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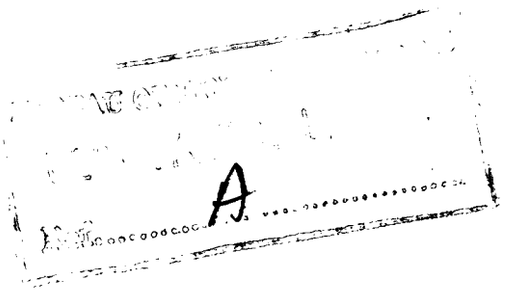

EXPLANATORY NOTES, HODGSON DOWNS 1:250,000 GEOLOGICAL SHEET

Compiled by

P.R. Dunn

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INTRODUCTION

The Hodgson Downs Sheet area contains rocks of Upper Proterozoic, Cambrian, and Cretaceous age. It is in the Gulf of Carpentaria region in 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 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 being 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 available for the area are:

i) Air photographs at 1 to 50,000 scale flown by the Royal Australian Air Force in 1950.

ii) An uncontrolled photomosaic at 1 inch to 4 miles scale.

iii) A planimetric map at 1 inch to 4 miles scale 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 to 250,000 scale.

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 and 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 of Mineral Resources 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.

PHYSIOGRAPHY

Drainage

Most of the Sheet area is drained by the Strangeways, 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 latter a tributary of the Limmen Bight River. The north-flowing rivers were developed consequent to a down-warping of an early Tertiary land surface towards the valley of the Roper River. The Towns and Cox Rivers are consequent to 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-Beetaloo Tableland, Gulf Fall, and Coastal Plains (Dunn, et al., 1962). The Hodgson Downs Sheet area includes each of these three units; the Gulf Fall area is subdivided into Mature Gulf Fall, Dissected Tableland, Nutwood Downs Basin, and Cox River Plateau areas (Plate 1).

Part of the north-eastern margin of the Barkly-Beetaloo 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

in this area is poorly developed and flows north-east into the Gulf drainage system. The edge of the Tableland is marked in places by a 100 foot scarp of lateritized Cretaceous sediments. Scarp-retreat is an active erosional process 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 downwarped surfaces of the Tableland.

The Mature Gulf Fall Area comprises the area from which almost all the early Tertiary land surface was eroded and the underlying Upper Proterozoic rocks were exposed. Broad flat valleys were formed 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 west and south-dipping sandstone ridge 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 plains. The topography within the Gulf Fall Area is mainly controlled by Upper 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 to Upper Proterozoic sediments but still includes many, scattered, low mesas of Cretaceous sediments. The Arnold River drainage basin occupies most of this area.

The Nutwood Downs Basin is the drainage basin of the upper Hodgson River. The Basin is about 150 feet above the level of the lower Hodgson River, and the river leaves the basin through a narrow gorge of sandstone. It is formed on Cambrian sediments and volcanics and is enclosed by scarps of Cretaceous sediments 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-Beetaloo Tableland it is covered by detrital sand. The Cox River passes through the Plateau in a narrow, steep-sided valley.

The Coastal Plains are a low-lying remnant of the early Tertiary lateritized land surface. The early warping of the land surface

reduced the level of these plains so that they were too low to develop an erosional drainage system. The porous nature of the laterite and underlying sediments allows the absorption of rainwater which has restricted the development of surface drainage. Several low rubble-covered hills are scattered through the plains.

STRATIGRAPHY

Table 1 summarizes the stratigraphy of the Sheet area.

Upper Proterozoic

All sediments and volcanics deposited within the McArthur Basin (See Tectonic History) are regarded as Upper Proterozoic. Woolnough (1912) and Jensen (1914) considered them to be Cambrian, but later mapping has shown a strong unconformity between these sediments and overlying lower Middle Cambrian limestone (Randal 1962). Structural relationships with Upper Proterozoic rocks elsewhere indicate that the rocks are probably of late Upper Proterozoic age.

Most of the Upper Proterozoic rocks in this Sheet area belong to the Roper Group, but in the north-east corner strong warping and faulting has exposed older rocks. A sequence of conglomerate and feldspathic rocks underlain by acid and intermediate volcanics possibly belongs to the Tawallah Group which contains the oldest known rocks deposited in the McArthur Basin. The conglomerate contains boulders of quartz, sandstone, and chert. Elsewhere in this corner area small outcrops of chert, chert breccia, and feldspathic sandstone occur. These sediments belong to the McArthur Group which is well exposed in the Urapunga Sheet area immediately to the north. The chert and chert breccia belong to the Kookaburra Creek Formation and the sandstone to the Mt. Birch Sandstone.

Unconformably overlying the McArthur Group is the Roper Group, which is a sandstone-siltstone sequence with interbedded shales and minor carbonate rocks. The Group was deposited under shallow water conditions. The sediments occur throughout most of the McArthur Basin except for those of the Maiwok Sub-Group, which are confined to the Maiwok Sub-Basin area. The lowest formation in the Roper Group is the Limmen Sandstone which crops out in several small areas throughout the Hodgson Downs Sheet area. In the north-east there is a short steeply-dipping ridge of silicified quartz sandstone about 100 feet thick which 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 2,000 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 shaley 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 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. Outcrop west of the Hodgson River is rare, but further 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 those in the Abner Sandstone. Generally, it has finer banding and bedding, 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, arenaceous types. The Velkerri Formation is the basal unit and 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 the central west area where it grades laterally into the Kyalla Member; elsewhere, the Sandstone grades up into the Kyalla Member which overlies it throughout the Maiwok Basin; inter-fingered with these two members is the Sherwin Ironstone Member of oolitic and pisolitic ironstone and ferruginous sandstone (Cochrane and 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 Upper Proterozoic formation is the Chambers River Formation which crops out mainly as rubble-covered hills in minor basins and synclines. Only the bottom 1,000 feet of the formation are exposed here, but north-west in the Katherine Sheet area about 3,000 feet are exposed without a definable top.

Lower Cambrian (?)

No fossil evidence is available for the rocks assigned to the Lower Cambrian, but they show no obvious erosional break with overlying lower Middle Cambrian limestone and they overlie the Upper Proterozoic sediments with strong unconformity.

The Bukalara Sandstone rests on eroded Upper 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 tholeitic basalt, agglomerate, and tuff; in places the basalt contains numerous quartz, jasper, and chalcedony-filled

amygdales. There are sandstone dykes in the basal laval flow which suggest 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 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 cores in the area (Mackay 1957). By correlation with a similar sequence in the Katherine Sheet area (Randal 1962) this limestone 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 terrestial 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, fresh-water 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 the 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 fresh-water 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.

Igneous Intrusions

Dolerite sills intrude the upper part of the Roper Group in the northern half of the Sheet area. One particular sill within the Bukalorkmi Sandstone Member of the McMinn Formation is a finer-grained dolerite than that in lower sills. A coarse-grained dolerite intrudes the Abner Sandstone; it is best exposed just east of the Strangways River and appears only as lenses within the formation further east. A third sill is intruded above the Bessie Creek Sandstone and crops out at two localities, south of Mais Bluff and north of Hodgson Downs Homestead. These three dolerite sills occur in similar stratigraphic positions in the Urapunga Sheet area to the north.

Although the texture of the dolerite varies, its composition is generally uniform. The amphibole is a pigeonite and the 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.

STRUCTURE

Plate 2 shows the main structures in the Sheet area.

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

No strong folding has occurred. The sediments were not buried deeply enough to allow steep folding and most external

stress has been taken up in faulting. However, a peculiar 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 portion of the Hodgson Downs Sheet area and are flanked by north-trending faults to the east and west. Several north-north-east-trending 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 partial thrust movement.

In places several "split-domes" are aligned along the one fault zone. Reed and Hollister (1936) have described similar structures in the Newport-Inglewood belt of Southern California and suggest that they may reflect basement tear-faulting.

Most of the faulting took place after deposition of the Upper Proterozoic sediments and before deposition of the Cambrian sediments.

Some small displacement of the Cambrian along older fault lines indicates slight continued movement 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 Upper Proterozoic sandstones follow two intersecting 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 unidirectional.

TECTONIC HISTORY

Upper Proterozoic sedimentation in the Hodgson Downs Sheet area was in the centrol west portion of the McArthur Basin. The McArthur Basin is a large and complex depositional

structure consisting of a number of composite basins which overlap in space and time. Strong hinge-line faults, controlled mainly by basement ridges or faults, developed in places while sediments were being deposited, and these faults resulted in sharp local thickening of sediments. The Basin extends for at least three hundred and fifty miles from central Arnhem Land to the Northern Territory-Queensland border. Sediments of the Tawallah and McArthur Groups were deposited first, mainly in areas to the east of the Hodgson Downs Sheet area. 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 area (Paine, 1962). The Roper Group thickens towards this sub-basin 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. Upper 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 Upper Proterozoic sediments in which local shallow basins were formed. Ridges of steeply dipping Upper Proterozoic sediments along fault lines have affected the limits of Cambrian sedimentation. The Cambrian volcanics covered part of the sandstone and filled valleys in the Upper Proterozoic sediments; they probably did not extend much further east than their present area of outcrop. The overlying limestone has a similar distribution to the volcanics.

No sedimentation is evident in the interval between the deposition of the Cambrian limestone and the Cretaceous sediments, when tectonic conditions were quiet. The initial Cretaceous deposits were terrestial 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 epicontinental sea in which most of the Cretaceous sediments were deposited.

After emergence of the Cretaceous sediments no appreciable erosion occurred during the early Tertiary and they were lateritized. Subsequently the flat lateritic surface was downwarped 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, Appendix I). 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 10 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. 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 14 diamond drill holes with an aggregate length of 2,566 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 partially or completely replaces hematite in the oolites. It is similar to the Roper Bar and Constance Range deposits (Edwards, 1956-57; Edwards and Baker, 1956; Cochrane and Edwards 1960).

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

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TABLE I - SUMMARY OF STRATIGRAPHY OF HODGSON DOWNS SHEET AREA

AGE	Rock Units: Group or Sub Group	Rock Units: Formation	Rock Units: Member	Approx. Thickness	Lithology	Stratigraphic Relationship	Topography	Remarks
Recent				to 50 ft.	Sandy alluvium, transported black soil		Flood plains and swamps	
Cainozoic				to 50 ft.	Superficial cover - mostly sand, some laterite, soil, rubble and travertine.	Overlies older rocks.	On surface of plateaus and flat mature land surfaces.	Sand mainly derived from older friable sandstone.
Lower Cretaceous	Mullaman Beds			to 200 ft.	Calcareous and ferruginous sandstone, massive, white, friable sandstone; siltstone mudstone and porcellanite. Local calcarenite lens.	Unconformably overlies older rocks.	Tablelands and mesas. Undulating hills below tablelands.	Plant and marine fossils.
Middle Cambrian		Tindall Limestone		?	Massive crystalline limestone with chert nodules.	Overlying Lower Cambrian volcanics	Small outcrop in creek bank.	No fossils found.
		Antrim Plateau Volcanics		200 ft.	Massive and vesicular basic lavas. Red feldspathic sandstone.	Unconformable on Upper Proterozoic sediments.	Rounded low hills.	
		Nutwood Downs Volcanics		400 ft.	Massive and amygdaloidal basalt some agglomerate. Flaggy red feldspathic sandstone.	Conformably overlies Bukalara Sandstone.	Low rounded hills and flat topped hills.	Jointed
		Cox Formation		150 ft.	Massive, fine-grained sandstone, siltstone, green shale. Local calcareous sandstone.	Conformably overlies Bukalara Sandstone in Cox River area.	Mesas and broad gently undulating plains.	
Lower Cambrian		Bukalara Sandstone		200 ft.+	Blocky buff, white and red quartz sandstone; minor shale bands.	Unconformably overlies Upper Proterozoic	Jointed tablelands	Prominently cross-bedded sometimes slumped.
	Roper Group			to 6000 ft.	Arenaceous sediments with interbedded shales. Minor calcareous rocks. Some ironstone.	Unconformably overlies McArthur Group sediments.	Prominent sandstone ridges and broad flat valleys.	Occupies large proportion of area mapped. Divided into 1 Sub-Group and 6 Formations.
UPPER PROTEROZOIC	Maiwok Sub Group			Up to 3000 ft.	Mainly fine-grained flaggy sandstone, shale and siltstone with some friable sandstone horizons. Some ironstone and calcareous sediments.	Topmost Upper Proterozoic; conformably overlies [illegible] sandstone.	Low rounded hills and broad valleys on shales.	Confined to Maiwok Sub-Basin. Divided into Chambers River, McMinn and Velkerri Formations.
		Chambers River Formation		Up to 1000 ft.	Flaggy fine sandstone and siltstone; some blocky medium sandstone horizons.	Top of Maiwok Sub-Group. Conformably overlies McMinn Formation.	Rounded hills	
		McMinn Formation		1200 ft.	Flaggy fine sandstone and greywacke, blocky friable sandstone horizons, ironstone and calcareous sediments, all interbedded with siltstone and shale.	Conformably overlies Velkerri Formation.	Blocky sandstone forms cuestas. Rounded hills.	Divided into four members.

TABLE I - SUMMARY OF STRATIGRAPHY OF HODGSON DOWNS SHEET AREA

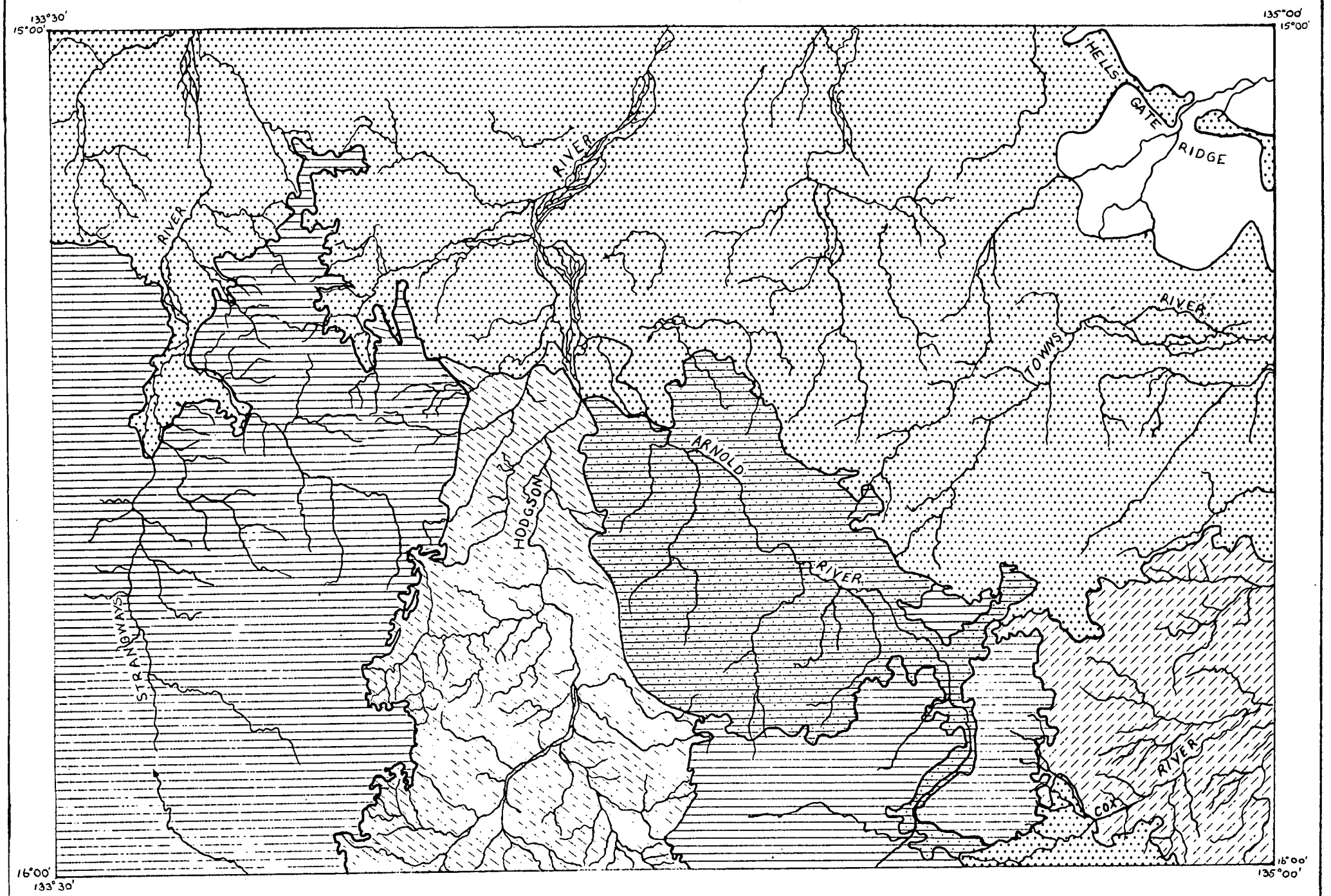
AGE	Rock Units: Group or Sub Group	Formation	Member	Approx. Thickness	Lithology	Stratigraphic Relationship	Topography	Remarks
UPPER PROTEROZOIC			Bukalorkmi Sandstone Member	40 ft. to 200 ft.	Medium to coarse-grained friable quartz sandstone, ferruginous sandstone.	Topmost member of McMinn Formation. Conformably overlies Kyalla Member.	Cuestas.	Extensively ripple marked.
			Kyalla Member	500 ft.+	Flaggy fine sandstone, siltstone and greywacke interbedded with shale. Greywacke slumped in places; blocky quartz sandstone. Cone-in-cone calcareous rock.	Interbedded with Moroak Sandstone and Sherwin Ironstone Members. Generally overlies them.	Rubble covered rounded hills and broad flat valleys.	
			Sherwin Ironstone Member	Up to 20 ft.	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	40 ft. to 150 ft.	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		1000 ft.	Laminated shale, siltstone and fine greywacke, calcareous in places.	Base of Maiwok Sub-Group. Conformably overlies Bessie Creek Sandstone.	A few low rounded bare hills. Broad valleys.	
		Bessie Creek Sandstone		100 ft. to 200 ft.	Friable, massive fine to coarse quartz sandstone.	Conformably overlies Corcoran Formation.	Prominent ridges reduced to sandy rises in places.	Is characteristically jointed.
		Corcoran Formation		400 ft. to 600 ft.	Shale, siltstone, fine micaceous sandstone; blocky sandstone.	Conformably overlies Abner Sandstone.	Broad valleys with low ridges.	
		Abner Sandstone		600 ft. to 1500 ft.	Quartz sandstone, ferruginous flaggy sandstone; siltstone and shale; greywacke, slumped in places.	Conformably overlies Crawford Formation.	Prominent ridges.	Divided into Munyi, Hodgson Sandstone, Jalboi and Arnold Sandstone Members.
			Munyi Member	Up to 200 ft.	Ferruginous sandstone and flaggy siltstone; shale.	Top of Abner Sandstone conformably overlies Hodgson Sandstone Member.	Capping on plateaux and dip slopes of sandstone.	
			Hodgson Sandstone Member	100 ft to 300 ft.	Friable, massive medium to coarse sandstone; siltstone.	Conformably overlies Jalboi Member.	Prominent ridges and hills.	Characteristically jointed.
			Jalboi Member	400 ft. to 600 ft.	Blocky and flaggy quartz sandstone, slumped greywacke, siltstone and shale.	Conformably between Hodgson and Arnold Sandstone Members.	Rounded hills and banded ridges.	

TABLE I - SUMMARY OF STRATIGRAPHY OF HODGSON DOWNS SHEET AREA

AGE	Rock Units: Group or Sub Group	Rock Units: Formation	Rock Units: Member	Approx. Thickness	Lithology	Stratigraphic Relationship	Topography	Remarks
			Arnold Sandstone Member	Up to 200 ft.	Blocky and massive friable quartz sandstone.	Base of Abner Sandstone. Conformably overlies Crawford Sandstone.	Sandstone ridges and hills.	Lenses out to west. Jointing similar to Hodgson Sandstone Member.
		Crawford Formation		400 ft.	Massive and flaggy quartz sandstone, greywacke, slumped in places, siltstone and shale. Buff and pink massive micaceous quartz greywacke possibly calcareous. Flaggy fine calcareous siltstone.	Conformably overlies Mainoru Formation.	Rockslope to Abner Sandstone ridges.	Characteristically contains glauconite Quartz greywacke weathers with distinctive rounded and pitted appearance.
		Mainoru Formation		Up to 1500 ft.	Flaggy siliceous siltstone and shale. Purple and red flaggy dolomite.	Conformably overlies Limmen Sandstone.	Outcrop poor low rubble covered rises.	
		Limmen Sandstone		300 ft. to 2000 ft.	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 Unconformably overlies McArthur Group.	Prominent ridges.	
	McArthur Group			?	Brecciated chert and feldspathic sandstone.	Overlies Tawallah Group.	Low scattered outcrops.	In extreme north-east corner of area. Represented by Kookaburra Creek Formation and Mt. Birch Sandstone.
		Kookaburra Creek Formation		?	Chert breccia, chert and feldspathic sandstone.	Conformably overlies Mt. Birch Sandstone.	Low scattered outcrops.	
		Mt. Birch Sandstone		?	Feldspathic sandstone.	Conformably overlies lower Mt. Vizard Formation elsewhere.	Low ridges	
	Tawallah Group?			?	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.

PHYSIOGRAPHIC SKETCH MAP - HODGSON DOWNS SHEET AREA

Plate 1.



Scale.
10 Miles to 1 inch

10 5 0 10 20 30 Miles.

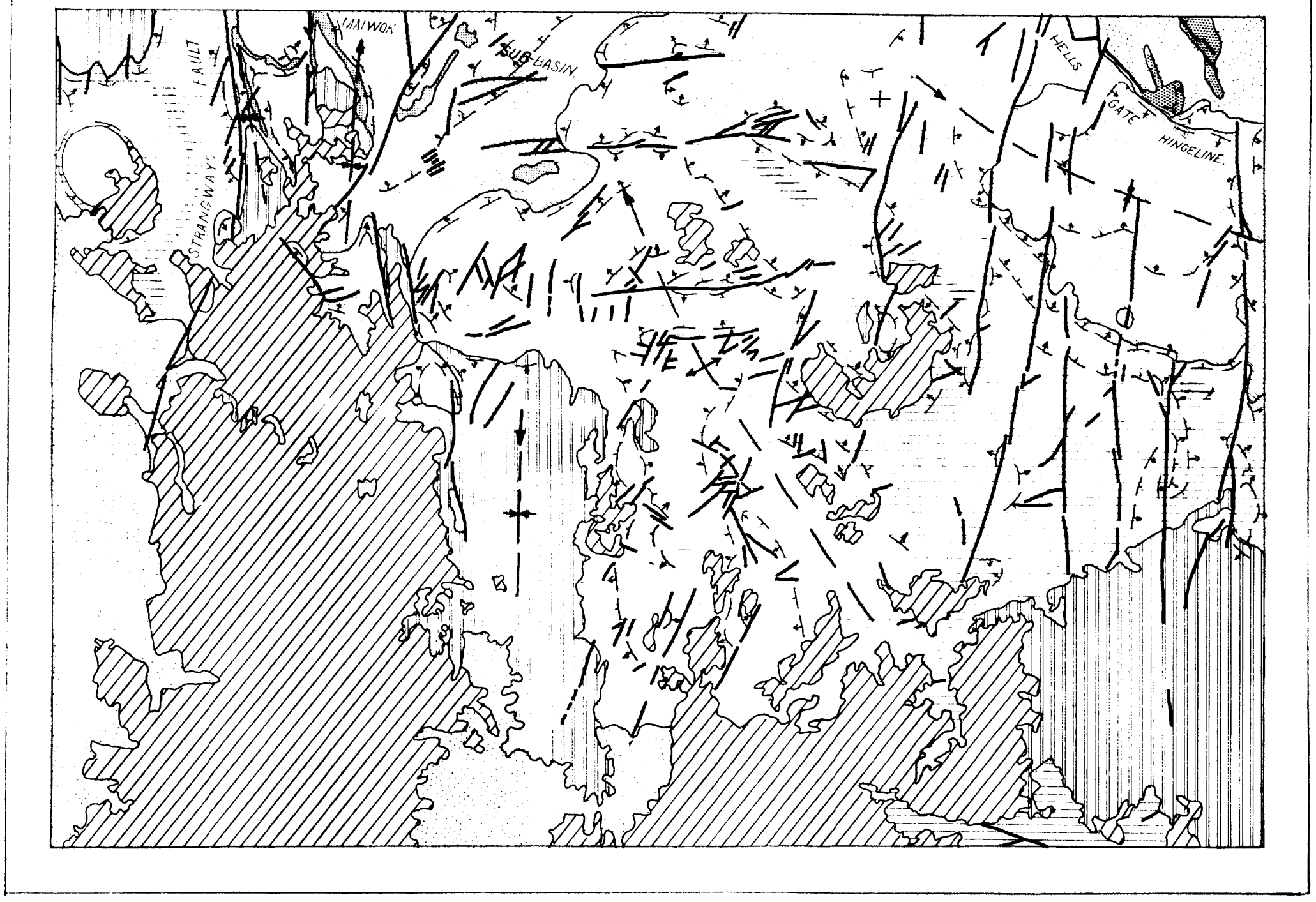
REFERENCE.

- Barkly-Beetaloo Tableland.
- Dissected Tableland.
- Mature Gulf Fall Area.
- Nutwood Downs Basin.
- Cox River Plateau.
- Coastal Plains.

To accompany Record 1962/90

TECTONIC SKETCH MAP — HODGSON DOWNS SHEET AREA

Plate 2.



Scale
10 Miles to 1 inch.

10 5 0 10 20 30 Miles.

REFERENCE

- Cainozoic.
- Cretaceous.
- Cambrian.
- Volcanics in collapse structure
- Maiwok Sub Group.
- Rest of Roper Group.
- Dolerite.
- McArthur and Iowaiah Groups.
- Geological boundary.
- Fault.
- Prevailing dip.
- Regional Anticlinal axis.
- Regional Synclinal axis.

To accompany Record 1962/90

HODGSON DOWNS

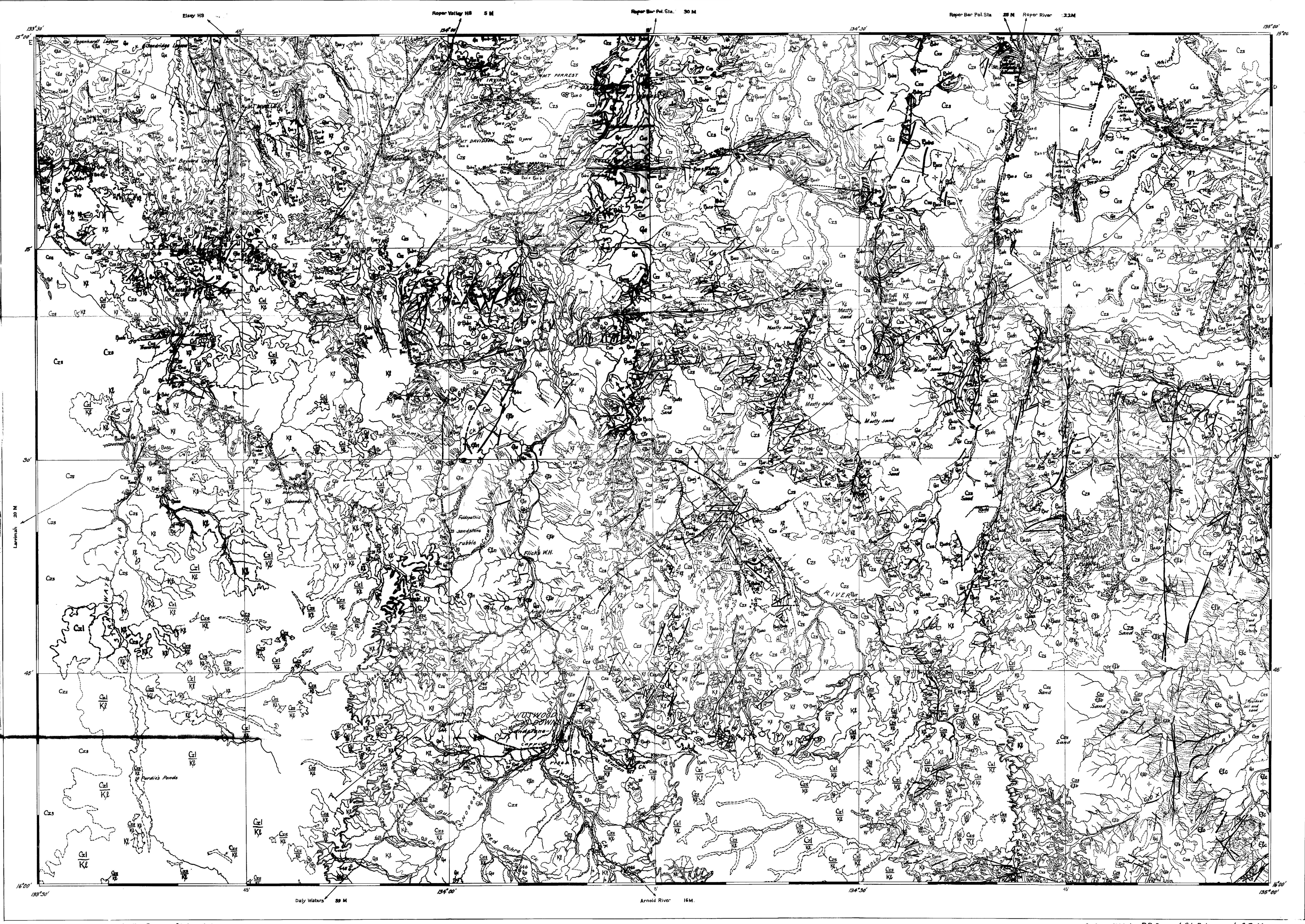
AUSTRALIA 1:250,000

NORTHERN TERRITORY

1:250,000 GEOLOGICAL SERIES SHEET SD 53-14

PRELIMINARY EDITION, 1962

SUBJECT TO AMENDMENT



Reference

Era	Period	Unit	Symbol	Description
CAINOZOIC	QUATERNARY		Qa	Alluvium
	UNDIFFERENTIATED		Czs	Sand, soil, travertine, rubble
			Czl	Laterite and lateritic soil
MESOZOIC	LOWER CRETACEOUS		Kl	Porcellanite, claystone, ferruginous and calcareous sandstone, massive white friable sandstone. Plant and marine fossils
PALAEOZOIC	?MIDDLE CAMBRIAN	?Tindall Limestone	Єmt?	Massive crystalline limestone with chert nodules
	?LOWER CAMBRIAN	Antrim Plateau Volcanics	Єla	Massive and amygdaloidal basic volcanics, red feldspathic sandstone
		Nutwood Downs Volcanics	Єln	Massive and amygdaloidal basalt, flaggy red feldspathic sandstone
		Cox Formation	Єlc	Purple micaceous siltstone and fine sandstone; green shale; white blocky quartz sandstone
		Bukalara Sandstone	Єlb	Massive and blocky buff and red quartz sandstone with minor shale bands. Prominent cross-bedding Some slumping
PRECAMBRIAN	UPPER PROTEROZOIC		Pvb	Volcanic breccia
			Pudl	Coarse to fine dolerite sills
	Roper Group, Maiwok Sub-Group	Chambers River Formation	Puc	Flaggy, micaceous fine sandstone and siltstone
		Mc Minn Formation: Bukalorkmi Sandstone Member	Punb	Friable ripple-marked quartz sandstone, ferruginous sandstone
		Kyalla Member	Puny	Flaggy micaceous siltstone and fine sandstone, blocky silicified sandstone
		Sherwin Ironstone Member	Puns	Ferruginous sandstone, oölitic and pisolitic siltstone
		Moroak Sandstone Member	Puno	Blocky friable sandstone with interbedded siltstone
		Velkerri Formation	Puv	Shale and fine siltstone
	Roper Group	Bessie Creek Sandstone	Pube	Fine to coarse friable quartz sandstone
		Corcoran Formation	Puco	Shale, siltstone, fine, micaceous sandstone, blocky sandstone
		Abner Sandstone	Pue	Mainly sandstone
		Munyi Member	Puem	Ferruginous sandstone and siltstone
		Hodgson Sandstone Member	Pueh	Medium to coarse friable quartz sandstone
		Jalboi Member	Puej	Blocky quartz sandstone, siltstone, micaceous sandstone with slump-structures
		Arnold Sandstone Member	Puea	Coarse to medium friable quartz sandstone
		Crawford Formation	Pur	Blocky quartz sandstone and siltstone. Blocky pink and buff quartz greywacke. Contains glauconite
		Mainoru Formation	Puu	Flaggy siliceous and micaceous siltstone and shale
		Limmen Sandstone	Puj	Silicified purple and white quartz sandstone with grit bands, poorly sorted coarse feldspathic sandstone, micaceous red and green siltstone
	Mc Arthur Group	Kookaburra Creek Formation	Pumu	Chert, chert-breccia, feldspathic sandstone
		Mount Birch Sandstone	Pumh	Feldspathic sandstone
	Tawallah Group		Put?	Polymictic conglomerate, medium to coarse sandstone
			Put?	Acid and intermediate volcanics.
	Undifferentiated		Pu	Isolated sandstone outcrops.

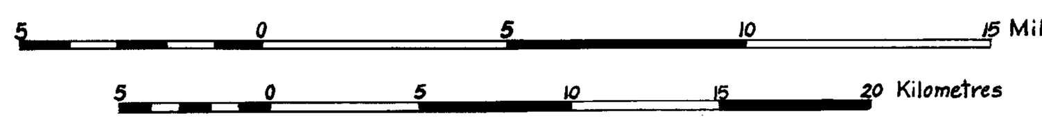
- Geological boundary
- Fault
- Synclinal axis
- Anticlinal axis, showing plunge
- Where location of boundaries, faults, axes is approximate, line is broken; where inferred, queried; where concealed, faults are shown by short dashes
- Strike and dip of strata
- Vertical strata
- Horizontal strata
- Dip < 15° (Air-photo interpretation)
- Dip 15-45° (Air-photo interpretation)
- Dip > 45° (Air-photo interpretation)
- Horizontal strata (Air-photo interpretation)
- Joint pattern (Air-photo interpretation)
- Trend of bedding (Air-photo interpretation)
- (Fe) Iron ore prospect
- B • 645 Water bore with reference number; "N.D" bore's reference no. unknown.
- Dud bore; D-dry, H-abandoned due to hard drilling
- Road
- Vehicle track
- Fence
- ■ H.S Homestead
- Landing ground
- 547 Spot height in feet, instrument levelled (datum: mean sea-level)
- ·547 Spot height in feet, barometric (datum: mean sea-level)
- Escarpment

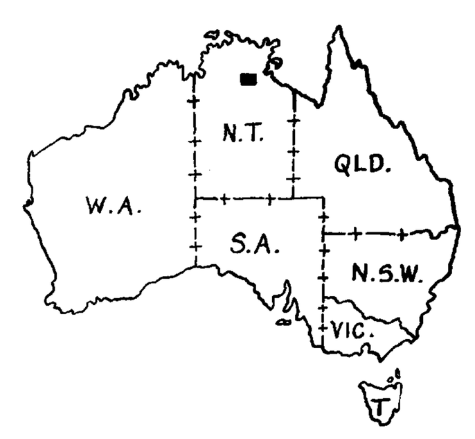
Compiled and published by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. Topographic base compiled by the Division of National Mapping, Department of National Development. Aerial photography by the Royal Australian Air Force; complete vertical coverage at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

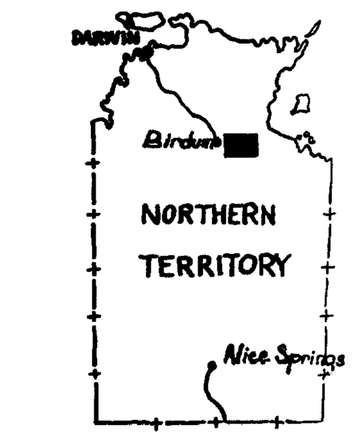
Geology 1960, by: P.R. Dunn, A.G.L. Paine and C.R. Mercer.
Compilation 1961, by: A.G.L. Paine.
Drawn by: A.G.L. Paine

Scale

1:250,000





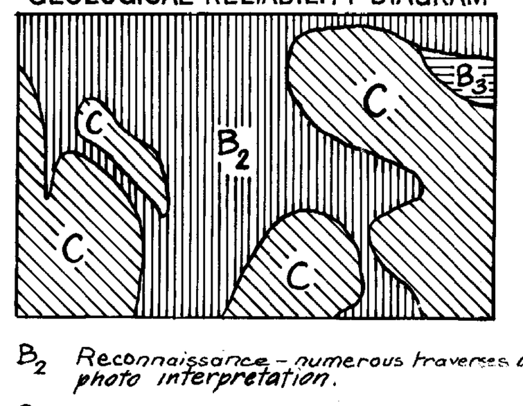


INDEX TO ADJOINING SHEETS
Showing Magnetic Declination

KATHERINE	URAPUNGA	ROPER RIVER
LARRIMAH	HODGSON DOWNS	MOUNT YOUNG
DALY WATERS	TANUMBIRINI	BAUHINIA DOWNS

Annual Change 30"E.

GEOLOGICAL RELIABILITY DIAGRAM

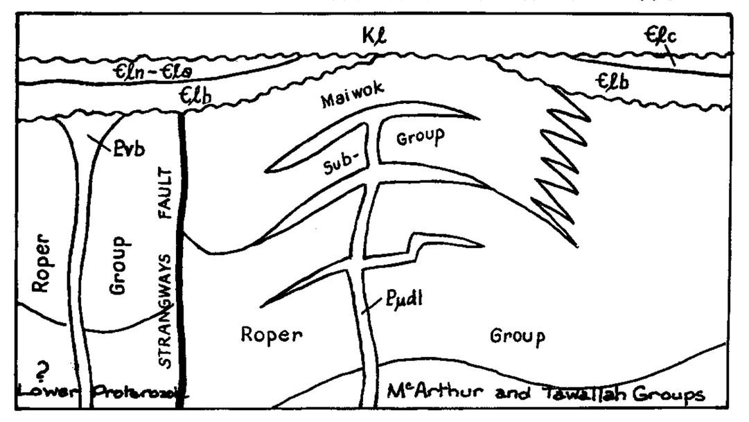


B_2 Reconnaissance - numerous traverses and air-photo interpretation.

B_3 Reconnaissance - helicopter traverses and air-photo interpretation.

C Air-photo interpretation only.

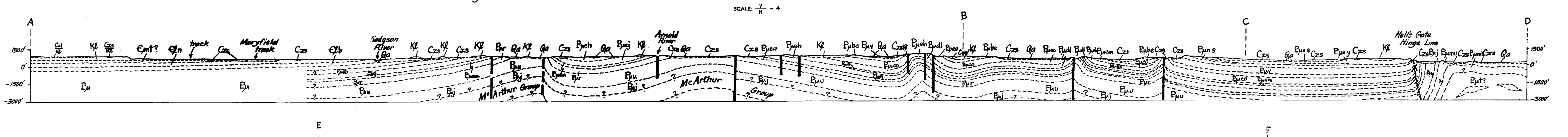
DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS

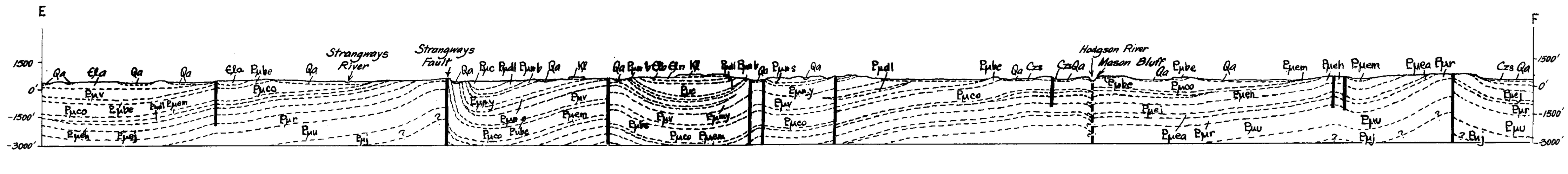


Unconformity

Sections

SCALE: V/H = 4





HODGSON DOWNS

SD 53-14

APPENDIX I.

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	Dud
1485	2	75	Good	Sandstone	
1487	3	87	-	Sandstone overlying volcanics	Dud
644	4	79	-	Sandstone overlying volcanics	Dud
645	5	222	1100	0 -10' Black soil 10-90' Yellow clay 90-50' 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 due 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.