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RECORDS:

1963/115

EXPLANATORY NOTES ON THE MILINGIMBI 1:250,000 GEOLOGICAL SHEET. NORTHERN TERRITORY.

Compiled by

P.Rix

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The Milingimbi Sheet area lies within the Arnhem Land Aboriginal Reserve, in the north-eastern sector of the Northern Territory. It is bounded by latitudes 12° and 13°S and by longitudes 133°30' and 135°E. Parts of the northern boundary of the Sheet area traverse the Arafura Sea.

Access may be gained by seagoing vessel or by aircraft to Maningrida Settlement or Milingimbi Mission, the only centres of permanent habitation in the area. Apart from in the immediate vicinity of the settlements, no vehicle tracks exist. The south-western part is impassable to land vehicles, being readily accessible only by helicopter, while the remainder of the area is difficult to negotiate in land vehicles due to the numerous major watercourses. The area was declared part of the Arnhem Land Aboriginal Reserve in 1931.

The average annual rainfall is from about 35 inches in the southern part to about 45 inches along the coast; it occurs mainly during the months December to March.

Air photographs and maps covering the area are: air-photographs at a scale of 1:50,000 flown by the Royal Australian Air Force in 1950; a photo-mosaic prepared by the Division of National Mapping, Department of National Development; and a planimetric map at 1:250,000 scale produced by the Royal Australian Survey Corps from a controlled, photoscale, slotted template assembly. The accompanying geological map was prepared by transferring information directly from reduced photo-overlays to a base prepared from the Survey Corps 1:250,000 Sheet.

Previous Investigations

In 1867 Cadell landed near the mouth of the Liverpool River and made several short journeys inland (Cadell, 1868). He described the Arnhem Land Plateau as consisting of "pinnacled sandstone rocks" extending "south and south-west as far as the eye could see". Lindsay (1883) passed through the Sheet area during his explorations of Arnhem Land, proceeding from the Muckaninnie Plains in the east to the Liverpool River near its confluence with the Mann River, and thence upstream, past Cuthbertson Falls which he named, to the southern margin of the Sheet area. He recorded the presence of "sandstone, slate, conglomerate and diorite" along the Liverpool River. Brown (1908) travelled along the north coast of Arnhem Land in the steamer "Federal" and made notes on the geology of the Liverpool River estuary. Love (1911) travelled from the Muckaninnie Plains to the north-west corner of the Sheet area, recording granite in the central and north-western parts of the area and sandstone elsewhere along his course. Gray (1915) examined the granite exposed in the north-west.

The adjoining Sheet areas have been mapped by the Bureau of Mineral Resources - Alligator River between 1953 and 1957 (Dunn, 1963); the remainder during 1962 - Mount Marumba (Roberts and Plumb, 1963); Junction Bay (Rix, 1963); and Arnhem Bay and Gove (Dunnet, 1963).

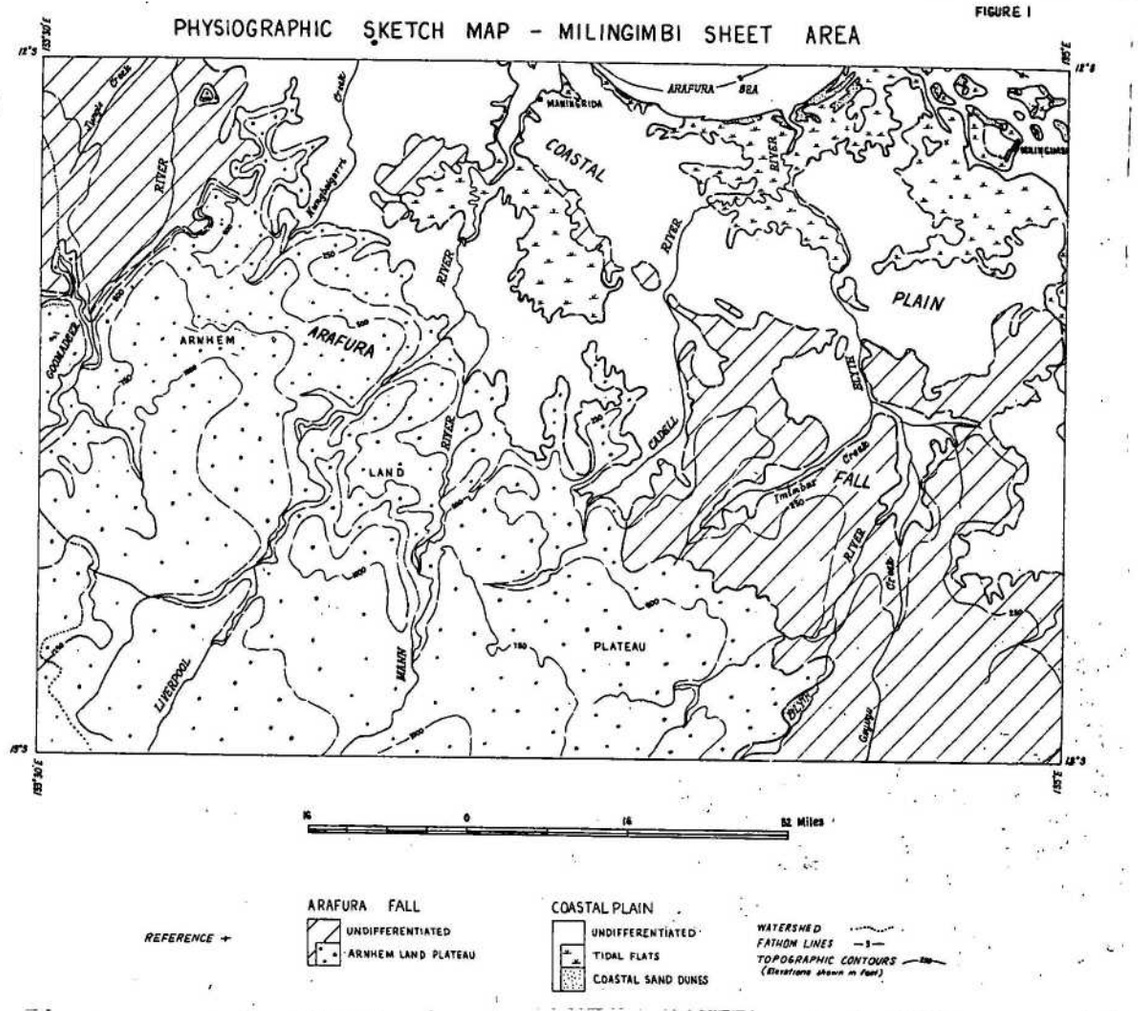
Prior to the 1962 field work a photogeological map of the Milingimbi Sheet area was prepared by Ruker (1962). Much of the interpretation is retained on the final geological map.

PHYSIOGRAPHY

Two major physiographic units occur in the Milingimbi Sheet area (see figure 1); these are the Arafura Fall, a north-sloping surface providing drainage to the Arafura Sea, and the Coastal Plain (Roberts and Dunn, in prep.).

FIGURE 1

PHYSIOGRAPHIC SKETCH MAP - MILINGIMBI SHEET AREA



The Arafura Fall occupies the southern and north-western parts of the Sheet area and extensive parts of adjoining Sheet areas. It comprises dissected, elevated country and contains most of the rock exposures present in the area. Within the Arafura Fall sandstones of the Kombolgie Formation form an area of conspicuously greater elevation than other rocks. This area is delineated on figure 1 and, following common usage, is termed the Arnhem Land Plateau. The Plateau is extremely dissected - in places the main watercourses form gorges up to 300 feet deep (see plate 1), while the tributaries, commonly incised along

joints and faults, form similar features. The intensity of the jointing in the sandstones of the Kombolgie Formation contributes to a very high permeability and helps control surface run-off. The margin of the Plateau is generally marked by a scarp; in the west it is up to 400 feet high, but in the east it is usually only about 50 feet high. The base of the Plateau is about 200 feet above sea level, while elevations within the Plateau rise to above 1250 feet in the south-western corner of the Sheet area.

Plate 1: Liverpool River - Arnhem Land Plateau.
Rocks exposed are horizontal arenites
of the Kombolgie Formation.

The parts of the Arafura Fall lying outside the confines of the Arnhem Land Plateau, the Undifferentiated Arafura Fall (see figure 1), comprise undulating hilly country and broad soil covered plains, the topography varying largely in response to the lithologies of the underlying rocks. The Buckingham Bay Sandstone and Raiwalla Shale form low rises, while the Marchinbar Sandstone forms a broad discontinuous cuesta striking west-north-west across the north-eastern part of the Sheet area. Granites in the north-west form low undulating areas.

The Coastal Plain covers most of the north-eastern part of the Sheet area. It comprises areas of low relief bordering the coast and extends up to 40 miles inland. Elevations range from sea level to 200 feet. Laterite, developed on a variety of rocks, probably underlies a great part of the area, but sand, soil and alluvium obscure it except along watercourses. The Tidal Flats form part of the Coastal Plain; they occur spasmodically along the coastline and extend up to 20 miles inland along the main watercourses.

They are subject to tidal and seasonal flooding and act as repositories for fine sand, silt and evaporite deposits. Coastal Sand Dunes occur within the Coastal Plain, being situated either along the present coastline or up to a few miles inland, where they represent ancient strand lines. The form and orientation of the dunes may be due partly to wind action.

Drainage: The main watercourses in the area are the Goomadeer, Liverpool, Mann, Cadell and Blyth Rivers, all of which drain into the Arafura Sea. In the far west of the area a watershed (see figure 1) separates the streams draining into the sea east of Coburg Peninsula from those draining into Van Dieman Gulf.

The drainage pattern probably formed on a Late Cretaceous or early Tertiary peneplain consisting dominantly of lateritised Cretaceous rocks. Subsequent uplift and erosion superimposed the streams on the Precambrian and Cambrian rocks, which because of their diverse lithology and structure, modified the drainage pattern.

STRATIGRAPHY

Table 1 contains a condensed account of the stratigraphy of the Sheet area. The nomenclature used will be fully defined by Dunn and Roberts (in prep.).

Age of the Units:

Brown (1908) and Jensen (1914) regarded the rocks along the north coast of Arnhem Land as "Permo-Carboniferous". Gray (1915) considered the basement rocks to be of Precambrian age, the sandstones of the Arnhem Land Plateau to be Permo-Carboniferous and younger strata to be Cretaceous. David (1932) regarded the granites as "older Proterozoic" and the sandstones of the Plateau as Permian; Hossfeld (1954) placed them in the Lower Proterozoic and Cambrian respectively.

Walpole (1963) and Dunn (1963) placed the Kombolgie Formation of the Arnhem Land Plateau in the Upper Proterozoic but subsequently regarded it as Middle Proterozoic (Davenportion) in age (Walpole et al, in prep.). Dunn (1963) assigned the Nimbuwah Granite (now the Nimbuwah Complex) to the Lower Proterozoic; it is now considered that the Nimbuwah Complex is comprised of granites of two ages, the older being placed tentatively in the Archaean, the younger tentatively in the Lower Proterozoic Agicondian System. Recent radiometric age determinations made at the Australian National University, Webb, McDougall and Cooper (in press) force the relegation of the Tawallah Group and its stratigraphic equivalents (including the Katherine River Group) to the lower of the two divisions of the Proterozoic at present in use in the Northern Territory.

A sequence of sedimentary rocks unconformably overlying the Katherine River Group - the Wessel Group - is tentatively regarded as Cambrian in age because of its stratigraphic relationships and because of the presence of Scolithus? ("pipe-rock") which is common in Cambrian (and Ordovician) strata in Central Australia.

ARCHAEAN

The Gunbatgari Granite, a gneissic biotite granite, is exposed as an inlier in the Arnhem Land Plateau. It is placed tentatively in the Archaean because of its gneissic fabric. Lithologically and structurally it is similar to the older granite of the Nimbuwah Complex.

LOWER PROTEROZOIC (AGICONDIAN SYSTEM) AND ARCHAEAN

The Nimbuwah Complex is an extension of the rocks mapped as Nimbuwah Granite by Dunn (1963) on the Alligator River Sheet area. The term Complex is used in place of Granite because granites of two ages are now believed to be present, although they have not yet been fully delineated. The older part of the Complex comprises gneissic granite with abundant biotite (which occurs as clots) and hornblende. In places the granite is porphyritic. The younger part of the Complex is a massive two-feldspar granite with small proportions of biotite and hornblende; in places it has a finely crystalline equigranular texture. A large part of the area mapped as granite is covered with residual soil.

LOWER PROTEROZOIC

The Lower Proterozoic strata of the Sheet area were deposited in the McArthur Basin which extended from Arnhem Land in the north to beyond the Queensland border in the south - see Roberts & Dunn (in prep.).

Katherine River Group:

The Kombolgie Formation is a dominantly arenaceous unit but contains two volcanic members - the Goomadeer Volcanic Member and Nungbalgarri Volcanic Member. The Goomadeer Volcanic Member is lenticular and rests unconformably on rocks of the Nimbuwah Complex. Where it is absent from the succession quartz sandstone of the Kombolgie Formation rests directly on the older rocks. The sandstone is medium grained, white and blocky to massive; thin beds of quartz pebble-conglomerate occur within the sandstone and locally at its base. It is overlain by basalt of the Nungbalgarri Volcanic Member. In places a thin bed of quartz sandstone is interbedded with the basalt. The Member also crops out on the Alligator River Sheet area (Dunn, 1963), but although delineated it was not named. Above the Nungbalgarri Volcanic Member the Formation comprises interbedded white, pink and purple quartz sandstone and feldspathic sandstone. In the south-western part of the Sheet area the uppermost beds of the Kombolgie Formation grade laterally into beds of the McKay Formation.

The McKay Formation differs from the uppermost beds of the Kombolgie Formation by being more ferruginous, more feldspathic and vertically more variable in lithology. The lateral boundary of the McKay Formation is somewhat arbitrary but the base of the unit is lithologically well defined.

The Cottee Formation conformably overlies the McKay Sandstone in places, and in others conformably overlies the Kombolgie Formation. It is overlain with probable unconformity by the Shadforth Sandstone - (an unconformity between the two units has been mapped on the Mt. Marumba Sheet area (Roberts and Plumb, 1963)). The unit is poorly exposed but the outcrops available indicate that it is comprised mainly of dolomitic siltstone, siltstone, shale, sandstone, dolarenite, dolomite and possibly basalt.

The Shadforth Sandstone consists dominantly of quartz sandstone, which in places is slightly feldspathic. The Sandstone becomes glauconitic towards the top.

On the adjoining Mount Marumba Sheet area, the Shadforth Sandstone is overlain conformably by the McCaw Formation (Roberts & Plumb, 1963), but on the Milingimbi Sheet area this unit is not exposed due to soil cover and overlapping of unconformably overlying beds. The Formation consists of dolomitic siltstone, shale and fine grained sandstone interbedded with dolomite.

The Gundi Greywacke (formerly the Gundi Greywacke Member of the Diljin Hill Formation) unconformably overlies the Shadforth Sandstone (and the unexposed McCaw Formation). On the Milingimbi Sheet area quartz sandstone is dominant in the unit although some feldspathic sandstone and quartz-greywacke beds are present. Spheroidal Beltonella-like forms occur in two isolated outcrops of sandstone mapped tentatively as Gundi Greywacke two miles west of the Blyth River at Latitude 12°53'S.

UPPER(?) PROTEROZOIC

Dolerite Intrusions: Numerous dolerite sills and dykes intrude the Katherine River Group strata. On the Mount Marumba Sheet area (Roberts & Plumb, 1963) similar sills and dykes intrude rocks of the Upper(?) Proterozoic Roper Group and were faulted, folded and eroded with those rocks prior to the deposition of the Wessel Group.

CAMBRIAN(?)

The Cambrian(?) rocks of the Sheet area were deposited in the Arafura Basin (see Roberts & Dunn, in prep.), in the northern part of Arnhem Land. The south-western part of the Basin lies within the Milingimbi Sheet area. Exposures of the rocks occur in the north-eastern half of the Sheet area.

Wessel Group: The exposed succession of Cambrian(?) rocks is termed the Wessel Group and has been divided into four formations.

The Buckingham Bay Sandstone is the basal unit of succession. It comprises alternating medium-grained massive purple quartz-greywacke, quartz sandstone (containing Scolithus) and flaggy fine grained micaceous quartz greywacke.

The Raiwalla Shale forms the major part of the Wessel Group. The unit consists dominantly of fissile grey, green and purple shales. Laminated purple-grey fine grained slightly dolomitic sandstone with interbeds of fissile brown-purple siltstone and white, ripple marked, cross bedded quartz sandstone occurs towards the top of the unit.

The Marchinbar Sandstone conformably overlies the Raiwalla Shale and consists of flaggy, thin bedded, medium grained white quartz sandstone and slightly feldspathic sandstone.

The Elcho Island Formation is exposed only in one small area along the eastern margin of the Sheet area. The exposure, which is at the base of the unit, contains fine grained micaceous glauconitic sandstone with interbeds of friable white medium-grained quartz sandstone. On the Wessel Islands - Truant Island Sheet area (Plumb, 1963) and on the Arnhem Bay - Gove Sheet area (Dunnet, 1963) interbedded dolomitic siltstone, chert, chert-breccia and dolomitic sandstone overly these beds.

LOWER CRETACEOUS

The Mullaman Beds unconformably overly rocks of the Wessel Group and on fossil evidence (Skwarko, 1963) are placed in the Lower Cretaceous. The rocks are horizontal and commonly deeply lateritised; areas where complete lateritisation has occurred have been mapped as laterite.

CAINOZOIC

Cainozoic laterite, lateritic soils and ferricrete are widely distributed in the Sheet area. Laterite formed on a late Cretaceous or early Tertiary erosion bevel (probably a peneplain with scattered inselbergs). The Cretaceous rocks were particularly susceptible to lateritic alteration and much of the existing laterite appears to have been derived from them. Residual soils developed on laterite have, for mapping purposes, been included with laterite as has ferricrete which is thought to have been derived primarily from the erosion of laterite. Exposures of ferricrete are most common along the coast and in the banks of streams flowing across the Coastal Plain.

Weathering and erosion subsequent to the uplift of the lateritized surface has led to the development of residual soil; the deposition of sand and soil over extensive areas; and the development of coastal sand dunes.

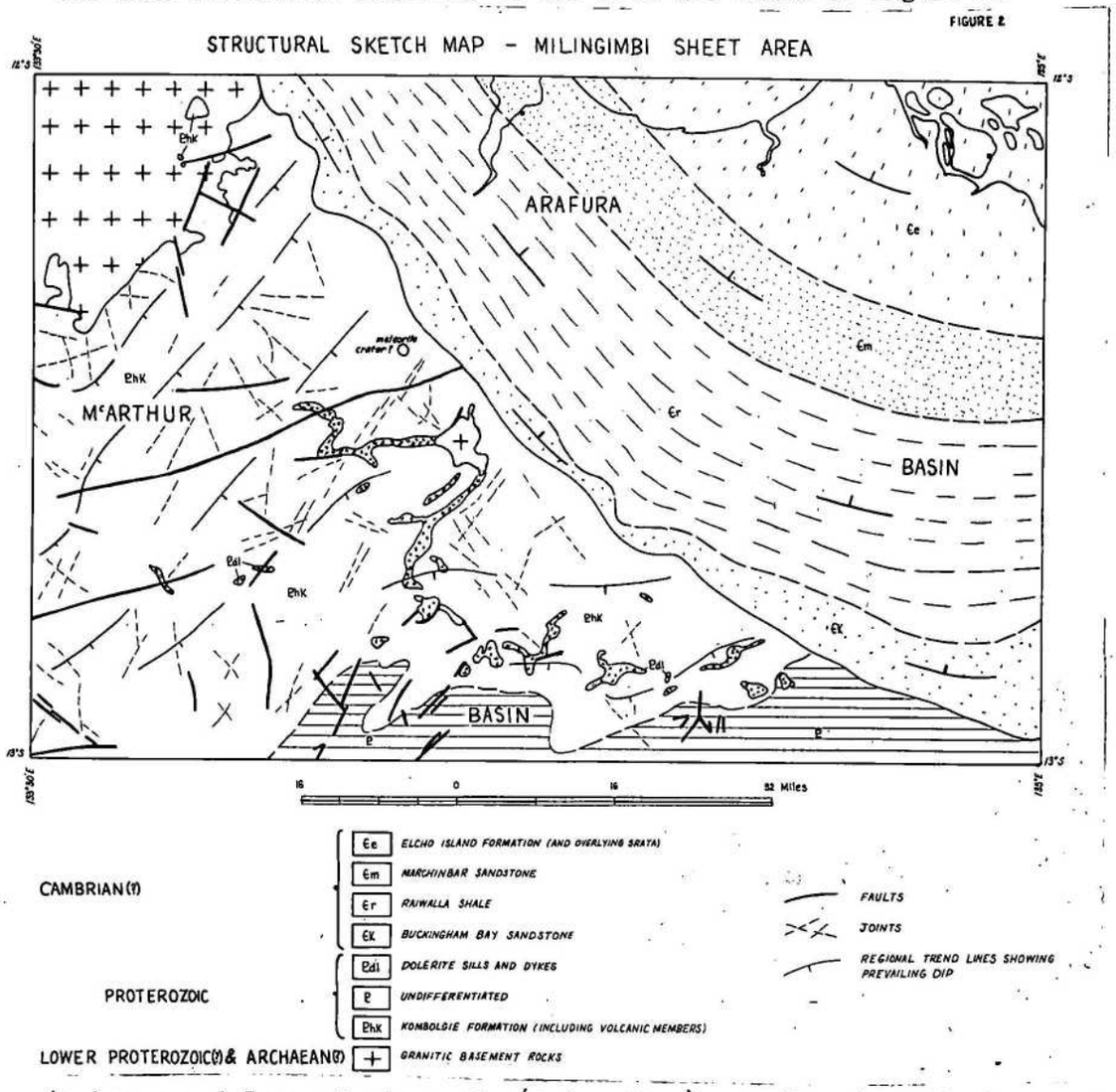
Riverine alluvium and coastal silt, sand and evaporite deposits are extensive in the north-eastern part of the Sheet area. The coastal deposits have been differentiated from the normal riverine alluvium on the accompanying map.

STRUCTURE

The main structural features of the area are shown on figure 2.

FIGURE 2

STRUCTURAL SKETCH MAP - MILINGIMBI SHEET AREA



Archaean and Lower Proterozoic (Agicondian) granites form the basement to the Proterozoic sedimentary sequence. The Archaean rocks have a distinct gneissic fabric but insufficient observations have been made to establish the orientation of the stress field or fields which have been operative. However the Archaean(?) Myra Falls Metamorphics, which crop out on the adjoining Alligator River Sheet (Dunn, 1963), have been folded about an east-west axis, being distinct in this respect from the overlying sediments of the Agicondian System which were folded about northerly to north-westerly axes.

The McArthur Basin strata dip gently to the south-east and south; dips over 5° are rare. Two long faults, but with little displacement occur in the western part of the Sheet area. They strike at about 060° in contrast to a group of small faults in the southern part of the area which strike mostly at 030°. Several minor faults, particularly in the north western part of the Sheet strike at 330°.

Jointing is intense in the arenites of the Kombolgie Formation; the most prominent directions are 120°, 30°, 45° and 60°.

Three miles west of the Liverpool River, at latitude 12°24'S, a circular structure one mile in diameter forms a ridge rising from a sandy plain which is underlain by sandstones of the Kombolgie Formation. The ridge is up to 50' high and is composed of angular fragments of sandstone from 3" to 10" across set in a sandstone matrix. The structure could possibly represent the rim of an ancient meteorite crater.

The Cambrian(?) rocks, deposited in the Arafura Basin, dip gently northwards in the eastern part of the Sheet area and gently to the north-east in the western part. No faults or folds have been distinguished but minor faults and flexures may be present.

The Lower Cretaceous rocks are horizontal; minor faults occur locally.

GEOLOGICAL HISTORY

The oldest rocks in the Sheet area, the Gunbatgari Granite and the gneissic granite of the Nimbuwah Complex suffered deformation either during their formation or subsequently but prior to the intrusion of the Agicondian granite. The latter (the massive equigranular part of the Nimbuwah Complex) may have been emplaced during the same time interval as many of the granites of the Pine Creek Geosyncline (Walpole et al, in prep.).

Following a period of erosion of the Archaean - Lower Proterozoic terrain, regional subsidence resulted in the development of the McArthur Basin, which, beginning in post-Agicondian times, became the site for the deposition of immense volumes of sediments, varying considerably in thickness from place to place within the Basin. In the Milingimbi Sheet area the Basin probably contained about 4000 feet of sediments, mostly of the Katherine River Group, probably with thin representatives of the Mt. Rigg Group (Lower(?) Proterozoic) and Roper Group (Upper(?) Proterozoic) (see Roberts and Dunn, in prep.). In a trough to the east over 40,000 feet of sediment accumulated. Variations in the balance between the rate of subsidence of the Basin and the rate of supply of sediments led to the development of several unconformities in the McArthur Basin succession. The unconformities are mostly restricted in extent although the unconformity between the Mount Rigg and Roper Group is of regional significance.

Dolerite sills and dykes intruded the rocks of the McArthur Basin probably in a single phase of activity towards the close of sedimentation in the Basin. The McArthur Basin strata (and the dolerite intrusions) were faulted and folded in Precambrian times; the rocks of the Milingimbi Sheet area suffered only minor deformation, while to the east (in the Arnhem Bay-Gove Sheet area) deformation was much more intense (Dunnet, 1963).

The deformation was followed by a period of erosion and eventually, in Cambrian(?) times by the initiation of sedimentation in the Arafura Basin. The thickness of strata accumulated in the Basin can not be estimated with any degree of accuracy - calculations based on a regional dip of 1° through the exposed part of the succession give a thickness of 5,500 feet.

Epeirogenic movements since the deposition of the Arafura Basin strata resulted in their exposure and erosion; and, in Lower Cretaceous times, to a marine transgression and deposition of the Mullaman Beds. Post Lower Cretaceous epeirogenic uplift exposed the Mullaman Beds to lateritization and further uplift initiated the present cycle of erosion. A comparatively recent Pleistocene(?) marine transgression, resulting in drowned topography along the north coast of Arnhem Land, was followed by regression and coastal emergence in very resent times; the latter produced the large areas of estuarine alluvium and evaporite deposits above the present day tidal range.

ECONOMIC GEOLOGY

No economic mineral occurrences apart from water are known in the Sheet area although discoveries in adjacent areas suggest that exploration for bauxite may be warranted.

Water

Surface water is plentiful in the area - the major watercourses contain numerous large permanent waterholes which are replenished annually and numerous springs occur throughout the area. Notable among the latter are the springs which provide flowing water to Jungle and Guyuyu Creeks.

Bauxite

Bauxite occurs extensively along the coastal districts of Arnhem Land. Occurrences of silica rich bauxite have been noted on Elcho Island (Plumb, 1963), where they are associated with laterite developed on rocks of the Elcho Island Formation. It is possible that similar deposits, obscured by soil, sand or alluvium may occur on the Milingimbi Sheet area.

Petroleum

Wade (1924) reported on bitumen occurrences on Elcho Island in rocks near the base of the Elcho Island Formation (see Dunnet, 1963). Until the present survey the existence of the Arafura Basin as a geologic entity was not known. Its possible Palaeozoic age, its lack of major structural deformation and the apparent marine origin of the strata it contains make the Basin worthy of further investigation as a potential site of petroleum accumulation.

In August, 1963 the author examined the supposedly bituminous strata on Elcho Island but was unable to confirm Wade's 1924 report. However numerous small, flat "cakes" of pliable bitumen were found along the beaches on the west coast of the Island, but they appear to have been washed up from the sea under the influence of the north-west monsoon. The source of the bitumen is unknown.

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TABLE 1 : STRATIGRAPHY OF THE MILINGIMBI SHEET AREA

ERA	PERIOD	ROCK UNIT AND SYMBOL	LITHOLOGY	MAXIMUM THICKNESS IN FEET	PHYSIOGRAPHIC EXPRESSION	STRATIGRAPHIC RELATIONSHIPS	DISTRIBUTION	REMARKS
CAINOZOIC	Quaternary	(Qa)	Unconsolidated coastal silt, sand and evaporite deposits.	50?	Low, swampy tidal flats.		Along coast and up to 20 miles inland along major water courses.	Deposits in part due to emergent coastline.
		(Qa)	Alluvium	50?	River flats		Widespread but mainly in north-east along major watercourses.	Dissected in places due to recent slight emergence of coastline.
	Undifferentiated	(Czs)	Sand	50?	Coastal dunes and bars		Along coast and up to few miles inland.	Deposits in part due to emergent coastline.
		(Czs)	Sand, residual soil	50?	Plains and gentle slopes		Universal, but mainly in north-east half.	Probably includes aeolian deposits.
		(Czi)	Laterite, lateritic soil, ferruginous cemented detritus (ferricrete)	50?	Plains; where dissected, exposed in scarps.		Isolated exposures throughout area.	Laterite aluminous in places.
MESOZOIC	Lower Cretaceous	Mullaman Beds (Klm)	Siltstone, claystone, sandstone.	40	Moderately resistant - occurs mainly as mesas.	Unconformably overlies rocks of the Wessel Group.	Isolated exposures throughout area.	Fossiliferous on Mt. Marumba Sheet area.
PALAEOZOIC	Cambrian(?)	WESSEL GROUP: Elcho Island Formation (Ge)	Flaggy, fine-grained micaceous glauconitic sandstone interbedded with friable medium grained white quartz sandstone.	50+	Poorly resistant - forms low hills	Conformably overlies Marchinbar Sandstone.	Small exposure along eastern margin.	Has very shallow dip to north. Best exposed on Sheet areas to east.
		Marchinbar Sandstone (Gm)	Flaggy thin bedded medium grained cross bedded, ripple marked white quartz sandstone and slightly feldspathic sandstone.	800?	Moderately resistant - tends to form cuestas.	Conformably overlies Raiwalla Shale	North-eastern half of Sheet area.	Has regional north-easterly dip. Thickness doubtful, may thin to west.
		Raiwalla Shale (Gr)	Fissile grey, green and purple shales, laminated fine-grained slightly dolomitic sandstone; fissile brown purple siltstone; white ripple marked, cross-bedded quartz sandstone.	3,000?	Poorly resistant - forms broad low hills.	Conformably overlies Buckingham Bay Sandstone.		Has regional, north-easterly dip. Thickness doubtful.
		Buckingham Bay Sandstone (Gk)	Massive white medium grained quartz sandstone; Massive purple medium grained quartz greywacke, flaggy purple fine grained micaceous quartz greywacke. Ripple marked, cross bedded.	500?	Moderately resistant. Where horizontal - largely sand covered; where dipping - forms cuestas.	Unconformably overlies Proterozoic and Archaean rocks.		Has regional, north-easterly dip. Thickness variable

ERA	PERIOD	ROCK UNIT AND SYMBOL	LITHOLOGY	MAXIMUM THICKNESS IN FEET	PHYSIOGRAPHIC EXPRESSION	STRATIGRAPHIC RELATIONSHIPS	DISTRIBUTION	REMARKS
PRECAMBRIAN	UPPER(?) PROTEROZOIC	Dolerite Sills (Pdl)	Massive dolerite	200	Poorly resistant - forms valley floors - largely soil covered.	Intrudes Upper Proterozoic rocks.	Isolated exposures throughout Arnhem Land Plateau.	
	LOWER PROTEROZOIC	KATHERINE RIVER GROUP: Gundi Greywacke (Phg)	Massive white to purple cross bedded, ripple marked quartz sandstone, minor quartz greywacke and slightly feldspathic sandstone.	200+	Resistant - forms soil covered plateau with marginal scarps.	Unconformably overlies McCaw Formation.		Has sub-horizontal dip.
		McCaw Formation (Pha)	Not exposed on Sheet area.		Not exposed on Sheet area.	Conformably overlies Shadforth Sandstone.		Exposed on adjoining Mt. Marumba Sheet.
		Shadforth Sandstone (Phs)	Blocky medium grained cross bedded, ripple marked quartz sandstone; minor slightly feldspathic sandstone; glauconitic sandstone.	200	Resistant forms cuestas.	Unconformably overlies Cottee Formation.		Has gentle southerly dip.
		Cottee Formation (Phc)	Flaggy purple and green dolomitic siltstone; purple siltstone and shale. Feldspathic glauconitic sandstone, dolarenite, dolomite, algal dolomite, basalt.	600+	Poorly resistant - forms low, largely soil covered areas.	Conformably overlies McKay Sandstone.		Has gently southerly dip; contains algae.
		McKay Sandstone (Phm)	Flaggy medium to fine grained ripple marked ferruginous and feldspathic sandstone; blocky medium grained cross-bedded ripple marked quartz sandstone.	500	Poorly resistant - forms low rubbly rises - occasional more resistant beds.	Conformably overlies Kombolgie Formation in places, in others grades laterally into upper parts of Kombolgie Formation.		Has gentle southerly dip.
		Kombolgie Formation (Phk)	Excluding Members: Massive to flaggy, medium to coarse grained white pink and purple quartz sandstone; minor feldspathic sandstone, pebble conglomerate. Cross bedded and ripple marked.	1500+	Highly resistant - forms Arnhem Land Plateau.	Unconformably overlies Nimbuwah Complex and Cadell Granite. Upper beds grade laterally into beds of McKay Sandstone.	Throughout the Arnhem Land Plateau - Members restricted to west and north-west of Plateau.	Has general very shallow south-easterly dip.
		Nungbalgarri Volcanic Member (Phn)	Basalt, amygdaloidal in places; minor blocky medium grained quartz sandstone.	200	Poorly resistant - forms valleys			Occurs within Formation. More extensive in distribution than Goomadeer Volcanic Member.
		Goomadeer Volcanic Member (Pho)	Basalt, amygdaloidal in places.	100	Poorly resistant - forms bench resting on granite.			Occurs at base of Formation; is lenticular.
	Lower Proterozoic (Agicondian System) and Archaean	Nimbuwah Complex (A/Bgn	Later Granite: Massive non-porphyritic biotite-hornblende granite. Earlier Granite: gneissic porphyritic biotite-hornblende granite.		Poorly resistant - forms low, rounded hills.	Unconformably overlain by Kombolgie Formation.	North-west	Granite types not differentiated on map.
	Archaean	Gunbatgari Granite (Agg)	Gneissic porphyritic biotite granite.		Poorly resistant - forms low, rounded hills.	Unconformably overlain by Kombolgie Formation.	Small area between Cadell and Mann Rivers in centre of Sheet area.	Probably related to the gneissic part of the Nimbuwah Complex.

AUSTRALIA 1:250,000

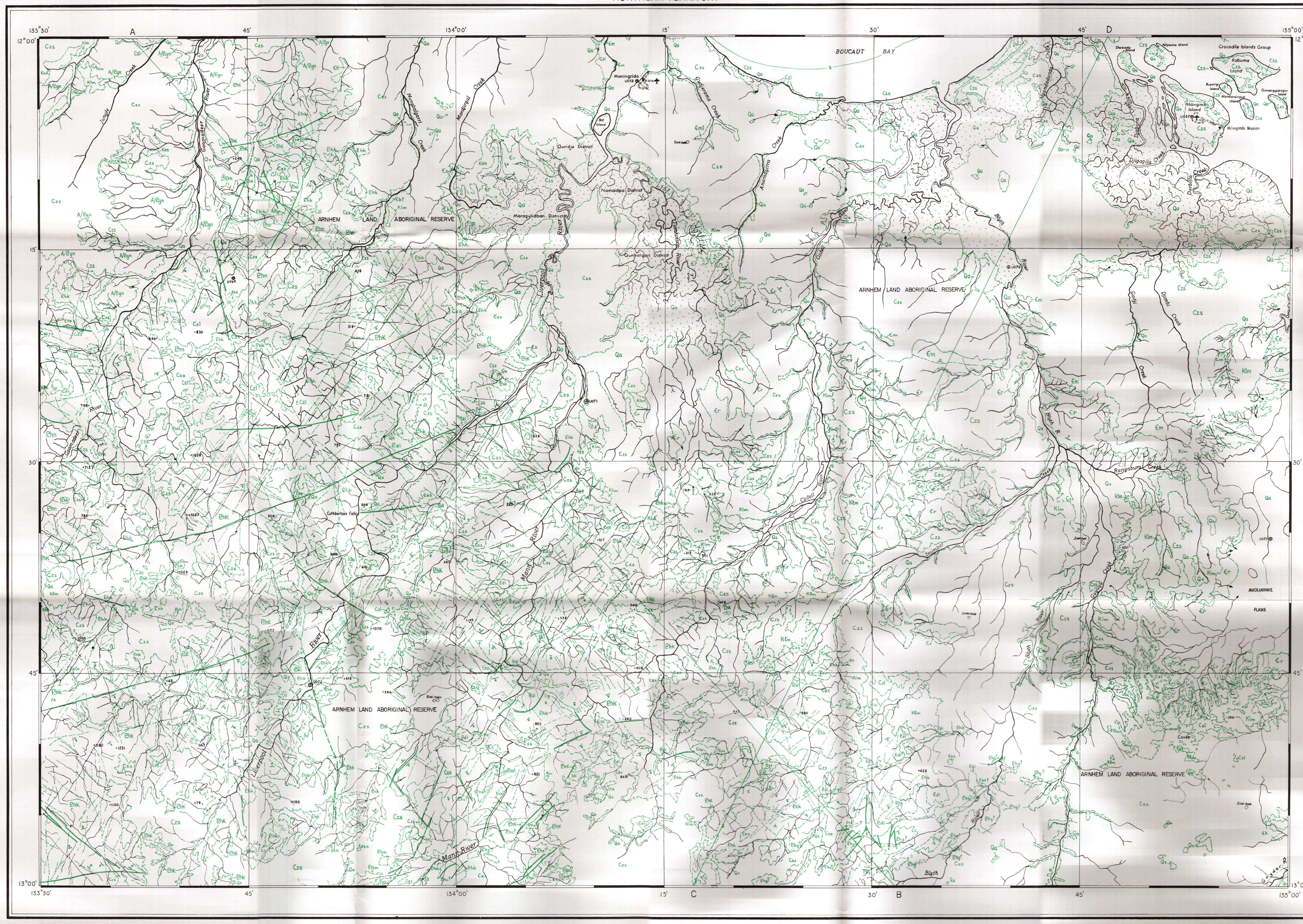
MILINGIMBI

NORTHERN TERRITORY

1:250,000 GEOLOGICAL SERIES SHEET SD 53-2

PRELIMINARY EDITION, 1963

SUBJECT TO AMENDMENT



CAINOZOIC — QUATERNARY		Qa	Coastal silt, sand, evaporite deposits; Alluvium
CAINOZOIC — UNDIFFERENTIATED		Czs	Sand dunes; Sand, residual soil
		Czl	Laterite, lateritic soil, ferriginous cemented detritus
MESOZOIC — LOWER CRETACEOUS	Mullaman Beds	Klm	Siltstone, claystone, sandstone
PALAEOZOIC — CAMBRIAN (?) — WESSEL GROUP	Elcho Island Formation	€e	Flaggy micaceous glauconitic sandstone; quartz sandstone
	Marchinbar Sandstone	€m	Flaggy thin-bedded quartz sandstone
	Raiwalla Shale	€r	Fissile grey, green and purple shales; fine-grained sandstone, siltstone
	Buckingham Bay Sandstone	€k	Massive white quartz sandstone; massive purple quartz greywacke; flaggy purple micaceous quartz greywacke
PRECAMBRIAN — UPPER (?) PROTEROZOIC		Pdl	Dolerite sills
PRECAMBRIAN — LOWER PROTEROZOIC — KATHERINE RIVER GROUP	Gundi Greywacke	Phg	Massive quartz sandstone; quartz greywacke; minor feldspathic sandstone
	McCaw Formation	Pha	(Section only)
	Shadforth Sandstone	Phs	Blocky quartz sandstone; minor feldspathic sandstone, glauconitic sandstone
	Cottee Formation	Phc	Flaggy purple and green dolomitic siltstone; purple siltstone and shale; feldspathic glauconitic sandstone, dolarenite, dolomite, algal dolomite, basalt
	McKay Sandstone	Phm	Flaggy ferruginous and feldspathic sandstone; blocky quartz sandstone
	Kombolgie Formation	Phk	Massive to flaggy quartz sandstone, minor felaspathic sandstone, pebble conglomerate
	Nungbalgarri Volcanic Member	Phn	Basalt, minor quartz sandstone
	Goomadeer Volcanic Member	Pho	Basalt
LOWER PROTEROZOIC (AGICONDIAN SYSTEM) & ARCHAEAN	Nimbuwah Complex	A/Pgn	Massive biotite - hornblende granite; gneissic porphyritic biotite - hornblende granite
ARCHAEAN	Gunbatgari Granite	Agg	Gneissic porphyritic biotite granite

Geological boundary

Fault

Where location of boundaries, faults and folds is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted, faults are shown by short dashes

Horizontal strata

Strike and dip of strata

Dip < 15° } air-photo interpretation

Trend of bedding showing dip } air-photo interpretation

Horizontal strata } air-photo interpretation

Joint pattern } air-photo interpretation

Water-hole

Falls in small river

Swamp

Vehicle track

"Milingimbi" Homestead

Landing ground

Height in feet, barometric datum, mean sea level

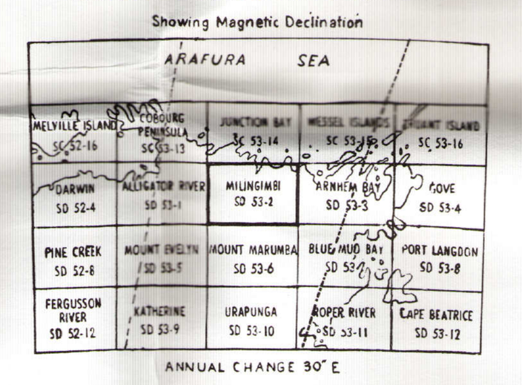
Astronomical station

Fathom line

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

INDEX TO ADJOINING SHEETS

Showing Magnetic Declination



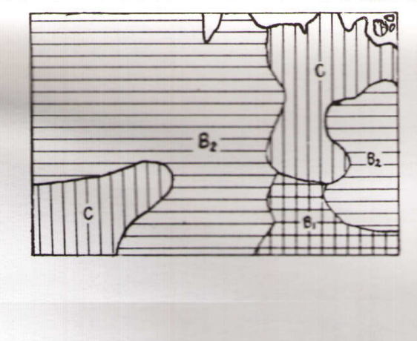
ANNUAL CHANGE 30' E

Scale 1 : 250,000

MILES

KILOMETRES

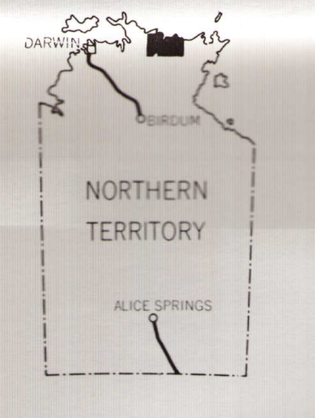
GEOLOGICAL RELIABILITY DIAGRAM



B1 Ground traverses and air-photo interpretation

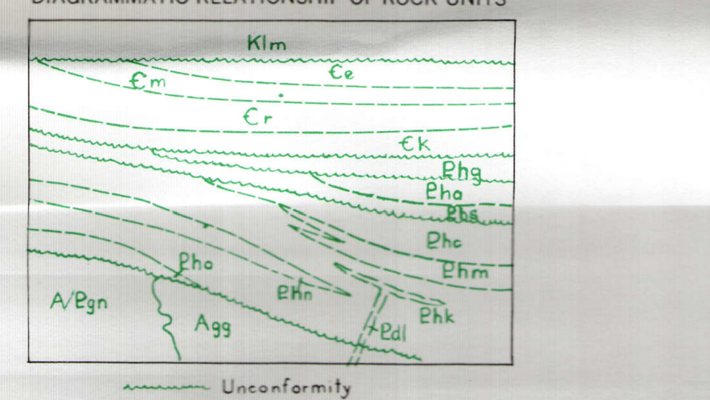
B2 Helicopter traverses and air-photo interpretation

C Air-photo interpretation



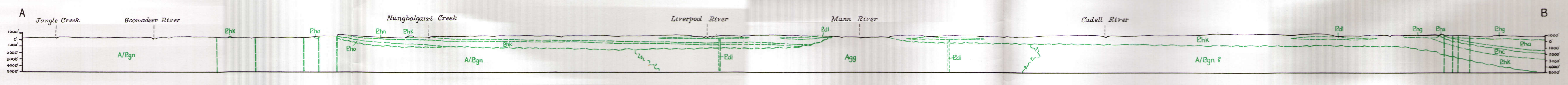
Geology, 1962, by: P. Rix, R.A. Ruker.
Compiled, 1963 by: H.G. Roberts, F.H. Peniguel
Drawn by: F.H. Peniguel, W.W. Webb.

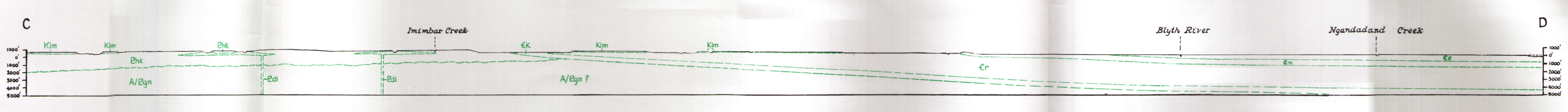
DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



Sections

(Cainozoic sediments omitted)





MILINGIMBI SD 53-2