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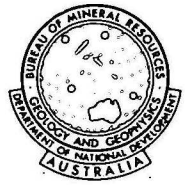

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STRATIGRAPHIC DRILLING IN THE SOUTHERN CARPENTARIA BASIN, 1970

by

R.S. Needham, J. Smart, K.G. Grimes*, and H.F. Doutch

*Geological Survey of Queensland

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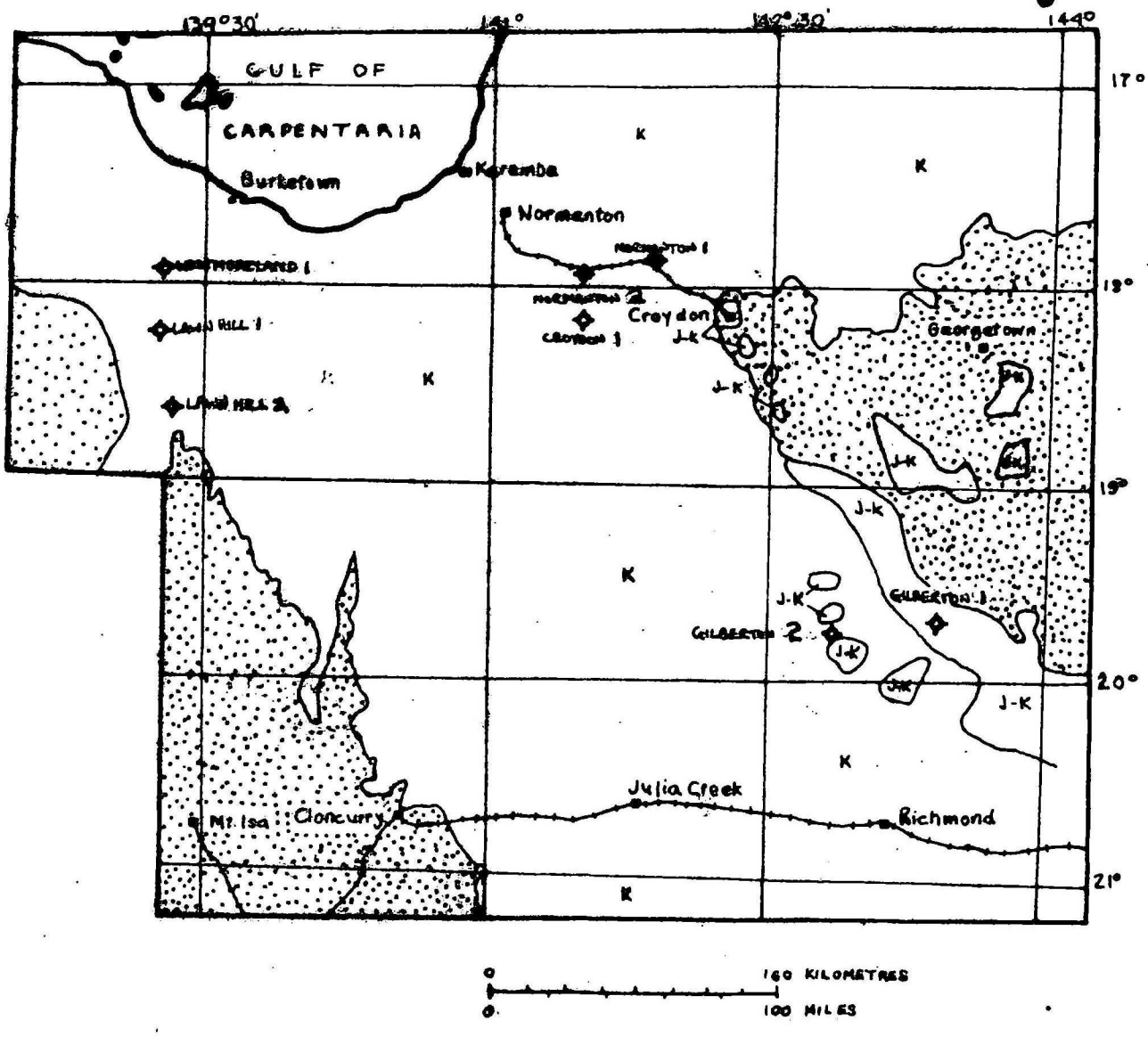
SUMMARY

Stratigraphic drilling during 1970 in the south and west of the Carpentaria Basin in northern Queensland supplemented surface mapping of poorly exposed units, provided information concerning depths, thickness, and dips of strata, and provided fresh rock for palaeontological, palynological, and chemical studies.

Drilling produced cores of the Hampstead and Loth Formations (the Eulo Queen Group), the Gilbert River Formation, the Wallumbilla Formation, the Toolebuc Limestone, and the Allaru Mudstone. Cores were taken of the basement rocks when penetrated. Comparison and correlation of lithology and palynology between the Jurassic - Cretaceous sandstone of the Gilberton area and the northern Eromanga Basin sequence was facilitated. The thickness and subcrop extent of several units in the Cretaceous and Cainozoic sequence under the Claraville and Armraynald Plains were determined.

LOCALITY MAP

Fig. 1



K — Cretaceous mudstone and labile sandstone (with Cainozoic cover)

J+K — Jurassic - Cretaceous sandstones

Basement

Stratigraphic hole

To accompany Record 1971/142

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INTRODUCTION

Stratigraphic drilling during June and July 1970 was undertaken to augment results of 1969 field mapping and drilling in the southern part of the Carpentaria Basin (Doutch et al., 1970; Grimes & Smart, 1970). Five holes were drilled with a Mayhew 1000 rig, which was manned by two drilling crews, over a period of 54 days; footage totalled 821 m with 278 m of coring averaging 70% recovery (one hole was continuously cored to 243.9 m). Three holes were drilled by a Fox 500 rig with one crew, over a period of 27 days; footage totalled 457 m with 39 m of coring averaging 85% recovery.

The object of the drilling was to provide lithological information of Mesozoic rocks in the south and west of the Carpentaria Basin and to confirm their subcrop extent, as a check on surface mapping. Specific objectives were:

(a) to obtain fresh lithological samples from unexposed or poorly exposed units;

(b) to obtain fresh material for palynological examination, for comparison with equivalent Jurassic and Cretaceous units in the Eromanga Basin, and to attempt to erect preliminary palynological controls;

(c) to check thicknesses, dip, and extent of subcrop of units, towards the centre of the basin; also to check for lateral or local variation of units;

(d) to continuously core the Toolebuc Limestone for close comparison with wireline logs and to obtain fresh samples of the oil shale within the formation for chemical analysis;

(e) to test wireline logging equipment and to obtain radiometric and electric logs of all holes drilled.

Much useful information was obtained, but as all holes apart from Gilberton 2 were limited to a depth of 152 m (500 feet) drilling often ceased before desired lithological targets were reached. Gilberton 2 was completed at a depth of 244 m (800 feet); it was cored continuously through the Wallumbilla Formation, the Gilbert River and Loth Formations, and most of the Hampstead Formation (nomenclature after Smart et al., 1971).

Good cores of the whole of the Toolebuc Limestone were obtained from Croydon 1 but no gamma-log was obtained for comparison. A bottom-hole core of Toolebuc Limestone was obtained in Normanton 2 together with a gamma-log, but only 8 m of the formation was penetrated before drilling ceased at 152 m (500 feet). Holes Normanton 1 and 2 and Croydon 1 indicate the subcrop extent of the Toolebuc Limestone and the thickness of Cainozoic sediments over the Claraville Shelf.

Westmoreland 1 and Lawn Hill 1 penetrated Allaru Mudstone, of which cores were taken for palynological study; cores from Lawn Hill 1 yielded a microflora indicative of a post-Toolebuc Limestone (Allaru Mudstone) age (Burger, pers. comm.). Cores of the Toolebuc Limestone and the Wallumbilla Formation were taken in Lawn Hill 1, but in spite of the hole's proximity to the margin of the Carpentaria Basin, the expected pre-Wallumbilla Formation quartzose sandstone did not occur within the depth drilled.

Lithological logging of core and cuttings was carried out with the aid of a binocular microscope at the drill site by members of the field party (H.F. Doutch, J. Smart, R.S. Needham, BMR, and K.G. Grimes, GSQ). Selected cores were examined for micropalaeontological information by D. Burger, BMR.

Electric and radiometric (gamma-ray) logging of holes was attempted by members of the field party. The logger accompanying the Fox Rig produced no useful logs owing to failure of the paper-drive mechanism. The Widco 1000 wireline logger accompanying the Mayhew 1000 rig provided useful radiometric logs of most holes, although minor mechanical faults developed at times. Correlation of Mesozoic units by wireline logs is discussed more fully in Doutch et al. (1970).

No estimates of water supply yields from the holes were made.

Naming of the holes is by 1:250,000 Sheet areas, i.e. BMR Gilberton 2 refers to the second stratigraphic hole drilled by the Bureau of Mineral Resources in the Gilberton 1:250,000 Sheet area.

Locations are shown in Figure 1, and on Preliminary and coloured editions of the 1:250,000 geological sheets that post-date the drilling.

BMR Gilberton 1 (Figure 2)

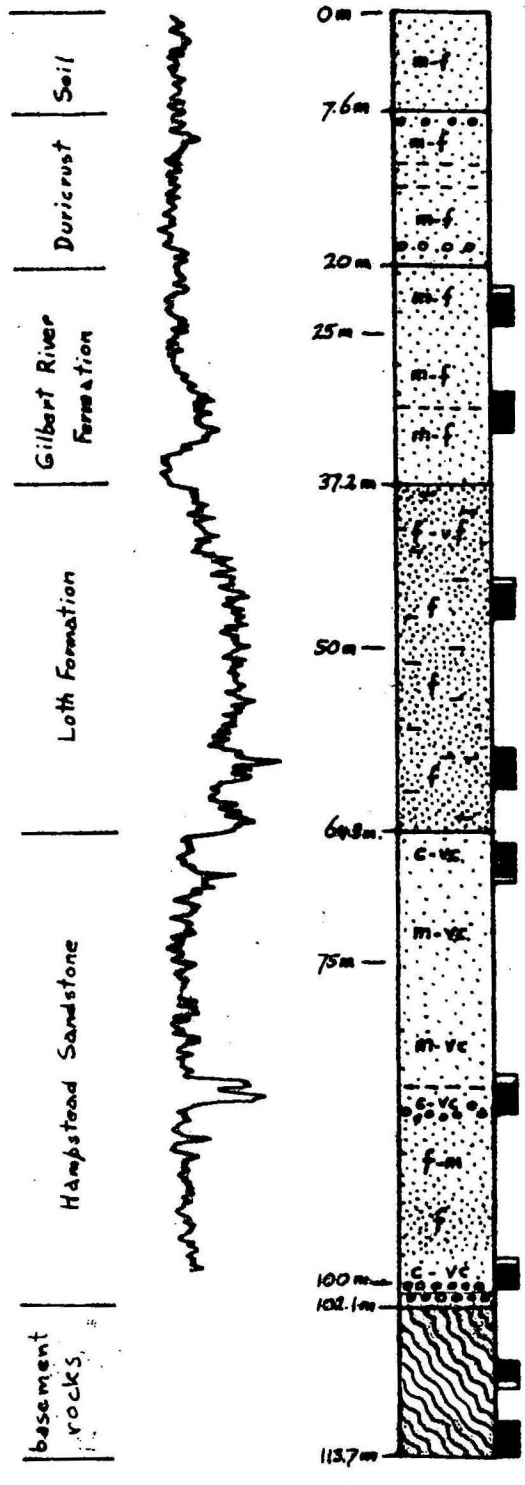
Position: 19°42'S, 143°44'E (position approximate), on the Gilberton Plateau, 48 km east-northeast of Middle Park homestead, 120 km by road north of Richmond.

Access: Bush track from Chudleigh Park homestead to Middle Park homestead, over the Gilberton Plateau.

Objectives: (a) to provide comparison of Jurassic-Cretaceous sandstones in the Gilberton Sheet area (Smart et al., 1971) with the Northern Eromanga sequence of Vine (1966);

(b) to obtain fresh core of the Jurassic-Cretaceous sandstones for palynological and petrological examination;

(c) to check thicknesses of Mesozoic units and the depth of the basement below the Gilberton Plateau.



Red friable sandy soil.

Sand, clayey in part, a few pebbles, fragments sandstone in indurated sandy matrix

CORE 1. 21·35 - 24·35 m. recovered 2.01 m
Quartzose clayey sandstone, slightly weathered; thin bedded.

CORE 2. 29.74 - 32·74 m. recovered 2·98 m.
Quartzose clayey sandstone and siltstone, thin bedded, ripple-drifted; some white clayey siltstone.

Fine quartzose sandstone and siltstone

CORE 3 42.7 - 45.7 m. recovered 2.8 m.
Soft fine sandstone and siltstone, clayey and micaceous, ripple-drifted.

CORE 4 57.9 - 60.9 m. recovered 2.95 m.
Quartzose sandstone; interbeds soft micaceous siltstone, ripple-drifted.

CORE 5 65.67 - 68.67 m recovered 2.77 m
White quartzose sandstone, cross-bedded.

Quartzose sandstone; rare plant fragments.

CORE 6 83·87 - 86·87 m. recovered 2.60 m.
Coarse pebbly quartzose sandstone; 60 cm silty clay at top.

Quartzose sandstone, cross-bedded.

CORE 7 98.50 - 100.50 m recovered 1.18 m
Quartzose sandstone, pebbly bands; metamorphic clasts.
White clay; coarse to very coarse grains of quartz.
CORE 8 106.75 - 108·6 m. recovered 1.12 m.
Weathered metamorphic rock.
CORE 9 111.32 - 113·76 m. recovered 2.44 m.
Weathered amphibolite.

Fig. 2

B.M.R. GILBERTON S.H. 1.

Drilling

Drilling rate was fair. The hole was drilled with air to 71 m, when lost circulation and caving forced a change to mud. The high porosity of the formations, particularly the Hampstead Sandstone, required large quantities of mud; over 26000 litres of water were used together with one ton of bentonite. The difficulty of carrying water from the nearest supply (27 km) over rough, thickly wooded terrain caused numerous delays. Nine cores, totalling 24.2 m, were taken, with average recovery of 82%.

Log

0 - 7.6 m Red sandy soil

7.6 - 20 m 'Duricrust': yellow and red iron-stained indurated sandy siltstone, with iron-stained rounded to angular quartz grains

20 - 37.2 m Gilbert River Formation: weathered or slightly weathered to 30 m. Fine- to medium-grained, subangular to rounded, quartzose sandstone. Cross-bedded, with silty clay matrix.

Core 1, 21.35 - 24.35 m, recovered 2.01 m.

Core 2, 29.74 - 32.74 m, recovered 2.98 m.

37.2 - 64.3 m Loth Formation: very fine to fine, subangular, white quartzose sandstone, in part micaceous and ripple-drifted. Interbeds of pale yellow, red, and mauve micaceous siltstone.

Core 3, 42.7 - 45.7 m, recovered 2.8 m.

Core 4, 57.9 - 60.6 m, recovered 2.95 m.

64.3 - 102.1 m Hampstead Sandstone: medium- to coarse-grained, ill-sorted, subangular quartzose sandstone; quartz grains commonly pitted; thick beds and cross-beds; few pebbles of igneous rocks. Rare plant remains from 70 - 78 m.

Core 5, 65.67 - 68.67 m, recovered 2.77 m.

Core 6, 83.87 - 86.87 m, recovered 2.60 m.

Core 7, 98.50 - 100.5 m, recovered 1.18 m.

102.1 - 113.7 m Basement Rocks: black, fine-grained amphibolite weathered to 111.0 m.

Core 8, 106.75 - 108.5 m, recovered 1.12 m.

Core 9, 111.32 - 113.76 m, recovered 2.44 m.

Burger (pers. comm.) did not find any palynological samples fresh enough for useful determinations.

The gamma-ray log clearly picked out the Loth Formation. A distinct peak occurred within the Hampstead Formation from 83.8 to 85.3 m.

BMR Gilberton 2 (Figure 3)

Position: 19°51'S, 142°48'E, 0.5 km east of Evelyn Bore, Reg. No. 4333, 14.5 km SSE of Kaldah homestead, which is approximately 140 km by road northeast of Richmond.

Access: The drill site is adjacent to the main Richmond-Kaldah homestead track.

Objectives: (a) to obtain continuous core of the Jurassic-Cretaceous succession, thus facilitating detailed palynological and lithological examination;

(b) to test the thickness of the succession and to obtain core of the strata immediately overlying the basement and examine it for evidence of a Lower Jurassic or possibly Triassic age;

(c) to obtain a complete wireline log of the succession;

(d) to facilitate comparison of the Carpentaria Basin sequence of Smart et al., (1971) with the Northern Eromanga sequence of Vine (1966).

Drilling

The drilling rate below 100 m was extremely slow because of worn bits and wedging of thin-bedded units in the core barrel. The drill string was jammed down the hole at 164.52 m for 2½ days, caused by loss of circulation. The hole was continuously cored from 18 m, with an average recovery of 67%. Details of coring are given in Table 1.

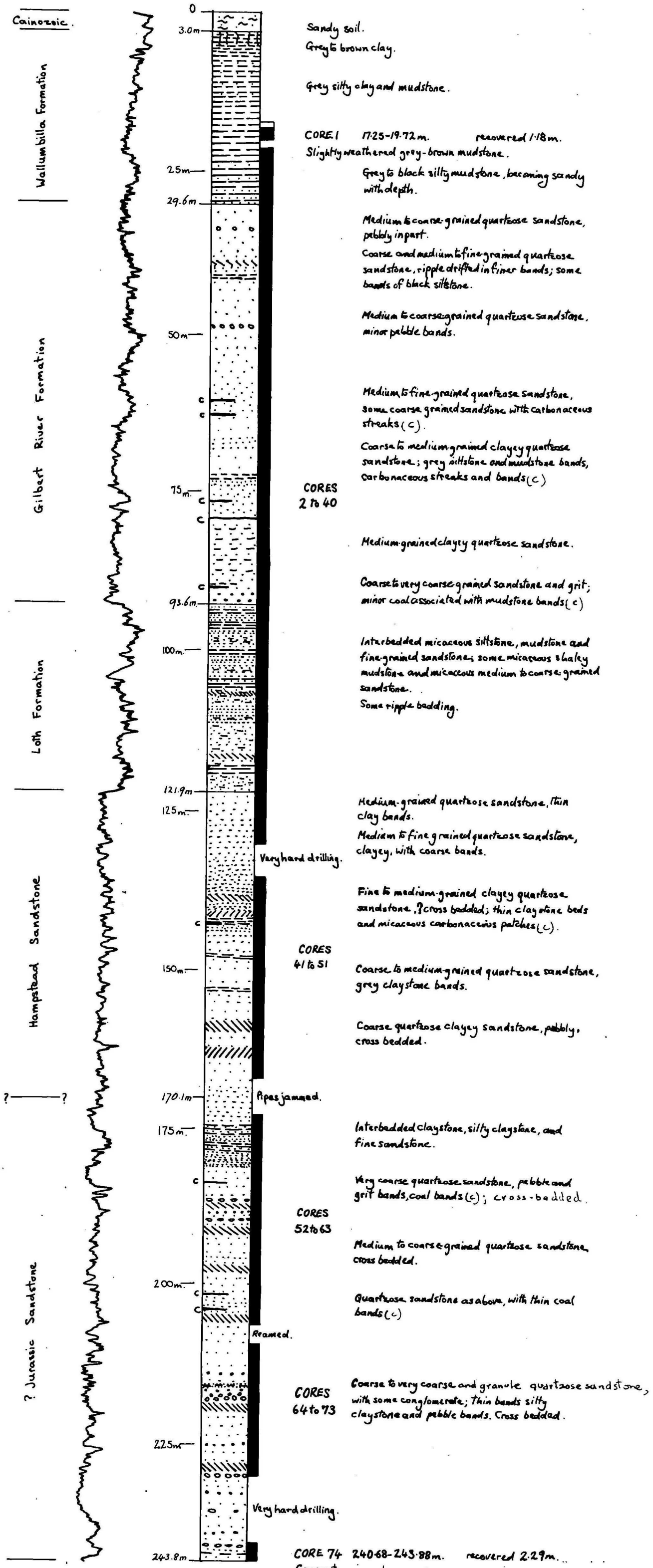


Fig 3

B.M.R. GILBERTON S.H. 2

To accompany Record 1971/142

E54/A16/8

TABLE 1

CORE DETAILS - BMR GILBERTON S.H. 2

Core	Interval From	Interval To	Length Cored	Length Recovered	%Recovery
1	17.25	19.32	2.07	1.18	57.0
2	21.48	22.73	1.25	1.22	97.6
3	22.73	25.22	2.49	2.45	98.4
4	25.22	28.05	2.83	2.45	86.6
5	28.05	31.08	3.03	2.905	95.9
6	31.08	34.10	3.02	2.31	76.5
7	34.10	36.70	2.55	1.93	75.7
8	36.70	39.70	3.00	3.00	100
9	39.70	42.72	3.02	3.02	100
10	42.72	45.72	3.00	2.72	90.6
11	45.72	48.56	2.84	2.57	90.5
12	48.56	50.88	2.32	2.12	91.4 Lost in reaming
13	51.25	54.28	3.03	2.88	95.0
14	54.28	57.41	3.13	2.95	94.2
15	57.41	60.42	3.01	1.93	64.1
16	60.42	63.45	3.03	3.66	87.7
17	63.45	66.28	2.83	2.34	82.6
18	66.28	69.18	2.90	2.10 (1.62)	72.4
19	69.18	72.08	2.90	1.92 (3.16)	66.2 0.30 picked up in next core
20	72.08	75.12	3.04	2.86	94.0
21	75.12	78.32	3.20	3.05	95.3
22	78.32	81.89	3.57	0.65 (2.39)	18.2
23	81.89	84.66	2.77	2.75 (3.04)	99.2 0.36 picked up in next core
24	84.66	87.35	2.69	2.68	99.6
25	87.35	90.55	3.15	2.20	69.8
26	90.55	93.21	2.66	2.64	99.2
27	93.21	96.30	3.07	2.54	82.7
28	96.30	98.92	2.62	2.62	100
29	98.92	102.09	3.17	2.34	73.8
30	102.09	105.38	3.32	0.54	16.2
31	105.38	108.31	2.93	2.50	85.3
32	108.31	111.21	2.90	1.38	47.5
33	111.21	114.27	3.06	2.09	68.3
34	114.27	117.54	3.27	0.85	25.9
35	117.54	120.47	2.93	2.68	91.4
36	120.47	123.57	3.10	2.45	79.0
37	123.57	125.09	1.52	Nil	0.0

Core	Interval From	To	Length Cored	Recovered	%Recovery
38	125.09	128.11	3.08	2.15 (1.99)	69.8
39	128.59	130.91	2.32	2.07 2.33	89.2 0.08 picked up in next core
40	130.91	133.16	2.25	2.25	100.0
41	138.90	142.02	3.12	2.97	95.1
42	142.02	145.22	3.20	2.17	67.8
43	145.22	146.87	1.65	1.49	90.3
44	146.87	150.02	3.30	2.50	75.7
45	150.02	152.15	3.20	1.80	56.2
46	152.15	153.22	1.07	0.76	71.0
47	153.22	156.01	2.79	2.44	87.4
48	156.01	159.03	3.02	2.24	74.1
49	159.03	161.63	2.60	1.10	42.3
50	161.63	164.52	2.89	2.68	92.1
51	167.22	170.32	2.70	2.63	97.4
52	170.32	173.40	3.08	2.15	69.8
53	173.40	176.37	2.97	0.73	24.5
54	176.37	179.66	3.29	3.05	92.7
55	179.66	182.80	3.14	2.29	72.9
56	182.80	185.92	3.12	0.60	19.2
57	185.92	189.13	3.21	0.74	23.0
58	189.13	192.37	3.24	3.12	96.2
59	192.37	195.34	2.97	1.24	41.7
60	195.34	198.47	3.13	1.46	46.6
61	198.47	201.66	3.19	1.32	41.3
62	201.66	203.64	1.98	1.80	90.9
63	203.64	206.75	3.11	2.20	70.7 drilled out
64	209.01	211.93	2.92	2.74	93.8
65	211.94	215.08	3.14	3.00	95.5
66	215.08	218.12	3.04	2.53	83.2
67	218.12	221.32	3.20	2.81	87.8
68	221.32	224.46	3.14	2.55	81.2
69	224.46	227.52	3.06	2.95	96.4
70	227.52	228.26	0.74	(0.90) (Gained 0.16)	121.6
71	228.26	230.08	1.82	1.56	85.7
72	230.08	230.17	0.9	0.9	100
73	230.17	230.36	0.19	0.18	94.7
74	240.68	243.88	3.20	2.29	71.5

Log

0 - 3 m Sandy soil

3 - 29.6 m Wallumbilla Formation: grey-black mudstone, weathered to 20 m; some carbonaceous material on fracture surfaces; becomes sandy with light grey siltstone bands towards the base.

29.6 - 93.6 m Gilbert River Formation: light grey fine, medium- and coarse-grained (rounded to sub-angular) quartzose sandstone with white clayey matrix; few pebble bands and mudstone bands; minor carbonaceous layers up to 5 mm common towards base. Rare plant fragments.

93.6 - 121.9 m Loth Formation: white to grey very fine to fine-grained micaceous sandstone interbedded with grey mudstone and micaceous siltstone bands; some ripple-bedding.

121.9 - 175.0 m Hampstead Sandstone: light grey, fine to medium-grained clayey quartzose sandstone with pebble bands, becoming coarser below 145 m; grey claystone bands, carbonaceous patches, cross-bedding common.

175.0 - 243.8 m Jurassic sandstone: (possibly Hampstead Sandstone). Coarse to very coarse-grained quartzose sandstone and conglomerate, strongly cross-bedded, with numerous grit and pebble bands and a few silty claystone and coaly bands.

D. Burger (pers. comm.) noted that Core 53 at 174.30 m yielded an Upper to Middle Jurassic microflora which could be identified with Evans' (1966) spore unit J5-6, probably somewhere in the upper part. Similar microflora is known from the Hooray Sandstone in the Eromanga Basin (Vine, 1966). Core 31 at 105.89 m and core 27 at 93.98 m both yielded assemblages which represent a level very close to the Jurassic-Cretaceous boundary, i.e. approximately at the transition of Jurassic unit J5-6 and Cretaceous unit K1a. Equivalent assemblages are also known from the Hooray Sandstone, and the higher part of the Orallo Formation in the Surat Basin (Burger, 1968) Core 7 at 34.44 m and Core 4 at 25.87 m produced Cretaceous microfloras, assigned to the upper part of unit K1a. These assemblages are also known from the upper Hooray Sandstone and the higher Bungil Formation in the Surat Basin.

Other cores examined were barren or yielded poor samples unsatisfactory for detailed study.

Basement was not reached; the increasing coarseness of the sandstone sequence towards the bottom of the hole and also a greater range of rock types encountered in pebble bands towards the bottom of the hole suggested that basement was probably fairly close.

The gamma-ray log of the hole displayed a general increase in radioactivity in the interval from 90 to 120 m, and this is taken as representing the Loth Formation; the gradual transition of rock type made it impossible to place a definite base to the Loth Formation from lithological evidence alone. Radioactivity is more variable toward the bottom of the hole; the log shows a peak at the bottom. No electric log was obtained taken due to water penetrating the probe unit.

BMR Normanton 1 (Figure 4)

Position: 17°56'S, 141°48'E, 200 m east of May Vale homestead, both 1.5 km north of Blackbull siding on the main Normanton-Croydon Road, 90 km from Normanton.

Access: May Vale homestead track.

Objectives: (a) to test the thickness of Cainozoic sediments over the Claraville Shelf and to ascertain the Mesozoic units present within 155 m of the surface;

(b) to test the easterly extent of the Toolebuc Limestone;

(c) to obtain a bottom core (depth 155 m) for palynological study, including dating of the mudstone unit(s);

(d) to obtain a wireline log of the succession penetrated.

Drilling

Drilling rate was good; a core of 3 m (100% recovery) was taken at the bottom of the hole. Water occurred below 30 m depth.

Log

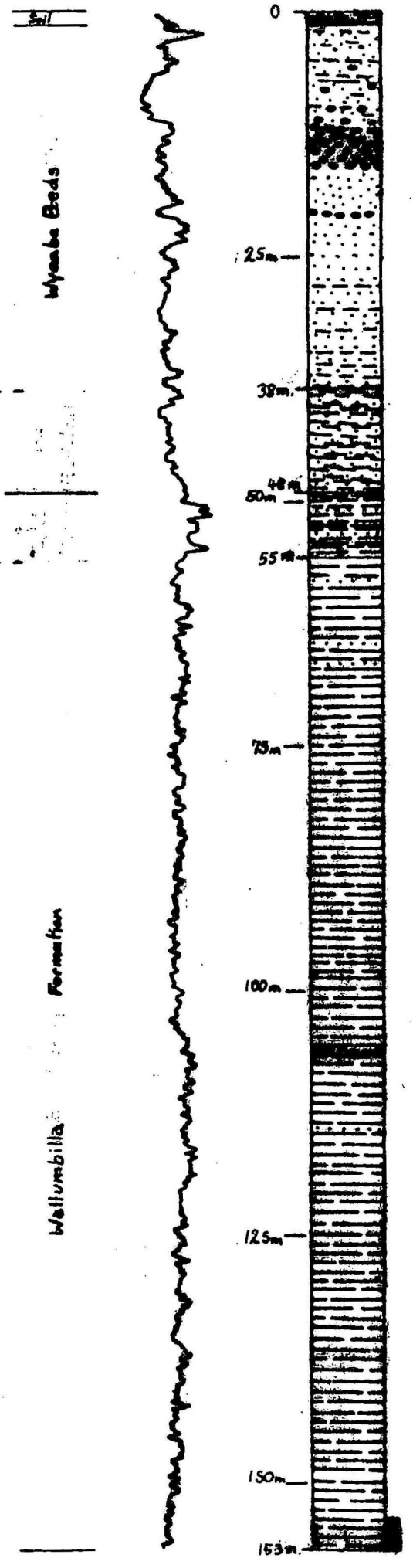
0 - 38 m Wyaaba Beds: silty clay and sand. Poorly consolidated, buff coloured with yellow and red ferruginous staining.

38 - 48 m Allaru Mudstone? light grey to brown clay with quartzose sand grains; some pisoliths and haematitic fragments;

48 - 55 m Toolebuc Limestone? light mauve weathered mudstone;

55 - 153 m Wallumbilla Formation: grey to black mudstone and claystone.

Core 1, 152.4 - 155.44 m, recovered 3.04 m.



Soil(

Poorly sorted silty clays, sand, silt; red-brown pitted quartz fragments.

Quartzose pebbles.

Brown quartzose sand, silty below 18m, pebbles at 19.50m.

Grey clay (calcareous?) with coarse clear-brown quartz grains; red ferruginous clay beads, pisolites and haematitic fragments

Grey clay with clear-buff quartz grains; some light mauve mudstone 53.35-54.43m. Mostly purple-mauve mudstone with quartz fragments; some light grey clay.

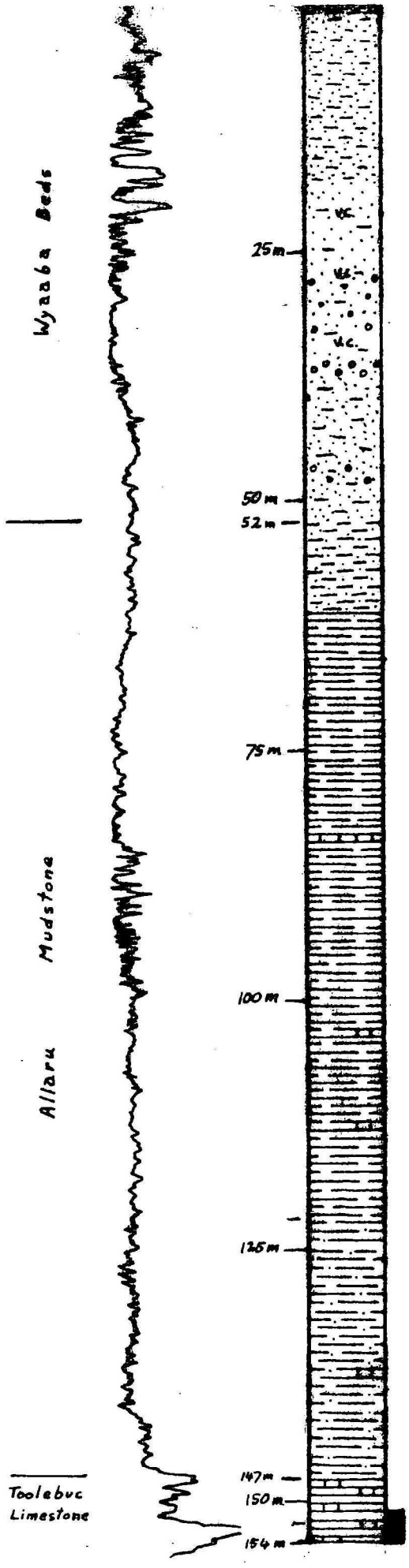
- purple mudstone and quartz grains)

Grey to dark grey clayey mudstone

- pebbles)

CORE 1 152.40-155.44m. recovered 3.04m.

Black mudstone, silty sandy bands irregular and rare at top, but [illegible] at bottom.



Soil

Orange/brown, illsorted, fine to coarse-grained sand, silt, some grey clay, and ferruginous fragments.

Very coarse clear to brown quartz sand, loosely cemented by light grey clay.

As above with well rounded quartz pebbles up to 5cm. Fragments of black slate

Very soft, illsorted quartz sandstone with grey clay matrix.

As above, with quartz pebbles to 2cm.

As above, no pebbles.

As above, plus weathered clayey mudstone

Yellow silty mudstone

Grey silty mudstone

— Calcareous band

Grey silty mudstone

— hard band

Grey silty mudstone

— hard band

Grey silty mudstone

Grey silty mudstone, with silt, sand.

— hard band

Grey mudstone, silt, sand.

Dark grey silty mudstone, white crystalline limestone bands increasing in thickness and frequency with depth.
CORE 1 150.9–153.9, recovered 2.79m.

Fig 5 **B.M.R. NORMANTON S.H. 2**

To accompany Record 1971/142 E54/7/3

D. Burger (pers. comm.) noted that palynological samples taken from the core were either barren or yielded organic material unsuitable for age determination.

Neither the Gilbert River Formation nor basement rocks were encountered within 155 m of the surface.

An unusual mauve weathered mudstone could be taken to represent the weathered remnants of the Toolebuc Limestone because it correlated with a peak in the radiometric log, the hole thus having penetrated the Toolebuc Limestone very near its subcrop to the east. It follows that the grey clay between these rocks and the quartzose sand of the Wyaaba Beds could be a remnant of Allaru Mudstone. However, the ferruginous clay and pisoliths in it are reminiscent of reworked laterite in other boreholes (cf Warner, 1968; Smart & Grimes, 1971) and may indicate the base of the Wyaaba Beds, while the mauve mudstone may not be Toolebuc Limestone but rather part of a deep weathering horizon in the Bulimba Formation and/or Wallumbilla Formation. Irrespective of the presence or absence of the Toolebuc Limestone, and lack of fossils notwithstanding, regional distribution of the Allaru and Wallumbilla Formations strongly suggests that the mudstone from this hole is part of the Wallumbilla Formation. A minor gamma-ray peak occurs near the surface within the Wyaaba Beds.

BMR Normanton 2 (Figure 5)

Position: 17°59'S, 141°28'E, about 150 m south-southwest of East Haydon siding, 61 km from Normanton on the Croydon road.

Access: The hole is adjacent to the track running south from East Haydon to the gravel pits at Clarina Creek.

Objectives: (a) to test the thickness of the Cainozoic sediments over the Claraville Shelf;

(b) to determine the depth of the Toolebuc Limestone.

Drilling

Drilling rate was good. A core of 2.79 m (93% recovery) was taken at the bottom of the hole. A small quantity of water was encountered at 20 m depth.

Log

0 - 52 m Wyaaba Beds: silty clay, soft siltstone and fine to coarse-grained sand. Poorly consolidated, with a light grey clay matrix; some ferruginous staining.

52 - 147 m Allaru Mudstone: grey silty mudstone.

147 - 154 m Toolebuc Limestone: dark grey shaly calcareous mudstone with horizontal white prismatic calcite bands (recrystallized Inoceramus fragments) which increase in percentage with depth. The thickness of the bands increases from 0.8 mm to 1.6 mm with depth.

Core 1, 150.88 - 153.92 m, recovered 2.79 m.

The increase in radioactivity at 147 m was taken to represent the top of the Toolebuc Limestone. This formation was probably not completely penetrated.

BMR Croydon 1 (Figure 6)

Position: 18°18'S, 141°30'E, (position approximate), 80 km west of Croydon.

Access: Dirt road to Old Coralie homestead, then approximately 26 km cross-country to the west.

Objectives: (a) to test thickness of Cainozoic sediments over the Claraville Shelf;

(b) to test depth and thickness of Toolebuc Limestone and to obtain continuous core of the Toolebuc Limestone for lithological and chemical studies;

(c) to obtain a radiometric log of the Toolebuc Limestone, thus enabling detailed comparison between radiometric log and continuous core;

(d) to determine the Mesozoic units present within 155 m of the surface.

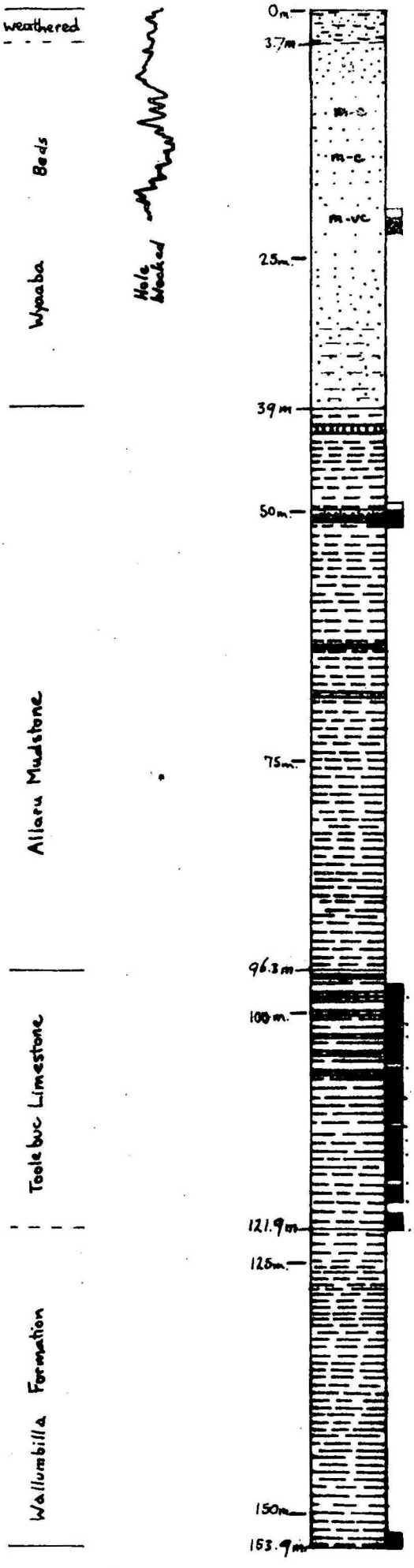
Drilling

The drilling rate was slow; coring rate was very slow through some of the Toolebuc Limestone. Fourteen cores totalling 22 m were taken with an average recovering of 75%. Details of cores are given in Table 2. Water occurred below 20 m depth.

Log

0 - 39 m Wyaaba Beds: soft clayey sandstone and soft sandy mudstone; grey to white in places, poorly consolidated and poorly sorted.

39 - 96.3 m Allaru Mudstone: grey mudstone; some silty, calcitic, carbonaceous and gypsiferous bands.



Grey sandy clay, reddish in lower part; sand v.c.

Grey-white soft clayey sandstone, poorly sorted.

CORE 1 19·81 - 22·40 m. recovered 1·57 m.
Top 1·00 m. loose sand, washed out; soft clayey quartzose sandstone and grey-white silty mudstone with sand grains.

Soft grey sandy mudstone, sand m-c.

Grey to brown silty mudstone, hard calcareous band at 41·75 - 42·36 m.

CORE 2 48·76 - 50·90 m. recovered 1·57 m.
Grey laminated silty mudstone, black carbonaceous streaks and gypsum bands. 20 cm. impure limestone with cone-in-cone structure at top.

Grey mudstone as above, with a few thin hard calcareous bands.

Grey mudstone

CORES 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 — Continuously cored. 97·63 - 121·92 m. recovered 22·34 m.
Black to dark brown calcareous, bituminous shale; abundant calcite bands, decreasing with depth. More bituminous at top than lowest part.

Black - dark grey mudstone, slightly calcareous?

Dark grey non-calcareous mudstone

Dark grey mudstone

CORE 14 152·40 - 153·92 m. recovered 1·47 m.
Dark grey mudstone

Fig 6 B.M.R. CROYDON SH. 1

To accompany Record 1971/142

E54/A11/1

TABLE 2

CORE DETAILS - BMR CROYDON S.H.1

Core	Interval (m) From	To	Length (m) Cored	Recovered	%Recovery
1	19.81	22.40	2.59	1.57	60.8
2	48.76	50.90	2.13	1.57	73.9
3	97.54	98.40	0.86	0.79	91.2
4	98.40	101.45	3.05	2.97	98.0
5	101.45	102.72	1.27	1.78*	100+*
6	102.72	105.77	3.05	2.59	85.0
7	105.77	108.81	3.05	2.49	81.7
8	108.81	111.86	3.05	2.95	98.7
9	111.86	112.95	1.07	1.02	98.0
10	112.95	114.78	1.83	1.65	91.6
11	114.78	117.83	3.05	2.64	86.7
12	117.83	119.18	1.37	1.37	100.0
13	120.39	121.92	1.52	1.40	88.3
14	152.40	153.92	1.52	1.47	96.7

* Picked up material dropped by previous cores

96.3 - 121.9 m (?) Toolebuc Limestone: cores 3 to 6: black to dark brown calcareous shale with abundant thin calcite bands and bands of impure white limestone; cores 7 to 9 dark brown calcareous shale, shelly material common, bituminous appearance; cores 10 to 13 dark brown calcareous mudstone with few calcite veins; becoming less calcareous and bituminous with depth.

121.9 - 153.9 m Wallumbilla Formation: 121.9 - 135 m dark grey mudstone, top parts lightly calcareous. 135 - 153.9 m dark grey mudstone.

Palynological samples taken from the core were either barren or yielded organic material unfit for closer determination (D. Burger pers. comm.).

At the first attempt no detailed radiometric log was obtained owing to a temporary mechanical failure of the logging equipment. A second attempt was made to log the hole seventeen days later, but it was blocked at a depth of 21 m. The base of the Toolebuc Limestone is suggested here to be the bottom of the calcareous bituminous strata. Cores of the Toolebuc Limestone will eventually be tested for shale oil and trace metal content.

BMR Westmoreland 1 (Figure 7)

Position: Long. 17°53'S, Lat. 139°20'E, 27 km west-southwest of Burketown, 50 m west of the Burketown-Gregory Downs Road, 400 m south of the Westmoreland turnoff.

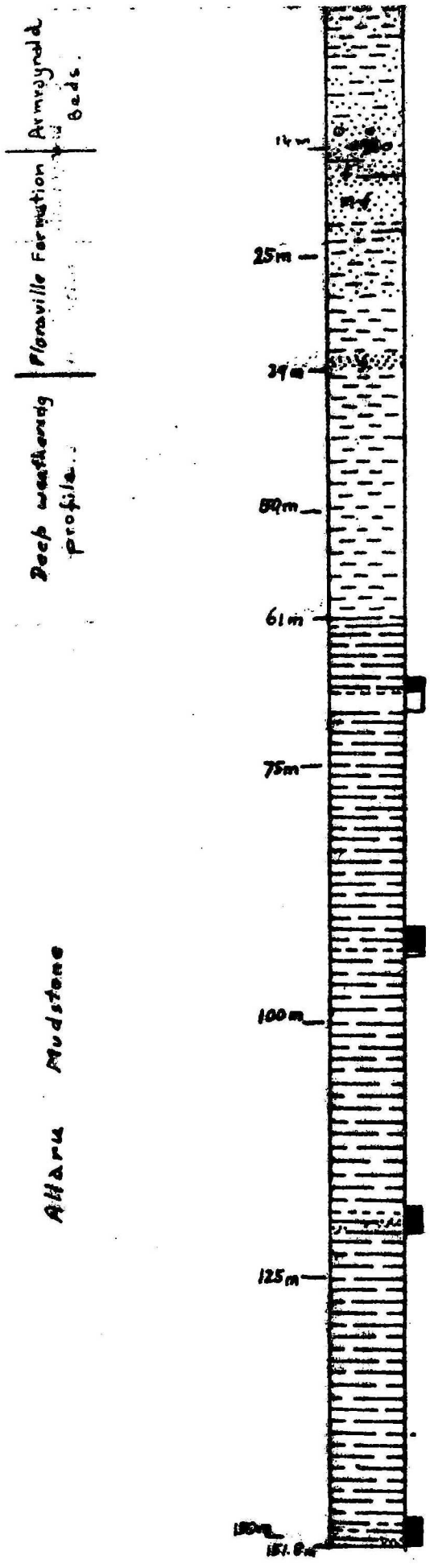
Access: Adjacent to formed road.

Objectives: (a) to determine the presence or absence of the Normanton Formation;

(b) to determine those Mesozoic units present within 152 m of the surface of the Armraynald Plain;

(c) to obtain cores for palynological and lithological examination;

(d) to obtain core of the Toolebuc Limestone if present.



Grey and brown clay and silt, minor sand

Light brown sandy clay and silt.

Light brown sand and clay

Pebbles and hard (silcreted) medium sandstone

Silcrete, white clayey very fine sandstone, and pale gre

Grey medium to fine sandstone. some silcrete.

Light green and grey clay and silt with white m-f. sandstone

White sandy clay, slightly mottled

Mottled pink and grey sandy clay

Mottled red and grey clay with hard white sandstone bed at bottom.

White to light grey clay.

Mottled red and grey clay.

Light grey clay

Brown and dark grey mudstone

Blue-grey and brown mudstone

CORE 1. 67.06-69.72 m. recovered 1.09 m.
Blue-grey mudstone, with 2cm of white siltstone at base

Blue-grey mudstone, with minor white siltstone.

CORE 2 91.44-94.03 m. recovered 2.44 m.
Dark grey mudstone, slightly micaceous with minor bands of siltstone.

(Hard band)
Dark grey mudstone, minor light grey siltstone.

CORE 3 118.87-121.24m. recovered 2.36 m.
10cm of white siltstone, overlying dark grey mudstone with interbedded very fine grained sandstone.

Dark grey mudstone with minor light grey hard siltstone and clay.

— (hard band)

CORE 4 149.35-151.79m recovered 2.44 m
Soft dark grey mudstone with pockets of pyrite and minor sand lenses. one 12 cm band of hard white siltstone.

Fig 7 **B.M.R. WESTMORELAND S.H.1**

To accompany Record 1971/142

E54/A5/2

Drilling

Drilled with air to 4 m, and then changed to mud as the drill was being clogged by damp clay and the air compressor was not functioning at maximum efficiency. Four cores, totalling 9 m, were taken, with an average recovery of 82.8%. No groundwater was encountered during drilling.

Log

0 - 14 m Armraynald Beds: grey and brown clay and silt with minor sand; a pebble band between 12 m and 14 m;

14 - 39 m Floraville Formation: silcrete and silcreted sandstone, shale, sandy clay, white at top and mottled pink and grey below; a bed of hard, white fine-grained sandstone at the bottom;

39 - 61 m Deep weathering profile: 39-43 m, white to light grey clay; 43-55 m, mottled red and grey clay; 55-61 m, light grey and brown clay;

61 - 151.8 m Allaru Mudstone: blue-grey, pyritic mudstone with minor thin beds of hard white siltstone and thin lenses and partings of very fine-grained quartz sandstone.

Core 1, 67.06 - 69.72 m, recovered 1.09 m

Core 2, 91.44 - 94.03 m, recovered 2.44 m

Core 3, 118.87 - 121.24 m, recovered 2.36 m

Core 4, 149.35 - 151.79 m, recovered 2.44 m

The Normanton Formation is probably absent from the Mesozoic section, although its base could be present in the deep weathering profile. The hole finished in the Allaru Mudstone above the Toolebuc Limestone. Palynological results were largely inconclusive but suggested a post-Toolebuc age. A graphic radiometric log could not be produced owing to failure of the paper drive mechanism in the logger; however, no large deflections of the pen occurred during logging operations.

BMR Lawn Hill 1 (Figure 8)

Position: 18°20'S, 139°16'E, 38 km north of Gregory Downs Hotel. 15 m on eastern side of the Burketown-Gregory Downs road, 300 m south of the crossing of Running Creek.

Access: Adjacent to formed road.

Objectives: (a) to determine the Mesozoic units present within 152 m of the surface of the Armraynald Plain;

(b) to attempt to intersect and core the Toolebuc Limestone;

(c) to obtain cores of the units for palynological and lithological examination.

Drilling

The hole was drilled with air to 4 m, at which depth the driller changed to mud as the air compressor was faulty and could not generate sufficient pressure to lift the cuttings. There was almost complete loss of circulation while drilling the interval 6-12 m, possibly due to swelling of the clay beds and the formation of large fissures in the overlying beds. Swelling of the clays also tended to block the hole and reaming was required on a number of occasions. Four cores totalling 11.6 m were taken with an average of 97% recovery. No water was encountered.

Log

0 - 12 m Armraynald Beds: 0-6 m, grey and brown clay with very fine sand and silt; 6-12 m no recovery of cuttings due to loss of circulation;

12 - 29.6 m Floraville Formation: 12-21 m, mottled, orange and grey clay with minor fine sand; 21-24 m, orange siltstone and clay with minor fine sand; 24-29.6 m, brown medium to fine sand and clay with a gravel bed from 27.4-28 m.

29.6 - 152.4 m Allaru Mudstone: 29.6 - 64 m, deep weathering profile (?), yellow-brown clay, with hard bands at 56.1 - 56.7 m and 59.4 m; 64 - 152.4 m, grey (minor brown) pyritic mudstone with thin lenses of fine-grained, glauconitic, quartz sandstone, and minor beds of impure and cone-in-cone limestone.

Core 1, 70.10 - 72.94 m, recovered 2.84 m

Core 2, 91.44 - 94.49 m, recovered 2.94 m

Core 3, 121.92 - 124.66 m, recovered 2.65 m

Core 4, 149.35 - 152.40 m, recovered 2.95 m

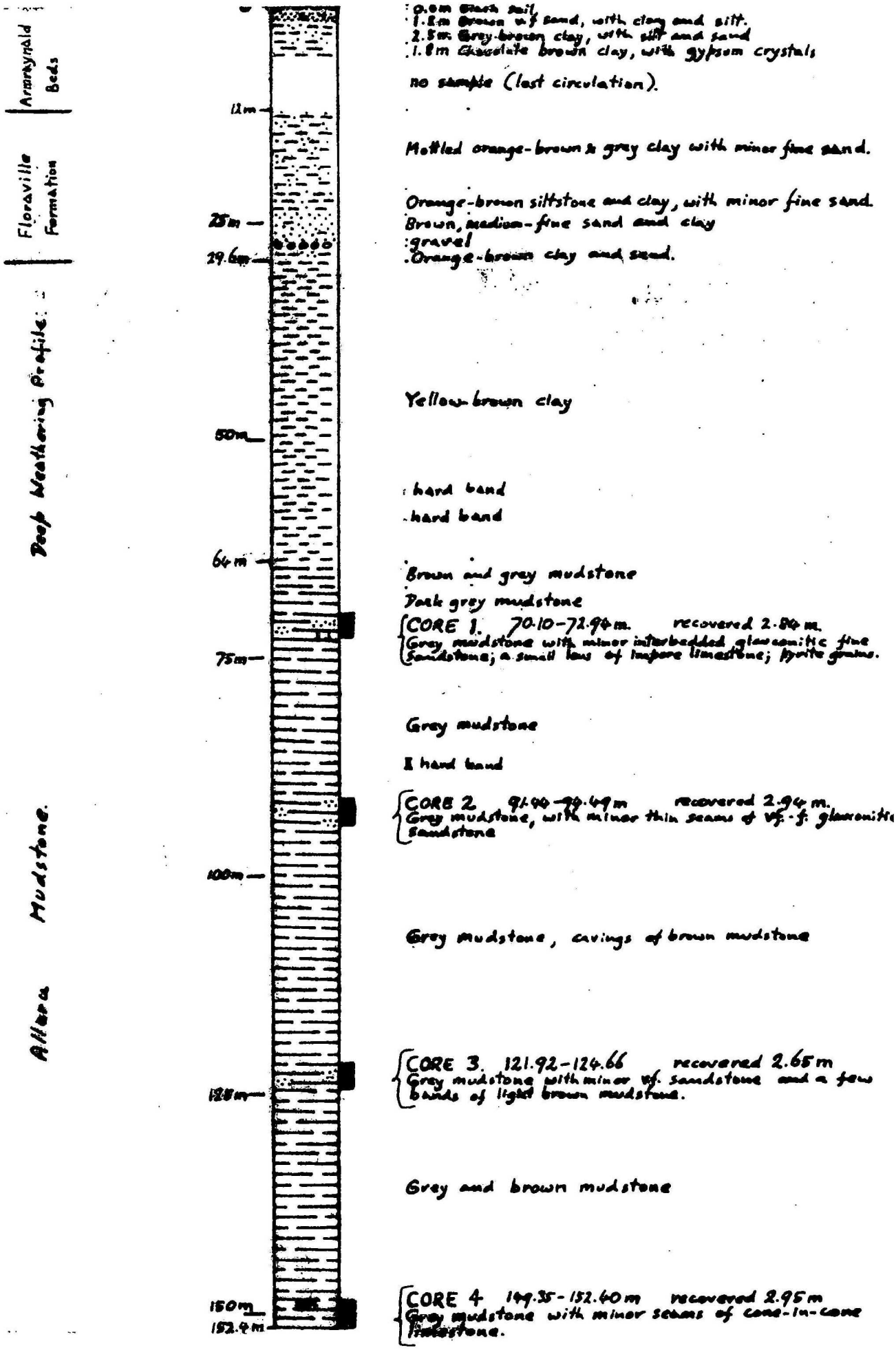


Fig 8 B.M.R. LAWN HILL SH. 1

To accompany Record 1971/142 E54/A9/31

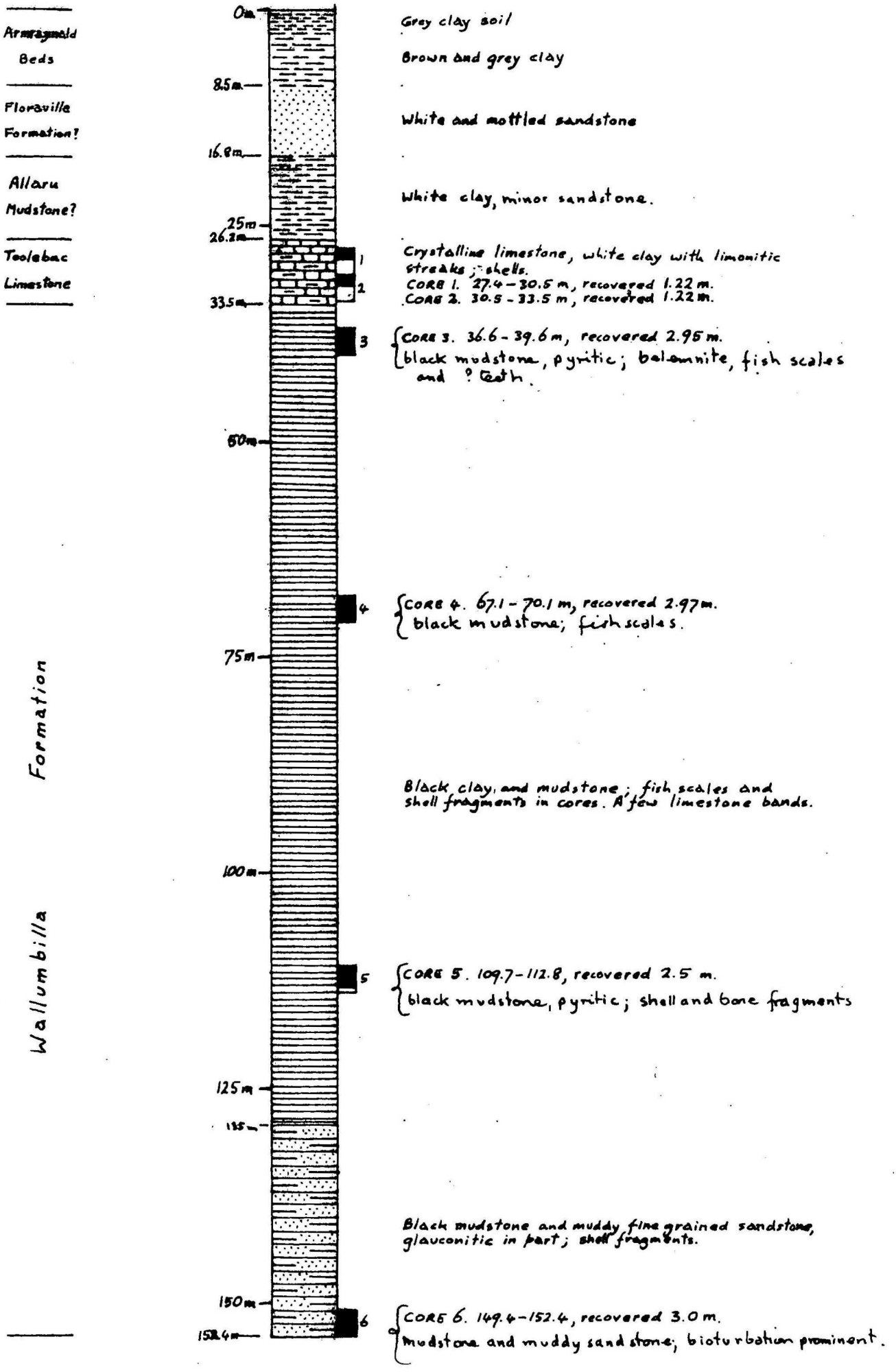


Fig 9 **BMR LAWN HILL S.H 2.**

To accompany Record 1972/142 E54/A9/30

The Toolebuc Limestone was not penetrated. D. Burger (pers. comm.) noted that core 2, at a depth of 93.55 m yielded a microflora which probably lies in the interval of unit K2b+, which is only known from above the Toolebuc Limestone in the Eromanga Basin. A graphic radiometric log could not be produced owing to failure of the paper drive mechanism in the logger. However, no large deflections of the pens occurred during logging operations.

BMR Lawn Hill 2 (Figure 9)

Position: 18°41'S, 139°19'E, 8 km east of Gregory Downs Hotel along the road to Nardoo homestead, at a bend in the road.

Access: Adjacent to and on the north side of the road.

Objectives: (a) to determine the Mesozoic units present within a depth of 152.4 m (500 feet) of the surface under the Armraynald Plain.

(b) to obtain cores for palynological determination.

(c) to obtain core of Toolebuc Limestone if present.

Drilling

No water was encountered during drilling. Drilling rate was fair to good. Six cores were taken totalling 18.2 m, with an average recovery of 76%.

Log

0 - 8.5 m alluvium, brown and grey clay;

8.5 - 16.8 m Floraville Formation: white and mottled very fine to medium-grained sandstone;

16.8 - 26.2 m Allaru Mudstone?: white clay, minor sandstone;

26.2 - 33.5 m Toolebuc Limestone: crystalline limestone, white clay with limonite streaks, shell material;

33.5 - 152.4 m Wallumbilla Formation: 33.5 - 135 m black clay and mudstone, fish scales and shell fragments in cores. A few thin limestone bands. 135 - 152.4 m black mudstone and muddy fine-grained sandstone, glauconitic in part; shell fragments.

D. Burger (pers. comm.) noted that those cores sampled from BMR Lawn Hill 2 were either barren or yielded organic material unsuitable for closer determination.

The top of the Toolebuc Limestone may be within the white clay interval which is supposed to represent the Allaru Mudstone. The bottom may be lower than 33.5 m, but is above core 3, which is neither calcareous nor bituminous.

In spite of the hole's proximity to Precambrian outcrop, no Jurassic-Cretaceous sandstones were intersected within 152 m of the surface. A graphic radiometric log could not be produced owing to failure of the paper drive mechanism in the logger.

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