COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Report No. 11

THE NELSON BORE, SOUTH-WESTERN VICTORIA, MICRO-PALAEONTOLOGY AND STRATIGRAPHICAL SUCCESSION

By

I. CRESPIN

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**Issued Under The Authority Of Senator the Hon. W. H. Spooner, M.M.,
Minister For National Development
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LIST OF REPORTS

1. Preliminary Report on the Geophysical Survey of the Collie Coal Basin-N.G. Chamberlain, 1948.
2. Observations on the Stratigraphy and Palaeontology of Devonian, Western Portion of Kimberley Division, Western Australia-Curt Teichert, 1949.
3. Preliminary Report on Geology and Coal Resources of Oaklands-Coorabin Coalfield, New South Wales-E. K. Sturmfels, 1950
4. Geology of the Nerrima Dome, Kimberley Division, Western Australia-D. J. Guppy, J. O. Cuthbert and A. W. Lindner, 1950
5. Observations of Terrestrial Magnetism at Heard, Kerguelen and Macquarie Island, 1947-1948. (Carried out in co-operation with the Australian National Research Expedition, 1947-1948). N. G. Chamberlain, 1952.
6. Geology of New Occidental, New Cobar and Chesney Mines, Cobar, New South Wales -C. J. Sullivan, 1951.
7. Mount Chalmers Copper and Gold Mine, Queensland-N. H. Fisher and H. B. Owen, 1952.
8. Geological and Geophysical Surveys, Ashford Coal Field, New South Wales-H. B. Owen and L. W. Williams.
9. The Mineral Deposits and Mining Industry of Papua and New Guinea-P. B. Nye and N. H. Fisher
10. Geological Reconnaissance, South-Western portion of Northern Territory-G. F. Joklik.
11. The Nelson Bore, South-Western Victoria; micro-palaeontology and stratigraphical succession-I. Crespin,
12. Stratigraphy and micro-palaeontology of the Marine Tertiary rocks between Adelaide and Aldinga, South Australia-I. Crespin,
13. Geology of Dampier Land-R. O. Brunnschweiller,
14. A Provisional Isogonic Map of Australia and New Guinea Showing Predicted Values for the Epoch 1955·5-F. W. Wood and I. B. Everingham, 1953
15. Progress Report on the Stratigraphy and Structure of the Carnarvon Basin, Western Australia; M. A. Condon.
16. Seismic Reflection Survey at Roma, Queensland; J. C. Dooley.
17. Mount Philp Iron Deposit; E. K. Carter and J. H. Brooks.

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C O N T E N T S

LIST OF PLATES

SUMMARY

The Nelson Bore is the deepest yet to be drilled in Victoria, and palaeontological evidence indicates that the entire sequence of beds from the depth of 108 feet down to 7,299 feet is of Tertiary age. Richly fossiliferous limestone, marly limestone, dolomitic limestone, and flint occur from 108 feet down to 812 feet and fossiliferous glauconitic sandstone and grit from 816 feet down to 989 feet. Lignitic sandstone and siltstone are present from 989 feet down to 7,299 feet; these beds contain plant remains throughout, but foraminifers and mollusca have not been found below the depth of 5,304 feet. The main foraminiferal assemblages are characteristic of the Janjukian Stage of Victoria, which is regarded as upper Eocene, and the "Anglesean" Stage which is most probably middle Eocene. The unfossiliferous beds below 5,304 feet are tentatively regarded as ?Palaeocene. Comparisons are made of the lithology and microfaunal assemblages in the Nelson Bore with similar occurrences elsewhere in south-eastern South Australia and south-western Victoria.

I. INTRODUCTION

The Nelson Bore is situated in the Parish of Glenelg, south-western Victoria, at the south-western end of the bridge over the Glenelg River near Nelson and 15 miles south-east of Mt. Gambier, South Australia. A rotary drilling plant, owned by the Commonwealth Government, was used in putting down this bore, which was financed by the Commonwealth and Victorian Governments and was drilled to test the possible presence of a structure suitable for oil accumulation. Operations commenced in November 1941, and ceased on 28th November 1945, at a depth of 7,299 feet. This bore, which was cored throughout, proved the greatest thickness of Tertiary sediments yet found in Australia. Prior to the drilling of the Nelson Bore, the greatest thickness was in Holland's Landing Bore, Parish of Bengworden South, East Gippsland, in which 3,524 feet of Tertiary beds were found to overlie rocks of Jurassic age. (Crespin, 1941).

The Nelson Bore passed through bryozoal, marly, cherty, and dolomitic limestones, flint, glauconitic sandstone, and lignitic siltstone and sandstone. Four hundred and twenty seven samples, which had been collected at fairly close intervals, were examined.

II. HISTORICAL NOTES

Interest in the microfaunal content of the limestones in the vicinity of Mt. Gambier dates back to 1860 when the Reverend J.E. Tenison Woods published a paper entitled "On Some Tertiary Rocks in the Colony of South Australia". Appended to this paper were two notes on the microfossils, one by George Busk on the bryozoa and the other by W.K. Parker and T. Rupert Jones on the foraminifera.

Also in 1860 T. Burr referred to a "white coral limestone (bryozoal limestone) containing flint and chert" at Mt. Gambier and Mt. Schanck.

In 1862 Tenison Woods published his well-known "Geological Observations in South Australia" in which he discussed the Mt. Gambier limestones. In 1867 he wrote four short papers on the Tertiary rocks of South Australia, the first one being in the form of an introduction and the other three giving descriptions of echinoids, bryozoa, and mollusca from Mt. Gambier.

In 1881, Waters described bryozoa from south-western Victoria, and in 1882 he described further species from the Mt. Gambier limestone. Many of these species have been recognised in the limestones in the Nelson Bore.

No further work on the microfaunas in the rocks in south-eastern South Australia and south-western Victoria was undertaken until 1930, when the possibilities of obtaining oil in the area were being considered. Between 1930 and 1935 the late F. Chapman and the writer, on behalf of the Geological Branch, Department of the Interior, (now the Bureau of Mineral Resources, Geology and Geophysics, Ministry of National Development,) made micropalaeontological examination of numerous surface and subsurface samples submitted by the Geological Survey of Victoria and by various private companies engaged in the search for oil in the area. The writer has drawn on these unpublished departmental reports for some of the information given in

Section VI of the Report.

III. DESCRIPTION OF BORE SAMPLES AND THEIR FORAMINIFERAL CONTENT

A detailed description of the lithology and foraminiferal content of samples examined is presented.

Unfortunately the first sample received for examination was not collected until the bore had reached the depth of 108 feet. However, below that depth, samples taken at close intervals were submitted.

108 feet. Whitish bryozoal limestone with foraminifera.

- Anomalina subnonionoides
- Carpenteria rotaliformis
- Cassidulina subglobosa var. horizontalis
- Cibicides victoriensis
- Cibicides sp. 2
- Clavulinoides szaboi var. victoriensis
- Dentalina soluta
- Dorothia parri
- Eponides repandus var.nov.
- Eponides scabriculus
- Gaudryina collinsi
- Globigerina triloculinoides
- Globulina inaequalis
- Gypsina globulus
- Lagena aff. crumenata
- Lenticulina sp.
- Robulus sp.
- Sigmoidella cf. elegantissima
- Sigmoidella cf. kagaensis
- Sigmomorphina cf. bornemanni
- Sigmomorphina jacksonensis
- Sphaeroidina variabilis

112 feet. Hard, almost flinty limestone.

132 feet. Friable grey bryozoal marl with foraminifera.

- Anomalina ammonoides var.acuta
- Anomalina perthensis
- Bolivina fastigia
- Bolivina victoriana
- Carpenteria rotaliformis
- Cassidulina subglobosa var. horizontalis
- Eponides repandus var.nov.
- Eponides cf. toulmini
- Globigerina ouachitsensis
- Gypsina globulus
- Heronallenia vicksburgensis
- Lagena aff. crumenata
- Lagena marginata

List contd. on next page.

Cibicides pseudoconvexus
Cibicides sp. 2
Dentalina sp.nov.
Discorbis sp.nov.
Dorothia parri
Ellipsonodosaria cf. cocoaensis
Marginulina costata
Pseudoglandulina clarkei
Robulus limbosus
Robulus sp.
Sigmomorphina cf. bornemanni
Siphoninella chambersi
Sphaeroidina variabilis
Spiroplectammina mississippiensis

152-172 feet. Hard to friable grey bryozoal marl.

192 feet. Friable pale-grey bryozoal marly limestone, with foraminifera.

Angulogerina sp. 2
Angulogerina sp. 9
Anomalina ammoncides var. acuta
Bdelloidina sp.
Bolivina fastigia
Bolivina scalprata var. retiformis
Carpenteria globiformis
Cassidulina alabamensis
Cassidulina cf. armata
Cassidulina sp.
Cibicides finlayi
Cibicides vortex
Cibicides sp. 2
Dentalina soluta
Dentalina sp.
Discorbis sp.nov.
Dyocibicides biserialis
Elphidium crassatum
Eponides repandus var.nov.
Eponides scabriculus
Frondicularia sp.nov. aff. midwayensis
Gaudryina collinsi
Gaudryina (Pseudogaudryina) cf. proreussi
Globigerina cf. angipora
Globigerina trilocularis
Globigerina triloculinoides
Guttulina hantkeni
Gyroidina soldanii
Heronallenia vickburgensis
Heronallenia sp.nov.aff.lingulata
Lagena favosopunctata
Lagena laevis
Lagena sulcata
Patellina cf. corrugata
Pullenia bulloides
Robulus limbosus
Sigmoidella bortonica
Sigmomorphina vaughani
Siphonina australis
Spiroplectammina mississippiensis
Textularia sp.
Vaginulina legumen
Vaginulina sp.

198 feet. Greyish flint with bryozoa.

220 feet. Hard bryozoal limestone.

230 feet. Fawn to grey flint with bryozoa.

253 feet. Friable grey bryozoal marly limestone with foraminifera.

Bulimina pupula
Buliminella madagascarensis var. spicata
Cyclammina incisa
Dorothia parri
Eponides scabriculus
Gaudryina collinsi
Globulina gibba
Globulina rotundata
Operculina cf. victoriensis
Robulus sp.
Sphaeroidina variabilis

293-328 feet. Friable whitish bryozoal marl with foraminifera.

Alabamina westraliensis
Anomalina ammonoides var. acuta
Anomalina subnonionoides
Bolivina fastigia
Bolivina scalprata var. retiformis
Buliminella cf. pupa
Carpenteria rotaliformis
Cassidulina alabamensis
Cassiduline cf. armata
Cassidulina subglobosa var. horizontalis
Cibicides umbonifer
Cibicides sp. 1
Dentalina cf. cooperensis
Dentalina cf. fissicostata
Discorbinella cf. biconcava
Dorothia subglabra
Dyocibicides biserialis
Elphidium crassatum
Elphidium sp.
Eponides repandus var.nov.
Eponides scabriculus
Frondicularia sp.
Globigerina triloculinoides
Guttulina irregularis
Guttulina sp.
Gyroidina soldanii
Gyroidina soldanii var. octocamerata
Marginulina cf. subbullata
Nodosaria latejugata
Nodosaria sp.
Pseudopolymorphina sp.nov.
Pullenia bulloides
Pullenia quinqueloba
Robulus gyroscalprum
Robulus inornatus
Rotorbinella finlayi
Sigmoidella bortonica
Sigmoidella plummerae
Sigmomorphina cf. bornemanni
Sigmomorphina jacksonensis
Sigmomorphina pseudoregularis
Sigmomorphina vaughani
Stomatorbina torrei
Vaginulina sp.

348 feet. Grey flint.

368-390 feet. Moderately friable bryozoal marly limestone with foraminifera.

Alabamina westraliensis
Angulogerina subangularis
Anomalina perthensis
Bolivina fastigia
Bolivina scalprata var. retiformis
Bolivina sp.
Carpenteria rotaliformis
Cassidulina alabamensis
Cassidulina cf. armata
Cassidulina subglobosa var. horizontalis
Cibicides umbonifer
Cibicides sp. 1
Clavulinoides sp.
Discorbinella cf. biconcava
Discorbis cf. bulla
Discorbis sp. 1
Dyocibicides biserialis
Eponides repandus var.nov.
Eponides scabriculus
Eponides sp.nov.
Gaudryina (Pseudogaudryina) crespinae
Globigerina cf. ouachitaensis
Globigerina triloculinoides
Globulina gibba
Globulina inaequalis
Gyroidina soldanii
cf. Hofkerina
Lagena globosa
Lagena hexagona
Lagena cf. orbignyana
Lagena sulcata
Patellina cf. corrugata
Planulina cocoaensis
Quinqueloculina sp.
Robulus arcuato-striatus
Spiroplectammina wilcoxensis
Stomatorbina torrei
Textularia sp.
Victoriella plecte

410 feet. Hardened grey marly limestone; bryozoal limestone.

432 feet. Friable cream bryozoal marly limestone with foraminifera.

Angulogerina sp. 2
Carpenteria rotaliformis
Cassidulina alabamensis
Cassidulina cf. armata
Cassidulina sp.nov.
Cibicides vortex
Eponides sp.nov.
Heronallenia sp.nov.aff. lingulata
Lenticulina convergens
Lingulina metungensis
Pullenia bulloides
Robulus arcuato-striatus
Robulus inornatus

List continued on next page.

Globigerina cf. ouachitaensis
Gyroidina scrobiculata
Sigmomorphina chapmani
Sigmomorphina cf. trinitatensis
Spiroplectammina mississippiensis
Vaginulina cf. loeblichi
Victoriella plecte

453 feet. Friable cream bryozoal marl with a few poorly preserved foraminifera.

Eponides scabriculus
Victoriella plecte

465 feet. Friable grey bryozoal marly limestone.

Anomalina perthensis
Anomalina subnonionoides
Cassidulina alabamensis
Cassidulina sp.nov.
Cibicides lobatulus
Cibicides umbonifer
Cibicides sp. 2
Cyclammina incisa
Elphidium sp.
Eponides repandus var.
Eponides scabriculus
Globigerina cf. angipora
Globulina sp.
Guttulina caudata
Heronallenia sp.nov.aff. lingulata
Lenticulina gibba
Marginulina cf. costata
Nodosaria cf. latejugata
Pseudopolymorphina sp.nov. 2
Pullenia bulloides
Robulus alato-limbosus
Robulus gyroscalprum
Robulus sp.
Sigmomorphina chapmani
Sigmomorphina vaughani
Spiroplectammina cf.mississippiensis
Textularia cf. fistulosa
Victoriella plecte

474-494 feet. Friable cream to greyish bryozoal marly limestone with foraminifera.

Ammodiscus parri
Carpenteria rotaliformis
Eponides scabriculus
Gaudryina collinsi
Operculina cf. victoriensis
Pseudopolymorphina sp. 1
Pyrulina cylindroides
Sigmomorphina chapmani

List continued on next page.

Guttulina spicaeformis
Lingulina metungensis
Sigmomorphina jacksonensis
Vaginulina cf. loeblichi
Vaginulina cf. saundersi
Victoriella plecte

517 feet. Friable whitish marly limestone with all organisms altered and indeterminate.

534-557 feet. Pinkish limestone, with indeterminate fossils.

578 feet. Hard cream bryozoal limestone.

582 feet. Hard pinkish dolomitic limestone.

587 feet. Cream limestone, composed entirely of small crystals of calcite.

597 feet. Hard greyish bryozoal marly limestone.

607 feet. Pale pinkish dolomitic limestone.

625 feet. Cream limestone, composed entirely of small crystals of calcite.

635 feet. Hard greenish-grey bryozoal marly limestone.

646 feet. Friable whitish bryozoal marly limestone with foraminifera.

Annulopatellina sp.nov.
Anomalina perthensis
Bolivina scalprata var. retiformis
Bolivinopsis crespinae
Buliminella madagascarensis var. spicata
Cassidulina cf. subglobosa
Cibicides lobatulus
Cibicides pseudoungerianus;
Globigerina triloculinoides
Globulina gibba
Glomospira charoides
Guttulina caudata
Gyroidina scrobiculata
Heronallenia sp.nov.
Heronallenia vicksburgensis
Lagena sulcata
Lamarckina sp.

List continued on next page.

Cibicides umbonifer
Cibicides sp. 1
cf. Coskinolina
Discorbinella sp.
Discorbis spp.
Eponides repandus var.nov.
Gaudryina (Pseudogaudryina) crespinae
Patellina cf. corrugata
Pullenia bulloides
Sigmoidella plummerae
Sigmomorphina cf. bornemanni
Sigmomorphina chapmani
Spirillina cf. inaequalis
Spiroplectammina wilcoxensis
Stomatorbina torrei

666-689 feet. Hard,cream to greyish, bryozoal marly limestone.

700 feet. Friable pale-grey bryozoal marly limestone with poorly preserved foraminifera.

Cyclammina rotundata
Hofkerina cf. semiornata

720 feet. Moderately hard friable white bryozoal marl with foraminifera.

Ammodiscus parri
Anomalina perthensis
Cassidulina sp.nov.
Cibicides sp. 1
Cyclammina incisa
Dentalina cf. obliqua
Discorbinella sp.nov.
Ellipsonodosaria sp.
Eponides repandus var.nov.
Gaudryina (Pseudogaudryina) crespinae
Globigerina triloculinoides
Glomospira charoides
Guttulina caudata
Gyroidina cf. scrobriculata
Heronallenia vicksburgensis
Heronallenia sp.nov.aff.lingulata
Hofkerina cf. semiornata
Lagena sulcata
Marginulina sp.
Notorotalia sp.nov.
Patellina cf. corrugata
Pullenia bulloides
Robulus spp.
Stomatorbina torrei
Vaginulina legumen

730-736 feet. Moderately hard grey bryozoal marly limestone.

746 feet. Hard cream bryozoal marly limestone.

756 feet. Friable light-grey finely-bedded marl with bryozoa as white casts along bedding planes and with foraminifera.

Angulogerina subangularis
Angulogerina sp. 2
Cassidulina subglobosa var. horizontalis
Cassidulina sp.nov.
Cibicides perforatus var. notocenicus
Cibicides sp. 1
Cyclammina incisa
Dentalina cf. havanaensis
Dentalina soluta
Ellipsonodosaria cf. cocoaensis
Globigerina cf. angipora
Globigerina ouachitaensis
Globigerina triloculinoides
Globulina rotundata
Glomospira charoides
Guttulina irregularis
Guttulina spicaeformis
Gyroidina scrobriculata
Heronallenia sp.nov.aff. lingulata
Hopkinsina bortotara
Lagena cf. crumenata
Lagena favosopunctata
Lagena sulcata
Marginulina glabra
Marginulina subbullata
Marginulinopsis sp.
Nodosaria cf. latejugata
Pseudoglandulina clarkei
Pseudopolymorphina sp.nov.
Pullenia bulloides
Pullenia compressiuscula
Robulus gyroscalprum
Robulus sp.
Saracenaria italica
Sigmoidella plummerae
Sigmomorphina chapmani
Siphogenerina sp.nov.
Sphaeroidina variabilis
Vagulinopsis gippslandicus

770-790 feet. Hard greyish-white bryozoal marly limestone.

807 feet. Hard light-grey bryozoal marly limestone, partly crystalline and with small foraminifera very encrusted.

811 feet. Hard cream bryozoal marly limestone.

812 feet. Hard greyish-white crystalline limestone.

816 feet. Moderately coarse reddish grit, consisting of quartz grains and brown glauconite. Foraminifera too poorly preserved for determination.

818-874 feet. Friable sandstone, consisting of moderately coarse quartz grains, somewhat ironstained, and a few minute poorly preserved foraminifera.

877 feet. Hard moderately coarse calcareous grit with foraminifera.

Angulogerina sp. 2	Eponides repandus var.nov.
Anomalina subnonionoides	Sigmomorphina chapmani
Carpenteria rotaliformis	Sigmomorphina vaughani
Cyclammina incisa	Victoriella plecte
Elphidium howchini	

902 feet 6 inches. Hard moderately coarse calcareous grit.

903-922 feet. Friable quartz sandstone.

923 feet. Moderately coarse grit.

939 feet. Moderately fine ochreous calcareous grit, with occasional small pebbles, many quartz grains coated with limonite, fragments of cidaroid spines replaced with calcite, and indeterminate fish teeth and spines.

947 feet. Fine ochreous calcareous grit, with subangular quartz grains coated with limonite, grains of dark green glauconite, brown ovoid pellets, foraminifera, small limonitic casts of indeterminate gastropoda, and indeterminate fish teeth.

Cyclammina rotundata

953 feet. Fine-grained black sandstone, with abundant grains of green glauconite, ovoid pellets of glauconite, numerous crystals of ? siderite, glauconitic replacement of foraminifera, echinoid spines, thin-shelled molluscs, and indeterminate fish remains.

Cyclammina incisa

963 feet. Dark brown gritty glauconitic calcareous sandstone with numerous quartz grains, some coated with ? limonite, abundant brown to green glauconite grains, ovoid pellets, some with concentric structure, grains of ? siderite, foraminifera, fragments of bryozoa, and glauconitic replacement of thin-shelled gastropoda.

Cyclammina rotundata (common)

976 feet. Glauconitic sandstone, with abundant brown and green glauconite, ovoid pellets of brown glauconite, grains of quartz coated with limonite, and foraminifera.

Cyclammina incisa

989 feet. Hard pebbly grit.

992 feet. Fine-grained dark-grey micaceous sandstone, consisting almost entirely of fine quartz grains, with pyrites, mica flakes, and glauconite grains, and foraminifera.

Cyclammina incisa

1002-1042 feet. Fine dark-grey micaceous sandstone with ? algal markings, glauconite grains, and foraminifera.

Cyclammina incisa
Cyclammina paupera

1048 feet. Friable moderately fine sandstone.

1069-1119 feet. Light to dark grey fine-grained micaceous sandstone with pyrite common (patches at 1109 feet), a little glauconite, carbonaceous material, and mica flakes.

1129-1145 feet. Mottled, dark to light grey, micaceous sandstone, with ? algal markings and foraminifera.

Cyclammina sp. (small species)

1155-1231 feet. Light-grey micaceous sandstone with irregular bands of dark grey shale and containing numerous particles of carbonaceous material, also pyrite and green glauconite.

1241-1254 feet. Dark brownish-grey carbonaceous micaceous sandstone, with pyrite and glauconite.

1260 feet. Mottled,dark to light grey, micaceous sandstone.

1270-1280 feet. Fine dark-grey micaceous sandstone with patches of glauconite and ? algal markings.

1290 feet. Friable bedded dark to light grey carbonaceous micaceous shale.

1300-1341 feet. Moderately fine-grained fawn-coloured micaceous sandstone.

1359-1362 feet. Mottled, dark to light grey, micaceous shale.

1364 feet. Friable light-grey micaceous sandstone.

1382 feet. Friable grit, with coarse to fine rounded quartz grains, pyrite, and glauconite.

1403-1449 feet. Light to dark grey micaceous shale interbedded with micaceous sandstone, with numerous carbonaceous fragments and pyrite.

1510-1520 feet. Friable dark-grey micaceous sandstone.

1533-1563 feet. Friable dark-grey carbonaceous micaceous sandstone.

1573 feet. Light-grey sandstone, interbedded with grey shale.

1583-1600 feet. Grey sandstone interbedded with carbonaceous

shale and containing numerous grains of pyrite and green glauconite.

1610 feet. Friable moderately coarse light-grey sandstone.

1644 feet. Light-grey pebbly sandstone.

1669-1700 feet. Friable light-grey sandstone, with fine to coarse quartz grains, carbonaceous material and glauconite.

1733-1810 feet. Friable grey micaceous sandstone.

1820-1830 feet. Grey micaceous sandstone with pyrite.

1835 feet. Dark-grey carbonaceous sandstone with pyrite.

1845-1855 feet. Dark-grey micaceous shale interbedded with fine-grained micaceous sandstone.

1865 feet. Grey to dark-grey micaceous sandstone, consisting chiefly of angular to subangular quartz grains and some pyrite.

1868 feet. Coarse sandstone.

1878-1888 feet. Fine-grained carbonaceous micaceous sandstone interbedded with dark-grey shale.

1901 feet. Fine-grained grey micaceous sandstone.

1903 feet. Dark-grey mudstone and fine-grained sandstone, consisting of fine angular quartz grains, rounded pebbles, and pyrite.

1913-1922 feet. Fine-grained grey micaceous sandstone.

1924-1942 feet. Unconsolidated sand with quartz grains coated with limonite, brown glauconite, ovoid pellets of limonite, and small indeterminate fish teeth.

1953-1990 feet. Fine-grained grey micaceous sandstone.

2008-2016 feet. Fine-grained grey to dark-grey lignitic micaceous sandstone with pyrite and a few tests of foraminifera replaced with pyrite.

Cyclammina cf. *incisa*
Cyclammina sp.

2017 feet. Hard lignitic sandstone.

2027-2056 feet. Friable micaceous lignitic sandstone.

2066 feet. Moderately hard dark-grey micaceous lignitic sandstone with ? algal markings.

2078-2088 feet. Friable micaceous lignitic sandstone.

2092-2126 feet. Friable grey sandstone, containing fine angular to large subangular quartz grains and some pyrite.

2136-2146 feet. Fine grey micaceous sandstone with numerous carbonaceous fragments and foraminifera.

Cyclammina complanata
Cyclammina incisa
Cyclammina sp.
Haplophragmoides sp.

2156-2166 feet. Grey micaceous sandstone.

2176-2186 feet. Mottled dark-grey to grey micaceous sandstone with carbonaceous fragments, foraminifera, and pyritic cast of molluscan shell.

List continued on next page.

Ammodiscus cf. parri
cf. Haplophragmoides

2196-2206 feet. Hard dark-grey micaceous and pyritic sandstone with ? algal markings.

2236-2278 feet. Fine-grained grey micaceous sandstone with pyrite.

2285-2290 feet. Pale to dark-grey micaceous lignitic sandstone with abundant carbonaceous fragments and foraminifera.

Cyclammina complanata
Cyclammina sp. (common at 2290 feet)
cf. Haplophragmoides

2295 feet. Grey lignitic micaceous sandstone.

2296 feet. Hard grey sandstone.

2299-2330 feet. Friable dark to light grey micaceous sandstone.

2340 feet. Moderately hard laminated light to dark-grey sandstone with carbonaceous fragments and foraminifera.

Ammodiscus sp.
Cyclammina cf. paupera
Cyclammina sp. (common)

2350 feet. Hard dark-grey micaceous sandstone with pyrite.

2363 feet. Friable grey micaceous sandstone with pyrite.

2366-2398 feet. Grey to dark-grey micaceous sandstone with carbonaceous fragments and pyrite.

2406-2408 feet. Dark-grey lignitic shale interbedded with fine-grained grey micaceous sandstone and foraminifera.

Cyclammina incisa
Cyclammina cf. paupera

2418-2427 feet. Dark-grey micaceous lignitic sandstone with foraminifera.

Cyclammina incisa

2519-2554 feet. Grey to dark-grey micaceous lignitic sandstone.

2563 feet. Dark-grey micaceous lignitic siltstone.

2573-2574 feet. Dark-grey to grey micaceous sandstone.

2582 feet. Dark-grey micaceous lignitic siltstone.

2590-2600 feet. Hard dark-grey lignitic sandstone with pyrite.

2617-2632 feet. Mottled light to dark-grey micaceous sandstone.

2642-2652 feet. Mottled light to dark grey micaceous sandstone with foraminifera.

Ammodiscus sp.
Cyclammina rotundata
Cyclammina sp.

2662-2672 feet. Similar to previous sample, but no foraminifera present.

2681 feet. Lignitic sandstone with foraminifera.

Ammodiscus cf. *parri*
Ammodiscus sp.
Bathysiphon cf. *angleseaensis*
Cyclammina sp. (common)
Rhizammina sp.

2712 feet. Grey micaceous sandstone.

2720-2732 feet. Laminated dark-grey lignitic siltstone and micaceous sandstone.

2735 feet. Grey micaceous sandstone and grey siltstone.

2737-2756 feet. Grey micaceous sandstone interlaminated with dark-grey siltstone.

2758 feet. Massive pyrite.

2766 feet. Grey micaceous sandstone with carbonaceous fragments.

2781 feet. Moderately hard dark-grey siltstone interbedded with grey sandstone.

2787 feet. Unconsolidated quartz sand with pyrite and carbonaceous fragments.

2798-2810 feet. Lignitic siltstone interbedded with grey sandstone.

2818 feet. Grey micaceous sandstone.

2820 feet. Hard, slightly lignitic, grey micaceous sandstone.

2828 feet. Hard lignitic sandstone, with plant remains, and patches of resinous substance.

cf. *Cinnamomum*
cf. *Banksia*

2830 feet. Dark-grey lignitic micaceous sandstone.

2837-2865 feet. Moderately hard finely-bedded dark-grey siltstone and micaceous sandstone.

2868 feet. Fine-grained sandstone with particles of plant remains.

2874 feet. Fawnish-grey siltstone with pyrite and patches of indeterminate plant remains, pyritic replacement of pelecypoda and other indeterminate organisms, and ? phosphatic particles.

2876 feet. Grey micaceous siltstone with carbonaceous fragments.

2886-2894 feet. Moderately hard to friable laminated dark-grey siltstone and micaceous sandstone.

2906-2918 feet. Grey lignitic sandstone

2919-2925 feet. Grey micaceous siltstone and sandstone, with carbonaceous fragments.

2929 feet. Dark brownish-grey lignitic siltstone with bands of micaceous sandstone.

2931 feet. Hard grey micaceous sandstone.

2954 feet. Dark-grey siltstone with indeterminate plant remains.

2963-2979 feet. Dark-grey and light-grey siltstone with foraminifera.

cf. Bathysiphon

2997 feet. Friable micaceous sandstone.

3003 feet. Hard to friable grey micaceous sandstone with foraminifera.

Cyclammina incisa
Cyclammina cf. paupera

3024-3059 feet. Hard to friable dark-grey to black micaceous lignitic sandstone with foraminifera.

Cyclammina incisa
Cyclammina paupera

3069-3123 feet. Grey micaceous sandstone and dark-grey siltstone.

3136 feet. Unconsolidated, fine quartz sand.

3146-3154 feet. Friable grey to dark-grey micaceous sandstone with carbonaceous fragments and foraminifera.

Cyclammina sp. (small and abundant).

3205 feet. Unconsolidated fawnish sand with small quartz pebbles.

3236 feet. Fawnish micaceous sandstone.

3244 feet. Grey lignitic micaceous sandstone with fine lignitic bands and foraminifera.

Cyclammina sp.

3274-3293 feet. Grey lignitic micaceous sandstone.

3321 feet. Greyish micaceous sandstone.

3360-3390 feet. Friable micaceous and lignitic sandstone.

3566 feet. Hard brownish massive siltstone.

3612 feet. Hard dark-grey fine-grained micaceous sandstone with foraminifera and pelecypoda.

Foraminifera: Cyclammina incisa
Pelecypoda: Nuculana cf. chapmani

3617-3618 feet. Similar to previous sample but no fossils present.

3625-3634 feet. Hard grey massive siltstone with pyrite, indeterminate plant remains, and also pelecypoda (Nuculana cf. chapmani) at 3632 feet.

3635 feet. Hard fawn-coloured massive siltstone, with indeterminate plant and ? fish remains.

3636-3655 feet. Hard grey massive siltstone with pyrite and indeterminate plant remains.

3690 feet. Grey grit with carbonaceous fragments.

3712-3718 feet. Hard grey fine-grained micaceous lignitic sandstone with ? algal markings at 3718 feet.

3723-3740 feet. Hard grey to dark-grey fine-grained micaceous sandstone.

3746-3795 feet. Friable dark-grey carbonaceous siltstone, inter-laminated with sandstone and containing massive pyrite.

3805-3874 feet. Alternating bands of hard and friable, grey to dark-grey, micaceous and lignitic sandstone.

3875 feet. Friable coarse sandstone.

3887 feet. Hard, dark to light grey, micaceous sandstone.

3920-4220 feet. Friable sandstone.

4221 feet. Laminated grey siltstone.

4250 feet. Grey sandstone.

4302 feet. Grey siltstone.

4366 feet. Moderately hard dark-grey lignitic and micaceous siltstone with patches of sandstone, indeterminate plant remains, and resin.

4506 feet. Grey micaceous sandstone, with carbonaceous fragments.

4681 feet. Grey sandstone with pyrite.

4742-4743 feet. Hard grey micaceous sandstone with indeterminate plant remains and thin bands of lignitic siltstone.

4746-4790 feet. Grey to dark-grey lignitic siltstone.

4792 feet. Hard grey fine-grained micaceous sandstone with carbonaceous fragments.

4807-4811 feet. Coarse-grained to fine-grained sandstone.

4868-4869 feet. Grey sandstone.

4876 feet. Coarse-grained to fine-grained sandstone with thin bands of lignitic material.

4920 feet. Hard fine-grained micaceous sandstone with thin bands of lignitic material.

5112 feet. Grey sandstone, with thin bands of dark-grey shale and pyrite.

5191 feet. Grey micaceous sandstone.

5304 feet. Hard to friable grey micaceous sandstone, interbedded with bands of lignitic siltstone and foraminifera.

Cyclammina sp.

5391 feet. Friable grey micaceous sandstone interbedded with thin bands of lignitic siltstone.

5391-5427 feet. Friable sandstone with pyrite and pyritic replacement of woody fragments.

5458 feet. Grey sandstone.

5536 feet. Hard grey pyritic sandstone.

5597 feet. Grey micaceous sandstone with carbonaceous fragments and aggregate of pyrite.

5708 feet. Grey sandstone with laminae of micaceous lignitic siltstone at bottom of core.

5782-5784 feet. Grey lignitic micaceous fine sandstone passing down to a hard grey sandstone with a little glauconite.

5835-5861 feet. Dark-grey bedded lignitic micaceous sandstone with indeterminate plant remains, and passing down to brownish-grey sandstone with numerous glauconite grains.

5914-5915 feet. Grey micaceous sandstone with fine bands of lignitic shale and patches of glauconite.

5973-6236 feet. Dark-grey to grey lignitic sandstone with fine bands of lignitic material.

6292-6298 feet. Hard thin-bedded lignitic siltstone and coarse sandstone with patches of glauconite, small quartz pebbles and pyrite.

6328 feet. Massive pyrite.

6336 feet. Pale-grey to whitish sandstone with pyrite.

6418 feet. Dark-grey micaceous sandstone.

6485 feet. Grey sandstone with numerous glauconite grains.

6576-6578 feet. Dark-grey lignitic micaceous sandstone passing into a mottled light to dark-grey sandstone.

6676-6682 feet. Light-grey lignitic sandstone with bands of lignitic material.

6751-6754 feet. Lignitic micaceous sandstone with irregular patches of lignitic material and pyrite, with an indeterminate microfossil at 6751 feet.

6843-6844 feet. Lignitic sandstone passing down to coarser sandstone and with some pyrite.

7077-7299 feet. Sandstone and lignitic sandstone with pyrite.

IV. DESCRIPTION OF LITHOLOGICAL UNITS

Considerable detailed stratigraphical work has been undertaken recently in the Glenelg area by the Geological Survey of Victoria, and the Chief Government Geologist, Dr. D.E. Thomas, has kindly permitted the writer to study the stratigraphical nomenclature proposed for the deposits in that area. No formal names are given to the three distinct lithological units that have been recognised in the bore samples because it is unsatisfactory at present to make a definite correlation between the subsurface deposits found in the Nelson Bore and surface formations outcropping in the area. The units will be discussed under the following headings, which are arranged in downward stratigraphical sequence:

Limestone
Glauconitic sandstone
Lignitic sandstone

However, in the detailed description given below, these different lithologies will be discussed in ascending sequence.

These three units are indicated in Plate I, which shows the stratigraphical sequence, lithology, and zonal fossils, in the bore section.

a. Lignitic sandstone

Lignitic sandstone is a general term given to the bed of light to dark-grey, friable to moderately hard,micaceous lignitic sandstone, with intercalations of thin bands of moderately hard dark-grey siltstone, which occurs in the Nelson Bore from the depth of 992 feet down to 7,299 feet. The sandstone is composed of fine to moderately fine angular grains of clear quartz, flakes of mica, and fine particles of plant remains; foraminifera are present down to a depth of 5,304 feet. Massive pyrite is common between 2,758 feet and 6,328 feet. The characteristic branch-like markings which occur in similar sediments at Anglesea and which are suspected to be of algal origin can be seen on the fractured surface of the bore cores between the depths of 1,270 feet and 3,718 feet.

b. Glauconitic sandstone

Glauconitic sandstone is a general term given to include the brown to green glauconitic sandstone and fossiliferous grit which occur in the Nelson Bore between the depths of 816 feet and 989 feet. The base of this sequence is marked by a hard pebbly grit, and the lithological change between it and the underlying fine-grained lignitic sandstone is marked. The exact relationship of the two formations, each with its characteristic lithology, is not clear, for as far as is known the junction has not been found in outcrop.

c. Limestone

The limestone unit includes the sequence of friable to hard bryozoal limestone, crystalline limestone, dolomitic limestone, flint, bryozoal limestone, and marly limestone, which was cut between the depths of 812 feet and 108 feet.

Two members can be recognised in this limestone unit. The lower member extends from 812 feet up to 635 feet and consists of grey and white, friable to hard, bryozoal marly limestone. The upper member is found from 625 feet up to 108 feet (the highest sample in the sequence and the first received for micropalaeontological examination) and consists of crystalline limestone, pinkish

dolomitic limestone, grey flint, bryozoal limestone, and marly limestone. The junction between the underlying glauconitic sandstone and the limestone has not been found in outcrop, but there is a definite lithological break between the depths of 812 feet and 816 feet in the Nelson Bore.

Probably the most interesting lithological types included under the heading "Limestone" are the flint and dolomitic limestone. In the Nelson Bore, the flint, which is interbedded with bryozoal marly limestone, is found at higher horizons than the dolomitic limestone. The flint is met with at depths of 348, 230, 198, and 112 feet, and the dolomitic limestone at 607, 582, and 536 feet. Both rock types occur in outcrop in the Mt. Gambier area and it has been the general opinion that the main period of silicification of the limestone was in Pleistocene times and that the alteration is still proceeding. Evidence from bore samples shows that the main period of silicification was in the upper Eocene.

V. FORAMINIFERAL ASSEMBLAGES AND AGE OF THE DIFFERENT LITHOLOGICAL UNITS

Foraminifera are not common in the lignitic sandstone and siltstone, nor in the glauconitic sandstone, but they are abundant in the limestone. The foraminiferal assemblages in these different formational units are discussed below.

Associated with the foraminifera in the limestone are abundant bryozoa. Many of the species were described by Waters from south-western Victoria (1881) and from Mt. Gambier, south-eastern South Australia (1882). The majority of species are restricted to this area and some of them are found in upper Eocene deposits of other parts of southern Victoria. Other species were described by McGillivray (1895), Canu and Bassler (1935), and Stach (1936). A few sponges, echinoids, brachiopods, molluscs, and ostracods are present in the limestone, indeterminate fish remains in the glauconitic sandstone, and plant remains and molluscs in the lignitic sandstone.

Fragmentary plant remains are common in the lignitic sandstone, but only two specimens are well enough preserved for generic determination. Leaf fragments which have been referred to Banksia and Cinnamomum occur in a hard lignitic sandstone at the depth of 2,828 feet. Associated with indeterminate plant fragments in a hard grey siltstone at the depth of 3,632 feet is a small marine pelecypod which is referred to as Nuculana cf. chapmani, a species described by Finlay (1926) from the upper Eocene beds at Aldinga, South Australia.

The evidence of the foraminifera, the lowest record of which is at the depth of 5,304 feet, shows that middle Eocene and upper Eocene deposits are represented in the Nelson Bore, between the depths of 5,304 feet and 112 feet. The age of the sample at 108 feet is at present indefinite and those samples between 7,299 feet and 5,304 feet are referred to as basal Tertiary.

a. Foraminiferal assemblage in the lignitic sandstone

No palaeontological evidence is available in the samples below the depth of 5,304 feet to indicate a definite age for the beds, but similarity of lithology below that depth down to the bottom of the bore at 7,299 feet, with those immediately above 5,304 feet, suggests that the bore was still in the Lower Tertiary when drilling ceased. It is probable that these beds may be the equivalent of the unfossiliferous deposits of the Boonah Sandstone at Eastern View, Otway area, south-western Victoria, which have been tentatively placed in basal Tertiary (Raggatt and Crespin, 1952).

The foraminiferal assemblage in the lignitic sandstone and siltstone above 5,304 feet and up to 989 feet is dominated by the arenaceous genus Cyclammina, and the thickness of 4,395 feet of Cyclammina-bearing beds in the Nelson Bore is the greatest yet proved in bores in south-eastern Australia.

Cyclammina makes its earliest appearance in the sample at 5,304 feet. A small species, possibly new, is common in the sample at 3,146-3,154 feet. Above this depth, the species represented are C.complanata Champan, C.incisa Stache, C.paupera Chapman, and

C.rotundata Chapman and Crespin. Cyclammina is associated with Ammodiscus and Bathysiphon at 2,681 feet, and both of these genera occur occasionally in other samples. The large tests of Ammodiscus are referable to A.parri Crespin and the fragments of Bathysiphon most probably represent B.angleseaensis Crespin (Crespin, 1950). Both of these species occur with Cyclammina in the lignitic sandstones at Anglesea, and the same assemblage is also found under similar lithological conditions in the Holland's Landing Bore, Parish of Bengworden South, Gippsland, between the depths of 2,938 feet and 2,898 feet (Crespin, 1941).

The age of the Cyclammina-bearing beds is regarded as middle Eocene. Beds of similar lithology and foraminiferal content underlie the upper Eocene deposits containing Hantkenina alabamensis at Brown's Creek, Otway area, and are stratigraphically below the beds at Bird Rock, Torquay, containing Hantkenina (Parr, 1947; Raggatt and Crespin, 1952).

b. Foraminiferal assemblage in the glauconitic sandstone

Fossils are poorly preserved in the glauconitic sandstone and grit between the depths of 989 feet and 816 feet. Glauconitic replacement of tests of foraminifera is common below the depth of 947 feet and the only determinable species are Cyclammina incisa and C.rotundata. Between 947 and 902 feet, foraminifera are moderately common and include the upper Eocene form Victoriella plecte as well as Cyclammina incisa.

The age of the glauconitic sandstone and grit is regarded as basal Janjukian (upper Eocene).

c. Foraminiferal assemblages in the limestone

Foraminifera are very common in the limestones between the depths of 812 feet and 112 feet, but many of them are not well preserved. The assemblage includes species such as Ammodiscus parri and Cyclammina incisa which occur in the underlying middle Eocene lignitic sandstone, and upper Eocene species such as Victoriella plecte and Vaginulinopsis gippslandicus (Stache, 1864; Chapman, 1921;

Chapman and Crespin, 1930a, 1930b; Crespin, 1950).

Associated with these are numerous small species which have been described from the Eocene, chiefly upper Eocene, deposits throughout the world. Species described from the Janjukian (upper Eocene) of Victoria include Bolivina victoriana, Carpenteria rotaliformis, Lingulina metungensis, and Siphonina australis, (Chapman and Crespin, 1930b; Cushman, 1927, 1936). Species described by Parr (1938) from the upper Eocene of Perth, Western Australia, include Angulogerina subangularis, Anomalina perthensis, Bolivinopsis crespinae, Cibicides umbonifer, C. pseudoconvexus, and Pseudoglandulina clarkei. Upper Eocene and lower Oligocene species from New Zealand include Bulimina pupula, Cibicides vortex, C. perforatus var. notocenicus, Gyroidina scrobriculata, Globigerina angipora, Hopkinsina bortotara, Robulus gyroscalprum, Rotorbinella finlayi, and Sigmoidella bortonica (Finlay, 1939; Dorreen, 1948; Stache, 1864).

Many species can be determined as American forms and others show points of resemblance to established species but are not quite definite enough to be referred to them. Recognised upper Eocene and lower Oligocene species include Cassidulina alabamensis, Heronallenia vicksburgensis, Planulina cocoaensis, Sigmomorphina jacksonensis, S. vaughani, and Stomatorbina torrei (also recorded from the upper Eocene of New Zealand) (Bandy, 1949; Cushman, 1926, 1928; Cushman and Bermudez, 1937; Cushman and Ozawa, 1930). Two species, Anomalina ammonoides var. acuta and Globigerina triloculinoides, which are moderately common, were described from the Palaeocene (Midway) of Texas by Mrs. Plummer (1926).

Associated with the forms listed above are species described from the Balcombian (probably lower Miocene) deposits in Victoria, such as Gaudryina collinsi, G. (Pseudogaudryina) crespinae, Clavulinoides szaboi var. victoriensis, Eponides scabriculus, Hofkerina semiornata, Operculina victoriensis, and Sigmomorphina chapmani, (Chapman, 1910; Chapman, Parr and Collins, 1934; Heron-Allen and Earland, 1924; Howchin, 1889). The occurrence in the upper Eocene limestones in the Nelson Bore of Miocene species described from the Lepidocyclina horizon in Victoria is interesting, and until further

research is carried out on the foraminifera in the upper part of the Bird Rock cliff section and at the type locality for the Balcombian Stage at Balcombe Bay, Mornington Peninsula, and other important sections in Victoria, the problem of the stratigraphical range of these species cannot be solved.

In assigning an upper Eocene age to the limestones in the Nelson Bore, some importance is placed on the presence of Victoriella plecte in many samples. This species is widely distributed in upper Eocene deposits in Australia and its importance as a zonal form for the upper Eocene is confirmed by its association in south-western Victoria with Hantkenina alabamensis var. compressa and in North-West Australia with upper Eocene species of Discocylina. An upper Eocene age is further confirmed by the discovery of the upper Eocene Western Australian species Bolivinopsis crespinae, Alabamina westraliensis, Angulogerina subangularis, Cibicides umbonifer, and C. pseudoconvexus, which are also found associated with Hantkenina at Bird Rock, Torquay, and at Johanna River, and at Brown's Creek, Otway area.

The age of the sample at 108 feet is uncertain, because of the presence of several tests of Cibicides victoriensis, a species described by Chapman, Parr and Collins (1934) from the Balcombian deposits at Kackeraboite Creek, near Mornington, Victoria, which are most probably lower Miocene.

VI. COMPARISON OF THE BEDS IN THE NELSON BORE WITH OTHER BORES AND OUTCROPS IN THE AREA

Precise correlation of the beds in the Nelson Bore with other bores in the area is not possible owing to lack of information. Several bores have been drilled, over a period of years, by private companies in the search for oil in south-eastern Australia, especially in the Hundreds of Blanche and Caroline, South Australia. Remarks on the Robe Bore are based on reports by Dr. L. Keith Ward (1917, 1941); those on the Associated Oil Bore, Hundred of Blanche, are based on the driller's log notes by R.A. Keble in a report for Oil Search Ltd., Sydney (1931); and those on bores in Knight's Dome

(Mt. Gambier) and the Hundred of Caroline are based on personal investigations. Information on bores in western Victoria is taken from unpublished departmental palaeontological reports by Chapman and the writer on behalf of the Geological Survey of Victoria. The positions of these bores are shown in a locality map (Plate 2).

Considerable detailed work has been carried out recently in the area under discussion by the Geological Survey of Victoria and the Department of Mines, Adelaide, but results of these investigations have not yet been published.

As far as can be ascertained, the only bore in south-eastern South Australia to reach the Jurassic bedrock was one at Robe, which is 92 miles north-west of Nelson. This bore was drilled to the depth of 4,504 feet, and rocks at 1,468 feet were referred to the Jurassic. Apparently the lignitic sandstone similar to that in the Nelson Bore was 1,193 feet thick.

The total thickness of lignitic sandstone and siltstone was not proved in the Associated Oil bore, 25 miles north-west of Nelson and 10 miles north-west of Mt. Gambier, in which a thickness of 1,760 feet of these beds was recorded before drilling ceased at 2,110 feet, nor in No. 2 Bore, Knight's Dome, 6 miles west-north-west of Mt. Gambier, in which operations ceased at 2,013 feet after passing through 1,933 feet of lignitic sandstone and siltstone. Samples from No. 2 Bore, Section 337, Hundred of Caroline, are available only for the top 603 feet, though the bore continued to 1,226 feet; information suggests that the bore penetrated the lignitic sandstone immediately below the depth of the lowest sample available.

The Nelson Bore proved at least 6,310 feet of lignitic sandstone and siltstone.

The lignitic sandstone and siltstone in the Nelson Bore are very similar in character to the deposits in No. 2 Bore, Knight's Dome, and in the Associated Oil Bore. The possible algal markings which are such a feature of the lignitic sandstones at Anglesea and which also occur in samples in the Nelson Bore between the depth of 1,270 feet and 3,718 feet are present in samples in the Associated Oil Bore, and Cyclammina is recorded in that bore in the last sample

at 2,110 feet.

A deposit similar to that referred to as "glauconitic sandstone and grit" in the Nelson Bore between the depths of 816 feet and 976 feet is also present in five bores in south-eastern South Australia. This bed, composed of quartz grains and pebbles, glauconite, foraminifera, bryozoa, corals, and fish remains, is found in the Robe Bore at 275 feet, in the Associated Oil Bore at 350 feet, in No. 1 Bore, Knight's Dome, from 67 feet to 84 feet (No. 2 Bore was not cored above 316 feet), and in No. 2 Bore, Section 337, Hundred of Caroline, from 592 feet to 603 feet.

Numerous shallow bores were put down in the Dartmoor district in south-western Victoria; the deepest was 546 feet. Most of these penetrated the lignitic sandstone at shallow depths after passing through foraminiferal, bryozoal marls containing Victoriella plecte. There is little doubt that the Victoriella-bearing beds are similar in age to the limestones found in the Nelson Bore between the depths of 112 feet and 816 feet and that the stratigraphical sequence of marls containing Victoriella plecte, overlying lignitic sandstone, is similar to that found in the Nelson Bore.

The only bore in western Victoria to reach the Jurassic bedrock was the old Comaum Bore, 36 miles north-west of Casterton and one mile east of the South Australian border near Lake Coeie. The records of this bore are incomplete, but a sample examined from a depth below 1,000 feet and labelled "Near bottom of Bore" was referable to the Jurassic. From the few samples available, it appears that the lignitic sandstone was met with somewhere between 362 feet and 509 feet. The sample at 362 feet contained typical Janjukian fossils and the one at 509 feet was lignitic sandstone.

Three bores have been drilled in the Portland district, but only one of them was in the search for oil. This bore was put down in North Portland, 38 miles south-east of Nelson, and reached the depth of 2,835 feet, when drilling ceased in foraminiferal, bryozoal marly limestone. Only a few samples were sub-

mitted for examination. Those between the depths of 400 feet and 1,911 feet contained a foraminiferal assemblage similar to that found in the upper part of the "Limestone" in the Nelson Bore. The sample at 2,000 feet contained numerous well-preserved tests of Victoriella plecte together with other typical Janjukian species. Although it is known that the bore ceased at 2,835 feet in foraminiferal marls, the foraminiferal content in the last samples is not known.

The bore in the Botanic Gardens, Portland, which was drilled for coal, stopped at 2,265 feet in beds similar to those recorded from the North Portland Bore. The sample at 2,198 feet contained numerous tests of Victoriella plecte. The thickness of the upper Eocene (Janjukian) beds in the Portland area has not been proved, but evidence seems to indicate that they are probably more than 2,000 feet thick, and thicker than in any other area in south-eastern Australia.

Fossiliferous rocks from surface outcrops and quarries have been examined from several localities in the Mt. Gambier area and in south-western Victoria. All the sediments from the South Australian deposits consist of bryozoal limestone, but the Victorian exposures range from bryozoal limestone to bryozoal and foraminiferal marl.

Foraminifera are poorly preserved in the limestone from Knight's Quarry, Mt. Gambier. However, lithological evidence suggests that the beds are upper Eocene and equivalent to the upper limestone member in the Nelson Bore. The limestone in the Wandilo Ballast Pit, 10 miles north of Mt. Gambier, is also referred to that age.

The zonal Janjukian form, Victoriella plecte, is present in the limestone in a large quarry at Ferguson's Farm, 5 miles south-west from Mt. Gambier on the Kongorong Road, and the typical Janjukian bryozoan, Aspidostoma airensis, is recorded from a similar rock in a quarry, 1 mile from Carpenter's Rocks near Bullock's Head Well on the track to Mt. Gambier in the Hundred of Kongorong.

Outcrops of fossiliferous rocks are numerous in south-western Victoria, especially in the vicinity of Dartmoor and in some of the surrounding parishes, and extensive micropalaeontological examination has been made on behalf of the Geological Survey of Victoria. The sediments along the banks of the Glenelg River near Dartmoor consist of foraminiferal marls with an assemblage characteristic of the Janjukian. Beds of similar age also occur in the Parish of Wataepolan. Purplish-coloured siltstones in the Parish of Killara contain numerous tests of Cyclammina and belong to the "Anglesean Stage" (middle Eocene). The similarity between these beds and those in the upper part of the Anglesea section (Raggatt and Crespin, 1952) is most striking.

Bryozoal limestones outcrop in a road cutting between Nelson and Drik Drik on the north side of Moleside Creek, in Ravine Creek and in Cowland's Quarry near Dartmoor, in Curran's Creek, Parish of Palpara, and in the Parishes of Wataepolan and Wanwin. The foraminifera are rather poorly preserved and the only recognizable species is Operculina victoriensis. It seems probable that the limestones are lower Miocene in age.

No lower Pliocene (Kalimnan Stage) rocks have been found in south-western Victoria or in south-eastern South Australia, but upper Pliocene (Werrikooian Stage) limestones outcrop in the parish of Werrikoo, at Portland and in the cliff sections along the Glenelg River. Pleistocene sands containing small shallow-water foraminifera occur at the top of many of the Dartmoor bores.

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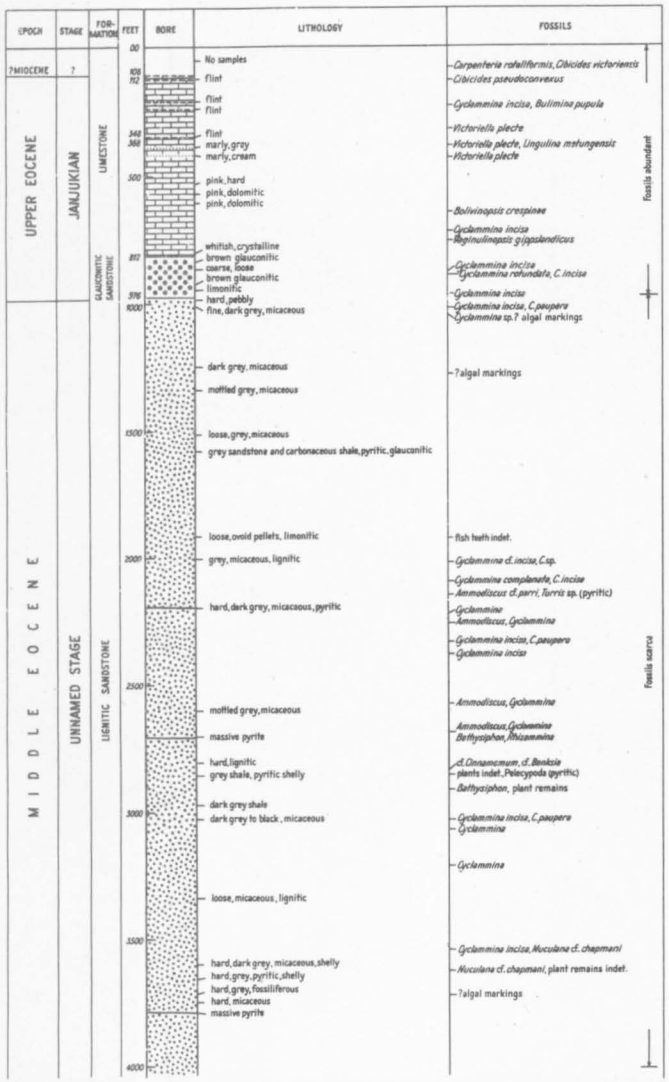
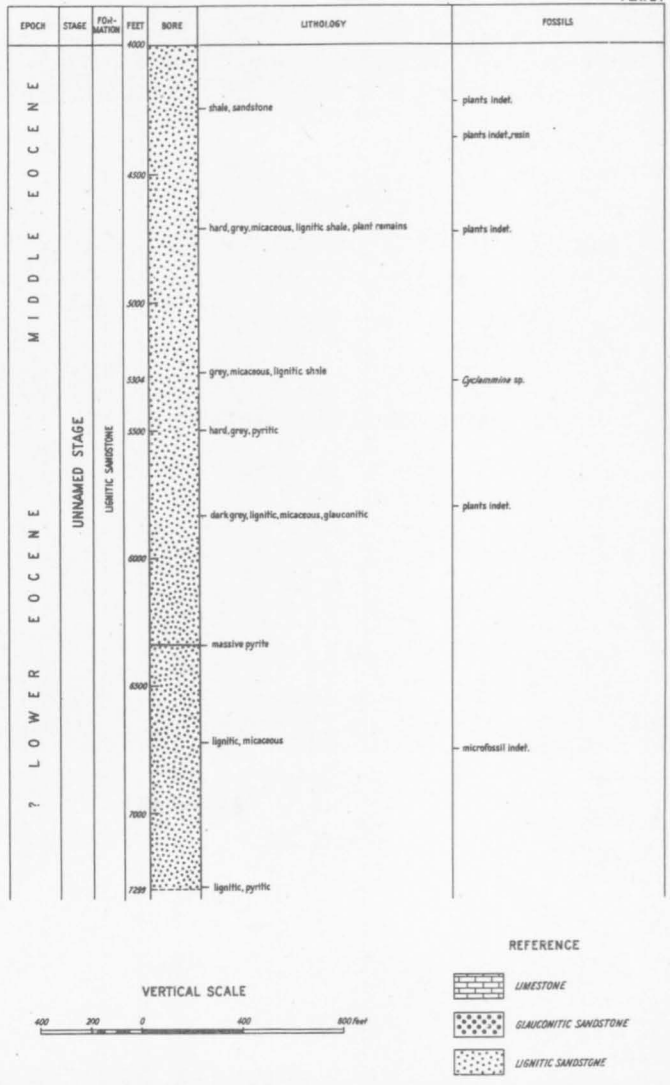
PLATE 1





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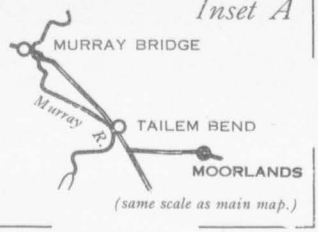
STRATIGRAPHIC SEQUENCE, LITHOLOGY AND ZONAL FOSSILS IN NELSON BORE.

V 25-5
W.A.

PLATE 2

BORES IN NELSON - MT. GAMBIER AREA



SCALE

MILES 30 15 0 30 60 MILES

see Inset A

BORDERTOWN

SOUTH AUSTRALIA

AUSTRALIA

VICTORIA

ROBE

COMAUM

MT. BURR

Glenelg River

CASTERTON

HAMILTON

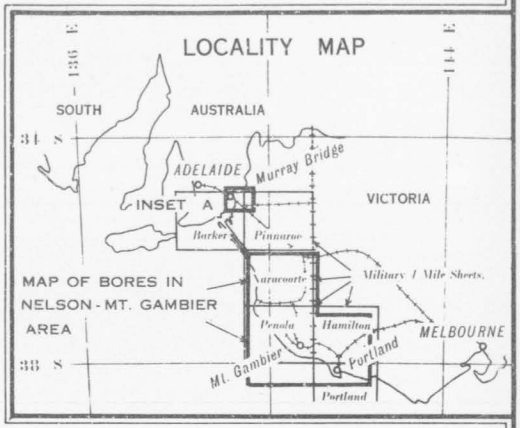
MT. GAMBIER

DARTMOOR

CAROLINE

NELSON

PORTLAND



SYMBOLS

RAILWAYS

BORES

A.J.D. Feb. '50.

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V 25-4