Rept.Bk.No. 65/79
G.S. No. 3817
Pal. Rep. 14/67

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

PALAEONTOLOGY SECTION

LAKE MACDONNELL GYPSUM DEPOSIT

Hd. Kevin

DEPARTMENT OF MINES BORE A.A.10W

MICROPALAEONTOLOGICAL EXAMINATION

by

J.M. LINDSAY
PALAEONTOLOGIST
PALAEONTOLOGY SECTION

D.M. 311/67

23rd October, 1967.

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DEPARTMENT OF MINES BORE A.A.10W

MICROPALAEONTOLOGICAL EXAMINATION

ABSTRACT

Lake Macdonnell bore A.A.10W (total depth 150 feet) intersected a Quaternary sequence consisting of a thin salt crust and lime sand (Recent, marine), Yamba Formation (Recent to Pleistocene, gypsiferous, lagoonal), Bridgewater Formation, upper member (Pleistocene, aeolianitic), and Bridgewater Formation, lower member (Pleistocene, ?littoral marine). This sequence tests and broadly supports part of the framework of South Australian Quaternary units recently developed by J.B. Firman. The distribution in the bore of 49 species of foraminifera is recorded and related to the units recognized.

INTRODUCTION

Bore A.A.10W was drilled by Department of Mines cable-tool rig, in Lake Macdonnell, Section 19, Hundred of Kevin, between March 16th and 28th, 1967, as the deepest of a current series of mineral exploration holes. The site of A.A.10W is about 8 miles south of Penong, and approximately 30 chains southeast of the position of the Lake Macdonnell Bore (Salt Bore), drilled by the Department of Mines in 1948 (Willington, 1949, Plan on p. 264).

Cable-tool sludges from A.A.10W to total depth of 150 feet were submitted for palaeontological examination. Foraminifera are by far the most abundant and best-preserved fossils present. The distribution of identified species is shown in Plan 67-708 accompanying this report, together with a columnar

section (based on a bore log by M.N. Hiern) and a stratigraphic interpretation.

Previous palaeontological reports on Lake Macdonnell bores by Cotton (1949 a, b), Crespin (1949 a, b), and Pike (1949), are appendices to reports by Dickinson and King (1949) and Willington (1949). Cotton (1949a) and Crespin (1949a), emphasizing respectively the mollusca and the foraminifera, briefly noted Quaternary faunas between 19 and 62 feet. Cotton differentiated late, middle, and early Recent beds down to 60 feet, and late Pleistocene dune limestone at 60 - 62 feet. He recorded the presence of *Anadara trapezia* at 28 feet. Crespin considered gypsiferous material from 19 - 22 feet to be sub-Recent and that all samples from 22 to 62 feet were most probably Pleistocene in age. Cotton (1949b) and Crespin (1949b), in their later notes on the Salt Bore (total depth 293 feet) presented differing stratigraphic interpretations of the sequence between 113 feet and 238½ feet, underlying agreed Pleistocene and overlying highly weathered gneissic bedrock. Cotton proposed Miocene (113 - 149 feet) over Oligocene or older (149 - 232 feet), whereas Crespin suggested lower Pliocene (113 - 149 feet) over ?Miocene (160 - 236 feet). They could obtain very little specific palaeontological evidence for the age of the yellow limestone, sandstone and sand between 113 (?recte 118) and 149 feet, both remarking on the poor state of preservation of the fossils present.

The present stratigraphic interpretation differs from those of both Cotton and Crespin in two main respects. Firstly, formal stratigraphic terminology is now available to name all but the topmost of the Recent to Pleistocene units. Secondly, the yellow unit between 118 and 150 feet in bore A.A.10W is considered to be neither Miocene nor Pliocene, but Pleistocene in age, a microfauna of at least 26 species of identifiable

foraminifera having been recovered from it which is similar to that in the overlying Recent to Pleistocene, different in a number of aspects from known South Australian Pliocene microfaunas, and quite unlike known South Australian Miocene microfaunas.

STRATIGRAPHIC SUMMARY

Unit	Depth (feet)	Thickness (feet)
Salt crust and lime sand (Recent)	0 - 1	1
Yamba Formation (Recent to Pleistocene)	1 - 30	29
Bridgewater Formation - upper member (Pleistocene)	30 - 118	88
Bridgewater Formation - lower member (Pleistocene)	118 - 150	32+

FORMATIONS ENCOUNTERED

Salt crust and lime sand (Recent)

The abundant and varied microfauna of this unit suggest a marine environment of deposition. Cibicides refulgens occurs in some quantity. This species was found by Logan (1959) to be a valuable indicator of normal salinity at Shark Bay, Western Australia, where it is restricted to oceanic bay facies. This thin unit thus records the period of most recent inundation by the sea, followed by isolation and evaporation to salt crust, a cycle distinct from the earlier regime of gypsum precipitation which formed the underlying Yamba Formation.

Yamba Formation (Recent to Pleistocene)

The Yamba Formation was defined by Firman (1966) for gypsiferous beds of lacustrine or aeolian depositional environment, consisting of "crystalline, seed or powdery gypsum, gypsiferous clays, and gypsum-quartz sand mixtures", source lakes being typically "valley-lakes in old stream courses running through the lowland northwest, north, and northeast of

the Pinnaroo Block". Yamba Formation was noted by Firman to be "older than saline crusts of the ephemeral lakes", and to have a maximum known thickness of 25 feet. The gypsiferous beds in bore A.A.10W between 1 and 30 feet are lithologically and stratigraphically similar to Yamba Formation as thus defined, and are therefore referred to that unit. Firman (1967, stratigraphic table) extended the usage of Yamba Formation from the Murray Basin to the West Coast Basins, and included the earliest development of Yamba Formation in the uppermost Pleistocene, at the level of Loveday Soil. Yamba Formation is accordingly shown as a Pleistocene to Recent unit in this report, the interval 23 - 30 feet being included in the Pleistocene as it has characters transitional to the underlying Bridgewater Formation. The lagoonal origin of the gypsiferous deposits has been previously discussed by Dickinson and King (1949, pp. 129, 130).

Bridgewater Formation - upper member (Pleistocene)

Boutakoff (1963, Table 1) applied the term Bridgewater Formation to both Victorian and South Australian deposits, the latter "calcareous dunes and dune limestones (calcaeolianites); reef and coarse sand (marine fauna)", with "numerous interdune soils".

Firman (1967 a, b) accepted this usage, but emphasized dune deposition. He has distinguished an upper and a lower member of the Bridgewater Formation in South Australia, separated by Ripon Calcrete. In Lake Macdonnell, bore A.A.10W, the upper member consists of pale grey, hard to soft calcarenitic sandy limestones, aeolianitic at least in part, and at the base (111 - 118 feet) dark grey in a bed thought to be stratigraphically equivalent to the dark grey brecciated source material of Ripon Calcrete. Calcrete or "kunkar" - type lime-cemented

material is present at various levels in the upper member as noted by Firman. Some gypseous material is generally present. Foraminifera are mostly recrystallized and more or less abraded, but form a consistent assemblage with Recent affinities, as shown in the accompanying plan.

Bridgewater Formation - lower member (Pleistocene)

These yellow-brown sandy limestones, calcareous sandstones and sands between 118 and 150 feet form a distinctive unit with a foraminiferal fauna closely akin to that of the overlying Recent to Pleistocene sequence. The microfauna becomes more varied with depth, both lithology and microfauna becoming increasingly suggestive of a marine littoral environment of deposition.

DESCRIPTIONS OF SAMPLES

Depth (feet)	Description
0 - 0'2"	White crystalline salt crust, with a relatively small content of calcarenitic fragments and foraminifera, mostly somewhat abraded and rounded, but some fresh, dominated by Discorbis mira, Elphidium crispum, Cibicides refulgens, and Reussella sp.cf.R. armata.
0'2" - 1'	Medium-grained calcarenitic sand, speckled white, fawn, dark grey, and with an abundant and varied microfauna, mostly fresh, prominent constituents being species of Discorbis, Miliolidae, Textularia, Clavulina, Elphidium, Reussella; Peneroplis pertusus, Cibicides refulgens, and Marginopora vertebralis; small gastropods and pelecypods.
1 - 7	Pale grey marl and gypsum, with calcarenitic fragments, and foraminifera mostly species of Discorbis and Elphidium.
7 - 23	Off-white to pale grey crystalline gypsum.
23 - 30	Predominantly gypsum; fragments of friable pale to darker grey silty fragmental limestone; small amount of greenish-grey lime-

Depth (feet)	Description
	stone with frequent valves of smooth ostracodes; minor aeolianitic limestone fragments, brown calcareous crust fragments; grey lime sand of recycled calcarenitic fragments and rare recrystallized abraded and lime-coated foraminifera; occasional small pelecypod and gastropod fragments and casts.
30 - 38	Pale grey calcarenitic sandy limestone, constituent calcarenitic fragments in part abraded, rounded, recrystallized, lime-coated, probably aeolianitic; some fresher material; occasional small gastropods, pelecypods, ostracodes, echinoid spines; foraminifera dominated by Elphidium advenum and Triloculina tricarinata. Very rare pyrite grains.
38 - 59	Pale grey calcarenitic sandy limestone generally similar to above; hard, recrystallized, to loose and friable; part aeolianitic; some calcrete; occasional dark grey fragments containing fine carbonaceous material); apparently some gypsum content; foraminifera not common, mostly recrystallized, many abraded; Discorbis mira and Elphidium spp. are prominent.
59 - 63	Pale grey marl and calcarenitic sandy limestone with barnacle plates, oyster fragments, occasional echinoid spines; common Elphidium advenum.
63 - 76	Pale grey calcarenitic sandy limestone; part-aeolianitic; much is lime-coated; part gypseous; part saccharoidal; scattered dark grey fragments; occasional gastropod, pelecypod moulds, oyster fragments; foraminifera infrequent, abraded, heavily recrystallized, with common Discorbis mira.
76 - 80	Pale grey marl and calcarenitic sandy limestone, generally as above; a small pyrite grain.
80 - 105	Pale grey calcarenitic sandy limestone, appears variously aeolianitic, earthy lime-coated, or marine littoral; part apparently gypseous; scattered dark grey fragments; occasional gastropod, pelecypod moulds, barnacle plates; foraminifera generally recrystallized, and with common Discorbis mira.
105 - 111	Driller reports a cavity.
111 - 118	Dark grey calcarenitic sandy limestone, coloured by fine carbonaceous material; part bryozoal and algal, probably marine; part aeolianitic; occasional small pyrite grains; much is hard, recrystallized, with few foraminifera released; rare moulds of Marginopora vertebralis, Elphidium rotatum

Depth (feet)	Description
118 - 123	Yellow-brown sandy limestone, some sandstone and sand; foraminifera rare, recrystallized, dominated by Discorbis mira; some fragments show gradation from dark grey to yellow-brown colouration.
123 - 125	Driller reports a cavity.
125 - 132	Similar to 118 - 123 feet, but with a more varied microfauna, still heavily recrystallized.
132 - 138	As above, but microfauna dominated by miliolids, mostly Triloculina trigonula, and with Quinqueloculina seminulum and Triloculina striatotrigonula.
138 - 150	Similar yellow-brown sandy limestone, sandstone and sand, with a varied microfauna and rare fragmentary molluscan impressions; foraminifera include common Marginopora vertebralis, Peneroplis pertusus, and miliolids.

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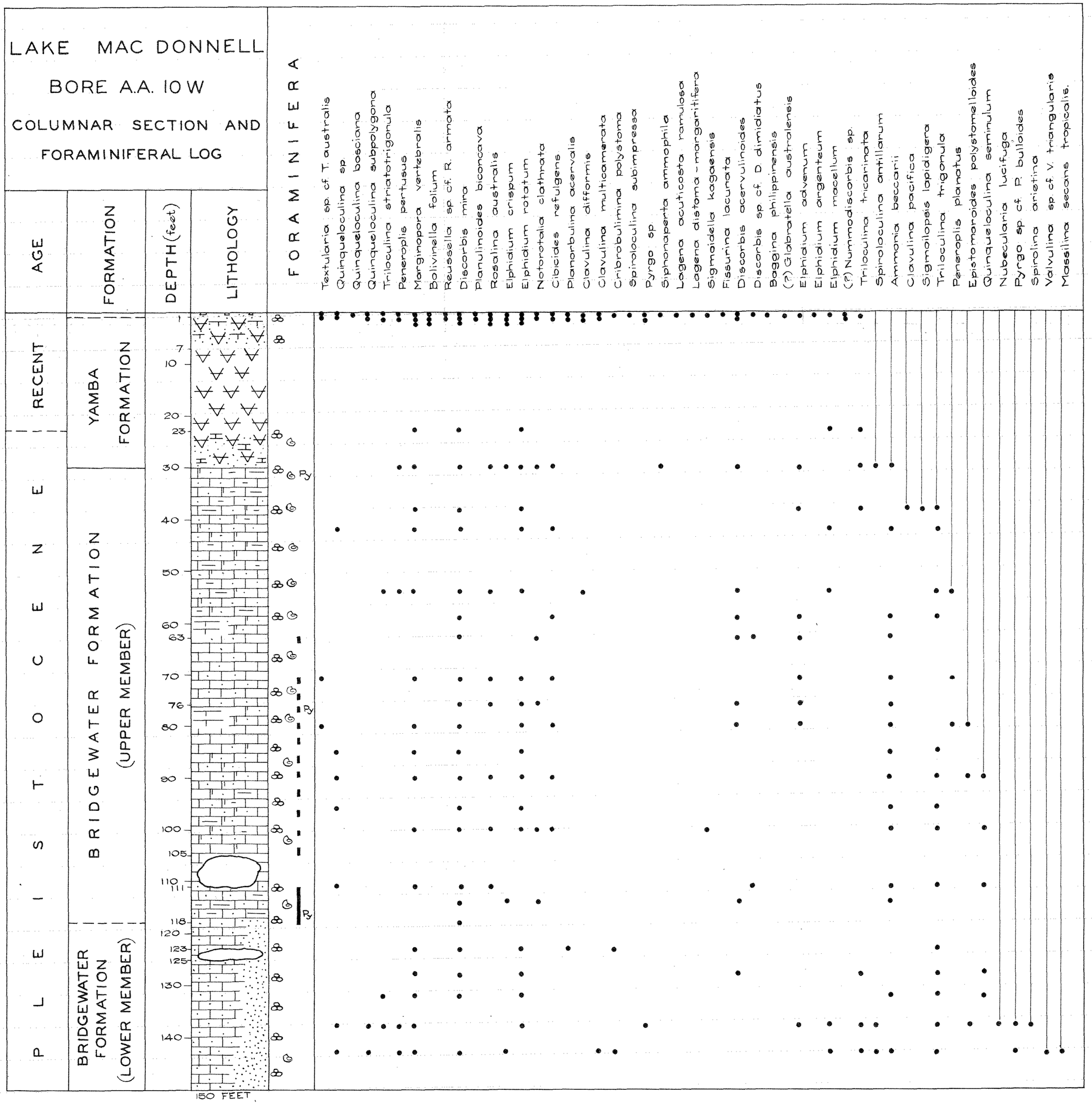
J. M. Lindsay.

JML:CC
23.10.1967

J.M. LINDSAY
PALAEONTOLOGIST
PALAEONTOLOGY SECTION

LAKE MAC DONNELL
BORE A.A. 10 W
COLUMNAR SECTION AND FORAMINIFERAL LOG



To accompany Pal. Rep. 14/67 by J. M. Lindsay.

- ∀ Gypsum
- ⁂ Microfossils
- ⓖ Megafossils
- Py Pyrite present
- ▮ Carbonaceous matter present.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

LAKE MAC DONNELL GYPSUM DEPOSIT
BORE No. AA 10 W. — SEC. 19, HD. KEVIN.
COLUMNAR SECTION AND FORAMINIFERAL LOG

		Drn. J.M.L.	SCALE: Vertical 1" = 15 feet
		Tcd. AMcD	67 - 708 Db 7/6
		Ckd. L.V.W.	
Director of Mines		Exd.	DATE: 20-10-67