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RECORDS.

1960/70

EXPLANATORY NOTES TO THE MOUNT DRUMMOND 4-MILE AREA NORTHERN TERRITORY

Compiled by

J.W.Smith and H.G.Roberts.

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CONTENTS

	Page.
INTRODUCTION	1
PREVIOUS INVESTIGATIONS	1
PHYSIOGRAPHY	2
Drainage	4
STRATIGRAPHY	4
LOWER PROTEROZOIC	4
MURPHY METAMORPHICS	4
CARRARA RANGE VOLCANICS	5
BLUFF RANGE BEDS	7
UPPER PROTEROZOIC	7
WESTMORLAND CONGLOMERATE	7
MALONEY CONGLOMERATE	8
BENMARA VOLCANICS	8
WOLLOGORANG FORMATION	9
CONSTANCE SANDSTONE	9
MULLERA FORMATION	10
Mistake Creek Sandstone Member	11
MITTIEBAH SANDSTONE	12
TYSON SANDSTONE	12
CAMBRIAN	13
PEAKER VOLCANICS	13
BORDER WATERHOLE FORMATION	13
BURTON BEDS	14
CURRANT BUSH LIMESTONE	14
DON CREEK DOLOMITE	15
MESOZOIC	15
TERTIARY	16
CLEANSKIN LIMESTONE	16
STRUCTURE	17
FOLDING	18
FAULTING	20
ECONOMIC GEOLOGY	22
REFERENCES	23

FIGURES
Figure 1 - Page 2
" 2 - Page 6
" 3 - Page 11
" 4 - Page 18

TABLE 1 - STRATIGRAPHY OF MOUNT DRUMMOND 4-MILE SHEET.

EXPLANATORY NOTES TO THE MOUNT DRUMMOND 4-MILE AREA, NORTHERN TERRITORY.

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INTRODUCTION

The Mount Drummond 4-mile sheet area is bounded by latitudes 18°S and 19°S and 136°30' and 138°00'. The southern side of the area is 60 to 70 miles north of the Barkly Highway and the eastern margin is the Queensland border. The area was mapped by a Bureau of Mineral Resources party from May to October 1959 as part of the Bureau's programme of regional mapping between the Roper River and the Northern Territory - Queensland border.

Access to the area is poor and the only roads are in the southern part of the sheet; graded roads link Gallipoli Outstation to Highland Plains Homestead, and Mitchiebo Waterhole to the Alexandra - Gallipoli road, and an ungraded road runs from Gallipoli to Springvale Homestead.

Geological mapping was done with the aid of aerial photographs (at a scale of 1; 48,000). Maps covering the area are:

Mount Drummond photoscale maps.
Mount Drummond 4-mile map.
Brunette Downs 8-mile map.

PREVIOUS INVESTIGATIONS

There has been little previous mapping in the area. Öpik (1956a) mapped the Highland Plains Homestead area in the extreme east of the sheet. Öpik (1956b) mentions the Cambrian "Alexandria Beds" around Alexandria Station, on the Playford River just south of the Mount Drummond area.

Mount Isa Mines Ltd (Battey, 1958) prospected the Carrara Range area for copper in 1957. Battey related the Carrara Range volcanics with the Colless Volcanics of the Lawn Hill area. In 1958 E.K. Carter, Bureau of Mineral Resources, made rapid reconnaissances in the Mittiebah and Carrara Ranges.

PHYSIOGRAPHY

The Mount Drummond sheet includes part of the Barkly Tableland and part of the hill country flanking the Gulf of Carpentaria.

The National Mapping Division of the Department of National Development has determined spot heights ranging from 737 to 1044 feet in the Fish Hole Creek - Caulfield Claypan area, along Buddycurrawa Creek, and to the south of Mitchiebo Waterhole. These heights suggest that the unsurveyed Carrara and Bluff Ranges, the highest parts of the Sheet area, are 1300 to 1400 feet above sea level.

The physiographic forms of the various units are listed in Table 1. For convenience of description the area has been divided into four physiographic regions (Figure 1)

FIGURE 1.
Sketch of Physiographic Divisions

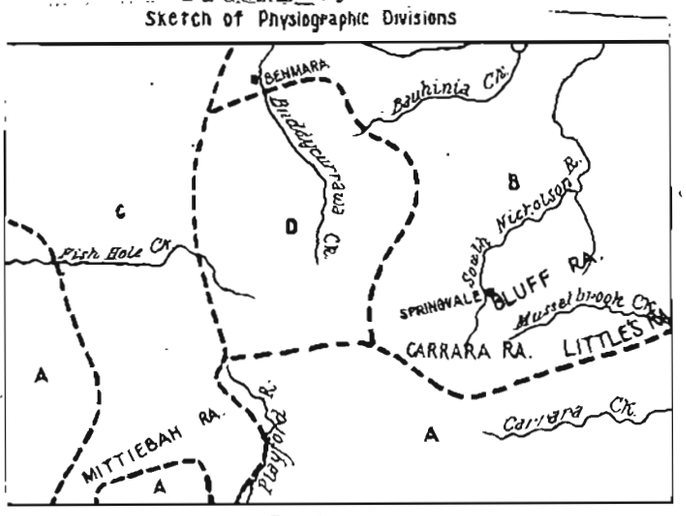

Fig. 1

(a) The "downs" country of the south and south-western sectors of the sheet area consists of plains covered with Mitchell grass, and rare stands of Lancewood trees. Small outcrops of strongly lateritized chert and siltstone form isolated low hills rising 20 to 30 feet above the surrounding plain. Carrara Creek and Don Creek have cut shallow, rough gorges in the Don Creek Dolomite which underlies the "black soil" covering most of the "downs" country.

(b) The eastern hills occupy the north-east quarter of the Sheet area. In the south, strike ridges of the Carrara Range Volcanics and the Bluff Range Beds rise 200 to 300 feet above the level of the surrounding country. Bluff Range consists mainly of Constance Sandstone, which forms rough dissected country with steep scarps. From Bluff Range north-west to Bauhinia Creek, horizontally-bedded Mesozoic sediments cap the Mullera Formation, which is itself eroded to form rounded, steep-sided hills. In the north-east the Constance Sandstone forms rough, dissected country and the less resistant Mullera Formation, Wollogorang Formation, and Westmoreland Conglomerate crop out as low, rounded hills capped in places with up to 50 feet of Mesozoic sediments.

(c) The western hills are about 200 feet higher than the surrounding country in the Mittiebah Range and Waterfall Creek areas. They are lower than the eastern hills.

From Waterfall Creek northwards, the Mullera Formation and Mittiebah Sandstone crop out as low ridges striking north-north-east. The ridges become more sharply defined in the north and rise to 100 feet above the surrounding plain. West of these ridges scrub-covered plains, from which protrude low hills of Cambrian rocks and Mittiebah Sandstone, form a semi-desert area.

(d) The low central area between the eastern and western hills is mainly covered by sand, but a few sandstone outcrops occur as low rises up to 20 feet high. There are several large claypans in this area, the largest of which, Caulfield Claypan, is about 8 miles long. In the south, low, west-striking ridges of Constance Sandstone and Mullera Formation separate the low central area from the "downs" country.

Drainage

The streams of the Mount Drummond area drain both into the Gulf of Carpentaria and inland; most of the drainage is into the Gulf. The major river of the area is the Nicholson River; it flows eastwards across the north of the Mount Drummond sheet area and eventually enters the Gulf of Carpentaria near Burketown, Queensland. The South Nicholson River, Carrara Creek, and Buddycurrawa Creek are the principal tributaries of the Nicholson River . The Nicholson and South Nicholson Rivers have braided channels with numerous anabranchs and in places are 300 yards wide. The drainage pattern of the Gulf-flowing streams was established on the surface of Mesozoic rocks and has been superimposed on the underlying Proterozoic rocks.

Most of the internal-draining streams flood out locally onto the "downs" country, but the two largest, Fish Hole Creek and the Playford River drain into the Lake Sylvester area south-west of Brunette Downs Station; both these rivers have reached the senile stage. There are numerous springs in the Sheet area, most of them in the Bluff Range; they are either within the Constance Sandstone, or more commonly where it is faulted against softer less porous rocks.

STRATIGRAPHY

The stratigraphy of the Mount Drummond sheet is summarized in Table 1.

LOWER PROTEROZOIC

MURPHY METAMORPHICS

The Murphy Metamorphics crop out mainly in the north-west of the area around Murphy's Creek. They also crop out in a small faulted area on the south side of the Carrara Range between Boomerang Creek and Fish Hole Creek.

The rocks are very low-grade, dynamically metamorphosed yellow and purple quartz-sericite schists, sheared siltstone, and greywacke, with, less commonly, sheared calcareous siltstone and metamorphosed ashstone; only schists and sheared siltstone have been mapped on the south side of the Carrara Range. The schistosity is everywhere parallel to the bedding and the rocks show meagre cleavage. Quartz veins, and less commonly quartz-feldspar (orthoclase?) veins, are associated with the sediments. A sheared altered intermediate plutonic rock, probably monzonite, intrudes the sediments of the Murphy Metamorphics in the Pandanus Creek area. A sheared feldspar porphyry in the same area is unveined by quartz and this suggests that the prophyry, too, is intrusive in origin since if the porphyry were volcanic in origin it would be reasonable to expect it to be quartz veined also.

The Murphy Metamorphics are thought to underlie the Carrara Range Volcanics unconformably because of their higher degree of metamorphism; their more intense folding; the fact that the basal sediments of the overlying Carrara Range Volcanics in the Carrara Range area contain numerous quartz pebbles. No obvious equivalents to the Murphy Metamorphics are known on the adjacent sheet areas of Calvert Hills and Lawn Hill: The oldest rocks on these areas are the Myally Beds of the Lawn Hill area. The finer horizons of the Myally Beds are slightly metamorphosed, but, unlike the Murphy Metamorphics, consist mainly of arenites and volcanics.

CARRARA RANGE VOLCANICS

The Carrara Range Volcanics crop out in the Carrara Range and in one small area in Maloney Creek on the north side of the Bluff Range.

In the Carrara Range the rocks are intermediate to basic volcanics, mainly lavas with minor tuff and agglomerate

bands, and sandstone, conglomerate, and siltstone. A typical section is shown in Figure 2. The Carrara Range Volcanics' outcrop in Maloney Creek is a volcanic breccia consisting of volcanic fragments (95%), angular to well-rounded, with a sandstone matrix (5%) In two areas, one south-west and the other north-east of Mount Drummond, cobble and boulder conglomerates overlying the lavas contain numerous lava cobbles and boulders, suggesting local erosinal breaks or minor contemporaneous movement within the Volcanics. In one other area, north of Mount Drummond, boulder conglomerate without volcanic boulders grades laterally into intermediate lava.

FIGURE 2.

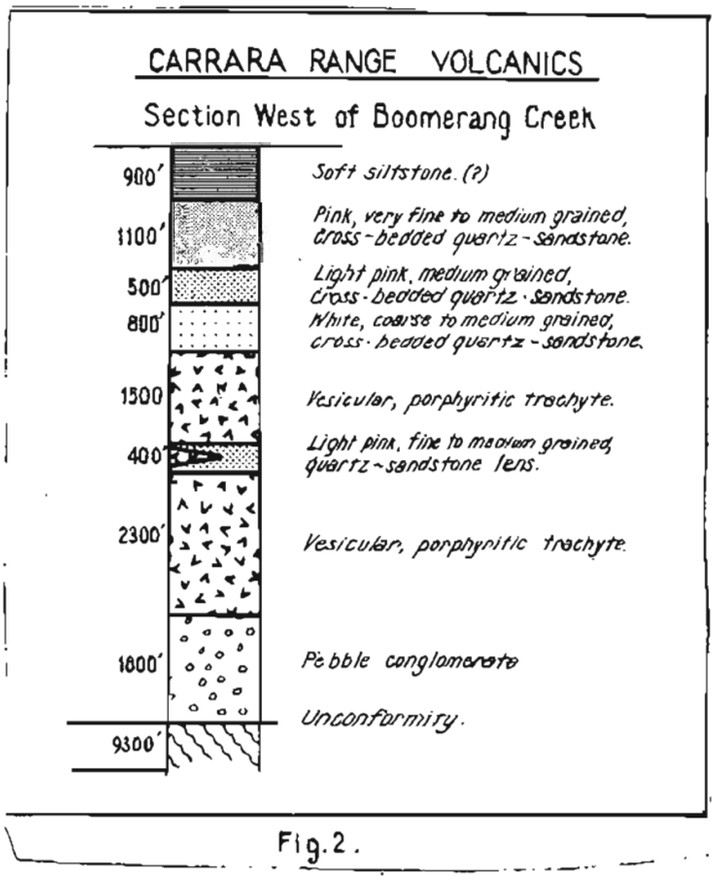

Fig.2.

Since the Carrara Range Volcanics are conformably overlain by the Bluff Range Beds, which are equivalent in part, at least, to the Lower Proterozoic Lawn Hill Formation, the Volcanics are also considered to be Lower Proterozoic. On the adjacent Calvert Hills Sheet the Cliffdale Volcanics are unconformably overlain by the Westmoreland Conglomerate. The Cliffdale Volcanics have been previously regarded as Upper Proterozoic (Firman, 1959), but it would now appear better to regard them as Lower Proterozoic and equivalent to the Carrara Range Volcanics.

BLUFF RANGE BEDS

The Bluff Range Beds crop out within, and south and west of, the Bluff Range, and around Highland Plains Homestead.

The rocks in the Bluff Range area are white to yellow siltstone, sandstone, calcareous sandstone, and limestone. Those west of Highland Plains Homestead are grey and purple siltstone, sandstone, dolomite, and dolomitic siltstone. Though the two areas differ in detail the rocks have been mapped as one unit because their range of grain size is similar; both areas contain "limey" beds; the degree of deformation is similar. South-west of Bluff Range, limestone and calcareous sandstone lens out sharply westwards; elsewhere the beds have a fairly uniform lithology. In the Bluff Range area the beds aggregate 5000 feet and west of Highland Plains Homestead 9000 feet; but in neither area is the section complete.

Because of similarity in lithology and degree of folding, the Bluff Range Beds are considered to be, at least in part, equivalent to the Lawn Hill Formation of the Lawn Hill sheet.

UPPER PROTEROZOIC

WESTMORELAND CONGLOMERATE

In two areas sediments underlying the Constance Sandstone have conglomerate as one of the dominant rock types; they have been correlated with the Westmoreland Conglomerate (Carter, 1959). Though conglomerate is ubiquitous the rocks have a diverse lithology. Rocks cropping out in a similar stratigraphical position in Maloney Creek have been given a separate name because of their distance from known Westmoreland Conglomerate. These will be dealt with separately.

The two areas of outcrop and their main lithologies are:-

North of Bauhinia Creek - Cobble to very coarse conglomerate, red micaceous greywacke, siltstone, dolomite, and arkosic conglomerate.

North of Benmara Creek - Pebble to boulder conglomerate, sandstone, and siltstone.

The rocks in the Bauhinia Creek area occupy the core of the Bauhinia Dome. (Rapid facies changes in the rocks, the size of the boulders (to 3 feet), granite fragments in the dolomite, and the arkosic conglomerate, all suggest a close proximity to basement, of which granite is a part).

The formation is about 1000 feet thick in the Benmara Creek area and about 4500 feet in the Bauhinia Dome.

MALONEY CONGLOMERATE

The Maloney Conglomerate crops out north of the Bluff Range and is the base of the Upper Proterozoic sequence in the area; the section is about 5000 feet thick but is incomplete.

The rocks are pebble to boulder conglomerate, sandstone, greywacke, siltstone, and minor calcareous beds. In Maloney Creek the conglomerate overlies a volcanic breccia which has been included in the Carrara Range Volcanics. In two exposures the conglomerate contains cobbles of the same volcanic rocks that occur in the breccia. East of the South Nicholson River greywacke of the Maloney Conglomerate grades laterally into the Constance Sandstone.

BENMARA VOLCANICS

The Benmara Volcanics crop out in a small area between Benmara Creek and its main tributary.

The rocks are rhyolite underlain by quartz sandstone and rare arkose. They crop out on the west side of north-

striking Murphy Metamorphics. One small outcrop of ignimbrite in Benmara Creek, to the east of the Metamorphics, has been correlated with the Benmara Volcanics.

The total thickness of the Benmara Volcanics is about 400 feet; the upper 200 feet are lavas.

The Benmara Volcanics are probably stratigraphically equivalent to the Peter's Creek Volcanics, which crop out widely in the adjoining Calvert Hills 4-mile Sheet area.

WOLLOGORANG FORMATION

The Wollogorang Formation (Carter, 1959) crops out in the extreme north-east of the sheet area.

The sediments are sandstone, siltstone, dolomite and dolomitic siltstone. About 900 feet of strata (representing the uppermost beds of the Wollogorang Formation) are exposed in the core of a gentle anticline. At least two dolomites occur in this section.

The Wollogorang Formation, on the Mount Drummond Sheet, appears to be conformably overlain by the Constance Sandstone; but, on the Calvert Hills Sheet, dolomitic pebbles in the base of the Constance Sandstone suggest a local erosional break between the two units. A break probably exists between the Westmoreland Conglomerate and the Constance Sandstone in the Bauhinia Domearea also. Southwards the Wollogorang Formation lenses out and does not crop out in the Bluff Range area.

CONSTANCE SANDSTONE

The Constance Sandstone (Carter, 1959) has a wide distribution on the Mount Drummond Sheet area. It crops out mainly in the north and north-east, in the Bluff Range and from the Bluff Range westwards to the Waterfall Creek area.

The dominant rock type is a white to light pink quartz sandstone, commonly fine to medium-grained, and rarely coarse-grained. Towards the base the sandstone is commonly

superficially stained red by iron. A lens of coarse-grained siltstone about 100 feet thick crops out near the junction of Bauhinia Creek and Nicholson River. Two siltstone lenses 200-300 feet thick occur in the sandstone in the Waterfall Creek area above a well-banded siltstone up to 1000 feet thick, which is here the basal unit of the Constance Sandstone. Cross-bedding is abundant in the sandstone, and though variable in direction, suggest the sandstone was laid down mainly from the south and west.

A well-exposed section to the west of the Wollogorang Formation outcrop contains about 1700 feet of Constance Sandstone; in the Bluff Range the Sandstone is 1300 feet thick, and in the south-west, it is about 5500 feet thick.

The Constance Sandstone has the most widespread distribution of the Upper Proterozoic rocks in the Mount Drummond area. It thins northwards, and north of the Nicholson Granite is only 100-200 feet thick. In this respect it contrasts with the Wollogorang Formation, which thins southwards from the Nicholson Granite.

MULLERA FORMATION

Outcrops of the Mullera Formation are widely distributed in the area, but in the central-east the Formation is largely obscured by a thin but widespread mantle of Mesozoic sediments.

The sediments of the Mullera Formation are sandstone, greywacke, siltstone, shale, glauconitic sandstone and ironstone. The Mistake Creek Sandstone Member (described separately) is included in the Formation. Siltstone and shale, commonly micaceous, and grey, green, purple, and rarely black, are the most common rock types but outcrop at these rocks is poor. To the west of the north-striking Murphy Metamorphics and north of the Mittiebah Range, the dominant rock types are white and pink siltstone and fine-grained sandstone.

Ironstone is locally developed as thin bands from 2 to 10 feet thick; but three bands of ironstone 15 to 20 feet thick crop out on the southern limb of a faulted syncline west of springvale Homestead; they grade westwards into a single band of ferruginous greywacke.

Lateral variation is common in the Mullera Formation in the east of the area. 3,800 feet of sediments are exposed west of Springvale Homestead but this section is incomplete (see figure 3). 8000 feet occur in an incomplete section exposed north of the Mittiebah Range; the formation thins northwards, and around Pandanus Creek it is only 1250 feet thick.

Outcropping Mullera Formation is largely confined to the Nicholson Basin (see under STRUCTURE). The Formation is widely distributed in the western part of the adjoining Lawn Hill Sheet, but does not crop out north of the Nicholson Granite on the Calvert Hills Sheet area.

FIGURE 3.

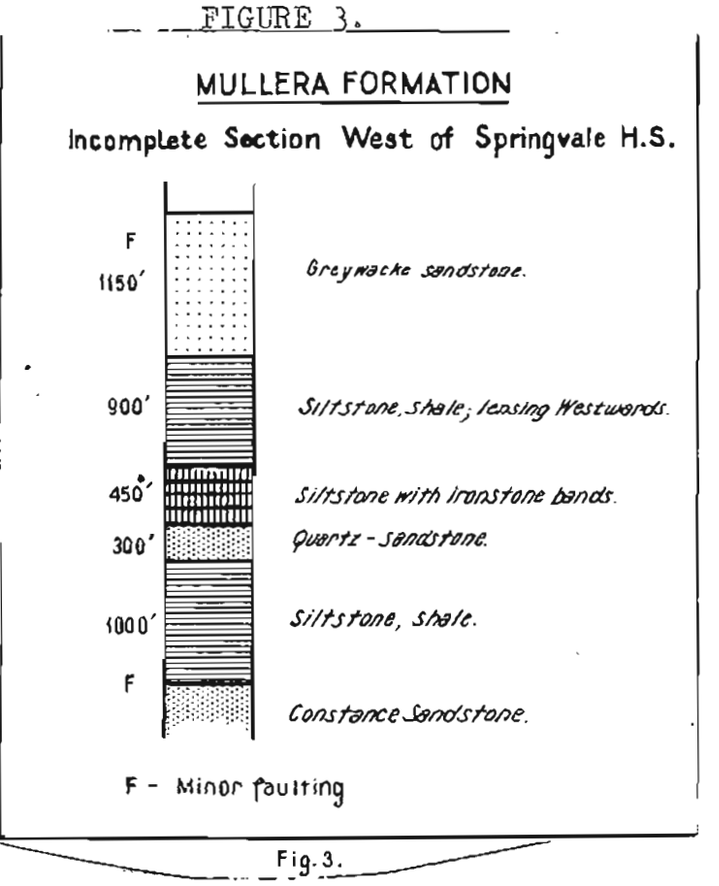

Fig. 3.

Mistake Creek Sandstone Member.

The Mistake Creek Sandstone crops out in the Bauhinia Creek - South Nicholson River - Mistake Creek area.

The sandstone is a fine to medium-grained quartz sandstone and is characterized by small-scale torrential cross-bedding. It is near the base of the Mullera Formation and is possibly equivalent to the Middle Creek Sandstone Member in the Lawn Hill Sheet area. The Mistake Creek Sandstone is about

650 to 700 feet thick.

MITTIEBAH SANDSTONE

The Mittiebah Sandstone is confined to the north-west and south-west of the Sheet area. It does not crop out within the Nicholson Basin.

In the Mittiebah Range, the Sandstone is a fine to medium-grained quartz sandstone with glauconitic sandstone towards the base; in the north-west the sandstone contains some well-rounded pebbles and cobbles. Cross beds are abundant; in the Mittiebah Range they indicate a provenance to the south and west, but in the north-west they indicate a provenance to the east - possibly the Murphy Metamorphics.

In the Mittiebah Range an incomplete section of the Sandstone is 9000 feet thick and, like the Mullera Formation, it thins to the north. At Pandanus Creek, 1600 feet of sediments are exposed in an incomplete section.

The Mittiebah Sandstone is confined to the Mount Drummond Sheet area and the extreme south of the Calvert Hills Sheet area.

TYSON SANDSTONE

The Tyson Sandstone crops out only in the extreme north, around Tyson Creek and Buddycurrawa Creek.

The formation is a fine to medium-grained sandstone interbedded with rare bands of pebble conglomerate 1 to 3 feet thick. South of the Nicholson River the base of the Sandstone is a pebble conglomerate, but the constituent pebbles do not indicate their source.

The Sandstone is not folded or faulted, but it is strongly jointed with a dominant direction of 130°. The maximum thickness is about 50 feet.

Because of apparent slight cross-cutting of the Tyson Sandstone across shallow-dipping Mullera Formation the Sandstone is considered to be unconformable on the Mullera Formation and probably equivalent to the Bukalara Sandstone,

which crops out widely in the north of the Calvert Hills Sheet area.

CAMBRIAN

PEAKER VOLCANICS

The Peaker Volcanics crop out in the west and south-west of the area and north of Mitchiebo Waterhole. In several localities weathering of the volcanics has produced areas of black soil contiguous to outcrops of the unit. The volcanics are particularly susceptible to lateritization.

The rocks are mainly intermediate lavas, best termed trachytes although they do not have typical trachytic texture; the weathered lavas are bright red. There are light grey vesicular basalts near the base of the formation. South of Peaker Piker Creek the volcanics contain unfossiliferous sandstone lenses.

Both the Mullera Formation and the Mittiebah Sandstone are unconformably overlain by the Peaker Volcanics. The distribution of the volcanics is closely allied to that of the overlying Middle Cambrian (Burton Beds) and in one place a lens-shaped mass of lava, probably representing the last phase of extrusive activity, is interbedded in a siltstone sequence in which, only 20 feet above the lava lens, Middle Cambrian fossils have been found. The Peaker Volcanics are therefore considered to be lower Middle Cambrian. Elsewhere similar volcanic rocks have been found e.g. Tennant Creek (Helen Spring Volcanics) and Lawn Hill (Colless Volcanics) but these have been regarded as Lower Cambrian or Upper Proterozoic.

BORDER WATERHOLE FORMATION

The Border Waterhole Formation crops out in the east of the area around Highland Plains Homestead and Lancewood Creek. Similar sediments to those in the Border Waterhole Formation occur in the west of the Sheet area but are temporarily given a separate name (the Burton Beds) because of the

possibility of faunal differences.

The Formation consists of white and cream siltstone and chert with very subsidiary limestone. There is a shattered pebble conglomerate at the base of the formation north of Lancewood Creek. The rocks are fossiliferous and of Middle Cambrian age (Öpik, 1956a).

The maximum thickness of the Border Waterhole Formation is about 150 feet.

BURTON BEDS

The Burton Beds crop out widely in the south-west and west of the area and north and north-west of Mitchiebo Waterhole.

The rocks are white and cream siltstone, occasionally silicified, and chert. West of Tobacco Waterhole a red friable sandstone crops out towards the base of the Beds. The rocks are highly fossiliferous; fossils show that they are the equivalent of the lower Middle Cambrian "Alexandria Beds". Maximum thickness observed was about 75 feet. In the west, the Burton Beds rest conformably on the Peaker Volcanics but around Highland Plains Homestead and Lancewood Creek there are no Volcanics and the Border Waterhole Formation unconformably overlies the Bluff Range Beds.

CURRANT BUSH LIMESTONE

The Currant Bush Limestone crops out along Lancewood Creek in the east of the area.

The dominant rock type is a light cream to grey thin-bedded, rarely thick-bedded, limestone. Friable medium-grained sandstone crops out about 3 miles west of the Gallipoli-Highland Plains road and leached siltstone and shale crop out at Lancewood Waterhole. The latter were mapped as a separate unit (the Lancewood Shale) by Öpik.

The Limestone is highly fossiliferous, and is of lower Middle Cambrian age.

The maximum thickness of the Currant Bush Limestone is about 500 feet but the Limestone lenses out abruptly westwards and has not been mapped in the west of the area.

DON CREEK DOLOMITE

The Don Creek Dolomite is widely distributed over most of the south and south-west of the sheet, but most of it is soil-covered and it crops out only in the Carrara and Don Creeks' drainage system, and in an area around Tobacco Waterhole.

The rocks are mainly dolomite with chert bands in places and rare sandstone lenses. No fossils were found.

The thickness could not be determined but bores in the south of the sheet area obtain water from dolomite at about 320 feet.

Öpik (1956a) related the dolomite in the east of the area to the Camooweal Dolomite, for which there is evidence for an Upper Proterozoic age. For this age to be possible in the Lancewood Creek area the dolomite would have to be thrust, since the Currant Bush Limestone dips south under the dolomite. Some faulting is present (but probably not thrust faulting)but not along all of the dolomite - Currant Bush Limestone contact. The dolomite is therefore considered to be younger than the Currant Bush Limestone and upper Middle Cambrian or younger in age; consequently it has been re-named the Don Creek Dolomite.

MESOZOIC

Mesozoic sediments crop out widely in the north-east of the area; there are also minor outcrops around Lancewood Creek, north of Carrara Range, and at the headwaters of Fish Hole Creek.

All outcrops except that in Fish Hole Creek consist of probable freshwater sediments; in several localities [illegible] preserved plant remains have been found. The sediments are mudstone, siltstone, sandstone and fine to pebble conglomerate.

The maximum thickness mapped was about 190 feet in No-return Creek.

The outcrop in Fish Hole Creek is small and consists of fine to medium-grained sandstone which contains marine pelecypods of probable Neocomian age. (Dickins, 1960). Specimens identified include Inoceramus sp. nov. Iotrigonia sp. nov., Trigoniidae gen. et. sp. and a specimen similar in shape to Fissilunula clarkei (Moore, 1870). One large belemnite guard was also identified. The sandstone is probably less than 20 feet thick.

Elsewhere in the Northern Territory marine Mesozoic sediments overlie freshwater sediments.

TERTIARY.

CLEANSKIN LIMESTONE

On Cleanskin Plain - at the headwaters of Cleanskin Creek - and in Fish Hole Creek black soil partly covers poorly outcropping limestone. The limestone is commonly chalcedonic with a skeletal appearance.

In Fish Hole Creek the limestone is unfossiliferous, but it appears to overlie fossiliferous Mesozoic and on this evidence it has been placed in the Tertiary. Similar limestones crop out at Brunette Downs, Austral Downs, and near Urandangi; they are between 550 feet and 780 feet above sea level; but the limestone at Cleanskin Plain and Fish Hole Creek is between 800 and 950 feet above sea level. The Carl Creek Limestone cropping out on the Lawn Hill Sheet area has also been placed in the Tertiary. The limestones were probably deposited in shallow freshwater lakes which were formed in much the same topography as that existing today.

There are small outcrops of limestone in Buddycurrarwa Creek and north of the Carrara Range. The limestones are silicified, unfossiliferous, and horizonatally bedded. They have been tentatively placed in the Tertiary but could be older.

STRUCTURE

The general structural disposition of the stratigraphic units has been listed in Table 1.

FOLDING

Lower Proterozoic rocks and the Nicholson Basin

During Upper Proterozoic times shallow-water sediments were deposited within the Nicholson Basin. The Basin was bounded on the west by the Murphy Metamorphics, on the north by the Nicholson granite, on the east by the Lawn Hill Formation and the Ploughed Mountain Beds, and in the south by the Carrara Range Volcanics and the Bluff Range ... Beds. During the deposition of the Mullera Formation the Basin may have been partly enclosed and sedimentation may have ceased altogether within the Basin at the end of deposition of the Mullera. Post-Mullera compression caused the formation of west-trending broad, gentle flexures in the sediments. Dips within the Basin average less than 10° but steepen slightly towards the margins. The Murphy Metamorphics bound the Nicholson Basin in the west. Their northerly strike indicates a regional change of 90° from their strike in the Carrara Range area.

FIGURE 4.

STRUCTURAL SKETCH MAP, MT. DRUMMOND AREA

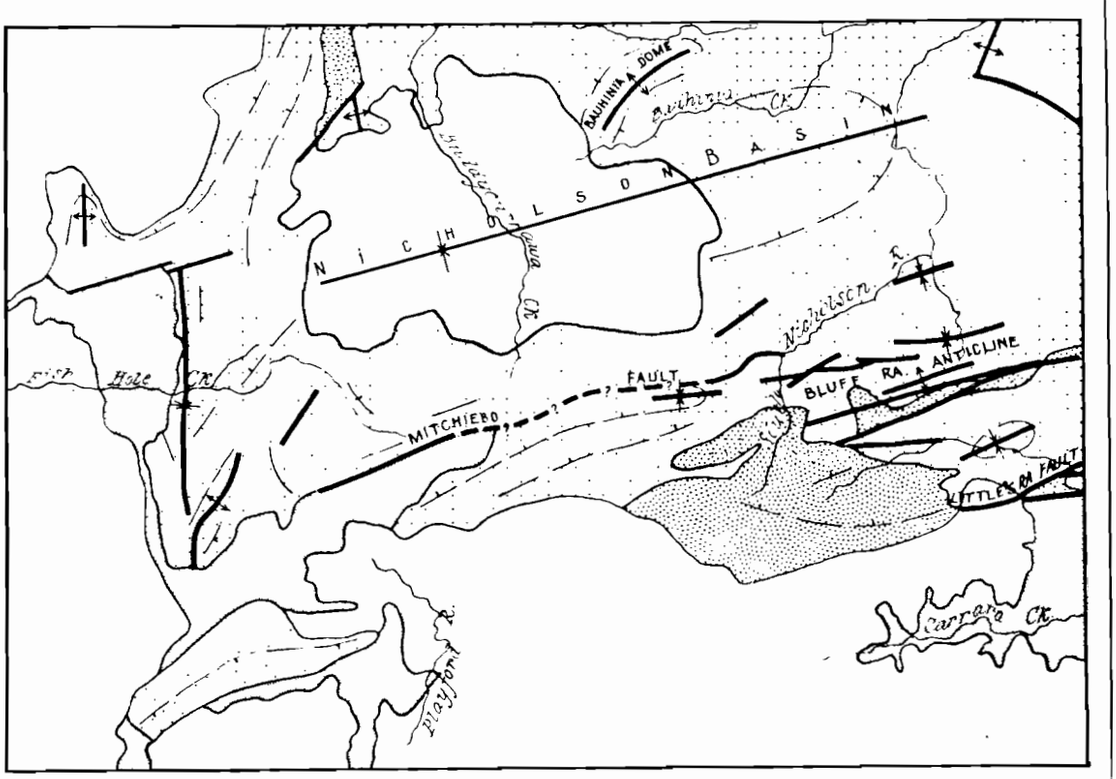

Fig. 4.

Scale

20 10 0 20 40 Miles

Reference

- Anticline or dome.
- Syncline or basin.
- Fault.
- Inferred fault.
- Trend line with dip
- Lower Proterozoic.
- Upper Proterozoic.
- Cambrian.
- Recent.

Bauhinia Dome

The Bauhinia Dome is the site of a ridge whose 'core' is of Westmoreland Conglomerate and which sank below sea level before the Constance Sandstone was laid down. Brief reference to the Bauhinia Dome has been made in the description under the Westmoreland Conglomerate, indicating the strong possibility of a basement ridge which became submarine prior to the deposition of the Constance Sandstone. In places the strike of the Constance Sandstone appears to be slightly at a variance with that of the Westmoreland Conglomerate; this disconformity appears, however, to be local since elsewhere e.g. Benmara Creek the units are conformable. Dips

in the Bauhinia Dome vary between 10° and 35° and folding is on a curving east to south-east axis. The Constance Sandstone to the south of the Dome is sharply folded and dips of over 70° have been mapped.

Syncline to the west of Springvale Homestead.

The syncline within the Mullera Formation strikes west and has a very shallow plunge to the west. Dips on the limbs are shallow and average about 10°. Most of the northern limb has been eliminated by a major fault (the Mitchiebo Fault). Similar west-south-west faults (though apparently with little throw) affect the southern limb, and therefore the calculation of 3800 feet for the thickness of the sediments on the limb is only approximate.

Bluff Range Anticline

In the Bluff Range, dips in the Constance Sandstone give the impression of a broad anticline over the more highly folded Lower Proterozoic Bluff Range Beds; though they may be partly depositional. The anticline is about 25 miles long, about 8 miles broad and strikes west-south-west. The dips on both limbs are shallow and average about 6°; on the north limb the dips steepen to 15° close to the Bluff Range, whereas on the south limb the dips are more variable and small inliers of Bluff Range Beds crop out.

Structures in the west of the area.

A large north-striking, north-plunging syncline is the main structure in the west of the area. It trends from Waterfall Creek 24 miles northwards to the headwaters of Boxer Creek, where its continuation is obscured by a major west-striking fault. The syncline contains Constance Sandstone, Mullera Formation, and Mittiebah Sandstone; most of the western limb is covered by Cambrian sediments and volcanics. A complementary anticline occurs to the east of

the syncline; it has a curving axis and strikes from north to north-east. Dips of the sediments in the anticline and syncline average about 30° but are more than 60° in places.

Between the southern limit of the anticline and the Mittiebah Range the regional strike changes from north to west; dips average 60°, but range up to vertical.

FAULTING

Bluff Range Fault System

In the Bluff Range a series of strike faults affects both the Bluff Range Beds and the Constance Sandstone. The faults dip 60°N to vertical, and in some places form impressive scarps up to 100 feet high. Many of the faults can be traced on the ground - one for at least 25 miles. Some reverse faults; but it is doubtful if movement on any of these faults was very great.

Little Range Fault

The Little Range Fault has been traced for about 30 miles and strikes west ; the eastern 24 miles (18 of which are in the Lawn Hill 4-mile area) is marked by a rugged south-facing escarpment. In the Mount Drummond area the fault scarp is about 200 feet high, and through it Musselbrook Creek has cut an impressive gorge at Border Waterhole. For the remaining 6 miles the fault can be traced beneath the sand by means of change in pattern on the photographs, to the western edge of the Carrara Range, where it bifurcates. No definite age or ages can be assigned to the fault, but in the Lawn Hill area it has affected both the Currant Bush Limestone and the Boarder Waterhole Formation of Middle Cambrian age. The distribution of the Colless Volcanics in Colless Creek closely follows the fault line and suggests that the fault provided egress for the basalts. The Colless Volcanics are lower Middle Cambrian or older; it is therefore fairly certain that there have been at least

two movements on the fault. The Constance Sandstone is strongly fractured around Border Waterhole, and this seems to indicate a large movement; no calculations can be made on the throw of the fault, but it was certainly more than 800 feet. In one area there is evidence of a horizontal component to the movement, with the south side moving west.

An almost parallel fault in the Lancewood Creek area also affects Cambrian sediments; towards the Queensland border it tends to feather-out, and the total movement was probably not great.

Mitchiebo Fault

The Mitchiebo Fault is about 35 miles long and was mapped from west-north-west of Mitchiebo Waterhole to north-west of Springvale Homestead where it bifurcates. North-west of Mitchiebo Waterhole the fault has severly disturbed the Constance Sandstone and the Cambrian sediments; the latter with one exception crop out on the south side of the fault and have dips up to 75° adjacent to the fault. Eastwards from Mitchiebo Waterhole the outcrop is poor but the fault is inferred from: the generally steep dips; the disappearance of the northern limb of the syncline west of Springvale Homestead; and the repitition of the Constance Sandstone and the Mullera Formation.

There is little faulting in the west of the area. A fault terminates a syncline at the headwaters of Boxer Creek, and a long curving fault was mapped west of Benmara Homestead. The throw of these faults could not be determined.

Though no direct evidence can be found for faulting in Pre-Cambrian times, it is unlikely that all the faulting in the area has taken places in post-Pre-Cambrian times. There were probably two periods of faulting, one at the end of the Lower Proterozoic and the other after the Mittiebah Sandstone was laid down; and further movement -

partly along established faults - occurred after the Middle Cambrian deposition, and, more slightly, after the Mesozoic deposition.

ECONOMIC GEOLOGY

In 1957 Mount Isa Mines Ltd prospected the Carrara Range area for minerals, but no discoveries of economic importange were made. Very sparse malachite stains were observed by the Mount Drummond party in a sandstone lens at the divide between Boomerang Creek and Fish Hole Creek.

Ironstones occur within the Mullera Formation. Samples collected from them suggest that they may be too silica rich (the most favourable analysis was SiO_2 21.8%, Fe_2O_3 72.5%), but a detailed sampling programme is necessary to confirm this.

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TABLE 1.

STRATIGRAPHY OF MOUNT DRUMMOND 4-MILE SHEET.

ERA	PERIOD	ROCK UNITS, SYMBOL	DISTRIBUTION	THICKNESS IN FEET	LITHOLOGY	TOPOGRAPHY	STRUCTURE	PALAEONTOLOGY	STRATIGRAPHICAL RELATIONSHIPS	ECONOMIC GEOLGY	REMARKS
CAINOZOIC	QUATERNARY	Sandy soil (Cza)	Widely in Buddycurrawa Ck., also around edges of ranges.	Gen. thin; to 100 where banked by winds.	Various sandy soils	Plains with turpentine, spinifex and sparse tree cover.					
		Black soil (Czs)	Wide distribution S.W. & S. Also smaller distn. Fish-hole Ck., Cleanskin Plain.	Usually thin.	Heavy clay soil; black, boggy when wet. Sink-holes.	Grass plains, featureless except for rare Lancewood stands.					Formed on Don Creek Dolomite, Tertiary chalcedonic limestones and Peaker Volcanics.
		Lateritic soil (Czl)	Small areas, especially Benmara Ck. and north-west.	Thin.	Leached ferruginous aluminous, fine soil, nodular in places.						
	TERTIARY	Cleanskin Limestone (Tl)	Cleanskin Plain, Fish-hole Ck. Small poss. o/cs Buddycurrawa Ck., Carrara Range.	Thin. Probably less than 50.	White-light grey chalcedonic limestone, white chert.	Grass plains. Where o/c v. low rough rises.	Horizontal?	No fossils found	Post-Mesozoic?	Possible shallow water.	Probably equivalent to Bruncette Limestone, etc. and Carl Ck. Limestone.
			U N C O N F O R M I T Y								
MESOZOIC			Mainly N.E. Also thin deposits in E.	190	Conglomerate, siltstone, mudstone, sandstone, minor greywacke.	Mesas, flat-topped remnants, particularly on Mullera Formation.	Horizontal. Minor movements along pre-existing faults.	Poor plant remains. Also pelecypods and belemnites.	Unconformable on Cambrian sediments.		Both freshwater and marine present.
			U N C O N F O R M I T Y								
PALAEOZOIC	CAMBRIAN	Don Ck. (Cmd)	Wide distribution, but poor o/c. Best Carrara Ck. and Don Ck.	Unknown, but several hundred feet.	Dolomite, dolomitic limestone, chert, sandstone lenses.	Rough, shallow gorges in Carrara & Don Cks.	Flat-lying rare minor folds.	Stromatolithe.	Underlain in Lancewood Ck. area by Currant Bush Limestone.	Very good aquifer. Approx. depth of water 320'.	also regarded as Upper Proterozoic or Lower Cambrian) Camooweal Dolomite (Opik 1956a)
		Currant Bush Limestone (Cmc)	Only around Lancewood Ck. in extreme E. of area.	500	Thin-bedded grey limestone with some sandy beds, chert lenses & shale.	Low, rough terrain.	Dipping S. off fault, shallows abruptly.	Highly fossiliferous (to be examined).	Underlain by Border F.H. Formation. Overlain by Don Ck. Dolomite.		
		Burton Beds.	Widely south & south west.	75 +	Leached siltstone, chert.	Rounded hills with lateritic caps.	Sub-horizontal except near faults.	Highly fossiliferous (to be examined)	Overlies Peaker Volcanics.		
		Border Waterhole Formation (Cmo)	Around Lancewood Ck. Highland Plains Hstd.	150	Leached siltstone, chert.	Rounded hills with occasional lateritised caps.	Sub-horizontal except near faults.	Fossiliferous (Opik 1956a)	Probably underlies Currant Bush Limestone.		
		Peaker Volcanics (Cmp)	Mainly west and south-west.	120	Trachyte basalt minor sediments.	Lateritised flat-tops, and low rounded hills. Black soil cover.	Sub-horizontal.		Unconformably overlies Mittiebah Sandstone.		Thought to be Middle Cambrian, possibly equivalent to Colless Volcanics (previously considered to be Lower Cambrian or Upper Proterozoic).
			U N C O N F O R M I T Y								
PROTEROZOIC	UPPER	Tyson Ck. Sandstone (Put)	North-centre around Tyson & Buddycurrawa Cks.	50 (+)	Cross-bedded quartz-sandstone, pebble conglomerate	Flat-tops where dissected.	Sub-horizontal		Probably unconformably overlies Mullera Formation.		Probably equivalent to Bukalara Sandstone (Calvert Hills 4-mile).
			U N C O N F O R M I T Y								
		Mittiebah Sandstone (Pumi)	Southwest and north-west.	9,000 S.W. 1,600 N.S.	Cross-bedded quartz-sandstone, glauconitic sandstone; rare pebbles and cobbles.	Rugged dissected country. Mittiebah Range 200' high (approx.).	Shallow dips 0-30°. A few steeper to 60°. Little faulted.		Conformably overlies Mullera Formation in west.		Not known elsewhere. Possibly minor distribution on Calvert Hills sheet.
		Mullera Formation (Pul)	General	6,000 north of Mittiebah R; 3,300 west of Springvale.	Siltstone, shale, sandstone, galuconitic sandstone, ironstone, greywacke.	Shale; rounded, rubble covered hills, occasional lateritic caps. SS; rugged locally where horizontal.	Shallow dips 0-30°.		Conformably overlies Constance Sandstone.	Ironstone, siliceous, developed west of Springvale Homestead, very locally elsewhere.	Ironstone development limited to enclosed basin? 6,000 feet thickness on Lawn Hill 4-mile within basin.
		Mistake Creek Sandstone Member (Pums)	S. Nicholson Rv. Bauhinia Ck.	650	Torrentially cross-bedded sandstone.	Flat-topped hills, where dipping, rugged o/c	Sub-horizontal, Dips to 15° in places. Minor faulting.		Towards base of Mullera Formation.		Possibly equivalent to Middle Creek Member (Lawn Hill 4-mile sheet)
		Constance Sandstone (Pua)	Wide distribution but mainly N.E. & E.	1,700 N.E. 5,500 Waterfall Ck.	Cross-bedded sandstone with siltstone lenses.	Rugged dissected topography. Rivers in gorges.	Gentle folding to 30°; rarely steeper. Much faulting.		Possibly disconformably on Wollogorang Formation.	Permanent W.H.s and springs.	Greater development of siltstone towards west of sheet. 3000'(+) thick on Lawn Hill 4-mile sheet.
			D I S C O N F O R M I T Y ?								
		Wollogorang Formation (Puh)	Only in extreme N.E.	900	Dolomite, siltstone sandstone, dolomitic sandstone.	Rolling country. Occasional prominent dip & scarp slopes.	Gentle anticlinal structure. Dips to 30°. Some faulting.				Greater development on Calvert Hills 4-mile sheet, to 1,000 feet; lenses out westwards and southwards.
		Benmara Volcanics (Pube)	Small area S. of Benmara Ck.	400	Rhydite, ignimbite quartz-sandstone, arkose.	Rounded ridges; rougher surface on volcanics.	Shallow dips west - to 30°. Minor faulting.		Possible disconformable under Constance Sandstone. Unconformably on Murphy Metamorphics.		Probably equivalent to Peters Ck. Volcanics (Calvert Hills 4-mile sheet).
		Westmoreland Conglomerate (Puw)	2 separate areas Bauhinia Ck., Benmara Ck.	4,500	Conglomerate, greywacke, siltstone, dolomite.	Rolling rounded hills with subdendritic drainage.	Dips 0-60°. Anticlinal and domal structures.	Possible stromatoliths in dolomite in Bauhinia Ck.	Disconformable under Constance Sandstone.		In part probably equivalent to each other in time but no close relationship between specific rock types.
		Maloney Conglomerate (Puy)	N. side of Bluff Range.	5,000	Conglomerate, sandstone, greywacke, siltstone.		Strongly faulted north of Bluff Range.		Unconformably on Carrara Range Volcanics.		No dolomite in Westmoreland Conglomerate in type area. Dolomite in west and Bauhinia Ck.
			U N C O N F O R M I T Y								
	LOWER	Bluff Range Beds (Plb)	In, S & W of Bluff Range, Also W of Highland plains.	9000	Siltstone, sandstone, calcareous siltstone, limestone, dolomite.	Well developed ridges with dip and scarp slopes.	Dips generally N. 0-80°. Strongly strike-faulted.		Unconformably below Constance Sandstone.		Probably equivalent in part to Ploughed Mt. Beds and Lawn Hill Fm. Markedly lenticular south-west of Bluff Range. Rocks in Highland Plains area differ from those in Bluff Range.
		Carrara Range Volcanics (Plc)	Carrara Range area only.	9,300	Porphyritic trachyte minor tuff, agglom. Conglom., siltstone sandstone.	Conglom. and sandstone form rugged strike ridges. Volcanics rounded hills.	Dips generally N.0-80°. Very strongly faulted, (mainly strike faults)		Probably unconformable on Murphy Metamorphics. Conformable with Bluff Range Beds.	V. poor malachite staining.	Possibly equivalent to Cliffdale Volcanics.
			U N C O N F O R M I T Y								
		Murphy Metamorphics (Blm)	Murphy's Creek area, also south side of Carrara Range.	?	Quartz-sericite schist, sheared siltstone met. ashstone; intruded by feldspar porphyry (?) monzonite.	Low rounded hills, o/c poor.	Near-vertical dips. Murphy's Ck. overall very steeply west.				Much quartz-veining but none in sheared porphyry and monzonite. No obvious equivalents in surrounding area.

MOUNT DRUMMOND

AUSTRALIA 1 : 253,440 — NORTHERN TERRITORY — 4 MILE GEOLOGICAL SERIES SHEET E53-12

Compiled by Bureau of Mineral Resources, Geology and Geophysics.

Geology and compilation November 1959, by : J.W. Smith and H.G. Roberts

REFERENCE

CAINOZOIC

- **RECENT-TERTIARY**
  - Csa — Sandy soil and alluvium
  - "Black" soil
  - Czl — Lateritic soil
- **TERTIARY ?** — Cleanskin Limestone — Tl — Limestone, chert

UNCONFORMITY

MESOZOIC

- **LOWER CRETACEOUS-JURASSIC ?** — Conglomerate, sandstone, siltstone

UNCONFORMITY

PALAEOZOIC

- **CAMBRIAN**
  - Don Creek Dolomite — Emd — Dolomite, chert, sandy in places (sand soil over)
  - Currant Bush Limestone — Emc — Thin-bedded grey limestone
  - Border Waterhole Formation — Emo — Siltstone, chert
  - Burton Beds — Emb — Siltstone, chert
  - Peaker Volcanics — Emp — Intermediate to basic volcanics

UNCONFORMITY

PROTEROZOIC

- **UPPER PROTEROZOIC**
  - Tyson Sandstone — Put — Quartz-sandstone, minor pebble-conglomerate

UNCONFORMITY

  - Mititjebah Sandstone — Pumt — Quartz-sandstone, glauconitic sandstone
  - Mullera Formation — Pul — Siltstone, shale, sandstone, glauconitic sandstone, ironstone, greywacke
  - Mistake Creek Sandstone Member — Pums — Sandstone
  - Constance Sandstone — Pus — Sandstone, minor siltstone

DISCONFORMITY ?

  - Wollogorang Formation — Puh — Dolomite, siltstone, sandstone
  - Benmara Volcanics — Pube — Rhyolite, sandstone, minor arkose and ignimbrite
  - Westmoreland Conglomerate — Pum — Conglomerate, greywacke, siltstone, dolomite
  - Maloney Conglomerate — Puy — Conglomerate, greywacke, sandstone, minor siltstone

UNCONFORMITY

- **LOWER PROTEROZOIC**
  - Bluff Range Beds — Plb — Siltstone, sandstone, limestone
  - Carrara Range Volcanics — Plc — Trachyte, sandstone, conglomerate, siltstone, minor agglomerate, tuff

UNCONFORMITY

  - Murphy Metamorphics — Plm — Intrusive monzonite, feldspar porphyry; Quartz-sericite schist, sheared siltstone, minor dolostone

- Geological boundary
- Anticline showing plunge
- Syncline showing plunge
- Fault

Where location of boundary, fold or fault is approximate line is broken; where inferred, queried. Where concealed faults are shown by short dashes, folds by dotted lines.

Strike and Dip of Strata
- Inclined
- Horizontal
- Vertical

- Trend lines and dip from air-photo interpretation
- Joints from air-photo interpretation

Mineral Deposits
- Ironstone
- Marine fossil locality
- State boundary
- Vehicle track
- Bore
- Waterhole
- Claypan
- Sand-dunes
- Homestead or Hut
- Yard
- Astrofix

INDEX TO ADJOINING SHEETS

Showing Magnetic Declination

WALLHALLOW	CALVERT HILLS	WEST MORELAND
BRUNETTE DOWNS	MT DRUMMOND	LAWN HILL
ALROY	RANKEN	CAMOOWEAL

Scale 4 Miles to 1 Inch

GEOLOGICAL RELIABILITY DIAGRAM

B. Reconnaissance—regional traverses and air-photo interpretation

C. Air-photo interpretation only

Darwin — Burketown — NORTHERN TERRITORY

Section A-B-C

NATURAL SCALE

Section D-E

NATURAL SCALE