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1962/92

EXPLANATORY NOTES
URAPUNGA 1:250,000 GEOLOGICAL SHEET, NORTHERN TERRITORY

Compiled by

P.R. Dunn

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EXPLANATORY NOTES TO THE URAPUNGA 1:250,000 GEOLOGICAL SHEET, NORTHERN TERRITORY

INTRODUCTION

The Urapunga 1:250,000 Sheet area lies between latitudes 14°S. and 15°S. and longitudes 133°30'E. and 135°E. in the Northern Territory of Australia. It is drained entirely by the Roper River and its tributaries which flow eastwards into the Gulf of Carpentaria. The outcropping rocks are mainly Upper Proterozoic and are unconformably overlain by Cambrian and Cretaceous formations.

The population, of aboout 100 Europeans and half-castes and about 500 aboriginals, is concentrated on six cattle stations, a mission and a police station. During the dry season these properties are connected by two graded earth roads to the Stuart Highway in the east; a light-aircraft service operates each week throughout the year; and a shallow-draught coastal vessel lands heavy supplies at the mission and at Roper Bar 2 to 3 times a year.

The area north of the Roper River and east of longitude 134°40'E. is within the Arnhem Land Aboriginal Reserve.

Photographs and maps available for the area are:

Air-Photographs at 1:50,000 scale flown by the Royal Australian Air Force in 1950.

A military map in the 1 inch to 4 miles series; - information on this map is sketchy.

An uncontrolled photomosaic at approximately 1 inch to 4 miles scale.

A planimetric map at 1 inch to 4 miles prepared by the Division of National Mapping, Department of National Development, from a controlled photo-scale, slotted template assembly. The geological map was produced on a photo-scale trace of this assembly and reduced to 1:250,000.

PREVIOUS INVESTIGATIONS

The information on the map, which these notes accompany, was obtained during 1958-1959 by geologists of the Bureau of Mineral Resources; before this no systematic mapping had been carried out over the complete Sheet area.

Leichardt (1847) passed through the area and made a few observations on the rock types. Brown (1908) was the first geologist to record a visit after he had sailed up the Roper River to Roper Bar and noted the rocks flanking the river. In 1911, Woolnough (1912) travelled along the Roper River from Elsey Station to Roper Bar and thence along the Hodgson River to Hodgson Downs Homestead. Wherever possible rock names used by Woolnough have

been retained.

Wade (1924) traversed the Roper River from Elsey Station to Waggon Wheel Lagoon during his survey of the petroleum prospects of north-western Australia. He noted the presence of bitumen glance in the basalt overlying sandstone at Waggon Wheel Lagoon.

No further geological work was recorded until interest was renewed in the adjacent Bulman lead prospect in 1951-1952 and in the local iron deposits several years later. Opik (1952) produced a sketch map which extended south from the Bulman area to Mainoru Homestead and later Enterprise Exploration Pty. Co. Ltd. conducted a helicopter reconnaissance from which they made a map including an eastern portion of the Sheet area (Patterson, 1958). Since 1955 geologists of Broken Hill Pty. Co. Ltd. have mapped the southern half of the Sheet area in reconnaissance detail (Cochrane, 1956) and extensively sampled and drilled the iron ore deposits south of the Roper River (Cochrane, 1957; Bennett, 1959, Cochrane and Edwards, 1960). Malone (1956) of the Bureau of Mineral Resources produced a map of the Sheet area by photo-interpretation.

PHYSIOGRAPHY.

Drainage. The whole of the Urapunga Sheet area is drained by the Roper River into the Gulf of Carpentaria. The major tributaries of the Roper River are the Wilton, Hodgson, Strangways, and Phelp Rivers. The present topography has developed by erosion of a post-Cretaceous peneplain which was warped to form a shallow syncline. The Roper River flows east along the axis of the syncline and the upper reaches of its main tributaries were developed consequently on the warped surface; the courses of the tributaries cut across lithological boundaries. The secondary drainage and the lower reaches of the main tributaries have not been greatly affected by the warping and are mainly controlled by the structure and lithology of the underlying formations. The course of the Roper River is partly controlled by the geology; this is particularly noticeable near Roper Bar where it is controlled by a strong ridge of steeply dipping sandstone.

Plate 1 shows the Sheet area divided into 3 main physiographic divisions: Cretaceous tableland; Gulf Fall area; and coastal plains. The Wilton River Plateau is a part of the Gulf Fall area.

The Cretaceous tableland in the north-west, together with numerous mesas elsewhere in the Sheet area, are remnants of the old peneplain. The tableland surface is about 600 feet above sea-level in the north-west, and as it was warped after the

Cretaceous, some of the mesas near the Roper River are now only 200 to 300 feet above sea-level. The tableland sediments are porous and no definite stream system has developed; erosion has been effected mainly be scarp retreat.

The Gulf Fall area occupies most of the Sheet area and consists mainly of Upper Proterozoic sediments that have been eroded to a mature surface, generally lower than the post-Cretaceous peneplain. Broad, flat-floored valleys have been formed on incompetent shale, siltstone, and carbonate sediments; thin-bedded fine-grained sandstone and greywacke form rounded, rubble-covered hills; and the competent sandstone beds occur as long cuesta-form ridges. Some of the higher hills and ridges are near faults where the sandstone beds dip most steeply; others, such as Mount McMinn, are preserved beneath particularly resistant sandstone cappings. The highest of these hills is about 400 feet above plain level.

Hell's Gate Ridge is a prominent strike ridge which trends north-west across the centre of the area; it continues strongly for 50 miles south and east of the Sheet area. However, north of the Roper River the dip of the beds becomes shallower and the ridge merges with the western margin of the Wilton River Plateau. Only the Roper and Hodgson Rivers cut through the ridge; to the west of the ridge these rivers and the lower reaches of their tributaries flow in braided channels; east of the ridge the rivers have well-defined courses in much narrower valleys. Apparently a local base level of erosion was formed above the ridge while the superimposed rivers were cutting their way through it. Similar but smaller base levels were formed on Costello Creek and the upper reaches of Flying Fox Creek while they were cutting through resistant sandstone beds. Many of the streams have incised their flood plains owing to a recent fall in sea-levels, particularly below the Hell's Gate Ridge.

The Wilton River Plateau is part of the Gulf Fall area. It is a mature, dissected plateau of Upper Proterozoic flat-lying fine sandstone capped, in places, by strongly jointed medium-grained sandstone. The Wilton River and its tributaries cross the plateau in well-developed valleys, which are up to a mile wide. The margin of the plateau is marked in places by scarps up to 100 feet high, but generally it grades into the rounded hills and shallow dip slopes of the dissected Gulf Fall. The "Ruined City" is an outlier of the plateau in which a series of deeply weathered joints in sandstone have produced a spectacular effect resembling a city of intersecting streets. A less spectacular but more accessible example of this type of weathering occurs at Hell's Gate on the track to Roper Bar.

Two small areas in the extreme east of the Sheet are part of the extensive sand and laterite-covered coastal plains which form a major unit of the physiography of the adjoining Roper River Sheet area (Dunn, 1962b). They represent portions of the post-Cretaceous peneplain, which has been warped down to a level at which it is effectively protected from erosion.

STRATIGRAPHY

Table 1 summarizes the stratigraphy. Many of the names of Upper Proterozoic rock units are new. The only previously published rock units were used by Woolnough (1912), and Cochrane and Edwards (1960), who did not define the units adequately; the names of these units have been retained where possible and with the new rock units are fully defined by Dunn, et al, (1962).

Upper Proterozoic

Brown (1908) regarded the sandstone cropping out near the tidal estuary of the Roper River as Permo-Carboniferous through a dubious correlation with rocks in the Port Keats area. He also tentatively correlated the limestone at Roper Bar with Cambrian limestone at Alexandria Station and Daly River. Several years later Woolnough (1912) suggested a Cambrian age for the sandstone along the Roper River believing it was conformable with the established Cambrian limestone near Katherine. Later geologists have tentatively assigned the rocks to the Upper Proterozoic (David, 1950; Noakes, 1956) or Middle Proterozoic (Hossfeld, 1954) by a series of broad correlations supported by the apparent absence of diagnostic fossils. The rocks now included in the Katherine River Group have been regarded as Desert Sandstone (Woolnough, 1912), Permo-Carboniferous? (David, 1931), Upper Proterozoic (Noakes, 1949), and Cambrian (Hossfeld, 1954). The latest mapping by the Bureau of Mineral Resources shows that all these rocks unconformably overlie the Lower Proterozoic and are unconformably overlain by Lower to Middle Cambrian volcanics and limestone; they are therefore all assigned to the Upper Proterozoic.

The Upper Proterozoic sediments in the Urapunga Sheet area were deposited in 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 resulted in sharp local thickening of sediments and the development of local unconformities. The

Basin extends for at least three hundred and fifty miles from central Arnhem Land to the Queensland border. Most of the sequence in the Urapunga Sheet area was deposited on a shallow slope, which graded gently from a platform area in the north-west (the Arnhem Land Platform) towards the centre of the Basin. Late stage warping and faulting formed the depression of the Maiwok Sub-Basin (Plate 2).

The Katherine River Group is a predominantly arenite-volcanic sequence which is the platform sediments in the north-west of the McArthur Basin. In the Katherine-Darwin area (Walpole 1962), to the north-west of the Urapunga Sheet area, flat-lying Sandstone of the Katherine River Group forms a strongly jointed plateau. The Diljin Hill Formation overlies the jointed sandstone on the margin of the platform and is the only outcropping representative of the Group in the Urapunga Sheet area. The limestone of the bottom Diamond Creek Member marks a brief period of quiet conditions when terrigenous sedimentation almost ceased. However, after extrusion of volcanics, arenaceous sediments were again deposited to form the purple Gundi Greywacke Member, after which further vulcanism and sedimentation formed the West Branch Volcanic Member.

The Katherine River Group is correlated with the Tawallah Group on the eastern side of the McArthur Basin (Smith, 1962). The marked unconformity between the Katherine River Group and the overlying carbonate-sandstone sequence of the Mount Rigg Group is not present between the Tawallah Group and the McArthur Group, but the late stage vulcanism in the Katherine River Group would have sufficiently upset the tectonic stability of the north-western area to create an unconformity in a relatively short period.

The Mount Reid Beds which crop out near Roper Bar are unconformably overlain by McArthur Group sediments and are therefore tentatively correlated with the Katherine River and Tawallah Groups.

Sedimentation of the Mount Rigg Group began with the deposition of coarse clastics of the Bone Creek Formation; in this Sheet area only a white quartz sandstone is present but farther west the base is marked by a considerable thickness of boulder conglomerate (Ruker, 1959). Conditions quietened for the deposition of the carbonate-rich Dook Creek Formation in which a remarkably consistent bed of chert breccia occurs (Ruker, 1959). Stromatolites are present in the Formation.

Outcrop of the McArthur Group is confined to a broad anticlinal structure in the Roper Bar area. This Group also represents a period of mainly non-clastic sedimentation and is correlated with the Mount Rigg Group. However, the sequences differ considerably in detail and it is not possible to equate the constituent formations. A stromatolite-bearing dolomite at the bottom of the Mount Vizard Formation forms the base of the McArthur Group. Where the dolomite overlies rhyolite at Mount Reid it contains many angular fragments of quartz and feldspar. The dolomitic and siliceous sediments throughout the rest of the Formation.contain some fine clastics and are interbedded with sandstone beds. The overlying Mount Birch Sandstone is feldspathic and the upper white member forms a distinct sandstone throughout the area. This formation is the only dominantly sandstone unit in the Group, but small sandstone beds are present throughout the Kookaburra Creek Formation. The sediments in the Kookaburra Creek Formation are mainly cherty, but the presence of stromatolites and oolites suggest that they were originally carbonates (Edwards, 1958). The Yalwarra Volcanic Member represents a period of vulcanism in the middle of the Formation. The presence of boulder conglomerate within this member suggests that the volcanics also temporarily upset a fairly stable period in the erosion of the nearest land mass.

The lithologies of the Mount Rigg and McArthur Groups suggest that at least some of the sediments were derived from both sides of the McArthur Basin. Boulder conglomerate at the base of the Mount Rigg Group confirms the westerly sediment source implied by the presence of the Arnhem Land Platform; the feldspathic material in the McArthur Group sediments also suggests near-source sedimentation, probably from the east.

The appearance of the Roper Group marks a return to terrigenous sedimentation. The sandstone-shale sequence with subordinate carbonate is the most widespread and lithologically consistent within the McArthur Basin. It overlies the Mount Rigg Group with a marked unconformity and in places its contact with the McArthur Group is unconformable.

Sandstone is the main outcropping rock of the Group, but the total thickness of siltstone and shale is probably twice or three times as great as the sandstone. Bedding in the sandstone is generally thinner than in the Katherine River Group and the proportion of argillaceous minerals present is sufficient for some rocks to be classified as greywackes. Moderately large scale cross-bedding, ripple-marks, load casts, clay-gall impressions, and a variety of unidentified shallow-water surface markings are common.

The thickest and best part of the Roper Group is exposed in the Hell's Gate Ridge area. Towards the west and north-west the Group thins considerably and several units appear to lens out completely e.g. Bessie Creek Sandstone, Arnold Sandstone Member and Crawford Sandstone.

The Limmen Sandstone is the basal unit of the Roper Group. It crops out mainly in the Roper Bar area, but also appears near Mountain Valley Homestead and in the centre of dome structures along fault lines. Near Roper Bar the lower part of the Sandstone comprises a hard siliceous coarse-to medium-grained sandstone which forms steep bluffs and hills. The resistant material is overlain by finer-grained flaggy micaceous sandstone and greywacke which appears mainly as rubble on the dip slopes. In the Mountain Valley area the Sandstone is composed almost wholly of white friable quartz sandstone; near Flying Fox Creek the Sandstone is underlain by a lens of coarse sandstone and conglomerate with interbedded limestone and chert which is tentatively included in the formation; the sandstone in the lens contains several circular impressions with markings similar to Beltanella forms.

The deposition of the overlying Mainoru Formation marks a return to some non-clastic sedimentation and shows some of the lateral variations exhibited by the earlier non-clastic groups. In the north-west the bedded, glauconitic Mountain Valley Limestone Member makes up the lower half of the Formation; the limestone is overlain by flaggy and laminated siliceous shale and siltstone which are possibly silicified marl. A small band of purple limestone and calcareous siltstone is the only outcrop of the Formation in the Strangways Fault area. Near Roper Bar no limestone member crops out but small lenses of limestone occur in calcareous shale at the Bar. Other outcrops are confined to blocky siliceous siltstone and chert and lenticular flaggy glauconitic greywacke, the Wooden Duck Member. The white siliceous siltstone and shale of the Mainoru Formation grades up into pink and green micaceous siltstone and greywacke at the base of the Crawford Formation. This boundary is normally not exposed and the lowest outcrop of the Crawford Formation is commonly a pink, micaceous, feldspathic, quartz greywacke which weathers into a rounded "sculptured" surface characteristic of the formation in the Sheet area. South of the Sheet area quartz greywacke grades laterally into a cleaner sandstone which constitutes the bulk of the Crawford Formation. Glauconite is a diagnostic mineral in the Formation.. The overlying Abner Sandstone is subdivided into four members on the varying grainsize and proportion of argillaceous and ferruginous material in it. The Arnold and Hodgson Sandstone Members are relatively clean sandstone which form spectacularly jointed ridges and plateaux. The Arnold

Sandstone Member appears only in the Hell's Gate Ridge; elsewhere the Jalboi Member is at the base of the formation. The Jalboi Member consists of micaceous sandstone and greywacke with many beds of quartz sandstone. Shallow water-surface markings and slumping is probably better developed in the micaceous sandstone of this member than anywhere else in the McArthur Basin succession; it also contains helical sandstone forms which were possibly formed by organisms (similar forms are described from near Willeroo, Northern Territory (Opik, 1956)). The ferruginous Munyi Member forms a contrasting capping on the Hodgson Sandstone Member with its darker colour and lack of jointing. The iron content is probably nowhere high enough to be of economic importance. Overlying the Abner Sandstone, the Corcoran Formation crops out very poorly and it is only west of the Strangways Fault that a complete section of flaggy micaceous siltstone and shale is exposed. Elsewhere several small outcrops of calcareous siltstone and minor limestone lenses occur, but the lateral variations within the Formation are not known. The thickness of the Bessie Creek Sandstone ranges considerably and in places the friable sandstone has broken down altogether to leave no trace of outcrop. However, at "Ruined City" the most spectacular and probably thickest outcrop of the Sandstone in the Sheet area is exposed.

Within the Maiwok Sub-Basin the Bessie Creek Sandstone is overlain by the Maiwok Sub-Group, but outside the Sub-Basin it is overlain by poorly defined sediments, which do not exhibit the features of the Sub-Group; to the south they have been mapped as the Cobanbirini Formation (Smith, 1962). At the base of the Maiwok Sub-Group the Velkerri Formation occupies a considerable thickness of section but rarely crops out; the McMinn Formation commonly forms the lowest outcrop. The McMinn Formation is principally a succession of interbedded blocky quartz sandstone, flaggy micaceous sandstone, siltstone, and shale. At the base of the Formation the blocky quartz sandstone is a resistant bed which is referred to as the Moroak Sandstone Member. The maximum thickness of this is 300 feet in the Sherwin Creek area, but thins to 40 feet in other places. The proportion of blocky quartz sandstone decreases up the section and the Sandstone Member grades into the Kyalla Member. The boundary is commonly occupied by the Sherwin Ironstone Member or by a dolerite sill. The Sherwin Ironstone Member when present appears on this boundary north of the Roper River, but in the Sherwin Creek area and farther south it occurs as several beds interfingered with both members (see Economic Geology). Above the Ironstone Member the sand content decreases until only shale and lenses of cone-in-cone limestone are present in the middle of the Kyalla Member.

Above this the arenaceous content again increases until it is sufficient to constitute the Bukalorkmi Sandstone Member at the top of the formation. The upper boundary of the Bukalorkmi Sandstone Member is marked by a sharp change to fine-grained calcareous material at the base of the Chambers River Formation. This Formation also gradually becomes more sandy and the topmost exposed beds are blocky quartz sandstone. The Chambers River Formation is the youngest exposed unit in the McArthur Basin and has no defined top.

Lower Cambrian

The Antrim Plateau Volcanics crop out in the extreme south-west of the Sheet area. They form part of an extensive series of basic volcanics which underlie Middle Cambrian limestone over a large area of the Northern Territory and extend into Western Australia. The basaltic lavas overlie and are intercalated with a friable tuffaceous sandstone. Wade (1924) reported finding bitumen glance near Waggon Wheel Lagoon in these volcanics.

Palaeozoic?

The age of the Sandstone outcrop at Canopy Rock is probably Palaeozoic. It forms a 50 foot high isolated monolith (Canopy Rock), near the eastern end of the Mountain Valley air-strip. It is a massive, ripple-marked, silicified sandstone with clay-gall impressions and it unconformably overlies the Mountain Valley Limestone Member. Similar less-spectacular outcrops overlie the Mainoru Formation and Crawford Formation in the same general area; they do not correspond to any other known unit in a similar stratigraphical position. None of the outcrops is large enough to appear on the 1:250,000 map.

Lower Cretaceous

The Mullaman Beds include all the Mesozoic sediments which cover large portions of the northern part of the Northern Territory. Remnants of this extensive unit occur as a tableland in the north-west and as numerous flat-topped mesas throughout the area north of the Roper River. The sediments are characteristically iron-stained, either buff, purple or red-brown but, in places, a massive white friable sandstone occurs near the base. The basal units, which may include a purple pebble conglomerate and coarse sandstone as well as the white friable sandstone, contain plant fossils and are probably of lacustrine or lagoonal origin. The overlying buff and red-brown calcareous sandstone, shale, and porcellanite is marine and contains fragments of pelecypods, ammonites, and other fossils. Where it appears, the porcellanite is at the top of the sequence and is probably a product of the lateritization of shale. The non-marine beds are not everywhere

present and the marine beds may form the base.

Work on the systematic classification of fossils from the Mullaman Beds in adjacent areas is still in progress, but the plant remains already recognised include Taeniopteris, Cycadites, Pterphyllum, and Ptilophyllum species (White, 1960); and the invertebrates include a species of the ammonite Australiceras and of the pelecypods Tatella, Fissilunula, Pseudavicula, Nototrigonia, and Pteratrigonia (Skwarko, 1961). All these fossils indicate a Lower Cretaceous age, probably Neocomian or possibly Aptian.

Cainozoic

A superficial cover of sand, laterite, and soil masks some of the underlying formations in the north-west and south-east corners of the Sheet area. The sand in the north-west is mainly derived from the breakdown of sandy sediments from the Cretaceous tableland. Between Mountain Valley Homestead and Flying Fox Creek a ridge of black manganese-rich sandstone of unknown relationships protrudes through this sand. In the south-eastern area the sand covers lateritic remnants of an old peneplain surface.

The aggrading valleys of the main rivers are covered by extensive alluvial flats. In the north the alluvium is generally sandy, but in the valleys of the Roper River and its lower tributaries it is a transported black soil on which fair quality Mitchell grass grows. Most of the alluvial soil near a permanent supply of water would have agricultural possibilities, but the present seasonal flooding prevents its use.

Igneous Intrusives

Dolerite sills occur throughout the Roper Group; in places five different sills with an aggregate thickness of almost 1000 feet intrude the succession. The two topmost sills each occur within consistent stratigraphic horizons over hundreds of square miles; the upper finer-grained one within the Bukalorkmi Sandstone Member, and the other at the base of the Kyalla Member about six hundred feet stratigraphically below. Each of the lower sills appears within a limited portion of the succession in which it transgresses from one bed to another. The mineralogy of the dolerite is fairly consistent throughout; it is a pigeonite dolerite with a plagioclase intermediate between labradorite and andesine. The texture varies in the upper sills; the top sill is fine-grained, almost basaltic in appearance, and the one below contains layers ranging from fine to coarse; the lower sills are consistently medium-grained, showing very little range within themselves or from sill to sill.

Only one transgressive dyke was mapped; it occupies a minor fault-line striking north-east, 6 miles north-west of Mainoru Homestead.

The intrusions appear to pre-date the major fault movements of the Upper Proterozoic and are unconformably overlain by Lower Cambrian Antrim Plateau Volcanics.

STRUCTURE

Plate 2 shows the main structures and tectonic units of the Sheet area.

Folding

Several regional fold structures are apparent. Some of these, such as the monocline of the Hell's Gate Hingeline and the syncline to the east of the Showell Creek Fault were probably active during sedimentation and, with the Wilton River Plateau and Maiwok Sub-Basin, are partly depositional structures. The Jalboi Syncline is made up of an eastern limb of the Hell's Gate Hingeline and a steep western limb formed by later movement along the Chapman Fault Zone. The anticline of McArthur Group sediments in the south-east was also probably formed by a combination of depositional structure and superimposed faulting and folding.

Minor folds occur adjacent to most of the major faults against which beds dip up to 80° in places. A series of half domes appear adjacent to some of the faults. These domes are semi-elliptical structures, some only a mile long, which dip steeply at each end as well as parallel to the fault line; in places similar structures, usually smaller, dip away from the opposite side of the fault giving a "split-dome" appearance. Similar structures occur in the Hodgson Downs Sheet area, and have been compared with shallower structures in the Newport - Inglewood belt of Southern California which, Reed and Hollister (1936) suggest, reflect basement tear faulting (Dunn, 1962a). Broad dome structures adjacent to the Flying Fox and Die Jumb Fault Zones are in line with the continuation of the Strangways Fault, suggesting that these domes were formed by the same forces that created the Strangways Fault superimposed on the west-north-west fault system.

Faulting

The faults in the area trend in two main directions; north, and west-north-west.

The north-trending faults are part of the system of faults which dominate the post-sedimentation structure within

the central McArthur Basin. The Strangways Fault has greatly influenced the geology of the adjacent areas and was probably active during sedimentation when it partly delineated a western margin to the Maiwok Sub-basin. The faults on the eastern side of the Sheet area show considerable displacement in places south of the Wilton River Plateau, but either die out or show little evidence of movement within the Plateau; the most distinct of these, the Showell Creek Fault, can be traced across the Plateau only by a line with a dark soil pattern which possibly indicates the presence of a weathered dolerite dyke-filling.

The westerly-trending faults are mainly confined to the area of the Maiwok Sub-Basin. In the centre of the Sub-Basin the sedimentary sequence is repeated by the Flying Fox in a series of step faults with blocks generally downthrown to the south. The amount of movement along these faults varies considerably along their length and in some places it is reversed over a short distance. Like most of the north-trending faults, the westerly faults do not extend onto the Wilton River Plateau; the Chapman Fault Zone appears to be diverted along the Plateau margin.

There are several minor faults trending in other directions. The north-east trending Mainoru Fault has very little displacement and appears in an area of slight down-warping between the main Arnhem Land Platform area and the Wilton River Plateau.

Many of the faults have been active over a long period; some were active during Upper Proterozoic sedimentation and slight displacement of some Cretaceous sediments indicates that the latest movement was post-Cretaceous.

Jointing.

The friable sandstones of the Roper Group display joint systems, which each have minor characteristics of their own. They are best developed in the Bessie Creek Sandstone and Hodgson Sandstone Member; the Bessie Creek Sandstone has a closer-spaced joint system which is probably a result of the Sandstone being generally more friable and finer-bedded than the Hodgson Sandstone Member.

ECONOMIC GEOLOGY

Iron (Cochrane and Edwards, 1960) - In places the Sherwin Ironstone Member of the McMinn Formation is an iron-ore body. Although Woolnough (1912) had noted these iron-rich sediments it was not until 1955 that geologists of Broken Hill Pty. Ltd.

realized their ore potential. During 1955 and 1956 a programme of surface sampling delineated a number of potential orebodies in the scarps and on the dip slopes of the Moroak Sandstone Member south of the Roper River. Diamond drilling, in 1958, confirmed the extension of the ironstone downdip below overburden. In the area of its maximum development, near Sherwin Creek, the ironstone occurs in three distinct beds separated by up to 70 feet of sandstone and siltstone.

On the surface the ironstone is oolitic and pisolitic hematite in a ferruginous sandstone matrix, but below the zone of weathering it consists of oolites of ochreous hematite, granules of greenalite, and quartz grains in a sideritic cement.

Outside the Sherwin Creek area only a single major bed of ironstone is present. Broken Hill Pty. Ltd. geologists traced this bed south-westwards to the Hodgson Downs Homestead area where it widens into further orebodies (Dunn, 1962a). In 1958, geologists of the Bureau of Mineral Resources discovered and delineated the extension of the same iron bed north of the Roper River.

A series of small lenses of quartz hematite, 3 miles upstream from Roper Bar, was noted by W. Murphy (1912). They constitute a vertical lode near the contact of the Mount Reid Beds and Urapunga Group. The deposit is not large enough to be of immediate economic significance.

Water

Since the area receives a moderate rainfall, sufficient surface water is available to supply current stock needs in all but the driest years. The Roper River runs permanently over most of its course and there are many large permanent waterholes in the creeks and billabongs. The stock-carrying capacity of some of the better-grassed areas could probably be improved by the installation of bores or dams: many of the sandstone beds would be good aquifers.

Copper and Lead

The chert of the Kookaburra Creek Formation contains small inclusions of chalcopyrite and galena. Several large gossanous bodies crop out on the brecciated chert. Broken Hill Pty. Ltd. drilled one gossan near Mount Vizard, but failed to find significant mineralization.

Flagstones

The flaggy siltstone and greywacke of the Mainoru and Crawford Formations in the area of Mainoru Station make excellent flagstones which are used for paving by the local stations.

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TABLE I - SUMMARY OF STRATIGRAPHY OF URAPUNGA SHEET AREA

AGE	Rock Units: Group or Sub Group	Formation	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 and rubble.	Overlies older rocks	On 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 procellanite. Conglomerate.	Unconformably overlies older rocks	Tablelands and mesas.	Plant and marine fossils
Palaeozoic		Sandstone at Canopy Rock		60 ft. +	Medium to coarse-grained white blocky sandstone; silicified; Clay-gallmarked.	Unconformably overlies Mainaru Formation.	Isolated pinnacles	Comparative age and relationships indeterminate (Not shown on 1:250,000 maps).
Lower Cambrian		Antrim Plateau Volcanics		200 ft.	Massive and vesicular basic lavas. Red feldspathic sandstone	Unconformable on Upper Proterozoic sediments.	Rounded low hills.	
					UNCONFORMITY			
UPPER PROTEROZOIC	Roper Group			to 6000 ft.	Arenaceous sediments with interbedded shales. Minor calcareous rocks. Some ironstone.	Unconformably overlies McArthur and Mt. Rigg Group. Sediments.	Prominent sandstone ridges and broad flat valleys.	Occupies large proportion of area mapped. Divided into 1 Sub-Group and 6 other Formations.
	Maiwok Sub Group			Up to 3000 ft.	Mainly fine-grained flaggy micaceous sandstone, shale and siltstone with some friable sandstone horizons. Some ironstone and calcareous sediments.	Topmost Upper Proterozoic; conformably overlies Bessie Creek Sandstone.	Low rounded hills and broad valleys. Cuesta-form ridges.	Confined to Maiwok Sub-Basin. Divided into Chambers River, McMinn and Velkerri Formations.
		Chambers River Formation		Up to 1000 ft.	Flaggy fine micaceous 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 micaceous sandstone and greywacke bloeky 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.
			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.	Cuesta-form ridges.	Extensively ripple-marked.

TABLE I - SUMMARY OF STRATIGRAPHY OF URAPUNGA SHEET AREA

AGE	Rock Units: Group or Sub Group	Formation	Member	Approx Thickness	Lithology	Stratigraphic Relationship	Topography	Remarks
UPPER PROTEROZOIC			Kyalla Member	500 ft. +	Flaggy fine micaceous 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.	Interbedded with Moroak Sandstone and Kyalla Members.	In scarps and on dip slopes.	Medium grade iron ore in places. Forms 3 horizons at Sherwin Creek.
			Moroak Sandstone Member.	40 ft. to 300 ft.	Blocky medium sandstone interbedded with shale and siltstone.	At base of McMinn Formation where it conformably overlies Velkerri Formation.	Scarps and cuesta-form ridges.	
		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 and plateaus reduced to sandy rises in places.	Is characteristically jointed. Especially well developed at "Ruined City".
		Corcoran Formation		400 ft to 600 ft.	Shale, siltstone, fine micaceous sandstone; blocky sandstone.	Conformably overlies Crawford Formation.	Broad valleys with low ridges.	Divided into four members, Munyi, Hodgson Sandstone, Jalboi and Arnold Sandstone.
		Abner Sandstone		300 ft. to 1000 ft.	Quartz sandstone, ferruginous flaggy sandstone; siltstone and shale, greywacke, slumped in places.	Conformably overlies Abner Sandstone.	Broad valleys with low ridges.	
			Munyi Member	Up to 100 ft.	Ferruginous sandstone and flaggy siltstone; shale	Top of Abner Sandstone conformably overlies Hodgson Sandstone Member.	Capping on plateaus and dipslopes of sandstone.	
			Hodgson Sandstone Member	100 ft. to 200 ft.	Friable, massive medium to coarse sandstone; siltstone	Conformably overlies Jalboi Member	Prominent ridges and hills.	Characteristically jointed as at Nellie Gate.
			Jalboi Member	100 ft. to 500 ft.	Blocky and flaggy quartz sandstone, slumped greywacke, siltstone and shale.	Conformably between Hodgson and Arnold Sandstone Members.	Rounded hills and banded ridges.	Lenses out towards the north-west.
			Arnold Sandstone Member	Up to 200 ft.	Blocky and massive friable quartz sandstone	Base of Abner Sandstone. Conformably overlies Crawford Formation.	Sandstone ridges and hills.	Lenses out to north. Jointing similar to Hodgson Sandstone Member.

TABLE I - SUMMARY OF STRATIGRAPHY OF URAPUNGA SHEET AREA

AGE	Group or Sub Group	Rock Units: Formation	Rock Units: Member	Approx Thickness	Lithology	Stratigraphic Relationship	Topography	Remarks
UPPER PROTEROZOIC		Crawford Formation		Up to 400 ft.	Buff and pink massive micaceous quartz greywacke. Flaggy fine micaceous siltstone.	Grades up from Mainoru Formation.	Rounded ridges.	Weathers with distinctive rounded and sculptured appearance.
		Mainoru Formation		200 ft. to 500 ft.	Blocky buff marl, cherty marl and chert. Papery calcareous micaceous siltstone, some greywacke. Limestone in places, at bottom.	Conformably overlies Limmen Sandstone.	Flat valleys with low rubbly ridges of cherty material.	Has two members, Mountain Valley Limestone and Wooden Duck.
			Wooden Duck Member	50 ft.	Flaggy greywacke and siltstone with glauconite bands.	Below marls in Mainoru Formation.	Low broken ridges.	Only differentiated in small area north of Roper River.
			Mountain Valley Limestone Member	200 ft.	Bedded glauconite limestone with some brecciated limestone. Interbedded flaggy marl.	Base of Mainoru Formation. Conformably overlies Limmen Sandstone	Limestone plains.	Crops out only in northern area.
		Limmen Sandstone		300 ft. to 400 ft.	Massive quartz sandstone - silicified surface. Laminated sandstone. Conglomerate and grit at base. Overlain by red flaggy fine sandstone, siltstone and greywacke with interbedded blocky quartz sandstone.	Unconformably overlies Kookaburra Creek Formation and Mt. Rigg Group. Base of Roper Group.	Rugged dissected areas in north. Prominent bluffs and escarpments in south.	
		UNCONFORMITY IN PLACES						
	McArthur Group			2500 ft. +	Cherts, "stromatolite" dolomite, feldspathic sandstone, calcareous sediments and volcanics	Unconformable beneath Limmen Sandstone and unfonformably overlies Mt. Reid Beds.		In Urapunga-Roper Mission area only.
		Kookaburra Creek Formation		Up to 1200 ft.	Chert, chert breccia, calcareous sandstone, silicified dolomite, marl and greywacke. Stromatolites in chert. Volcanic member. (see below)	Topmost member of McArthur Group. Conformably overlies Mt. Birch Sandstone.	Low rugged hills.	Traversed by numerous faults marked by manganese-rich gossanous chert breccia. Traces of copper and lead mineralization.
			Yalwarra Volcanic Member	250 ft to 530 ft.	Basic to intermediate vesicular volcanics, feldspathic sandstone, volcanic agglomerate, feldspathic conglomerate.	In the middle of the Kookaburra Creek Formation.	Sandstone and conglomerate in ridges.	

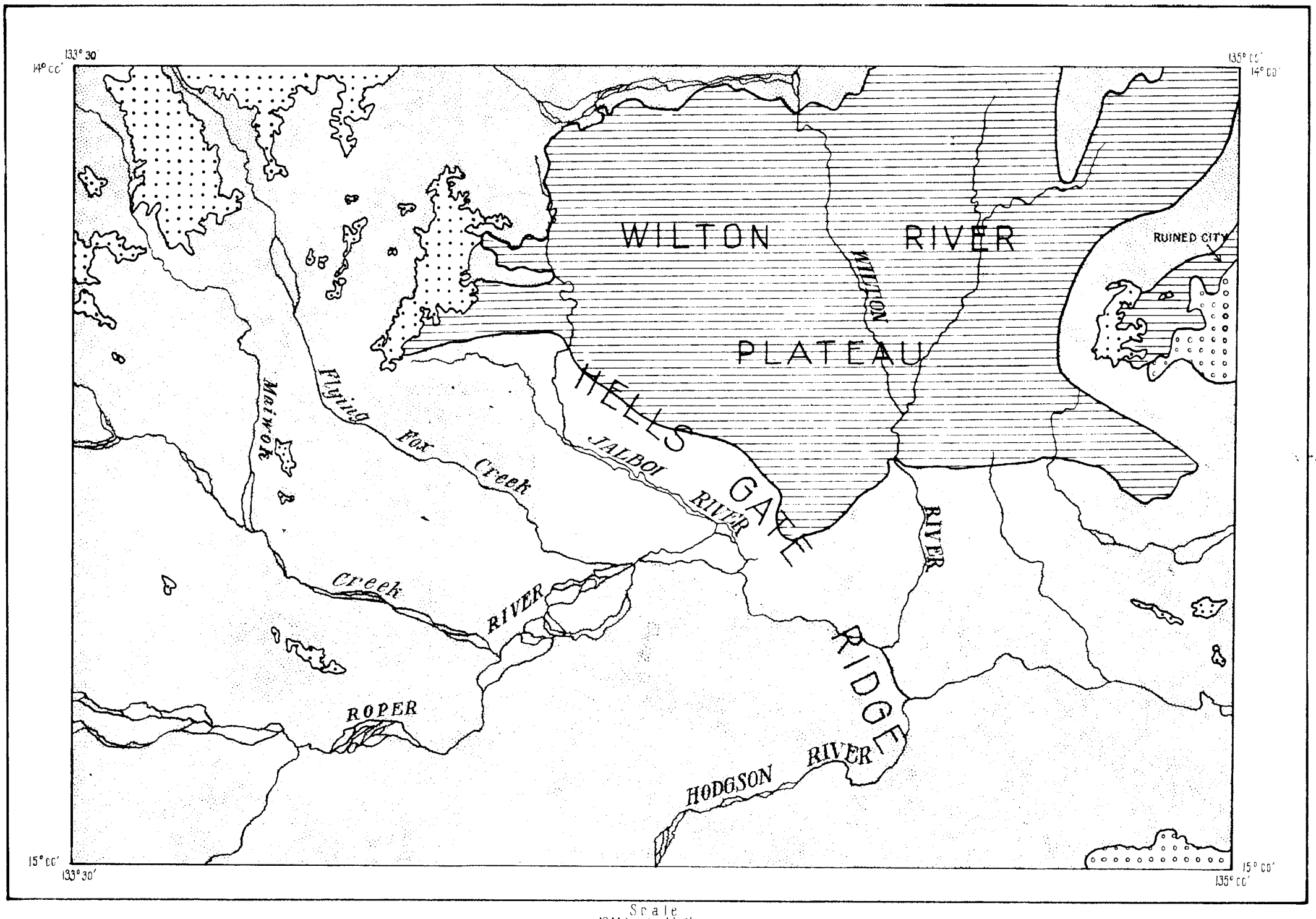
TABLE I - SUMMARY OF STRATIGRAPHY OF URAPUNGA SHEET AREA

AGE	Rock Units: Group or Sub Group	Rock Units: Formation	Rock Units: Member	Approx Thickness	Lithology	Stratigraphic Relationship	Topography	Remarks
		Mt. Birch Sandstone		250 ft.	Buff and brown feldspathic sandstone and quartz greywacke. Overlain by white feldspathic sandstone.	Conformably overlies Mt. Vizard Formation.	Small rugged ridges and part of strong ridges with Mt. Vizard Formation.	
		Mt. Vizard Formation		To 1200 ft.	"Stromatolite" dolomite at base, bedded dolomite, sandstone and fine grained calcareous sandstone and siltstone - some slumped. Chert with sponge spicules.	Lowest formation exposed in McArthur Group.	Prominent ridge.	
					UNCONFORMITY			
PROTEROZOIC	Mt. Reid Beds			Greater than 200 ft.	Porphyritic rhyolite overlain by massive white sandstone containing boulders.	Unconformable beneath undifferentiated McArthur Group sediments.	Low hills except where capped by sandstone - high bluff.	In small area near Mt. Reid east of Urapunga Homestead.
UPPER	Mt. Rigg Group.			1500 ft. in this area.	Sandstone, limestone, chert breccia, siltstone and volcanics.	Unconformably overlies Katherine River Group sediments.	Sandstone and chert ridges, limestone.	Also deposited in Beswick Basin (Randal 1961). Divided into Margaret Hill Conglomerate, Bone Creek, Dook Creek and Beswick Ck. Forms. Only Bone Creek and Dook Creek Formations present here.
		Dook Creek Formation		1000 ft.	Bedded limestone, "collenia" limestone, chert breccia, marl, calcareous siltstone and some sandstone.	Part of Mt. Rigg Group occupying similar position to McArthur Group below Limmen Sandstone.	Limestone plains and low hills. Chert breccia in rugged ridges.	
		Bone Creek Formation		500 ft.	White sandstone	Lowest Formation of Mt. Rigg Group in this area. Conformably overlain by Dook Creek Formation and unconformable on Katherine River Group.	Dissected sandstone country.	

TABLE I - SUMMARY OF STRATIGRAPHY OF URAPUNGA SHEET AREA

AGE	Rock Units: Group or Sub Group	Rock Units: Formation	Rock Units: Member	Approx Thickness	Lithology	Stratigraphic Relationship	Topography	Remarks
					UNCONFORMITY			
	Katherine River Group			Up to 5000 ft. outside Sheet area.	Mainly sandstone and interbedded volcanics Volcanics acid to basic. Some conglomerate sedimentary breccia and minor limestone.	Unconformably overlies Lower Proterozoic.	High jointed sandstone plateaus with steep valleys	Only the topmost of 3 constituent formations, the Diljin Hill Formation crops out on this Sheet area.
		Diljin Hill Formation		1400 ft.	Basic volcanics, limestone, toffaceous sandstone and greywacke	Top of Katherine River Group.		Divided into three Members.
			West Branch Volcanic Member	1000 ft.	Black amygdaloidal basic volcanics interbedded with sandstone and tuffaceous greywacke. Some tuff.	Topmost member of Diljin Hill Formation of Katherine River Group. Overlies Gundi Greywacke Member with local unconformity.	Low rounded hills with ridges of sandstone.
			Gundi Greywacke Member	300 ft.	Purple tuffaceous quartz greywacke. Jointed.	Member of Diljin Hill Formation; conformably overlies Diamond Creek Member	Massive rugged escarpments and tableland.
			Diamond Creek Member	100 ft.	Basalt and interbedded limestone siltstone and conglomerate.	Conformably overlies jointed Kombolgie Formation sandstone west from Urapunga Sheet area.	Valleys between sandstone.

PHYSIOGRAPHIC SKETCH MAP URAPUNGA SHEET AREA



Scale
10 Miles to 1 Inch

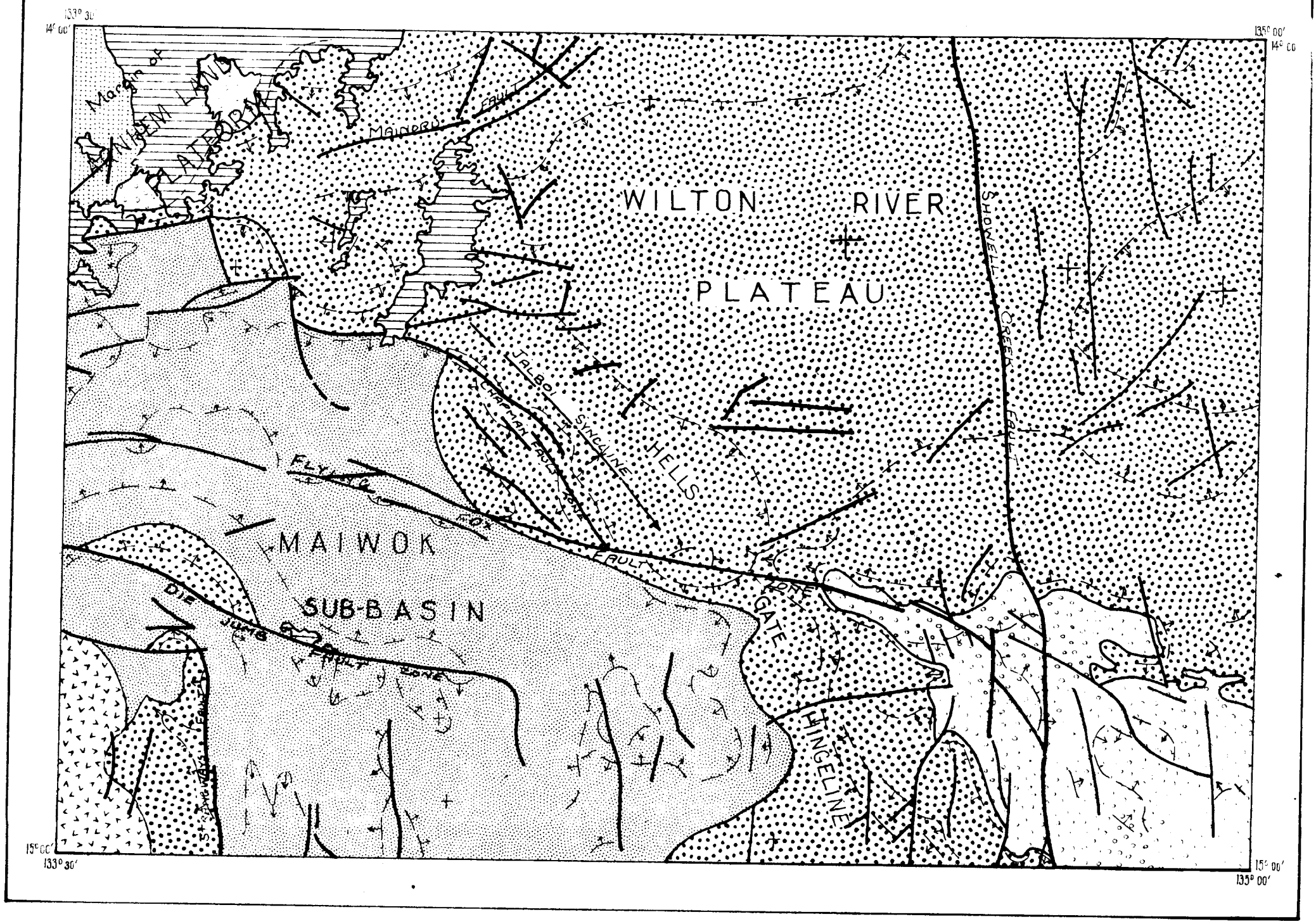
10 5 0 10 20 30 40 Miles

Reference

- Cretaceous Tableland
- Gulf Fall Area
- Wilton River Plateau
- Coastal Plains

To accompany Record 1962/92

TECTONIC SKETCH MAP URAPUNGA SHEET AREA



Scale

10 Miles to 1 inch

10 5 0 10 20 30 40

Reference

- Cretaceous tableland
- Mainly Maiwok Sub-Group
- Group and Sub-Group boundaries
- Prevailing dip and strike.
- Plunging synclinal axis
- Cambrian volcanics
- Roper Group below Maiwok Sub-Group
- Mainly McArthur and Mt. Rigg Group
- Katherine River Group.
- Fault
- Horizonatal strata.

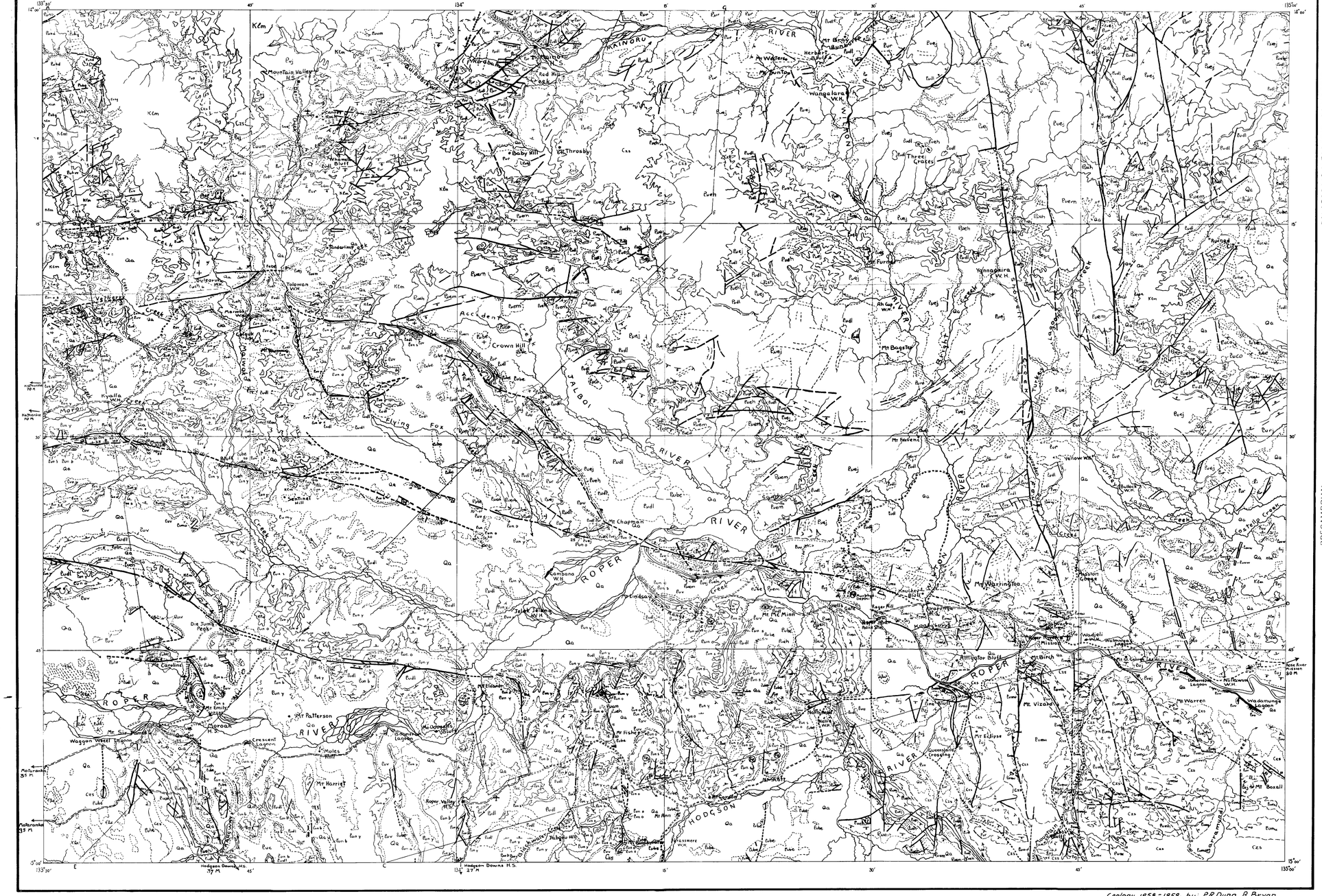
To accompany Record 1962/92

AUSTRALIA 1:250,000

URAPUNGA
NORTHERN TERRITORY

1:250,000 GEOLOGICAL SERIES SHEET SD53-10

PRELIMINARY EDITION, 1962
SUBJECT TO AMENDMENT



Reference

PALAEOZOIC MESOZOIC CAINOZOIC

QUATERNARY		Qa	Alluvium, transported black soil
UNDIFFERENTIATED		Czs	Sand, laterite, soil
LOWER CRETACEOUS	Mullaman Beds	Klm	Siltstone, quartz sandstone, in part ferruginous; conglomerate, porcellanite; freshwater and marine fossils
LOWER CAMBRIAN	Antrim Plateau Volcanics	Clo	Amygdaloidal basalt, feldspathic sandstone

PRECAMBRIAN

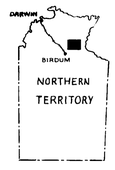
UPPER PROTEROZOIC		Pudl	Dolerite sills
		Pus	Quartz sandstone
Roper Group — Maiwok Sub-Group	Undifferentiated		
	Chambers River Formation	Puc	Blocky quartz sandstone, flaggy micaceous quartz sandstone, siltstone
	McMinn Formation — Bukdorrkimi Sandstone Member	Pumb	Flaggy friable quartz sandstone ferruginous sandstone
	Kyalla Member	Puky	Flaggy quartz sandstone, micaceous quartz greywacke, siltstone, cone-in-cone dolomite
	Sherwin Ironstone Member	Puns	Pisolitic and oolitic ironstone, ferruginous sandstone
	Moroak Sandstone Member	Puno	Blocky-coarse sandstone, non-outcropping interbedded siltstone and shale
	Velkerri Formation	Puv	Pink calcareous greywacke, calcareous siltstone, laminated shale
	Bessie Creek Sandstone	Pube	Massive white friable quartz sandstone
	Corcoran Formation	Puco	Micaceous fine-grained sandstone, shale, minor limestone
	Abner Sandstone — Munty Member	Puam	Ferruginous sandstone and siltstone, shale
	Hodgson Sandstone Member	Puch	Massive and flaggy quartz sandstone
	Jalboi Member	Puej	Massive and flaggy quartz sandstone interbedded with pink slumped micaceous quartz greywacke, siltstone and shale
	Arnold Sandstone Member	Puea	Massive and flaggy quartz sandstone
	Crawford Formation	Pur	Massive and flaggy slumped micaceous quartz greywacke, micaceous siltstone; few glauconite bands
	Mainoru Formation	Puu	Micaceous siltstone, blocky chert, pink to cream siltstone in part silicified
	Wooden Duck Member	Puuw	Flaggy quartz greywacke, micaceous greywacke, few glauconite bands
	Mountain Valley Limestone Member	Puum	Grey flaggy limestone, brown marl, glauconitic in places
	Limmen Sandstone	Puj	Massive and flaggy silicified quartz sandstone, micaceous quartz greywacke; basal quartz pebble conglomerate
Mt Rigg Group	Dook Creek Formation	Puo	Quartz sandstone, siltstone, chert, dolomite containing 'Stromatolites'
	Bone Creek Formation	Punc	White flaggy silicified quartz sandstone, basal boulder conglomerate
McArthur Group	Kookaburra Creek Formation — Valmarra Volcanic Member	Pumu	Silicified dolomite in part oolitic, containing 'Stromatolites', chert, ferruginous chert breccia sandstone
		Pumw	Interbedded amygdaloidal basic and intermediate volcanics and feldspathic sandstone; volcanic breccia and boulder agglomerate at base
	Mount Birch Sandstone	Pumh	White and brown feldspathic sandstone, calcareous near base
	Vizard Formation	Pumv	Interbedded quartz sandstone and siltstone; dolomitic in places, silicified dolomite with 'Stromatolites' Chert with sponge spicules
Tawallah Group	Mount Reid Beds	Putx	Ferruginous quartz sandstone, grit, conglomerate, underlain by red porphyritic rhyolite
Katherine River Group	Dillon Hill Formation — West Branch Volcanic Member	Puhw	Amygdaloidal basalt, tuff interbedded with coarse greywacke and agglomerate; sandstone
	Gundi Greywacke Member	Puhg	Purple tuffaceous greywacke
	Diamond Creek Member	Puhd	Interbedded amygdaloidal basalt and dolomite, banded siltstone, conglomerate in places

- Geological boundary
- Fault
  Where position of boundaries and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries are dotted and faults are shown by short dashes
- Strike and dip of strata
- Vertical strata
- Overturned strata
- Horizontal strata
- Dip < 15°
- Dip 15°–45°
- Trend of bedding (air photo interpretation)
- Joint pattern
- Dyke & dolerite
- Unworked iron deposit
- Road
- Vehicle track
- Homestead
- Landing ground

Geology 1958-1959, by: P.R. Dunn, R. Bryan, K.A. Plumb, R.A. Ruker.
Compilation 1960, by: R. Bryan.

Compiled and issued 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 at 1:50,000 scale. Transverse Mercator Projection.

Scale 1:250,000
5 0 5 10 15 Miles
5 0 5 10 15 20 Kilometres

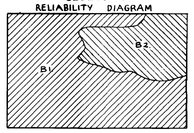


INDEX TO ADJOINING SHEETS
Showing Magnetic Declination

MT EVELYN	MT MARUMBA	BLUE MUD BAY
KATHERINE	URAPUNGA	ROPER RIVER
LARRIMAH	HODGSON DOWNS	MT YOUNG

ANNUAL CHANGE 30'E

GEOLOGICAL RELIABILITY DIAGRAM

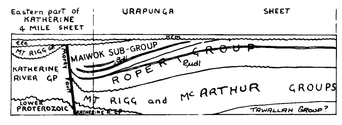


B1. Detailed reconnaissance, numerous traverses.
B2. Air-photo interpretation, few traverses.

INDEX TO 1MILE SHEETS

CANOPY ROCK	MT. THROSBY	SNOWDEN PEAK
FLYING FOX CREEK	MT. FURNER	BENDA BLUFF
MAIWOK CREEK	MT. CHAPMAN	URAPUNGA
MT. PATTERSON	ROPER VALLEY	MT. ECLIPSE

Diagrammatic Relationship of Rock Units



Unconformity

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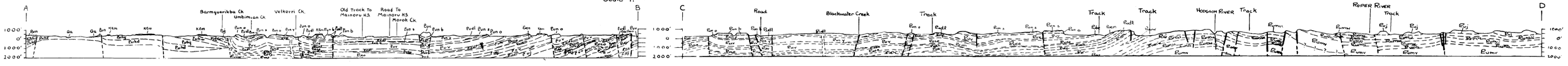

URAPUNGA
SD53-10

Copies of this map can be obtained from the Bureau of Mineral Resources, Geology and Geophysics, Canberra, A.C.T., or Darwin N.T.