exposed in the area of the Willowra Regional Gravity Ridge, but, by analogy with the Papunya Regional Gravity Ridge in the Hermanns-

burg Sheet area to the south (Shaw & Stewart, 1975; Anfiloff & Shaw, 1973), the Willowra Ridge may be underlain by granulite, which may be overlain by metasediments and which has been brought up along the major faults in the north of the Sheet area.

GEOLOGICAL HISTORY

Again, because of the paucity of outcrop and consequent lack of knowledge of rock relations, the geological history of the Mount Theo Sheet area outlined below is very interpretative.

1. Early Proterozoic (or earlier) deposition (on unknown basement) of Lander Rock Beds, consisting of pelitic and psammitic sediments, and intrusion of minor mafic igneous rocks.

2. Folding, development of slaty cleavage and axial-plane schistosity, and low-grade regional metamorphism (locally high-grade).

3. Uplift and erosion.

4. Subsidence and marine transgression.

5. Deposition in a late Early Proterozoic shallow marine environment of quartzite, shale, and mudstone of Reynolds Range Group, and intrusion of minor mafic igneous rocks.

6. Folding of the Reynolds Range Group, and intrusion during early Middle Proterozoic of granite bodies into Lander Rock Beds and Reynolds Range Group, with associated thermal metamorphism.

7. Uplift of entire area, possible formation of large faults, and further uplift in northern part of area; deposition and brecciation of quartz in faults.

8. Erosion and planation of Proterozoic rocks throughout remainder of Proterozoic.

9. Evidence in the neighbouring Mount Peake 1:250 000 Sheet area indicates that major fault movement and formation and brecciation of quartz fault-fillings occurred after the Early Cambrian.

10. Planation and quiescence throughout remainder of Palaeozoic and Mesozoic; deep weathering (to about 100 m below ground level) in Late Cretaceous and/or Early Tertiary time; formation of laterite.

11. Uplift and warping in adjacent area to south; erosion of elevated region; deposition of Cainozoic alluvial sand, silt, and clay in local basins by north-flowing rivers; deposition of thick colluvium around hills and ridges.

12. Miocene weathering; formation of second laterite on basement highs and on upper surface of Cainozoic sediments, except in south of Sheet area, where rapid deposition of Cainozoic alluvium prevented weathering; lithification of early colluvium to fanglomerate.

13. Further deposition of Cainozoic alluvial deposits in south of area, completing burial of Proterozoic rocks and resulting in a relatively flat featureless landscape.

14. Dissection of laterite on basement highs in northwest of area; elsewhere, formation of laterite gravel and red soil beside laterite; dissection of fanglomerate deposits.

15. Formation of Quaternary sand plain and dunes; deposition of Quaternary alluvium and red soil by north-flowing streams (the much reduced descendants of the Tertiary rivers); formation of calcrete around stream floodouts and from groundwater in low areas; downslope movement of colluvium from hills and ridges, forming present-day soil slopes.

ECONOMIC GEOLOGY

This section comprises short notes on materials known to occur in the Mount Theo Sheet area, which are now or may in the future be of possible economic value.

Base metals

Hydrated copper silicate (chrysocolla) is present in small amounts at Wilson's Find, 12 km west-northwest of Mount Singleton (specimen locality 32); copper minerals are also reputed to occur in the Marinbunga Hills, but were not seen in the 1972 survey. Small amounts of cellular quartz-limonite gossan are present at Keyser Hill (specimen locality 13), and Pontifex (1973) interpreted the boxwork as residual after pyrite and possible chalcopyrite; he also identified small blebs of fresh pyrite and chalcopyrite in the quartz of the gossan, where they had been protected from weathering. The results of analyses of the gossan and four samples of laterite from other localities in the Sheet area are set out in Table 2.

Iron

The lower Tertiary laterite is presumably fairly extensive beneath the Quaternary superficial deposits of the area, and contains up to about 35.6 percent Fe (sample 22 in Table 2). Most, however, contains considerable sand and clay, and cannot be regarded as an economic deposit at the present time.

Specular hematite is present in the vein quartz at Turners Dome, and in small quartz veins at the eastern end of the Yinabalgu Hills. Hematite also occurs in the Mount Thomas Quartzite at the eastern end of the Wabudali Range.

Limestone

No deposits of bedded limestone are known in the area. Nodular calcrete forms a large proportion of the superficial cover of the Sheet area, and may be suitable for cement manufacture; alternatively, it could be crushed and made into a 'terrazo' type of building stone, or used as a source for a polishing material for plated ware.

Quartz crystal

Vein quartz at Karadi Hill is composed of subhedral prismatic quartz crystals up to 9 cm long and 2.5 cm across.

Tungsten

Wolframite is present in quartz lodes at Wilson's Find, and was mined for tungsten in the 1940s (Kiek, 1941). About 2 tonnes of concentrate was produced; the mine is now abandoned.

Uranium

Uranium minerals are not known in the Mount Theo Sheet area. However, carnotite has been found in Quaternary calcrete in the adjoining Mount Doreen Sheet area, and by analogy the large areas of calcrete in the Mount Theo Sheet area could be prospective for uranium.

TABLE 2. ANALYSES OF GOSSAN AND LATERITE

Sample No.	*Rock type*	*Locality*	*Grid reference*	*Parts per million* *Cu*	*Pb*	*Zn*	*Mn*	*Bi*	*Ni*	*Ag*	*Se*	*Fe (%)*
72110307	Laterite	25 km NW of Chilla Well	683800E 636800N	11	29	72	763	N.D.	13	1	<2	8.9
72110309A	Laterite	21 km NNE of Chilla Well	714000E 639800N	13	16	9	108	N.D.	6	1	<2	9.4
72110313C	Gossan	Keyser Hill	805500E 584300N	300	540	30	290	40	10	<1	25	**
72110317	Laterite	Nungurmanu Hill	767300E 612000N	10	41	13	37	N.D.	6	19	4	31.2
72110322	Laterite	Djanba Hill	739000E 649500N	11	38	8	82	N.D.	6	48	14	35.6

**—Not determined. N.D.—not detected. Method: Atomic absorption spectrophotometry.

Analysts: Australian Mineral Development Laboratories. (Reports AN 2285/73—Sample 13C only; AN 1916/74—all Se and Fe); B. I. Cruikshank & G. F. Sparksman (BMR Lab. Report No. 14, 6 March, 1974).

The BMR airborne survey in 1958 found that granites in the northern part of the Mount Doreen Sheet area have anomalously high radioactivity compared to the surrounding rocks (Carter, 1960), although it is not known how much of this is caused by the potassium, thorium, and uranium in the granites. However, the granites may be the source of the known uranium deposits to the south, and if so, then the Cainozoic sediments of the Yaloogarrie Basin in the Mount Theo Sheet area immediately north of the granites may also contain sedimentary uranium. The 1958 survey located an area with anomalously high radioactivity near Atlee Creek, in the east of the Yaloogarrie Basin (Fig. 2) which lends some support to this possibility. The area of Lander Rock Beds extending east of the Marinbunga Hills is characterized by a very low level of radioactivity. If uranium is found in the sediments of the Yaloogarrie Basin, the lines of relict drainage marked on the map may be useful in tracing further movement of uranium in solution in groundwater, and in locating its ultimate sites of precipitation, possibly in the large areas of calcrete.

Water

Surface water is rare in the Mount Theo Sheet area. Rockholes are known at the western end of the Wabudali Range (Inter Amoru Rockhole), about 1.5 km southwest of Turners Dome (Kolu Rockhole), at Nungurmanu Hill, and about 150 m southeast of the granulite outcrop 01 in the southwest of the Sheet area. A waterhole is situated on a small stream 15 km east of Atlee Creek, on the southern edge of the Sheet area. Soaks are known in the east of the Wabudali Range (Whitington Soak), and on the northern sides of Mount Campbell and the Kalga Hills; the last two were dry when visited in 1972.

Underground water is exposed at Caves Well, where a pool 0.7 m deep exists at the end of a cave in Quaternary calcrete (Murray, 1904); the pool has been deepened and is now used for watering stock. Apart from this, useful supplies of underground water were found in fifteen bores and wells, out of a total of forty-six drilled; it is used for the domestic supply at Chilla Well homestead and for stock watering elsewhere. Data sheets on the bores and wells are held on file at the Resident Geologist's Office, Alice Springs, and in the BMR Technical Files.

Seven of the fifteen successful bores and wells obtain their supplies from Quaternary calcrete, and six of these produce 1.25 l/sec* or more; three supplies are suitable for human consumption, the other four are suitable only for animals. Of the eight other bores and wells, three draw their water from Cainozoic sand, one from laterite on granite, one from Cainozoic clay, and three from unknown sources.

Seven bores and wells sited in the floodout area of Yaloogarrie Creek penetrated up to 100 m of unconsolidated sediments in the Yaloogarrie Basin, but only two produced usable supplies of stock water; the others gave small supples of saline water, and were abandoned. The sediments in the Yaloogarrie Basin consist mostly of silt and clay, which probably explains the small supplies found. It is noticeable that all the water found in the southern part of the basin is salty, that near the centre of the basin is suitable only for stock, whereas the water from the northern

* The minimum supply needed for a successful bore is about 1 l/sec.

end of the basin, derived from calcrete, is generally suitable for human consumption. The floodout of Atlee Creek also overlies at least 40 m of unconsolidated sediments in a small sub-basin on the eastern side of the Yaloogarrie Basin. Atlee Creek Bore in the central part of the sub-basin, produces 1.07 l/sec of stock water, whereas six bores farther south gave nothing. Another even smaller basin of unconsolidated sediments is present in the Keyser Hill area; of the nine bores here, two were dry, five found only small supplies (less than 0.38 l/sec), one found an adequate supply (1.01 l/sec) of stock water, and one found a large supply (1.9 l/sec) of water marginal for stock. It thus appears that, in general, the southern parts of the small Cainozoic basins contain only small supplies of saline water, whereas the northern parts of the basin contain useful supplies of water suitable for both humans and stock.

The relict drainage courses marked on the map suggest that the Cainozoic basins extend into the northern parts of the Sheet area. If this is so, then the most prospective areas for any future water bores are the calcrete plains in the central and northeast parts of the Sheet area, as shown in Figure 2. The area of sand plain between Chilla Well and Mount Theo is probably also prospective for underground water.

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