Geology of the Wiso Basin, Northern Territory

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DEPARTMENT OF NATIONAL DEVELOPMENT & ENERGY
BUREAU OF MINERAL RESOURCES, GEOLOGY
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ABSTRACT

The Wiso Basin, a structural downwarp in the central western part of the Northern Territory, contains a sequence of near-horizontal Middle Cambrian to ?upper Palaeozoic sedimentary rocks. It is continuous with the Daly River Basin to the north, and with the Georgina Basin to the northeast and possibly the southeast. Most of the basin surface is a flat plain which has developed in semi-desert country.

Some of the rock sequences of the basin are imprecisely known because of poor outcrop. Cambrian to Ordovician sediments include five mappable rock units; disconformities and unconformities separate some units and may occur within the less well known ones. The basin sequence is thin in the northern and central parts (generally less than 500 m), but thickens southwards into the Lander Trough (up to 1000 m); farther south, the Cambrian to Ordovician sediments are faulted against the Arunta Block on the southern margin of the basin. ?Upper Palaeozoic sandstone overlies these rocks in the Lander Trough and transgresses the faults.

Almost flat-lying Mesozoic sediments overlie the northern part of the basin, and these, together with the older rocks of the basin, were extremely weathered during the formation of a laterite soil profile in Late Cretaceous or Early Tertiary time. A thin veneer of Cainozoic sediments, including extensive sand plains and dunefields, has since formed over the basin, and a sparse vegetation of spinifex and light scrub has developed.

Few mineral occurrences have been recorded in the basin, but supplies of water are present in the sediments, and the possibility of hydrocarbon accumulations in the Lander Trough cannot be dismissed.

INTRODUCTION

The Wiso Basin is a structural downwarp in which Palaeozoic rocks are preserved. It underlies an area of 160 000 km^2 in the central northwest of the Northern Territory (Fig. 1), and covers all or parts of nineteen 1:250 000 Sheet areas (Fig. 2). The country is arid, and in the southern, drier areas includes parts of the Tanami Desert. As a result, little development has taken place, and the few permanent settlements are restricted to the north, where rainfall is higher and beef cattle may be grazed.

Access is poor because only a few roads cross the basin. The bitumen-sealed Stuart Highway and the Overland Telegraph Line, which pass immediately east of the basin, provide two major lines of communication between Darwin and Adelaide. Several tracks extend westwards from settlements on the highway. One of these, extending west from Tennant Creek, was re-graded in 1975, but is impassable after heavy rain. The Murranji Track, from Newcastle Waters to Top Springs, is now a disused stock route, having been replaced in the 1960s by the bitumen-sealed Buchanan Highway between Daly Waters and Top Springs. Station tracks cross the northern parts of the basin, and extend along the Lander and Hanson River floodouts in the extreme south of the basin. Small settlements surround the area,

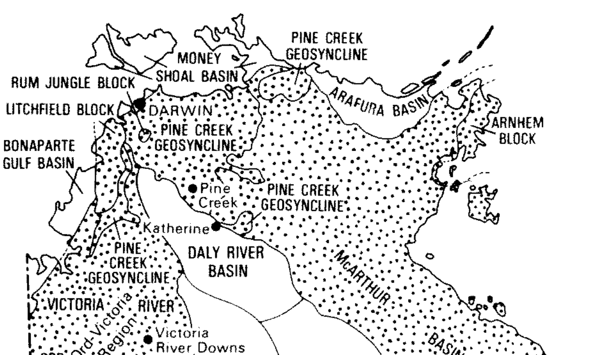

Fig. 1. Phanerozoic basins and basement provinces, Northern Territory (after D'Addario, 1975).

and Tennant Creek, a gold and copper mining town to the east, and Katherine, to the north of the basin, provide the main service centres for the district.

Acknowledgements

In writing the various sections of this Bulletin, we acknowledge the extracts, large and small, which we have taken either verbatim or in a paraphrased form from previous BMR reports by the following authors:

Milligan, Smith, Nichols, & Doutch (1966): Previous investigations, physiography, Palaeozoic, Mesozoic or Cainozoic, and Cainozoic.

Randal & Brown (1967): Previous investigations, climate and vegetation, physiography, Montejinni Limestone, Mullaman beds, laterite soil profile, Camfield beds, Birdum Creek beds, black soil, structure, water, construction materials, copper, bauxite, and phosphate.

Brown (1969): Physiography.

Randall (1973): Water.

Skwarko (1973): Mullaman beds.

We thank Mrs. C. Williams and Mr. G. Trott of the BMR Cartographic Section for drawing the figures.

Previous investigations

Brown (1895) travelled to the Victoria River region via Willeroo and Delamere in 1894, and referred to the Cambrian limestones and to the basalt outcrops, which he believed to be the younger; he later (1909) regarded the volcanics as Mesozoic to Tertiary in age. Towards the end of 1894 he journeyed overland from Darwin to Adelaide along the Overland Telegraph Line noting (1895) Cretaceous rocks and Cambrian Limestone between Katherine and Daly Waters.

Davidson (1905) was the first person to cross the central part of the basin, traversing, in 1900, from Kelly Well (Tennant Creek*), on the Overland Telegraph Line, to Western Australia, and returning to Barrow Creek (southeast of the basin). He made passing references to ferruginous sandstone and ironstone conglomerate (almost certainly pisolitic laterite) and figured a section at Buchanan Hills (southern WINNECKE CREEK) of 15 m of conglomerate capping 60 m of sandstone and limestone. He also recorded granite and 'iron saturated' schist from the area south of the basin.

L. A. Wells made preliminary topographic surveys of the Victoria River region and in a short report (1907) referred to the limestone at Mounts Williams and Wallaston, in northern WAVE HILL. Brown (1909), on a map that he dated and used, noted limestone along the western edge of the tableland between Figtree Creek, in western VICTORIA RIVER DOWNS, and Bullock Creek, in northeastern WAVE HILL, but visited none of these localities when he journeyed from Pine Creek to Tanami via Willeroo and Wave Hill.

In 1909, Chewings (1928, 1931) was commissioned to sink a series of wells for a proposed stock route from Barrow Creek to Wave Hill. He observed the formation now called the Lake Surprise Sandstone in the southern part of the Wiso Basin, and noted (1928, p. 323) that the sandstone was '. . . much disturbed and fractured in places though its general position was more or less hori-

* The names of 1:250 000 Sheet areas in this Bulletin are printed in capital letters.

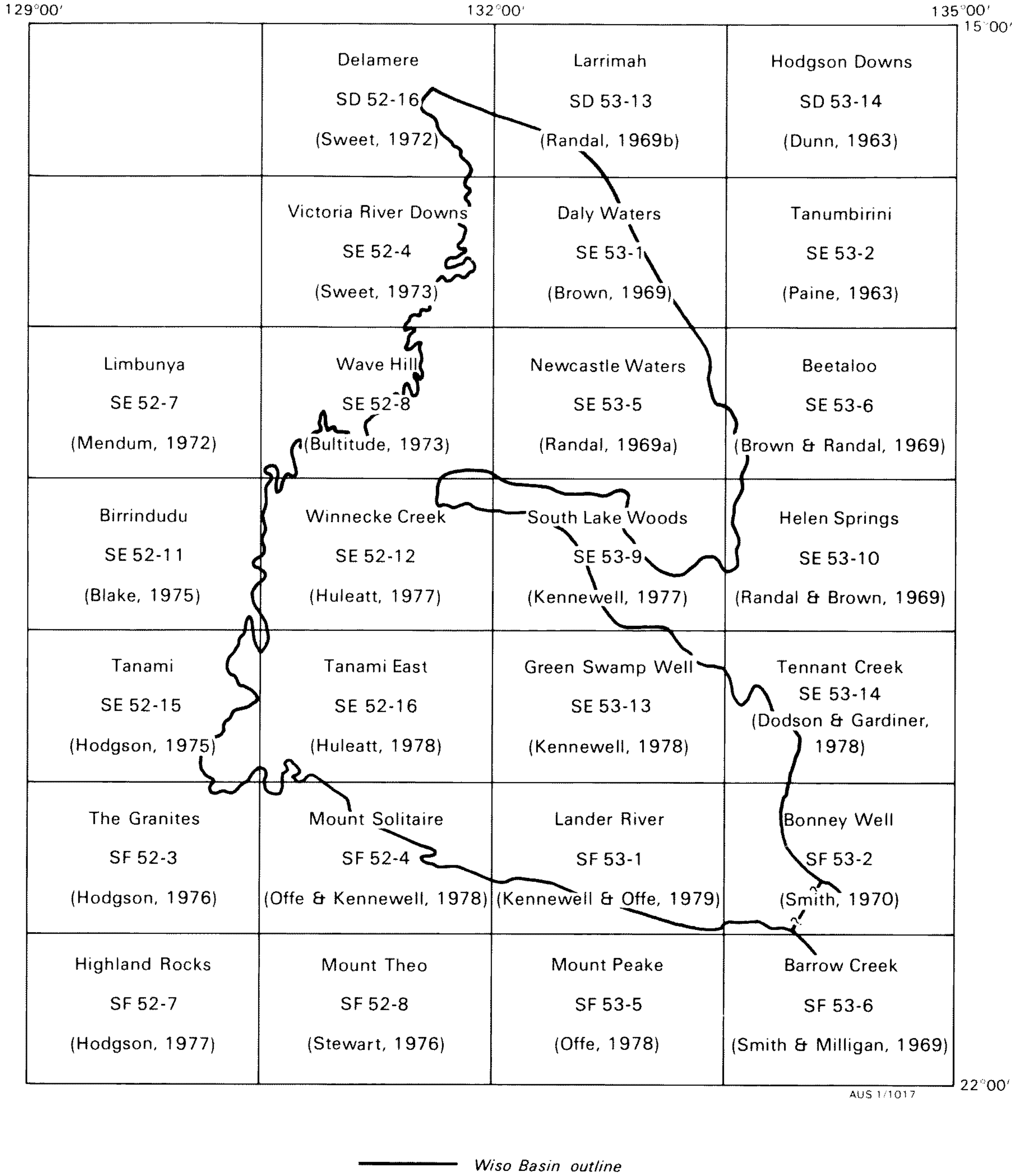

Fig. 2. Index to 1:250 000 Sheets covered by Plate 1, and references to Explanatory Notes.

zontal'. He suggested that it was Palaeozoic—possibly Cambrian. He also described the sandstone and shale of the central part of the basin, and considered them to be a distinct formation which he referred to as the Winnecke Creek Tableland formation (now subdivided into the Hooker Creek Formation, Lothari Hill Sandstone, Point Wakefield beds, and younger rocks). He considered the formation to be younger than the sandstone in LANDER RIVER owing to its apparent superficial nature, as '. . . in no case, notwithstanding that the Tableland Formation covers such extensive areas of country, did it appear to have had any great vertical dimensions' (Chewings, 1931, p. 9). He also examined limestone and siltstone (Montejinni Limestone) where they underlie the Winnecke Creek Tableland formation in the extreme north of WINNECKE CREEK. Because of the folding in the beds (actually slump folding), he considered them to be unconformable under the essentially flat-lying Winnecke Creek Tableland formation, and probable correlatives of Devonian limestone in Western Australia.

Woolnough (1912) passed to the north and east of the basin, commented on some of Brown's (1909) observations, and reproduced his map.

Winters (1915) journeyed along the Overland Telegraph Line from Pine Creek to Newcastle Waters in 1914, and commented on the Cambrian limestone and Cretaceous rocks; he briefly commented on the groundwater environment of the eastern part of the basin and considered it similar to that of the Barkly Tableland (Fig. 1).

Wade (1924) published a map which included the western part of the basin and on which he erroneously showed granite outcrops at latitude 18°30'S, longitude 131°E.

Ward (1926) visited the basin in 1925 during a groundwater investigation of the Northern Territory, and selected water-bore sites along stock routes.

In 1937, P. S. Hossfeld visited scattered outcrops of potentially metalliferous rocks between The Granites and Tennant Creek (Hossfeld, 1938a). He also sampled auriferous reefs in an area 56 km south of Tennant Creek and 16 km west of the Stuart Highway, which he named the Wiso Area (Hossfeld, 1938b). Later he used the name Wiso Tableland for '. . . the large unmapped area bounded by Newcastle Waters, Wave Hill, The Granites and Barrow Creek believed to be underlain by Cambrian sediments' (Hossfeld, 1954, p. 134). He presumed that a northwards continuation of these sediments joined the 'Buldiva' (Daly River) Basin, the whole constituting the 'Buldiva-Wiso' Basin.

Between 1949 and 1953 Traves (1955) examined the western part of the region during the geological mapping of the Ord-Victoria region; he also examined water-supply problems at Wave Hill station (Traves, 1953). Noakes & Traves (1954) examined rocks along the Stuart Highway in the northeast part of the basin during a survey of the Barkly Tableland.

In 1959, Phillips (1959) flew over the Tanami Desert and recorded outcrops of more or less flat-lying sandstone in the south of TANAMI EAST, and crystalline rock farther south.

N. J. Mackay (Northern Territory Administration) examined the western part of the region during water-supply investigations, and commenced mapping WAVE HILL and VICTORIA RIVER DOWNS at 1:250 000 scale. The work was not completed, but his maps and unpublished notes were used by Barclay & Hays (1965) during water-supply investigations in these Sheet areas between 1961 and 1963.

In 1960, the Geophysical Branch of BMR ran airborne magnetometer and radiometric traverses across the eastern third of GREEN SWAMP WELL (Spence, 1962). The magnetic intensity was found to be of low relief, and the Tomkinson Creek beds were found to be effectively non-magnetic. In 1962, one aeromagnetic traverse (unpublished BMR map) from Gordon Downs to Tennant Creek passed across northern GREEN SWAMP WELL. Interpretation of the results showed that the maxium depth to magnetic basement was of the order of 1800 m below sea level in the central northern part of this Sheet area.

As part of a stratigraphic drilling program in the Georgina Basin, BMR drilled a shallow stratigraphic drillhole, BMR Barrow Creek 18 (Grg 18) in northern BARROW CREEK in 1962 (Milligan, 1963). This drillhole penetrated Palaeozoic rocks, and indicated that in this area these rocks extend across the Proterozoic ridge separating the Wiso and Georgina Basins.

In 1963, Smith (1963) made two helicopter traverses into eastern GREEN SWAMP WELL and recorded low outcrops of horizontal sandstone interbedded with siltstone and chert.

In 1964, Aero Service Ltd (1964a) flew an aeromagnetic survey over the southern Wiso Basin for Exoil Oil Co. Pty Ltd, and produced a map showing depths to magnetic basement which indicate the presence of the Lander Trough.

An airborne magnetometer survey was made for Barkley Oil Co. Pty Ltd by Aero Service Ltd (1964b) between the headwaters of the Dry River and the headwaters of Sunday Creek in the southern part of LARRIMAH.

In 1965, Compagnie Générale de Géophysique (1966) completed an aeromagnetic survey over parts of DALY WATERS for Mercure International Petroleum Ltd, and demonstrated that flat-lying basalt is present at shallow depth. Société Nationale des Pétroles d'Aquitaine (1966) prepared a geomorphological study of part of DALY WATERS for the same company.

In 1965, Wongela Geophysical Pty Ltd carried out a contract gravity survey for BMR over almost all the Wiso Basin (Flavelle, 1965; Fraser, Darby, & Vale, 1977) with stations spaced at 7 km intervals. The remaining small areas in LARRIMAH and DELAMERE were completed in 1967 (Whitworth, 1970).

Photointerpretation of WINNECKE CREEK, SOUTH LAKE WOODS, TANAMI EAST, GREEN SWAMP WELL, MOUNT SOLITAIRE, and LANDER RIVER by Rivereau & Perry (1965) was followed by geological mapping (Milligan & others, 1966) and the preparation of preliminary geological maps. Ten stratigraphic holes were drilled at the same time. In the same year, 1965, HELEN SPRINGS and BEETALOO were mapped as a continuation of the regional mapping of the Barkly Tableland portion of the Georgina Basin (Randal, Brown, & Doutch, 1966).

Photointerpretation, partly by Perry (1966) and partly by Rivereau (1966), preceded geological mapping of the northern part of the Wiso Basin in 1966 (Randal & Brown, 1967); geological maps and explanatory notes of NEWCASTLE WATERS, LARRIMAH, and DALY WATERS were subsequently published (Randal, 1969a, b; Brown, 1969). Skwarko (1967, 1973) summarised the Cretaceous stratigraphy of the basin, and Brown (1968) commented on the Cambrian sediments of the area.

American Overseas Petroleum Ltd (1967) compiled a report on the southern Wiso Basin. The same company carried out an aeromagnetic survey which included a large area in the southern Wiso Basin and provided many estimated depths to magnetic basement (Adastra Hunting Geophysics Pty Ltd, 1967). A reflection and refraction seismic survey over the Lander Trough in eastern LANDER RIVER mapped several horizons dipping southwards and faulted against the Arunta Block (Ray Geophysics, 1967).

Randal (1973) summarised the groundwater characteristics of the northern Wiso Basin and compiled a comprehensive list of the water-bore data. Milligan (1976) summarised the basin geology known at that time.

BMR investigations 1974–77

In 1974, BMR embarked on a program to finalise the mapping and geological interpretation of the Wiso Basin. The program included drilling additional stratigraphic holes, reinterpreting the available geophysical data, and revising the mapping of the southern six Sheet areas. During the first field season a series of shallow stratigraphic holes was drilled across the northern margin of the Lander Trough. In 1975 a further stratigraphic hole—BMR Green Swamp Well 6—was drilled to 337 m, and traverses by helicopter were used to map WINNECKE CREEK, TANAMI EAST, SOUTH LAKE WOODS, GREEN SWAMP WELL, MOUNT SOLITAIRE, and LANDER RIVER; geological maps and explanatory notes of these Sheet areas are now available (Huleatt. 1977, 1978; Kennewell, 1977, 1978; Offe & Kennewell, 1978; Kennewell & Offe, 1979, respectively). Kennewell, Mathur & Wilkes (1977) have synthesised the geology and geophysics of the Lander Trough; Kennewell (1980) has described the cores and cuttings of stratigraphic holes and water-bores drilled in the Wiso Basin up to 1976; and this Bulletin synthesises the recent and earlier BMR work throughout the basin.

Climate and vegetation

The Wiso Basin extends over a large part of the Northern Territory, and, as a result, experiences great differences in both climate and vegetation (Bureau of Census and Statistics, 1970). The northern part borders the tropical north of Australia, and the southern part includes desert areas.

The average annual rainfall in the far north of the basin is almost 750 mm, most of which falls in the wet season from November through to March under the influence of the northwest monsoon. Little useful rain falls during the remainder of the year. The average annual rainfall decreases steadily southwards from 710 mm at Larrimah to 430 mm at Newcastle Waters, 360 mm at Tennant Creek and about 250 mm on the southwestern margin of the basin, where the rainfall is much less regular. Average annual evaporation increases from 2300 mm in the north to about 2900 mm in the south.

The normal daily temperature ranges for January show a slight southward decrease from about 37 to 26°C in the northern part of the area to 37 to 23°C in the southern part; Wave Hill settlement has a daily maximum of about 39°C. The normal daily temperature ranges for July show a much more pronounced drop southwards, from 30 to 14°C in the north to 22 to 7°C in the south. Frosts are rare in the northern part of the basin.

The dominant wind direction is from the southeast in winter, but varies between north, east, and south during the summer.

Spinifex, with scrub in a few areas, is the main vegetation in the northern Wiso Basin. Grass may be present on plains. As the climate becomes drier towards the south of the basin, scrub becomes less prominent, and spinifex, with a few low shrubs and rare clumps of scrub, covers most areas, though saltbush and grasses grow in playa lakes.

PHYSIOGRAPHY

Almost all the Wiso Basin forms part of one physiographic zone, a large plain referred to as the Main Plateau by Hays (1967; Fig. 3). The northern and northwestern margins of the basin are flanked by a low scarp which demarcates a second physiographic zone, the Dissected Margin (Hays, 1967), from the Main Plateau. Much of Hays's third main physiographic zone, the Northern Plain, corresponds to the valley of the Victoria River, northwest of the Wiso Basin.

Hays postulated the presence of four mature erosion surfaces in the north of the Northern Territory, and related them to his physiographic zones (Fig. 3). He considered that most of the Main Plateau represents the remnants of a large plain—the Tennant Creek Surface, on which a standard laterite soil profile has developed. The other, higher parts of the Main Plateau contain remnants of an earlier, topographically higher land surface, the Ashburton Surface, on which a vestigial laterite profile is preserved. Hays mapped residuals of the Ashburton Surface in prominent ridges in southeastern SOUTH LAKE WOODS, in TENNANT CREEK, and in southern WINNECKE CREEK.

The Dissected Margin is the main topographic feature in the low area immediately west of the scarp in the northwestern part of the basin and is closely associated with Hays's Wave Hill Surface (Fig. 3), but includes few to abundant residuals of the older and higher Tennant Creek Surface. The Northern Plain is closely associated with Hays's Koolpinyah Surface, a younger surface prominent on the coast of the Northern Territory.

The Main Plateau, dominant in the Wiso Basin, slopes gently northward from elevations of about 400 m, on the southern margin of the basin, to a shallow depression—less than 205 m—trending east across the centre of the basin. Lake Woods has formed in the eastern part of this depression, and the large calcrete areas near Cattle Creek homestead in WAVE HILL have developed in the western part. Farther north, the plateau rises onto a low, east-trending ridge up to 290 m high in central DALY WATERS, and in the far northern part of the basin it slopes gently downwards to elevations of about 200 m.

Paterson (1970) revised the physiography of the area immediatetly northwest of the Wiso Basin. The Main Platetau corresponds roughly to his Sturt Plateau, the Dissected Margin to his Victoria River Plains and Benches, and the Northern Plain to his Victoria River Plateau.

Eight distinct physiographic units have been recognised in the Wiso Basin (Plate 1).

Low rises, pediments, and rock outcrops rise almost imperceptibly from the surrounding sand plains, and are present throughout the basin but sparse in the northern part. Most rises are covered by rubble of ferricrete and weathered rock, although low outcrops, small scarps, and a few prominent hills are present. Vegetation is commonly sparse, and short creeks in places incise the gently sloping surface. Pediments surrounding many rises consist of clayey sand with a few pebbles of ferricrete and weathered rock, and are commonly covered by scrub. Rocks crop out generally in small scarps produced by erosion of low rises; in places they are capped by the ferruginous zone of the laterite soil profile and are extremely weathered.

Sand plains are the most extensive physiographic unit. They are characteristically flat and featureless, and have a monotonous cover of spinifex and small shrubs. Dunefields occur only in the southern part of the basin, where wind has formed the sand into dunes up to 20 m high and up to 10 km long. Their orientation is west-northwest, roughly parallel to the present prevailing winds. Spinifex growth has stabilised the dunes to a large extent.

Laterite areas occupy large parts of the north of the basin. They consist of low rises with a surface of rubbly ironstone and thin patchy soils, and intervening areas of abandoned drainage systems with a continuous cover of red sandy and loamy soils (Brown, 1969).

Black-soil plains have developed in the northern part of the basin, on the western edge of Lake Woods, on

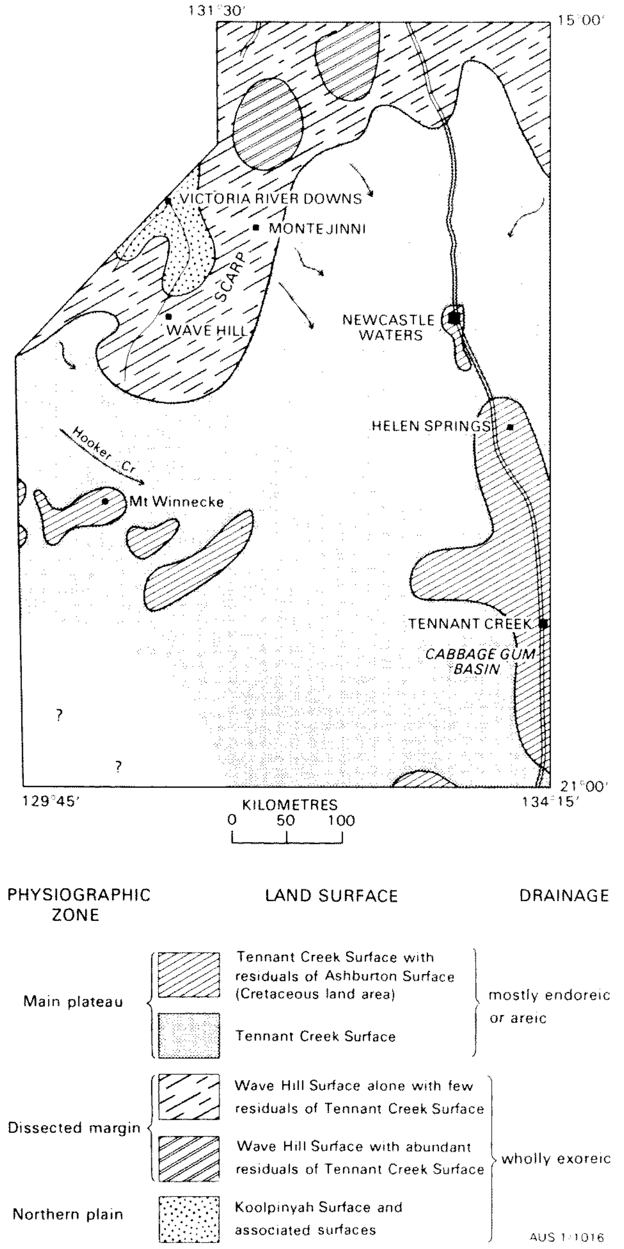

Fig. 3. Distribution of the erosion surfaces in the Wiso Basin (after Hays, 1967).

Sturt Plain, in central eastern WAVE HILL, and in some smaller areas. They are lower than nearby laterite areas, are flat, and have a grass-covered pedocalcic soil rich in organic material (Brown, 1969).

Alluvial flats and floodouts are areas inundated by the ephemeral streams which flood the sand plains. Alluvial flats are present only in the extreme north of the basin, where areas of pedocalcic soils are mainly confined to topographic depressions and broad valleys of present-day or former streams (Brown, 1969). Floodouts are confined to the southern parts of the basin; they have formed where prominent streams (e.g., the Lander and Hanson Rivers, and Winnecke Creek) and smaller creeks, flowing on to the flat sand plains, have deposited their load of sand, silt, and clay, and reworked sand from the plains, to construct broad sheets of alluvium on which scrub, grass, and spinifex grow.

Calcrete areas, claypans, and salt lakes are present throughout the basin. They are grouped in Plate 1 as they commonly have a similar physiographic setting, developing in broad shallow depressions. They support saltbush, spinifex, and grass. Calcrete areas are rubbly plains with calcrete mounds up to a metre high and separated by sand. In places the calcrete is incised, forming scarps up to 4 m high. The calcrete is limited to the southern half of the basin, where it underlies extensive areas in the central parts of GREEN SWAMP WELL and TANAMI EAST, northwestern BONNEY WELL, and central eastern WAVE HILL. Claypans and salt lakes are flat, rounded features from several metres to many kilometres long. They are commonly dry with a sun-cracked surface, but contain water after heavy rain. The surface of the salt lakes is generally covered by a crust of gypsum or halite produced by the evaporation of the contained water. The claypans and salt lakes are scattered throughout the semi-desert of the southern Wiso Basin, and in central GREEN SWAMP WELL form elongate areas up to 35 km long extending along topographic depressions.

Rocky hills, scarps, and pediments are prominent in the Dissected Margin (Hays, 1967), extend over the northwestern part of the basin, and form an area of more rugged topography influenced by the geological structure. Resistant beds in the flat-lying Mullaman beds form topographic benches above a plain which has an elevation of about 220 m and which corresponds to the unconformity at the base of the Mullaman beds. Superficial deposits on this surface are mainly grey pedocalcic soils on the Montejinni Limestone, and red sands and loams on outliers of the ferruginous sediments at the base of the Cretaceous sequence (Brown, 1969).

Basalt plains and terraces form extensive areas of low relief along the western edge of the basin. They have a rolling downs topography typical of basic volcanics, and form excellent grazing country for cattle. Drainage is clearly defined with a dendritic pattern, and the terraces are composed of resistant basalt flows, intercalated sediments, and limestone.

STRATIGRAPHY

The Wiso Basin is a slight Palaeozoic structural downwarp (and topographic depression) in which sediments accumulated on a basement of folded Proterozoic rocks and flat-lying Lower Cambrian basalts during Cambrian, Ordovician, and ?late Palaeozoic time.

The extent of the eastern, northern, and western parts of the basin appears to have been controlled by slight pre-Templetonian (Middle Cambrian) folding which separated the Wiso and Georgina Basins, and may have produced the structural ridge separating the Wiso and Daly River Basins; the same folding may have uplifted the area west of the Wiso Basin. The resultant structural depression controlled the extent of subsequent deposition. On the southern margin, structural disturbance due to the Alice Springs Orogeny controlled the extent of the basin, as its boundary closely corresponds with a large, possibly overthrust fault.

The conditions under which basin sediments accumulated were similar throughout large areas of central Australia during early Palaeozoic time, and a sequence of transgressions common to several central Australian basins has been compiled by Miss J. Gilbert-Tomlinson

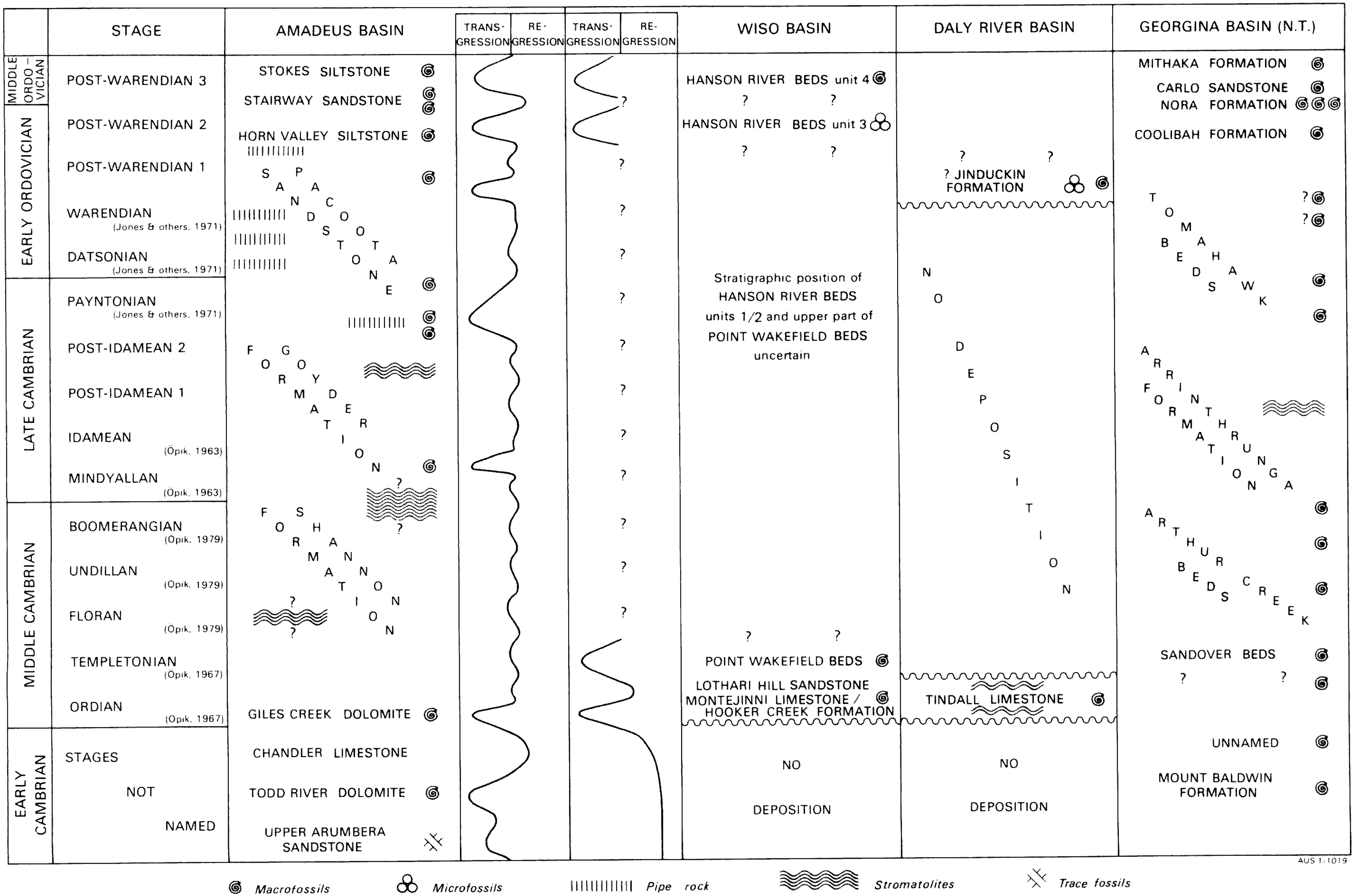

Fig. 4. Correlations of rock units and known transgressions and regressions in the Wiso Basin and surrounding basins (compiled in 1976 by Joyce Gilbert-Tomlinson).

(see Fig. 4). Early Palaeozoic deposition probably took place in basins covering large areas, which were subsequently tectonically separated into structural depressions containing similar sediments during the Late Devonian to Early Carboniferous Alice Springs Orogeny. These depressions include the other Palaeozoic basins (e.g., the Ngalia, Georgina, and Daly River Basins) of the Northern Territory.

The areal extent of the Wiso Basin is shown in Figure 1. The eastern and western boundaries are marked by the extent of the Montejinni Limestone or the undivided Montejinni Limestone and Hooker Creek Formation, and the southern margin is marked by the extent of the Lake Surprise Sandstone. The northern margin is obscured by the thin, flat-lying Mullaman beds, but is defined by a basement ridge (Fig. 16), interpreted from the elevations of the basement surface indicated by drillholes in the area. On its northern margin the basin is continuous with both the Daly River Basin and the northern part of the Georgina Basin, and in the southeast it is continuous with the southern Georgina Basin, extending across the basement ridge between the Tennant Creek Block and the northern part of the Arunta Block.

As a result of the 1975 geological survey, substantial revisions have been made to the nomenclature of rock units in the southern part of the basin. The definitions of new rock units are published in this Bulletin, and the previous and new nomenclatures are compared in Figure 5.

A correlation of the rock units in the Wiso Basin with those of the surrounding basins is given in Figure 4. Several marine transgressions and regressions are known from the study of lower Palaeozoic rocks, particularly in the Amadeus and Georgina Basins, and the resulting periods of deposition and erosion have been partly recorded in the stratigraphic sequence of the Wiso Basin.

PROTEROZOIC AND LOWER CAMBRIAN BASEMENT ROCKS

The Wiso Basin sequence overlies parts of many Proterozoic provinces, and obscures the relations between many of them. The basement rocks range from high-grade metamorphics of the Arunta Block to gently folded sediments of the Victoria River Basin. Aeromagnetic anomalies in places provide an indication of the nature of some basement rocks, and the extent of

<table>
<tr><th>Previous usage (Chewings, 1931)</th><th colspan="3">Previous usage (Milligan & others, 1966; Milligan, 1976)</th><th colspan="2">Present usage</th></tr>
<tr><td rowspan="4">Winnecke Creek Tableland formation (Permo-Carboniferous)</td><td colspan="3">Birdum Creek beds</td><td colspan="2">Birdum Creek beds</td></tr>
<tr><td colspan="3">Camfield beds</td><td colspan="2">Camfield beds</td></tr>
<tr><td colspan="3">Merrina beds</td><td colspan="2">Buchanan Hills beds</td></tr>
<tr><td colspan="3">Mullaman beds</td><td colspan="2">Mullaman beds</td></tr>
<tr><td>Devonian formation</td><td colspan="3">Dulcie Sandstone</td><td colspan="2">Lake Surprise Sandstone</td></tr>
<tr><td>? Devonian formation</td><td colspan="2">Hanson River beds</td><td rowspan="6">Undivided early Palaeozoic rocks</td><td colspan="2">Hanson River beds</td></tr>
<tr><td rowspan="5">Winnecke Creek Tableland formation (Permo-Carboniferous)</td><td rowspan="4">Merrina beds</td><td rowspan="2">Quartz sandstone, sand, silt, clay</td><td colspan="2">Point Wakefield beds</td></tr>
<tr><td colspan="2">Lothari Hill Sandstone</td></tr>
<tr><td>Siltstone and dolomite</td><td>Hooker Creek Formation</td><td rowspan="3">Undivided Montejinni Limestone and Hooker Creek Formation</td></tr>
<tr><td>Dolomite</td><td rowspan="2">Montejinni Limestone</td></tr>
<tr><td colspan="2">Montejinni Limestone</td></tr>
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Fig. 5. Previous and present stratigraphic nomenclature in the Wiso Basin.

the provinces suggested by the aeromagnetic surveys is shown in Figure 23.

Basement rocks are not exposed in the northern and northeastern parts of the Wiso Basin, where Palaeozoic sediments cover the basement rise defining the basin margin. The Dunmara aeromagnetic survey (Compagnie Générale de Géophysique, 1966) suggests that a flat-lying shallow magnetic horizon, probably basic volcanics, is present in this area. Several thousand metres of non-magnetic rocks underlie this horizon; they may belong to either the Victoria River Basin, or the gently folded rocks of the McArthur Basin which crop out about 100 km to the northeast. These non-magnetic rocks overlie magnetic rocks, probably of the Tomkinson Creek beds. The relations between the basement rocks of the Wiso Basin are shown schematically in the rock relationship diagram in Plate 1.

The *Arunta Block* (Shaw & Stewart, 1975; Offe & Kennewell, 1978) forms basement to the basin on its southern margin, where it consists mainly of metaquartzite, schistose metasandstone, and mica schist of the Lower Proterozoic Lander Rock beds. These have been affected by greenschist to amphibolite facies metamorphism, and have been intruded by Lower Proterozoic granites, which have hornfelsed the surrounding Lander Rock beds and are prominently foliated. Metamorphosed sandstone, possibly equivalent to the Reynolds Range Group, is also present in isolated outcrops.

The *Central Mount Stuart Formation* (Stewart, 1976) is of Adelaidean to earliest Cambrian age and rests unconformably on the Arunta Block near the southeast margin of the basin. It contains sandstone, arkose, greywacke, and minor conglomerate and dolomite, and may be stratigraphically equivalent to part of the Victoria River Basin.

Rocks of the *Granites-Tanami Block* (Blake, Hodgson, & Smith, 1975) are stratigraphically equivalent to those of the Arunta Block, and form basement to the southwestern and western parts of the Wiso Basin. The basal rock unit, the Lower Proterozoic Tanami Complex, grades laterally into the Lander Rock beds of the Arunta Block, and consists of intensely folded sedimentary rocks, metamorphised to schist and gneiss in some places, with acid and basic lavas and tuff. This is overlain by acid volcanics and sandstone. These rocks and the Tanami Complex are intruded by granites, acid porphyry, and minor gabbroic rocks. The acid volcanics and granite have been dated at between 1820 and 1710 m.y. (Blake, Hodgson, & Muhling, 1979).

The *Birrindudu Basin* sequence (Blake & others, 1975) forms basement to the Wiso Basin in the west and northwest where it overlies The Granites-Tanami Block, and contains a more gently folded, almost unmetamorphosed Carpentarian to Adelaidean sequence of sediments and minor acid volcanics, including the Birrindudu Group.

The *Victoria River Basin* (Sweet, 1977) underlies the northwestern part of the basin and contains gently folded sediments mostly of Adelaidean age.

The *Antrim Plateau Volcanics* (Bultitude, 1976) overlie rocks of The Granites-Tanami Block and the Birrindudu and Victoria River Basins in many places, apparently filling topographic depressions in the Early Cambrian land surface. Where preserved, they consist of tholeiitic basalt with minor interbeds of marine sediments, and thin southwards.

Fig. 6. Folded and faulted quartzite of the Tomkinson Creek beds at locality SLW 1 (lat. 18°19'S, long. 132°40'E), in central northern SOUTH LAKE WOODS. (M/2237)

The *McArthur Basin* sediments (Dunn, 1963), of Carpentarian age, crop out northeast of the basin, and their distribution beneath the Mesozoic rocks is uncertain.

The *Nutwood Downs Volcanics and Bukalara Sandstone* (Dunn, 1963) overlie the McArthur Basin sediments in HODGSON DOWNS, and are stratigraphically equivalent to the Antrim Plateau Volcanics.

The *Tomkinson Creek beds* (Mendum & Tonkin, 1976), of Carpentarian age, underlie the northeastern part of the basin and separate the Wiso and Georgina Basins. The sediments and associated sills and acid volcanics are intensely folded and faulted (Fig. 6), generally with a north-northwest trend, similar to that of the basement ridge (Fig. 16). They extend as a basement ridge into the central part of the basin.

The *Helen Springs Volcanics* (Randal & Brown, 1969) are flat-lying tholeiitic basalts overlying the Tomkinson Creek beds; they are correlatives of the Antrim Plateau Volcanics.

The *Warramunga Group* (Mendum & Tonkin, 1976) underlies the Tomkinson Creek beds and is of Early Proterozoic age. It is made up of geosynclinal sediments, tuffs, acid volcanics, and intrusives. Many granite bodies intrude the Warramunga Group.

The *Hatches Creek Group* (Smith, 1970) unconformably overlies the Warramunga Group beneath the southeast part of the basin. It comprises sediments and acid and basic lavas deposited during Carpentarian time and later intensely folded and faulted.

PALAEOZOIC WISO BASIN ROCKS

Montejinni Limestone

Derivation of name and type section

Traves (1955) derived the name of the formation from Montejinni homestead (lat. 16°39'S, long. 131°46'E), near which the limestone is exposed in hills 7 to 10 m high. He stated: 'At the bottom of the typical section of the formation are about 40 feet [12 m] of crystalline limestone, thickly bedded to massive, fine to coarse-grained, grey, cream and brown, containing abundant chert nodules which are commonly found along the bedding planes. This is overlain by 20 to 40 feet [6 to 12 m] of crystalline limestone, thinly bedded, fine-grained, grey, and with very few if any, chert nodules'. As the underlying Antrim Plateau Volcanics crop out nearby, the section is presumed to be very near the base of the rock unit, and probably represents the lower limestone unit referred to below.

Distribution, lithology, and thickness

The Montejinni Limestone in the northwest part of the basin crops out in a belt extending from the Cattle Creek floodout in the south to the east of Delamere homestead. In the central part of this belt the formation forms a rugged dissected terrace flanking a plateau; to the south it merges into the plateau, and crops out as sparse low rises capped by calcrete in many places and separated by sand plains. Sinkholes have developed at several localities (Fig. 7). The unit also forms isolated mesas west of the plateau and terrace, and in the north crops out as boulders in grassy plains and woodlands. The limestone is continuous under the Mullaman beds between Larrimah and Willeroo, and extends across a low basement rise (Fig. 16) into the Daly River Basin, where it crops out as the Tindall Limestone. In the eastern part of the Wiso Basin, low rises capped by calcrete are typical, but throughout the southern half of the basin the Montejinni Limestone does not crop out, as it is covered by younger Palaeozoic sediments. Dolomite cropping out as low rises capped by calcrete in the central parts of the basin, and on the basin margin in the southwest and east, is mapped as undivided Montejinni Limestone and Hooker Creek Formation because of its uncertain correlation.

The Montejinni Limestone in the northern half of the basin consists of limestone, dolomitic limestone, dolomite, silty carbonate, and calcareous mudstone or siltstone, and in places contains abundant chert nodules and stringers along bedding planes (Randal & Brown, 1967), whereas dolomite with minor dolomitic siltstone and chert beds are typical in the subsurface of the southern half.

Between Cattle Creek and Delamere homesteads, on the northwest margin of the basin, a three-fold division of the formation has been recognised at several localities and in stratigraphic drillholes and water-bores: an upper and lower limestone unit, separated by a middle mudstone unit. This division was shown on the DELAMERE and VICTORIA RIVER DOWNS geological maps (Sweet, 1972, 1973), but because of topography, paucity of outcrop, and scale of mapping it was not shown elsewhere. The 'typical section' of the Montejinni Limestone described by Traves (1955) apparently refers to the lower limestone unit (Randal & Brown, 1967).

The following composite section has been estimated by Randal & Brown (1967) from surface exposures northeast of Top Springs, in VICTORIA RIVER DOWNS.

Unit 3	10.7 m +	Limestone, grey to brownish with stromatolites at base and *Girvanella* and *Biconulites* higher in the section; contains small patches of dolomite and is partly silicified.
Unit 2	12.2 m	Mudstone, calcareous, red-brown and yellow-buff, and silty carbonates; produce red-brown soil with rubble of red travertine. The unit is poorly exposed. A persistent band of silicified rocks occurs at the base.

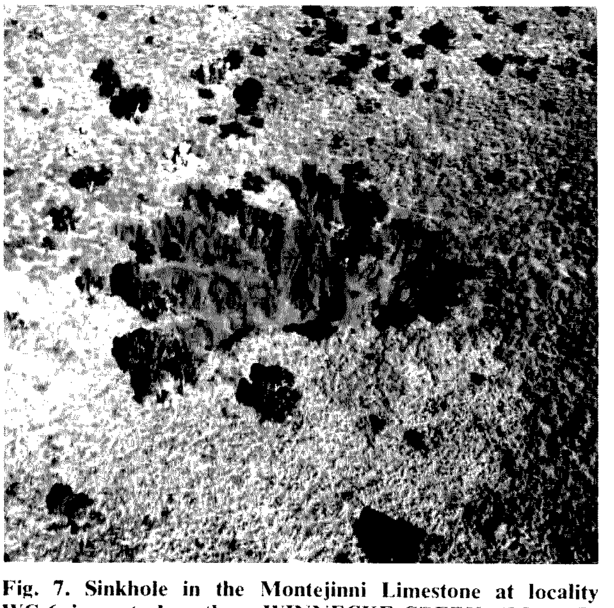


Fig. 7. Sinkhole in the Montejinni Limestone at locality WC 6, in central northern WINNECKE CREEK. (M/2237)

Unit 1	15-18 m	Limestone, mottled, containing chert nodules and patches of dolomite; overlain by laminated coarsely crystalline pale limestone that weathers to form flat slabs in black and grey soils.
	37.9 m +	

The following sequence was penetrated in the Homestead Bore at Birrimba, 35 km north-northeast of Top Springs homestead:

Soil	9.1 m	Clayey soil and ferruginous rock.
Unit 3	31.7 m	Limestone, brown, microcrystalline; and dolomite.
Unit 2	6.6 m	Mudstone, buff, calcareous; some limestone.
Unit 1	3.1 m +	Calcilutite, grey and brown.
	41.4 m +	

The same divisions occur in a measured section at latitude 16°53'S, longitude 131°39'E, on the upper reaches of Townsend Creek:

Unit 3	6.1 m	Limestone, dark grey, dolomitic, with *Redlichia, Biconulites*, and *Lingulella*.
	3.0 m	Limestone, stromatolitic.
Unit 2	12.2 m	Siltstone, yellow, white, buff, calcareous, thin-bedded, and laminated.
Unit 1	6.1 m	Limestone, stromatolitic.
	18.3 m	Limestone, thin-bedded, light grey.
	12.2 m	Limestone, dark grey, cherty.
	57.9 m	

The three divisions extend southward into WAVE HILL, but have not been mapped separately there. In a sinkhole 37 km north of Cattle Creek station the section is:

	0.9 m	Ironstone, pisolitic.
Unit 3	4.0 m	Chert rubble; some grey crystalline limestone blocks.
Unit 2	4.9 m	Siltstone, red to buff, calcareous.
	12.5 m	Siltstone, red and chocolate-brown, calcareous.
Unit 1	0.5 m	Limestone, dolomitic, stromatolitic.
	0.5 m	Limestone, dolomitic; thick chert bands and nodules.
	2.1 m	Limestone, foetid, black and grey, thick-bedded; chert nodules.
	30.0 m	Presumably all limestone in a deeper secondary inaccessible sinkhole (sounded by line and illuminated by torch).
	55.4 m +	

About another 6 m of unit 3 is exposed in adjacent rises. The section dips about 1° in a direction about 100°.

Farther south a few thin siltstone beds occur: at locality WV 25 a 1.5-m bed of chocolate-brown and yellow calcareous siltstone is underlain by stromatolitic cherty limestone, and overlain by light grey crystalline limestone with rare chert nodules. In the scarp east of Chungamidgee Waterhole on the road from Wave Hill to Cattle Creek—one of the localities described by Traves (1955, p. 33)—the siltstone (unit 2) is missing. Unit 1, thick-bedded grey crystalline limestone and abundant chert nodules directly overlain by thin-bedded light grey crystalline limestone, is overlain to the east by massive crystalline limestone and calcilutite of unit 3, on which a karst topography is developed. Elsewhere along the scarp, unit 3 contains more chert than it does to the north, and, without the intervening siltstone unit, the two limestone units cannot be separated. The drillers' log of Wave Hill 37 (WE) bore on Wave Hill station suggests the presence of all three units (see p. 46).

The siltstone (unit 2) is the most persistent in outcrop. The lower limestone unit (unit 1) appears to lens out north of Fraynes Knob, and the siltstone rests directly on the Lower Cambrian Antrim Plateau Volcanics. The siltstone unit disappears beneath the Mullaman beds about 16 km northeast of Delamere homestead, and the upper limestone unit (unit 3) is overlapped by the Mullaman beds 40 km southeast of Delamere homestead.

All three units, however, extend considerable distances to the east under the Mesozoic rocks. Stratigraphic hole BMR Larrimah 2, 64 km west of Larrimah, is located about 130 km east of the northern outcrops of the Montejinni Limestone, yet between 11.0 and 49.7 m it intersected a section similar to those above (see p. 41). The Hidden Valley Bore penetrated 48.8 m of unit 3 underlain by 9.2 m of unit 2 resting on the Antrim Plateau Volcanics (see p. 42).

The Montejinni Limestone thickens southward, from 38.7 m in stratigraphic hole BMR Larrimah 2 to 58 m in the Hidden Valley Bore, and more than 55 m in a sinkhole north of Cattle Creek homestead. In the central south of the basin, in GREEN SWAMP WELL, it is over 151 m thick. If this regional trend of southward thickening continues, it could be even thicker in the Lander Trough, in the southern Wiso Basin, where it is concealed by younger sediments.

In the central and southern parts of the basin, where dolomite appears to be the main rock type, poor exposure restricts correlation of units in the Montejinni Limestone. Huleatt (1977), however, identified unit 1 in the vertical walls of a sinkhole at locality WC 6 (Fig. 7), in central northern WINNECKE CREEK, where it is overlain by chocolate-brown siltstone with minor chert concretions of unit 2. Unit 3 is exposed as a massive fossiliferous dolomite or dolomitic limestone with chert nodules in northern WINNECKE CREEK. BMR Green Swamp Well 6 stratigraphic hole penetrated an incomplete section of 151 m of Montejinni Limestone (see p. 56). Although this hole is about 300 km from the areas in which the threefold subdivision has been recognised, three distinct units, which may correspond to those in the northwestern part of the basin, are present; they are shown in the generalised section below.

Unit 3	76.0 m	Dolomite, grey to white, microcrystalline to medium crystalline; interbeds of red and white, dolomitic and micaceous siltstone; some gypsum veins throughout.
Unit 2	15.7 m	Siltstone, grey, micaceous, dolomitic in parts; rare gypsum veins.

Unit 1	59.5 m +	Dolomite, grey to white, fine to medium crystalline; rare thin interbeds of grey to white dolomitic siltstone; many gypsum veins in places.
	151.2 m +	

On the eastern margin of the basin, 54 km east of the section described above, BMR Green Swamp Well 1 penetrated 56.4 m of grey-brown and red-brown dolomite with rare beds of chert and siltstone overlying quartz sandstone of the Tomkinson Creek beds (see p. 52). Because of its uniform lithology, thickness, and stratigraphic position at the base of the Wiso Basin, this dolomite is mapped as the Montejinni Limestone, although thinner dolomites are present in the Hooker Creek Formation in this area.

Elsewhere in the southern part of the basin, many dolomite outcrops, although most probably of the Montejinni Limestone, have been mapped as undivided Montejinni Limestone and Hooker Creek Formation as it is impossible to firmly allocate them to either formation.

Upper and lower contacts

The unconformable contact between the underlying Antrim Plateau Volcanics and the Montejinni Limestone is apparent at most places along the northwestern margin of the basin, but the best exposures are near Cullenjacky Bore on the Top Springs/Wave Hill road. The contact between the Montejinni Limestone and Precambrian rocks is not exposed. Structure contours on the basal contact of the Montejinni Limestone are shown in Figure 16. The limestone is unconformably overlain in the northern part of the basin by the Mesozoic Mullaman beds, which overlap the limestone to rest directly on the underlying Lower Cambrian Antrim Plateau Volcanics. The eroded upper contact implies that the thickness in this area is less than the original depositional thickness.

Throughout most of the central and southern parts of the basin, the Montejinni Limestone is overlain conformably and with a gradational contact by dolomitic siltstone of the Hooker Creek Formation. Only on the eastern basin margins is it unconformably overlain by the Point Wakefield beds.

Depositional environment, fossils, and age

The Montejinni Limestone is of Middle Cambrian age and was deposited in or near a shallow epeiric sea which covered large areas of the Northern Territory during that time. Sedimentation took place in a quiet environment, probably as the result of precipitation of carbonates assisted by living organisms, together with transportation of terrigenous material from a land surface of Antrim Plateau Volcanics and older rocks.

Stromatolite beds, which occur at the base of unit 3 and in places at the top of unit 1, suggest intertidal deposition, probably in water with restricted circulation and high salinity. Unit 3 above the basal stromatolite bed contains abundant shelly fossils, suggesting well-circulated water of normal salinity, and abundant *Girvanella* (filamentous blue-green algae), indicating shallow-water deposition. The depositional environment of unit 2, a mudstone or siltstone with a dominant red colour and a lack of fossils, is open to speculation. The reason for the change from carbonate sedimentation is not clear; Brown (1968) suggested that the sea regressed, and that the mudstone was deposited in a subaerial, perhaps supratidal environment. Unit 1 contains trilobites, indicating a marine environment. The patchy dolomitisation of the limestones, in which the original textures have been destroyed and euhedral dolomite rhombs have formed, is apparently of diagenetic origin.

In BMR Green Swamp Well 6, several cores contain veins of gypsum and laminated fragmented dolomite with irregular pores typical of deposition under supratidal sabkha conditions (Illing, Wells, & Taylor, 1965).

The only fossils recorded from the formation by Traves (1955) were 'abundant girvanelloids'. A fossil assemblage from BMR Green Swamp Well 1 was examined by C. Gatehouse and A. A. Öpik (Milligan & others, 1966); the fauna is listed below:

48.8–51.8 m—phosphatic brachiopods (indet.), '*Helcionella*', eocrinoid plates, sponge spicules.

57.9–61.0 m—*Acrotreta* Kutorga, 1848; *Acrothele* Linnarsson, 1876; eocrinoid plates; chancelloriidae; hyolithid fragments; sponge spicules.

45.7–61.0 m—spinose phosphatic brachiopods, eocrinoid plates, chancelloriidae, sponge spicules.

The age of these samples is most probably '*Xystridura* time of early Middle Cambrian' according to Öpik (in Milligan & others, 1966).

An outcrop of Montejinni Limestone at locality WB10, in northeastern WINNECKE CREEK, yielded an *Acrothele* Linnarsson, 1876, of late Early to middle Middle Cambrian aspect, along with *Biconulites* s.l. and eocrinoid plates. The age of this fauna is most likely to be early Middle Cambrian (Milligan & others, 1966). Other fossil localities are listed in Appendix 3.

Many outcrops of Montejinni Limestone have been examined to determine whether conodonts are present, but all are barren; the samples analysed are listed in Appendix 1.

Regional correlations

Outcrops of the Montejinni Limestone on the eastern edge of the Wiso Basin have been mapped by previous workers (Milligan & others, 1966; Mendum & Tonkin, 1976) as the Gum Ridge Formation of the western Georgina Basin. Although outcrop is not continuous between the Wiso and Georgina Basins, the occurrence of early Middle Cambrian fossils in the Gum Ridge Formation indicates that it correlates with the Montejinni Limestone.

The upper part of the Montejinni Limestone (unit 3) appears to be continuous with part of the Tindall Limestone of the Daly River and northwestern Georgina Basins. Unit 3 in BMR Larrimah 2 stratigraphic hole is similar to limestone within the Daly River Basin in BMR Larrimah 1, in the valley of Birdum Creek 17 km northwest of Larrimah. This limestone is identical in lithology and faunal content with outcrops of uncertain stratigraphic position in the Tindall Limestone about 32 km to the north, in the valley of Elsey Creek (Randal & Brown, 1967).

On the basis of fossil evidence, the Montejinni Limestone also correlates with the trilobite band at the base of the Giles Creek Dolomite in the Amadeus Basin (Fig. 4).

Hooker Creek Formation
(new name)

Derivation of name and type section

The name of this formation is derived from Hooker Creek Native Settlement, at latitude 18°20'S, longitude 130°38'E, in WINNECKE CREEK. The formation was previously included in the Winnecke Creek Tableland formation of Chewings (1931) and the Merrina beds of Milligan & others (1966) and Milligan (1976). The type section of the formation is between 24.4 and 185.9 m in BMR Green Swamp Well 6 stratigraphic hole (see p. 56), at latitude 19°20'S, longitude 132°59'E. Four cores, and cuttings at 3-m intervals from this section, are stored at the BMR Core and Cuttings Laboratory, Fyshwick, ACT. This section is overlain by the Lothari Hill Sandstone and underlain by the Montejinni Limestone. A generalised log of the type section, from the top, is:

6.1 m	Siltstone, calcareous, grey, few sand grains, grades to slightly calcareous in parts, siliceous matrix.
27.4 m	Sandstone, white, quartzose, very fine to fine-grained, subangular to subrounded, dolomitic or siliceous matrix; interbedded with siltstone, red-brown, grey-green, or white-grey, micaceous or dolomitic in parts, siliceous.
28.9 m	Dolomite, buff-brown, fine-grained; interbedded with siltstone, dolomitic, red to grey, micaceous in parts.
50.7 m	Siltstone, dolomitic to slightly dolomitic, micaceous, red-brown, red, pink, or grey; rare interbeds of dolomite, cream, very fine-grained.
9.4 m	Dolomite, grey-white, finely crystalline.
39.0 m	Siltstone, dolomitic, micaceous, red or buff-brown.
161.5 m	

This is the thickest recorded section of the Hooker Creek Formation, which can be traced both to the east and the west by correlation between the stratigraphic holes drilled by BMR in 1965 (see section C–D, Plate 1).

Distribution, lithology, and thickness

The formation crops out as low rises in the area around Hooker Creek, and forms a thin capping on scarps mainly underlain by the Antrim Plateau Volcanics to the north of Hooker Creek. In outcrop, most dolomite has been removed from the dolomitic siltstones by weathering and ferruginisation, possibly during periods of intense weathering in Late Cretaceous or Tertiary time. As a result, a red-brown colour is prominent throughout rocks of the formation. Outcrops are typified by red-brown laminated, bioturbated, micaceous siltstone, clayey in parts, with a few beds of finely crystalline dolomite on which a karst topography has developed in places. The uppermost beds of the formation (e.g., those exposed at Lothari Hill, in southwestern WINNECKE CREEK) include red-brown fine-grained silty and clayey sandstone.

The sandstone extends northward, underlying most parts of WINNECKE CREEK and western SOUTH LAKE WOODS, and crops out as rubble-strewn rises, as low scarps surrounding rises, and, in several places, in the walls of sinkholes. It may constitute the 'remnant of silicified lateritized shale' recorded overlying the Montejinni Limestone in the scarp 5.9 km east of Chumgamidgee Waterhole by Traves (1955). It has not been recognised any farther north. Randal & Brown (1967) identified up to 16 m of unit 2 of the Montejinni Limestone in Willeroo Beef Road DWH 2, 3, and 5; this may instead be interpreted as a northward extension of the Hooker Creek Formation, but we consider it to be part of the Mullaman beds.

The formation is exposed in the scarp in the Buchanan Hills (Fig. 14) and in the incised creek beds at the base of the scarp (Fig. 8), and the section, from the top, is shown below; thicknesses are approximate:

40 m	Buchanan Hills beds.
6 m	Claystone, white and pink with some micaceous siltstone laminae.
15 m	Sandstone, pink, red, and red-brown, fine-grained; siltstone and claystone with rare thin argillaceous dolomite beds.
3 m	Sandstone, grey and blue-grey, dolomitic, fine-grained; siltstone, cross-laminated, with scour-and-fill structures, undulate bedding, and slump structures.
10 m	Scree covering siltstone and claystone.
5 m	Claystone, white, fissile.
6 m	Dolomite, commonly overlain by travertine. Base not exposed.
45 m	

BMR Winnecke Creek 2, located at the base of the Buchanan Hills, penetrated the Hooker Creek Formation at a depth of 12.2 m, just below the basal dolomite of the section described above. The section penetrated is shown below, and together with that exposed in outcrop in the Buchanan Hills, provides a composite section of the formation from its basal contact with the Montejinni Limestone to its upper, eroded contact with the Buchanan Hills beds.

12.2 m	Cainozoic alluvium.
15.2 m	Claystone, brown, shaly, slightly dolomitic, micaceous; grades to dolomitic siltstone in parts.
29.6 m	Siltstone, grey-green, brown, dolomitic in parts, quartzose, micaceous, chloritic in parts; grades to claystone in parts.
7.0 m	Claystone, red-brown, pink, grey, dolomitic, micaceous, soft to hard; grades to siltstone in parts.
8.4 m +	Montejinni Limestone.
51.8 m	

West of the type section, isolated outcrops of Hooker Creek Formation occur in depressions in TANAMI EAST, where the formation is overlain by the Lothari Hill Sandstone.

Northeast of the type section the formation thins onto a ridge of basement rocks which extends into the basin. Whether it is present on the northern side of this ridge beneath NEWCASTLE WATERS and DALY WATERS is uncertain. In the eastern part of the basin a similar thinning onto basement is indicated by drilling. The formation probably extends to the south, into the Lander Trough, forming part of sequence II of Kennewell & others (1977).

Fig. 8. Low-amplitude folds in the Hooker Creek Formation at the base of Buchanan Hills, locality WC 28, in central southern WINNECKE CREEK. (M/2237)

Upper and lower contacts

The Hooker Creek Formation overlies the Montejinni Limestone with a gradational contact in BMR Green Swamp Well 6 and in several other stratigraphic drillholes. The proportion of dolomitic siltstone beds in the Montejinni Limestone increases upwards; above the contact, dolomitic siltstone of the Hooker Creek Formation is dominant. A notable and typical feature of the Hooker Creek Formation is the gradation apparent in stratigraphic hole cuttings (Milligan & others, 1966, fig. 25) from dolomitic siltstone to laminated dolomite.

The Hooker Creek Formation is overlain with a gradational contact in the type section, in several other drillholes in the central part of the basin, and in outcrop at Lothari Hill, in WINNECKE CREEK, by the Lothari Hill Sandstone. To the east of the type section the Lothari Hill Sandstone is absent, and the Point Wakefield beds unconformably rest on the Hooker Creek Formation. In some places the flat-lying Buchanan Hills beds cap low rises of Hooker Creek Formation.

Depositional environment, fossils, and age

The lamination and dolomitic nature of the sediments suggest deposition in an area of restricted circulation, while the fauna indicates marine conditions. The sediments were most likely deposited in a restricted marine environment, such as a wide coastal lagoon which was inundated by the sea from time to time. Tidal or marine currents would have been present during deposition of some dolomite beds, as oncolites are present at locality WB1, in WINNECKE CREEK.

Fossils have been recorded from the Hooker Creek Formation at several localities (see Appendix 3). Dolomite at locality WB1 contains the pteropod *Biconulites* and fragmental indeterminable brachiopods and trilobites, and subspherical and ellipsoidal oncolites in which 1.5-6.5-μm algal filaments are preserved (Dr M. Walter, BMR, personal communication 1975). BMR Tanami East 1, in central northern TANAMI EAST, yielded fragments of inarticulate brachiopods at a depth of 79.2 m. BMR Winnecke Creek 2 yielded the inarticulate phosphatic brachiopod *Lingula* in cuttings from 21.3 to 24.4 m and indeterminate trilobite fragments from 36.6 to 39.6 m. The fossils indicate an early Middle Cambrian age.

Regional correlations

The Hooker Creek Formation was deposited contemporaneously with parts of the Giles Creek Dolomite of the Amadeus Basin (see Fig. 4).

Undivided Montejinni Limestone and Hooker Creek Formation

Dolomite and chalcedony of uncertain stratigraphic position crop out, generally as low benches, in several parts of the Wiso Basin where exposures are poor. As their photopattern—in which the overlying colluvium surrounds areas of calcrete and a few claypans etched with lineaments—is similar to that of both the Montejinni Limestone in northern WINNECKE CREEK and the Hooker Creek Formation in southeastern WINNECKE CREEK, they have been mapped as undivided Montejinni Limestone and Hooker Creek Formation. The largest area mapped in this way is in southwestern TANAMI EAST, where a flat-lying sequence is overlain by the Lothari Hill Sandstone. Non-fossiliferous dolomite with fine-grained sandstone and siltstone interbeds crop out in beds up to 3 m thick which are silicified; the silica forms a matrix surrounding carbonate fragments, particularly at locality TE 32. Other rock types present include light to dark grey calcareous and non-calcareous dololutite with occasional blue-grey chert nodules; red quartzose calcilutite; and laminated micaceous fine-grained quartz sandstone and siltstone with halite casts. A few possible echinoderm fragments have been observed in thin section.

The considerable thickness of the dolomite suggests correlation with the Montejinni Limestone, as dolomites of the Hooker Creek Formation are shown by drilling to be generally less than 10 m thick. In TANAMI EAST these rocks form the basal rock unit of the basin.

Undivided Montejinni Limestone and Hooker Creek Formation has also been mapped on the central western margin of SOUTH LAKE WOODS, where pavements with rounded boulders of light brown crystalline dolomite containing faint algal structures are exposed. These rocks may correlate with either outcrops of Montejinni Limestone in central northern WINNECKE CREEK or dolomite penetrated by BMR Winnecke Creek 1, which intersected 43.9 m of Hooker Creek Formation. The Point Wakefield beds cap rises in this area, indicating that the dolomites are older than these rocks and hence must belong to one of the two formations mentioned above.

Rocks cropping out in central northern GREEN SWAMP WELL are of uncertain stratigraphic position, and are also mapped as undivided Montejinni Limestone and Hooker Creek Formation—the only recorded carbonate rock units underlying the Point Wakefield beds, which crop out in the surrounding area.

Lothari Hill Sandstone
(new name)

Derivation of name and type section

The Lothari Hill Sandstone is named from Lothari Hill, at latitude 18°50′S, longitude 131°29′E, in the southeast part of WINNECKE CREEK, where the unit overlies the Hooker Creek Formation with a gradational contact and forms the upper part of the hill. This formation was previously included in the Winnecke Creek Tableland formation of Chewings (1931) and in the Merrina beds of Milligan & others (1966) and Milligan (1976).

The type section of the Lothari Hill Sandstone is between the surface and a depth of 93.9 m in BMR Green Swamp Well 4 stratigraphic drillhole, at latitude 19°16′S, longitude 132°39′E. One core, and cuttings at 3-m intervals, are available from this section and are stored at the BMR Core and Cuttings Laboratory, Fyshwick, ACT. The section consists almost entirely of white, weathering brown, fine-grained subrounded to subangular quartzose sandstone, which is dolomitic in places. Sparse beds of dark brown or white soft fissile tight silty claystone, dark brown or white and grey cryptocrystalline silty chert, and white hard microcrystalline dolomite are present throughout the remainder of the section (see p. 54). Although the type section is the thickest section recorded, the top of the formation is eroded, and thicker sections may be present in other parts of the basin.

Distribution, lithology, and thickness

The unit is exposed in scarps surrounding low rises throughout most of TANAMI EAST, and underlies areas of little exposure in GREEN SWAMP WELL and possibly SOUTH LAKE WOODS. How far south it extends into the Lander Trough, where it may be concealed by younger sediments, is uncertain. To the north it thins, probably due to erosion, against a basement rise which extends across the northern parts of SOUTH LAKE WOODS and WINNECKE CREEK. Whether it is preserved north of this rise is uncertain.

In outcrop the Lothari Hill Sandstone is typically reddish brown—but white in places—fine-grained, poorly sorted, and clayey; in places it is micaceous and grades to clayey siltstone and claystone. The red colouration at depth is due to iron oxides which may have been derived from deposition in an oxidising environment, although some surface exposures are red as a result of lateritisation during Late Cretaceous or Tertiary time. Polygonal mud-cracks, and vertical burrows up to 1 cm in diameter and filled with sand, are present in some exposures (Fig. 9). Although the sandstone is typically thick-bedded and even-textured, some low-angle cross-bedding is present in places. The greatest recorded thickness of the Lothari Hill Sandstone is 93.9 m in the type section in BMR Green Swamp Well 4.

Upper and lower contacts

The Lothari Hill Sandstone overlies the Hooker Creek Formation gradationally in the stratigraphic holes which penetrated the contact, and in outcrops in which the contact is exposed. It is apparently conformable on the Hooker Creek Formation in most parts of the basin.

The upper contact with the Point Wakefield beds has been penetrated only in BMR Green Swamp Well 3, where correlations with nearby stratigraphic drillholes imply an unconformable contact. The Lake Surprise Sandstone unconformably overlies the Lothari Hill Sandstone in southwestern TANAMI EAST, and the Buchanan Hills beds cap low outcrops in many parts of the basin.

The Montejinni Limestone, Hooker Creek Formation, and Lothari Hill Sandstone have gradational contacts. The complete sequence was probably deposited during the Ordian Stage of Middle Cambrian time (see Fig. 24). This is supported by the overlying Point Wakefield beds, deposited partly during the following Templetonian Stage of Middle Cambrian time and resting on the Lothari Hill Sandstone and underlying formations with a slight unconformity.

Fig. 9. Desiccation cracks and possible vertical burrows in the Lothari Hill Sandstone at locality TE 4 (lat. 19°35′S, long. 131°11′E), TANAMI EAST. (M/2237)

Depositional environment and age

The depositional environment of the Lothari Hill Sandstone is inferred to be tidal as it contains polygonal mud-cracks, symmetrical ripple marks, vertical burrows, and low-angle medium-bedded cross-bedding. These features, together with a primary red colouration and a lack of preserved fossils, indicate deposition in an intermittently desiccated, possibly oxidising environment with oscillatory movement of water.

No fossils have been recorded in the Lothari Hill Sandstone, and its age is inferred from its stratigraphic position. Its gradational contact with the underlying Hooker Creek Formation, of early Middle Cambrian age, suggests that it is of similar age.

Regional correlations

If it is of Ordian (Middle Cambrian) age, the Lothari Hill Sandstone probably correlates with parts of the Giles Creek Dolomite of the Amadeus Basin and parts of the Wonarah beds of the Georgina Basin, which are of similar age.

Point Wakefield beds
(new name)

Derivation of name and reference section

The Point Wakefield beds are a poorly known and poorly exposed sequence of rocks named from Point Wakefield, at latitude 19°59'S, longitude 133°21'E, in the southeast corner of GREEN SWAMP WELL, where they are exposed in a prominent scarp. They were previously included in the Winnecke Creek Tableland formation of Chewings (1931) and the Merrina beds of Milligan & others (1966) and Milligan (1976).

The reference section for the unit is between 0.7 and 25.9 m in BMR Green Swamp Well 1 stratigraphic hole, at latitude 19°25'S, longitude 133°30'E. It consists of brown and white claystone which is calcareous in places, silty in places, and contains a few chert beds, possibly produced by weathering (see p. 52). Cuttings from this section are stored at the BMR Core and Cuttings Laboratory, Fyshwick, ACT.

Distribution, lithology, thickness, depositional environment, fossils, and age

The unit is typically exposed in rubble-strewn slopes and small scarps developed on the margins of low rises in GREEN SWAMP WELL, SOUTH LAKE WOODS, western TENNANT CREEK, and possibly southern NEWCASTLE WATERS. It is inferred to be covered by calcrete in central GREEN SWAMP WELL and possibly western TENNANT CREEK and BONNEY WELL. It extends northwards onto the ridge of Proterozoic rocks in SOUTH LAKE WOODS, and is obscured by the overlying Mullaman beds; it probably thins to the north, where it has not been recorded in drillholes. In the southern Wiso Basin it is obscured by younger sediments, but probably extends southwards into the Lander Trough.

The unit forms low exposures in which only small sections are exposed, so it is poorly known, and no composite section can be inferred. Two distinct rock types (Ꞓmp$_1$ and Ꞓmp$_2$ in Plate 1) have been recognised in the unit; these may correspond to a lower calcareous rock subunit and an upper arenaceous and lutaceous rock subunit.

Ꞓmp$_1$ is a white calcareous claystone that is silty in part, and present in fragments within the calcrete in central GREEN SWAMP WELL, where it is inferred to underlie the thin surficial calcrete deposit. Similar brown and white calcareous silty claystone was penetrated in the reference section, BMR Green Swamp Well 1, and is similarly capped by calcrete in outcrop. A brown and white silty claystone (possibly with an original carbonate content leached by weathering) crops out in the beds of ephemeral creeks at locality TC 1, at latitude 19°20'S, longitude 133°37'E, in the extreme west of TENNANT CREEK; a fauna—including phosphatic brachiopods, and ptychopariid trilobites from which a Templetonian (early Middle Cambrian) age has been determined (P. Jell, formerly University of Queensland, personal communication 1976)—has been recorded from this locality. A large featureless plain extending across eastern GREEN SWAMP WELL and southwestern TENNANT CREEK has rare calcrete outcrops and shallow internally draining depressions developed on it, and may be underlain by Ꞓmp$_1$. This plain extends into the northwest corner of BONNEY WELL, where it adjoins a long belt of calcrete mapped previously (Smith, 1970) as of probable Tertiary age; this calcrete may overlie calcareous claystone of the Point Wakefield beds.

Stratigraphic drillhole BMR Barrow Creek 18 (Grg 18), located between the Wiso and Georgina Basins, penetrated 37.5 m of 'white clay with quartz granules' overlying 3.6 m of light green dolarenite between 54.9 m and total depth, 96.0 m (Milligan, 1963). These rocks are correlated with and represent the greatest recorded thickness of the Point Wakefield beds (see p. 64). A brachiopod recovered from the dolarenite in the drillhole was recognised by Dr A. A. Öpik as having a structure characteristic of an age no older than Late Cambrian (Milligan, 1963). Calcareous claystones penetrated beneath the Hanson River beds in BMR Lander River 4 and 5 (see pp. 59–60) may also form part of subunit Ꞓmp$_1$ of the Point Wakefield beds.

The depositional environment of this subunit is difficult to determine because of poor outcrop, but its fine calcareous nature and the presence of brachiopods and trilobites suggest shallow-marine deposition.

Ꞓmp$_2$ is a flat-lying interbedded well-sorted sandstone and laminated claystone subunit (Fig. 10) which crops out in elevated areas of GREEN SWAMP WELL, SOUTH LAKE WOODS, and possibly NEWCASTLE WATERS. In GREEN SWAMP WELL it appears to overlie the calcareous claystone of Ꞓmp$_1$. It apparently unconformably overlies the Montejinni Limestone, Hooker Creek Formation, and Lothari Hill Sandstone, and unconformably overlies the Tomkinson Creek beds at locality TC 1.

A typical exposure is in a prominent scarp at locality GSW 18, in the southeastern corner of GREEN SWAMP WELL. The section, from the top, is:

4 m	Sandstone, yellow-brown, fine-grained, angular, well sorted, low-angle cross-bedding throughout.
2 m	Claystone, red-brown, finely laminated, highly micaceous.
2 m	Sandstone, red, fine-grained, angular, very well sorted, hard.
8 m	Claystone, as above.
2 m	Sandstone, as above.
4 m	Sandstone, red, fine-grained, angular, well sorted, friable.
22 m	

Fig. 10. Typical exposure of sandstone and claystone of the Point Wakefield beds at locality GSW 25 (lat. 19°51'S, long. 133°12'E), in southeast GREEN SWAMP WELL. (M/2237)

Scree and soil containing fragments of calcrete (possibly from the calcareous claystone of Ꞓmp_1) occur at the base of this scarp.

The depositional environment of the subunit is uncertain, but the well-sorted sandstone suggests high-energy deposition, whereas the laminated claystone suggests low-energy deposition. A shallow-marine depositional environment in which the sand was winnowed by wave action, and the winnowed clay was perhaps deposited in areas of quieter water, is supported by the presence of silicified stromatolites at locality GSW 14. The cross-bedded sandstones and claystones may, however, represent alternating channel-bar and backswamp deposits in a series of fluvial meandering stream cycles in which fossils were not preserved.

No diagnostic fossils have been recorded in the subunit, and its age is imprecisely known. Silicified linked bulbous stromatolites from locality GSW 14, in central GREEN SWAMP WELL, are not distinctive, and thus have no biostratigraphic significance; as isolated specimens they cannot be palaeoenvironmentally interpreted (Dr M. Walter, BMR, personal communication 1975). As this subunit overlies rocks in which Ordian (early Middle Cambrian) trilobites have been recorded, and is overlain by the Hanson River beds, which contain Arenigian (Ordovician) conodonts, its age must lie between these intervals. If Ꞓmp_2 overlies Ꞓmp_1, as it appears to, in the Point Wakefield area in GREEN SWAMP WELL, and if Ꞓmp_1 is the same age in this area as it is at locality TC 1, then a post-Templetonian age is inferred for Ꞓmp_2 at Point Wakefield.

Upper and lower contacts

The Point Wakefield beds are inferred to be unconformable on the underlying rocks because sections in stratigraphic drillholes BMR Green Swamp Well 1, 2, and 3 (latitude 19°25'S, longitude 133°30'E; 19°24'S, 133°16'E; and 19°20'S, 133°03'E respectively) show them overlying the Montejinni Limestone, Hooker Creek Formation and Lothari Hill Sandstone respectively (see cross-section C-D, Plate 1).

At Point Wakefield astronomical station, in the southeastern part of GREEN SWAMP WELL, sandstone, possibly of the Hanson River beds, overlies the Point Wakefield beds (Ꞓmp_2), but the contact is not exposed and its nature is not known. In the northern part of the basin the Point Wakefield beds are unconformably overlain by the Mullaman beds, and, in the central part, low rises of Point Wakefield beds are capped by the Buchanan Hills beds.

Regional correlations

The Point Wakefield beds may be stratigraphically equivalent to parts of the Sandover beds of the Georgina Basin, and parts of the Shannon Formation of the Amadeus Basin.

Hanson River beds

Derivation of name and reference area

The Hanson River beds are named from the Hanson River, which flows from southwest of Tea Tree Well (Fig. 1) to the area north of Numagalong homestead in BONNEY WELL. Here it dissipates in a floodout which at latitude 20°25'S is about 7 km east of the reference area for the beds. The reference area is around latitude 20°25'S, longitude 133°17'E, and includes low outcrops in which sandstone and dolomite crop out. The name was first applied informally by Milligan & others (1966); it is uncertain whether the beds were previously included in the 'Devonian formation' or the Winnecke Creek Tableland formation by Chewings (1931). Randal (1973) first published the name and Milligan (1976) first described the unit.

Distribution, lithology, thickness, depositional environment, fossils, and age

The Hanson River beds, which are poorly exposed, occupy an area in the southern part of the basin flanking the Lander Trough; they extend from northwestern BONNEY WELL, across northern LANDER RIVER and southern GREEN SWAMP WELL, into eastern MOUNT SOLITAIRE and TANAMI EAST. Sand plain covers most areas interpreted as being underlain by Hanson River beds, and only in northern LANDER RIVER are these rocks well exposed as low scarps of sandstone and dolomite between areas of calcrete (Fig. 11). Elsewhere rubbly rises are typical.

The total thickness of the Hanson River beds is uncertain. They form part of the Palaeozoic sequence II (Kennewell & others, 1977), which is 350 m thick beneath the northern end of seismic line R-2 but thickens southwards to 800 m in the Lander Trough. As sequence II also contains older Palaeozoic rocks, the thickness of the Hanson River beds is less than that of sequence II.

Although no continuous section of the beds is available, the regional structure suggests that four ill-defined rock units are present within the Hanson River beds.

Fig. 11. Low rise of the Hanson River beds (unit 3) at locality LR 1, in central northern LANDER RIVER. This typical outcrop of the Hanson River beds demonstrates the generally poor exposure of rocks in the Wiso Basin. (M/2237)

Unit 1, the basal unit, underlies a large plain which extends from southeastern TANAMI EAST, across southwestern GREEN SWAMP WELL, northeastern LANDER RIVER, and possibly western BONNEY WELL. The rocks rarely crop out, and are shown by the shallow stratigraphic drillhole BMR Lander River 3 to be weathered at a depth of over 60 m.

This unit is a mainly clastic sequence which crops out as low, rubbly, lateritised rises in the sand plain. Fine to medium-grained, rounded to angular, moderately sorted sandstone is typically interbedded with orange-brown and green, slightly fissile, slightly micaceous claystone and siltstone (see graphic logs of BMR Lander River 2 to 5, pp. 58–60); dolomite 1.6 m thick at the bottom of BMR Lander River 2 is also assigned to the unit. The greatest recorded thicknesses are in BMR Lander River 2 and 3, which penetrated the unit to total depths of 68.2 and 67.4 m respectively; BMR Lander River 4 and 5 penetrated the unit in the upper 45 and 39 m respectively. Isolated exposures of well-rounded, well-sorted quartz sandstone crop out at several localities—e.g., GSW 10, 13, and 50, in central GREEN SWAMP WELL—and may represent the basal part of unit 1. The poor sorting of many of the rocks suggests continental, perhaps fluvial, deposition. Although it is considered to be part of the Hanson River beds, no fossils have been found within unit 1, and the possibility of part of it being a flat-lying Mesozoic or Tertiary sequence cannot be disproved.

Unit 2 is inferred to be stratigraphically higher than unit 1, as it crops out to the south of unit 1 in an area where the Hanson River seismic survey (Ray Geophysics, 1967) shows the Hanson River beds dipping southwards into the Lander Trough. The relation between unit 2 and unit 1 is not clear. An interpretation of unit 1 as a deeply weathered part of unit 2 in which clays have been mobilised by the weathering process and have filled pores in well-sorted sandstone is feasible.

Unit 2 was penetrated in BMR Bonney Well 1 and 2 stratigraphic holes (see pp. 62–63), where it includes both fine-grained, well-rounded, well-sorted sandstone and angular, poorly sorted sandstone grading to sandy siltstone. Also present is light green, soft, very fissile claystone which is silty in places, very highly micaceous in places, and contains some glauconite grains. Tracks and burrows are abundant. The maximum recorded thickness of unit 2 is 74.5 m in BMR Bonney Well 2, but this may represent only a small part of the total sequence. Fragmented phosphatic brachiopods recovered from the bottom-hole core in BMR Bonney Well 1 indicate shallow-marine deposition, but are not diagnostic of age. Two samples of glauconite from this same core were dated by the Rb-Sr technique, yielding ages of 451 and 465 m.y. assuming an initial Sr^{87}/Sr^{86} ratio of 0.701, or 433 and 441 m.y. assuming an initial Sr^{87}/Sr^{86} ratio of 0.710 (Dr L. P. Black, BMR, personal communication 1976).

Dolomite cropping out in the walls of a sinkhole at locality GSW 5, in southwestern GREEN SWAMP WELL, probably forms part of unit 2 of the Hanson River beds, as it is overlain by 4 m of brown to white, fine and coarse-grained, rounded, well to moderately sorted sandstone. Also present are interbeds of grey-green, hard, slightly silicified claystone with large mica flakes and numerous tracks and burrows. These are similar to the rocks of unit 2 penetrated by BMR Bonney Well 1 and 2 stratigraphic holes. The dolomite is light grey to light brown, finely crystalline, and micaceous or glauconitic in parts. Ooliths and indistinct algal structures indicate shallow-marine deposition.

Sediments cropping out at localities LR 6, 7, 8, and 15 in the northern part of the reference area of the Hanson River beds may also form part of this unit.

Unit 3 overlies these sediments and was penetrated between 62 and 84.1 m in BMR Lander River 1 stratigraphic hole. It crops out as dolomite with a capping of calcrete in the southern part of the reference area at locality LR 10, and in central northern LANDER RIVER. The correlation of these outcrops and the rocks in BMR Lander River 1 is based on the presence of conodonts of middle Arenigian (Ordovician) age at all three localities (Dr E. C. Druce, formerly BMR, personal communication 1976; see Appendix 3).

In BMR Lander River 1, unit 3 includes white, crystalline, laminated limestone which is partly replaced by dolomite along joints and laminae, and which contains beds and laminae of dark brown to dark grey laminated and bioturbated mudstone. Overlying this is grey micaceous, dolomitic siltstone, in turn overlain by brown fine-grained, well to poorly sorted, well-rounded to angular sandstone of the Lake Surprise Sandstone. The greatest recorded thickness of unit 3 is 22.1 m in BMR Lander River 1, but the total thickness may be much greater than this, as the base of the unit was not intersected.

Exposure is poor in the reference area, but, at locality LR 10, crystalline, thinly bedded limestone containing brachiopods is overlain by white silicified, poorly sorted angular to rounded sandstone.

Unit 4, the uppermost recorded unit of the Hanson River beds, includes limestone and dolomite and crops out in an easterly trending belt extending from locality LR 1, in central northern LANDER RIVER, westward through localities LR 31 and LR 38 to locality WB 2, in the northeast corner of MOUNT SOLITAIRE. Dolomite immediately underlying the Lake Surprise Sandstone at locality LR 18, in the reference area, may also be of the same unit and age. All these localities except LR 1 contain conodont faunas indicating a latest Arenigian (Ordovician) age (Dr E. C. Druce, formerly BMR, personal communication 1977; see Appendix 3).

Coarsely crystalline dolomite, white hard micaceous claystone, and well-sorted to subrounded sandstone crop out at locality LR 1, from which J. Pojeta Jr (United States Geological Survey) and J. Gilbert-Tomlinson (BMR; personal communication 1980) have identified a fauna of molluscs with subordinate brachiopods and trilobites (Appendix 3). They noted that:

> Elsewhere in Australia the molluscan fauna of LR 1 occurs in the Amadeus Basin: *Pinnocaris* sp. A. occurs in the Stairway Sandstone; *Ctenodonta* cf. *C. youngi*, *Sthenodonta*? sp., and *Cyrtodonta* cf. *C. watti* are all close to species occurring in the Stairway Sandstone. *Palaeoneilo cf. P. smithi* is very close to the species occurring in the Stokes Siltstone.
>
> '*Redonia*' sp. is very similar to a form occurring in the Tabita Formation of northwest New South Wales.
>
> The fauna has been transported as indicated by the disarticulated trilobites and pelecypod molluscs, although on morphological grounds the pelecyods were all probably infaunal or semi-faunal. The rostroconch was also probably infaunal.
>
> Among the brachiopods the orthid and strophomenoid were probably epifaunal and the *Lingulella*? sp. probably infaunal.
>
> The monoplacoplorans and gastropods were probably epifaunal.

The species of bivalve molluscs listed above are described or revised in Pojeta, Gilbert-Tomlinson, & Shergold (1977) and Pojeta & Gilbert-Tomlinson (1977).

Calcrete overlies this unit in many places, and the best exposures are in a prominent scarp of limestone at locality LR 38 and as dolomite at the base of a scarp of Lake Surprise Sandstone at locality LR 18. Most other exposures (e.g., localities LR 31, WB 2) consist of fragments of limestone or dolomite in a matrix of calcrete.

White and light red-brown, weathered, highly micaceous claystone containing trace fossils directly underlies the Lake Surprise Sandstone at locality LR 29. Because of its proximity to locality LR 31, at which unit 4 of the Hanson River beds crops out, the claystone is considered to be a bed within this unit, but is probably younger than the other rocks described. The greatest exposed thickness of unit 4 is about 5 m at locality LR 1, but its total thickness is probably much greater than this, as its upper and lower contacts are not exposed.

The Hanson River seismic survey (Ray Geophysics, 1967; Kennewell & others, 1977) indicates that the base of the Palaeozoic sequence (sequence II) deepens as it passes into the Lander Trough south of the Hanson River beds outcrops. Unless units 1 to 4 thicken southwards, younger units must be present within the Hanson River beds beneath the Lake Surprise Sandstone in the Lander Trough.

Upper and lower contacts

At Point Wakefield, in GREEN SWAMP WELL, poorly exposed, well-rounded, well-sorted medium-grained sandstone possibly of the Hanson River beds caps a hill composed of Point Wakefield beds; the contact is obscured by scree, and its nature is unknown. The Lake Surprise Sandstone unconformably overlies the Hanson River beds: it directly overlies dolomites of middle Arenigian age at locality LR 10 and in BMR Lander River 1, both in eastern LANDER RIVER, and younger dolomites at locality LR 1 (late Arenigian to Llanvirnian) and in the area south of localities LR 38 and LR 31 (probably latest Arenigian). The Buchanan Hills beds also overlie the Hanson River beds in eastern LANDER RIVER.

Regional correlations

Unit 4 of the Hanson River beds correlates with the Stokes Siltstone and Stairway Sandstone of the Amadeus Basin, and with the Carlo Sandstone and Mithaka Formation of the Georgina Basin (Fig. 4). Unit 3 is an equivalent of the Horn Valley Siltstone of the Amadeus Basin, and the Nora Formation of the Georgina Basin. The stratigraphic positions of units 2 and 1 are uncertain. Unit 2 is lithologically similar to the Pacoota Sandstone of the Amadeus Basin, and glauconite from both rock units has yielded a similar isotopic (Rb–Sr) age (Wells, Forman, Ranford, & Cook, 1970). The presence of the Jinduckin Formation, an equivalent of the upper Pacoota Sandstone, in the Daly River Basin to the north demonstrates that an extensive post-Warendian I transgression covered central Australia during this period. This transgression may be represented in the Wiso Basin by unit 2 of the Hanson River beds.

Lake Surprise Sandstone (new name)

Derivation of name and type section

The Lake Surprise Sandstone is named from Lake Surprise, at latitude 20°14'S, longitude 131°48'E, in northeastern MOUNT SOLITAIRE. It was previously mapped (Milligan, 1976) as Dulcie Sandstone. The type section is between 3 and 62 m in stratigraphic drillhole BMR Lander River 1 (see p. 58), at latitude 20°31'S, longitude 133°30'E, on the eastern edge of LANDER RIVER. The lithology throughout the type section is uniform, consisting of white to light brown, very fine to medium-grained sandstone which has well-rounded and well-sorted grains. In some places, where a matrix of silt and clay is present, sorting is bimodal. The top of this section has been eroded and is covered by aeolian sand; the basal contact has been determined only from cuttings. One core, and cuttings at 3-m intervals, from this section are stored at the BMR Core and Cuttings Laboratory, Fyshwick, ACT.

Distribution, lithology, and thickness

The formation is poorly exposed over about 15 000 km^2 in a west-northwest-trending area extending across the central part of LANDER RIVER and the northeast part of MOUNT SOLITAIRE. In outcrop the sandstone is white, grading to dark brown where highly ferruginised, and ranges from very fine to medium-

Fig. 12. Low-angle cross-bedding in a typical exposure of the Lake Surprise Sandstone at locality LR 13 (lat. 20°23'S, long. 132°48'E), in central LANDER RIVER. (M/2237)

grained. It is well sorted, well rounded, and in some places a matrix of silt and clay is present. Ferruginisation is prominent in many outcrops and is probably a result of the formation of the Late Cretaceous or Early Tertiary laterite soil profile mapped in some parts of the basin. Silicification has also affected the rocks, and an opaline matrix is present in some exposures.

Cross-bedding is common throughout the sandstone and is generally at a low angle (Fig. 12). At locality LR 46 and to a lesser extent at LR 53, deformation of cross-bedded sandstones has resulted in folds with amplitudes of about 2 m; at locality LR 46, the beds are overturned (Fig. 13). These structures were probably produced by slumping after deposition.

The Hanson River seismic survey (Ray Geophysics, 1967) indicates a maximum thickness for this sandstone of about 150 m.

Upper and lower contacts

The Lake Surprise Sandstone unconformably overlies Hanson River beds of middle Arenigian age in BMR Lander River 1, and Hanson River beds of probable latest Arenigian age in the area south of localities LR 31 and LR 38, where the contact is not exposed. Interpretation of seismic data (Kennewell & others, 1977) indicates that the sandstone is not faulted against the Arunta Block but rests on it unconformably. It transgresses the faults which juxtapose the Hanson River beds and older rocks against the Arunta Block.

Depositional environment and age

The depositional environment of the Lake Surprise Sandstone is debatable. The good sorting, rounding, and low-angle cross-bedding suggest shallow-marine or beach deposition. Yet these features could also have been produced by streams which drained a source area of rounded, well-sorted sandstone or quartzite with little fine matrix, and which deposited well-sorted and rounded fluvial sediments with little evidence of the expected fining-upwards sequences. No attempt was made to determine source rock or source area for the sandstone. Reineck & Singh (1975, p. 244) recorded overturned foresets and contorted foresets in abundance in the lowermost large-scale cross-bedded parts of channel-bar deposits of the braided Brahmaputra River in India; intensely contorted cross-bedding in the Lake Surprise Sandstone at localities LR 46 and 53 may have a similar origin.

The age of the Lake Surprise Sandstone is uncertain, as no fossils have been found in it. It must be younger than the underlying Hanson River beds, which contain sediments of Arenigian (Ordovician) age, but, as it is overlain only by aeolian sand, no younger limit for its age is available.

Regional correlations

The tectonic setting of the Lake Surprise Sandstone —a clastic rock unit unconformably overlying Ordovician sediments in a faulted crustal downwarp—is simi-

Fig. 13. Complex folding in the Lake Surprise Sandstone at locality LR 46, in northwest LANDER RIVER (M/2237)

lar to that of the Mereenie Sandstone and Pertnjara Group of the Amadeus Basin, the Mount Eclipse Sandstone of the Ngalia Basin, and the Cravens Peak beds and Dulcie Sandstone of the Georgina Basin. If the Lake Surprise Sandstone has a similar genesis to these formations, and is contemporaneous with them, then it is probably of fluvial origin and of latest Silurian to earliest Carboniferous age. Data from the Hanson River seismic survey (Ray Geophysics, 1967) suggest that the Lake Surprise Sandstone extends across a fault that Kennewell & others (1977) interpreted to be contemporaneous with the Alice Springs Orogeny, of Late Devonian to Early Carboniferous age. If their interpretation is correct, the unit must have been deposited after that time.

YOUNGER ROCKS OVERLYING THE WISO BASIN

MESOZOIC

Mullaman beds

The Mullaman beds (Noakes, 1949; Skwarko, 1966, 1973) extend over the northern part of the basin. They are flat-lying, and underlie most of DALY WATERS, NEWCASTLE WATERS, LARRIMAH, and parts of WAVE HILL, VICTORIA RIVER DOWNS, and DELAMERE. Hughes (1978) has correlated Mesozoic sediments in the northern part of the Northern Territory previously mapped as Mullaman beds with rock units of the Bonaparte Gulf Basin. The name Mullaman beds is retained in the northern Wiso Basin because the rock units present cannot be correlated unequivocally with those identified by Hughes.

The Mullaman beds are well exposed in a prominent scarp which extends along the northwestern margin of the plateau that underlies the northern Wiso Basin. West of this scarp the beds are generally exposed in isolated mesas, whereas to the east they are exposed in small breakaways developed around low rises, and as rubble in sand and soil on the plateau. The beds are exposed in cliffs and escarpments from near Mount Wollaston, in WAVE HILL, to north of Willeroo homestead, in DELAMERE. In areas of poor exposure, information has been obtained from stratigraphic drillholes and water-bores.

Four rock units have been recognised within the Mullaman beds in the Wiso Basin, and these, together with their macrofossils and microfossils, have been fully described by Skwarko (1973).

Unit A

The basal unit is a saccharoidal sandstone with beds of cobble and pebble conglomerate, locally differing in grainsize and silt content and containing only plant fossils. It is non-marine, and is correlated with the basal unit A of the Inland Belt Suite of Skwarko (1966). Although a ?Neocomian to Aptian age was attributed to this unit on the basis of plant impressions (M. E. White *in* Skwarko, 1973), R. J. Hughes (formerly BMR, personal communication 1977) considers it most likely to be equivalent to the Upper Jurassic to Neocomian Petrel Formation of the Money Shoal Basin. The basal unconformity of the Mesozoic rocks is exposed in the Top Springs area, where small and low remnant outcrops of ferruginised grit and subangular cobble and pebble conglomerate with fossil impressions of twigs, branches, and logs overlie the pre-Mesozoic land surface. Skwarko (1973) concluded, on the basis of lithologic differences, that the western and northwestern edge of the lacustrine depositional environment of this rock unit was roughly parallel to and west of the present-day scarp near the northwest margin of the Wiso Basin.

Unit 6

The second unit in the Mullaman beds overlies unit A disconformably, and is correlated with unit 6 of the Coastal Belt Suite by Skwarko (1973). It consists of leached cream claystone and siltstone with numerous slip features and irregular, closely spaced ironstained joint planes, and contains a marine fauna. Its thickness is 36 m in stratigraphic drillhole BMR Daly Waters 1, where its contact with the overlying sandstone is gradational.

Unit 6a

Skwarko (1973) established this unit for sandstone which apparently conformably overlies unit 6. It consists of quartz sandstone, is indurated, medium-grained, micaceous, and in places contains a large percentage of glauconite. It contains many undescribed trace fossils, and the gastropod *Neritokrikus tuberosus* Skwarko, 1966, which suggests an Aptian age. R. J. Hughes (formerly BMR, personal communication 1977) considers units 6 and 6a most likely to be equivalent to the Aptian Darwin Member of the Bathurst Island Formation in the Money Shoal Basin.

Unit C

The fourth and uppermost rock unit of the Mullaman beds is mainly micaceous siltstone and claystone which, in the southern portion of VICTORIA RIVER DOWNS, grades upwards into 1 m of grit and pebble conglomerate that may or may not mark the original top of the unit. In most outcrops, however, the claystone persists to the erosional surface, where protracted weathering has given the uppermost few metres the appearance of a breccia (Skwarko, 1966). Skwarko (1973) considered this rock unit to be an equivalent of his unit C of the Inland Belt and of the Polland Waterhole Shale of northwestern Queensland. Although a fauna of arenaceous foraminifera suggests an Aptian rather than Albian age, he considered an Albian age most likely on the basis of the above correlation. Hughes (1978) did not record Albian fossils in the Money Shoal Basin, and (personal communication 1977) considers that these rocks are equivalent to either part of the Eromanga Basin sequence, which is not represented in the Darwin area, or the Darwin Member of the Bathurst Island Formation, which is of Aptian age.

MESOZOIC OR CAINOZOIC

Buchanan Hills beds
(new name)

Derivation of name and reference section

The Buchanan Hills beds are named from the Buchanan Hills, at latitude 18°52′, longitude 131°06′, a prominent scarp in which the reference section of the beds (at locality WC 28) is exposed (Fig. 14). This section consists of about 40 m of very fine to coarse-grained, poorly sorted angular sandstone which is extremely weathered and has a ferruginous and siliceous matrix owing to the development of a laterite soil profile on the outcrop. The contact with the underlying Hooker Creek Formation is sharp.

Fig. 14. The reference section of the Buchanan Hills beds overlying the Hooker Creek Formation in the Buchanan Hills, central southern WINNECKE CREEK. (M/2237)

Distribution, lithology, and thickness

The beds are generally poorly and discontinuously exposed, cropping out as small scarps where low rises have been incised, or as scree in colluvium covering the rises. These rises occur throughout WINNECKE CREEK, SOUTH LAKE WOODS, TANAMI EAST, GREEN SWAMP WELL, and parts of MOUNT SOLITAIRE and LANDER RIVER. The distribution of the beds in the northern Wiso Basin is uncertain.

Quartz sandstone is typical; it is poorly sorted, very fine to coarse-grained, grades to sandy siltstone at some localities, contains pebbles and cobbles at others, and is typically angular, although well-rounded grains may also be present. The beds are commonly very weathered and in places lateritised. The maximum thickness exposed (outside the reference area) is 4 m at locality SLW 54.

BMR Bonney Well 3 penetrated sandstone similar to the Buchanan Hills beds overlying crystalline rocks of the Arunta Block, suggesting that the Buchanan Hills beds extend across the major fault on the southern margin of the Lander Trough in southwestern BONNEY WELL.

Upper and lower contacts

The beds unconformably overlie many rock units, including rocks of the Wiso Basin sequence and basement rocks. Their basal contact is rarely exposed, but at locality SLW 54, in southeastern SOUTH LAKE WOODS, a basal cobble conglomerate 2 m thick containing large fragments of the underlying Tomkinson Creek beds forms the base of the unit. The upper contact is eroded.

Depositional environments, fossils, and age

As the beds are unfossiliferous, their age is uncertain. In the reference area of the Hanson River beds, they apparently unconformably overlie rocks of Early Ordovician age, and hence must be Ordovician or younger. They must be older than the laterite profile that developed on them sometime during Late Cretaceous or Early Tertiary time. Hence the only limits which can be placed on their age are post-early Ordovician and pre-Late Tertiary. Their texture suggests a continental, possibly fluvial origin, and their occurence at Buchanan Hills, on the edge of a large gentle slope over which streams are presently flowing, suggests an origin similar to that of the Hooker and Winnecke Creeks alluvia. The Buchanan Hills beds may be similar fluvial deposits developed before the laterite profile formed. Should these rocks correlate with the basal non-marine unit of the Mullaman beds, they would be of Late Jurassic to Early Cretaceous age.

Regional correlations

In the Canning Basin, to the west, similar poorly sorted coarse-grained quartz wacke and granule conglomerate of the Lake George beds (Crowe & Towner, 1976) unconformably overlie the Lower Cretaceous Anketell Sandstone. These rocks may correlate with the Buchanan Hills beds.

Laterite profile

A laterite profile (see physiography map in Plate 1) is well developed on many rock units throughout the Wiso Basin. The uppermost ferruginous zone forms an almost continuous sheet over most of LARRIMAH, DELAMERE, and DALY WATERS, but occurrences south of this area are generally limited to topographically high areas. The extreme weathering which has affected almost all rocks in the southern Wiso Basin probably represents the lower pallid zone of this laterite profile, preserved despite the erosion of the upper ferruginous and mottled zones. The laterite profile has been removed by erosion in the Dissected Margin (Fig. 3) in the northwest part of the basin.

The ferruginous zone of the laterite profile is exposed along the edge of the Main Plateau and in minor low scarps and rises on the plateau surface, but is commonly covered with red to dark brown sandy and loamy soils.

On the argillaceous Upper Jurassic to Lower Cretaceous sediments, the ferruginous zone of nodular and pisolitic ironstone passes down into the mottled zone of ironstained and bleached sedimentary rock, and then into the pallid zone of bleached rock with thin hematite veins. These relations can be seen in the scarp of the Sturt Plateau east of Top Springs, in VICTORIA RIVER DOWNS. Some sections of ferruginous zone material (e.g., at Frew Pond, south of Dunmara, in southeastern DALY WATERS) show apparent bedding

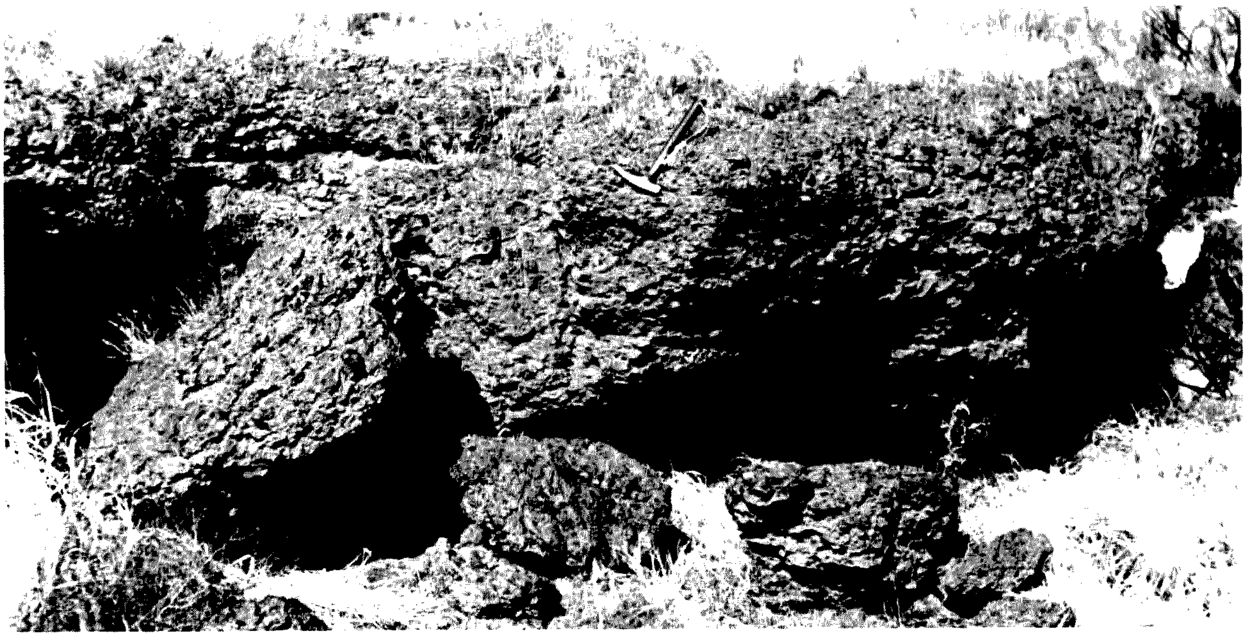


Fig. 15. Laterite conglomerate containing large fragments of the Point Wakefield beds at locality GSW 27, in southeast GREEN SWAMP WELL. (M/2237)

and size sorting of the ironstone pisolites, and may be laterite conglomerate (see below). According to Traves (1955) laterite profiles on the Antrim Plateau Volcanics lack a definite pallid zone. In the southern Wiso Basin the ferruginous zone is best exposed at Buchanan Hills, in southern WINNECKE CREEK, where the upper 12 m of the outcrop has been extremely weathered, producing a capping of pisolitic laterite; the mottled zone of the laterite profile is present within the scarp beneath this, and the pallid zone extends beneath the scree slopes. Isolated laterite occurrences cap breakaways throughout the southern part of the basin, but only the pallid zone is preserved in most.

Nine samples from the ferruginous zone were analysed for iron, aluminium, and silicon (Randal & Brown, 1967). Iron contents range from 22.9% for a specimen from a locality about 9 km north-northeast of WG Bore, in central southeastern WAVE HILL, to 46.4% at locality WV 77, in northeastern WAVE HILL. Aluminium contents are low, less than half as abundant as iron and less abundant than silicon, except in two samples; in one of these, silicon and aluminium are equal at 10.5%, and in the other the content of aluminium is 11.1% and silicon 11.0%. The lowest aluminium content is 1.5%—in a specimen from near Murranji Bore, in southern DALY WATERS; the same specimen contains 44.2% iron.

Highly ferruginous rocks are present above and below the unconformity at the base of the Mullaman beds at some localities. Five samples of these rocks were analysed for the same elements as the laterite samples (Randal & Brown, 1967); they contained from 22.1 to 42.4% iron and from 1.9 to 4.8% aluminium. The amounts of trace elements, especially of manganese, were generally much higher than in the laterite samples.

The laterite has not been dated in the Wiso Basin. The youngest dated rocks it overlies are of Early Cretaceous age, providing an older limit to its age. In the Bullock Creek area, in north-northeastern WAVE HILL, it seems to be older than the Miocene Camfield beds (Plane & Gatehouse, 1968), which rest on a surface eroded almost 60 m topographically below the laterite. Also in the same area, a conglomerate near the base of the Camfield beds contains pellets of pisolitic ironstone presumably derived from the laterite profile (Randal & Brown 1967).

Idnurm & Senior (1978) have palaeomagnetically dated a Late Certaceous to Eocene deep weathering profile (the Morney Profile) in southwest Queensland. They suggested that it may be part of an Australia-wide weathering event formed during very humid conditions which existed in Australia at this time (Shackleton & Kennett, 1975). This weathering event may be represented by the laterite profile in the Wiso Basin.

Palaeomagnetic results obtained from the Montejinni Limestone are thought to have been influenced by chemical remagnetisation related to regional lateritisation (Luck, 1970), and show a pole which lies close to that of the Canaway Profile—a deep weathering profile developed in southwest Queensland (Idnurm & Senior, 1978)—indicating that this mid-Tertiary weathering event also affected the Wiso Basin.

Laterite conglomerate

Laterite conglomerate (KTc) crops out on a plain topographically lower than the laterite in a small area north of the Buchanan Hills along the banks of Winnecke Creek, in WINNECKE CREEK. It consists of pisoliths and iron-rich rock fragments up to 20 cm across derived from the laterite profile and later cemented by iron oxide.

In a sinkhole section at locality WV 77, in northeastern WAVE HILL, rubbly ferruginous material overlies siltstone of the middle unit of the Montejinni Limestone (Randal & Brown, 1967), and may be a similar deposit.

Similar laterite conglomerates of ferruginised sediment in an iron oxide matrix occur as linear rises at locality TE 27, in the northeast corner of TANAMI EAST, and at locality GSW 27, in southeastern GREEN SWAMP WELL (Fig. 15). The conglomerate at GSW 27 may be preserved in a solution-collapse structure.

The age of these laterite conglomerates is uncertain, but they are probably slightly younger than the laterite profile.

Silcrete

Minor occurrences of siliceous crust, or silcrete (not depicted in Plate 1), are present throughout the basin, particularly on outcrops of the Hanson River beds in their reference area in LANDER RIVER; on low rises and prominent ridges of the Tomkinson Creek beds, which make up the basement in SOUTH LAKE WOODS and TENNANT CREEK; and on some outcrops of Lake Surprise Sandstone. This may be of a younger age than the Late Cretaceous to Eocene Morney Profile, and relate to a mid-Tertiary—probably late Oligocene—episode of weathering (the Canaway Profile) that occurred in southwest Queensland across a poorly drained land surface, levelled in many places by deposition, beneath which silica accumulated (Idnurm & Senior, 1978).

CAINOZOIC

Camfield beds

The Camfield beds were first named by Plane & Gatehouse (1968), and the definition proposed by M. A. Randal but unpublished is shown below. The name is derived from Camfield Pastoral Lease, along the Camfield River in northern WAVE HILL. The beds crop out along Bullock Creek, a tributary of the Camfield River 19 km southeast of Camfield homestead, and in similar tributaries of the Camfield River south of Bullock Creek. They are also present in the valley of Cattle Creek southwards from its confluence with the Camfield River to near Cattle Creek homestead, in central eastern WAVE HILL.

Two reference sections, described below, occur at about latitude 17°07'S, longitude 131°31'E. Section (a) overlies section (b), but may be separated by a thickness of up to 9 m of concealed sediments.

Section (a)

Top (eroded)

0.6 m	Dark grey hard limestone, thick-bedded.
2.4 m	Hard and soft buff limestone with vertical burrows, medium-bedded; 5 cm beds of calcareous shale.

Section (b)

Top

3.0 m	Cherty limestone, poorly bedded.
0.9 m	Cherty limestone, medium-bedded; gastropods.
2.1 m	Red-grey gypsiferous siltstone; some bones.
1.2 m	White-buff limestone, opaline silica; gastropods and bones.
4.6 m	Mottled red and grey calcareous sandy siltstone.
6.4 m	Red calcareous siltstone.
21.2 m	

————-Unconformity————

3.0 m + Antrim Plateau Volcanics

The rocks are essentially flat-flying, but some pitches and rolls have been caused by slumping and solution collapse. Lack of accurate levelling, and indefinite correlation of horizons, prevented an accurate measurement of the reference sections. The top of the unit has been eroded and an unknown amount removed.

The gypsiferous siltstone and the calcareous siltstone may be the leached remnants of impure limestones. The limestone and the siltstone contain flattened polished pebbles of agate derived from the underlying Antrim Plateau Volcanics.

In the Cattle Creek area, where the unit rests mainly on the Montejinni Limestone, the agate pebbles are rare. The pebbles are scattered throughout the unit, but are dense near the base. A coarse conglomerate near the base consists of clasts of basalt, chert fragments, and pellets of pisolitic ironstone presumably derived from the lateritisation of pre-Tertiary rocks. The pellets are similar to those in cemented and loose lateritic gravels which occur in many parts of the region over all pre-Tertiary units.

In the Bullock Creek area, gypsiferous siltstone in the unit is reddish and has a poorly developed boxwork fabric, but, in the Cattle Creek area, siltstone interbeds are greyish-white and are lustre-mottled by thin laminae of gypsum. Fine to medium-grained sandstones in the same area have a similar fabric. Algae and stromatolites occur in the limestone parts of the sequence.

The outcrops are mainly as mesas in the Bullock Creek area, where they are up to 21 m above adjacent stream beds and about 30 m below the main surface of the Main Plateau. In the Cattle Creek area, only 6 m of the beds are exposed as rough low hills with rectangular drainage. In both areas, pavements and low cliffs of limestone occur in and about the watercourses.

The Camfield beds unconformably overlie the Lower Cambrian Antrim Plateau Volcanics and the lower Middle Cambrian Montejinni Limestone, and their top is eroded. The unit has not been seen in contact with the Upper Jurassic to Lower Cretaceous Mullaman beds.

Plane & Gatehouse (1968) reported lungfish teeth, scutes of turtles, crocodile teeth, post-cranial bones of giant ground birds, and representatives of the families Diprotodontidae and Thylacoleonidae from the beds. Freshwater gastropods occur in the rocks and commonly form rich coquinite beds. The bone-beds have been found only in the Bullock Creek area; only poorly preserved gastropods have been found in the Cattle Creek area, but, as the rock types are similar, bones may be present there too.

Plane (*in* Plane & Gatehouse, 1968) considered that the beds are middle to late Miocene in age—younger than the Kutjamarpu fauna of the Lake Eyre Basin (Stirton, 1967), and older than the Alcoota fauna near Alice Springs (Woodburne, 1967).

The presence of algae and stromatolites indicates that the sediments were deposited in shallow water. A nearshore environment is supported by the fragmentation of fossil material and the conglomeratic material in the sequence. Deposition may have been in water that was normally saline, as indicated by the gypsum, but subjected to freshwater flooding which brought in the gastropods. The environment may have been lacustrine, lagoonal, or estuarine.

Birdum Creek beds

The Birdum Creek beds (Randal, 1969b) crop out immediately north of the Wiso Basin, at localities L 21 and L 22, in western LARRIMAH, and probably extend into the basin, concealed by the surficial cover of the alluvium of Western Creek, Forrest Creek, and Dry River, in southwestern LARRIMAH.

They comprise white nodular fossiliferous limestone, at least 15 m thick, sparsely distributed in central LARRIMAH from Birdum Creek near Larrimah township, in the east, to the valley of Dry River, in the west.

No reference section has been designated for the unit, but Randal (1969b) nominated a reference area about BMR Larrimah 3 stratigraphic hole, in central eastern LARRIMAH, where the unit crops out as scattered boulders in grassy valleys and floodouts and on low rises. Its estimated thickness is from BMR Larrimah 3 stratigraphic hole, which is sited on an outcrop of the unit and penetrated 15 m of white to pale yellow chalky and hard limestone with patches of sandy clay and chalcedony before passing into sand and sandstone of probable Mesozoic age.

The unit, which contains at least two genera of freshwater gastropods, is of Tertiary age, and may be an equivalent of the Camfield beds. It unconformably overlies Mesozoic rocks and the lower Middle Cambrian Tindall Limestone.

Brunette Limestone

The Brunette Limestone (Randal & Brown, 1969) is a surficial deposit of white nodular limestone which extends from the Barkly Tableland into HELEN SPRINGS, and probably correlates with the Birdum Creek beds.

Unnamed sandstone

An unnamed sandstone (Czs) which is medium-grained, well sorted, and well rounded crops out at locality GSW 36, in southeastern GREEN SWAMP WELL. It is poorly consolidated, medium-bedded, and contains vertical holes 1 mm in diameter. Its thickness and distribution are uncertain owing to poor exposure, but it may correlate with sediments in the Cabbage Gum Basin—a shallow, presumably Tertiary basin in southwestern TENNANT CREEK (Fig. 3; Mendum & Tonkin, 1976).

Calcrete

Calcrete (Czk) commonly forms a capping on limestone and dolomite, and is restricted to the southern part of the basin as it does not form over a bedrock of Mullaman beds. Large areas of calcrete have formed over the Montejinni Limestone south of Cattle Creek homestead, in southeastern WAVE HILL, and over undivided Montejinni Limestone and Hooker Creek Formation in central and southwestern TANAMI EAST and eastern WINNECKE CREEK.

Fragments of white calcareous claystone of the underlying Point Wakefield beds are preserved at the base of calcrete outcrops in central GREEN SWAMP WELL. This calcrete may extend beneath a thin aeolian sand cover in the southeast part of that Sheet area and be continuous with outcrops in southwestern TENNANT CREEK and northwestern BONNEY WELL.

Outcrops in the northern half of LANDER RIVER contain fragments of crystalline dolomite of the underlying Hanson River beds. These calcretes have a distinctive photopattern caused by intersecting lineaments which are apparently produced by upward seepage of water along intersecting joints; carbonate and silica leached from the bedrock have been subsequently deposited as linear ridges on the surface.

Calcrete crops out in depressions in MOUNT SOLITAIRE, and at locality MTS 59, 8 km north-northwest of Mount Davidson, it contains fragments of crystalline carbonate rock.

Finely crystalline dolomitic limestone is typical of the calcrete, but in many places it contains abundant quartz grains and fragments of the underlying rocks, and in some places, particularly in the upper parts of outcrops, is partly or completely replaced by chalcedony. The greatest observed thickness of calcrete in outcrop is 4 m at locality GSW 12, in central GREEN SWAMP WELL.

Colluvium

Colluvium (Czc) is present in the southern part of the Wiso Basin underlying pediments extending from many low rises and, in central TANAMI EAST, filling a large depression. Sand is the main constituent, but silt, clay, and rock fragments derived from nearby rises are generally present. The colluvium is probably transported by soil creep, small streams, and sheet flow to form surficial deposits.

A second, thicker, and probably older type of colluvium is visible on aerial photographs in the Buchanan Hills area, in southern WINNECKE CREEK, where it forms a deposit underlying the scree slope. In BMR Winnecke Creek 2 stratigraphic drillhole, at the base of the Buchanan Hills, the colluvium fills a depression in the earlier topography produced by the erosion of a prominent dolomite bed of the Hooker Creek Formation, which crops out in the surrounding area. Here the colluvium is composed of silt, sand, and a gravel of silty dolomite, dolomitic siltstone, chert, hard claystone, and pisolitic ironstone pellets (Milligan & others, 1966), and is 12.2 m thick.

BMR Winnecke Creek 3 stratigraphic drillhole, at Merrina Waterhole, 20 km northeast of BMR Winnecke Creek 2, penetrated buff, white, and red fine-grained sands, yellow and pink soft sandy clay, and rare beds of red soft sandy micaceous silt to a total depth of 49.4 m. The rocks were interpreted as of Palaeozoic age by Milligan & others (1966), but their soft weathered nature suggests that they are perhaps of a thick Cainozoic colluvium deposit similar to that in the Buchanan Hills.

Alluvium

Alluvium (Qa) fills the broad depressions along which rivers flow in the northern Wiso Basin, and underlies the floodouts of the Lander and Hanson Rivers in the south. Many creeks in the southeastern and southwestern parts of the basin deposit alluvium on the sand plains which cover the basin. In the northern part of the basin the alluvium is mainly fine-grained clayey sand (Randal, 1969a), and includes pedocalcic soils and the small sandy floodout fans of minor creeks (Brown, 1969). In the central part of Lake Woods, reworked clayey alluvium is finer-textured than the clayey black soils that border the lake (Randal, 1969b).

BMR stratigraphic drilling near the Hanson River floodout showed that the alluvium underlies some areas of the sand plains in eastern LANDER RIVER. Here it is a fine-grained sand with minor medium and coarse grains, and is angular to rounded, poorly sorted, poorly consolidated, weathered, and contains a few iron oxide concretions. A well-sorted, poorly consolidated bed of angular to rounded granule conglomerate is present at the base of the alluvium in places. The greatest thickness penetrated in this area was 9 m in BMR Lander River 7 stratigraphic drillhole.

Gravel

Gravel (Czg) forms eluvial deposits on many low rises throughout the Wiso Basin. It is most extensive in northern DALY WATERS, and extends over large areas through the remainder of the basin.

Wind and water action has commonly deflated the gravel deposits, leaving them no more than a few metres thick. Pebbles and cobbles of the underlying rock type are generally highly lateritised or weathered, and enclosed in a matrix of sand, silt, and clay. In most places the underlying rock types can be identified from the fragments preserved in the gravel.

Black soil

Black soil (Czb) underlies grassy plains in southeastern WAVE HILL; on the Sturt Plain in southeastern DALY WATERS; and in the area surrounding Lake Woods in southeastern NEWCASTLE WATERS. The black and grey pedocalcic soils develop over Cambrian and Tertiary carbonate rocks and Cretaceous siltstone and claystone (Randal, 1973). The soils are probably partly residual deposits and partly alluvial (Randal & Brown, 1967).

Lake deposits

Lake deposits (Ql) are present throughout the southern Wiso Basin, forming in playa lakes that periodically hold the water which drains into topographic depressions. The sand, silt, clay, and evaporites which constitute the deposits are probably several metres thick in most instances. The clastic sediments are transported and deposited by stream, slope wash, and wind action; the evaporites are formed in salt lakes by the concentration of salts as the water rapidly evaporates, but are absent from claypans, which generally hold fresh water.

Aeolian sands

Aeolian sand (Qs) forms a veneer up to several metres thick over large areas of the basin. It is typically quartzose, moderately sorted, well rounded, and fine to coarse-grained. Staining by iron oxides has produced a ubiquitous red-brown colour. Dunes up to 20 m high have formed in the central and southern parts of the basin, and are now stabilised by the growth of spinifex and other vegetation.

STRUCTURE

The Wiso Basin is structurally simple, being almost flat-lying in all but its southernmost part. It has formed on a basement of highly to mildly deformed Proterozoic rocks and almost flat-lying Lower Cambrian rocks. The inferred subcrop of basement rock units beneath the Wiso Basin is shown in Figure 23.

Basement structure

Structure contours on the base of the Montejinni Limestone (and hence of the Wiso Basin) are shown in Figure 16, and are based on drillhole information and on outcrop elevations. Shallow depths to the base of the Montejinni Limestone in most areas are also indicated by aeromagnetic surveys (Aero Service Ltd, 1964a, b; Compagnie Générale de Géophysique, 1966; Adastra Hunting Geophysics Pty Ltd, 1967) which recorded shallow magnetic anomalies corresponding to features in the basement rocks over many parts of the basin. The depths to these anomalies have been plotted in Figure 23; although approximate, they provide maximum depths to the base of the non-magnetic Palaeozoic rocks.

The crest of a slight basement rise extending at least from DELAMERE to western BEETALOO (Fig. 16) defines the northern limit of the Wiso Basin. The sediments are continuous across this ridge, forming part of the Daly River Basin to the north of it; they are also continuous with sediments in the Georgina Basin, to the east. A second prominent basement ridge is evident across the central part of the basin where Proterozoic rocks crop out in a belt extending northwest across SOUTH LAKE WOODS and the northeast corner of WINNECKE CREEK (Plate 1).

South of this ridge the basin floor dips gently southwards, and, in the southernmost part of the basin, dips more steeply into the Lander Trough, a poorly defined structural downwarp in which at least 1000 m of Wiso Basin sediments are preserved (Kennewell & others, 1977). The structure of the trough is outlined briefly under GEOPHYSICS.

Lineaments

Creek and river channels are commonly aligned to form lineaments in the northern part of the basin. The most prominent lineament extends about 400 km northeast from near Wave Hill Police Station, in WAVE HILL. It is expressed in linear trends of the Victoria River, Coolibah Creek, and parts of the Armstrong River, Dry River, and King River (in KATHERINE, northeast of the basin). These features are parallel to some fault and fold trends in the Victoria River Basin, and probably reflect structural features in the basement rocks.

C. Maffi (formerly BMR) examined Landsat 1 imagery available for the Wiso Basin, and indicated many sets of lineaments (Fig. 17). Scan lines, and scratches that were probably produced during photoprocessing, may have precluded the detection of several lineaments in roughly east-west and north-south directions. The annotation was done without extrapolating: each line in Figure 17 represents a continuously visible trace on the images; thus two or more lineaments in line may represent a single lineament not continuously visible on the images, for example A–B and C–D. Several circular arrangements of lineaments are evident —for example E, F, G, and H—and may represent features (perhaps dome structures similar to those in TANAMI, west of the basin) in the basement rocks. Lineaments I, J, and K coincide with roads, but are thought to represent true lineaments along which the terrain has been favourable to road construction.

Folding

Several distinct rock sequences containing slightly different fold systems and separated by unconformities have been identified in the basin.

The Montejinni Limestone, Hooker Creek Formation, and Lothari Hill Sandstone form the lowermost sequence, shown by drilling to dip—at about 0.3°—into a broad syncline (section A–B, Plate 1). The elevations of outliers of Gum Ridge Formation (an equivalent of the Montejinni Limestone) on topographic highs in TENNANT CREEK, to the east of the basin, indicate dips of about 0.1° to the west on the eastern limb of this synclinal structure. In the dissected area west of the Main Plateau and south of Willeroo, where there is adequate borehole and outcrop control, the spacing of the structure contours (see Fig. 16) indicates that the regional dips in this basal sequence are less

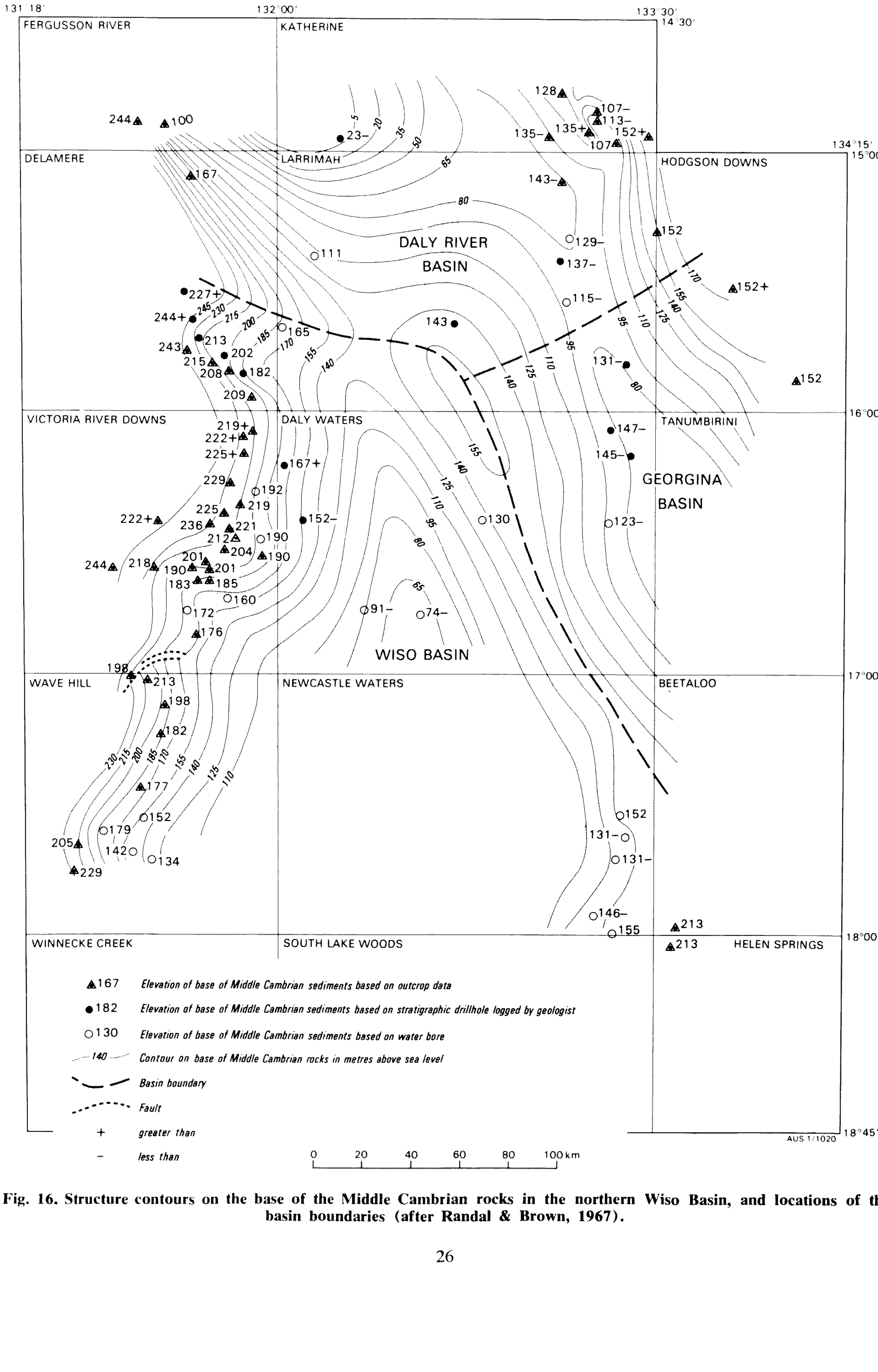
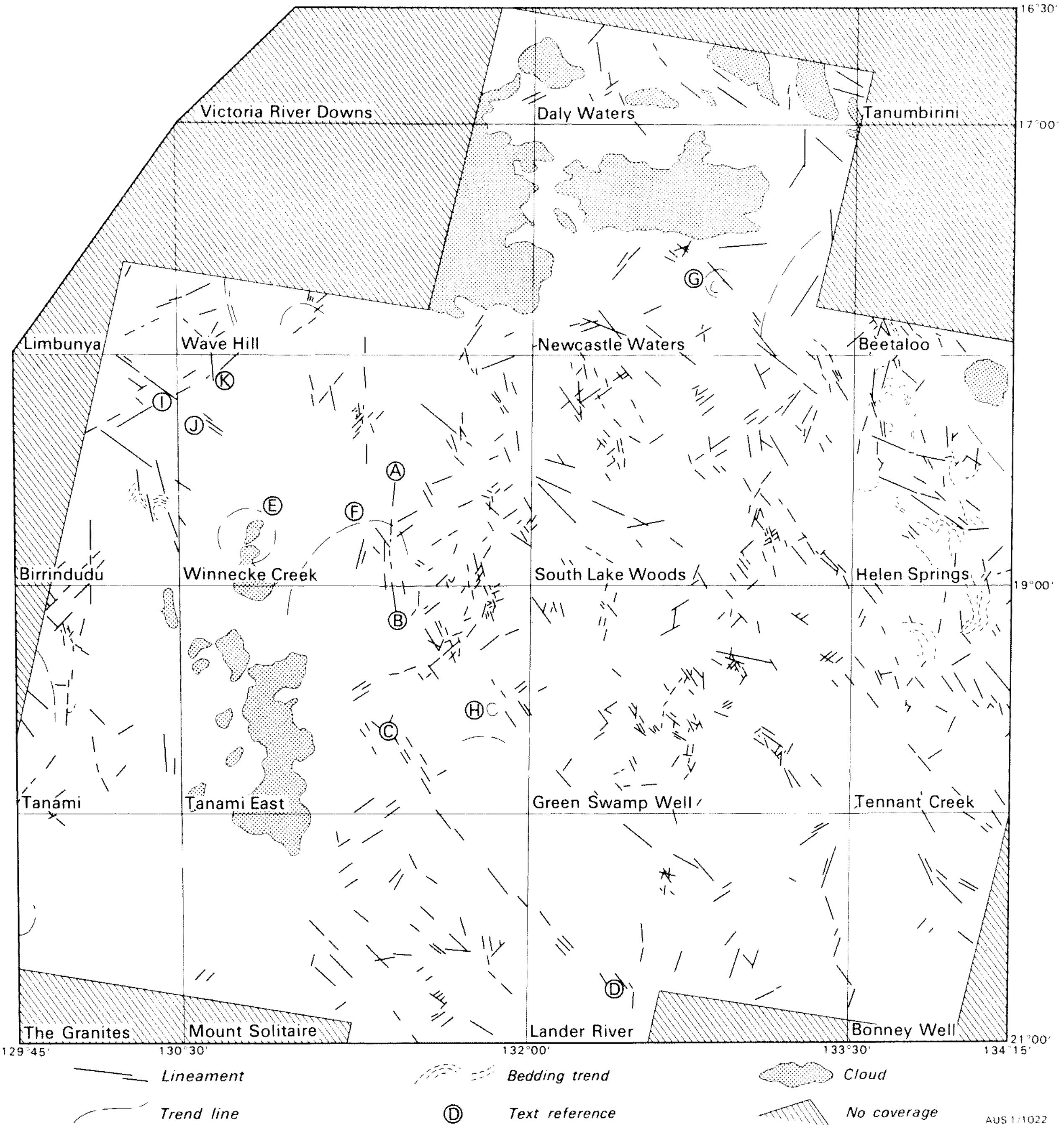


Fig. 16. Structure contours on the base of the Middle Cambrian rocks in the northern Wiso Basin, and locations of the basin boundaries (after Randal & Brown, 1967).



Prepared from uncontrolled ERTS image mosaic

Fig. 17. Lineament analysis from Landsat images, southern and central Wiso Basin (interpreted in 1976 by C. Maffi).

than about 0.25°. Superimposed on these gentle regional dips in several places are local dips up to about 35°. Some of these steeper dips occur along minor faults near Mount Wallaston, on the northern margin of WAVE HILL. The faults do not appear to displace the overlying Mullaman beds. Other local steep dips—including those in the Montejinni Limestone in outcrops about 11 km east-northeast of Top Springs, in eastern VICTORIA RIVER DOWNS—are of uncertain origin, and are tentatively attributed to collapse following solution of carbonate rocks either within the Montejinni Limestone or in limestone beds in the Antrim Plateau Volcanics.

In the Dissected Margin, in the northwest part of the basin, the present relief of the base of the Montejinni Limestone is about 100 m. The absence of unit 1 (maximum thickness about 30 m) from outcrop sections north of Fraynes Knob, in eastern VICTORIA RIVER DOWNS, is probably because the sea in which it was deposited did not cover the higher parts of the gently sloping surface, which had a relief of about 30 m. Deposition of unit 1 apparently levelled the surface, as the overlying units—deposited probably in water that was less than 10 m deep—persist laterally. There is no evidence of their wedging-out against the present structurally high areas or of changes to a deeper-water facies towards the present structurally low areas.

In the area between the Buchanan Hills and Lothari Hill, in southern WINNECKE CREEK, two distinct photopatterns have been mapped and interpreted (Fig. 18): one over the stratigraphically lower Montejinni Limestone and Hooker Creek Formation; the other over

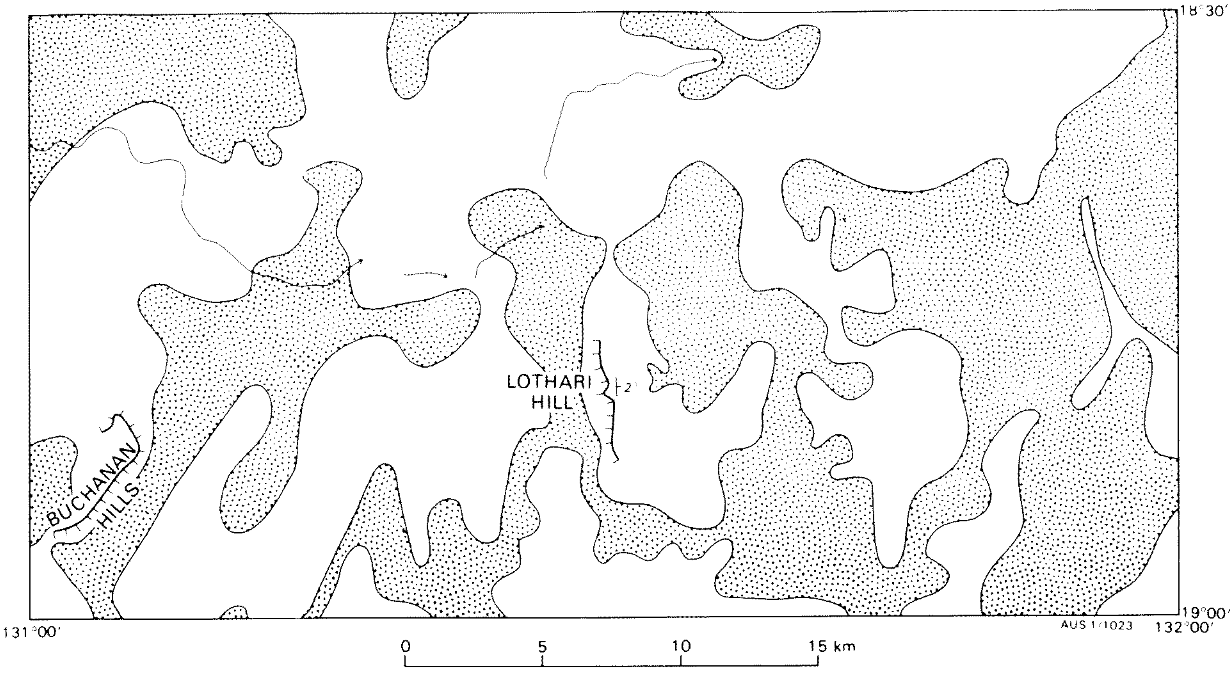


Fig. 18. Diagrammatic representation of photopatterns in the Buchanan Hills/Lothari Hill area.

the stratigraphically higher Lothari Hill Sandstone and Buchanan Hills beds. There is little topographic relief throughout most of this area, and the distribution of these two photopatterns, and of the rock units over which they have developed, may reflect shallow larger-scale folds throughout the area. The photopattern underlain by the Montejinni Limestone and Hooker Creek Formation (stippled in Fig. 18) may outline anticlinal axes in which these lower stratigraphic units have been truncated. The photopattern underlain by the Lothari Hill Sandstone and Buchanan Hills beds (shown in white in Fig. 18) may define synclinal axes in which downwarping has preserved these stratigraphically higher rock units. Although the folds may be broad and ill-defined, north-northeast-trending axes may be present east of the Buchanan Hills.

In the southern part of the basin this Ordian sequence dips into the Lander Trough and is faulted against the Arunta Block.

The Hanson River beds and Point Wakefield beds form a second structurally distinct rock sequence which overlies the Lothari Hill Sandstone unconformably. This sequence is almost undeformed over all but the southern part of the basin, where it is interpreted as dipping gently southwards into the Lander Trough and being faulted against the Arunta Block. A southward dip of over 2° into the Lander Trough is inferred from the difference between the elevation of a dolomite bed intersected in BMR Lander River 1, and the maximum elevation of the same bed which is interpreted to underlie the Lake Surprise Sandstone in BMR Lander River 7. Slight folding or uplift may have occurred at several times during deposition of this sequence, producing the numerous breaks in its depositional history.

This second sequence is described as sequence II under GEOPHYSICS. Downwarping and faulting of the sequence most probably took place contemporaneously with the Alice Springs Orogeny, which affected the Amadeus Basin to the south during Late Devonian or Early Carboniferous time (Wells & others 1970).

The Lake Surprise Sandstone forms a third structurally distinct rock sequence; it overlies the Lander Trough, where it forms the uppermost sequence I. It is almost flat-lying and extends across one of the faults on the southern margin of the basin. Large slump structures in the sandstone suggest that structural disturbances may have been taking place during its deposition.

The Mullaman beds form the fourth and uppermost structurally distinct rock sequence, and are preserved only in the northern part of the basin. The configuration of the base of the Mullaman beds (Fig. 19) is partly controlled by predepositional topography over much of the region—for example, the strike ridges of the Ashburton Range, east of the basin, were topographic highs when the beds were being deposited; and the basal non-marine unit and some of the later marine units are irregular in thickness (Skwarko, 1967).

Some regional tilting may have taken place during Tertiary time, as the surface of the Main Plateau has broad variations in elevation, which are reflected in the regional drainage pattern. This tilting might have produced the closed drainage basin of Lake Woods.

Faulting

The most significant faulting in the basin is on the southern margin of the Lander Trough, where a series of parallel east-southeast faults with an overall displacement of over 2000 m juxtapose Proterozoic and Palaeozoic sediments against crystalline rocks of the Arunta Block. The regional structure suggests that the Lander Trough was produced by a crustal downwarp, and that these faults are overthrusts (Kennewell & others, 1977). The seismic data support this broad interpretation, but

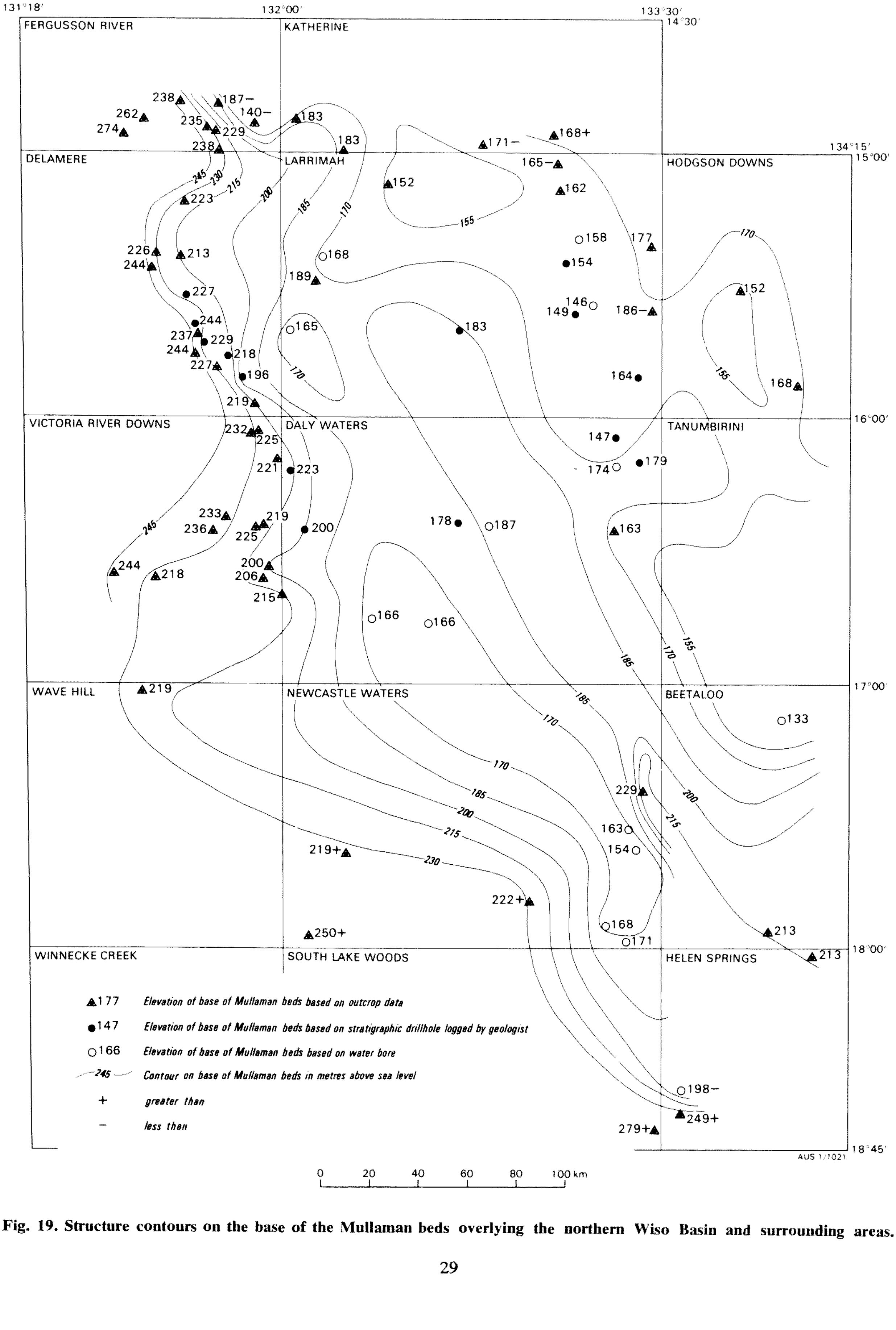


Fig. 19. Structure contours on the base of the Mullaman beds overlying the northern Wiso Basin and surrounding areas.

insufficient information is available to confirm the thrust nature of the faults.

Several major northeast-trending faults have been interpreted in the Proterozoic rocks beneath the basin (Fig. 23), but are not apparent in the surface geology.

At Gallery Hill, in northeastern VICTORIA RIVER DOWNS, a reverse fault with a curved (concave up) surface dipping west intersects the Mullaman beds. On its eastern side, bedding is subhorizontal, but on its western side bedding is parallel to the fault. The dip of the fault surface, and of the beds parallel to it, changes from about 45° to near-horizontal in a short distance, and probably resulted from eastward gravity sliding of argillaceous Mullaman beds in the regional dip direction, as the fault does not seem to continue into the underlying Antrim Plateau Volcanics. The razor-back ridge of Gallery Hill follows the strike of the up-turned beds on the western side of the fault surface.

Near Mount Wallaston, parallel faults about 2 km apart bound a graben with a maximum downthrow of about 30 m.

Well-marked slickensides in the Hooker Creek Formation at locality WC 11 (latitude 18°21'S, longitude 131°15'E) may be due to faulting, or collapse into solution cavities in the underlying Montejinni Limestone.

At locality SLW 35, in central eastern SOUTH LAKE WOODS, a silicified fault breccia trending east-northeast is evidence of faulting in the Point Wakefield beds.

GEOPHYSICS

Gravity

(by S. P. Mathur)

Reconnaissance gravity surveys by BMR have covered the Wiso Basin: the Bouguer anomalies in Figure 20 have been taken from the gravity map of Australia (BMR, 1976). Fraser, Darby, & Vale (1977) have divided the regional gravity pattern in the basin into two main provinces: Buchanan Regional Gravity Platform in the north, and Lander Regional Gravity Low in the south. In the northern province the gravity gradients are small, and the average anomaly level is about –200 $\mu m.s^{-2}$, slightly higher than in the neighbouring provinces. This higher anomaly level suggests that the northern part of the Wiso Basin is an area of relatively shallow Proterozoic basement. The southern province shows a west-northwesterly trending gravity trough, with Bouguer anomalies ranging from –300 to –800 $\mu m.s^{-2}$, which is bounded by a steep gradient in the south and a gentler gradient to the north. The regional gravity low lies over the Lander Trough, inferred from the aeromagnetic data in the southern part of the basin. This low is the northernmost of a series of prominent westerly trending regional gravity lows covering central Australia, all of which have been interpreted by Mathur (1976) as areas of crustal downwarp which formed by deep crustal folding and faulting during the Late Devonian or Early Carboniferous Alice Springs Orogeny and in which sedimentary rocks are preserved. The presence of shallow basement in the northern part of the basin has been substantiated by drilling results, and the presence of thicker sediments in the Lander Trough has been confirmed by a seismic survey.

Seismic

(by S. P. Mathur)

Only one seismic survey has been made in the Wiso Basin. The area surveyed by Ray Geophysics (1967) lies in the southeastern part of the Lander Trough (Fig. 21), where aeromagnetic and gravity surveys had suggested the presence of a thick layer of sediments. One-way refraction and five-fold CDP reflection data were recorded over about 215 km of traverses using weight-drop as the source of energy.

Kennewell & others (1977) re-examined the seismic data, and mapped two refractors (A and B) and three reflectors (C, D, and E); seismic results along the traverse R-1, together with the stratigraphic hole data and magnetic-source depth estimates, are shown in Figure 22. Refractor A and reflector C are considered to represent the same lithological boundary—an unconformity; similarly, refractor B and reflector D coincide in many places, and seem to represent another unconformity. These horizons divide the rocks in the southeastern Lander Trough into three main sequences underlying the superficial cover of Cainozoic sediments. From their correlation with outcrop and shallow drilling

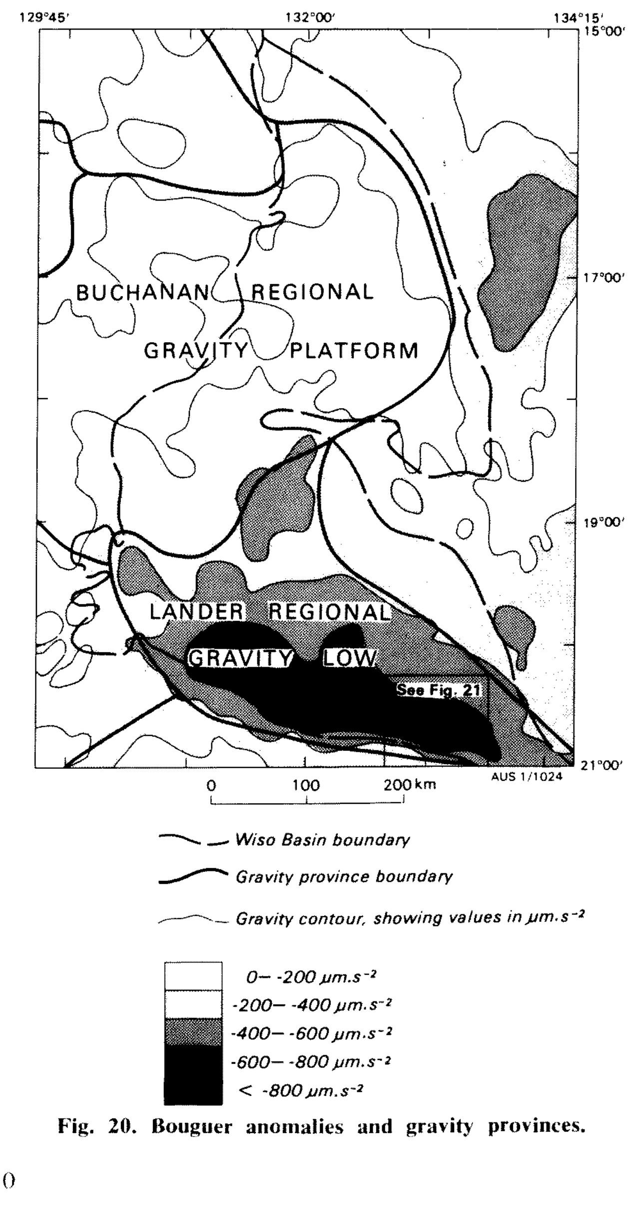


Fig. 20. Bouguer anomalies and gravity provinces.

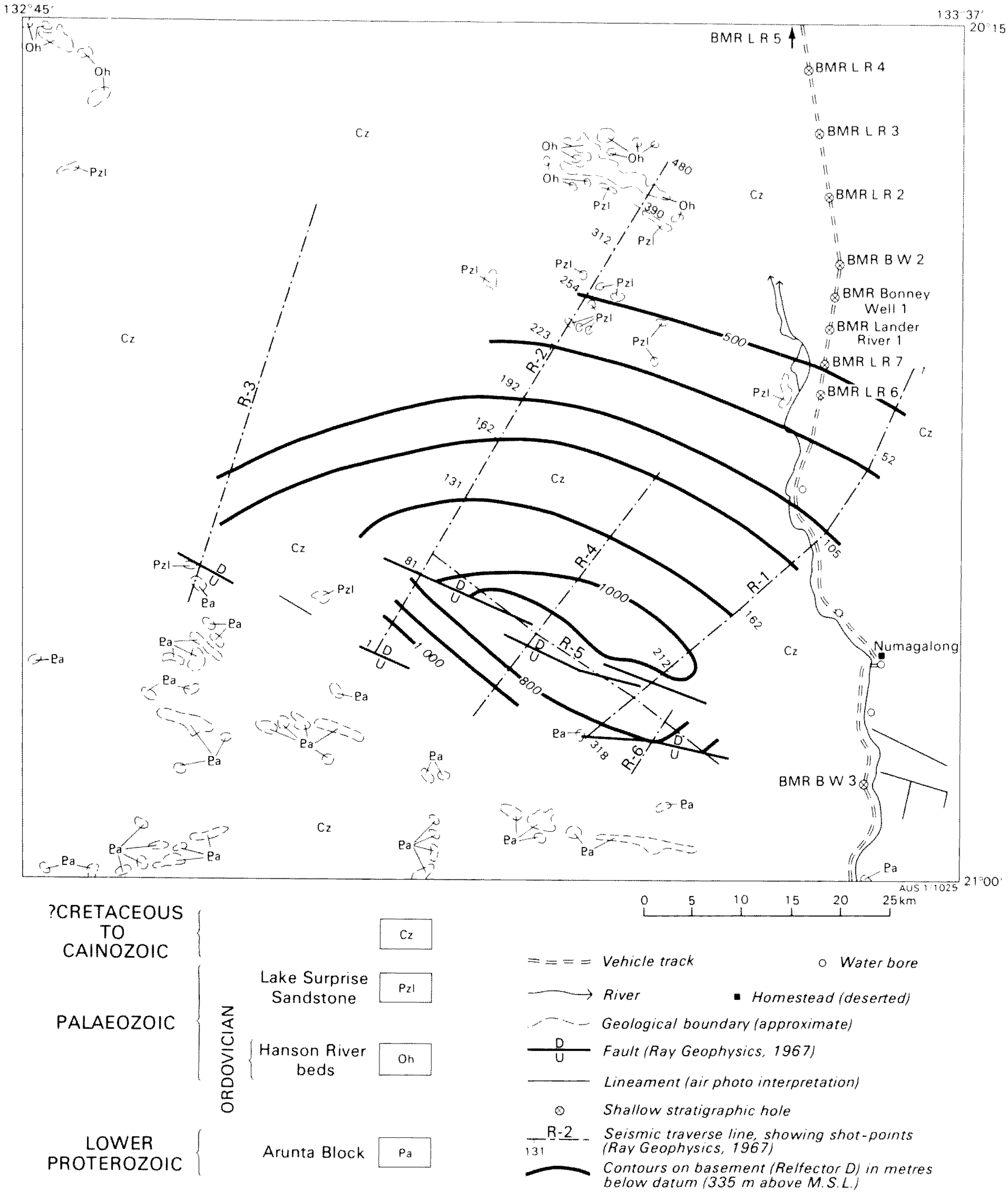


Fig. 21. Geology, seismic lines, and depths to basement in the eastern Lander Trough.

information near the northeastern ends of the traverses R-2 and R-1, and from their seismic velocities, the three sequences are interpreted to be:

I—upper Palaeozoic Lake Surprise Sandstone, a flat-lying thin sequence which thins northwest;

II—Cambrian to Ordovician, partly marine sediments, forming a wedge which thickens from 350 m at the northeast end of the traverses to a maximum of 800 m; and

III—Proterozoic basement which probably includes the Adelaidean to lowest Cambrian Central Mount Stuart Formation, and the Carpentarian Hatches Creek Group, which crops out to the southeast. Horizon E is probably a boundary between two distinct rock units within this sequence. The magnetic results show that the anomaly sources lie below reflector D, and support the interpretation of this sequence as Proterozoic basement.

The contours in Figure 21 show the structure of the basement surface (reflector D). The trough is indicated to be a half-graben bounded by an en-echelon reverse fault system to the southwest against the Arunta Block. The contours represent the structure in general terms

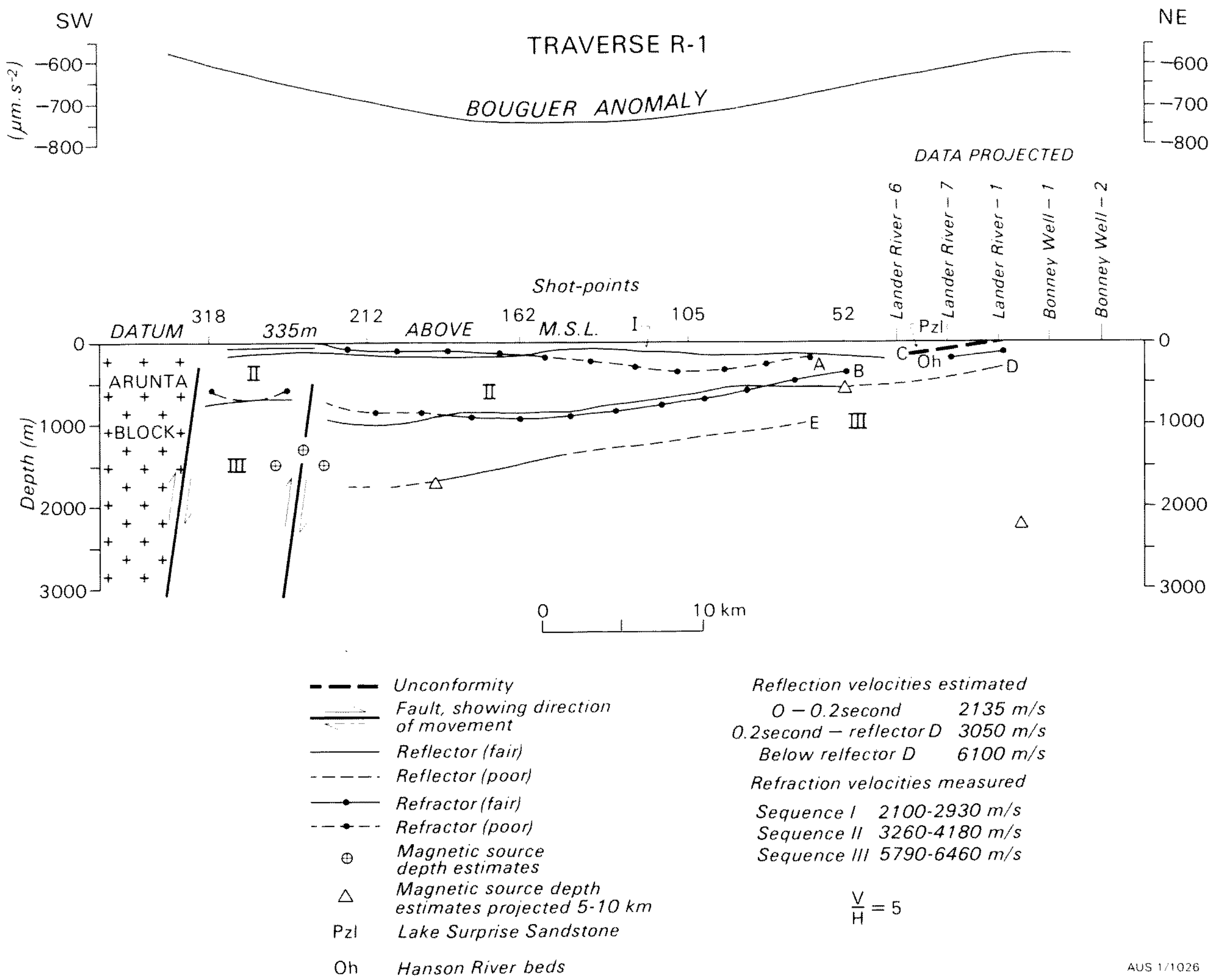


Fig. 22. Section along seismic line R-1, showing seismic horizons and magnetic-source depth estimates.

only, because the quality of the seismic data is poor, the correlation of the reflection is questionable over the cross-traverse (R-5) which lies in the fault zone, and the velocities of the sequences estimated from one-way refraction and normal-move-out reflection data are not reliable. As the seismic results show that the trough of sediments underlies the gravity low bounded by the –600 $\mu m.s^{-2}$ contour in the southeastern part of the Lander Regional Gravity Low (Fig. 20), the gravity data suggest that the trough extends about 300 km in a west-northwesterly direction.

Magnetics

(by P. G. Wilkes)

The depths to magnetic basement compiled from the 1966 airborne magnetometer survey by Adastra Hunting Geophysics Pty Ltd (1967) are shown in Figure 23.

Two main problems hinder an interpretation of the Wiso Basin aeromagnetic data. Firstly, there are several different magnetic horizons which produce superimposed anomalies; this results in reduced accuracy in determining depth estimates. The individual depth estimates are probably of not better than 15-20% accuracy; this also makes it difficult to distinguish between areas of near-surface weakly magnetic basement and areas of non-magnetic sediments with magnetic horizons near the top of the sequence. Secondly, establishing geological correlations with the different magnetic horizons is not straightforward.

Over and adjacent to the Wiso Basin, magnetic anomalies are associated with the Antrim Plateau Volcanics (mainly basalts), Hatches Creek Group, Warramunga Group, and the Arunta Block rocks. The Antrim Plateau Volcanics are extensive, particularly in the northern part of the basin, and extend at least as far as the northwest corner of WINNECKE CREEK; they also crop out in TANAMI, and may extend eastwards from there into the Wiso Basin. The Hatches Creek Group is magnetic in BONNEY WELL, especially in the eastern part, where basic lavas have anomalies up to 2500 nT. The Warramunga Group is magnetic in TENNANT CREEK, where it contains ironstone bodies associated with mineralisation and disseminated magnetite (Finney, 1967); it has generally been assumed that the Warramunga Group is magnetic in other areas, but this has not been confirmed. Rocks of the Arunta Block are magnetic—e.g., in the northwestern corner of BARROW CREEK.

From the magnetic anomalies recorded in Figure 23, the depth to magnetic basement in areas A, B, C, and D appears to be greater than in areas E, F, and G. In area A, which corresponds to the Lander Trough, magnetic basement is generally deeper than 1200 m below sea level. The southern margin of area A is bounded by rocks of the Arunta Block, which crop out

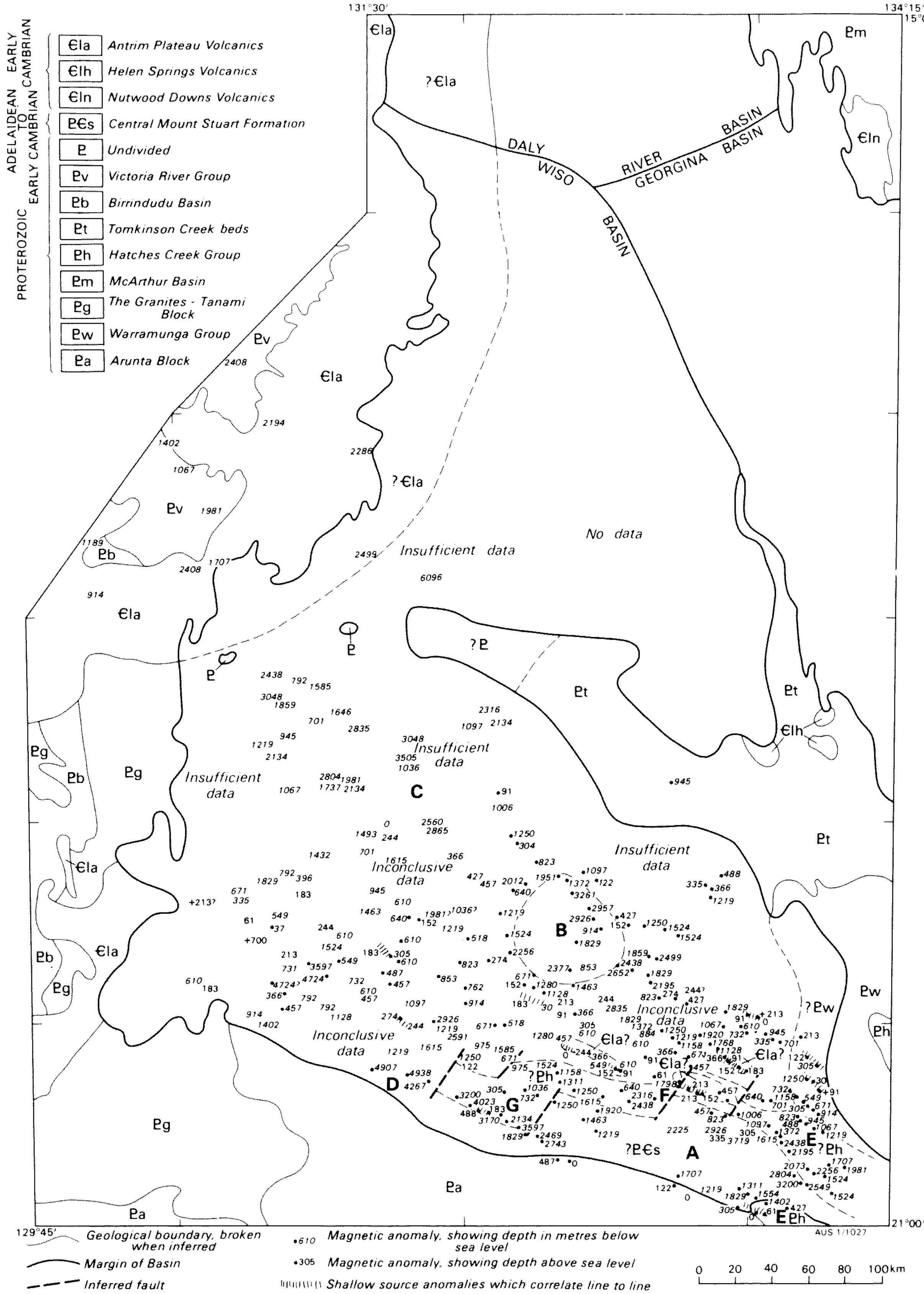


Fig. 23. Inferred subcrop of basement rocks beneath the Wiso Basin (from aeromagnetic data interpreted in 1976 by P. G. Wilkes).

just to the south of the Wiso Basin. The greater depths to magnetic horizons in rocks of the Lander Trough than in the Arunta Block, and the marked change in magnetic response between the two domains, suggest that the boundary between the Arunta Block and the Wiso Basin is faulted. The magnetic profiles across the southern margin of the Lander Trough are too complex to enable the nature of the margin to be determined without formulating models.

Area B appears to be underlain by homogeneous rocks. Area C is poorly covered by the aeromagnetic data, but its deepest magnetic horizon appears to lie somewhere between 2500 and 3750 m below sea level. In area D, the depth to magnetic basement is estimated as at least 4000 m below sea level which—if correct—indicates the presence of a narrow southeast-trending trough of sediments.

A magnetic zone extending from BONNEY WELL into LANDER RIVER and MOUNT SOLITAIRE (areas E, F, G in Fig. 23) may represent a westward extension of the Hatches Creek Group, but the geological correlation is not clear. Some of the shallower magnetic anomalies may indicate Antrim Plateau Volcanics immediately beneath the Wiso Basin sediments.

Shallow-source anomalies in Figure 23 appear to correlate line to line, and are tentatively assigned to basic lavas, possibly within the Hatches Creek Group.

The Antrim Plateau Volcanics have a characteristic magnetic expression which has enabled at least some of their boundaries to be delineated in LIMBUNYA, BIRRINDUDU, WAVE HILL, and VICTORIA RIVER DOWNS (Fig. 23). Further aeromagnetic surveys should assist their delineation in other areas of cover.

GEOLOGICAL HISTORY

The history of the Wiso Basin sequence commenced when the sea transgressed the land surface of much of the present Northern Territory during early Middle Cambrian (Ordian) time, and caused dolomite and limestone (Montejinni Limestone) to be deposited as it regressed. Dolomitic silts (Hooker Creek Formation) and fine sands (Lothari Hill Sandstone) probably accumulated in tidal flats on the margins of this sea. A model showing the positions of the three formations relative to the regressing Middle Cambrian sea is shown in Figure 24. Although palaeontological control is too poor to allocate ages to the time lines in Figure 24, deposition probably commenced and finished during Ordian (Middle Cambrian) time. Uplift and erosion, possibly with gentle folding of the sediments, followed this regression, and may have accentuated the previously structurally high Tennant Creek Block which then separated the Wiso and Georgina Basins.

Another transgression followed during Middle Cambrian (Templetonian) time, when calcareous silt and clay, sand, and clay (Point Wakefield beds) were laid down, possibly on a gently undulating surface as the beds were not deposited in some places.

The history between late Middle Cambrian and Early Ordovician (middle Arenigian) time is conjectural, as outcrop of the sediments is so poor, but must have been typified by periods of slight erosion, and deposition of fluvial sands (unit 1 of the Hanson River beds) and marine sands (unit 2 of the Hanson River beds).

During Ordovician (middle and late Arenigian to Llanvirnian) time, dolomites (units 3 and 4 of the Hanson River beds) accumulated in a retreating and again transgressing sea. How long this pattern of transgression and regression continued is uncertain, as any Ordovician sediments younger than unit 4 are concealed in the Lander Trough.

Crustal deformation and faulting, possibly thrust-faulting, followed, probably as part of the Alice Springs Orogeny, which affected the Amadeus Basin during

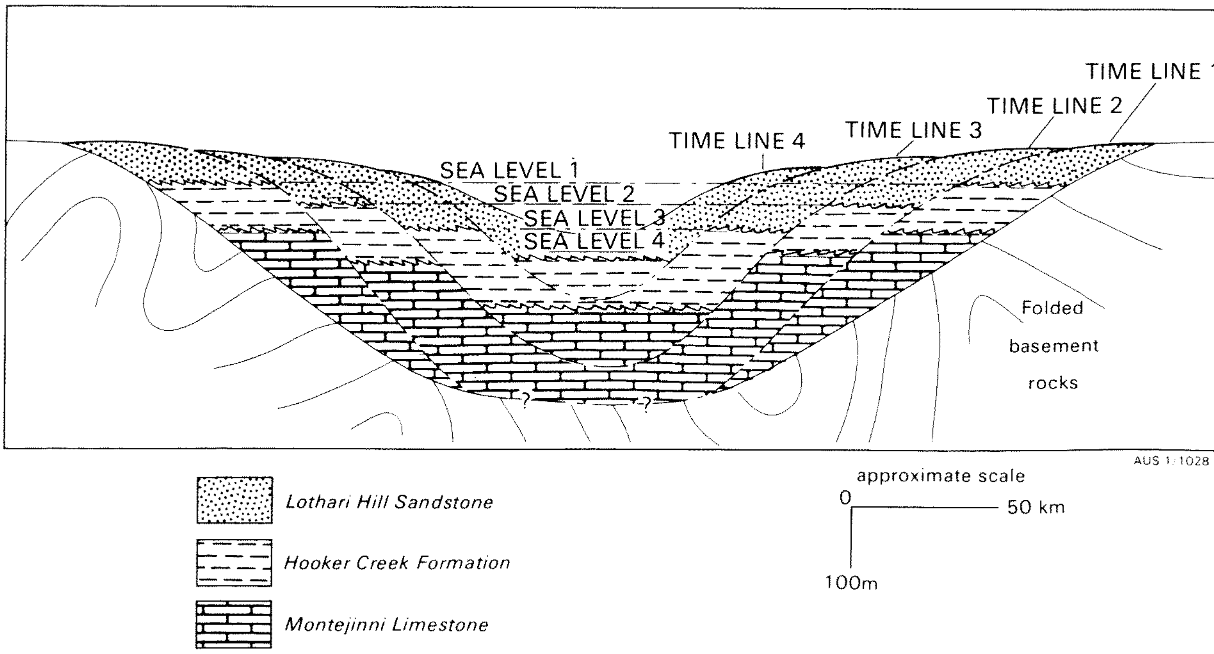


Fig. 24. Possible model of Middle Cambrian (Ordian) sedimentation in and near a regressive sea. The four time lines represent the depositional surface at four points in time: time line 1 is the oldest; time line 4 the youngest. A probable gradual regression of the sea punctuated by minor transgressions is simplified by the four sea levels.

Late Devonian or Early Carboniferous time. Downwarping preserved most of the basin sediments in the southern part of the basin, while uplift and erosion removed the younger sediments in the northern part of the basin. The whole Palaeozoic sequence was eroded south of the present basin margin.

At the same time, or perhaps a little later, sands (Lake Surprise Sandstone) were deposited either in a shallow sea or by braided streams covering at least the southern part of the basin.

After a long period of erosion which persisted through the latter part of Palaeozoic and early Mesozoic time, sand and gravel (unit A of the Mullaman beds) accumulated during Late Jurassic to Neocomian (Cretaceous) time. Later, the Aptian sea, which covered many parts of Australia, transgressed the northern part of the basin, depositing clay, silt, and glauconitic sand (units 6, 6a, and C of the Mullaman beds).

Uplift and erosion during the Late Cretaceous and Early Tertiary was accompanied, at least for part of that time, by the deposition of fluvial sands (Buchanan Hills beds). Soon after these sands were deposited, intense weathering of the land surface resulted in the development of a laterite profile. Some erosion of the ferruginous zone of the profile then took place, and the resultant gravels were recemented by iron oxide (laterite conglomerate).

Erosion of this laterite profile was only local on the Main Plateau, but produced a scarp in the northwestern part of the basin. Later, during Miocene time, lakes covered some areas below this scarp, and filled drainage depressions on the Main Plateau, depositing limestone and calcareous silt (Camfield beds and Birdum Creek beds). Gentle tilting of the Main Plateau probably took place during Tertiary time. Sands (Czs) were deposited in GREEN SWAMP WELL, probably at the same time as they filled the Cabbage Gum Basin in TENNANT CREEK, before the later surficial deposits accumulated during late Cainozoic time.

Calcrete (Czk) developed in the drainage depressions, probably over calcareous bedrock, and was exposed by erosion. Erosion also left a capping of residual gravels (Czg) on low rises, together with flanking scree slopes underlain by colluvium (Czc) partly filling topographic depressions. Rivers flowed from elevated areas surrounding the basin onto the flat plain of the Main Plateau, depositing their load of sand, silt, and gravel (Qa). Sand derived from weathered bedrock, colluvium, and alluvium has been spread by the wind throughout the basin, forming a thin veneer of aeolian sand (Qs). In parts of these sand plains, dunes have developed parallel to the prevailing winds. Black-soil plains (Czb) have formed over some areas in the north of the basin, and salt lakes and claypans (Ql) have developed in the poorly drained depressions.

MINERAL RESOURCES

Petroleum

The petroleum potential of all but the southernmost portion of the Wiso Basin is negligible, as the sediments are probably less than 500 m thick over almost all of this area.

In the southernmost part of the basin, up to 1000 m of Palaeozoic sediments are preserved in the eastern part of the Lander Trough (Kennewell & others, 1977), but the thickness of these sediments elsewhere in the trough is not known. By analogy with the Ngalia Basin to the south (Wells & Moss, in prep.), the Palaeozoic rocks may be irregular in thickness, and up to 2000 m might be preserved in some places. Too little is known of the geology of the Lander Trough to make a reliable assessment of its petroleum potential, but, as it is the only part of the basin with potential, it is discussed below.

The Montejinni Limestone could be a source rock, as it contains marine fossils and stromatolites, and as traces of bitumen were found in it in BMR Green Swamp Well 1 stratigraphic hole (Milligan & others, 1966). The overlying Hooker Creek Formation and Lothari Hill Sandstone are much less likely to provide a source for petroleum, as they were deposited mainly in tidal flats or in supratidal areas under probable oxidising conditions. Siltstone and claystone beds within these rocks might, however, make good caprock. This sequence, including the Montejinni Limestone, was probably buried deeply enough during Middle Cambrian time to generate hydrocarbons, as the bitumen mentioned above most likely originated within it. The unconformity on which the Point Wakefield beds rest was produced by erosion after very slight folding, suggesting that unless petroleum generated before this period of erosion was trapped in the resultant structures it would have been lost through seepage at the surface.

The overlying Point Wakefield beds are partly marine in origin, but are unlikely to be source rocks. The fine-grained sandstones within them are well sorted, and may form good reservoir rocks, whereas the interbedded claystone may act as caprock. Both the thickness and the immediate post-depositional history of these Cambrian rocks is uncertain, but they were probably not buried deeply until Ordovician time, when the overlying Hanson River beds were deposited.

The Hanson River beds may be the most prospective rock unit in the trough, as parts of them were deposited at the same time as the Pacoota Sandstone, which contains gas and condensate in the Amadeus Basin, and the Early Ordovician sediments which contain gas in the Georgina Basin. The sequence contains marine fossils in dolomite and sandstone—potential source rocks—at several levels; beds of well-sorted porous fine-grained sandstone would be excellent reservoir rocks, and beds of claystone could form caprocks. The Hanson River sequence is buried to less than 1000 m in the eastern part of the Lander Trough, but may be present at greater depths in other parts of the trough. It is overlain unconformably by the Lake Surprise Sandstone in the eastern Lander Trough, and its thickening into the trough beneath this flat-lying unit suggests that folding and substantial erosion may have taken place before the younger sandstone was deposited. If this is so, the Hanson River beds may have been subjected to conditions under which oil and gas were generated, before the Lake Surprise Sandstone was deposited. No structural closure within these rocks is obvious on the Hanson River seismic survey traverses, but the unconformity at the base of the Lake Surprise Sandstone shows minor variations in elevation which may reflect slight folding in the underlying sediments. Unless closure is present in other parts of the trough, any petroleum generated would probably have been lost through seepage at the unconformity surface on which the Lake Surprise Sandstone rests.

The Lake Surprise Sandstone is thin and permeable, is exposed at the surface wherever preserved, and hence is not prospective for petroleum. It is not likely to form a seal to prevent migration of petroleum out of the gently folded Hanson River beds, which underlie it.

Fossiferous units of the Mesozoic Mullaman beds may be a source of hydrocarbons in the northern Wiso Basin, but it is unlikely that they were buried deeply enough, preserved in sufficient thickness, or contain traps for petroleum.

Although the Lander Trough must be considered as a source of petroleum, the relatively thin rock sequences separated by unconformities representing periods of erosion lower its potential.

Water

The water resources of the northern Wiso Basin have been the subject of an extensive study by Randal (1973), and his main conclusions, together with more recent data on the water potential of the southern Wiso Basin, are presented here.

Because of both the seasonal and unreliable rainfall and the semi-arid climate of the basin, surface water is inadequate for pastoral use. Newcastle Creek contains permanent water-holes between Lake Woods and Newcastle Waters township, and Stuart Swamp, near Daly Waters, is regarded as permanent. Water-holes in Birdum Creek and near Hidden Valley homestead usually contain water but may be dry if the rainy season is either late or abortive for some years in succession. Numerous water-holes are present in the plateau north of the dissected area in northern DALY WATERS, but the chance of their failing is high, even though a few may persist over some years (Randal & Brown, 1967). Most salt lakes and claypans hold water only after heavy rains. The pastoral industry therefore does not in the main rely on surface water, but uses it merely to supplement groundwater obtained by boring.

The basal rock unit of the basin, the Montejinni Limestone, is the main producing aquifer in the western part of the Main Plateau and on its immediate western flanks. Groundwater occupies joints, fissures, cavities, and, as at Monster Bore in eastern VICTORIA RIVER DOWNS, gravel and clay at the unconformity with the underlying Antrim Plateau Volcanics. Present knowledge suggests that most water is available from the bottom unit, reasonable supplies from the middle unit, and little from the upper unit of the formation. However, as the formation is flat-lying, or nearly so, this observation may merely reflect the relative positions of the units to the water-table. The Montejinni Limestone produced 8500 l/h of water containing 2300 ppm total dissolved salts in BMR Green Swamp Well 1 (Kennewell, 1978), and should produce good supplies of water from relatively shallow depths in many parts of the northern and central Wiso Basin.

Laminated dolomitic siltstone of the Hooker Creek Formation is a less reliable source of water, as it is non-productive in BMR Tanami East 1 and BMR Winnecke Creek 1, 2, 3, and 4 stratigraphic holes. It produced 3200 l/h in BMR Green Swamp Well 2 and a large flow in BMR Green Swamp Well 4; these flows had total dissolved salt contents of 3203 and 1186 ppm respectively, and indicate that the Hooker Creek Formation may be a useful aquifer in the central eastern part of the basin.

The Lothari Hill Sandstone is similarly unreliable: it produced a flow of about 8000 l/h with 2831 ppm total dissolved salts in BMR Green Swamp Well 5, and a large salty flow in BMR Green Swamp Well 4; yet water only seeped out of this formation in BMR Tanami East 1 and BMR Green Swamp Well 3.

Calcareous claystone of the Point Wakefield beds yielded no water in BMR Green Swamp Well 1 and BMR Lander River 4, and its potential as an aquifer must be low. The nearby BMR Lander River 5 produced a flow of water from an unidentified aquifer, which may, however, be the overlying Hanson River beds. The potential of the sandstone and claystone part of the Point Wakefield beds has not been tested.

The water potential of the Hanson River beds has been tested on the eastern margin of LANDER RIVER, where a sequence of stratigraphic drillholes—BMR Lander River 1 to 5 and BMR Bonney Well 1 and 2—yielded flows of between 3000 and 6000 l/h of generally good quality stock water.

The Lake Surprise Sandstone was very porous in the three stratigraphic holes which penetrated it (BMR Lander River 1, 6, and 7), giving flows of 6000 to 12 000 l/h of good quality stock water.

Detailed analyses of the water obtained from the stratigraphic holes mentioned above are listed in Appendix 2.

Over much of the basin the Mullaman beds are absent or too thin to be important aquifers. They are known to contain aquifers in only a few bores in the northern part of the basin. In the area about the Murranji Track in southern DALY WATERS the sequence contains a far greater amount of impermeable claystone and mudstone than sandstone, and is virtually without aquifers. The sandstone parts of the sequence have good aquifer characteristics, but their continuity has not been established. Many occur at high elevations and hence are above the water-table. The basal sandstone unit has produced flows of water at several localities, and drillers' logs for several bores in the northern part of the basin suggest that aquifers are present there within the Mullaman beds. Hence, although the Mullaman beds yield water in many parts of the region, they cannot be relied on to do so at any given site, and any bore sited in their outcrop area must be programmed to drill below their base if necessary. The Mullaman beds are better regarded as non-productive overburden.

It is improbable that any bore is tapping groundwater from either the Birdum Creek beds or the Camfield beds. Only one stratigraphic drillhole, BMR Larrimah 3, is known to have begun in the Birdum Creek beds, and it showed that the base of the unit was above the water-table.

The unnamed sandstone at locality GSW 36, in south-eastern GREEN SWAMP WELL, may be part of an extensive but poorly exposed rock unit which correlates with sandstone in the Cabbage Gum Basin, in TENNANT CREEK, and with sediments up to 100 m thick in Cainozoic basins which have been drilled in MOUNT PEAKE and MOUNT THEO, south of the basin (Offe, 1978; Stewart, 1976). Fluvial sediments in parts of these basins have yielded good supplies of water suitable for stock or human consumption, and if similar basins are present underlying areas with no bedrock outcrops, such as the Lander and Hanson River floodouts and some extensive sand plains, they may yield good supplies of water.

Calcrete contains reliable aquifers in many parts of Australia, and may also do so in the Wiso Basin. Its potential is untested throughout most of the basin, but Austerity Well (and Bore), on the northern edge of MOUNT PEAKE, yielded 3200 l/h of water containing 3631 ppm total dissolved salts (Milligan & others, 1966) from calcrete. Chewings (1928) tapped shallow confined groundwater in wells he sank through calcrete and sandstone (Randal, 1973) in the southern part of the basin.

Colluvium is present in many parts of the basin, but is generally thin and above the water-table; hence its water potential is poor. BMR Winnecke Creek 3 penetrated 49.4 m of colluvium beneath the bed of Winnecke Creek, but no aquifers were present.

Alluvium of the Hanson River floodout in eastern LANDER RIVER was penetrated by several stratigraphic drillholes and yielded seepages of water with low salt content.

Lake deposits may provide supplies of water. Water held in claypans has a low salt content, and, if preserved in lake sediments, may be useful and at shallow depth.

Gravel, black soil, and aeolian sand are probably too thin to be a source of water.

Construction materials

Flaggy carbonate rocks and flaggy sandstones have been used for minor building purposes—pathways around homesteads, mounting bore equipment, and foundations for cattle troughs.

The Montejinni Limestone may contain suitable stone for quarrying and dressing, but its distance from any market precludes its use at present.

There are no large deposits of good quality quartz sand on the surface. The ferruginous and silty sand of the desert areas is of doubtful value for building purposes, but has been mixed with a high percentage of cement for paving floors. Minor pockets of good quality sand occur in streams, but major construction would rapidly deplete those within reasonable hauling distances. The basal saccharoidal sandstone of the Mullaman beds is very friable beneath a surficial silicified skin and weathers to a very pure quartz sand. Deposits from this unit may be discovered at workable depths beneath the silt and laterite material in the lower parts of the Main Plateau and along its margins. Similar deposits have been worked near the old Manbulloo Aerodrome in KATHERINE, to the north of the basin.

Clayey soils make excellent earth tanks for the storage of bore-water. The soil becomes plastic and impervious when wet, and, if the tanks are kept moist and vegetated, they are virtually watertight.

Supplies of gravel suitable for road surfacing are widespread, but occur in usually thin and sparse deposits. Along the Dunmarra/Top Springs road, in DALY WATERS and VICTORIA RIVER DOWNS, lateritic gravel was scraped and compressed to form the road surface. The same type of gravel was used as an underlay for the tar-sealing of the Katherine/Top Springs road south of Willeroo.

The main roads near Top Springs are composed of rolled gravels, obtained by scraping travertinous rubble formed on the calcareous mudstone unit of the Montejinni Limestone. Along all the major roads, suitable materials for underlays and aggregates should be found within reasonable hauling distances, but the material will have to be crushed in many places.

Copper

Copper stains are present in some of the basal beds of the Montejinni Limestone immediately above the unconformity with the Antrim Plateau Volcanics (Randal & Brown, 1967). They also occur in the undivided Montejinni Limestone and Hooker Creek Formation at locality TE 31, in southwestern TANAMI EAST. They may be produced by leaching of the underlying Antrim Plateau Volcanics, which in places contain native copper in geodes, and azurite and malachite stains in vesicles and joints (Randal & Brown, 1967).

Bauxite

Only small amounts of bauxite have been recorded in the basin. Several samples of laterite on the Antrim Plateau Volcanics and the Mullaman beds were analysed for bauxite, but the aluminium contents are low, and are less than the silicon content in all but two samples. In these samples the aluminium and silicon contents are about the same: 10.5% in one, and about 11.0% in the other. The iron contents of these laterites range from 22.9 to 46.4%, and the samples containing the most iron contain the least silicon, but their silicon content is still greater than 7.5%.

Phosphate

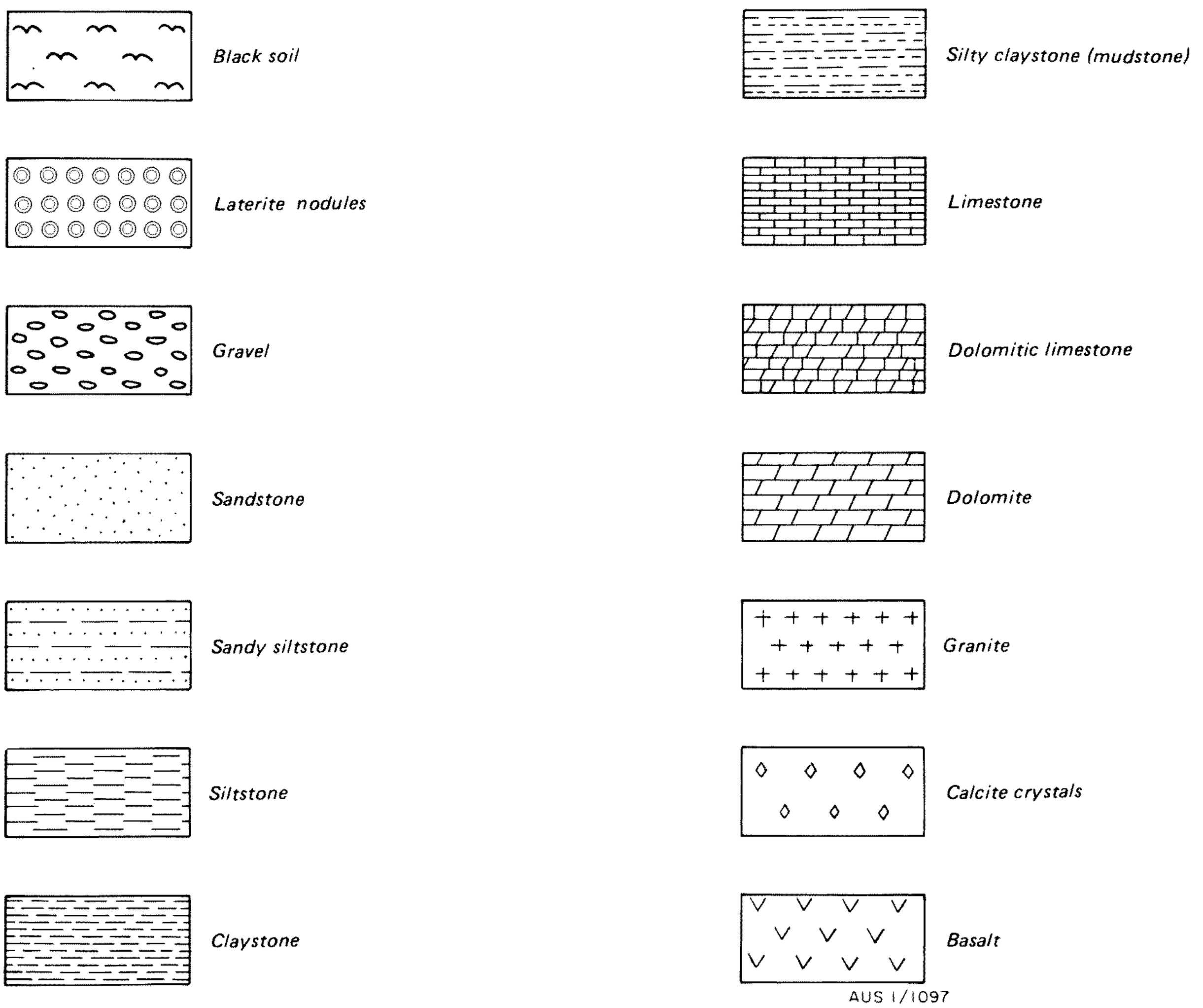
Traces of phosphate occur in several parts of the basin. The highest phosphate contents recorded in the north Wiso Basin are between 1 and 7% in cuttings of a white to buff mudstone from the 36.6 to 39.6 m interval of BMR Larrimah 3, immediately underlying the basal unit of the Mullaman beds; the phosphate seems to have been concentrated by weathering before deposition of the Mullaman beds. A similar occurrence of phosphate was found by officers of IMC Development Corporation in cuttings from BMR Helen Springs 4.

Two samples of dolomite collected from the Hanson River beds at localities 8 km apart in the north central part of LANDER RIVER contain 10.6 and 3.2% phosphate (Milligan & others, 1966).

GRAPHIC LOGS

The logs of 51 drillholes in the Wiso Basin are graphically presented by 1:250 000 Sheet area (from west to east and north to south) below. The lithologies for most of the drillholes were described by geologists; for the rest of the holes (those with an asterisk by the name) only drillers' logs are available. The graphic logs for some of the holes are uncertain where, for example, some lithologies recorded by drillers are suspect (e.g. in McCraes Bore, in VICTORIA RIVER DOWNS, and in Murranji Stock Route No. 11 Bore, in DALY WATERS.

REFERENCE


Black soil
Laterite nodules
Gravel
Sandstone
Sandy siltstone
Siltstone
Claystone
Silty claystone (mudstone)
Limestone
Dolomitic limestone
Dolomite
Granite
Calcite crystals
Basalt
AUS 1/1097

DELAMERE

WILLEROO BEEF ROAD DWH No. 1 BORE

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CRETACEOUS OR TERTIARY				2.7	2.7	*Lateritic nodules and siltstone*
LATE JURASSIC TO EARLY CRETACEOUS	MULLAMAN BEDS			32.0	29.3	*Siltstone, white, buff, and yellow, sandy, contains sparse beds of silicified quartz sandstone, angular to subrounded*
EARLY CAMBRIAN	ANTRIM PLATEAU VOLCANICS			T.D. 136.6	104.6	*Basalt, weathered to 43.9m*

WILLEROO BEEF ROAD DWH No. 2 BORE

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CRETACEOUS OR TERTIARY				3.0	3.0	*Lateritic nodules*
LATE JURASSIC TO EARLY CRETACEOUS	MULLAMAN BEDS			31.1	28.1	*Siltstone, white, purple, brown, a few dark red beds, sandy in most parts; beds of light brown crystalline dolomite, blue, red, and grey chert, and red calcareous siltstone at base*
EARLY CAMBRIAN	ANTRIM PLATEAU VOLCANICS			T.D. 183.5	152.4	*Basalt, weathered to 47.9m, red, blue-grey with some green fragments*

AUS I/1098

WILLEROO BEEF ROAD DWH No. 3 BORE

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICK-NESS (m)	LITHOLOGY
LATE JURASSIC TO EARLY CRETACEOUS	MULLAMAN BEDS			36.6	36.6	*Siltstone and claystone, white to buff, ferruginised towards top; a few medium to coarse sandstone beds in upper half; red calcareous clayey mudstone and light brown to grey, fine chert in lower half*
EARLY CAMBRIAN	ANTRIM PLATEAU VOLCANICS			TD 178.3	141.7	*Basalt, partly altered, aphanitic to ophitic texture, some amygdules with chalcedonic silica filling*

WILLEROO BEEF ROAD DWH No. 4 BORE

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICK-NESS (m)	LITHOLOGY
CRETACEOUS OR TERTIARY				4.2	4.2	*Ironstone, pisolites, angular fragments, ferruginised fine sediment, claystone*
LATE JURASSIC TO EARLY CRETACEOUS	MULLAMAN BEDS			22.0	17.8	*Claystone and sandy claystone, white, fine to coarse quartz grains, grades to sandstone*
EARLY CAMBRIAN	ANTRIM PLATEAU VOLCANICS			TD 125.3	103.3	*Basalt, buff, strongly weathered and copper-stained at top, dark grey and massive below 50m*

WILLEROO BEEF ROAD DWH No. 5 BORE

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICK-NESS (m)	LITHOLOGY
CRETACEOUS OR TERTIARY				3.0	3.0	*Ironstone, ferruginised fine sediments*
LATE JURASSIC TO EARLY CRETACEOUS	MULLAMAN BEDS			27.4	24.4	*Sandy claystone, white and buff, grades to clayey sandstone, sandstone, and claystone; interbedded with clayey siltstone, dark brownish red in basal half*
EARLY CAMBRIAN	ANTRIM PLATEAU VOLCANICS			TD 99.7	72.3	*Basalt, grey and brown, coarsely textured, partly altered towards top*

AUS 1/1099

LARRIMAH

BMR LARRIMAH 2

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
L. JUR. TO E. CRET.	MULLAMAN BEDS			7.6	7.6	*Sandstone and sandy claystone, poorly consolidated*
CAMBRIAN TO ORDOVICIAN	?JINDUCKIN FORMATION		11.0	11.0	3.4	*Siltstone, buff, clayey, some ferruginous nodules*
MIDDLE CAMBRIAN (ORDIAN)	MONTEJINNI LIMESTONE UNIT 3		12.3 21.6	21.3	10.3	*Limestone, yellow, crystalline; and calcilutite, grey-brown*
	MONTEJINNI LIMESTONE UNIT 2		23.2 39.9	38.1	16.8	*Calcareous mudstone, buff and chocolate-brown, some chert nodules and limestone beds*
	MONTEJINNI LIMESTONE UNIT 1		42.7	49.7	11.6	*Dolomitic limestone, yellow-brown, porous and vuggy in parts, some cavity fill of sandy mudstone*
EARLY CAMBRIAN	ANTRIM PLATEAU VOLCANICS		53.3	53.6	2.9	*Basalt, partly altered and silicified, some calcite veins and copper carbonate staining*

DRY RIVER STOCK ROUTE No. 6 BORE*

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
LATE JURASSIC TO EARLY CRETACEOUS	MULLAMAN BEDS			18.6	18.6	*Clay, ironstone, shale*
UNCERTAIN				31.7	13.1	*Ironstone and basalt*
EARLY CAMBRIAN	ANTRIM PLATEAU VOLCANICS			TD 158.8	127.1	*Basalt*

VICTORIA RIVER DOWNS

McCRAES BORE*

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Red soil*
?LATE JURASSIC TO CRETACEOUS	?MULLAMAN BEDS	UNCERTAIN		12.2	9.2	*Limestone in clay*
?MIDDLE CAMBRIAN	?MONTEJINNI LIMESTONE	UNCERTAIN		29.0	16.8	*Limestone*
EARLY CAMBRIAN	ANTRIM PLATEAU VOLCANICS			42.7	13.7	*Basalt*

Note: Compact mudstone frequently termed limestone by drillers

AUS I/1100

PIKERS RETREAT BORE*

AGE	UNIT	GRAPHIC LOG	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC			1.2	1.2	*Black soil*
MIDDLE CAMBRIAN (ORDIAN)	MONTEJINNI LIMESTONE		21.6	20.4	*Limestone and layers of clay*
EARLY CAMBRIAN	ANTRIM PLATEAU VOLCANICS		25.6	4.0	*Puggy clay*
			37.8	12.2	*Fine-grained basalt*

DALY WATERS

HIDDEN VALLEY BORE

AGE	UNIT	GRAPHIC LOG	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC			3.0	3.0	*Brown clay*
LATE JURASSIC TO EARLY CRETACEOUS	MULLAMAN BEDS		12.1	9.1	*Red laterite material, slightly calcareous*
			18.3	6.2	*Yellow-brown clay-rich shale*
			42.7	24.4	*Yellow-brown ferruginised sandstone*
			47.2	4.5	*Light grey, slightly calcareous sandstone*
MIDDLE CAMBRIAN (ORDIAN)	MONTEJINNI LIMESTONE		71.4	24.2	*Yellow, slightly impure limestone*
			86.9	15.5	*Light brown limestone*
			90.8	3.9	*Pale grey limestone*
			96.0	5.2	*Light brown silty limestone*
			105.2	9.2	*Dark, reddish brown, leached limestone*
EARLY CAMBRIAN	ANTRIM PLATEAU VOLCANICS		112.8	7.6	*Dark grey basalt*

AUS I/1101

MURRANJI STOCK ROUTE NO. 11 BORE*

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				6.1	6.1	Soil
LATE JURASSIC TO EARLY CRETACEOUS	MULLAMAN BEDS			25.9	19.8	Clay and sandstone
				39.6	13.7	Yellow sandstone
				92.7	53.1	Red clay, yellow sandy clay
MIDDLE CAMBRIAN (ORDIAN)	MONTEJINNI LIMESTONE			104.2	11.5	Yellow limestone
				106.7	2.5	Red clay
				164.6	57.9	Yellow limestone
		UNCERTAIN		176.8	12.2	Volcanic rock
				185.3	8.5	Hard limestone, caves, honeycomb

AUS I/1102

MURRANJI STOCK ROUTE NO. 12 BORE*

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				0.6	0.6	*Sandy soil*
LATE JURASSIC TO EARLY CRETACEOUS	MULLAMAN BEDS			7.6	7.0	*Sandy clay*
				18.3	10.7	*Red sandstone*
				114.3	96.0	*Red and yellow clay, siltstone, and sandy clay*
MIDDLE CAMBRIAN (ORDIAN)	MONTEJINNI LIMESTONE			164.6	50.3	*Yellow limestone*
				176.8	12.2	*Red clay*
				185.3	8.5	*Limestone, gravel, water*

AUS I/1103

DRY RIVER STOCK ROUTE No. 8 BORE

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CRETACEOUS OR TERTIARY				0.9	0.9	*Limonitic ironstone, sparse silty claystone*
L. JURASSIC TO E.CRETACEOUS	MULLAMAN BEDS			15.2	14.3	*Clayey siltstone and silty claystone, white and buff; some pinkish basalt in lower part*
EARLY CAMBRIAN	ANTRIM PLATEAU VOLCANICS			276.8	261.6	*Basalt, grey or brown; rare interbeds of sandstone, chert, and limestone*

WIDGEE BORE

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Red clayey soil, ironstone, claystone, quartz grains*
L. JURASSIC TO E.CRETACEOUS	MULLAMAN BEDS			9.1	6.1	*Red clayey soil, ironstone, quartz grains, traces of white limestone*
MIDDLE CAMBRIAN (ORDIAN)	MONTEJINNI LIMESTONE			18.9	9.8	*Limestone, white to light brown, dolomitic; clay or silt; sand grains*
				39.3	20.4	*Limestone, white to light brown; calcilutite, contains some dolomite and clay*
				40.8	1.5	*Limestone and dolomite, brown, microcrystalline*
				47.3	6.5	*Clay, buff, calcareous; and limestone, grey to brown*
				50.4	3.1	*Limestone, grey to brown; calcilutite*

BMR DALY WATERS 1 & 1B

AGE	UNIT		GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC					3.1	3.1	*Black soil overlying clay with ironstone pisolites*
CRETACEOUS (? ALBIAN)	MULLAMAN BEDS	UNIT C		4.6–7.4; 27.4–28.9	30.5	27.4	*Claystone, white and hard at top grading to light grey and soft at depth, grades to buff and pink; hematite and limonite veins common*
CRETACEOUS (APTIAN)		UNIT 6A			42.7	12.2	*Sandstone, friable, poorly consolidated, buff, fine-grained, glauconitic, and white, very fine-grained, micaceous*
CRETACEOUS (? APTIAN)		UNIT 6		64.0–66.9	78.6	35.9	*Buff to light green sandstone, very fine to fine, friable, glauconitic, clay matrix in parts; interbedded with light grey, buff, light purple claystone, soft*
LATE JURASSIC TO NEOCOMIAN		UNIT A		78.0–81.0	85.3	6.7	*Silty claystone, and purple, pink, buff and grey medium to fine-grained glauconitic sandstone*
					85.6	0.3	*Sandstone, medium to coarse-grained*

AUS 1/1104

WAVE HILL

WAVE HILL No. 37 (WE) BORE*

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				0.6	0.6	*Surface soil*
MIDDLE CAMBRIAN (ORDIAN)	MONTEJINNI LIMESTONE			14.6	14.0	*Limestone*
				15.5	0.9	*Quartzite*
				33.8	18.3	*Hard limestone*
				36.3	2.5	*Sandy clay*
				37.5	1.2	*Puggy clay*
				39.9	2.4	*Hard shale*
				60.7	20.8	*Hard limestone*
				62.2	1.5	*Puggy clay*
				66.2	4.0	*Quartzite and washed sand*

NEWCASTLE WATERS

BRADMAN BORE*

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Black soil*
?LATE JURASSIC TO CRETACEOUS	?MULLAMAN BEDS	UNCERTAIN		22.0	19.0	*Limestone clay*
				35.1	13.1	*Limestone boulders*
?MIDDLE CAMBRIAN	?UNDIVIDED HOOKER CREEK FORMATION AND MONTEJINNI LIMESTONE			41.8	6.7	*Yellow limestone, clay, and boulders*
				44.5	2.7	*Limestone*
				52.4	7.9	*Water-bearing country with very hard bars*

Note: Compact mudstone frequently termed limestone by drillers

BENAUD BORE*

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				0.6	0.6	*Black soil*
LATE JURASSIC TO CRETACEOUS	MULLAMAN BEDS			3.7	3.1	*Red sandy clay*
				11.6	7.9	*Yellow clay*
				21.6	10.0	*Red clay*
				23.2	1.6	*White sand clay*
				26.5	3.3	*Yellow clay*
				32.3	5.8	*Yellow clay and boulders*
?MIDDLE CAMBRIAN	?UNDIVIDED HOOKER CREEK FORMATION AND MONTEJINNI LIMESTONE			41.8	9.5	*Very hard limestone, quartz, and ribbonstone*
				42.4	0.6	*Water, small supply*
				47.6	5.2	*Very hard quartz and ribbonstone*
				53.3	5.7	*Limestone and water-bearing country*

AUS I/1105

BURGE BORE*

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				1.8	1.8	*Black soil*
LATE JURASSIC TO CRETACEOUS	MULLAMAN BEDS			2.7	0.9	*Red clay and sand*
				11.3	8.6	*Yellow clay and sand*
				18.3	7.0	*Red clay and sand*
				31.7	13.4	*Yellow clay and sand*
				36.9	5.2	*Red clay and gravel*
				40.3	3.4	*Red clay*
EARLY OR MIDDLE CAMBRIAN	HELEN SPRINGS VOLCANICS			47.5	7.2	*Yellow clay*
	OR UNDIVIDED HOOKER CREEK FORMATION AND MONTEJINNI LIMESTONE	UNCERTAIN		71.3	23.8	*Blue limestone or basalt*

WINNECKE CREEK

BMR WINNECKE CREEK 1

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	
CAINOZOIC				3.0	3.0	*Sand, reddish*
MIDDLE CAMBRIAN (ORDIAN)	HOOKER CREEK FORMATION			17.0	14.0	*Claystone, brown, purple, red, shaly, micaceous, ferruginised; interbedded with siltstone, dark red-brown, ferruginised, micaceous*
				46.9	29.9	*Siltstone, red-brown, ferruginised, micaceous, hard; interbedded with siltstone, red-brown, purple, dolomitic, micaceous, hard; grades to silty dolomite in rare parts*
	UNDIVIDED HOOKER CR FORMATION AND MONTEJINNI LIMESTONE		51.8	52.9	6.0	*Dolomite, aphanitic, calcareous, grey, dense, hard, micaceous, silty and sandy, caves*

AUS 1/1106

BMR WINNECKE CREEK 2

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				12.2	12.2	*Sand, silt, and gravel of silty dolomite, dolomitic siltstone, hard claystone, pisolitic ironstone*
MIDDLE CAMBRIAN (ORDIAN)	HOOKER CREEK FORMATION			27.4	15.2	*Claystone, brown, shaly, slightly dolomitic, micaceous, grades to dolomitic siltstone in parts*
				57.0	29.6	*Siltstone, grey-green, brown, dolomitic in parts, quartzose, micaceous, chloritic in parts, grades to claystone in parts*
				64.0	7.0	*Claystone, red-brown, pink, grey, dolomitic, micaceous, grades to siltstone in parts, soft to hard*
	MONTEJINNI LIMESTONE		69.2	72.4	8.4	*Dolomite, medium crystalline to saccharoidal, grey to buff, very vuggy, algal structures, caves*

BMR WINNECKE CREEK 3

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Sand, soil, ironstone*
				6.1	3.1	*Clay, pink, yellow, sandy*
				36.3	30.2	*Sandstone, red, buff, and white at top and in a few beds, silty, fine-grained, soft to hard, sparse beds of pink claystone and red and white siltstone*
				49.4	13.1	*Claystone, khaki, yellow, soft, sandy in parts*

BMR WINNECKE CREEK 4

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Gravel of red pisolites and quartz pebbles*
LATE CRETACEOUS OR EARLY TERTIARY	BUCHANAN HILLS BEDS			12.2	9.2	*Clay, yellow, red, sandy, quartz grains from fine sand to conglomerate size*
				27.4	15.2	*Sand, red, poorly sorted, fine to coarse-grained, argillaceous, partly compacted, rare basalt pebbles*
MIDDLE CAMBRIAN (ORDIAN)	HOOKER CREEK FORMATION			47.5	20.1	*Siltstone, red, slightly sandy, micaceous in parts, clayey at top*
			53.3	53.7	6.2	*Dolomite, cream and pale brown, hard, calcareous, pelletal, some intraclasts, limonite on joints, vuggy*

AUS I/1107

TANAMI

BMR TANAMI 60

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	Reddish-brown sand
MIDDLE CAMBRIAN	UNDIVIDED HOOK. CK FM. AND MONT. LST.			5.0	2.0	White limestone
EARLY PROTEROZOIC	UNNAMED GRANITE		20.1	20.4	15.4	*Weathered, pale pink, medium to fine-grained porphyritic granite*

BMR TANAMI 61

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				6.0	6.0	*Red to pale brown sand*
MIDDLE CAMBRIAN (ORDIAN)	LOTHARI HILL SANDSTONE			15.0	9.0	*Chocolate-brown mudstone*
MIDDLE CAMBRIAN (ORDIAN)	UNDIVIDED HOOKER CK. FM. AND MONTEJINNI LIMESTONE			16.0	1.0	*Chert*
EARLY PROTEROZOIC	UNNAMED GRANITE		39.6	39.9	23.9	*Disaggregated medium-grained granite*

BMR TANAMI 62

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				5.0	5.0	*Reddish brown sand and lateritic ironstone*
MIDDLE CAMBRIAN (ORDIAN)	LOTHARI HILL SANDSTONE				31.6	*Pale reddish brown mudstone and sandstone*
MIDDLE CAMBRIAN OR EARLY PROTEROZOIC	LOTHARI HILL SANDSTONE OR UNNAMED GRANITE		36.6	36.9	0.3	*Coarse sand grains in palygorskite matrix; (mudstone breccia or altered granite)*

BMR TANAMI 63

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				5.0	5.0	*Reddish brown sand and lateritic ironstone*
MIDDLE CAMBRIAN (ORDIAN)	LOTHARI HILL SANDSTONE			26.0	21.0	*Pale brown mudstone*
EARLY PROTEROZOIC	UNNAMED GRANITE		62.5	62.8	36.8	*Pink, brown-weathering, medium to fine-grained greisenised granite*

AUS I/1108

BMR TANAMI 64

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Reddish-brown sand*
MIDDLE CAMBRIAN (ORDIAN)	UNDIVIDED HOOKER CR. FORMATION AND MONTEJINNI LIMESTONE			24.0	21.0	*Pale buff limestone*
EARLY PROTEROZOIC	UNNAMED IGNEOUS ROCK		53.3	53.9	29.9	*Maroon weathered gabbro, possibly intruding granite*

BMR TANAMI 65

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				2.0	2.0	*Reddish brown sand*
CAINOZOIC OR MIDDLE CAMBRIAN (ORDIAN)	CALCRETE OR UNDIVIDED MONTEJINNI LIMESTONE AND HOOKER CREEK FORMATION			21.0	19.0	*Maroon limestone*
			67.1	67.4	46.4	*Pale buff clayey mudstone*
						White to ironstained friable sandy dolomite

BMR TANAMI 66

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Reddish brown clay*
				11.0	8.0	*Pale grey clay*
CAINOZOIC OR MIDDLE CAMBRIAN (ORDIAN)	CALCRETE OR UNDIVIDED MONTEJINNI LIMESTONE AND HOOKER CR. FORMATION			12.0	1.0	*Maroon mudstone*
			30.8	31.8	19.8	*Pale grey clayey mudstone*

BMR TANAMI 67

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC			4.6	4.7	4.6	*Reddish-brown sand*
MIDDLE CAMBRIAN (ORDIAN)	UNDIVIDED HOOKER CR. FM AND MONTEJINNI LIMESTONE				0.1	*White, cellular, very fine-grained dolomite with some quartz*

AUS I/1109

TANAMI EAST

BMR TANAMI EAST 1

AGE	UNIT	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC			3.0	3.0	*Gravel, pisolitic laterite pebbles*
MIDDLE CAMBRIAN (ORDIAN)	LOTHARI HILL SANDSTONE		15.2	12.2	*Sandstone, red, silty, ferruginised, quartzose, friable*
			18.0	2.8	*Claystone, brown, mottled, laminated*
			30.0	12.0	*Sandstone, red, silty, ferruginised, quartzose, friable*
	HOOKER CREEK FORMATION		47.9	17.9	*Siltstone, red-brown, ferruginised, dolomitic in parts, micaceous; interbedded with claystone, brown, micaceous, dolomitic*
			48.8	0.9	*Dolomite, pink, aphanitic, micaceous*
		74.2–79.2	82.9	34.1	*Siltstone, red-brown, dolomitic, micaceous, hard, ferruginous in parts; interbedded with claystone, brown and grey mottled, slightly micaceous, fissile*
			93.9	11.0	*Sandstone, grey to green-grey, fine to very fine-grained, micaceous, glauconitic, bioturbated, graded bedding, cross-bedded; interbedded with siltstone and claystone, as above*
			119.5	25.6	*Siltstone, very dolomitic, red-brown and purple, slightly micaceous, hard, a few interbeds of claystone and fine sandstone*
		122.5	125.6	6.1	*Dolomite, saccharoidal, medium crystalline*

AUS I/1110

GREEN SWAMP WELL

BMR GREEN SWAMP WELL 1

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
MIDDLE TO LATE CAMBRIAN	POINT WAKEFIELD BEDS			15.2	15.2	*Calcareous claystone and sandstone, white, soft; interbedded with claystone, brown, soft, rare quartz grains*
				25.9	10.7	*Claystone, brown, white, soft, silty in parts, ferruginous in parts*
MIDDLE CAMBRIAN (ORDIAN)	MONTEJINNI LIMESTONE			27.4	1.5	*Calcite crystals, brown, medium crystalline*
				39.6	12.2	*Calcareous dolomite, brown and white, silty, saccharoidal, microcrystalline, hard*
			44.8 45.0	82.3	42.7	*Dolomite, brown, grey, microcrystalline, grades to medium crystalline in parts, saccharoidal in parts, laminated in parts, hard, vuggy, fractured, porous, rare pyrite, veins of white dolomite with tarry residue at about 72m*
CARPENTARIAN	TOMKINSON CREEK BEDS			93.0	10.7	*Quartz sandstone, purple, rarely white, medium-grained, moderately sorted, subangular to subrounded, ferruginous and siliceous*

AUS I/1111

BMR GREEN SWAMP WELL 2

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
MIDDLE TO LATE CAMBRIAN	POINT WAKEFIELD BEDS			18.3	18.3	*Siltstone, red-brown, friable, soft, some fine sand grains, ferruginous; interbedded with claystone, white or brown, micaceous, soft*
MIDDLE CAMBRIAN (ORDIAN)	HOOKER CREEK FORMATION			25.9	7.6	*Siltstone, light brown, yellow, fawn, light grey, micaceous, soft, clayey*
				61.9	36.0	*Dolomitic siltstone, red-brown and light grey, micaceous, microcrystalline, ferruginous in parts, sparse interbeds at base of dolomite, light brown, microcrystalline, hard*
	MONTEJINNI LIMESTONE		67.7	69.3	7.4	*Dolomite, brown, green, grey, microcrystalline, hard; grades to dolomitic siltstone red-brown, mottled, rare claystone beds*

BMR GREEN SWAMP WELL 3

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Sand, clay, and ironstone gravel*
MIDDLE TO LATE CAMBRIAN	POINT WAKEFIELD BEDS			12.2	9.2	*Sandstone, white, fine-grained, subangular, well sorted, soft, interbedded with siltstone, red-brown, laminated*
				29.6	17.4	*Siltstone, yellow-tan, red, brown, tan, micaceous, laminated, containing fine, angular quartz grains, interbedded with sandstone, subrounded, moderately sorted*
MIDDLE CAMBRIAN (ORDIAN)	LOTHARI HILL SANDSTONE			41.5	11.9	*Sandstone, brown, white, fine to medium-grained, subangular, moderately sorted, poorly consolidated*
				45.4	3.9	*Claystone, red-brown, very silty, soft*
				51.8	6.4	*Sandstone, yellow-brown, fine-grained, subangular, well sorted*
				60.4	8.6	*Claystone, dark brown, silty and sandy, soft*
				88.4	28.0	*Sandstone, yellow-brown, fine-grained, quartzose, angular to subangular; some beds of claystone, silty, sandy, soft*
	HOOKER CREEK FORMATION		88.4	91.4	3.0	*Sandstone, brown, grey-green, very dolomitic, calcareous in parts; interbedded with claystone, red-brown, dolomitic, very silty, microcrystalline*

AUS 1/1112

BMR GREEN SWAMP WELL 4

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
MIDDLE CAMBRIAN (ORDIAN)	LOTHARI HILL SANDSTONE			7.9	7.9	*Sandstone, quartzose, white, yellow, brown, fine to medium-grained, moderately to well sorted, subangular*
				12.8	4.9	*Claystone, white, silty, soft*
			91.4 91.5	93.9	81.1	*Sandstone, white, light grey, brown below 52m, fine-grained, well sorted, subrounded, sparse mica, sparse dolomitic beds, poorly consolidated*
	HOOKER CREEK FORMATION			102.4	8.5	*Claystone, dark brown, silty, dolomitic, micaceous, minor interbeds of sandstone, as above*
				106.0	3.6	*Dolomite, grey-brown, silty, carbonaceous*
			109.7 112.8		72.3	*Siltstone, red-brown, rare grey beds, quartzose, contains rare pyrite and gypsum, grades to dolomite, buff, silty, aphanitic*
	MONTEJINNI LIMESTONE		178.3	179.6	1.3	*Dolomite, grey, aphanitic, rare pellets, slightly calcareous, hard, vugs to 2cm across, calcite veins, gypsum in vugs and joints*

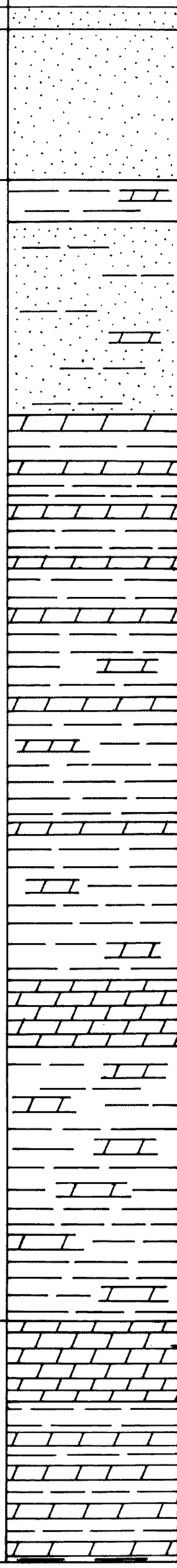
AUS 1/1113

BMR GREEN SWAMP WELL 5

AGE	*UNIT*	*GRAPHIC LOG*	*CORE*	*DEPTH (m)*	*THICK-NESS (m)*	*LITHOLOGY*
CAINOZOIC				3.0	3.0	*Sand, red, contains ironstone pebbles*
MIDDLE CAMBRIAN (ORDIAN)	LOTHARI HILL SANDSTONE			87.5	84.5	*Sandstone, white, yellow, and pink at top, red below 16m, quartzose, fine to medium-grained, well sorted, silty and clayey, subrounded, poorly consolidated, rare beds of dolomitic siltstone and dolomite in basal 6m*
	HOOKER CREEK FORMATION			89.9	2.4	*Siltstone, red-brown, rare grey-green mottling, dolomitic, moderately hard, micaceous; contains lenses of siltstone, medium bedded, bioturbated, poor core recovery, suggests much of interval is sandstone, as above*

AUS 1/1114

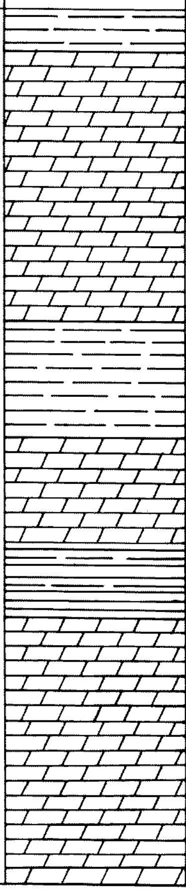
BMR GREEN SWAMP WELL 6



AGE	*UNIT*	*CORE*	*DEPTH (m)*	*THICKNESS (m)*	*LITHOLOGY*
CAINOZOIC			3.1	3.1	*Quartz sand and pisolitic gravel*
MIDDLE CAMBRIAN (ORDIAN)	LOTHARI HILL SANDSTONE		3.1 – 24.4	21.3	*Sandstone, red-brown and buff-grey, quartzose, fine to medium-grained, poorly to moderately sorted*
	HOOKER CREEK FORMATION	30.5	24.4 – 30.5	6.1	*Siltstone, calcareous, grey, few sand grains, siliceous matrix*
		30.5 – 32.2	30.5 – 57.9	27.4	*Sandstone, white, quartzose, very fine to fine-grained, subangular to subrounded, dolomitic matrix in parts; interbedded with siltstone, micaceous or dolomitic in parts*
		76.2 – 77.9	57.9 – 86.8	28.9	*Dolomite, buff-brown, fine-grained; interbedded with siltstone, dolomitic, red to grey, micaceous in parts*
			86.8 – 137.5	50.7	*Siltstone, dolomitic to slightly dolomitic, red-brown, red, pink, or grey, micaceous; rare interbeds of dolomite, cream, very fine-grained*
		143.9 – 146.6	137.5 – 146.9	9.4	*Dolomite, grey-white, finely crystalline*
		182.2 – 185.2	146.9 – 185.9	39.0	*Siltstone, dolomitic, red or buff-brown, micaceous*
	MONTEJINNI LIMESTONE		185.9 – 197.2	11.3	*Dolomite, grey-buff, microcrystalline, traces of gypsum*
		214.0 – 217.2	197.2 – 218.9	21.7	*Dolomite, as above; interbedded with siltstone, grey, green to red, thinly laminated, dolomitic, micaceous, gypsum veins*
			218.9		*Siltstone, see below*

AUS I/1115

BMR GREEN SWAMP WELL 6 (Continued)



AGE	UNIT	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
MIDDLE CAMBRIAN (ORDIAN)	MONTEJINNI LIMESTONE		225.5	6.6	*Siltstone, red, dolomitic, micaceous, some gypsum*
		229.2 – 232.1; 242.6 – 245.5	261.9	36.4	*Dolomite, grey, black, fine-grained, gypsiferous in parts filling cavities, laminated to massive; rare interbeds of siltstone, grey-green, thinly laminated to massive, some gypsum, dolomitic in parts*
		274.9 – 277.6	277.6	15.7	*Siltstone, grey-white, dolomitic, some iron staining, micaceous, laminated, rare dolomite beds, sparse gypsum*
			292.6	15.0	*Dolomite, grey-white, fine to medium-grained, sparse gypsum, rare siltstone beds*
		293.2 – 295.3	301.8	9.2	*Siltstone, grey to white, dolomitic; and dolomite, grey to red, fine to medium crystalline*
		310.6; 333.1	337.1	35.3	*Dolomite, light to dark grey and black, fine-grained with thin irregular laminations, some cavities filled or partly filled with gypsum, some stylolites, rare red-grey dolomitic siltstone beds*

AUS I/ 1116

LANDER RIVER

BMR LANDER RIVER 1

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Sand, red-brown, coarse to fine-grained, well rounded*
?LATE PALAEOZOIC	LAKE SURPRISE SANDSTONE		28.6–31.6	62.0	59.0	*Sandstone, white to light brown, generally fine-grained, grades from medium-grained to very fine-grained, well rounded, well sorted, silt and clay matrix in parts, generally soft but slightly silicified and hard in parts*
ORDOVICIAN	HANSON RIVER BEDS UNIT 3		71.0	71.0	9.0	*Siltstone, dolomitic, grey, micaceous, moderately hard, slightly fissile*
				84.1	13.1	*Limestone, white, medium crystalline, hard, partly altered to dolomite, contains laminae and beds of dark brown to grey laminated mudstone containing ferruginous ooids in parts*

BMR LANDER RIVER 2

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Sand, red-brown, fine to coarse-grained*
			24.2	25.2	22.2	*Sandstone, brown, fine to coarse-grained, moderately to well sorted, angular to rounded, poorly consolidated, weathered*
ORDOVICIAN	HANSON RIVER BEDS UNIT 1		25.6; 51.5	52.7	27.5	*Siltstone, brown, white, grades to green at base, soft, clayey, contains abundant angular to rounded coarse to fine sand grains, grades to sandstone in parts*
			54.3	56.0	3.3	*Sandstone, red-brown, fine to coarse-grained, generally angular, poorly sorted*
			65.2	66.6	10.6	*Siltstone, sandy, light green, clayey, soft; interbedded with dolomite, brown, hard, medium crystalline at base*
				68.2	1.6	*Dolomite, white, algal, hard, silicified*

AUS 1/1118

BMR LANDER RIVER 3

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				9.0	9.0	*Sand, red-brown, medium to fine-grained, angular with rare subrounded grains*
ORDOVICIAN	HANSON RIVER BEDS UNIT 1		15.0–17.0	24.0	15.0	*Siltstone, brown, some light green, sandy, grades to fine sandstone in parts, contains a few angular granules*
				54.0	30.0	*Sandstone, brown, coarse-grained, angular, poorly sorted, silty and clayey; interbedded with siltstone, brown, clayey, soft, weathered, slightly micaceous*
				63.0	9.0	*Claystone, yellow-brown and white, soft, silty, contains a few sand grains, silicified in parts*
			64.8	67.4	4.4	*Sandstone, white, fine to coarse-grained, frosted, friable; contains fragments of quartzite, white, coarse-grained, and claystone, white, soft, waxy texture*

BMR LANDER RIVER 4

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				4.0	4.0	*Sand, red-brown, medium-grained, moderately sorted, subangular to subrounded*
ORDOVICIAN	HANSON RIVER BEDS UNIT 1			45.0	41.0	*Siltstone, brown, weathered, clayey, contains abundant rounded to angular frosted quartz grains, grades to sandstone in parts, slightly calcareous below 30m*
MIDDLE TO LATE CAMBRIAN	POINT WAKEFIELD BEDS		46.9	52.0	7.0	*Claystone, white, moderately soft to hard, silicified in parts, a few laminae with rounded quartz grains, calcareous*

AUS 1/1119

BMR LANDER RIVER 5

AGE	*UNIT*	*GRAPHIC LOG*	*CORE*	*DEPTH (m)*	*THICKNESS (m)*	*LITHOLOGY*
CAINOZOIC				3.0	3.0	*Sand, red-brown, fine-grained, rounded, moderately sorted, quartzose, unconsolidated*
ORDOVICIAN	HANSON RIVER BEDS UNIT 1			24.0	21.0	*Siltstone, light to red-brown, clayey, contains rounded sand grains, grades to sandstone in parts, weathered*
				39.0	15.0	*Claystone, brown, soft, contains a few angular sand grains, grades to sandstone in parts, weathered*
MIDDLE TO LATE CAMBRIAN	POINT WAKEFIELD BEDS		56.0 59.6	57.6 93.0	54.0	*Claystone, white, grades to light grey and brown in upper part, contains many silicified beds to several metres thick with traces of chalcedony and manganese oxide staining, slightly calcareous above 72m*

AUS 1/1120

BMR LANDER RIVER 6

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Sand, red-brown, medium-grained, moderately sorted, rounded to angular, poorly consolidated*
?LATE PALAEOZOIC	LAKE SURPRISE SANDSTONE		93.0	103.3	100.3	*Sandstone, white, generally fine-grained but grades from very fine to medium-grained, well sorted, contains white clay matrix in parts, poorly consolidated above 80m, laminated indistinctly in cores*

BMR LANDER RIVER 7

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Sand, red-brown, medium-grained, subrounded to rounded, rare angular coarse grains, well sorted*
				12.0	9.0	*Sandstone, light brown, coarse-grained; grades to granule conglomerate at base, angular to rounded, poorly sorted*
?LATE PALAEOZOIC	LAKE SURPRISE SANDSTONE		101.1	113.1	101.1	*Sandstone, white, grades to light orange at top, generally fine-grained, grades from very fine to medium-grained, generally well sorted but grades to moderately sorted, well rounded, poorly consolidated, contains little matrix*

AUS 1/1121

PARKLANDS BORE

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
?ORDOVICIAN	?HANSON RIVER BEDS UNIT 1			43.6	43.6	*Sandstone, brown, creamy brown, grey, red-brown, fine to medium-grained, silty throughout, a few coarse beds*

BONNEY WELL

NUMAGALONG BORE

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
?ORDOVICIAN	?HANSON RIVER BEDS UNIT 1			24.4	24.4	*Sandstone, brown, reddish brown, and grey, fine to very coarse-grained, silty*
				30.5	6.1	*Siltstone, khaki and pale brown*

BMR BONNEY WELL 1

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Sand, red-brown, fine to coarse-grained, poorly sorted*
				12.0	9.0	*Sandstone, brown, medium to fine-grained, poorly sorted, abundant silt and clay, sparse ironstone concretions and silicified beds*
ORDOVICIAN	HANSON RIVER BEDS UNIT 2			18.0	6.0	*Claystone, white, soft, friable, rare mica*
				30.0	12.0	*Sandstone, white, fine-grained, subangular to rounded, some grains frosted, poorly sorted, soft*
				42.0	12.0	*Claystone, white, brown, silty, soft, friable, rare quartz grains*
				60.0	18.0	*Sandstone, brown, fine to medium-grained, angular to well rounded, well sorted to silty and clayey, sparse beds of claystone*
			74.0	76.0	16.0	*Claystone, grey, moderately soft, fissile, micaceous; interbedded with sandstone, fine-grained, well sorted, well rounded, abundant mica, glauconite grains in parts*

AUS 1/1122

BMR BONNEY WELL 2

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				4.5	4.5	*Sand, red-brown, coarse-grained, angular*
CAINOZOIC				30.0	25.5	*Sandstone, brown, light brown, and green, fine to coarse-grained, well to poorly sorted, poorly consolidated, weathered*
ORDOVICIAN	HANSON RIVER BEDS UNIT 2			78.0	48.0	*Sandstone, red-brown to light brown, fine-grained, poorly sorted and angular at top grading to well sorted and angular at base, very silty and clayey, moderately soft, grades to siltstone in beds to several metres thick*
ORDOVICIAN	HANSON RIVER BEDS UNIT 2			101.4	23.4	*Claystone, light green, rarely brown and white, soft, silty, sandy; contains a few beds of siltstone, light green, micaceous, glauconitic, and very fine sandstone*
ORDOVICIAN	HANSON RIVER BEDS UNIT 2		101.4	104.5	3.1	*Sandstone, white, fine-grained, subrounded to rounded, well sorted*

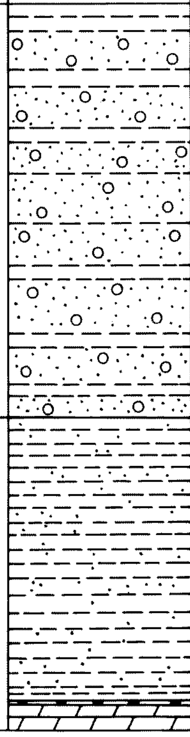
BMR BONNEY WELL 3

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
CAINOZOIC				3.0	3.0	*Clay, red-brown, silty, soft, silicified in parts*
CAINOZOIC				12.0	9.0	*Sandstone, white to brown, fine to coarse-grained, moderately sorted, angular, grades to granule conglomerate at base*
LATE CRETACEOUS OR EARLY TERTIARY	BUCHANAN HILLS BEDS			18.0	6.0	*Sandstone, fine to coarse-grained, angular, poorly sorted, clayey*
LATE CRETACEOUS OR EARLY TERTIARY	BUCHANAN HILLS BEDS			69.0	51.0	*Siltstone, light brown and light grey, soft, sandy, slightly micaceous, grades to silty and clayey sandstone in parts, weathered*
LATE CRETACEOUS OR EARLY TERTIARY	BUCHANAN HILLS BEDS			75.0	6.0	*Sandstone, brown, angular, fine-grained, poorly sorted*
LATE CRETACEOUS OR EARLY TERTIARY	BUCHANAN HILLS BEDS			87.0	12.0	*Siltstone, brown, soft, clayey and sandy; interbedded with claystone, white, silicified, weathered*
PROTEROZOIC	ARUNTA BLOCK				19.9	*Granite or acid gneiss, coarsely crystalline, very soft, decomposed, cuttings contain quartz, mica, chlorite, and amphibole in a clay matrix (probably decomposed feldspar)*
PROTEROZOIC	ARUNTA BLOCK		106.9	109.9	3.0	*Pegmatite, light pink, very hard, crystals of feldspar with perthitic texture to 1m across, sparse biotite, muscovite and chlorite*

AUS I/1123

BARROW CREEK

BMR BARROW CREEK 18 (Grg 18)

AGE	UNIT	GRAPHIC LOG	CORE	DEPTH (m)	THICKNESS (m)	LITHOLOGY
ORDOVICIAN	HANSON RIVER BEDS UNIT 1			54.9	54.9	*Brown clay, gravel, and sand*
MIDDLE TO LATE CAMBRIAN	POINT WAKEFIELD BEDS			92.4	37.5	*White clay with quartz granules*
				93.0	0.6	*Purple puggy clay*
			■	96.0	3.0	*Dolomite, light green, medium-grained, micaceous, discrete sand grains < 10%, brachiopod no older than Late Cambrian at 93.34m*

AUS I/1117

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APPENDIX 1
BMR REGISTERED SAMPLES AND WORK DONE ON THEM

The following abbreviations have been used for rock unit names:

S	Sand
C	Calcrete
US	Unnamed sandstone
LC	Laterite conglomerate
BHB	Buchanan Hills beds
LSS	Lake Surprise Sandstone
HRB	Hanson River beds
PWB	Point Wakefield beds
LHS	Lothari Hill Sandstone
UML-HCF	Undivided Montejinni Limestone and Hooker Creek Formation
HCF	Hooker Creek Formation
ML	Montejinni Limestone
APV	Antrim Plateau Volcanics
UP	Undivided Proterozoic rocks
TCB	Tomkinson Creek beds
GTB	Rocks of The Granites-Tanami Block

Sample no.	Locality/ BMR well (depth in m)	Lat.	Long.	Lithology/ water	Rock unit	Thin section	Cono-donts	XRD	Water analysis	Dating
75720001	GSW 5	19°56'S	132°31'E	Dolomite	HRB	X	X			
75720002	GSW 5	19°56'S	132°31'E	Dolomite	HRB	X	X			
75720003	GSW 5	19°56'S	132°31'E	Dolomite	HRB	X	X			
75720004	GSW 5	19°56'S	132°31'E	Dolomite	HRB	X	X			
75720005	GSW 5	19°56'S	132°31'E	Claystone	HRB	X	X			
75720006	GSW 5	19°56'S	132°31'E	Dolomite	HRB	X	X			
75720007	GSW 5	19°56'S	132°31'E	Sandstone	HRB	X	X			
75720008	GSW 12	19°29'S	132°33'E	Dolomite	C	X	X			
75720009	GSW 35	19°44'S	132°55'E	Dolomite	C	X	X			
75720010	GSW 18	20°00'S	132°22'E	Dolomite	C		X			
75720011	GSW 9	19°30'S	132°46'E	Dolomite	C	X	X			
75720012	GSW 31	19°05'S	132°52'E	Dolomite	C	X	X			
75720013	SLW 4	18°42'S	132°01'E	Dolomite	UML-HCF	X	X			
75720014	LR 18	20°24'S	133°18'E	Dolomite	HRB	X	X			
75720015	LR 33	20°08'S	132°36'E	Dolomite	HRB		X			
75720016	LR 27	20°13'S	132°39'E	Dolomite	HRB	X	X			
75720017	LR 9	20°23'S	133°17'E	Dolomite	HRB		X			
75720018	LR 10	20°23'S	133°15'E	Dolomite	HRB		X			
75720019	LR 14	20°16'S	132°47'E	Dolomite	HRB	X	X			
75720020	LR 41	20°23'S	132°18'E	Dolomite	HRB		X			
75720021	LR 31	20°11'S	132°34'E	Dolomite	HRB		X			
75720022	LR 16	20°22'S	133°18'E	Dolomite	HRB	X	X			
75720023	LR 38	20°10'S	132°24'E	Dolomite	HRB	X	X			
75720024	MS 3	21°00'S	131°28'E	Dolomite	UML-HCF	X	X			
75720025	MS 10	20°24'S	131°18'E	Dolomite	UML-HCF		X			
75720026	MT	21°03'S	130°45'E	Dolomite	Unknown	X	X			
75720027	LR 1	20°16'S	132°47'E	Dolomite	HRB	X		X		
75720028	LR 18	20°25'S	133°21'E	Sandstone	LSS	X		X		
75720029	LR 7	20°21'S	133°17'E	Sandstone	?HRB	X				
75720030	LR 44	20°06'S	132°13'E	Dolomite	HRB	X				
75720031	LR 25	20°13'S	132°42'E	Sandstone	HRB	X				
75720032	LR 23	20°30'S	133°16'E	Sandstone	HRB	X				
75720033	GSW 8	19°03'S	132°20'E	Claystone	PWB	X		X		
75720034	GSW 33	19°39'S	132°59'E	Sandstone	PWB	X				
75720035	GSW 36	19°44'S	132°54'E	Sandstone	US	X				
75720036	GSW 26	19°50'S	133°15'E	Claystone	PWB	X				

Sample no.	Locality/ BMR well (depth in m)	Lat.	Long.	Lithology/ water	Rock unit	Thin section	Conodonts	XRD	Water analysis	Dating
75720037	GSW 10	19°18'S	132°54'E	Sandstone	?PWB	X				
75720038	GSW 28	19°45'S	133°13'E	Siltstone	PWB	X				
75720039	SLW 18	18°08'S	132°51'E	Sandstone	TCB	X				
75720040	SLW 18	18°08'S	132°51'E	Sandstone	TCB	X				
75720041	SLW 35	18°38'S	133°08'E	Sandstone	PWB	X				
75720042	SLW 34	18°44'S	133°03'E	Siltstone	Unknown	X				
75720043	SLW 1	18°19'S	132°40'E	Quartzite	TCB	X				
75720044	SLW 1	18°19'S	132°40'E	Quartzite	TCB	X				
75720045	SLW 1	18°19'S	132°40'E	Quartzite	TCB	X				
75720046	SLW 53	18°39'S	133°17'E	Quartzite	TCB	X				
75720047	SLW 2	18°45'S	132°07'E	Sandstone	HCF	X				
75720048	SLW 36	18°33'S	133°02'E	Siltstone	PWB	X				
75720049	SLW 24	18°16'S	132°26'E	Sandstone	TCB	X				
75720050	SLW 15	18°09'S	132°39'E	Siltstone	BHB	X				
75720051	SLW 41	18°22'S	132°57'E	Claystone	PWB	X				
75720052	SLW 33	18°52'S	133°01'E	Quartzite	TCB	X				
75720053	SLW 43	18°16'S	133°01'E	Sandstone	PWB	X				
75720054	SLW 39	18°27'S	132°58'E	Sandstone	PWB	X				
75720055	SLW 31	18°58'S	132°48'E	Quartzite	TCB	X				
75720056	SLW 55	18°50'S	133°17'E	Quartzite	TCB	X				
75720057	BMR LR4 (49.6)	20°18'S	133°29'E	Dolomite	PWB	X	X			
75720058	BMR LR2 (65.5)	20°23'S	133°30'E	Dolomite	HRB	X	X			
75720059	BMR LR4 (52.0)	20°18'S	133°29'E	Dolomite	PWB	X	X			
75720060	BMR LR1 (75.5)	20°31'S	133°30'E	Dolomite	HRB	X	X			
75720061	BMR LR5 (56.7)	20°14'S	133°28'E	Dolomite	HRB		X			
75720062	BMR LR1 (84.0)	20°31'S	133°30'E	Sandstone and dolomite	HRB	X	X			
75720063	BMR LR5 (58.8)	20°14'S	133°28'E	Dolomite	HRB		X			
75720064	BMR LR3 (67.4)	20°23'S	133°29'E	Quartzite	HRB	X				
75720065	BMR LR3 (65.0)	20°23'S	133°29'E	Claystone	HRB	X				
75720066	BMR LR2 (52.8)	20°23'S	133°30'E	Sandstone	HRB	X				
75720067	BMR BW1 (74.6)	20°30'S	133°31'E	Sandstone	HRB	X				
75720068	BMR BW1 (74.7)	20°30'S	133°31'E	Sandstone	HRB	X				
75720069	BMR LR2 (25.5)	20°23'S	133°30'E	Claystone	HRB	X				
75720070	BMR BW2 (88.9)	20°28'S	133°31'E	Sandstone	HRB	X				
75720071	BMR BW2 (89.2)	20°28'S	133°31'E	Sandstone	HRB	X				
75720072	BMR LR6 (93.4)	20°35'S	133°29'E	Sandstone	LSS	X				
75720073	BMR LR4 (37.5)	20°18'S	133°29'E	Siltstone	HRB		X			
75720074	BMR BW2 (100.5)	20°28'S	133°31'E	Siltstone	HRB		X			
75720075	BMR LR2 (87.5)	20°23'S	133°30'E	Siltstone	HRB		X			
75720076	BMR BW2 (82.5)	20°28'S	133°31'E	Siltstone	HRB		X			
75720077	BMR LR2 (46.5)	20°23'S	133°30'E	Siltstone	HRB		X			
75720078	BMR BW3 (28.5)	20°55'S	133°32'E	Siltstone	?HRB		X			
75720079	BMR BW3 (48)	20°55'S	133°32'E	Sandstone	?HRB		X			
75720080	BMR BW3 (76.5)	20°55'S	133°32'E	Claystone	?HRB		X			
75720081	BMR BW3 (67.5)	20°55'S	133°32'E	Claystone	?HRB		X			
75720082	BMR BW1 (40.5)	20°30'S	133°31'E	Claystone	HRB		X			
75720083	BMR LR4 (40.4)	20°18'S	133°29'E	Claystone	HRB		X			
75720084	Unnamed bore (33.5 m)	20°46'S	133°31'E	Sandstone	?HRB		X			
75720085	Unnamed bore	20°46'S	133°31'E	Water	-				X	
75720086	BMR LR2	20°23'S	133°30'E	Water	-				X	
75720087	BMR BW2	20°28'S	133°31'E	Water	-				X	
75720088	BMR LR3	20°23'S	133°29'E	Water	-				X	
75720089	BMR BW3	20°55'S	133°32'E	Water	-				X	
75720090	BMR BW1	20°30'S	133°31'E	Water	-				X	

Sample no.	Locality/ BMR well (depth in m)	Lat.	Long.	Lithology/ water	Rock unit	Thin section	Cono-donts	XRD	Water analysis	Dating
75720091	BMR LR5	20°14'S	133°28'E	Water	-				X	
75720092	BMR LR1	20°31'S	133°30°E	Water	-				X	
75720093	Bore	20°35'S	133°29'E	Water	-				X	
75720094	Bore	20°52'S	133°32'E	Water	-				X	
75720095	BMR LR7	20°33'S	133°30'E	Water	-				X	
75720096	BMR LR6	20°35'S	133'29'E	Water	-				X	
75720097	SLW10	18°00'S	132°22'E	Sand	S			X		
75720098	SLW43	18°17'S	133°00'E	Sandstone	PWB	X		X		
75720099	SLW31	18°57'S	132°47'E	Quartzite	TCB	X				
75720100	SLW40	18°30'S	132°57'E	Sandstone	TCB	X				
75720101	WC31	18°50'S	131°07'E	Limestone	HCF		X			
75720102	WC52	18°40'S	131°52'E	Dolomite	UML-HCF		X			
75720103	WC51	18°42'S	131°51'E	Limestone	UML-HCF		X			
75720104	WC59	18°46'S	131°50'E	Limestone	ML		X			
75720105	WC59	18°46'S	131°50'E	Limestone	ML		X			
75720106	WC52	18°40'S	131°52'E	Dolomite	ML		X			
75720107	TE7	19°40'S	130°37'E	Dolomite	UML-HCF		X			
75720108	TE5	19°36'S	130°53'E	Limestone	UML-HCF		X			
75720109	TE11	19°47'S	130°31'E	Limestone	UML-HCF		X			
75720110	TE11	19°47'S	130°31'E	Limestone	UML-HCF		X			
75720111	WC6	18°03'S	131°15'E	Chert	ML	X				
75720112	WC6	18°03'S	131°15'E	Chert	ML	X				
75720113	WC6	18°03'S	131°15'E	Dolomite	ML	X				
75720114	WC 28	18°51'S	131°05'E	Siltstone	HCF	X				
75720115	WC 28	18°51'S	131°05'E	Siltstone	HCF	X				
75720116	WC 40	18°41'S	131°17'E	Siltstone	HCF	X				
75720117	WC 40	18°41'S	131°17'E	Siltstone	HCF	X				
75720118	WC 40	18°41'S	131°17'E	Sandstone	HCF	X				
75720119	WC 40	18°41'S	131°17'E	Siltstone	HCF	X				
75720120	WC 55	18°50'S	131°59'E	Sandstone	UML-HCF	X				
75720121	WC 55	18°50'S	131°59'E	Claystone	UML-HCF	X				
75720122	WC 55	18°18'S	131°16'E	Claystone	UML-HCF	X				
75720123	WC 31	18°49'S	131°08'E	Breccia	HCF	X				
75720124	WC 31	18°49'S	131°08'E	Sandstone	HCF	X				
75720125	TE 5	19°35'S	130°54'E	Calcrete	C	X				
75720126	TE 18	19°07'S	130°38'E	Sandstone	BHB	X				
75720127	WC 44	18°50'S	131°30'E	Silcrete	BHB	X				
75720128	WC 32	18°49'S	131°05'E	Sandstone	LC	X				
75720129	WC 25	18°57'S	131°03'E	Sandstone	LHS	X				
75720130	WC 28	18°51'S	131°05'E	Sandstone	BHB	X				
75720131	WC 28	18°51'S	131°05'E	Silcrete	BHB	X				
75720132	WC 28	18°51'S	131°05'E	Sandstone	BHB	X				
75720133	WC 28	18°51'S	131°05'E	Sandstone	BHB	X				
75720134	WC 4	18°05'S	130°39'E	Claystone	HCF	X				
75720135	WC 4	18°05'S	130°39'E	Claystone	HCF	X				
75720136	WC 1	18°01'S	130°41'E	Siltstone	APV	X				
75720137	WC 7	18°02'S	131°22'E	Silcrete	Unknown	X				
75720138	WC 5	18°14'S	130°42'E	Quartzite	UP	X				
75720139	WC 5	18°14'S	130°42'E	Quartzite	UP	X				
75720140	TE 28	19°43'S	130°43'E	Limestone	UML-HCF	X				
75720141	TE 30	19°44'S	130°45'E	Sandstone	LHS	X				
75720142	TE 32	19°52'S	131°30'E	Breccia	UML-HCF	X				
75720143	TE 32	19°52'S	131°30'E	Dolomite	UML-HCF	X				
75720144	TE 7	19°40'S	130°38'E	Dolomite	UML-HCF	X				
75720145	TE 7	19°40'S	130°38'E	Limestone	UML-HCF	X				
75720146	TE 7	19°40'S	130°38'E	Dolomite	UML-HCF	X				
75720147	TE 15	19°03'S	131°10'E	Sandstone	LHS	X				
75720148	TE 14	19°09'S	131°15'E	Sandstone	LHS	X				

Sample no.	Locality/ BMR well (depth in m)	Lat.	Long.	Lithology/ water	Rock unit	Thin section	Conodonts	XRD	Water analysis	Dating
75720149	TE 26	19°02'S	131°38'E	Sandstone	LHS	X				
75720150	TE 4	19°34'S	131°11'E	Sandstone	LHS	X				
75720151	TE 34	19°55'S	130°41'E	Quartzite	GTB	X				
75720152	TE 34	19°55'S	130°41'E	Sandstone	GTB	X				
75720153	TE 19	19°08'S	130°30'E	Quartzite	GTB	X				
75720154	WC 16	18°29'S	130°31'E	Quartzite	UP	X				
75720155	WC 7	18°02'S	131°22'E	Chert	UP	X				
75720156	WC 7	18°02'S	131°22'E	Sandstone	UP	X				
75720157	BMR GSW 6 (30.96)	19°20'S	132°59'E	Sandstone	HCF	X				
75720158	BMR GSW 6 (31.93)	19°20'S	132°59'E	Sandstone	HCF	X				
75720159	BMR GSW 6 (76.63	19°20'S	132°59'E	Siltstone	HCF	X				
75720160	BMR GSW 6 (77.20)	19°20'S	132°59'E	Siltstone	HCF	X				
75720161	BMR GSW 6 (143.87)	19°20'S	132°59'E	Siltstone	HCF	X				
75720162	BMR GSW 6 (144.48)	19°20'S	132°59'E	Dolomite	HCF	X				
75720163	BMR GSW 6 (77.55)	19°20'S	132°59'E	Siltstone	HCF	X				
75720164	BMR GSW 6 (146.00)	19°20'S	132°59'E	Dolomite	HCF	X				
75720165	BMR GSW 6 (182.64)	19°20'S	132°59'E	Siltstone	HCF	X				
75720166	BMR GSW 6 (197.21)	19°20'S	132°59'E	Dolomite	ML	X				
75720167	BMR GSW 6 (199.60)	19°20'S	132°59'E	Gypsum	ML	X				
75720168	BMR GSW 6 (216.33)	19°20'S	132°59'E	Siltstone	ML	X				
75720169	BMR GSW 6 (216.95)	19°20'S	132°59'E	Dolomite	ML	X				
75720170	BMR GSW 6 (230.27)	19°20'S	132°59'E	Dolomite	ML	X				
75720171	BMR GSW 6 (230.43)	19°20'S	132°59'E	Dolomite	ML	X				
75720172	BMR GSW 6 (231.34)	19°20'S	132°59'E	Gypsum	ML	X				
75720173	BMR GSW 6 (244.75)	19°20'S	132°59'E	Dolomite	ML	X				
75720174	BMR GSW 6 (245.26)	19°20'S	132°59'E	Dolomite	ML	X				
75720175	BMR GSW 6 (260.91)	19°20'S	132°59'E	Dolomite	ML	X				
75720176	BMR GSW 6 (262.23)	19°20°S	132°59'E	Siltstone	ML	X				
75720177	BMR GSW 6 (262.84)	19°20'S	132°59'E	Sandstone	ML	X				
75720178	BMR GSW 6 (275.74)	19°20'S	132°59'E	Siltstone	ML	X				
75720179	BMR GSW 6 (293.22)	19°20'S	132°59'E	Dolomite	ML	X				
75720180	BMR GSW 6 (293.83)	19°20'S	132°59'E	Dolomite	ML	X				
75720181	BMR GSW 6 (294.14)	19°20'S	132°59'E	Dolomite	ML	X				
75720182	BMR GSW 6 (294.52)	19°20'S	132°59'E	Gypsum	ML	X				
75720183	BMR GSW 6 (310.37)	19°20'S	132°59'E	Dolomite	ML	X				
75720184	BMR GSW 6 (309.52)	19°20'S	132°59'E	Dolomite	ML	X				
75720185	BMR GSW 6 (313.72)	19°20'S	132°59'E	Dolomite	ML	X				
75720186	BMR GSW 6 (334.09)	19°20'S	132°59'E	Dolomite	ML	X				
75720187	BMR GSW 6 (336.27)	19°20'S	132°59'E	Dolomite	ML	X				
75720188	BMR GSW 6 (337.08)	19°20'S	132°59'E	Dolomite	ML	X				
75720189	BMR GSW 6 (184.40)	19°20'S	132°59'E	Siltstone	HCF	X				
75720190	BMR GSW 6 (146.15)	19°20'S	132°59'E	Dolomite	HCF	X				
75720191	BMR GSW 6 (144.53)	19°20'S	132°59'E	Evaporite	HCF			X		
75720192	BMR GSW 6 (151.49)	19°20'S	132'59'E	Evaporite	HCF			X		
75720193	BMR GSW 6 (197.26)	19°20'S	132°59'E	Evaporite	ML			X		
75720194	BMR GSW 6 (221.22)	19°20'S	132°59'E	Evaporite	ML			X		
75720195	BMR GSW 6 (230.43)	19°20'S	132°59'E	Evaporite	ML			X		
75720196	BMR GSW 6 (231.34)	19°20'S	132°59'E	Evaporite	ML			X		
75720197	BMR GSW 6 (291.08)	19°20'S	132°59'E	Evaporite	ML			X		
75720198	BMR GSW 6 (291.33)	19°20'S	132°59'E	Evaporite	ML			X		
75720206	BMR GSW 6 (260.91)	19°20'S	132°59'E	Dolomite	ML					X
75720207	BMR BW 1 (74.58)	20°30'S	133°31'E	Sandstone	HRB					X
75720208	BMR GSW 6 (263.04)	19°20'S	132°59'E	Dolomite	ML					X
75720209	BMR BW 2 (88.92)	20°28'S	133°31'E	Sandstone	HRB					X

APPENDIX 2

WATER ANALYSIS DATA - SOUTHERN WISO BASIN

Well	Flow	Ca		Mg		Na		K		CO_3		HCO_3		SO_4		Cl		F	NO_3	
	l/hr	mg/l	me/l	mg/l	me/l	mg/l	me/l	mg/l	me/l	mg/l	me/l	mg/l	me/l	mg/l	me/l	mg/l	me/l	mg/l	mg/l	me/l
BMR Lander River 6	12000	43	2.1	57	4.7	598	26.0	94	2.4	7	0.2	341	5.6	389	8.1	749	21.1		33	0.5
BMR Lander River 7	>>1200	58	2.9	85	7.0	735	32.0	88	2.3	7	0.2	361	5.9	494	10.3	989	27.9		46	0.7
Bore at 20°52'S, 133°32'E	>>1200	9	0.4	3	0.2	13	0.6	8	0.2	-		60	1.0	8	0.2	9	0.2		8	0.1
Bore at 20°40'S, 132°28'E	>>1200	7	0.3	4	0.3	90	3.9	73	1.9	7	0.2	220	3.6	41	0.9	57	1.6		8	0.1
BMR Lander River 1	6000	75	3.7	96	7.9	850	37.0	80	2.0	-		447	7.3	658	13.7	1087	30.6		8	0.1
BMR Lander River 5	6000	25	1.2	23	1.9	305	13.3	44	1.1	20	0.7	320	5.3	124	2.6	280	7.9		52	0.8
BMR Bonney Well 3	1200	24	1.2	16	1.3	131	5.7	27	0.7	-		274	4.5	63	1.3	95	2.7		30	0.5
BMR Lander River 3	3000	60	3.0	68	5.6	565	24.6	61	1.6	13	0.4	314	5.1	377	7.8	729	20.6		41	0.7
BMR Bonney Well 2	6000	113	5.6	117	9.6	1025	44.6	110	2.8	-		481	7.9	774	16.1	1424	40.2		9	0.1
BMR Lander River 2	6000	153	7.6	312	25.7	2574	112.0	228	5.8	-		634	10.4	2006	41.8	3517	99.2		6	0.1
Bore at 20°46'S, 132°51'E	>>1200	14	0.7	10	0.8	283	12.3	28	0.7	-		394	6.5	73	1.5	217	6.1		7	0.1
BMR Green Swamp Well 1	8500	61		72		560		87		-		426		421		675		2.2	26	
BMR Green Swamp Well 2	3200	89		91		830		98		-		283		904		895		3.5	9	
BMR Green Swamp Well 4 (cased to 91 m)	24000	32		39		290		45		-		160		235		360		0.6	24	
BMR Green Swamp Well 4 (uncased)	24000	378		71		380		61		-		105		1267		455		0.5	22	
BMR Green Swamp Well 5	8000	108		184		575		315		-		368		-		1256		1.3	15	
Parklands Bore	5600	95		69		460		76		-		397		274		720		2.2	3	
Bobs Well	3000	87		125		890		114		5		661		844		1738		0.0	40	
Austerity Well, 21°02'S, 132°35'E	3200	87		125		890		114		5		661		602		1105		1.6	40	

APPENDIX 2 (continued)

Well	Cations	Anions	Diff	Sum	Diff x 100 / Sum	TDS	Conductivity	Total hardness as $CaCO_3$	Carbonate hardness as $CaCO_3$	Noncarbonate hardness as $CaCO_3$	Total alkalinity as $CaCO_3$	pH	Na to total cation ratio
	me/l	me/l				mg/l	μ-S/cm @ 25°C	mg/l	mg/l	mg/l	mg/l		
BMR Lander River 6	35.3	35.6	0.3	70.8	0.4%	2137	3460	342	279	63	290	8.5	0.74
BMR Lander River 7	44.1	45.0	0.9	89.1	1.0%	2678	4111	495	296	199	306	8.4	0.73
Bore at 20°52'S, 133°32'E	1.5	1.5	0.0	3.0	2.0%	87	146	35	35	-	49	7.9	0.39
Bore at 20°40'S, 132°28'E	6.5	6.4	0.1	12.9	0.4%	395	678	34	34	-	192	8.4	0.61
BMR Lander River 1	50.7	51.8	1.2	102.5	1.1%	3074	4659	582	367	216	367	8.1	0.73
BMR Lander River 5	17.5	17.2	0.3	34.7	0.9%	1030	1815	157	157	-	296	8.7	0.76
BMR Bonney Well 3	8.9	9.0	0.1	17.9	0.3%	521	908	126	126	-	224	8.3	0.64
BMR Lander River 3	34.7	34.7	0.1	69.4	0.1%	2069	3426	430	257	172	279	8.5	0.71
BMR Bonney Well 2	62.7	64.3	1.7	127.0	1.3%	3809	5682	764	394	370	394	8.3	0.71
BMR Lander River 2	151.1	151.4	0.3	302.5	0.1%	9108	11494	1666	520	1146	520	8.1	0.74
Bore at 20°46'S, 132°51'E	14.5	14.2	0.3	28.7	1.0%	824	1441	76	76	-	323	8.1	0.85
BMR Green Swamp Well 1						2330							
BMR Green Swamp Well 2						3203							
BMR Green Swamp Well 4 (cased to 91 m)						1186							
BMR Green Swamp Well 4 (uncased)						2740							
BMR Green Swamp Well 5						2831							
Parklands Bore						2096							
Bobs Well						4644							
Austerity Well, 21°02'S, 132°35'E						3631							

Water analyses for bores in the northern Wiso Basin and surrounding areas are presented in Randal (1970).

APPENDIX 3
FOSSIL LOCALITIES AND FAUNAS

Skwarko's (1973) descriptions of Mesozoic fossil-bearing localities in the Wiso Basin are not repeated here.

LARRIMAH

Locality	L 19; 3 km east-southeast of Brolga Waterhole
Lithology	Silicified clean quartz sandstone
Fossils	Indeterminate plant fragments
Unit	Mullaman beds, unit A
Age	Cretaceous (?Neocomian-Aptian)

Locality	L 20; 2.7 km south of Blue Waterhole
Lithology	Silicified clean quartz sandstone
Fossils	Indeterminate plant fragments
Unit	Mullaman beds, unit A
Age	Cretaceous (?Neocomian-Aptian)

VICTORIA RIVER DOWNS

Locality	VRD 1; on track to Killarney, 6.4 km from Katherine/Top Springs road
Lithology	Purple, brown, white, and grey laminated siltstones
Fossils	Foraminifera - Ammobaculites, Milliammonia, (D. Belford, BMR, personal communication in Randal & Brown, 1967)
Unit	Mullaman beds
Age	Early Cretaceous

Locality	VRD 6; 11.7 km north of Peartree (Figtree) Creek on the Katherine/Top Springs road
Lithology	Grey bituminous limestone with chert patches
Fossils	Redlichia, Biconulites, Girvanella
Unit	Montejinni Limestone
Age	Early Middle Cambrian (Ordian)

Locality VRD 108; 4.8 km southeast of Palm Spring
Lithology Grey bituminous limestone with pink dolomitic patches
Fossils *Redlichia* pygidium, *Biconulites*, *Lingulella*, indeterminate phosphatic brachiopods
Unit Montejinni Limestone
Age Early Middle Cambrian (Ordian)

Locality VRD 111; near Winari Spring
Lithology Grey bituminous limestone with pink dolomitic patches
Fossils *Redlichia* fragments
Unit Montejinni Limestone, near the base of the upper limestone unit
Age Early Middle Cambrian (Ordian)

Locality VRD 231C; about 2 km east of the junction of the Dunmara/ Timber Creek road and the Willeroo/Top Springs road (about 11 km east of Top Springs and near McGaskills Bore)
Fossils Non-diagnostic algal stromatolites
Unit Montejinni Limestone

Locality VRD 14/33/1B; 4.0 km east-southeast of Winari Spring
Lithology Limestone
Fossils Non-diagnostic algal stromatolites
Unit Montejinni Limestone, unit 3

WAVE HILL

Locality WV 15; on track from Cattle Creek outstation to new Dunmara/Timber Creek road, 15.3 km northeast of Cattle Creek outstation
Lithology Limestone
Fossils *Biconulites*
Unit Montejinni Limestone
Age Early Middle Cambrian
Collected by BMR, 1966

Locality WV 53; on east-west trending fence, 10.5 km east of the Camfield River/Cattle Creek junction
Lithology Limestone

Fossils	*Redlichia* with lineopunctate test
Unit	Montejinni Limestone
Age	Early Middle Cambrian (Ordian)
Collected by	BMR, 1966

Locality	WV 113; 6.4 km east-northeast of Horse Bore, on Bullock Creek
Lithology	White limestone with opaline silica
Fossils	Mammalian bones, gastropods, teeth, tortoise shells
Unit	Camfield beds
Age	Middle to late Miocene
Collected by	BMR, 1966

Locality	WV 114; 0.8 km southeast of Horse Bore, Camfield station
Lithology	Buff porcellanite, partly silicified
Fossils	Gastropods
Unit	Camfield beds
Age	Tertiary
Collected by	BMR, 1966

Locality	WV 118a; 6.4 km east of Camfield River and 13 km southeast of Sailor Jack Bore
Lithology	Pink porous limestone
Fossils	Gastropods (two genera)
Unit	Camfield beds
Age	Tertiary
Collected by	BMR, 1966

Locality	WV 122; in Bullock Creek about 4.8 km upstream from Horse Bore
Lithology	Chert nodules in creek traced to base of Montejinni Limestone
Fossils	*Redlichia* cranidia, *Biconulites*
Unit	Montejinni Limestone
Age	Early Middle Cambrian, (Ordian)
Collected by	BMR, 1966

WINNECKE CREEK

Locality	WB9
Lithology	Dololutite and silty dololutite, rare dolomitic siltstone
Fossils	Phosphatic brachiopods, *Biconulites*
Unit	Montejinni Limestone
Age	Early Middle Cambrian
Collected by	BMR, 1965

Locality	BMR Winnecke Creek 2
Lithology	Claystone (21.3 to 24.4 m) and siltstone (36.6 to 39.6 m)
Fossils	21.3 to 24.4 m - *Lingula* 36.6 to 39.6 m - indeterminate trilobite fragments
Unit	Hooker Creek Formation
Age	?Middle Cambrian
Collected by	BMR, 1965

Locality	WC 31
Lithology	Fine to coarse red siltstone overlying grey crystalline dolomite
Fossils	Linguloid brachiopods
Unit	Hooker Creek Formation
Age	?Early Middle Cambrian
Collected by	BMR, 1975

Locality	WC 30
Lithology	Grey coarse to finely crystalline dolomite
Fossils	Linguloid brachiopods
Unit	Hooker Creek Formation
Age	?Early Middle Cambrian
Collected by	BMR, 1975

Locality	WB 1
Lithology	Algal dolomite with oncolites and dense to scattered fragmental trilobites

<u>Fossils</u> — <u>Biconulites</u>, fragmental brachiopods and trilobites, and subspherical and ellipsoidal oncolites
The oncolites do not contain <u>Girvanella</u> tubules, but do contain abundant 1.5-6.5-m algal filaments. The preservation of these filaments in a carbonate oncolite is very unusual and warrants further study (M.R. Walter, BMR, personal communication 1977)

<u>Unit</u> — Hooker Creek Formation

<u>Age</u> — Early Middle Cambrian

<u>Collected by</u> — BMR, 1965

TANAMI EAST

<u>Locality</u> — BMR Tanami East 1, 79.2 m

<u>Lithology</u> — Thin-bedded quartz siltstone

<u>Fossils</u> — Non-diagnostic inarticulate brachiopod fragments

<u>Unit</u> — Hooker Creek Formation

<u>Collected by</u> — BMR, 1965

GREEN SWAMP WELL

<u>Locality</u> — GSW 14

<u>Lithology</u> — Stromatolitic chert

<u>Fossils</u> — Silicified linked bulbous stromatolites. They are not distinctive and thus have no biostratigraphic significance. As isolated specimens they cannot be palaeoenvironmentally interpreted (M.R. Walter, BMR, personal communication, 1977)

<u>Unit</u> — Point Wakefield beds

<u>Collected by</u> — BMR, 1975

<u>Locality</u> — BMR Green Swamp Well 1

<u>Lithology</u> — Dolomite

<u>Fossils</u> — 48.8 to 57.8 m - phosphatic brachiopods (indet.), '<u>Helcionella</u>', eocrinoid plates, sponge spicules
57.9 to 61.0 m - <u>Acrotreta</u> Kutorga, 1848; <u>Acrothele</u> Linnarsson, 1876; eocrinoid plates; Chancelloriidae; hyolithid fragments; sponge spicules
45.7 to 61.0 m (approx.) - eocrinoid plates, Chancelloriidae, sponge spicules

Unit	Montejinni Limestone
Age	Dr A.A. Öpik made the following comment on the fossils. 'On this evidence, and the presence of other fossils, the age of these samples is most probably *Xystridura*-time of early Middle Cambrian' (Milligan & others, 1966)
Collected by	BMR, 1965

TENNANT CREEK

Locality	WB 20
Lithology	Chert
Fossils	Trilobites, ?*Biconulites*
Unit	Montejinni Limestone
Age	?Middle Cambrian
Collected by	BMR, 1965

Locality	WB 21
Lithology	Chert breccia
Fossils	Trilobites, including *Redlichia*
Unit	Montejinni Limestone
Age	Early Middle Cambrian
Collected by	BMR, 1965

Locality	WB 22
Lithology	Chert
Fossils	Trilobites, ?*Biconulites*
Unit	Montejinni Limestone
Age	?Middle Cambrian
Collected by	BMR, 1965

MOUNT SOLITAIRE

Locality	WB 2
Lithology	Quartzose dolomite
Fossils	*Polycandodus* sp. Uyeno & Barnes, *Triangulodus brevibasis* (Sergieva); see Van Wamel (1974)
Unit	Hanson River beds, unit 4
Age	Ordovician (latest Arenigian)
Collected by	BMR, 1965

Locality	HENT 151A, lat. 20°06'15"S, long. 131°59'10"E
Lithology	Uncertain
Fossils	'Fibrous conodont'
Unit	Hanson River beds, unit 4
Age	Late Early or Middle Ordovician
Collected by	American Overseas Petroleum, ca 1967

LANDER RIVER

Locality	WB 5
Lithology	Fine-grained laminated sandstone
Fossils	Orthoid brachiopods
Unit	Hanson River beds, unit 2
Age	?Ordovician
Collected by	BMR, 1965

Locality	WB 6
Lithology	Medium-grained sandstone
Fossils	Meagre trilobite free-cheek fragments
Unit	Hanson River beds, unit 2
Age	?Ordovician
Collected by	BMR, 1965

Locality	WB 7
Lithology	Pelletal, phosphatic, bioclastic quartzose dolomite
Fossils	Fragmental brachiopods,?conodonts
Unit	Hanson River beds
Age	?Ordovician
Collected by	BMR, 1965

Locality	WB 8
Lithology	Pelletal, phosphatic, bioclastic quartzose dolomite
Fossils	Fragmental brachiopods
Unit	Hanson River beds
Age	?Ordovician
Collected by	BMR, 1965

Locality	WB 12
Lithology	Medium-grained sandstone, silicified in parts
Fossils	Trilobite, nautiloids, and trace fossils (field determination) of Rhizocorallium, indet. (palmate fodinichnia)
Unit	Hanson River beds, unit 2
Age	?Ordovician
Collected by	BMR, 1965

Locality	WB 13
Lithology	Bioclastic microcrystalline dolomite
Fossils	Trilobites, gastropods, conodonts, ?vertebrates
Unit	Hanson River beds
Age	?Ordovician
Collected by	BMR, 1965

Locality	WB 14
Lithology	Fine-grained sandstone
Fossils	Brachiopods, trilobites
Unit	Hanson River beds, unit 2
Age	?Ordovician
Collected by	BMR, 1965

Locality	LR 1
Lithology	Finely crystalline grey dolomite
Fossils	(a) Brachiopoda - Lingulella? sp.

orthid
strophomenoid

(b) Trilobita - calymenid
asaphid new genus

(c) Mollusca - (i) - Monoplacophora
limpet-shaped species
Tropidodiscus sp.
Pterotheca? sp.

(ii)- Gastropoda
Clathrospira? sp.

(iii)- Rostroconchia
Pinnocaris sp. A

(iv) - Pelecypoda

Palaeoneilo cf. *P. smithi* Pojeta & Tomlinson
Ctenodonta cf. *C. youngi* Pojeta & Tomlinson
Deceptrix sp.
Sthenodonta? sp.
'*Redonia*' sp.
Cyrtodonta cf. *C. watti* (Tate)

Unit — Hanson River beds, unit 4
Age — Ordovician (late Arenigian to Llanvirnian)
Collected by — J.G. Tomlinson, 1975

Locality — LR 10
Lithology — Dolomite
Fossils — *Protopanderodus?* sp. Barnett, cf. *Rhipidioprultus?*, *Ptiloconus* sp., *Scolopodus quadraplicatus*, cf. *Paltodus bassleri*, *Scolopodus emarginatus*, and form known in Nora Formation of Georgina Basin
Unit — Hanson River beds, unit 3
Age — Ordovician (middle Arenigian, (late Latorpian))
Collected by — BMR, 1975

Locality — LR 15
Lithology — Chert
Fossils — Brachiopods indet.
Unit — Hanson River beds
Age — ?Ordovician
Collected by — BMR, 1975

Locality — LR 18
Lithology — Dolomite
Fossils — *Polycandodus* sp. Uyeno & Barnes
Unit — Hanson River beds, unit 4
Age — Ordovician (latest Arenigian)
Collected by — BMR, 1975

Locality	LR 25
Lithology	Well-sorted, well-rounded, medium-grained sandstone
Fossils	Non-diagnostic trace fossils
Unit	Hanson River beds
Collected by	BMR, 1975

Locality	LR 31
Lithology	Dolomite
Fossils	*Polycandodus* sp. Uyeno & Barnes, '*Ligonodia*' n. sp. A (Kennedy thesis), ?*Aphelognathus*, *Paltodus* cf. n. sp. A (Kennedy thesis), and many fibrous forms
Unit	Hanson River beds, unit 4
Age	Ordovician (probably latest Arenigian)
Collected by	BMR, 1975

Locality	LR 33
Lithology	Dolomite
Fossils	Unidentifiable fragments
Unit	Hanson River beds
Collected by	BMR, 1975

Locality	LR 38
Lithology	Dolomite
Fossils	Fragments, including ?*Polycandodus* and ?*Aphelognathus*
Unit	Hanson River beds, unit 4
Age	Ordovician (probably latest Arenigian)
Collected by	BMR, 1975

Locality	BMR Lander River 1, 75.10 to 76.00 m
Lithology	Dolomite
Fossils	Conodont (new genus), ?*Paltodus*, ?*Scolopodus quadraplicatus* Branson & Meth
Unit	Hanson River beds, unit 3
Age	Ordovician (middle Arenigian)
Collected by	BMR, 1974

Locality	BMR Lander River 1, 83.20 to 84.80
Lithology	Dolomite
Fossils	Scolopodus quadraplicatus Branson & Meth, ?Panderodus sp. Uyeno & Barnes
Unit	Hanson River beds, unit 3
Age	Ordovician (middle Arenigian)
Collected by	BMR, 1974

Locality	HENT 161C, lat. 20°07'50"S, long. 132°13'20"E
Lithology	Uncertain
Fossils	'Fibrous conodonts'
Unit	Hanson River beds, unit 4
Age	Middle Ordovician (equivalent to upper Stairway Sandstone or Stokes Siltstone of the Amadeus Basin)
Collected by	American Overseas Petroleum, ca 1967

Locality	HENT 168B, lat. 20°10'05"S, long. 132°24'25"E
Lithology	Uncertain
Fossils	Cordylodus sp., Trucherognathus sp., 'fibrous conodonts'
Unit	Hanson River beds, unit 4
Age	Middle Ordovician (equivalent to upper Stairway Sandstone or Stokes Siltstone of the Amadeus Basin)
Collected by	American Overseas Petroleum, ca 1967

Locality	HENT 169, lat. 20°10'05"S, long. 132°24'25"E, stratigraphically 4.6 m above HENT 168 B
Lithology	Uncertain
Fossils	'Fibrous conodonts'
Unit	Hanson River beds, unit 4
Age	Middle Ordovician (equivalent to Stokes Siltstone of Amadeus Basin)
Collected by	American Overseas Petroleum, ca 1967

Locality	HENT 170, lat. 20°10'15"S, long. 132°24'25"E, stratigraphically 8.8 m above HENT 169
Lithology	Uncertain
Fossils	Paltodus? sp., Drepanodus sp., Trucherognathus sp., Trichonodella sp., conodont n. gen. A, conodont n. gen. B

Unit	Hanson River beds, unit 4
Age	Middle Ordovician (equivalent to Stokes Siltstone of Amadeus Basin)
Collected by	American Overseas Petroleum, ca 1967

Locality	HENT 171, lat. 20°10'15"S, long. 132°24'25"E
Lithology	Uncertain
Fossils	Conodont fragments
Unit	Hanson River beds
Age	?Middle Ordovician
Collected by	American Overseas Petroleum, ca 1967

Locality	HENT 172, lat. 20°10'20"S, long. 132°24'20"E
Lithology	Uncertain
Fossils	*Scandodus* sp., *Acontiodus* cf. *arcuatus* Lindstrom
Unit	Hanson River beds, unit 3
Age	Early Ordovician (Arenigian; equivalent to Horn Valley Siltstone of Amadeus Basin)
Collected by	American Overseas Petroleum, ca 1967

Locality	HENT 173, lat. 20°10'55"S, long. 132°24'10"E
Lithology	Uncertain
Fossils	'Fibrous conodont' fragments
Unit	Hanson River beds
Age	?Middle Ordovician (possibly equivalent to Stokes Siltstone of Amadeus Basin)
Collected by	American Overseas Petroleum, ca 1967

Locality	HENT 174, lat. 20°13'50"S, long. 132°43'10"E
Lithology	Uncertain
Fossils	Indeterminate conodont fragments
Unit	Hanson River beds
Age	Ordovician
Collected by	American Overseas Petroleum, ca 1967

Locality	HENT 188, lat. 20°23'30"S, long. 133°17'30"E
Lithology	Uncertain
Fossils	*Acontiodus* sp., *Depranodus* sp., 'fibrous conodonts'
Unit	Hanson River beds, unit 4
Age	Latest Early Ordovician (equivalent to lower Stairway Sandstone of Amadeus Basin)
Collected by	American Overseas Petroleum, ca 1967

BONNEY WELL

Locality	Geopeko Rover 1, lat. 20°00'S, long. 133°39'E
Lithology	Not recorded, probably dolomite
Fossils	Indeterminate corneous brachiopod ? *Acrothele* sp. *Biconulites* Sponge spicules of *Chancelloria* and *Pleodioria* forms *Pleodioria* and *Chancelloria* Ptychoparioid trilobite fragment (pygidium) Indeterminate trilobite protaspis Moulds of algal filaments
Unit	Undivided Montejinni Limestone and Hooker Creek Formation
Age	?Middle Cambrian
Collected by	Geopeko Ltd.

Reference

VAN WAMEL, W.A., 1974 - Conodont biostratigraphy of the Upper Cambrian and Lower Ordovician of north-western Öland, south-eastern Sweden. *Utrecht Micropalaeontological Bulletin* 10.

APPENDIX 4
DESCRIPTIONS OF THIN SECTIONS

Latitudes and longitudes of localities listed below are given in Appendix 1.

<u>Slide no. 75720001</u>, locality GSW 5, dolomite, Hanson River beds

90% dolomite, as pisoliths 3 mm across with stylolites on edges (50%) and as medium crystalline matrix (40%).

10% quartz, angular fine grains in matrix.

Tr. mica, finely crystalline in matrix.

<u>Slide no. 75720003</u>, locality GSW 5, dolomite, Hanson River beds

50% quartz, angular, fine-grained, some solution on grain boundaries.

50% dolomite, medium crystalline as matrix.

Tr. mica, finely crystalline.

<u>Slide no. 75720005</u>, locality GSW 5, claystone, Hanson River beds

80% clay.

15% quartz, fine-grained, angular to rounded.

5% mica, imbricated, finely crystalline.

Tr. hematite, as staining.

<u>Slide no. 75720006</u>, locality GSW 5, dolomite, Hanson River beds

90% dolomite, as highly and coarsely recrystallised ooliths (70%) and coarsely crystalline matrix (20%).

10% quartz, fine-grained, angular, in matrix.

<u>Slide no. 75720007</u> , locality GSW 5, sandstone, Hanson River beds

80% quartz, coarsely crystalline, angular, much solution on grain boundaries.

5% mica, aligned along grain boundaries.

15% pores.

<u>Slide no. 75720008</u> , locality GSW 12, dolomite, calcrete

90% dolomite, as finely crystalline fragments up to 1 cm (40%) in very finely crystalline matrix (50%).

10% quartz, as coarse angular grains.

Slide no. 75720011, locality GSW 9, dolomite, calcrete

90% dolomite, as finely crystalline fragments (40%) in very finely crystalline matrix (50%).

10% quartz, fine to coarse angular to rounded grains as matrix.

Slide no. 75720013, locality SLW 4, dolomite, undivided Montejinni Limestone and Hooker Creek Formation

100% dolomite, medium to coarsely crystalline.

Tr. chalcedony, infilling pores.

Slide no. 75720016, locality LR 27, dolomite, Hanson River beds

50% dolomite, very coarsely crystalline, as matrix.

50% quartz, coarse-grained, rounded, some solution on grain boundaries.

Slide no. 75720014, locality LR 18, dolomite, Hanson River beds

99% dolomite, coarsely crystalline, some euhedral.

1% limonite, filling vugs and cleavage traces in crystals, mainly in centres of crystals.

Tr. quartz, coarse-grained, well-rounded, associated with limonite.

Slide no. 75720019, locality LR 14, dolomite, Hanson River beds

95% dolomite, as coarsely crystalline fragments (55%) and as finely crystalline matrix (40%).

5% quartz, fine-grained, angular, in fragments.

Slide no. 75720022, locality LR 16, dolomite, Hanson River beds

98% dolomite, finely crystalline, contains grains of coarsely crystalline dolomite (70%) in matrix of finely crystalline dolomite (28%).

1% quartz, fine to coarse-grained, angular to rounded, in fragments and matrix.

1% apatite, as medium grains and crystals.

Slide no. 75720024, locality MS 3 dolomite, undivided Montejinni Limestone and Hooker Creek Formation, as fragments in calcrete

90% dolomite, as finely crystalline fragments (50%) and as very finely crystalline matrix (40%).

5% quartz, finely to coarsely crystalline, in fragments and matrix.

5% clay, as fragments.

Slide no. 75720026, locality MT, dolomite, stratigraphic position uncertain

100% dolomite, very finely crystalline in matrix of medium crystalline dolomite.

Tr. quartz, as coarse grains in matrix.

Slide no. 75720027, locality LR1, dolomite, Hanson River beds

100% dolomite, coarsely to medium crystalline, interlocking texture, slightly weathered.

Tr. chalcedony, filling vugs.

Slide no. 75720028, locality LR 18, sandstone, Lake Surprise Sandstone

80% quartz, medium to coarse-grained, rounded to subangular, slight solution on crystal boundaries, no quartz overgrowths.

10% clay, as matrix.

10% pores.

Slide no. 75720029, locality LR 7, sandstone, ?Hanson River beds

90% quartz, rounded, medium-grained, partly interlocking texture owing to considerable quartz overgrowth.

1% clay, aligned around quartz grains.

9% pores.

Slide no. 75720030, locality LR 44, dolomite, Hanson River beds

100% dolomite, medium crystalline, even texture.

Slide no. 75720031, locality LR 25, sandstone, Hanson River beds

95% quartz, medium-grained, rounded, interlocking grains produced by considerable quartz overgrowths.

5% pores.

Slide no. 75720032, locality LR 23, sandstone, Hanson River beds

70% quartz, medium to fine-grained, well-rounded to sub-angular, much solution on grain boundaries, trace of quartz overgrowth.

30% pores.

Slide no. 75720033, locality GSW 8, claystone, Point Wakefield beds

90% hematite.

10% chalcedony or clay filling pores.

Slide no. 75720034, locality GSW 33, sandstone, Point Wakefield beds, as fragment in Cainozoic gravel

70% quartz, fine-grained, angular, some solution on grain boundaries.

10% clay, aligned along edges of grains.

20% pores.

Slide no. 75720035, locality GSW 36, unnamed sandstone

60% quartz, angular to rounded, some solution on grain boundaries, no quartz overgrowth.

20% clay, as matrix.

20% pores.

Slide no. 75720036, locality GSW 26, claystone, Point Wakefield beds

40% quartz, fine-grained, angular.

40% clay, as grains and matrix.

Tr. mica, as grains.

20% pores.

Slide no. 75720037, locality GSW 10, sandstone, ?Point Wakefield beds

70% quartz, coarse-grained, rounded, prominent quartz over-growths in parts.

10% hematite, as matrix.

20% pores.

Slide no. 75720038, locality GSW 28, siltstone, Point Wakefield beds

30% quartz, silt-size grains, angular.

20% mica, fine grains.

50% hematite, as matrix.

Slide no. 75720039, locality SLW 18, sandstone, Tomkinson Creek beds

80% quartz, fine to coarse, angular to rounded; some solution of grains; some grains contained overgrowths before solution.

20% opal, as matrix.

Slide no. 75720040, locality SLW 18, sandstone, Tomkinson Creek beds

100% quartz, very coarse to silt grains in finely crystalline quartz matrix, large overgrowths common, interlocking texture.

Tr. opal, filling pores in matrix.

Slide no. 75720041, locality SLW 35, sandstone, Point Wakefield beds

60% quartz, coarse to fine-grained, angular to rounded, overgrowths.

40% hematite, replacing quartz and as matrix.

Slide no. 75720042, locality SLW 34, siltstone, stratigraphic position uncertain

30% quartz, fine-grained, angular.

70% hematite, as matrix.

Slide no. 75720043, locality SLW 1, quartzite, Tomkinson Creek beds

100% quartz, fine-grained, rounded, most grains have quartz overgrowths.

Tr. ?opal, as matrix.

Slide no. 75720044, locality SLW 1, quartzite, Tomkinson Creek beds

100% quartz, coarsely crystalline, rounded, with abundant quartz overgrowths, some matrix of finely crystalline silica.

Slide no. 75720045, locality SLW 1, quartzite, Tomkinson Creek beds

90% quartz, coarse-grained, rounded, moderate quartz overgrowths, some finely crystalline quartz matrix.

10% pores.

Slide no. 75720046, locality SLW 53, quartzite, Tomkinson Creek beds

100% quartz, medium to coarse-grained, rounded, much quartz overgrowths giving interlocking texture.

Slide no. 75720047, locality SLW 2, sandstone, Hooker Creek Formation

40% quartz, fine-grained, angular.

50% hematite and clay, as matrix.

1% mica, as fine grains.

9% pores.

Slide no. 75720048, locality SLW 36, siltstone, Point Wakefield beds

30% quartz, fine-grained, angular.

70% hematite and clay, as matrix.

Slide no. 75720049, locality SLW 24, sandstone, Tomkinson Creek beds

60% quartz, medium-grained, rounded, moderate quartz overgrowths.

30% clay, as matrix.

10% pores.

Slide no. 75720050, locality SLW 15, siltstone, Buchanan Hills beds

70% quartz, fine-grained, angular.

25% clay and hematite, as matrix.

5% pores.

Slide no. 75720051, locality SLW 41, claystone, Point Wakefield beds

50% quartz, fine-grained, angular.

50% clay, as matrix.

Slide no. 75720052, locality SLW 33, quartzite, Tomkinson Creek beds

80% quartz, medium-grained, rounded, much quartz overgrowths, some finely crystalline quartz as matrix.

20% pores.

Slide no. 75720053, locality SLW 43, sandstone, Point Wakefield beds

100% quartz, fine-grained angular, and as overgrowths,probably from original rock; no solution of grain boundaries.

Slide no. 75720054, locality SLW 39, sandstone, Point Wakefield beds
50% quartz, fine-grained, angular.
30% hematite, as matrix.
20% pores.

Slide no. 75720055, locality SLW 31, quartzite, Tomkinson Creek beds
80% quartz, medium-grained, rounded, as grains with large quartz overgrowths and thin rims of chalcedony in parts.
20% pores.

Slide no. 75720056, locality SLW 55, quartzite, Tomkinson Creek beds
99% quartz, coarse-grained, rounded, complete overgrowths to give interlocking texture.
1% clay, along grain boundaries.

Slide no. 75720057, BMR Lander River 4, 49.6 m, dolomite, Point Wakefield beds
10% claystone, mainly micaceous with a few coarse rounded quartz grains.
85% dolomite, replacing claystone in veins.
5% chalcedony, replacing dolomite.

Slide no. 75720058, BMR Lander River 2, 65.5 m, dolomite, Hanson River beds.
100% dolomite, interlocking grains, finely to coarsely crystalline.
Tr. mica, on stylolite.

Slide no. 75720059, BMR Lander River 4, 52.0 m, dolomite, Point Wakefield beds
5% claystone, contains a few rounded quartz grains.
90% dolomite, replacing claystone as veins, very finely crystalline.
3% quartz, coarse grains in dolomite.
2% chalcedony, as veins.

Slide no. 75720060, BMR Lander River 1, 75.5 m, dolomite, Hanson River beds
60% quartz, fine, angular to rounded grains, some solution on grain boundaries, no quartz overgrowths.
40% dolomite, coarse interlocking crystals, as matrix.
Tr. mica, as thin laminae.

Slide no. 75720062, BMR Lander River 1, 84.0 m, sandstone, Hanson River beds

80% quartz, fine-grained, angular.

10% mica, as matrix, aligned along grain boundaries.

10% pores.

Slide no. 75720064, BMR Lander River 3, 67.4 m, quartzite, Hanson River beds

95% quartz, rounded, coarsely crystalline, abundant quartz overgrowths to give interlocking grains.

5% pores.

Slide no. 75720065, BMR Lander River 3,65.0 m, claystone, Hanson River beds

50% mica, fine to coarse-grained, imbricated.

50% quartz, fine-grained, angular to rounded.

Slide no. 75720066, BMR Lander River 2, 52.8 m, sandstone, Hanson River beds

80% quartz, rounded, medium-grained, replaced by hematite in parts.

10% hematite, as coating on quartz grains, as fine rounded grains, and as matrix.

10% pores.

Slide no. 75720067, BMR Bonney Well 1, 74.55 m, sandstone, Hanson River beds

95% quartz, fine-grained, angular, much solution at grain boundaries, no quartz overgrowths, slight imbrication.

5% mica, fine-grained, as laminae.

Tr. glauconite, as rounded fine grains.

Tr. calcite, as fossil fragments and matrix.

Slide no. 75720068, BMR Bonney Well 1, 74.65 m, sandstone, Hanson River beds

80% quartz, generally fine, some medium, angular to subrounded, very slight quartz overgrowths, solution at grain boundaries.

5% glauconite, medium grains.

15% calcite, as matrix and as fossil fragments.

<u>Slide no. 75720069</u>, BMR Lander River 2, 25.55 m, claystone, Hanson River beds

80% clay, finely crystalline, preferred orientation in two directions, as matrix.

20% quartz, angular to rounded, fine to coarse-grained, no overgrowths, little solution on boundaries.

Tr. limonite, as fine to medium rounded grains, possibly weathered glauconite.

<u>Slide no. 75720070</u>, BMR Bonney Well 2, sandstone, Hanson River beds

80% quartz, fine to medium-grained, angular, imbricated, no quartz overgrowths, slight grain boundary solution.

5% glauconite, as coarse rounded grains.

5% mica, as matrix.

10% pores.

<u>Slide no. 75720071</u>, BMR Bonney Well 2, 89.2 m, sandstone, Hanson River beds

80% quartz, fine-grained, angular, no quartz overgrowths, slight solution on grain boundaries.

20% pores.

Tr. feldspar, as grains.

Tr. mica, as grains.

<u>Slide No. 75720072</u>, BMR Lander River 6, 93.35, sandstone, Lake Surprise Sandstone

90% quartz, subrounded, uniform, medium grains, no quartz overgrowths, much solution on grain boundaries.

10% pores.

<u>Slide no. 75720111,</u> locality WC 6, chert, Montejinni Limestone

Hand specimen: Cream-white hard fine-grained chert with coarser-grained lenses; zone of weathering surrounding specimen.

Thin section: Fine quartz crystals form a compact mosaic in which scattered lenses of coarser crystals to 0.01 mm have the same texture as the fine crystals.

Slide no. 75720112, locality WC 6, chert, Montejinni Limestone
Hand specimen: Cream-red mottled hard fine-grained chert with manganese staining common on surface.

Thin section: Cryptocrystalline quartz accompanies some coarser quartz crystals. Vugs and veins partly or wholly filled with chalcedony are common, and translucent iron oxides partly replace the rock. Traces of mica and opaque minerals are present.

Slide no. 75720113, locality WC 6, dolomite, Montejinni Limestone
Hand specimen: Fawn to light brown, hard and massive crystalline dolomite with some thin yellow-brown iron oxide veins, and vugs containing a white mineral.

Thin section: Fine to very coarsely crystalline carbonate rock contains interlocking grains with no matrix or cement. Chalcedonic vug fillings and fine quartz grains, subrounded and with normal extinction, are common throughout the rock.

Slide no. 75720114, locality WC 28, siltstone, Hooker Creek Formation
Hand specimen: Pale pink to red coarse-grained micaceous siltstone; very hard; no obvious bedding; tends to break into blocky fragments.

Thin section: Red to brown even-textured siltstone comprises mainly subangular quartz grains and elongate to equant muscovite grains with minor opaque minerals and carbonate in the groundmass. The red colouration is due to iron oxide staining.

Slide no. 75720115, locality WC 28, siltstone, Hooker Creek Formation
Hand specimen: Pink-brown fine-grained siltstone containing small-scale trough cross-lamination; very hard; some distinct grains of muscovite.

Thin section: Silt-size subangular to subrounded quartz grains are dominant. Muscovite as silt-size grains or laths and as interstitial grains is abundant. Opaque minerals are common, and minor dolomite may be present in the matrix.

Slide no. 75720116, locality WC 40, siltstone, Hooker Creek Formation
Hand specimen: Cream hard silicified siltstone, with a poorly developed conchoidal fracture, interbedded with shale.

Thin section: Very fine siltstone contains grains of quartz and mica, and trace amounts of opaque minerals showing no preferred orientation.

Slide no. 75720117, locality WC 40, siltstone, Hooker Creek Formation
Hand specimen: Dark red-brown fine-grained micaceous siltstone; even texture, small voids common, no bedding apparent.

Thin section: Coarse angular to subrounded (subangular dominant) quartz grains are set in a red-brown matrix of secondary hematite, mica, and clay minerals. Many quartz grains have been corroded and replaced by commonly opaque iron oxide. Grains have normal to slightly undulose extinction and a few are composite. Slight preferred orientation of elongate quartz grains.

Slide no. 75720118, locality WC 40, sandstone, Hooker Creek Formation
Hand specimen: Red-brown micaceous silty sandstone with some lamination and small claystone clasts parallel to the lamination; porous.

Thin section: Red, well-laminated fine-grained rock contains 70% angular to subrounded (subangular dominant) quartz grains, of which half are elongate and indistinctly aligned parallel to bedding. Sparse composite grains, and grains with undulose extinction, are present. Lath-like grains of muscovite form less than 5% of the rock. The matrix, originally of very fine quartz grains with some clay minerals, is partly replaced by red iron oxides. The angularity of many quartz grains is due in part to secondary solution of the silica.

Slide no. 75720119, locality WC 40, siltstone, Hooker Creek Formation
Hand specimen: Deep red-brown poorly laminated micaceous siltstone with sparse layers of fine silty sandstone and some thin laminae of claystone to 2 mm thick.

Thin section: Very fine quartz grains and clay minerals form laminae, of which some contain coarser subangular quartz grains. Muscovite and iron oxide have partly replaced the matrix concentrated in the finer-grained laminae.

Slide no. 75720120, locally WC 55, sandstone, undivided Montejinni Limestone and Hooker Creek Formation
Hand specimen: Cream to brown fine-grained quartz sandstone with irregular laminations; micaceous, hard, slightly siliceous.

Thin section: The quartz grains are mainly subangular, but range from subangular to subrounded; secondary solution of silica has produced some angularity. A few small elongate grains of muscovite are also present. Microcrystalline quartz with some clay minerals and rare opaque minerals form a matrix (40%) in which some cavities are filled with brown clay with a continuous extinction pattern.

Slide no. 75720121, locality WC 55, claystone, undivided Montejinni Limestone and Hooker Creek Formation
Hand specimen: Pink to red, very hard cherty siliceous claystone with minor laminae of micaceous quartzose sandstone. Large voids are abundant and have no fillings.

Thin section: White to pink, highly siliceous claystone, and laminae of red-brown fine-grained subangular quartz sandstone with a few muscovite grains are set in a matrix similar to the claystone, but containing some iron oxides.

Slide no. 75720122, locality WC 55, claystone, undivided Montejinni Limestone and Hooker Creek Formation
Hand specimen: Dark red-brown laminated claystone with abundant grains of a green mineral, possibly glauconite, slightly elongate parallel to the bedding; porous and vuggy.

Thin section: Highly ferruginous elongate grains of glauconite are set in a very dark brown to black iron oxide matrix with abundant channel fillings of finely crystalline silica with some opaline silica cavity fillings. Abundant subangular quartz grains are probably remnants of an original very fine-grained quartz siltstone or silty claystone.

Slide no. 75720123, locality WC 31, breccia, Hooker Creek Formation
Hand specimen: Pink and green breccia of grey-green angular siltstone-claystone fragments in a pink to red siliceous matrix.

Thin section: Subangular to rounded pebble-size fragments of silty claystone are set in a matrix of opaline silica. The fragments are very fine-grained clay/quartz rock with some silt-size subangular quartz grains. The matrix is mainly opaline silica with common cavity linings or partial fillings of red brown iron oxides with continuous extinction.

Slide no. 75720124, locality WC 31, sandstone, Hooker Creek Formation
Hand specimen: Deep red-brown, finely laminated fine-grained silty sandstone; micaceous; contains some thin claystone clasts.

Thin section: Dark red, thinly laminated sandstone comprises very fine quartz grains, mainly subangular and moderately well sorted, in a siliceous matrix with minor clay minerals which has largely been replaced by red iron oxides. Lath-like grains of muscovite are aligned parallel to the bedding planes. Many quartz grains have been corroded and partly replaced by iron oxides.

Slide no. 75720125, locality TE 5, calcrete
Hand specimen: Pink, very well-laminated, very fine-grained calcrete with a white, leached weathered crust; moderately porous.

Thin section: The calcite groundmass contains about 30% subrounded quartz grains and a few quartzite fragments to 1 mm in diameter. Rare grains of plagioclase and heavy minerals are present.

Slide no. 75720126, locality TE 18, sandstone, Buchanan Hills beds
Hand specimen: Dark brown to yellow ferruginous sandstone. Poorly sorted, mostly subangular quartz grains range from silt to very coarse sand in a ferruginous matrix containing apparent clasts of very highly ferruginous rock in a limonitic matrix.

Thin section: Segregation of grains has resulted in coarser and less densely packed grains concentrated in the highly ferruginous zones with a matrix of red-brown and almost black iron oxide. Grains in these zones are quartz with rare hornblende, mainly 0.05 to 2.0 mm, subangular and minor rounded, and intensely corroded; many are intensely fractured. About 60% show markedly undulose extinction. These coarse-grained zones are surrounded by finer-grained zones containing more densely packed angular to subrounded (subangular dominant) quartz grains less than 0.05 mm; the ferruginous matrix is red-brown, and only about 30% of the grains have undulose extinction. The quartz in the finer-grained zones is not as corroded as in the coarser-grained zones, although fractures are quite intense.

Slide no. 75720127, locality WC 44, silcrete, Buchanan Hills beds
Hand specimen: White to grey, very fine-grained siliceous rock, containing very fine quartz grains in a silica matrix; hard.

Thin section: The rock is a quartz sandstone whose grains are set in a matrix of finer quartz with some clay minerals and mica. Grains are up to 0.1 mm in diameter, angular to subrounded (subangular dominant), and moderately to well sorted. Composite quartz grains are present but not abundant. About half the grains show slightly to intensely undulose extinction, and some are markedly corroded. Many small vugs are partly or completely filled with concentric layers of silica; grains of muscovite and rare hornblende are also present.

Slide no. 75720128, locality WC 32, sandstone, laterite
Hand specimen: Brown-red fine to coarse-grained quartz sandstone with a ferruginous matrix, and a few small limonite-filled vugs.

Thin section: Subangular to rounded quartz grains are set in a matrix of quartz and clay minerals. Grains have red iron oxide coatings which appear to be corroding and replacing the quartz core. Grains, which are mostly fractured, are up to 0.4 mm and have straight or slightly undulose extinctions.

Slide no. 75720129, locality WC 25, sandstone, Lothari Hill Sandstone
Hand specimen: Fine to very coarse-grained subangular to subrounded quartz sandstone with a few pebble-size grains in a yellow-brown matrix; very porous.

Thin section: Quartz grains, 0.05-2 mm, are set in a red-black opaque iron oxide matrix. The larger grains are mainly subrounded, but some are subangular. Much angularity is secondary, and due to replacement of quartz by the opaque matrix. Many grains are composite, are probably derived from Precambrian basement quartzites, and often have strongly sutured grain contacts. Finer grains are mostly subangular, but range from angular to subrounded, and show undulose and straight extinction.

Slide no. 75720130, locality WC 28, sandstone, Buchanan Hills beds
Hand specimen: White fine-grained subrounded siliceous quartz sandstone; moderately well sorted and porous; laminae of white opaline silica.

Thin section: Cryptocrystalline opaline material with some iron oxide staining forms even-textured bands in the rock and occurs as a matrix to the fine to medium sand grains. Quartz grains are generally subrounded, but range from rounded to subangular and have a coating of iron oxide.

Slide no. 75720131, locality WC 28, silcrete, Buchanan Hills beds
Hand specimen: White fine to medium-grained quartz sandstone with silica cement; poorly sorted; hard and massive but porous.

Thin section: Fine quartz grains are very poorly sorted; many of the larger grains are fractured; and subangular grains are dominant. Sparse quartzite and chert fragments are present, together with very small amounts of muscovite, which is partly altered to clay. The matrix is very fine silica and clay minerals, and forms about 40% of the rock.

Slide no. 75720132, locality WC 28, sandstone, Buchanan Hills beds
Hand specimen: Yellow and brown fine to coarse-grained, poorly sorted quartz sandstone with large cavities throughout, giving a 'nodular' appearance to the rock. Rock forms resistant ferruginous capping to outcrop.

Thin section: Quartz grains and rare muscovite and limonite are in a dense matrix of red-brown iron oxides. In many of the grains, iron oxides replace the quartz. Brown clay minerals have filled or partly filled cavities and have continuous extinction.

Slide no. 75720133, locality WC 28, sandstone, Buchanan Hills beds
Hand specimen: Pink to brown, fine to coarse-grained, poorly sorted subangular to subrounded quartz sandstone with a siliceous matrix; fairly porous.

Thin section: 60% granular quartz (some replaced by opaque minerals), 25% matrix, 15% pores, and traces of muscovite. About 10% of all grains, but up to 20% of the coarser grains (which are up to 2 mm in diameter), have a metamorphic origin. The matrix is of very fine-grained quartz, brown clay, and opaque minerals.

Slide no. 75720134, locality WC 4, claystone, Hooker Creek Formation
Hand specimen: Red claystone with abundant patches of white opaline silica; hard and non-porous.

Thin section: Partly opaque red-brown iron oxides contain abundant extremely fine-grained opaline silica, and patchy development of highly strained, coarsely crystalline quartz within the fine-grained material. This rock is probably a highly altered claystone.

Slide no. 75720135, locality WC 4, claystone, Hooker Creek Formation
Hand specimen: Purple claystone, well laminated in parts; some coarse irregular beds of purple siltstone. Small pores and vugs are filled with opaline silica.

Thin section: This is a very fine-grained silica rock with some clays; abundant coarse silt-size quartz grains that are commonly subangular; opaque minerals; iron oxide staining; and traces of mica. Laminations are defined by changes in the amount of coarse material present.

Slide no. 75720136, locality WC 1, siltstone, Antrim Plateau Volcanics
Hand specimen: Red-brown micaceous siltstone with poorly defined bedding and minor secondary silicification.

Thin section: Quartz silt has a matrix of fine silica and clay partly replaced by red iron oxides. Remnant grains of mica are present mainly in the finer layers. Rare grains of chert and quartzite are also present.

Slide no. 75720137, locality WC 7, silcrete, stratigraphic position uncertain
Hand specimen: Silcrete with fine to medium-grained quartz in siliceous matrix and minor limonite staining.

Thin section: Fine-grained siliceous matrix with some clay encloses subangular to subrounded (subangular dominant) coarse sand to fine silt-size quartz grains, which mostly have normal extinction although some of the coarser grains are composite. Ferruginous staining is present in patches, and some grains and cavities have chalcedonic coatings.

Slide no. 72720138, locality WC 5, quartzite, undivided Proterozoic
Hand specimen: White to pale fawn fine to medium-grained quartzite with no matrix or cement. Grains are subangular to subrounded, and a faint thin lamination is present throughout. Porosity may be due to leaching of matrix or cement.

Thin section: Subangular to more commonly rounded quartz grains with a few chert and composite quartz grains, ranging from silt to fine sand size, are moderately well sorted and have a mean diameter of about 0.15 mm. Mineralogical sorting is very good; shape sorting is poor to moderate; overgrowths are not common on quartz; and many grains show resorption zones where the silica is being removed and replaced by a brown secondary mineral, perhaps producing the angularity of some grains. Many of the quartz grains, particularly the larger ones, show intensely undulose extinction. Accessory minerals are rare, although some zircon was noted. All the primary matrix has been removed, leaving the rock quite porous, and there has been some replacement by a brown mineral, possibly iron-rich chalcedony, deposited in concentric layers along the empty channels, probably by the lateritization that affected the area. Some of the composite quartz grains appear to have been derived from quartzites, as they have highly undulose extinction and markedly sutured contacts.

Slide no. 75720139, locality WC 5, quartzite, undivided Proterozoic
Hand specimen: Very fine even-grained, medium grey, very hard dense quartzite with some secondary silicification.

Thin section: Grains are subangular to rounded, though subangular to subrounded are most common; the larger quartz grains are better rounded. Their size sorting is moderately good, and mineralogical sorting very good. They are cemented by microcrystalline quartz and many exhibit irregular boundaries caused by resorption of silica; about half have moderately to intensely undulose extinction; overgrowths cement the rock. Sparse rock fragments, quartzite grains, chert, and accessory minerals - including hornblende, zircon, and some mica, probably muscovite - are present.

Slide no. 75720140, locality TE 28, limestone, undivided Montejinni Limestone and Hooker Creek Formation
Hand specimen: Pink to red thinly and regularly laminated hard micaceous limestone, more calcareous along the bedding planes.

Thin section: Microcrystalline equigranular carbonate rock - probably calcite. Bedding is moderately developed and marked by ironstains. Quartz grains, which make up about 2-3% of the rock, are often slightly elongate and - like the subordinate mica grains - lie parallel to bedding.

Slide no. 75720141, locality TE 30, sandstone, Lothari Hill Sandstone
Hand specimen: Very fine-grained, highly porous pale brown silty sandstone; well-bedded and cross-bedded.

Thin section: Red, poorly banded silty sandstone consists of about 70% quartz and 30% matrix. Quartz grains range from silt to fine sand-size, are mainly subangular, have normal to slightly undulose extinction, and some are slightly corroded. Clay minerals, as vug fillings, have continuous extinction, and the matrix is a fine mixture of quartz and clay. Mica, opaque minerals, chert grains, and quartzite fragments are present in small amounts throughout the rock.

Slide no. 75720142, locality TE 32, breccia, undivided Montejinni Limestone and Hooker Creek Formation
Hand specimen: Pink and grey consolidated breccia of rounded to subrounded massive fragments of grey dolomite, with occasional veins of white calcite, in a fine-grained pink calcrete matrix which has abundant pinhole-size voids and is very porous.

Thin section: Breccia of fine-grained equigranular dolomite has a matrix of microcrystalline carbonate which forms about 40% of the rock and contain 3-4% fine angular to rounded quartz grains.

Slide no. 75720143, locality TE 32, dolomite, undivided Montejinni Limestone and Hooker Creek Formation
Hand specimen: Very fine-grained hard massive dolomite with a thin grey weathered crust.

Thin section: The dolomite is ironstained and equigranular, and contains scattered silt grains of fine quartz and rare opaque minerals. No cement or matrix is present and porosity is low.

Slide no. 75720144, locality TE 7, dolomite, undivided Montejinni Limestone and Hooker Creek Formation
Hand specimen: Pink to grey, very fine-grained, very hard dolomite, tight with indistinct lamination.

Thin section: The dolomite is well bedded, comprises equigranular crystals, and contains some silt-size quartz grains. The lamination is defined by opaque minerals.

Slide no. 75720145, locality TE 7, limestone, undivided Montejinni Limestone and Hooker Creek Formation
Hand specimen: Light grey, poorly laminated dolomitic limestone with a subrounded quartzite pebble in it.

Thin section: An interlocking medium-grained network of calcite crystals probably has a moderate dolomite component, and is probably recrystallised. The quartzite pebble contains fine recrystallised quartz grains - of which most show markedly undulose extinction - common opaque grains, and carbonate replacing quartz in many places.

Slide no. 75720146, locality TE 7, dolomite, undivided Montejinni Limestone and Hooker Creek Formation
Hand specimen: Pink to light grey medium-grained massive hard dolomite containing a few small voids.

Thin section: Finely to coarsely crystalline dolomite, but clusters of very coarse crystals have formed as a result of partial recrystallisation; some fine dolomite cement is present in unrecrystallised parts of the rock. Opaque minerals are rare, and iron oxide staining is present along fracture plains.

Slide no. 75720147, locality TE 15, sandstone, Lothari Hill Sandstone
Hand specimen. White fine-grained, slightly porous quartz sandstone with some limonite staining. Bedding is not visible.

Thin section: Quartz grains make up 75% of the rock and are mainly subangular; some angularity is due to secondary solution. Most have normal to slightly undulose extinction, although some are markedly undulose. Muscovite and opaque minerals are present in trace amounts. Up to 25% of the rock is matrix, consisting of clay and fine silica; brown-yellow clay filling cavities has continuous extinction.

Slide no. 75720148, locality TE 14, sandstone, Lothari Hill Sandstone
Hand specimen: Red massive, highly porous, very silty fine-grained sandstone with sparse muscovite; uniform throughout.

Thin section: Subangular quartz grains are set in a matrix of fine silica and clay minerals impregnated with red iron oxides. Quartz grains make up about 75% of the rock; most have normal extinction and moderately good sorting. Rare muscovite and rounded chert grains are present, and clay minerals with continuous extinction have filled or partly filled many cavities. Red iron oxides replace the matrix and also fill fractures in the quartz grains.

Slide no. 75720149, locality TE 26, sandstone, Lothari Hill Sandstone
Hand specimen: White fine-grained, subangular and moderately well-sorted quartz sandstone; some silica cement with slight iron oxide staining.

Thin section: Grains are angular to subrounded but mainly subangular, and most have normal extinction although some are undulose. Minor chert and quartzite fragments and muscovite and plagioclase grains are present, and are better rounded than the quartz grains. The cement consists of very fine-grained silica and clay minerals; reworked clays with continuous extinction have been deposited around the edges of cavities.

Slide no. 75720150, locality TE 4, sandstone, Lothari Hill Sandstone
Hand specimen: Red massive, moderately porous, very fine-grained silty sandstone with large-scale burrows; some leaching along weathered surfaces.

Thin section: Quartz grains make up about 60% of the rock; matrix and minor minerals such as muscovite and opaques about 30%; and pores 10%. Quartz grains are angular to subrounded but mainly subangular; most have an opaque iron oxide coating intruding into the grains along corrosion areas and fractures; and some have a markedly undulose extinction. Chert and composite fragments - probably quartzites - lath-like muscovite grains, and cavity-filling clay minerals with continuous extinction are common. The matrix is fine-grained silica and clays.

Slide no. 75720151, locality TE 34, quartzite, The Granites-Tanami Block
Hand specimen: Grey-green massive, very hard tight quartz with significant secondary silicification and some small quartz veins.

Thin section: The fine to medium and rare coarse quartz grains are strained, and recrystallisation has caused the intergrowth of some grains. Muscovite grains and rock fragments, mostly of quartzite, are present, and opaque grains are abundant. The cement is finely crystalline silica with some clay minerals, and constitutes about 30% of the rock.

Slide no. 75720152, locality TE 34, sandstone, Mount Charles beds, The Granites-Tanami Block

Hand specimen: Grey-green medium to coarse-grained subangular to subrounded, very hard tight quartz sandstone with a silica cement.

Thin section: Moderately well-sorted quartz grains (70%), and rounded to subrounded lithic grain (5%) - mainly quartzite with some granitic and chert fragments - with partial iron oxide coatings, are set in a very fine-grained silica cement with some clay minerals (25%). Quartz veins about 2 mm wide are conspicuous. Compaction has resulted in slight suturing of some grain contacts.

Slide no. 75720153, locality TE 19, quartzite, Mount Winnecke Formation, The Granites-Tanami Block

Hand specimen: Grey to pale mauve, indistinctly laminated, very hard medium-grained quartzite with rare opaques.

Thin section: Interlocking mosaic of quartz grains ranging from 0.2 to 2 mm; all show intensely undulose extinction and markedly sutured grain contacts, and overgrowths are evident. Laths of muscovite and rare heavy minerals (including zircon) and hornblende are present. Recrystallised silica cement makes up about 10% of the rock.

Slide no. 75720154, locality WC 16, quartzite, undivided Proterozoic

Hand specimen: White medium to fine-grained quartzite, in which moderately well-sorted subrounded quartz grains make up almost 100% of the rock; opaques are sparse. It has a poorly defined graded bedding but well-developed cross-bedding, and contains impressions of clay or siltstone casts up to 1 cm diameter.

Thin section: The quartz grains are in the range 0.04 to 0.3 mm and form a mosaic. The larger grains are rounded to subrounded, commonly with overgrowths, and enclosed in a mosaic of finer subangular to subrounded quartz grains with overgrowths, pressure solution features, and straight grain-to-grain contacts. Many grains are shattered, and no sutured contacts are present. Chert fragments, zircon, hornblende, and ?glaucophane grains are rare.

Slide no. 75720155, locality WC 7, chert, undivided Proterozoic
Hand specimen: White to cream, very fine-grained hard chert with rare coarse crystals or grains of quartz.

Thin section: Very fine grains of quartz are set in a microcrystalline matrix, in which rare vugs up to 2 mm wide are filled with strained secondary quartz. Long spicules of possible organic origin made up of secondary quartz are common. The larger quartz grains are up to 0.06 mm in diameter and subangular to subrounded, though mostly subrounded. Narrow elongate muscovite grains, opaque minerals, and scattered rhomb-shaped grains of quartz - probably pseudomorphs after carbonate - are also present.

Slide no. 75720156, locality WC 7, sandstone, undivided Proterozoic
Hand specimen: Brown, well and thinly bedded, slightly porous medium-grained quartz sandstone with significant secondary silicification.

Thin section: Subangular to rounded - though mostly subrounded - quartz grains (80%) have mainly normal but some markedly undulose extinction. Grain-to-grain contacts are straight, and, although there are some solution features, no overgrowths are present. Most of the cement has been removed and partly replaced by a crystalline silica coating on grains and filling in cavities. Minor amounts of plagioclase, muscovite, and rock fragments - mainly of quartzite, with minor chert and acid igneous rocks - are also present.

Slide no. 75720157, BMR Green Swamp Well 6, 30.96 to 31.04 m, sandstone, Hooker Creek Formation
Hand specimen: Fine-grained hard non-friable porous quartz sandstone with common opaque minerals, minor mica, and silica cement.

Thin section: Quartz grains (85%) are subangular (dominant) to subrounded, sorting is moderate, and most grains have normal extinction. Plagioclase grains are similar to the quartz, and rock fragments - mainly of chert but including some quartzite, opaque minerals, and dolomite grains - are common. The matrix is silica and dolomite with very small amounts of muscovite.

Slide no. 75720158, BMR Green Swamp Well 6, 31.93 to 31.98 m, sandstone, Hooker Creek Formation

Hand specimen: Red-brown massive, very fine-grained, highly silty quartzose sandstone with some muscovite. Dark brown micaceous siltstone is present at one end of the specimen.

Thin section: Quartz grains range from coarse silt to fine sand-size, are mainly subangular and moderately well sorted, and some have markedly undulose extinction. Fine grains of plagioclase, dolomite, and muscovite are present, and the larger mica grains show a preferred orientation, probably parallel to bedding. The cement consists of fine-grained quartz and clay minerals with traces of carbonates.

Slide no. 75720159, BMR Green Swamp Well 6, 76.63 to 76.73 m, siltstone, Hooker Creek Formation

Hand specimen: Red and fawn siltstone with indistinct bedding in part, some of which has been intensely disrupted - probably by bioturbation. Red and green fine micaceous beds are also present, and have also been disrupted to some extent. Mica is common in the siltstone, but less abundant in the claystone beds.

Thin section: Coarse subangular quartz silt with abundant silt-size dolomite grains, lath-shaped muscovite grains, and clasts of extremely fine-grained claystone are present. The muscovite grains are commonly parallel to the bedding planes.

Slide no. 75720160, BMR Green Swamp Well 6, 77.11 to 77.26 m, siltstone, Hooker Creek Formation

Hand specimen: Very dark brown siltstone in which the bedding is intensely disrupted in places - possibly due to bioturbation. Where the rock has been leached it is pale grey.

Thin section: Well-bedded coarse silt comprises subangular quartz, abundant muscovite, and minor plagioclase. The muscovite grains have a preferred orientation parallel to the bedding, except where it is disrupted. Much of the rock is heavily impregnated with red iron oxides, and fragments of a red iron-oxide-impregnated claystone are included in the coarser fraction. Opaque minerals are also present.

Slide no. 75720161, BMR Green Swamp Well 6, 143.87 to 144.02 m, siltstone, Hooker Creek Formation
Hand specimen: Light grey siltstone with irregular wavy lamination, some gypsum lenses and cavity fillings, and minor beds of sandy siltstone.

Thin section: Angular to subrounded quartz silt, intergrown in parts, with abundant muscovite and minor chlorite - both forming elongate grains parallel to bedding - and dolomite and plagioclase grains, are set in a matrix of dolomite.

Slide no. 75720162, BMR Green Swamp Well 6, 144.48 to 144.72 m, dolomite, Hooker Creek Formation
Hand specimen: Grey to white fine-grained massive dolomite being replaced in many parts by the gypsum which occupies cavities and veins and in places has inclusions of the host dolomite. About 35% of the rock has been replaced by gypsum, and stylolites are common.

Thin section: Interlocking fine to medium grains of crystalline dolomite with a few fine quartz grains contain veins and vug-fillings of gypsum, commonly with inclusions of the host dolomite. The gypsum is coarsely crystalline and contains trace amounts of fine-grained anhydrite. Brown stains occur along the stylolites.

Slide no. 75720163, BMR Green Swamp Well 6, 77.55 to 77.65 m, siltstone, Hooker Creek Formation
Hand specimen: Light grey-green micaceous siltstone, probably dolomitic, with irregular laminations, some fine sandstone beds, and, in the bottom half of the specimen, abundant small nodules, possibly of dolomite.

Thin section: Siltstone beds contain very coarse silt to fine sand-size subangular quartz grains throughout, and sandstone interbeds contain fine, angular to subrounded grains, mica, and dolomite in a matrix of silica, clays, and dolomite. In both siltstone and sandstone, muscovite grains are aligned parallel to bedding. Fine-grained crystalline dolomite nodules are present in the siltstone. Opaque minerals occur in small amounts throughout the rock.

Slide no. 75720164, BMR Green Swamp Well 6, 145.97 to 146.00 m, dolomite, Hooker Creek Formation
Hand specimen: Very fine-grained medium grey dolomite with abundant black stylolites parallel or subparallel to an indistinct lamination, and numerous small gypsum-filled cavities, many of which are highly elongate.

Thin section: Very finely to very coarsely crystalline dolomite contains fine sand to silt-size quartz grains throughout, and no matrix. Stylolites are marked by concentrations of deep brown to black iron oxides and quartz grains. Gypsum fills irregularly shaped cavities, and includes the host dolomite, quartz, anhydrite, and sparse muscovite grains.

Slide no. 75720165, BMR Green Swamp Well 6, 182.64 to 182.73 m, siltstone, Hooker Creek formation
Hand specimen: Fine-grained grey-green to brown micaceous siltstone with fine wavy discontinous laminae throughout, and a few thin gypsum veins which disrupt some of the bedding.

Thin section: Subangular quartz grains are set in a fine-grained silica and clay matrix heavily impregnated with iron oxides in parts, and muscovite and chlorite grains parallel to bedding but in a random orientation where the bedding is disrupted. The grey-green rock contains dolomite as both matrix and grains. Opaque minerals are common and many tend to have an elongate habit; plagioclase grains are rare; and some claystone laminae with a composition similar to the siltstone are present. A thin gypsum vein cuts the sample and contains some inclusions of the host rock.

Slide no. 75720166, BMR Green Swamp Well 6, 197.21 to 197.36 m, dolomite Montejinni Limestone
Hand specimen: Grey-green very fine-grained dolomite with abundant coarsely crystalline acicular veins of gypsum.

Thin section: The dolomite contains abundant silt-size quartz and common opaque grains. Veins of coarse-grained gypsum containing a little anhydrite and both large inclusions of the host dolomite and quartz grains derived from the dolomite have intensely disrupted the rock.

Slide no. 75720167, BMR Green Swamp Well 6, 199.60 to 199.65 m, siltstone and gypsum, Montejinni Limestone
Hand specimen: Deep brown laminated fine-grained and slightly micaceous siltsone with a vein of acicular gypsum up to 2.5 cm thick which contains inclusions of brown and green siltstone.

Thin section: Fine-grained subangular quartz grains in a matrix of fine silica and clay that has largely been replaced by iron oxide. Minor occasional chert and quartzite fragments are present as coarser grains. Muscovite is plentiful as long thin blade-like grains parallel or subparallel to the lamination, and gypsum is coarsely crystalline and contains inclusions of the host siltstone.

Slide no. 75720168, BMR Green Swamp Well 6, 216.33 to 216.41 m, siltstone, Montejinni Limestone
Hand specimen: Red, well-laminated micaceous siltstone with some paler leached zones, claystone interbeds, and disrupted bedding in places.

Thin section: Fine subangular quartz grains with mainly normal extinction are set in a matrix of fine silica, red iron oxides, dolomite, and clay minerals. Dolomite forms coarser grains, and muscovite grains and abundant aligned parallel to bedding except where it is intensely disrupted. Opaque minerals, and fragments composed of fine silica, clays, and iron oxides, are common, and distributed fairly evenly throughout the rock.

Slide no. 75720169, BMR Green Swamp Well 6, 216.95 to 217.00 m, dolomite, Montejinni Limestone
Hand specimen: Hard massive fine-grained light grey dolomite with abundant small voids, a thin vein of gypsum, and several stylolites.

Thin section: Finely to medium crystalline dolomite is partly recrystallised, and contains minor fine quartz grains, and numerous small irregularly shaped voids, some of which have a gypsum filling and inclusions of dolomite.

Slide no. 75720170, BMR Green Swamp Well 6, 230.27 to 230.35 m, dolomite, Montejinni Limestone
Hand specimen: Grey-green fine-grained dolomite with some gypsum veins and minor voids.

Thin section: The dolomite contains minor silt-size quartz grains and clusters of opaque minerals. Veins of coarsely crystalline gypsum with some inclusions of dolomite and small anhydrite grains fill many small voids.

Slide no. 75720171, BMR Green Swamp Well 6, 230.43 to 230.53 m, dolomite Montejinni Limestone
Hand specimen: Fine-grained light grey dolomite disrupted by gypsum veins, and containing numerous small voids, some of which have white coarsely crystalline gypsum fillings.

Thin section: Very finely crystalline dolomite has patches of coarser recrystallised grains, iron oxide stains along bedding planes in parts of the section, and minor silt-size quartz grains. A substantial amount of dolomite has been replaced by gypsum with abundant inclusions of dolomite, sparse quartz grains, and traces of anhydrite.

Slide no. 75720172, BMR Green Swamp Well 6, 231.34 to 231.42 m, dolomite and gypsum, Montejinni Limestone
Hand specimen: Light grey fine-grained dolomite with several stylolites and abundant small voids - some with a filling of gypsum - and a 3-cm vein of white acicular crystalline gypsum.

Thin section: Fine-grained interlocking crystals of dolomite, and rare dolomite grains up to coarse silt size, contain both abundant small irregularly shaped voids filled with gypsum and inclusions of the host dolomite. The acicular gypsum is coarsely crystalline, and contains rare inclusions of dolomite and anhydrite. Brown ferruginous coatings occur around the edges of some voids, veins, and stylolites.

Slide no. 75720173, BMR Green Swamp Well 6, 244.75 to 244.85 m, dolomite, Montejinni Limestone

Hand specimen: Light grey, finely to coarsely crystalline dolomite wth abundant stylolites forming the boundary between finer and coarser crystals, and some gypsum filling vugs.

Thin section: The coarse crystals have random distribution of the finely crystalline dolomite, which is granular and contains no cement or matrix. Stylolites are common, are marked by dense iron oxide stains, and in places form the contact between coarsely and finely crystalline dolomite. Gypsum forms distinct grains or vug-fillings and often has inclusions of the host dolomite. Opaque minerals are present in trace amounts only.

Slide no. 75720174, BMR Green Swamp Well 6, 245.26 to 245.36 m, dolomite, Montejinni Limestone

Hand specimen: Light grey, very fine-grained dolomite with numerous stylolites throughout. Several large circular structures are present; the core of the largest, which is somewhat coarser than the host rock, has a radius of about 15 mm surrounded by an 8 mm zone of fine-grained carbonate deposited in distinct layers. This is probably an oncolite growing around a nucleus of recrystallised dolomite.

Thin section: The host dolomite is finely to medium crystalline and has some very coarsely crystalline patches and rare opaque minerals. Stylolites are marked by dense iron oxide staining. The core of the oncolite is extremely fine to extremely coarse-grained dolomite, and the outer zone show several concentric layers, indicating various growth stages of the algae.

Slide no. 75720175, BMR Green Swamp Well 6, 260.91 to 261.01 m, dolomite Montejinni Limestone

Hand specimen: Grey-green fine-grained silty dolomite with wavy bedding defined by black material along bedding planes, and glauconite concentrated in the coarser-grained parts of the rock.

Thin section: Fine to medium-grained crystalline dolomite (70%) forms a network of interlocking grains which includes evenly distributed subangular fine quartz sand grains (25%). Traces of muscovite and some rare plagioclase grains are present, and glauconite (5%) is distributed throughout the thin section. Opaque minerals occur in clusters as though in a pyrite nodule, and in glauconite grains. Coarse dolomite is present as cavity fillings.

<u>Slide no. 75720176</u>, BMR Green Swamp Well 6, 262.23 to 262.36 m, siltstone, Montejinni Limestone
Hand specimen: Grey-green sandy siltstone with discontinuous lamination; mainly quartzose, slightly glauconitic and micaceous.

Thin section: Coarse silt to fine sand-size quartz grains - ranging from angular to subrounded, but mainly subangular - and minor plagioclase and dolomite grains of similar size and shape, are set in a dolomite and very fine-grained silica matrix. Glauconite is present in trace amounts as distinct grains; opaque minerals are common and randomly distributed; and muscovite occurs as elongate grains but is not abundant.

<u>Slide no. 75720177</u>, BMR Green Swamp Well 6, 262.84 to 263.04 m, sandstone, Montejinni Limestone.
Hand specimen: Interbedded fine-grained quartzose grey-green sandstone and dark grey siltstone. Siltstone beds and laminae are thin and some are irregular. Glauconite is common.

Thin section: The sandstone interbeds consist mainly of subangular fine-grained quartz with abundant dolomite and glauconite grains and sparse sand-size plagioclase and muscovite grains in a cement of finer-grained quartz, dolomite, and clay minerals; fragments of quartzite and chert, and opaque minerals, are present in trace amounts only. The siltstone layers consist of fine-grained quartz, abundant mica aligned parallel to the bedding planes, and sparse glauconite and carbonate.

<u>Slide no. 75720178</u>, BMR Green Swamp Well 6, 275.74 to 275.84 m, siltstone and sandstone, Montejinni Limestone
Hand specimen: Well-bedded grey siltstone and subordinate lighter grey, very silty fine sandstone in beds and laminae 1 mm to 20 cm thick. Mica is common throughout.

Thin section: Very fine-grained subangular quartz grains, and minor dolomite, muscovite aligned parallel to bedding, and opaque minerals with random distribution, are set in a clay matrix. Bedding is defined by slight changes in grainsize.

<u>Slide no. 75720179</u>, BMR Green Swamp Well 6, 293.22 to 293.34 m, dolomite, Montejinni Limestone
Hand specimen: Grey to brown, thinly laminated silty dolomite with small

pellets of a white mineral throughout. A gypsum vein 1.5 cm thick in the lower half of the specimen is coarsely crystalline and contains inclusions of the host rock.

Thin section: Fine-grained crystalline dolomite with silt-size quartz grains abundant in some parts and a few mica grains preserved, concentrated in the silty fraction. Small rounded pellets of extremely fine-grained dolomite are abundant. Mica is present as elongate grains parallel to bedding, and gypsum fills pore spaces and contains traces of anhydrite. Opaque minerals have a random distribution, and faint brown iron oxide stains are present around a few dolomite pellets.

Slide no. 75720180A, BMR Green Swamp Well 6, 293.83 to 293.88 m, dolomite, Montejinni Limestone
Hand specimen (whole sample): Very fine-grained grey dolomite with abundant gypsum veins up to 5 mm wide.

Thin section: The dolomite contains fine grains of quartz and traces of muscovite. A thick vein of coarsely crystalline gypsum, and numerous irregular fractures with gypsum fillings, contain inclusions of dolomite. Very fine opaque minerals occur throughout the dolomite, and much larger opaque and anhydrite grains are included in the gypsum fillings.

Slide no. 75720180B, BMR Green Swamp Well 6, 293.88 to 294.13 m, dolomite, Montejinni Limestone
Hand specimen (whole sample): Very fine-grained grey dolomite with numerous gypsum veins.

Thin section: Many of the gypsum veins contain inclusions of anhydrite and the host dolomite. Some patches in the dolomite are slightly coarser-grained and contain quartz grains. Opaque minerals are common and have a random distribution.

Slide no. 75720181A, BMR Green Swamp Well 6, ca 294.14 m, dolomite, Montejinni Limestone
Hand specimen: Very fine-grained grey-green dolomite intersected by a thin gypsum vein; small voids also filled with gypsum.

Thin section: The dolomite is uniformly finely crystalline and has opaque minerals throughout, many of which have a cubic shape indicative of pyrite. The gypsum vein and gypsum cavity fillings are coarsely crystalline, enclosing fragments of the host dolomite and abundant small grains of anhydrite.

Slide no. 75720181B, BMR Green Swamp Well 6, 294.36 m, gypsum, Montejinni Limestone
Hand specimen: A crystalline mass of dark blue-black to clear gypsum with rare grains of pyrite and some of the host dolomite included.

Thin section: The gypsum is coarsely crystalline, and contains minor amounts of fine-grained anhydrite, rare pyrite grains, and some ragged remnants of the host dolomite preserved as inclusions.

Slide no. 75720182, BMR Green Swamp Well 6, 294.52 to 294.62 m, dolomite and gypsum, Montejinni Limestone
Hand specimen: Grey-green very fine-grained dolomite fragments in a slightly coarser matrix (75%) with abundant veins of gypsum, normally about 0.5 cm thick but up to 1 cm where two or more veins intersect.

Thin section: The dolomite is finely crystalline, and contains some fine quartz grains, rare opaque minerals, and several veins of coarsely crystalline gypsum, most with small grains of anhydrite and dolomite inclusions.

Slide no. 75720183, BMR Green Swamp Well 6, 310.20 to 310.37 m, dolomite, Montejinni Limestone
Hand specimen: Green, fine-grained massive dolomite with abundant irregularly shaped bodies of highly siliceous dolomite, each with a white rim around it. Small cavities are partly filled with crystalline quartz.

Thin section: Non-siliceous microcrystalline dolomite is cut by a siliceous body comprising very fine-grained silica with some dolomite grains and dolomite rhombs. Veins of coarse-grained dolomite are present, but not abundant. Numerous unidentifiable organic fragments are present, together with one ?trilobite fragment. Opaque minerals are sparse.

Slide no. 75720184, BMR Green Swamp Well 6, 309.39 to 309.52 m, dolomite Montejinni Limestone
Hand specimen: Dark grey coarsely crystalline dolomite, massive with some stylolites, contains abundant cavities filled with white dolomite and silica,

and round white recrystallised grains which may represent organic remains.

Thin section: The dolomite forms finely to coarsely crystalline interlocking grains with no matrix. The numerous stylolites are outlined by a dark brown to opaque iron oxide. Most cavities have been filled with coarsely crystalline dolomite or medium-grained quartz. Opaques are common.

Slide no. 75720185, BMR Green Swamp Well 6, 313.72 to 313.80 m, dolomite, Montejinni Limestone
Hand specimen: Very fine-grained grey dolomite, massive, except in the top 0.5 cm of core, where a thin lamina is developed.

Thin section: The dolomite is uniform throughout except for one band which contains some slightly coarser quartz grains. Opaque minerals are common and randomly distributed. A thin vein of coarsely crystalline carbonate is present.

Slide no. 75720186, BMR Green Swamp Well 6, 344.09 to 334.19 m, dolomite, Montejinni Limestone
Hand specimen: Dark to light grey fine-grained dolomite, finely laminated on the top and bottom, but a 4-cm bed in the middle is slightly coarser-grained at its base. The finely laminated dolomite is more compact around the uneven base of this bed.

Thin section: This fine-grained dolomite is silty and coarsely crystalline, and has a lamination defined by ferruginous material and muscovite. Opaque minerals are sparse and randomly distributed. Cavities are irregular and filled with quartz and coarsely crystalline dolomite.

Slide no. 75720187, BMR Green Swamp Well 6, 336.27 to 336.32 m, dolomite, Montejinni Limestone
Hand specimen: Fine-grained light to dark grey well-bedded dolomite with thin light and thicker dark laminae.

Thin section: The dolomite forms an interlocking network of grains, among which opaque minerals are common and randomly distributed throughout. Coarsely crystalline dolomite fills veins.

<u>Slide no. 75720188</u>, BMR Green Swamp Well 6, 337.08 to 337.11 m, dolomite, Montejinni Limestone.
Hand specimen: Very fine-grained dark to light grey, colour-laminated dolomite.

Thin section: The dolomite is crystalline and uniform throughout. Opaque minerals are common and randomly distributed. Some cavities are filled with quartz and coarser-grained dolomite.

<u>Slide no: 75720189</u>, BMR Green Swamp Well 6, 184.40 to 184.51 m, siltstone, Hooker Creek Formation
Hand specimen: Dark brown micaceous siltstone with abundant fine, discontinuous laminae of dark brown claystone. Some bedding has been intensely disrupted, probably as a result of bioturbation.

Thin section: Subangular to subrounded quartz silt with normal extinction is accompanied by small amounts of quartzite and chert rock fragments, and abundant dolomite. Lath-like grains of muscovite are common, and parallel to the bedding where it is not disrupted. Iron oxide staining replaces the matrix in places. Very fine-grained claystone fragments are heavily impregnated with red iron oxides, and coarser-grained opaques are more common in the coarser sediment. Minor amounts of gypsum have filled some cavities.

<u>Slide no. 75720190</u>, BMR Green Swamp Well 6, 146.15 to 146.30 m, dolomite, Hooker Creek Formation
Hand specimen: Light grey dolomite with wavy bedding, probably a remnant algal structure. Gypsum fills small vugs and partings parallel to bedding.

Thin section: Fine to coarse-grained crystalline dolomite has well-developed bedding in places, defined by dark ironstained bands and laminae with a very high quartz silt content. A large part of the section is partly recrystallised, and has gypsum deposited in it, obliterating all traces of bedding. Gypsum also fills cavities and contains abundant inclusions of dolomite. Opaque minerals are present in small amounts.

GEOLOGY OF THE WISO BASIN

NORTHERN TERRITORY

1980

SCALE 1 : 1 000 000

0 20 40 60 80 100 KILOMETRES

Lambert Conformal Conic Projection, standard parallels 16° 00′ and 20° 00′

Published by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development and Energy. Issued under the authority of the Minister for National Development and Energy. Base map compiled by BMR from 1:250 000 Planimetric Series of the Division of National Mapping, Department of National Development and Energy from aerial photography at 1:50 000 scale.

Compiled 1978 by P. J. Kennewell, G. Matveev from maps at 1:1 000 000, 1:500 000 and 1:250 000 scale included in the following publications: Smith, & Milligan; 1964; Milligan, Smith, Nichols, & Doutch, 1966; Smith, 1970; Mendum, 1972; Randal, 1973; Huleatt, 1977, 1978; Kennewell, 1977, 1978; Sweet, 1977; Kennewell, & Offe, 1978; Offe, 1978; Offe, & Kennewell, 1978; Blake, Hodgson, & Muhling, 1979
Gravimetry 1977 by Geophysical Branch, BMR
Design by Cartography Section, BMR
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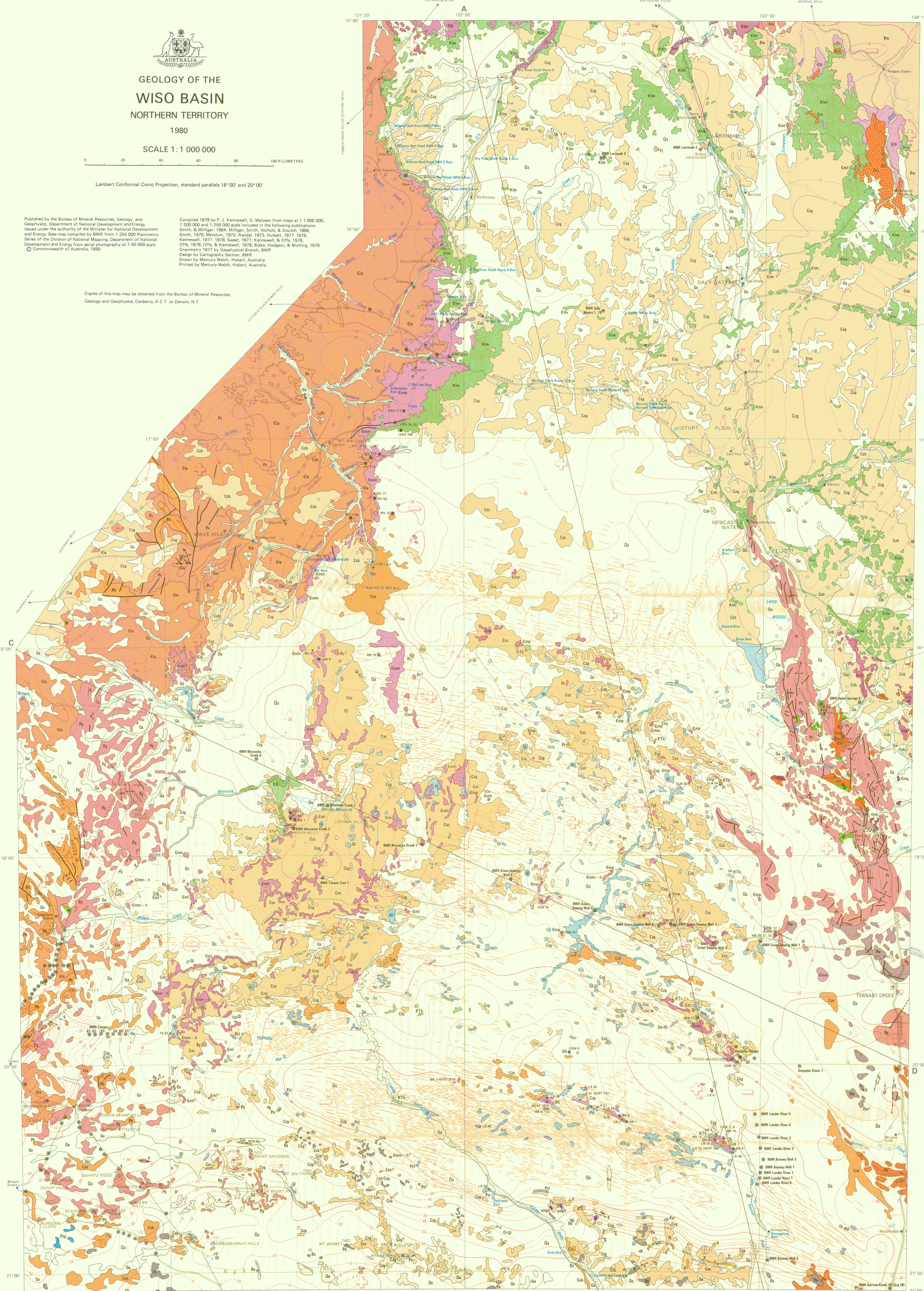
Copies of this map may be obtained from the Bureau of Mineral Resources, Geology and Geophysics, Canberra, A C T or Darwin, N T



CAINOZOIC	QUATERNARY		Qa	Sand, silt, clay, gravel: alluvial
			Qs	Sand; minor silt, clay: mainly aeolian
			Ql	Sand, silt, clay, evaporites: lacustrine
			Czb	Sand, silt, clay: black soil
			Czc	Sand, silt, clay, gravel: colluvial
			Czg	Gravel, sand, silt, clay; residual gravel generally developed over laterite crust; some laterite outcrops
			Czk	Limestone, dolomite, sandy in parts, chalcedonic concretions: calcrete
			Czs	Medium, well sorted, well rounded sandstone
	TERTIARY	Birdum Creek beds	Ti	Limestone, some chert
		Camfield beds	Tc	Conglomeratic limestone, chalcedonic limestone, calcareous sandstone, siltstone, conglomerate at base
		Brunette Limestone	Tb	Chalcedonic limestone, chert nodules, chalcedony, sandstone
MESOZOIC	LATE CRETACEOUS OR EARLY TERTIARY		KTc	Laterite conglomerate, cemented by iron oxide
		Buchanan Hills beds	KTb	Very fine to coarse, poorly sorted, angular sandstone
	LATE JURASSIC TO EARLY CRETACEOUS		M	Undivided sandstone, siltstone; rare cobble and boulder conglomerate
		Mullaman beds	Klm	Saccharoidal sandstone, pebble and cobble conglomerate, claystone, siltstone, medium sandstone, micaceous siltstone and claystone: probable lacustrine and marine
PALAEOZOIC		Pedestal beds	Pzp	Sandstone; minor conglomerate, shale, siltstone
		Lake Surprise Sandstone (WISO BASIN SEQUENCE)	Pzl	Very fine to medium, well rounded, well sorted sandstone, with silt and clay matrix in parts
	ORDOVICIAN	Hanson River beds (WISO BASIN SEQUENCE)	Oh	Sandstone, siltstone, mudstone, claystone, dolomite, limestone
	CAMBRIAN TO ORDOVICIAN	Jinduckin Formation (DALY RIVER BASIN SEQUENCE)	€Oj	Sandstone, siltstone, marl, carbonate rocks
	MIDDLE CAMBRIAN (TEMPLETONIAN) TO LATE CAMBRIAN	Point Wakefield beds (WISO BASIN SEQUENCE)	€mp	€mp: Undivided €mp₁, €mp₂
			€mp₂	Fine, angular, well sorted sandstone, red-brown, laminated claystone (Solid geology only)
			€mp₁	White calcareous claystone, silty in parts (Solid geology only)
	MIDDLE CAMBRIAN (ORDIAN)	Lothari Hill Sandstone (WISO BASIN SEQUENCE)	€ml	Fine, subrounded to subangular sandstone, poorly sorted and dolomitic in parts, grading to clayey siltstone, claystone; rare chert, dolomite
		Hooker Creek Formation	€mh	Dolomitic to slightly dolomitic red brown laminated siltstone, micaceous in parts, finely crystalline dolomite, fine to very fine sandstone, dolomitic in parts; rare calcareous siltstone, claystone
			€mm – h	Dolomite; rare sandstone, siltstone
		Montejinni Limestone	€mm	Limestone, partly dolomitic, partly stromatolitic, calcareous mudstone
		Anthony Lagoon beds (GEORGINA BASIN SEQUENCE)	€my	Sandstone, dolomitic siltstone, dolomite, dolomitic limestone with chert nodules
		Tindall Limestone	€mt	Limestone, dolomitic limestone, siltstone
		Gum Ridge Formation	€mg	Fossiliferous siltstone, chert, silicified limestone; some sandstone, leached calcareous sandstone
	EARLY CAMBRIAN	Antrim Plateau Volcanics	€la	Tholeiitic basalt; minor agglomerate, sandstone, siltstone, chert
		Helen Springs Volcanics	€lh	Tholeiitic basalt; minor sandstone, breccia
		Nutwood Downs Volcanics	€ln	Basalt, feldspathic sandstone
		Bukalara Sandstone	€lb	Sandstone; minor shale
	ADELAIDEAN TO EARLY CAMBRIAN	Central Mount Stuart Formation	P€s	Arkose, quartz sandstone and greywacke, siltstone, dolomite; minor silty sandstone, pebble conglomerate. Section and rock relationship diagram only
PROTEROZOIC	ADELAIDEAN	VICTORIA RIVER SEQUENCE	Pv	Sedimentary rocks
	CARPENTARIAN TO ADELAIDEAN	BIRRINDUDU BASIN SEQUENCE	Pb	Sedimentary rocks; minor acid volcanics, granophyre, granite, acid porphyry, gabbroic rocks
	CARPENTARIAN	McARTHUR BASIN SEQUENCE	Pm	Sedimentary rocks
		Hatches Creek Group	Ph	Sandstone, pebble conglomerate, greywacke, siltstone, shale, acid and basic lava
		Tomkinson Creek beds	Pt	Sandstone; minor siltstone, pebble conglomerate
	EARLY PROTEROZOIC	Warramunga Group	Pw	Sedimentary rocks, tuff, acid volcanics, intrusive rocks
		THE GRANITES – TANAMI BLOCK ROCKS	Pg	Sedimentary rocks, metamorphosed in part, acid and basic volcanics, tuff
		ARUNTA BLOCK ROCKS	Pa	Metaquartzite, schistose metasandstone, mica schist, granite, hornfels

Geological boundary

Anticline, Syncline – showing trend of plunge

Fault

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

Strike and dip of strata

Vertical strata

Trend-line; airphoto interpretation

V 820 Macrofossil locality; VRD 1 Microfossil locality – with reference number

× L22 Locality described in text

Brecciated vein quartz

Plug; dl – dolerite, amph – amphibolite

BMR stratigraphic hole

Bore; Abandoned bore – for details see appendix 1 in Randal (1973)

pa Position approximate

Highway

Road

Vehicle track

Railway with station

Airport

Landing ground

Town

Settlement

Homestead

Trigonometrical station

1603 Elevation in metres

Sand dunes

Gravity contour and value

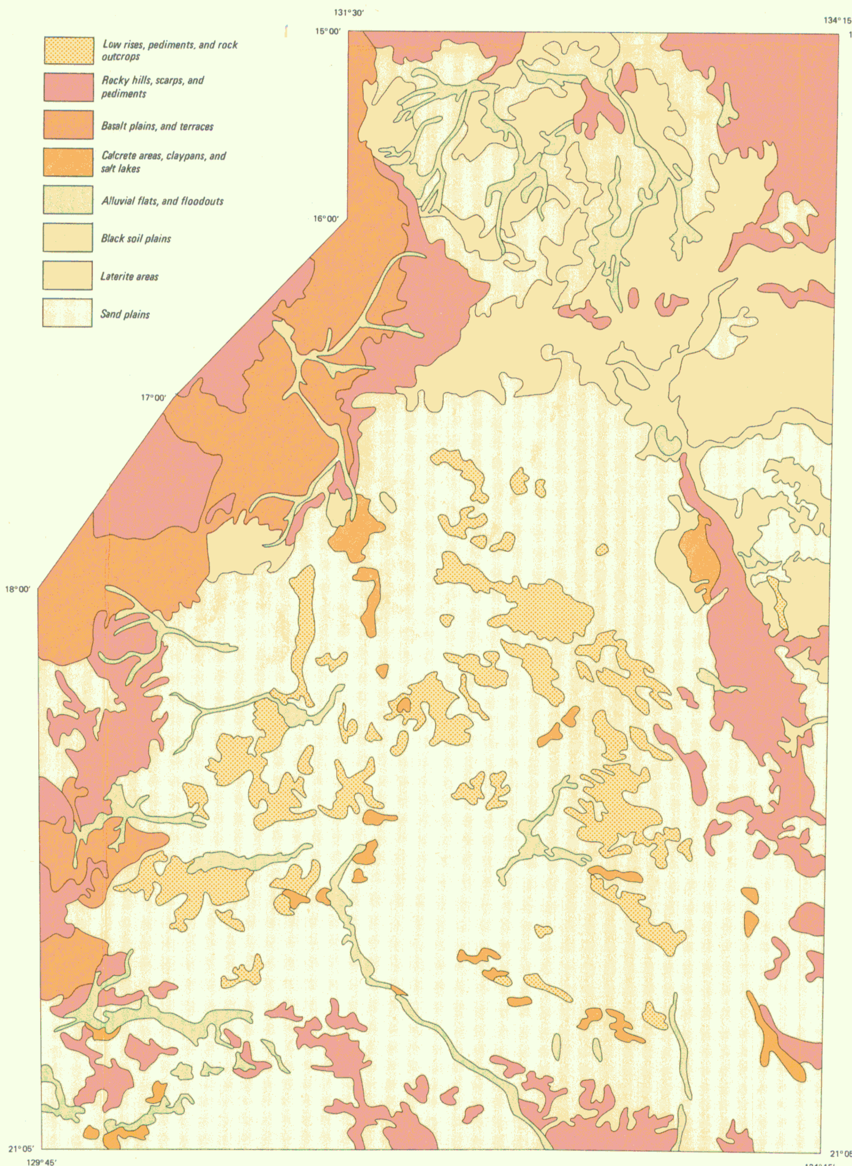
Gravity anomaly – relative high

Gravity anomaly – relative low

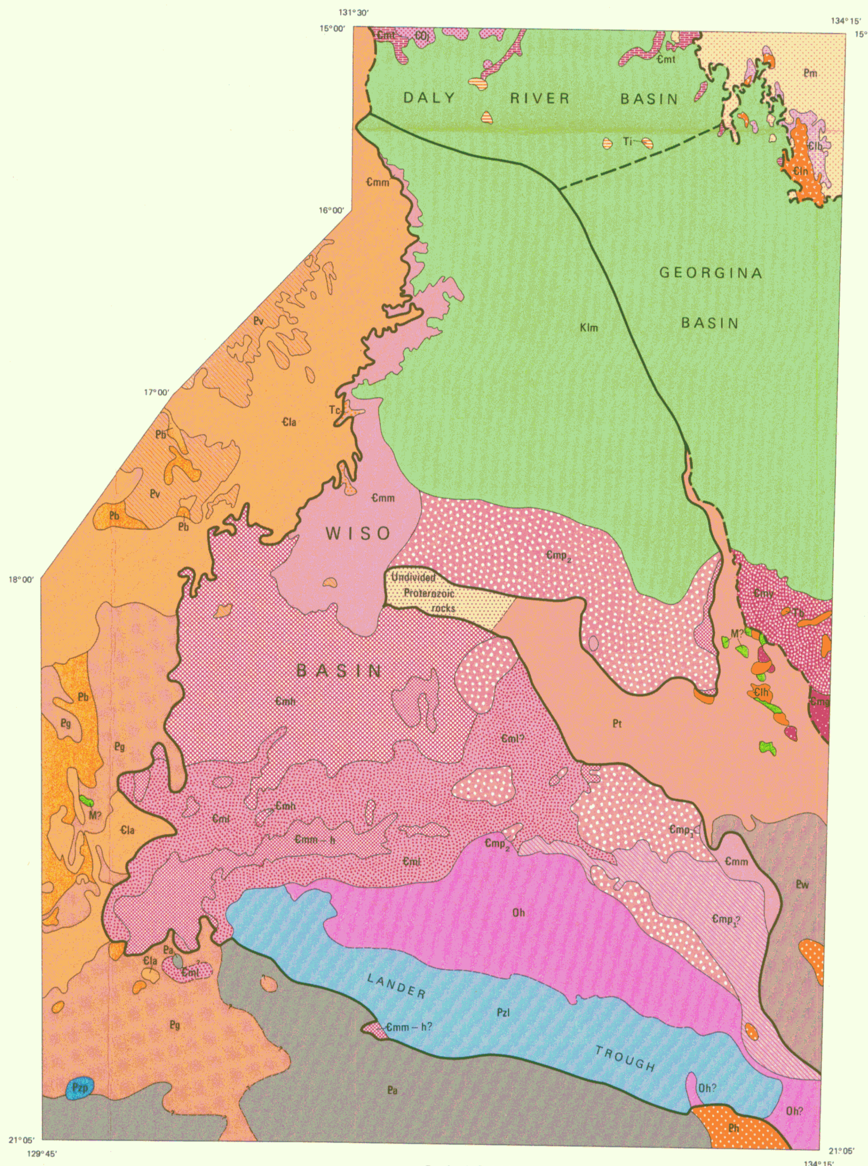
For the calculation of Bouguer anomalies 2.2 g/cm³ has been adopted as an average rock density

Reconnaissance surveys only, average station spacing 11 km

PHYSIOGRAPHY



SOLID GEOLOGY



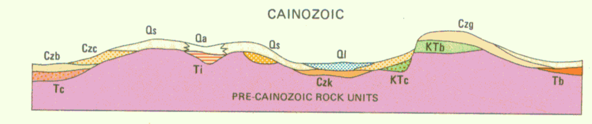
Scale 1:3 000 000

Margin of Wiso Basin

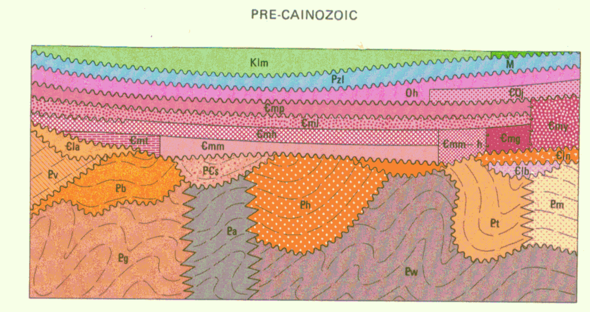
Margin of adjoining Palaeozoic Basins

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS

CAINOZOIC



PRE-CAINOZOIC



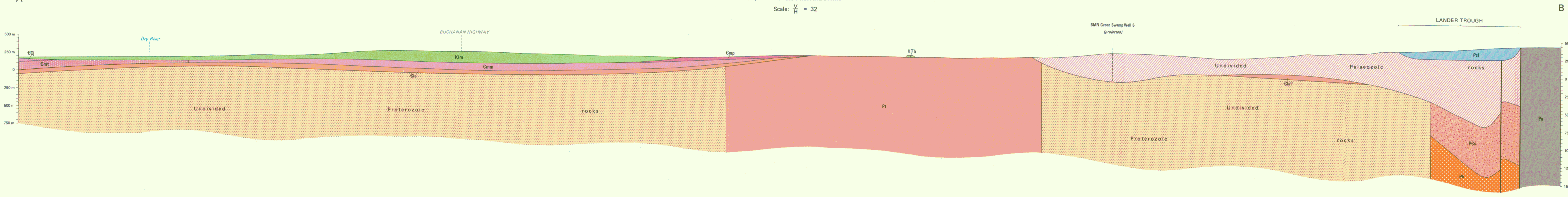
Unconformity

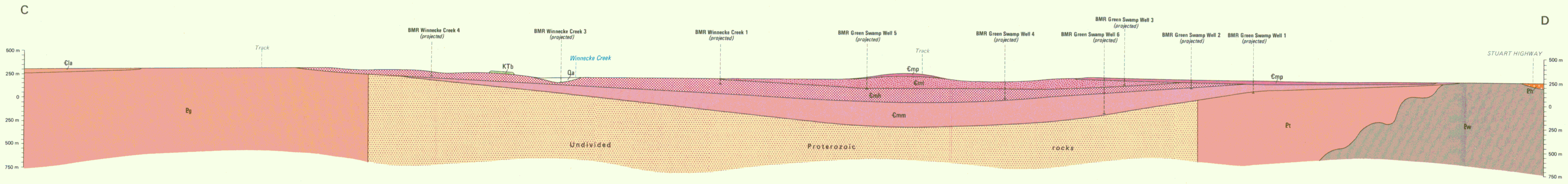
Facies change

SCHEMATIC SECTIONS

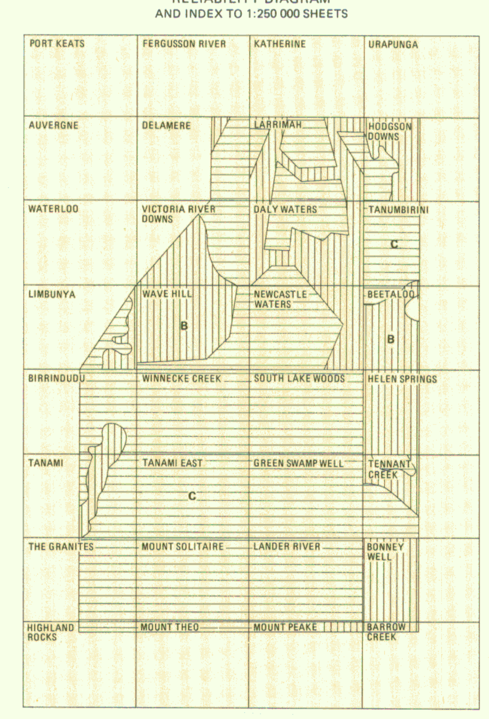
Superficial Cainozoic sediments omitted

Scale: H/V = 32





RELIABILITY DIAGRAM AND INDEX TO 1:250 000 SHEETS



Geology: B Detailed reconnaissance: numerous traverses, airphoto interpretation

C General reconnaissance: few traverses, airphoto interpretation

LOCALITY MAPS