Rept. Bk. No. 61/79
G.S. No 3259
D.M. 980/65
Pal. Rept. No. 12/65

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

PALAEONTOLOGICAL SECTION

RIVER MURRAY DRAINAGE INVESTIGATION
PROGRESS REPORT No. 4

STRATIGRAPHY AND MICROPALAEONTOLOGY OF WAIKERIE BORE No. 2

by
J. M. Lindsay
Palaeontologist

D.M. 980/65

22nd September, 1965

RB 61/79

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CONTENTS

Plan:

Rept. Bk. No. 61/79
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RIVER MURRAY DRAINAGE INVESTIGATION, PROGRESS REPORT NO. 4, STRATIGRAPHY AND MICROPALAEONTOLOGY OF WAIKERIE BORE NO. 2.

ABSTRACT

Waikerie Bore No. 2, 2½ miles southwest of Waikerie township, bottomed at 775 feet in sands of the Knight Group, after passing through a sequence of Quaternary beds, Norwest Bend Formation, Morgan Limestone, Finniss Clay equivalent (?), Mannum Formation, "Gambier Limestone", Ettrick Formation, "Ettrick-Buccleuch undifferentiated", Buccleuch Group, and Knight Group clays.

INTRODUCTION

Waikerie Bore No. 2, a phase of the Waikerie programme of the River Murray Drainage Investigation, was designed as a deep probe to explore the hydrogeology and stratigraphy of the Tertiary section down to Knight Group sands in a position where such information is lacking.

Beach Petroleum Monash No. 1 well has recently been drilled 30 miles to the east. Australian Oil and Gas Corporation's Loxton oil bore (Ludbrook, 1961, p. 9) and Beach Petroleum Loxton No. 2 well (Ludbrook, N.H. and Lindsay, J.M. 1963, Beach Petroleum N.L. Loxton No. 2 well, Subsurface Stratigraphy and Micropalaeontological Study. Geol. Surv. S.Aust. Pal. Rept. 8/63, G.S. 2691 (unpublished)) are some 45 miles to the south-east. A water bore on Bungunnia Station 45 miles to the N.N.W. bottomed in purple slates at 1275 feet (Ludbrook,op. cit. p. 8).

Waikerie Bore No. 2 is 2½ miles S.W. of Waikerie township, in section 692, hundred of Waikerie, 132.35 feet above Mean Sea Level (Roberts, G.T. 1965, River Murray Drainage

Investigation, Progress Report No. 3, Geol. Surv. S.Aust. Hyd. No. 1713, G.S. 3266, Plan 65-826). It was drilled by a Department of Mines percussion rig between May 10 and July 31, 1965 (Bore Serial No. 847/65). Sludge samples were collected at least every 5 feet, and 31 open-tube cores were taken, the latter providing virtually undisturbed sediment for examination, and thus extremely useful lithological and palaeontological control.

This report presents lithological data, and stratigraphic data based mainly on identification of foraminifera considered to be stratigraphically significant. No detailed study of the foraminiferal faunas was attempted, but in view of the good tube-samples available some quantitative recording has been considered useful and justified.

Plan No. 65-1025 summarizes this report in graphical form with a columnar section and a micropalaeontological log showing the distribution of some more significant foraminiferal species.

STRATIGRAPHIC SUMMARY

Formation	Depth (feet)	Thickness (feet)
Sand, kunkar, lacustrine limestone and clay (Recent to Pleistocene).	0 - 25	25
Norwest Bend Formation (Upper Pliocene).	25 - 48	23
Morgan Limestone (Middle and Lower Miocene)	48 - 129	81
Finniss Clay equivalent ? (Lower Miocene)	129 - 140	11
Mannum Formation (Lower Miocene)	140 - 365	225
"Gambier Limestone" (Lower Miocene)	365 - 385	20
Ettrick Formation (Lower Miocene and Oligocene)	385 - 508	123
"Ettrick - Buccleuch undifferentiated" (Oligocene to Upper Eocene)	508 - 645	137

Stratigraphic Summary (contd.)

Formation	Depth (feet)	Thickness (feet)
Buccleuch Group (Upper Eocene)	645 - 700	55
Knight Group (Upper Eocene)	700 - 775	75 +

FORMATIONS ENCOUNTERED

Recent to Pleistocene units

These comprise a sequence 25 feet thick, of brown sandy soil, red-brown sand with kunkar fragments, rubbly kunkar sand and clay, and at 20 feet pale grey ostracod limestone.

Norwest Bend Formation (Upper Pliocene)

23 feet of fossiliferous calcareous sandstone to sandy limestone are closely comparable with Norwest Bend Formation known from outcrops and bores elsewhere at Waikerie.

Morgan Limestone (Middle and Lower Miocene)

The top unit of Morgan Limestone consists of 6 feet (48 - 54 feet) of mottled calcarenitic limestone with Globigerinoides "transitorius" and Parrellina craticulatiformis. Beneath this, core sampling has defined a bryozoal marl unit 31 feet thick (54 - 85 feet), rubbly with marly limestone near the base, and passing into the bottom unit of calcarenitic limestone 44 feet thick (85 - 129 feet). The zone of Lepidocyclina howchini occurs at 105 - 110 feet.

Finniss Clay equivalent (?) (Lower Miocene)

11 feet of grey shelly marl between 129 and 140 feet, appear to occupy a stratigraphic position comparable with that of the Finniss Clay, separating limestones of Morgan Limestone and Mannum Formation.

Mannum Formation (Lower Miocene)

The Mannum Formation is represented by bryozoal and echinoid limestones (calcarenites) 225 feet thick (140 - 365 feet), often rubbly and marly, becoming glauconitic in the lower part.

"Gambier Limestone" (Lower Miocene)

Glauconitic marly limestones becoming more marly downwards, occur between 365 - 385 feet and contain Victoriella conoidea and Gyroidinoides sp. 1. They appear to be transitional between Mannum Formation limestones and Ettrick Formation marls.

Ettrick Formation (Lower Miocene and Oligocene)

Between 385 and 508 feet, two units of the Ettrick Formation can be distinguished, ranging downwards through marl to dark clay.

(1) 385 - 485 feet:

100 feet of brown to grey glauconitic marls becoming darker greenish-grey towards the base comprise the bulk of the Ettrick Formation. Victoriella continues down to 420 feet. The distinctive Globigerina angulisuturalis occurs at 410 feet, and according to Blow and Banner (in Eames et al. 1962, p. 84) is a Miocene species. The Miocene - Oligocene boundary has been tentatively and rather arbitrarily put at 420 feet. Cibicides pseudoconvexus enters at 445 feet, Guembelitria sp. at 458 feet, and Massilina torquayensis at 467 feet. All are considered to be pre-Miocene species. Cassigerinella chipolensis makes its lowest appearance at 472 - 485 feet, and the beds at this level are still therefore of post-Eocene age (Blow and Banner, op. cit. p. 83; Jenkins, 1964).

(2) 485 - 508 feet:

23 feet of very dark grey glauconitic clay appear to be related to the above sequence. Foraminifera include very rare Guembelitria sp. and Globigerina sp. cf. G. linaperta, with more frequent agglutinating species such as Haplophragmoides rotundata indicative of a restricted depositional environment.

"Ettrick - Buccleuch undifferentiated"(Oligocene to Upper Eocene)

Unit (ii) (490 - 508 feet) of the Ettrick Formation described above, could also be regarded as the top of the series of dark clays and sands which extend from 490 feet to the bottom of the bore at 775 feet, representing Ettrick Formation, Buccleuch Group, and Knight Group. At 490 feet, this paralic sequence is probably Oligocene in age; by 650 feet it is certainly Upper Eocene. The beds between have poor faunas, and are described together here as "Ettrick - Buccleuch undifferentiated". Two units are clearly present:

(1) 508 - 570 feet: (62 feet thick).

These clayey sands are brown to grey in colour and rather poorly fossiliferous. At the top they contain Chiloguembelina cubensis, Massilina torquayensis, and Globigerina linaperta.

(2) 570 - 645 feet: (75 feet thick)

This is a sequence of silty clays, somewhat carbonaceous and lignitic, dark grey to 610 feet and dark brown below that. Foraminifera are small and extremely rare but a fragment of Porosorotalia crassimura occurred at 635 feet.

Buccleuch Group (Upper Eocene)

These beds are about 55 feet thick (645 - 700 feet). Faunally, the top corresponds to the upper limit of the Upper

Eocene microfaunule, and the base to the level at which this microfaunule began to be well established following the more limited faunas of the upper Knight Group.

Lithologically, the downward sequence consists of greyish-brown shelly sands, dark brown carbonaceous clays, and near the base, grey glauconitic shelly marl. Turritella is prominent throughout. Typical foraminifera include Bolivinella sp. 1, Lamarckina airensis, Porosorotalia crassimura, and near the base, Pseudopolymorphina sp. and Carpenteria sp. Globigerapsis index is extremely rare; Linderina sp., Halkyardia sp. and Asterigerinella adelaidensis are occasionally present.

Knight Group (Upper Eocene)

From about 700 feet to the bottom of the hole at 775 feet, sediments assigned to the Knight Group were intersected. They are mostly dark brown clays with sands at 748 - 749 feet and at 770 - 775 feet. Below 700 feet the faunas rapidly diminish and no foraminifera were recovered from the core at 720 - 721 feet. Turritella however persists below this in occasional shelly bands as do foraminifera such as Cibicides umbonifer, Chiloguembelina cubensis, Pseudopolymorphina sp. and associated species.

DESCRIPTIONS OF SAMPLES

(Adapted from Bore Log by G.T. Roberts)

Depth (feet)	Type of sample	Description
3	Percussion sludge	Red-brown sand with fragments of pink-brown sandy kunkar-limestone.
5	"	do.
9 - 10	Open-tube core	Rubbly kunkar-limestone, sand, and clay.
15	Percussion sludge	Abundant fragments of kunkar-limestone, partly in travertine-coated pebbles.

Depth (feet)	Type of sample	Description
20	Percussion sludge	Pale brown sandy kunkar-limestone, pale grey sandy clay, and pale grey limestone, the latter very fine-grained, silty, sandy, with common ostracod and very rare gastropod moulds.
25	"	Calcareous sand and sandstone to sandy limestone, mottled brown to white, with common poorly-preserved gastropod and pelecypod moulds.
30	"	Brown sandy limestone, gritty; hard, recemented in part.
35	"	Calcareous sandstone and a little sandy limestone, mottled off-white to yellow-brown, partly recrystallized, gritty, some silt and ferruginous clay content; abundant fragmentary pelecypod moulds, occasional oyster fragments, frequent echinoid spines, rare barnacle plates, a fish tooth, very rare foraminifera; an occasional glauconite grain.
36	"	Fine to coarse-grained calcareous sand, with some cementation; more frequent foraminifera.
40	"	Brown calcareous sandstone to sandy limestone, mostly hard, recrystallized; common fragmentary gastropod and pelecypod moulds; a few oyster fragments; quartz content very fine-grained sand to granule size.
45	"	As above, with barnacle plates, echinoid, bryozoal and oyster fragments; more varied foraminifera, with Ammonia beccarii frequent.
50	"	Fine-grained calcarenitic limestone, mottled red-brown, cream, pale grey; slightly glauconitic; some content of very fine to fine-grained sand, silt, and ferruginous clay; common bryozoa and Ditrupa; abundant and varied foraminifera including the planktonics Globigerinoides bispherícus (V)*, G. trilobus "immaturus" (V), and G. "transitorius" (V).
52	"	Cream calcarenitic limestone, similar to above, with Parrellina craticulatiformis (V).
55 - 56	Open-tube core	Grey, plastic, calcareous clay (marl), with a network of brown iron-stained cracks; abundant small foraminifera, including Cassigerinella chipolensis (A), Globigerina apertura (V), and

Depth (feet)	Type of sample	Description
55 - 56	Open-tube core	G. angustiumbilicata (V).
61 - 62	"	Bryozoal marl, mottled cream - pale brown, friable to plastic; patches of black (?manganese oxide) speckling; with Globigerinoides ruber (V) and Astrononion obesum (C).
66 - 67	"	Soft marl and harder recrystallized marly limestone, mottled off-white, pale yellow-brown, darker brown, and with black speckling as above; abundant bryozoa and common finely-broken mollusc fragments; large Operculina victoriensis (A).
71 - 72	"	Bryozoal marl and patches of harder rubbly marly limestone, as above; mottled pale yellow-brown to pale grey; microfauna dominated by large Operculina victoriensis (A); Parrellina craticulatiformis is frequent but small; Carpenteria proteiformis (V) and Amphistegina lessonii (V) enter.
76 - 77	"	Marl, pale grey with some brown mottling; silty, bryozoal.
81 - 82	"	Rubbly marl and marly limestone, pale grey to pale yellow-brown, with large Operculina (A).
86	Percussion sludge	Bryozoal limestone (calcarenite), recrystallized, cream, pale yellow-brown; slightly glauconitic; Parrellina craticulatiformis (A, large).
90	"	Cream bryozoal marl with abundant Operculina, Amphistegina and Parrellina craticulatiformis.
95	"	Marly bryozoal limestone (calcarenite), mottled pale grey - pale brown, with Crespinella sp. 1 (V); echinoid fragments frequent.
100	"	Cream silty bryozoal limestone (calcarenite) with frequent Parrellina, Amphistegina, and Operculina.
105	"	Cream bryozoal limestone (calcarenite), with Lepidocyclina howchini (V, small).
110	"	Bryozoal and echinoid limestone (calcarenite), with L. howchini (V) and common Crespinella, Amphistegina, and Operculina; frequent algal concretions.

Depth (feet)	Type of sample	Description
115 - 125	Percussion sludge	Pale brown bryozoal and echinoid limestone (calcarenite), much is hard, recrystallized; abundant small brown clayey pockets; very fine-grained sandy, silty; Pararotalia verriculata (V) enters at 120 feet.
131 - 132	Open-tube core	Grey finely shelly marl, silty, very fine-grained sandy, soft; with frequent miliolid foraminifera.
136 - 137	"	Similar to above, with Pararotalia mackayi (C), and Cassigerinella chipolensis (F); abundantly foraminiferal.
140	Percussion sludge	Bryozoal limestone and shelly marl with the echinoid Fibularia gregata and the foraminifera Austrotrillina howchini (V) and Carpenteria rotaliformis (V).
145	"	Pale brownish-grey limestone (calcarenite), hard, recrystallized to soft, marly; speckled with small brown ferruginous clayey pockets; Austrotrillina howchini (C), Pararotalia spp. (C).
147 - 160	"	Pale grey-brown echinoid and bryozoal limestone (calcarenite), marly in part, similar to above.
165 - 170	"	As above, with Astrononion centroplax (F), Pararotalia spp. (A) and Operculina (A).
175 - 195	"	Bryozoal and echinoid marl and marly limestone (calcarenite), with hard limestone at 180 feet; rare small sponge spicules; pale brownish-grey; ferruginous clayey spots as above.
196 - 215	"	Pale brown to pale grey echinoid and bryozoal limestone (calcarenite) with Operculina (A); very fine-grained sandy, spotted ferruginous clayey as above.
216 - 217	Open-tube core	Greyish-brown rubbly marl and marly limestone, part recrystallized, part soft, clayey; abundant bryozoal and echinoid fragments; large Operculina (A).
222 - 255	Percussion sludges	Bryozoal and echinoid limestone (calcarenite), pale brown, pale grey, or cream, with Fibularia gregata; part-recrystallized, slightly glauconitic; variable content of very fine-grained sand, silt, and ferruginous clay as above; Globigerina sp. cf. G. ciperoensis (V) appears.

Depth (feet)	Type of sample	Description
260 - 280	Percussion sludges	Similar to above, silty; some foraminifera filled with glauconite; Globigerina ouachitaensis (V) enters; Operculina becomes rare and small.
285 - 286	Open-tube core	Grey echinoid and bryozoal marl to rubbly marly limestone, silty, finely glauconitic; Operculina is absent.
291 - 292	"	Similar to above, and with Parrellina centrifugalis (V); sparsely and finely shelly.
300	Percussion sludge	Pale grey echinoid and bryozoal limestone (calcarenite), finely glauconitic; Carpenteria rotaliformis (F) is prominent.
310 - 311	Open-tube core	Grey silty marl, mostly soft, some cementation to marly limestone which is darker grey-brown, saccharoidal; finely glauconitic, sparsely shelly; echinoid and bryozoal fragments abundant; Globigerina sp. cf. G. ciperoensis (V), Astrononion centroplax (R) and Parrellina centrifugalis (V) continue.
315 - 345	Percussion sludges	Grey echinoid-rich limestone (calcarenite), silty, in part hard recrystallized, some darker grey-brown saccharoidal; finely glauconitic; frequent small sponge spicules, Fibularia gregata.
358 - 359	Open-tube core	Grey, finely speckled green, glauconitic, rubbly marly limestone and marl in alternating harder and softer layers; in part darker saccharoidal as above; silty, very fine-grained sandy; abundant echinoid and bryozoal fragments; Amphistegina lessonii (C) and Polystomellina sp. (C) are prominent.
360	Percussion sludge	Grey, finely speckled green, glauconitic, echinoid and bryozoal marly limestone (calcarenite), somewhat recrystallized, silty, very fine-grained sandy.
365 - 370	"	Pale brownish-grey bryozoal and echinoid limestone (calcarenite), somewhat recrystallized, in part darker saccharoidal; silty, finely glauconitic; Victoriella conoidea (F), and Textularia vertebralis (F) enter.

Depth (feet)	Type of sample	Description
375	Percussion sludge	Marly limestone to marl but otherwise similar to above; small sponge spicules common; Victoriella (r) continues.
380	"	Marly limestone and marl, silty, as above, with Victoriella (C), Amphistegina (A), and the entry of Gyroidinoides sp. 1 (V).
385 - 390	"	Mostly marl, some cementation to marly limestone, grey to brown, silty, finely glauconitic; Gyroidinoides sp. 1 (R), Victoriella (V, fragmentary) continue.
400 - 401	Open-tube core	Khaki-brown silty marl with some harder marly limestone patches; finely glauconitic (some oxidized brown); abundant bryozoal, common echinoid, and frequent oyster fragments; Victoriella (R) continues; Bolivinopsis sp. (V) and Dimorphina janjukensis (V) enter.
410 - 411	"	Greenish grey-brown soft silty glauconitic marl with Pseudopolymorphina rutila parri (V), Globigerina angulisuturalis (V) G. sp. cf. G. ciperoensis (V) and Gyroidinoides sp. 1 (A).
420 - 421	"	Similar to above lithologically; lowest extent of Victoriella (V); Svratkina sp. 1 (V) enters.
430 - 431	"	Greenish and brownish-grey marl as above; common echinoid and bryozoal fragments; small amount of cementation to marly limestone.
440 - 441	"	Greenish-grey marl with scattered green glauconite patches; silty, very fine-grained sandy; firm to soft.
445 - 450	Percussion sludges	Grey marl and harder marly limestone, silty, very fine-grained sandy, finely glauconitic; Cibicides pseudoconvexus (R) enters.
458 - 459	Open-tube core	Grey soft marl with scattered hard lumps of marly limestone, similar to above; some grey chert fragments; Guembelitria sp. (R) and Svratkina sp. 2 (V) appear.
460 - 463	Percussion sludges	Grey marl and limestone as above; slightly micaceous and carbonaceous, rather glauconitic.

Depth (feet)	Type of sample	Description
465	Percussion sludges	Grey marl with frequent fragments of brown spicular siltstone-limestone; rare fragments of Turritella sp.
467 - 468	Open-tube core	Grey, greenish and brownish marl, finely glauconitic and shelly; common hard silty limestone fragments as above; slightly pyritic; Massilina torquayensis (V) enters, Guembelitria sp. (C) continues.
472 - 473	"	Rather dark greenish-grey glauconitic marl, shelly, with frequent Turritella sp.; foraminifera include Cassigerinella chipolensis (V), Guembelitria sp. (A), Massilina torquayensis (V), and Dentalina sp. aff. D. spinulosa (V)
475	Percussion sludge	As above.
480 - 481	Open-tube core	Dark greenish-grey glauconitic shelly marl, compact, silty, very fine-grained sandy, with Guembelitria sp. (C) and Cassigerinella chipolensis (C).
480 - 481	Open-tube core	Dark greenish-grey glauconitic shelly marl, compact, silty, very fine-grained sandy, with Guembelitria sp. (C) and Cassigerinella chipolensis (C).
485	Percussion sludge	As above, with Cassigerinella chipolensis (R) and Alabamina westraliensis (V); slightly pyritic.
490 - 491	Open-tube core	Very dark grey glauconitic silty clay, non-calcareous but with occasional fine-grained shelly fragments; compact; somewhat pyritic; abundant glauconite ovoid pellets, common faecal pellets; slightly carbonaceous; foraminifera include Haplophragmoides rotundata (F), Guembelitria sp. (V), and Globigerina sp. cf. G. linaperta (V).
495 - 505	Percussion sludges	Similar to above; abundant glauconite pellets, some dark green, some oxidized and brown.
510	"	Brownish-grey silty sand, somewhat clayey, in part cemented to sandstone and rubbly; shelly, sparsely glauconitic; the sand is very fine to very coarse-grained and much is iron-stained; the microfauna includes Chiloguembelina cubensis (C), Globigerina linaperta (V), and Massilina torquayensis (F).
512 - 520	"	Greyish-brown sand, very fine to very coarse-grained; soft, silty and clayey; limonitic and iron-stained grains common; slightly micaceous, glauconitic, and shelly; bryozoa common, foraminifera rare, with Textularia sp. cf. T. pseudomiozea (V), and

Depth (feet)	Type of sample	Description
512 - 520 (contd.)	Percussion sludges	Planorbulina sp. cf. P. mediterranensis (V).
525	"	Dark brownish-grey gritty, clayey, and silty sand, with rare bryozoa and occasional Cibicides sp.
527	"	Sand with thin lenses of clay, very dark grey-brown, carbonaceous, plastic; frequent pyrite-quartz aggregates; rare foraminifera include Cibicides umbonifer (R) and Uvigerina canariensis (V).
530 - 560	"	Brownish-grey sand, somewhat clayey and silty; occasional gastropod, pelecypod, echinoid and bryozoal fragments; foraminifera very rare; slightly glauconitic and carbonaceous.
565	"	Grey gritty sand; somewhat clayey, carbonaceous, slightly shelly; occasional quartz-pyrite aggregates; very rare barnacle plates, Turritella sp. fragments, bryozoa; pelecypod fragments frequent, foraminifera rare and small.
567	"	Darker grey sand, gritty, pyritic, somewhat clayey; abundant pyrite and quartz-pyrite aggregates; common black lignitic fragments, some pyritized; fauna as above.
570	"	Dark grey carbonaceous silty clay, sandy, gritty; some brown mudstone, indurated in part; abundant quartz-pyrite aggregates; apparently unfossiliferous.
575 - 576	Open-tube core	Dark grey silty clay, somewhat carbonaceous and lignitic, non-calcareous; with thin laminae of light grey silt, very fine-grained sandy; micaceous, finely glauconitic; frequent pyrite-quartz aggregates; foraminifera extremely rare - a depauperate Bulimina sp. cf. B. pupoides.
580 - 590	Percussion sludges	Grey clay, similar to above; very rare bryozoal fragments and depauperate foraminifera.
592 - 593	Open-tube core	Similar to 575 - 576 feet; somewhat carbonaceous and lignitic, but otherwise unfossiliferous.
595 - 605	Percussion sludges	Clay, silty and very fine-grained sandy, as above.
605 - 615	"	Dark brown, otherwise as above.
617 - 618	Open-tube core	Chocolate-brown silty clay, carbonaceous, lignitic, slightly pyritic and glauconitic, very fine-grained sandy; extremely rare small foraminifera.

Depth (feet)	Type of sample	Description
620 - 640	Percussion sludges	Similar to above, with Porosorotalia crassimura (V) entering at 635 feet.
645	"	Greyish-brown shelly sand with barnacle plates, molluscan bryozoal and echinoid fragments, often abraded and stained brown; glauconitic, slightly gritty, clayey, pyritic; foraminifera include Globigerina linaperta (V), Sherbornina atkinsoni (V), Carpenteria sp. (V), Glabratella crassa (V), Spirillina medioscabra (V), and Porosorotalia crassimura (F).
648	"	Dark greyish-brown shelly sand similar to above, and calcareous silty mudstone; frequent Turritella sp., occasional corals, Reussella finlayi enters.
650 - 655	"	Dark grey-brown shelly muddy sand, gritty, glauconitic; somewhat ferruginous, pyritic, carbonaceous; a little cementation to sandstone and mudstone; common Turritella sp.; Bolivinella sp. 1 (V), Globigerapsis index (V) and Lenticulina sp. aff. L. gyroscalpra (V) enter.
662 - 663	Open-tube core	Very dark brown carbonaceous clay with coarser laminae of silt and very fine-grained sand; compact, stiff; pyritic, slightly glauconitic; common well-broken mollusc fragments; abundant and varied but small foraminifera, with Globigerina linaperta (F) and Chiloguembelina cubensis (F).
665 - 675	Percussion sludge	Very dark brown clay and sand, shelly, with Turritella sp. prominent; Crespinina kingscotensis (R) and Linderina sp. (V) enter.
680	"	Brown, shelly, glauconitic clayey sand, with glauconite-impregnated fragments; common barnacle plates, abundant bryozoa and mollusca; Halkyardia sp. appears.
685	"	Dark brownish-grey, speckled green, glauconitic marl and sand, with Lamarckina airensis (V); similar to above.
688 - 690	"	Grey clayey sand, shelly, glauconitic; Pseudopolymorphina sp. enters.
695 - 696	Open-tube core	Glauconitic shelly marl, dark greenish-grey and paler brownish-grey; silty and sandy; pyritic; frequent large Turritella; a varied microfauna including Asterigerinella adelaidensis (V), Pseudopolymorphina sp., Lamarckina airensis (F), and Carpenteria sp. (C).

Depth (Feet)	Type of sample	Description
700	Percussion sludge	Similar to above, with Gyroidina octocamerata (V); foraminifera rather infrequent.
705	"	Very dark brown sandy and silty clay, carbonaceous, somewhat shelly glauconitic and pyritic, with foraminifera generally as above.
710 - 715	"	Very dark brown carbonaceous silty clay, micaceous, slightly shelly glauconitic and pyritic; some fine-grained sand; Cibicides umbonifer (A) is the predominant foraminifer.
720 - 721	Open-tube Core	Very dark brown carbonaceous and lignitic silty clay with laminae of pale grey-brown silt and very fine-grained sand; finely micaceous, slightly pyritic and glauconitic; rare gastropod and very rare pelecypod nuclei, no foraminifera seen.
725 - 740	Percussion sludges	Similar to above.
743 - 744	Open-tube core	Lithologically similar to above but with frequent small foraminifera, including Chiloguembelina cubensis (V); bryozoal and Turritella fragments very rare; pelecypod nuclei abundant.
745	Percussion sludge	Similar to above.
748 - 749	"	Shelly clayey sand, dark brown, very fine-grained to coarse and gritty; carbonaceous, glauconitic, pyritic; abundant bryozoa, frequent Turritella, barnacle plates, echinoid fragments; foraminifera larger, more frequent and varied with Pseudopolymorphina sp. and associated species.
750	"	Similar to above with large Lenticulina sp. aff. L. gyroscalpra (V).
755 - 765	"	Similar to 743 - 744 feet; finely shelly and with some foraminiferal species continuing rarely.
770 - 775	"	Silty and clayey sand, brown to grey, gritty at 770 feet; occasional cemented aggregates of sandstone, mudstone, and pyrite-quartz; slightly glauconitic and shelly with rare Turritella; foraminifera are rare, with Sherbornina atkinsoni (V) and Crespinina kingscotensis (V).

* Scale of abundance of foraminifera in routine picking of washed samples:

A = abundant (more than 25 specimens)
C = common (11 - 25)
F = frequent (6 - 10)
R = rare (3 - 5)
V = very rare (1 - 2)

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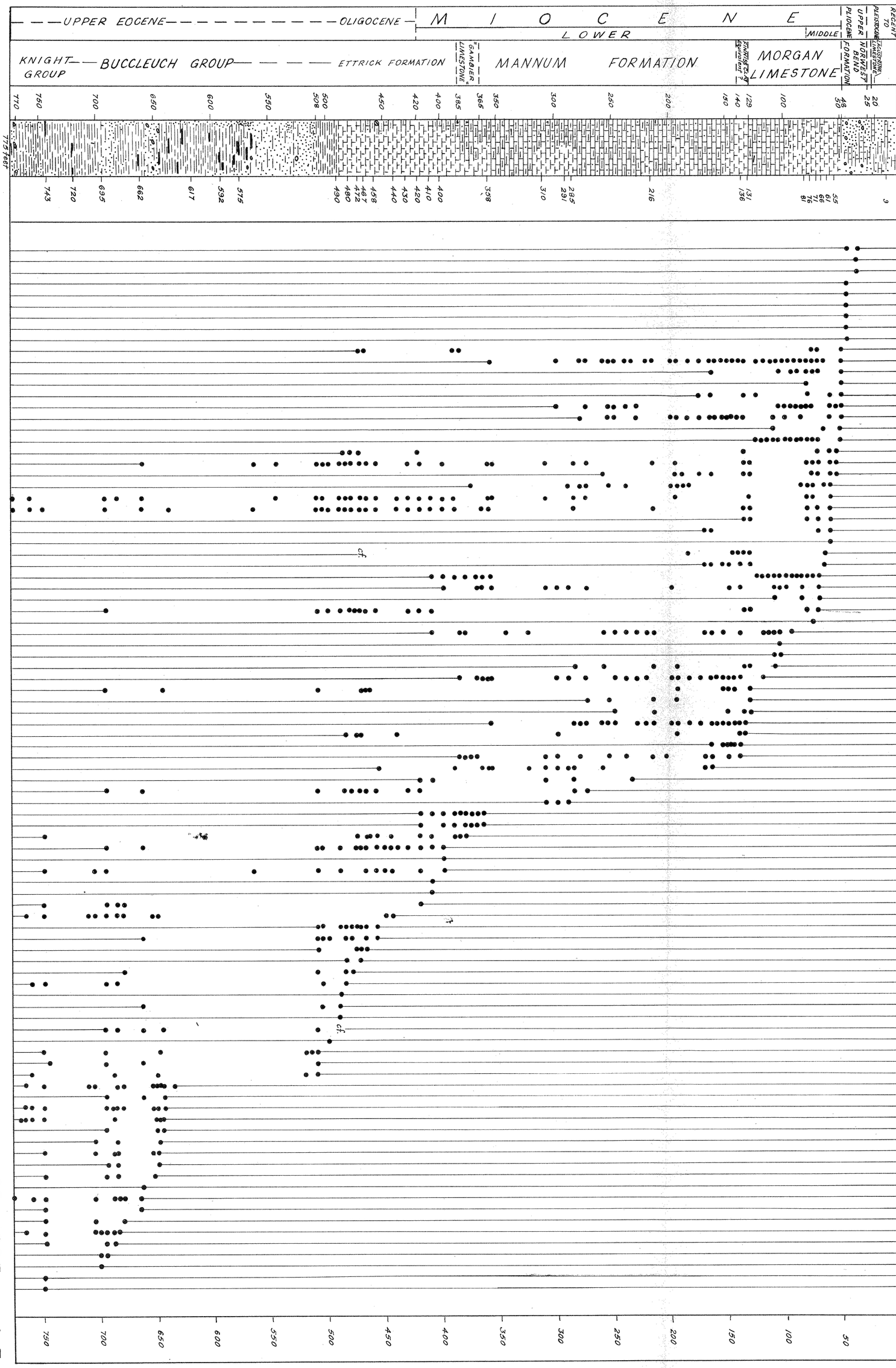
WAIKERIE BORE 2

COLUMNAR SECTION and MICROPALAEONTOLOGICAL LOG.



To accompany Pal Rep 1965 by J.M. Lindsay

65-1025

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