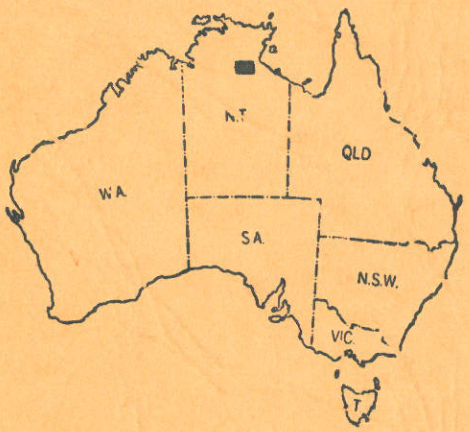
1 : 250,000

GEOLOGICAL SERIES

EXPLANATORY NOTES

HODGSON DOWNS, N.T.



Sheet SD 53-14

International Index

COMMONWEALTH OF AUSTRALIA

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

1 : 250,000 GEOLOGICAL SERIES

EXPLANATORY NOTES

HODGSON DOWNS, N.T.

Sheet SD 53–14

Compiled by P. R. Dunn

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DEPARTMENT OF NATIONAL DEVELOPMENT

Minister : SENATOR THE HON. SIR WILLIAM SPOONER, K.C.M.G., M.M.

Secretary : SIR HAROLD RAGGATT, C.B.E.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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Explanatory Notes on the Hodgson Downs Geological Sheet

Compiled by

P. R. Dunn

The Hodgson Downs Sheet area contains rocks of Proterozoic, Cambrian, and Cretaceous age. It is in the Gulf of Carpentaria region of the Northern Territory, and forms part of the drainage basins of the Roper, Towns, and Limmen Bight Rivers.

Nutwood Downs and Hodgson Downs Homesteads are the only permanent habitations. A graded earth road from Daly Waters provides access to Nutwood Downs for most of the year; a similar road to Hodgson Downs from Mataranka via Elsey Homestead is open in the dry season only; other tracks in the area are not in general use, and are suitable only for 4-wheel-drive vehicles. The eastern half of the area is trackless and uninhabited ; the country is too poor to support more than a few wild cattle. Nutwood Downs has an airstrip which is open throughout the year.

Air photographs and maps covering the area and available during 1960 were: air photographs at a scale of 1 : 50,000 flown by the Royal Australian Air Force in 1950; an uncontrolled photomosaic at a scale of 1 inch : 4 miles; and a planimetric map at a scale of 1 inch : 4 miles, produced by the Division of National Mapping, Department of National Development, from a controlled photo-scale slotted template assembly. The geological map was plotted on a photo-scale trace of this assembly and reduced to 1 : 250,000.

Previous Investigations

Woolnough (1912) was the first geologist to record a visit to the Hodgson Downs Sheet area. During a reconnaissance of the Northern Territory he travelled south along the Hodgson River from Roper Bar to Nutwood Downs Homestead and then south-east to Tanumbirini Homestead.

Geologists of Broken Hill Pty Co. Ltd worked in the area between 1955 and 1958 (Cochrane & Edwards, 1960 ; Cochrane, 1956, 1957 ; Bennett, 1959). They mapped the northern third of the Sheet in reconnaissance detail, and later drilled sedimentary iron ore deposits north-west of Hodgson Downs Homestead.

Jones (1955) and Mackay (1957), of the Bureau of Mineral Resources, reported on the water resources of the Nutwood Downs area. Malone (1956) photo-interpreted the geology of the extreme north-east corner of the Sheet, an area which was later visited by geologists of Enterprise Exploration Pty Ltd during a helicopter reconnaissance of country between Arnhem Land and the Limmen Bight River (Patterson, 1958).

The Geophysical Branch of the Bureau of Mineral Resources carried out a gravity traverse along the track from Daly Waters to Nutwood Downs and Tanumbirini in 1960 as part of a regional gravity survey of the Northern Territory.

These notes are based on regional mapping by geologists of the Bureau in 1960. Some geological information on the north-eastern region was obtained from geologists of Broken Hill Pty Co. Ltd, who were operating a helicopter in that area during 1960. Mapping of three of the four adjoining Sheets—Urapunga (Dunn, 1963), Tanumbirini (Paine, 1963), and Mount Young (Plumb & Paine, 1963)—has been completed by the Bureau.

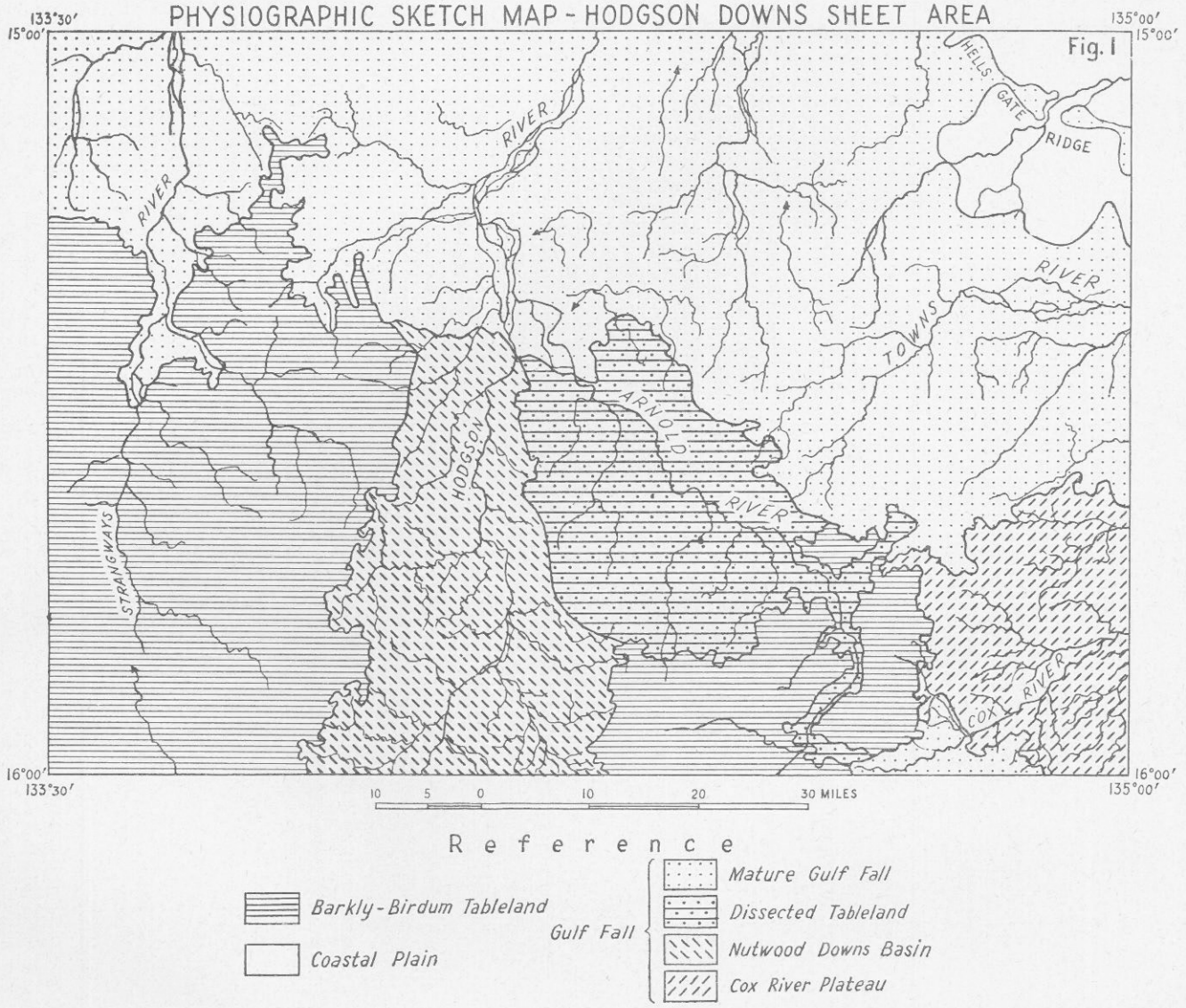
PHYSIOGRAPHY

Drainage

Most of the Sheet area is drained by the Strangways, Hodgson, and Arnold Rivers, which are north-flowing tributaries of the Roper River. Drainage in the east is into the Towns and Cox Rivers (the Cox is a tributary of the Limmen Bight River). The north-flowing rivers were developed consequent on a down-warping of an early Tertiary land surface towards the valley of the Roper River. The Towns and Cox Rivers are consequent on a similar warping towards the coast. The Arnold River follows a course inland from and parallel to the line of flexure of the coastal warp. The rivers flow only during the wet season, but large waterholes remain throughout the year.

The area between the Roper River and the Queensland Border has been divided into three broad physiographic units: Barkly–Birdum Tableland, Gulf Fall, and Coastal Plain (Dunn, Smith, & Roberts, in prep.). The Hodgson Downs Sheet area includes each of these three units; the Gulf Fall is subdivided into Mature Gulf Fall, Dissected Tableland, Nutwood Downs Basin, and Cox River Plateau (Fig. 1).

Part of the north-eastern margin of the *Barkly–Birdum Tableland* occurs in the south and west of the Sheet area. It is mainly formed of Cretaceous sediments (which are capped with duricrust and are a remnant of an early Tertiary land surface), and Tertiary sediments (overlying Cambrian limestone) Drainage is poorly developed and flows north-east into the Gulf drainage system. The edge of the Tableland is marked in places by a 100-feet scarp of lateritized


PHYSIOGRAPHIC SKETCH MAP - HODGSON DOWNS SHEET AREA
Fig. 1
133°30'
15°00'
135°00'
15°00'
16°00'
133°30'
16°00'
135°00'
HELLS GATE RIDGE
RIVER
RIVER
RIVER
TOWNS
ARNOLD
RIVER
HODGSON
RIVER
STRANGWAYS
COX
RIVER
10 5 0 10 20 30 MILES
Reference
Barkly-Birdum Tableland
Coastal Plain
Gulf Fall
Mature Gulf Fall
Dissected Tableland
Nutwood Downs Basin
Cox River Plateau

Cretaceous sediments. Scarp-retreat is active in the headwaters of the upper tributaries of the Hodgson River and north of Maryfield Creek. Elsewhere the margins are bevelled through erosion by streams developed on the downwarp surfaces of the Tableland.

The *Gulf Fall* comprises the area from which almost all the early Tertiary land surface has been eroded. The *Mature Gulf Fall* is characterized by broad flat valleys lying between strike-ridges of sandstone which have a relief of about 200 feet. The main rivers are aggrading, and anastomosing stream patterns are developed in the broad valleys. These rivers have reached a local base level upstream from the Hell's Gate Ridge at about 150 feet above sea-level. The Hell's Gate Ridge is part of a strongly developed sandstone ridge, dipping south and west, which can be traced discontinuously from north of the Roper River for about 150 miles south and east; it appears in the north-east corner of this Sheet in its least distinctive form, being little higher than the adjacent Coastal Plain. The topography within the Gulf Fall is mainly controlled by Proterozoic structure; most of the prominent hills are formed along strike ridges or are developed adjacent to faults.

The *Dissected Tableland* is an area in which the Tableland has been bevelled down, exposing Proterozoic rocks, but still includes many scattered low mesas of Cretaceous rocks. The Arnold River drainage basin occupies most of it.

The drainage basin of the upper Hodgson River (the *Nutwood Downs Basin*) is about 150 feet above the level of the lower Hodgson River. Drainage is through a narrow gorge of sandstone. The Basin is formed on Cambrian sediments and volcanics and is enclosed by scarps of Cretaceous rocks on three sides. The volcanics form rolling ' downs ' type hills and are partly surrounded by rough jointed sandstone.

The *Cox River Plateau* is an elevated area of Cambrian sandstone in the south-east of the Sheet area. In the east the sandstone is dissected by close joints. Near the Barkly–Birdum Tableland it is covered by detrital sand. The Cox River passes through the Plateau in a narrow, steep-sided valley.

The *Coastal Plain* is a low-lying area of little relief bordering the coast of the Gulf of Carpentaria. Part of the Plain extends on to the north-eastern part of the Hodgson Downs Sheet area.

STRATIGRAPHY

The Sheet area contains Proterozoic, Cambrian, Cretaceous, and Cainozoic rocks. Woolnough (1912) and Jensen (1914) considered the Proterozoic rocks to be of Cambrian age, but they have since been shown to be overlain with strong unconformity by lower Middle Cambrian limestone (Randal, 1963). Radiometric age determinations made at the Australian National University

(A. W. Webb and I. McDougall, pers. comm.), indicate that the Tawallah Group, which may possibly be represented in the Sheet area, is of Lower Proterozoic age. The overlying McArthur Group is placed tentatively in the Lower Proterozoic and the Roper Group tentatively in the Upper Proterozoic.* The Proterozoic rocks of the Sheet area were deposited in the McArthur Basin, which extends from Arnhem Land in the north, to beyond the Queensland border in the south. The stratigraphy of the Sheet area is summarized in Table 1.

Lower Proterozoic

Possible representatives of the *Tawallah Group* are exposed in the north-eastern part of the Sheet area; the exposures consist of conglomerate and feldspathic sandstone underlain by acid and intermediate volcanics. The conglomerate contains boulders of quartz, sandstone, and chert.

Lower (?) Proterozoic

Small exposures of chert, chert breccia, and feldspathic sandstone of the *McArthur Group* occur in the northern part of the Sheet area. The chert and chert breccia belong to the *Kookaburra Creek Formation* and the sandstone to the *Mount Birch Sandstone*.

Upper (?) Proterozoic

Unconformably overlying the McArthur Group is the *Roper Group,* which is a sandstone-siltstone sequence with interbedded shales and minor carbonate rocks. The sediments occur throughout most of the McArthur Basin, though the Maiwok Sub-Group is confined to the Maiwok Sub-Basin. The lowest formation in the Roper Group is the *Limmen Sandstone,* which crops out in several small areas throughout the Hodgson Downs Sheet. In the north-east a short steeply-dipping ridge of silicified quartz sandstone about 100 feet thick unconformably overlies the McArthur Group. In the south the outcrops consist of a white silicified quartz sandstone underlain by a thick sequence of flaggy fine-grained micaceous sandstone and siltstone, in turn underlain by purple micaceous sandstone ; the total thickness is about 2000 feet. A bed of siltstone and shale below this is tentatively included in the Limmen Sandstone. Several outcrops of steeply-dipping sandstone west of the Strangways River are also part of the Limmen Sandstone; the sandstone here is overlain by purple and red flaggy dolomite and dolomitic sediments, which represent a carbonate facies of the *Mainoru Formation.* Elsewhere the Mainoru Formation crops out poorly as low rubble-covered rises in the cores of domes. The outcrops are mainly composed of flaggy siliceous siltstone, cherty in places. South of the Cox River some shaly beds are exposed. Above the Mainoru Formation is the *Crawford Formation*, a succession of blocky pink and white sandstone beds interbedded with micaceous siltstone and fine micaceous sandstone: Glauconite is characteristic of the Formation. In the Hell's Gate Ridge the Crawford Formation is a medium to fine-grained blocky to massive micaceous quartz greywacke which has a distinctive rounded and pitted weathered habit. The appearance of the

* The Lower Proterozoic–Upper Proterozoic boundary is arbitrarily assumed to be at about 1350 million years.

TABLE I.—SUMMARY OF STRATIGRAPHY OF HODGSON DOWNS SHEET AREA

Age	Rock Unit and Symbol	Approx. Thickness (feet)	Lithology	Stratigraphic Relationship	Topography	Remarks
Quaternary ..	.. ..	to 50	Sandy alluvium, transported black soil		Flood plains and swamps.	
Cainozoic ..	.. ..	to 50	Superficial cover—mostly sand, some laterite, soil, rubble and travertine.		On surface of plateaux and flat mature land surfaces.	Sand mainly derived from older friable sandstone.
Lower Cretaceous	Mullaman Beds	to 200	Porcellanite and claystone. Calcareous and ferruginous sandstone, massive, white, friable sandstone. Local calcarenite lens.	Unconformable on older rocks.	Tablelands and mesas. Undulating hills below tablelands.	Plant and marine fossils.
Middle Cambrian	Tindall Limestone (Cmt) ..	?	Massive crystalline limestone with chert nodules.	Overlying Lower Cambrian Volcanics	Small outcrop in creek bank.	No fossils found.
	Antrim Plateau (Cla) Volcanics ..	200	Massive and amygdaloidal basic lavas. Red feldspathic sandstone.	Unconformable on Upper Proterozoic sediments.	Rounded low hills.	
	Nutwood Downs Volcanics (Cln)	400	Massive and amygdaloidal basalt, some agglomerate. Flaggy red feldspathic sandstone.	Conformable on Bukalara Sandstone.	Low rounded hills and flat-topped hills.	Jointed.
	Cox Formation (Clc) ..	150	Purple micaceous siltstone, fine-grained sandstone, green shale. Blocky white quartz sandstone. Local calcareous sandstone.	Conformable on Bukalara Sandstone in Cox River area.	Mesas and broad gently undulating plains.	
Lower Cambrian	Bukalara Sandstone (Clb) ..	200	Blocky buff, white and red quartz sandstone; minor shale bands.	Unconformable on Proterozoic	Jointed tablelands	Prominently cross-bedded sometimes slumped.
Upper (?) Proterozoic	Roper Group — (Pvb)	?	Acid to intermediate (?) volcanic-breccia	Not known	Low hills	Exposed in circular area. May be collapse structure.
	(Pdl)	200	Massive dolerite	Intrudes Proterozoic rocks as sills	Plains	Intruded at several stratigraphic levels.
	Maiwok Sub-Group — Chambers River Formation (Prc)	Up to 1000	Flaggy fine sandstone and siltstone; some blocky medium sandstone horizons.	Top of Maiwok Sub-Group. Conformable on McMinn Formation	Rounded hills	
	McMinn Formation (Prn) ..	1200	Flaggy fine sandstone and greywacke, blocky friable sandstone horizons, ironstone and calcareous sediments, all interbedded with siltstone and shale.	Conformable on Velkerri Formation.	Blocky sandstone forms cuestas. Rounded hills.	Divided into four members.
	Bukalorkmi Sandstone Member (Prl)	40	Medium to coarse-grained friable quartz sandstone, ferruginous sandstone.	Topmost member of McMinn Formation. Conformable on Kyalla Member.	Cuestas	Extensively ripple-marked.
	Kyalla Member (Pry) ..	500+	Flaggy fine sandstone, siltstone and greywacke interbedded with shale. Greywacke slumped in places; blocky quartz sandstone. Cone-in-cone calcareous rock.	Interbedded with and generally over Moroak Sandstone and Sherwin Ironstone Members.	Rubble-covered rounded hills and broad flat valleys.	
	Sherwin Ironstone Member (Prz)	Up to 20	Oolitic and pisolitic hematite, sideritic when fresh; ferruginous sandstone.	Lenses within Moroak Sandstone and Kyalla Members	In scarps and on dip slopes.	Medium grade iron ore in places
	Moroak Sandstone Member (Prk)	40 to 150	Blocky medium sandstone interbedded with shale and siltstone.	Generally at base of McMinn Formation where it conformably overlies Velkerri Formation	Scarps and cuestas	
	Velkerri Formation (Prv) ..	1000	Laminated shale, siltstone and fine greywacke, calcareous in places.	Base of Maiwok Sub-Group. Conformable on Bessie Creek Sandstone	A few low rounded bare hills. Broad valleys	
	Bessie Creek Sandstone (Pre)..	100 to 200	Friable, massive fine to coarse quartz sandstone.	Conformable on Corcoran Formation	Prominent ridges reduced to sandy rises in places	Is characteristically jointed.
	Corcoran Formation (Pro) ..	400 to 600	Shale, siltstone, fine micaceous sandstone; blocky sandstone.	Conformable on Abner Sandstone	Broad valleys with low ridges	
	Abner Sandstone (Pra) ..	600 to 1500	Quartz sandstone, ferruginous flaggy sandstone, siltstone, and shale; greywacke, slumped in places.	Conformable on Crawford Formation	Prominent ridges	
	Munyi Member (Prm) ..	Up to 200	Ferruginous sandstone and flaggy siltstone; shale.	Top of Abner Sandstone, conformable on Hodgson Sandstone Member	Capping on plateaux and dip slopes of sandstone	
	Hodgson Sandstone Member (Prh)	100 to 300	Friable, massive medium to coarse sandstone; siltstone.	Conformable on Jalboi Member	Prominent ridges and hills	Characteristically jointed
	Jalboi Member (Prj) ..	400 to 600	Blocky and flaggy quartz sandstone, slumped greywacke, siltstone and shale.	Conformable between Hodgson and Arnold Sandstone Members	Rounded hills and banded ridges	
	Arnold Sandstone Member (Prx)	Up to 200	Blocky and massive friable quartz sandstone.	Base of Abner Sandstone, conformable on Crawford Sandstone	Sandstone ridges and hills	Lenses out to west. Jointing similar to Hodgson Sandstone Member
	Crawford Formation (Prr) ..	400	Blocky and flaggy quartz sandstone, greywacke, slumped in places, siltstone and shale. Buff and pink massive micaceous quartz greywacke possibly calcareous. Flaggy fine calcareous siltstone.	Conformable on Mainoru Formation	Backslope to Abner Sandstone ridges	Characteristically contains glauconite. Quartz greywacke weathers with distinctive rounded and pitted appearance
	Mainoru Formation (Pru) ..	Up to 1500	Flaggy siliceous and micaceous siltstone and shale. Purple and red flaggy dolomite.	Conformable on Limmen Sandstone	Outcrop poor, low rubble-covered rises	
	Limmen Sandstone (Pri) ..	300 to 2000	Silicified purple and white clean quartz sandstone with grit bands; poorly sorted feldspathic sandstone, fine micaceous siltstone, red and green shale.	Base of Roper Group. Unconformable over McArthur Group	Prominent ridges	
Lower (?) ..	McArthur Group — Kookaburra Creek Formation (Pmu)	?	Chert breccia, chert and feldspathic sandstone.	Conformable on Mt. Birch Sandstone	Low scattered outcrops	
Proterozoic	Mount Birch Sandstone (Pmh)	?	Feldspathic sandstone	Conformable on Lower Vizard Formation elsewhere	Low ridges	
Lower Proterozoic	Tawallah Group ? (Pt)	?	Polymictic conglomerate, medium to coarse sandstone, underlain by acid to intermediate volcanics.	Not obvious in this area	Large hills and low ridges	Stratigraphic position uncertain

weathered rock suggests a possible original carbonate content which has not been detected in surface samples. On air photographs the Crawford Formation has a banded pattern caused by the prominence of the sandstone beds; the Formation forms a gentle backslope to ridges of *Abner Sandstone.* In this area the Abner Sandstone has been divided into four essentially arenaceous members. The *Arnold* and *Hodgson Sandstone Members* are very similar and form prominent ridges and plateaux of rough, jointed sandstone. The (lower) Arnold Sandstone Member is thickest east of the Arnold River and lenses out in the Strangways River area. Between the two sandstone members the *Jalboi Member* contains less resistant beds of micaceous sandstone and siltstone as well as quartz sandstone. Numerous ripple marks, clay-gall marks, flute-casts, and other surface markings are present, together with slump rolls. Several cylindrical casts with convolute surface markings suggest the presence of organic fossils at the time of deposition. The top member of the Abner Sandstone is the *Munyi Member,* which is mainly composed of ferruginous sandstone and siltstone; it commonly appears as a dark capping on dip slopes of the Hodgson Sandstone Member. The *Corcoran Formation* overlies the Munyi Member and crops out poorly because its constituents are generally fine-grained and soft. Outcrops west of the Hodgson River are rare, but farther east several resistant beds of blocky sandstone crop out near the top of the Formation and in scarps below the *Bessie Creek Sandstone.* The Bessie Creek Sandstone is a jointed sandstone similar to that in the Abner Sandstone. Generally, it has finer banding and bedding and a closer joint system, and is more friable.

The *Maiwok Sub-Group* conformably overlies the Bessie Creek Sandstone in the northern portion of the Sheet area. The sediments are flaggy and arenaceous. The *Velkerri Formation,* the basal unit, is composed of laminated and flaggy fine-grained sediments, which crop out in only a few places. The overlying *McMinn Formation* forms much more distinctive outcrops; in many places scarps of the basal *Moroak Sandstone Member* form abrupt ridges above the plains covering sediments of the Velkerri Formation. The McMinn Formation is divided into four constituent members: The Moroak Sandstone Member is at the base except in an area just north and north-west of Hodgson Downs Homestead, where it grades laterally into the *Kyalla Member;* elsewhere, the sandstone grades up into the Kyalla Member, which overlies it throughout the Maiwok Sub-Basin; interfingered with these two members is the *Sherwin Ironstone Member* of oolitic and pisolitic ironstone and ferruginous sandstone (Cochrane & Edwards, 1960) ; the topmost member is the *Bukalorkmi Sandstone Member,* which is a sandstone 50 to 60 feet thick with local developments to 200 feet thick ; in the Hodgson Downs Sheet area it includes a ferruginous sandstone bed not present farther north. The topmost unit is the *Chambers River Formation,* which crops out mainly as rubble-covered hills in minor basins and synclines. Only the bottom 1000 feet of the Formation are exposed here, but north-west in the Katherine Sheet area about 3000 feet are exposed without a definable top (Randal, 1963).

In parts of the Mount Young and Tanumbirini Sheet areas (Plumb & Paine, 1964; Paine, 1963), the Bessie Creek Sandstone is overlain by flaggy shales and arenaceous sediments which constitute the *Cobanbirini Formation.* The Cobanbirini Formation is a lateral equivalent of the Maiwok Sub-Group and does not crop out in the Hodgson Downs Sheet area, although it may be covered by Cambrian sediments in the south-east.

Igneous Intrusions

Three main dolerite sills intrude the upper part of the Roper Group in the northern part of the Sheet area and extend on to the Urapunga Sheet area (Dunn, 1963). The uppermost sill is finer grained than the lower sills and intrudes the Bukalorkmi Sandstone Member ; the second sill intrudes above the Bessie Creek Sandstone and is exposed just east of the Strangways River—farther east it appears only as lenses.

Although the texture of the dolerite varies, its composition is generally uniform. The pyroxene is a pigeonite and feldspars are more andesine than labradorite; some interstitial quartz is present.

Portions of a circular igneous collapse structure occur near Cattle Creek in the north-west corner of the Sheet area. The core is occupied mainly by highly weathered acid to intermediate (?) volcanic material containing many angular fragments of sediments and volcanics and large rounded boulders of granite. The Roper Group sediments around the structure are severely fractured and dip steeply towards the centre. Mesozoic sediments and soil obscure a large portion of this structure.

Lower Cambrian

No fossils have been found in the rocks assigned to the Lower Cambrian, but they show no obvious erosional break with overlying lower Middle Cambrian limestone, and overlie the Proterozoic sediments with strong unconformity.

The *Bukalara Sandstone* rests on eroded Proterozoic sediments as a jointed horizontal capping or in shallow-dipping basins and synclines; in the basins some slumping is evident. The formation is widespread and crops out as dissected tablelands over hundreds of square miles of country to the south-east of this Sheet area. In the Cox River area only, the Bukalara Sandstone grades up into the *Cox Formation.* The *Nutwood Downs Volcanics* overlie the Bukalara Sandstone in the Nutwood Downs Basin and in several isolated areas to the north-west. The volcanics are tholeiitic basalt, agglomerate, and tuff ; in places the basalt contains numerous quartz, jasper, and chalcedony-filled amygdales. The presence of sandstone dykes in the basal laval flow suggests that it was extruded before the underlying Bukalara Sandstone was lithified. In places the lavas are overlain by a flaggy feldspathic sandstone which is included in the Nutwood Downs Volcanics. In the north-west of the Sheet area a similar

basaltic sequence crops out; this forms the southern limit of a mass of *Antrim Plateau Volcanics* exposed on the Katherine and Urapunga Sheet areas. The Antrim Plateau and the Nutwood Downs Volcanics are believed to be parts of the same widespread tholeiitic basalt sequence which covered a large portion of the northern part of the Northern Territory and adjacent parts of Western Australia.

Middle Cambrian

Limestone overlies the Nutwood Downs Volcanics in the bank of a creek 6 miles south-west of Nutwood Downs Homestead. Limestone has also been recorded in bore cuttings in the area (Mackay, 1957). By correlation with a similar sequence in the Katherine Sheet area (Randal, 1963), it is tentatively included in the *Tindall Limestone*.

Lower Cretaceous

The Cretaceous sediments in the area belong to a sequence which covers a large part of the northern half of the Northern Territory. The basal member is locally a massive, very friable, white quartz sandstone overlain by a purple ferruginous sandstone containing plant remains; the ferruginous sandstone is the basal bed in places where the white sandstone is absent. These lower beds are of terrestrial origin and are overlain by marine sediments which constitute the bulk of the Cretaceous sequence. Some of the marine sediments are calcareous and some small lenses of limestone have been observed. Weathering during early Tertiary times silicified some of the finer-grained sediments to form porcellanite. Shelly fossils found within the sequence on adjacent Sheet areas indicate a Neocomian to Aptian age for the marine sediments (Skwarko, 1962).

Cainozoic

Large parts of the Sheet area are covered by sand, laterite, soil, rubble, travertine, freshwater limestone, and alluvium. Sand covers the greatest area and is derived mainly from the breakdown of the various friable sandstones. The laterite, which commonly underlies the sand, is a remnant of an early Tertiary land surface. The soil varies with composition of the parent rock, but it is mostly skeletal except for the black soil developed on underlying calcareous or basic igneous rocks. Gilgai features are common in the black soil. Travertine and freshwater limestone occur near the Strangways River, where underlying sediments are probably Cambrian limestone. Transported black soil forms the extensive alluvial flats of the Hodgson and Strangways Rivers.

STRUCTURE

(Fig. 2)

Folding

Regional folding affects the Proterozoic and Cambrian sediments. The Maiwok Sub-Group is exposed in two broad asymmetrical synclines separated by an anticline of the lower Roper Group. The western syncline is steepened

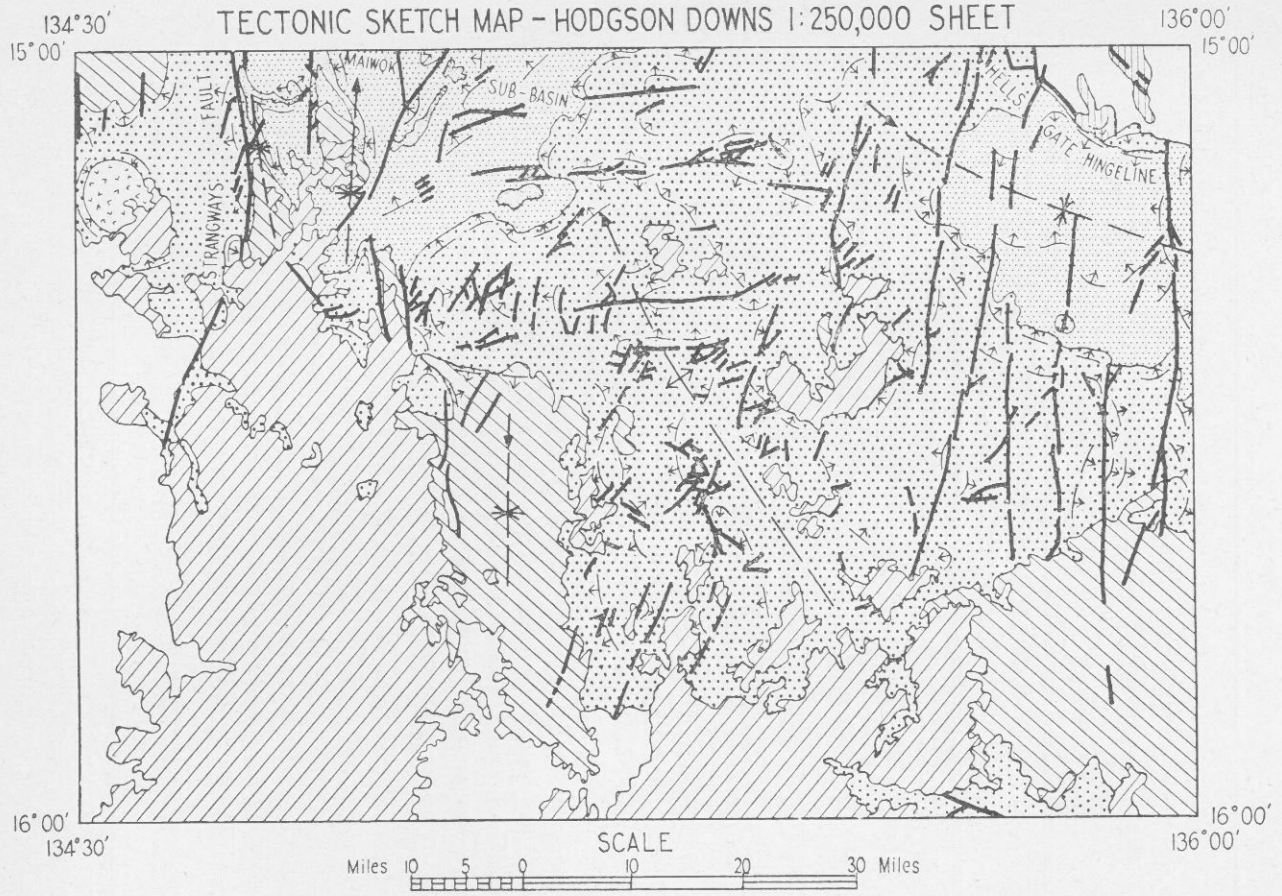

TECTONIC SKETCH MAP – HODGSON DOWNS 1:250,000 SHEET
134°30'
136°00'
15°00'
16°00'
MAIWOK
SUB-BASIN
FAULT
STRANGWAYS
WELLS
GATE HINGELINE
VII
SCALE
Miles 10 5 0 10 20 30 Miles
Cainozoic
Cretaceous
Cambrian
Volcanics in collapse structure
Maiwok Sub-Group
Remainder of Roper Group
Dolerite
McArthur and Tawallah Groups
Geological boundary
Regional anticlinal axis
Regional synclinal axis
Fault
Prevailing dip

FIG. 2.

against the Strangways Fault and the eastern syncline against the Hell's Gate Hingeline. The Cambrian sandstone and volcanics in the Nutwood Downs area are warped into a broad syncline. Several smaller shallow synclines and anticlines occur in the Proterozoic rocks.

None of the folding is strong: the sediments were not buried deeply enough to allow steep folding, and most external stress has been taken up in faulting. However, a series of half domes and 'split domes' have been developed adjacent to the faults. The half domes are semi-elliptical structures bounded on one side by a fault, and the 'split domes' are a combination of two asymmetrical half-domes on opposite sides of the fault.

Faulting

Most of the major faults in the area trend north or west. The west-trending faults appear in the central north and are flanked by north-trending faults to the east and west. Several north-north-easterly faults between the two major fault areas suggest a resultant movement between the two. The Strangways Fault is a major north-trending fracture which was probably active during sedimentation and influenced the distribution of sediments. The Hell's Gate Hingeline is, in the Hodgson Downs Sheet area, a west-trending lineament which had a similar influence on sedimentation. Later movement along the Hingeline in places has caused overturning of adjacent sediments, suggesting a thrust movement. Most of the faulting occurred in Precambrian times, but slight displacement of the Cambrian rocks along established fault lines indicates that movements continued into the Palaeozoic.

Jointing

The main quartz sandstone units in the Hodgson Downs Sheet area, the Hodgson and Arnold Sandstone Members of the Abner Sandstone, the Bessie Creek Sandstone, and the Bukalara Sandstone, are all jointed. The joints in the Proterozoic sandstones follow two directions; the jointing in the Bessie Creek Sandstone is closer spaced than in the members of the Abner Sandstone. The joints in the Bukalara Sandstone are very closely spaced and parallel.

TECTONIC HISTORY

Proterozoic sedimentation in the Hodgson Downs Sheet area was in the central-west portion of the McArthur Basin. Strong hingeline faults, controlled mainly by basement ridges or faults, developed in places while the sediments were being deposited. This resulted in sharp local variations in the thickness of the sediments. The Basin extends for at least 350 miles from Arnhem Land to the Queensland Border. Sediments of the Tawallah and McArthur Groups were deposited first, mainly in areas to the east of the Hodgson Downs Sheet. The Roper Group was then deposited over most of the McArthur Basin, but developed its maximum observed thickness in a rapidly subsiding sub-basin in the

Tanumbirini Sheet area (Paine, 1963); thickening towards this sub-basin can be seen in the south-eastern corner of the Hodgson Downs Sheet area. The Maiwok Sub-Basin developed at a late stage in the sedimentary history of the McArthur Basin and its extent and the thickness of its contained sediments were determined, in part, by early movements along lineaments such as the Strangways Fault and Hell's Gate Hingeline. Proterozoic sedimentation ceased with the deposition of the Maiwok Sub-Group in the Maiwok Sub-Basin.

Uplift and erosion preceded the deposition of Cambrian sandstone on a platform of Proterozoic sediments in which local shallow basins were formed. Ridges of steeply dipping Proterozoic sediments along fault lines have determined the limits of Cambrian sedimentation. The Cambrian volcanics covered part of the sandstone and filled valleys in the Proterozoic sediments; they probably did not extend much farther east than their present area of outcrop. The overlying limestone has a similar distribution.

No sedimentation is evident in the interval between the deposition of the Cambrian limestone and the Cretaceous sediments. The initial Cretaceous deposits were terrestrial, consisting of white cross-bedded sand overlain by local swamp sediments. The swamps were probably formed on low-lying coastal regions prior to the incursion of a shallow epicontental sea in which most of the Cretaceous sediments were deposited.

After the Cretaceous sediments emerged, they were not appreciably eroded during the early Tertiary, when they were lateritized. Subsequently the flat lateritic surface was down-warped in two directions, north to the present Roper River and north-east to the present coastline. Present-day drainage has been developed consequently to this warped surface.

ECONOMIC GEOLOGY

Water

The stock-carrying capacity of most of the Sheet area is very poor and surface water is more than sufficient for the few stock present. However, the Nutwood Downs Basin and Hodgson River Valley contain some good grazing country. Numerous waterholes in the Hodgson River and its tributaries provide sufficient water for current needs in most of this area, although stock-carrying capacity could be improved by bores. Several bores have been sunk south-west of Nutwood Downs Homestead, where very little surface water is available (Mackay, 1957, and Appendix). The sediments overlying the Nutwood Downs Volcanics have proved to contain ample available water just above the basalt. The volcanics contain water along joint and fracture planes, but the hardness of the rock makes its recovery uneconomical.

Iron

Ten miles north-west of Hodgson Downs Homestead the Sherwin Ironstone Member of the McMinn Formation may be of economic interest. Geologists of Broken Hill Pty Co. Ltd discovered the deposits in 1955 when following the iron

horizons from Roper Bar. After surface sampling in 1955 and 1956 they drilled the deposits in 1958, putting down fourteen diamond drill holes with an aggregate length of 2566 feet. In depth the iron ore (which appears as hematite oolites and sandstone on the surface) consists of hematite oolites, greenalite granules, and interstitial siderite which commonly replaces hematite partly or completely in the oolites. It is similar to the Roper Bar and Constance Range deposits (Edwards, 1956–57 ; Edwards & Baker, 1956 ; Cochrane & Edwards, 1960).

Broken Hill Pty Co. Ltd carried out further drilling in 1961 to test the limits of the ore.

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APPENDIX.

Record of bores in the Hodgson Downs Sheet Area (after Mackay, 1957).

Reg. No.	Local Bore No.	Total Depth (in feet)	Yield (gal./hr.)	Strata	Remarks
1486	1	127	—	Sandstone overlying volcanics.	
1485	2	75	Good	Sandstone.	
1487	3	87	—	Sandstone overlying volcanics.	
644	4	79	—	Sandstone overlying volcanics.	
645	5	222	1100	0– 10′ Black soil. 10– 90′ Yellow clay. 90–150′ Boulders and clay. 150–180′ Limestone. 180–215′ Yellow limestone. 215–222′ Gravel and sand.	
646	6	110	1440	Limestone and sandstone.	
877	7	41	—	0– 4′ Loam 4– 39′ Soft clay. 39– 41′ Basalt.	Abandoned owing to hard drilling.
878	8	68	500	0– 32′ Brown shale. 32– 68′ Sandstone.	
881	11	52	—	? Volcanics	
—	ND	420	2000	0– 52′ Clay and Sandstone. 52–395′ Hard red basalt. 395–420′ White sandstone.	

Registered numbers are those given to the bore by the Water Resources Branch of the Northern Territory Administration. The bores are all within 25 miles of Nutwood Downs Homestead, mostly to the south and west.

6253/7/70—300—O

ALEX. B. DAVIES, Government Printer, Western Australia