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BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

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1964/67

EXPLANATORY NOTES ON THE BLUE MUD BAY - PORT LANGDON 1:250,0(GEOLOGICAL SERIES SHEET SD53-7/8

compiled
by

K.A.Plumb and H.G.Roberts

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INTRODUCTION

The Blue Mud Bay - Port Langdon 1:250,000 Geological Sheet area lies wholly within the Arnhem Land Aboriginal Reserve, in the north-eastern part of the Northern Territory; it contains the Blue Mud Bay and the western third of the Port Langdon 1:250,000 Sheet areas. It lies between latitudes 13°00'S and 14°00'S and longitudes 135°00'E and 137°00'E.

The only permanently inhabited settlements in the Sheet area are the Groote Eylandt and Umbakumba Mission Stations, both on Groote Eylandt. The population of these settlements is about fifteen Europeans and a few hundred aborigines.

Access to the Sheet area is poor. Groote Eylandt Mission is accessible by sea and air, and a vehicle track links it to Umbakumba Mission. The mainland can be reached by sea although no landing facilities exist, and 4-wheel-drive vehicles can travel overland from Mainoru Station to the south-west, or Rose River Mission to the south, during the dry season only; no vehicle tracks exist on the mainland within the Sheet area. A small landing field, suitable only for light aircraft in dry weather, and lacking any facilities, is situated on the Koolatong River flats. A weekly air service connects Groote Eylandt Mission with Darwin.

The average annual rainfall for the Sheet area is between 45 and 50 inches. Most of the rain falls during the summer months, from December to May, under the influence of the north-west monsoon. Maximum daily temperatures range from about 90°F to 95°F in December to about 80°F in June; minimum temperatures range between about 80°F and 60°F for the same months.

Maps and air photographs of the Sheet area available during 1962 were air photographs at a scale of 1:50,000 flown by the Royal Australian Air Force in 1950; uncontrolled photomosaics of Blue Mud Bay - Western Extension and Blue Mud Bay - Eastern Extension at a scale of approximately 4 miles to 1 inch; planimetric maps of Blue Mud Bay and Port Langdon Sheet areas at a scale of 1 to 250,000 prepared by the Royal Australian Survey Corps from a controlled, photo-scale, slotted template assembly. The geological map was compiled on a photo-scale trace of this assembly and reduced to 1:250,000 scale.

Previous Investigations

In 1803 Matthew Flinders (1814) noted the general geological and physiographic features of the islands and coast of Blue Mud Bay whilst charting the coast-line of Australia. In 1818 King (1826) made similar observations along the coast of Arnhem Land. W.H. Fitton (1825), in an account of the geology of parts of the Australian coast, included detailed descriptions of rocks from Arnhem Land, based on specimens and information supplied to him by Flinders and by King.

Lindsay passed through the Sheet area in 1883 during his survey of Arnhem Land and made numerous observations of the rocks in the Walker River/Parsons Range area (Lindsay 1884, 1887), he mentioned that a prospecting party led by Walker had been in the area during 1875. Brown (1908) and Jensen (1914) visited Blue Mud Bay and Groote Eylandt by sea and made geological notes. Love (1911) and Murphy (1912) led prospecting parties on the mainland of Arnhem Land and gave sketchy accounts of the geology.

In 1954 the Broken Hill Pty Co. Ltd made a reconnaissance survey of the eastern part of Arnhem Land and determined the basic structure and stratigraphy of the area (Crohn, 1956); this work provided a basis for a photogeological map of the Blue Mud Bay - Port Langdon Sheet area produced by Ruker (1962). In 1955 Dixon, of Frome-Broken Hill Co. Pty Ltd made a reconnaissance survey of the Gulf of Carpentaria; he visited Groote Eylandt and noted the unconformity at the base of the Groote Eylandt Beds (Dixon, 1956).

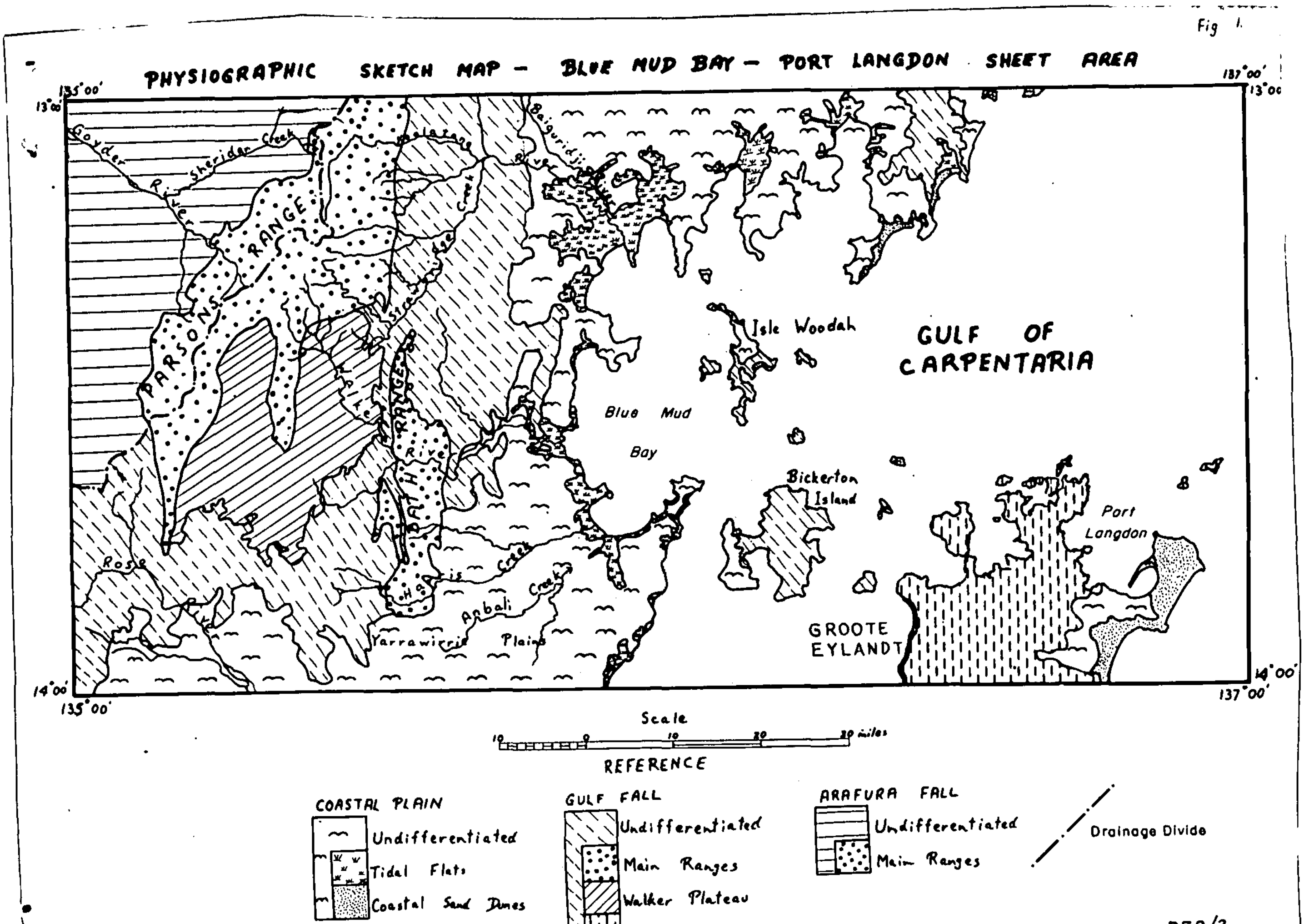
During 1958 the Bureau of Mineral Resources conducted an underwater gravity survey along part of the Northern Coast of Australia; several measurements were made in the Blue Mud Bay - Port Langdon Sheet area (Williams and Waterlander, 1958). A reconnaissance airborne magnetometer survey of the Gulf of Carpentaria (including part of the Sheet area) was completed for Delhi Australian Petroleum Ltd in 1962 (Hartman, 1962).

These notes and the accompanying geological map are based on a regional survey of Arnhem Land by geologists of the Bureau of Mineral Resources during 1962.

PHYSIOGRAPHY

The Sheet area contains parts of the three major physiographic divisions of Arnhem Land - the Arafura Fall, the Gulf Fall, and the Coastal Plain (Roberts, Dunn, & Plumb, in prep.). Their distribution is shown in Figure 1.

Fig 1.



Gulf Fall: The Gulf Fall is defined as the dissected hilly country with moderate to strong relief drained by streams flowing into the Gulf of Carpentaria; a watershed in the north-western part of the Sheet area divides it from the Arafura Fall. Elevations within the Gulf Fall range from 1100 feet in the Parsons Range to sea-level along the coast. The present topography is controlled mainly by the differential erosion of the bedrock. Three physiographic units - the Main Ranges, the Walker Plateau and the Groote Eylandt Plateau - have been differentiated on Figure 1.

The Undifferentiated Gulf Fall is an area of undulating and hilly country bordering the Main Ranges and Walker Plateau and with relief ranging between about 50 and 150 feet. Most of this area is underlain by rocks of the McArthur Group, although exposures of Roper Group occur in the south-west and scattered mesas of Cretaceous rocks are present throughout. The topography ranges from long parallel strike ridges in folded areas to low rounded hills in areas of flat-lying rocks. The elevation reaches a maximum of 550 feet in the south-west and gradually decreases eastwards to where the outcrops disappear beneath the Coastal Plain.

The Main Ranges are the Bath Range, in the central part of the Sheet area, and the Parsons Range, which forms the watershed between, and lies within, the Gulf Fall and the Arafura Fall, in the north-west. The Bath Range is an elongate, north-trending dissected plateau of flat-lying rocks at the axis of a broad syncline; elevations range up to 500 feet and the relief above the surrounding country is up to 350 feet. The Parsons Range consists of a series of prominent north-easterly strike ridges of resistant sandstones of the Parsons Range Group; in the north these ridges trend into a small plateau of shallower dipping sandstone. Elevations range from 800 feet in the south to 1100 feet in the north; relief varies from about 400 feet near the Walker Plateau to 900 feet around the upper Koolatong River.

The Walker Plateau, a dissected depressed plateau surrounding the headwaters of the Walker River, has a bedrock of horizontal Lower Cretaceous rocks with inliers of Proterozoic rocks in the valleys; much of the area is now covered by sand. The elevation of the Plateau, which is partly surrounded by the higher Main Ranges, varies from about 350 to 500 feet; the elevation of the river bed ranges down to about 170 feet.

The Groote Eylandt Plateau is a rugged dissected plateau with elevations ranging up to 400 feet; it is composed of horizontal rocks of the Groote Eylandt Beds. Cliffs up to 150 feet high are common along its margins.

Arafura Fall: The Arafura Fall is confined to the north-west of the Sheet area and contains the western part of the Parsons Range, of the Main Ranges. The bedrock of the area, outside the Parsons Range, is folded Roper Group rocks and dolerite sills, with scattered thin outliers of Cretaceous rocks. Relief is low; scarps, when present, are usually only about 50 feet high; elevations range from about 250 to 500 feet. Scarps and mesas occur where resistant sandstones crop out, and low rounded hills are formed where soft units, such as the Mainoru Formation, crop out. Much of the area is now covered by soil.

Coastal Plain: The Coastal Plain is an area of low relief which borders the coast and extends up to 60 miles inland. The surface slopes gently seawards and elevations range from sea-level to about 300 feet around the headwaters of the Rose River. The bedrock is mostly laterite, which has formed on a variety of rocks, but mainly on Cretaceous siltstone. Most of the Plain is now covered by sand and the laterite is exposed in small scarps, up to 30 feet high, along the coastline. Maximum relief is developed to the east of the Baiguridji River where the general level of the laterite surface rises towards the north. Erosion has, in places, produced relief of up to 100 feet.

The Tidal Flats occur within the Coastal Plain: they are low-lying areas near the coast subject to seasonal and tidal flooding. The flats represent emerged lagoons in which deposits of silt, fine sand, and evaporites have accumulated; small, meandering tidal creeks cross them.

Extensive Coastal Sand Dunes occur along the northern part of the mainland coast and along the east coast of Groote Eylandt. The dunes, which are up to 250 feet high, have been built up by wind action from beach sand deposits stranded by marine regression.

Drainage: The Arafura Fall is drained by the Goyder River and its tributaries, a north-flowing system which enters the Arafura Sea on the northern coast of Arnhem Land. The Gulf Fall and Coastal Plain are drained by the Koolatong, Walker, and Rose River systems, and by numerous minor streams flowing into the Gulf of Carpentaria.

Within the Coastal Plain a simple pattern of consequent streams has developed sub-perpendicular to the coastline. In the Arafura Fall the major streams are superimposed consequent streams; the minor subsequent streams form a dendritic pattern. The major streams in the Gulf Fall are also superimposed, but the subsequent streams are controlled by the structure of the Proterozoic rocks.

STRATIGRAPHY

The stratigraphy of the Sheet area is summarized in Table 1. It will be fully described and defined in Roberts et al. (in prep.).

PRECAMBRIAN

Within the Sheet area extensive exposures of Precambrian rocks occur. Recent radiometric age determinations made at the Australian National University (Webb, McDougall, & Cooper, 1963) indicate that the Tawallah Group (Dunn, Smith, & Roberts in prep.), a lateral equivalent of the Parsons Range Group, contains rocks ranging in age from a minimum of 1480 m.y. to older than 1600 m.y. For the present these dates are taken to indicate a Lower Proterozoic age for the Parsons Range Group. Recent determinations made on rocks from the Roper Group (McDougall, pers. comm.) are considered by the present authors to indicate an Upper Proterozoic age for the Group.

The ages assigned to the older rock units are based entirely on their structural and stratigraphic relationships.

Archaean

The Myaoola Granite, which is exposed on a peninsula between Trial and Myaoola Bays in the north-eastern part of the Sheet area, is characterized by a foliation, garnet (or biotite after garnet), and two feldspars, one of which is porphyritic. It is probably related to the Bradshaw Granite, exposed to the north in the Arnhem Bay - Gove Sheet area (Dunnet, in prep.).

Lower Proterozoic and Archaean

The Mirarrmina Complex consists of igneous and metamorphic rocks exposed to the north of the Parsons Range. Although the contacts are obscured by faulting it is likely that most of the complex is unconformably overlain by the Ritarango Beds.

The oldest rocks of the Complex are foliated and folded garnetiferous gneisses and granites, porphyritic in potash feldspar; in the Arnhem Bay - Gove Sheet area (Dunnet, in prep.) the rocks are associated with low-grade metasediments. They are probably Archaean.

The gneisses and granites have been intruded by stocks of massive gabbro and dolerite, and reaction of the gneisses and granites with the basic magma has formed large amounts of diorite; intense hybridization is developed adjacent to the contacts, which are chilled. The basic rocks are massive to weakly foliated in outcrop, with a varying colour index and quartz content, Thin sections indicate a composition range from tonalite to meladiorite and gabbro. Mafic inclusions or segregations are common; pyrite and chalcopyrite are common. The gabbro may be Archaean in age, but is more likely Lower Proterozoic.

Large dykes trending north-north-east and small stocks of massive quartz-feldspar-porphyry have intruded these older rocks. The porphyry is characterized by rounded, resorbed, and embayed quartz phenocrysts up to half an inch in diameter and large spherical feldspars up to one inch in diameter, set in a fine-grained siliceous groundmass. Hybrid rocks occur at the contact of the porphyry with the gabbro. The youngest rocks of the Complex consist of numerous north-north-easterly dykes of pyritic dolerite intruded along shear zones in the Complex; they appear to intrude the Ritarango Beds. The quartz-feldspar porphyry may be co-magmatic with the Fagan Volcanics and the dolerite dykes with a laccolith intruding the Fagan Volcanics, and both are thus probably of Lower Proterozoic age.

Lower Proterozoic

The Grindall Metamorphics are undifferentiated geosynclinal sediments which have been highly folded and subjected to low-grade regional metamorphism. They are exposed on islands in Blue Mud Bay and on the mainland near Grindall Point. Their grade of metamorphism (greenschist facies) is considered evidence of a distinct structural break between them and the older Myaoola Granite. The Metamorphics are intruded by the Caledon Granite.

The Caledon Granite, which is exposed near the coast, is a massive granite with low biotite content and no foliation. It shows many features of a high-level granite and intrudes the Grindall Metamorphics and the Myaoola Granite. One thin section contains fayalite and serpentine with minor amounts of augite and orthopyroxene; potash feldspar is more abundant than plagioclase. The Granite is probably co-magmatic with the Bickerton Volcanics.

The Ritarango Beds are exposed only in the north-western part of the Sheet area and no relationships with the Grindall Metamorphics or the Caledon Granite are known. Although intensely faulted, the Beds and the overlying Fagan Volcanics are not strongly folded, and are therefore probably younger than the Grindall Metamorphics. The base of the unit is not exposed; the exposed section consists dominantly of arenites and is about 10,000 feet thick. Local shearing and quartz veining is common.

The Fagan Volcanics unconformably overlie the Ritarango Beds. The unit contains three main volcanic flows interbedded with sediments. The lower flow is overlain by massive purple ashstone, in places containing numerous interbeds of quartz sandstone; the middle flow is overlain by alternating beds of purple tuffaceous shale and feldspathic quartz sandstone, in which the third flow is interbedded near the top of the unit. The presence of compaction bands in outcrop and the thickness and extent of individual flows suggests that the volcanics may be welded ash-flows. Thin sections show them to have a rhyolitic or trachytic composition with phenocrysts of quartz and potash feldspar in a fine-grained felsic or feldspathic groundmass. No ignimbritic texture is present.

The Bickerton Volcanics are exposed only in the coastal parts of the Sheet area and consist of massive red porphyritic acid igneous rocks. From their similarity in appearance and stratigraphic position to the Fagan Volcanics they are considered to be of similar age. Thin sections show phenocrysts of sericite after plagioclase, quartz, and serpentine after (?) olivine; the groundmass is a micrographic intergrowth of quartz and alkali feldspar. The presence of olivine suggests that the Volcanics are co-magmatic with the Caledon Granite.

The Sheridan Formation is exposed in a few isolated localities around the headwaters of the Koolatang River; the sediments are small valley infillings derived from the erosion of the unconformably underlying Fagan Volcanics. The unit is unconformably overlain by the Mattamurta Sandstone.

McARTHUR BASIN SUCCESSION

Unconformably over the older rocks of the Sheet area a thick succession of sediments was deposited in the McArthur Basin, which extends from the northern coast of Arnhem Land, southwards to beyond the Northern Territory / Queensland Border (Roberts et al, in prep.). In the Sheet area this succession has been divided into three Groups - the Parsons Range, McArthur, and Roper Groups; the Groote Eylandt Beds are considered a lateral equivalent of the rocks of the Parsons Range Group. In the Sheet area most of the McArthur Basin sediments were deposited in a central, more deeply subsiding, north-trending belt; to the west, in the Mount Marumba Sheet area (Roberts & Plumb, 1963), the total succession is thinner and to the east, on the coast of Blue Mud Bay, the section is considerably thinner than in the central belt.

LOWER PROTEROZOIC

The Groote Eylandt Beds crop out on the islands and coast around Blue Mud Bay. In the north the exposed section is only about 300 feet thick: a thin basal conglomerate is overlain by 50 to 100 feet of flaggy, reddish-brown, micaceous sandstone, succeeded by flaggy and blocky, white cross-bedded quartz sandstone.

A facies change occurs at the northern end of Bickerton Island and the section thickens markedly to the south-east to about 2000 feet on Groote Eylandt. The lower part consists of massive, grey to purple-brown, pebbly sandstone. Feldspar, clay after feldspar, and white clay matrix are abundant and quartz pebbles up to one inch in diameter occur throughout; very large scale cross-bedding is characteristic. Massive boulder conglomerate occurs in places; rounded boulders of Bickerton Volcanics and sandstone similar to the Groote Eylandt Beds, up to five feet in diameter, are present. These impure basal rocks grade upwards into blocky, cross-bedded, white and pink quartz sandstones, which are the youngest beds exposed on Groote Eylandt.

Parsons Range Group: Exposures of the Parsons Range Group in the Sheet area are confined to the Parsons Range. The Group contains mainly quartz arenites, although lutites and carbonate-lutites occur in the upper half.

The Katherine River Group to the west (Walpole, Malone, Dunn, Randal, & Yates, in prep., and Roberts et al., in prep.), the Tawallah Group to the south (Dunn et al., in prep.), and the Groote Eylandt Beds to the east, are regarded as stratigraphic equivalents of the Parsons Range Group. In the central subsiding belt of the McArthur Basin the Group is about 20,000 feet thick. The Groote Eylandt Beds in the east are only 300 feet thick; and to the west in the Mount Marumba Sheet area (Roberts & Plumb, 1963) the Katherine River Group is about 9000 feet thick.

The Mattamurta Sandstone is the basal unit of the Group and consists dominantly of quartz sandstone and feldspathic quartz sandstone with a maximum thickness of about 10,000 feet. It is overlain by the Badalngarrmirri Formation, consisting of quartz sandstone beds up to several hundred feet thick alternating with beds of less resistant siltstone and fine-grained sandstone from 200 to 300 feet thick. The overlying Marura Siltstone consists mainly of fine-grained sediments containing varying proportions of dolomite. It is usually poorly exposed. The more resistant Fleming Sandstone, at the top of the Group, is a jointed, medium to coarse-grained quartz sandstone. The lower part of the unit is characteristically flaggy and thin-bedded.

LOWER(?) PROTEROZOIC

McArthur Group: The McArthur Group is exposed mainly to the south and east of the Parsons Range. These rocks, together with a small northerly extension into the Arnhem Bay / Gove Sheet area, represent the northernmost exposure of rocks of the McArthur Group, although possible stratigraphic equivalents (upper part of the Habgood Group) occur farther to the north (Dunnet, in prep.). The Group is very extensive in the southern part of the Carpentaria Province (Dunn et al., in prep.).

In the Blue Mud Bay / Port Langdon Sheet area a maximum thickness of about 12,000 feet was deposited in a north-south belt between the Parsons Range Fault Zone and the Koolatong Fault Zone; to the east of the latter the only units present, the Bath Range Formation, Baiguridji Formation, Yarrawirrie Formation, and Blue Mud Bay Beds, thin to only about 1500 feet total thickness. West of the Parsons Range Fault Zone, in the Mount Marumba Sheet area (Roberts & Plumb in prep.), the Dook Creek Formation, a probable stratigraphic equivalent of the McArthur Group, is only about 1000 feet thick.

By analogy with rocks deposited elsewhere in the McArthur Basin most of the McArthur Group rocks in the Blue Mud Bay- Port Langdon Sheet area are thought to have been deposited in a fore-reef environment.

In the eastern part of the Sheet area the Blue Mud Bay Beds overlie the Groote Eylandt Beds with apparent conformity and appear to be overlain conformably by the Baiguridji Formation. Although the section is thinner, the succession in the Blue Mud Bay Beds resembles the Zamia Creek Siltstone and Yarrawirrie Formation. It is not known whether the beds are a stratigraphic equivalent of part, or all, of the McArthur Group below the Baiguridji Formation; lithologies suggest they may simply be the result of an overlap of the Zamia Creek Siltstone and Yarrawirrie Formation on to a stable shelf.

The basal unit of the McArthur Group in this Sheet area is the Koolatong Siltstone. Siltstone and dolomitic siltstone dominate the lithology of the unit, particularly in the lower half, while higher in the sequence flaggy to massive dolomite, chert breccia, and algal dolomite become locally prominent, particularly in the Strawbridge Creek area. Thin interbeds of fine-grained sandstone occur throughout.

The Strawbridge Breccia is composed entirely of massive chert breccia containing angular fragments of banded chert in a chalcedony matrix. It is resistant and well exposed. Overlying the Strawbridge Breccia is the Vaughton Siltstone, which consists almost entirely of fine-grained fissile and flaggy thin-bedded rocks. The lower part of the unit contains dolomitic siltstone, with minor interbeds of dolomitic fine-grained sandstone, chert and dolomite; the upper part consists of distinctive black shale. The overlying Conway Formation contains persistent beds of algal chert. The algae form colonies which occur in single beds over wide areas. Associated with the beds of algal chert are laminated cherty siltstone and dolomitic siltstone.

The Zamia Creek Siltstone consists of regular interlaminated chert, cherty siltstone, and dolomitic siltstone. Graded bedding is a common feature of the unit. The overlying Yarrawirrie Formation is distinguished from the Zamia Creek Siltstone by a flaggy quartz sandstone and a 'chert fragment sandstone', a rock containing abundant angular chert fragments and quartz grains set in a silty matrix. Mushroom-shaped growths of botryoidal quartz and lenses of algal chert occur within the unit.

The Baiguridji Formation crops out very poorly in a valley between the Yarrawirrie Formation and Bath Range Formation. Dolomitic siltstone occurs at the base, overlain by flaggy purple to pink, micaceous fine-grained sandstone and siltstone. The top has flaggy, grey-green, fine cherty sandstone and siltstone which commonly crop out in a cliff or scarp beneath the resistant Bath Range Formation.

The Bath Range Formation contains a diversity of rock types. The base is marked by two or three bands of massive white to pale grey rhyolite. Higher up in the unit pelletal dolomite and pelletal chert (silicified pelletal dolomite?) are characteristic. Interbedded with these are laminated dolomitic siltstone, flaggy fine-grained feldspathic sandstone, chert sandstone, chert breccia, and interlaminated siltstone and chert.

The few small outcrops of the Kookaburra Creek Formation which underlie the Roper Group in the south-western corner of the Sheet area are characterized by the abundance of oolitic chert. No definite relationship is visible between the Kookaburra Creek Formation and the Bath Range Formation, which is inferred to underlie it. The Kookaburra Creek Formation is the only unit of the McArthur Group which can be traced in outcrop beyond the southern border of the Sheet area; it provides a link with the McArthur Group succession to the south.

UPPER(?) PROTEROZOIC

Roper Group: The Roper Group, which is composed of alternating sandstone and siltstone, is about 2000 feet thick in the Blue Mud Bay - Port Langdon Sheet area, compared with 6000 feet farther south on the Urapunga Sheet area (Dunn, 1963). Associated with this northward thinning there is a general increase in the proportion of silty rocks within the Group.

The Limmen Sandstone is the lowest unit of the Group and unconformably overlies the McArthur Group. A basal conglomerate, containing pebbles of chert from the McArthur Group, is present.

The characteristic feature of the generally poorly outcropping Mainoru Formation is the abundance of flaggy, purple, micaceous shale and fine-grained glauconitic sandstone. The lower half of the unit consists largely of flaggy cherty siltstone and dolomitic siltstone which crop out as prominent ridges in places.

The contact between the Mainoru Formation and the overlying Crawford Formation is gradational; in the Blue Mud Bay - Port Langdon Sheet area the Crawford Formation contains much more silt-sized material than farther to the south. It generally crops out as a small scarp, controlled by beds of massive, pink, micaceous quartz greywacke; glauconite is characteristic of the unit.

The Abner Sandstone is divided into four members, but the two sandstone members, the Arnold Sandstone Member and the Hodgson Sandstone Member, are not very prominent in the Sheet area; the Arnold Sandstone Member thins out completely in the north. The main component of the formation in the Sheet area is the Jalboi Member, which consists chiefly of micaceous siltstone and glauconitic micaceous sandstone; only a few thin quartz sandstone beds occur. The ferruginous sandstone of the Munyi Member is not as prominent as in the Urapunga Sheet area; to the north quartz sandstone and micaceous shale is present in its place.

The Corcoran Formation only crops out occasionally in creeks and low rises. It is overlain by the Bessie Creek Sandstone, which is a useful marker bed and is the youngest unit of the Roper Group unit in the Sheet area.

Undifferentiated Dolerite Intrusives: Extensive sills of dolerite, up to 300 feet thick, and following single beds for large distances, are common within the Roper Group. The sills exhibit the same structural deformation as the enclosing sedimentary rocks. Preliminary radiometric dating (McDougall, pers. comm.) indicates an Upper Proterozoic age.

On the east coast of Bickerton Island a small sill of fine-grained dolerite intrudes the Groote Eylandt Beds; it shows no apparent similarity to those intruding the Roper Group.

Near the headwaters of the Koolatong River a laccolith of dolerite and diorite intrudes the Fagan Volcanics. This has been subjected to the same deformation as the enclosing volcanics and is therefore considered to be of similar age to the volcanics and to be unconformably overlain by the Parsons Range Group.

MESOZOIC

Lower Cretaceous

Thin outliers of horizontal Mullaman Beds unconformably overlie the Precambrian rocks throughout the Sheet area. The top of the unit has been eroded off, leaving a maximum section only about 50 feet thick. Marine and freshwater sediments are present. Massive quartz sandstone and ferruginous sandstone, of freshwater origin, generally occur locally in topographically low areas. The overlying marine claystone and clayey sandstone are more widespread. Exposures around the headwaters of the Walker River contain an abundant shelly fauna of Neocomian age (Skwarko, 1964); fossil lists are shown in Appendix 1.

CAINOZOIC

Laterite: A laterite profile is present beneath the sand cover of the Coastal Plain and is exposed in small scarps bordering the coast. It has generally developed on Lower Cretaceous rocks, but is found also on Precambrian rocks, such as granite. The profile is generally about 20 to 30 feet thick, with a maximum of about 50 feet. A ferruginous zone consisting of ferruginous loam, a mottled zone, and a pallid zone consisting of white clay, can be recognized. The original texture of the rock is destroyed in the ferruginous zone and the profile is truncated by erosion in places. It is probably of Tertiary age.

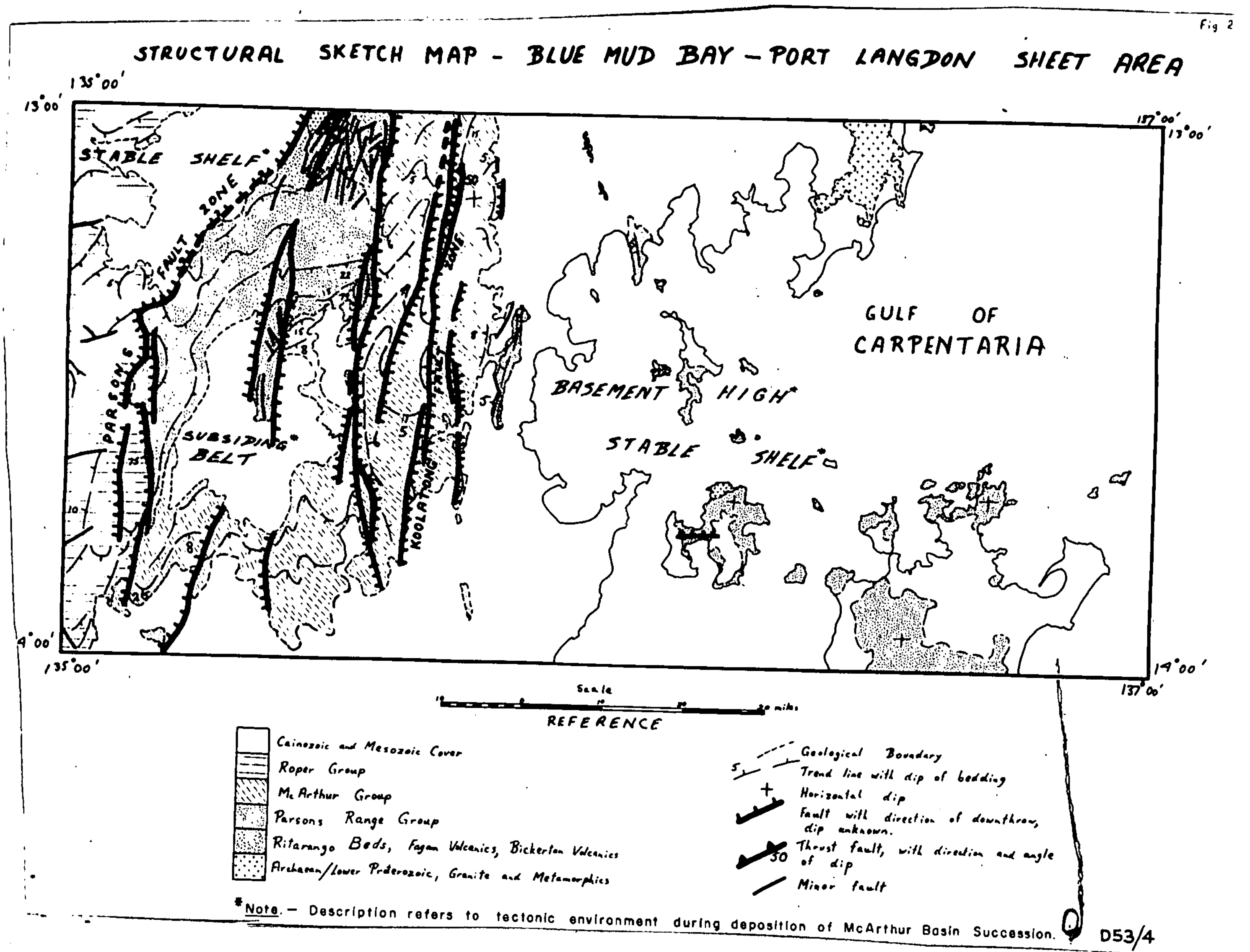
Large areas, principally the Yarrawirrie Plains in the south, and the north-western corner of the Sheet area, are covered by a younger ferruginous cemented detritus ('ferricrete'). This is included with laterite on the map.

Soils: Large areas of the Sheet area are covered by alluvium, residual soils, and sand; they are described in Table 1 and the physiography of the Coastal Plain.

STRUCTURE

The structure of the Blue Mud Bay - Port Langdon Sheet area is dominated by a faulted and folded horst structure bounded by the Parsons and Koolatong Fault zones, with comparatively stable blocks to the east and west. A marked difference in structural style is present between the Archaean and Lower Proterozoic basement rocks and the overlying Proterozoic sedimentary rocks. The degree of deformation in any area is closely related to the thickness of sediment deposited there. The Lower Cretaceous rocks are undeformed.

The structure of the Sheet area is illustrated in Figure 2.



BASEMENT ROCKS

Both the Myaoola Granite and the gneissic granite of the Mirarrmina Complex are foliated; their structural history is complex. Outcrops of the Myaoola Granite are insufficient to determine a structural pattern. The Mirarrmina Complex gneisses show no regular fold pattern but schists, farther north in the Arnhem Bay - Gove Sheet area (Dunnet, in prep.), have a steep dipping foliation striking about 190°. Later faulting, related to that in the Ritarango Beds and Fagan Volcanics, can be recognised.

The Grindall Metamorphics are tightly folded, with dips generally greater than 60°, about an axis plunging about 60° to 060°. A slatey cleavage is subparallel to bedding. Prominent joints are perpendicular to, and parallel to, the axis of folding; faulting is common parallel to these joints. Only one main folding phase can be recognised.

PROTEROZOIC SEDIMENTARY ROCKS

Central Horst Block: The structure of the area between the Parsons Range and Koolatong Fault Zones is dominated by north-trending faults and broad folding about north-trending axes. The intensity of faulting decreases with decreasing age of the rocks; this is considered to be the result of a long history of recurrent fault movements rather than a product of depth of burial.

The most intense faulting occurs within the Ritarango Sandstone where bedding and fold structures are obscured by numerous shear zones. Two sets of faults are present. The dominant set strikes between 190° and 200° and dips steeply. The minor faults in this group show right-lateral strike-slip displacement but this is obscured on the larger faults, such as those bordering the Mitchell and Parsons Range, by apparent vertical displacements up to 25,000 feet; this movement probably occurred late in their development.

The second set of faults is a conjugate set of minor faults striking about 300° and 330° and intersecting along a line plunging steeply to the north. Strike-slip movements dominate the movement pattern, which shows orthohombic symmetry, resulting from north-easterly compression. These faults are best developed in the cores of folds.

The structure of the Fagan Volcanics is similar, but with a decrease in intensity.

Within the rocks of the McArthur Basin intensity of faulting decreases markedly and only the major faults persist. These faults belong mainly to the set striking between 180° and 200° and dips are steep. Apparent displacements are usually vertical but right-lateral strike-slip movements do occur. Within the Koolatong Fault Zone, near the Koolatong River, a small thrust fault, dipping about 50°W, has been observed. Elsewhere exposures are generally too poor to accurately determine the attitude of faults.

Development of the McArthur Basin has been controlled by major faults. The Parsons and Koolatong Fault Zones appear to have bounded the central belt of major subsidence, and other faults, such as that bordering the eastern side of the Parsons Range, may have been operative also. After sedimentation, the vertical movements on these ancient faults have been reversed.

Folding in the area is confined to the development of broad folds about axes striking between 180° and 210°; dips generally range between 5° and 20°, with steeper dips, up to vertical, in the vicinity of faults. The main structure is a large syncline outlined by the Parsons Range with the eastern limb faulted out. East of this the area shows numerous broad folds secondary to faulting. The relatively incompetent McArthur Group rocks are more folded than the Parsons Range Group.

Western Stable Block: Outcrops in the area west of the Parsons Fault Zone are almost exclusively Roper Group sediments. The structure consists simply of irregular warping, with dips of the order of 5° to 10°, and minor cross-faulting.

Eastern Stable Block: The area occupied by the basement ridge to the east of the Koolatong Fault Zone has been very stable since the folding of the Grindall Metamorphics. The sediments are subhorizontal, with minor faulting; the present structure probably reflects the attitude of the original sedimentary basin with little subsequent deformation.

GEOLOGICAL HISTORY

The Geological History of the Sheet area is summarized in Table 2.

ECONOMIC GEOLOGY

Manganese

The occurrence of manganese on the shores of Blue Mud Bay was first noted by Flinders in 1803 (Flinders, 1814); Brown (1908) recorded manganese on a beach at Groote Eylandt, overlying lateritic rocks.

In November 1960, during a reconnaissance visit to Groote Eylandt by the Bureau of Mineral Resources, hand-picked specimens of manganese were collected from the vicinity of Groote Eylandt Mission; assays indicated grades of better than 50% Mn. Following these results a reconnaissance study was made of the area in December 1961, and at least five major deposits were located in the vicinity of the Mission.

At present the Broken Hill Pty Co. Ltd is engaged in testing the area and extensive deposits of manganese ore are indicated. No estimate of reserves is available at this stage.

The deposits occur as beds of pisolitic nodular and massive material on the flanks of sandstone ranges. Similar deposits occur on the mainland, but only small occurrences have been noted to date.

Future Prospects

Extensive deposits of bauxite occur on Gove Peninsula to the north of the Sheet area (Dunnet, in prep.) associated with a laterite profile formed on Lower Cretaceous rocks. The extensive laterite deposits of the Coastal Plain on the Blue Mud Bay - Port Langdon Sheet area must therefore be considered as likely areas for exploration for bauxite. No bauxitic laterite has been noted to date and the extensive sand cover would hamper exploration.

Syngenetic lead, zinc, and copper mineralization occurs in the rocks of the McArthur Group in the southern part of the Carpentaria Province and, although no sulphides have yet been found in the McArthur Group rocks of the Blue Mud Bay - Port Langdon Sheet area, the similarity of the rocks in the two areas suggests that closer exploration is warranted.

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APPENDIX 1

Lower Cretaceous Fossils Collected on Blur Mud Bay - Port Langdon Sheet Area.

(after S.K. Skwarko, 1964)

Locality Number:- T.T. 65.
Locality: 13°23'S, 135°01'E.
Fauna:

Pelecypoda: *Lopatinia* sp.
Exogyra travesi Skwarko, 1964.
Pterotrigonia (Rinetrigonia) capricornia Skwarko, 1963.
Nototrigonia (?) *walkeri*, Skwarko, 1964.
Cyrenopsis sp.nov.
Paraesa anticlithona Skwarko, 1964.
Iotrigonia (Zaletrigonia) hoepeni Skwarko, 1963.

Age: Late Neocomian.

Locality Number: T.T.66.
Locality: Headwaters of Walker River, 13°34'S, 135°29½'E.
Fauna:

Pelecypoda: *Maccoyella corbiensis* (Moore, 1870).
Maccoyella cf. *transitoriana* Skwarko, 1964.
Exogyra australiana Skwarko, 1964.
E. travesi Skwarko, 1964.
Nototrigonia aberrata Skwarko, 1963.
N. nimbosa Skwarko, 1964.
Eriphyla (?) *bauhiniana* Skwarko, 1964.
Ostrea sp.

Age: Late Neocomian.

Locality Number: T.T.67
Locality: Walker River, $13^{\circ}38\frac{1}{2}$'S, $135^{\circ}29$'E.

Fauna: Pelecypoda: *Exogyra travesi* Skwarko, 1964.
Maccoyella sp. cf. *M. transitoriana* Skwarko, 1964.
Pterotrigonia (Rinetrigonia) capricornia Skwarko 1963
Pelecypoda indet.

Age: Late Neocomian.

Locality Number: T.T. 68.
Locality: Upper Walker River, $13^{\circ}37$'S, $135^{\circ}30$'E.

Fauna: Pelecypoda: *Grammatodon arnhemense* Skwarko, 1964.
Maccoyella sp. cf. *M. transitoriana* Skwarko, 1964.
Pterotrigonia (Rinetrigonia) capricornia, Skwarko, 1963.
Nototrigonia crescenta Skwarko, 1963.
N.(?) *walkeri* Skwarko, 1964.
?*Panopea* sp. cf. *P. Aramacensis* (Eth.fil.,1892)
Eriphyla(?) *bauhiniana* Skwarko, 1964.
Pelecypoda indet.

Age: Late Neocomian.

TABLE 1

STRATIGRAPHY - BLUE MUD BAY - PORT LANGDON SHEET AREA

ERA	AGE	ROCK UNIT AND SYMBOL	MAXIMUM THICKNESS (in feet)	LITHOLOGY	PHYSIOGRAPHIC EXPRESSION	DISTRIBUTION	REMARKS
CAINOZOIC	QUATERNARY	(Qa)		Coastal silt, fine sand and evaporite deposits.	Tidal flats.	Borders coast, and extends inland along the main watercourses.	Generally represent emerged lagoonal deposits; subject to tidal and seasonal inundation.
			30	Alluvium	River flats.	Flood plains of main watercourses.	Eustatic change in sea level has entrenched streams into their own alluvium.
	UNDIFFERENTIATED	(Czs)	300	Sand dunes (calcareous in places).	Dunes	Bordering coast and tidal flats on coastal plain.	Aeolian dunes on Groote Eylandt are up to 300 feet high.
		(Czs)	50	Sand, residual soil.	Coastal plains, valleys, hill-slopes, plateau cappings.	Widespread.	Sand covers a large part of the Coastal Plain. Residual soils are most common in the Gulf and Arafura Falls.
		UNCONFORMITY					
		(Czl)	20	Laterite, lateritic soil, ferruginous cemented detritus (ferricrete).	Forms small scarps and low rises.	Coastal Plain.	Profile up to 50 feet thick. Generally developed on Lower Cretaceous rocks. Probably Tertiary in age. Ferruginous cemented detritus covers large areas.
		UNCONFORMITY					
MESOZOIC	LOWER CRETACEOUS	Mullaman Beds (Klm)	50+	Massive, white and yellow claystone, sandy claystone and clayey sandstone; massive quartz sandstone and ferruginous sandstone.	Mesa and plateau cappings; low outcrops within coastal plain; valley infillings.	Discontinuous outcrops throughout Sheet area.	Marine and freshwater facies present; marine dominant. Fossils indicate Neocomian age. Outcrops generally lateritized.
		UNCONFORMITY					
PRECAMBRIAN	UPPER (?) PROTEROZOIC	(Bdl)	300	Massive dolerite and diorite, sometimes porphyritic and vesicular.	Generally areas of poor relief.	Bickerton Island; headwaters of Koolatong River; north-western corner of Sheet area.	Laccolithic intrusion in Fagan Volcanics; small sill in Groote Eylandt Beds; extensive sills in Roper Group. Always shows same structure as rocks they intrude. Probably variable in ages of intrusion.
		ROPER GROUP: Bessie Creek Sandstone (Pre)	100	Friable, massive fine to medium grained quartz sandstone.	Moderately resistant - forms low ridges and scarp cappings.	West of Parsons Range	Distinctive jointing in places forms 'Castle' topography.
		ROPER GROUP: Corcoran Formation (Bro)	400	Thinly flaggy micaceous quartz sandstone and micaceous quartz greywacke.	Poorly resistant - forms low rubble-covered rises within broad valleys.		
		ROPER GROUP: Abner Sandstone (Bra) — Munyi member (Brm)	100	Ferruginous sandstone and siltstone; minor quartz sandstone and micaceous shale.	Crops out poorly. Remnants cap hills of Hodgson Sandstone Member.		Changes northwards; iron content decreases - quartz sandstone and shales become dominant.

ERA	AGE	GROUP	ROCK UNIT AND SYMBOL	* MAXIMUM THICKNESS (in feet)	LITHOLOGY	PHYSIOGRAPHIC EXPRESSION	DISTRIBUTION	REMARKS
PRECAMBRIAN	UPPER (?) PROTEROZOIC	ROPER GROUP	Hodgson Sandstone Member (Erh)	100 to 150	Blocky to massive, friable medium-grained quartz sandstone. Cross-bedded.	Prominent ridges and plateau cappings.	West of Parsons Range	Weathers into distinctive "Castle" topography.
			Jalboi Member (Erj)	400	Blocky white quartz sandstone alternates with interbedded flaggy green, white and purple glauconitic micaceous sandstone and micaceous siltstone.	Parallel ridges and valleys with poor outcrop.		Micaceous siltstone and micaceous sandstone become more prominent towards the north. Main member of Abner Sandstone in this Sheet area.
			Arnold Sandstone Member (Erx)	0 - 100	Blocky to massive, friable, medium-grained quartz sandstone. Cross-bedded.	Prominent ridges and plateau cappings.		Similar to Hodgson Sandstone Member. Thins out towards the north.
			Crawford Formation (Err)	100	Blocky to massive, pink micaceous quartz greywacke; flaggy purple micaceous sandstone and siltstone and green micaceous glauconitic sandstone.	Small scarp overlying Mainoru Formation.		Becomes generally finer grained and thinly bedded to the north; contact with Mainoru Formation gradational.
			Mainoru Formation (Eru)	500	Flaggy, laminated cherty siltstone and dolomitic siltstone. Flaggy purple micaceous shale and fine-grained glauconitic sandstone. Minor dolutite.	Crops out poorly as low rises amongst soil-covered plain. Cherty siltstone sometimes forms scarps.		Becomes more dolomitic towards the north.
			Limmen Sandstone (Eri)	100	Massive to flaggy, fine to medium grained quartz sandstone. Minor pebble conglomerate.	Forms prominent ridges.		Basal unit of Roper Group. Unconformably overlies Kookaburra Creek Formation.
					UNCONFORMITY			
	LOWER (?) PROTEROZOIC	McARTHUR GROUP	Kookaburra Creek Formation (Emu)	500+ Section Incomplete	Oolitic chert, cherty siltstone, chert, chert breccia.	Scattered outcrops and ridges amongst sand of Coastal Plain.	South-western corner of Sheet area.	Top unit of McArthur Group. No relationship observed with Bath Range Formation - inferred to overlie it. Oolitic cherts are characteristic.
			Bath Range Formation (Eme)	500+ No top exposed	Pelletal chert; massive white rhyolite; laminated dolomitic siltstone; flaggy fine-grained feldspathic chert sand-sandstone; chert breccia; interlaminated siltstone and chert; pelletal dolomite.	Forms scarp cappings and prominent ridges.	Between Parson's Range and western shore of Blue Mud Bay.	Good marker unit. Occurrence of distinctive white rhyolite beds near base, and pelletal cherts throughout, are characteristic. Interlaminated siltstone-chert common.
			Baiguridji Formation (Emi)	800	Flaggy grey-green and purple, fine-grained cherty sandstone and siltstone; flaggy dolomitic siltstone, flaggy micaceous fine-grained sandstone and siltstone.	Crops out poorly. Always forms valley below scarp of Bath Range Formation.	Between Parson's Range and western shore of Blue Mud Bay.	

ERA	AGE		ROCK UNIT AND SYMBOL	MAXIMUM THICKNESS (in feet)	LITHOLOGY	PHYSIOGRAPHIC EXPRESSION	DISTRIBUTION	REMARKS
PRECAMBRIAN	LOWER PROTEROZOIC	McARTHUR GROUP	Yarrawirrie Formation (Bmy)	800	Blocky, coarse-grained chert sandstone and quartz sandstone; flaggy chert and dolomitic siltstone; algal chert; laminated siltstone-chert; laminated dolomitic siltstone with chert nodules; botryoidal quartz.	Prominent strike ridges. Crops out well.	Between Parsons Range and western coast of Blue Mud Bay	Distinguished from Zamia Creek Siltstone by blocky ripple-marked sandstone with abundant angular chert fragments. Lenses of algal chert present near top of unit.
			Zamia Creek Siltstone (Bmz)	800	Interlaminated chert, cherty siltstone and dolomitic siltstone; minor algal chert.	Fairly prominent, rubble covered strike ridges. Not quite as prominent as overlying Yarrawirrie Formation.		Regularly interlaminated, fine-grained sediments are characteristic. Some graded bedding visible in places.
			Conway Formation (Bmc)	200	Algal chert; cherty siltstone;dolomitic siltstone.	Narrow prominent ridges.	Between Parsons and Bath Ranges and around watershed of Koolatong River and Strawbridge Creek.	Contains two or three persistent beds of algal chert - useful marker beds.
			Vaughton Siltstone (Bmv)	3000	Black shale; dolomitic siltstone; minor chert, dolomite, and dolomitic sandstone.	Crops out poorly; forms wide valley between Conway Formation and Strawbridge Breccia.		Little known because of poor outcrop. Black shale at top is characteristic.
			Strawbridge Breccia (Bms)	200	Massive chert breccia - angular fragments of chert, and occasionally fine sandstone, in chalcedony matrix.	Crops out as persistent and prominent strike ridges.		Useful marker bed.
			Koolatong Siltstone (Bmk)	up to 4600	Massive and flaggy brown siltstone; flaggy dolomitic siltstone and silty dolomite; flaggy and massive dolomite; algal dolomite; fine-grained sandstone; chert, chert chert breccia, cherty siltstone.	Crops out poorly. Scattered outcrop amongst soil and in scarps below Lower Cretaceous capping.		Base of McArthur Group. Conformably overlies Fleming Sandstone. Dolomite becomes more prominent towards top of unit; silt dominant at base. Persistent bed of chert breccia in Koolatong -Strawbridge watershed area.
			Blue Mud Bay Beds (Bmm)	400 + No top exposed	Flaggy dolomitic siltstone and fine-grained sandstone; chert; blocky quartz sandstone and chert sandstone; algal dolomite; laminated chert.	Low strike ridge bounded by valleys.	Near Blue Mud Bay coast between Koolatong and Walker Rivers.	Contacts with adjoining rocks covered by soil. Overlies Groote Eylandt Beds with apparent conformity; appears to be overlain conformably by Baiguridji Formation. Probably a lateral equivalent of lower part of McArthur Group.
		PARSONS RANGE GROUP	Fleming Sandstone (Bpf)	500	Flaggy to massive, pink to white, medium to coarse-grained quartz sandstone; ferruginous sandstone; cross-bedded and ripple marked.	Prominent strike ridges.	Along eastern flanks of Parsons Range	Good outcrop and distinctive joint pattern makes it good marker bed. Top of Parsons Range Group.- conformably overlain by Koolatong Siltstone.
			Marura Siltstone (Bpm)	1500	Flaggy and fissile, purple -brown, siltstone, shale and dolomitic siltstone; minor flaggy purple-brown fine-grained sandstone, grey sandy dolomitic and dolomitic sandstone, black fine-grained dolomite, cherty siltstone, quartz sandstone.	Crops out poorly. Forms valley between adjoining units.		Predominance of purple-brown siltstones characteristic. Good marker bed.

ERA	AGE		ROCK UNIT AND SYMBOL	MAXIMUM THICKNESS (in feet)	LITHOLOGY	PHYSIOGRAPHIC EXPRESSION	DISTRIBUTION	REMARKS
PRECAMBRIAN	LOWER PROTEROZOIC	PARSONS RANGE GROUP	Badalngarrmirri Formation (Bpb)	7500	Blocky to flaggy medium-grained quartz sandstone alternates with interbedded fine micaceous sandstone; purple ferruginous and feldspathic sandstone; siltstone;dolomite.	Sandstonescrop out well as prominent, parallel strike ridges, with valleys of softer rocks between.	Parsons Range	Alternating sequence is characteristic.
			Mattamurta Sandstone (Bpt)	10,000	Blocky to massive, medium-grained, quartz sandstone and feldspathic quartz sandstone; minor pebble conglomerate.	Crops out as prominent ridge and plateau - main unit of Parson's Range.		Base of Parson's Range Group; unconformably overlies Fagan Volcanics and Sheridan Formation.
			Groote Eylandt Beds (Bta)	300 to	Massive, clay-rich, grey, pebbly sandstone and feldspathic sandstone; blocky white quartz sandstone; massive boulder conglomerate; flaggy, reddish brown micaceous sandstone.	Prominent hills and dissected plateaux.	Shoreline of, and islands within, Blue Mud Bay.	Lateral equivalent, in part, of Parsons Range Group. Unconformably overlies Bickerton Volcanics, Grindall Metamorphics and Caledon Granite; overlain by Blue Mud Bay Beds.
					UNCONFORMITY			
			Sheridan Formation (Bs)	500	Feldspathic and lithic greywacke; pebbly greywacke, feldspathic sandstone; siltstone; pebble conglomerate.	Hill cappings in valley of Fagan Volcanics.	Headwaters of Sheridan Creek and the Koolatong River.	Unconformably overlies Fagan Volcanics; unconformably overlain by Mattamurta Sandstone. Deposits derived directly from Fagan Volcanics and Ritarango Beds.
					UNCONFORMITY			
			Bickerton Volcanics (Bli)	500+	Massive red porphyritic acid volcanics.	Low rounded hills.	Bickerton and Round Hill Islands.	Unconformably overlain by Groote Eylandt Beds; inferred to unconformably overlie Grindall Metamorphics (no exposed contact). Possible equivalent of Fagan Volcanics.
			Fagan Volcanics (Blg)	2000	Massive red to blue-grey porphyritic acid and intermediate volcanics; massive purple ashstone; interbedded flaggy feldspathic quartz sandstone and purple tuffaceous shale; blocky greywacke.	Moderately soft unit. Rugged, dissected area below level of more resistant Parsons Range.	Headwaters of the Koolatong River.	Unconformably overlies Ritarango Beds; unconformably overlain by Sheridan Formation and Mattamurta Sandstone. Lateral lithological changes common.
					UNCONFORMITY			
			Ritarango Beds (Blr)	10,000 +	Blocky and massive quartz sandstone, feldspathic lithic sandstone and arkose; minor siltstone and coarse-grained quartz sandstone.	Prominent hills and ridges bounded by faults.	Southern extension of the Mitchell Range; (to the north of Parsons Range).	Unconformably overlain by Fagan Volcanics; unconformably overlies Mirarrmina Complex.
					UNCONFORMITY			
			Caledon Granite (Bgc)		Massive pink hornblende-biotite granite; massive pink olivine-biotite granite.	Low outcrops around coast of Blue Mud Bay.	Islands and coast of Blue Mud Bay.	Intrudes Grindall Metamorphics and Myaoola Granite; unconformably overlain by Groote Eylandt Beds; possibly comagmatic with Bickerton Volcanics.

ERA	AGE	ROCK UNIT AND SYMBOL	✱ MAXIMUM THICKNESS (in feet)	LITHOLOGY	PHYSIOGRAPHIC EXPRESSION	DISTRIBUTION	REMARKS
PRECAMBRIAN	LOWER PROTEROZOIC	Grindall Metamorphics (Eld)		Green chlorite-slate and chlorite muscovite slate; chlorite phyllite; sheared feldspathic greywacke and sandstone; flaggy purple siltstone; sheared volcanics; greenschists.	Low outcrops bordering sea-shore.	Various islands in Blue Mud Bay.	Tightly folded; subjected to greenschist facies regional metamorphism. Intruded by Caledon Granite; unconformably overlain by Groote Eylandt Beds; inferred to be overlain, unconformably, by Bickerton Volcanics.
				UNCONFORMITY			
	LOWER PROTEROZOIC AND ARCHAEAN	Mirarrmina Complex (A/Bn)		Porphyritic-garnetiferous gneisses and granites; massive gabbro, dolerite and diorite; massive quartz-feldspar porphyry.	Very poorly resistant. Scattered boulders amongst soil cover.	Along western side of Parsons and Mitchell Ranges in north-west of Sheet area.	Complex of igneous intrusions; ranges in age from Archaean to Lower Proterozoic.
	ARCHAEAN	Myaoola Granite (Agy)		Partly porphyritic garnetiferous biotite granite. Weakly foliated.	Low outcrops around coast.	Between Point Arrowsmith and Trial Bay.	Intruded by Caledon Granite. Biotite knots after garnet. Probably unconformably overlain by Grindall Metamorphics.

✱ Note:- All thickness based on visual estimates in the field or estimated from maps. No measured sections available.

TABLE 2.

GEOLOGICAL HISTORY - BLUE MUD BAY-PORT LANGDON SHEET AREA

ERA	AGE	EVENT	REMARKS
CAINOZOIC	Tertiary to Recent	Slight epeirogenic movements with alternate transgression and regression of sea on Coastal Plain - alternating sedimentation and erosion.	Topographically high areas eroded continuously. Deposition of sand, ferricrete, alluvium, and coastal deposits alternates with erosion of earlier laterite plain.
	Tertiary(?)	Epeirogenic uplift and erosion of earlier surface. Laterite profile developed on new erosion surface.	Topographic highs remain within Gulf Fall due to resistance to erosion.
	Lower Cretaceous to Tertiary	Epeirogenic uplift and regression of sea. Slight erosion.	
MESOZOIC	Lower Cretaceous	Marine transgression. Deposition of fresh-water and marine sediments on stable shelf - Mullaman Beds.	Fresh water deposits older than marine.
PALAEOZOIC	Upper Proterozoic to Lower Cretaceous	Erosion of Precambrian terrain to form low plain areas with topographic highs of resistant rocks.	Region very stable. Base of Lower Cretaceous sediments correspond to old erosion plain. Main ranges, such as Parsons Range, formed at this stage.
PRECAMBRIAN	Upper Proterozoic	Faulting and folding of Upper Proterozoic rocks.	Belt of maximum subsidence uplifted to form horst. Vertical movements occur on earlier wrench faults.
		Dolerite intrusion.	Extensive sills within Roper Group.
	Lower Proterozoic	Faulting and folding of Lower Proterozoic rocks. Uplift of area east of Parsons Fault Zone.	Area east of Parsons Fault Zone becomes stable block.
		Deposition of McArthur Group (up to 12,000 feet of carbonates and silts) in subsiding trough, bordered by semi-stable shelves.	Maximum deposition between Parsons and Koolatong Fault Zones.
		Deposition of Parsons Range Group (20,000 feet of sandstone; minor silts and carbonates) within subsiding trough; deposition of Groote Eylandt Beds on semi-stable shelf to east.	Maximum subsidence between Parsons and Koolatong Fault Zones.
		Faulting and folding of Lower Proterozoic rocks. Erosion and deposition of Sheridan Formation in valleys.	
		Intrusion of dolerite and diorite.	Laccolith within Fagan Volcanics; dyke-rocks in Mirarrmina Complex.
		Acid vulcanism, intrusion of acid igneous rocks, deposition of silts and sands.	Fagan Volcanics and quartz-feldspar-porphyry within Mirarrmina Complex in central belt; Bickerton Volcanics on eastern stable shelf; Caledon Granite within basement rocks to east.
		Intrusion of dolerite and diorite.	Mirarrmina Complex.
		Faulting and folding of Ritarango Sandstone.	Faults can be traced into Mirarrmina Complex.
		Development of central subsiding trough. Deposition of Ritarango Sandstone.	No indication of equivalent sedimentation in east. Trough probably bounded by Parsons and Koolatong Fault Zones.
		Orogeny. Intense folding of Grindall Metamorphics and crystalline basement.	Eastern part of Sheet area becomes a stable block.
		Deposition of geosynclinal sediments - Grindall Metamorphics.	
	Archaean	Intense folding, metamorphism and granitization of sediments.	Myaoola Granite; gneisses of Mirarrmina Complex. Oldest rocks exposed in the Sheet area.

AUSTRALIA 1:250,000

BLUE MUD BAY - PORT LANGDON

NORTHERN TERRITORY

1:250,000 GEOLOGICAL SERIES SHEET SD 53-7,8

PRELIMINARY EDITION, 1964

SUBJECT TO AMENDMENT

Reference

CAINOZOIC	QUATERNARY			Qa	Coastal silt, fine sand and evaporite deposits
				Qa	Alluvium
	UNDIFFERENTIATED			Czs	Sand dunes (calcareous in places)
				Czs	Sand, residual soil
				Czl	Laterite, lateritic soil, ferruginous cemented detritus (ferricrete)
MESOZOIC	LOWER CRETACEOUS		Mullaman Beds	Klm	Massive white and yellow claystone, sandy claystone; massive quartz sandstone
PRECAMBRIAN	UPPER (?) PROTEROZOIC			Pdl	Fine to coarse-grained dolerite; porphyritic and vesicular dolerite
		Roper Group	Bessie Creek Sandstone	Pre	Friable, massive, fine to medium quartz sandstone
			Corcoran Formation	Pro	Flaggy micaceous quartz sandstone and quartz greywacke
			Abner Sandstone		
			Munyi Member	Prm	Ferruginous sandstone and siltstone; minor quartz sandstone and micaceous shale
			Hodgson Sandstone Member	Prh	Blocky to massive, friable, medium quartz sandstone
			Jalboi Member	Prj	Flaggy green, white and purple glauconitic micaceous sandstone and siltstone; quartz greywacke, blocky white quartz sandstone
			Arnold Sandstone Member	Prx	Blocky to massive, friable, medium quartz sandstone
			Crawford Formation	Prr	Blocky to massive pink micaceous quartz greywacke; flaggy purple micaceous sandstone and siltstone; micaceous glauconitic sandstone
			Mainoru Formation	Pru	Flaggy, laminated, cherty and dolomitic siltstone; flaggy purple micaceous shale and fine glauconitic sandstone; minor dolutite
			Limmen Sandstone	Pri	Massive to flaggy fine to medium quartz sandstone; minor pebble conglomerate
	LOWER (?) PROTEROZOIC	McArthur Group	Kookaburra Creek Sandstone	Pmu	Oolitic chert, cherty siltstone, chert, chert breccia
			Bath Range Formation	Pme	Pelletal chert, massive white rhyolite, laminated dolomitic siltstone; flaggy fine sandstone, chert-sandstone, chert breccia, laminated siltstone-chert, pelletal dolomite.
			Baiguridji Formation	Pmi	Flaggy grey-green and purple, fine cherty sandstone; dolomitic siltstone; micaceous sandstone and siltstone
			Yarrawirrie Formation	Pmy	Blocky chert-sandstone and quartz sandstone; flaggy chert and dolomitic siltstone; algal chert; laminated and nodular cherty siltstone
			Zamia Creek Siltstone	Pmz	Chert, cherty siltstone and dolomitic siltstone; minor algal chert
			Conway Formation	Pmc	Algal chert, cherty siltstone, dolomitic siltstone
			Vaughton Siltstone	Pmv	Black shale; dolomitic siltstone; minor chert; dolomite and dolomitic sandstone
			Strawbridge Breccia	Pms	Massive chert breccia
			Koolatong Siltstone	Pmk	Flaggy brown green and grey siltstone; dolomitic siltstone and silty dolomite; dolomite, fine-grained sandstone; minor chert, chert breccia and cherty siltstone
			Blue Mud Bay Beds	Pmm	Flaggy dolomitic siltstone and sandstone; chert; blocky quartz sandstone and chert-sandstone; algal dolomite, laminated chert
	LOWER PROTEROZOIC	Parsons Range Group	Fleming Sandstone	Ppf	Flaggy to massive, pink to white, medium to coarse quartz sandstone
			Marura Siltstone	Ppm	Flaggy and fissile siltstone, shale and dolomitic siltstone; fine-grained sandstone, sandy dolomite, dolomitic sandstone, dolomite, cherty siltstone, quartz sandstone
			Badalngarrmirri Formation	Ppb	Blocky to flaggy medium quartz sandstone, fine-grained micaceous sandstone, purple ferruginous and feldspathic sandstone; siltstone, minor algal chert and dolomite
			Mattamurta Sandstone	Ppt	Blocky to massive, medium quartz sandstone and feldspathic sandstone; minor pebble conglomerate
			Groote Eylandt Beds	Pta	Massive, grey, pebbly quartz sandstone and feldspathic sandstone; massive boulder conglomerate; flaggy red-brown micaceous sandstone
			Sheridan Formation	Ps	Feldspathic and lithic greywacke; pebbly greywacke; feldspathic sandstone; siltstone; pebble conglomerate
			Bickerton Volcanics	Pli	Massive red porphyritic acid volcanics
			Fagan Volcanics	Plg	Massive red to blue-grey porphyritic acid and intermediate volcanics; purple ashstone; feldspathic quartz sandstone; purple shale and greywacke
			Ritarango Beds	Plr	Blocky and massive medium-grained quartz sandstone, feldspathic sandstone and arkose; minor siltstone and coarse quartz sandstone
			Caledon Granite	Pgc	Massive pink hornblende-biotite granite; massive pink olivine-biotite granite
			Grindall Metamorphics	Pld	Green chlorite-slate and chlorite-muscovite-slate; chlorite-phyllite; sheared feldspathic greywacke and sandstone; flaggy purple siltstone; sheared volcanics; greenschists
	LOWER PROTEROZOIC AND ARCHAEAN		Mirarrmina Complex	A/Pn	Porphyritic garnetiferous gneisses and granites; massive diorite and dolerite; massive quartz-feldspar porphyry
	ARCHAEAN		Myaoola Granite	Agy	Foliated porphyritic garnetiferous 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

Strike and dip of strata

Trend lines, Joint pattern — air-photo interpretation

Macrofossil localities

Text reference to specimen locality

Age determination locality and reference number

Unexploited manganese deposit

Sand dunes

Vehicle track

Fence

Landing ground

Astronomical station

Trigonometrical station

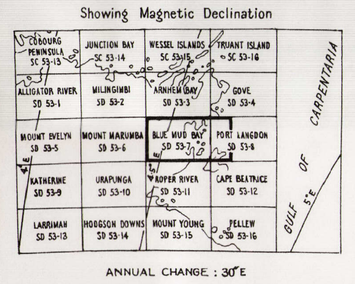
·473 Height in feet

Swamp

Compiled and issued by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. Topographic base compiled by the 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



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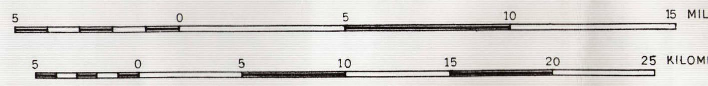
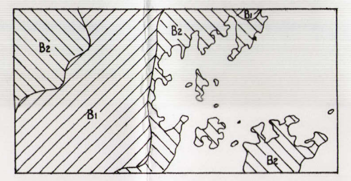


GEOLOGICAL RELIABILITY DIAGRAM



B1 - Numerous ground traverses and air-photo interpretation.

B2 - Helicopter traverses and air-photo interpretation.

Geology, 1962, by: P.R. Dunn, H.G. Roberts, K.A. Plumb, D. Dunnet, P. Rix.
Compiled, 1963, by: H.G. Roberts, K.A. Plumb. W. Webb.
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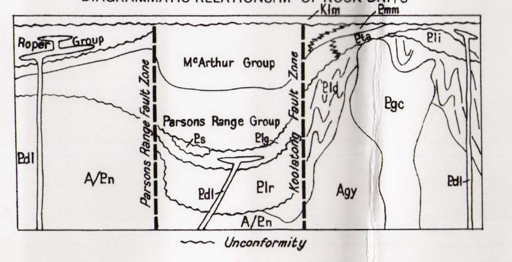
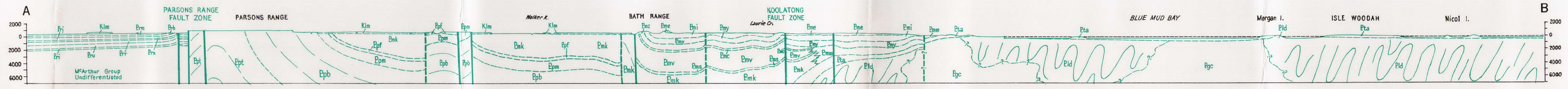
DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



Section A-B

Scale: $\frac{V}{H} = 2$

(Cainozoic sediments omitted; attitude of faults not known)



BLUE MUD BAY - PORT LANGDON

SHEET SD 53-7,8

AUSTRALIA 1:250,000

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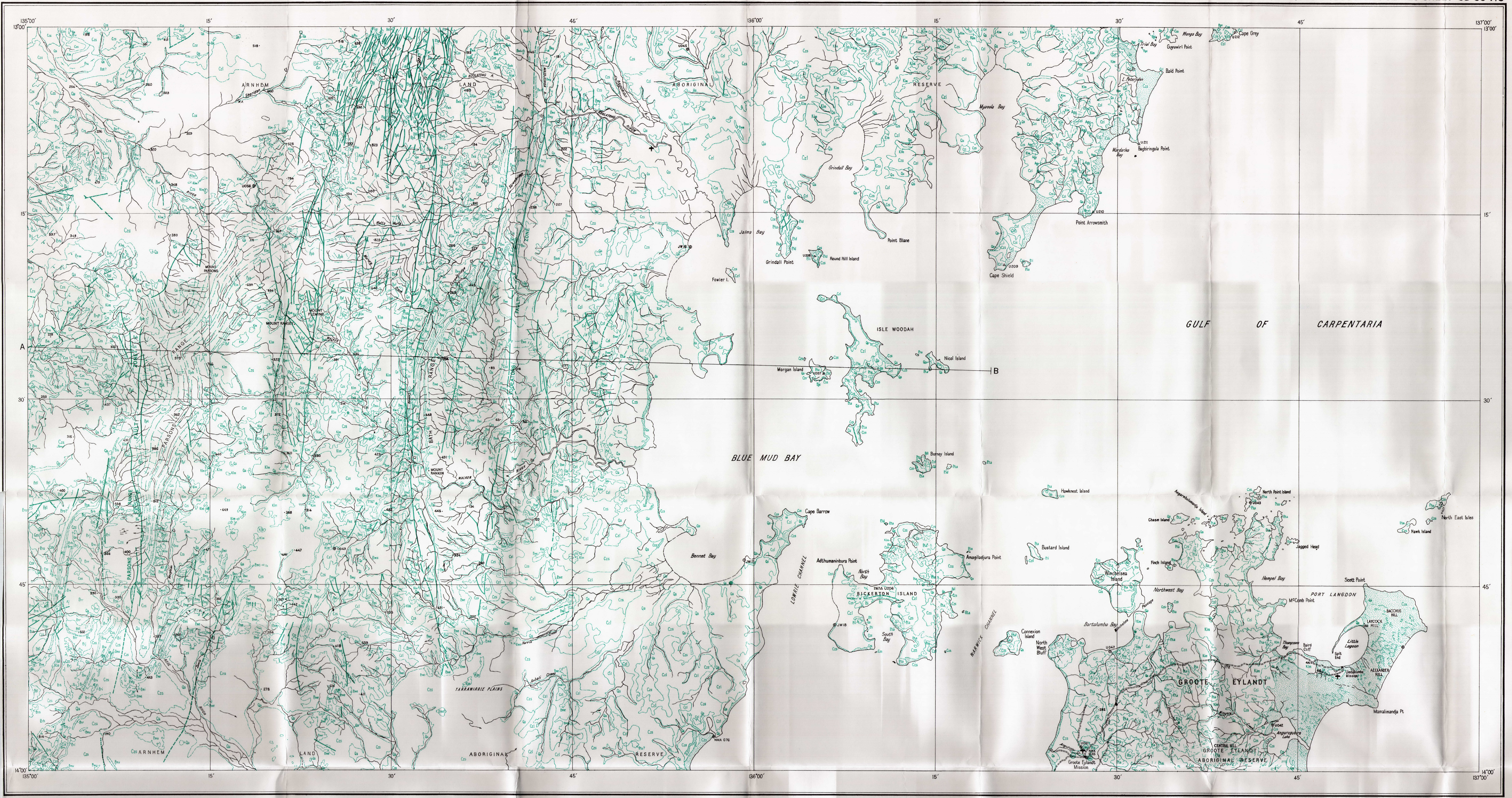

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	UNDIFFERENTIATED		Czs	Sand dunes (calcareous in places)
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		Roper Group: Bessie Creek Sandstone	Pre	Friable, massive, fine to medium quartz sandstone
		Corcoran Formation	Pro	Flaggy micaceous quartz sandstone and quartz greywacke
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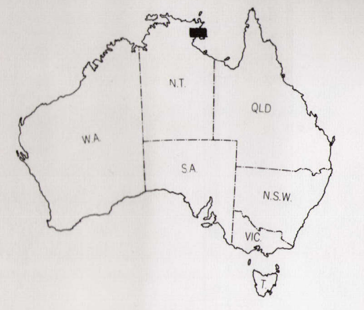

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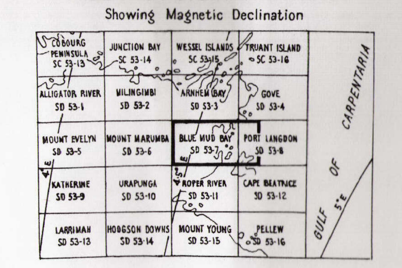

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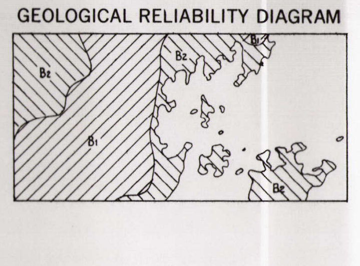
Scale 1 : 250,000

MILES

KILOMETRES

GEOLOGICAL RELIABILITY DIAGRAM



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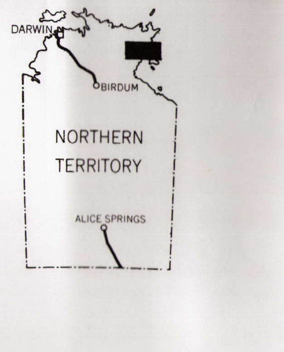

Section A-B

Scale: V/H = 2

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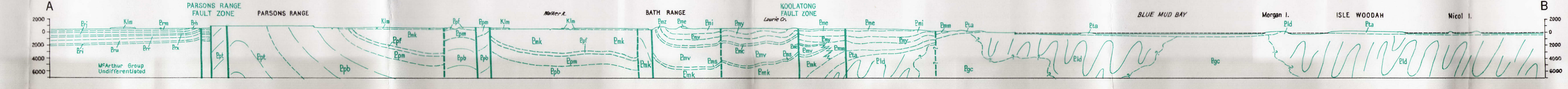
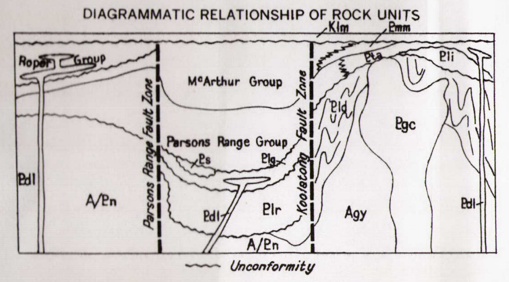


DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



BLUE MUD BAY - PORT LANGDON

SHEET SD 53-7,8