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THE GEOLOGY OF THE SANDOVER RIVER 1:250,000 SHEET AREA NORTHERN TERRITORY

by

R. A. H. Nichols

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Records 1964/63

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SUMMARY

In 1963, the geology of the Sandover River 1:250,000 Sheet area Northern Territory, was systematically mapped using aerial photographs and numerous ground traverses.

The altitude in the western half of the area is approximately 1000 feet at the highest points, falling to 650 feet in the north-east. The major rivers flow from south-west to north-east and east, but in the southern part of the area, some flow to the south-east. Outcrops are often separated by extensive areas of grey soil and red desert country.

The rocks are of Lower Palaeozoic, Mesozoic and Tertiary ages, and are predominantly carbonates of Cambrian and Ordovician age. The minimum known thickness of the total section is 1400 feet. The Lower Palaeozoic rocks consist of the Meeta Beds, either Middle or Upper Cambrian in age, the Tomahawk Beds and the Ninmaroo Formation which are assigned Upper Cambrian to Lower Ordovician ages. The oldest rocks appear to form the Meeta Beds, but the Camooweal Dolomite is similar to dolomite in the Meeta Beds, and may occur as isolated boulders in the extreme north-east of the Sheet area. The stratigraphic relationship between the Camooweal Dolomite and the Meeta Beds is unknown.

The Meeta Beds are most widespread in the northern and central parts of the Sheet area. The unit consists of buff dolutites, pelletal and intraclastic dolarenites, in places quartzose, and dolrudites which may be intraformational conglomerates. Chert nodules and lenses occur along the bedding and joint planes. Dark brown - grey, quartz sandstones, ripple-marked and cross-bedded, form interbeds. Isolated specimens of algae and gastropods were the only fossils found. The minimum thickness is approximately 1000 feet.

The Meeta Beds pass up into the Tomahawk Beds, and beds mapped as the Ninmaroo Formation. The boundaries between the Meeta Beds and the other units are concealed.

The Tomahawk Beds consist of dolutite, pelletal and oolitic dolarenites, orange and white, quartz sandstone and siltstone, and crop out in the south-western part of the Sheet

area. The sandstones and siltstones are current - bedded and contain white, silt laminae which show micro-slumping. Trilobites, ribeirioids(?) and possibly brachiopods and monoplacophorans(?) were found in these beds. The minimum thickness is approximately 200 feet.

The Tomahawk Beds appear to pass laterally into beds similar to those of the Ninmaroo Formation, comprising dolutites, algal dolomites, and some oolitic, and quartzose oolitic dolarenites. Sandstone and siltstone are rare. Diagnostic fossils were not found in these beds, but they are continuous with beds of the Ninmaroo Formation mapped on the Tobermory Sheet area to the south. The minimum thickness is approximately 425 feet.

In the southern part of the Sheet area, brown, current-bedded and conglomeratic sandstones overlie the Tomahawk Beds and probably parts of the Ninmaroo Formation. Fossils were not found in the sandstones but they are thought to be of Mesozoic age. Similar beds were not found below the Tertiary(?) limestone in the northern part of the area. The minimum thickness is 20 feet.

The Tertiary limestone (Austral Downs Limestone) is red and white and dominantly microcrystalline. Layered, possibly algal(?) varieties occur, but diagnostic fossils were not found. It is often highly siliceous, and large, irregularly shaped nodules and thin lenses stand out on the weathered surface. The minimum thickness is approximately 40 feet.

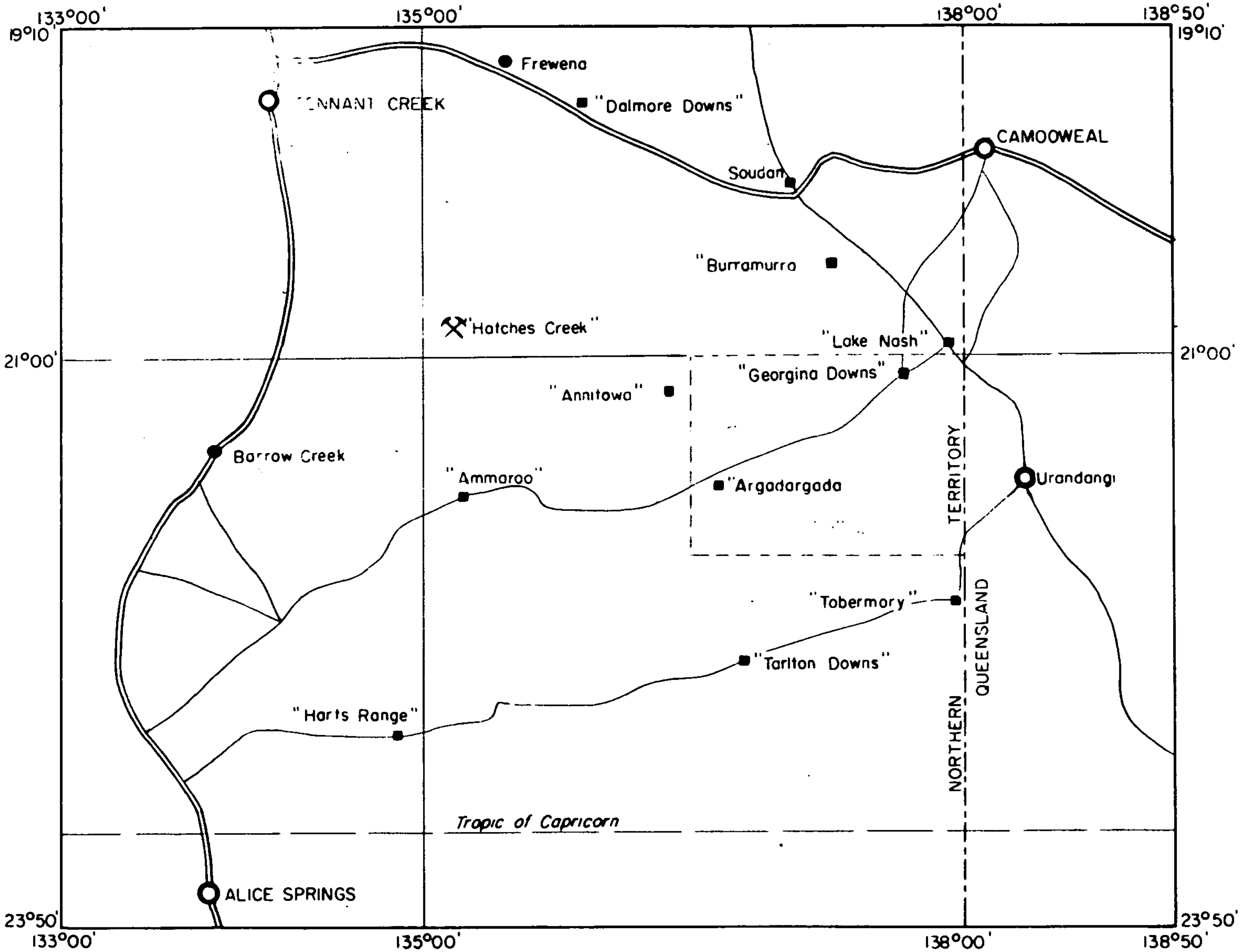
Superficial deposits of grey soil and chert gravel, red desert soil and sand, and river alluvium occur mainly in the northern half of the area.

INTRODUCTION

Location

The Sandover River Sheet area is situated in the eastern part of the Northern Territory between latitudes 21°S and 22°S and longitudes 136°30'E and 138°0'E. Unsealed roads from Camooweal in the north-east on the Barkly Highway, Urandangi in the east, and Connor's Well in the south-west on the Stuart Highway, provide access to the area (Fig. 1). Numerous station tracks facilitate traverses in the plains country in the northern and eastern parts of the area, but tracks are rare in the desert and hill country to the west and south. The desert

Fig 1



LOCALITY MAP SHOWING ACCESS TO SANDOVER RIVER SHEET AREA, N.T.

REFERENCE

Towns — *Homestead*

Bitumen — *Sheet area boundary*

Unsealed roads — *Hotel and filling station*

SCALE

32 0 32 64 96 128 160 Miles

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country in the north-west is Crown Land, but the remainder of the area is divided between four cattle stations (Lake Nash, Georgina Downs, Argadargada, and a small part of Manners Creek in the south-east). Gidyea poisoning occurs around No.18 Bore (Argadargada).

Previous Investigations

The Sandover River Sheet area has not been previously mapped systematically.

In 1936, Whitehouse named the limestones of the Georgina River and its main tributaries, the Georgina Limestones, and stated that they contained fossiliferous zones ranging from Middle to Upper Cambrian.

Öpik (1957, p.42) recorded that D.M. Traves, during 1947-8, collected pebbles containing Middle Cambrian fossils, near Argadargada on the Sandover River flood plain, in the south-west of the sheet area. The source area for the pebbles was later found further west on the Elkedra Sheet area.

In 1952, Traves and Öpik (Öpik, 1957, p.42) considered the fossiliferous pebbles to be in the "area of the Camooweal Dolomite". The Camooweal Dolomite was thought to be late Precambrian or Lower Cambrian in age to the north of the Sandover River Sheet area.

Öpik (1957, p.33) stated that the dolomite and dolomitic limestone around Landerandera Waterhole in the south-west of the Sheet area "may or may not be Camooweal Dolomite", and that it is possible to confuse the Camooweal Dolomite with Ordovician dolomites in the region. He also stated (p.5) that, "no Cambrian rocks occur along the Georgina" which flows over dolomite in the north-eastern part of the Sheet area.

The adjoining Sheet areas of Mt. Isa, Urandangi, Glenormiston, Tobermory, Huckitta, Elkedra, Frew River and Avon Downs were mapped by geologists of the Bureau of Mineral Resources between 1953 and 1963, and the dolomite formations of various ages were established. These were thought to range from Upper Proterozoic to Lower Ordovician.

In 1961, the Bureau of Mineral Resources, Geophysical Branch produced a map (G371-12-1), which included the Sandover River Sheet area, showing the results of the reconnaissance gravity survey (1957-60) of the Amadeus and Georgina Basins, Northern Territory and Queensland.

In 1962, Mulder (Bataafse Internationale Petroleum Maatschappij) compiled a report on the photointerpretation of the geology of the Georgina Basin.

In 1962-3, a Bureau of Mineral Resources core-drilling programme included a stratigraphic core-hole, GRG.14, on the Sheet area. The stratigraphic information was recorded by Milligan (1963), and the sedimentary petrology by Nichols and Fehr (1964).

In 1963, Doeringsfeld, Amuedo and Ivey compiled a photo-geological evaluation report on Permit 53 N.T. (for United Australian Oil, Inc. and Amalgamated Petroleum N.L.) which covers the Sheet area between 21°S and 21°40'S, and 136°40'E and 138°E.

In 1963, a field party consisting of K.G. Smith, E.N. Milligan, R.A.H. Nichols and W.H. Morton mapped the Sandover River Sheet area on a scale of 1:46,500. A number of water bores have been drilled on the station properties and the driller's information is included. Drain samples were collected and examined by the Bureau's Resident Geologists at Alice Springs. W.H. Morton provided logs of the sequences from three known, deep water bores (Bathurst No.4 (replacement), Nos. G.1 and G.2) drilled on Lake Nash station in 1963.

Maps and Air Photographs

The Sheet area is covered by vertical air photographs taken in 1947 at a scale of 1:46,500. The air photographs of the grey soil and desert areas are poor, but those covering the hill country are adequate. Large gaps occur at the western end of run 8 and in the middle of run 13.

In 1949, the Division of National Mapping produced a planimetric map at a scale of 1:253,440. Photoscale compilations are available for the Sheet area, and these contain new cultural information obtained by spot aerial photography in 1958-9. At present a new edition of the Sandover River Sheet area is being prepared by the Division of National Mapping.

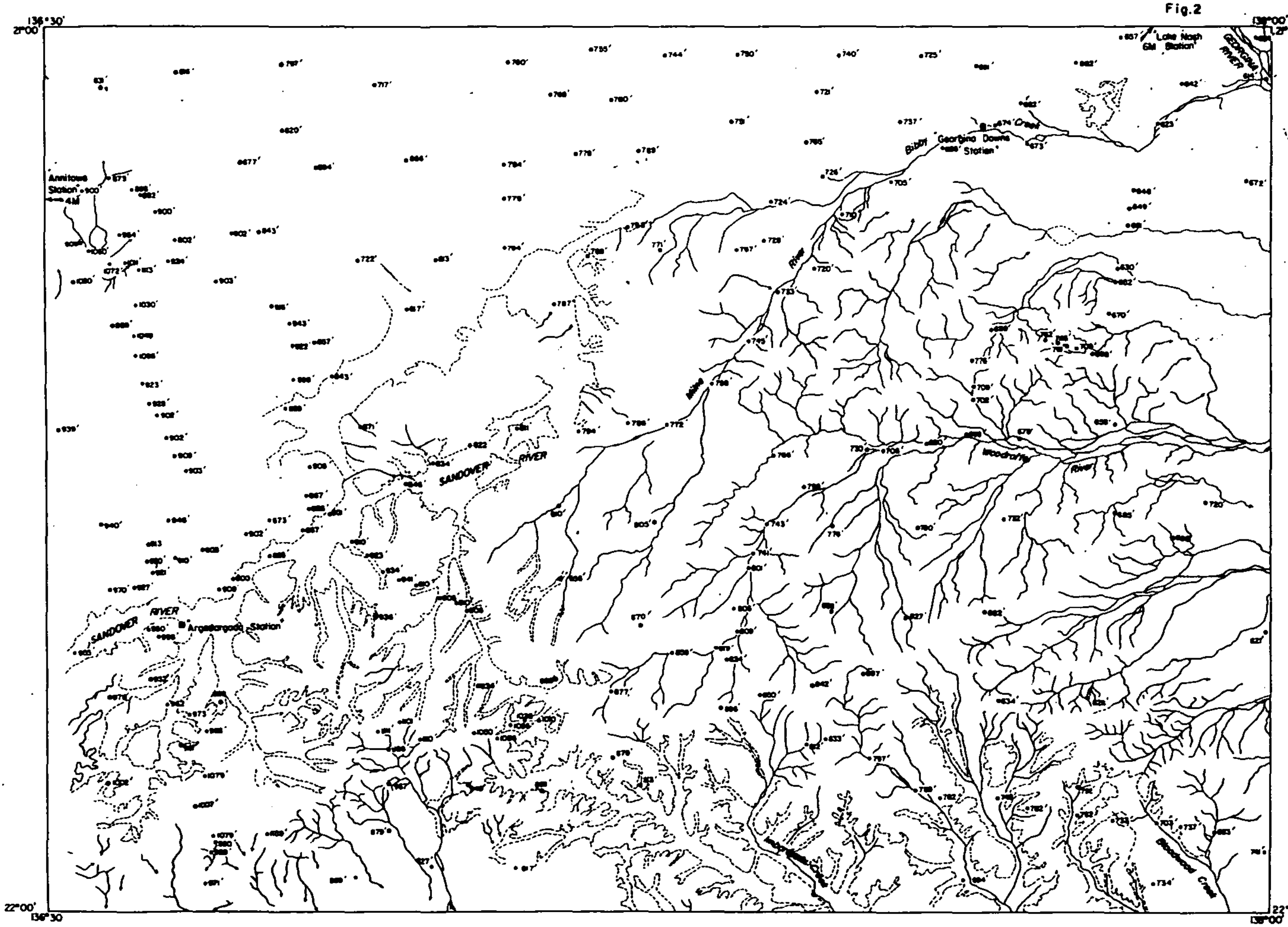
In 1963, new water bores, fences and tracks were located and plotted during geological traverses.

PHYSIOGRAPHY

Topography

The northern and central parts of the Sandover River Sheet area consist of grey soil plains and desert country with altitudes between 700-800 feet. Low, isolated groups of hills, generally flat-topped, rise about 75 feet above the plains.

Fig.2



ELEVATIONS AND DRAINAGE PATTERNS ON THE SANDOVER RIVER SHEET AREA, N.T.

Flood plain · Spot heights · Homestead

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Between the north-eastern and south-eastern parts of the Sheet area, the country is more dissected. Hills are extensive and rise from 150-200 feet above broad valleys, giving a general altitude of 800-950 feet.

The land surface gradually rises to 900-950 feet in the north-western and south-western parts of the Sheet area, with hills rising approximately 150 feet above the valleys to heights of 1000-1100 feet. Near the southern limit of the Sheet area, an arcuate divide striking approximately east-west, separates two drainage basins (Fig.2.).

Drainage

The northern river system drains most of the Sheet area and consists of the Sandover and Woodroffe Rivers and their tributaries. The rivers flow north-east and east, during periods of heavy rainfall, into the Georgina River.

The flood plain of the Sandover River changes to a narrow, more defined course in the north-eastern part of the Sheet area, where it is called the Milne River and Bibby Creek. It is braided and meandering, and contains several waterholes. The gradient is low, and the river falls approximately 350 feet in 100 miles.

The Woodroffe River has similar features, but its flood plain is less extensive. Several drainage patterns have been developed within the river systems and may reflect underlying structure.

The tributaries of both rivers are unbraided and branch many times. The main tributaries often flow parallel to the main stream and bisect hill masses, but some turn at right angles in parts of their courses. This may reflect a structural pattern of joints or faults. The minor tributaries occupy steeper, shorter, entrenched courses in the hills, and may radiate from, or flow around them.

The southern river system consists of the Imbordjudu, Manners and Bloodwood Creeks. The creeks and smaller streams near Mt. Hogarth flow south-eastwards beyond the Sheet area, while other streams in the same area die out on level, sandy country. In this section, the parallelism of streams may reflect the regional dip, or joint and fault trends in the area.

Other relevant physiographic features are described by Stewart (1954). Most of the Sheet area is included in the Barkly region, surveyed by the C.S.I.R.O. and two members of the Bureau of Mineral Resources in 1947-48. The geomorphological

TABLE I. STRATIGRAPHIC TABLE - SANDOVER RIVER SHEET AREA.

AGE	UNIT	MAP SYMBOL	MAXIMUM THICKNESS AND LOCALITY	LITHOLOGY	TOPOGRAPHIC EXPRESSION	REMARKS
CAINOZOIC		Cza		Alluvium	River and stream deposits.	
		Czb		Grey soil	Undulating plains	
		Czg		Gravel	Residual deposits on plains and scree slopes.	
		Czs		Sand	Undulating plains, river valleys, dunes.	
	Austral Downs Limestone	Ta	44' + No.37 bore Lake Nash	Limestone, white, red calcilutite.	'Pavements' and boulders.	Confined to N.E.corner of Sandover River Sheet area; associated with boulders of ?Ꞓd dolomite. No undiff. Mesozoic rocks found.
MESOZOIC	Undifferentiated	M	20' + 13m. S.E. of Mt.Hogarth	Brown , coarse grained and conglomeratic sandstone.	Tops of low hills.	Confined to southern part of Sandover River Sheet area, overlying Ꞓ-Ot. No Ta limestone found.
CAMBRO-ORDOVICIAN	Ninmarco Formation	Ꞓ - On	425' + 12m. N.N.E. Bathurst No.1 Bore, Lake Nash.	Grey, dolutite; algal dolomite, dolarenite; some sandstone and siltstone.	Low ranges of hills, with scarps on the northern edges.	No fossils found other than algae. Possibly equivalent to top part of Tomahawk Beds.
CAMBRO-ORDOVICIAN	Tomahawk Beds	Ꞓ - Ot	200'+ 4m. S.W. of Mt. Hogarth.	Buff, pelletal dolarenite; dolutite; orange-brown quartz sandstone and siltstone, some cross-bedded.	Isolated low hills and mesas.	Trilobites found west of Argadargada, and south of Mt.Hogarth.
UPPER - CAMBRIAN TO	Meeta Beds	Ꞓ mh	?1036' + At No.16 Bore. Lake Nash.	Buff dolutite, pelletal dolarenite, chert nodules lenses; brown quartz sandstone, ripple marked cross-bedded, some pellets.	Isolated low hills and ranges, occasionally flat topped.	Gastropods found west of Georgina Downs; algae occur N.W. of Argadargada W.H.
MIDDLE CAMBRIAN	Camooweal Dolomite?	Ꞓ mh	? 2' + Along Georgina R. (N.E.corner of map)	Buff, white, medium crystalline dolomite, pelletal dolarenite.	Scattered boulders on grey soil plains.	Stratigraphic position uncertain, but rocks occur near dolomite previously mapped as Camooweal Dolomite.

units are as follows. The desert and hill country areas are respectively termed "non-lateritic Tertiary Plains", and a mixture of "dissected non-lateritic Tertiary Plains" and "dissected Tertiary Swamp". The grey soil areas are termed "Tertiary Swamp". A small area of Austral Downs Limestone in the north-east is referred to as "Tertiary Lake Limestone". Some alluvium is described as "post-Miocene, coarse textured alluvia of the Georgina Basin", and some as "Channel alluvia of the Georgina major tributaries".

STRATIGRAPHY

Introduction

Outcrop and weathered detritus predominate in the hill country, while chert gravel and lateritized scree occur on the grey soil and desert plains.

Fossils were collected from widely separated localities, but they are rare and not always diagnostic or generically identifiable. The succession is summarised on Table 1.

Precambrian rock units are not exposed in the Sheet area and most of the succession consists of rocks which may be subdivided into a Cambrian unit and overlying Cambro-Ordovician units, or consists of rocks which cannot be subdivided, and are considered Cambro-Ordovician in age. (Fig.3).

Certain fossiliferous rock units in the southern part of the Sandover River Sheet area are extensions of units mapped on adjacent Sheet area. These are named the Tomahawk Beds (Є-Ot). However, in the northern part of the Sheet area, relatively unfossiliferous rock units, which appear to underlie the Tomahawk Beds, have been named the Meeta Beds; but it is difficult to assign them to a subdivision of the Cambrian. Beds mapped as the Ninmaroo Formation occur in the south-east of the area (Fig.4).

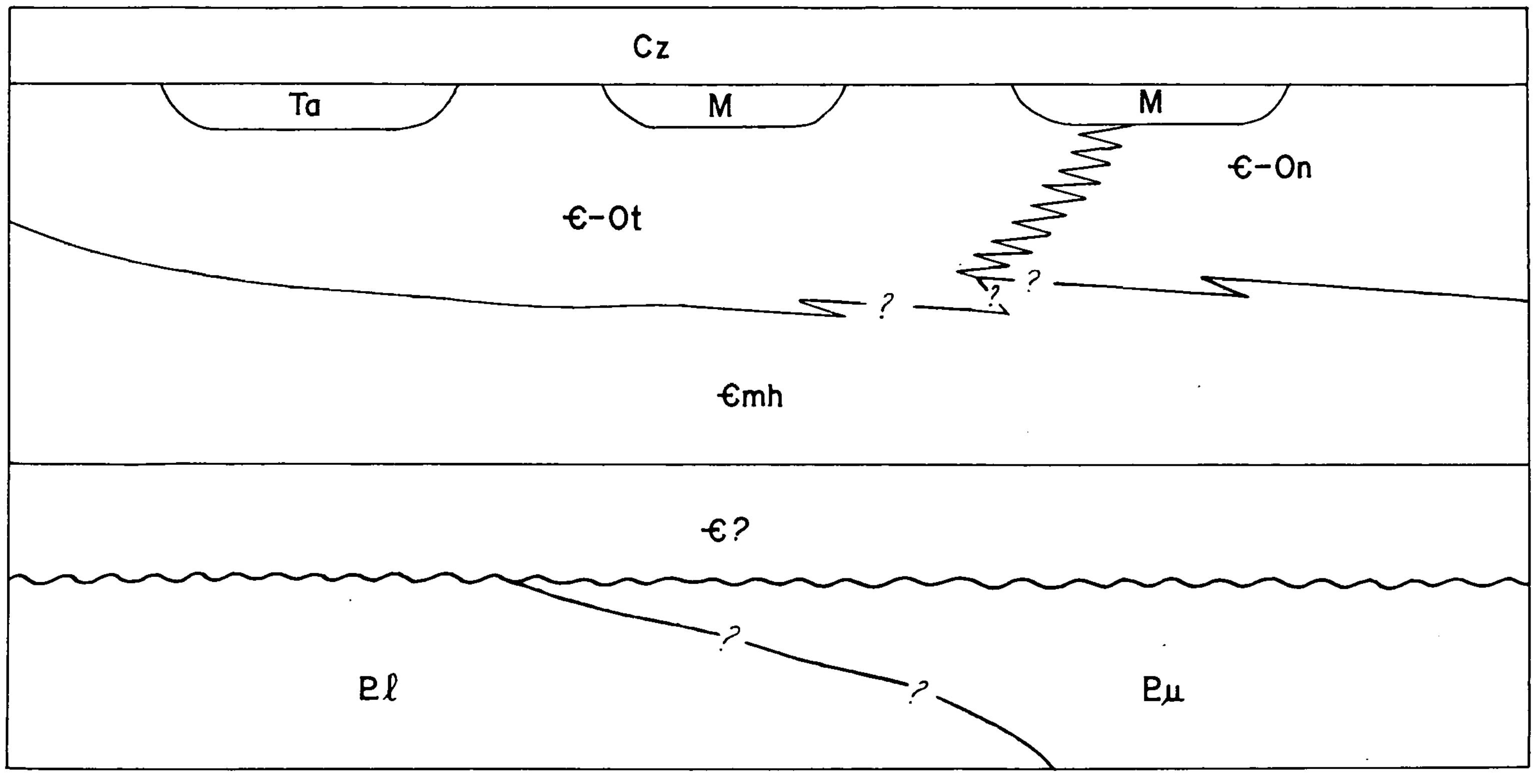
Mesozoic (?) and Tertiary (?) rocks crop out in the south and north-eastern parts of the area. Superficial deposits are of Cainozoic age and may be Tertiary and Quaternary.

Driller's logs were obtained for 58 water bores on the Sheet area; in 38 cases lithological information was included by the drillers, but this is not always reliable. Water from 12 bores has been analysed by the Animal Industries Branch, Alice Springs.

Amalgamated Lake Nash No.1 well on Permit 53, N.T. is six miles north-west of the north-eastern corner of the Sheet area, and information from the well may be extrapolated to

Fig. 3

ROCK RELATIONSHIP DIAGRAM



Reference

Cz	*Cainozoic*
Ta	*Austral Downs Limestone*
M	*Mesozoic*
Є-On	*Ninmaroo Formation*
Є-Ot	*Tomahawk Beds*
Єmh	*Meeta Beds*
Є?	*Cambrian Undifferentiated*
Pu	*Upper Proterozoic*
Pl	*Lower Proterozoic*

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assist in dating the rock units mapped on the Sandover River Sheet area.

PALAEOZOIC

Introduction

The oldest rock units occur in the north-east of the Sheet area and form part of the carbonate sequence of the Barkly Tableland. This sequence was mapped and described on the Avon Downs and Ranken 1:250,000 Sheet areas by Randal and Brown (1962 a,b). The most important stratigraphic unit, with reference to the present study, is the Camooweal Dolomite. This name was first published by Öpik (1957), who described the character and extent of the Camooweal Dolomite.

The Camooweal Dolomite crops out in the south-eastern corner of the Avon Downs Sheet area, around Lake Nash (Randal and Brown, 1962b), and seems to continue southwards onto the Sandover River Sheet area under the grey soil cover. Dolomite occurs as separate blocks in the north-eastern corner of the Sandover River Sheet area, and consists of thinly bedded, possibly slumped dolutite, pelletal and intraclastic dolarenites and dolrudites, and quartzose, pelletal dolarenites. These dolomites may represent the Camooweal Dolomite, but as fossils were not found, their precise age is unknown.

However, six miles north in the Lake Nash No.1 Well, unfossiliferous dolomite, which crops out at the well, extends down to 560 feet where it overlies early Middle Cambrian fossiliferous limestone (Jones and Gatehouse, B.M.R., pers. comm.). The age of the unfossiliferous dolomite in Lake Nash No.1 Well may range from upper Middle Cambrian to Lower Ordovician, and is here tentatively correlated with the Camooweal Dolomite. Unconformities or disconformities between the dolomite and the limestone were not recorded in Lake Nash No.1.

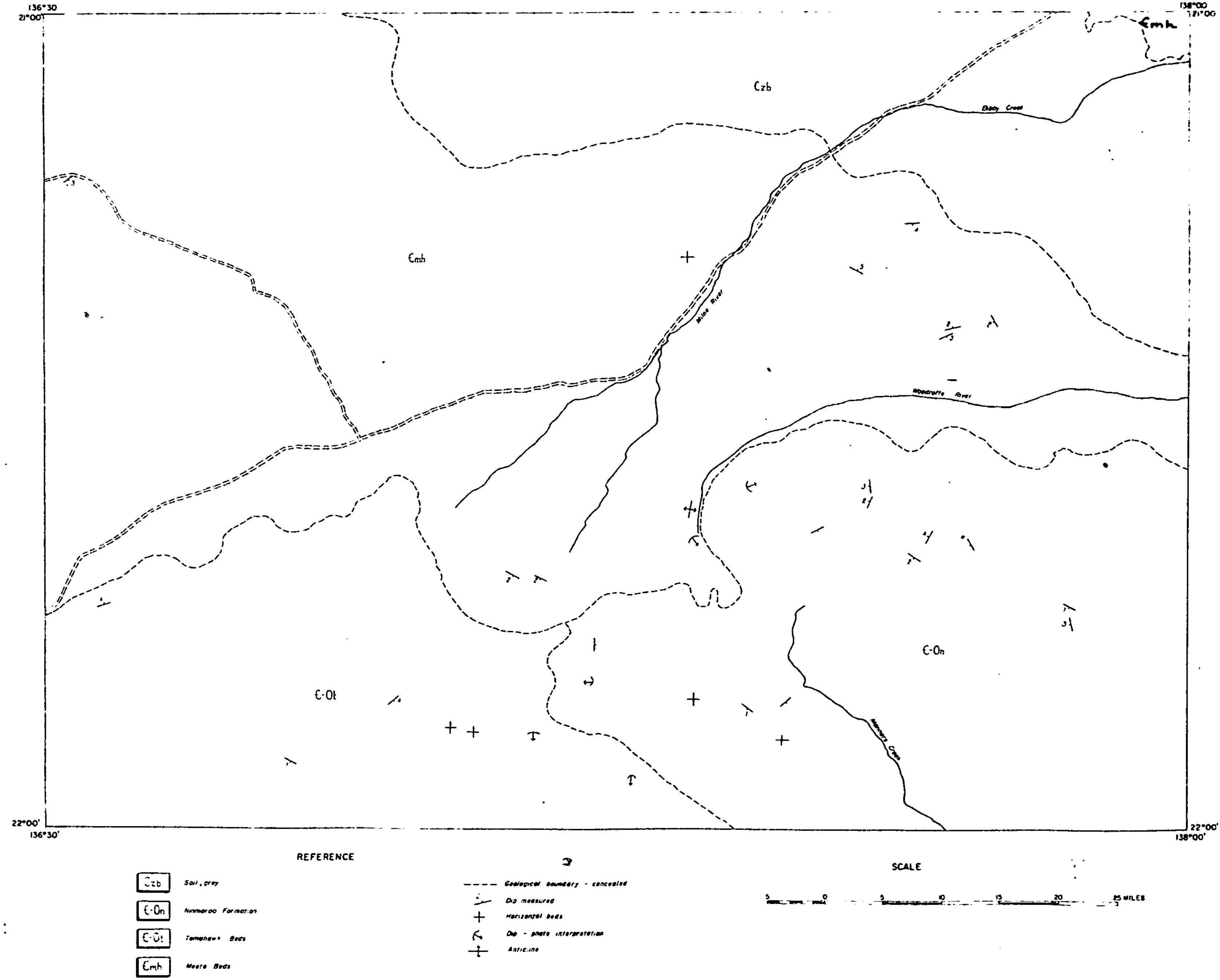
The pelletal and intraclastic dolarenites in the north-eastern corner of the Sandover River Sheet area may be equivalent to, or stratigraphically higher than, the unfossiliferous dolomite in Lake Nash No.1, but as low southerly dips were photo-interpreted in the vicinity of the well (Randal and Brown, 1962b), the dolarenites of the Sandover River Sheet area are included in the overlying Meeta Beds.

Meeta Beds

Introduction

The name Meeta Beds, is used to describe a suite of rocks which cannot be mapped within definitive boundaries, but which are distinct from those above and below. The base and the top

GENERALISED LOWER PALAEOZOIC GEOLOGY OF SANDOVER RIVER SHEET AREA Fig.4



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of the unit are not seen, but the Meeta Beds appear to overlie the Camooweal Dolomite and underlie the Tomahawk Beds and possibly the Ninmaroo Formation. However, they may in part, be the lateral equivalent of the top part of the Camooweal Dolomite, and the lower parts of the Tomahawk Beds and the Ninmaroo Formation. The Meeta Beds are lithologically similar to parts of the Arrinthrunga Formation, and may be of Upper Cambrian age based on evidence obtained by Milligan (1963) and Nichols and Fehr (1964). Assuming there is no discontinuity between the Middle Cambrian limestone and the upper dolomite in Lake Nash No.1 Well, the Meeta Beds may also be Middle Cambrian in age. At present the most reliable information is from Lake Nash No.1.

Distribution and Lithology

West and south-west of Lake Nash, the Meeta Beds crop out in the northern and central parts of the area. They occur as boulders and scree on the plains, and as outcrop on low hills, separated by large areas of plains country. This prevents accurate stratigraphic correlation and structural interpretation. Most outcrops are horizontally bedded, but gliding and slumping occurred during weathering, and consequently true dip is obscure. The beds vary from 1 inch to approximately 2 feet 6 inches thick.

Several different lithologies were recognised in the Meeta Beds. Details of the matrix, i.e. "micrite" or "sparry" cement (Folk, 1959) will be presented after a study of the thin sections. The lithologies, with selected localities, are described below. (Point Nos. are on air photographs held at the Bureau of Mineral Resources, Canberra).

1. Dolutite: buff, microcrystalline, cryptocrystalline; thinly bedded,1"-6", occasionally leached. (Locality: SR 326; Airphoto run 7, No.5402.)
2. Dolomite: buff, medium to coarse crystalline; thick bedded, 1'6" - 2'6"; vuggy; occasional chert nodules. (Locality; SR 326; Airphoto 7/5402).
3. Dolarenite: buff, pelletal and intraclastic; pellets and intraclasts rounded, scattered and with grain-on-grain texture; medium to well sorted; matrix dolutite but some dolomitic cement; some recrystallisation; medium bedded, 6" - 1'6"; rare gastropods. (Locality: SR 323a; Airphoto Elkedra 3/5133).

4. Dolarenite: buff, quartzose, pelletal and intraclastic, textures as above; quartz sand, sub-angular to sub-rounded; forms 5%-20%; matrix dolutite and dolomitic cement; poor to medium sorting. (Locality: SR 253-5; Airphoto 4/5463).

5. Dolarenite: buff, oolitic, sometimes quartzose; infrequent lithology; ooliths, spherical, 50%-80% packing; quartz sand as above; matrix dolutite and dolomitic cement(?); medium to well sorted. (Locality: SR 267; Airphoto 4/5461).

6. Dolrudite: buff, intraclastic; large intraclasts, 2-3 cms., long, subangular to subrounded, of micro-crystalline dolomite; matrix dolutite;poorly sorted; thin to medium bedded. (Locality: SR 257; Airphoto 4/5462).

7. Dolomite: buff, algal, layered-columnar; in situ; medium bedded. (Locality: SR 257; Airphoto 7/5384).

8. Quartz Sandstone: brown, grey, medium to coarse-grained (micro-conglomeratic): some porous; quartz subangular to subrounded; medium to well-sorted; siliceous cement; ripple-marked, cross-bedded. Some white, clay-silt pellets (rudite size); some faecal remains; some agate, some completely silicified; thin to thick-bedded. Maximum exposure, 30 feet. (Locality: SR 254; Airphoto 4/5464: SR 317; Airphoto 6A/5005).

Chert: Nodules and thin lenses of chert occur in parts of the sequence. They are secondary and their shape is often controlled by bedding and joint planes.

Chert gravel forms isolated patches and scattered rubble in the plains country. The chert is often cryptocry-stalline but also contains ooliths and pellets. The ooliths and pellets are scattered and concentrated in grain-on-grain texture. The chert represents silicified dolutites and dolarenites or their calcareous equivalents.

Sedimentary structures: Current- and ripple-bedding, and scour and fill structures are rare in the dolomite, and are generally confined to the microconglomeratic and sandstone horizons. Large scour and fill possibly occurs in the dolomite north of Woodroffe River.

Thickness: The total thickness of the Mcota Beds is unknown, but is probably more than 1036 feet at No.16 Bore (Lake Nash). The driller's log records an almost continuous sequence of "limestone" (probably dolomite), except for two feet of "fine white rock", and nine feet of "red conglomerate". Water bores G.1 and G.2 (Lake Nash) were drilled in the Meeta Beds and the lithological logs are enclosed (Table 2).

Palaeontology

Gastropods were found 13 miles west-south-west of Georgina Downs Homestead in the northern part of the Sheet area. Large and small tests, distinguishable in hand specimen, were found to be strongly recrystallised, and unidentifiable during subsequent studies.

Algal dolomite crops out half way up the sequence six miles north-west of Argadargada Waterhole. In plan view, the algae are subcircular and approximately six inches in diameter. In vertical section they are layered; the amplitude of the layers is approximately one inch. The algae are in situ and were the only type found in the northern part of the Sheet area.

Rare pieces of algal dolomite occur 21 miles east-north-east of Argadargada Homestead. They are different from those described above, and are layered-columnar, the columns being only ½ inch in diameter.

Tomahawk Beds

Introduction

The succession in the south-west of the Sandover River Sheet area forms part of the Tomahawk Beds which range from Upper Cambrian to Lower Ordovician in age, and which were named on the adjoining Huckitta Sheet area (Smith, Vine and Woolley, 1960). The Tomahawk Beds on the Sandover River Sheet area are continuous with the Tomahawk Beds on the adjoining Huckitta and Elkedra Sheet areas to the west, and the Tobermory Sheet area to the south.

The hills between Argadargada Homestead and Landerandera Waterhole possible form the northernmost outcrops of the Tomahawk Beds on the Sheet area. The boundary between the Tomahawk Beds and the Meeta Beds is not exposed, but the Toma-Hawk Beds overlie the Meeta Beds, although the concealed lower part may be laterally equivalent to the top part of the Meeta Beds.

Distribution and Lithology

In the western part of the Sheet area the Tomahawk Beds consist of pelletal and oolitic dolarenites and dolutites, interbedded with, and overlain by orange-brown, quartz sand-stone and siltstone. The maximum visible thickness of this sequence is 173 feet. The maximum visible thickness of the dolomite, four miles south-west of Mt. Hogarth, is 68 feet, and consists of:

1. Quartzose dolomite (Dolomitic sandstone): buff, brown, microcrystalline, with quartz sand.
2. Dolarenite: buff, grey, pelletal-oolitic, well-sorted; 70% packing.
3. Dolarenite: buff, grey pelletal, microcrystalline; medium sorting.
4. Dolutite: buff, microcrystalline, cryptocrystalline.

These lithologies alternate in beds which vary from six inches to one foot thick; the total thickness of each lithology is obscured by talus, but the pelletal-oolitic dolarenite is predominant. Details of the matrix, i.e. "micrite" or "sparry" cement (Folk, 1959), will be presented after a study of thin sections. The base of the dolomite sequence is not exposed and fossils were not found. Nevertheless, it is included in the Tomahawk Beds, and not in the Meeta Beds on the basis of similarity with Tomahawk Beds on adjoining Sheet areas.

Quartz sandstone and siltstone often form the uppermost visible parts of the Tomahawk Beds which have been eroded into bluffs and mesas. Rapid lateral variation occurs in parts, and at locality SR 5, 22 miles south of Argadargada Homestead, K.G. Smith recorded:

1. Sandstone: 10 feet, white hard, fine-grained, very silty, with worm trails.
2. Sandstone: 10 feet, white and brown, fine to medium-grained, thin bedded, silty with worm trails.
3. Sandstone: 15 feet, white, medium grained, thin bedded, silty.
4. Sandstone: 5 feet, yellow, cream, medium grained, laminated and thin bedded, with trilobites and numerous worm trails.
5. Sandstone: 20 feet, white, grey, fine-grained, silty

   13 feet concealed.
6. Sandstone: 2 feet, yellow, cream and red, medium-grained, thin bedded, with trilobites and numerous worm trails.

Base not exposed: total thickness revealed, 75 feet.

The sandstones and siltstones are deeply weathered and fractured, and sections have slumped down-hill.

The sandstone and siltstone in the northern outcrops are orange to brown, with fine to medium-grained, often well-sorted quartz grains, and thin fissile beds. They are sometimes current-bedded, and contain laminae of white silt and clay which exhibit slump structures and micro-faulting. The siltstone is also light brown to white, partly silicified, fissile, and forms thin interbeds.

Palaeontology

Fossils were found 6 miles south-east of Mt. Hogarth; 6 miles west-south-west, and 22 miles south of Argadargada Homestead (Fossil localities SR 1,2,5). They consist of trilobites, a brachiopod or ribeirioid(?), and indicate a late Upper Cambrian age (Öpik and Tomlinson, pers.comm.).

Ninmaroo Formation

Introduction

In the south-eastern part of the Sheet area, dolomites predominate. They are lithologically similar to units mapped as the Ninmaroo Formation on the Tobermory Sheet area, and they have been mapped as the Ninmaroo Formation on the Sandover River Sheet area. They appear to overlie the Meeta Beds but it is difficult to separate the two units. They were assumed to pass laterally into the Tomahawk Beds to the west, as certain facies could not be traced westwards. They range from Upper Cambrian to Lower Ordovician in age on adjacent Sheet areas.

Distribution and lithology

In the south-eastern part of the Sheet area, E.N. Milligan records thin-bedded, buff and light grey, aphanitic, fine crystalline dolutite which forms most of the sequence, though outcrop is poor. Interbeds of medium to thick bedded algal dolomite, pellet dolarenite and intraformational, dolomite breccia form benches. Normally, these benches occur at intervals of 20-30 feet, but in the middle of the sequence they occur at intervals of 1-10 feet, and are responsible for the characteristic, dark grey pattern on the air photos.

Rocks occurring less commonly, are beds of grey and pink, oolitic dolarenite, sandy, oolitic dolarenite, and pink and green mottled, dark grey and light blue-grey, aphanitic dolutite. Pink and green mottled, sandy siltstone, and silty dolutite were observed in bore-drain cuttings and spoil from the water bores.

Sandy dolomite seems to be more common in the extreme south of the Sheet area, apparently near the top of the exposed section. Only a few thin sandstone beds (some with oscillation ripple marks) were observed; they are in the middle and lower part of the sequence.

Nine miles north-north-east of Bathurst No.1 bore (Lake Nash), a partial section, measured by E.N. Milligan (the top being the highest topographic level), is as follows:

Dolomite: 215 feet, thin-bedded.
Dolomite: 100 feet, medium to thick-bedded.
Dolomite: 110 feet, thin-bedded.
Thickness 425 feet.

The base of the section is not exposed. The only characteristic that distinguishes the top dolomite from the bottom, is the common occurrence of scattered silt grains, including minute, but conspicuous flakes of glauconite, green clay or chloritic material; This was very common in the upper part of the top dolomite, but rare in the lowest dolomite. The middle dolomite can be traced intermittently along strike for 25 miles. Thirty feet from the top, a distinctive six foot marker bed, with numerous conical cavities giving a spongy appearance, can be traced along strike for some 15 miles, and across strike for about five miles. Thick beds and dip slopes show the regional dip of 1° to the south-west. Thin beds are often slumped. The lithological log for Bathurst No.4 Bore (Lake Nash) is enclosed (Table 2).

The paucity of sandstone and siltstone in this part of the sheet area may result from a thinning of the sandstone and siltstone rock-unit further west (Tomahawk Beds). Alternatively, erosion to a lower level than further west, may also account for the absence of the sandstone and siltstone.

Palaeontology

The only fossils found were stromatolitic algae, with some stroma up to two feet across. They occur at five horizons in the upper part of the sequence, and extend laterally for about two miles.

MESOZOIC

Undifferentiated Mesozoic(?)

Introduction

Coarse quartz sandstones and conglomeratic sandstones overlie some of the Tomahawk Beds, and are tentatively assigned to the Mesozoic.

Similar lithologies do not crop out above the Meeta

Beds in the northern part of the Sheet area, or below the Austral Downs Limestone (Tertiary?) in the north-eastern part of the area.

Distribution and Lithology

The sandstones form isolated outcrops over a wide area; they crop out on the top of the hills west of Argadargada Homestead, and eastwards between the Homestead and Tolley's Bore. Further outcrops are situated west, and north-west of Bathurst No.1 Bore (Lake Nash). They are the youngest beds exposed in the southern part of the Sheet area; the contact with the Tomahawk Beds is covered by scree, but there is no angular unconformity.

The sandstones are dark brown, of coarse arenite size, and in places, current bedded and lateritized. The quartz grains are angular and subangular, and in some areas, occur with quartz sandstone pebbles. The pebbles vary in size from 1.5 - 6.0 cms., are well rounded but not highly spherical. The bedding is poorly defined, but current bedding is obvious; the maximum visible thickness is 20 feet.

Palaeontology

Fossils were not found.

CAINOZOIC

Austral Downs Limestone. (Tertiary?)

Introduction

The Austral Downs Limestone (Noakes, 1951) is similar to the limestone of that name mapped on the Avon Downs Sheet area to the north (Randal and Brown, 1926b), and probably formed a continuous unit in this part of the Sheet area.

Distribution and lithology

In the north-eastern part of the Sheet area between Georgina Downs Homestead and the Georgina River, the limestone crops out as horizontal "pavements" and also forms scree. It occurs with boulders of buff, pelletal and microcrystalline dolomite, principally in the desert country, but small cobbles are also scattered on the adjacent grey soil plains.

The thickness of the unit is unknown, and driller's logs, in the area of outcrop, do not differentiate between limestone and dolomite. Apart from the log of No.37 Bore (Lake Nash), which may indicate 44 feet of Austral Downs Limestone, the logs of other bores in the area, i.e. Nos.13, 26, 28, (Lake Nash) do not reveal any significant thickness of Tertiary(?) limestone.

The limestone is white, grey and red in colour, and varies from microcrystalline to nodular and layered. Irregular nodules, lenses and patches of silica, possibly opaline, characterise the limestone and weather to a dark brown-black colour in relief.

Palaeontology

Some of the layered specimens may represent algal growth, but diagnostic features and other determinable fossils were not found.

Superficial Deposits (Tertiary-Quaternary)

Superficial deposits are most widespread in the northern half of the Sheet area. They consist of grey-brown soil, red sand-soil, chert gravel and river alluvium. Full details of the superficial deposits are given by Stewart, Christian and Perry (1954). Some river gravels contain quartz pebbles, and reportedly, topaz and minor garnet. However, all suspected topaz pebbles given to the party, proved to be quartz, suggesting that topaz is rare or absent. The quartz may be derived from the erosion of Mesozoic conglomerates to the south, and the garnets from the Arunta Complex, near the headwaters of the Sandover River on the Alcoota Sheet area.

STRUCTURE

Introduction

The structure of the area is difficult to interpret as many outcrops are separated by large areas of grey soil and desert country. Furthermore, the structure of each outcrop is often obscured by surface gliding or slumping, producing erroneous dips and strikes. The reliable dips do not exceed 5°, and the majority are $1-2^{\circ}$. These low dips are difficult to record accurately in carbonate rocks owing to solution along bedding planes, and correlation with the structure of adjacent outcrops is hindered by facies change within the carbonates.

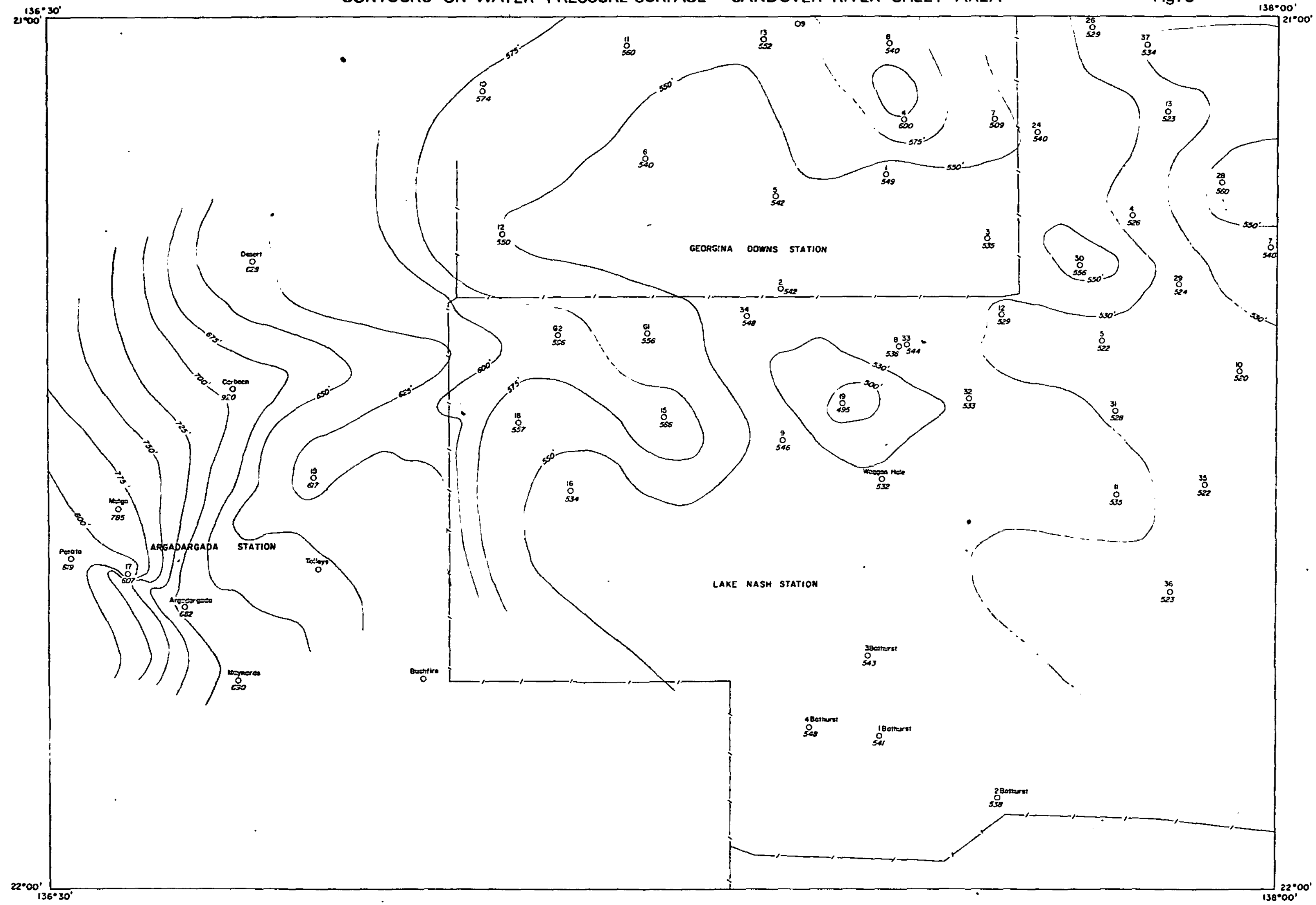
Folding

A study of aerial photographs reveals vague structures, but there is little field evidence to support them.

The regional dip is mainly to the south-south-west, but varies from $1-5^{\circ}$ towards $160-220^{\circ}$. In the eastern part of the Sheet area, dips vary from $2-4^{\circ}$ towards 165° and 125°. Complementary dips on opposite limbs were not recorded, but despite poor surface evidence, broad synclines and anticlines may occur.

CONTOURS ON WATER PRESSURE SURFACE – SANDOVER RIVER SHEET AREA

Fig. 8



REFERENCE

775' Contour lines of piezometric surface — Station boundary

36 Bore number
523 Height of piezometric surface above mean sea level

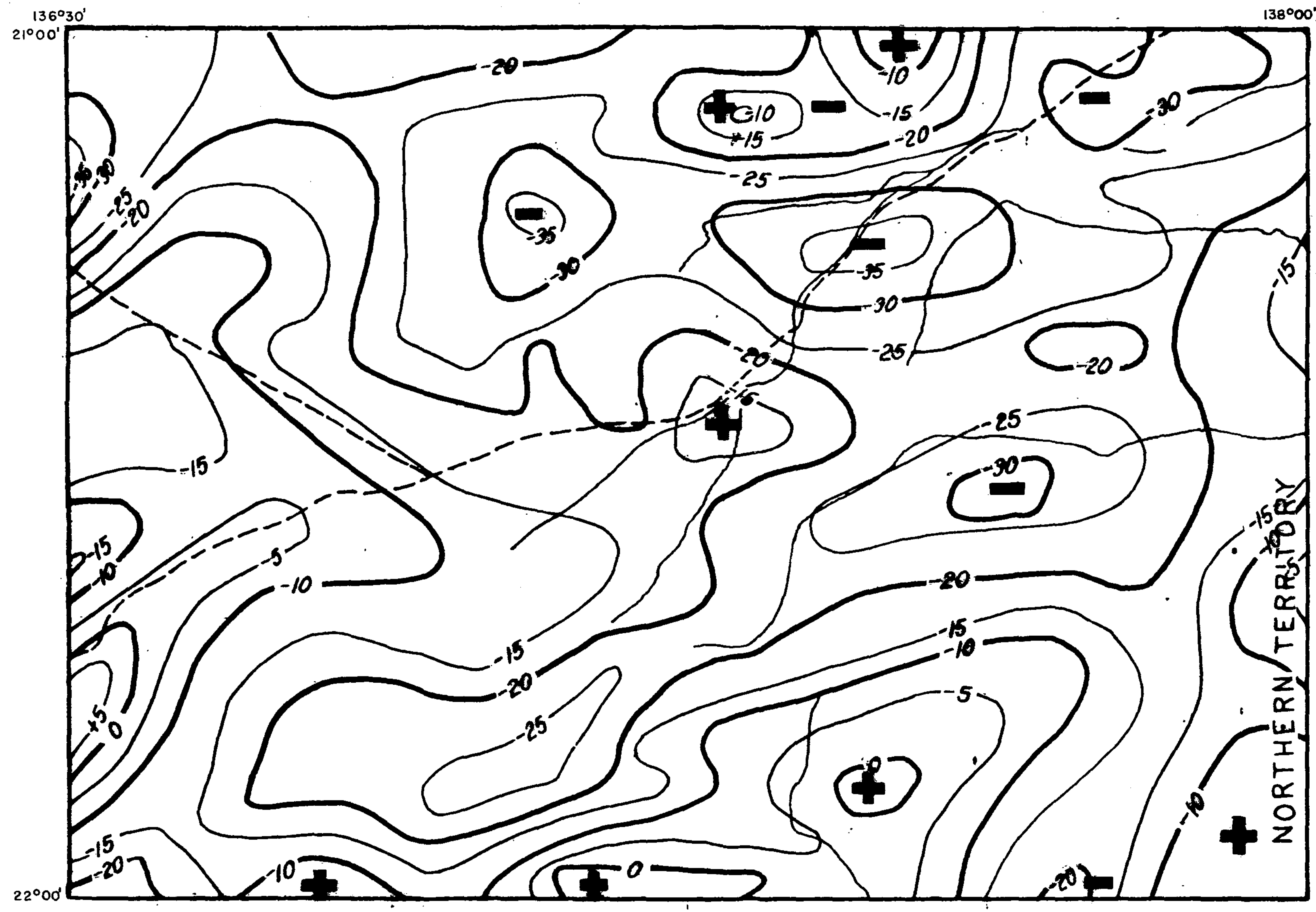
SCALE

5 0 5 10 15 20 25 30 MILES

Bureau of Mineral Resources, Geology and Geophysics

To accompany Record 1964/63

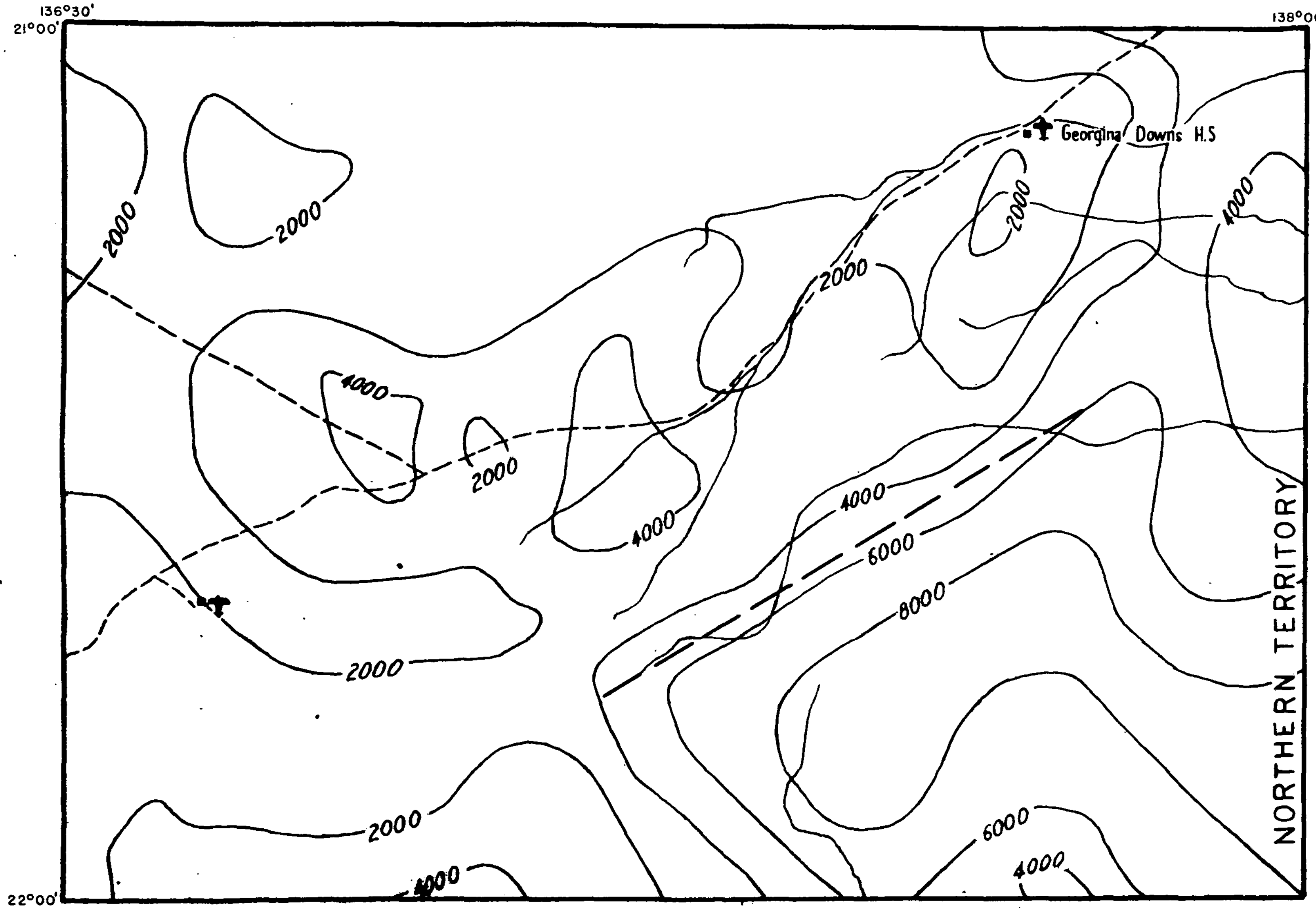
Fig.7



BOUGUER ANOMALIES — SANDOVER RIVER SHEET AREA from BMR Geophysical Section Map No. G371-12-1.

Bureau of Mineral Resources, Geology and Geophysics May 1964 To accompany Report 1964/63

Fig.6



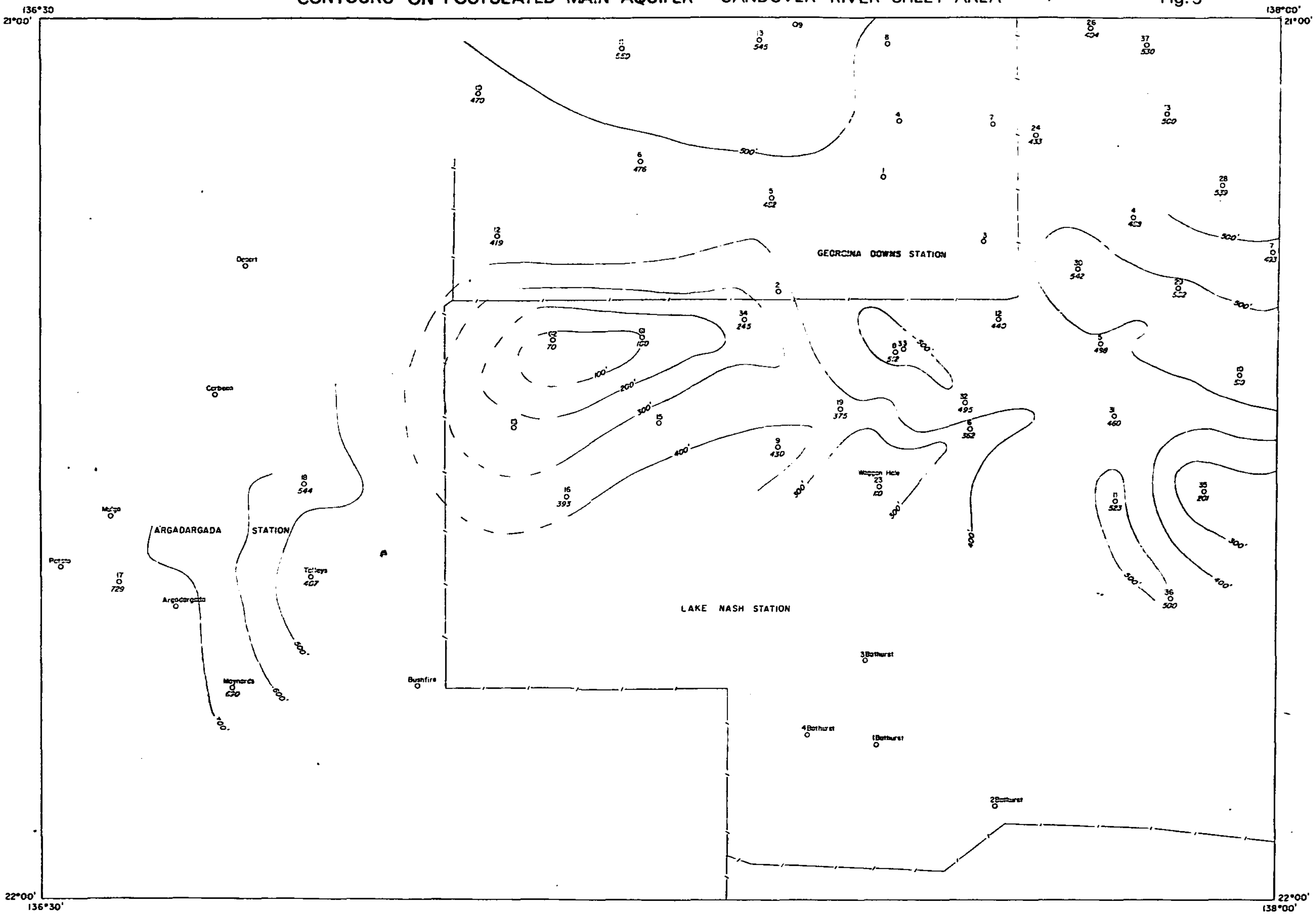
PRELIMINARY DEPTHS TO MAGNETIC BASEMENT — SANDOVER RIVER SHEET AREA after Wells + Milsom 1964

SCALE
10 0 10 20 30 40 Miles

Bureau of Mineral Resources, Geology and Geophysics *May 1964* *To accompany Record 1964/63*

CONTOURS ON POSTULATED MAIN AQUIFER – SANDOVER RIVER SHEET AREA

Fig. 5



REFERENCE

500' Contour lines of postulated main aquifer

Station boundary

9 Bore number

430 Height of postulated main aquifer above mean sea level

SCALE

5 0 5 10 15 20 25 30 MILES

Bureau of Mineral Resources, Geology and Geophysics

To accompany Record 1964/63

LK

Supporting evidence in this area is provided by plotting a hypothetical aquifer (Fig. 5.) (Randal, 1962). In the north-central part of the area the beds are flat-lying, but in the north-west part the dip is 3° to 165°. In the western-central part of the Sheet area dips vary from 1-2° and very weak folds may be present. Near Carbeen Bore (Argadargada), approximately 30 feet of sandstone is exposed. This may result from preservation in the core of a syncline. However, the greater thickness may also result from lateral thickening or down-faulting. The evidence from the hypothetical aquifer (Fig.5) in this area is unreliable as data is scarce.

In the south-western part of the Sheet area, the Tomahawk Beds have slumped and dips cannot be measured accurately. Dips appear to be low and may be undulating; the regional dip appears to be south-westerly. The Tomahawk Beds form part of an arcuate divide separating two drainage basins, and the different river profiles on either side of the divide may reflect a broad anticlinal structure. Shallow, longitudinal profiles of north-flowing streams contrast with the steeper profiles of the south-flowing ones, and a thicker sequence of dolomite is exposed in the southern streams. This may indicate an anticline with a steeper limb to the south-east and an axial trend of north-east to south-west.

In the southern and south-eastern parts of the Sheet area, dips range from 1-5° towards 165-215°. Fold axes cannot be determined, but drainage patterns suggest minor folding. The trend of marker beds denotes a regional strike of 300°.

Deeper basement structures are suggested by preliminary aerial magnetometer results (Wells and Milsom, 1964)(Fig. 6). The structures may have influenced Cambrian sedimentation. Preliminary results indicate that magnetic basement is approximately 2000 feet below sea level in the northern and western parts of the Sheet area, and deepens to approximately 8000 feet in the south-eastern part of the area. The Bouguer Anomaly Map is included for comparison (Fig. 7.) Both maps show similar structural trends in the area, i.e., an east-west trend in the northern part, and a north-east to south-west trend in the southern part.

In four parts of the area, positive Bouguer anomalies coincide with deepening or deep magnetic basement; this may mean a greater thickness of carbonates in these areas. However, four positive anomalies coincide with shallow magnetic basement; these may either represent a thicker carbonate sequence in localised deeps in Upper Proterozoic sandstone over relatively shallow magnetic basement, or more likely, igneous and metamorphic bodies at shallow depths below a thinner carbonate sequence.

Two negative anomalies coincide with deep magnetic basement, but six coincide with shallow basement. All these anomalies may either be a result of thinning of the carbonate sequence around Upper Proterozoic sandstone "highs", irrespective of the depth of magnetic basement, or more likely, they are a result of acid igneous rocks occurring at shallow depths below a thinner cover of carbonates.

Faulting

There is little surface evidence of faulting and only four faults are recorded in the area. In the south-east, normal faults strike east-north-east and displacements of approximately 200 feet were measured. Although additional faults may be concealed by large areas of superficial deposits, it seems that stresses were too weak to cause large scale faulting.

The magnetic gradients with strong linear trends from south-east to north-west and south west to north-east may represent basement faulting along these trends. The two strike directions intersect in the western part of the Sheet area, and although there is no surface evidence of faulting, Imbordjudu Creek and Sandover River follow these directions.

Jointing

The dolomite is well-jointed and the dominant trend is north-east to south-west. Minor sets strike east-west and north-west to south-east. The predominance of joints over faults suggests that orogenic forces were weak and stresses were dissipated along joints.

GEOLOGICAL HISTORY

The geological history of the Sandover Sheet area can only be discussed in general terms as fossils are rare and the stratigraphic sequence is poorly exposed.

Archaean and Proterozoic rocks are not exposed on the Sheet area, but their location, with reference to the area indicates the general shape of the basin of deposition.

Archaean rocks of the Arunta Complex crop out 60 miles south and south-south-west on the Tobermory and Huckitta Sheet areas (Smith and Vine 1960; Smith 1964).

Lower Proterozoic rocks of the Hatches Creek Group crop out 60 miles west and north-west in the Davenport Ranges on the Elkedra and Frew River Sheet areas (Smith, Stewart and Smith, 1961), and 80 miles east on the Urandangi Sheet area (Noakes, 1951). Lower Proterozoic granites crop out 50 miles south-south-west on the Huckitta Sheet area (Smith, Vine and Woolley, 1960).

Lower Proterozoic rocks are considered to be magnetic basement on the eastern and western margins of the Georgina Basin, but some Lower Proterozoic rocks may occur above the magnetic sequence, and Archaean rocks may also form parts of the magnetic basement in the Sandover River Sheet area.

Upper Proterozoic sandstones, siltstones and arkoses of the Elyuah Formation, Grant Bluff Formation and the Field River Beds crop out 50 to 60 miles south and south-west on the Tobermory and Huckitta Sheet areas (Smith and Vine, 1960); Smith, 1964). Upper Proterozoic Pilpah Sandstone crops out 35 miles north-east on the Mt. Isa Sheet area (Öpik, Carter and Noakes, 1961), and may be equivalent to the sandstone recorded at 995 feet (i.e. 255 feet of Cambrian sediments below M.S.L.) in Lake Nash No.1 Well (Amalgamated Petroleum N.L.). Upper Proterozoic rocks are not exposed west of the Sandover River Sheet area; they possibly thin-out on the magnetic basement "high" (see p. 16).

Preliminary results of the aeromagnetic survey (Wells & Milsom, 1964) indicate that the non-magnetic sediments range from 2000-8000 feet in thickness below M.S.L. in the Sandover River Sheet area. The known thickness of the Lower Palaeozoic carbonate succession varies from 0-3000 feet below M.S.L. on adjacent sheet areas, but from this information it is difficult to determine the thickness of the Upper Proterozoic sequence in the Sandover River Sheet area. The age of the fault (NE - SW) on the preliminary aeromagnetic map, and its effect on Upper Proterozoic or Cambrian sedimentation is unknown.

At present, it seems that Upper Proterozoic sandstones, siltstones and arkoses, derived from Archaean and Lower Proterozoic rocks, were deposited in narrow basins, and thinned rapidly to the east and west. They possibly accumulated on a shallow shelf in the north and west, and in a deep gulf in the south-east, (if pre-Upper Proterozoic faulting occurred).

Upper Proterozoic rocks were uplifted, eroded and possibly faulted before Cambrian sedimentation.

The Cambrian seas transgressed the eroded Upper Proterozoic surface, but the age of the transgression is unknown. The presence or absence of Lower Cambrian rocks in the succession has not been proved.

A shelf area of carbonate deposition developed during Middle Cambrian times and shallow warm waters, rich in calcium and magnesium covered the Sandover and adjacent Sheet areas. This environment persisted throughout Cambrian and Lower Ordovician times and a complex group of carbonate sediments accumulated.

During deposition of the Meeta Beds on the Sandover River Sheet area, shallow, warm waters were rich in carbonate and chemical precipitation formed carbonate mud and helped to form ooliths in places and possibly pellets (Illing, 1954). Highly saline conditions with rich magnesium concentrations may have combined with very slow subsidence to cause penecontemporaneous dolomitisation. The textures and sedimentary structures were thus preserved.

Impersistent current action helped to shape the ooliths and possibly form the pellets, but it did not completely winnow the deposits. Some of the pellets may be of faecal origin.

Periodic storms or disturbance of the sea floor caused the break-up or reworking of partly consolidated dolomites and produced the intraformational conglomerates (Folk, 1959).

Algae flourished in the photosynthetic zone, and although restricted in the northern part of the area, they indicate a shallow, sunlit, marine environment. Gastropods also existed but were not abundant.

At times, elevation of nearby land, climatic or current change caused the deposition of quartz sand and rare clay-silt pellets in current and ripple-marked beds. These conditions were widespread in the northern part of the area, and represent erosion of islands of Upper Proterozoic sandstone in the shelf sea, or erosion of larger Lower Proterozoic land areas to the east and west.

In later Upper Cambrian times in the southern part of the area, sediments of the Tomahawk Beds accumulated in a shallow, shelf environment with warm waters, rich in calcium and magnesium. Quiet, precipitating conditions alternated with more turbulent conditions and deposits of carbonate mud were interbedded with well sorted, oolitic and pelletal sediments. Persistent currents deposited large numbers of ooliths and pellets, grain-on-grain (Dunham, 1962), and left little matrix. This environment seems to have been unfavourable for organic growth.

Conditions suddenly changed, and quartz sand and silt were swept across parts of the carbonate shelf. The area probably became shallower as adjacent land was uplifted and eroded; quartz sand and silt were deposited without forming large scale current beds. Slight disturbances caused small scale slumping and microfaulting.

Animal life was not prolific under these conditions, but some trilobites, molluscs and possibly brachiopods existed.

Further east, in late Upper Cambrian times, and possibly in Lower Ordovician times, the environment was also one of shallow, warm water saturated with calcium and magnesium. Stromatolitic and columnar algae flourished in the photosynthetic zone. Chemical precipitation, and possibly algal precipitation and disintegration formed carbonate mud, while areas of more persistent current action and precipitation favoured the formation of ooliths (Newell, Purdy and Imbrie, 1960).

Elevation of distant land, weak current or climatic change again produced quartz silt which occurs in some of the sediments.

Evidence of subsequent sedimentation in the Sandover River Sheet area is absent, but proof that deposition continued in adjacent areas exists further south on the Tobermory and Huckitta Sheet areas.

During Middle Ordovician times a shallow environment of carbonate and sandstone deposition existed on the Tobermory Sheet area (Smith and Vine,, (1960). Siluro-Devonian sediments were deposited in the southern part of the Toko Ranges (P.Jones, B.M.R. pers.comm.), and Devonian Dulcie Sandstone was deposited in the centre and north-western parts of the Huckitta Sheet area (Smith, 1964).

The area was also uplifted and eroded between Siluro-Devonian and the Mesozoic.

During the Mesozoic the southern part of the Sandover River Sheet area was either a continental or littoral environment. Very strong fluvial and possibly marine currents transported rounded large pebbles of quartz and sandstone from the south, and deposited them with coarse quartz sand in cross-beds. The northern part of the Sheet area was probably an area of non-deposition, as conglomeratic sandstones are not present below the Tertiary limestone.

A further period of uplift, and slight folding or tilting, occurred during late Mesozoic and early Tertiary, and marine or lacustrine conditions developed, probably only in the north-eastern part of the Sheet area. During Miocene (?) times (Noakes, 1951), lime-mud was precipitated from shallow, warm water possibly inhabited by some algae. In some cases silica may have been precipitated concomitantly. Lateritisation of some of the land surface probably occurred at the same time (Stewart, 1954, p.51).

Slight uplift and erosion followed and superficial deposits of brown-grey soils and river alluvium were deposited in swamps and the Georgina River basin during the Tertiary and Quaternary.

ECONOMIC GEOLOGY

Petroleum Prospects

Products of oxidation and/or polymerization of crude oil were recorded in vuggy dolomite in GRG.14 and in Amalgamated Lake Nash No.1 Well (six miles north of the Sandover River Sheet area). However, it is difficult to evaluate the petroleum prospects in areas of poor exposure and indeterminate structure where limited subsurface control is available. Additional subsurface data will be required before a reliable evaluation can be attempted.

Gravity and aeromagnetic surveys have been completed and the structural trends and provisional depths to magnetic basement have been determined. Some structures are present, but the different Cambrian rock units, their relationships and their thicknesses are unknown. Consequently, interpretations and predictions are still hypothetical.

Although the preliminary results of the magnetometer survey are valuable, factors such as the relative magnetic values of the Archaean, Lower Proterozoic and Upper Proterozoic rocks are unknown, and the high density of carbonate rocks compared with that of the Upper Proterozoic rocks complicates the gravity anomaly determination.

A seismic traverse by the Bureau of Mineral Resources in the north-eastern part of the Georgina Basin (Robertson, 1962), has demonstrated that seismic work would be difficult and costly in this region.

The complete succession, the different rock units, their ages and direction of facies changes are unknown. Deep stratigraphic wells are therefore necessary to obtain this information. As a first step in obtaining subsurface data the following drilling sites are suggested:

TABLE 3 : WATER BORE DATA FROM SANDOVER RIVER SHEET AREA. NORTHERN TERRITORY

STATION No. OR NAME.	POSITION	ELEVATION (FEET)	TOTAL DEPTH (FEET)	MEMBER WITH AQUIFER	DEPTH OF AQUIFERS (FEET) * MAIN SUPPLY	DEPTH TO STANDING WATER LEVEL	PUMP DEPTH (FEET)	SUPPLY IN G.P.H.	QUALITY	REMARKS
LAKE NASH NO.1. BATHURST	64 m. @ 204° from Lake Nash Homestead 15 m.S.E. of Kings Waterhole	797	341	Ninmaroo ?	-	256	320	960	V.Good.	
" No.2.	65 m.@ 194° from Lake Nash Homestead. 25 m.S.E.of Kings W.H.	727	315	Ninmaroo ?	-	189	288	458	V.Good (Soft)	Attempt at deepening hole made on 15.6.41. Hole very crooked and possibly tools at bottom.
" No.3	58 m.@ 208° from Lake Nash Homestead. 10 m. E. of Kings W.H.	897	680	Ninmaroo ?	-	354	477	None	-	Water could not be raised even though it was pumped for 2½ hrs, continuously with plunger and foot valves 123' below S.W.L.
No.3 BATHURST REPLACEMENT	2 m.N.of No.3 Bathurst	-	1000	Meeta Beds ?	410	400	-	220	-	-
LAKE NASH No.4 BATHURST	65 m.@ 208° from Lake Nash Homestead. 10 m.SSE. of Kings W.H.	812	392	Ninmaroo ?	-	264	280	1417	V.Good	-
No.4 BATHURST REPLACEMENT	On site of Bathurst No.4.	812	730	-	310,390,550,680, 693,712, 728	297	-	1500	-	-
LAKE NASH No.4	18 m.@ 198° from Lake Nash H.S. on Bull Ck.	651	275	Meeta Beds "Limestone"	146; 163 *	125	164	2400	N.I.	-
LAKE NASH No.5 CHARCOAL BORE	28 m.@ 197° from Lake Nash H.S.	688	252	"	166. 190 *	166	208	Good	Good	
LAKE NASH No.6	40 m.SSW.of Lake Nash Homestead .(not located)	698	623	Meeta Beds? "Flint Rock Limestone"	100, 240,356 *	150	346	2400	Good	Replaced by No.32
LAKE NASH No.7	21 m.@ 166° from Lake Nash H.S.; onState boundary fence.	635	142	Meeta Beds "Limestone"	95. 142 *	95	128	2400	Good	-
LAKE NASH No.8	37 m. @ 221° from Lake Nash H.S. Headwaters Bull Creek.	750	403	Meeta Beds	238 *	214	242	2400	Good	Replaced by No.33
LAKE NASH No.9	48 m. @ 223° from Lake Nash Homestead	766	721	Meeta Beds	250, 284, 336*	220	300	2400	Good	-
LAKE NASH No.10	30 m.@ 175° from Lake Nash H.S. 3 m. W. of State Border	625	171	Meeta Beds "Limestone"	115	105	140	2400	-	-
LAKE NASH No.11	40 m.@ 190° from Lake Nash H.S. S. of Woodroffe River	685	264	Meeta Beds? "Limestone clay Limestone"	162 *	150	186	2400	-	-
LAKE NASH No.12	30 m.@ 212° from Lake Nash H.S. Abadabada Ck.	699	400	Meeta Beds "Limestone"	214 259 *	170	263	10 2400	-	? S.W.L. of 205' 18/9/15.
LAKE NASH No.13 BEANTREE BORE	10 m.@ 200° from Lake Nash H.S.	623	290	Meeta Beds "Hard limestone and boulders"	100. 120 *	100	120	15, 400, 1800.	-	-
LAKE NASH 15 MEETA BORE	54 m.@ 231° from Lake Nash H.S.on Milne R.	777	822	Meeta Beds "Limestone"	248 - ?	191	309	small. 1800	-	-

STATION No. OR NAME	POSITION	ELEVATION (FEET)	TOTAL DEPTH (FEET)	MEMBER WITH AQUIFER	DEPTH OF AQUIFERS (FEET) * MAIN SUPPLY	DEPTH TO STANDING WATER LEVEL	PUMP DEPTH (FEET)	SUPPLY IN G.P.H.	QUALITY	REMARKS
LAKE NASH 16 (Waterhole Bore)	66 m. @ 233° from Lake Nash Homestead	814	1036	Meeta Beds "Limestone and Boulders"	314 421 *	280	409	Soakage 400	-	Tested at 340', 356', 409' for 6 hrs. each; all tested 400 g.p.h. Not equipped.
LAKE NASH 18	64 m. @ 237° from Lake Nash Homestead.	812	672	Meeta Beds "Limestone"	270 - ?	255	300	600 1650	-	
LAKE NASH 19	43 m. @ 221° from Lake Nash Homestead.	745	765	Meeta Beds -	293 370 *	250	304	Soakage 1650	-	
LAKE NASH 23	46 m. @ 213° from Lake Nash Homestead.	730	739	Meeta Beds ? "Limestone"	123-129 619-621 *	198	280	Soakage ?	-	
LAKE NASH 24 (Winnecke Bore)	18 m. @ 230° from Lake Nash Homestead.	673	241	Meeta Beds "Limestone"	100-200 200-241 *	133	-	Small	2,050 ppm	
LAKE NASH 26 (Desert Bore)	9 m. @ 253° from Lake Nash Homestead.	659	273	Camooweal Dolomite ? "Limestone"	136 255 *	130	-	20	Fresh	
LAKE NASH 28	14 m. @ 176° from Lake Nash Homestead.	680	164	?Meeta Beds "Limestone"	130 141 *	120		- -	Good	
LAKE NASH 29	23 m. @ 185° from Lake Nash Homestead.	645	165	Meeta Beds "Limestone"	131 143 *	121	148'6"	2000	-	
LAKE NASH 30	24 m. @ 207° from Lake Nash Homestead.	690	166	Meeta Beds "Limestone"	144 148 *	134	153'6"	Small 2000	Good	
LAKE NASH 31	34 m. @ 192° from Lake Nash Homestead.	658	330	Meeta Beds "Limestone"	140 177 198 *	130	219	Small Small 2000	-	
LAKE NASH 32	37 m. @ 210° from Lake Nash Homestead.	713	225	Meeta Beds "Limestone-sandstone junction"	209-218 *	180	-	1900	-	Replacement for No. 6
LAKE NASH 33	36 m. @ 219° from Lake Nash Homestead.	775	647	Meeta Beds -	278'6" 352 377'6" 625-628	131'6"	-	Soak) 240) 770	-	Replacement for No. 8
LAKE NASH 34	45 m. @ 234° from Lake Nash Homestead.	760	525	Meeta Beds "Limestone"	212 485 515 *	?212	-	450 2,400	-	
LAKE NASH 35 (Scotty Bore)	40 m. @ 180° from Lake Nash Homestead.	720	530	?Meeta Beds "Limestone"	234 519 *	198	324	Soak 1680	-	
LAKE NASH 36 (Bottams Bore)	48 m. @ 184° from Lake Nash Homestead.	670	186	Tomahawk Beds. "Limestone"	157-163 168-171 *	147	161	2,880	-	
LAKE NASH 37 (Geebees Bore)	5 m. @ 219° from Lake Nash Homestead.	660	135	Camooweal Dolomite?	123-130 *	126 +	126	2,800	-	
LAKE NASH G1	53 m. @ 242° from Lake Nash Homestead	850	757	Meeta Beds -	355 450 494-503 750 *	294'6"	-	750 2250	TDS 1190	1st hole abandoned at 170' because of crooked hole. Bubbles at 355'
LAKE NASH G2	59 m. @ 241° from Lake Nash Homestead.	830	902	Meeta Beds	280 520 740-780 *	244	390	200 250 600 1400	TDS 1680	

STATION No. OR NAME	POSITION	ELEVATION (FEET)	TOTAL DEPTH (FEET)	MEMBER WITH AQUIFER	DEPTH OF AQUIFERS (FEET) * MAIN SUPPLY	DEPTH TO STANDING WATER LEVEL	PUMP DEPTH (FEET)	SUPPLY IN G.P.H.	QUALITY	REMARKS
LAKE NASH (Advice Bore)	2 m. (?) S.E. of Kings Waterhole, Lake Nash station.	834	730	Meeta Beds ?	348 730 *	340	-	200 9600	-	
GEORGINA DOWNS No. 1	9 m. @ 242° from Georgina Downs Homestead	705	303	[illegible] "	-	160	208	-	-	Equipped and working (previously Lake Nash No. 3)
GEORGINA DOWNS No. 2	27 m. @ 233° from Georgina Downs Homestead	733	330	"	-	191	225	-	-	Broken (7/7/63) (previously Lake Nash No. 14).
GEORGINA DOWNS No. 3	9 m. @ 185° from Georgina Downs Homestead	710	352	"	-	175	206	-	-	Working; (previously Lake Nash No. 20)
GEORGINA DOWNS No. 4	7 m. @ 275° from Georgina Downs Homestead	737	234		-	137	205	-	-	Working; (previously Lake Nash No. 21)
GEORGINA DOWNS No. 5 (Stokes Bore)	18 m. @ 253° from Georgina Downs Homestead	724	252	Meeta Beds	180 242 *	182	-	80 1400	Good	Red clay 0' - 220 ft.
GEORGINA DOWNS No. 6	28 m. @ 267° from Georgina Downs Homestead	770	404	Meeta Beds	294 *	230	294	1400	TDS 2120	Calcareous, sandy clay 0 - 130 ft.
GEORGINA DOWNS No. 7	Homestead Bore	672	238	Camooweal Dolomite (?)	-	-	165	-	TDS 1356	
GEORGINA DOWNS No. 8	10 m. @ 30[illegible]$^\circ$ from Georgina Downs Homestead	730	237	Camooweal Dolomite (?)	-	-	190	-	-	-
GEORGINA DOWNS No. 10	40 m. @ 275° from Georgina Downs Homestead	770	329	Meeta Beds (?)	196 300 *	196	270	2880	TDS 970	Drought relief.
GEORGINA DOWNS No. 11	28 m. @ 283° from Georgina Downs Homestead	755	340	Camooweal Dolomite ? "Dolomitic Limestone"	205 *	195	306	2,000	TDS 768	Drought relief bore.
GEORGINA DOWNS No. 12	40 m. @ 258° from Georgina Downs Homestead	790	443	Meeta Beds "Dolomite"	240-252 271-272 * 432-433	240	420	Small 600 400	-	Drought relief bore
GEORGINA DOWNS No. 13	20 m. @ 288° from Georgina Downs Homestead	750	206	Camooweal Dolomite ? "Limestone Dolomite"	202-204 205-206 *	198	205	100 1500	-	Drought relief.
ARGADARGADA No. 1	Argadargada Homestead	920	810	Tomahawk Beds ? Meeta Beds ?	-	240	-	2,800	TDS 1467	
ARGADARGADA TOLLEY'S BORE	10 m. @ 071° from Argadargada Homestead	892	500	Meeta Beds	440 470 485	-	-	2,800		
ARGADARGADA MAYNARDS BORE	7 m. @ 141° from Argadargada Homestead	940?	830	Tomahawk Beds	250	250	-	650		Tested at 434' gave 650 gph. Tested at 830' gave 300 gph. Abandoned due to hard rock.
ARGADARGADA BUSHFIRE BORE	20 m. @ 107° from Argadargada Homestead	-	400 500	-	-	-	-	-	-	Abandoned because of hard drilling.
NO. 17 STOCK ROUTE	5 m. @ 307° from Argadargada Homestead	927	293	Meeta Beds?	120 198 *	120	268	Small 1040	TDS 1070	
NO. 18 STOCK ROUTE	14 m. @ 042° from Argadargada Homestead	867	325	Meeta Beds	323	250	295	2,800	TDS 1415	Collared 6' away from original No. 17 Lake Nash.
ARGADARGADA POTATO BORE	9 m. @ 298° from Argadargada Homestead	935	120	-	-	116	-	3000	498	

STATION No. OR NAME	POSITION	ELEVATION (FEET)	TOTAL DEPTH (FEET)	MEMBER WITH AQUIFER	DEPTH OF AQUIFERS (FEET) * MAIN SUPPLY	DEPTH TO STANDING WATER LEVEL	PUMP DEPTH (FEET)	SUPPLY IN G.P.H.	QUALITY	REMARKS
ARGADARGADA MULGA BORE	9 m. @ 335° from Argadargada Homestead	945	185	-	-	160	-	-	1610	Drift sands to T.D.
ARGADARGADA CARBEEN BORE	17 m. @ 013° from Argadargada Homestead	920	302	-	-	228	-	2,050	-	Clays, with water in gravel.
ARGADARGADA DESERT PLAIN BORE	26 m. @ 019° from Argadargada Homestead	900	326	-	-	272	-	2,800	1822	

1. Five miles south of No.6 Bore (Georgina Downs) to obtain stratigraphical information about the Meeta Beds and units below, and their structural relationship with the Upper Proterozoic or shallow magnetic basement. The total depth is approximately 3000 feet.

2. Between No.12 and Bathurst No.1 water bores on Lake Nash Station to investigate structures, associated with magnetic anomalies, and their possible influence on Cambrian sedimentation; total depth is approximately 5000 feet.

Water Resources

The area receives approximately 10 inches of rain each year. This is adequate for pasture growth with suitable soil conditions, but it does not provide permanent surface water for the present number of stock. The rivers and streams quickly dry up, and nearly all waterholes are empty by September. Although several dams have been constructed, the cattle industry depends on underground water.

At present there are 58 water bores in the area, 37 of which are operating most of the time. Ten bores are drought relief bores and are not used continually. Four bores did not strike water, and three bores were abandoned.

The bores range in depth from 142 feet to 1036 feet; the majority are between 200 feet and 700 feet deep, and contain sub-artesian water in two or three aquifers between 130 feet and 360 feet. The quality of the water is generally good. The deep bores, between 500 feet and 700 feet deep, have several aquifers which produce poor supplies ranging up to 600 gallons per hour. In these bores, yields are variable and unpredictable. In the north-eastern part of the area, the shallow bores, between 120 feet and 300 feet deep, generally record one aquifer with a supply of 2000-3000 gallons per hour (Table 3).

It appears that bores on the grey soil plains (in Camooweal Dolomite?) yield good supplies at shallow depths, whereas, in the hill and desert country (in the Meeta Beds) the bores yield low supplies, and the aquifers are at greater depths. In the Meeta Beds the aquifers may become tighter or thinner, or change in lithology. The standing water levels in the bores on Lake Nash station vary from 90-300 feet below surface, the majority being at 100-150 feet (Fig. 8). The hydrodynamic gradient is from north-west to south-east in the central and eastern parts of the area. Here, the pattern conforms with that established by Randal (1962).

Information is not available for all the water bores on the sheet area, and more hydrological and barometric information is necessary to interpret the subsurface hydrodynamics.

Sand

Pure quartz sand is rare, occurring only as some recent alluvium in the river courses. Sand in the red desert areas is often mixed with clay.

Gravel

Chert gravel occurs in large and small patches on the grey soil plains, but is not size sorted. Some of the dolomite weathers to a loose unsorted rubble.

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TABLE 2.

BATHURST NO.4 BORE REPLACEMENT

Advice A57/6, Lake Nash

Description of Samples

0- 10	Soil; sandstone, red ferruginous, fine quartz grains. Sandstone, white and mottled red, calcareous, fine quartz grains, Buckshot gravel.
10- 20	Soil; clay, dark brown and mottled, silty and sandy, with lumps of travertine.
20- 30	Gravel; consisting mainly of pebbles up to one inch across of sandstone, white and mottled brown, fine quartz grains.
30- 40	Gravel; as for 20-30 feet, with travertine and very coarse Buckshot gravel.
40- 50	Sandy clay and silt; dark brown, earth. Sand is fine to coarse grained, composed of angular fragments of ferruginous and mottled decomposed rock (probably gneiss and micaceous schist).
50- 80	Sandy clay and silt; as for 40-50 feet.
80- 90	Sandy clay and silt; as for 40-50 feet with much less "sand" fragments.
90-110	Sandy clay and silt; as for 80-90 feet.
110-120	Sandy clay and silt; as for 80-90 feet, but very coarse pebbles of decomposed rock.
120-140	Sandy silt; brown, fine to very coarse sand and gravel, composed of mainly angular pebbles of sandstone (as for 20-30 feet), silicified sandstone, and decomposed gneiss and micaceous schist.
140-150	Sandy silt; as for 120-140 feet, slightly calcareous.
150-160	Sandy silt; as for 120-140 feet, but pebbles consist mainly of white very fine crystalline dolomite.
	BASE OF TERTIARY ? SEDIMENTS
160-170	Dolomite; white, very fine crystalline and microcrystalline
170-180	Dolosiltite; grey-white, micaceous Dolomite; grey-white microcrystalline and very fine crystalline Siltstone; light grey, micaceous, calcareous.

180-190	Dolomite; buff, fine crystalline Dolosiltite; grey, very fine crystalline, laminated, slightly silty Siltstone; grey calcareous, laminated.
190-200	Dolomite; buff, very fine to fine crystalline
200-210	Dolomite; as for 190-200 feet Siltstone; yellow, clayey.
205-207	Siltstone; yellow, clayey, with water-worn pebbles of buff microcrystalline dolomite and red fine grained ferruginous sandstone.
210-220	Dolomite; white and buff, aphanitic, some calcite veins.
220-230	Dolomite; as for 210-220 feet Dolomite; as for 190-200 feet Dolosiltite; buff, laminated, very fine crystalline, slightly silty.
230-240	Siltstone; yellow-brown, calcareous, with red fine grained ferruginous sandstone and white aphanitic dolomite.
240-250	Siltstone; as for 235-240 feet
250-260	Limestone and Dolomite; buff, microcrystalline and cryptocrystalline Chert
260-270	Dolomite and Dolosiltite; as for 220-230 feet
270-280	Dolomite; buff and white, microcrystalline and cryptocrystalline Dolomite; blue, aphanitic.
280-290	Dolomite; as for 270-280 feet with more blue, which has vugs lined with calcite crystals Dolosiltite; buff, micaceous, laminated.
290-300	Dolomite and Dolosiltite; as for 280-290 feet Dolomite; buff, very fine crystalline.
300-310	Dolomite and Dolosiltite; as for 290-300 feet, mostly in the form of apparently waterworn, well rounded, pebbles. Possibly from an unconsolidated pebble bed?
310-320	Dolomite; blue, buff and grey, microcrystalline and cryptocrystalline, laminated. Some waterworn pebbles as in 300-310 feet (Water)

320-330	Dolomite; white and buff, aphanitic
330-550	No Returns; Returns probably going into cave below 330 feet or sealing up aquifer at 310 feet.
550-560	Dolomite; white and grey, cryptocrystalline, microcrystalline and fine crystalline. The fine crystalline material is in very small cuttings or mostly crushed into a chalk powder.
560-570	Dolomite; grey, very fine to fine crystalline and microcrystalline. Sample mostly as a chalky powder.
570-580	Dolomite; as for 560-570 feet
580-590	Dolomite; grey and blue, aphanitic
590-600	Dolomite; as for 580-590 feet, laminated
600-610	Dolomite; grey and blue, aphanitic and very fine crystalline Dolosiltite; blue, laminated, micaceous
610-620	Dolomite; grey, microcrystalline to very fine crystalline, vuggy
620-630	Dolomite; blue-grey, aphanitic
630-640	Dolomite; blue-grey, aphanitic
640-650	Dolomite; blue-grey, aphanitic
650-660	Dolomite; blue-grey, aphanitic, some micaceous and laminated
660-670	Dolomitised Sandstone; white, fine grained quartz, well rounded, well sorted Dolomite; blue-grey, aphanitic
670-680	Siltstone; grey-green, calcareous, laminated Dolomite; blue-grey, aphanitic
680-687	Dolomite; blue-grey, aphanitic Sandy Dolomite; white, very fine grained quartz, vugs lined with dolomite crystals (Aquifer)
690-700	Dolomite; blue-grey, aphanitic Dolomite; buff, microcrystalline to fine grade crystalline
700-715	Dolomite; white, fine grade crystalline, intergranular porosity, soft. (Sample crushed into fine crystals) Dolomite; blue-grey, aphanitic (Aquifer 709-712 feet)
715-720	Dolomite; blue-grey, aphanitic

720-730	Dolomite; white, microcrystalline to fine crystalline similar to the white dolomite at 700-715 feet (Sample crushed into fine crystals).

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BORE G1 LAKE NASH Advice A57/1

0 - 2	Chert; Soil; red, clay-sand soil
2 -45	Sandy Clay; red-white mottled, hard drilling, some dolomite and chert.
45-102	Dolomite; very hard, grey-white, microcrystalline to very fine crystalline; clear crystals of dolomite, probably from vugs. Much yellow and pink staining.
102-108	Dolomite; white and grey, microcrystalline to very fine crystalline.
108-120	Dolomite; white, microcrystalline to very fine crystalline, with coarse clear crystals lining vugs.
120-162	Dolomite; as for 108-120 feet.
162-172	Dolomite; grey and white, microcrystalline to very fine crystalline, slightly sandy with some glauconite?; coarse dolomite crystals lining vugs.
172-179	Dolomite; as for 108-120 feet
179-201	Dolomite; white, very fine crystalline, vuggy, with coarse dolomite crystals lining vugs.
201-240	Dolomite; as for 179-201 feet.
240-270	Dolomite; buff, cryptocrystalline. Some pelletal dolomite, microcrystalline pellets in aphanitic dolomite Siltstone; buff, calcareous.
270-285	Dolomite; as for 201-240 feet Sandstone; red-brown, fine grained, ferruginous
285-290	Dolomite; blue, aphanitic, with disseminated pyrite Dolomite; buff, microcrystalline, vuggy Sandstone; as for 270-285 feet
290-305	Dolomite; grey and white, aphanitic, with disseminated pyrite Dolomite; grey and white, microcrystalline, vuggy Sandstone and Marl; red and brown fine grained sandstone, yellow marl.

305-317	Dolomite; as for 285-290 feet, dolomite crystals lining vugs, some yellow staining
317-358	Dolomite; brown, fine grade crystalline, vuggy porosity Dolomite; as for 285-290 feet (Aquifer?)
358-388	Dolomite; white and buff, microcrystalline to very fine crystalline, abundant vugs lined with dolomite Marl; yellow and brown. (Water, approx. 500 gph)
388-422	Dolomite; blue, cryptocrystalline to microcrystalline, vuggy.
422-430	Sandy Dolomite; white, microcrystalline to fine crystalline, abundant vugs lined with dolomite crystals (granular sample); very fine grained quartz grains
430-455	Dolomite; grey, aphanitic, veins and vugs filled with microcrystalline dolomite
455-458	Sandy Dolomite; as for 422-430 feet
458-494	Dolomite; grey, aphanitic and very fine crystalline, veins and vugs lined with coarse crystalline dolomite and sandy dolomite as for 422-430 feet. Dolositite; blue-grey, micaceous, occurring in thin laminations between dolomite.
494-503	Sandy Dolomite; white, fine crystalline, open vugs lined with euhedral dolomite crystals (Aquifer) Much yellow staining (fine "sandy" powder sample) Some ferruginous fine grained sandstone.
503-536	Dolomite; grey-white, aphanograde, very hard
536-544	Dolomite; grey and white, aphanograde to fine crystalline, vuggy, some yellow staining
544-614	Dolomite; grey and white, aphanograde to fine crystalline, vuggy, some yellow staining
614-624	Dolomite; white, microcrystalline to fine crystalline, very vuggy (Water)
624-675	Dolomite; blue-grey, hard, aphanograde, much re-crystallisation, stylolitic porosity, fine grade pelletal
675-700	Dolomite; grey-white, aphanograde, some fine grade of pellets, some very fine crystalline

700-725	Dolomite; blue-grey, grey-white, white, aphanograde to fine crystalline, vuggy (Water)
725-750	Dolomite; white, aphanograde to fine crystalline, vuggy porosity (Water)

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BORE G2 LAKE NASH Advice A57/2

0- 91	No samples
91- 99	Dolomite; white, microcrystalline to fine crystalline. some fine grained sandy dolomite, and ferruginous fine grained quartz sandstone
99-113	Dolomite; white, pink and grey green, very fine crystalline, dolomite crystals lining vugs. Some intergranular porosity. Some sandy dolomite, very fine grained quartz.
113-121	Sandstone; white and brown, very fine grained quartz sandstone. (re Red quartz sandstone in outcrop)
121-128	As for 99-113 feet
128-145	As for 113-121 feet
145-150	As for 99-113 feet
150-161	As for 113-121 feet
161-163	As for 99-113 feet
163-187	As for 113-121 feet
187-216	As for 99-113 feet
216-241	Dolomite; white and pink, very fine to fine crystalline
241-254	Dolomite; grey, aphanitic, laminated, micaceous Dololutite; blue-grey, micaceous
254-283	Dolomite; white, microcrystalline, vuggy. (Water) Dolomite; grey and white, aphanitic, disseminated pyrite
283-290	Dolomite; white, cryptocrystalline to microcrystalline. Many free dolomite crystals in sample, probably from vugs.
290-316	Dolomite; white, cryptocrystalline to very fine crystalline, euhedral dolomite crystals lining vugs (Water)
310	Dolomite; white, fine crystalline - sample crushed to a fine chalky powder

315	Dolomite; light-grey, cryptocrystalline to microcrystalline, fine granular sample
330	Dolomite; white, cryptocrystalline to microcrystalline, some free dolomite crystals
348	Dolomite; as for 330 feet, vugs lined with dolomite crystals
	Dolomite; green, aphanitic
350	Dolomite; blue-grey, aphanitic
	Dololutite; blue, laminated, micaceous
362	Dolomite; grey, aphanitic laminated
	Dolomite; white, very fine crystalline some free dolomite crystals
363	Dolomite; white, very fine crystalline, yellow stained, many free euhedral crystals of dolomite
365	Dolomite; white, very fine crystalline, euhedral dolomite crystals
366	Dolomite; white, very fine to fine crystalline, yellow stained
368	Dolomite; white and grey, cryptocrystalline to microcrystalline
	N.B. Pump test taken at this depth, with pump set at a depth of 322 feet: Forked at 200 gph: S.W.L. at 258 feet.
368-414	Dolomite; white, fine crystalline, vuggy, free dolomite crystals. Sample as a fine chalky powder.
414-419	Dolomite; grey-white, cryptocrystalline to microcrystalline to fine crystalline, vuggy, yellow staining
419-428	Dolomite; grey-white, microcrystalline to fine crystalline, vuggy, yellow staining
428-429	As for 368-414 feet
429-456	As for 419-428 feet
456-476	As for 368-414 feet
476-490	As for 419-428 feet
490-500	Dolomite; white, very fine to fine crystalline, yellow stained, vuggy, dolomite crystals lining vugs. Few very fine grains of quartz (fine granular sample)

500-514	Dolomite; white and grey, cryptocrystalline to very fine crystalline, yellow stained, vuggy, dolomite crystals lining vugs. Some very fine grains of quartz (Fine granular sample)
514-520	Dolomite; light-grey, aphanitic
520-540	Dolomite; grey and white, cryptocrystalline to microcrystalline, vuggy, free euhedral dolomite crystals. Some grey-green sandy dolomite and siltstone. Dololutite; blue-grey, laminated micaceous N.B. S.W.L. increase to 244' at this depth
540-600	Dolomite; dark grey, aphanitic, laminated, disseminated pyrite. Hard drilling
600-615	Dolomite; white, cryptocrystalline to microcrystalline, yellow staining, disseminated pyrite, vuggy with dolomite crystals lining vugs. (Fine granular sample) Sandy Dolomite; dark grey, fine grained quartz
615-632	Dolomite; grey, aphanitic, yellow staining, disseminated pyrite
632-666	Dolomite; white and grey, cryptocrystalline to microcrystalline, disseminated pyrite, vuggy, some with microcrystalline pellets
666-740	Dolomite; light grey, cryptocrystalline to microcrystalline, occasionally containing a quartz silt
740-802	Dolomite; white and grey, aphanitic to fine crystalline, vuggy. Sample returned as a "sandy" chalk
802-815	Dolomite; white, very fine to fine crystalline, vuggy. Sample returned as a "sandy" chalk
815-825	Dolomite; purple-brown, microcrystalline to very fine crystalline, quartz silty, intergranular porosity
825-850	Dolomite; white and grey, aphanitic to fine crystalline, vuggy, much red and yellow staining and limonite fragments

Water

850-870	Dolomite; white and grey, aphanitic to fine crystalline, vuggy, some cuttings show quartz silty Dolomite; purple-brown, as for 815-825 feet
870-896	Sandy Dolomite; white and grey, aphanitic, fine grained quartz sand. Dolomite; purple-brown, as for 815-825 feet
896-902	Dolomite; grey, microcrystalline to fine crystalline, Many large open vugs. Very porous. (Water)

W.H. Morton, Alice Springs
F53/8-58

PRELIMINARY EDITION, 1964

SUBJECT TO AMENDMENT

AUSTRALIA 1:250,000

SANDOVER RIVER

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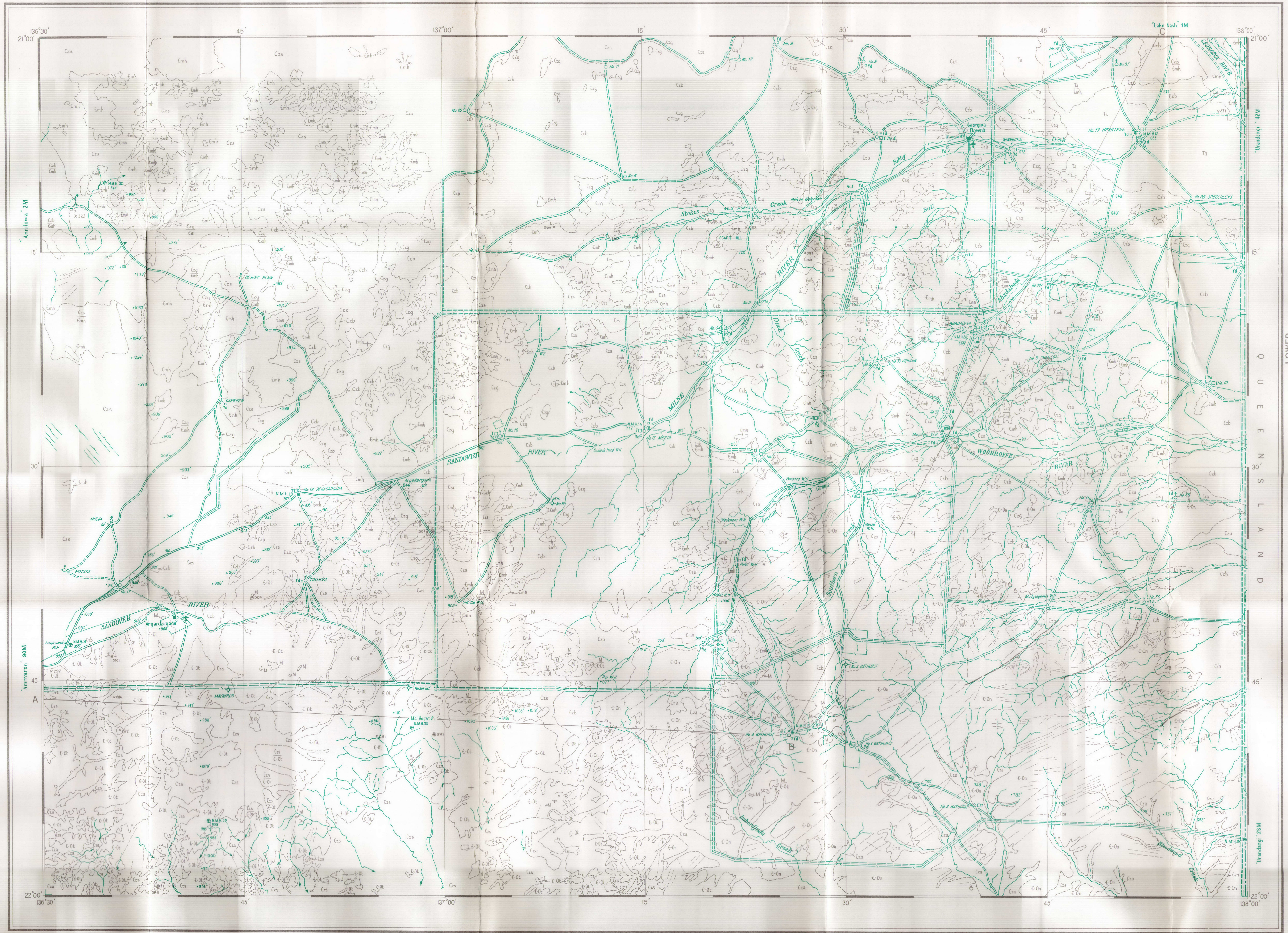


Reference

CAINOZOIC			Cza	Alluvium: silt, clay, sand, some chert and quartz gravel
			Czb	Grey soil with small patches of chert gravel
			Czs	Red sand, some red clay-soil
			Czg	Chert and ferruginous gravel with grey soil, silt, red sand
	TERTIARY	Austral Downs Limestone	Ta	Limestone: white, red, crystalline, layered algal (?), siliceous
MESOZOIC		Undifferentiated	M	Cross-bedded quartz sandstone, conglomerate, quartz and sandstone pebbles
LOWER PALAEOZOIC	LOWER ORDOVICIAN TO UPPER CAMBRIAN	Tomahawk Beds	€-Ot	Dolarenite: buff, grey, pelletal, oolitic, sandy; dolutite; quartz sandstone, siltstone: brown, white, cross-bedded, micro slumped
		Ninmaroo Formation	€-On	Grey dolutite; algal dolomite; pelletal dolarenite, with some ooliths, quartz; some sandstone and siltstone
	UPPER TO MIDDLE CAMBRIAN	Meeta Beds	€mh	Buff dolutite; pelletal dolarenite, with some ooliths; chert nodules and lenses; brown and grey quartz sandstone with some clay pellets, ripple marked and cross-bedded
	CAMBRIAN (?)		€	Section only

Geological boundary

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

Prevailing strike and dip of strata

Horizontal strata

Dip < 15° } air-photo interpretation

Trend lines } air-photo interpretation

Joint pattern } air-photo interpretation

Prevailing dip of gently folded strata

Fossil locality , - Algal (general)

SR2 Macrofossil locality

X 7 Specimen locality (text reference prefixed by SR)

GRG14 Core hole

Non-flowing bore

Non-flowing bore with windpump

Abandoned bore

Dam

WH Waterhole

T Tank for water

Sand dunes

Road

Vehicle track

Fence

"Georgina" Homestead

Landing ground

Yd Yard

N.M.H.15 Astronomical station

•766′ Height in feet, instrument levelled } datum: mean sea level

•1043′ Height in feet, barometric } datum: mean sea level

Compiled and issued by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. Topographic base compiled by the Division of National Mapping, Department of National Development. Aerial photography by the Royal Australian Air Force; complete vertical coverage at 1:50,000 scale. Transverse Mercator Projection.

INDEX TO ADJOINING SHEETS

Showing Magnetic Declination

TENNANT CREEK SE 53-14	ALROY SE 53-15	RANKEN SE 53-16	CAMOOWEAL SE 54-13	DOBBYN SE 54-14
BONNEY WELL SF 53-2	FREW RIVER SF 53-3	AVON DOWNS SF 53-4	MOUNT ISA SF 54-1	CLONCURRY SF 54-2
BARROW CREEK SF 53-6	ELKEDRA SF 53-7	SANDOVER RIVER SF 53-8	URANDANGI SF 54-5	DUCHESS SF 54-6
ALCOOTA SF 53-10	HUCKITTA SF 53-11	TOBERMORY SF 53-12	GLENORMISTON SF 54-9	BOULIA SF 54-10
ALICE SPRINGS SF 53-14	ILLOGWA CREEK SF 53-15	HAY RIVER SF 53-16	MOUNT WHELAN SF 54-13	SPRINGVALE SF 54-14

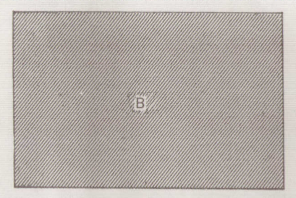
ANNUAL CHANGE 1′30″E

Scale 1 : 250,000

5 0 5 10 15 MILES

5 0 5 10 15 20 25 KILOMETRES

GEOLOGICAL RELIABILITY DIAGRAM

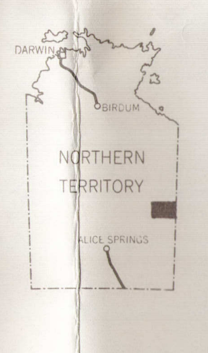


B *Detailed reconnaissance numerous traverses and air-photo interpretation*

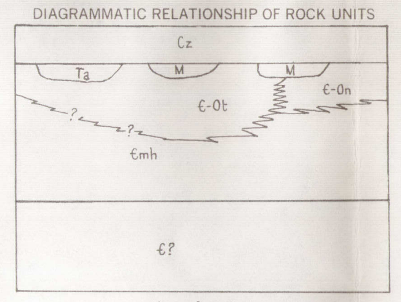
Geology by:-1963 K.G.Smith, E.N.Milligan, R.A.H.Nichols, W.H.Morton.

Compiled by:-1963 K.G.Smith, E.N.Milligan, R.A.H.Nichols,

Drawn by:- N.L.Kruger.



DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



~ Unconformity ~

Section A-B-C