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PRELIMINARY REPORT ON THE GEOLOGY OF DAMPIER LAND

(no plates available)

by

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PRELIMINARY REPORT ON THE GEOLOGY OF DAMPIER LAND.

Report No. 1949/11.
(Geol. Ser. 31.

I. SUMMARY.

A. Dampier Land is the name given to the area north of the road between Broome and Derby in the Kimberley District of Western Australia. It extends to Cape Leveque and the Sunday Islands.

B. The topography is essentially flat with an average elevation above sea level of about 200 feet. Scattered elevated areas rise to a maximum height of 460 feet above sea-level at Mt. Jowlaenga.

C. Rocks of three geological ages outcrop in the area, namely, Pre-Nullagine, Mesozoic and Recent. Pre-Nullagine metamorphic rocks outcrop in the Sunday Islands, Mesozoic sediments, mainly sandstones, are found scattered throughout the area and recent deposits are confined to creek beds and the coastal areas. Many new localities of Mesozoic fossils have been found as a result of this survey, and the age of the sediments has been established for the first time with any certainty.

D. Dips in the area are invariably very low. As a result structure in the area is difficult to determine without detailed study. Dip readings from the scattered outcrops suggest the possibility of a low domal structure centred in the Fraser River-Mt. Jowlaenga area. Rectangular jointing is a feature of many of the outcrops.

E. The geological history of the Kimberley Area from Devonian times onwards is connected with a subsiding basin and a shoreline retreating to the west. An increase in depth to the basement rocks from east to west is a distinct possibility. Diastrophism is restricted to gentle folding with some faulting.

F. The petroleum prospects of Dampier Land compare favourably with areas previously examined in the Kimberley District. Further detailed work is required in the area to define the structure and stratigraphy more exactly.

II. INTRODUCTION

The survey of Dampier Land was undertaken to investigate the extent of the Mesozoic deposits, which were previously known to exist from information obtained from deep water bores at Broome and near Derby, and as surface outcrops at Point Torment, north of Derby. (Basedon, 1917; Clapp, 1925; Teichert, 1939, 1942.). A series of reconnaissance traverses was made in an effort to visit all known rock exposures.

The town of Broome was used as a base for the reconnaissance. Vehicles used were a Jeep, trailer and 3-ton Dodge Truck; the latter was used as a main mobile camp during the survey which lasted 6 weeks.

Roads and tracks in the area are limited and are in poor condition.

Mount Clarkson was reached by following an old track north from near the junction of the Logue River and the Broome-Derby Road; the Mount Jowlaenga area was reached by turning north near Nilli-bubbaca Well and then running on a compass bearing through very dense scrub.

Cape Leveque is situated at the north end of the track from Broome to Cape Leveque Lighthouse. The track runs parallel to and a short distance from the west coast. Other points visited in this area were reached by side tracks.

The Sunday Islands were visited on a Mission lugger from Kalumbo Anchorage.

Party members consisted of the writers with Braden Davey and Gordon Baker, drivers and mechanics.

III. [illegible].

Dampier Land is a low peninsula with an average elevation above sea level of about 200 feet. Scattered areas have greater elevation, such as Mount Clarkson (305'), King Peaks (278') and the Mount Jowlaenga Area. (about 450'). Mt. Jowlaenga (460') is the highest point in Dampier Land.

Elsewhere it is essentially flat and covered with sand and dense scrub (known as pindan) which varies little throughout the area. The tidal areas which are dry or wet depending upon the tide and season are a feature of the coast line (Spring tide at Derby is 45 feet). At other points vertical cliffs as much as 80 feet high form the coast line e.g. Pender Bay, Cape Leveque.

Drainage in the area is limited and the only well defined water courses seen during the reconnaissance were Deep Creek, Fraser River, Logue River and Nelligo Creek which flow for a short time during the monsoon. After the monsoon ends pools are left for a time but, with few exceptions, these eventually become dry.

Particularly well developed coastal dunes are active in the vicinity of Cape Leveque where they rise to over 100 feet above sea-level.

IV. [illegible] GEOLOGY.

A. Recent Deposits.

Under this heading are included sedimentary deposits formed within Recent times under conditions similar to those existing at present. In some cases these sediments are still being deposited.

1. Fluviatile.

Fluviatile sediments are limited to their distribution and are found in the beds of the few streams. Deposits were noted in Deep Creek, Nelligo Creek, Logue River and Fraser River all of which have an accumulation of rather coarse quartz sand in their beds.

2. Estuarine.

A feature of most, at least, of the tidal estuaries such as Folk Creek and Willie Creek is the calcareous shelly sandstone which occurs in patches over the surface. A sample of calcareous shelly sandstone from Racecourse Plains, 16 miles south of Broome, contained foraminifera, bryozoa and pelecypods.

Foraminifera: cf. Discorbis, Elphidium crispum (Linne), Elphidium sp.

Generally the estuaries are covered with a fine mud probably containing lime and certainly salt with abundant fragments of shells of living species.

3. Littoral and Aeolian.

(a) The youngest lithified deposits in the area are -

i. Brown shelly sandstone on the beach a short distance south of Cape Leveque.

ii. Brown shelly sandstone on the beach on the north side of Sheaton Bluff.

Both these formations have fragments of living shells and may still be in the process of formation though no direct evidence of this was available.

(b) Ironstone conglomerates of Pender Bay. These rocks outcrop at beach level.

(c) Sand dunes at Cape Leveque are active and rise to over 100 feet and extend inland as far as 300 yards.

Features of interest in the dune areas are as follows -

i. Aeolian ripple marks trending in diverse directions.

ii. Coarser grains on the crests of the ripples.

iii. Variations in grain size within a small area and varying from medium quartz sand to a coarse quartz grit usually with shell fragments.

The beaches where affected by tidal movement show the same variations in grain size, but the ripple marks usually trend along the beach with little variation in direction. These have some features which are comparable with structures to be described in the Mesozoic sandstones.

B. Mesozoic Deposits.

1. Lithology and Description.

(a) Marine and Littoral, Aeolian.

Sediments of this type are found throughout Dampier Land as scattered outcrops and evidence from the bores at Broome and Derby indicates they are present to a depth of as much as 1,450 feet.

Most of the outcrops are found along the coastline from near Broome to Cape Leveque and thence along the north coast and down the east coast at least as far as Goodenough Bay. The sandstones occur as sea-cliffs or rocky reefs partly covered at high tide (Photo No. 5.). The sandstones were examined at Cable Beach, Entrance Point, Reb Rocks, Gantheaume Point, Cape Leveque area, Malumbo Anchorage, Kelligo Creek, Stone Hill and Pender Bay.

These sandstones differ from others in this group in that no marine fossils were identified apart from worm burrows and similar markings of probable marine origin. (Photo. No. 6).

All outcrops of coastal sandstones are much alike. Small differences were noted between outcrops and they will be described in geographical groups for comparison.

i. Broome Area.

Sandstone about 80 feet thick outcrops along the coast near Broome. The sandstone in this area ranges in grain size from a medium to a coarse sandstone, commonly finely laminated and varying from a calcareous quartz sandstone to a ferruginous quartz sandstone. A noticeable feature of some layers is the abundance of mica, a characteristic found throughout the area.

Here as elsewhere ripple marks are present in places and cross bedding throughout the section. Excellent examples of both are to be seen at Entrance Point. These features suggest shallow water or perhaps aeolian conditions of deposition.

A characteristic of the section near Gantheaume Point is the fragmental layers in which the fragments consist of small 'biscuits' of sandstone and which may represent temporary land surfaces during the deposition of the beds.

Near the top of the outcropping section is a thin plant bed which will be referred to under lacustrine deposits.

At Cable Beach, Entrance Point and Gantheaume Point the sandstones are capped with ironstone gravels and conglomerates with a surface covering of red sandy soil.

ii. Cape Leveque to Shenton Bluff.

The coastal sandstones along this portion of the coast reach a maximum thickness of 105 feet at Shenton Bluff. At this locality the outcrop varies from massive to flaggy quartz sandstone with harder bands weathering in relief. Soft white clay bands are present and are identical with pockets of clay material found at Cape Leveque and near Broome.

The section exhibits good examples of cross-bedding and intra-formational structures such as small scale folding of soft beds between more rigid beds. (Photo No. 4). Current ripple marks trending in diverse directions occur in adjacent bands of the sandstone.

Markings on the bedding planes at various localities are attributed to either contemporary animal life or recent abrasion.

The section is usually capped with a hard white siliceous sandstone of lateritic origin.

In the vicinity of Cape Leveque the sandstones reach a thickness of approximately 60 feet. They are strongly cross-bedded and range in grain size from fine to coarse with pockets and bands of white clay. Former land surfaces are exposed as shelves towards the base of the cliffs at Cape Leveque. These surfaces are gently sloping and undulating, somewhat similar to the surface features on the windward side of a sand dune.

Immediately east of Cape Leveque the beds are different lithologically in that they are in part resistant sandstones which appear to be strongly calcareous, and in part unconsolidated sands. One band of grey calcareous sandstone at this locality is characterised by white inclusions which may be remains of shells. Similar forms were noted at other points but no convincing proof was obtained though further work in the area may establish the existence of fossils.

Further outcrops of a similar kind were observed during an aerial reconnaissance of Dampier Land in the following positions - Deep Water Point, One Arm Point, Swan Point, Thomas Bay, Chile Head, Packer I, Cape Borda and Sandy Point.

iii. King Peaks and Tree Hill.

Sandstones with ferruginous lateritic coppings outcrop at Tree Hill (between Brooke and Le Grange) and King Peaks (south of Beagle Bay Mission).

Tree Hill is an isolated outcrop of ferruginous quartz sandstone rising about 70 feet above the surrounding country. The grain size ranges from fine to coarse with some cross-bedding; pellets of finer material are also present. The upper part of the outcrop consists of a mass of fractured blocks with thin bands of yellow ochre. As elsewhere the bedding is near horizontal. This particular outcrop has a high iron content and caused a noticeable deflection of the compass.

At least four flat-topped outcrops were sighted in the King Peaks area. Only two were visited (2 miles from Neville's Well on a bearing of 300°) but it is assumed that all are similar. These outcrops are a red to black ferruginous quartz sandstone which in some bands may be coarse enough to be termed a grit. Generally speaking the outcrop is massive but bedding may be recognised in places and is horizontal. The outcrop is riddled with worm burrows. Doubtful plant remains were examined at the outcrops visited. (Photo No. 1.).

iv. Other Areas.

This group comprises all outcrops other than the coastal sandstones and includes the following areas - Mount Clarkson, Langey Crossing, Mount Josiah (Fraser River), Stony Ridge and Veeda Station.

Mount Clarkson is an isolated hill rising to about 140 feet above the surrounding plain. Lithologically the outcrop consists of layers of mainly fine sandstone with some silty beds and less commonly coarse sandstone which varies in colour from white to burgundy.

Some layers are obviously calcareous and others noticeably porous. Layers of clay pellets are present which may conceivably be fossil relics.

Fossiliferous beds are present but are difficult to locate and fossils are hard to extract. The best example was found as a "float" at the base of the outcrop though a band containing fossils in a reasonably good state of preservation was examined about 10 feet below the top of the outcrop. The horizontal bedding is well marked and further small extensions of the outcrop were traced to the east-south-east of Mount Clarkson for 6 to 8 miles.

Cross-bedding, penecontemporaneous structures and jointing are well developed.

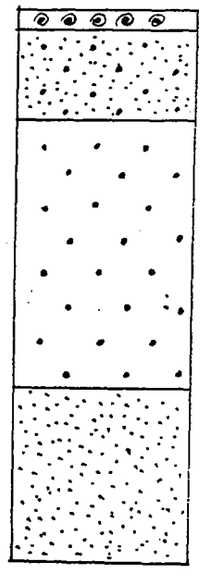
Low outcrops are present near Langey Crossing on the Fitzroy River. One locality was examined on the south side of the main road immediately west of the crossing. A shallow pit has been excavated for road surfacing material. The outcrop consists of ferruginous laterite capping white sandy marl (the colour may be due to surface bleaching) with bands rich in marine fossils.

Mount Jowlaenga Area is of particular interest. The area is essentially flat with a few outstanding mesas and very low surface outcrops. (Photo No. 2). There are six distinct mesas in the area, three of which have been named Stony Hill, Mount Jowlaenga and Stony Hill, south-east of Mount Jowlaenga. This latter name has been replaced by Dampier Hill as it is obviously confusing.

The following additional names for these outstanding hills are proposed to clarify description of the area both geographically and geologically - Reeves Hill, North Cliffs and Castle Rock all of which are plotted on the accompanying map (Note: North Cliffs and Castle Rock were named by Dr. Reeves of the Vacuum Oil Co.). During the season Reeves Hill, Castle Rock, Dampier Hill and the low rocky outcrops extending towards Stony Ridge on the Broome-Derby Road were visited.

Reeves Hill is a mesa rising abruptly to a height of 180 feet above the surrounding country. As is the case with all the outcrops in this area the surface layer is highly silicified to form a hard flinty sandstone. The degree of silicification decreases with depth, but the upper-most 35 feet shows evidence of silicification. The original rock was apparently a quartz sandstone possibly calcareous.

Underlying the upper silicified layer is 90 feet of grey quartz sandstone possibly calcareous, 80 feet of soft brown grey and white calcareous quartz sandstone and at the base of the outcrop white calcareous quartz sandstone or siltstone. The upper beds contain marine fossils.



6' Marine fossils

White siliceous quartz sandstone

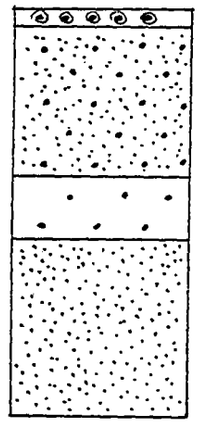
Grey quartz sandstone, possibly calcareous

Brown, white, grey, calcareous quartz, sandstone

White calcareous quartz sandstone or siltstone

Vertical section at Reeves Hill.

Castle Rock is similar to Reeves Hill and rises 130 feet above the surrounding country. Fossils were found in the same relative position, i.e. in the upper few feet of the outcrop. The actual section differs in appearance from that described from Reeves Hill, but this may be due to weathering.



6' Marine fossils

White siliceous quartz sandstone

Brown quartz sandstone

Brown concretionary ferruginous quartz sandstone

Talus and Sand.

Vertical Section at Castle Rock

Although correlation is not suggested it is of interest to note that the brown concretionary sandstone described from Castle Rock is similar to the rock towards the base of Mount Clarkson. The appearance and structures in both sandstones, however, is considered to be due to secondary causes.

Dampier Hill is part of a somewhat larger dissected flat-topped area which continues in a broken line towards Stony Ridge gradually losing elevation in that direction due to a low dip of approximately 2° to the south. The lithology is similar to the other outcrops already described and marine fossils were again observed near the top of the outcrop.

The remaining outcrops viz. Stony Hill, Mount Joolaenga and North Cliffs were not visited, but it is suggested that they are essentially the same as those described.

The outcrops on the southern side of the Fraser River all appear to have a low dip to the south. Where measured the angle varied slightly, but the general dip appeared to be 2°.

Stony Ridge is situated on the main road between Broome and Derby and derives its name from the group of low rocky hills outcropping in the area. There are at least seven of these outcrops on the south side of the road and all are very similar lithologically. The maximum height above ground level is about 60 feet.

The outcrops are badly fractured by weathering and some are simply piles of unorientated boulders.

Lithologically they vary from sandstones to fine conglomerate with siliceous quartz sandstone the most abundant variety. The coarser bands consist almost entirely of quartz with some red jasper and the grains are both well rounded and well sorted. Bedding varies from fine to massive and examples of cross-bedding and ripple marks were observed, but are neither common nor well defined.

Readings were difficult to obtain, but the impression gained was that the beds have a dip varying between 1° and 4° to the north. No fossils were obtained.

(b) Lacustrine.

Deposits of this type are widespread in Dampier Land and in the lower reaches of the Lennard River basin to the north-east of Derby. They are readily identified by the presence of plant fossils. Other unfossiliferous beds probably belong to this group of sediments.

(i) Dampier Land.

Of considerable importance is the thin plant bed near the top of the sandstones on the coast at Broome and Cape Leveque. This is the only fossil horizon so far found in the coastal sandstones.

It appears likely that the sandstones underlying the plant bed are in part, at least, terrestrial. The probably authentic report of dinosaur footprints in the sandstone approximately 50 feet below the plant horizon supports this belief.

(ii) Lower Lennard River Basin.

Yarrada Hill is a low outcrop 20 miles east of Derby. It is composed of low dipping finely bedded to flaggy sandstones and siltstones commonly highly micaceous. Small scale cross-bedding is common at least in the higher portion of the outcrop. Bedding planes where exposed are irregular and smooth with some ripple marks and similar surface structure. Grooves and scratches on the surfaces are of doubtful origin.

The plant bed is 8 to 9 feet below the surface of the outcrop and is rich in organic remains in the form of stalks, woody material and rare leaf impressions. Towards the base of the exposed outcrop softer beds are present.

Thinly bedded micaceous sandstones outcrop along the bank and in the bed of the May River at the foot of Yarrada Hill and represent the extension of this outcrop which also continues as low ridges to the south and south-west.

Micaceous sandstones with plant impressions similar to, though better preserved than those at Yarrada Hill, were found in a gully beside the road between Meda and Kimberley Downs Stations, 10 miles east of Meda Station.

A richly fossiliferous plant bed was found near the fence 10 miles south of Kimberley Downs Station immediately underlying a conglomerate bed.

Similar plant remains have beenreported from the vicinity of Point Torment in micaceous sandstones and grits (Basedow, 1917).

2. Age and Palaeontology.

(a) Marine Fossils.

As has already been indicated fossiliferous marine horizons are rare, but where discovered reasonably good collections were made. They are listed below in descending order.

The highest marine horizon so far identified in the area is that near the top of the outcrops at Reeves Hill, Castle Rock and Dampier Hill. The following fossils were identified by Miss Crespin from these localities -

Dimitobelus sp.
Pinnatimurex cf. clarkei (Moore)
Modiola cf. ensiformis Eth.fil
Pahana sp.
cf. Trigonia

(possibly basal Lower)

This group of fossils indicates a Lower Cretaceous Age for the horizon. The underlying beds of the outcrop continue downwards without any known stratigraphic break and may be basal Lower Cretaceous or Upper Jurassic.

The fossil horizon in the Mt. Jowlaenga area is underlain by marine beds at Langey Crossing. Miss Crespin has identified the following fossils from this locality -

Belemnopsis sp.
Ostrea sp.

These fossils place this horizon in the late Middle to early Upper Jurassic.

The lowest marine horizon with determinable fossils is that examined at Mount Clarkson. These fossils have Middle Jurassic affinities (Dr. Teichert) and the following have been identified from the samples collected -

Belemnopsella nov. sp.
Pleuromya ? sp.

(b) Fresh Water Fossils.

The plant fossil horizons of the Mesozoic are well distributed and will eventually provide good horizon markers. Unfortunately it has been found difficult to identify some of the specimens collected and the precise age of those determined is uncertain. The ages suggested in the following paragraphs are, therefore, tentative and subject to alteration when better information is available.

The horizon of some importance is that examined at Entrance Point, Ganthaume Point and Cape Leveque. As mentioned before it is found at the top of the coastal sandstone at these localities and it seems possible that this horizon may be traced from Broome to Cape Leveque if it has resisted erosion.

The plant identified from this horizon is cf. Otozamites and the age is considered to be Lower Cretaceous.

Beds with well preserved plant remains were examined and sampled from Yarrada Hill and a low rise 10 miles south of Kimberley Downs Homestead. As yet no species have been identified, but it is probable that they are Jurassic or Cretaceous and may eventually be correlated with other horizons with identified plant remains.

Otozamites cf. beaudesnia (Oldham and Morris) has been identified by Miss Crespin from a sample collected 10 miles east of Sale Station and is considered to indicate a Jurassic age.

Jurassic plants were collected from well near Point Torment by Hanedon (1917) and from an illustration in his narrative report it appears that Phillotheca is one of the plants present in these beds.

A collection of fossils was made from a low ridge which crosses the new road to Liverings about 8 miles south-east of Yeeda Homestead. These fossils have not been examined by a palaeontologist, but are similar to Matheria sp.

c. Pre-Mullerine Deposits.

During the season a visit was made to the Sunday Islands near the north tip of Dampier Land. As far as could be seen the islands are composed entirely of metamorphic rocks with some later intrusives and similar to those described from Yampi Sound.

Fallon Island, Allora Island, Salaral Island and Pancock Island were examined from the lugger close inshore and appeared to be essentially quartzites, well jointed and folded with variable dips.

A landing was made near the Mission on the west side of Sunday Island. The outcrops in this locality and elsewhere along the west coast are predominantly a coarse grained quartzose rock which might be termed a quartz mica schist. (Photo No. 7). The rock shows pronounced shearing and most if not all specimens have mica present either as scattered flakes or books along particular bands. Some bands are rich in dark tourmaline. A large "floater" of quartz-feldspar-mica gneiss was noticed in the valley near the Mission buildings. For further information reference should be made to Easedow's report (1917).

V. STRUCTURAL GEOLOGY

The possibility of a greater thickness of sediments in Dampier Land than elsewhere in the Desert basin aroused interest in the structure of the area. The purpose of the present work was to examine the area on a reconnaissance scale paying particular attention to fossiliferous horizons. The following will, therefore, be in the form of suggestions on which the information available and will be modified and added to as further work is completed.

The beds of the Mesozoic sediments are invariably low dipping throughout the area. The steepest measured was 10-12° to the south at Helgubo Anchorage. (Photo No. 3). Elsewhere owing to the small outcrops they are difficult to measure.

Jointing is found in all the Mesozoic outcrops examined and in general appears to approach an east-west, north-south trend e.g. Stony Ridge east-west, north-south; One Arm Point north 82° east, north 8° west; Cape Leveque north 80° east; Melligo Creek north 70° west. This information is not sufficient to establish a joint pattern for the area as the usual rectangular jointing may be due to some surface process such as lateritisation.

Of particular interest in the unravelling of the structure of the area are the bore logs and fossil determinations prepared by Miss Crespin of the bores at Broome and Derby. They are reproduced hereunder -

No. 1 Bore - Broome.

30 feet	Brick red sand.
68 feet	Whitish micaceous sandstone
88-380 feet	Whitish sandstone with fine angular quartz grains and flakes of white mica.
400 feet	Fine whitish to yellowish quartz sand.
537 feet	Fine sand

[illegible] feet Yellowish sand.

[illegible] feet Coarse sand with ? sponge.

[illegible] feet Whitish to yellowish sandstone.

[illegible] feet Hard sandstone

[illegible] feet Greyish sandstone

[illegible] feet Greyish, carbonaceous shale with small foraminifera.

Foraminifera: cf. Sigmoilina, cf. Lituotuba.

[illegible] feet Greyish sandstone.

[illegible] feet Grey glauconitic sandy marl.

[illegible] feet Greyish carbonaceous shale.

[illegible] feet Grey shale

[illegible] feet Grey shale.

[illegible] feet Grey carbonaceous shale.

[illegible] feet Hard shale with carbonaceous fragments and pyrites.

[illegible] feet Greyish sandstone.

[illegible] feet Hard grey calcareous sandstone with patches of green glauconite.

1435 feet Hard calcareous sandstone.

Correlation with other bores and comparison with surface outcrops places the complete bore in the Jurassic-Cretaceous.

No. 2 Bore - Broome

[illegible]-1840 feet Greyish micaceous marl with some carbonaceous material.

1840-1305 feet Grey sandy marl with angular to sub-angular quartz grains, foraminifera and a few fragments of a pelecypod.

Foraminifera: Lenticulina sp.

1305-1390 feet Grey sandy marl with foraminifera.

Foraminifera: cf. Tolypammina.

1390-1405 feet Quartz sand.

[illegible]-1455 feet Hard sandstone and dark grey to black carbonaceous shale.

[illegible]-1468 feet Coarse sand with large rounded grains.

[illegible]-1634 feet Hard, dark grey micaceous, carbonaceous shale.

[illegible]-1775 feet Grey, sandy shale with a little carbonaceous material and glauconite grains.

[illegible]-1834 feet Dark grey micaceous, carbonaceous shale.

Mesozoic - 0 to 1468 feet.

Permian - 1468 feet to 1834 feet.

No. 3 Bore - Broome

[illegible] feet	Fine whitish micaceous sandstone.
[illegible] feet	Coarse sandstone.
[illegible] feet	Fine sand.
[illegible] feet	Coarse sand
[illegible] feet	Quartz sand.
[illegible] feet	Quartz sand.
[illegible] feet	Brown sandstone.
[illegible] feet	Brownish to yellowish sandstone
[illegible] feet	Greyish sandy shale with foraminifera.
	Foraminifera: Lenticulina sp. Bentocerris cf. plate-angularis Franke
[illegible] feet	Hard chocolate coloured sandstone
[illegible] feet	Greyish shale with glauconite.
1011-1042 feet	Greyish micaceous shale with foraminifera and ostracods.
	Foraminifera: Ammodiscus sp. Haplophragmium sp.
	Ostracods: Cythere sp.
1042-1100 feet	Grey micaceous shale with carbonaceous fragments.
1159-1184 feet	Grey shale with ostracods indeterminate.
1170-1178 feet	Hard brownish sandstone.
1178-1173'9"	Dark green glauconitic sandstone with fossils
	Cephalopods: Belemnopsis sp.
1173'9"-1175'6"	Hard calcareous sandstone with a little glauconite.
1175'6"-1302'	Grey sandstone
1402-1436 feet	Hard calcareous sandstone
Mesozoic -	0 - 1436 feet.

No. 4 Bore - Broome

918-960 feet	Sandstone with glauconite grains
960-980 feet	Sandstone with angular quartz grains.
1286-1287'6".	Glauconitic sandstone.
1298-1301 feet	Sandstone with some glauconite.
1401-1416'6"	Sandstone with some glauconite.
1416'6"-1418'	Sandstone with some glauconite.
Mesozoic -	0 - 1418 feet.

Moon Bore - Derby

[illegible] feet — Fine white sandstone with flakes of mica.

[illegible]-1269 feet — Hard greyish mudstone.

[illegible] feet — Greyish calcareous sandstone with fragments of brachiopods, foraminifera, ostracods and brachiopods spines are present in washings.

Foraminifers: Calcitornella sp.
Prodicodaria woodwardi Howchin
Geinitzina triangularis Chapman and Howchin
Hodosarin spirillinaeformis Crespin
Hodosaria sp.

Ostracods: Healdia cf. chawneri Crespin
Hollinella sp.

[illegible]-2000 feet — Dark grey to black micaceous sandstone.

[illegible] feet — Highly polished ovate and flattened ovate pellets of brown limonite in dark brown limonitic matrix.

[illegible] feet — Calcareous sandstone and dark grey micaceous shale with patches of calcareous material.

Mesozoic - 0 - ? feet.

Permian - ? - 2371 feet.

At 1260 feet in the above bore the assemblage of forams is the same as that found at Nerrima, 90 miles South east of Derby, in the Noonkanbah Formation of the Permian. Whether the top of the Permian is to be found at 1260 feet at Derby is not clear.

The surface horizon of the bores at Broome may be taken as the plant bed found on the coast with cf. Otozamites. The base of the Mesozoic was identified in No. 2 bore only but there is little doubt that the depth to Permian will be similar in all bores and will closely approximate 1600 feet.

The only other possible correlation between the Broome bores and surface outcrops is the occurrence of Eurermonsis sp. at Langey Crossing and at 1672 feet in M. 3 Bore Broome. Without further evidence this correlation is unreliable.

At present the relation between the Mesozoic section at Broome and that in the Mount Jowlaenga area is unknown though the evidence points to the possibility of the 200 feet of outcropping sediments in this area being stratigraphically higher than the plant bed at Broome. If this should be the case it allows for as large 1650 feet of Mesozoic sediments, mainly sandstones, above the top of the Permian sediments.

Broadly speaking the relative position of the beds remains much the same on the west coast of Dampier Land as the plant horizon of the formation is found at the same height above sea level at both Broome and Cape Leveque. Admittedly nothing is known about the horizon between these points. Then again the gradual decrease in the height of the outcrops from the Mount Jowlaenga area to Fairy Ridge may be due to a dip of the beds to the south but in fact the measure dip of 2° south would account very closely for this fall to the south.

Insufficient evidence is available to establish a relationship between the basal beds east and north of Derby and those near Broome although they could belong to the same horizon.

Reeves has measured a low dip to the north in the sandstones at North Cliffs and a low easterly dip at Mount Clarkson, (Reeves, 1948). This information points to the possibility of a basinal area existing in Dampier Land. Further work will be necessary to define the structure of the area more completely.

VI. GEOLOGICAL HISTORY

The basement rocks of the Kimberley Area, i.e., the Pre-Cambrian sedimentary, igneous and metamorphic rocks gradually emerged, from Devonian times, to the south of a line from the Sunday Islands along the face of the King Leopold Ranges.

Commencing with the Devonian coral reefs and followed by glacial deposits, marine and freshwater beds of the Permian and Mesozoic, accompanied by undulations in land or sea level, were laid down in this subsiding basin to an estimated maximum thickness of about 12000 feet (Wade, 1936).

Outcrops of Pre-Mesozoic sediments are lacking in Dampier Land but information from bores at Broome and Derby leaves no doubt as to their presence though whether or not the full section of Pre-Mesozoic sediments is present is yet to be proved.

Comparison with other areas and the relative position of Dampier Land to the known edge of the basin indicates that there is a possibility that the basin may be deeper than further east.

The lithology of the Mesozoic from surface and sub-surface information may be divided into two distinct groups, sandstones and shales. The bores at Broome indicate that sandstones are dominant to approximately 1000 feet and below this shales and marls are the dominant type.

This suggests that the Mesozoic sediments were deposited in a basin to the south-west of the highlands of Pre-Cambrian rocks which extend from the Sunday Islands in a south-easterly direction.

Whereas the lower Mesozoic sediments in the section beneath Broome indicate off-shore conditions with marine life, the surface beds have the characteristics of near-shore marine and terrestrial deposits probably connected with a shore line retreating seawards.

Diastrophism since the deposition of the Mesozoic sediments has been restricted to gentle folding and some faulting. It appears likely that Tertiary folding and faulting accompanied the intrusion of the leucite rocks of the Fitzroy River Basin.

VII. PETROLEUM PROSPECTS.

Evidence of petroleum in the Fitzroy River Basin is limited to trace showings of oil in shallow beds in the Devonian limestone near Price's Creek. No bores have been completed on sites where the necessary structural and stratigraphical conditions prevail. The Freney Kimberley No. 1 Bore at Nerrima when completed will be the first to fulfil these conditions.

It can be said, therefore, that up to the present no area in the Kimberley Division has been prospected for oil to a final stage.

The results of the current year's work in Dampier Land indicates that there is every probability that this area may be the most promising so far examined in the Kimberley Division.

About 1650 feet of Mesozoic sediments overlie the Permian sediments which are found outcropping elsewhere in the Fitzroy Basin and which contain beds rich in marine fossils. The presence of Devonian sediments beneath the Permian both here and elsewhere in the Fitzroy Basin is yet to be proved, but it appears likely that Devonian limestone or its equivalent will be found. The results of the Derrima bore will be of considerable interest in this respect as both localities have a similar distance relationship to the Devonian shore-line.

The next stage of the investigation will be to determine whether any suitable structures exist in the area and then to carry out detailed mapping of any structure located. In addition the areal geology should be completed and the fossil collections of the various fossiliferous horizons extended.

During the further geological examination of the area there is a definite need of a planned geophysical survey to extend our knowledge of the Devonian-Mesozoic basin to areas in which no outcrops exist and in which sub-surface information is non-existent.

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The descriptions of the bore logs from Broome and Derby were also compiled by Miss Crespin with some modification of the formation boundaries by the writers.

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PHOTOGRAPHS

Photographs are not available in the hard copy of record 1949/11.

No. 1. Horizontal Mesozoic sandstone at King Peaks.

No. 2. View north across Fraser River from Castle Rock with North Cliffs in background and part of Reeves Hill in middle distance.

No. 3. Gently dipping Mesozoic sandstone at Malumbo Anchorage.

No. 4 Small scale structure in sandstone at Shenton Bluff.

No. 5 Cliffs at Cantheaume Point with plant horizon at top of section.

No. 6. Worm tracks on bedding plane near Malumbo Anchorage.

No. 7. Steeply dipping Pre-Ballogine quartz mica schists and quartzites on west coast of Sunday Island.

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