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EXPLANATORY NOTES

JUNCTION BAY, N.T.

Sheet SC/53—14

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COMMONWEALTH OF AUSTRALIA

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

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Compiled by P. Rix

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DEPARTMENT OF NATIONAL DEVELOPMENT

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Explanatory Notes on the Junction Bay Geological Sheet

Compiled by

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The Junction Bay Sheet area lies within the Arnhem Land Aboriginal Reserve, in the north-eastern sector of the Northern Territory. It is bounded by latitudes 11° and 12° S and by longitudes 133° 30′ and 135° E. Only the southern part of the Sheet area is land; the remainder includes part of the Arafura Sea.

The area is uninhabited, but Maningrida Settlement lies only 4 miles south of the Sheet boundary in the adjoining Milingimbi Sheet area. No roads or tracks exist in the area; access may be gained by sea-going vessel or, as during the 1962 survey, by helicopter. Rainfall averages about 45 inches per annum and occurs mainly during the months December to March.

Air photographs and maps of the area available in 1962 were: air photographs at a scale of 1:50,000 flown by the Royal Australian Air Force in 1950; a photomosaic prepared by the Division of National Mapping, Department of National Development; and a planimetric map at 1:250,000 scale produced in 1961 by the Royal Australian Survey Corps from a controlled photoscale, slotted-templet assembly. The accompanying geological map was compiled on the photoscale assembly, reduced, and transferred to a base prepared from the Survey Corps 1:250,000 map.

Previous Investigations

In 1867 Cadell landed in the estuary of the Liverpool River about 10 miles south of Entrance Island, and made several short journeys inland and along the coast (Cadell, 1869). He recorded a few geological observations on the Junction Bay Sheet area. Brown (1908) also recorded observations on the Sheet area during his journey along the north coast of Arnhem Land. In 1958 Williams & Waterlander (1959) conducted an underwater gravity survey along the coast, but did not make any geological observations.

The Milingimbi Sheet area (Rix, 1964) and the Wessel Islands-Truant Island Sheet area (Plumb, 1964), which adjoin the Junction Bay Sheet area, were mapped by the Bureau of Mineral Resources during 1962.

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PHYSIOGRAPHY

Two major physiographic units occur in the Junction Bay Sheet area (Fig. 1)—the *Arafura Fall*, a north-sloping surface draining to the Arafura Sea, and the *Coastal Plain* (Roberts, Dunn, & Plumb, in prep.).

The *Arafura Fall* is restricted to the south-western part of the Sheet area. The highest point within the Fall is an isolated hill capped by rocks of the Kombolgie Formation, immediately west of the King River; the hill rises to about 200 feet above sea-level, but elevations in the remainder range between 100 and 150 feet.

The *Coastal Plain* is the major physiographic unit of the area; it extends southwards from the coast and terminates against the Arafura Fall. It comprises areas of low relief, ranging in elevation from sea-level to about 100 feet; laterite probably underlies most of the Plain, but younger sediments obscure it except along watercourses. *Tidal Flats* form part of the Coastal Plain; they occur in narrow zones along the coastline and extend up to 20 miles inland along the main watercourses. They are subject to tidal and seasonal flooding, and contain fine sand, silt, and evaporite deposits. *Coastal Sand Dunes* lie along the present coastline or 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 King, Goomadeer, and Liverpool Rivers enter the sea in the Sheet area; the mouth of the Liverpool River is between Gumeradji and North-East Points. The relationship of the drainage system to the outline of the coast suggests that the sea transgressed in Pleistocene(?) time, submerging part of the drainage system. Subsequent slight emergence of the land is indicated by the relict coastal dunes and by the incision of streams into their own alluvium.

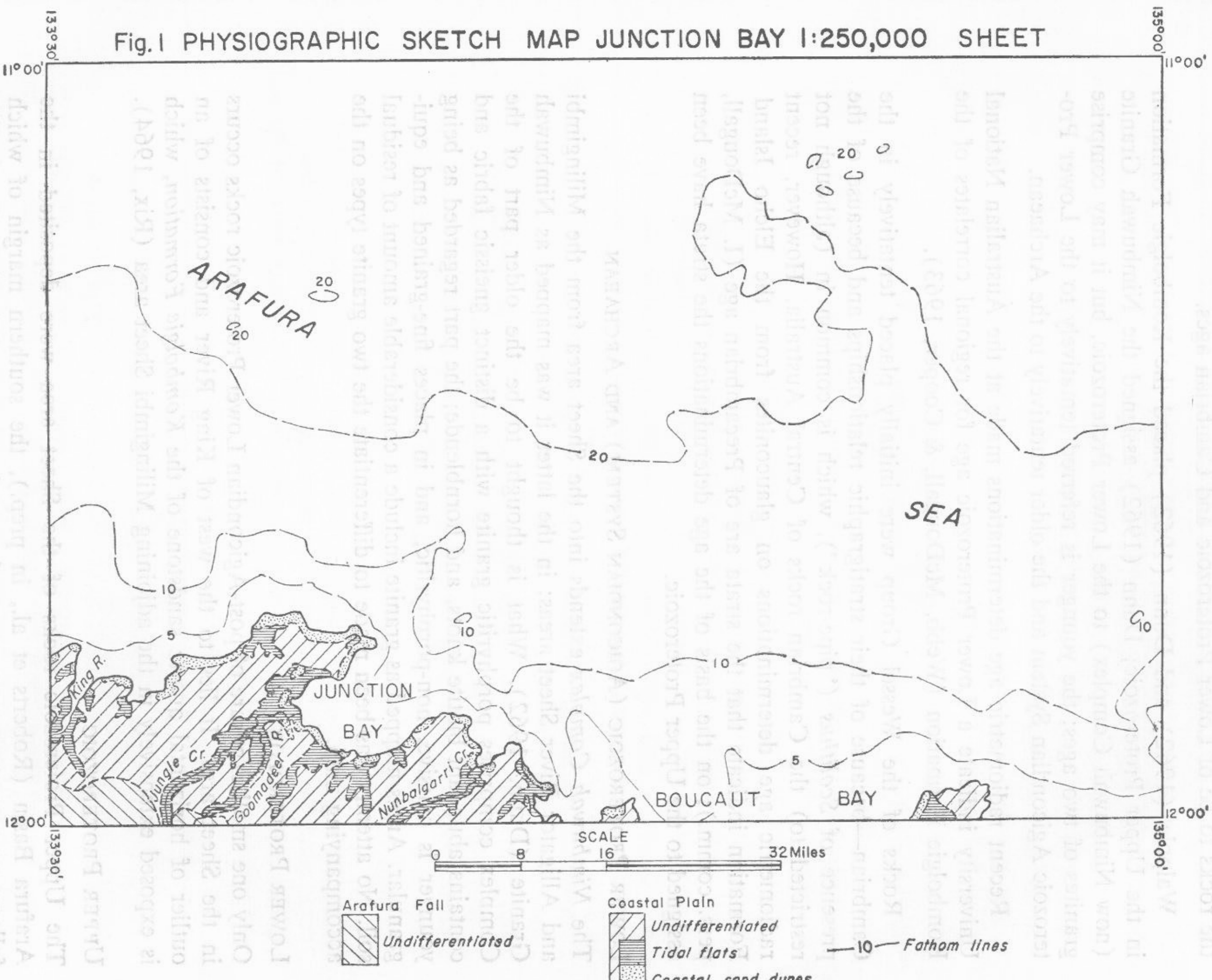
Submarine Topography: Available bathymetric information shows that the submarine topography of the Sheet area has very little relief. The sea-floor slopes gently northwards and reaches a depth of 20 fathoms between 20 and 40 miles from the shore.

STRATIGRAPHY

The stratigraphy of the Sheet area is summarized in Table 1. The nomenclature used will be fully defined by Roberts et al. (in prep.).

Age of the Units: Brown (1908) and Jensen (1914) regarded the rocks along the northern coast of Arnhem Land as Permo-Carboniferous. Gray (1915) considered the basement rocks to be of Precambrian age, the sandstone of the Arnhem Land Plateau to be Permo-Carboniferous, and younger

Fig. I PHYSIOGRAPHIC SKETCH MAP JUNCTION BAY 1:250,000 SHEET



Bureau of Mineral Resources, Geology and Geophysics February, 1964 C53/A14/1 JVE strata to be Cretaceous. David (1932) showed 'older Proterozoic' and Permian rocks on his geological map, and Hossfeld (1954) considered the rocks to be of Lower Proterozoic and Cambrian ages.

Walpole (1962) and Dunn (1962) placed the Kombolgie Formation in the Upper Proterozoic; Dunn (1962) assigned the Nimbuwah Granite (now Nimbuwah Complex) to the Lower Proterozoic, but it may comprise granites of two ages; the younger is referred tentatively to the Lower Proterozoic Agicondian System and the older tentatively to the Archaean.

Recent radiometric age determinations made at the Australian National University indicate a Lower Proterozoic age for regional correlates of the Kombolgie Formation (Webb, McDougall, & Cooper, 1963).

Rocks of the Wessel Group were initially placed tentatively in the Cambrian—because of their stratigraphic relationships and because of the presence of *Scolithus* ('pipe-rock'), which is common in (although not restricted to) the Cambrian rocks of Central Australia. However, recent radiometric age determinations on glauconites from the Elcho Island Formation indicate that the strata are of Precambrian age (I. McDougall, pers. comm.); on the basis of the age determinations the strata have been assigned to the Upper Proterozoic.

Lower Proterozoic (Agicondian System) and Archaean

The *Nimbuwah Complex* extends into the Sheet area from the Milingimbi and Alligator River Sheet areas; in the latter it was mapped as Nimbuwah Granite (Dunn, 1962). What is thought to be the older part of the Complex comprises porphyritic granite with a distinct gneissic fabric and contains abundant biotite knots, and hornblende; the part regarded as being younger is massive, non-porphyritic, and in places fine-grained and equigranular. Areas mapped as granite include a considerable amount of residual soil. No attempt has been made to differentiate the two granite types on the accompanying map.

Lower Proterozoic

Only one small exposure of post-Agicondian Lower Proterozoic rocks occurs in the Sheet area. It lies to the west of King River and consists of an outlier of horizontal quartz sandstone of the *Kombolgie Formation*, which is exposed extensively in the adjoining Milingimbi Sheet area (Rix, 1964).

Upper Proterozoic

The Upper Proterozoic rocks of the Sheet area were deposited in the Arafura Basin (Roberts et al., in prep.), the southern margin of which follows an arcuate course across the northern part of Arnhem Land. The north-westernmost exposures of rocks deposited in the Basin occur in the Junction Bay Sheet area. The rocks dip shallowly to the north-east. The succession is termed the *Wessel Group* and has been divided into four formations, only two of which are exposed in the Sheet area. The *Buckingham Bay Sandstone* is the basal unit of the succession. It crops out near the Goomadeer River, where it consists of massive, white, cross-bedded quartz sandstone. The *Raiwalla Shale* overlies the Buckingham Bay Sandstone in the Milingimbi Sheet area (Rix, 1964), but its easily eroded rocks are not exposed in the Junction Bay Sheet area. The *Marchinbar Sandstone* overlies the Raiwalla Shale and crops out very close to sea-level at Entrance Island on the east side of Rolling Bay. It is usually exposed as flat jointed pavements, overlain by laterite and, in places, by ferricrete. The Marchinbar Sandstone is overlain by the *Elcho Island Formation* in the Wessel Islands-Truant Island Sheet area (Plumb, 1964); this formation is not exposed in the Junction Bay Sheet area, although it may underlie parts of the eastern half.

Lower Cretaceous

The *Mullaman Beds* unconformably overlie the Precambrian rocks, and on fossil evidence (Skwarko, 1964) are placed in the Lower Cretaceous. The rocks are horizontal and are usually deeply lateritized.

Cainozoic

Cainozoic laterite, lateritic soils, and ferruginous cemented detritus (ferricrete) are widely distributed in the Sheet area. Laterite formed on a late Cretaceous or early Tertiary erosion bevel (probably a peneplain). The Cretaceous rocks were particularly susceptible to lateritic alteration and most of the existing laterite appears to have been derived from them, although it may also have been developed directly on rocks of the Nimbuwah Complex and the Elcho Island Formation. Residual soils on laterite have been included with the laterite, as has ferricrete—thought to have been derived primarily from the mechanical and chemical destruction of laterite. Exposures of ferricrete are most common along low parts of the coastline, where they may overlie downwarped laterite profiles.

Erosion and weathering since the lateritized surface was uplifted have 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 on the mainland. The coastal deposits have been differentiated from the riverine alluvium on the accompanying map.

TABLE 1 STRATIGRAPHY OF THE JUNCTION BAY SHEET AREA

Era	Period	Rock Unit and Symbol	Lithology	Maximum Thickness (in feet)	Physiographic Expression	Distribution	Stratigraphic Relationships and Remarks
Cainozoic	Quaternary	(Qa)	Unconsolidated coastal silt, sand, and evaporite deposits	50?	Low swampy tidal flats: mangroves common	Along coast, and inland along major water-courses	Sediments exposed by coastal emergence. Subject to tidal and seasonal flooding
		(Qa)	Alluvium	50?	River flats	In flood plains of drainage system	Eroded in places since coastal emergence
	Undifferentiated	(Czs)	Sand	50?	Coastal dunes and bars	Along coast and up to three miles inland	Form and orientation of dunes modified by winds
		(Czs)	Sand, residual soil	50?	Plains and gentle slopes	Extensive	Mostly sand derived locally from erosion of sandstones
			Laterite, lateritic soil, ferruginous cemented detritus (ferricrete)	50?	Plains and gentle slopes. Where dissected forms small scarp	Mainly in west, but numerous exposures (ferricrete) along coast	Laterite may be aluminous in places
Mesozoic	Lower Cretaceous	Mullaman Beds (Klm)	Siltstone, claystone, sandstone	50?	Low lateritized hills, with small marginal scarp in places	Small exposures in west	Unconformably overlies rocks of Wessel Group. Contains fossils elsewhere
				UNCONFORMITY			
Pre cambrian	Upper Proterozoic	Wessel Group: Marchinbar Sandstone (Pwm)	Flaggy, thin-bedded, ripple-marked, cross-bedded, medium-grained, white quartz sandstone and slightly feldspathic sandstone	800?	Moderately resistant; crops out as jointed pavements along coast	Few small exposures along coast to east of Nungbalgarri Creek	Conformably overlies Raiwalla Shale in the Milingimbi Sheet area (Rix 1964)
		Wessel Group: Raiwalla Shale (Pwr)	Rocks not exposed. In the Milingimbi Sheet area (Rix, 1964) the unit consists of: fissile grey, green, and purple shales; laminated, fine-grained slightly dolomitic sandstone; and fissile, brown to purple siltstone	3,000?	Low, flat, soil-covered areas	Probably underlies more recent deposits in Majari Creek–Cuthbert Point District	Conformably overlies Buckingham Bay Sandstone in Milingimbi Sheet area
		Wessel Group: Buckingham Bay Sandstone (Pwk)	Massive, white, medium-grained, cross-bedded quartz sandstone	500?	Forms low sand-covered ridges	Goomadeer River District	Unconformably overlies rocks of the Nimbuwah Complex. Uncomformably overlies Roper Group in Arnhem Bay Sheet area (Dunnet, 1964)
				UNCONFORMITY			
	Lower Proterozoic	Katherine River Group: Kombolgie Formation (Phk)	Massive medium to coarse-grained, white, cross-bedded, ripple-marked quartz sandstone; minor pebble conglomerate	100 +	Strongly resistant, caps small hill	Small exposure to west of King River	Unconformably overlies rocks of the Nimbuwah Complex (Milingimbi Sheet area)
				UNCONFORMITY			
	Lower Proterozoic (Agicondian System) and Archaean(?)	Nimbuwah Complex (A/Pgn)	Massive non-porphyritic biotite-hornblende granite; gneissic porphyritic biotite-hornblende granite	—	Poorly resistant, forms very low rises	Very poor exposures near Goomadeer River and in south-west of Sheet area	Areas mapped as Nimbuwah Complex include considerable areas of residual soil

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STRUCTURE

Only small exposures of the Nimbuwah Complex occur in the Sheet area and no structural observations have been made on them. The single small exposure of the Kombolgie Formation has a sub-horizontal dip.

The most significant structure in the Sheet area is the Arafura Basin. Rocks deposited in the Basin underlie much of the land area and probably underlie much of the sea floor, although in the latter case deposits of Mesozoic and younger sediments probably overlie them. The north-westernmost exposures of the rocks of the Basin occur in this Sheet area; the strata dip gently to the north-east. Minor faults occur at several localities, but no faults or folds of regional importance have been found.

The Lower Cretaceous rocks are horizontal and have been only very slightly faulted.

GEOLOGICAL HISTORY

What are thought to be the oldest rocks in the Sheet area (the gneissic granites of the Nimbuwah Complex) were deformed either during or after their formation, but apparently before the intrusion of the Lower Proterozoic granite. The latter may have been emplaced during the time of the Agicondian Orogeny in the Pine Creek Geosyncline.

After a period of erosion of the Archaean-Lower Proterozoic granite terrain, regional subsidence caused the development of the McArthur Basin, and the deposition in it of a thick sequence of sediments and volcanics. In the Junction Bay Sheet area, only isolated remnants of the basal beds of this succession survived a period of erosion which followed the faulting and folding of the McArthur Basin sediments and preceded the development of the Arafura Basin. A succession of lutites and arenites, possibly over 5000 feet thick, accumulated in the Arafura Basin during Upper Proterozoic times.

Epeirogenic movements since the deposition of the Upper Proterozoic rocks resulted in their exposure and erosion; and, in Lower Cretaceous times, to a marine incursion and the deposition of the Mullaman Beds. Epeirogenic uplift after the Lower Cretaceous exposed the Mullaman Beds to lateritization, and further uplift initiated the present cycle of erosion. A Pleistocene marine transgression caused drowning of the topography along the coast, and was followed by regression and coastal emergence in very recent times.

ECONOMIC GEOLOGY

No economic mineral occurrences are known in the Sheet area, although bauxite has been discovered in adjoining areas.

Water

With the possible exception of Jungle Creek all the creeks in the area are seasonal and persist only as disconnected waterholes in the dry season.

Bauxite

Bauxite occurs extensively along the coastal districts of Arnhem Land; occurrences have been noted on Elcho Island (Plumb, 1964), and on Marchinbar Island (Owen, 1954), where they are associated with laterite developed on rocks of the Elcho Island Formation. Similar types of deposit, obscured by soil, sand, or alluvium, may occur in the Junction Bay Sheet area.

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