

PATA LIMESTONE AND BOOKPURNONG BEDS.

STANDARD SUBSURFACE SECTION.

DRAINAGE SHAFT 18 LOXTON

by

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PALAEONTOLOGIST

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CONTENTS

	<u>Page</u>
Abstract	1
1. Introduction	1
2. Stratigraphical Sequence	1
3. Description of Sludges	2
Loxton Sands	2
Bookpurnong Beds	3
Pata Limestone	4
Transitional Bed	4
Morgan Limestone	5
4. Correlation of other drainage bores in area	5
5. References	6
6. Columnar Section	58-211
7. Micropalaeontological log	

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ABSTRACT:

The standard subsurface section for the Pata Limestone and Bookpurnong Beds of Miocene age is described.

In upward sequence Morgan Limestone, Pata Limestone and Loxton Sands are intersected in Drainage Bore 18 on Section 377, Hundred of Gordon.

1. INTRODUCTION:

The drainage Bore sunk to a depth of 295 feet from the bottom of Engineering and Water Supply Department Shaft 18 on Section 377 Hundred of Gordon is selected as standard subsurface section for the Pata Limestone and Bookpurnong Beds. Both formations are known almost entirely from bore cuttings, although twelve feet of the Bookpurnong Beds are exposed $2\frac{1}{2}$ miles west of Loxton when the water level of the River Murray is low.

2. STRATIGRAPHICAL SEQUENCE

In upward succession, the sequence in Drainage Bore 18 consists of-

Morgan Limestone (Lower Miocene)

Below 192 feet and not bottomed at 295 feet the boring passed through grey white somewhat marly bryozoal limestone with a rich microfauna dominated by Operculina victoriensis, Amphistegina lessonii, and Parellina craticulatifomis; Lepidocyclina gippslandica occurs between 245 and 267 feet and other species characterizing the Batesfordian assemblage are present.

Between 182 and 196 feet a greenish grey micaceous glauconitic sandy marl separates the Morgan Limestone from the overlying Pata Limestone, and represents a passage bed between the two formations, the presence of glauconite also suggesting a change in sedimentation. The microfauna also appears to be transitional, with foraminiferal elements of the overlying and underlying limestones.

The Pata Limestone occurs between 126 and 182 feet.

It is lithologically similar to the Morgan Limestone, and is typically a pale grey partially recrystallized bryozoal limestone, marly in parts and with hard bands with abundant Ditrupea. The megafauna has not been described but includes species of Turritella, Dentalium, Nuculana, Limopsis and Carditidae.

The microfauna is distinguished by the entry of Orbulina universa and Cibicides victoriensis, the latter being restricted to the formation. Orbulina suturalis and species of the Porticulasphaera glomerosa series are also present.

Bookpurnong Beds

Above the Pata Limestone a brown to greenish-grey micaceous silty sands and marls of the Bookpurnong Beds occur. These are richly fossiliferous with abundant mollusca including Leioptyrga quadricingulata and shallow water foraminifera, particularly miliolid species. Flintina intermedia which has been regarded (Parr 1939, p.70) as restricted to the Kalimnan, is usually present in some numbers. This species makes its first appearance at the top of the Pata Limestone and continues through to the Loxton Sands in the Murray Basin. It has been recorded by Chapman (1916, p.352) as occurring with Amphistegina and Operculina at 315 - 325 feet in Mallee Bore 9.

Loxton Sands

Above 78 feet the yellow calcareous quartz sands, fine near the base, with abundant muscovite, were intersected. The depth at which they were entered in the shaft is not accurately recorded, but they generally occur in the Loxton area within a few feet of the surface. Typical shelly grits with Donax depressus were recovered from the shaft.

The Bookpurnong Beds and Loxton Sands are believed to be, but not necessarily established as of Upper Miocene age.

3. DESCRIPTION OF THE SLUDGES:

LOXTON SANDS

32 - 50ft. Yellow calcareous medium sand with subangular to subrounded quartz grains, fairly well polished, muscovite, shell fragments and a few poorly preserved foraminifera.

- 50 - 63 ft. Yellow-brown calcareous fine and coarse quartz sand with subrounded polished quartz grains, muscovite, Balanus sp, and a few small foraminifera.
- 63 - 76ft. Yellow calcareous fine sand with fine angular quartz grains and coarse subrounded polished grains, muscovite, biotite, small foraminifera including Elphidium pseudonodosum and Elphidium macellum and ostracodes.
- 76 - 78ft. Yellow fine micaceous marly sand with fine angular quartz grains, abundant small muscovite flakes, ostracodes mollusca including Syrnola (Evelynella) adelaidensis, ostracodes and foraminifera with Flintina intermedia, Elphidium advenum, E. pseudonodosum and E. macellum.

BOOKPURNONG BEDS

- 78 - 105ft. Dark green-grey carbonaceous sandy marl with glauconite and muscovite.

The sediments were laid down in shallow water into which silty and carbonaceous matter was carried. There is an abundant microfauna dominated by Flintina intermedia, Elphidium pseudonodosum, lagenids and miliolids.

Mollusca include Leiopyrga quadricingulata, Salaputium abbreviata, Tawera dictua. Balanus is also present.

- 105 - 118ft. Brownish green-grey micaceous silty sand and grit. Washed residues consist of light reddish-brown fine angular calcite fragments and coarse subrounded both clear and milky quartz grains conspicuously ironstained. Leiopyrga quadricingulata and other mollusca are present with numerous small foraminifera dominated by Bolivina spp. and lagenids.
- 118 - 126ft. Greenish grey highly fossiliferous sandy glauconitic marl. Washed residues consist mainly of abundant dark green and brown glauconite, calcite, fine angular quartz grains, limonite and numerous

ostracodes. Foraminiferal species of the upper part of the formation (? Upper Miocene) continue but some such as Operculina victoriensis and Marginopora vertebralis usually more characteristic of the Lower Miocene appear. Mollusca include Nuculana sp. nov., Turritella sp, and Dentalium (Laevidentalium) sp.

PATA LIMESTONE

126 - 150 ft. Grey-white partially recrystallized limestone with abundant large flat Operculina (? victoriensis), Cibicides victoriensis Marginopora vertebralis together with Ditrupa spp. fish otoliths, Nuculana sp. nov, Turritella so., Limopsis sp., Carditidae and Nuculidae.

150 - 165 ft. Pale grey marly bryozoal limestone with numerous Operculina and Cibicides victoriensis and Ditrupa.

One specimen of Flintina intermedia in the sample would represent the earliest appearance of this species. While the possibility of contamination during the drilling process must not be overlooked it has also been noted in a sample from the same stratigraphic level in the Murrayville district of Victoria. Mollusca (Nuculana and Carditidae) and crustacea are present.

165 - 182 ft. Pale grey marly bryozoal limestone with some glauconite. The microfauna is characterized by numerous Operculina victoriensis and Cibicides victoriensis with planktonic forms including Orbulina universa, Orbulina suturalis, Globigerinoides bisphaerica, G. triloba and species of the Porticulasphaera glomerosa series. The megafauna contains species of Turritella, Dentalium, Nuculana, Limopsis and Carditidae.

TRANSITIONAL BED

182 - 196 ft. Greenish grey micaceous glauconitic sandy marl. Washed residues consist of fine to medium angular quartz grains, yellow limestone fragments, dark bright green glauconite pellets, and shell fragments.

The megafauna includes species of Dentalium, Nuculana, Barbatia, Carditidae, and Corbula. The microfauna is dominated by Globigerinoides bisphaerica, Cibicides pseudoungerianus and Massilina ammophila. It appears to be transitional between that of the Morgan Limestone and that of the Pata Limestone.

MORGAN LIMESTONE

- 196 - 202 ft. Grey-white marly and partially recrystallized bryozoal limestone with Operculina victoriensis, Amphistegina lessonii and Parellina craticulatifomis, the latter restricted to the formation. Echinoids are also present.
- 202 - 209 ft. Grey - white marly bryozoal limestone with rich microfauna including the three species above and Planorbulinella plana, Carpenteria proteiformis, Globigerinoides bisphaerica and Globoquadrina dehiscens.
- 209 - 245 ft. Light grey marly bryozoal limestone, with abundant bryozoa. Microfauna similar to that of 202 - 209 feet.
- 245 - 267 ft. Light grey marly bryozoal limestone with Lepidocyclina gippslandica associated with Operculina victoriensis, Amphistegina lessonii, Parellina craticulatifomis, Globigerinoides bisphaerica.
- 267 - 295 ft. Light grey marly bryozoal limestone, with a similar microfauna including numerous small species.

4. CORRELATION OF OTHER DRAINAGE BORES IN THE AREA

Table 1 relates the sequence in three other bores in the area to the standard section.

Table 1

	Hd. Gordon Sec. 489	Hd. Gordon Sec. 537	Hd. Gordon Block 496
	ft. Depth	Feet	Feet
Existing shaft	0 - 30'	0 - 35'	0 - 24'
Loxton Sands	30' - 76'	35' - 71'	24' - 54'
Bookpurnong Beds	76' - 105'	71' - 72'6"	54' - 112'
Pata Limestone			112' - 167'
Transitional bed			? 167' - 180'
Morgan Limestone			180' - 200'

6. REFERENCES

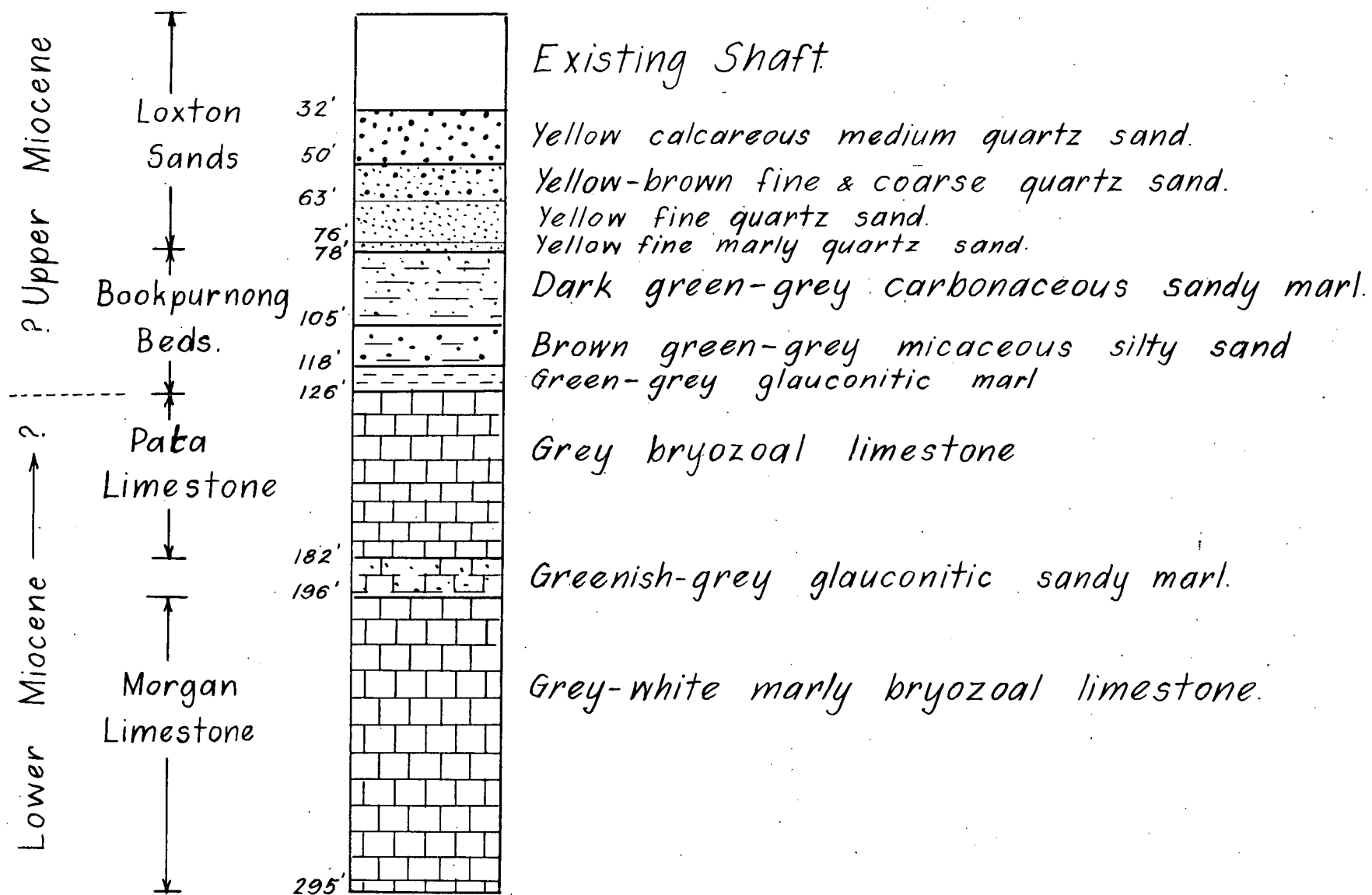
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NHL:JAH.
11/8/58.



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S.A. DEPARTMENT OF MINES

COLUMNAR SECTION

Standard Subsurface Section
Section 377 Hd. Gordon Shaft 18

Approved

Passed

Scale: 50' to 1"

Drn. N.H.L.

Tcd. B.F.

Ckd. R.R.

Exd.

58.211

Jb3

Date 1-8-58

Director

Exd.

Date 1-8-58

No. Amendment Exd. Date

SEC. 377, HUNDRED OF GORDON

	LOXTON SANDS				BOOKPURNONG BEDS			PATA LIMESTONE			MORGAN LIMESTONE					
	32-50	50-63	63-76	76-78	78-105	105-118	118-126	126-150	150-165	165-182	182-196	196-202	202-209	209-245	245-267	267-295
<u>Fissurina</u> sp.	x	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-
<u>Cassidulina</u> sp.	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
? <u>Elphidium</u> sp.	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<u>Reussella</u> sp.		x	-	-	-	-	x	-	-	-	-	-	-	-	-	-
<u>Bolivina</u> spp.		x	x	-	-	x	x	-	x	-	-	-	-	x	-	x
<u>Cibicides pseudoungerianus</u> (Cushman)		x	-	-	-	-	x	x	x	x	x	x	x	x	-	x
<u>Lagena</u> spp.			x	x	x	x	x	-	-	-	-	-	-	-	-	-
<u>Guttulina irregularis</u> (d'Orbigny)			x	-	x	-	-	-	-	-	-	-	x	-	-	x
<u>Guttulina problema</u> d'Orbigny			x	-	x	x	x	-	-	x	x	-	x	x	-	x
<u>Angulogerina</u> sp.			x	-	-	-	-	-	-	-	-	-	-	-	-	-
<u>Patellina</u> cf. <u>inconspicua</u> (Brady)			x	-	-	-	-	-	-	-	-	-	-	-	-	-
<u>Elphidium pseudonodosum</u> Cushman			x	x	x	x	x	-	-	-	-	-	-	-	-	-
<u>Elphidium macellum</u> (Fichtel & Moll)			x	x	x	x	x	-	x	-	-	-	-	-	-	-
<u>Elphidium</u> sp.			x	x	x	x	-	x	-	-	x	-	-	-	-	-
<u>Notorotalia</u> sp.			x	x	x	x	x	-	-	-	-	-	-	-	-	-
<u>Quinqueloculina vulgaris</u> d'Orbigny				x	x	x	x	x	x	x	x	-	x	-	-	-
<u>Quinqueloculina</u> spp.				x	x	x	x	-	x	x	x	-	-	-	-	-
<u>Flintina intermedia</u> (Howchin)				x	x	x	-	-	x	-	-	-	-	-	-	-
<u>Lagena striata</u> (d'Orbigny)				x	-	-	-	-	-	-	-	-	-	-	-	-
<u>Lagena sulcata</u> Walker & Jacob				x	x	-	-	-	-	-	-	-	-	-	-	-
<u>Guttulina lactea</u> (Walker & Jacob)				x	x	-	-	-	-	-	-	-	-	-	-	-
<u>Pseudopolymorphina</u> sp.				x	-	-	-	-	-	-	-	-	x	-	-	-
<u>Elphidium advenum</u> Cushman				x	x	x	x	-	-	-	-	-	-	-	-	-
<u>Astrononion</u> sp.				x	-	x	x	-	-	-	-	-	-	-	-	-
<u>Triloculina trigonula</u> (Lamarck)					x	-	x	-	-	x	-	x	-	-	-	-
<u>Triloculina</u> sp.					x	-	x	-	-	-	-	-	-	-	-	-
<u>Flintina triquetra</u> (Brady)					x	-	-	-	-	-	-	-	-	-	-	-
<u>Massilina adelaidensis</u> (Howchin & Parr)					x	-	-	x	-	-	-	-	-	-	-	-

[illegible]

	LOXTON SANDS				BOOKPURNONG BEDS			PATA LIMESTONE			MORGAN LIMESTONE					
	32-50	50-63	63-76	76-78	78-105	105-118	118-126	126-150	150-165	165-182	182-196	196-202	202-209	209-245	245-267	267-295
<u>Baggina philippinensis</u> (Cushman)		m				x		-	-	-	-	-	-	-	-	-
<u>Elphidium parri</u> Cushman						x		x	x	-	x	-	x	-	-	-
<u>Elphidium crassatum</u> Cushman						x		x	-	-	-	-	-	-	-	-
<u>Notorotalia howchini</u> (Chapman, Parr & Collins)						x		x	-	x	x	-	-	-	-	x
<u>Rotalia</u> sp.						x		-	-	-	-	-	-	-	-	-
<u>Operculina "victoriensis"</u> Chapman & Parr						x		x	x	x	x	x	x	x	x	x
<u>Textularia</u> spp.								x	x	-	x	x	x	-	-	-
<u>Dorothia</u> sp.								x	x	x	x	x	x	-	-	-
<u>Articulina</u> sp.								x	x	x	-	-	-	-	-	-
<u>Massilina</u> sp.								x	x	x	-	-	-	-	-	-
<u>Cornuspira involvens</u> Reuss								x	-	-	-	-	-	-	-	-
<u>Cornuspira tasmanica</u> Parr								x	x	x	x	-	-	-	-	-
<u>Cornuspira</u> sp.								x	x	x	x	-	-	-	-	-
<u>Sphaeroidina</u> sp.								x	-	-	-	-	-	-	-	-
<u>Cibicides victoriensis</u> Chapman, Parr & Collins								x	x	x	-	-	-	-	-	-
<u>Sigmoidella</u> cf. <u>elegantissima</u> (Parker & Jones)									cf.	x	x	x	x	x	x	-
<u>Sphaeroidina bulloides</u> d'Orbigny									x	-	-	-	-	-	-	x
<u>Siphonina australis</u> Cushman									x	x	-	-	-	-	-	x
<u>Textularia</u> cf. <u>sagittula</u> DeFrance										x	-	-	-	-	-	-
<u>Gaudryina</u> (<u>Pseudogaudryina</u>) sp.										x	-	-	-	-	-	x
<u>Liebusella rudis</u> (Costa)										x	-	-	x	-	-	-
<u>Schenckella howchini</u> (Cushman)										x	-	-	-	-	-	-
<u>Sigmollina asperula</u> (Karrer)										x	x	-	-	-	-	-
<u>Sigmollina chapmani</u> Cushman										x	-	-	-	-	-	-
<u>Sigmollina victoriensis</u> Cushman										x	x	x	-	-	-	-
<u>Cornuspiroides expansus</u> (Chapman)										x	-	-	-	-	-	-
<u>Lenticulina</u> sp.										x	-	-	-	-	-	-
<u>Uvigerina</u> spp.										x	-	x	-	-	-	x
<u>Cibicides</u> sp.										x	-	-	-	-	-	-
<u>Dyocibicides</u> sp.										x	-	-	-	-	-	-
<u>Canceris</u> sp.										x	-	-	-	-	-	-
<u>Anomalina colligera</u> Chapman & Parr										x	x	x	x	-	-	-

	LOXTON SANDS				BOOKPURNONG BEDS			PATA LIMESTONE			MORGAN LIMESTONE					
	32-50	50-63	63-76	76-78	78-105	105-118	118-126	126-150	150-165	165-182	182-196	196-202	202-209	209-245	245-267	267-295
<u>Globigerina bulloides</u> d'Orbigny								x			x	-	x	x	-	-
<u>Globigerinoides bisphaerica</u> Todd								x			x	-	x	x	x	x
<u>Globigerinoides triloba</u> (Reuss)								x			x	x	x	x	x	-
<u>Globigerinoides</u> spp.								x			x	-	x	-	-	-
<u>Orbulina universa</u> d'Orbigny								x			-	-	-	-	-	-
<u>Orbulina suturalis</u> Bronnimann								x			-	-	-	-	-	-
<u>Porticulasphaera</u> cf. <u>glomerosa</u> series (Blow)								x			x	-	-	-	-	-
<u>Elphidium howchini</u> Cushman (?)								x			x	-	x	x	x	x
<u>Quinqueloculina lamarckiana</u> d'Orbigny											x	-	x	-	-	-
<u>Triloculina tricarinata</u> d'Orbigny											x	-	-	-	-	-
<u>Sphaeroidina bulloides</u> d'Orbigny											x	-	x	-	-	-
<u>Cibicides refulgens</u> Montfort											x	-	x	x	-	-
<u>Cibicides subhaudingeri</u> Parr											x	-	x	x	x	x
<u>Astroncion australe</u> Cushman & Edwards											x	-	-	-	-	x
<u>Carpenteria rotaliformis</u> Chapman & Cressin											x	-	-	-	-	x
<u>Sigmomorphina subregularis</u> Howchin & Parr											x	-	x	x	-	x
<u>Chrysalidinella costata</u> (H. A & E.)											x	-	-	x	-	-
<u>Cassidulina subglobosa</u> Brady											x	-	x	-	-	x
<u>Ehrenbergina</u> sp.												x	x	x	-	x
<u>Cibicides lobatulus</u> (Walker & Jacob)												x	x	-	-	x
<u>Stomatobina torrei</u> (Cushman & Bermudez)												x	x	x	-	-
<u>Parellina craticuliformis</u> Wade												x	x	x	x	x
<u>Ceratobulimina (Ceratocancris) australis</u> C. & H.												x	-	-	-	-
<u>Cerobertina</u> sp.												x	-	-	-	-
<u>Amphistegina lessonii</u> d'Orbigny												x	x	x	x	x
<u>Textularia corrugata</u> H. A & E.													x	-	x	x
<u>Textularia pseudogramen</u> Chapman & Parr													x	cf.	-	x
<u>Gaudryina (Pseudogaudryina) crespinae</u> Cushman													x	-	-	-
<u>Clavulinoides victoriensis</u> Cushman													x	-	-	-
<u>Biloculinella globula</u> Bornemann													x	-	-	-
<u>Nodosaria soluta</u> Reuss													x	-	-	-
<u>Dentalina</u> sp.													x	-	-	-

	LOXTON SANDS				BOOKPURNING BEDS			PATA LIMESTONE			MORGAN LIMESTONE					
	32-50	50-63	63-76	76-78	78-105	105-118	118-126	126-150	150-165	165-182	182-196	196-202	202-209	209-245	245-267	267-295
<u>Robulus</u> spp.												x	-	-	-	
<u>Marginulina</u> spp.												x	-	-	-	
<u>Sigmomorphina chapmani</u> (H. A. & E.)												x	-	-	-	
<u>Guttulina</u> (<u>Sigmoidina</u>) <u>silvestrii</u> C. & O.												x	-	-	-	
<u>Guttulina</u> (<u>Sigmoidina</u>) <u>pacifica</u> C. & O.												x	x	-	-	
<u>Globulina gibba</u> d'Orbigny												x	-	-	-	
<u>Reussella simplex</u> Cushman												x	-	-	-	
<u>Reussella decorata</u> H. A. & E.												x	-	-	-	x
<u>Cassidulina laevigata</u> d'Orbigny												x	-	-	-	x
<u>Eponides repandus</u> (Fichtel & Moll)												x	x	x	x	x
<u>Globoquadrina dehiscens</u> (C. P. & C.)												x	-	-	-	
<u>Planorbulinella plana</u> (H. A. & E.)												x	-	-	-	
<u>Gypsina globulus</u> Reuss												x	x	x	x	x
<u>Carpenteria proteiformis</u> Goës												x	-	-	-	
<u>Loxostomum limbatum</u> (Brady)													-	-	-	x
<u>Conorbella patelliformis</u> (Brady)													x	-	-	x
<u>Crespinella</u> sp.													x	-	-	
<u>Reussella ensiformis</u> Chapman													x	-	-	
<u>Reussella spinulosa</u> (Reuss)													x	-	-	
<u>Tubulogenerina mooraboolensis</u> Cushman													x	-	-	
<u>Glabratella "cruciformis"</u> (H. A. & E.)													x	-	-	