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EXPLANATORY NOTES TO ACCOMPANY GORDON DOWNS 1:250,000 SHEET SE 52-10, WESTERN AUSTRALIA

Compiled by

J.W. Smith

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1:250,000 SHEET - SE 52-10

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EXPLANATORY NOTES TO ACCOMPANY THE GORDON DOWNS 1:250,000 SHEET SE/52-10

INTRODUCTION

The Gordon Downs 1:250,000 Sheet area lies between latitudes 18° and 19°S and longitudes 127°30' E and 129°00' E in the north-eastern part of Western Australia. The eastern edge of the Sheet area borders the Northern Territory. Halls Creek is the only town and is situated in the north-west part of the Sheet area. It is about 380 miles and 250 miles respectively from the ports of Derby and Wyndham.

The European population of Halls Creek is about 160; the rest of the European population in the Sheet area, totalling about 40, live at Flora Valley, Gordon Downs, Nicholson, Ruby Plains and Moola Bulla cattle stations. Semi-permanent habitations also exist at Old Halls Creek township, about 7 miles east of the present town, Koongie Station, Sophie Downs Station, Elvire Homestead, Palm Springs, Duffers Mine, Golden Crown Mine and a mine north-west of Ruby Plains Homestead. Halls Creek, which was originally a gold mining centre, is now a small supply centre for cattle stations in the surrounding district.

The two main roads in the area are the Great Northern Highway joining Derby and Wyndham, which passes through Halls Creek, and a road from Halls Creek to Nicholson Station which continues to join the Stuart Highway in the Northern Territory. Another well-used road links Ruby Plains Station and stations to the south to the Great Northern Highway. The eastern part of the Sheet area is well served by roads between stations.

Air flights connect Halls Creek with Perth and Darwin at least once weekly. The major stations are also visited weekly by a flight which connects Wyndham with Alice Springs in the Northern Territory.

The rainfall of the area averages about 17 inches a year and falls mainly in the period December to February - known locally as the "wet".

Aerial photographs and maps available for the area include:-
Air photographs at a scale of 1:50,000 (Gordon Downs Sheet SE/52-10).
Photomosaics at 1 inch to 1 mile and 1 inch to 4 miles scale obtainable from the Department of Lands and Surveys, Perth, Western Australia.
1 inch to 4 miles scale planimetric map prepared by the Mapping Branch, Department of Lands and Surveys, Perth, Western Australia.

PREVIOUS INVESTIGATIONS

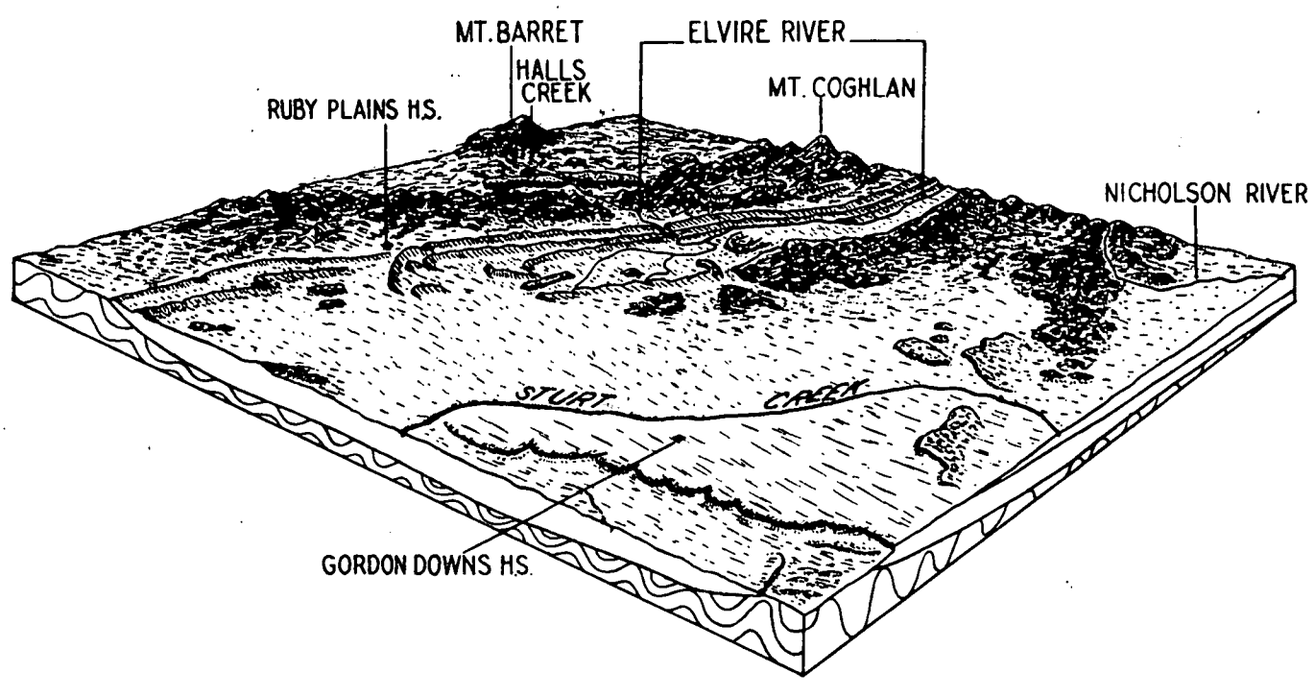
The first geological investigations in the area were made by Hardmann (1883, 1884, 1885) in 1883 and 1884 in the Halls Creek - Flora Valley Homestead area extending on to the south part of the Dixon Range 1:250,000 Sheet area immediately to the north. The discovery of alluvial gold by Hardmann in the Halls Creek area led to a gold rush and mining activity continued until nearly the end of the nineteenth century. The gold bearing area was surveyed by Woodward (1891).

Wade (1924) visited the area and Finucane (1939) mapped the mines and the adjacent geology. Edwards & Clarke (1940) made a special study of the Antrim Plateau Volcanics. Traves (1955) contributed greatly to the knowledge of the geology of the Ord-Victoria region during a land use survey conducted by the Land Research and Regional Survey Section of C.S.I.R.O. in 1949 and 1952, and Harms (1959) made an appraisal of the whole Kimberley region. Ruker (1961) mapped an area around Saunders Creek and subdivided the Halls Creek Metamorphics, and his nomenclature, where practical, has been used in this report.

PHYSIOGRAPHY

A physiographical sketch of the area is shown in Figure 1.

Fig. 1



PHYSIOGRAPHICAL SKETCH GORDON DOWNS 1:250,000 SHEET

E52/10/10

Bureau of Mineral Resources, Geology and Geophysics, April 1963. To accompany Record No. 1963/

Traves (1955) divided the Ord-Victoria region into several physiographic units of which three cover the Gordon Downs Sheet area:-

a) Halls Creek Ridges
b) Ord Basin
c) Sturt Block.

(a) The Halls Creek Ridges occupy the western part of the Sheet area and include the outcropping areas of the Lamboo Complex and Albert Edward Group and the main belt of the Halls Creek Metamorphics. The altitude of the country ranges from 1000 to 2227 feet at Mount Barret.

The Lamboo Complex, on the Sheet area forms the lowest country, with low rounded rises to 100 feet high. South and south-west of Halls Creek, laterite caps granite and forms flat-topped hills. The Halls Creek Metamorphics are strongly dissected in the north and resistant formations, such as the Mcola Bulla Formation and the Saunders Creek Formation, form strike ridges up to 400 feet high. Otherwise the country consists of either rough irregular hills up to 300 feet high which are mainly composed of basic rocks of the Biscay Formation or "closely-spaced" dissected hogsbacks of the Olympio Creek Formation which are rarely over 100 feet high. In the south of the area the relative elevation of the country is less and the most prominent ridges (which consist of basic rocks of the Biscay Formation) are about 150 feet high. On the west side of the Halls Creek Ridges the Upper Proterozoic Albert Edward Group forms north-north-east trending cuestas that have west-facing scarps. The two most prominent ridges, formed by the Mount Kinahan Formation and the Mount Forster Sandstone are up to 400 feet above the surrounding country. South and south-east of Flora Valley Homestead the country is low lying with the exceptions of the strike ridge of the Nyuless Sandstone and flat-topped mesas of the Tertiary Lawford Beds. In the south of the Sheet area the prominent feature is the strike ridges of the Mount Forster Sandstone some 250 feet high, other units tend to form low discontinuous strike ridges.

(b) The Ord Basin occurs in the northern portions of the Sheet area and is situated west of the Halls Creek Ridges within the drainage system of the Ord River. This area of the Ord Basin is, in fact atypical. In the west where the dip is greatest the Antrim Plateau Volcanics form very rough-weathering discontinuous strike ridges up to 300 feet high, eastwards where the dip flattens mesas to 50 feet high are the common land form. In two areas the Headleys Limestone subhorizontally overlies the Antrim Plateau Volcanics forming a small scarp up to 30 feet high.

(c) The Sturt Block occupies the rest of the Sheet area and consists of a mainly soil-covered, elevated plateau. In the north the cover consists of black soil with some lateritic soil and in the south it is mainly sandy.

Mesas and plateaus up to 100 feet high of the Gardiner Formation and the Antrim Plateau Volcanics, the latter often with a lateritic cap, occur in the east of the area. In the south-east of the Sheet area the Gardiner Formation forms an arcuate ridge trending roughly west with a scarp on the south side about 100 feet high. Low rises of Halls Creek Metamorphics and isolated low ranges of the Gardiner Formation occur south of the scarp. West of this arcuate ridge low ridges of the Mount Kinaham Formation rise to 50 feet above the surrounding plains.

The Gordon Downs Sheet area is situated at the headwaters of the large drainage systems of the Ord, the Fitzroy and the Sturt Rivers. The Ord and the Fitzroy drain northwards and westwards respectively to the sea and the Sturt drains inland southwards. Rivers of the Fitzroy System, mainly the Margaret River and its tributaries drain the lower western part of the Halls Creek Ridges. They usually have shallow sandy river beds; waterholes are rare. The Ord River System whose principal tributary on the Sheet area is the Elvire River, drains the rest of the Halls Creek Ridges, with the exception of south of Ruby Plains, and the Ord Basin. The Turner and Nicholson Rivers drain most of the eastern part of the Ord Basin on the Sheet area. Permanent water holes exist along the Elvire River and its tributaries, particularly where they cut through the scarps formed by the Albert Edward Group. The Sturt System is characterised by flat broad senile drainage, particularly the Sturt River itself which is a mile wide in places. Scattered shallow water holes are not permanent.

STRATIGRAPHY

The stratigraphy and distribution of the units is summarised in Table 2. The Lower Proterozoic Halls Creek Metamorphics are intruded by the Lower Proterozoic Lamboo Complex. These are unconformably overlain by an Upper Proterozoic sedimentary succession (the Albert Edward Group and Gardiner Formation) which is itself unconformably overlain by the Lower Cambrian (?) Lacy Creek Formation and Antrim Plateau Volcanics. The Headleys Limestone, the basal unit of the Cambrian Hardmann Basin sequence cropping out on the Dixon Range Sheet area extends southwards on to the Gordon Downs Sheet area where it overlies the Antrim Plateau Volcanics. Sandstone overlying the Antrim Plateau Volcanics may be related to the Elder Sandstone occurring in the Dixon Range Sheet area. Thin Tertiary (?) sediments occur as scattered outcrops.

LOWER PROTEROZOIC

Halls Creek Metamorphics.

The Halls Creek Metamorphics crop out mainly in the east Kimberleys in a north-north-east trending belt which strikes across the western part of the Gordon Downs Sheet area. The linear distribution and the nature of

the rocks of the Halls Creek Metamorphics suggest this belt was a zone geosynclinal deposition and therefore the term Halls Creek Geosyncline will be used. They also occur on the Sheet area in the extreme south-east and as inliers within the Lamboo Complex.

The rocks of the Halls Creek Metamorphics consist of sheared greywacke, sandstone, conglomerate, arkose, limestone, marble, calc-silicate rocks, slate, phyllite, schist, and acid to basic volcanics (with contemporaneous basic sills). Metamorphism is low grade and usually of the greenschist facies; rarely andalusite and actinolite schists occur. Inliers in the Lamboo Complex occasionally include garnet-mica schist and grossularite-wollastonite schist.

The Metamorphics have been divided into six formations of which the top unit - the Moola Bulla Formation - is unconformable on the rest. The middle two units - the Biscay and the Olympio Creek Formations - occupy most of the outcrop area.

The Ding Dong Downs Formation, the oldest unit, crops out in the core of two anticlines in the Saunders Creek area. It consists of epidotised amygdaloidal basalt with sheared albitised rhyolite, sheared greywacke, mica schist and slate. Structure within the unit is complex and its relationship to the overlying Saunders Creek Formation is not definite although they appear to be conformable. No thickness can be estimated for the unit.

The Saunders Creek Formation, which also only occurs in the two anticlines in the Saunders Creek area, consists of cross-bedded feldspathic sandstone, quartz sandstone with minor slate. Pebble conglomerate bands with sub-angular fragments of quartz and sericitised acid volcanics up to 5 feet thick but usually about 1 foot thick, occur in the lower part of the unit. Heavy minerals are common in the matrix and include thorogummite (Ruker, 1961), a silicate mineral containing uranium.

The unit thins markedly to the south-east and this, together with the fact that the conglomerate only occurs in the Saunders Creek area, suggests derivation of the Formation from the north-west. It is about 600 feet in the Saunders Creek area and about 100 feet thick in the eastern anticline.

The Biscay Formation is composed of acid to basic volcanics, sheared greywacke, slate, limestone, limestone conglomerate and calc-silicate rocks. The dominant rock is a fine to medium-grained basalt or dolerite, often porphyritic in feldspar; some of the basic bands are undoubtedly flows, others are probably contemporaneous sills. Acid and intermediate volcanics occur rarely in the north of the area but to the south and west of the Old Halls Creek Fault intermediate volcanics are commonly interbedded with basic volcanics in the core of the main anticlinorium (See Structure). Limestone in the formation occurs mainly towards the top of the unit e.g. the Duffers Limestone Member.

The thickness of the Biscay Formation is not known. It appears to thin over the western anticline in which the Ding Dong Downs Formation crops out. Thinning continues rapidly eastwards and the unit, which is about 2000 feet thick to the east of the anticline, is absent at the northern end of the eastern anticline.

The Olympio Creek Formation is mainly composed of sheared greywacke and slate with subsidiary sheared sandstone, limestone, limestone breccia, acid to basic volcanics, and basic sills.

The greywacke and slate in most places rhythmically alternate in bands usually one to two feet thick; in places, such as north-west of Mount Kinahan and south-west of Ruby Plains Homestead, slate is absent. Many of the greywacke bands are graded and show sedimentary structures, such as load casting, micro cross-bedding, current ripple marking etc., which are common in greywacke sequences deposited by turbidity current. Current direction could not be determined (on the northerly adjacent Dixon Range Sheet area fine conglomerate occurring on the east side of the main belt of outcrop may suggest a source direction to the east with the sediments moving south down the Halls Creek Geosyncline).

Limestone in the Formation is usually low in the unit, although a limestone breccia band occurs towards the top of the unit, south west of Old Halls Creek. Igneous rocks are also confined to the lower part of the unit.

The thickness of the Olympio Creek Formation cannot be determined accurately; north-west of Mount Kinahan it appears to be in excess of 10,000 feet.

The Koongie Park Formation consists of fine to medium-grained quartz sandstone with epidotised amygdoloidal basalt and minor feldspathic sandstone and ferruginous sandstone. The unit is a lateral equivalent to the top of the Olympio Creek Formation.

Dips within the unit are subvertical. On the western side of the outcrop, facings appear easterly; on the east side they are not apparent. However the rocks are similar to those in the east and the Formation may be folded into a syncline with the basalt in the core. The minimum thickness therefore is 3200 feet.

The Moola Bulla Formation consists of sheared feldspathic sandstone, arkose, pebble to boulder conglomerate and slate. The formation is readily divisible into five, slate being confined to the second and fourth subdivision and the coarse conglomerate to the top subdivision. The unit is a shallow-water deposit and may represent a final phase of deposition in the Halls Creek Geosyncline. It rests unconformably on the Koongie Park Formation and the Olympio Creek Formation. The unit is over 11,000 feet thick.

Lamboo Complex.

The Lamboo Complex crops out in a north-north-east trending belt which lies immediately to the west of, and parallel to, the main belt of outcrop of the Halls Creek Metamorphics. In the Sheet area the belt crops out in the north-west; a fine-grained granite body to the north-east of Sophie Downs Homestead, remote from the main belt of outcrop, is included in the Complex.

The Complex intrudes the Halls Creek Metamorphics and is unconformably overlain by the Upper Proterozoic Albert Edward Group, as at Mount Barret; it is therefore considered Lower Proterozoic. Traves' (1955) definition of the Lamboo Complex, in which he restricted the name to the igneous rocks and excluded the mappable remnants of the Halls Creek Metamorphics, has been adopted. It should be noted however that some of the rocks, particularly the early fine-grained gneissic granite, may be granitised sediments.

The succession of basic and acid intrusions of the Lamboo Complex has been mainly worked out from the northerly-adjacent Dixon Range 1:250,000 Sheet area where the Complex is well exposed. The succession applicable to the Gordon Downs Sheet is:-

dolerite dykes
acid and pegmatite dykes
fine-grained granite
coarse-grained granite — "rapakivi" granite; porphyritic granite; even-grained granite
medium-grained gneissic granite
fine-grained gneissic granite
uralitised gabbro and dolerite
fine- to medium-grained gabbro.

Several of these intrusions only crop out in small areas on the Gordon Downs Sheet area.

Fine to medium-grained gabbro crops out only west of Duffers Mine in the north of the area in an igneous structure known as the Armanda Ring Complex; this is a differentiated, often altered gabbro grading to leuco-gabbro (only exposed on the Dixon Range Sheet area) which has been intruded by fine-grained granite. The shape of the granite is an oval ring and it is probably a ring dyke. In places small-scale rhythmical layers are preserved in the gabbro and dip towards the centre of the structure at about 20°. On the Dixon Range Sheet area similar layers of gabbros are associated with ultrabasic rocks in differentiated bodies. (Ultrabasic rocks are exposed in two areas in the Gordon Downs Sheet area, as a pyroxenite in a small roof pendant in the coarse-grained granite and as a strongly sheared serpentinite dyke occupying the northern end of the Caroline Fault.)

Fine to medium-grained uralitised gabbro crops out north-west of Halls Creek and is also common on the Dixon Range Sheet area. As with the gabbro in the Armanda Ring Complex, the gabbro contains prominent hornblende or rarely biotite. It differs from the gabbro in the Complex in being unbanded. No conclusive evidence exists to suggest whether the gabbros are separate or related intrusions.

Fine-grained gneissic granite occurs only north-north-east and east of Mount Barret. On the Dixon Range Sheet area it is charnockitic. The granite is believed to be the oldest of the acid intrusions but as stated previously it may be a granitised sediment.

Medium-grained gneissic granodiorite (or granite) crops out west of Rockhole Homestead. On the Dixon Range Sheet area it is known to intrude the basic rocks and is intruded by the coarse-grained granite.

Coarse-grained granite is the most widespread in outcrop area of the granites. It is variable in texture and may be even-grained, or porphyritic in either lath-shaped or rounded feldspars. The latter have been termed "rapakivi" granite on the preliminary map but subsequent petrological work has shown the feldspars to be unzoned and they were probably rounded by magmatic corrosion. On the Dixon Range Sheet area rounded feldspars occur as porphyroblasts in both the medium-grained gneissic granodiorite and uralitised gabbro. The coarse-grained granite which commonly shows slight gneissocity usually crops out as large rounded boulders as opposed to the early granites which occur as scattered outcrops or low rises.

Fine-grained granite crops out north-east of Sophie Downs Homestead as an oval shaped body and intrudes the gabbro of the Armanda Ring Complex as a ring dyke. No evidence is obtainable of its age relative to the other intrusions of the Complex, but because it is little stressed and consists principally of quartz and feldspar with only accessory minerals, a feature of late stage granites, it is considered the youngest of the granites.

The rocks are cut by rhyolite, pegmatite and dolerite dykes. The rhyolite and pegmatite dykes usually trend north-north-east to east whereas the dolerite dykes trend north-west to north-north-west; this trend is very pronounced on the Dixon Range Sheet area where in places the dykes occur as swarms.

The Lamboo Complex was intruded during the folding of the Halls Creek Metamorphics. The basic (- ultrabasic) bodies were intruded before, or during the early stages of folding of the Halls Creek Metamorphics. Folding appears to have been almost complete before emplacement of the coarse-grained granite since, on the Dixon Range Sheet area, it intrudes across folded structures containing the uralitised gabbro and fine-grained gneissic granite.

UPPER PROTEROZOIC

The Upper Proterozoic rocks in the Sheet area crop out in a north-north-east trending belt through Beaudesert Bore and the Albert Edward Range, at Mount Barret in the extreme west, and in the south-east and east.

Those rocks in the Albert Edward Range, and at Mount Barret, form the Albert Edward Group (in part equivalent to the Kearney Beds (Wells, 1959) on the southerly adjacent Billiluna Sheet) and those in the south-east and east form the Gardiner Formation (the Gardiner Beds of Wells, 1959). Details of the general lithology of the individual units are shown in Table 2.

Albert Edward Group.

The lower part of the sequence consists of sandstone and shale with lenses of dolomite and the upper part of the sequence is dominantly shale with minor sandstone and dolomite. Both the Mount Kinahan Formation and its member the Brim Creek Dolomite, lens out in the north of the Sheet area. The member also lenses out southwards west of Ruby Plains Homestead, although small lenses of dolomite do occur within the Mount Kinahan Formation in the south of the Sheet area. The exposure at Mount Barret has been related to the Mount Kinahan Formation; however, in places, the sandstone is feldspathic and it could be related to the generally feldspathic King Leopold Sandstone widely exposed west of the Sheet area. The overlying Duerdin Formation also thins northwards but extends on to the south part of the Dixon Range Sheet area before lensing out; in the south of the Sheet area it contains rare sandstone.
The three overlying Formations, the Mount Forster Sandstone, the Elvire Formation and the Boonall Dolomite, have the widest distribution and show little variation in thickness or lithology. The upper part of the Mount Forster Sandstone is more variable in the south and centre containing some siltstone, shale and fine conglomerate whereas in the north it is almost entirely medium-grained quartz sandstone. No variation occurs in the Elvire Formation and the Boonall Dolomite with the exception that the division between the two is more gradational in the north.

The Timperley Shale comprises over half the total observed thickness of the Albert Edward Group. It only crops out in the north and centre of the belt, where exposure is generally poor. The Nyuless Sandstone and the Flat Rock Formation, usually obscured by the overlying Cambrian Antrim Plateau Volcanics, have an even more limited distribution than the Timperley Shale, occurring only west and south of Flora Valley Homestead.

The exposed thickness of the Albert Edward Group is about 7700 feet.

Lithological variations in the Beaudesert Bore - Albert Edward Range area are essentially seen in the linear direction north-north-east. However

in the south and east of the Sheet area a sandstone unit, the Gardiner Formation, which rests unconformably on the Halls Creek Metamorphics, is about 4000 - 5000 feet thick. Bores in the Gordon Downs area pass through alluvium into shale presumably Upper Proterozoic and possibly belonging to the Flat Rock Formation. It would therefore seem that there is a lateral facies variation from rocks of the Albert Edward Group to sandstone in the south-east and east of the Sheet area. This is supported by the increased thickness of the isolated sandstone ridge of the Mount Kinahan Formation south-east of Beaudesert Bore.

CAMBRIAN.

The Lacy Creek Formation, which crops out in the east of the Sheet area, unconformably overlies the Upper Proterozoic Gardiner Formation and is conformably overlain by the Antrim Plateau Volcanics. It consists of fine to medium grained quartz sandstone, siltstone and limestone.

Apart from Cryptozoon which occurs in the limestone, no other fossils were recorded in the unit which is assigned to the Lower Cambrian because of its stratigraphic relationships. No equivalent to the unit is known in the Flora Valley Homestead - Boonall Yard area although in places a thin pebble conglomerate band occurs at the base of the Antrim Plateau Volcanics.

The Formation is about 100 feet thick.

The Antrim Plateau Volcanics have a wide distribution throughout the Ord-Victoria Region. In the Sheet area they are confined to the north-centre, north-east, and east; the last occurrence is the southernmost extension of the Volcanics in Western Australia.

The unit unconformably overlies the Upper Proterozoic Albert Edward Group in the main area of outcrop, but in the east it conformably overlies the Lacy Creek Formation. It is overlain possibly unconformably by the Headleys Limestone and is considered Lower Cambrian.

The Antrim Plateau Volcanics mainly consist of basic volcanics, but also locally contain chert and rarely at the base, a pebble conglomerate. The basic volcanics consist of fine-grained basalt, porphyritic pyroxene basalt and feldspar basalt, amygdaloidal basalt and in places minor tuff. Several flows can be recognised and are exposed over large distances; some are up to 200 feet thick and in some the amygdaloidal top constitutes up to half the thickness of the flow. The chert is mainly confined to the eastern part of the area; it is interbedded with the basalt and contains Corophyton sp., ?Collenia sp. aff. symmetrica, Fenton and Fenton, Newlandia sp.

East of Boonall Yard the Volcanics are about 1550 feet thick.

The Headleys Limestone crops out in the central northern portion of the Sheet area as outliers and as the southernmost extension of the Negri Group of the Hardmann Basin sequence, cropping out widely on the Dixon Range Sheet area. The Limestone consists of coarsely flaggy, fine-grained, grey and light yellow limestone (which becomes more flaggy towards the top of its section where fully exposed in the Dixon Range Sheet area). Minor stringers, lenses and nodules of chert parallel the bedding.

No fossils have been recorded in the Headleys Limestone. The lowest recorded fossils in the Negri Group of the Hardmann Basin sequence occur in the Linnekar Limestone (two units above the Headleys Limestone) and consist of Redlichia and Biconulites (Traves, 1955), indicative of an upper Lower or lower Middle Cambrian age. The age of the Headleys Limestone is therefore also Lower or Middle Cambrian.

On the Gordon Downs Sheet area the Headleys Limestone is about 60 feet thick and its total thickness on the Dixon Range Sheet area is about 140 feet.

A small outcrop, assigned to the Elder Sandstone, at the headwaters of Addie Creek east-north-east of Flora Valley Homestead, is about 30 feet thick and consists of white friable, medium-grained quartz sandstone. It unconformably overlies the Antrim Plateau Volcanics. The Elder Sandstone crops out widely in the Hardmann Basin.

The age of the Elder Sandstone is in doubt; it was previously regarded as Middle or Upper Cambrian and conformable on the Negri Group (Traves, 1955). However in the Hardmann Range, in the south of the Dixon Range Sheet area, it is unconformable on the Headleys Limestone and Nelson Shale of the Negri Group. Devonian sandstones cropping out south of the Cambridge Gulf are lithologically similar and the Elder Sandstone may be related to these.

TERTIARY.

(?) Tertiary rocks in the area have been subdivided into units - the Lawford Beds; and scattered gravel, sandstone and siltstone.

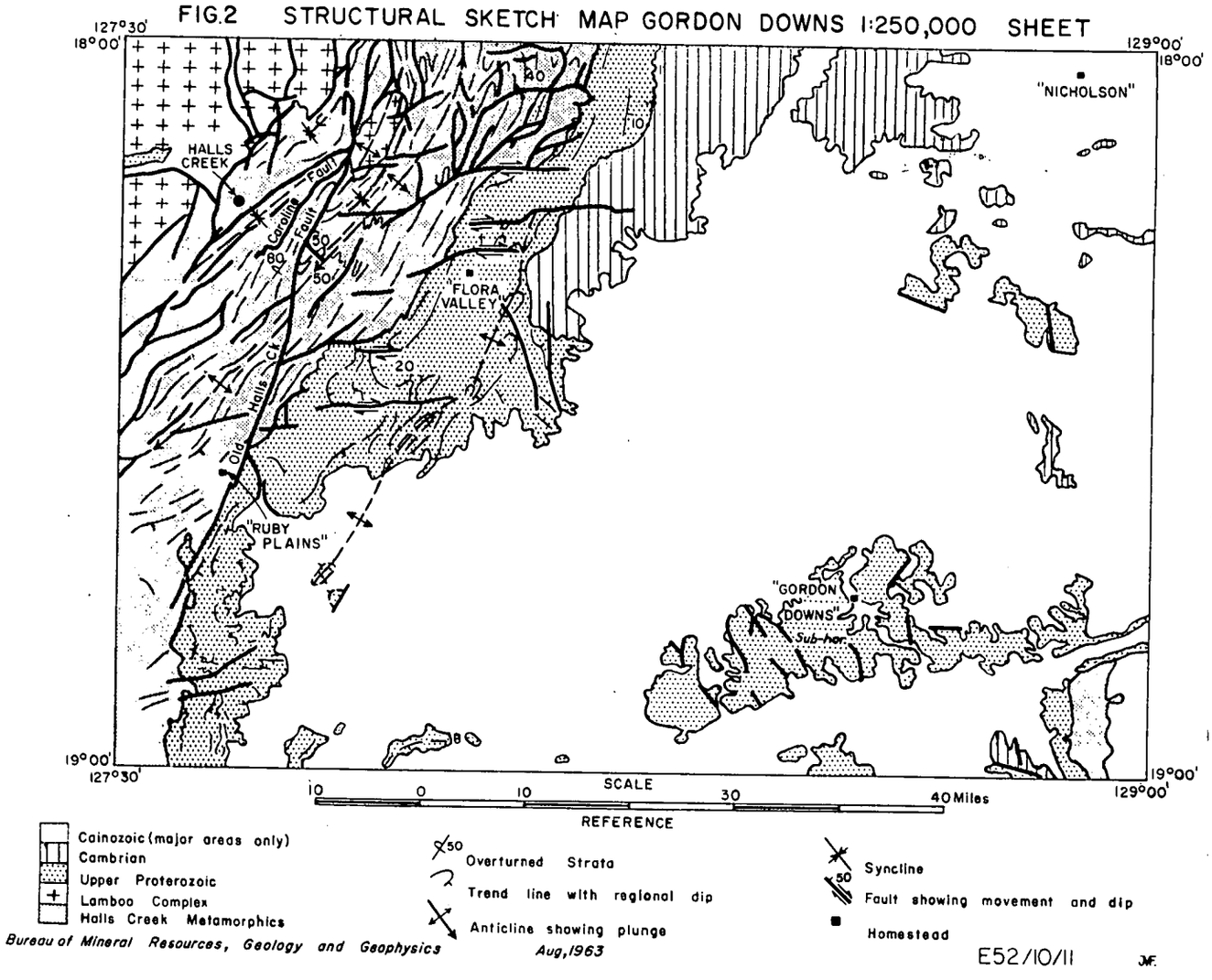
The Lawford Beds crop out around Mount Timperley in the centre of the Sheet area, in isolated outcrops in Calico Creek area, and west of Douri Dam. The best outcrop is at Mount Timperley where there is about 30 feet of white, massive chalcedonic limestone. At the base is a poorly exposed leached, rubbly, white calcareous siltstone. No fossils have been found. Similar chalcedonic limestones occur on the Billiluna Sheet area. The name used there by Wells (1959) has been extended to the Gordon Downs Sheet area since it is probable that, though the limestone is probably freshwater, it formed a continuous deposit.

Gravel, sandstone and siltstone-shale outcrop poorly in the Wolf Creek area, south of Halls Creek, and as siltstone and shale under the lateritic cap at the headwaters of the Fox River and Duerdin Creek. It is possible that the ages of these rocks may vary since those in the Wolf Creek area are unconsolidated and may post date lateritisation.

STRUCTURE

A structural sketch map of the area is shown in Figure 2.

FIG.2 STRUCTURAL SKETCH MAP GORDON DOWNS 1:250,000 SHEET



Lower Proterozoic rocks in the Sheet area are highly folded. Upper Proterozoic rocks and the Antrim Plateau Volcanics are usually gently folded in the west of the area; in the east they are subhorizontal as are younger rocks throughout the area.

In the main area of their outcrop the Halls Creek Metamorphics strike north-north-east. Dips range from horizontal to 20° of overturning; commonly they range between 60° and vertical. Folding is strongly related to competency of the rocks. The Metamorphics are folded into an anticlinorium which pitches south-south-west to south-west throughout most of the Sheet area but in the north, around Saunders Creek, there is a major change in pitch to north-north-east. The presence of the anticlinorium was determined by:-

1. Stratigraphic relationship and distribution of the units.
2. Facings on the rocks; in the case of Saunders Creek Formation determined by current bedding and of the Olympio Creek Formation by graded bedding. Results in the widespread Olympio Creek Formation show the western limb of the anticlinorium to be very highly folded and generally slightly overturned whereas the eastern limb is highly folded, but not overturned. Slate is absent in some areas on the eastern limb and here the structure is simpler, usually with a shallow dip east or south-east.
3. Measurements on minor folds and on cleavage/bedding relationships in the Biscay Formation at, and east of, Old Halls Creek indicate a pitch south-south-west of 30 to 50°.

West of the fault block containing the Koongie Park Formation and the Moola Bulla Formation, acid to basic volcanic rocks crop out. These probably belong to the Biscay Formation and possibly indicate a western limb of a synclinorium developed to the west of the anticlinorium.

Folding in the competent Koongie Park Formation & Moola Bulla Formation is less complex than on the units of the Halls Creek Metamorphics. The Koongie Park Formation appears to be folded into a tight syncline and the Moola Bulla Formation has a uniform dip in the main area of outcrop to the west-north-west at an average dip of about 70°.

Folding in the Upper Proterozoic is generally gentle. From Douri Dam northwards to the edge of the Sheet area, dips generally become shallower away from the Lower Proterozoic belt; they vary from 30 to 40° to about 10°. However in a series of domes and anticlines striking from south-east of Flora Valley Homestead to east of Douri Dam dips steepen to as much as vertical. Around, and south-west of, Beaudesert Bore the strike of the rocks is west and dips up to 60° are not uncommon. Strong "concertina" folding is present east and south-east of Beaudesert Bore; the axis of the "concertina" folds is approximately at right angles to the regional strike. In the east and south-east of the Sheet area the Upper Proterozoic is subhorizontal.

Dips in the Antrim Plateau Volcanics conform to those of the Upper Proterozoic. In the main area of outcrop they shallow from 15° eastwards to subhorizontal; in the east the dips are subhorizontal.

In the younger rocks the dips are subhorizontal but in the Elder Sandstone(?) they are up to 15° due to adjacent fault movement.

The major fault in the area is the Old Halls Creek Fault which strikes north-north-east throughout most of the Sheet area and all of the northerly adjacent Dixon Range Sheet area. Its total length is therefore not less than 120 miles. Movement affecting the anticlinorium indicates the fault has a transcurrent movement with east side moving north and the "repitching" of the Biscay Formation of the anticlinorium on the west side of the fault of the anticlinorium suggests that west side is up. Measurements on the fault at Old Halls Creek indicate that the fault there dips east at 50°. The fault affects both the Lower Proterozoic and Upper Proterozoic; it is not cut by other faults.

On the east side of the Old Halls Creek Fault the predominant fault direction is east-north-east; several of the faults affect the Upper Proterozoic and tend to be arcuate. On the west side of the Old Halls Creek Fault, faults adjacent to it, with large vertical throw strike north-east. The Caroline Fault is occupied in its northern end by a dolomitised serpentinite dyke. In the Lamboo Complex in the Sheet area faults tend to be more random.

In the south-east in the Gardiner Formation faults trend north-north-west.

ECONOMIC GEOLOGY

Gold.

The principal mines, and the production figures of the Halls Creek Field, where known are:-

Ruby Queen (to 1908, 6220 ozs, subsequently about 2000 ozs).
Bradleys (1563 ozs).
The Brockman group of mines including the Golden Crown, Faugh and Ballagh and Lady Margaret Mines.
The mines around Old Halls Creek, in particular the Jubilee.
Small mines in the Ruby Queen area produced, at least, a further 2500 ozs.

The field ceased to be of importance by the end of the nineteenth century and subsequently only minor work was carried on. At the time of writing (1962) an exploratory shaft is being sunk at the Golden Crown and small scale, spasmodic mining is done at Old Halls Creek, Ruby Queen and a mine about 20 miles south-south-west of Halls Creek. Until recently gold was won from the Duffers Mine. After the "wet" panning of creeks in selective spots by aboriginals returns small quantities of gold.

The gold is found in small quartz reefs, often associated with basic rocks or in the adjacent basic rocks themselves; mines thus situated are the Brockman group, on the eastern limb of the anticlinorium at the top of the Biscay Formation, and the Old Halls Creek group and Duffers Mine, both of

which are also adjacent to the Old Halls Creek Fault. The Ruby Queen and Bradley mines are associated with quartz reefs intruding the greywacke/slate sequence of the Olympio Creek Formation. In the past much gold was won from small alluvial flats in the Brockman area.

Uranium.

Uranium was discovered at Bulman Waterhole in the Saunders Creek area in 1955. Two exploratory drill holes were sited and drilling of one about 1¼ miles south-south-west of Bulman Waterhole was completed. The radioactive mineral is thorogummite associated with the heavy minerals in the conglomerate bands. No subsequent work has been carried out and the occurrence is not considered economic.

Copper.

Copper has been found associated with (1) basic rocks of the Ding Dong Formation, (2) limestone and basic rocks of the Biscay Formation, (3) the Antrim Plateau Volcanics and (4) the Headleys Limestone.

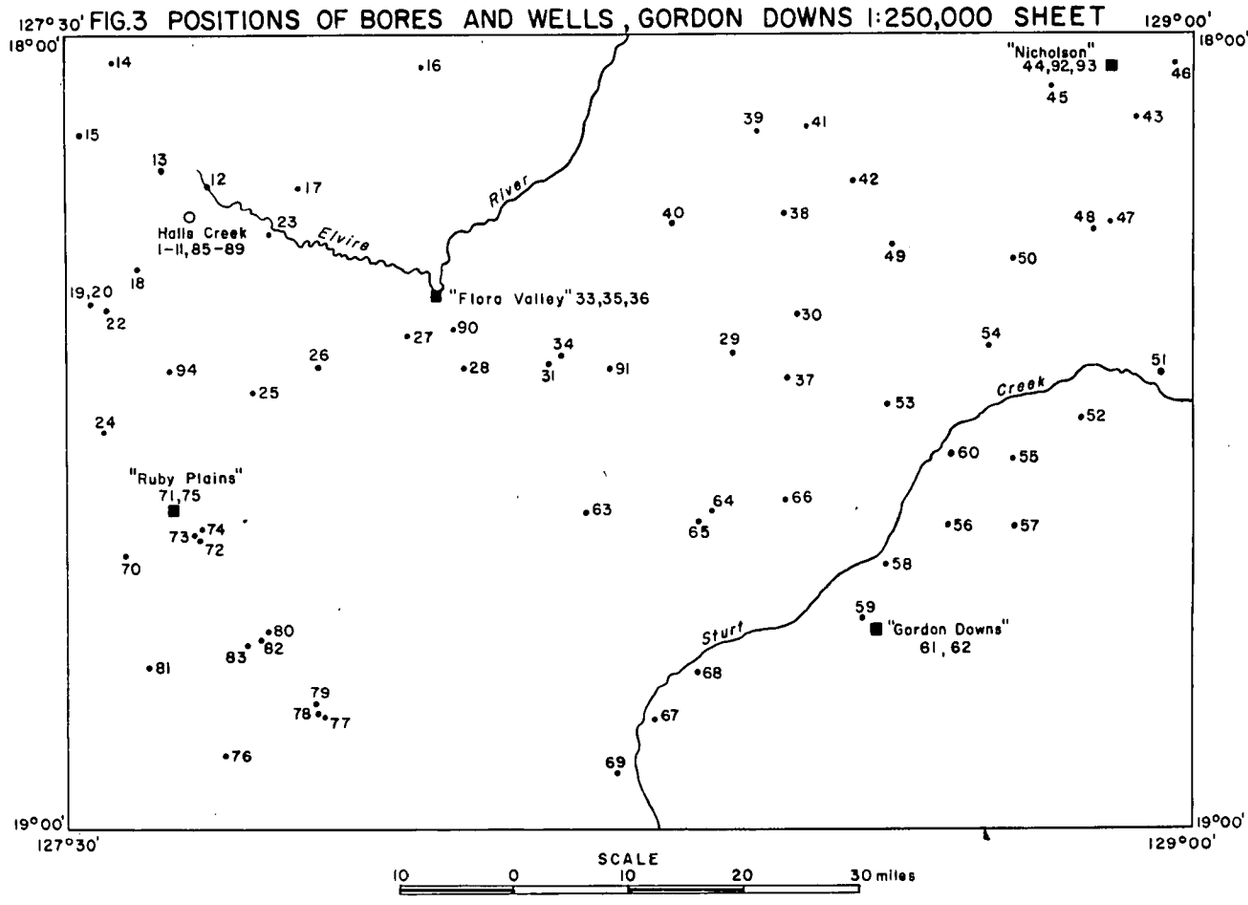
Native copper and malachite have been observed in epidotised basalt towards the top of the Ding Dong Downs Formation about 1¼ miles south of Bulman Waterhole.

In the Biscay Formation copper has been observed in the form of malachite stains in the Saunders Creek area, and immediately north of Faugh and Ballagh. A half mile west of the western edge of the Sheet area, about 6 miles south-west of Old Rockhole Homestead, malachite stains occur in a gossan on a limestone band which probably extends under soil cover on to the Gordon Downs Sheet area.

Copper in the Antrim Plateau Volcanics occurs as malachite stains which occupy vesicles in the tops of the flows. Covellite, surrounded by malachite, occurring as irregular blobs, has been observed in one place in the Headleys Limestone.

Water.

Table 1 contains details of the bores and wells in the Gordon Downs Sheet area; their positions are shown in Figure 3. During 1963 about 30 new bores were sited on the Sheet area and details of these are given in a report on the hydrology of the area (Morgan, 1963).



Bureau of Mineral Resouces, Geology and Geophysics Aug, 1963

E52/10/12 JMF

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TABLE 1

GROUNDWATER - BORE RECORDS

One Mile Sheet	Serial Number	Name	Type	Depth (feet)	Supply g.p.hr.	Aquifer	Salinity p.p.m.	Locality
HALLS CREEK	1	-	b abd.	96	450	Alluvium	?	Township, Valda Avenue
	2	-	b add.	80	nil	Laterite profile	-	DCA.
	3	Post Office	b,np.	130	?	" "	?	Post Office
	4	Council reserve	b,np.	135	150	" "	600	Townsite
	5	-	b abd	?	nil	Weathered Halls Creek metamorphics	-	Pensioners reserve
	6	Pensioners	b,np.	60	700	Alluvium	good	Pensioners reserve
	7	Garden	b,np.	100	1,300	"	good	Township
	8	Race course	b,np.	148	1,000	"	good	Township
	9	-	-	?	400	"	good	Township No.3
	10	-	w.	451	500	"	480	Township No.1
	11	-	w.	?	?	"	good	Mission bore
	12	Banjo's	b.	?	good	"	350	Moola Bulla Station
	13	Shephards	w,np.	?	poor	"	210	" " "
	14	Dougals	w,np.	?	poor	Weathered Lamboo Complex	280	" " "
	15	5 mile	w,np.	?	?	Alluvium	280	" " "
	16	-	w.	-	-	-	-	Ding Dong Downs Station
	17	-	-	-	-	-	-	Sophie Downs Station
	85	-	b abd.	140	-	-	-	Township
	86	Drovers Camp	b.	186	300	Halls Creek Metamorphics	600	Township
	87	No.2	b.	145	950	Halls Creek Metamorphics	-	-
	88	-	- abd.	?	-	-	-	Hotel
	89	-	b.	?	-	-	-	Township
ROCK HOLE	18	Fly Well	w,np.	30 approx.	-	Laterite over Lamboo Complex	-	Koongie Park Station
	19	-	b.	-	-	Lamboo Complex	-	" " "
	20	-	b abd.	120	-	" "	-	" " "
	21	-	b.	?	poor	Weathered Lamboo Complex	good	" " "
	22	-	w.	30 approx.	?	" "	350	" " " (old Rockhole homestead)
	23	-	w.	40 approx.	?	Halls Creek Metamorphics	?	Old Halls Creek Town well
	24	-	w.	40 approx.	?	" "	?	Mullens homestead
	25	-	w.	?	?	" "	?	Ruby Queen Mine Shaft
	26	-	w.	10	good	Brim Creek Dolomite	good	Palm Springs
	27	-	w.	50	poor	Timperley Shale	good	Elvire Station homestead
	94	-	w.	20	?	Halls Creek Metamorphics	good	north-east Mullens homestead

One Mile Sheet	Serial Number	Name	Type	Depth (feet)	Supply g.p.hr.	Aquifer	Salinity p.p.m.	Locality
FLORA VALLEY	28	Black Bank	b.	156	580	Alluvium over Timperley Shale	good	Flora Valley Station
	29	Woongoverri	b.	395	600	Alluvium ?	good	" " "
	30	Eurootoo (no.3)	b.	157	2,800	Alluvium	490	" " "
	31	FV4	b. abd.	635	small	Flat Rock Formation	?	" " "
	32	-	w,np.	?	?	Antrim Plateau Volcanics	good	" " "
	33	-	b. abd.	80	-	Timperley Shale	-	" " " (horse yard)
	34	Government Well	w. abd.	15	reported fair	Antrim Plateau Volcanics	good	" " "
	35	-	w,np.	50	200	Timperley Shale	good	" " " (homestead)
	36	FB.	b.	71	400	" "	good	
	37	-	w.	?	?	Alluvium	-	Gordon Downs Station
	90	FV 24	b.	?	?	Timperley Shale	-	Horn Valley Station
	91	Mungo Tank Bore	b.	?	?	Flat Rock Formation	-	" " "
ANTRIM	38	Poonka (No.4)	b.	500	500	Alluvium	brackish	Flora Valley Station
	39	-	b.	73	?	Antrim Plateau Volcanics	-	" " "
	40	-	b.	?	?	" "	?	" " "
	41	-	b.	102	?	" "	?	Turner River Station
NICHOLSON	42	10 and 10a	b.	162	1,280	Alluvium	good	Turner River Station
	43	N5	b.	194	poor	Upper Proterozoic Shale (or basalt?)	?	Nicholson Station
	44	-	w.	27	?	Alluvium	?	" " (old homestead well)
	45	23	b.	145	1,600	"	?	" "
	46	Koolerong	b.	90	1,500	Antrim Plateau Volcanics		" "
	47	24	b.	?	?	Gardiner Formation	10,360	" "
	48	GD.5	b.	644	small	Flat Rock Formation?	good	" "
	92	-	w.	42	?		?	
	93	-	w.	27	?		?	
NICHOLSON SOUTH	49	7	b.	495	1,100	Antrim Plateau Volcanics	good	Nicholson Station
	50	GC	b.	82	1,600	Lacy Creek Formation	good	Gordon Downs Station
	51	Alice (No.15)	b.	84	2,000		?	" " "
	52	GA	b.	86	1,300	Lateritic rocks	good	" " "
	53	6 GD.	b.	490	?			" " "
	54	GD4.	b.	251	?	Antrim Plateau Volcanics	?	" " "

One Mile Sheet	Serial Number	Name	Type		Depth (feet)	Supply g.p.hr.	Aquifer	Salinity p.p.m.	Locality
MT. WITTENOOM	55	Myardia 13	b.		564	1,000	Antrim Plateau Volcanics?	?	Gordon Downs Station
	56	14	b,p.		350	1,200	" "	good	" " "
	57	GB.	b.		151	1,100	Weathered Antrim Plateau Volcanics	good	" " "
	58	Apsley 12	b.		395	850	Alluvium	?	" " "
	59	-	w.		?	?	"	?	" " "
	60	-	b.		?	?	Weathered basalt?	?	" " "
GORDON DOWNS	61	-	b.		45	1,000	Gardiner Formation	good	Gordon Downs Station
	62	-	w.		18	good	" "	good	" " "
COW CREEK	63	SC.1	b.	abd.	420	?	Flat Rock Formation	?	Sturt Creek
	64	27	b.	abd.	855	?	" " "	?	" "
	65	25	b.	abd.	500	?	" " "	?	" "
	66	-	b.	abd.	?	?	?	?	" "
ANJAMMIE	67	26	b		213	1,400	Alluvium	?	Sturt Creek
	68	SC.4	b,	abd.	60	-	Alluvium	?	" "
	69	5	b,	abd	612	nil	Flat Rock Formation	?	" "
RUBY PLAINS	70	Illjarrah	w.		95	750	Alluvium	good	Ruby Plains Station
	71	-	b.		100	?	Halls Creek Metamorphics	good	" " "
	72	7	b.	abd.	?	-	" "	good	" " "
	73	4A	b.	abd	117	-	Duerdin Formation	-	" " "
	74	4	b.	abd	99	-	" "	-	" " "
	75	-	2.		117	400	Soils and weathered Halls Creek Metamorphics	good	" " "
EAST WOLF CREEK	76	Beaudesert	b. and w.		115	900	Alluvium	420	" " "
	77	6	b.	abd.	140	-	Timperley Shale ?	-	" " "
	78	8	b.	abd	75	-	" "	-	" " "
	79	9	b.	abd	138	-	" "	-	" " "
	80	-	b.	abd	?	small	" "	good	" " "
	81	2	b.	abd	175	?	" "	1,540	" " "
	82	Digimont	b.	abd	95	?	" "	saline	" " "
	83	5	b.	abd	157	small	" "	5,320	" " "

b = bore
w = well
np = non pressure water
p = pressure water
abd = abandoned

TABLE 2

STRATIGRAPHY - GORDON DOWNS 1:250,000 SHEET

		NAME AND SYMBOL	THICKNESS IN FEET	LITHOLOGY	TOPOGRAPHY	DISTRIBUTION	REMARKS
CAINOZOIC	QUATERNARY	(Qa)		Alluvium		Confined to areas adjacent to major rivers e.g. Sturt Creek.	
		(Cze)		Travertine		Confined to small area, south-east of Bindi Tank in the extreme south of area.	
		(Czl)		Lateritic soil	Plains with sparse spinifex and tree growth.	Mainly in the north-east and east of Sheet area; also centre and rare scattered occurrences elsewhere.	
		(Czb)		Black clay soil (with gilgais)	Grass-covered treeless plains.	Widespread in centre, north-east and east of Sheet area, rare scattered occurrences elsewhere	
		(Czs)		Sand, soil	Mainly spinifex-covered plains.	Widespread in south of Sheet area, scattered occurrences elsewhere	
	TERTIARY	(Tp)		Laterite	Low flat topped hills and plateaus.	Mainly in north-east of Sheet area.	
		(Tf)	50	Gravel, sandstone, siltstone.	Scattered low plateaus.	In centre and south of Sheet area.	Unfossiliferous
		(Tl)	50?	Chalcedonic limestone, calc, siltstone	Creeks beds andcaps hills.	Scattered outcrops east and central part of Sheet area.	Unfossiliferous
PALAEOZOIC	MIDDLE CAMBRIAN?	Elder Sandstone (Cme)	50	Friable medium grained white quartz, sandstone.	One small outcrop.	North-east of Flora Valley Homestead.	Age uncertain, unit may be Devonian.
					UNCONFORMITY ?		
	MIDDLE CAMBRIAN	Headleys Limestone (Cmy)	140	Flaggy to coarsely flaggy thin-bedded limestone, minor chert	Rough, low lying dissected plateau country.	East and north-east of Flora Valley Homestead.	Unfossiliferous. Basal unit of Hardmann Basin sequence (Dixon Range 1:250,000).
					UNCONFORMITY ?		
	LOWER CAMBRIAN	Antrim Plateau Volcanics (Cla)	1550	Porphyritic fine-grained basalt, tuff, minor chert	Very rough dissected country; vesicular basalt bands exceptionally rough.	North-central part of Sheet area, also around Mt. Wittenoom.	Algae in chert bands.
	LOWER CAMBRIAN?	Lacy Creek Formation (Cll)	100	Fine to coarse-grained quartz and ferruginous sandstone, fine to pebble conglomerate, siltstone, shale, algal limestone.	Low rises and under scarp of Antrim Plateau Volcanics.	East and south-east of Sheet area.	In places east of Flora Valley Homestead, minor pebble to cobble conglomerate may be equivalent to Lacy Creek Formation.
					UNCONFORMITY		

		NAME AND SYMBOL	THICKNESS IN FEET	LITHOLOGY	TOPOGRAPHY	DISTRIBUTION	REMARKS
U P P E R P R O T E R O Z O I C		Gardiner Formation (Eud)	4000-5000	Fine to coarse-grained quartz sandstone, rare fine to pebble conglomerate, ferruginous sandstone.	Rough plateau with scarp to south in main outcrop. Elsewhere as isolated mesas.	South-east and east of Sheet area.	Equivalent to Albert/Edward Group less Flat Rock Formation. Formerly Gardiner Beds (Wells, 1959).
	ALBERT	Flat Rock Formation (Euf)	about 1000	Purple shale, ferruginous dolomitic sandstone, quartz sandstone.	Poorly outcropping, sandstone forms low ridges.	Only south-east of Flora Valley Homestead.	Thickness incomplete.
		Nyuless Sandstone (Euy)	125	Flaggy to coarsely flaggy fine to medium-grained quartz sandstone, green fine-grained feldspathic sandstone.	Low persistent strike ridge - to 100 feet high.	Only south-east and east of Flora Valley Homestead.	
		Timperley Shale (Euj)	4145	Green-grey shale, minor siltstone, sandstone.	Very poor outcrop, mainly confined to creek beds.	Mainly Flora Valley, Mount Timperley area, also around Boonall Yard. Not seen in south of area.	
	EDWARD	Boonall Dolomite (Eub)	95	Coarsely flaggy yellow and light grey dolomite, minor dolomite breccia, chocolate shale, siltstone.	Low persistent strike ridge.	Universal Albert Edward Range - Beaudesert Bore area.	
		Elvire Formation (Eue)	195	Chocolate shale with green siltstone, minor sandstone.	Poorly outcropping usually in scarp slope under Boonall Dolomite.	Universal Albert Edward Range - Beaudesert Bore area.	Rhythmical alternations between shale and siltstone.
		Mount Forster Sandstone (Euo)	320	Fine-coarse grained quartz sandstone, fine conglomerate, shale, siltstone. Prominent c.g. sst. - fine conglomerate with black and brown quartz fragments.	Basal point forms very prominent strike ridge. Majority low discontinuous strike ridges.	Universal Albert Edward Range - Beaudesert Bore area.	
	GROUP	Duerdin Formation (Euu)	470	Shale, usually grey, also pink, minor siltstone, sandstone.	Poorly outcropping, usually in scarp slope under Mount Forster Sandstone.	Universal Albert Edward Range - Beaudesert Bore area.	More sandstone in south of Sheet area.
		Mount Kinahan Formation (Euk)	550	Coarsely flaggy quartz sandstone, minor basal conglomerate, feldspathic sandstone, shale, dolomite.	Resistant prominent strike ridges.	Albert Edward Range; not present extreme north. Extends to south of Sheet area. Mount Barrett.	
		Brim Creek Dolomite Member (Eum)	900	Flaggy to massive dolomite, dolomitic shale with quartz sandstone and dolomitic shaly conglomerate.	Rounded rough hills.	Albert Edward Range. Lenses out south of Boonall Bore and west of Ruby Plains Homestead.	Top of Mount Kinahan Formation.

UNCONFORMITY

		NAME AND SYMBOL	THICKNESS IN FEET	LITHOLOGY	TOPOGRAPHY	DISTRIBUTION	REMARKS	
LOWER PROTEROZOIC	LAMBOO COMPLEX	Undifferentiated Lamboo Complex/ Halls Creek Metamorphics (Bgr)		Intimate mixtures of granite and gabbro/metamorphics.				
		(Bga)		Fine-grained granite.	Variable, usually rough hills with rounded boulders.	Intruding Armanda Complex as ring dyke. Also north-east of Sophie Downs Homestead.	Often leucocratic. Less sheared than fine-grained gneissic granite.	
		(Bgs)		Coarse-grained granite with porphyritic rounded feldspars.	Rough hills with large boulder outcrops.	North of Halls Creek.	Possibly rapakivi granite.	Same Age Of
		(Bgm)		Coarse-grained with porphyritic euhedral feldspars.	Rough hills with large boulder outcrops			
		(Bgu)		Coarse-grained, slightly gneissic granite.	Rough hills with large boulder outcrops.			
	COMPLEX	(Bgn)		Medium-grained gneissic granodiorite (or granite) in places porphyritic.	Low rounded hills	West of Halls Creek	Wide distribution Dixon Range 1:250,000 Sheet.	
		(Bgv)		Fine-grained gneissic granite.	Usually low rounded hills.	North-west of Halls Creek.	Charnokitic on Dixon Range 1:250,000 Sheet area.	
		(Bab)		Fine to medium-grained hornblende or biotite-bearing gabbro.	Variable, usually low country with large rounded boulders.	Mainly north of Halls Creek.	Relationship to banded gabbro not certain.	
		(Bam		Fine to medium-grained banded gabbro.	Rough hills with rounded boulders.	Armanda Ring Complex.	Mainly hornblende bearing Associated with ultrabasic rocks in differentiated bodies in Dixon Range 1:250,000 Sheet area.	

	NAME AND SYMBOL	THICKNESS IN FEET	LITHOLOGY	TOPOGRAPHY	DISTRIBUTION	REMARKS
LOWER PROTEROZOIC — HALLS CREEK METAMORPHICS	Undifferentiated (Elh)		Mica schist, slate, sheared greywacke, feldspathic sandstone, calc silicate rocks.	Variable, calc silicate rocks caps hills in Lamboo Complex.	Within Lamboo Complex. Also extreme S.E. of Sheet area.	
	Moola Bulla Formation (Elc)	10000+	Sheared feldspathic sandstone, arkose, conglomerate, slate.	Rough, hilly country, where slate is prominent lower rough country.	N.N.E. striking fault block east of Halls Creek. Possibly also in S.E. of Sheet area.	Divisible into 5 units. Shallow water deposit.
			UNCONFORMITY			
	Koongie Park Formation (Elk)	Unknown	Quartz sandstone, epidotised basalt. Minor feldspathic sandstone, ferruginous sandstone.	Resistant strike ridges. Basalt forms low rounded hills.	N.N.E. striking fault block east of Halls Creek.	Probably folded into syncline with basalt in the core.
	Olympio Creek Formation (Elv)	10000+	Sheared greywacke, slate, conglomerate. Minor sheared sandstone, acid-intermediate volcanics, basic volcanics and sills, limestone, limestone breccia.	Generally rounded steep-sided hills, also low rises with poor outcrop.	Widespread in west on flanks of anticlinorium.	Usually alternating greywacke and slate. Greywacke deposited by turbidity current.
	Bissay Formation (Elr)	2000+ Probably much thicker in most areas	Basic flows and sills, intermediate-acid volcanics, sheared greywacke, slate, limestone, limestone conglomerate, calc-silicate rocks.	Variable, basic rocks usually most resistant	Widespread throughout west of area. Major unit in core of anticlinorium.	Limestone usually at top of unit.
	Duffers Limestone Member (Elf)	Unknown	Sheared limestone, limestone conglomerate, calc-silicate rocks, slate.	Resistant discontinuous strike ridges.	Triangular shaped outcrop north end of Sophie Downs granite.	
	Saunders Creek Formation (Els)	1600	Feldspathic sandstone, quartz sandstone, pebble conglomerate bands, minor slate.	Resistant ridges to 300 feet high.	Surrounding two anticlines in the north of Sheet area.	Thorogummite with heavy minerals in conglomerate.
	Ding Dong Downs Formation (Eld)	Unknown	Amygdaloidal epidotised basalt, sheared rhyolite, sheared greywacke, schist, slate.	Rounded rough hills.	In the core of two anticlines, north of Sheet area.	Probably Lower Proterozoic possibly Archaen.

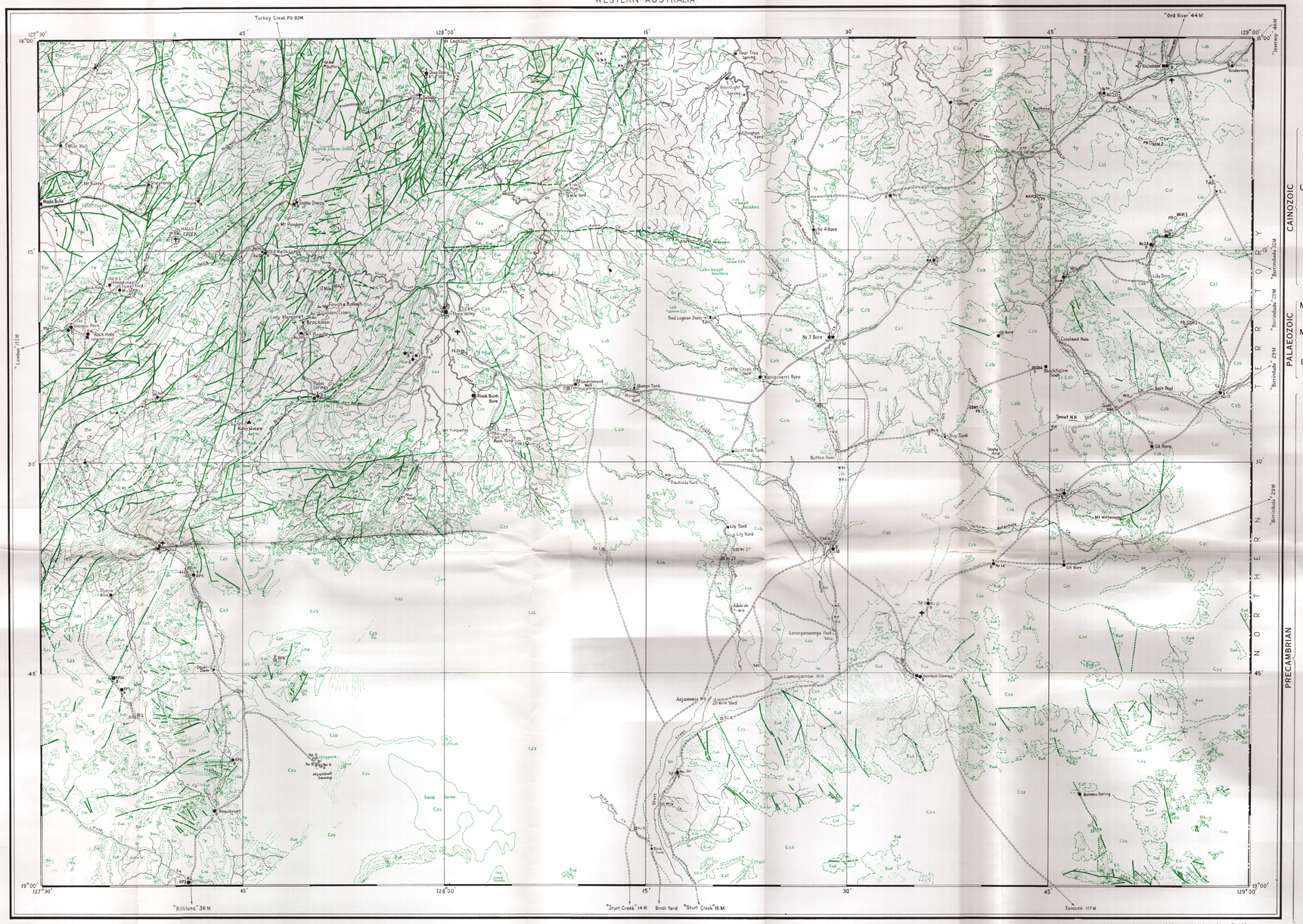
AUSTRALIA 1:250.000

GORDON DOWNS
WESTERN AUSTRALIA

1:250.000 GEOLOGICAL SERIES SHEET SE 52-10

PRELIMINARY EDITION, 1963

SUBJECT TO AMENDMENT



Reference

- Geological boundary
- Syncline
- Anticline, showing plunge
- Overturned anticline
- Plunge of drag fold
- Fault

Where location of boundaries, faults and folds 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
- Horizontal strata
- Overturned strata
- Dip-slip fault
- Trend of bedding, showing direction of dip (air-photo interpretation)
- Joint pattern
- Top of bed indicated by cleavage
- Top of bed indicated by cross-bedding
- Top of bed indicated by graded bedding
- Strike and dip of foliation
- Vertical dip of foliation
- Platy flow, inclined
- Platy flow, vertical
- Strike and dip of joints
- Direction of sedimentation
- Shear zone
- Fossil locality, general
- Macrofossil locality
- Dyke or vein (q-quartz, peg-pegmatite, rh-rhyolite, do-dolerite)
- Mine
- Mine, not being worked
- Unexploited mineral deposit
- Cu Minor mineral deposit
- Au Gold
- Cu Copper
- U Uranium
- Battery
- Battery, not operating
- B Bore
- PB Proposed bore
- DB Abandoned bore, dry
- S Spring
- Dam on stream
- W Well
- T Tank
- Windpump
- WH Waterhole
- Swamp
- Road
- Vehicle track
- Fence
- "Elvire" Homestead
- Hut
- Yd Yard
- Airport
- Landing ground
- Trigonometrical station

Reference

CAINOZOIC	QUATERNARY	Qa	Alluvium
	UNDIFFERENTIATED	Cze	Travertine
		Czl	Lateritic soil
		Czb	Black clay soil with gilgais
		Czs	Sand, soil
	TERTIARY	Tp	Laterite
		Tf	Sandstone, siltstone, gravel
	Lawford Beds	Tl	Chalcedonic limestone, calcareous siltstone
PALAEOZOIC	MIDDLE CAMBRIAN? Elder Sandstone	€me	Friable medium-grained white quartz sandstone
	MIDDLE CAMBRIAN Headleys Limestone	€my	Floggy to coarsely floggy grey limestone, minor chert
	LOWER CAMBRIAN Antrim Plateau Volcanics	€la	Fine-grained porphyritic basalt, amygdaloidal basalt, minor chert
	Lacy Creek Formation	€ll	Fine to coarse-grained quartz and ferruginous sandstone, fine-pebble conglomerate, siltstone shale, algal limestone
TERRITORY	UPPER PROTEROZOIC Albert Edward Group — Gordiner Formation	Pud	Fine to coarse-grained quartz sandstone
	Flat Rock Formation	Puf	Purple shale, purple dolomitic ferruginous sandstone, quartz sandstone
	Nyuless Sandstone	Puy	Floggy to coarsely floggy fine to medium-grained white quartz sandstone, green fine-grained feldspathic sandstone
	Timperley Shale	Puj	Grey and green shale, minor sandstone, siltstone
	Boonall Dolomite	Pub	Coarsely floggy yellow, light grey dolomite, dolomite breccia, chocolate shale
	Elvire Formation	Pue	Chocolate shale, green siltstone, minor sandstone
	Mt. Forster Sandstone	Puo	Fine to coarse-grained quartz sandstone, fine conglomerate, siltstone, shale
	Duerdin Formation	Puu	Grey shale, minor siltstone, sandstone
	Mt. Kinahan Formation	Puk	Coarsely floggy, fine to coarse-grained quartz sandstone, minor feldspathic sandstone, dolomite
	Brim Creek Dolomite Member	Pum	Floggy to massive dolomite, dolomitic shale
NORTHERN	Lamboo Complex	Pgo	Fine-grained granite, granophyre
		Pgr	Intimate mixture of granite gabbro, metamorphics
		Pgs	Rapakivi granite
		Pgm	Porphyritic coarse-grained granite
		Pgu	Coarse, even-grained granite
		Pgn	Medium-grained gneissic granodiorite
		Pgv	Fine-grained gneissic granite
		Pab	Fine to medium-grained unaltered gabbro
		Pam	Fine to medium-grained gabbro
PRECAMBRIAN	LOWER PROTEROZOIC Halls Creek Metamorphics — Undifferentiated	Plh	Sheared greywacke, feldspathic sandstone, slate, muscovite-quartz schist, marble
	Moola Bulla Formation	Plc	Sheared feldspathic sandstone, arkose, fine to boulder conglomerate, slate
	Koongie Park Formation	Plk	Quartz sandstone, minor ferruginous and feldspathic sandstone
		Plk	Epidotised amygdaloidal basalt
	Olympio Creek Formation	Plo	Sheared greywacke, sandstone, slate
			Basic volcanics and sills
			Intermediate and basic volcanics
			Acid volcanics
			Limestone, limestone breccia, calc-silicate rocks
	Biscay Formation	Plr	Basic volcanics and sills
			Intermediate volcanics
			Intermediate and basic volcanics
			Acid volcanics
			Sheared greywacke, slate, minor limestone, calc-silicate rocks
	Duffers Limestone Member	Plu	Limestone, calc-silicate rocks, slate
	Saunders Creek Formation	Pls	Feldspathic and quartz sandstone, fine conglomerate, slate
	Ding Ding Downs Formation	Pld	Epidotised amygdaloidal basalt, albitised rhyolite, sheared greywacke

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

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Showing Magnetic Declination

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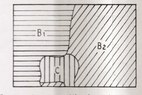
ANNUAL CHANGE 1°E

Scale 1 : 250,000

5 0 5 10 15 MILES
5 0 5 10 15 20 25 KILOMETRES

Section
Scale: V/H = 1

GEOLOGICAL RELIABILITY DIAGRAM



B1. Numerous traverses with photo interpretation.
B2. Occasional traverses with photo interpretation only.
C. Photo interpretation only.

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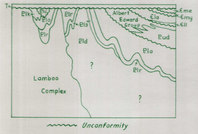
W.W. Webb. (BMR)
Drawn by: D.E. Brewtnall.

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



GORDON DOWNS
SHEET SE 52-10