COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

BULLETIN No. 73

Cretaceous Stratigraphy and Palaeontology of the Northern Territory

BY

S. K. SKWARKO

Issued under the Authority of the Hon. David Fairbairn
Minister for National Development
1966

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

MINISTER: THE HON. DAVID FAIRBAIRN, D.F.C., M.P.

SECRETARY: R. W. BOSWELL

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

DIRECTOR: J. M. RAYNER

THIS BULLETIN WAS PREPARED IN THE GEOLOGICAL BRANCH

ASSISTANT DIRECTOR: N. H. FISHER

Issued: 1st October 1966.

Published by the Bureau of Mineral Resources, Geology and Geophysics Canberra A.C.T.

CONTENTS

PART 1. CRETACEOUS STRATIGRAPHY OF THE NORTHERN TERRITORY

PART 2. MOLLUSCA OF THE COASTAL BELT

FIGURES

PART I

CRETACEOUS STRATIGRAPHY OF THE NORTHERN TERRITORY

SUMMARY

THE Cretaceous rocks are flat-lying or gently dipping, mainly unfolded and unfaulted; most of them form mesas and are affected to various degrees by silicification, ferruginization, and lateritization. They crop out in the southern and northern portions of the Northern Territory.

In the southern portion of the Northern Territory the Rumbalara Shale of Aptian (Lower Cretaceous) age unconformably overlies the probably Jurassic De Souza Sandstone. It is ochreous at the base and contains rare marine fossils throughout. On the Hay River 1:250,000 Sheet area about 150 miles north-east of Rumbalara, sediments of similarly fine lithology have been found on microfossil evidence to be of Albian (Lower Cretaceous) age.

The Mullaman Beds are of Cretaceous age and crop out extensively in the northern portion of the Northern Territory and in north-western Queensland. They consist of shale, claystone, siltstone, sandstone, conglomerate, and grit, which were deposited in marine, lacustrine, and fluviatile environments; they are mostly shallow-water sediments. They were deposited in three areas: the Coastal Belt, the Inland Belt, and the Darwin Area.

The Coastal Belt stretches along the western periphery of the Gulf of Carpentaria and extends for a considerable distance inland. The Cretaceous succession has been divided into seven units, not formally named. Sedimentation began in Neocomian time with the deposition of plant-bearing sandstone (Unit 1), probably in coastal, brackish-water lakes. The sea invaded the low-lying land in the late Neocomian, and more quartz sandstone, with a marine fauna (Unit 2), was laid down in a shallow-water shelf environment during the remaining portion of Neocomian and early Aptian times. Some siltstone (Unit 3) was also laid down before the end of the Neocomian, but beds of intermediate Neocomian—Aptian age (Unit 4) consist once again of quartz sandstone, this time with siltstone. The early Aptian sediments are composed of saccharoidal marine sandstone (Unit 5) which passes up into pebbly marine siltstone (Unit 6), which is still of Aptian age. Sedimentation in the Coastal Belt ceased in the Albian after the deposition of marine marginal sandstone and conglomerate which passes up into shale (Unit 7). Aptian and Albian macro- and microfossils are similar to those in the Great Artesian Basin.

The overall thickness of the Coastal Belt suite is only about 200 feet, but this is a minimum value as most outcrops have erosional surfaces, and unknown thicknesses have been removed. No complete sections have been found.

Possibly still in the Neocomian, downward movement in a broad inland belt allowed the formation of a lake or a chain of lakes, which were most extensive in Aptian time. The Inland Belt extends diagonally across the northern portion of the Northern Territory into north-western Queensland over a distance of about 900 miles; it is up to 200 miles wide.

Sedimentation in the Inland Belt began with the deposition of the non-marine Lees Sandstone (Unit A). This is a plant-bearing quartz sandstone of ?Neocomian and Aptian age. It is overlain apparently conformably by siltstone and fine-grained sandstone (Unit B), which is also plant-bearing and of Aptian age. Arenaceous Foraminifera are abundant in Polland Shale (Unit C) which disconformably overlies Unit B, and are similar to those found in the Lower Wilgunya Formation (?Aptian) of Queensland, which was deposited in the Great Artesian Basin; the Polland Shale, is, however, probably of Albian age. The whole of the northern portion of the Northern Territory and north-western Queensland seems to have been submerged under sea in Albian time, when the Polland Shale was deposited. This shale is thus not confined to the Inland Belt, although it is best exposed in that area. The overall thickness of the Inland Belt suite is about 140 feet, but the original thickness was probably greater.

In the Darwin Area, deposition of the Mullaman Beds continued longer and the conditions of sedimentation differed from those in the Coastal and Inland Belts. About 3000 feet of marine fossil-bearing sandstone and mudstone accumulated here probably between Aptian and Turonian times. Most if not all of these sediments are still preserved under Tertiary and post-Tertiary sediments.

ACKNOWLEDGEMENTS

The work on which this Bulletin is based has been in partial fulfilment of the requirements for the degree of Doctor of Philosophy in the University of Warsaw, and I wish especially to thank the Chairman of the Palaeozoological Section in the Department of Palaeontology, Doc. Dr Adam Urbanek, and Prof. K. Pozaryski for their helpful criticism.

I wish to acknowledge with sincere thanks the assistance of Travers Nicholas, Museum Curator, Bureau of Mineral Resources, Canberra, in proof-reading of the manuscript. I also wish to thank Oil Development N.L. for their permission to reproduce the Bathurst Island Bore 1 and 2 correlation charts, and to quote results of the refraction survey.

INTRODUCTION

Most of three field seasons (1960-1962) were spent examining the Cretaceous sediments and fossils of the northern portion of the Northern Territory. These sediments were traced into north-western Queensland. In addition I spent the 1963 winter season in the field as a member of a field party which, under the leadership of A. T. Wells, mapped a large area between Alice Springs and the South Australian border. My task on that occasion was the mapping of the post-Devonian sediments on the Kulgera and Finke 1 : 250,000 Sheet areas; these sediments include the Cretaceous Rumbalara Shale.

The bulk of the first part of this Bulletin is devoted to the presentation of geological data on the Cretaceous sediments of the northern portion of the Northern Territory, which will be presented under the title of 'Mullaman Beds'. The Cretaceous fossils are described in Part 2 (p. 53 onwards). Many conclusions reached and presented in this Bulletin would not have been possible without datings obtained from fossils collected during the survey.

The Cretaceous sediments of the Northern Region are contained in about fifty 1 : 250,000 Sheet areas. Outcrops are scarce or hard of access over much of this region, and more time could profitably be spent collecting additional information. Approximations made for lack of time in the field will become apparent with more detailed work in future years. The Cretaceous sediments of the Southern Region are much less complex; they are briefly described under the titles of Rumbalara Shale and sediments of the Hay River area. The ages of the subdivisions are given in general terms, because the faunas do not permit precise determination in terms of standard zones (see Fig. 24).

SOUTHERN REGION

In the southern portion of the Northern Territory, between Alice Springs and the South Australian border, considerable areas are covered by flat-lying sediments which were laid down in Cretaceous times in an eastern extension of the Great Artesian Basin. The occurrence of these beds is not limited to outcrop: bores show that at least in some places they continue below the surface, covered by Quaternary sediments. The beds have been mapped on the Tobermory and Hay River 1 : 250,000 Sheet areas by Smith & Vine (1960) and Smith (1963) respectively, and on the Kulgera, Finke, and Hale River Sheet areas by Wells, Stewart, & Skwarko (1964); they are shown on Quinlan's map (1962) of the southern portion of the Northern Territory.

RUMBALARA SHALE (APTIAN)

In 1951 Öpik examined flat-lying ochre-bearing sediments in the north-eastern portion of the Finke Sheet area and named them the Rumbalara Shale. The fossils which he found there, and later examined, allowed him to date the Rumbalara Shale as Lower Cretaceous (Öpik, Appendix 2, in Sullivan & Öpik, 1951). More recently Skwarko (1962, unpubl.) correlated the Shale with the Lower Wilgunya Formation of the Queensland portion of the Great Artesian Basin, which is usually regarded as of Aptian age. The Aptian age of the Rumbalara Shale was confirmed by Terpstra & Evans (1963, unpubl.) in their study of microfossils (see below).

The type locality of the Rumbalara Shale is at the ochre mine which lies about 25 miles north-east from Rumbalara railway siding, 120 miles south of Alice Springs. Sullivan & Öpik (op. cit.) described in detail the sequence at the type locality, which, simplified, is as follows:

10 feet siliceous laterite;
14 feet ferruginous sandstone;
76 feet soft white kaolinitic rock with hard bands of porcellanite; most pelecypods which were found came from this horizon;
8 feet relatively hard sandy bed; sponge horizon;
28 feet soft white kaolinitic rock with hard bands of porcellanite; Radiolaria and fragmental Pelecypoda were found here;
1.5–4 feet yellow ochre, probably of bacterial origin;
1.5–4 feet hard limonite with quartz boulders;
140+ feet red and grey cross-bedded sandstone with some conglomerate.

The lower boundary of the Rumbalara Shale was placed at the base of the ochre layer, the hard limonitic layer and the underlying beds being included in the De Souza Sandstone, which may be Jurassic in age.

Fossils: Öpik was the first to find fossils in the Rumbalara Shale. His list of determinations included:

Purisiphonia clarkei Bowerbank, 1869
Purisiphonia sp. nov.
Rhizocorallium sp. nov.
Cyrene sp.
Fissilunula sp.cf.*F.clarkei* (Moore, 1870)
Maccoyella reflecta (Moore, 1870)
Panope sp. cf. *P. rugosa* (Moore, 1870)
Pecten (*Camptonectes*) sp.
Pseudavicula anomala (Moore, 1870)
Tatella maranoana (Etheridge Jnr, 1892)
Tatella sp. cf. *T. maranoana* (Etheridge Jnr, 1892)
large indeterminate pelecypods
indeterminate gastropods
Pentacrinate stem joints
silicified wood.

In 1962 Veevers described in detail *Rhizocorallium* found at Rumbalara (see Figs 22, 23).

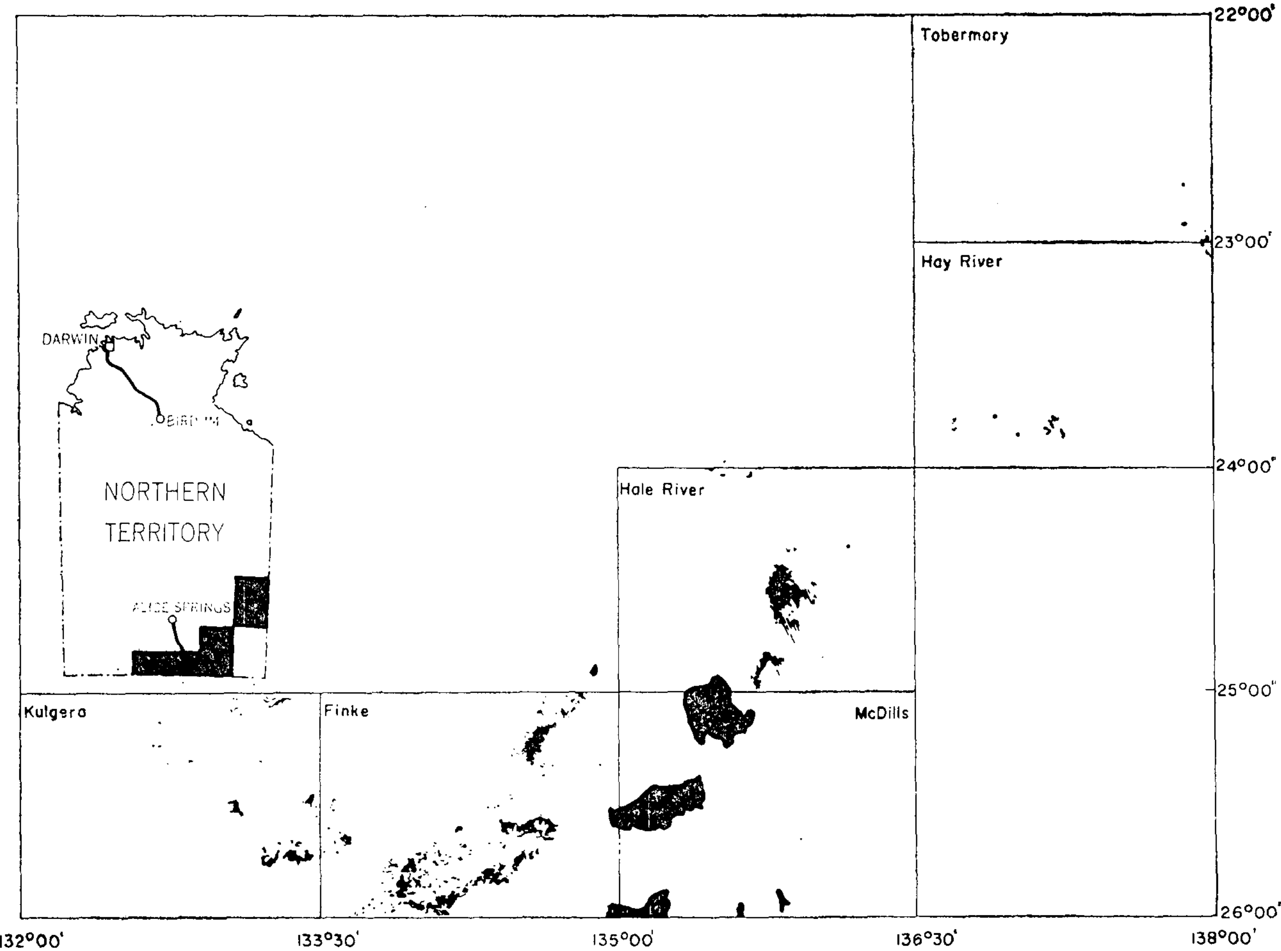


Fig. 1. Southern Region: Distribution of Rumbalara Shale and sediments of the Hay River area.

In outcrop the Rumbalara Shale is invariably leached, and most samples which were submitted for micropalaeontological study yielded poor results; Crespin (Appendix I, in Sullivan & Öpik, 1951) identified *Cenosphaera* and *Dictyomitra* from the ochre mine samples.

Terpstra & Evans (1963, unpubl.) examined the first unweathered ditch samples of the Shale, which came from Birthday Bore, Andado station. The following forms were identified:

Spores and Pollens:
- *Cyathidites australis rimalis* Balme, 1957
- *Gleicheniidites circinidites* (Cookson, 1953)
- *Cicatricosisporites australiensis* (Cookson, 1953)
- *Cicatricosisporites cooksonii* Balme, 1957
- *Schizosporis reticulatus* Cookson & Dettman, 1958
- *Lycopodiumsporites austroclavatidites* (Cookson, 1953)
- *Lycopodiumsporites* sp. cf. *L. circolumenus* Cookson & Dettman, 1958
- *Lycopodiumsporites tenuis* Balme, 1957
- *Disaccites* spp. undiff.
- *Classopollis torosus* (Reissinger, 1950)
- *Microcachryidites antarcticus* Cookson, 1947
- *Inaperturopollenites limbatus* Balme, 1957
- *Sphagnumsporites australis* (Cookson, 1947)
- *Vitreisporites pallidus* (Reissinger, 1939)

Megaspore:
- *Pyrobolospora reticulata* Cookson & Dettman, 1958

Microplankton:
- *Veryhachium* sp.
- *Hystrichosphaera* sp.
- *Odontochitina operculata* (Wetzel, 1933) (Deflandre, 1937)
- *Muderongia tetracantha* (Cookson & Eisenack, 1958)
- *Chlamydophorella nyei* Cookson & Eisenack, 1958
- *Gonyaulax edwardsi* Cookson & Eisenack, 1958
- *?Canningia* sp.
- Leiospheres indet.
- *Dingodinium cerviculum* Cookson & Eisenack, 1958
- *Muderongia mcwhaei* Cookson & Eisenack, 1958
- *Hystrichosphaeridium pulcherrimum* Deflandre & Cookson, 1955
- *Hystrichosphaera sp.*
- *Veryhachium* sp.
- aff. *Tasmanites*

Foraminifera:
- *Ammodiscus cretaceus* (Reuss, 1845)
- *Ammobaculites erectus* Crespin, 1963
- *Ammobaculites fisheri* Crespin, 1953
- *Ammobaculites fragmentarius* Cushman, 1927
- *Ammobaculites minimus* Crespin, 1953
- *Ammobaculites* sp. cf. *A. romaensis* Crespin, 1953
- *Ammobaculites* sp. cf. *A. succinctus* Crespin, 1963
- *Cibicides* sp.
- *Lenticulina* sp.

Haplophragmoides arenatus Crespin, 1963
Haplophragmoides gigas Cushman, 1927
Bimonilina variana Eicher, 1960
Miliammina sproulei Nauss var. *gigantea* Mellon & Wall, 1956
Textularia anacooraensis Crespin, 1953
Trochammina sp.
Verneuilina howchini Crespin, 1953

Terpstra & Evans remark: 'The Foraminifera . . . are all known from Lower Cretaceous strata of Australia. At present, there is insufficient knowledge of the precise stratigraphical range of the species within the Lower Cretaceous, mainly on account of lack of stratigraphic control. In general, however, the microfauna indicates that the bore section may be correlated with the Wilgunya Formation below the Toolebuc Member of the northern Eromanga Basin on the basis of a recent examination of outcrop samples from that area (Terpstra, 1963).

This conclusion is fully supported by the palynological evidence . . .'.

This confirms the evidence from macrofossils that the Rumbalara Shale is of the same age as the Roma Formation and the Lower Wilgunya Formation.

SEDIMENTS OF THE HAY RIVER AREA (ALBIAN)

Small outcrops of Cretaceous sediments have been mapped in the north-eastern part of the Hay River Sheet area, in the Lake Caroline area, along the lower course of the Plenty River and in the south-western part of the Tobermory Sheet area. In the north-eastern portion of the Sheet area are outcrops of fine to medium-grained sandstone with stringers, lenses, and beds of siltstone, capped in some places by a few feet of lateritized coarse-grained angular sandstone (J. N. Casey, pers. comm.). At the northern end of Lake Caroline 20 feet of red, yellow and brown shale are overlain by five feet of greenish medium-grained cross-bedded quartz greywacke. Specimens of the shale contain Radiolaria (I. Crespin, pers. comm.). In a mesa on the south-eastern end of another lake some two miles south of Lake Caroline, 11 feet of sandy siltstone are overlain by 40 feet of medium-grained finely cross-laminated quartz greywacke; in another mesa in the same area gypsiferous blue unfossiliferous siltstone crops out. Along the Plenty River the maximum observed section is 23 feet thick. It consists of a thin-bedded coarse-grained sandstone with pellets of siltstone and stringers of micaceous sandstone, and interlaminated sandy siltstone. No fossils were found in this section, but a bore put down along the Plenty River penetrated 246 feet of fossiliferous sediments. These consisted of about 150 feet of pink, yellow, cream, and white claystone and mudstone underlain by dark grey siltstone, underlain again by about 70 feet of fine-grained grey glauconitic sandstone.

The following microfossils were identified from this bore (Crespin & Evans, 1962, unpubl.):

Foraminifera (arenaceous):
Ammobaculites fisheri Crespin, 1953
Haplophragmoides sp. A. Crespin, 1963
Haplophragmoides sp. nov.
Haplophragmoides spp.
Trochammina sp. cf. *T. raggatti* Crespin, 1944
cf. *Verneuilinoides kansasensis* Loeblich & Tappan, 1950

Spores and pollens:
Cyathydites australis Couper, 1953
Gleicheniidites circinidites (Cookson, 1953)
Baculatisporites comaumensis (Cookson, 1953)
Apiculati spp.
Trilobosporites trioreticulatus Cookson & Dettmann, 1958
aff. *Balmeisporites glenelgensis* Cookson & Dettman, 1958
Pityosporites spp.
Podocarpidites spp.
Microcachryidites antarcticus Cookson, 1947
Classopollis torosus (Reissinger, 1950)
Polypodiaceaesporites sp. nov.

Microplankton:
Gonyaulax spp.
Diconodinium sp. cf. *D. glabrum* Eisenack & Cookson, 1960
Diconodinium sp.

The arenaceous Foraminifera indicate Lower Cretaceous age generally, but closer dating was possible with the help of spores and pollen, which suggested correlation with the Upper Wilgunya Formation. The Upper Wilgunya Formation is usually regarded as of Albian age, and this is the age which was suggested for the fossiliferous beds on the Hay River Sheet area.

At this stage it is very difficult to draw a boundary between the Albian sediments of the Hay River area and the Aptian Rumbalara Shale which covers large areas in the Hale River, McDills, Finke, and Kulgera Sheet areas.

NORTHERN REGION

Cretaceous sediments of the Northern Region cover considerable areas in the northern portion of the Northern Territory and extend well into north-western Queensland (see Fig. 3). They range in age from Neocomian to Albian on the mainland, and from Aptian to Turonian offshore, and include marine, lacustrine, and fluviatile deposits, most of which are shallow-water fossiliferous sediments.

During the 1960-1962 field seasons I collected fossils and made stratigraphical observations over much of this region. The size of the region, over a quarter of a million square miles, did not allow much detailed work in the time available, and the present account is general and introductory. It is hoped and expected that efforts of future workers will supplement and modify it.

MULLAMAN BEDS

On Bathurst and Melville Islands, and possibly at Shoal Bay and Point Charles, Cretaceous sediments are considerably thicker (probably up to 2980 feet on Bathurst Island) than on the inland mainland. They are slightly inclined and, except for coastal sections exposed by wave-action, they are covered by a fairly continuous layer of Tertiary and post-Tertiary sediments.

The inland Northern Territory Cretaceous sediments, on the other hand, occur as relatively thin and scattered remnants of what were once more continuous and more extensive sheets. These remnants extend south-eastwards from near Darwin, and the Port Keats area south of Darwin, as far as 22° S and 141° E in north-western Queensland (see Fig. 3). Whether marine or non-marine they are generally flat-lying or dip very gently, and consist of conglomerate, sandstone, siltstone, and claystone, with a maximum thickness less than 130 feet in any single section. Only in a few places are they overlain by younger sediments, which usually consist of their weathered products.

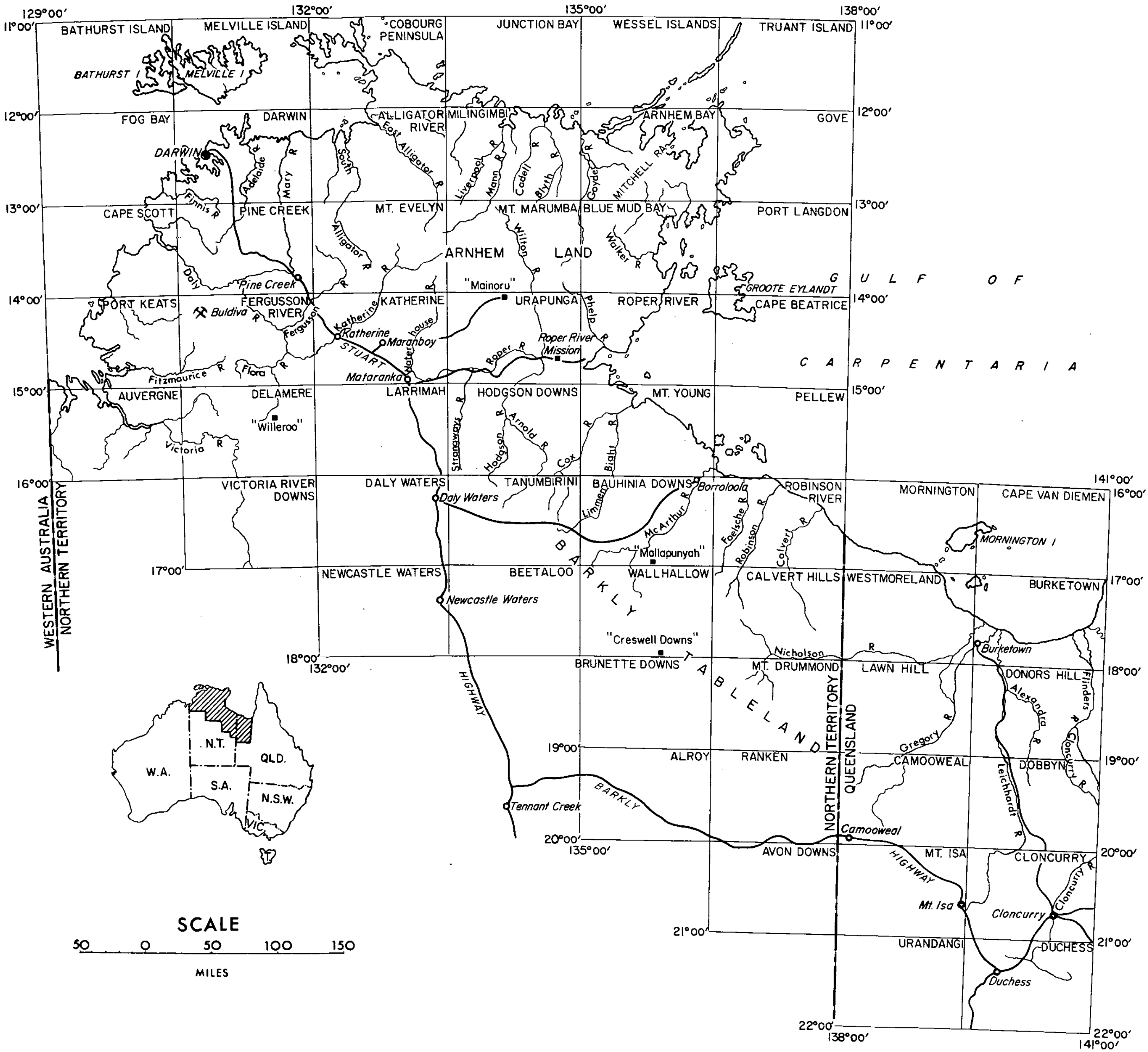
Although an unknown, but probably not very great, thickness and large area of the mainland Mullaman sediments has been removed by erosion and weathering —mostly by successive scarp retreat of individual layers—the flatness of the upper erosion surface is in most cases maintained. This is due to the near-horizontal bedding and vertical preferential splitting planes, which ensure steepness of eroded edges and give rise to mesa-type topography so characteristic of areas where Cretaceous rocks crop out. Porcellanites which develop on the fine-grained Cretaceous sediments by excessive impregnation with silica form a resistant cover over underlying sediments and may have been partly instrumental in the formation of the mesa topography.

Cretaceous sediments have been laid down on a surface of considerable relief, and overlie older rocks with or without an angular unconformity. They have been exposed for a long time to weathering and erosion; lateritization, ferruginization, and silicification have all left their imprint, but vary markedly in degree in the different parts of the area.

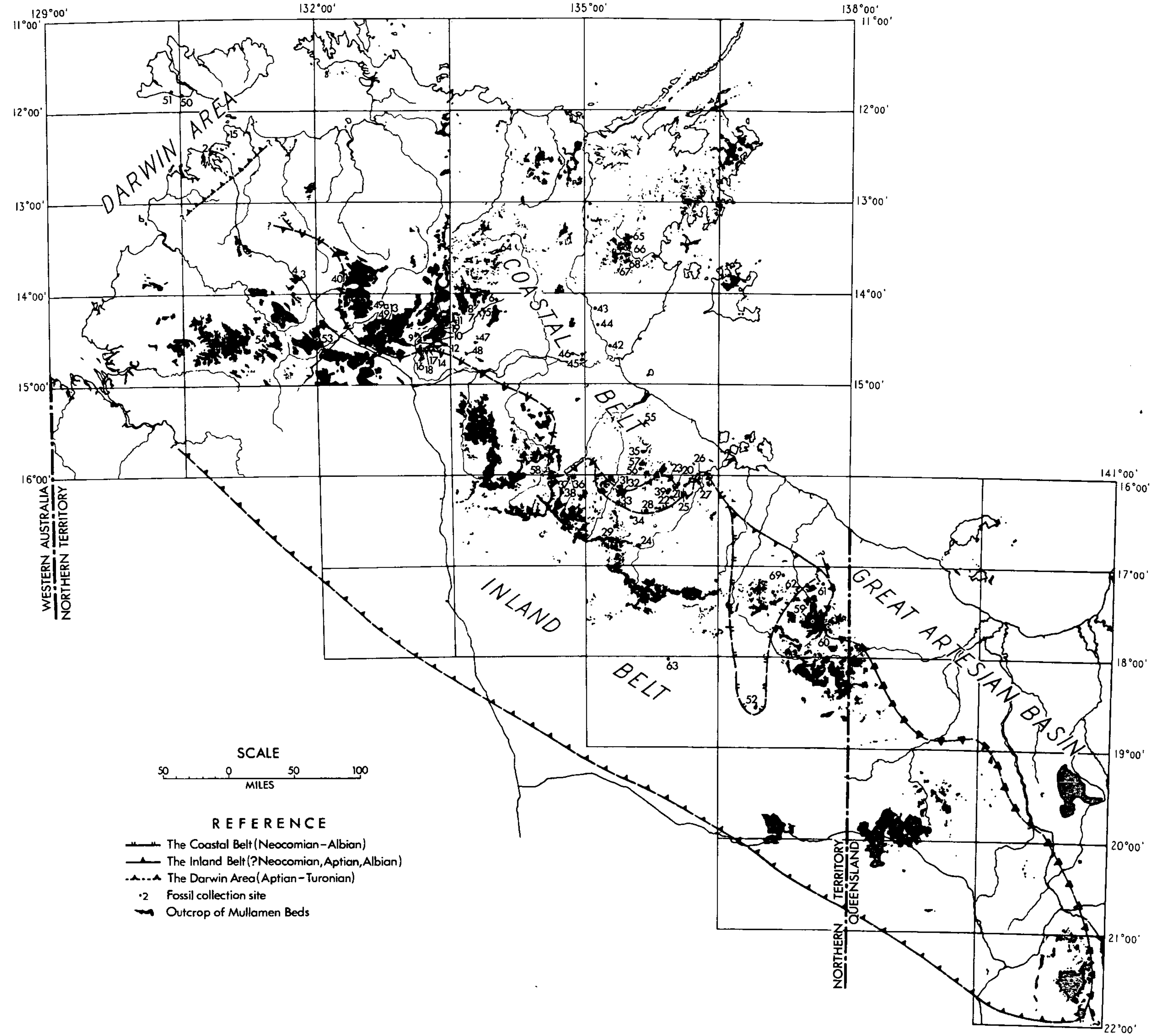
The study of the inland sediments is difficult, and the unravelling of their stratigraphy owes as much to the palaeontologist as to the field geologist. Particularly in the Fergusson River—Pine Creek Sheet area (see Fig. 2), but also to a varying extent in the whole region, the differences in elevation of outcrops and variation in the preserved thicknesses of successive layers and in detailed lithological content of each horizon are both countless and bewildering; the lack of persistent marker beds and horizons makes the correlation of individual outcrops additionally difficult. In view of this, the frequent occurrence of fossils in many outcrops examined was an extremely fortunate coincidence, and although an examination of a large number of sections over a considerable area as well as the consideration of the regional picture allowed certain generalizations, it was the critical examination and dating of fossils which allowed a stratigraphical column to be built up. It should be stressed that the typical sections described below for each of the three areas of sedimentation are no more than broad approximations of lithological content.

Structurally, the Cretaceous strata are not interesting in the field. Folding, even of non-tectonic origin, is not common, and faults other than small-scale gravitational slips are seldom observed. However, the study of the history of Cretaceous sedimentation reveals that crustal sagging has taken place in the Inland Belt in the ?Neocomian and Aptian, and elevation in late Aptian times. Since the margins of the Inland Belt correspond fairly closely to those of the earlier Daly River, Barkly, and Georgina Basins, it seems possible that these movements occurred along rejuvenated faults.

The coarser marine sediments of the different Cretaceous phases of sedimentation seem to have been deposited in a shallow rather than a deep-water environment. Grading in sandstones was observed in many parts of the area. Cross-bedding is quite common in sandstones of both the marine and the non-marine environment, but ripple-marking is generally rare. Profusion of Mollusca as well as the



129°00′
132°00′
135°00′
138°00′
141°00′
11°00′
12°00′
13°00′
14°00′
15°00′
16°00′
17°00′
18°00′
19°00′
20°00′
21°00′
22°00′
BATHURST ISLAND
MELVILLE ISLAND
COBOURG PENINSULA
JUNCTION BAY
WESSEL ISLANDS
TRUANT ISLAND
BATHURST I
MELVILLE I
FOG BAY
DARWIN
ALLIGATOR RIVER
MILINGIMBI
ARNHEM BAY
GOVE
CAPE SCOTT
PINE CREEK
MT. EVELYN
MT. MARUMBA
BLUE MUD BAY
PORT LANGDON
ARNHEM LAND
GULF OF CARPENTARIA
GROOTE EYLANDT
PORT KEATS
FERGUSSON RIVER
KATHERINE
URAPUNGA
ROPER RIVER
CAPE BEATRICE
AUVERGNE
DELAMERE
LARRIMAH
HODGSON DOWNS
MT. YOUNG
PELLEW
VICTORIA RIVER DOWNS
DALY WATERS
TANUMBIRINI
BAUHINIA DOWNS
ROBINSON RIVER
MORNINGTON
CAPE VAN DIEMEN
MORNINGTON I
NEWCASTLE WATERS
BEETALOO
WALLHALLOW
CALVERT HILLS
WESTMORELAND
BURKETOWN
BRUNETTE DOWNS
MT. DRUMMOND
LAWN HILL
DONORS HILL
ALROY
RANKEN
CAMOOWEAL
DOBBYN
AVON DOWNS
MT. ISA
CLONCURRY
URANDANGI
DUCHESS
Darwin
Pine Creek
Buldiva
Katherine
Maranboy
Mataranka
"Mainoru"
Roper River Mission
"Willeroo"
Daly Waters
Borroloola
"Mallapunyah"
Newcastle Waters
"Creswell Downs"
Burketown
Tennant Creek
Camooweal
Mt. Isa
Cloncurry
Duchess
Finnis R
Adelaide R
Mary R
South Alligator R
East Alligator R
Liverpool R
Mann R
Cadell R
Blyth R
Goyder R
MITCHELL RA
Wilton R
Walker R
Daly R
Katherine R
Fergusson R
Waterhouse R
Roper R
Phelp R
Fitzmaurice R
Flora R
Victoria R
Strangways R
Hodgson R
Arnold R
Cox R
Bight R
Limmen R
McArthur R
Foelsche R
Robinson R
Calvert R
Nicholson R
Gregory R
Alexandra R
Flinders R
Leichhardt R
Cloncurry R
STUART HIGHWAY
BARKLY HIGHWAY
BARKLY TABLELAND
WESTERN AUSTRALIA
NORTHERN TERRITORY
QUEENSLAND
N.T.
QLD.
W.A.
S.A.
N.S.W.
VIC.
SCALE
50 0 50 100 150
MILES



129°00'
132°00'
135°00'
138°00'
141°00'
11°00'
12°00'
13°00'
14°00'
15°00'
16°00'
17°00'
18°00'
19°00'
20°00'
21°00'
22°00'
DARWIN AREA
COASTAL BELT
INLAND BELT
GREAT ARTESIAN BASIN
WESTERN AUSTRALIA
NORTHERN TERRITORY
QUEENSLAND
SCALE
50 0 50 100
MILES
REFERENCE
The Coastal Belt (Neocomian–Albian)
The Inland Belt (?Neocomian, Aptian, Albian)
The Darwin Area (Aptian–Turonian)
Fossil collection site
Outcrop of Mullamen Beds

presence of corals is also taken as evidence of shallow-water sedimentation. Similar sedimentary features have not been observed in the finer-grained sediments, in which marine macrofossils are rare. Slump rolls in quartz sandstone were observed by Öpik (pers. comm.) in the Camooweal area, north-western Queensland.

For the purpose of description of sedimentary types, palaeontological content, and age, the Cretaceous strata of the Northern Region, which in this paper are referred to under the name of ' Mullaman Beds ', are divided into three areas, each area reflecting the governing environmental conditions during sedimentation. The three areas are: the Coastal Belt, the Inland Belt, and the Darwin area (see Fig. 3).

Previous work

The presence of Mesozoic strata in the Northern Territory has been known since 1895, when ammonites and other fossils collected by Brown from Point Charles, close to Darwin, were dated as Lower Cretaceous by Etheridge (1895). Actually, however, the first fossils (Radiolaria) found in beds of similar age were listed two years earlier by Hinde (1893) from Fanny Bay, Darwin, though they could not be dated at the time. Subsequent collections of macrofossils from the Darwin coast were also identified and described by Etheridge (1902a, 1904, 1907), who regarded them as representative of a distinct horizon in the Lower Cretaceous. Whitehouse (1928) later considered this horizon to be equivalent to the British upper Albian *substuderi* zone (Spath, 1926) on the basis of the contained ammonites.

In Whitehouse's opinion the probable age of Cretaceous beds exposed on Melville Island, north of Darwin, was upper Cenomanian (*vectense* zone of Spath). Both Melville and Bathurst Islands were visited in 1954 by Daily (1956), whose report described in detail the local stratigraphy, and listed collected fossils (field determinations only). On Bathurst Island, Cretaceous sediments are known to range in age from Aptian to Turonian (Wright, 1963). In 1960 and 1961 two bores put down by Oil Development N.L. penetrated over 1000 feet of Cenomanian sediments. A refraction survey which followed showed that the depth of the basement surface ranges from 1160 feet in the south-eastern portion of the island to 2980 feet in the north-west. Closer datings of fossiliferous beds on Melville and Bathurst Islands, as well as near Darwin, caused little controversy, as they were based on diagnostic marine microfossils and macrofossils with restricted time ranges and wide geographical distribution.

Brown (1895, 1906, 1908) was the first geologist to map and describe in detail some outcrops of Mesozoic strata of the inland Northern Territory. He correlated outcrops in the Pine Creek and Katherine Districts with the Lower Cretaceous marine beds at Darwin. Woolnough (1912) also mapped large areas of Mesozoic outcrops, both coastal and inland, as Cretaceous, but Jensen (1914, 1915) separated the Cretaceous beds at Darwin from all the inland Mesozoic strata; he regarded these inland ' Plateau Sandstones ' as equivalents of ' Borroloola beds ', which he thought were of Permo-Carboniferous age.

Voisey (1938) favoured Jurassic age for the inland plant-bearing sediments—this dating was originally suggested by Walkom (1937), who identified a single specimen of *Otozamites bengalensis*, a plant, from sediments in the vicinity of

Buldiva, about 120 miles south of Darwin. The range of *Otozamites* is Triassic to Lower Cretaceous, but at the time its known range in Australia was thought to be restricted to the Jurassic.

Noakes (1949) considered that the inland beds were of Lower Cretaceous age and had been deposited in a lacustrine environment. He placed them in his Mullaman Group as a lower unnamed unit, which he believed to be conformably overlain on the Darwin coast by his upper unit, the Darwin Formation. He regarded the Radiolaria in the topmost beds of the Buldiva section as further evidence for his subdivision. Noakes correlated the non-marine beds with part of the Blythesdale ' Series ' of Queensland, and the Darwin Formation with a portion of the Roma ' Series ' of Queensland.

Traves (1955) considered that the marine fossils which he found at several places near the coast of the Gulf of Carpentaria, and plant remains farther inland in the eastern Northern Territory, supported this interpretation, and correlated them accordingly. Walpole (1958) correlated outcrops near Maranboy with the Darwin Formation. Brunnschweiler (Appendix in Traves, 1955), however, disagreed with this view after examining additional plant material from the ' sandstone beds ' of lacustrine origin in the vicinity of Willeroo. These he dated as Jurassic, possibly Middle Jurassic, and this suggested to him a time gap between the deposition of the Mullaman Beds* and the Darwin beds.

Hossfeld (1954) emphasized the fact that plant fossils, as well as marine remains, were collected from a few and widely scattered localities which in his opinion could hardly be correlated stratigraphically. He suggested (p. 151) that '. . . the whole of the (Mullaman) Group may well be of marine origin, and that small estuarine and fluviatile deposits were responsible for the few remains of *Otozamites*. . . . The Group was deposited as a result of a gradually transgressive epeiric sea which finally extended over the whole of North Australia. . . . Deposition probably commenced in late Jurassic times and continued into the Lower Cretaceous sea of Queensland and the adjoining States, in the region which was to become the Great Artesian Basin '.

In view of these, in some cases, diametrically opposed views, a detailed investigation of the upper Mesozoic sediments of the Northern Territory seemed justified. The survey and palaeontological study gave results which supported some of the earlier ideas and discounted others; but the overall picture which finally emerged showed that the Cretaceous sedimentary cycle in this part of Australia was more complex than was previously suspected.

On the Queensland side of the border the genetically related Cretaceous sediments have received the attention of field geologists only recently. Whitehouse (1954), when dealing with the sediments of the Great Artesian Basin, correlated the non-marine plant-bearing sediments with the Blythesdale Group, and the finer-grained marine sediments with the Rolling Downs Group. In the course of a geological mapping programme, geologists of the Bureau of Mineral Resources in collaboration with geologists of the Geological Survey of Queensland mapped the whole of the Queensland portion of the area under discussion. Information which was gained in the mapping appears in the Explanatory Notes of the individual 4-mile Sheet areas, and is summarized by Carter, Brooks, & Walker (1961).

* The name ' Mullaman Group ' was changed to ' Mullaman Beds ' by Bureau of Mineral Resources geologists to conform with the Australian code of stratigraphic nomenclature.

Nomenclature

Since 1889, when Woods used Daintree's name ' Desert Sandstone ' when referring to sandstone capping extensive tablelands of the northern portion of the Northern Territory, five names have been applied to Mesozoic Northern Territory strata by different authors at various times. Two referred to the coastal beds of the Darwin Area, and three to the inland sediments. Because of the recent discoveries all these names except two, i.e. Mullaman Beds and Point Charles Beds, have lost their meanings and have fallen out of use. They are as follows:

Desert Sandstone: A vague term originally used by Daintree (1872) when referring to loose superficial post-Cretaceous deposits of Queensland. It was applied in the Northern Territory for a short time by Woods (1889), and others, to almost any superficial rock covering, Cretaceous probably included.

Plateau Sandstone: A name originated by Woolnough (1912) and later used by Hossfeld (1937, 1954) and Voisey (1938) for sandstone which is now known to be of Lower Cretaceous age, and which forms the surface of the great plateau areas in the northern portion of the Northern Territory. The recent survey has shown that these plateaux are made up of sandstone of more than one age and deposited under more than one environment.

Mullaman Beds (Group): The two previously mentioned names have been used in the past to refer to unfossiliferous, plant-bearing, or molluscan sandstone which more recently was included by Noakes (1949) in his ' Mullaman Group '— ' Mullaman Beds ' of the more recent Bureau of Mineral Resources usage. Noakes' Mullaman Group included two units: the lower unnamed unit made up of the predominantly plant-bearing inland sandstone, which Noakes thought to be of Lower Cretaceous age; and the upper unit, the *Darwin Formation,* of Albian age, which is best developed in the coastal sections in and around Darwin. Noakes regarded the two as conformably related. He also correlated the Darwin marine outcrops with the Radiolaria-bearing porcellanites near Buldiva and throughout the Katherine-Darwin Region.

Geologists of the Bureau of Mineral Resources have applied the name ' Mullaman Beds ' to all Cretaceous sediments recently mapped in the northern portion of the Northern Territory, regardless of environment in which they accumulated and their age. It is proposed that the name should be retained in this sense, and it is so used in this Bulletin.

Point Charles Bed: First used by Whitehouse (1928) when he dated the submarine fossiliferous bed at Point Charles as upper Albian. Previously this bed was informally referred to by different authors as ' Point Charles strata ', ' Point Charles submarine bed ', ' Point Charles deposit ' or ' Point Charles bed ', and Noakes (1949) included it in the Darwin Formation. There is no reason why this name, as well as the ' Darwin Formation ', should not be retained, but application of both is obviously limited.

On the Queensland side of the border three formal names have been applied in the past to the Mesozoic sediments. The two which concern us here are Polland Shale and Lees Sandstone. The third, Kamileroi Limestone, used by Laing & Power (1959), refers to a unit hitherto not recognized in the Northern Territory, and consequently will not be further mentioned in this Bulletin.

Lees Sandstone (*Unit A*): A term applied by pik et al. (1961) to the non-marine plant-bearing sandstone and conglomerate which crops out in many places on the Mount Isa and the Camooweal 1 : 250,000 Sheet areas and which is regarded in the present paper as extending interruptedly to the north-west as far as the Pine Creek Sheet area and probably beyond. Formerly this sandstone was correlated by Whitehouse (1954) with the Blythesdale Group. On both sides of the border, this sandstone underlies the finer-grained marine sediments which were referred to by Öpik et al. (1961) as the Polland Shale.

Polland Shale (*Unit C*): In this report Polland Shale is regarded as extending as far as the Katherine Sheet area to the north-west in the Northern Territory and probably discontinuously as far as the Boulia Sheet area to the south, where it is known under the name of Wilgunya Formation. Whitehouse correlated sediments now included in Polland Shale with the Rolling Downs Group.

In the present paper I have refrained from introducing new formal nomenclature for the newly described Cretaceous units. It would be foolish to suggest that the final word had been spoken on the Cretaceous sediments.

The Mullaman Beds fall naturally into three belts of differing depositional characteristics: the Coastal Belt, the Inland Belt, and the Darwin Area (Fig. 3).

Coastal Belt

Cretaceous sediments of the Coastal Belt occupy a large area along the western and south-western coast of the Gulf of Carpentaria and extend as scattered outcrops for a considerable distance inland from the coast. They cover a large portion of the Mount Evelyn, Katherine, Urapunga, Mount Marumba, and Blue Mud Bay Sheet areas, and are also found in the Roper River, Mount Young, and Bauhinia Downs Sheet areas. A solitary outcrop is known in the Mount Drummond Sheet area. In the past these sediments probably extended into the Alligator River, Milingimbi, Arnhem Bay, Hodgson Downs, Calvert Hills, and Robinson River Sheet areas (compare Figs 2 and 3).

The age of these sediments ranges from Neocomian to Albian, the Neocomian beds representing the oldest known Cretaceous sediments in the Northern Territory. They are almost entirely marine, the only exception being the earliest estuarine sediments and some others which appear to have accumulated in a fluviatile environment. The main lithological types are sandstone, siltstone, and conglomerate in that order of abundance.

On Figure 4, columns a-f are representative of sections encountered in the Mullaman sediments of the Coastal Belt. Figure 5a, on the other hand, is composite and shows the minimum total known thickness of Mullaman sediments on the Coastal Belt; this column was compiled mainly from data from sections a-f on Figure 4.

Seven lithological units are recognized in the Coastal Belt suite (Fig. 5a). These are:

Unit 1: Lacustrine saccharoidal sandstone and conglomerate of Neocomian age with plant remains. It is conformably overlain by

Unit 2: Marine quartz sandstone and silty sandstone grading upwards to siltstone or claystone. Contains a late Neocomian marine fauna.

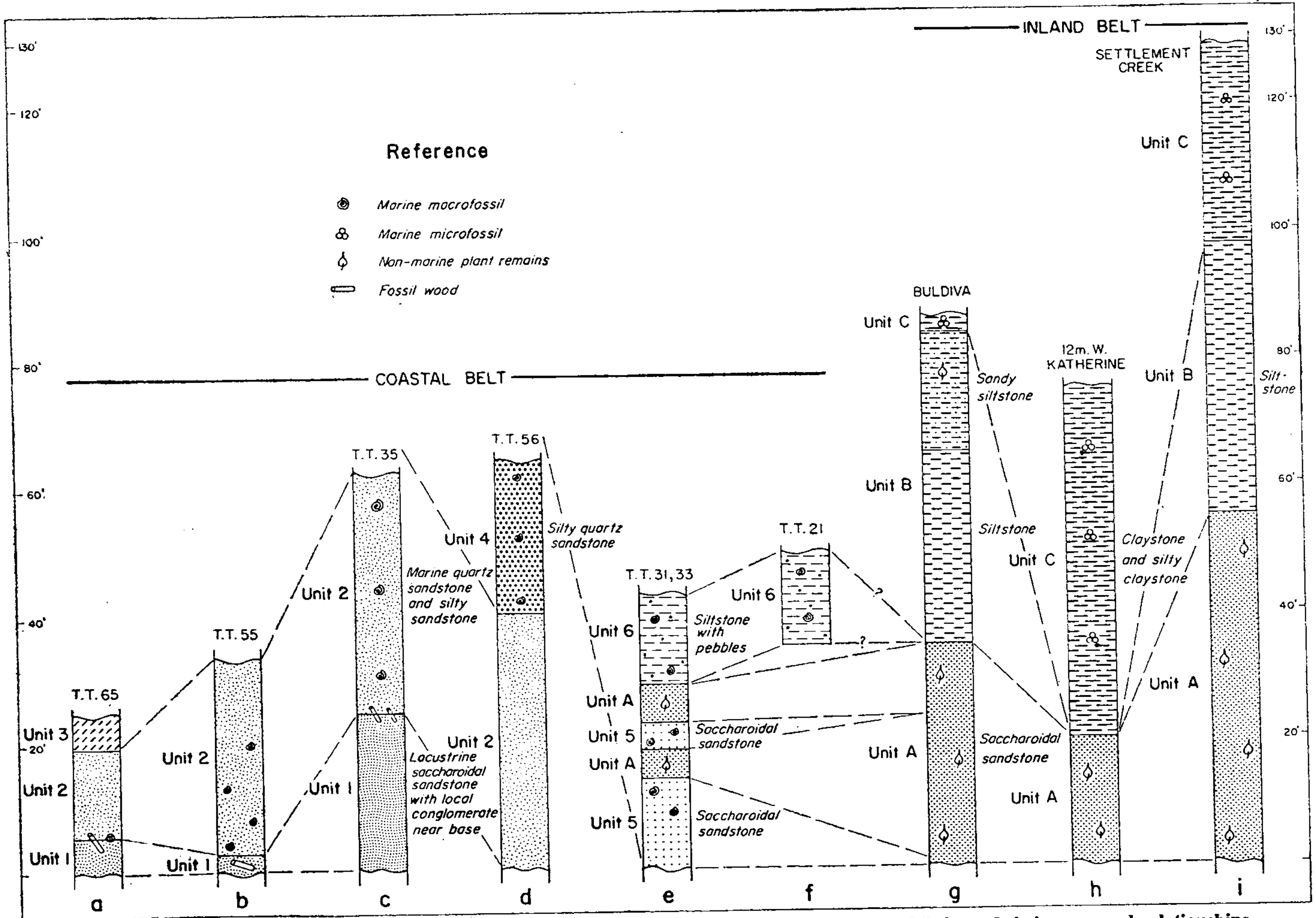


Fig. 4. Some representative sections of the Mullaman Beds in the Coastal Belt and the Inland Belt, and their proposed relationships.

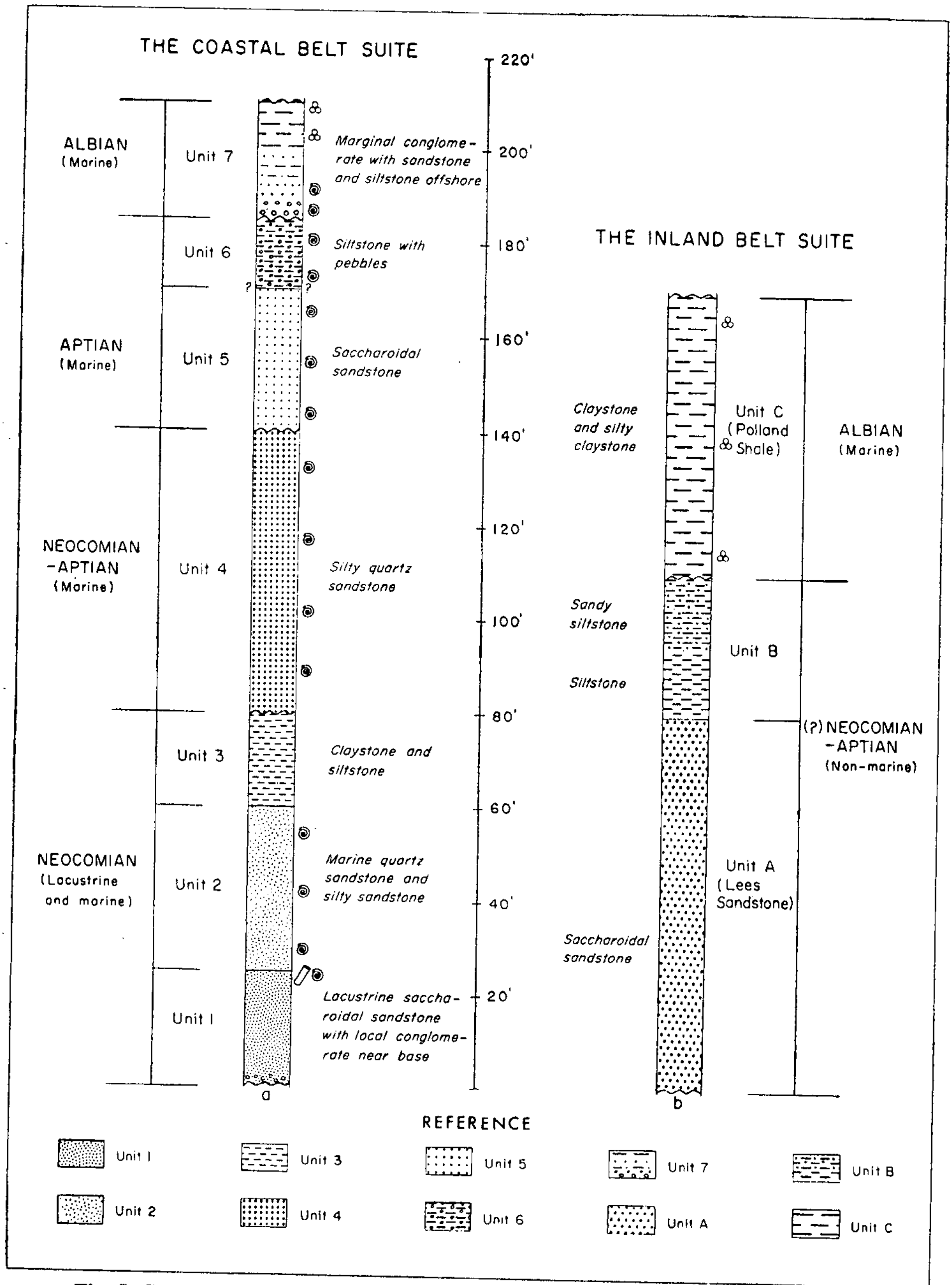


Fig. 5. Composite sections of Mullaman sediments in the Coastal and Inland Belts.

Unit 3: Marine siltstone and claystone which conformably overlie Unit 2. Contains rare marine fossils of Neocomian age.

Unit 4: Marine silty quartz sandstone with shelly fauna of Neocomian-Aptian age. Contact between Unit 4 and Unit 3 is not visible.

Unit 5: Saccharoidal sandstone with marine shelly fauna of Aptian age. Contact between Unit 5 and Unit 4 is not visible.

Unit 6: Marine siltstone with pebbles and an Aptian fauna. Contact between Unit 6 and Unit 5 is apparently conformable.

Unit 7: Marine conglomerate, sandstone, siltstone, and shale, with Great Artesian Basin fauna of Albian age. Contact between Unit 6 and Unit 7 is probably unconformable.

Unit 1 (Neocomian)

The oldest Cretaceous encountered on the Coastal Belt is quartz sandstone with or without a basal conglomerate. The basal conglomerate was observed at one of the three known outcrops of this Unit, at locality TT55 (see Fig. 3, also Fig. 4b), where it consists of rather poorly rounded pebbles and cobbles.

At localities TT65 and TT35 (see Fig. 3, also Fig. 4,a,c) the basal conglomerate is absent and the lowest rock is a rather poorly sorted and saccharoidal quartz sandstone with small lenses and haphazard admixture of siltstone in rare instances. It is fossiliferous; impressions after plant remains characterize its topmost beds where they may occur in large masses; single plants were found scattered throughout. Plants consist of indeterminate fragments, many of which resemble pieces of bamboo. Their presence as well as the exclusion of endemic forms of life give evidence of the initial non-marine, probably brackish, conditions which existed locally before flooding by the Neocomian sea.

The old surface which received the Neocomian sediments was uneven, although its relief was probably not very great. The non-marine beds, and to some extent the marine sandstone which overlies them, seem to be filling in hollows, valleys, and depressions in the old terrain which were developed during the previous cycle of erosion.

Fossils and age: The only fossils found in Unit 1 consist of indeterminate plant fragments, which cannot be used directly in determining the age. In at least one locality, however (TT55), shells from the bottom of the overlying Unit 2 occur intermingled with plant remains from the top of Unit 1. In the outcrop there is no evidence of a gap in sedimentation between the two units and consideration of the history of sedimentation suggests that marine conditions replaced the non-marine probably without any break in sedimentation. The marine fauna in Unit 2 is Neocomian, almost certainly upper Neocomian (see below); this would imply that Unit 1 was deposited either during the middle Neocomian or early upper Neocomian.

Unit 2 (late Neocomian)

All available evidence suggests a conformable relationship between Unit 1 and Unit 2; but whereas Unit 1 was laid down in a non-marine environment, Unit 2 is definitely marine. Unit 2 consists of up to 35 feet of saccharoidal sandstone, silty quartz sandstone, and some conglomerate. In most outcrops the sandstone is fairly pure, loosely packed, and saccharoidal. It has an admixture of grains of larger or smaller size, which are concentrated in lenses or occur individually throughout the sequence. Larger solitary pebbles and cobbles are also present. Some sections show a rather poorly developed gradation in the size of grains, finer towards the top, extending over thicknesses of up to ten feet. Cross-bedding is quite common, but ripple-marking rare. Grains of quartz are loosely packed and percolating solutions can migrate freely, coating the individual grains with a film of iron oxides and bringing about movement of carbonate and silica. Silica is concentrated in surface and subsurface bands and layers, which protect the inner sediments from further leaching; and in some places it is concentrated in considerable thickness, forming silica-rich massive rock known as grey-billy. Decalcification of Unit 2 sandstone has been no less complete than that of Unit 1 sandstone (see Fig. 20), and replacement of calcium carbonate by silica is similarly rare. In some outcrops a noticeable admixture of silt has been observed.

Conglomerates which are found associated with the Unit 2 sandstone are of at least two different types. The first type (such as that found at locality TT10) is not obviously marine and seems to be associated with old river courses which fed coarse detritus into the shallow sea from the nearby ranges. This conglomerate is very poorly sorted, and coarsely cross-bedded, and the individual pebbles and boulders are poorly rounded. It contains associated plant remains apparently brought in by rivers. The second type of conglomerate seems to be associated with the old coastlines. A good example of it has been encountered just west of locality TT40 in the Mount Evelyn 1:250,000 Sheet area (see Fig. 3), where it increases in coarseness westward and presumably marks the limit of penetration of sea in this area. Farther from the coastline (i.e. towards the east) its constituents are of more uniform size and are better rounded, and constitute the true basal conglomerate.

In most cases observed, however, the floor which received Cretaceous sediments in the Coastal Belt seems to have been swept clean of the weathered material by the advancing sea; but angular slabs of unweathered older rocks which are found embedded in the base of Mullaman Beds have not been moved laterally and were apparently enveloped where they lay by the younger sediments.

Fossils and age: Unit 2 is the most richly fossiliferous unit in the Coastal Belt Suite. Altogether, 66 molluscs have been described from it, 57 in the second part of this Bulletin, and in addition it has yielded brachiopods, corals, bryozoans, and echinoids, as well as plant remains, which are not very numerous and will be described in the near future.

The following molluscs have been identified from Unit 2:

Pelecypoda:

Lopatinia(?) sp.
Grammatodon arnhemense sp. nov.
Grammatodon psittaculum sp. nov.
Maccoyella sp. cf. *M. corbiensis* (Moore, 1870)
Maccoyella mullamanensis sp. nov.
Maccoyella neocomiana sp. nov.
Maccoyella sp. cf. *M. transitoria* sp. nov.
Maccoyella sp.
Pseudavicula dickinsi sp. nov.
Isognomon noakesi sp. nov.
Syncyclonema territorianum sp. nov.
Camptonectes dunni sp. nov.
Camptonectes magnificus sp. nov.
Camptonectes(?) mainoruensis sp. nov.

Camptonectes youngensis sp. nov.
Neithea sp. cf. *N. occidentalis* (Conrad, 1855)
Lima hossfeldi sp. nov.
Lima missiona sp. nov.
Lima sp. nov.
Plicatula townleyi sp. nov.
Ostrea woolnoughi sp. nov.
Ostrea sp. A
Ostrea sp. B
Ostreoid gen. et sp.
Exogyra australiana sp. nov.
Exogyra travesi sp. nov.
Mytilus(?) sp.
Modiolus(?) browni sp. nov.
Modiolus(?) katherineus sp. nov.
Brachidontes(?) voiseyi sp. nov.
Trigonia(?) marumbiana sp. nov.
Trigonia vertistriata Skwarko, 1963
Trigonia(?) sp. nov., Skwarko, 1963
Iotrigonia (Zaletrigonia) hoepeni Skwarko, 1963
Pterotrigonia (Rinetrigonia) capricornia Skwarko, 1963
Opisthotrigonia roperi Skwarko, 1963
Nototrigonia aberrata Skwarko, 1963
Nototrigonia yeuralba Skwarko, 1963
Nototrigonia crescenta Skwarko, 1963
Nototrigonia nimbosa sp. nov.
Nototrigonia ponticula Skwarko, 1963
Nototrigonia(?) walkeri sp. nov.
Austrotrigonia prima Skwarko, 1963
Eriphyla(?) bauhiniana sp. nov.
Cyrenopsis sp.nov.
Epicyprina aboriginea sp. nov.
Epicyprina australiana sp. nov.
Cyprina lateralis sp. nov.
Venilicardia(?) parsonsia sp. nov.
Venilicardia sp. nov.
Lucina sp. aff. *Lucina* sp., Woods, 1907
Paraesa antichthona sp. nov.
Paraesa neocomiana sp. nov.
Panopea sp. aff. *P. aramacensis* (Etheridge Jnr, 1892)
Panopea rosia sp. nov.
Panopea yiyintyia sp. nov.
Teredo sp.

Gastropoda:
Diodora(?) galea sp. nov.
Cellana(?) carpentaria sp. nov.
Pleurotomaria(?) sp. nov.
Cinulia sp. cf. *C. hochstetteri* (Moore, 1870)
Trachynerita(?) sp.

Cephalopoda:
Australiceras sp. cf. *A. jacki* (Etheridge Jnr, 1880)
Dimitobelus youngensis sp.nov.

This assemblage has been dated as Neocomian, probably late Neocomian (see pp. 64-67).

Unit 3 (late Neocomian)

In all sections examined west of the mouth of the Roper River and Groote Eylandt a layer of siltstone or claystone, here referred to as Unit 3, overlies the Unit 2 sandstone (see Fig. 4a). The passage from coarser into finer lithology is in many places rather abrupt, and in only a few places was it observed to extend over as much as a few feet. Yet there is no evidence of an unconformity between Unit 2 and Unit 3, and their relationship is taken as conformable.

As in the underlying sandstone the siltstone is poorly sorted and contains lenses of sand and clay as well as large and small pebbles distributed unevenly throughout. Even conglomerate was encountered in this Unit (see Fig. 21). The greatest thickness measured in any single outcrop was about 20 feet, but the top of Unit 3 is invariably an erosion surface, and consequently the total thickness is not known.

Fossils and age: Fossils are rare in Unit 3. Those that have been found are invariably strongly distorted by compaction and are indeterminable. Unit 3 is probably late Neocomian in age, as it is underlain without a break by Unit 2 of late Neocomian age and is overlain by Unit 4, which contains fauna intermediate between Neocomian and Aptian.

Unit 4 (Neocomian-Aptian)

In the southern portion of the Mount Young 1:250,000 Sheet area, two outcrops of sandstone (localities TT56,57; see Fig. 3 and Fig. 4) have yielded a marine molluscan fauna which is thought to be transitional in age between Neocomian and Aptian. These two outcrops are, in this bulletin, classed separately as a single stratigraphical unit, Unit 4.

Sediments included in Unit 4 consist of hard, indurated quartz sandstone of uniform composition and stained deeply by oxides of iron. They are flat-lying; the greatest measured thickness is 60 feet.

At locality TT56, where a greater thickness is exposed, the lower 40 feet of sandstone is red and friable at the top, but white, hard, and saccharoidal beneath. The base of this section is unconformable on much older rock, and the top is an erosional surface. Although no fossils were found in this lower portion of the section it seems possible that the horizon may be equivalent to Neocomian fossiliferous marine sandstone at locality TT35, which lies about 18 miles to the north (see Fig. 4 c,d). About the same distance to the south-west, at localities TT31-33, Mullaman sediments are of Aptian age, and it is suggested that the line joining these localities (i.e. TT55, 35, 57, 56, 31-33) approximately traces the southward migration of the Cretaceous coastline in this area (see also p. 63).

Fossils and age: The preceding discussion shows that Unit 4 sediments are geographically placed in the series of outcrops which are progressively getting younger to the south: from Neocomian at locality TT55 to Aptian at TT31-33.

Their very position suggests, therefore, an age somewhere between Neocomian and Aptian, and close examination of fossils found at TT56 and 57 further supports this suggestion.

The following fossils were found at TT56 and TT57:

Maccoyella transitoria sp. nov.
Exogyra travesi sp. nov.
Pterotrigonia (*Rinetrigonia*) *capricornia* Skwarko, 1963
Panopea sp. cf. *P. maccoyi* (Moore, 1870)
Panopea sp. cf. *P. sulcata* Etheridge Snr, 1872
Pelecypoda indet.

At this juncture it will suffice to state briefly that the *Maccoyella* is very closely related to *M. barklyi,* which is found in the Aptian of the Great Artesian Basin, and the two poorly preserved species of *Panopea* are probably identical with *P. sulcata* and *P. maccoyi,* also from the Great Artesian Basin. The *Exogyra* and the *Pterotrigonia* on the other hand have been hitherto found to be restricted to the Neocomian outcrops of the Mullaman Beds.

Unit 5 (Aptian)

Less than half a dozen of the outcrops of Mullaman Beds on the Coastal Belt were found to contain fauna with species of marine Mollusca already known from the Roma Formation (Aptian) of the Great Artesian Basin. Presence of these outcrops is evidence of marine sedimentation in the Coastal Belt in Aptian times, as well as of a definite link with the Great Artesian Basin, but their limited number tells little about the boundaries of the local Aptian sea; their distribution, however, suggests that this sea was probably not much smaller than the preceding Neocomian sea. The higher stratigraphical and topographical position of Aptian beds favoured their rapid disintegration.

In the western portion of the Bauhinia Downs 1:250,000 Sheet area, the Mullaman Beds consist of quartz sandstone overlain by siltstone. The sandstone member has been, in this Bulletin, placed in Unit 5 and the siltstone into Unit 6 (see Fig. 5a).

At locality TT31 the Unit 5 sandstone is 30 feet thick. It rests unconformably on Proterozoic rocks, and passes up into six feet of rubbly plant-bearing siltstone.

The sandstone is a poorly sorted cross-bedded ripple-marked medium-grained saccharoidal sandstone not unlike other saccharoidal sandstones in the Coastal Belt Suite, but its fossil content at locality TT31 is unusual in that it consists of alternating layers with plants and marine molluscs. The marine fossils are evidence of the occasional presence at this place of the shallow sea of the Coastal Belt; in addition they suggest a link between the sea in this area with the sea of the Great Artesian Basin in Queensland. The plant remains probably belong to the Inland Belt non-marine type of flora characteristic of Unit A (see p. 32); their presence at TT31 is due to successive retreat and advance of the waters of the Inland and Coastal Belts.

Unit 5 is so far known only from locality TT31. As can be expected, it was found to grade laterally in one direction into an entirely non-marine section (at locality TT32), and most probably it grades into a completely marine section in the opposite direction.

Fossils and age: The marine fossils of Unit 5 are those found at locality **TT31**, and consist of *Fissilunula clarkei* (Moore, 1870) and *Nototrigonia* sp. ind. aff. *N. cinctuta* (Etheridge Jnr, 1902). Both these forms are known from the Roma Formation (usually regarded as Aptian) of the Great Artesian Basin in Queensland and other parts of Australia, but only *F. clarkei* is confined to these beds.

The plant remains found at TT31 are indeterminate, but a rich assemblage characteristic of the Inland Belt Suite was found at the neighbouring locality, TT32.

Unit 6 (Aptian)

At locality TT33, close to localities TT31 and 32 (see Fig. 3), a yellow hard massive claystone and siltstone with marine fossils crops out stratigraphically higher than beds at TT31 and 32. This outcrop is only about 15 feet thick; its base is not visible, and its top is an erosion surface. It has been included in Unit 6 of the Coastal Belt suite, but although its stratigraphical position is unquestionably higher than that of Unit 5, it is not known whether the relationship between the two is conformable or unconformable. The dating by contained fossils suggests, however, that even if present, a break between the two units would be of very short duration.

Fossils and age: The fossil content at locality TT33 is limited to a new gastropod and to some wood fragments with *Teredo*-like borings. The same horizon is thought to be represented at localities TT20-22 in the north-eastern portion of the Bauhinia Downs Sheet area, and directly east from localities TT31-33. The fossil lists for localities TT20, 21, 22 are as follows:

TT20: (?)'*Macrocallista*' *plana* (Moore, 1870)
(?)*Thracia primula* Hudleston, 1890
Pelecypod frags indet.
Neritokrikus tuberosus gen. et sp. nov.
Peratobelus(?) *bauhinianus* sp. nov.

TT21: *Nuculana*(?) sp.
Maccoyella sp. cf. *M. corbiensis* (Moore, 1870)
Maccoyella sp. indet.
Entolium sp.
Nototrigonia sp. cf. *N. cinctuta* (Etheridge Jnr, 1902)
Eriphyla(?) *bauhiniana* sp. nov.
(?)*Fissilunula clarkei* (Moore, 1870)
Tatella sp. aff. *T. aptiana* Whitehouse, 1925
Genus indet. sp. nov.
Pelecypods indet.
Peratobelus(?) *bauhinianus* sp. nov.

TT22: Pelecypods(?)
Belemnites indet.

'*Macrocallista*' *plana, T. primula, M. corbiensis, N. cinctuta, F. clarkei,* and *T. aptiana* are usually associated with the Roma Formation (?Aptian) of the Great Artesian Basin. It would seem, therefore, that at least in some portions of the area marine sedimentation was continuous from Neocomian to Aptian. The types of clastics which were deposited in Aptian times were basically similar to those of Neocomian time: sandstone followed by siltstone.

The thicknesses involved are not known because all the Aptian sections discussed above have erosion surfaces at the top and rest on much older rocks with an unconformity. As shown in Fig. 5a the minimum overall thickness of Aptian sediments in the Coastal Belt is about 35 feet.

Unit 7 (Albian)

Cretaceous sections exposed in the eastern portion of the Calvert Hills Sheet area are of Albian age. Their nature gives evidence of extreme near-coast conditions of sedimentation in this area in Albian time.

At one locality, TT60, where fossils were collected (see Fig. 3), the Albian sediments on the east butt against an old shore of uplifted Unit A rocks of the Inland Belt. The Albian strata become progressively finer eastwards and consist of siltstone and claystone, grading to sandstone, grit, and conglomerate close to or at the old coastline.

The inference from these outcrops is that the non-marine and possibly marine sediments of the Inland Belt were somewhat uplifted in the late Aptian. This uplift appears to have been confined to the Inland Belt, and was accompanied, or more probably quickly followed, by a downwarp in an area marginal to the Inland Belt. This area became flooded by the shallow Great Artesian Basin from the east or south-east, but the penetration of this Albian sea seems to have been temporarily held back by the uplifted sediments of the Inland Belt. But finally the Albian sea flooded the whole Northern Region, depositing deeper-water, finer-grained sediment which is an upward extension of Unit 7 and is here described under the name of Unit C (p. 33).

Fossils and age: Fossils identified from TT60 include the following genera and species:

Pelecypoda:	*Aucellina hughendenensis* (Etheridge Snr, 1872)
	Teredo sp.
Brachiopoda:	*Argiope* sp. aff. *A. punctata* Moore, 1870
	Rhynchonella sp. aff. *R. solitaria* Moore, 1870
Cephalopoda:	*Dimitobelus canhami* (Tate, 1879)
Plants:	*Cladophlebis australis* (Morris, 1845)
	Brachyphyllum stems.
Bryozoa.	

All the molluscs are typically associated with the Tambo Formation of the Great Artesian Basin in Queensland, and *A. hughendenensis* and *D. canhami* are confined to it. The age of the Tambo Formation is regarded as Albian on ammonite correlation with Europe.

Inland Belt

The Inland Belt proper is a belt of flat-lying Mullaman sediments which have accumulated in a non-marine environment in Lower Cretaceous times (see Fig. 3). It extends diagonally across the northern portion of the Northern Territory from about the Port Keats/Cape Scott area in the north-west to the Duchess Sheet area in the south-east, in north-western Queensland—a distance of about 900 miles. Its breadth apparently does not exceed 200 miles. The Belt occupies all, or parts, of the following 1 : 250,000 Sheet areas: Cape Scott, Pine Creek, Mount

Evelyn, Port Keats, Fergusson River, Delamere, Katherine, Larrimah, Daly Waters, Newcastle Waters, Hodgson Downs, Tanumbirini, Beetaloo, Bauhinia Downs, Walhallow, Brunette Downs, Alroy, Calvert Hills, Mount Drummond, Ranken, Avon Downs, Westmoreland, Lawn Hill, Camooweal, Mount Isa, Urandangi, Donors Hill, Dobbyn, Cloncurry, and Duchess (Figs 2 and 3). Because of lack of outcrop its south-western margin is only broadly defined. The north-western margin of the Belt is not known, but may be covered by the Joseph Bonaparte Gulf.

The Inland Belt Suite consists of three units, one of which is marine and not limited to the Inland Belt:

Lees Sandstone (Unit A): Non-marine, mainly saccharoidal sandstone, with plant remains of Lower Cretaceous age. Probable age ?Neocomian, Aptian.

Unit B: Non-marine siltstone and sandy siltstone with rare and indeterminate plant remains. Age probably Aptian, on stratigraphy. Lower contact conformable.

Polland Shale (Unit C): Marine claystone, shale, and silty claystone with microfauna of Albian age. A sedimentary break of short duration may exist between Unit B and Unit C. Unit C corresponds to the upper part of Unit 7.

Lees Sandstone (Unit A) (?Neocomian, Aptian)

Plant-bearing saccharoidal sandstone was the first sediment to accumulate in the Inland Belt (Fig. 4g-i; Fig. 5b). The sandstone contains mostly quartz, and as in the marine and non-marine Neocomian saccharoidal sandstone of the Coastal Belt the size of constituent grains varies considerably. In some sections there is a marked admixture of siltstone, but this is rather rare. In outcrop the sandstone is massive, and apart from common cross-bedding there are very few structures. This, together with the presence of plant remains to the exclusion of other fossils, is regarded as a characteristic and distinguishing feature of this sandstone. Thicknesses of individual outcrops are greater than those of the marine sandstone of the Coastal Belt and sections up to 80 feet thick have been measured. There are no marker horizons.

Despite the lack of marker horizons, the varying thicknesses in individual sections, the differences of elevation between outcrops, and the incompleteness of the survey, it is suspected that only a single horizon is represented in all the examined sections. This is because of marked similarity in outcrop and lithology, its stratigraphical position with regard to other beds (see below), and its fossil content.

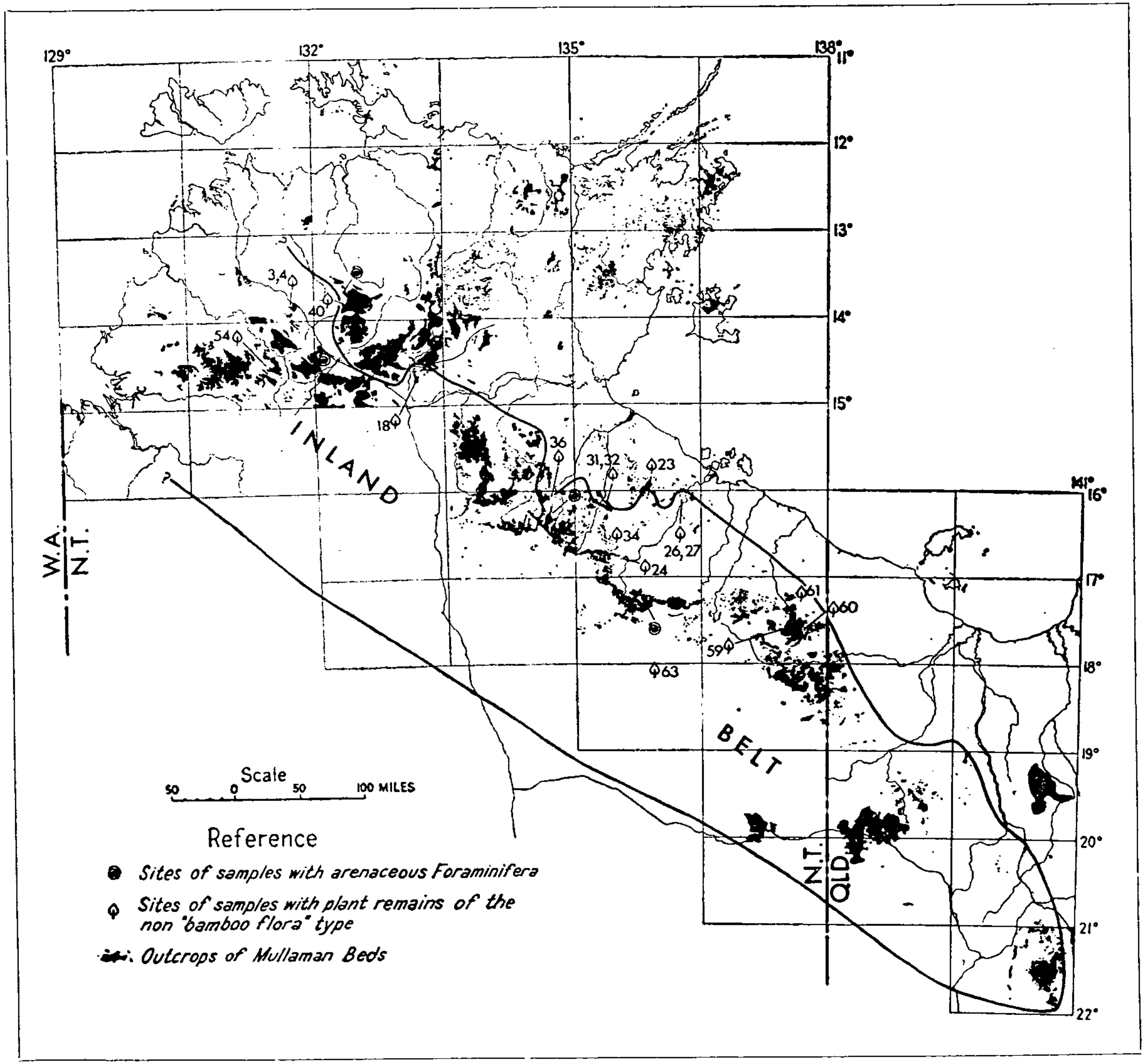


Fig. 6. Distribution of plant-bearing and foraminiferal localities within the Inland Belt.

The Unit A sandstone overlies older strata uncomformably with or without an angular unconformity. It rapidly grades upwards into siltstone, which is here included together with the overlying sandy siltstone in Unit B.

Fossils and age: Plants identified by Brunnschweiler (in Traves, 1955) and White (1961, unpubl.) from fifteen localities (see Fig. 6) within the Inland Belt of non-marine sedimentation are:

Pterophyllum fissum Feistmantel, 1879
Ptilophyllum pecten (Phillips, 1829)
(?)*Ptilophyllum oligoneurum* Tenison Woods, 1883
Cycadites sp. nov.
Cycadites sp. cf. *C. blandfordianus* Oldham & Morris, 1862
Otozamites bengalensis (Oldham & Morris, 1863)
Otozamites bechei Brongniart, 1828
Otozamites feistmanteli Zigno, 1881
Taeniopteris spatulata McClelland, 1850
Taeniopteris sp. cf. *T. tenison-woodsi* Etheridge Jnr, 1892
Williamsonia sp.
Elatocladus planus (Feistmantel, 1879)
Elatocladus sp. cf. *E. planus* (Feistmantel, 1879)
Elatocladus sp.
Brachyphyllum stems and twigs
Pagiophyllum stems
Microphyllopteris gleichenioides (Oldham & Morris, 1862)
Microphyllopteris sp. cf. *M. pectinata* (Hector, 1886)
Thinnfeldia pinnata Walkom
(?)*Hausmannia* sp.
Cladophlebis australis (Morris, 1845)
Cladophlebis sp. cf. *C. roylei* Arber, 1901
Cladophlebis sp. nov. aff. *C. roylei*
Cunninghamites sp.
Palissya sp.
Sphenopteris erecta (Tenison Woods, 1883)
Sphenopteris sp. indet.
Cladocladus sp. nov.
Baiera sp. indet. aff. *B. bidens* (Tenison Woods, 1883)
Phyllopteris sp. cf. *P. lanceolata* Walkom, 1919
Bathinella sp.
Coxiella sp.
Taxites sp. cf. *T. planus* Feistmantel, 1879
Auracarites sp. cf. *A. polycarpa* Tenison Woods, 1883
Equisetalean stem, indet. (?*Neocalamites*)
Fossil wood.

This flora, though prolific in genera and species, does not allow close dating as it is composed of long-ranging forms, but it is generally indicative of Upper Mesozoic times. There is, however, some evidence for supposing that sedimentation in this area had not begun before Neocomian times: in the Mount Evelyn Sheet area a thick section shows what is probably a Neocomian sandstone with poor marine fauna overlain by more sandstone with plant remains (locality TT40). At locality TT52 (Mount Drummond Sheet area) sandstone of definite Neocomian age (Unit 2) occupies a stratigraphically lower position than the adjoining plant-bearing sandstone of Unit A. In addition there is good evidence (see p. 27) that the Unit A sandstone continued to accumulate in Aptian times, as shown at sections TT31-32.

Unit B (Aptian)

The Unit A sandstone is overlain apparently conformably by a layer of siltstone which in turn is succeeded in some outcrops by a layer of fine-grained sandstone and in others by a sandy siltstone. Both these sediments contain in places some indeterminate plant remains and are thought to have accumulated in the same non-marine environment of the Inland Belt as Unit A. They have been grouped together as Unit B. The siltstone layer seldom exceeds 15 feet in thickness, and the thickness of the upper sandstone or sandy siltstone layer is comparable. The upper member is usually fine to medium-grained and is stained dark grey; it is easily distinguishable from the Unit A sandstone, which is white and which becomes stained red by percolating solutions.

Fossils and age: The only fossils found in Unit B sediments are indeterminate plant fragments, which do not provide a basis for dating. Stratigraphical evidence points to an Aptian age. As already stated, the underlying Unit A is of no later than Aptian, probably early Aptian, age, while the unconformably overlying marine Unit C is of Albian age.

Polland Shale (*Unit C*) (Albian)

In some areas the non-marine suite of the Inland Belt sediments is overlain disconformably by claystone and shale with marine microfossils (see Fig. 4, g, h, i; Fig. 5b), but coarser-grained sediments of Unit 7 grade into Unit C. This fine-grained layer of marine sediment may exceed 60 feet in thickness, but its surface is an erosion surface. For the sake of consistency this unit is referred to here as Unit C of the Inland Belt Suite of sediments, but at least a portion of this shale in north-western Queensland already bears the name ' Polland Shale ', given to it by Öpik et al. (1961).

In many places where Unit A and Unit B crop out, this shale is absent, and has probably been removed from these outcrops by erosion: the fine-grained sediment is probably a deeper-water deposit and consequently the sea in which it was laid down was of considerable extent rather than a local phenomenon. It is thus thought to have covered originally the whole of the Inland Belt of non-marine sedimentation and most probably extended farther to the north, covering at least in part and probably completely the Coastal Belt from which it has since been largely but not entirely removed by erosion (see Fig. 7; Fig. 5a).

Unit C shale contains small lenses of sand, and in places small gypsum concretions. It is soft and blue-grey when fresh, but turns pale and hard on desiccation. It is subject to staining by the percolating iron solutions, which impart to it yellow, purple-brown, and red colours. In addition the numerous cracks and crevices developed in it by desiccation of the top outcrops have become filled by loose secondary material which stains deeper than the surrounding shale. This network of angular cracks is preserved particularly well when the rock becomes impregnated with silica, giving an overall effect of brecciation.

Such ' brecciated ' shale or claystone has been observed in the Fergusson River Sheet area, in the northern escarpment of the Barkly Tableland, in the southern outcrops of the original Polland Shale of the Camooweal and Mount Isa Sheet areas, and in the Upper Wilgunya Formation in the Boulia area. In all these areas the foraminiferal content is strikingly similar and suggests that the sea in which this sediment accumulated was an extension of the shallow sea of the Great Artesian Basin in Queensland.

Fossils and age: The following genera and species of arenaceous Foraminifera were recently identified by I. Crespin (pers. comm.) and G. R. J. Terpstra (pers. comm.) from Unit C.

Ammodiscus cretaceus (Reuss, 1845)
Ammodiscus glabratus Cushman & Jarvis, 1928
Haplophragmoides sp. cf. *H. arenatus* Crespin, 1963
Haplophragmoides chapmani Crespin, 1944
Haplophragmoides dickinsoni Crespin, 1953
Haplophragmoides sp. cf. *H. gigas* Cushman, 1927
Haplophragmoides wilgunyaensis Crespin, 1963
Ammobaculites erectus Crespin, 1963
Ammobaculites minimus Crespin, 1953
Textularia anacooraensis Crespin, 1953
Verneuilina howchini Crespin, 1953
Verneuilinoides sp.
Miliammina sp.
Trochammina sp. cf. *T. depressa* Lozo, 1944
Trochammina sp. cf. *T. raggatti* Crespin, 1944
Trochammina sp.

Our present knowledge of the stratigraphical distribution of arenaceous Lower Cretaceous Foraminifera in Australia is unfortunately incomplete and the value of this list in dating is limited. Since however, Polland Shale is stratigraphically somewhat higher than Unit 7 (Albian) of the Coastal Belt Suite its age in the present paper is provisionally regarded as Albian.

Localities which have yielded samples with arenaceous Foraminifera are plotted on Figure 6. All but one are located within the boundaries of the Inland Belt. The single exception comes from the middle of the Mount Evelyn Sheet area (locality TT40), where a thick Lower Cretaceous section is at least in part marine and of Neocomian or Aptian age. A sample taken from the top of the section has yielded an assemblage of arenaceous Foraminifera typical of those found in other localities within the Belt as well as in the Lower Wilgunya Formation of Queensland.

Darwin Area

The stratigraphy of the Darwin Area contrasts sharply with that of the Coastal and Inland Belts, and its known areal extent is much smaller. However, only its south-eastern boundary can be at all plotted. Sedimentation here in Cretaceous times continued considerably longer than in other portions of the Northern Territory—from Aptian to Turonian; and a markedly greater thickness of sediments accumulated (possibly as much as 3000 feet on Bathurst Island).

Mullaman sediments crop out in the coastal cliffs at Darwin, on Cox Peninsula east of Darwin, and at Shoal Bay north-north-east of Darwin (see Fig. 7). The coastal outcrops in the southern portion of Melville and Bathurst Island are also included in the Darwin Area, as they were laid down in the same area of sedimentation, under the same conditions of deposition, and at about the same time.

Mullaman sediments in the Darwin Area seem to have been deposited in an elongate rapidly sinking trough whose axis is probably aligned in an east-southeasterly direction, the deepening from the only known margin being rapid in a west-north-westerly direction.

Darwin (uppermost Albian or early Cenomanian)

The near-horizontal Mullaman Beds at Darwin overlie steeply dipping Proterozoic rocks with an angular unconformity. In many sections a basal gravel or conglomerate is present, overlying a gently undulating contact. The conglomerate

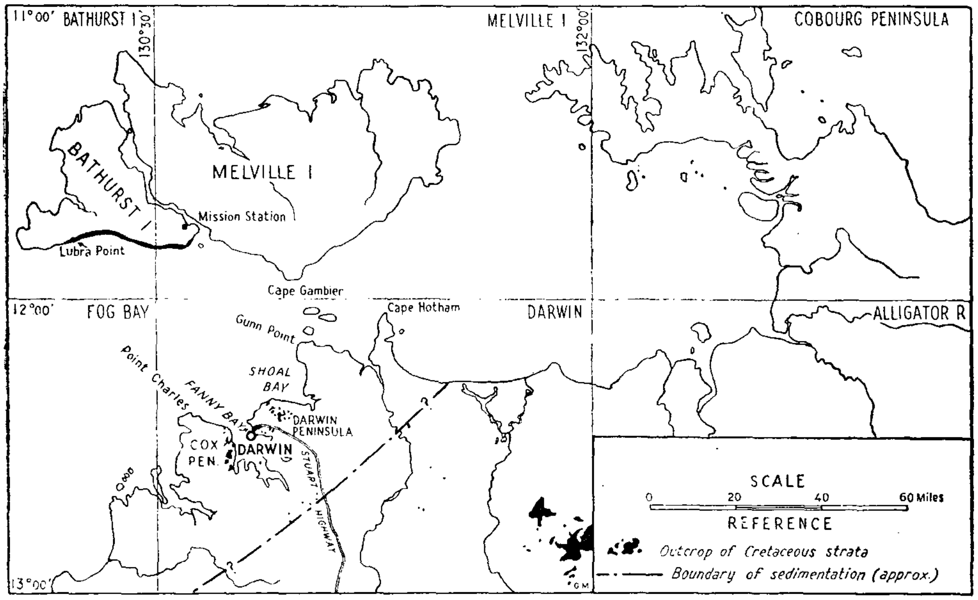


Fig. 7. Locality Map of the Darwin Area.

consists of unsorted somewhat water-borne quartz fragments which may or may not be cemented together. The pebbles, cobbles, and boulders are derived from lenses and veins of quartz in the underlying Proterozoic beds. Above this is up to 25 feet of deeply weathered quartz sandstone, which is in turn covered by up to 35 feet of silicified fossiliferous claystone.

Bedding planes are not easily discernible in Darwin sections, but at several outcrops the fairly persistent bands with belemnite casts provide good marker horizons, and it was with their help that it was possible to determine a gentle northerly dip.

Coloration is secondary, as all sections examined in Darwin have been strongly lateritized. The yellow-coloured shale is the one most commonly encountered (e.g. Nightcliff, Doctors Gully), but other sections show different portions of the lateritic profile. At Fanny Bay the mottled zone is exposed, and the pallid zone is well exemplified at Larrakeyah Quarry.

Fossils and age: The first fossils identified at Darwin were Radiolaria. Although Hinde (1893) listed some fifteen forms, most were new species and consequently unsuitable for dating. The belemnites which are abundant in the Darwin sections have not been closely studied, and consequently the dating of these sections as uppermost Albian or early Cenomanian is not based on palaeontological grounds. It has been considered for some time that the beds at Darwin are slightly higher stratigraphically than similar sediments at Point Charles and at Shoal Bay, near Darwin, which are of upper Albian age.

Point Charles (upper Albian)

Point Charles lies about 16 miles west-south-west along the northern coast from Darwin (see Fig. 7). At this place only unfossiliferous beds are visible above the waterline; they consist of 25 feet of mottled, leached, and silicified claystone similar to the shale outcropping at Fanny Bay, Darwin. The overlying 15 feet are post-Cretaceous silty sandstone which represents the ferruginized zone of a laterite profile.

Fossils and age: Fossils which were in the past collected at this classical locality have been derived from a submarine bed. They are ferruginized, free from matrix, and their preservation closely resembles that of some fossils occurring in a coastal cliff at Bathurst Island.

The original collections from this locality, which were made at the beginning of this century, were identified by Etheridge (1895), who assigned to them a Lower Cretaceous age. A composite list of Etheridge's determinations is as follows:

Nucula sejugata Etheridge Jnr, 1904
Aucella incurvus Etheridge Jnr, 1902
Avellana carolensis Etheridge Jnr, 1904
Ptychoceras(?) closteroides Etheridge Jnr, 1902
Scaphites cruciformis Etheridge Jnr, 1902
Histrichoceras(?) antipodeus Etheridge Jnr, 1902
Crioceras(?) sp.
Hamites(?) sp.
Ancyloceras(?) sp.
Belemnites sp.
Tubercle
Nodules and Coprolites

No closer dating was available until 1928, when Whitehouse re-examined the collections and concluded that the fauna was equivalent to the European *sub-studeri* Zone of the upper Albian, a zone above that of the Tambo Formation of the Great Artesian Basin of Australia. He supplemented and amended Etheridge's fossil list as follows:

Desmoceras s. str.
Beudanticeras
Spathiceras (a new genus proposed for *H. antipodeus*)
Hamites
Anisoceras
Labeceras

Appurdiceras
Scaphites
Tricoloceras (a new genus proposed for *P.(?) closteroides*)

No further work has been done on the Point Charles fauna.

Shoal Bay (Gunn Point) (upper Albian)

Shoal Bay is a large north-south bay about 20 miles north-north-east of Darwin (see Fig. 7). Its northern tip is Gunn Point. Six miles south of Gunn Point fossils were found at the beginning of this century. The section at this locality (locality TT15 on Fig. 3) consists of about 12 feet of fresh claystone or shale which crops out at the base of a 20-foot wave-cut cliff. The base of the section disappears beneath the beach sand, and the overall thickness is not known. The upper portion of the section is strongly lateritized, with a layer of pisolitic ironstone on top, and is probably considerably younger than the Cretaceous sediments at the base of the cliff.

Fossils and age: In 1907 Etheridge published a description of fossils found at this locality. These included:

Desmoceras carolensis Etheridge Jnr, 1902
Scaphites cruciformis Etheridge Jnr, 1902
Baculites williamsoni Etheridge Jnr, 1907
Crioceras sp.
Hamites(?) sp.
Ancyloceras(?) sp.

These fossils are pyritized, not ferruginized as at Point Charles, but the horizon is probably the same.

More material from the same locality was collected during the recent survey and awaits identification.

Bathurst Island (Aptian-Turonian)

Outcrops of Cretaceous strata on Bathurst Island occur only along the southern coast, where the Mullaman Beds crop out discontinuously in a wave-cut cliff which stretches from near the Mission Station in the east to Lubra Point in the west. In the north part of the island Cretaceous sediments are overlain by 40 to 100 feet of Tertiary and post-Tertiary plant-bearing non-marine sediments. The coastal section is readily divisible into two parts, the eastern and the western.

The eastern line of outcrops extends from the Mission Station to within 7 miles of Lubra Point. The rock here is predominantly fine-grained soft pale grey micaceous glauconitic sandstone containing beds of pale grey fossiliferous mudstone. The mudstone is well-bedded and contains fossils and flattened ferruginous concretions parallel to the bedding. Cross-bedding, lensing, and grading in the size of grains is commonly encountered in the sandstone layers, which contain marine macrofossils and in places carbonaceous matter.

In the western line of outcrops two main units are discernible. Sixty feet of glauconitic sandstone, fine-grained and very soft, forms the bottom of the visible section; it is richly micaceous, shows sulphur staining, and contains pyrite nodules surrounded by a halo of sulphur powder. It is overlain by 40 feet of interbedded sandstone and mudstone. Flattened concretions usually about 18 inches across characterize the lowest 10 feet of this unit. The mudstone is grey, and occurs in layers up to 9 inches thick; the sandstone is fine-grained, micaceous, with a high percentage of silty material (Daily, 1956, unpubl.).

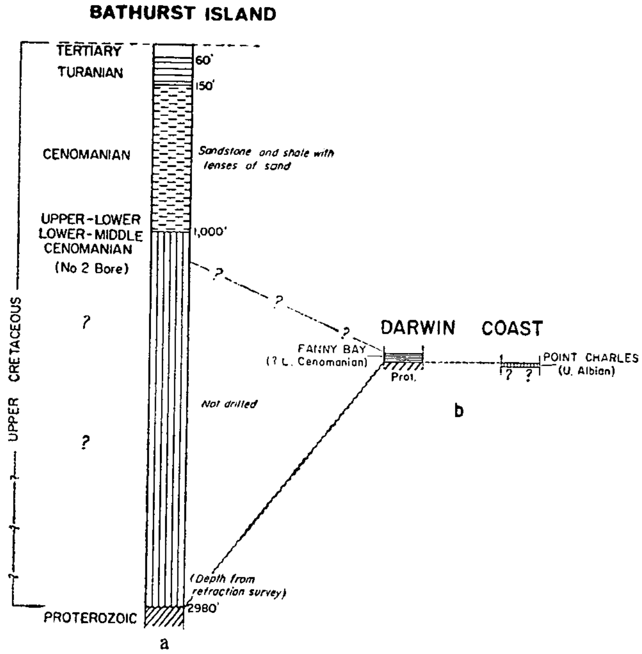


Fig. 8 Composite sections of lithological sequences and total thicknesses in the Mullaman Beds of the Darwin Area.

In 1960 and 1961 two bores were put down on Bathurst Island by Oil Development N.L., which penetrated over 1000 feet of Cenomanian sediments without reaching the base of the Cretaceous section (Fig. 9; Fig. 8,a). A refraction survey which followed drilling showed that the greatest thickness of strata above the basement, 2980 feet, was in the north-western part of the island and the least thickness was 1160 feet in the south-east. The basement rock is thought to be of Proterozoic age, and the presence of the previously suspected Permian sediments was not confirmed by the refraction survey. Probably the entire section above the basement is of Cretaceous age.

Fossils and age: Macrofossils from the southern coast of Bathurst Island were first collected in 1954 by Daily, and in 1960 and 1961 by members of Oil Development N.L. These two collections are lodged at the University of Adelaide. I have collected fossils from the same sections during a brief visit to the island in 1961, and this material is kept at the Bureau of Mineral Resources, Canberra. Daily lists field determinations in his report, and they include Acanthoceratids, *Baculites, Hamites, Scaphites, Beudanticeras,* Nautiloids, *Inoceramus, Mytilus, Dentalium,* and *Trigonia,* crustaceans, and echinoids, all of Cenomanian age.

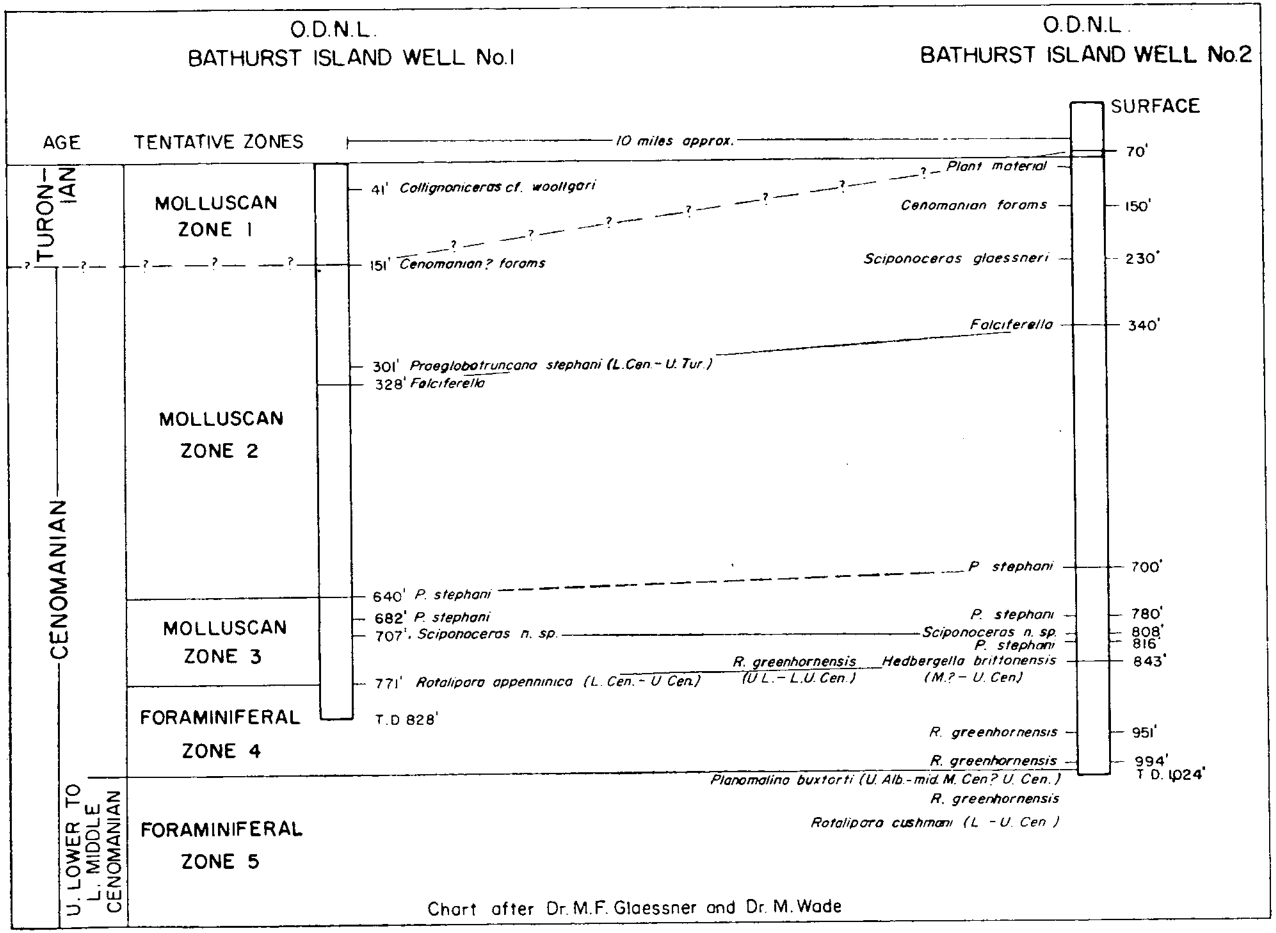


Fig. 9. Correlation chart of Bathurst Island Wells Nos. 1 and 2.

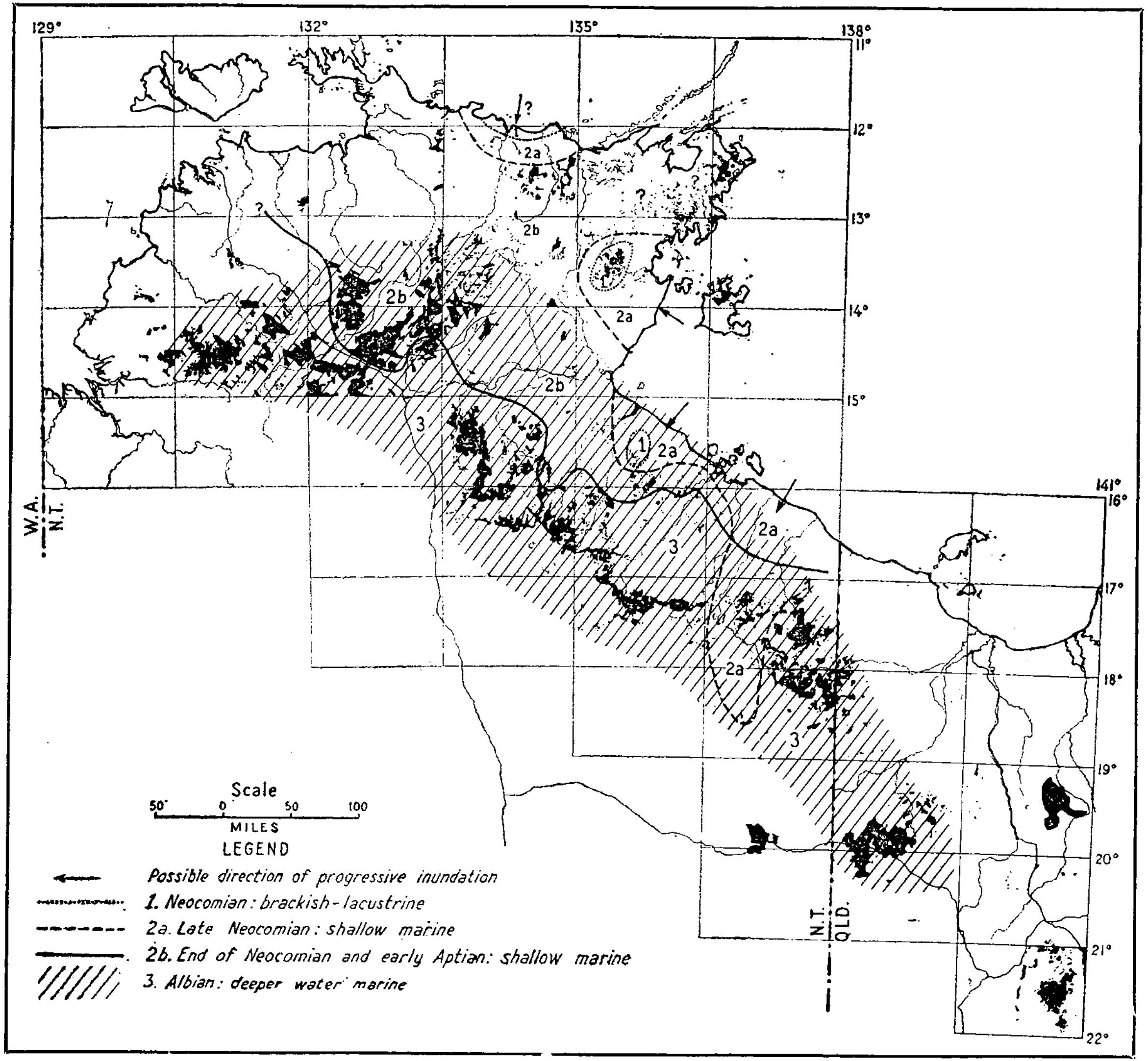


Fig. 10. Probable successive stages of marine Mullaman sedimentation.

In a Well Completion Report by R. Hare & Associates (1962, unpubl.) an appended correlation chart (Fig. 9 in this Bulletin) by Glaessner & Wade shows the subdivision of the Cenomanian-Turonian succession in Wells No. 1 and No. 2 on the basis of contained Foraminifera and Mollusca. Five zones are recognized, the oldest being of upper lower to lower middle Cenomanian in age. Daily, however, in his report mentions the presence of beds of Aptian age brought up by faulting the western part of the southern coastal cliffs.

Wright (1963) described Cenomanian ammonites from Bathurst and Melville Islands. He identified the following ammonites from Bathurst Island:

Albian: Hamites (*Hamites*) (?) sp.
Parengoceras attenuatum spinosum (Sommermeier, 1910)

Cenomanian:

i. From *in situ* in and near Tapara Bed, the following genera and species which seem to be typical of middle Cenomanian but whose stratigraphical position above the beach boulders places them well up in the upper Cenomanian:
Hamites (*Stomohamites*) *simplex* d'Orbigny, 1842
Sciponoceras glaessneri Wright, 1963
Hypoturrilites gravesianus (d'Orbigny, 1842)
Turrilites costatus Lamarck, 1801
Borissiakoceras(?) sp.
Acanthoceras tapara Wright, 1963
Acanthoceras mirialampiense Wright, 1963

ii. The beach boulder upper Cenomanian fauna included:
Sciponoceras sp.
Hypoturrilites gravesianus (d'Orbigny, 1842)
Scaphites dailyi Wright, 1963
Chimbuites mirindowensis Wright, 1963
Acanthoceras sp. cf. *A. quadratum* Crick, 1907
Euomphaloceras cunningtoni (Sharpe, 1855)
Euomphaloceras lonsdalei (Adkins, 1928)

Turonian: Collignoniceras sp. cf. *C. woollgari* (Mantell, 1822)

In 1963 I described *Nullamphiura felli*, an ophiuroid from the same Cenomanian cliffs that yielded Daily's fauna.

Melville Island (Cenomanian)

As on Bathurst Island, sediments of Cenomanian age crop out in cliffs on the southern coast of Melville Island, but their lateral extent is more limited, and they are almost confined to the Cape Gambier area: elsewhere on the island they are covered by a layer of post-Cretaceous sediments. Coastal sections show about 40 feet of strata, described in detail by Daily (1956). The total thickness of Mullaman sediments on this island is possibly over 1000 feet, as shown by the refraction survey. No drilling has been done here.

Fossils and age: Etheridge (1907a) described *Metacanthoplites rhotomagensis* Brongniart, 1841, and listed an *Inoceramus* from a section at Maclear Creek, Cape Gambier, which was collected by Brown. More recently Daily listed *Baculites*, Acanthoceratids, *Inoceramus*, and a crustacean from the same outcrop. The age of strata from which fossils have been collected is Cenomanian.

Even before Upper Jurassic time, the palaeogeography of the area around the western and south-western margin of the Gulf of Carpentaria, and for some distance inland, may have differed little from the geography of today.

On the other hand, the Neocomian-Albian sediments which occur in this area as scattered remnants of the once probably continuous sheet or sheets indicate that during the earlier half of the Cretaceous, the sea occupied a considerably larger area than it does today. Sedimentary structures in these beds, as well as their fossil content, both of which have been discussed above, point to the existence of a shallow epicontinental shelf from Neocomian to Aptian along the coast, and farther inland a belt or trough in which non-marine sediments were laid down in the ?Neocomian and Aptian. In Albian times the sea seems to have covered most of the northern part of the Northern Territory and a considerable portion of north-western Queensland. Only in post-Neocomian time were the seas covering the Great Artesian Basin and the Northern Region directly connected.

Fossils suggest that Cretaceous sedimentation began in the Neocomian. The two areas first to be inundated seem to be those along the coast on both sides of the present-day Roper River mouth. The northern coast of Arnhem Land (Fig. 10) may also have been inundated, but because of the dearth of fossils not very much is known about this region.

Gradual subsidence along the coastal plain gave rise initially to shallow sea, lagoons, or lakes for a short distance inland (Fig. 11, phase a), when quartz sandstone with plant remains accumulated. Absence of preserved endemic forms of life suggests brackish rather than freshwater environment. About this time or more probably a little later gentle downwarping or small-scale down-faulting may have initiated the formation of the Inland Belt. In this belt quartz sandstone with plant remains was deposited in a non-marine, possibly shallow-water, environment (Fig. 11, phase c).

Continued rise of the sea level rapidly flooded brackish lakes and lagoons along the coast (Fig. 11, phase b; Fig. 10, 2a). Plant fossils are preserved in these in close contact—or even intermingled—with marine shell remains. Plants are indeterminate, but shells are of Neocomian age. The typical fossils are the new subgenus *Zaletrigonia* and *Pterotrigonia.* Farther inland the somewhat different marine assemblages lack *Zaletrigonia,* and are probably a little younger, though still Neocomian, and occupy a distinct horizon topographically above the plant-bearing layers. Finally, towards the close of Neocomian times the sea overlapped from the lakes directly on to the old Proterozoic surface (Fig. 10, 2b).

Judging by present outcrop in the area a Cretaceous sea covered a large portion of the Northern Territory in the Neocomian. Figure 3 shows its probable extent. It seems to have covered most of Arnhem Land, a large portion of the Katherine-Darwin area, and a wide belt along the south-western periphery of the Gulf of Carpentaria. A single locality on the Mount Drummond Sheet area (Fig. 3, TT52) gives evidence of marine conditions in the Neocomian in that area, but plants present in neighbouring outcrops which are stratigraphically higher than TT52 indicate that the sea in that area probably withdrew before the end of Neocomian time.

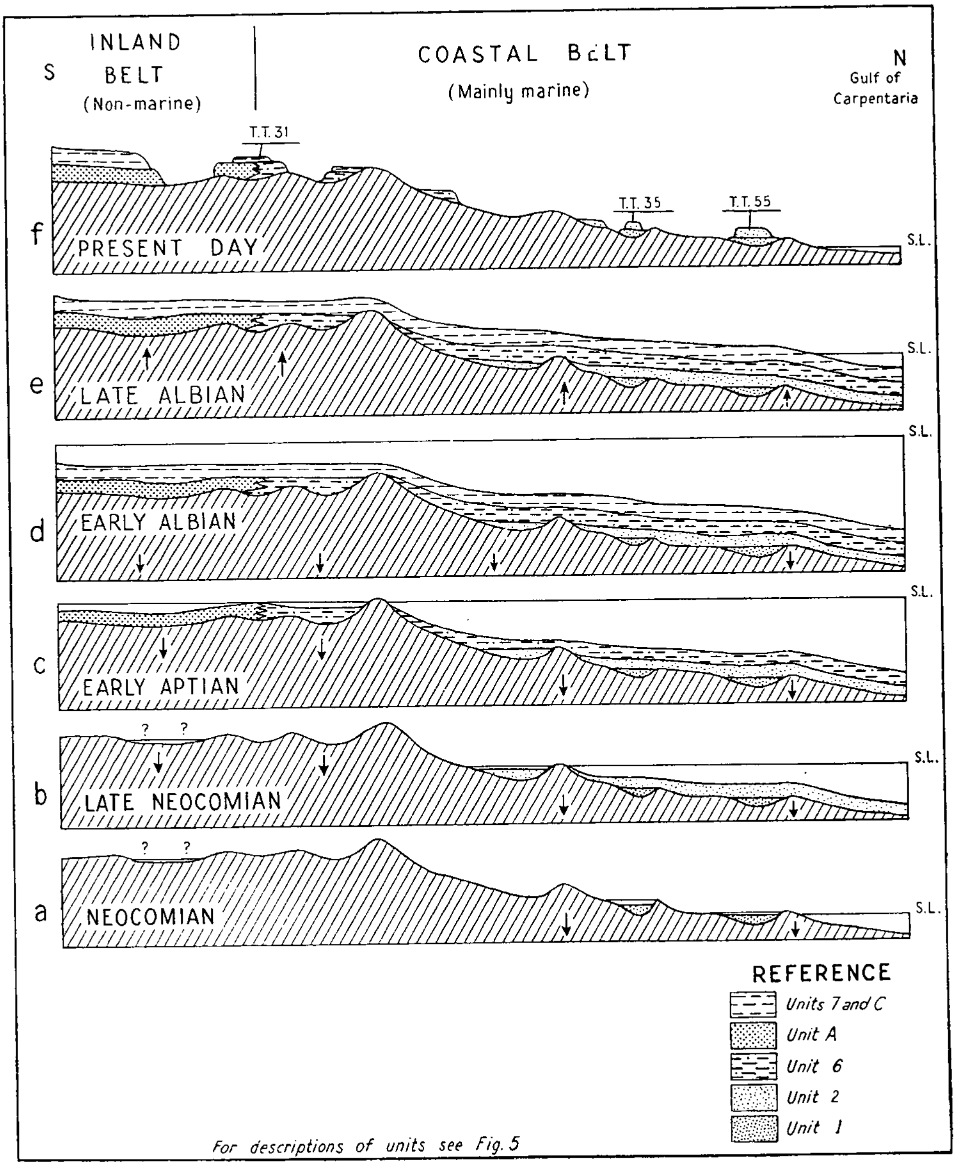


Fig. 11. Sedimentary history of Coastal and Inland Belts.

Little remains of sediments laid down in Aptian time, but the few outcrops which have been found (Fig. 3, TT20, 21, 22, ?28, 31, 33, ?47, ?48) give evidence that shallow-water marine conditions continued during at least the early Aptian. The areal extent of the sea in the Aptian is not known, but there is nothing to suggest that it covered an area smaller than in the Neocomian. On the other hand there is evidence that in at least one area, i.e. in the southern portion of the Mount Young Sheet area and the northern portion of Bauhinia Downs Sheet area, the sea continued to encroach on the land. Here the direction of the 'transgression' was north to south.

It is not known from which direction the middle portion of the Coastal Belt (i.e. the area which is included in the Roper River, Urapunga, Katherine, and Mount Evelyn Sheet areas) was flooded: whether from the north through Arnhem Land, or directly from the east. In this central region there is no evidence of the initial lacustrine Neocomian phase, and the oldest Neocomian sediments do not contain *Zaletrigonia*. It would seem that in this area the shallow-water marine environment did not become established until some time after areas to the north and to the south-east had been flooded by the sea (Fig. 10, 2b).

Only a small thickness of Cretaceous sediments accumulated during the Neocomian and Aptian; it consisted of sandstone, siltstone, claystone, and conglomerate. Sedimentary structures in sandstone, as well as the irregularity in grainsize, common admixture of pebbles and cobbles, and the presence of abundant molluscs as well as other forms of life, suggest a shelf, deltaic, or epicontinental environment with the source of sediment at no great distance. The rather abrupt passage from sandstone to claystone and siltstone observed in many sections may indicate change in the source of sediment: alternatively it may reflect a sudden change in the depth of the sea. Virtually no macrofossils have been found in the finer-grained sediments.

Islands of older rock projected above the surface of the sea, and rivers and streams coming down from these, as well as from surrounding areas of high relief, brought in the coarse detritus and plant remains which are found closely associated with the sediments containing marine fossils. There is no evidence of volcanic activity.

This shallow epicontinental environment was replaced by a deeper-water marine environment in Albian times, when a large part of the Northern Region (Fig. 10) became submerged. This sea was an extension of the Albian waters of the Great Artesian Basin. A layer of fine-grained sediments was deposited over the Coastal Belt and Inland Belt (Fig. 11, phase d), but most of this has since been removed from the Coastal Belt by weathering and erosion.

However, well before the onset of the widespread deeper-water conditions, possibly in the late Neocomian, but definitely in Aptian times, the crust sagged in an elongate belt extending south-eastwards from the central portion of the Pine Creek Sheet area in the Northern Territory to the Duchess Sheet area in north-western Queensland—a distance of about 900 miles. Perhaps significantly, the limits of this belt closely correspond to those of the Georgina, Barkly, and Daly River Basins. The sedimentary environment in this Inland Belt was nonmarine, as suggested by the complete lack of marine fossils and common occurrences of plant remains, and was brackish rather than freshwater. The Inland

Belt was thus occupied by a lake, or, more likely, a chain of lakes, before it was flooded by the Albian sea. The ubiquitous occurrence of cross-bedding and poor sorting of sediments may be indicative of shallow rather than deep water. Mainly quartz sandstone and some conglomerate were laid down initially, but these were followed apparently conformably by siltstone and some finer-grained sandstone.

Plant remains in the saccharoidal sandstone are only broadly indicative of Upper Mesozoic age, but lacustrine sedimentation there probably occupied the interval, or part of the interval, of time between the end of the Neocomian and the end of the Aptian. This is shown by Neocomian marine fossils already mentioned which underlie Unit A on the Mount Drummond Sheet area and the interfingering of the plant-bearing beds (Unit 5) on the Bauhinia Downs sheet area (e.g. TT31, Fig. 11f; Fig. 3) with marine Aptian beds of the Coastal Belt. In addition, some evidence in the Mount Evelyn Sheet area (Fig. 3; TT40) suggests that lacustrine sedimentation in that area may have begun even before Aptian time. That the lacustrine sedimentation in the Inland Belt ceased probably still in Aptian time is shown by the presence of the overlying fine-grained marine sediments of Unit 7, which are of Albian age and overlie the lacustrine sediments.

The Albian sea which flooded a large part of the Northern Region covered probably the whole of the Inland Belt of lacustrine sedimentation, and most if not all the Neocomian-Aptian beds of the Coastal Belt were probably also under the sea. The northern, north-western, and western limits of this sea are not well defined, as erosion which followed emergence has removed indications of the limits of the transgressions. The known distribution of Cretaceous beds suggests, however, that boundaries of the flooded area may have coincided, more or less, with those of the early Palaeozoic seas in this region.

Fine-grained sediments of Unit C, mostly claystone and some siltstone, were laid down, and both the microfossils and the rare macrofossils present in these beds suggest continuity with the inland sea of the Great Artesian Basin. In this paper Unit C includes the Polland Shale and is correlated with the Lower Wilgunya Formation of the Great Artesian Basin in north-western Queensland.

Sections at locality TT60, Calvert Hills Sheet area (Fig. 3), illustrate a marginal or near-shore lithological assemblage. Most fossils found there are marine, and are similar to those found at many places in the Great Artesian Basin of Queensland where Tambo (Albian) sediments crop out. These marine sediments abut from the east against the non-marine sandstone, showing that at least at this place progressive onlap of the sea had a westward direction. Since Albian beds are topographically lower than, or at the same elevation as, the lacustrine sandstone, the Inland Belt was uplifted, and non-marine sedimentation consequently ceased, before the Albian.

Near Darwin, coastal sections contain upper Albian fossils, which probably represent a higher horizon than the upper Albian faunas of the Great Artesian Basin (Whitehouse, 1928). Consideration of the regional picture in the Darwin Area reveals that the land there was flooded from the north-west, but the lateral extent of flooding seems to have been limited. It seems fairly certain that the north-westerly Albian flooding which proceeded from the Great Artesian Basin and the south-easterly transgression which proceeded from the Darwin

Area did not meet, and the two areas were always distinct. The final marine regression, which probably occurred still before the end of Albian time, exposed the accumulated sediments to weathering and erosion. It is not known with certainty whether the uplift which raised the Inland Belt sediments was a simple upheaval affecting the whole of the belt, or whether it involved complex differential movements at more than one time.

There is some evidence in favour of a complex upward movement or a series of upheavals. In the Fergusson River Sheet area, as well as in some other parts of the Northern Territory, outcrops of Cretaceous strata are found preserved at varying altitudes within short distances. Differences in elevation as large as 600 feet in 35 miles have been noted. This may be due to the relief in the surface which received Cretaceous sediments, or alternatively may be a result of post-Cretaceous block-faulting. In the Fergusson River Sheet area, the cover of Cretaceous strata, though strongly dissected by streams, is more continuous than in other parts of the region. Sections are thick and deeply weathered, and it seems that in comparison with the duration of the weathering cycle the dissection by headward migration of streams started fairly recently. It is conceivable that the sections were sheltered from the dissecting action of streams, possibly by their low altitude, for some time after their emergence, while still being exposed to the weathering process. This would imply at least two separate uplifts; the first would have brought the sediments slightly above sea level, exposing them to weathering, and the second elevated them to a higher level, thus exposing them to an accelerated erosion by steam-action.

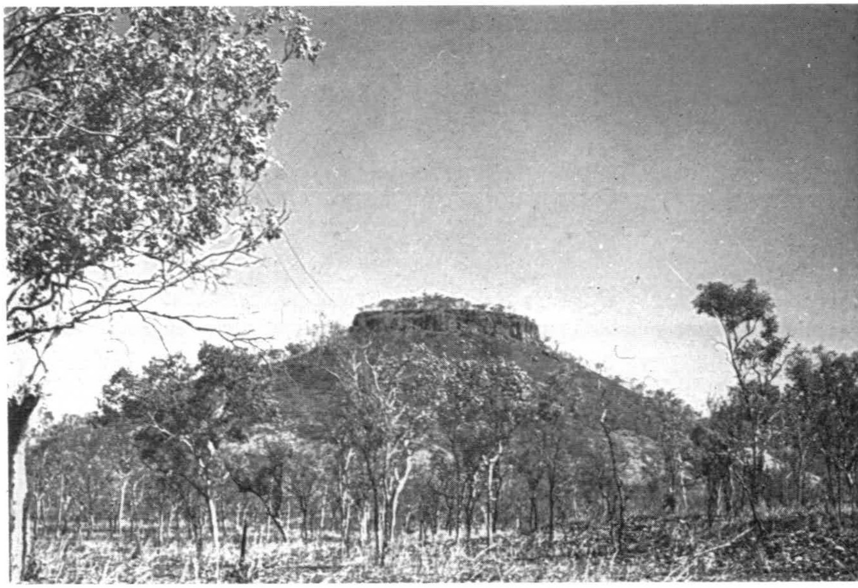


Fig. 12. A typical residual mesa of Cretaceous strata (Unit 2) in the Maranboy-Mainoru area, Northern Territory. Katherine 1:250,000 Sheet area.

Fig. 13. Badlands topography east of Thorntonia homestead, with Cretaceous and lateritic caps on mesas, north-western Queensland. Camooweal 1:250,000 Sheet area.

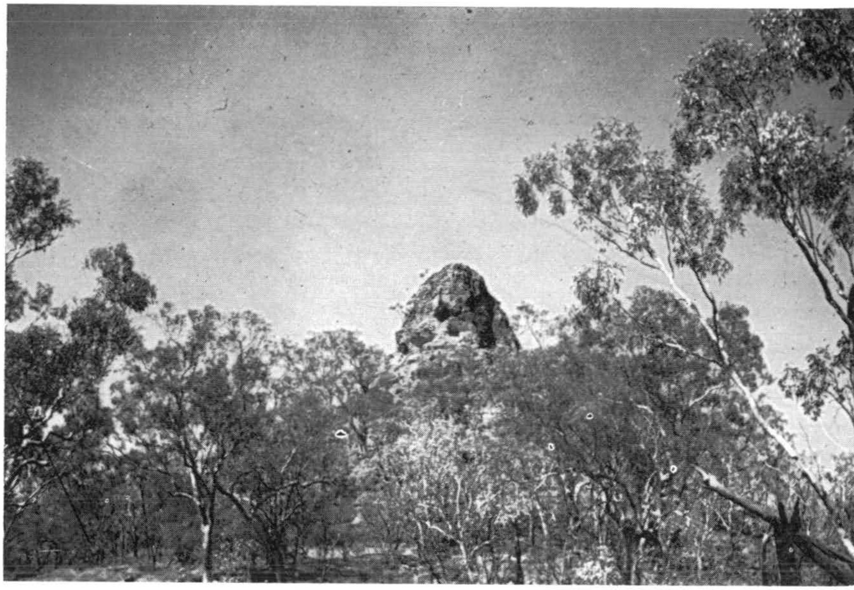


Fig. 14. Beasley Pillar, a residual outcrop of Unit C. About 12 miles west of Katherine; Katherine 1:250,000 Sheet area.

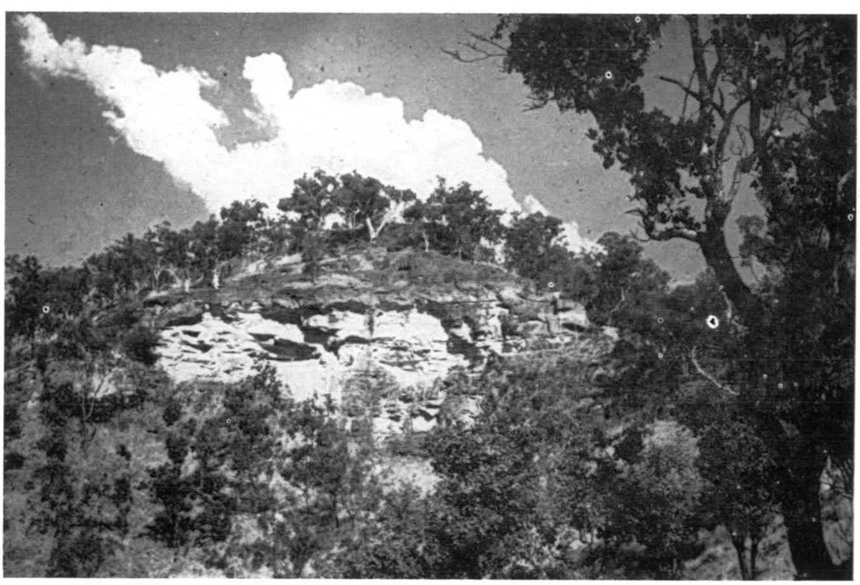


Fig. 15. A typical outcrop of Unit B. Fergusson River 1:250,000 Sheet area.

Fig. 16. Block separated from main outcrop by solution tubing in ferruginous zone developed on the Inland Belt sediments (probably Unit B). Approximately 6 miles south-west of Old Dorisvale homestead, Fergusson River 1:250,000 Sheet area.

Fig. 17. Impression after 'bamboo' type wood fragments from contact between Units 1 and 2. Note associated belemnite casts. Locality TT55, Mount Young 1:2250,000 Sheet area.

Fig. 18. Inclusion of saccharoidal sandstone (?Unit 2) with unusual structures, in red friable sandstone. Two miles east of TT56, Mount Young 1:250,000 Sheet area.

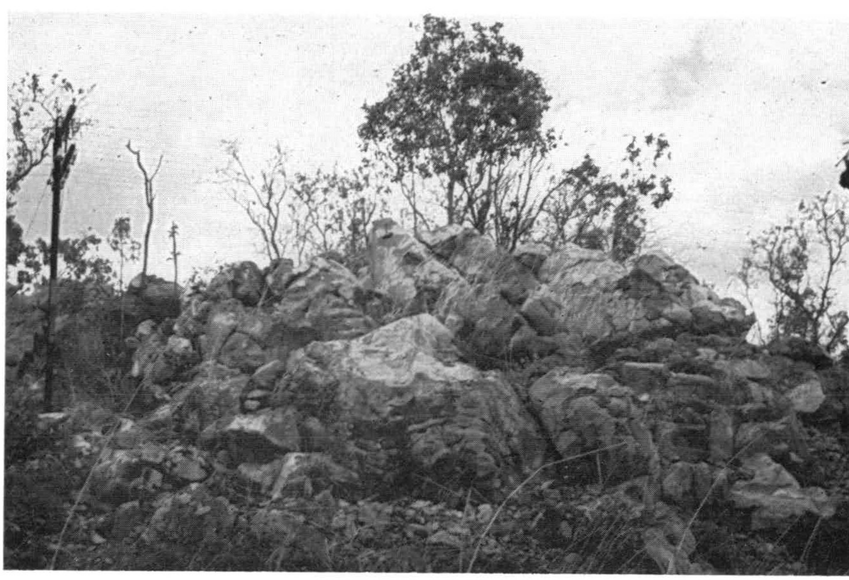


Fig. 19. Outcrop of non-marine saccharoidal sandstone. (Unit A) Katherine 1:250,000 Sheet area.

Fig. 20. Impressions after leached-out pelecypods, *P.* (*R.*) *capricornia* Skwarko, 1963, *Cyrenopsis* sp. nov. and *Venilicardia* (?) *parsonsia* sp. nov., in Unit 2. Locality TT65; Blue Mud Bay 1:250,000 Sheet area.

Fig. 21. Slate conglomerate in Unit 3. Locality TT47, Urapunga 1:250,000 Sheet area.

Figs. 22, 23. ***Rhizocorallium*** **sp. from the Rumbalara ochre mine. Finke 1:250,000 Sheet area, Southern Region.**

PART 2. MOLLUSCA OF THE COASTAL BELT

SUMMARY

THE marine Mollusca of the Coastal Belt Suite of sediments, which account for about three quarters of the total fauna of Mullaman Beds, were collected at forty-four localities, and are preserved as casts and moulds, the shell material having been leached out; they have consequently been studied through the medium of their latex reproductions. Fossils preserved in fine-grained sediments have been distorted by compaction of surrounding sediment. The following genera and species are described or discussed briefly:

Unit 2 (*late Neocomian*): *Lopatinia*(?) sp., *Grammatodon arnhemense* sp. nov., *G. psittaculum* sp. nov., *Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870), *M. mullamanensis* sp. nov., *M. neocomiana* sp. nov., *Maccoyella* sp., *Pseudavicula dickinsi* sp. nov., *Isognomon noakesi* sp. nov., *Syncyclonema territorianum* sp. nov., *Camptonectes dunni* sp. nov., *C. magnificus* sp. nov., *C.*(?)*mainoruensis* sp. nov., *C. youngensis* sp. nov., *Neithea* sp. cf. *N. occidentalis* (Conrad, 1855), *Lima hossfeldi* sp. nov., *L. missiona* sp. nov., *Plicatula townleyi* sp. nov., *Ostrea woolnoughi* sp. nov., *Ostrea* sp. A, *Ostrea* sp. B, Ostreidae gen. et sp., *Exogyra australiana* sp. nov., *E. travesi* sp. nov., *Mytilus* (?) sp., *Modiolus* (?) *browni* sp. nov., *M.*(?) *katherineus* sp. nov., *Brachidontes*(?) *voiseyi* sp. nov., *Trigonia*(?) *marumbiana* sp. nov., *T. vertistriata* Skwarko, 1963, *Trigonia*(?) sp. nov., Skwarko, 1963, *Iotrigonia* (*Z.*) *hoepeni* Skwarko, 1963, *Pterotrigonia* (*R.*) *capricornia* Skwarko, 1963, *Opisthotrigonia roperi* Skwarko, 1963, *Nototrigonia aberrata* Skwarko, 1963, *N. yeuralba* Skwarko, 1963, *N. crescenta* Skwarko, 1963, *N. nimbosa* sp. nov., *N. ponticula* Skwarko, 1963, *N.*(?) *walkeri* sp. nov., *Austrotrigonia prima* Skwarko, 1963, *Eriphyla bauhiniana* sp. nov., *Cyrenopsis* sp. nov., *Epicyprina aboriginea* sp. nov., *E. autraliana* sp. nov., *Cyprina lateralis* sp. nov., *Venilicardia*(?) *parsonsia* sp. nov., *Lucina* sp. aff. *Lucina* sp., Woods, 1907, *Paraesa antichthona* sp. nov., *P. neocomiana* sp. nov., *Panopea* sp. aff. *P. aramacensis* (Etheridge Jnr, 1892), *P. rosia* sp. nov., *P. yiyintyia* sp. nov., *Panopea* sp. nov., *Diodora*(?) *galea* sp. nov., *Cellana*(?) *carpentariana* sp. nov., *Pleurotomaria*(?) sp., *Cinulia* sp. cf. *C. hochstetteri* (Etheridge Snr, 1872), *Trachynerita*(?) sp., *Australiceras* sp. nov. aff. *A. jacki* (Etheridge Jnr, 1880), *Peratobelus bauhinianus* sp. nov., *Dimitobelus canhami* (Tate, 1879), *D. eremos* (Tate, 1889), *D. youngensis* sp. nov. Unit 2 is correlated with the Stanwell bed of eastern Queensland, the Nanutarra Formation of the north-western Carnarvon Basin, and possibly with the Jowlaenga Formation of the Dampier Peninsula, Western Australia and the bed with *Hatchericeras* in the Laura Basin, north Queensland. In broad terms Unit 2 can be correlated with late Neocomian in such overseas areas of Indo-Pacific Upper Mesozoic sedimentation as South Africa (Uintenhage), India (Kutch), South America (Patagonia) etc. The age of Unit 2 is regarded, however, as late rather than early Neocomian.

Unit 3: contains no identifiable Mollusca or any other fossils but is probably Neocomian in age since it rests conformably on Unit 2 and is overlain conformably by Unit 4, which is transitional in age between Neocomian and Aptian.

Unit 4: *Maccoyella transitoria* sp. nov., in addition to *E. travesi*, *P.*(*R.*) *capricornia* and (?)*T. vertistriata*, which are characteristic of the upper Neocomian Unit 2, and *Panopea* sp. cf. *P. sulcata* Etheridge Snr, 1872, and *Panopea* sp. cf. *P. maccoyi* (Moore, 1870), which are typical of Aptian or Albian sediments of the Great Artesian Basin. For this reason Unit 4 was dated as intermediate in age between Neocomian and Aptian.

Unit 5: *Fissilunula clarkei* (Moore, 1870) and *Nototrigonia* sp. ind. aff. *N. cinctuta* (Etheridge Jnr, 1902), both of which are known from the Aptian beds of the Great Artesian Basin and other parts of Australia. Unit 5 and Unit 6 are correlated with Melligo Quartzite of the Dampier Peninsula, W.A.

Unit 6: *Entolium* sp., *Eriphyla*(?) *bauhiniana* sp. nov., (?)*Fissilunula clarkei* (Moore, 1870), *Tatella* sp. cf. *T. aptiana* Whitehouse, 1925, (?) '*Macrocallista*' *plana* (Moore, 1870), (?)*Thracia primula* Hudleston, 1890, *Neritokrikus tuberosus* gen. et sp. nov., and *Peratobelus*(?) *bauhinianus* sp. nov.; also *Maccoyella* sp. cf. *M. corbiensis*. All the previously described forms are known from Aptian strata of the Great Artesian Basin.

Unit 7: *Aucellina hughendenensis* (Etheridge Snr, 1872), *Teredo* sp., and *Dimitobelus canhami* (Tate, 1879). Additional forms which, though present in this unit, are not discussed, are *Argiope* sp. aff. *A. punctata* Moore, 1870 and *Rhynchonella* sp. aff. *R. solitaria* Moore, 1870, other brachiopods, and two plants. The age of Unit 7 is Albian, probably lower Albian.

INTRODUCTION

CRETACEOUS fossils were collected at 68 localities (see below). Many of the field problems which were solved would remain puzzling, were it not for information on environment and dating obtained through the study of fossils.

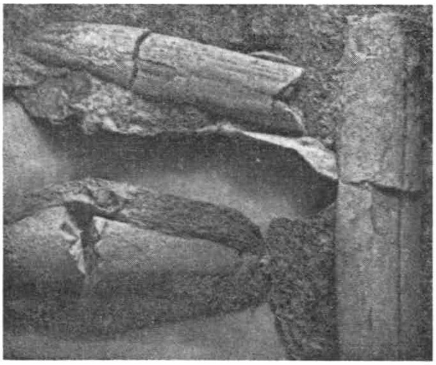
The molluscan fauna accounts for perhaps as much as 75 percent of the total fossil content of the Mullaman Beds. Of the remaining fossils many are plant remains from the Inland Belt, which have already been described from other parts of Australia in Jurassic sediments; in addition there are a few specimens of brachiopods, echinoids, bryozoans, and corals from the Coastal Belt itself, which will, it is hoped, be described in the near future; finally there is the prolific fauna from the Darwin area. Quite recently Wright (1963) described Cretaceous ammonites from Bathurst Island near Darwin. From this area there remain the pelecypods, gastropods, and belemnites from Bathurst Island and the neighbouring Melville Island, which were submitted for study to Dr L. R. Cox; in addition there are the two assemblages, one from Point Charles and the other from Gunn Point, on which some work has been done in the past but which are in need of revision. These, as well as the belemnites from sections at Darwin itself, will be described in the near future.

PRESERVATION OF FOSSILS AND TECHNIQUES OF STUDY

In northern Australia the flat-lying superficial layer of Cretaceous rocks has been exposed to weathering and leaching action for sufficiently long to enable the percolating solutions to dissolve and remove entirely the calcium carbonate from contained fossils. Only very occasionally has the calcium carbonate been replaced by silica, and in most cases only impressions after fossils remain. These consist of internal moulds which reflect the internal structure, and external casts which reflect the external appearance. This mode of preservation of fossils is by no means unique or confined to parts of Australia, and special preparatory methods which are a necessary prerequisite for their study have been evolved and successfully used in several parts of the world.

A latex solution was used in the preparation of the Northern Territory fossils. It is poured into the cast or around the mould, and on solidification is withdrawn, showing the shape and the detail in structure of the fossil before the removal of the shell material. A rubber made in this way gives a faithful reproduction of a fossil only as it appeared a certain time after its burial.

Fossils preserved in sandstone generally retain their original shape, but siltstone and clayey or silty sandstone of the Mullaman Beds Coastal Belt Suite were subjected to postdepositional compactional movement which distorted the included shells and other fossils. The examination of these distorted forms has brought up some interesting observations on the time and rate of compression of sediments. Text-figure 1 shows latex moulds of fractured belemnites; the presence of fragments in close juxtaposition and their small displacement suggest that, firstly, the belemnite was already enclosed in matrix when the fracture occurred, and, secondly, at the time of fracture the sediment was already in an advanced state of compaction. It will be observed, however, that the cross-sectional pattern of both broken ends is preserved; this implies that some movement of sediment around the fossil took place after the fracturing, and therefore the belemnite itself and not its mould was broken.



Text-fig. 1. Latex casts of fractured belemnite moulds x1. Locality TT1. CPC 4805.

Finally, the specimen on Text-figure 1 illustrates—as could be expected—that the removal of fossil material by leaching followed, and did not precede, the final compaction of the surrounding sediment; and yet other specimens show that at least in some cases there are exceptions to this order of events. A close study of pelecypod hinges in rubbers taken off from some moulds shows that in these the teeth and the sockets seem to have flowed into each other. This must have happened while the sediment was still in a plastic or subplastic state, i.e. before vertical movement finally stopped, but obviously after the shell material was removed. This would imply that compaction of sediment did not cease until well after the uplift. It is possible that the same percolating solutions which remove calcium carbonate are also responsible for continuation of movement due to compaction, which they help to maintain by progressive removal of finer rock particles.

Whereas the study of shells through their impressions in the surrounding rock is quite reliable and not inconvenient, the study of distorted shell impressions carries with it definite limitations: the distortion does not allow application of statistical methods, and in the description of the species only a few measurements are quoted with any degree of accuracy; because of the absence of the shell material only a single view of the shell is usually available in any one specimen, though careful searching may yield additional specimens which may show other aspects of the same species or of apparently the same species; in addition to being rather rare, pelecypod hinges may be rendered useless by the flowage of matrix along the hinge, and by the adpression of the umbo against the hinge; finally, the lack of original belemnite material does not allow study of alveolus and determination of position of the apical line. Because of these limiting factors, the genera and species described in the present paper constitute only a portion of the total molluscan fauna collected.

Lists of Fossils by Localities

The following are lists of macrofossils most of which were collected in the survey area between 1960 and 1962. They are listed in numerical order by their source localities, whose descriptions appear at the end of this Bulletin (pages 127-9). Lists from collecting sites outside the margins of the area are also included here for the sake of completeness and include sites in the Darwin Area as well as in the Inland Belt. The determinations of most of the plant remains are those of M. E. White; the naming of Mollusca is almost entirely my responsibility. Work by other palaeontologists is acknowledged individually. Most of the non-molluscan invertebrates such as corals, bryozoans, and brachiopods still await identification and description. The chart opposite shows the Unit and locality from which each described fossil comes.

TT1:	Ammonite indet. Belemnites (Dimitobelidae) indet.	upper Albian or lower Cenomanian
TT2:	Belemnites (Dimitobelidae) indet.	upper Albian or lower Cenomanian
TT3:	Plant remains indet.	Unit B (Aptian)
TT4:	Plant remains indet.	Unit B (Aptian)
TT5:	*Camptonectes magnificus* sp. nov. *Exogyra* sp. Brachiopods indet. Belemnites indet. Bryozoa(?)	Unit 2 (late Neocomian)
TT6:	*Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) *Syncyclonema territorianum* sp. nov. *Camptonectes magnificus* sp. nov. *Camptonectes(?) mainoruensis* sp. nov. *Camptonectes* spp. *Neithea* sp. cf. *N. occidentalis* (Conrad, 1855) *Lima hossfeldi* sp. nov. *Ostrea woolnoughi* sp. nov. *Ostrea* sp. indet. *Exogyra australiana* sp. nov. *Exogyra* sp. cf. *E. travesi* sp. nov. Pelecypods indet. Crinoid spines Brachiopods indet. Corals Belemnites indet. Barnacles	Unit 2 (late Neocomian)
TT7:	Bryozoa(?)	Unit 2 (late Neocomian)
TT8:	*Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) *Camptonectes magnificus* sp. nov. *Camptonectes(?)* sp. indet. *Pecten* sp. indet. *Plicatula* sp. *Exogyra* sp. cf. *E. australiana* sp. nov. Crinoid spines Belemnites indet. Brachiopods Corals Roots or worm borings indet.	Unit 2 (late Neocomian)
TT9:	*Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) Belemnites indet. Crinoid spines Roots indet.	Unit 2 (late Neocomian)
TT10:	*Pseudavicula dickinsi* sp. nov. *Syncyclonema territorianum* sp. nov. *Camptonectes magnificus* sp. nov. *Trigonia* sp. indet. *Eriphyla(?) bauhiniana* sp. nov. *Dosiniopsis(?)* sp. Pelecypods indet. Brachiopods indet. Belemnites indet.	Unit 2 (late Neocomian)

GENERA AND SPECIES	5	6	8	9	10	17	20	21	25	31	33	35	39	40	42	43	44	45	46	47	48	49	49a	52	53	55	56	57	60	64	65	66	67	68
PELECYPODA																																		
Lopatinia (?) sp.																		•													•			
Grammatodon arnhemense sp. nov.															•																			•
Grammatodon psittaculum sp. nov.												•																						
Maccoyella sp. cf. *M. corbiensis* (Moore, 1870)		•	•	•				•				•	•		•	•	•	•				•	•									•		
Maccoyella mullamanensis sp. nov.																		•																
Maccoyella neocomiana sp. nov.													•													•								
Maccoyella transitoria sp. nov.																											•	•				cf.	cf.	cf.
Maccoyella sp.																																		•
Maccoyella sp. indet.								•																										
Pseudavicula dickinsi sp. nov.					•							•										•				•								
Aucellina hughendenensis (Etheridge Snr, 1872)																													•					
Isognomon noakesi sp. nov.																														•				
Entolium sp.								•																										
Syncyclonema territorianum sp. nov.		•			•							•	•	•		•	•		•			•				•								
Camptonectes dunni sp. nov.																										•								
Camptonectes magnificus sp. nov.	•	•	•		•				•			•				•		•	?			•				•				•				
Camptonectes (?) mainoruensis sp. nov.		•											cf.					•																
Camptonectes youngensis sp. nov.												•																						
Neithea sp. cf. *N. occidentalis* (Conrad, 1855)		•																				•												
Lima hossfeldi sp. nov.		•														cf.										•								
Lima missiona sp. nov.																		•																
Lima sp. nov.																							•											
Plicatula townleyi sp. nov.																														•				
Ostrea woolnoughi sp. nov.		•																cf.																
Ostrea sp. A																														•				
Ostrea sp. B												•																						
Ostreidae gen. et sp.												•																						
Exogyra australiana sp. nov.		•	cf.						cf.			•				•		•														•		
Exogyra travesi sp. nov.		cf.																										•		•	•	•	•	
Mytilus (?) sp.																														•				
Modiolus (?) browni sp. nov.																														•				
Modiolus (?) katherineus sp. nov.												•											•											
Brachidontes (?) voiseyi sp. nov.																														•				
Trigonia (?) morumbiana sp. nov.																		•												•				
Trigonia vertistriata Skwarko, 1963												•															?							
Trigonia (?) sp. nov. Skwarko, 1963															•																			
Iotrigonia (Zaletrigonia) hoepeni Skwarko, 1963																								?		•					•			
Pterotrigonia (Rinetrigonia) capricornia Skwarko, 1963												•				•		•				•				•		•			•		•	•
Opisthotrigonia roperi Skwarko, 1963															•																			
Nototrigonia aberrata Skwarko, 1963												•																		•		•		
Nototrigonia yeuralba Skwarko, 1963																						•												
Nototrigonia sp. cf. *N. cinctuta* (Etheridge Jnr, 1902)								•		aff.																								
Nototrigonia crescenta Skwarko, 1963												•																						•
Nototrigonia nimbosa sp. nov.																																•		
Nototrigonia panticula Skwarko, 1963												•							•															
Nototrigonia (?) walkeri sp. nov.																															•			•
Austrotrigonia primo Skwarko, 1963																								•		•								
Eriphyla (?) bauhiniana sp. nov.					•			•				•					cf.						•									•		•
Cyrenopsis (?) sp. nov.																															•			
Fissilunula clarkei (Moore, 1870)								?		•																								
Epicyprina aboriginea sp. nov.												•																						
Epicyprina australiana sp. nov.												•																						
Cyprina lateralis sp. nov.												•																						
Venilicardia (?) parsonsia sp. nov.																															•			
Venilicardia sp. nov.												•																						
Tatella sp. aff. *T. (?) aptiana* Whitehouse, 1925								•															•											
Lucina sp. aff. *Lucina* sp. Woods, 1907												•																						
Paraesa antichthona sp. nov.																															•			
Paraesa neocomiana sp. nov.												•										•	•											
Panopea sp. aff. *P. aramacensis* (Etheridge Jnr, 1892)												•																						?
Panopea sp. cf. *P. maccoyi* (Moore, 1870)																												•						
Panopea rosia sp. nov.												•																						
Panopea sp. cf. *P. sulcata* (Etheridge Snr, 1872)																												•						
Panopea yiyintyia sp. nov.																										•								
(?) Thracia primula Hudleston, 1890							•																											
(?) Macrocallista plana (Moore, 1870)							•																											
Teredo (?) sp.																									•	•			•					
Genus indet. sp. nov.								•																										
GASTROPODA																																		
Cinulia sp. cf. *C. hochstetteri* (Moore, 1870)												•																						
Diodora (?) galea sp. nov.																										•								
Cellana (?) carpenteriana sp. nov.																										•								
Neritokrikus tuberosus sp. nov.							•				•									•	•													
Pleurotomaria (?) sp. A and B												•																						
Trachynerita (?) sp.												•																						
CEPHALOPODA																																		
Australiceras sp. nov. aff. *A. jacki* (Etheridge Jnr, 1880)						•																												
Peratobelus (?) bauhinianus sp. nov.							•	•										?																
Dimitobelus canhami (Tate, 1879)																													•					
Dimitobelus (?) youngensis sp. nov.																		?								•								

T11:	(?)*Ptilophyllum oligoneurum* Tenison Woods, 1883 (?)*Otozamites feistmanteli* Zigno, 1881	Unit A (?Neocomian, Aptian)
TT12:	Worm borings	Unit 2 (late Neocomian)
TT13:	Brachiopods indet. Worm borings indet. Root remains indet.	Unit 2 (late Neocomian)
TT14:	Ammonite frags. indet. Belemnite frags. indet.	Unit 2 (late Neocomian)
TT15:	Ammonites Gastropods Pelecypods Crustaceans	upper Albian
TT16:	Ammonite frag. indet. Belemnite frags. indet.	Unit 2 (late Neocomian)
TT17:	*Australiceras* sp. nov. aff. *A. jacki* (Etheridge Jnr, 1880) Ammonite frag. indet.	Unit 2 (late Neocomian)
TT18:	*Ptilophyllum pecten* (Phillips, 1829) *Ptilophyllum oligoneurum* Zigno, 1881 *Otozamites bengalensis* (Oldham & Morris, 1862) *Taeniopteris spatulata* McClelland, 1850 *Elatocladus* sp. Equisetalean stem indet.	Unit A (?Neocomian, Aptian)
TT19:	Wood frags. indet. Worm borings indet.	Unit 2 (late Neocomian)
TT20:	(?)'*Macrocallista*' *plana* (Moore, 1870) (?)*Thracia primula* Hudleston, 1890 Pelecypod frags. indet. *Neritokrikus tuberosus* gen. et sp. nov. *Peratobelus*(?) *bauhinianus* sp. nov. Wood fragments	Unit 6 (Aptian)
TT21:	*Nuculana*(?) sp. *Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) *Maccoyella* sp. indet. *Entolium* sp. *Nototrigonia* sp. cf. *N. cinctuta* (Etheridge Jnr, 1902) *Eriphyla*(?) *bauhiniana* sp. nov. (?)*Fissilunula clarkei* (Moore, 1870) *Tatella* sp. aff. *T. aptiana* Whitehouse, 1925 Genus indet. sp. nov. Pelecypods indet. *Peratobelus*(?) *bauhinianus* sp. nov.	Unit 6 (Aptian)
TT22:	Pelecypods(?) Belemnites indet.	Unit 6 (Aptian)
TT23:	*Pterophyllum fissum* (Feistmantel, 1879) *Elatocladus planus* (Feistmantel, 1879) *Brachyphyllum* stems	Unit A (?Neocomian, Aptian)
TT24:	*Otozamites bechei* Brongniart, 1828 *Elatocladus planus* (Feistmantel, 1879) *Brachyphyllum* type conifer frags. *Pagiophyllum* type conifer stems	Unit A (?Neocomian, Aptian)

TT25:	*Maccoyella* sp. *Camptonectes magnificus* sp. nov. *Camptonectes* sp. indet. *Exogyra* sp. cf. *E. australiana* sp. nov. *Nototrigonia* indet. Pelecypods indet. Belemnites indet. Brachiopods spp.	Unit 2 (late Neocomian)
TT26:	*Pterophyllum fissum* Feistmantel, 1879 *Elatocladus* sp. *Brachyphyllum* sp.	Unit B (Aptian)
TT27:	Plant remains indet.	Unit B (Aptian)
TT28:	*Eriphyla(?)* sp. Belemnites	?Unit 6 (?Aptian)
TT29:	Worm borings(?)	
TT31:	*Nototrigonia* sp. indet. aff. *N. cinctuta* (Etheridge Jnr, 1902) *Fissilunula clarkei* (Moore, 1870) Plant remains indet.	Unit 5 (Aptian)
TT32:	*Pterophyllum fissum* Feistmantel, 1879 *Otozamites bechei* Brongniart, 1828 *Otozamites bengalensis* (Oldham & Morris, 1862) Conifer foliage and stems: *Brachyphyllum* and *Pagiophyllum* type *Microphyllopteris gleichenioides* (Oldham & Morris, 1862) *Thinnfeldia pinnata* Walkom *Hausmannia* sp. Bennettitalean flowers and seeds Cone of *Arthrotaxites* type Petrified stem Silicified wood	Unit A (?Neocomian, Aptian)
TT33:	*Neritokrikus tuberosus* gen. et sp. nov. Worm tubes?	Unit 6 (Aptian)
TT34:	*Otozamites bechei* Brongniart, 1828 *Brachyphyllum* sp. *Microphyllopteris gleichenioides* (Oldham & Morris, 1862)	Unit A (?Neocomian, Aptian)
TT35:	*Grammatodon psittaculum* sp. nov. *Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) *Pseudavicula dickinsi* sp. nov. *Syncyclonema territorianum* sp. nov. *Camptonectes magnificus* sp. nov. *Camptonectes youngensis* sp. nov. (?)*Camptonectes* sp. Ostreidae gen. et sp. *Exogyra australiana* sp. nov. *Modiolus(?) katherineus* sp. nov. *Trigonia vertistriata* Skwarko, 1963 *Trigonia* sp. *Pterotrigonia (Rinetrigonia) capricornia* Skwarko, 1963 *Nototrigonia aberrata* Skwarko, 1963 *Nototrigonia crescenta* Skwarko, 1963 *Nototrigonia ponticula* Skwarko, 1963	

	Eriphyla(?) bauhiniana sp. nov. *Epicyprina aboriginea* sp. nov. *Epicyprina australiana* sp. nov. *Cyprina lateralis* sp. nov. *Cyprina* sp. indet. *Lucina* sp. aff. *Lucina* sp., Woods, 1907 *Paraesa neocomiana* sp. nov. *Panopea rosia* sp. nov. *Panopea* sp. aff. *P. aramacensis* (Etheridge Jnr, 1892) *Cinulia(?)* sp. *Pleurotomaria(?)* sp. *Trachynerita(?)* sp. Gastropod gen. et sp. indet. Belemnites indet. Ammonite frag.	Unit 2 (late Neocomian)
TT36:	*Pterophyllum fissum* Feistmantel, 1879 *Otozamites bechei* Brongniart, 1828 *Otozamites bengalensis* (Oldham & Morris, 1862) *Brachyphyllum* sp.	Unit A (?Neocomian, Aptian)
TT37:	Worm tubes(?)	?
TT38:	Worm tubes(?)	?
TT39:	*Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) *Maccoyella neocomiana* sp. nov. *Maccoyella* sp. *Camptonectes(?)* sp. cf. *C.(?) mainoruensis* sp. nov. *Ostrea* spp. Brachiopods	Unit 2 (late Neocomian)
TT40:	*Syncyclonema territorianum* sp. nov. Pelecypods indet. Plants indet.	?Unit 2 (late Neocomian)
TT42:	*Grammatodon arnhemense* sp. nov. *Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) *Maccoyella* sp. *Trigonia(?)* sp. nov. *Nototrigonia* sp. *Opisthotrigonia roperi* Skwarko, 1963 *Eriphyla(?)* sp. Pelecypods indet. Brachiopods Belemnites indet. Bryozoa	Unit 2 (late Neocomian)
TT43:	*Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) *Maccoyella* sp. *Syncyclonema territorianum* sp. nov. *Camptonectes magnificus* sp. nov. *Lima* sp. cf. *L. hossfeldi* sp. nov. *Exogyra australiana* sp. nov. *Pterotrigonia (Rinetrigonia) capricornia* Skwarko, 1963 Crinoid spines Belemnites Corals	Unit 2 (late Neocomian)
TT44:	*Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) *Eriphyla(?)* sp. cf. *E.(?) bauhiniana* sp. nov. *Dosiniopsis(?)* sp. Pelecypods indet.	Unit 2 (late Neocomian)

TT45: *Lopatinia(?)* sp. *Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) *Maccoyella* sp. cf. *M. mullamanensis* sp. nov. *Camptonectes magnificus* sp. nov. *Camptonectes(?) mainoruensis* sp. nov. *Lima missiona* sp. nov. *Ostrea* sp. cf. *O. woolnoughi* sp. nov. *Exogyra australiana* sp. nov. *Trigonia* sp. indet. *Trigonia(?) marumbiana* sp. nov. *Pterotrigonia (Rinetrigonia) capricornia* Skwarko, 1963 *Peratobelus(?) youngensis* sp. nov. Corals Belemnites indet.	Unit 2 (late Neocomian)
TT46: *Syncyclonema territorianum* sp. nov. (?)*Camptonectes magnificus* sp. nov. *Nototrigonia ponticula* Skwarko, 1963 Pelecypods indet. Belemnites indet. Bryozoa	Unit 2 (late Neocomian)
TT47: *Nototrigonia* sp. indet. *Neritokrikus tuberosus* gen. et sp. nov. *Rhizocorallium* sp. *Diplocriterium* sp.	?Unit 6 (Aptian)
TT48. *Neritokrikus tuberosus* gen. et sp. nov. Belemnites sp.	?Unit 6 (Aptian)
TT49: *Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) *Pseudavicula dickinsi* sp. nov. *Syncyclonema territorianum* sp. nov. *Camptonectes magnificus* sp. nov. *Neithea* sp. cf. *N. occidentalis* (Conrad, 1855) *Lima* sp. *Pterotrigonia (Rinetrigonia) capricornia* Skwarko, 1963 *Nototrigonia yeuralba* Skwarko, 1963 *Paraesa neocomiana* sp. nov. Crinoid spines Corals	Unit 2 (late Neocomian)
TT49a: *Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) *Buchia(?)* sp. *Lima* sp. nov. *Ostrea* spp. *Modiolus(?) katherineus* sp. nov. *Nototrigonia* sp. *Eriphyla(?) bauhiniana* sp. nov. *Tatella* sp. aff. *T. aptiana* Whitehouse, 1925 *Paraesa neocomiana* sp. nov. Pelecypods indet. Belemnites indet. Brachiopods Corals Gastropods	Unit 2 (late Neocomian)
TT50: *Nullamphiura felli* Skwarko, 1963; remaining fauna not identified	(Cenomanian)
TT51: Fauna not identified.	

TT52: *Austrotrigonia prima* Skwarko, 1963
(?)Iotrigonia (Zaletrigonia) hoepeni Skwarko, 1963
Trigonia sp. ind.
Lima sp.
Pelecypods indet.
Belemnites indet.
Wood fragments indet. — Unit 2 (late Neocomian)

TT53: *Teredo* sp.
Dimitobelus sp. cf. *D. eremus* (Tate, 1889)
Glyphaea sp. cf. *G. arborinsularis Etheridge Jnr,* 1917 — Unit 7 **(Albian)**

TT54: Plants indet. — Unit A (?Neocomian, Aptian)

TT55: *Maccoyella neocomiana* sp. nov.
Pseudavicula dickinsi sp. nov.
Syncyclonema sp. cf. *S. territorianum* sp. nov.
Camptonectes magnificus sp. nov.
Camptonectes dunni sp. nov.
Camptonectes sp. cf. *C. dunni* sp. nov.
Lima hossfeldi sp. nov.
Trigonia sp. indet.
Iotrigonia (Zaletrigonia) hoepeni Skwarko, 1963
Pterotrigonia (Rinetrigonia) capricornia Skwarko, 1963
Austrotrigonia prima Skwarko, 1963
Eriphyla(?) sp.
Panopea yiyintyia sp. nov.
Teredo sp.
Diodora(?) galea sp. nov.
Diodora(?) sp.
Cellana(?) carpentariana sp. nov.
Peratobelus(?) youngensis sp. nov.
Gastropods indet.
Brachiopods
Wood fragments — Unit 2 (late Neocomian)

TT56: *Maccoyella transitoria* sp. nov.
(?)Trigonia vertistriata Skwarko, 1963
Eriphyla(?) sp. indet.
Brachiopods — Unit 4 (Neocomian-Aptian)

TT57: *Maccoyella transitoria* sp. nov.
Exogyra travesi sp. nov.
Pterotrigonia (Rinetrigonia) capricornia Skwarko, 1963
Panopea sp. cf. *P. maccoyi* (Moore, 1870)
Panopea sp. cf. *P. sulcata* Etheridge Snr, 1872
Pelecypods indet. — Unit 4 (Neocomian-Aptian)

TT58: Belemnites indet. — ?

TT59: *Otozamites bechei* Brongniart, 1828
Microphyllopteris gleichenioides (Oldham & Morris, 1862)
Conifer foliage and twigs — Unit A (?Neocomian, Aptian)

TT60: *Aucellina hughendensis* (Etheridge Snr, 1872)
Teredo sp.
Argiope sp. aff. *A. punctata* Moore, 1870
Rhynchonella sp. aff. *R. solitaria* Moore, 1870
Dimitobelus canhami (Tate, 1879)
Cladophlebis australis (Morris, 1845)
Brachyphyllum stems.
Bryozoa — Unit 7 (Albian)

TT61:	Conifer fragments indet.	Unit A (?Neocomian, Aptian)
TT62:	Ammonite indet.	Unit 2 (late Neocomian)
TT63:	*Pterophyllum fissum* Feistmantel, 1879 *Ptilophyllum pecten* (Phillips, 1829) *Otozamites bechei* Brongniart, 1828 *Otozamites bengalensis* (Oldham & Morris, 1862) *Taeniopteris spatulata* McClelland, 1850 *Brachyphyllum* stems *Pagiophyllum* stems *Thinnfeldia pinnata* Walkom In addition Brunnschweiler identified *Cycadites* sp. nov. and *Elatocladus* sp. cf. *E. planus* (Feistmantel, 1879) from this locality.	Unit A (?Neocomian, Aptian)
TT64:	*Isognomon noakesi* sp. nov. *Camptonectes magnificus* sp. nov. *Plicatula townleyi* sp. nov. *Ostrea* sp. A *Exogyra travesi* sp. nov. *Mytilus(?)* sp. *Modiolus(?) browni* sp. nov. *Brachidontes(?) voiseyi* sp. nov. *Trigonia(?) marumbiana* sp. nov. *Nototrigonia aberrata* Skwarko, 1963 Brachiopods	Unit 2 (late Neocomian)
TT65:	*Lopatinia(?)* sp. *Exogyra travesi* sp. nov. *Iotrigonia (Zaletrigonia) hoepeni* Skwarko, 1963 *Pterotrigonia (Rinetrigonia) capricornia* Skwarko, 1963 *Nototrigonia(?) walkeri* sp. nov. *Cyrenopsis* sp. nov. *Paraesa antichthona* sp. nov.	Unit 2 (late Neocomian)
TT66:	*Maccoyella* sp. cf. *M. corbiensis* (Moore, 1870) *Maccoyella* sp. cf. *M. transitoria* sp. nov. *Ostrea* sp. *Exogyra australiana* sp. nov. *Exogyra travesi* sp. nov. *Nototrigonia aberrata* Skwarko, 1963 *Nototrigonia nimbosa* sp. nov. *Eriphyla(?) bauhiniana* sp. nov.	Unit 2 (late Neocomian)
TT67:	*Maccoyella* sp. cf. *M. transitoria* sp. nov. *Exogyra travesi* sp. nov. *Pterotrigonia (Rinetrigonia) capricornia* Skwarko, 1963 Pelecypods indet.	Unit 2 (late Neocomian)
TT68:	*Grammatodon arnhemense* sp. nov. *Maccoyella* sp. cf. *M. transitoria* sp. nov. *Pterotrigonia (Rinetrigonia) capricornia* Skwarko, 1963 *Nototrigonia crescenta* Skwarko, 1963 *Nototrigonia(?) walkeri* sp. nov. *Eriphyla(?) bauhiniana* sp. nov. (?)*Panopea* sp. cf. *P. aramacensis* (Etheridge Jnr, 1892) Pelecypods indet.	Unit 2 (late Neocomian)
TT69:	*Buchia(?)* sp. indet.	

THE AGES OF THE COASTAL BELT FOSSIL COLLECTIONS

The prolific marine macrofauna of the Coastal Belt is made up predominantly of species hitherto undescribed. Its application to dating would thus seem to be necessarily limited, particularly since the majority of species represented belong to class Pelecypoda, and few Cretaceous pelecypods have ever proved reliable correlating and dating media over large distances. For this reason it was thought expedient to look for an additional and independent medium as an aid to closer dating.

Consideration of stratigraphic sections (Fig. 5, p. 22) shows that the total stratigraphical column for the Coastal Belt was built up from a number of scattered outcrops whose bases invariably rest unconformably on much older strata, and whose tops are almost all erosional surfaces. Since the outcrops contain no persistent marker horizons, it becomes obvious that correlation from outcrop to outcrop is somewhat hazardous and not very reliable. Thus, neither fossils by themselves nor stratigraphy alone are likely to give us accurate ages.

During a single transgression, a sea invades land generally normal to the coastline, and littoral sediments laid down closest to the old shoreline will be the oldest: their age will be progressively younger farther inland. This argument was applied to Mullaman sediments with a hope of obtaining closer dating. The best area of study—partly because of the density of collecting sites—was regarded as one covered by the Bauhinia Downs and Mount Young 1:250,000 Sheets. A line traced south through localities TT55, 35, 57, 56, and 31 is oriented roughly at right angles to the coastline and in the past may have paralleled the direction of progressive marine overlap. If so, then TT55 should be the oldest and TT31 the youngest, while the ages of the intermediate localities should be intermediate between the two, becoming younger to the south. Topography of the old surface was expected to introduce complications to this assumption, yet on consideration of the individual faunal assemblages in the listed localities it is surprising how closely they adhere to the theoretical expectations.

Seventeen species of Pelecypoda and a belemnite were identified from locality TT51. All eighteen are new and none are represented at locality TT31.

The marine assemblage at TT31 is poorly represented, as it contains only two species, both pelecypods. One of these, however, *Fissilunula clarkei* (Moore, 1870), occurs in many parts of Australia and is invariably associated with sediments of Aptian age. The other is a poorly preserved trigoniid which has some affinities with *Nototrigonia cinctuta* (Etheridge Jnr, 1902). *N. cinctuta* occurs in Roma and Tambo (Aptian and Albian) sediments of the Great Artesian Basin. It would seem, therefore, that the age of the fauna at TT31 is probably Aptian.

Proceeding coastwards from TT31, at localities TT56 and TT57—whose relative positions and fossil content allow us to consider them together—we find two species of *Panopea*, one probably belonging to *P. sulcata* Etheridge Snr, 1872, and the other to *P. maccoyi* (Moore, 1870). Both of these are well known from the Roma and Tambo sediments of the Great Artesian Basin. The other three species identified from these two localities are new or relatively new: *Maccoyella transitoria, Exogyra travesi, Pterotrigonia (Rinetrigonia) capricornia,* and *Trigonia vertistriata*; and all apart from *M. transitoria* are found in the rich assemblage at locality TT35.

It is suggested here that the fauna at TT56 and TT57 is transitional between Aptian at TT31 and Neocomian at TT35.

Locality TT35 contains over twenty species out of which only one, *Maccoyella* sp. cf. *M. corbiensis,* may have been previously described. *M. corbiensis* is a well known fossil from Aptian beds—but unknown from Albian strata—of the Great Artesian Basin. On stratigraphical and indirectly palaeontological evidence, therefore, the age of TT35 is pre-Aptian, but probably not greatly older than Aptian. Similarly, the position of TT55 in relation to TT35 and its fauna would suggest that TT55 is somewhat older than TT35; but how much older it is not possible to say without palaeontological evidence. The age of TT35, therefore, is regarded as Neocomian, probably late Neocomian.

The fossil assemblage at TT20 yielded (?)*Thracia primula* Hudleston, 1890, an Aptian-Albian form from the Great Artesian Basin, while at TT21, the post-Neocomian element is seen in the presence of *Nototrigonia* sp. cf. *N. cinctuta* (Etheridge Jnr, 1902), *Tatella* sp. aff. *T. aptiana* Whitehouse, 1925, and (?)*Fissilunula clarkei* (Moore, 1870). These two localities are consequently regarded as probably Aptian in age. No Aptian element was, however, found in assemblages at the neighbouring localities TT22, 25, 28, and 39, most of which, however, are too poorly fossiliferous for close dating (*M.* sp. cf. *M. corbiensis* found at TT21 and TT39 and elsewhere is on the Coastal Belt associated with typically Neocomian assemblages, and its presence in any given assemblage cannot be taken as evidence of post-Neocomian age).

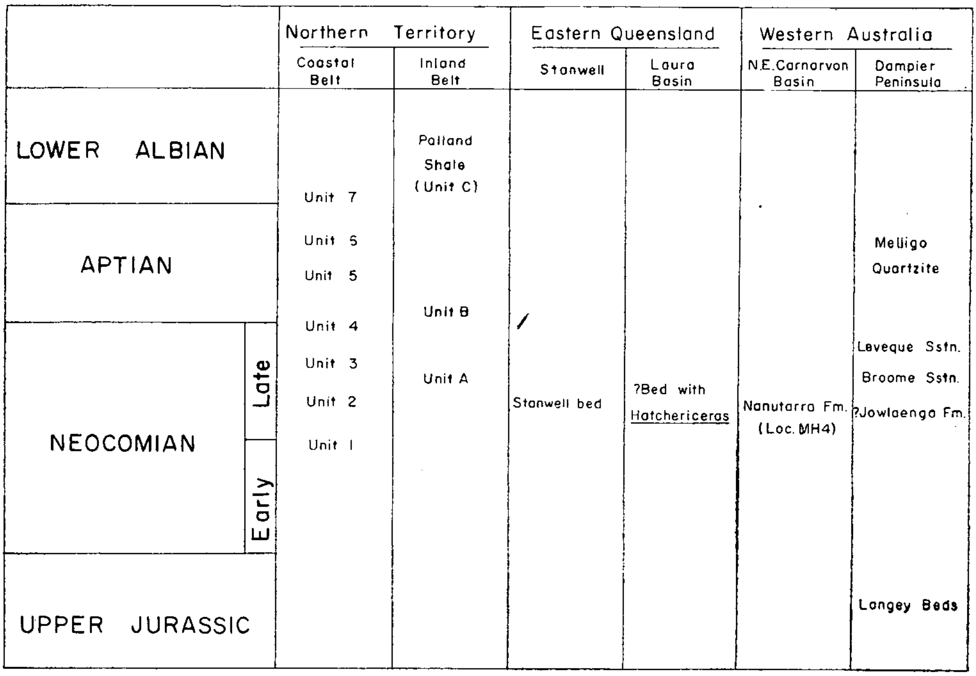


Fig. 24. Correlation chart of marginal areas of Lower Cretaceous sedimentation in Australia.

Overseas Correlation

From the stratigraphical—or more correctly, purely palaeogeographical—evidence, the lowest fossiliferous marine horizon of the Mullaman Beds is represented by the assemblage from locality TT55 (see pp. 63, 4 above). Comparison of fossil content from this locality with that from TT65, which occupies a similar position near the coast, suggests that both localities represent the same horizon. Their combined fossil list is as follows—

Lopatinia(?) sp.
Maccoyella neocomiana sp. nov.
Pseudavicula dickinsi sp. nov.
Syncyclonema sp. cf. *S. territorianum* sp. nov.
Camptonectes magnificus sp. nov.
Camptonectes dunni sp. nov.
Lima hossfeldi sp. nov.
Exogyra travesi sp. nov.
Trigonia sp. indet.
Iotrigonia (*Zaletrigonia*) *hoepeni* Skwarko, 1963
Pterotrigonia (*Rinetrigonia*) *capricornia* Skwarko, 1963
Nototrigonia(?) *walkeri* sp. nov.
Austrotrigonia prima Skwarko, 1963
Eriphyla(?) sp.
Teredo sp.
Cyrenopsis sp. nov.
Paraesa antichthona sp. nov.
Panopea yiyintyia sp. nov.
Diodora(?) *galea* sp. nov.
Cellana(?) *carpentariana* sp. nov.
Peratobelus(?) *youngensis* sp. nov.
Brachiopods
Wood fragments.

Probably the most significant elements in this fauna from the point of view of world-wide correlation are the Trigoniidae *Pterotrigonia* (*Rinetrigonia*) and *Iotrigonia*.

Overseas, the distribution of *Rinetrigonia* is as follows: in the Indo-Pacific Region it is found in the Neocomian of Natal, ' Middle Cretaceous ' of Zululand, Trichinopoly group of South India; in Japan it is confined to the ' Middle ' Cretaceous; in South America it occurs in Lower Cretaceous beds which are probably Neocomian in age (Nakano, 1960). Since only in India has *Rinetrigonia* been reported from Jurassic strata (Tithonian Oomia beds of Kutch) it must be concluded that this subgenus is primarily a Lower Cretaceous fossil, and it is not surprising that its two Australian occurrences, one in the Nanutarra Formation and the other at Stanwell (see below), have influenced the dating of these beds as Neocomian.

Iotrigonia is another Indo-Pacific trigoniid. Its world distribution is wide, as it has been identified from South Africa, North-west India, Chile, Peru, Australia, and New Zealand—in every case from Lower Cretaceous strata.

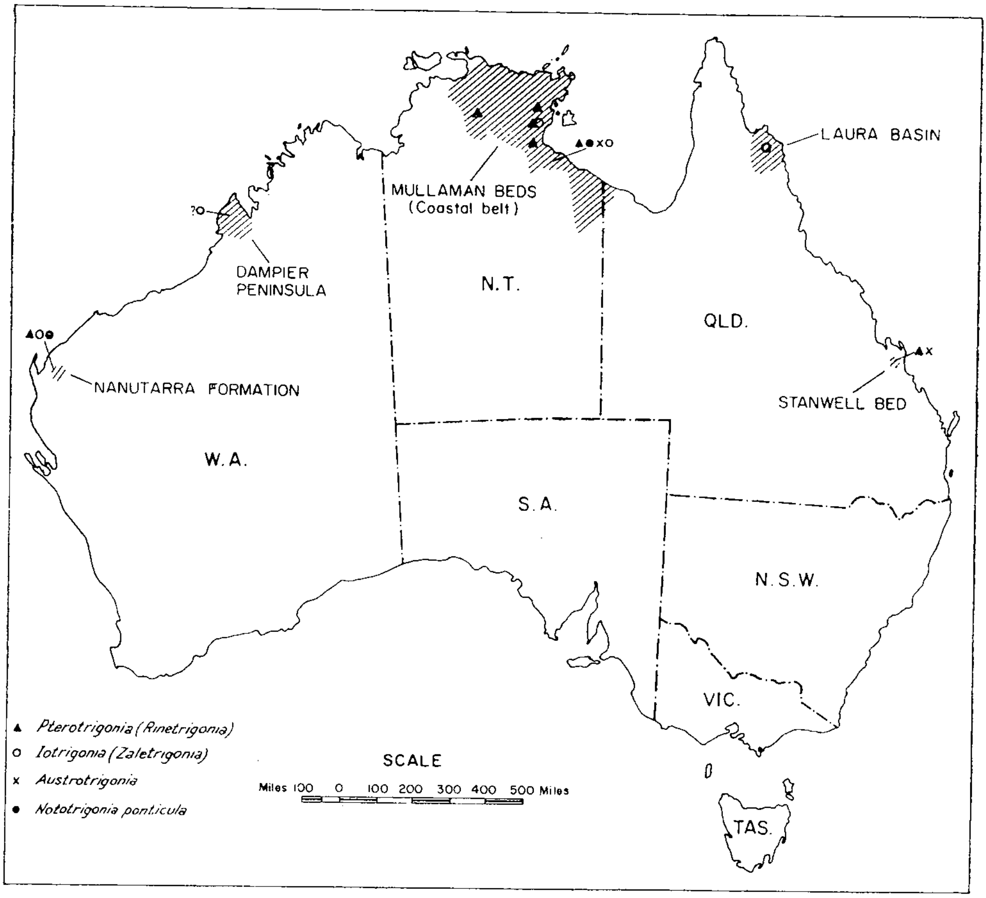


Fig. 25. Distribution of some key trigoniids in northern Australia.

Thus, the presence of *P.* (*R.*) *capricornia* and *I.* (*Z.*) *hoepeni* is strong evidence for the Lower Cretaceous age of Unit 2 of the Coastal Belt Suite.

Some of the other genera present, e.g. *Syncyclonema* and *Exogyra,* are confined to Jurassic and Cretaceous rocks, but the time ranges of *Camptonectes, Lima,* and *Panopea* are too long to be useful for dating in this case. On the other hand *Dosiniopsis* and *Eriphyla* do not occur in rocks older than Cretaceous, while *Lopatinia* has been hitherto reported only from Lower Cretaceous rocks of Russia and Upper Cretaceous of South America.

The age of the combined assemblage seems to be, therefore, definitely Cretaceous rather than Upper Jurassic, probably Lower Cretaceous. It is important to attempt closer dating, and this can be achieved by comparison partly with overseas assemblages and partly with other Australian assemblages.

The commonest, as well as the most abundant, shells at locality TT65 are those of *I.* (*Z.*) *hoepeni* and those of *P.* (*R.*) *capricornia.* Comparison of *P.* (*R.*) *capricornia* with *P.* (*R.*) *ventricosa* (Krauss, 1842) from the Oomia beds of Kutch and Uintenhage beds of South Africa (Skwarko, 1963a, p. 21, 22) shows that they are very closely related indeed. The age of the Oomia beds is Tithonian-Neocomian, but that of the Uintenhage beds Neocomian. Similar comparison of *P.* (*R.*) *capricornia* with a large new *Rinetrigonia* from the Neocomian bed near Stanwell (Skwarko, in press) shows that the relationship between these two forms is possibly even closer than between the Northern Territory form and the Indian species. Thus, the abundance of *Rinetrigonia* at TT65 suggests a Neocomian age for the collection.

I. (*Z.*) *hoepeni* has no close relative in the Oomia beds nor in the Neocomian Uintenhage beds of South Africa, but at both these Indo-Pacific sites species of *Iotrigonia* do occur. Only that portion of the Oomia section which is of Neocomian age has *Iotrigonia* present in it. It appears, therefore, that presence of *Iotrigonia* as well as the combination of *Iotrigonia* with *Rinetrigonia* in Unit 2 of the Coastal Belt Suite, gives evidence for the Neocomian age of this unit.

At locality TT55 *Rinetrigonia* is rare, but it is abundant at TT35, which on palaeogeographical evidence is regarded as a little younger than TT55. At TT55 the place of *Rinetrigonia* seems to be taken by another trigoniid, which was referred to as a new genus, *Austrotrigonia* (Skwarko, 1963a).

Correlation with the Nanutarra Formation

A rich assemblage of marine fossils collected from the Nanutarra Formation of the north-western Carnarvon Basin, Western Australia, was described by Cox in 1961. At the time of publication the age of this formation was in dispute, as in spite of strong evidence for the Lower Cretaceous age of the marine fossils, the fossil plants directly associated with them suggested Upper Jurassic age. Work on the Mullaman sediments of the Northern Territory, results of which are summarized in the present Bulletin, has shown that here, as well as in the Carnarvon Basin, recent discoveries compel an upward extension of time ranges of some Australian Mesozoic plants into the Lower Cretaceous, at least as far as Aptian.

Cox's list of pelecypods from the three localities in the Nanutarra Formation includes 38 determinations, out of which those singled out by him from the most prolific locality, MH4, as critical evidence for dating are:

Pterotrigonia australiensis Cox, 1961
Pacitrigonia(?) *nanutarraensis* Cox, 1961
Maccoyella sp. aff. *M. corbiensis* (Moore, 1870)
Maccoyella sp. aff. *M. barklyi* (Etheridge Jnr, 1892)
Maccoyella sp. cf. *M. moorei* (Etheridge Jnr, 1892)
Eriphyla playfordi Cox, 1961
Panopea glaessneri Cox, 1961

From locality YM17 (11 determinations) whose assemblage did not yield any of the forms listed above, Cox identified *Pseudavicula anomala* (Moore, 1870), a well known Aptian form which has a widespread distribution in Australian Lower Cretaceous sediments in the Great Artesian Basin. Two species of *Glycymeris, G. mckelleri* Cox, 1961, and *Glycymeris* sp., were also identified.

The third locality is located 4½ miles north-west from Pyramid Hill, which lies about 23 miles south-south-east from MH4 and YM17. Here only two fossils were identified, *Maccoyella* sp. aff. *M. corbiensis* (Moore, 1870) and *Maccoyella* sp. aff. *M. moorei* (Etheridge, 1892).

Pterotrigonia australiensis Cox, 1961, belongs to a subgenus *Rinetrigonia* van Hoepen, 1929, and its similarity with *P.* (*R.*) *capricornia* Skwarko, 1963, implies a possibility of correlation of the Nanutarra Formation with Unit 2 of the Coastal Belt Suite of the Mullaman Beds, Northern Territory.

Cox's doubts regarding his generic placing of *P.(?) nanutarraensis* are substantiated in the present paper (p. 98), where his only specimen is redescribed as a new species of a subgenus of *Iotrigonia.* This strengthens evidence for correlation of the MH4 assemblage with Unit 2: there is marked similarity between *Iotrigonia* (*Zaletrigonia*) *nanutarraensis* (Cox, 1961) and *I.* (*Z.*) *hoepeni* Skwarko, 1963. In addition this similarity strengthens evidence for the Lower Cretaceous age of MH4: the range of *Iotrigonia* is from Upper Jurassic to ' middle ' Cretaceous, but the subgenus *Zaletrigonia* is hitherto known only from Unit 2 of the Mullaman Beds, which is dated as late Neocomian.

The genera and species which are present in the MH4 assemblage support this correlation and dating: *Maccoyella* sp. aff. *M. corbiensis* of MH4 finds its equivalent in *Maccoyella* sp. cf. *M. corbiensis* in the Mullaman Beds; *Maccoyella* sp. aff. *M. barklyi* may correspond to the new species *M. transitoria,* while *Eriphyla playfordi* Cox, 1961 has similarities with *Eriphyla(?) bauhiniana* sp. nov. *Maccoyella* sp. cf. *M. moorei* finds no equivalent in the Mullaman Beds, which in addition have only small species of *Panopea* present.

The greatest difference in the faunal content between MH4 and Unit 2, however, is seen in the relative abundance of Nototrigoniinae in Unit 2. Nototrigoniinae seemed to have been absent from MH4. Only very little new material has become available from MH4 since Cox described the bulk collection, but it yielded incomplete specimens and fragments of shells which have the typical appearance of Nototrigoniinae (see p. 103 figs 8a, b).

It is suggested here that Unit 2 of the Coastal Belt and the collection from locality MH4 of the Nanutarra Formation represent a similar horizon and are of the same age, viz. late Neocomian.

Specimens referred by Cox to *Pseudavicula anomala* (Moore, 1870) do not belong to this genus and species (see p. 81); fossils at locality YM17 are, however, Cretaceous in age as shown by the presence of two species of *Glycymeris* —a genus which does not occur in pre-Cretaceous sediments. Of the remaining eight determinations from locality YM17 none correspond to any from the Mullaman Beds of the Northern Territory, and it must be inferred that the assemblage at YM17 may represent a horizon not obviously represented in the Lower Cretaceous sediments of the Northern Territory. The geographical proximity of YM17 and MH4, however, coupled with the considerable local variations in faunas which is characteristic of Neocomian assemblages in Australia, implies that the age of strata at locality YM17 may not differ greatly from that at MH4.

The two fossils collected at the third locality, which is near Pyramid Hill, probably represent the same horizon as at MH4.

Finally, the two species of *Maccoyella* from a locality north-west of Pyramid Hill were referred by Cox with a qualification to species which are known from Aptian strata of the Great Artesian Basin but which also occur at locality MH4. The age of this small collection could therefore be the same as that of MH4 or it could be younger, possibly Aptian.

Correlation with the Stanwell Assemblage

The first report of a molluscan fauna of Neocomian age from the Australian continent was in 1946, when Whitehouse described and discussed the following assemblage of fossils from the Stanwell area, eastern Queensland:

Iotrigonia limatula Whitehouse, 1946
Pisotrigonia sp.
Indotrigonia(?) sp.
Pseudomonotis sp.
Astarte(?) sp.
Panopea(?) sp.
Hibolites sp.

He dated these as probably Valanginian (lower Neocomian) on the basis of the presence of *Iotrigonia* and *Pisotrigonia*—two genera not found in Europe but characteristic of the Indo-Pacific faunas of the Uintenhage and Oomia beds. Determination of the only other Trigoniidae present as another Indo-Pacific genus, *Indotrigonia,* was not definite, but the presence of other contained species did not conflict with the faunal assemblages in Kutch and East Africa. In spite of the fact that at Kutch forms referred by Whitehouse to *Pisotrigonia* are not confined to the Neocomian but are also found in the underlying Tithonian portion of the section, it was argued that the age of the Stanwell fauna was Neocomian, probably Valanginian (lower Neocomian), on evidence from South Africa, Texas, and Patagonia.

The fossil list from Stanwell which is presented above is being revised, but changes which are being made do not affect its dating as Neocomian.

Pisotrigonia van Hoepen, 1929, is a synonym of *Pterotrigonia* van Hoepen, 1929. Whitehouse's specimens of *Pterotrigonia* were fragmentary and small, but more complete material was collected from apparently the same locality in 1962. This material is as yet undescribed, but its preliminary examination has underlined the close relationship of the *Pterotrigonia* from Stanwell to the Northern Territory Neocomian species *Pterotrigonia (Rinetrigonia) capricornia* Skwarko, 1963.

As was recently demonstrated (Skwarko, 1963a) specimens from Stanwell referred by Whitehouse to *Indotrigonia(?)* sp. do not belong to this genus, but are probably identical with *Austrotrigonia prima* Skwarko, 1963. Skwarko illustrated a moderately well preserved externo-internal cast of ' *(?)Austrotrigonia prima* ' Skwarko, 1963, from a collection made by members of Queensland University some time after Whitehouse described the original collection. Specimens collected in 1962 show more and finer detail. *(?)A. prima* is being redescribed in a separate paper as *A. secunda* (MS name).

Iotrigonia limatula Whitehouse, 1946, belongs to *Iotrigonia* s. str., which is characterized by strong V-shaped ribbing on the flank. No true iotrigoniids are known so far from the Mullaman Beds, which contain, however, a subgenus of *Iotrigonia (Zaletrigonia* Skwarko, 1963) in which the anterior set of oblique ribs are poorly developed and only the proximal-most of these form V-patterns with the strong posterior oblique ribs.

Whitehouse's '*Pseudomonotis* sp.' was regarded by Brunnschweiler (1960) as probably conspecific with *Meleagrinella* sp. cf. *M. superstes* (Spitz, 1914) from the Jowlaenga Formation (which he dated as Neocomian) of the Dampier Peninsula, Western Australia. No *Meleagrinella* has yet been found in the Mullaman Beds.

No new material of *Astarte(?)* sp., *Panopea(?)* sp., and *Hibolites* sp. of sufficiently good quality to enable their true identity to be determined has been collected.

Similarity of fossil assemblages at Stanwell and Unit 2 of the Coastal Belt Suite of the Mullaman Beds seems thus to be established, as both contain closely related pterotrigoniids and austrotrigoniids, and almost equally closely rated iotrigoniids.

At Uintenhage the critical molluscan assemblage rich in *Pterotrigonia* and *Iotrigonia* was dated as Valanginian on the basis of contained lower Neocomian ammonites. This led Whitehouse to suggest the probability that the Stanwell assemblage (which lacks ammonites) was also of Valanginian age. As known now, however, the two assemblages are somewhat less similar than they were originally thought to be. *Austrotrigonia,* which characterizes the Stanwell assemblage, finds no counterpart in the Uintenhage fauna. The two assemblages may not be exactly isochronous, as is further shown by comparison of the Stanwell and Uintenhage assemblages. On independent palaeogeographical evidence, however, the Unit 2 fauna is probably late and not early Neocomian in age. On this evidence it is suggested here that the Stanwell fauna is in fact most probably late Neocomian in age.

Correlation with the Laura Basin

Work on the geology of the Laura Basin, Queensland, is currently in progress and neither its fossils nor its strata are yet fully worked out. Woods (1963) in an unpublished report lists preliminary determinations of marine Lower Cretaceous Mollusca:

Hatchericeras lakefieldense Woods, 1962
Nuculana sp.
Iotrigonia sp. nov.
'*Trigonia*' spp.
Tatella(?) sp. nov. A.
'*Macrocallista*' sp. nov.
Modiolus sp.
Entolium aff. *argentinus* (Stanton, 1901)
'*Pseudomonotis*' spp.
Pleuromya(?) sp.

One of the specimens which were grouped by Woods under '*Trigonia*' spp. in the list above was recently illustrated (Skwarko, 1963) as *Iotrigonia* (*Zaletrigonia*) sp. cf. *I.* (*Z.*) *hoepeni*. The age of *I.* (*Z.*) *hoepeni* is late Neocomian.

One of the species included in '*Pseudomonotis*' spp. reputedly closely resembles Whitehouse's '*Pseudomonotis*' sp. from Stanwell.

Of the remaining species in the list only the ammonite is, at this stage, of importance in dating and correlation. Woods described it in 1962, emphasizing the fact that up till then the genus *Hatchericeras* was recorded only from strata in Patagonia which could be Hauterivian (lower Neocomian) in age. In the unpublished report of 1963, however, he writes: 'While the subfamily Neocomitinae, to which *Hatchericeras* belongs, is not known to range above the Lower

Hauterivian, the reference of the genus to that part of Neocomian is based solely on phylogenetic evidence, and it is not proposed to attempt any refinement of the age determination of the present fossiliferous horizon beyond Neocomian'.

It is suggested here that the Laura Basin bed with *Hatchericeras* may be correlated with Unit 2 of the Coastal Belt Suite of the Mullaman Beds on the basis of the presence of *I.* cf. (*Z.*) *hoepeni*, and possibly with the Stanwell bed on the basis of '*Pseudomonotis*' sp., and consequently it is suggested that its age is late rather than early Neocomian.

Younger Cretaceous assemblages of fossils from Laura Basin are too sketchily known to allow conclusions on correlation to be drawn from them.

Correlation with the Dampier Peninsula Suite

Brunnschweiler in 1960 described late Mesozoic fossils of the Dampier Peninsula, Western Australia, which consisted of the following assemblages:

Melligo Quartzite (Aptian)	*Fissilunula clarkei* (Moore, 1870) *Panopea rugosa* Moore, 1870 Gen. ind. cf. *Homomya* Agassiz, 1843 *Apiotrigonia* sp. nov. cf. *A. minor* var. *nankoi* Nakano, 1957 *Cyrenopsis opallites* Etheridge Jnr, 1902 *Cyrenopsis* sp. cf. *C. meeki* Etheridge Jnr, 1892 *Panopea* sp. cf. *P. maccoyi* Moore, 1870 Belemnites sp. indet. (possibly *Neohibolites*)
Leveque Sandstone (Neocomian)	*Inoceramus* sp. nov. a cf. *I. anglicus* Woods, 1911 *Inoceramus* sp. nov. b cf. *I. anglicus* Woods, 1911 *Inoceramus* sp. nov. c aff. *I. neocomiensis* d'Orbigny, 1845
Broome Sandstone (Neocomian)	a non-marine unit with plant remains
Jowlaenga Formation (early Neocomian)	*Hibolites* sp. cf. *H. subfusiformis* (Raspail, 1829) Ancyloceratoid genus indet. *Meleagrinella* sp. nov. aff. *M. curta* (Hall, 1880) *Meleagrinella* sp. cf. *M. superstes* (Spitz, 1914) *Apiotrigonia* sp. cf. *A. minor* (Yabe & Nagao, 1925) *Quenstedtia* sp. nov. aff. *Q. rodborensis* (Lycett, 1875)
Langey Beds (late Upper Jurassic)	*Belemnopsis* sp. cf. *B. aucklandica* (Hochstetter, 1863) *Belemnopsis* sp. cf. *B. alfurica* (Boehm, 1905) *Kossmatia* sp. cf. *K. tenuicostata* (Gray, 1830) *Kossmatia* sp. aff. *K. tenuicostata* (Gray, 1830) *Buchia malayomaorica* (Krumbeck, 1923) *Calpionella schneebergeri* Brunnschweiler, 1961, also *Nucula, Cucullea, Modiolus, Exogyra, Opis,* and *Astarte.*

The presence of the Upper Jurassic Langey Beds illustrates that in this part of Australia Mesozoic marine sedimentation began earlier than in other parts of the margin of the continent.

The Jowlaenga Formation, however, was probably laid down at about the same time as the Stanwell bed and Unit 2 of the Coastal Belt Suite: in the Jowlaenga Formation are present *Meleagrinella* sp. cf. *M. superstes* (Spitz, 1914), which also seems to occur at Stanwell (Brunnschweiler, 1960), and *Apiotrigonia* sp. cf. *A. minor* (Yabe & Nagao, 1925), which probably belongs to subgenus *Zaletrigonia,* which is well represented both in the Mullaman sediments and in the Laura Basin bed with *Hatchericeras.*

Three out of six plants which were identified down to specific level from the Broome Sandstone are also present in the Inland Belt Suite Unit A, which is regarded as ?Neocomian-Aptian in age, but comparison of the two lists (compare Brunnschweiler, 1960, p. 25, with p. 32 of this Bulletin) brings out an even closer relationship between the assemblages of the two areas. It is here proposed to correlate Broome Sandstone with Unit A of the Inland Belt of Mullaman Beds.

Leveque Sandstone with its *Inoceramus* fauna finds no equivalent in the known beds of Neocomian age elsewhere on the continent. Melligo Quartzite on the other hand contains a typical Aptian Great Artesian Basin fauna, which occurs extensively in eastern and southern Australia, and which is also represented in the Mullaman Beds of the Northern Territory in Units 5 and 6 of the Coastal Belt Suite.

SYSTEMATIC DESCRIPTIONS

PELECYPODA

The order of systematic classification for pelecypods which is followed in this Bulletin—purely for the sake of convenience of reference—is mainly that set out in *Osnovy Paleontologii* vol. 3 (Orlov, 1960). The classification of Gastropoda, on the other hand, is after the *Treatise on Invertebrate Paleontology,* vol. I (Moore, 1961).

Superfamily ARCACEA
Family CUCULLAEIDAE Stewart, 1930
Genus LOPATINIA Schmidt, 1872

Type species: Pectunculus petschorae Keyserling, 1846.

LOPATINIA(?) sp.
(Pl. 1, fig. 6; Text-fig. 2)

Material: A single internal impression of a left valve.

Description: The specimen is about 1.5 cm long and probably 1.2-1.5 cm high when complete with an umbo, which is not preserved. It is well inflated. The shell is produced very slightly anteriorly.

Text-fig. 2. Lateral view of an internal cast of *Lopatinia(?)* sp. CPC 4976. x2.

The posterior adductor scar is narrow and long, located directly under and along the posterior portion of hinge plate.

The hinge-plate is convex dorsally; it is very narrow in the central portion, slightly wider at its ends, and extends over almost half of the shell-margin. Dentition of the left valve includes four elongate lateral teeth on the anterior and four on the posterior distal portion of the plate. These are separated from each other by three slit-like sockets. Median teeth, if originally present, have not been preserved on this specimen.

Discussion: Neither the external aspect of the shell nor the nature of its dorsalmost portion is known, but the dentition as far as it can be observed, and musculature, are typical of the genus *Lopatinia,* to which our specimen is referred with qualification.

Lopatinia has been hitherto known only from the Lower Cretaceous of the Soviet Union and the United States of America.

Locality and age: Localities TT45 and TT65; Unit 2, late Neocomian.

Family PARALLELODONTIDAE Dall, 1898

Genus GRAMMOTODON Meek & Hayden, 1860

Type species: Grammatodon inornatum Meek & Hayden, 1860.

GRAMMATODON ARNHEMENSE sp. nov.

(Pl. 1, figs 5, 7, 8)

Material: Two almost complete external impressions of the right valve; fragmental external impression of the left valve. Single cast of the hinge of the right valve.

Holotype: Plate 2, figure 5 (CPC 4932). A relatively undistorted specimen which shows an external aspect of the shell.

Paratype: Plate 2, figure 6 (CPC 4931). Illustrates dentition of the right valve and supplements information provided by the holotype.

Diagnosis: The shell is sculptured with very thin closely spaced radial striae which are separated by relatively wide, flat interspaces. The hinge-plate is very narrow in the middle, gradually widens anteriorly and posteriorly, but is still narrow at its extremities. Median teeth are very short and are oriented vertically in the centre of the plate, but slope outwards away from the umbo; they number about 20. Lateral teeth number 7-8, are robust, and slightly oblique to the hinge-margin.

Differential diagnosis: The typical external ornament coupled with the rather unusual dentition characteristics distinguish *G. arnhemense* sp. nov. from previously described forms.

Description: The shell is trapeziform, about 4 cm long, 2½-3 cm high. The posterior umbonal carina is prominent.

External sculpture consists of fine, but prominent, closely spaced radial riblets which number 7-8 to a centimetre close to the ventral shell-margin. These striae are separated by relatively wide, flat-bottomed interspaces. Concentric growth-lines are very fine; growth rugae are prominent and deep.

The dental plate is very narrow in the middle, broadens only slightly to the front and back, and is still relatively narrow at its extremities. Dentition consists of relatively long oblique lateral teeth which number 3 or 4 at each end of the plate; they are inclined slightly to the hinge-margin. The middle third of the hinge-plate is occupied with very short and closely spaced median teeth which are vertical in the centre of the plate but incline increasingly from the vertical with the increasing distance from the umbo.

Occurrence and age: Localities TT42 and TT48; Unit 2, late Neocomian.

GRAMMATODON PSITTACULUM sp. nov.

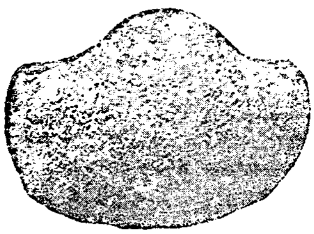
(Pl. 1, figs 1-4; Text-fig. 3)

Material: One internal cast of the right valve and three external impressions of the left valve.

Holotype: Plate 1, figure 1 (CPC 4743). The most complete specimen, showing external ornament.

Paratype: Plate 1, figures 2, 3 (CPC 4744). Shows the internal aspect of the shell.

Diagnosis: The small size of mature specimens, the semiequilateral shape of the shell, and the reticulate, nodular ornamentation are regarded as the diagnostic features of the species.



Text-fig. 3. Internal cast of a right valve of *Grammatodon psittaculum* sp. nov. CPC 4744. x3. Locality TT35. Late Neocomian.

Differential diagnosis: Of the recently described Australian Grammatodons, *Grammatodon* sp. A, Cox, 1961, from Neocomian beds of the Carnarvon Basin seems to resemble the new species most closely, but possesses a diagonal ridge on the surface of the shell which is absent in the new species. *Grammatodon* sp. B, Cox, 1961, has different ornamentation and is more strongly produced laterally; and *Grammatodon* sp. C is considerably more attenuated. No other previously described Australian or overseas species which are known to me compare closely with the new species.

Description: The shell is small, up to 1.5 cm long and 1 cm high, but very strongly inflated. It is elongate, trapezoidal, subequilateral, equivalve. The beak is prominent, strongly inflated, incurved, offset very slightly anteriorly; it overhangs the hinge-line. The hinge-line is straight, very narrow, slightly less than the length of the shell. The hinge-plate of the right valve has two pairs of deep and narrow lateral teeth which are oriented parallel to the plate margin. The central portion of the hinge, which usually is occupied by short transverse riblets, is obscured from view.

Ornamentation consists of numerous closely spaced, round-crested radial riblets crossed by concentric growth-lines which give rise to reticulate pattern with a small node on each corner of a square.

Occurrence and age: Locality TT35; Unit 2, late Neocomian.

Superfamily PTERIACEA

Family AVICULOPECTINIDAE Etheridge, 1906, em. Newell, 1938

Subfamily OXYTOMINAE Ichikawa, 1958

Genus MACCOYELLA Etheridge, 1892

Type species: Avicula barklyi Moore, 1870.

MACCOYELLA sp. cf. M. CORBIENSIS (Moore, 1870)

(Pl. 6, figs 1-11; Text-fig. 4)

For convenience of reference a synonymy list for *M. corbiensis* is given below.

1870 *Avicula corbiensis* Moore, *Quart. J. geol. Soc. Lond.,* 26, 254, pl. 11, fig. 7.

1872 *Crenatula(?) gibbosa* Etheridge Jnr, *Quart. J. geol. Soc. Lond.,* 28, 339, pl. 19, fig. 3.

1892 *Maccoyella corbiensis* Moore; Etheridge Jnr, *in* Jack & Etheridge, *The Geology and Palaeontology of Queensland and New Guinea,* 458, 459, 563, pl. 22, figs 8, 9.

1902 *Maccoyella corbiensis* Moore; Etheridge Jnr, *Mem. geol. Soc. N.S.W., Palaeont.,* 11, 21, pl. 1, figs 6-10.

1902 *Maccoyella corbiensis* Moore; Etheridge Jnr, *Mem. Roy. Soc. S. Aust.,* 2 (1), 13, pl. 1, figs 9, 10.

1907 *Maccoyella corbiensis* Moore; Etheridge Jnr, *Rec. Aust. Mus.,* 6 (5), 320, pl. 61, figs 1-6.

1961 *Maccoyella* aff. *corbiensis* Moore; Cox, *Bur. Min. Resour. Aust. Bull.* 61, 15, 16, pl. 1, figs 9-13.

Material: Four internal and twenty external impressions of the left valve; three left valves and one right valve. All specimens are variously incomplete.

Text-fig. 4. Latex mould showing hinge of *Maccoyella* sp. cf. *M. corbiensis* (Moore 1870). x3. CPC 4958 Locality TT35. Late Neocomian.

Description: The left valve is very convex, small to medium, ovate along the vertical axis, slightly inequilateral, larger than the right valve, and uniformly and strongly inflated. The umbo is not well marked off from the rest of the shell. It is slightly prosogyrous.
strongly curved over the hinge-line and is

The left anterior auricle seems to be obsolete. The left posterior auricle is well developed, of acutely triangular shape, smooth, moderately wide proximally, attenuated distally, convex in the vertical cross-section. Its dorsal edge is straight and long and inclined at right angles to the vertical shell axis. Its ventral margin is concave.

The dentition on the left valve is confined to a single triangular centrally situated dental process which is placed very slightly in front of the umbo. The anterior slope of the process is shorter than the posterior slope and dips into the valve; the posterior slope is directed dorsally, narrowing the hinge-line and then ventrally broadening it. A low shelf extends beneath and parallel to the dorsal shell-margin and is interrupted only at one place, just in front of the umbo.

Musculature of the left valve is somewhat obscure except for a conspicuous impression of the anterior adductor muscle scar.

Ornamentation of the shell consists of primary and secondary radiating costae. The primary ribs number from 9 to 13. They originate at the umbo and proceed as straight and simple costae towards the distal margin, the distance between any two ribs increasing gradually and evenly. They are relatively narrow throughout their length, but their cross-sectional shape alters with the slight widening from sharp to rounded. The interspaces are many times wider than the ribs and are only rarely striated with concentric growth-lines. The secondary ribs alternate with the primary ribs. They originate at varying distances from the umbo, usually at the upper ventral portion of the umbonal slope. They are identical with the primaries except for their smaller thickness and relief, and may be completely absent from some valves.

The right valve is straight or slightly convix. It is smaller than the left valve, and except for the strongly produced posterodorsal portion its outline is subcircular. Sculpture of this valve consists of very faint radial striae which radiate out from beneath the umbo and proceed in a rigid or slightly sinuous pattern distally. The striae are of two orders. The produced portion of the valve is unornamented by radial costae. The whole of the right valve is also striated by rather prominent growth-rugae which parallel the periphery of the valve.

Musculature on the right valve consists of a single semicircular posterior adductor scar which is situated in the posteroventral portion of the shell, and a pallial line which originates close to the middle of the hinge, where it is closely associated with a very shallow elongate anterior muscle impression, and proceeds ventrally in a curved line, meeting the adductor impression on its mid-anterior margin.

Dentition of the left valve consists of a subauricular notch with a closely associated anterior ear. The ligament area is not distinct. Ligament grooves were not observed.

Discussion: The Northern Territory specimens of *M. corbiensis,* which in this part of Australia are of Neocomian age, differ morphologically from some Great Artesian Basin Aptian forms.

The Northern Territory specimens are noticeably smaller and slightly more equilateral, and their hinge-plates seem to be less well developed; their ribbing is relatively widely spaced and their posterial auricles are longer and more attenuated. Finally, there are differences in the detail of hinge structure. Differences in size, however, are by themselves hardly sufficient to warrant specific distinction, while the small-scale morphological differences may or may not be entirely governed by the size factor. Work in progress on Queensland *Maccoyella* by Day has shown that specimens which in the past were referred to *M. corbiensis* represent in fact two species (R. W. Day, pers. comm.). Since at this juncture it is difficult to know the true status of *M. corbiensis* (Moore, 1870) the Northern Territory forms are referred to this species with a qualification. Specimens of *M. corbiensis* illustrated and described by Etheridge (1907) from Aptian sediments of central Queensland seem to be identical with the Northern Territory Neocomian forms.

Etheridge (1907) remarked upon close affinities of his specimens of *M. corbiensis* from central Queensland with *Oxytoma rockwoodensis* Etheridge Jnr, 1892. Similarity between this species and our specimens of *M. corbiensis* is also convincing and it is suggested that *O. rockwoodensis* is a synonym of *M. corbiensis.* The smaller number of costae in *O. rockwoodensis* is paralleled in those Northern Territory specimens in which the secondary ribs were late in developing or have failed to develop altogether—a feature which is not uncommon.

In 1921 Bonarelli & Nagera used Moore's type '*Avicula*' *corbiensis* as the type species of *Mimetostreon,* their new subgenus of *Gryphaea* which was to include 'grooved Gryphaeas'. It appears, however, that these authors misinterpreted the original description of *M. corbiensis,* translating 'striae' as grooves, not ridges. Some of the South American Albian forms which they recorded from Albian strata of San Martin, Santa Cruz, Argentina, as *A. corbiensis* are generally similar to Moore's type species, but seem to possess an inverse ornamentation pattern to that of *M. corbiensis,* and consequently cannot be included with that species.

Cox (1961) figured and described several specimens of '*Maccoyella* aff. *corbiensis*' from the Neocomian Nanutarra Formation of the north-east Carnarvon Basin, Western Australia. His smaller specimens closely resemble the Northern Territory specimens of *M. corbiensis* and the two forms are probably conspecific.

Occurrence and age: Localities TT6, 8, 9, 21, 35, 39, 42-45, 49, 49a, 66; Unit 2, late Neocomian. TT21; Unit 6, early Aptian.

MACCOYELLA MULLAMANENSIS sp. nov.

(Pl. 6, fig. 12; Text-fig. 5)

Material: Two internal impressions of the left valve, one poorly preserved impression of the outside of the left valve.

Holotype: Plate 6, figure 12 (CPC 4947). Shows the internal structure of the left valve.

Diagnosis: The shell is ornamented with a few and widely spaced simple radiating ribs. Dentition on the left valve consists of a median process situated below and a little in front of the umbo; this is followed and preceded by pronounced swelling of the hinge-plate.

Text-fig. 5. Latex mould showing hinge of *M. mullamanensis* sp. nov. x3. Holotype CPC 4947. Locality TT66. Late Neocomian.

Differential diagnosis: M. mullamanensis sp. nov. can be readily distinguished from *M. neocomiana* sp. nov. and *M. corbiensis* (Moore, 1870) through its more complex dentition and smaller number of radiating ribs.

Description: The shell is of small size for the genus, being about 30mm long, vertically ovate, with an inflated left valve and probably flat right valve. The outside of the left valve is ornamented with 5-7 simple radiating ribs of a single order.

A large but shallow adductor scar is present below and a little behind the umbo, but the pallial line has not been preserved in our specimens.

The hinge-plate is uneven and complex. It consists of a small median triangular process which is situated a little in front of and below the umbo, and two globular swellings, one anterior and near the tooth, another behind the umbo. The anterior swelling continues on to the dorsal margin of the shell and even extends on to the shell's exterior in a series of curved blade-like processes.

Occurrence and age: Locality TT45; Unit 2, late Neocomian.

MACCOYELLA NEOCOMIANA sp. nov.

(Pl. 6, figs 14-17)

Material: Two internal and two external impressions of the left valve; one external impression of the right valve.

Holotype: Plate 6, figure 15 (CPC 4751). The best preserved specimen, showing the external view of the left valve.

Paratype: Plate 6, figure 16 (CPC 4752). Specimen showing external aspect of the left valve.

Diagnosis: The shell is of small size for the genus, with length exceeding height. The left valve is weakly inflated and radially striated with widely spaced strongly diverging single-order barbed costae. The right valve is radially striated, with more numerous but finer radiating costae.

Differential diagnosis: The new species can be distinguished from *M. corbiensis* (Moore, 1870) by its greater length, its sparser and barbed costae, and the lesser inflation of the left valve. *M. transitoria* sp. nov. (see below) is a narrower shell and possesses barbed but numerous ribs belonging to two orders.

Description: The shell grows to 40 mm in length; it is inequivalve, apparently biconvex, with the convexity of the right valve less than that of the left valve, subequilateral, with length exceeding height. Its surface is striated with complex single-order costae.

The left valve is weakly inflated, rather long, but of unknown height, equilateral except for a posterior ear. The umbo is narrow, rapidly broadening distally, pointed, not incurved, centrally placed. Ribbing is limited to less than a dozen costae, which have small barb-like processes at more or less equal intervals. The hinge-plate on the left valve is narrow, but the detail of its dental processes is not known.

The right valve is slightly but evenly convex, circular in outline except for its posterodorsal margin, where a posterior ear complicates the periphery. The ear is small and has a straight dorsal edge and a sigmoidal anterior margin. There is a small umbonal process in the middle of the dorsal margin of the right valve, and a deep notch placed in front of and below the umbo.

Occurrence and age: Localities TT39 and TT55; Unit 2, late Neocomian.

MACCOYELLA TRANSITORIA sp. nov.

(Pl. 6, figs 18-22)

Material: Numerous specimens showing the external aspect of the left valve; two internal casts and two external moulds of the right valve.

Holotype: Plate 6, figure 21 (CPC 4748). Shows the exterior of the left valve.

Paratypes: Plate 6, figures 19 (CPC 4750) and 22 (CPC 4749). Illustrate the structure of the right valve and supplement the description of the species.

Diagnosis: A small shell vertically ovate, with a densely ribbed left valve and a less densely ribbed right valve. Ribbing on the left valve is of three orders. The first-order ribs have barbs.

Differential diagnosis: The closest known ally of *M. transitoria* sp. nov. is *M. barklyi* (Moore, 1870), from the Aptian Roma Formation of the Great Artesian Basin. The new species can be distinguished from it by: denser costation on the left valve and a sparser ribbing on the right valve; absence of prominent growth-rugae on the dorsal edge of the anterior auricle of the left valve; absence of a deep groove for the passage by byssus on the right valve; position of the adductor muscle scar on the right valve, which is located farther posterodorsally than in *M. barklyi;* smaller size.

Maccoyella moorei (Etheridge, 1892) can be readily distinguished from the new species by denser ribbing and greater convexity of the left valve.

Description: The shell is medium in size, subequilateral, inequivalve, plano-convex.

The left valve is moderately inflated, ribbed with radiating costae of two orders. Primary ribs originate at the umbo; they number about 20 and are more prominent than the secondary ribs, which originate well below the umbo and alternate with primary ribs. The internal structure of the left valve is not known.

The right valve is flat, with widely spaced radiating costae which may or may not belong to two orders; it is round but somewhat irregular in shape with greatest peripheral convexity in the antero-dorsal portion of the shell and anterior to the deep subumbonal notch. Musculature of the right valve seems limited to a relatively large circular adductor muscle scar which is situated a little to the left of the centre of the shell. A pallial sinus departs from the anteroventral margin of the muscle-scar and arches round in a semicircle towards the subumbonal notch.

Occurrence and age: Localities TT56 and TT57; Unit 4, Neocomian-Aptian. Also, with qualification, from TT66-68, Unit 2, late Neocomian.

MACCOYELLA sp.

(Pl. 6, fig. 13)

A single small external impression of a right valve of *Maccoyella* from locality TT68, Unit 2, (late Neocomian) is figured. This is the only specimen referable to this genus from that locality and the nature of the left valve is not known. The description and the naming of this probably new species is withheld until more material becomes available.

MACCOYELLA sp. indet.

(Pl. 6, fig. 23)

Material: One large incomplete external impression of the right valve.

Description: The shell is large, flat, ornamented with radial ribs of first and second order. The primary ribs are narrow and low, round in cross-section, with broad interspaces several times their width on both sides. Secondary ribs alternate with the primary ribs, and differ from them only in smaller thickness. Growth-lines are fine, sinuous, closely spaced. There are few growth-rugae, but they are shallow and prominent, forming conspicuous steps in the shell's surface with occasional offsetting of radial ribs.

Discussion: The size and the shape of the specimen, as well as its ornamentation, suggest a large *Maccoyella*. There are two species of large *Maccoyella* described from the Roma Formation of the Great Artesian Basin; *M. reflecta* (Moore, 1870), and *M. umbonalis* (Moore, 1870). In both of these the flat valves look rather alike, and it is very likely that the specimen presently described from the Northern Territory Aptian beds belongs to one of these two species.

Occurrence and age: Locality TT21, Unit 6, early Aptian.

Genus PSEUDAVICULA Etheridge Jnr, 1892

Type species: Lucina anomala Moore, 1870.

PSEUDAVICULA DICKINSI sp. nov.

(Pl. 5, figs 1-5)

Material: Numerous internal and several external impressions of both valves.

Holotype: Plate 5, figure 1 (CPC 4746). Specimen showing the proximal aspect of a right valve.

Paratype: Plate 5, figure 5 (CPC 4938). Latex mould of an internal impression of a right valve.

Diagnosis: The shell is a little less than average size for the genus, equivalve, vertically ovate; its umbones are raised, narrow, protruding, and strongly inflated and incurved. External sculpture is confined to fine radial striae and even finer growth striae.

Differential diagnosis: The only two other known species of *Pseudavicula* are also Australian forms. One of them, *P. anomala* (Moore, 1870), can be distinguished from the new species by its larger size, more rounded shape, and less inflated proximal portion of the shell. The other, *P. papyracea* Etheridge, 1907, can be distinguished by a less rounded umbo, lack of radial ornament, and an inequivalve nature of the shell.

Description: The shell is rather small for the genus, orbicular to vertically ovate in shape, asymmetrical, auricular, equivalve. The umbones are prominent, raised, well inflated, attenuated with rounded dorsal extremity, incurved, and hanging over the hinge-margin.

Convexity of the shell decreases very rapidly towards the anterior margin, less rapidly towards the posterior margin, and gradually towards the anteroventral and ventral margins. The periphery of the shell is convex except in the anterodorsal portion under the anterior umbonal slope, where it is slightly concave. This concavity is interrupted by a well developed anterior ear. The dorsal auricular margin is almost straight and slightly inclined towards the lateral shell axis. The posterior ear is very small and inconspicuous. External sculpture is confined to faint radial riblets which are closely but irregularly spaced and which seem to originate on the umbo.

Musculature of the left valve consists of at least one relatively large circular adductor muscle impression and a thin and discontinuous pallial line.

Dentition on the right valve is limited to a small and triangular centrally placed process.

Discussion: In the past, four 'species' were referred by different authors to the typically Australian genus *Pseudavicula* Etheridge, 1907. These were: *P. anomala* (Moore, 1870), *P. australis* (Moore, 1870), *P. alata* (Etheridge Snr, 1872) and *P. papyracea* Etheridge Jnr, 1907. Of these, *P. alata* was doubtfully placed with *Maccoyella barklyi* (Moore, 1870) by Etheridge (1902a), and *P. australis* was made a synonym of *P. anomala* by Whitehouse (1925).

Both *P. anomala* and *P. papyracea* are restricted in occurrence to the Aptian Roma Formation of the Great Artesian Basin (Dickins, 1960). The new species, *P. dickinsi,* is, on the other hand, so far known only from Neocomian beds of the Northern Territory.

The shell identified by Cox (1961) as *P. anomala* from the Nanutarra Formation (now regarded as late Neocomian age) of the Carnarvon Basin, Western Australia, belongs to a different genus and species.

Occurrence and age: Localities TT10, 35, 49, and 55; Unit 2, late Neocomian.

Subfamily AUCELLINAE Fisher, 1887, em. Ichikawa, 1958

Genus AUCELLINA Pompeckj, 1901

Type species: Aucellina gryphaeoides Sowerby, 1836.

AUCELLINA HUGHENDENENSIS (Etheridge Snr, 1872)

(Pl. 1, figs 9-12)

1872 *Avicula hughendenensis* Etheridge Snr, *Quart. J. geol. Soc. London,* 28, 346, pl. 25, fig. 3.

1884 *Avicula liversidgei* Etheridge Jnr, *J. Roy. Soc. N.S.W.,* 17, 90-92, pl. 2, figs 1-3.

1892 *Aucella hughendenensis* (Etheridge Snr); Etheridge Jnr, *in* Jack & Etheridge, *The Geology and Palaeontology of Queensland and New Guinea,* 460, pl. 25, figs 1-6.

1902 *Aucella hughendenensis* (Etheridge Snr); Etheridge Jnr, *Mem. geol. Surv. N.S.W., Palaeont.,* 11, 16, pl. 5, figs 6, 7.

1905 *Aucella hughendenensis* (Etheridge Snr); Etheridge Jnr, *S. Aust. parl. Pap.,* 71, pl. 1, figs 10-13.

1907 *Aucella hughendenensis* (Etheridge Snr); Etheridge Jnr, *Rec. Aust. Mus.,* 6 (5), 321, pl. 58, pl. 59, figs 7-12.

1911 *Aucella hughendenensis* (Etheridge Snr); Süssmilch, *Introduction to the Geology of New South Wales,* 12, fig. 6.

Material: Numerous external impressions of both valves; all material distorted or crushed.

Discussion: The well known Australian Lower Cretaceous pelecypod *A. hughendenensis* is an important fossil by virtue of its abundance in the Tambo (upper Albian) Formation of the Great Artesian Basin in Queensland, to which its occurrence has hitherto been confined.

These specimens are the first to be recorded from the Northern Territory, where they occur at a single known locality, TT60, in strata which are thought to have been deposited in a western extension of the Great Artesian Basin. Although all the material is crushed by compaction, the right valves because of their natural flatness are little distorted and unmistakably retain the shape of Etheridge's Queensland species.

Superfamily PINNACEA

Family BAKEVELLIDAE King, 1850

Subfamily ISOGNOMONINAE Dall, 1895

Genus ISOGNOMON Solander in Humphry, 1786

Type species: Ostrea isognomon Linn., 1758.

ISOGNOMON NOAKESI sp. nov.

(Pl. 1, figs 18,19)

Material: Three internal impressions of the right valve and two external impressions of the left valve.

Holotype: Plate 1, figure 18 (CPC 4997). The best preserved specimen, which shows detail of the inside of the right valve.

Paratype: Plate 1, figure 19 (CPC 4998). Specimen showing external appearance of the left valve.

Diagnosis: The diagnostic features of *I. noakesi* are a combination of broad, robust grooves and interspaces on the hinge-plate with strongly concave antero-dorsal margin and relatively large inflation. The ornamentation of the new species is also characteristic.

Differential diagnosis: I. orientalis (Hamlin, 1884) from the Aptian strata of Lebanon is a much thicker shell, and less inflated; in addition it is not as high as *I. noakesi* and the interspaces on its hinge-plate are flat, not concave as in the new species.

Description: The shell is 4 cm long and at least 8 cm high. The dorsal hinge-margin is convex or straight; anterior shell margin is markedly invaginated in its dorsal portion; the main body axis is at right angles to the hinge-plate. The umbo is acute, pointed.

External shell sculpture is limited to successively overlapping growth-plates. On specimens at my disposal these plates are well preserved on the distal portions of each valve only. None are visible on the umbonal portion and the proximal portion of the shell, though they may have been abraded off.

The ventral margin of the hinge-plate is oriented at right angles to the main body axis, but its margin is not straight but undulating, because of the overlap of hinge-plate interspaces. The plate itself is not excessively high. It has five grooves and six interspaces, both rather broad, and the interspaces particularly are striated and concave-bottomed. Interspaces measure 4 mm by 14 mm; they are concave-bottomed, finely striated, with well defined margins. Grooves are only slightly narrower than the interspaces.

The muscle scar is circular and deep, but not very large, its greatest width being 11 mm.

Occurrence and age: Locality TT64, Unit 2, late Neocomian.

Superfamily PECTINACEA

Family PECTINIDAE Lamarck, 1801

Subfamily ENTOLIINAE Korobkov, 1960

Genus ENTOLIUM Meek, 1864

Type species: Pecten demissus Phillips, 1829.

ENTOLIUM sp.

(Pl. 1, figs 13-17)

Material: A single incomplete external impression of a valve.

Description: The specimen when complete is probably about 3 cm long and 3½ cm. high. The ventral portion of the valve is probably evenly circular, but its anterodorsal and posterodorsal portions are straight or slightly concave. Sides of the umbo form a 90° angle at the dorsal shell margin. Sculpture of the valve is confined to evenly concentric growth-lines, which are spaced closely together but are of uneven strength.

Auricles are large and triangular; their dorsal margins probably form a straight line, their free lateral margins meet the dorsal margin at a slightly obtuse angle. Four grooves, two on each side of the umbo, join the dorsal with the inner auricular margins, being parallel to the lateral free margins.

Occurrence and age: Locality TT21, Unit 6, Aptian.

Genus SYNCYCLONEMA Meek, 1864

Type species: Pecten rigidus Hall & Meek.

SYNCYCLONEMA TERRITORIANUM sp. nov.

(Pl. 1, figs 13-17)

Material: Two external impressions of the left valve and one of the right valve; numerous impressions showing internal aspect of both right and left valves.

Holotype: Plate 1, figure 14 (CPC 4754). An incomplete impression of the exterior of the right valve.

Paratypes: Plate 1, figure 3 (CPC 4753), and Plate 1, figure 7 (CPC 4755). These two specimens supplement the description of the species.

Diagnosis: The diagnostic features of the species are the regularly ovate shape, pointed and subequal auricles, and shell surface devoid of lineation other than very fine growth-lines.

Differential diagnosis: The only *Syncyclonema* hitherto recorded in Australia, *S.(?) sociale* Etheridge Jnr, 1902, can be readily distinguished from the new species by the crenulated interior edge of the shell. Many species of *Syncyclonema* have been described from different parts of the world, but the combination of the diagnostic features of the new species distinguishes it from them.

Description: The shell is up to 25 mm long and 35 mm high, equilateral, nearly equivalve, vertically ovate, suborbicular and compressed. The right valve has a narrowing and pointed umbo. Its external ornamentation is confined to very fine concentric growth-lines. The auricles are symmetrically placed, and subequal in size; their outer and dorsal edges are straight, meeting at a sharp angle. The resilifer pit is triangular and inverted, with triangular elevated protrusions one on either side. The auricular sulci are very shallow.

The left valve is also almost flat, with subequal auricles, pointed umbo, and a broad low beak. Its sculpture is similar to that of the right valve. Its musculature consists of two elongate, narrow muscle scars diagonally opposed to each other, situated one on either side of the umbo.

Remarks: Korobkov (1960) erected a new subfamily, Entoliinae, in which he tentatively included, among other genera, the genus *Syncyclonema* Meek, 1864.

Occurrence and age: Localities TT6, 10, 35, 39, 40, 43, 44, 46, 49, 55; Unit 2, late Neocomian.

Subfamily CHLAMYDINAE Korobkov, 1960
(' CHLAMYSINAE ' Korobkov)
Genus CAMPTONECTES Meek, 1864

Type species: Pecten lens Sowerby, 1821.

CAMPTONECTES DUNNI sp. nov.
(Pl. 3, fig. 9)

Material: A single external impression of the right valve.

Holotype: Plate 3, figure 9 (CPC 4760). The species is based on a single specimen.

Diagnosis: The diagnostic feature of this new species is a combination of a relatively small and free anterior auricle, bifurcating and joining costae, and a characteristic subrectangular shape of the whole shell.

Differential diagnosis: C. dunni sp. nov. can be distinguished from perhaps its closest ally, *C. martinsensis* Stephenson, 1952, from the Cenomanian of Texas, by its distinctive shape and relatively free and smaller anterior auricle; the nature of costation in the new species is also somewhat different.

Description: The shell is 50 mm high and almost as long, subrectangular in shape, weakly inflated, inequilateral. The umbo is slightly acute, rounded, depressed, and slightly prosogryous. The anterodorsal shell-margin is straight or very gently convex; the remainder of the periphery is evenly convex; the greatest curvature is found where the ventral margin meets the anterodorsal and the posterodorsal shell-margins.

Sculpture consists of radiating ribs and of growth-rugae of irregular relief in the distal extremity of the shell. Costae are shallow and flat-crested. They originate as very thin riblets on the ventral portion of the umbo, and widen fairly rapidly distally, but their width varies in different parts of the shell at the same distance from the umbo. Some ribs bifurcate near the ventral periphery; others join together to form single ribs.

The anterior auricle is well developed. It has a straight dorsal margin, a sigmoidally flexed ventral periphery, and a straight anterior margin. The surface of the auricle is shallowly flexed and ornamented with growth-rugae which parallel the anteroventral periphery, and with radial riblets on the distal portion of the ear. The sulcus is shallow but distinct. The posterior auricle is not preserved.

Occurrence and age: Locality TT55, Unit 2, late Neocomian.

CAMPTONECTES MAGNIFICUS sp. nov.

(Pl. 2, figs 1-9)

Material: Four incomplete external impressions of the right valve, and three incomplete impressions of the left valve.

Holotype: Plate 2, figure 8 (CPC 4756). The most complete mature specimen of the left valve.

Paratypes: Plate 2, figures 7 and 9 (CPC 4758 and CPC 4757 respectively). These two right valves supplement the description of the species.

Diagnosis: The costae are relatively narrow and rigid only on the umbo; they are subject to bifurcations and multiple branchings in the distal portion of the shell particularly in the mid-ventral region. Costae are wider than interspaces in the proximal portion of the shell, but thinner than interspaces elsewhere.

Differential diagnosis: The two Cenomanian North American species, *C. ellsworthi* Stephenson, 1952, and *C. moodyi* Stephenson, 1952, seem to resemble the new species more than other previously described forms in the complex bifurcating type of ribbing. In *C. magnificus,* however, the costae are more rigid and are narrower, and the interspaces are deeper and wider in the distal portion of the shell.

Description: The shell grows to a large size: the holotype, which is the largest specimen available, is about 9 cm in diameter. It is orbicular, nearly plano-convex, subequilateral, subequivalve.

The right valve is weakly inflated and sculptured with arched, subparallel, plain, and radiating costae which depart from the umbo in the anteroventral and postero-ventral directions, curving slightly dorsally. Ribs are thin and increase in width only very gradually distally. Occasionally, especially in the distal portion of the shell, they have attached lateral barbs which transgress interspaces diagonally and may join together any two ribs. In the mid-ventral portion of the shell they may form an inverted V-pattern which may extend dorsally as far as the ventral portion of the beak. The interspaces are wider than the ribs distally, but narrow considerably towards the umbo. They are flat-bottomed, striated with fine and regularly spaced growth-striae.

The right anterior auricle is about one and a half times as long as it is high; its dorsal edge is straight and at right angles to the shell's vertical axis; the ventral edge is flexed, meeting both the dorsal auricular margin and the shell-margin at right angles; the auricular surface is flexed; the auricle is ornamented with conspicuous growth-rugae which parallel its anterior and anteroventral margins, and with vestigial radial ribs in its distal extremity. A thin and ventrally impersistent carina runs parallel to the shell-margin, gradually thickening ventrally, closely adpressed to the shell-margin; the auricular sulcus is shallow but fairly conspicuous and can be distinguished by a change in direction of growth of growth-rugae.

The posterior ear on the right valve is smaller and of simpler structure than the anterior ear. Its dorsal edge is short and straight, its posterior margin is very slightly concave. The surface of the auricle is ribbed with parallel costae which are subparallel to the auricular dorsal edge.

The left valve is moderately inflated, with a broad obtuse umbo ornamented with concentric growth-lines and growth-rugae, and a complex pattern of radial ribs. Here the costae are thicker than in the right valve, they are attenuated, rectangular to subrounded in cross section, separated by flat-bottomed, deep interspaces which are narrower than ribs in the proximal portion of the shell but wider distally. Costae are simple, originate at the umbo and proceed anteroventrally and posteroventrally in broad arched curves; an inverted V is formed of bifurcating costae on the shell's mid-line at the ventral portion of the umbo; repeated complex forking occurs in the distal—particularly centrally distal—portion of the shell; the angle of separation of secondary riblets increases ventrally.

The anterior ear is large and flexed in a vertical plane; its dorsal margin is straight and at right angles to the vertical axis; its anterior margin is sigmoidally curved, its surface is concave with the axis of flexure running laterally. Surface sculpture consists of simple radial ribs similar to that in the dorsal portion of the shell, and of growth-rugae which parallel the anterior ear margin.

The posterior ear of the left valve is smaller than its anterior ear. It is triangular, with the juncture between the straight dorsal and posterior margins obtuse and well rounded. Its sculpture consists of radial ribs, which originate at its proximal end and proceed distally, arching to the left and to the right of the mid-line; and transverse growth-rugae which parallel the posterior auricular margin.

Occurrence and age: C. magnificus sp. nov. is widely distributed in the Coastal Belt, where it is typical of Neocomian sediments. Localities TT5, 6, 8, 10, 25, 35, 43, 45, ?46, 49, 55 and 64, Unit 2 (late Neocomian).

CAMPTONECTES(?) MAINORUENSIS sp. nov.

(Pl. 3, figs 1, 2, 5)

Material: Eight fragmental impressions showing external ornament.

Holotype: Plate 3, figure 5 (CPC 4759). The largest available fragment.

Diagnosis: Radiating costae are flat and wide with narrow and shallow linear interspaces. They are displaced at varying distances from the umbo by unusually broad 'growth-bands' which are regularly concentric, well defined, and irregularly spaced.

Differential diagnosis: Characteristic features listed under the diagnosis of the new species serve to distinguish it from previously described forms.

Description: The shell is a large mature specimen measuring probably well over 10 cm in height, weakly convex proximally, depressed distally, vertically ovate. The surface of the valve descends in a number of shallow conspicuous and rather wide and irregularly spaced 'growth-bands'. Growth-lines are rarely discernible. The shell surface is sculptured with numerous parallel, wavering, low and broad, flat-crested, radiating ribs which are separated from each other by shallow and narrow interspaces. The ribs are widest in the mid-ventral portion of the shell, narrower towards the anterior and posterior shell-margins. The direction of growth of ribs is repeatedly offset by the growth-rugae. One specimen (Pl. 3, fig. 2) shows secondary riblets developing along some interspaces and alternating with primary ribs.

Remarks: Fragmentary preservation allows examination of only some aspects of the shell. Auricles were not seen. Although the proximal-most portion of the shell is missing its overall shape can be inferred from the arrangement of ribs and growth-rugae.

Occurrence and age: Localities TT6, TT45 and perhaps TT39, Unit 2, late Neocomian.

CAMPTONECTES YOUNGENSIS sp. nov.

(Pl. 3, figs ?3, ?4, 7, 8, 11)

Material: Four incomplete external impressions and one complete internal impression of the right valve.

Holotype: Plate 3, figure 7 (CPC 4671). The most complete and best preserved specimen, showing exterior of right valve.

Diagnosis: The anterior auricle is relatively small. Radial ribbing is confined in distribution to the auricles and to the anterior and the posterior shell margins. It is absent from the rest of the shell.

Differential diagnosis: Radial costae are absent from the middle portion of the shell of *C. martinsensis* Stephenson, 1952, from the Cenomanian of Texas; but in this species they are evenly distributed along the entire periphery of the shell.

Sculpture on the left valve of *C. hectori* Woods from the Senonian of New Zealand seems to be similar to that in *C. youngensis*. The new species, however, is a smaller shell and has a relatively smaller anterior auricle.

Description: The shell is about 40 mm high and 35 mm long. It is compressed, inequilateral, suborbicular. The umbo is broad, depressed, narrowing rapidly, poorly inflated, situated a little behind the mid-line.

Surface sculpture consists of concentric growth-lines, of growth-rugae which are spaced at irregular intervals, and of radial riblets. The distribution of costae is limited to the anterodorsal and posterodorsal portions of the periphery; they are sinuous, narrow, flat-crested, and with linear shallow interspaces. They bifurcate a short distance from the shell margin.

The right anterior auricle has a straight dorsal margin, a rounded anterior, and a posteroventrally incurved ventral margin. It is sculptured with growth-rugae, and occasionally on its distal end with ribbing similar to that on the surface of the valve proper. The auricular sulcus is well developed; its surface is aligned with irregularly retreating wavy growth-rugae.

The right posterior auricle has a straight dorsal margin about half the length of that of the anterior auricle. The posterior margin is also straight and directed posteroventrally; the ventral portion is usually sculptured with radial riblets. Radial sculpture of the left valve is also irregular and confined to the distal shell margin. Its ventral margin is usually devoid of radial ornament.

Occurrence and age: Locality TT35, Unit 2, late Neocomian.

Subfamily PECTININAE Lamarck, 1801

Genus NEITHEA Drouet, 1824

Type species: Pecten aequicostatus Lamarck, 1819.

NEITHEA sp. cf. N. OCCIDENTALIS (Conrad, 1855)

(Pl. 4, figs 1-3)

Material: Three external impressions of the left valve; four internal and five external impressions of the right valve.

Description: The shell is of small to medium size, slender, equilateral, strongly inequivalve, with the right valve very inflated and the left valve flat or slightly concave. The umbo of the right valve is convex, strongly recurved, narrow, and tapering fairly rapidly and evenly upwards.

Auricles on the right valve are small, triangular, with a slightly convex surface, and possibly ornamented with faint vertical striations.

Costation of the right valve consists of prominent ribs which originate on the umbo and proceed, diverging slightly, towards the ventral shell-margin. Ribs are thin, attenuated, angular to subrounded in cross-section, about the same width as the flat-bottomed interspaces. They are of three orders and consist of six primary ribs which are of highest relief and most prominent, and of the secondary ribs, of which there are two between every two sets of primary ribs. The primaries are compound and accompanied on one or both sides by somewhat smaller and less conspicuous ribs. All costae give rise to corrugations on the ventral margin of the right valve; these corrugations alternate with the ribs and grooves on the left concave valve.

The left valve is round to semioval in outline; its auricles were not observed. Ribbing on the right valve consists of an alternating series of: one primary rib flanked by two deep grooves, one on either side, with two sets of two secondary costae, each separated from the other by a broad shallow groove, while each pair of secondary ribs has a very narrow and shallow groove between them. The secondary costae of the left valve are of apparently the same relief as primary costae, and because of shallowness of the separating groove have an appearance of a bisected primary rib.

Discussion: It is very difficult to distinguish our Northern Territory specimens of *Neithea* from the North American *N. occidentalis* (Conrad, 1855) from the Comanche (Lower Cretaceous) strata. The specimens figured in the present paper are smaller and have somewhat less prominent ribs than the North American forms, but larger specimens were in fact observed in the field.

Occurrence and age: Localities TT6 and TT49; Unit 2, late Neocomian.

Family LIMIDAE d'Orbigny, 1847

All the Northern Territory specimens which are placed in the Limidae are poorly preserved and consist of incomplete internal and external impressions of both valves. Their proximal portions are invariably missing, and the nature of dentition is not known. Thus, although the subdivision of specimens into three species has been relatively simple, and it is suspected that all three do indeed belong to Limidae, their subgeneric affinities cannot be ascertained, and all have been placed in the genus *Lima* Bruguière, 1792.

Genus LIMA Bruguière, 1792

Type species: Ostrea lima Linn., 1758

LIMA HOSSFELDI sp. nov.

(Pl. 4, figs 5-7; ?8, ?9)

?1961 *Lima* sp. Cox, *Bur. Min. Resour. Aust. Bull.* 61, 18, 19, pl. 2, figs 5, 6.

Material: One external and three internal impressions of the right value, one external and one internal impression of the left valve.

Holotype: Plate 4, figure 5 (CPC 4983). The best preserved external impression of the right valve.

Diagnosis: The new species can be distinguished from previously described species of *Lima* by its very narrow and shallow interspaces which separate broad, low and slightly wavering costae. Some growth-rugae and growth-striae are present.

Differential diagnosis: The new species can be distinguished from *L. pecosensis* Stanton, 1947, from Comanche (Lower Cretaceous) strata of the U.S.A. by its shallower interspaces and absence of growth-striae. *L. aspera* (Mantell) from the Lower Chalk of the British Isles seems to be closely related to the new species. The two can, however, be distinguished by the narrower posterodorsal extremity of *L. hossfeldi.* A species which is perhaps closest to the Australian form in sculpture and outline is the British Bajocian *Lima* (*Plagiostoma*) *educta* Whiteborne, 1883. It is, however, a much smaller species.

Cox (1961) recently figured a specimen of *Lima* from the Neocomian Nanutarra Formation of the north-western Carnarvon Basin, Western Australia. This unnamed form seems to be closely similar to the new species, but its costae appear to be wavering more closely. It is possible, however, that the two forms belong to the same species.

Description: The shell is moderately large, elongate-ovate, inequilateral, produced posteroventrally, moderately inflated. Umbones are weakly inflated, not incurved, pointed. The anterior shell-margin is very gently concave proximally and slightly convex distally. The ventral margin is strongly arched. The posterior margin is broadly convex. The proximal-most portion of the shell is not available for examination, and its finer detail is not known.

Ribbing consists of up to sixty straight or somewhat sinuous radiating riblets, whose wavering seems to increase distally. They are flat-crested and broad, with narrow and shallow interspaces. Several growth-rugae cut across the costae, offsetting them slightly.

Occurrence and age: Localities TT6, TT55, and perhaps TT43; Unit 2, late Neocomian.

LIMA MISSIONA sp. nov.

(Pl. 4, fig. 10)

Material: A single incomplete external impression of a right valve.

Holotype: Plate 4, figure 10 (CPC 4984). The species is based on a single specimen.

Diagnosis: The diagnostic feature of this species is the combination of the following: strong radial ribbing consisting of narrow costae which broaden very slowly distally; ribs rectangular in cross-section and three to four times as wide as the deep interspaces.

Differential diagnosis: Combination of the characteristic features listed above distinguish *L. missiona* sp. nov. from the previously described forms.

Description: When complete the shell is at least 6 cm high and 4 cm long. It is well inflated, ornamented with numerous rather thin but rigid radiating costae. These are originally thin and the interspaces very narrow, but both increase in width gradually with the increasing distance from the umbo. Ribs are rectangular in cross-section, while the interspaces are deep and only a third or a quarter the width of ribs.

Only few growth-rugae are present. They are most prominent in the anterior portion of the shell, and the amount of offsetting of ribs is not large.

Occurrence and age: Locality TT45, Unit 2, late Neocomian.

LIMA sp. nov.

(Pl. 4, fig. 4)

Material: A single proximally incomplete external impression of the right valve.

Description: The specimen is broad, fairly small, and weakly inflated. Its ventral margin is strongly convex, the posterior margin broadly arched, and the anterior margin straight or slightly concave. Sculpture consists of very numerous and fine, slightly wavy radiating riblets which are transgressed by concentric growth-rugae with very little offsetting.

Discussion: This species can be easily distinguished from *L. hossfeldi* sp. nov., already described, by its much finer radial ribbing, and is almost certainly a new species, but its naming is withheld in the hope of finding more complete material.

Occurrence and age: Locality TT49a, Unit 2, late Neocomian.

Superfamily SPONDYLACEA

Family PLICATULIDAE Cox, 1952

Genus PLICATULA Lamarck, 1801

Type species: Plicatula gibbosa Lamarck, 1801.

PLICATULA TOWNLEYI sp. nov.

(Pl. 5, figs 21-23)

Material: Three external impressions of the left valve, one incomplete internal impression of the right valve.

Holotype: Plate 5, figure 21 (CPC 4989). A well preserved mature specimen of the left valve.

Paratype: Plate 5, figure 23 (CPC 4991). Supplements the description of the new species.

Diagnosis: The shell is ornamented with growth folds of fairly high relief; these seem to be haphazardly oriented in the young portion of the shell, but aligned in regular rows in the mature portion. The radially arranged folds and interspaces tend to be rectangular in cross-section.

Differential diagnosis: Combination of characters listed under the diagnosis of the shell distinguish the new species from the previously described forms.

Description: The mature specimen measured 5 cm in length and 6.5 cm in height; it is weakly inflated. In overall shape it is elliptical.

The external ornamentation of the left valve consists of up to a dozen crenulated growth-folds which broadly overlap each other. The crenulations are haphazardly distributed in the immature specimens, but in the postumbilical part of the mature shell the corrugations on the successive growth folds are arranged in even radiating rows of ' riblets ' and ' interspaces '. The riblets are of a relatively high relief and are of the same width or may be up to about twice as broad as the interspaces. Both the riblets and the interspaces tend towards rectangular cross-section.

The teeth on the right valve are straight and robust and inclined to each other at about 60°.

Occurrence and age: All our specimens were collected at locality TT64, Unit 2, late Neocomian age.

Superfamily OSTREACEA

Family OSTREIDAE Lamarck, 1818

Subfamily OSTREINAE Lamarck, 1818

Genus Ostrea Linn., 1758

Type species: Ostrea edulis Linn., 1758

Ostrea woolnoughi sp. nov.

(Pl. 4, fig. 13)

Material: A single external impression of a valve.

Holotype: Plate 4, figure 13 (CPC 4987). A monotypic species.

Diagnosis: The surface of the valve is covered by a number of large growth-plates of different sizes and variable overlap.

Differential diagnosis: The large overlap of the growth-plates and their thinness separates *O. woolnoughi* sp. nov. from previously described species.

Description: The shell is flat, about 6 cm long and 8 cm high. The surface consists of flat, compressed, large growth-plates overlapping each other haphazardly with a wide overlap margin.

Occurrence and age: The holotype was collected at locality TT6 (Unit 2) which is of late Neocomian age. Another specimen probably belonging to the same species was identified from locality TT45, which is also of late Necomian age.

Ostrea sp. A

(Pl. 4, fig. 11)

Material: A single internal impression of a ?right valve was collected at locality TT64 which belongs to Coastal Belt Suite Unit 2 and is late Neocomian in age. The specimen is that of an oyster, but, although it may be a new species, its description is withheld in the hope of obtaining additional material.

Ostrea sp. B
(Pl. 4, fig. 12)

Material: A single internal impression of a right valve from locality TT35 (Unit 2, late Neocomian) represents a thick-shelled oyster with a deep muscle scar. The specimen probably belongs to a species hitherto not known in Australia.

Ostreidae gen. et sp. 4
(Pl. 3, figs 6, 10)

Material: Two fragments, one of a near-complete shell showing type of sculpture on the exterior of the shell.

Description: The shell is probably about 5.0-5.5 cm high and just under 5 cm long when complete. Its inflation is small. Sculpture consists of roughly concentric growth-plates up to 5 mm broad which successively overlap each other. The plates are widest along the vertical axis of the shell, and gradually taper laterally. The ventral margin is broadly and evenly rounded, the anterodorsal and posterodorsal margins seem to be fairly straight, but figure 6 shows a prominent flexure in the periphery of shell near the umbo.

Discussion: Although in outline the shell is reminiscent of pectinids, the lack of radial ribbing discounts this affinity. The concentric platy sculpture may be suggestive of an ostreoid, and the overall shape does not contradict this. The fragments are, therefore, referred to the oysters, but until better preserved material allows closer examination of the proximal portion of the shell, their generic affinity will remain in doubt.

Occurrence and age: The two fragments were derived from locality TT35, Unit 2, late Neocomian.

Subfamily EXOGYRINAE Vialov, 1936

Genus Exogyra Say, 1820

Type species: Exogyra costata Say, 1820

Exogyra australiana sp. nov. 8135
(Pl. 5, figs 6-11)

Material: Ten external impressions and very numerous internal impressions of the left valve; four imperfect internal impressions of the right valve.

Holotype: Plate 5, figure 7 (CPC 5025). One of the well preserved specimens showing the external aspect of the left valve.

Paratypes: Plate 5, figure 9 (CPC 5029); inside of a right valve. Plate 5, figures 10, 11 (CPC 5001) shows the internal structure of the left valve. These two specimens supplement the description of the new species.

Diagnosis: The shell is rather small for the genus, short, and strongly incurved, with a prominent umbonal ridge, and with ' concentric ' irregular ornament on the left valve, made up of growth-rugae. Crenulation on the inside of the left valve parallels its periphery at some distance from the margin of the valve.

Differential diagnosis: The separation of *E. australiana* sp. nov. from the many overseas forms is made relatively easy by comparison of such shell characters as the prominent umbonal ridge and the somewhat peculiar ornamentation of the left valve. Only one overseas species, *E. sigmoidea* Reuss, described by Woods (1912) from the Lower Cretaceous of Boxford, England, exhibits shell characters comparable with that of the new species. The British form, however, is less incurved, more elongated ventrally, and its umbonal ridge seems sharper, while the crenulation on the inside of the left valve appears on the margin of the British form.

Description: The shell is arcuate, small (measuring no more than 2 cm in any direction), and very inequivalve. The vertical shell axis is less than one and a half times as long as the lateral axis. A section across the vertical axis is triangular.

The left valve is strongly inflated and divided into two portions, one anterior to the other, by an umbonal carina or a rounded ridge in the shell surface. This carina forms an acute angle in juvenile forms but approaches a right angle in mature specimens. The anterior slope is strongly inclined towards the commissure; it is striated with numerous lines of growth which vary in thickness. The striae are subparallel to each other and proceed transversely towards the posterior portion of the shell surface in a ventral direction. The anterior portion of the shell is thicker than the posterior portion; it is ornamented with a number of 'radiating' folds of irregular shape and of varying direction which follow the growth-lines and probably form the loci of greater deposition of shell material; they seem to radiate out from beneath the umbo.

The umbo is not separated from the rest of the shell; it is strongly coiled in the plane of the posterior slope, or forced into a lower plane by an object of attachment which frequently distorts it—occasionally together with a considerable portion of the shell (see Pl. 5, fig. 6).

The interior of the left valve shows a relatively large and deep muscle impression which is situated between the umbo and the ventral shell margin. A row of crenulations parallels the periphery of the interior of this valve at some distance from its margin.

The right valve has a shape approaching that of the human ear. It is small and flat or slightly convex; its exterior is not available for examination; its internal surface is undulating.

Discussion: Species of *Exogyra* Say, 1820, are commonly associated with Lower Cretaceous molluscan assemblages in many parts of the world, yet the only previous report of this genus from Australia was of a specifically indeterminate form or forms from the late Tithonian strata of Dampier Peninsula, Western Australia, by Brunnschweiler (1957). The relative abundance of *E. australiana* sp. nov. from the Lower Cretaceous Mullaman Beds of the Northern Territory is, therefore, a welcome addition to the list of Australian bivalves of this age.

Occurrence and age: Localities TT6, cf. 8, cf. 25, 35, 43, 45, 66; Unit 2, late Neocomian.

EXOGYRA TRAVESI sp. nov.

(Pl. 5, figs 16-20)

Material: Five external impressions of the left valve and three incomplete internal impressions of the right valve.

Holotype: Plate 5, figure 18 (CPC 4993). An incomplete external impression of the left valve.

Paratype: Plate 5, figure 17 (CPC 4992). An incomplete internal impression of the right valve.

Diagnosis: The proximal portion of the shell is strongly incurved on the left valve, less incurved on the right valve. External sculpture on the left valve is concentric and similar to that of *E. australiana* sp. nov. The peripheral margin of the left valve is crenulated, and a deep subumbonal notch may be present on this valve.

Differential diagnosis: E. travesi sp. nov. can be distinguished from its closest ally, *E. australiana* sp. nov., described above, by its greater size and by the peripheral position of crenulation on the inside of the right valve.

Description: The shell is moderately large, strong inequilateral, planoconvex, strongly incurved. The left valve is strongly inflated. Its ornamentation consists of radial growth-plates or irregular folds which originate directly beneath the umbo which is strongly incurved. The area of attachment can be quite large and is invariably placed in the dorsal portion of the left valve. The right valve is also moderately large, flat, with a crenulated inner periphery, with a large adductor scar which is situated posteroventrally from the umbo. A deep and broad notch is present directly under the umbo of the right valve.

Occurrence and age: Localities TT64-67, and perhaps TT6; Unit 2, late Neocomian. TT57, Unit 4, Neocomian-Aptian.

Superfamily MYTILACEA

Family MYTILIDAE Fleming, 1828

Genus MYTILUS Linn., 1758

Type species: Mytilus edulis Linn., 1758.

MYTILUS(?) sp.

(Pl. 5, fig. 12)

Two incomplete external impressions, one of a left valve and another of a right valve, may belong to the genus *Mytilus* Linn., 1758. Their external sculpture is confined to fine subconcentric ribbing, which seems to follow the lines of growth. The proximal portions of both valves are damaged and their internal structures are not known.

Occurrence and age: Locality TT64, Unit 2, late Neocomian.

Genus MODIOLUS Lamarck, 1799

Type species: Mytilus modiolus Linn., 1758.

MODIOLUS(?) BROWNI sp. nov.

(Pl. 5, fig. 14)

Material: A single external impression of the left valve.

Holotype: Plate 5, figure 14 (CPC 4935). The species is based on a single specimen.

Diagnosis: The shell is narrow proximally but widens rapidly away from the umbo. It is ornamented with even concentric costae which are separated from each other by narrow V-shaped interspaces.

Description: The greatest dimensions of this shell are 15 mm by 26 mm. It is narrow proximally; its width increases slowly at first, more rapidly distally. The dorsal margin is slightly concave, the posterior margin more or less regularly convex, the anteroventral margin slightly convex, and the greatest curvature is in the ventral margin. The surface of the shell is ornamented with regularly spaced riblets of even thickness which are separated from each other by narrow linear or V-shaped interspaces. These riblets extend over most of the shell surface, but seem to be absent from the subumbonal portion of the shell, which is lined with growth-lines only. Growth-rugae may be present.

Remarks: The single specimen does not show the dentition of the shell and consequently its generic placing is not certain.

Occurrence and age: Locality TT64, Unit 2, late Neocomian.

MODIOLUS(?) KATHERINEUS sp. nov.

(Pl. 5, fig. 13)

Material: Two external impressions of the left valve.

Holotype: Plate 5, figure 13 (CPC 4745). Better preserved of the two specimens.

Diagnosis: Diagnostic character of the new species is the combination of its small size, fine concentric ornamentation, the diagonal orientation of its maximum tumidity, and the general outline of the shell.

Differential diagnosis: Modiolus(?) katherineus sp. nov. can be readily distinguished from all but one of the known Australian species of *Modiolus* by its small size, rather unusual shape, and characteristic orientation of its diagonal ridge. The single figure of the remaining species, *Modiolus unica* Moore, 1870 (p. 253, pl. 13, fig. 5), is not clear and does not allow close comparison with our specimen. The longitudinal striations to which reference is made in the description of *M. unica* (p. 253) are not found in our specimen.

Description: The shell is small, subtrapezoid in outline, elongated posteroventrally and well inflated, with maximum tumidity located along a diagonal ridge a little above the mid-height.

The anterior extremity is not strongly produced. The anterior margin of the shell is moderately convex; the dorsal shell-margin is probably straight, forming a very obtuse and rounded angle with the posterodorsal margin which is very straight initially but increases in convexity ventrally. The posteroventral margin is strongly arched. The ventral margin is straight or very gently concave.

The umbo originates at the hinge-margin. It is oblique, conspicuous, prosogyrous, and located a little back from the anterior extremity.

The diagonal ridge is well developed, inclined at about 20° proximally and about 35° distally. There is also a shallow carina which runs parallel to the ridge and ventral to it.

Remarks: The generic designation is not certain as the dorsal margin of the shell is obscured and it is not possible to determine the presence or absence of hinge teeth.

Occurrence and age: Localities TT35 and TT49a; Unit 2, late Neocomian.

Genus BRACHIDONTES Swainson, 1840

Type species: Modiola sulcata Lamarck, 1801.

BRACHIDONTES(?) VOISEYI sp. nov.

(Pl. 5, fig. 15)

Material: Single external impression of the right valve.

Holotype: Plate 5, figure 15 (CPC 4934). Description of this species is based on a single specimen.

Diagnosis: The shell is small and ornamented with irregularly directed costae. Riblets dorsal of the postumbonal ridge are directed posteriorly, those in the distal portion of the shell both posteriorly and ventrally.

Differential diagnosis: Characters of the shell defined under the diagnosis distinguish the new species from the previously described forms.

Description: The shell is small, its greatest dimension being only 23 mm. It is well inflated. A postumbonal ridge extends from near the dorsal shell margin to the ventral margin; it determines the region of greatest inflation. The dorsal shell margin is evenly and gently convex; the posterodorsal margin is even more gently rounded; the anteroventral margin in sigmoidally curved—convexly dorsally; the ventral margin is closely flexed.

Shell sculpture consists of radial costae and growth-rugae. Costae dorsal of the postumbonal ridge are directed posteriorly, those in the distal portion of the shell both posteriorly and ventrally. The three growth-rugae which are present in the holotype are conspicuous and of high relief. The proximal portion of the shell is striated with growth-lines which were not preserved on the remainder of the shell.

Occurrence and age: Locality TT64, Unit 2, late Neocomian.

Superfamily TRIGONIACEA

Family TRIGONIIDAE Lamarck, 1819

Subfamily TRIGONIINAE Lamarck, 1819

(Pleurotrigoniinae van Hoepen, 1929)

Genus TRIGONIA Bruguière, 1789

Type species: Venus sulcata Hermann, 1781.

Subgenus TRIGONIA s. str.

8136

TRIGONIA(?) MARUMBIANA sp. nov.

(Pl. 7, fig. 1)

Material: Two incomplete external impressions of the left valve, and one of the right valve.

Holotype: Plate 7, figure 1 (CPC 5002). Shows an almost complete external impression of a left valve.

Diagnosis: The diagnostic feature of the new species is a combination of the following characteristics: laterally elongate, posteriorly produced shape; large disc ornamented with up to thirty regular, simple, closely spaced concentric costae; inconspicuous and simple marginal carina only slightly thicker than disc costae; a rather narrow area lined with up to 10 evenly spaced simple radial riblets which are somewhat finer than disc costae; a shallow and narrow antecarinal depression.

Differential diagnosis: The combination of the diagnostic characters listed in the preceding paragraph serves to distinguish *T.(?) marumbiana* from previously described species.

Description: The shell is produced posteriorly moderately and evenly inflated. The umbo is broad and opisthogyrous. The anterior shell-margin is evenly convex; the dorsal margin is gently concave; the ventral margin was not observed. The disc occupies a large proportion of the surface of the valve. It is ornamented with up to 30 concentric costae which are simple, narrow, circular in cross-section, and separated by narrow interspaces which are V-shaped in cross-section. The costae and interspaces cover the disc almost entirely, but there is a very narrow and shallow antecarinal depression. The marginal carina is similar in appearance to the disc costae and is only slightly more robust.

The area occupies only about a quarter of the shell's surface. It is ornamented with up to 10 simple and evenly spaced radiating costae which are thinner than the disc costae.

Discussion: Both in its shape and the relative proportion of size of the disc to that of the area, *T.(?) marumbiana* sp. nov. is not like most forms included in subgenus *Trigonia* s. str.; it was referred to this subgenus with a qualification.

In its ornamentation it bears a striking resemblance to the typical Australian Tertiary genus *Eotrigonia* Cossman, 1912. That the two forms are not congeneric, however, seems to be borne out by the differences in the disc-area ratios and by absence of sulcus in *Eotrigonia.*

Occurrence and age: Localities TT45 and TT64, Unit 2, late Neocomian.

TRIGONIA VERTISTRIATA Skwarko, 1963

(Pl. 7, fig. 2)

1963 *Trigonia vertistriata* Skwarko, *Bur. Min. Resour. Aust. Bull.* 67, 15, pl. 1, figs 4-6.

The original specimens of *T. vertistriata* were derived from locality TT35 of late Neocomian age (Coastal Belt Suite Unit 2), and it may occur at locality TT56. No additional material has since been collected.

TRIGONIA(?) sp. nov., Skwarko, 1963

(Pl. 7, fig. 3)

1963 *Trigonia(?)* sp. nov., Skwarko, *Bur. Min. Resour. Aust. Bull.* 67, 15, 16, pl. 1, fig. 7.

The original specimen of *Trigonia(?)* sp. nov., Skwarko, 1963, was collected at locality TT42, Unit 2, late Neocomian. No additional material has since been collected.

Subfamily MEGATRIGONIINAE van Hoepen, 1929

In 1963 I regarded Rutitrigoniinae van Hoepen, 1929, as a synonym of Megatrigoniinae van Hoepen, 1929. In this I followed, uncritically, Saveliev (1958) —a fact which Nakano (1965, p. 16) neglected to mention in his recent excellent treatment of Megatrigoniinae. Nakano's summary of Saveliev's subdivision of the Megatrigoniinae is not altogether consistent with Saveliev's own work (compare Saveliev, 1958, pp. 113-115 and pp. 282-285 with Nakano, 1965, p. 15).

Genus IOTRIGONIA van Hoepen, 1929

Type species: Iotrigonia crassitesta van Hoepen, 1929

Subgenus ZALETRIGONIA Skwarko, 1963

Type species: Zaletrigonia hoepeni Skwarko, 1963

In 1961 Cox described the marine macrofauna of Nanutarra Formation, north-west Carnarvon Basin, Western Australia (see p. 67). Comparison of the Nanutarra marine assemblage with that of the Coastal Belt Unit 2 of the Mullaman Beds Suite brings up several similarities on the generic level, the most prominent of which is the relative abundance in each of the large *Pterotrigonia* (large *Pterotrigonia* was also found in the Neocomian assemblage from near Stanwell, which was dated in 1946 as Valanginian by Whitehouse). On the other hand, one of the most conspicuous anomalies between the Nanutarra and the Unit 2 assemblages is the relative abundance of *Iotrigonia* (represented by subgenus *Zaletrigonia* Skwarko, 1963) below the horizon with *Pterotrigonia* in Unit 2, and its apparent complete absence in the Nanutarra Formation. (No specimens referable to *Zaletrigonia* have ever been reported from the Stanwell area, which, however, has (?)*Austrotrigonia prima* similar to *Austrotrigonia prima* Skwarko, 1963, of Unit 2; *Iotrigonia* sp. cf. *I.* (*Zaletrigonia*) *hoepeni* Skwarko, 1963, was however, identified from Normanby River, Laura Basin, Queensland). This may be due to the fact that the horizon with the Nanutarra assemblage corresponds exactly to the Unit 2 assemblage (e.g. at TT35), where no *Zaletrigonia* was found.

What little material has become available from the Nanutarra Formation since Cox's description of the main collection has yielded no *Zaletrigonia;* however, critical re-examination of Cox's trigoniid material in the light of new discoveries has revealed that his *Pacitrigonia(?) nanutarraensis* Cox, 1961 is in fact a species of *Zaletrigonia,* different from *Z. hoepeni.*

The new description of Cox's species appears below.

IOTRIGONIA (ZALETRIGONIA) HOEPENI Skwarko, 1963

(Pl. 7, fig. 12)

1963 *I.* (*Zaletrigonia*) *hoepeni* Skwarko, *Bur. Min. Resour. Aust. Bull.* 67, 18-20, pl. 1, figs 10-14; text-fig. 1.

The original description of this species was based on material from localities TT55, TT65, and ?TT52, all Unit 2, late Neocomian. No additional material has become available since that time.

IOTRIGONIA (ZALETRIGONIA) NANUTARRAENSIS (Cox, 1961)

(Text-fig. 6)

1961 *Pacitrigonia(?) nanutarraensis* Cox, *Bur. Min. Resour. Aust. Bull.* 61, 21, 22, pl. 3, fig. 1.

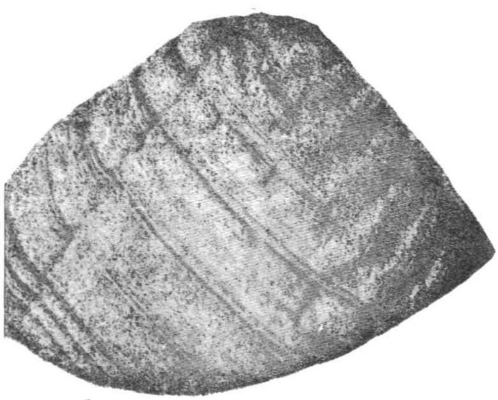
Material: Single posteriorly incomplete external impression of left valve.

Holotype: Text-figure 6 (CPC 3798).

Diagnosis: The anterior oblique ribs are irregular in distribution, few in number, and join distally with the foremost oblique ribs of the posterior set. Posterior oblique ribs are robust, subsigmoidally flexed with concave flexure directed towards the umbo.

Differential diagnosis: I. (*Z.*) *nanutarraensis* (Cox, 1961) can be distinguished for its nearest ally, *I.* (*Z.*) *hoepeni* Skwarko, 1963, from the late Neocomian strata of the Northern Territory, by its more robust and conspicuously flexed posterior oblique ribs, and by its few and irregularly spaced anterior oblique ribs.

Description: The shell is large and thick, and only moderately well inflated. The umbo is somewhat rounded, a little impressed. The posterodorsal margin is straight near the umbo; the anterodorsal margin is probably slightly convex proximally and straight distally. The foremost portion of the shell dips very steeply into the commissure.



Text - fig 6. *I. (Z.) nanutarraensis* (Cox, 1961). Latex mould of antero-proximal portion of the shell. Holotype CPC 3798, Locality MH4.
Late Neocomian.

Sculpture consists of wide, complex, 'concentric' ribs which parallel the lines of growth, and of two sets of oblique ribs, one anterior to the other. The concentric ribs originate close to the anterior shell-margin and are best developed in the ventral two-thirds of the shell; they are broadly convex and more or less symmetrical in cross-section, and are separated by shallow and broad interspaces which are striated with irregularly spaced hollow grooves. The distal-most ribs seem to be split up into component riblets, about three in number, all separated from each other by conspicuous narrow interspaces.

Oblique ribs of the posterior set are much more prominent than those of the anterior set, and are more numerous, numbering no less than seven. They are almost parallel to each other and are subsigmoidally flexed, with the concave flexure facing the umbo. They are short and cover only about the third of the shell closest to the posterodorsal shell margin from which they seem to originate. The anterior oblique ribs are inconspicuous. They are few in number (less than five) and are broadly and not very regularly spaced. They originate near the umbo in front of the oblique set of teeth and proceed posteroventrally, the posterior-most ones joining distally with the anterior-most ribs at the posterior set to form a ' V '. A prominent groove joins the umbo with the ventral shell-margin close to the anterior shell-margin; in front of it the surface of the shell is prominently flexed and rounded. This feature is, however, thought to be aberrant and is not regarded as a specific character.

Occurrence and age: Locality MH4, Nanutarra Formation (late Neocomian), north-western Carnarvon Basin, Western Australia.

Subfamily PTEROTRIGONIINAE van Hoepen, 1929, em.
Kobayashi & Nakano, 1957

Genus PTEROTRIGONIA van Hoepen, 1929

Type species: Pterotrigonia cristata van Hoepen, 1929

Subgenus RINETRIGONIA van Hoepen, 1929

Type species: Trigonia ventricosa Krauss, 1847

PTEROTRIGONIA (RINETRIGONIA) CAPRICORNIA Skwarko, 1963

(Pl. 7, figs 11, 14)

1963 *P.* (*Rinetrigonia*) *capricornia* Skwarko, *Bur. Min. Resour. Aust. Bull.* 67, 21, 22, pl. 2, figs 2-8.

P. (*R.*) *capricornia* is one of the most widely distributed Neocomian pelecypods in the Mullaman Beds of the Northern Territory. It was identified from collections from the following localities: TT35, 43, 45, 49, 55, 57, 65, 67 and

68; all of which except TT57 represent Unit 2, which is of late Neocomian age. The age of TT57, Unit, is regarded as transitional between Neocomian and Aptian.

Subfamily NOTOTRIGONIINAE Skwarko, 1963

Genus OPISTHOTRIGONIA Cox, 1952

Type species: Trigonia retrorsa Kitchin, 1903

OPISTHOTRIGONIA ROPERI Skwarko, 1963

(Pl. 7, fig. 15)

1963 *Opisthotrigonia roperi* Skwarko, *Bur. Min. Resour. Aust. Bull.* 67, 24, 25, pl. 3, figs 12, 13.

The original description of this species was based on a well preserved specimen from locality TT42, Unit 2, late Neocomian. No additional material has become available since that time.

Genus NOTOTRIGONIA Cox, 1952 em.

Type species: Nototrigonia cinctuta (Etheridge Jnr, 1902)

Yeuralba Group

NOTOTRIGONIA ABERRATA Skwarko, 1963 8140

(Pl. 7, fig. 4; pl. 8, figs 1, 2)

1963 *Nototrigonia(?) aberrata* Skwarko, *Bur. Min. Resour. Aust. Bull.* 67, 31, pl. 5, fig. 5.

The description of *N. aberrata* was based on a single posteriorly incomplete specimen of an external impression of a left valve from locality TT35.

During the 1962 field season three additional specimens referable to this species were collected from localities TT64 and TT66, which, like TT35, are of late Neocomian age. Two of the best specimens, one an outside impression of a left valve and another an outside impression of a right valve, were chosen as hypotypes, and with this material it was found possible to make some minor amendments both to the diagnosis and to the original description of the species. The two hypotypes are illustrated on Plate 8, figures 1, 2.

Amendments to the diagnosis: The original diagnosis is correct, except that, firstly, the disc costae do not necessarily diverge posteriorly in all specimens, and, secondly, when compared with the whole of the shell surface the area is relatively small.

Amendments to the description: Only the description of the area of *N. aberrata* needs amending: it is relatively narrow, separated from the sulcus by a moderately thick and conspicuous marginal carina, which has a serrated edge on the right valve, but which seems to be smooth on the left valve. Radial riblets on areas of both valves have also serrated edges.

NOTOTRIGONIA YEURALBA Skwarko, 1963

(Pl. 7, fig. 6)

1963 *Nototrigonia yeuralba* Skwarko, *Bur. Min. Resour. Aust. Bull.* 67, 30, 31, pl. 3, fig. 6.

One of the first specimens of *N. yeuralba* came from locality TT49, late Neocomian. No additional material has been collected since the original description.

Cinctuta Group

NOTOTRIGONIA sp. cf. N. CINCTUTA (Etheridge Jnr, 1902)

(Pl. 5, fig. 7)

1963 *Nototrigonia* sp. cf. *N. cinctuta* (Etheridge Jnr, 1902); Skwarko, *Bur. Min. Resour. Aust. Bull.* 67, 28, pl. 3, figs 3-5.

No additional material has been obtained since the description of this form. The original material was obtained from locality TT21, Unit 6, early Aptian.

NOTOTRIGONIA CRESCENTA Skwarko, 1963 8106

(Pl. 7, fig. 5, text-fig. 7)

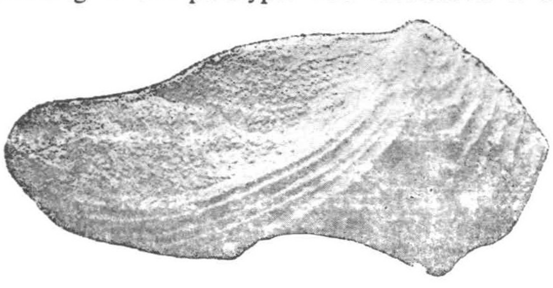
1963 *Nototrigonia crescenta* Skwarko, *Bur. Min. Resour. Aust. Bull.* 67, 29, 30, pl. 4, fig. 8.

The description of this species in 1963 was based on a single specimen. Since that time one additional specimen had been identified from collection TT68 of Unit 2 (late Neocomian). Like the holotype this specimen is a right valve, and like the holotype it is incomplete, but it does show a large part of the escutcheon, which was not preserved on the holotype, and also greater detail on the sulcus.

The specimen from locality TT68 is here given the status of a hypotype (CPC 4805) and is figured three times magnified (text-figure 7).

Supplement to the original description of N. crescenta:

The dorsal shell-margin seems to be flexed gently convexly close to the umbo, concave distally, but the flexure is probably at least in part due to the crushing of the paratype. The escutcheon is about twice as broad as the area, its surface is concave and ornamented with fine radial riblets which originate at or near the umbo and proceed posteriorly subparallel to the area. The sulcus increases in breadth very rapidly away from the umbo. It is deep, striated with very fine concentric growth-striae, and on its posterior portion by equally fine radial striae.



Text - fig. 7. ***N. crescenta*** **Skwarko, 1963 Holotype CPC 4805. (x3). Locality TT68. Late Neocomian.**

NOTOTRIGONIA NIMBOSA sp. nov. 8137

(Pl. 7, figs 7, 9, 10)

Material: One external cast of an almost complete specimen, and an external cast of a fragment of the left valve.

Holotype: Plate 7, figures 9, 10 (CPC 5006). The most complete specimen, showing external impression of the whole shell.

Paratype: Plate 7, figure 7 (CPC 5007). Shows a well preserved area and supplements the description of the species.

Diagnosis: A combination of the following shell characters constitutes the diagnosis of *N. nimbosa* sp. nov.: costae on the disc are dorsally flexed anteriorly and strongly oblique in their posterior portions as on the right valve, or without the dorsal flexure as on the left valve; disc costae tend to break up into lines of tubercles in the posteroventral portion of the disc, and invariably end in prominent tubercles. Sulcus is large and on the right valve radially striated. The area is narrow. Marginal and escutcheon carinas are each ornamented with a row of tubercles.

Differential diagnosis: N. nimbosa sp. nov. can be distinguished from such closely related Nototrigoniinae as *N. cinctuta* (Etheridge Jnr, 1902) by its proportionally wider sulcus and tubercular marginal and escutcheon carinas; from *N. minima* Skwarko, 1963, by a narrower area, the detail of disc costae, and ribbing on the sulcus of the right valve; and from *N. crescenta* Skwarko, 1963, by the presence of radial ribbing on the sulcus of the right valve.

Description: The shell is about 3 cm high and 4.5 cm long, moderately inflated, produced posteriorly, subrostrate.

The umbo is opisthogyrous, acute, fairly well defined. The disc is narrow and occupies a little less than half of the surface area of the valve. It is ornamented with about twelve strongly oblique costae which on the right valve are tightly convex dorsally close to the anterior shell-margin, then steeply oblique in their posterior portions. Costae are narrow and of rather low relief except at their posterior extremities when they form prominent tubercles. Riblets tend to break up into rows of smaller tubercles in the posteroventral portion of the disc.

The sulcus is large, striated with lines of growth, and on the right valve with as many as thirteen radial riblets. These vary somewhat in thickness and are unevenly distributed.

Marginal and escutcheon carinas are prominent, accentuated by a line of tubercles, which are, however, not as large as those marking the posterior extremities of disc costae. There are probably as many as a dozen tubercles on each carina. The area is narrow, striated radially with four riblets of about the same relief as sulcus riblets. The escutcheon was not seen clearly.

Occurrence and age: Locality TT66, Unit 2, late Neocomian.

Ponticula Group

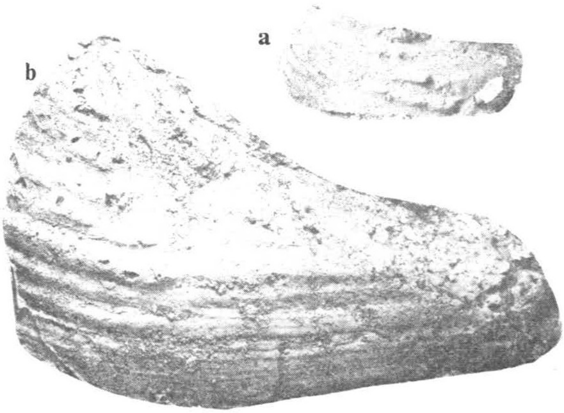
S 133

NOTOTRIGONIA PONTICULA Skwarko, 1963

(Pl. 8, fig. 10; text-fig. 8)

1963 *Nototrigonia ponticula* Skwarko, *Bur. Min. Resour. Aust. Bull.* 67, 31, 32, pl. 5, figs 1-4.

No additional material has been collected in the Northern Territory since the description of this species, but there is some evidence from poorly preserved fragmental material from the Nanutarra Formation in the Carnarvon Basin to



Text - fig. 8 a, b (?) *Nototrigonia ponticula*, Skwarko, 1963. a. Latex mould of an incomplete young specimen with radial ribbing on the area. CPC 4808. b. Latex mould of an incomplete mature specimen with the characteristically broad sulcus. CPC 4809. Port Hedland, W.A. Submitted by B. D. Morgan of the Broken Hill Pty Co. Ltd. Probably late Neocomian.

suggest that *N. ponticula* may indeed be present there. One of the Nanutarra specimens —an immature form—has radial ribbing on its area (text-fig. 8). The marine macrofauna from the Nanutarra Formation was described by Cox in 1961 and is regarded as of late Neocomian age.

The original specimens of *N. ponticula* were derived from locality TT35, Unit 2, late Neocomian age.

NOTOTRIGONIA(?) WALKERI sp. nov.

(Pl. 8, figs 5-7)

Material: Two incomplete external impressions, one of the left and the other of the right valve; an almost complete external impression of a young right valve; several fragments of discs.

Holotype: Plate 8, figure 7 (CPC 5012). An immature but almost complete specimen.

Paratype: Plate 8, figures 5 and 6 (CPC 5010 and CPC 5011). Anterior portions of both valves supplement the description of the species.

Diagnosis: The diagnostic feature of the new species is the combination of the concentric (anteriorly) and oblique (posteriorly) ribbing on the disc together with a very deep, wide and concentrically striated sulcus and a simple inconspicuous marginal carina. The angle between the disc and the anterior portion of the sulcus is very steep.

Differential diagnosis: The combination of features listed under the diagnosis serves to distinguish *N.(?) walkeri* from related forms.

Description: The mature shell is about 3 cm high and probably about 3.5 to 4.0 cm long. Except for the deep sulcus it is well inflated. The umbo is acute, slightly opisthogyrous, well defined. The disc is narrow, as in most Nototrigoniinae. Its ornamentation consists of up to 22 ribs, which are narrow, low, and regularly concentric in the greater anterior portion, but thicker, higher, and obliquely oriented in the short posterior portion. In their anterior portions the interspaces are flat and several times wider than the ribs.

The passage from disc to sulcus is sudden and steep, with the sulcus plunging at a steep angle towards the commissure. The sulcus is triangular and wide; its only lineation consists of growth-lines.

The marginal carina is a simple inconspicuous radial rib. The area and the escutcheon were not observed.

Remarks: Since none of the specimens in our possession shows the structure of the area it is not known whether it has radial ribbing. The new species is, therefore, placed in the Nototrigoniinae with a qualification.

Occurrence and age: Localities TT65 and TT68, Unit 2, late Neocomian.

Genus AUSTROTRIGONIA Skwarko, 1963

Type species: Austrotrigonia prima Skwarko, 1963

AUSTROTRIGONIA PRIMA Skwarko, 1963

(Pl. 8, fig. 13)

1963 *Austrotrigonia prima* Skwarko, *Bur. Min. Resour. Aust. Bull.* 67, 33, 34, pl. 6, figs 1-3, ?4.

The original material was derived from localities TT52 and TT55, both of which are of late Neocomian age (Unit 2). No new material has, since that time, come to hand.

A single specimen from Stanwell, however, illustrated in Skwarko (1963) on plate 6, figure 4 as *(?)Austrotrigonia prima* is being discussed and described as a new species of *Austrotrigonia* in a paper which is due to appear shortly (Skwarko, 1965).

Superfamily ASTARTACEA

Family ASTARTIDAE Sowerby, 1816

Genus ERIPHYLA Gabb, 1864

ERIPHYLA(?) BAUHINIANA sp. nov.

(Pl. 8, figs 3, 4, 8, ?9; pl. 15, fig. text-fig. 9)

Material: One external and one internal impression of the left valve; two internal and one external impressions of the right valve.

Holotype: Plate 8, figure 3 (CPC 5042). A well preserved external impression of the left valve.

Paratype: Plate 8, figure 4 (CPC 5014). Internal impression of a left valve; supplements the description of the species.

Diagnosis: The shell is suborbicular to subtriangular in shape. Concentric costae are narrow and blade-like in cross-section with relatively wide and flat-bottomed interspaces. The hinge is not wide. On the left valve there is a long and narrow tooth in front of the umbo and two teeth under the umbo; the sockets which separate subumbonal teeth correspond to a smallish front tooth and a larger triangular hind tooth on the right valve.

Differential diagnosis: The combination of the typically astartid external appearance of this shell and the type of dentition, which is characterized by a small number of teeth, is the diagnostic feature of the new species. *E.(?) bauhiniana* sp. nov. can be readily distinguished from the other Australian *Eriphyla, E. playfordi* Cox, 1961, from the Nanutarra (late Neocomian) Formation of the Carnarvon Basin, Western Australia, by exterior ornament as well as by shape of the shell.

Description: The shell is 21 mm high, suborbicular to subtriangular in shape, with length only slightly exceeding height; it is weakly but evenly inflated. The umbo is rather wide but pointed, prosogyral, very slightly offset anteriorly, a little depressed but not incurved. The posterior dorsal margin of the shell is slightly convex, but the rest of the periphery is strongly rounded on the ventral and posterior portions; the anterodorsal margin is concave immediately anterior of the umbo. Ornamentation of the shell consists of about 25 concentric evenly spaced ribs which are very thin in cross-section and are separated from each other by relatively wide and flat-bottomed interspaces.

Text - fig. 9. *Eriphyla(?) bauhiniana* sp. nov. Internal impression of a left valve. CPC 4802 (x2). Locality TT35. Late Neocomian.

The hinge is rather narrow. On the left valve a narrow protruding median tooth is flanked by two sockets, the posterior one being larger than the front one; these correspond to a smallish front tooth and a larger triangular hind tooth on the right valve. On the left valve a long narrow tooth in front of the umbo is oriented parallel to the anterodorsal shell-margin, and almost at right angles to the median tooth.

Discussion: Genus *Eriphyla* Gabb, 1864, is a typically Cretaceous genus. It is not certain whether our specimens do in fact belong to this genus, as, although the ornament and even dentition are of a kind associated with this form, some differences are seen in the overall shape. The Northern Territory astartid specimens are therefore placed in this genus with a qualification.

Occurrence and age: Localities TT10, 21, 35, cf. 44, 49a, 66 and 68; Unit 2 late Neocomian. Unit 6, early Aptian.

Superfamily CYRENACEA

Family CYRENIDAE Adams, 1858

Genus CYRENOPSIS Etheridge Jnr, 1902

Type species: Mactra meeki Etheridge Jnr, 1892.

CYRENOPSIS(?) sp. nov.

(Pl. 8, fig. 11)

Three specimens showing incomplete external impressions from locality TT65 (Unit 2, late Neocomian) belong most probably to the genus *Cyrenopsis* Etheridge Jnr, 1902.

No specimens of the internal structure of this form could be figured, as those which were examined in the field were lodged in rocks too large to enable freeing or transportation. The dentition as seen in the field closely resembled that figured by Etheridge Jnr (1892) on plate 26, figure 14, as 'Undetermined genus (?Unicardium)'. That specimen and two others which accompany it on that plate were included in *Cyrenopsis* as *C.* cf. *meeki* Etheridge Jnr, 1902, by Newton in 1915.

The ornamentation of our specimens consists of closely spaced, somewhat irregular, fine concentric riblets which parallel the line of growth and are separated by somewhat wider, concave-bottomed interspaces.

Superfamily ISOCARDIACEA

Family ISOCARDIIDAE Gray, 1840

Genus FISSILUNULA Etheridge Jnr, 1902

Type species: Fissilunula clarkei (Moore, 1870).

FISSILUNULA CLARKEI (Moore, 1870)

(Pl. 13, figs 6, 8)

1870 *Cytherea clarkei* Moore, *Quart. J. geol. Soc. Lond.*, 26, 250, pl. 13, fig. 1.

1872 *Cyprina expansa* Etheridge Snr, *Quart. J. geol. Soc. Lond.*, 28, 338, pl. 19, fig. 1.

1902 *Fissilunula clarkei* (Moore); Etheridge Jnr, *Mem. geol. Surv. N.S.W. Palaeont.*, 11, 36, pl. 6, fig. 3; pl. 9, fig. 1; pl. 10, figs 1, 2; pl. 11, fig. 2.

Material: Four incomplete internal casts of the right valve.

Discussion: F. clarkei is a widespread and well known Australian Lower Cretaceous bivalve which characterizes strata of Aptian age in Queensland, New South Wales, South Australia, and northern Western Australia. Öpik (in Sullivan & Öpik, 1951) recorded it from the Lower Cretaceous beds at Rumbalara, southern portion of the Northern Territory, and the assemblage was dated as Aptian by Skwarko (1962, unpubl.).

Dickins (1960, unpubl.) recorded *F. clarkei* from locality TT52 on the Mount Drummond 1:250,000 Sheet area. All specimens from that collection are poorly preserved, but some determinable Trigoniidae (Skwarko, 1963) are so far known only from Neocomian beds of the Northern Territory. Because of the Neocomian age of this collection and the very poor preservation of the bivalves referred to *F. clarkei* it is suggested that their comparison with this typically Aptian species be postponed until more or better material becomes available.

Occurrence and age: Locality TT31, Unit 5, and possibly TT21, Unit 6, both early Aptian.

Superfamily CYPRINACEA

Family CYPRINIDAE Adams, 1858

Genus EPICYPRINA Casey, 1952

Type species: Venus angulata Sowerby.

EPICYPRINA ABORIGINEA sp. nov.

(Pl. 9, figs 1-5, 8)

Material: Two internal moulds of the right valve and one of the left valve; one external cast of the left valve.

Holotype: Plate 9, figures 3, 5 (CPC 4766). The best preserved internal cast of the right valve.

Paratype: Plate 9, figure 1 (CPC 4765). Specimen showing dentition on the left valve, supplements the description of the species.

Diagnosis: The shell is large. The hinge is cyprinoid. On the right valve AI is moderately strong. AIII is not preserved on our specimens. 1 is strong, narrowly conical, tubercular. 3a is prominent, narrow, prosocline, descending from the cardinal margin behind and not in contact with 1. 3b is bifid, narrow, almost parallel sided. P1 is strong and elongate. On the left valve A11 is strong, mounted on a platform, its upper surface corrugated. A11 and 2a have merged. 2b is almost pear-shaped, its apex pointed, its base bifid. 4b is large, narrow, prosocline and curved. The nature of nymphs is not known. There is a shallow pallial sinus close to the posterior adductor scar.

Differential diagnosis: The external ornament of the new species, which is limited to simple concentric lineation, is similar to that found in a number of cyprinids, but the internal characters of the shell—particularly the structure of the teeth—distinguish the new species from previously described forms.

Description: The shell is moderately large, subtrigonal, equivalve, inequilateral, fairly strongly inflated, with maximum convexity in the vicinity of the obtuse posterior umbonal ridge, or occasionally in the middle of the shell. Inflation decreases rapidly towards the posterior shell-margin and less rapidly in other directions. Umbones are well defined, inflated, prosogyrous, slightly depressed, situated in the anterior quarter to one-third of the shell. The anterodorsal shell-margin is gently concave; the anterior margin is strongly convex; the ventral margin is broadly arched with a tendency to straighten out posteriorly; the posterodorsal and posteroventral margins are almost straight, and joined together with a rounded obtuse angle. Shell sculpture is limited to concentric, somewhat coarse growth-lines and growth-rugae.

The anterior muscle scar is circular, with its dorsal portion more deeply incised into the shell than its ventral portion. The posterior muscle scar is less strongly incised; it is tear-shaped, with the longitudinal axis aligned laterally. The pallial line runs close to the ventral shell-margin and parallel to it for almost its entire length, but is flexed in the immediate vicinity of the posterior muscle scar, giving rise to a shallow pallial sinus.

The hinge is cyprinoid, formula is

$$\frac{\text{A1 (A111) 1 3a 3b P1}}{\text{A11 2a 2b 4b P11}}$$

The detail of teeth structure is as described under 'diagnosis'.

Discussion: Genus *Epicyprina* was erected by Casey (1952) in order to separate from *Venilicardia* Stoliczka, 1871, species such as *Venus elongata* Sowerby and *V. subtrunctata* d'Orbigny. These two Upper Greensand (Albian) species differ from true *Venilicardia* in the presence of such features as transverse rugosities on the nymph, presence of rugae on the front lateral teeth, and by orthocline or weakly opisthocline orientation of 3a, which occupies a position between 1 and 2b in the closed shell.

The specimens, though by no means well preserved, show certain differences in their internal structure from that of *Epicyprina*. These are seen in the prosocline inclination of 3a, poorly developed and probably smooth A1, and presence of a shallow sulcus close to the posterior muscle scar. On the whole, however, the new species seems to be closer to *Epicyprina* than to *Venilicardia;* it is probably a new subgenus of *Epicyprina,* but an erection of a new subgenus is withheld in the hope of obtaining better material.

Occurrence and age: Locality TT35, Unit 2, late Neocomian.

EPICYPRINA AUSTRALIANA sp. nov.

(Pl. 9, figs 6, 7, 9)

Material: Three internal casts of the left valve and one of the right valve.

Holotype: Plate 9, figures 6, 7, 9 (CPC 4767). Specimen showing internal casts of both valves.

Diagnosis: The diagnostic features of the new species are seen in the detail of dental structure. The hinge is cyprinoid. On the right valve A1 is moderately strong and plain. A111 is very short and inconspicuous and is attached to the front of 3a. 1 is very prominent, subpyramidal in shape, its apex protruding into the left hinge-plate. 3a is sublaminar, the shape of its front part complicated by the attachment of A111; its orientation seems to be orthoclinal, 3b is narrow, triangular, elongate, bifid, prosocline, with a moderately deep longitudinal groove along almost its entire length. P1 is moderately strong, elongate. On the left valve A11 is narrow, elongate, sharp edged, mounted on a platform, apparently smooth. 2a is poorly differentiated from A11. 2b is broadly triangular, short, bifid, with a fairly sharp apex. P11 is not preserved. The nymphs are not preserved.

Differential diagnosis: E. australiana sp. nov. can be distinguished from its closest ally, *E. aboriginea* sp. nov., by the more attenuated A11, which lacks dorsal corrugations on *E. australiana,* by shorter and broader 2b, and by a less pointed 1.

Description: The shell is about 5 cm high and 6 cm long, equivalve, inequilateral, well but not strongly inflated, with an obtuse postumbonal carina. The umbones are prosogyrous, located in the anterior third of the shell, slightly obtuse, somewhat incurved. The anterodorsal shell-margin is straight or slightly concave; the anterior margin is convex, the ventral margin broadly arched, the posterodorsal margin gently convex; the posteroventral margin is much more strongly arched.

The anterior muscle scar is prominent, subcrescentic in outline, deeply impressed. The posterior scar is tear-shaped in outline and much less prominent. The pallial line is simple anteriorly but its direction in the posterior portion of the shell was not observed.

The hinge-plate is moderately broad and the hinge pattern is cyprinoid, the formula being

$$\frac{\text{A1 (A111) 1 3a 3b P1}}{\text{A11 2a 2b 4b P11}}$$

The detail of teeth structure is as described under ' diagnosis '.

Occurrence and age: Locality TT35, Unit 2, late Neocomian.

Genus CYPRINA Lamarck, 1818

Type species: Venus islandica Linn., 1767

CYPRINA LATERALIS sp. nov.

(Pl. 8, figs 12, 14, 15)

Material: Two almost complete external impressions, one of the left valve and the other of the right valve; an incomplete internal impression of the dorsal portion of the right valve.

Holotype: Plate 8, figure 12 (CPC 4762). The external impression of the right valve.

Paratype: Plate 8, figure 14 (CPC 4763). Shows the dentition on the right valve and thus supplements the description of the species.

Diagnosis: The shell is rather small for the genus, with an angular and prominent umbonal ridge. The visible teeth on the right valve are 1, 3b, 5b. 1 originates beneath the umbo. It is narrow, of high relief and oriented posterodorsally. 3b is robust, slightly bifid distally, oriented anterodorsally, joined with 1 under the umbo. 5b is low, elongate, triangular, oblique and parallel to escutcheon. Exterior of the shell is ornamented with fine concentric striae.

Differential diagnosis: A British cyprinoid, *C. cuneata* Sowerby from the Upper Greensand (upper Albian) of Blacktown, resembles *Cyprina lateralis* sp. nov. in the overall external characters of the shell; its carina, however, is more rounded than in the new species.

Description: The shell is about 5 cm long and 4-4.5 cm high, rather weakly inflated, subtrigonal in outline, inequilateral, equivalve, carinate. The umbones are prosogyrous, acute, not very inflated, well defined, somewhat incurved, situated at about the anterior third of the shell. The anterodorsal shell-margin is gently concave, passing into a strongly convex anterior margin; the ventral portion of the periphery is moderately arched anteriorly straightening out posteriorly; the posterior margin is uniformly and gently convex, its junction with the ventral margin being sharp and angular. The posterior umbonal ridge is obtuse, sharply angular and well defined; it extends from the proximal umbonal extremity down to the posteroventral shell-margin. Behind the umbonal ridge the shell surface dips steeply into the commissure. Immediately in front of the ridge the shell surface is very slightly concave, but rapidly flexes outwards, giving rise to maximum convexity in about the anterior third of the shell.

Ornamentation is limited to incremental lines, which are fine and closely spaced and tend to aggregate into irregularly spaced growth-rugae.

Lunule, escutcheon, and nymph are well developed. The hinge pattern is of the type usually associated with cyprinids. The following teeth were observed: 1, 3b, and 5b; of which 1 is narrow, of high relief, directed posterodorsally and originating beneath the umbo; 3b is more robust than 1, slightly bifid ventrally, directed anterodorsally, joined with 1 under the umbo; 5b is elongate and of low relief, triangular, oblique, parallel to escutcheon, and has a flat surface area.

Occurrence and age: Locality TT35, Unit 2, late Neocomian.

Genus VENILICARDIA Stoliczka, 1871

Type species: Cyprina bifida Zittel, 1864.

VENILICARDIA(?) PARSONSIA sp. nov. 8146

(Pl. 10, figs 1, 2)

Material: One internal and two incomplete external impressions of the right valve.

Holotype: Plate 10, figure 2 (CPC 5032). An external impression of the right valve.

Paratype: Plate 10, figure 1 (CPC 5033). An internal impression of the right valve.

Diagnosis: The shell is subtriangular, produced strongly posteriorly; with a postumbonal obtuse ridge. Ornamentation consists of concentric growth-lines and growth-rugae. 3a is probably strong and long, prosocline. 3b joins dorsally with 3a; it is strong, long, prosocline, and probably bifid. P1 is strong and elongate. The pallial line is probably entire.

Differential diagnosis: The elongate, triangular shape of the shell separates it from the previously described species of *Venilicardia*.

Description: The shell is well and evenly inflated, strongly inequilateral, produced posteriorly, subtriangular. The umbo is broad and ill defined, somewhat incurved. A very broad postumbonal carina joins the umbo with the postero-ventral shell-margin. Behind the carina the shell plunges very steeply into the commissure; perpendicularly near the umbo, less steeply in the distal portion of the shell. The surface of the valve is striated with poorly defined growth-striae and the more prominent growth-rugae, which are concentrated in the distal portion of the shell.

The hinge-plate is broad. Teeth on its front portion are not preserved in our specimens. The visible teeth on the right valve are as described above (see under 'Diagnosis'). The anterior adductor scar is subtriangular and fairly deeply incised. The posterior adductor scar is poorly defined. The pallial line is entire for all of its visible length, but is not preserved near the posterior adductor scar.

Occurrence and age: Locality TT65, Unit 2, late Neocomian.

VENILICARDIA sp. nov.

(Pl. 10, figs 3, 4)

Material: Two internal casts, one of a right valve and another of a left valve.

Description: The mature shell is about 7 cm long by 5 cm high, and evenly inflated.

The posterodorsal shell-margin, anterodorsal margin and ventral margin are all gently and evenly arched; areas of greatest peripheral curvature are in the posterior and anterior regions. The shell seems to be evenly inflated, with a postumbonal carina.

The hinge-plate is moderately broad. On the right valve A111 is weak. A1 is fairly strong and plain, its ventral margin is sigmoidally flexed; 1 is attached to its posterior extremity. 1 is strong, triangular, prosocline, with thin lamellar but long 3a, which is adpressed to it along the posterior margin. 3b is bifid, long, strong, with a longitudinal groove along its entire length. P1 is elongate, and prominent, subtubercular. On the left valve A11 is prominent, linear, sharp-crested, plain, and joined on to 2a posteriorly. 2a is sublamellar and strong. 2b is triangular with a pointed apex. P11 is elongate and smooth.

Anterior and posterior adductor muscle scars are fairly deeply incised in immature specimens. The pallial line is entire for most of its length, but it is not preserved near the posterior adductor scar.

Remarks: As the nature of the outside of the new species is not known it was decided to withhold giving the two shells a new name in the hope of obtaining better material in the future.

Occurrence and age: Locality TT35, Unit 2, late Neocomian.

Superfamily LUCINACEA

Family TANCREDIIDAE Lycett, 1850

Genus TATELLA Etheridge Jnr, 1901

Type species: Tatella maranoana Etheridge Jnr, 1901

TATELLA spp. aff. T.(?) APTIANA Whitehouse, 1925

(Pl. 10, figs 5-9)

Material: Numerous but poorly preserved and fragmentary external impressions of both valves; four internal impressions of both valves. One undistorted young specimen of internal mould and another of an external cast.

Description: Valves are elliptical, moderately inflated, inequilateral, apparently equivalve, strongly produced laterally. Umbones are very broad, poorly outlined, pressed close together. The umbonal region is almost indistinct from the broadly convex curvature of the dorsal shell-margin. The ventral shell-margin is gently convex; anterior and posterior margins are strongly and evenly convex.

The posterior adductor scar is elongate tear-shaped, with an attenuated extremity pointing towards the umbo. The anterior adductor scar and pallial line are not preserved.

The hinge-margin is of *Tatella* type, with a large tooth impression. External ornamentation is limited to incremental lines.

Remarks: In the Great Artesian Basin *Tatella(?) aptiana* Whitehouse, 1925 has a wide geographical distribution and seems to be restricted to Roma Formation sediments, which are regarded as Aptian. All our specimens from locality TT21 are strongly distorted, but as their orientation to direction of compression is variable it is possible to reconstruct the original shape of the shell. Adductor scars are but rarely preserved and no complete pallial line was observed. Characteristic tooth impressions suggest comparison with *T.(?) aptiana* Whitehouse, 1925, rather than with *Gari elliptica* Whitehouse, 1925. Two young specimens from locality TT21 are not distorted, but poorly preserved, and their positive identification is similarly uncertain.

Whitehouse (1925) classified *Tatella* with the family Tancrediidae Lycett, 1850.

Occurrence and age: Large specimens from locality TT21, Unit 6, early Aptian; small specimen from TT49a, Unit 2, late Neocomian.

Family LUCINIDAE Fleming, 1828

Genus LUCINA Lamarck, 1789

Type species: Venus edentula Linn., 1758.

LUCINA sp. aff. LUCINA sp., Woods, 1907

(Pl. 13, figs 1, 2)

Two internal casts, one of the right valve and the other of the left valve, from locality TT35 of late Neocomian age, bear a striking resemblance to Woods' *Lucina* sp. (1907, p. 152, pl. 24, figs 4, 5) from the Lower Greensand (lower Aptian) of the British Isles. Lack of specimens showing ext rnal aspect of the bivalve does not allow closer comparison.

Superfamily VENERACEA

Family VENERIDAE Leach, 1819

Genus PARAESA Casey, 1952

Type species: Venus faba Sowerby.

8132

PARAESA ANTICHTHONA sp. nov.

(Pl. 11, figs 11-13)

Material: Three internal impressions, one of the left valve, two incomplete of the right valve. An external impression of a dorsal portion of a right valve showing ornament and dorsal portion of the hinge plate.

Holotype: Plate 11, figure 12 (CPC 5030). Shows the internal aspect of the left valve.

Paratype: Plate 11, figure 13 (CPC 5019). Shows the external ornament.

Diagnosis: The hinge is typical of *Paraesa,* but with a rather robust 3a and 1. External ornamentation consists of fine concentric striae.

Differential diagnosis: P. antichthona sp. nov. can be distinguished from the type species *P. faba* (Sowerby) from the Lower Cretaceous of the British Isles, by the greater robustness of 3a and 1. The only other known representative of this genus in Australia, *P. neocomiana* sp. nov. (see below), has a much coarser concentric ornamentation.

Description: The shell measures about 35 mm in length and 27 mm in height. It is well and evenly inflated, with the tumidity decreasing gradually towards the front of the shell. The umbo is clearly defined and prosogyrous. The posterodorsal and ventral shell-margins are both evenly convex; the anterior and probably posterior shell-margins are more tightly and less evenly rounded. Immediately anterior of the umbo the shell is almost straight. The exterior of the shell is covered with fine concentric striae.

The hinge-plate is rather narrow. 3a is strong and triangular; it is opisthocline and does not quite reach the ventral edge of the hinge-plate. 1 is prosocline and a little more robust than 3a, also triangular and similarly with a pointed apex; its base rests on the ventral margin of the hinge-plate, but its apex does not quite reach the umbo. $3b_1$ and $3b_2$ are joined dorsally; they are both lamellar, though $3b_2$ is thicker than $3b_1$. The teeth on the left valve are abraded, but 2a and $2b_2$ can be clearly seen joined at the top, with thin lamellar 4b in the background.

Discussion: The genus *Paraesa* was erected by Casey in 1952. Its range in the British Isles is from the top of Lower Cretaceous upwards to Senonian. Our Northern Territory specimens are of Neocomian age, and thus, if their identification is correct, extend downwards the range of the genus.

The main difference between our specimens and the British Isles specimens is found in the nature of 3a and 1. Both these teeth are more robust in the Australian forms, but this feature is regarded as of specific rather than generic magnitude.

Occurrence and age: Locality TT65, Unit 2, late Neocomian.

PARAESA NEOCOMIANA sp. nov.

(Pl. 11, figs 1-6)

Material: Five internal casts, three of the left valve and two of the right valve; eight incomplete external casts of both valves.

Holotype: Plate 11, figure 1 (CPC 4769). An externo-internal mould of a right valve.

Paratypes: Plate 11, figure 2 (CPC 4770). An incomplete internal impression of a right valve. Plate 11, figure 3 (CPC 4771). External impression of dorsal portion of both valves offset slightly from their original position.

Diagnosis: Dentition is of *Paraesa* type. External ornament consists of about fifty regularly concentric ribs separated by narrower interspaces. The width of ribs varies somewhat.

Differential diagnosis: The new species can be distinguished from *P. antichthona* sp. nov. through the type of ornament, which is much coarser in *P. neocomiana.*

Description: The largest specimen is 34 mm long and 27 mm high. The shell is inequilateral, produced anteriorly and posteriorly, equivalve, evenly inflated but with a suggestion of a weak postumbonal carina. Only the apex of the umbo is well outlined; it is prosogyrous and somewhat incurved. The posterodorsal shell margin is evenly and gently convex. The anterodorsal margin is slightly concave beneath the umbo but becomes gradually convex, becoming quite strongly arched in the front of the shell. Convexity decreases ventrally. The very weak postumbonal carina imparts unevenness in the posteroventral portion of the periphery. The ornament of the shell consists of regularly concentric riblets which number about fifty on each valve, and which are separated by narrower interspaces. The riblets vary somewhat in thickness on any one valve.

The dentition is not at all well preserved, but seems to be of *Paraesa* type.

Occurrence and age: Localities TT35, 49, 49a, Unit 2, late Neocomian.

Genus MACROCALLISTA Meek, 1876

(?)'MACROCALLISTA' PLANA (Moore, 1870)

(Pl. 11, figs 14, 15)

Several strongly compressed external impressions of both valves of a pelecypod resemble in general appearance *'Macrocallista' plana* from Lower Cretaceous (mainly Aptian) strata of the Great Artesian Basin.

Occurrence and age: Locality TT20, Unit 6, Aptian.

Superfamily SAXICAVACEA

Family SAXICAVIDAE Swainson, 1835

Genus PANOPEA Menard, 1807

Type species: Panopea aldrovandi Menard, 1807

PANOPEA sp. aff. P. ARAMACENSIS (Etheridge Jnr, 1892)

(Pl. 12, figs 5, 6)

P. aramacensis was originally described as *Glycimeris aramacensis* by Etheridge (in Jack & Etheridge, 1892, p. 479, pl. 28, figs 7 and 8).

Material: Four incomplete external impressions of both valves.

Description: The shell is small for the genus, strongly inflated. It has a fairly broad, obtuse, and incurved umbo, and is ornamented with regular concentric ribs which are regularly convex in cross-section, and with linear or broadly V-shaped interspaces much narrower than the ribs.

Discussion: The specimens from the Northern Territory resemble Etheridge's *P. aramacensis* in ornamentation and small size, but are too fragmentary to be definitely compared.

P. aramacensis has been hitherto reported only from Lower Cretaceous strata of eastern Queensland, where it occurs in sediments laid down in the Great Artesian Basin.

Occurrence and age: Localities TT35 and ?TT68; Unit 2, late Neocomian.

Panopea sp. cf. P. maccoyi (Moore, 1870)

(Pl. 12, figs 11, 12)

For convenience of reference a synonymy list for *P. maccoyi* (Moore, 1870) is given below:

1870 *Mya maccoyi* Moore, *Quart. J. geol. Soc. Lond.*, 26, 253, pl. 13, fig. 8.
1872 *Panopaea sulcata* Etheridge Snr, *Quart. J. geol. Soc. Lond.*, 28, 342, pl. 21, fig. 2 (*non* fig. 2a).
1892 *Glycimeris sulcata* (Etheridge Snr); Etheridge Jnr, *in* Jack & Etheridge, *The Geology and Palaeontology of Queensland and New Guinea,* 571 (*non* pl. 27, fig. 18).
1892 *Glycimeris? maccoyi* (Moore); Etheridge Jnr, *in* Jack & Etheridge, *The Geology and Palaeontology of Queensland and New Guinea,* 480
1901 *Glycimeris maccoyi* (Moore); Etheridge Jnr, *Qld. geol. Surv. Bull.* 13, 30.
1902 *Glycimeris maccoyi* (Moore); Etheridge Jnr, *Mem. Roy. Soc. S. Aust.,* (2), 38, 39, pl. 4, figs 10, 11.
1952 *Panopaea* cf. *maccoyi* (Moore); Brunnschweiler, *Aust. J. Sci.,* 14 (1), 8.
1957 *Panopaea maccoyi* (Moore); Brunnschweiler, *Bur. Min. Resour. Aust. Rep.* 13, 10.

Material: Three external impressions of the right valve and two of the left valve.

Description: The shell is apparently equivalve, moderately inflated, very inequilateral, produced slightly to the front and very strongly to the back. Valves are gaping at their posterior extremities. Umbones are angular, obtuse, slightly prosogyrous, of unknown original inflation, strongly incurved. An anterior umbonal carina is present. Anterior and posterior shell-margins are regularly and tightly convex, ventral margin is virtually straight, posterodorsal margin is slightly concave. Sculpture is limited to concentric growth-lines and growth-rugae, which seem to be most accentuated in the anterior portion of the shell.

Discussion: Most of our specimens are crushed, distorted, or incomplete, which makes their comparison with Moore's original figure—itself of a rather poorly preserved specimen—uncertain. Moore's specimen is probably posteriorly incomplete and was derived from a locality between Amby and Maranoa Rivers in Queensland.

The comparison with an internal cast figured by Etheridge Jnr (1892, pl. 21, fig. 2) from Maryborough as *Glycimeris sulcata* and referred by him (1901) to

Glycimeris maccoyi is also inconclusive. The Northern Territory specimens bear great resemblance to specimens from the Lower Cretaceous strata from the Lake Eyre Basin, South Australia, figured by Etheridge Jnr (1902, pl. 4, figs 10, 11).

Occurrence and age: Locality TT57, Unit 4, Neocomian-Aptian.

PANOPEA ROSIA sp. nov.

(Pl. 12, figs 1-4)

Material: Three internal casts of the right valve and three of the left valve; incomplete fragments of the external impressions of both valves.

Holotype: Plate 12, figures 2, 3 (CPC 4774). A well preserved internal mould of both valves in position.

Paratype: Plate 12, figure 4 (CPC 4776). Shows the external aspect of the shell and supplements the description of the species.

Diagnosis: The shell is small for the genus, strongly inflated, with strongly curved umbones. Posterior gape is lacking. External sculpture is limited to incremental lines.

Differential diagnosis: The new species can be distinguished from *'Glycimeris' aramacensis* Etheridge Jnr, 1892, from the Lower Cretaceous strata at Aramac, Queensland, by the greater convexity, lack of definite posterior gape, and more strongly incurved umbones. The small size of the new species sets it aside from other hitherto described Australian forms.

Description: The shell measures no more than 45 mm in length and 25 mm in height; it is subrectangular, well inflated, produced moderately anteriorly and strongly posteriorly. The greatest convexity of the shell is along the anterior umbonal ridge, at the front quarter of the length of the shell; from there the inflation decreases very rapidly towards the posterior margin. Umbones are fairly prominent, broadly obtuse, with a pronounced anterior and less well marked posterior ridge. They are oriented obliquely to the commissure, strongly incurved, and situated at a little less than anterior third of the length of shell. Sculpture consists of irregularly spaced concentric incremental lines.

Occurrence and age: Locality TT35, Unit 2, late Neocomian.

PANOPEA sp. cf. P. SULCATA Etheridge Snr, 1872

(Pl. 12, figs 9, 10)

For ease of reference a synonymy list for *P. sulcata* Etheridge Snr is given below:

1872 *Panopaea sulcata* Etheridge Snr, *Quart. J. geol. Soc. Lond.,* 28, 342, pl. 21, fig. 2a (*non* fig. 2).

1892 *Glycimeris sulcata* Etheridge Snr; Etheridge Jnr *in* Jack & Etheridge, *The Geology and Palaeontology of Queensland and New Guinea,* 571, pl. 27, fig. 18.

Material: Two external impressions of the left valve and two of the right valve. Fragments of the internal and external moulds and casts of left and right valves.

Description: The shell is small to medium in size, very inequilateral, equivalve, strongly inflated, gaping at the back. Umbones are inflated, pointed, incurved. The anterior shell-margin is tightly rounded; the ventral margin broadly arched; the posterior margin convex; and the dorsal margin gently concave. Sculpture consists of many concentric deeply sulcated furrows which are most pronounced in the anterior portion of the shell. Plications parallel the growth-lines.

Remarks: Etheridge Jnr (1892, p. 57) writes: 'Individuals of *G. sulcata* vary greatly in appearance, both as regards the coarseness of the furrows on the surface and the marginal outline of the anterior end'. Similar variation was observed in the Northern Territory specimens, but in spite of this, similarity between our figured specimen and Etheridge's type specimen is quite marked.

Occurrence and age: Locality TT57, Unit 4, Neocomian-Aptian.

PANOPEA YIYINTYIA sp. nov.

(Pl. 12, figs 7, 8)

Material: One internal cast of both valves in position, together with an external impression of the right valve.

Holotype: Plate 12, figures 7, 8 (CPC 4777). The species is based on a single bivalve.

Diagnosis: The shell is small for the genus. It has relatively narrow umbones, a posterior gape, and irregular concentric lineation; it lacks definite ribbing.

Differential diagnosis: P. yiyintyia sp. nov. differs from *P. rosia* sp. nov. in greater size, in less incurved and narrower umbones, and in the presence of a gaping posterior extremity. Like *P. rosia,* it differs from the previously described species of *Panopea* in the lack of a well defined and regular ribbing.

Description: The shell is of medium size, elongate, strongly inequilateral, equivalve, well inflated, gaping posteriorly. The front portion of the shell is moderately produced; the rear portion very strongly produced. Umbones are prominent, rather narrow, very slightly acute, incurved. The anterior umbonal ridge is only slightly more prominent than the posterior ridge. Shell inflation decreases quickly anteriorly and ventrally, much more gradually in the posterior direction. The surface of the shell is ornamented with concentric growth-lines, growth-rugae, and rather indefinite and irregular ribs, all of which parallel each other.

Occurrence and age: Locality TT55, Unit 2, late Neocomian.

Superfamily PHOLADACEA

Family TEREDINIDAE Fleming, 1828

Genus TEREDO Linn., 1758

Type species: Teredo navalis Linn., 1758.

TEREDO(?) sp.

(Text-fig. 10)

Internal casts of burrows made originally by *Teredo,* or some other burrowing mollusc closely related to *Teredo,* were found at three localities in the Mullaman

Beds: TT60 (lower Albian), TT53 (early Aptian), and TT55 (late Neocomian) —illustrating that here, as well as in other parts of Australia, this marine organism lived and flourished in Cretaceous times. The unsatisfactory type of preservation limits observation of the specimens and no close study is attempted at this stage. It is noted, however, that individual burrows do not exceed 10 mm in diameter, and many are only half that breadth (see text-fig. 10). Since, however, the tubes are short (less than 4 cm) their length is most probably governed by the thickness of the tree trunk, and it must be inferred that these specimens are not fully developed and consequently do not necessarily differ in size from those reported in the past from other parts of Australia (Moore, 1870; Etheridge Jnr, 1892, 1902b; Cox, 1961). In at least some of the specimens from the Mullaman Beds there seems to be a persistent preference for uniplanar orientation of burrows, probably in the horizontal plane.

Text - fig. 10. Internal mould of a colony. CPC 4810. Locality. TT55. Late Neocomian.

Superfamily PANDORACEA

Family THRACIIDAE Dall, 1898

Genus THRACIA Leach in Blainville, 1824

Type species: Thracia corbuloidea Blainville, 1824.

8148

(?) THRACIA PRIMULA Hudleston, 1890

(Pl. 13, fig. 3)

For convenience of reference a synonymy list for *T. primula* is given below:

1890 *Thracia primula* Hudleston, *Geol. Mag.,* 7 (3), 245, pl. 9, fig. 7.

1892 *Corimya primula* (Hudleston); Etheridge Jnr, *in* Jack & Etheridge, The *Geology and Palaeontology of Queensland and New Guinea,* 481, pl. 28, fig. 11.

1902 *Corimya(?) primula* (Hudleston); Etheridge Jnr, *Mem. Roy. Soc. S. Aust.,* 2 (1), 36.

1902 *Corimya(?) primula* (Hudleston); Etheridge Jnr, *Mem. geol. Surv. N.S.W., Palaeont.,* 11, 38, pl. 3, figs 8, 9.

1925 *Thracia primula* Hudleston; Whitehouse, *Trans. Roy. Soc. S. Aust.,* 49, 31, pl. 1, fig. 5.

Material: Three complete specimens showing the exterior aspect of the valves only; numerous fragmentary material.

Description: The shell is up to 7 cm long and 5 cm high, suborbicular, apparently equivalve, inequilateral, with the anterior portion of the shell somewhat attenuated, and a broad posterior portion. The umbo is broad, narrowing rapidly, prosogyrous, protruding slightly beyond the hinge-line. The posterior shell-margin is broadly convex; the ventral margin even more broadly arched; the dorsal margin slightly convex; and the anterior margin slightly and irregularly convex. Ornamentation is confined to very fine closely set concentric riblets.

Discussion: All available Northern Territory specimens of (?) *Thracia primula* are squashed flat by compaction, and although the original inflation of the shell was probably small it is possible that the outline was modified.

The Northern Territory specimens resemble Hudleston's South Australian forms in the thinness of the shell. In the overall shape, the ventral margin is straighter in the South Australian form; the latter has also coarser growth-lines, but the New South Wales specimens described by Etheridge Jnr (1902b) seem to have somewhat finer concentric laminations.

Whitehouse (1925) argued in favour of retaining the original generic placing as suggested by Hudleston. The preservation of the Northern Territory material does not lend itself to taxonomic study.

Occurrence and age: Locality TT20, Unit 6, early Aptian.

INCERTAE SEDIS

Genus indet. sp. nov.

(Pl. 13, figs 4, 5)

Material: One external and one internal impression of the left valve; one internal impression of the right valve.

Description: The shell is about 80 mm long and 45 mm high, subelliptical, equivalve, inequilateral, compressed. Umbones are prosogyrous, broad, not well defined. The anterodorsal shell-margin is almost straight; the anterior and posterior margins strongly convex; the ventral and posterodorsal margins broadly arched. Sculpture of the shell consists of very fine growth-lines and of irregularly spaced shallow growth-rugae.

Muscle scars are prominent, situated dorsally close to the front and rear extremities of the hinge plate. Anterior adductor muscle scar is moderately deeply incised, elongately triangular, with a rounded base and attenuated apex which terminates close to the umbo. The posterior adductor scar is tear-shaped, with an attenuated somewhat flexed dorsal extremity. The pallial line is shallow and oblique to the ventral shell-margin in its anterior portion, deeply flexed, forming a sulcus, in its posterior portion.

The hinge-plate is long and narrow. Dentition of the right valve consists of a prominent and protruding, though narrow, process which is situated directly underneath the umbo and is oriented dorsoventrally. The process has a deep socket behind it, and this is succeeded by an elongate somewhat depressed ledge which is oriented obliquely to the commissure and forms the ventral margin of the posterior portion of the hinge-plate. There is a rather deep ligament groove beneath the dorsal edge of this elongate process.

Remarks: Generic and specific affinities of the specimen on Plate 13, figures 4 and 5, which is described above, are not known. Its dentition suggests that it may belong to one of the specialized burrowing families of Pelecypoda. The assemblage with which it occurs at locality TT21 consists almost exclusively of species which are already known from Lower Cretaceous strata of the Great Artesian Basin and it may, therefore, be an already known species; but unfortunately many species described from the Lower Cretaceous sediments of the Great Artesian Basin are still known only from their external characters.

Occurrence and age: Locality TT21, Unit 6, early Aptian age.

Pelecypoda genera indet.

(Pl. 11, figs 7-10)

Incomplete and complete specimens and rubbers illustrated in Plate 11, figures 7-10 are all derived from locality TT35 which is of late Neocomian age. These specimens are not described here as it is not possible to match them with any degree of certainty. Figures 9 and 10 represent specimens which, in spite of their superficial similarity, are not related even on the generic level; it is not known to which of these specimens on figures 7 and 8 belong.

GASTROPODA

Gastropods are rare in the Mullaman Beds. Although eight distinct genera were identified from our collections, most are represented by a single specimen. The only gastropod which is at all well represented and consequently better known is *Neritokrikus tuberosus* gen. et sp. nov.

Some of the material is limited to internal casts, and even generic determinations of such specimens should be regarded with caution, as the identification of univalves from internal casts is at best difficult and uncertain.

Superfamily FISSURELLACEA

Family FISSURELLIDAE Fleming, 1822

Subfamily DIODORINAE Wenz, 1938

Genus DIODORA Gray, 1821

Type species: Patella apertura Montagu, 1803.

DIODORA(?) GALEA sp. nov.

(Pl. 14, fig. 10)

Material: One well preserved impression of the exterior of the shell.

Holotype: Plate 14, figure 10 (CPC 4787). The species is based on a single specimen.

Diagnosis: The shell is strongly inflated, with an anteriorly situated pointed apex. The aperture is subrectangular, widening ventrally, with a wavy margin, Radial ribbing is of two orders; both sets of ribs progressively widen with increasing distance from the apex.

Description: The shell is of medium size, conical, and strongly inflated. The apex is situated anteriorly; it is acutely pointed, not incurved, and not perforated. Sides of the shell are straight. The aperture is subrectangular, widest in the ventral quarter, longer than wide, and with a wavy margin. The surface is ornamented with stout regular radial ribs of two orders: thick and prominent primary ribs alternate with less conspicuous secondary ribs; ribs of both orders are uniformly convex in cross-section and their width increases progressively with increasing distance from the apex. The interspaces are narrow. Growth-striae which transgress costae are but rarely visible.

Remarks: The nature of the interior of the shell is not known and the generic determination is, therefore, qualified.

Occurrence and age: Locality TT55, Unit 2, late Neocomian.

Superfamily PATELLACEA

Family PATELLIDAE Rafinesque, 1815

Subfamily NACELLINAE Thiele, 1929

Genus CELLANA Adams, 1869

Type species: Nacella cernica Adams, 1869.

CELLANA(?) CARPENTARIANA sp. nov.

(Pl. 14, fig. 11)

Material: One external and three internal impressions of the shell.

Holotype: Plate 14, figure 11 (CPC 4788). The species is based on a single specimen.

Diagnosis: The shell is longitudinally ovate. Its apex is situated anteriorly and is not incurved. Ribbing on the posterior slope is of three orders. Only the posterior wall of the shell is convex outwards, all other sides of the shell being straight.

Generic affinities: At first glance the new species seems to have greater affinities with *Nacella* Schumacher, 1817, than with other patellids, but it lacks a hooked apex and so probably does not belong to this genus. Wide spacing of ribs tends to separate our specimen from *Patella* Linn., 1758. It is referred tentatively to *Cellana* on the overall appearance, although the known range of this genus is only Miocene to Recent.

Description: The shell is moderately large and inflated. Its apex is obtusely pointed, situated anteriorly, and not incurved. The slopes are straight in the front and on the sides of the shell but convex on the posterior wall, with a wavy posterior margin. The posterior slope is ornamented with four primary, three secondary, and six tertiary straight radial ribs which gradually increase in breadth away from the umbo. The primary ribs are straight, sharp-crested, and prominent. Radial ribbing is also present on the sides and on the anterior of the shell, but it is not distinct and the costae there seem to belong to one order only. Ribs are crossed by irregular growth-rugae and somewhat more irregular growth-striae.

Occurrence and age: Locality TT55, Unit 2, late Neocomian.

Superfamily NERITACEA

Family NERITOPSIDAE Gray, 1847

Subfamily NERITOPSINAE Gray, 1847

Genus NERITOKRIKUS nov.

Type species: Neritokrikus tuberosus sp. nov.

Diagnosis: The shell is globular, turbiniform, with an unprotruding spire; sutures are not visible on the outside of the shell; the last whorl is large and internally smooth; first and second whorls are transversally ribbed inside the shell. The inner lip is not thickened by callus and not protruding as septum. The aperture is opened wide, half-moon shaped. The shell is covered on the outside with haphazardly distributed prominent tubercles.

Differential diagnosis: The new genus differs from many of the previously described genera belonging to Neritopsidae and Neridae in the virtual absence of an externally protruding spire and in an apparent lack of externally visible sutures.

The closest ally of *N. tuberosus* seems to be the European Upper Cretaceous *Neritoptyx* Oppenheim, 1892, from which, however, the new genus can be distinguished by the lack of the parietal tubercle as well as by the haphazard tuberculation.

The new genus can be distinguished from such forms as the now living *Vitteclithon* Baker, 1923, and *Neritodryas* Martens, 1869, and from the post-Upper Jurassic *Otostoma* d'Archiac, 1859, by the half-moon shape of its aperture.

NERITOKRIKUS TUBEROSUS sp. nov.

(Pl. 14, figs 4, 5, 9)

Material: Ten incomplete external impressions and six internal casts.

Holotype: Plate 14, figure 9 (CPC 4786). A specimen showing the anterior aspect of the shell.

Paratypes: Plate 14, figure 4 (CPC 4784) shows the internal aspect of the shell, and Plate 14, figure 5 (CPC 4785) shows the posterior view of the shell. Both these specimens supplement the description of the species.

Description: The shell is up to 30 mm in diameter and up to 25 mm high. The spire is very low on the outside and indistinguishable from the rest of the shell. The first two whorls expand rather slowly, the third rapidly; the first and second whorls are internally striated with transverse ribs, the third whorl is smooth inside. The aperture is half-moon shaped, widely opened, free of parietal tubercles and protruding callus. The whole exterior of the shell is covered with prominent but irregularly distributed tubercles.

Occurrence and age: Localities TT20, 33, 47, and 48; Unit 6, early Aptian.

Family NERITIDAE Rafinesque, 1815

Genus TRACHYNERITA Kittl, 1894

Type species: Trachynerita fornoensis Kittl, 1894.

TRACHYNERITA(?) sp.

(Pl. 13, fig. 9)

A single diagonally distorted specimen of an internal mould of a univalve may belong to *Trachynerita*. It was collected at locality TT35, Unit 2, late Neocomian.

Superfamily LITTORINACEA

Family PURPURINIDAE

Genus PURPURINA d'Orbigny, 1850

Type species: Purpurina bellona d'Orbigny, 1850.

PURPURINA(?) sp.

(Pl. 14, fig. 6)

A single fragment of an external impression of the shell is referred, with qualification, to genus *Purpurina*. It was collected at locality TT49a and is of late Neocomian age.

Superfamily PLEUROTOMARIACEA

Family PLEUROTOMARIIDAE Swainson, 1840

Genus PLEUROTOMARIA Defrance, 1826

Type species: Trochus anglicus J. Sowerby, 1818

PLEUROTOMARIA(?) sp. A

(Pl. 14, figs 7, 8)

A single dorsally incomplete internal mould of a gastropod from locality TT35 (late Neocomian) is thought to belong to *Pleurotomaria*. The spire is low and the whorls increase in breadth only gradually, but the unsatisfactory preservation does not allow definite generic allocation nor specific diagnosis.

PLEUROTOMARIA(?) sp. B

(Pl. 14, fig. 12)

A single obliquely squashed specimen of an internal cast of a gastropod from locality TT35 (late Neocomian) may belong to a species of *Pleurotomaria* different from that figured on Plate 14, figures 7 and 8. Its spire is low and its whorls increase in size gradually as in *Pleurotomaria(?)* sp. A, but its last whorl and possibly earlier whorls have oblique wavy bands on the inside surface.

Superfamily ACTEONACEA

Family RINGICULIDAE Meek, 1864

Genus CINULIA Gray, 1840

CINULIA sp. cf. C. HOCHSTETTERI (Moore, 1870)

(Pl. 14, figs 1, 2)

For convenience of reference a synonymy list for *C. hochstetteri* is given below:

1870 *Actaeon hochstetteri* Moore, *Quart. J. geol. Soc. Lond.*, 26, 256, pl. 10, fig. 19.

1892 *Cinulia hochstetteri* (Moore); Etheridge Jnr, *in* Jack & Etheridge, *The Geology and Palaeontology of Queensland and New Guinea,* 484.

1902 *Cinulia hochstetteri* (Moore); Etheridge Jnr, *Mem. Roy. Soc. S. Aust.*, 2 (1), 40, pl. 6, fig. 25.

Two specimens of a small gastropod, one of an internal mould and another of an external impression, closely resemble *Cinulia hochstetteri* (Moore, 1870) from the Lower Cretaceous strata of the Great Artesian Basin.

The Northern Territory specimens were derived from locality TT35, Unit 2, late Neocomian.

CEPHALOPODA

Order AMMONITIDA

Superfamily ANCYLOCERATACEA

Family ANCYLOCERATIDAE Meek, 1876

Subfamily ANCYLOCERATINAE Meek, 1876

Genus AUSTRALICERAS Whitehouse, 1926

Type species: Crioceras jacki Etheridge Jnr, 1880.

AUSTRALICERAS sp. nov. aff. A. JACKI (Etheridge Jnr, 1880).

(Pl. 14, fig. 13)

A single specimen was collected at locality TT17, which is probably late Neocomian in age. In its overall morphology it is closely allied to *A. jacki* (Etheridge Jnr, 1880) from Aptian strata of Queensland, but its suture, although definitely of *A. jacki* type, is considerably simpler. This may be possibly due in part to the imperfect state of preservation of the specimen.

Mr J. T. Woods, Queensland Museum, regards the specimen as a new species of *Australiceras* allied to *A. jacki* (pers. comm.). It is figured here for the sake of completeness of record, but its detailed description will appear in time under a separate title.

Order BELEMNOIDEA

Family BELEMNITIDAE d'Orbigny, 1845

Subfamily DIMITOBELINAE Whitehouse, 1924

Representatives of Dimitobelinae Whitehouse, 1924 are found mainly in Australia and New Zealand, but also in South India and New Guinea. Its members are characterized by the presence of lateral grooves instead of a ventral groove. Whitehouse (1924) included four genera in this subfamily, viz. *Peratobelus, Dimitobelus, Tetrabelus* and *Cheirobelus.* The basis for differentiation of these genera is primarily the nature and orientation of lateral grooves.

Glaessner's (1957) re-examination of Tate's belemnite collection from Wollumbilla brought about a revision of the taxonomy of the Dimitobelinae. His investigation revealed previous misorientation of *Dimitobelus canhami* (Tate, 1880), Whitehouse's type species of genus *Dimitobelus;* it appears that its ventrolateral grooves were originally interpreted as dorsolateral grooves. This, together with other observations, led Glaessner to re-define the Aptian *Peratobelus* as a genus of cylindrical or cyclindro-conical shape and characterized by the presence of ventrolateral grooves only, and the Upper Albian clavate Dimitobelus as having '. . . ventro-lateral grooves and lateral-double lines from which weaker dorsolateral lines may extend to the alveolar portion of the rostrum' (p. 89). He regarded *Cheirobelus* as generically indistinguishable from *Dimitobelus*, and *Tetrabelus* as at the most a subgenus of *Dimitobelus*. Thus Whitehouse's four genera of the Dimitobelinae were reduced to the Aptian *Peratobelus* and the upper Albian *Dimitobelus* and *(?)Dimitobelus (Tetrabelus)*.*

The unfavourable preservation of the majority of belemnites which were collected in the Lower Cretaceous strata of the Northern Territory limits the possibility of further advances in taxonomy through examination of this material. All specimens collected are casts—either external impressions of guards or internal moulds of alveolae. The actual position of the siphuncle can only be guessed at and the study of such features as the axial line and the structure of the phragmocone is not possible. On the other hand the imprints of longitudinal grooves are surprisingly well preserved in specimens from at least two localities. Since, however, not

* Since this bulletin was sent to press, Stevens (1965, The Jurassic and Cretaceous belemnites of New Zealand and a review of the Jurassic and Cretaceous belemnites of the Indo-Pacific Region. *N.Z. Geol. Surv. Pal. Bull.* 36, 59-63) in his discussion of the Dimitobelinae supported the inclusion of *Cheirobelus* in *Dimitobelus,* and in addition synonymized *Tetrabelus* with *Dimitobelus.* His examination of the presumed sole North American representative of Dimitobelinae convinced him that the distribution of Dimitobelinae is limited to the Indo-Pacific Region.

one specimen shows a siphuncle, it is not known whether the characteristic paired grooves on the guard are dorsolateral or ventrolateral in position. For the purpose of the present paper it is accepted tentatively that the belemnites from the Coastal Belt of the Northern Territory are members of the Dimitobelinae.

Genus PERATOBELUS Whitehouse, 1924

Type species: Belemnites oxys Tenison Woods, 1883.

PERATOBELUS(?) BAUHINIANUS sp. nov.

(Pl. 15, figs 7-11)

Material: Twelve incomplete external impressions of the guard, six internal impressions of the alveolus.

Holotype: Plate 15, figure 7 (CPC 4795). Incomplete mature specimen showing the shape of the guard and the nature of some grooves.

Paratype: Plate 15, figure 8 (CPC 4796). Incomplete specimen showing both ventrolateral grooves.

Diagnosis: The diagnostic feature of the new species is the combination of its shape with the number and nature of its grooves.

Differential diagnosis: P. oxys (Tenison Woods, 1883) and *P. australis* (Phillips, 1870) are both larger species whose guard is more symmetrically pointed and lateral grooves straighter and more deeply incised.

Description: The guard is up to 9 cm long and 1.5 cm thick, subcylindrical in shape. The dorsal surface is straight; the ventral surface is flexed gradually ventrally and then rapidly dorsally, the area of greatest flexure being in the distal three-quarters of the length of the guard in the region of the greatest circumference. Distal tapering starts about the distal quarter of the guard, where the ventral surface arches up dorsally while the dorsal surface continues in a straight line. The distal extremity is pointed.

Two sinuous subparallel ventrolateral grooves extend for at least four-fifths of the length of the guard; they are curved dorsally at their extremities. Three short and straight grooves each about a centimetre in length extend from the proximal extremity of the test: two of these occupy a lateral position, one on each side of the lateroventral groove; the third is in a midway position between the lateroventral grooves.

Discussion: The presence of the three short grooves in the apical portion of the guard of the holotype may be a freak development limited to that specimen, as they were not observed on other specimens. In most of our specimens, however, the proximal portion of the guard is not preserved.

Occurrence and age: Localities TT20 and TT21, Unit 6, early Aptian; locality TT45, Unit 2, late Neocomian.

Genus DIMITOBELUS Whitehouse, 1924

Type species: Belemnites canhami Tate, 1879.

DIMITOBELUS CANHAMI (Tate, 1879)

(Pl. 15, figs 13, 14)

1867 *Belemnitella diptycha* McCoy MS, *Ann. Mag. nat. Hist.*, 19 (3), 196, 356

1870 *Belemnites australis* (*non* Hector) Phillips *in* Moore, *Quart. J. geol. Soc. Lond.*, 26, pl. 16, figs 3, 4 (*non* 1, 2 and 5).

1879 *Belemnites canhami* Tate MS, *Trans. phil. Soc. S. Aust.* for 1878, 1879, 2, 7.

1880 *Belemnites canhami* Tate, *Proc. Roy. Soc. S. Aust.* for 1879, 1880, 3, 104, pl. 4, figs 2a-c.

1892 *Belemnites canhami* Tate; Etheridge Jnr, *in* Jack & Etheridge, *The Geology and Palaeontology of Queensland and New Guinea,* 490, pl. 35, figs 1, 3, 4, 7-9, 12-14.

1902 *Belemnites canhami* Tate; Etheridge Jnr, *Mem. Geol. Surv. N.S.W., Palaeont.,* 11, 45-46, pl. 8, figs 8, 9, ?pl. 10, fig. 2.

1924 *Dimitobelus canhami* (Tate); Whitehouse, *Geol. Mag.,* 61, 412, text-figs 2, 3.

1925 *Dimitobelus canhami* (Tate); Whitehouse, *Trans. Roy. Soc. S. Aust.,* 49, 35, pl. 2, figs 1-7, 9-11.

Over a dozen specimens of a belemnite apparently indistinguishable from *Dimitobelus canhami* from the Albian strata of the Great Artesian Basin were identified from locality TT60, which on the presence of this species as well as that of *Aucellina hughendenensis* (Etheridge Snr, 1872) is dated as Albian, probably early Albian.

DIMITOBELUS(?) YOUNGENSIS sp. nov.

(Pl. 15, figs 1-6, 12)

Material: Ten incomplete external impressions of the guard; seven moulds of the alveolus.

Holotype: Plate 15, figure 1 (CPC 4790). Mature specimen showing both grooves.

Paratype: Plate 15, figure 6 (CPC 4794). Specimen showing shape of the guard.

Diagnosis: The combination of the clavate shape of the guard together with the nature of its grooves constitutes the diagnosis of *D.(?) youngensis* sp. nov.

Differential diagnosis: In its abrupt truncation *D.(?) youngensis* sp. nov. is similar to the much larger, cylindrical form *Peratobelus australis* (Phillips, 1870). From related members of *Dimitobelus* it can be distinguished by its shape and the curvature of the lateral grooves.

Description: The guard is about 7 cm long and 1.5 cm thick, clavate, circular in cross-section. The dorsal surface is straight for most of its length, but gently flexed ventrally close to the distal extremity; the ventral surface arches gradually ventrally until the point of the greatest inflation, then rapidly dorsally. The lateral surface is flexed in a fashion similar to that of the ventral surface. The distal tapering is very rapid, resulting in a snub-nosed, pointed distal extremity.

Two sinuous subparallel ventrolateral grooves extend for at least four-fifths of the length of the guard; they are curved dorsally at their extremities.

The phragmocone is centrally situated and pointed.

Occurrence and age: Locality TT55, Unit 2, late Neocomian; possibly TT45, Unit 2, late Neocomian. This is the first record of *Dimitobelus* from sediments of Neocomian age in Australia: hitherto this genus was known from strata no older than Albian.

DERIVATION OF NEW NAMES

aboriginea, Epicyprina, L. *aborigineus,* ancestral, native.
antichthona, Paraesa, Gr. *antichthon,* southern hemisphere.
arnhemense, Grammatodon, after Arnhem Land, Northern Territory.
australiana, Epicyprina, after Australia.
australiana, Exogyra, after Australia.
bauhiniana, Eriphyla(?), after Bauhinia Downs Station, N.T.
bauhinianus, Peratobelus(?), after Bauhinia Downs Station, N.T.
browni, Modiolus(?), after H. Y. L. Brown, an Australian pioneer geologist.
carpentariana, Cellana(?), after the Gulf of Carpentaria, N.T.
dickinsi, Pseudavicula, after J. M. Dickins, palaeontologist, Bureau of Mineral Resources, whose work has broadened our knowledge of the genus *Pseudavicula.*
dunni, Camptonectes, after P. R. Dunn, geologist, Bureau of Mineral Resources, who made many observations on the stratigraphy of the Cretaceous strata of the Northern Territory.
galea, Diodora, L. *galea,* helmet.
hossfeldi, Lima, after P. S. Hossfeld, who worked and wrote on the stratigraphy of the Cretaceous sediments in the Northern Territory.
katherineus, Modiolus(?), after Katherine River, N.T.
lateralis, Cyprina, L. *lateralis,* of the side.
magnificus, Camptonectes, L. *magnificus,* noble, splendid.
mainoruensis, Camptonectes(?), after Mainoru Station, N.T.
marumbiana, Trigonia(?), after Mount Marumba, Arnhem Land, N.T.
missiona, Lima, after Roper River Mission, N.T.
mullamanensis, Maccoyella, after Mullaman Beds, a general name for the Cretaceous sediments in the northern part of the Northern Territory and in north-western Queensland.
neocomiana, Maccoyella, after its occurrence in sediments of Neocomian age.
neocomiana, Paraesa, after its occurrence in sediments of Neocomian age.
Neritokrikus (masc. gender), Gr. *nerites,* sea snail; *krikos,* ring, finger-ring.
noakesi, Isognomon, after L. C. Noakes, Bureau of Mineral Resources, who worked and wrote on the Cretaceous stratigraphy of the Northern Territory.
nimbosa, Nototrigonia, L. *nimbus,* rain-cloud.
parsonsia, Venilicardia(?), after Parsons Range, Arnhem Land, N.T.
psittaculum, Grammatodon, L. *psittaculus,* small parrot, used here adjectivally.
rosia, Panopea, after abandoned Rosie Creek Homestead in Arnhem Land, N.T.
territorianum, Syncyclonema, after Northern Territory, where it is widely distributed.
townleyi, Plicatula, after K. A. Townley, chief editor, Bureau of Mineral Resources, Canberra.
transitoria, Maccoyella, L. *transitorius,* passing, fleeting.
travesi, Exogyra, after D. M. Traves, who worked and wrote on the Cretaceous sediments in the Northern Territory.
voiseyi, Brachidontes(?), after A. H. Voisey, who worked and wrote on the Cretaceous strata of the Northern Territory.
walkeri, Nototrigonia(?) after Walker River, Arnhem Land, N.T.
tuberosus, Neritokrikus, L. *tuberosus,* full of lumps and swellings.
woolnoughi, Ostrea, after W. G. Woolnough, who worked and wrote on Cretaceous strata of the Northern Territory.
yiyintyia, Panopea after Yiyintyi Range, Arnhem Land, N.T.
youngensis, Camptonectes, after Mount Young, N.T.

UNIT 1 (Neocomian)	UNIT 2 (Late Neocomian)	UNIT 4 (Neocomian-Aptian)	UNIT 5 (Aptian)
TT 35, 55 (only the lower plant and wood-bearing portions of sections at these two localities)	TT5-10, 12-14, 16, 17, 19, 25, 35, 39,?40, 42, 43, 44, 45, 46, 49, 49a, 52,55, 62,64-68	TT 56, 57	TT 31

UNIT 6 (Aptian)	UNIT 7 (Albian)	UNIT A (?Neocomian, Aptian)	UNIT B (Aptian)
TT 20-22, ?28,33, ?47, ?48	TT 53, 60	TT 11, 18, 23, 24, 32, 34, 36, 54, 59, 61, 63	TT 3, 4, 26, 27

Fig. 26. Distribution of fossil collections by units

INDEX TO FOSSIL LOCALITY NUMBERS

TT1: Larrakeyah Quarry, Darwin. Darwin 1 : 250,000 Sheet 12° 28′ S, 130° 50′ E. Collected by S. K. Skwarko, 10.8.1960.

TT2: Myilly Point, Darwin. Darwin 1 : 250,000 Sheet 12° 27′ S, 100° 49½′ E. Collected by S. K. Skwarko, 10.8.1960.

TT3: 4.8 miles north of Pine Creek along Stuart Highway; mesa on western side of highway; collection made about 30 feet below top of mesa. Pine Creek 1 : 250,000 Sheet, 13° 47′ S, 131° 47′ E. Collected by S. K. Skwarko, 16.8.1960.

TT4: 7.0 miles north of Pine Creek along Stuart Highway; mesa on western side of highway; collection made about 25 feet below top of mesa. Pine Creek 1 : 250,000 Sheet 13° 47½′ S, 131° 44½′ E. Collected by S. K. Skwarko, 16.8.1960.

TT5: About 45 miles east of Mountain Valley road turnoff along Maranboy-Mainoru road (17 miles from Mainoru); in mesa just north of the road. Urapunga 1 : 250,000 Sheet 14° 09′ S, 133° 52′ E. Collected by S. K. Skwarko, 24.8.1960.

TT6: 4.5 miles west of Mainoru along Mainoru-Maranboy road; 1 mile north of the road. Urapunga 1 : 250,000 Sheet 14° 03½′ S, 134° 02′ E. Collected by S. K. Skwarko, 25.8.1960.

TT7: 18.2 miles west of Mainoru, along Mainoru-Maranboy road, just south of the road. Urapunga 1 : 250,000 Sheet 14° 10′ S, 133° 51′ E. Collected by S. K. Skwarko, 25.8.1960.

TT8: Solitary mesa 2 miles south-east of Mountain Valley Homestead. Urapunga 1 : 250,000 Sheet 14° 06′ S, 133° 49′ E. Collected by S. K. Skwarko, 26.8.1960.

TT9: 7 miles north of Beswick Homestead, 0.25 miles at 150° from Baker Creek crossing (Baker Creek is a tributary of the Waterhouse River). Katherine 1 : 250,000 Sheet 14° 28′ S, 133° 8′ E. Collected by S. K. Skwarko, 23.8.1960.

TT10: about 7 miles north-west of Maranboy-Mainoru road, along the western bank of Bukalorkmi Creek. Katherine 1 : 250,000 Sheet 14° 23½′ S, 133° 26½′ E. Collected by S. K. Skwarko, 28.8.1960.

TT11: 2 miles due north of locality TT10. 14° 22½′ S, 133° 25½′ E. Collected by S. K. Skwarko, 28.8.1960.

TT12: 1.5 miles north of Maranboy-Mainoru road, about 17 miles from Sugarbag Waterhole. Katherine 1 : 250,000 Sheet 14° 26′ S. 133° 28′ E. Collected by S. K. Skwarko, 29.8.1960.

TT13: Yeuralba, 28 miles north of Maranboy Police Station. Katherine 1 : 250,000 Sheet 14° 17′ S, 132° 49′ E. Collected by S. K. Skwarko, 30.8.1960.

TT14: 13 miles east of Beswick Homestead, along road, just east-south-east of Sugarbag Waterhole. Katherine 1 : 250,000 Sheet 14° 33′ S, 133° 17′ E. Collected by S. K. Skwarko, 30.8.1960.

TT15: Shoal Bay, about 6 miles due south of Gunn Point, which lies about 20 miles north-north-east of Darwin. Darwin 1 : 250,000 Sheet 12° 15′ S, 131° 01′ E. Collected by S. K. Skwarko, 5.9.1960.

TT16: 6 miles east of Beswick Homestead, about 3 miles due south of Maranboy-Mainoru road. Katherine 1 : 250,000 Sheet 14° 35′ S, 133° 13½′ E. Collected by S. K. Skwarko, 8.9.1960.

TT17: about 2 miles east-south-east from locality TT16. 14° 36′ S, 133° 15′ E. Collected by S. K. Skwarko, 8.9.1960.

TT18: 10 miles east of Beswick Homestead, 5.5 miles south of Maranboy-Mainoru road. Katherine 1 : 250,000 Sheet 14° 38′ S, 133° 14½′ E. Collected by S. K. Skwarko, 9.9.1960.

TT19: Halfway between locality TT10 and TT11. 14° 23½′ S, 133° 26′ E. Collected by S. K. Skwarko, 10.9.1960.

TT20: 1.5 miles west of Day Lagoon; approximately 18 miles west of Borroloola. Bauhinia Downs 1 : 250,000 Sheet 16° 06′ S, 136° 05′ E. Collected by H. G. Roberts and S. K. Skwarko, 16.9.1960.

TT21: 1.0 mile west of Ryan Bend Waterhole on Batten Creek; approximately 20 miles west-south-west from Borroloola. Bauhinia Downs 1 : 250,000 Sheet 16° 08′ S, 136° 02½′ E. Collected by H. G. Roberts and S. K. Skwarko, 15.9.1960.

TT22: Batten Creek, 4 miles south-east of Cow Lagoon (Clarke Creek). Close to the junction of four 1-mile Sheets. Bauhinia Downs 1 : 250,000 Sheet 16° 15′ S, 135° 59½′ E. Collected by S. K. Skwarko, 15.9.1960.

TT23: About 15 miles north of Cow Lagoon. Bauhinia Downs 1 : 250,000 Sheet 16° 01′ S, 135° 57½′ E. Collected by S. K. Skwarko, 15.9.1960.

TT24: 4 miles north-east of Top Station Hill (at junction of McArthur River and Tooganinie Creek). Bauhinia Downs 1 : 250,000 Sheet 16° 46½′ S, 135° 38′ E. Collected by S. K. Skwarko, 16.9.1960.

TT25: 1 mile east of Borroloola Jump-up (approximately 15 miles west of Borroloola). Bauhinia Downs 1 : 250,000 Sheet 16° 08′ S, 136° 09′ E. Collected by S. K. Skwarko, 16.9.1960.

TT26: 1.25 miles north of Borroloola. Bauhinia Downs 1 : 250,000 Sheet 16° 03′ S, 136° 18½′ E. Collected by S. K. Skwarko, 17.9.1960.

TT27: 1 mile north-west of Borroloola. Bauhinia Downs 1 : 250,000 Sheet 16° 03½′ S, 136° 18′ E. Collected by S. K. Skwarko, 18.9.1960.

TT28: In cliffs just east of the main road, 4½ miles south of Ellis Hut. Bauhinia Downs 1 : 250,000 Sheet 16° 24′ S, 135° 42′ E. Collected by S. K. Skwarko, 20.9.1960.

TT29: 5 miles west along O. T. Downs road from Three Knobs. Bauhinia Downs 1 : 250,000 Sheet 16° 33½′ S, 135° 21′ E. Collected by S. K. Skwarko, 22.9.1960.

TT31: 5 miles at 330° of the Old Bauhinia Downs Homestead. Bauhinia Downs 1 : 250,000 Sheet 16° 09½′ S, 135° 25½′ E. Collected by A. Webb and S. K. Skwarko, 22.9.1960.

TT32: 2 miles north-west of Old Bauhinia Downs Homestead. Bauhinia Downs 1 : 250,000 Sheet 16° 11′ S, 135° 27′ E. Collected by A. Webb, 22.9.1960.

TT33: 5 miles north-west of the Old Bauhinia Downs Homestead. Bauhinia Downs 1 : 250,000 Sheet 16° 10′ S, 135° 25′ E. Collected by S. K. Skwarko, 23.9.1960.

TT34: About 8 miles north-east of Three Knobs, and 6 miles north of Leila Top Crossing. Bauhinia Downs 1: 250,000 Sheet 16° 27½′ S, 135° 32′ E. Collected by K. A. Plumb, 1960.

TT35: 1.5 miles south-east of the abandoned Rosie Creek Homestead. Mount Young 1 : 250,000 Sheet 15° 44′ S, 135° 40′ E. Collected by A. G. L. Paine and S. K. Skwarko, 12.9.1960.

TT36: About 8 miles north-west of Tanumbirini Homestead; close to border of Hodgson Downs and Tanumbirini Sheet areas. Tanumbirini 1 : 250,000 Sheet 16° 03′ S, 134° 11′ E. Collected by A. G. L. Paine, 1.10.1960.

TT37: About 10 miles west of Tanumbirini Homestead. Tanumbirini 1 : 250,000 Sheet 16° 18′ S, 134° 43′ E. Collected by A. G. L. Paine, 27.9.1960.

TT38: About 10 miles west of Tanumbirini Homestead. Tanumbirini 1 : 250,000 Sheet 16° 11′ S, 134° 44′ E. Collected by A. G. L. Paine, 27.9.1960.

TT39: About 2.5 miles east of Days Lagoon. Bauhinia Downs 1 : 250,000 Sheet. Collected by Mount Isa Mines Ltd., 1956.

TT40: About 5 miles south-east of Coronet Hill mine; 2 miles due east of the southern tip of Little Mary Waterhole. Mount Evelyn 1 : 250,000 Sheet 13° 46′ S, 132° 24′ E. Collected by S. K. Skwarko, 7.6.1961.

TT42: 4 miles south-east of Murrejerro Waterhole. Roper River 1 : 250,000 Sheet 14° 34′ S, 135° 02′ E. Collected by S. K. Skwarko, 30.6.1961.

TT43: Approximately 20 miles north-north-west of Wonmurri Waterhole. Roper River 1 : 250,000 Sheet 14° 10′ S, 135° 06′ E. Collected by S. K. Skwarko, 2.7.1961.

TT44: About 9 miles north-west of Wonmurri Waterhole. Roper River 1 : 250,000 Sheet 14° 22′ S, 135° 8′ E. Collected by S. K. Skwarko, 3.7.1961.

TT45: About 2 miles north of the Roper Valley road; about 18 miles east of the Roper River Mission. Urapunga 1 : 250,000 Sheet 14° 44′ S, 134° 59′ E. Collected by S. K. Skwarko, 8.7.1961.

TT46: About 14.5 miles east of Roper River Mission. Urapunga 1 : 250,000 Sheet 14° 40½′ S, 135° 32½′ E. Collected by S. K. Skwarko, 10.7.1961.

TT47: 2.3 miles north-north-west of Sentinel Hill. Urapunga 1 : 250,000 Sheet 14° 33′ S, 133° 41½′ E. Collected by S. K. Skwarko, 13.7.1961.

TT48: About 6.5 miles north-west of Die Jumb Peak. Urapunga 1 : 250,000 Sheet 14° 11′ S, 133° 39½′ E. Collected by S. K. Skwarko, 13.7.1961.

TT49: 1.2 miles north of edge of plateau in cliffs facing Katherine River across main Yeuralba mine road. Katherine 1 : 250,000 Sheet 14° 17′ S, 132° 43′ E. Collected by S. K. Skwarko, 21.7.1961.

TT50: Southern coast of Bathurst Island. In wave-cut cliff between Marialampi Point and Pouplimadourie Creek. Melville Island 1 : 250,000 Sheet. Collected by S. K. Skwarko, 1961.

TT51: Southern coast of Bathurst Island, in wave-cut cliff between Pouplimadourie Creek and Mirindow Point. Melville Island 1 : 250,000 Sheet. Collected by S. K. Skwarko, 1961.

TT52: 12 miles north-west to west-north-west of the Mitchiebo Waterhole, in the headwaters of Fish Hole Creek. Mount Drummond 1 : 250,000 Sheet 16° 33′ S, 156° 56′ E. Collected by H. G. Roberts, 1959.

TT54: About 9 miles south-west of Daly River crossing on road to Dorisvale Homestead. Fergusson River 1 : 250,000 Sheet 14° 26′ S, 131° 27′ E. Collected by S. K. Skwarko, 19.8.1961.

TT55: On both sides of creek, on the western edge of Yiyintyi Range; 20 miles north-north-east of Rosie Creek. Mount Young 1 : 250,000 Sheet 15° 25½′ S, 135° 42′ E. Collected by K. A. Plumb and S. K. Skwarko, 8.9.1961.

TT56: Tawallah Pocket—16 miles from Rosie Creek bearing 195°. Mount Young 1 : 250,000 Sheet 15° 56′ S, 135° 58′ E. Collected by S. K. Skwarko, 11.9.1961.

TT57: 11 miles from Rosie Creek, bearing 188°. Mount Young 1 : 250,000 Sheet 15° 51½′ S, 135° 38′ E. Collected by S. K. Skwarko, 11.9.1961.

TT58: 20 miles north-west of Tanumbirini Homestead. Hodgson Downs 1 : 250,000 Sheet 15° 58′ S, 134° 38′ E. Collected by A. G. L. Paine and S. K. Skwarko, 11.9.1961.

TT59: About 0.5 miles south-west of Seigals Creek Homestead, in cliffs on west bank of Agnes Creek. Calvert Hills 1 : 250,000 Sheet 17° 36½′ S, 137° 34′ E. Collected by S. K. Skwarko, 19.9.1961.

TT60: About 12 miles east of Seigals Creek Homestead. Calvert Hills 1 : 250,000 Sheet 17° 39′ S, 137° 46′ E. Collected by S. K. Skwarko, 24.9.1961.

TT61: North side of Calvert Hills Wollogorang Road, about 30 miles east of Calvert Hills Homestead. Calvert Hills 1 : 250,000 Sheet 17° 11′ S, 137° 43½′ E. Collected by S. K. Skwarko, 26.9.1961.

TT62: Eagle Waterhole on Bluey Creek about 11 miles north-west of Calvert Hills Homestead. Calvert Hills 1 : 250,000 Sheet 17° 10′ S, 137° 11′ E. Collected by Enterprise Exploration Co. Pty. Ltd., 1952.

TT63: On the east side of Brunette Downs-Creswell Road, 2.3 miles north-east of Creswell No. 5 Bore. Brunette Downs 1 : 250,000 Sheet 18° 00½′ S, 136° 57′ E. Collected by M. A. Randal and S. K. Skwarko, 6.7.1962.

TT64: 25 miles north-west of Bulman. Mount Marumba 1 : 250,000 Sheet 13° 24½′ S, 134° 09′ E. Collected by S. K. Skwarko, 22.7.1962.

TT65: 30.6 miles at 260° from the northern tip of Fowler Island. Blue Mud Bay 1 : 250,000 Sheet 13° 23′ S, 135° 01′ E. Collected by S. K. Skwarko, 4.8.1962.

TT66: Headwaters of Walker River. Blue Mud Bay 1 : 250,000 Sheet 13° 34′ S, 135° 29½′ E. Collected by K. A. Plumb, 28.8.1962.

TT67: Walker River. Blue Mud Bay 1 : 250,000 Sheet 13° 38½′ S, 135° 29′ E. Collected by D. Dunnet, 27.8.1962.

TT68: Upper Walker River. Blue Mud Bay 1 : 250,000 Sheet 13° 37′ S, 135° 30′ E. Collected by K. A. Plumb, 28.8.1962.

TT69: Pack Saddle about 6.5 miles east-south-east of Calvert Hills Homestead. Calvert Hills 1 : 250,000 Sheet 17° 10′ S, 137° 11′ E. Collected by Enterprise Exploration Co. Pty. Ltd., 1952.

REFERENCES

BONARELLI, G., and NAGERA, J. J., 1919—Observaciones geologicas en las immediaciones del Laga San Martin (Territoria de Santa Cruz). *Minst. Agricult. (Argentina) Direct. Gen. de Minas, Geol. y Hidrol. Ser. B (Geologia) Bol. 27.*

BROWN, H. Y. L., 1895—Government Geologist's report on explorations in the Northern Territory, *S. Aust. Parl. Papers* 82.

BROWN, H. Y. L., 1906—Explorations made by the Government Geologist and Staff during 1905. *S. Aust. parl. Papers* 55.

BROWN, H. Y. L., 1908—Geological reconnaissance from Gulf to the MacArthur River, etc. *S. Aust. parl. Papers* 25.

BRUNNSCHWEILER, R. O., 1957—The geology of Dampier Peninsula, north-western Australia. *Bur. Min. Resour. Aust. Rep.* 13.

BRUNNSCHWEILER, R. O., 1960—Marine fossils from the Upper Jurassic and the Lower Cretaceous of Dampier Peninsula, Western Australia. *Bur. Min. Resour. Aust. Bull.* 59.

CARTER, E. K., BROOKS, J. H., and WALKER, K. R., 1961—The Precambrian mineral belt of north-western Queensland. *Bur. Min. Resour. Aust. Bull.* 51.

CASEY, R., 1952—Some genera and subgenera, mainly new, of Mesozoic Heterodont Lamellibranchs. *Proc. malac. Soc. London,* 29 (4).

COX, L. R., 1961—The molluscan fauna and probable Lower Cretaceous age of the Nanutarra Formation of Western Australia. *Bur. Min. Resour. Aust. Bull.* 61.

CRESPIN, IRENE, 1963—Lower Cretaceous arenaceous Foraminifera of Australia. *Bur. Min. Resour. Aust. Bull.* 66.

CRESPIN, IRENE, and EVANS, P. R., 1962—Cretaceous microfossils from the Hay River area, Northern Territory. *Bur. Min. Resour. Aust. Rec.* 1962/19 (unpubl.).

DAILY, B., 1956—Geological observations on Melville and Bathurst Islands, Northern Territory. *Adelaide University* (unpubl.).

DAINTREE, R., 1872—Notes on the geology of the colony of Queensland. *Quart. J. geol. Soc. Lond.*, 28, 271-317.

DICKINS, J. M., 1960—Characters and relationships of the Mesozoic pelecypod *Pseudavicula. Palaeontology*, 3 (3), 392-396.

DICKINS, J. M., 1960—Probable Neocomian (Lower Cretaceous) fossils from the Northern Territory. *Bur. Min. Resour. Aust. Rec.* 1960/18 (unpubl.).

EBERSIN, A. G., 1960—Osnovy Palaeontologii (Molluscs-Loricates, Bivalves, Scaphopods). *Moscow, Acad. Sci. USSR.*

ETHERIDGE, R., Jnr, 1892—*In* JACK, R. L., and ETHERIDGE, R. The Geology and Palaeontology of Queensland and New Guinea. *Govt Printer, Brisbane, Qld geol. Surv. Publ.* 92.

ETHERIDGE, R., Jnr, 1895—Official contributions to the palaeontology of South Australia. *S. Aust. parl. Papers* 82.

ETHERIDGE, R., Jnr, 1902a—The Cretaceous Mollusca of South Australia and the Northern Territory. *Mem. Roy. Soc. S. Aust.*, 2 (1), 1-54; 7 pls.

ETHERIDGE, R., Jnr, 1902b—Two undescribed Pelecypoda from the Lower Cretaceous of Queensland in the collection of the Queensland Museum. *Rec. Qld. Mus.*, 4

ETHERIDGE, R., Jnr, 1904—On the occurrence of the genus *Ptychoceras(?)* and other additional fossils in the Cretaceous beds of the northern Territory of South Australia. *Rec. Aust. Mus.*, 5 (2), 108-115.

ETHERIDGE, R., Jnr, 1907a—Official contribution to the palaeontology of South Australia. *S. Aust. parl. Papers* 54.

ETHERIDGE, R., Jnr, 1907b—Preliminary report on other fossils forwarded to me by the Government Geologist of South Australia. *S. Aust. parl. Papers* 55.

GLAESSNER, M. F., 1957—Cretaceous belemnites from Australia, New Guinea and New Zealand. *Aust. J. Sci.*, 20 (3), 88, 89.

GRAY, G. J., and JENSEN, H. I., 1915—Report on Maranboy Tinfield. *Bull. N. Terr. Aust.*, 14, 20-31.

HINDE, G. J., 1893—Note on a radiolarian rock from Fanny Bay, Port Darwin, Australia. *Quart. J. geol. Soc. Lond.*, 49, 221.

HARE, R., and Associates, 1962—Well Completion Report. Bathurst Island Well No 2 (unpubl.).

HOSSFELD, P. S., 1937—The tin deposits of the Buldiva-Collia area, Daly River District. *Aer. Surv. N. Aust.*, 18.

HOSSFELD, P. S., 1954—Stratigraphy and structure of the Northern Territory of Australia. *Trans. Roy. Soc. S. Aust.*, 77, 103-161.

JENSEN, H. I., 1914—Progress report on the geological survey of the Pine Creek district, N.T. *Bull. N. Terr.*, 10a.

JENSEN, H. I., 1915—Geological report on country between Pine Creek and Tanami etc. *Bull. N. Terr.*, 14.

KOROBKOV, I. A., 1960—In Ebersin, 1960.

LAING, A. C. M., and POWER, P. E., 1959—New names in Queensland stratigraphy, Carpentaria Basin. *Aust. Oil Gas J.*, 5.9.28.

MOORE, C., 1870—Australian Mesozoic geology and palaeontology. *Quart. J. geol. Soc. Lond.*, 26 (2).

NAKANO, M., 1960—Stratigraphic occurrences of the Cretaceous Trigoniids in the Japanese Islands and their faunal significances. *J. Sci. Hiroshima Univ.* Ser. C, 3(2).

NAKANO, M., 1965—On the Megatrigoniinae. *J. Sci. Hiroshima Univ.* Ser. C, 5(1).

NEWTON, R. B., 1915—On some molluscan remains from the opal deposits (Upper Cretaceous) of New South Wales. *Proc. malac. Soc. Lond.*, 11.

NOAKES, L. C., 1949—A geological reconnaissance of the Katherine-Darwin Region, Northern Territory, with notes of mineral deposits. *Bur. Min. Resour. Aust. Bull.* 16.

NOAKES, L. C., ÖPIK, A. A., and CRESPIN, I., 1952—Bonaparte Gulf Basin, north western Australia, a stratigraphical summary with special reference to the Gondwana System. *Cong. Int. Geol. XIXieme Sess. Alger. Symposium sur le series de Gondwana*, 91-106.

ÖPIK, A. A., CARTER, E. K., and NOAKES, L. C., 1961—Explanatory notes on the Mount Isa 4-mile geological sheet. *Bur. Min. Resour. Aust. expl. Notes*, 20.

QUINLAN, T., 1962—An outline of the geology of the Alice Springs area. In *Sci. ind. Res. Org. Melb. Land Res. Ser.* 6.

ROCHOW, K., 1963—The geology and occurrence of ground water on the Charlotte Waters 4-mile sheet, N. T. *Bur. Min. Resour. Aust.* (unpubl. MS.)

SAVELIEV, A. A., 1958—Lower Cretaceous Trigoniids from Mangyschlack and Western Turkmenia. *Trudy VNIGRI, SSSR.*, (125).

SKWARKO, S. K., 1962—Notes on Australian Lower Cretaceous Palaeogeography. *Bur. Min. Resour. Aust. Rec.* 1962/11 (unpubl.).

SKWARKO, S. K., 1963a—Australian Mesozoic Trigoniids. *Bur. Min. Resour. Aust. Bull.* 67.

SKWARKO, S. K., 1963b—A new Upper Cretaceous Ophiuroid from Australia. *Palaeontology*, 6 (3), 279-81.

SKWARKO, S. K., 1965—Some Lower Cretaceous Trigoniidae from eastern Australia (in preparation).

SMITH, K. G., 1963—Hay River, N.T.—1 : 250,000 Geological Series. *Bur. Min. Resour. Aust. explan. Notes* SF/53-16.

SMITH, K. G., and VINE, R. R., 1960—Summary of the geology of the Tobermory 4-mile geological sheet. Bur. Min. Resour. Aust. Rec. 1960/71 (unpubl.).

SPATH, L. F., 1926—On the zones of the Cenomanian and the uppermost Albian. *Proc. Geol. Ass.*, 37 (4), 420.

SULLIVAN, C. J., and ÖPIK, A. A., 1951—Ochre deposits, Rumbalara, Northern Territory. *Bur. Min. Resour. Aust. Bull.* 8.

TERPSTRA, G. R. J., 1963—Palaeontological examination of surface samples from Eromanga Basin. *Bur. Min. Resour. Aust. Rec.* 1963/85 (unpubl.).

TERPSTRA, G. R. J., and EVANS, P. R., 1962—Palaeontological examination of samples from Delhi-Santos Mornington Island No. 1 Well, Carpentaria Basin, Queensland. *Bur. Min. Resour. Aust. Rec.* 1962/177 (unpubl.).

TERPSTRA, G. R. J., and EVANS, P. R., 1963—Cretaceous microfossils from Andado Station, Northern Territory. *Bur. Min. Resour. Aust. Rec.* 1963/108 (unpubl.).

TRAVES, D. M., 1955—The geology of the Ord-Victoria Region, Northern Australia. *Bur. Min. Resour. Aust. Bull.* 27.

VEEVERS, J. J., 1962—*Rhizocorallium* in the Lower Cretaceous rocks of Australia. *Bur. Min. Resour. Aust. Bull.* 62 (2).

VIALOV, O. S., 1960 In Ebersin, 1960.

VOISEY, A. H., 1938—Notes on the stratigraphy of the Northern Territory of Australia with special reference to the Jurassic system. *J. Roy. Soc. N.S.W.*, 72, 136-159.

WALKOM, A. B., 1937—In P. S. Hossfeld: The tin deposits in the Buldiva-Collia area, Daly River District. *Aer. Surv. N. Aust., N.T., Rep.* 18.

WALPOLE, B. P., 1958—The Maranboy tin field, Northern Territory. *Bur. Min. Resour. Aust. Bull.* 37.

WELLS, A. T., STEWART, A., and SKWARKO, S. K., 1964—Geology of south-east margin of Amadeus Basin. *Bur. Min. Resour. Aust. Records* 1964 (unpubl.).

WHITE, M. E., 1961—Report on 1960 collections of Mesozoic plant fossils from the Northern Territory. *Bur. Min. Resour. Aust. Rec.* 1961/146 (unpubl.).

WHITEHOUSE, F. W., 1924—Dimitobelidae—a new family of Cretaceous belemnites. *Geol. Mag.*, 61 (723).

WHITEHOUSE, F. W., 1925—On Rolling Downs fossils collected by Prof. J. W. Gregory. *Trans. Roy. Soc. S. Aust.*, 49.

WHITEHOUSE, F. W., 1928—The correlation of the marine Cretaceous deposits of Australia. *Rept. Aust. Assoc. Adv. Sci.* 18 (1926), 275-280.

WHITEHOUSE, F. W., 1946—A marine early Cretaceous fauna from Stanwell (Rockhampton District). *Proc. Roy. Soc. Qld*, 57 (2).

WHITEHOUSE, F. W., 1954—Geology of the Queensland portion of the Great Artesian Basin. Appendix G. Artesian water supplies in Queensland. *Dept of Co-ordinator of Public Works, Queensland.*

WOODS, H., 1899-1913—The Cretaceous Lamellibranchia. *Monogr. palaeontogr. Soc.*, 53 to 66.

WOODS, J. E. T., 1889—The Desert Sandstone. *J. Roy. Soc. N.S.W.*, 22, 290-335.

WOODS, J. T., 1962—A new species of *Hatchericeras* (Ammonoidea) from North Queensland. *J. Geol. Soc. Aust.*, 8 (2).

WOODS, J. T., 1963—Marine Cretaceous fossils from the Cape Melville 4-mile Sheet area. (unpubl.).

WOOLNOUGH, W. G., 1912—Report on the geology of the Northern Territory. *Bull. N. Terr. Aust.*, 4.

WRIGHT, C. W., 1963—Cretaceous ammonites from Bathurst Island, Northern Australia. *Palaeontology*, 6 (4).

WRIGHT, R. L., 1963—Deep weathering on erosion surfaces in the Daly River Basin, Northern Territory. *J. geol. Soc. Aust.*, 10 (1), 151-163.

PLATES

All figures are reproduced at natural size, and all specimens photographed from lateral view, except where stated to the contrary.

PLATE 1

Figs		Page
1–4.	*Grammatodon psittaculum* sp. nov.	74
	1. Holotype CPC 4743. Latex cast of external impression of left valve. 2. Paratype CPC 4744. Internal cast of left valve. 3. Anterior view of CPC 4744. 4. Antero-lateral view of both valves in position. CPC 4942. Locality TT35. Late Neocomian.	
6.	*Lopatinia(?)* sp.	72
	Latex cast of impression of inside of ?left valve CPC 4976. Locality YT65. Late Neocomian.	
5, 7, 8.	*Grammatodon arnhemense* sp. nov.	73
	5. Holotype CPC 4932. Latex cast of incomplete right valve. Specimen slightly distorted. 7. Paratype CPC 4931. Latex reproduction of dentition on right valve. 8. Latex copy of distorted right valve. CPC 4933. Locality TT68. Late Neocomian.	
9–12.	*Aucellina hughendenensis* (Etheridge Snr, 1872)	81
	9. Broken mature right valve. CPC 4943. 10. Immature right valve. CPC 4940. 11. Immature left valve. CPC 4939. 12. Left valve distorted by compaction. CPC 4941. Locality TT60. Albian.	
13–17.	*Syncyclonema territorianum* sp. nov.	83
	13. Paratype CPC 4753. Latex cast of external impression of left valve. Locality TT6. 14. Holotype CPC 4754. Latex cast of external impression of right valve. Locality TT6. 15. Internal cast of right valve. CPC 4971. Locality TT35. 16. Latex cast of CPC 4971. 17. Paratype CPC 4755. Internal cast of right valve. Locality TT40. Late Neocomian.	
18, 19.	*Isognomon noakesi* sp. nov.	82
	18. Holotype CPC 4997. Latex cast of internal impression of right valve. 19. Paratype CPC 4998. Latex cast of external impression of left valve. Locality TT64. Late Neocomian.	

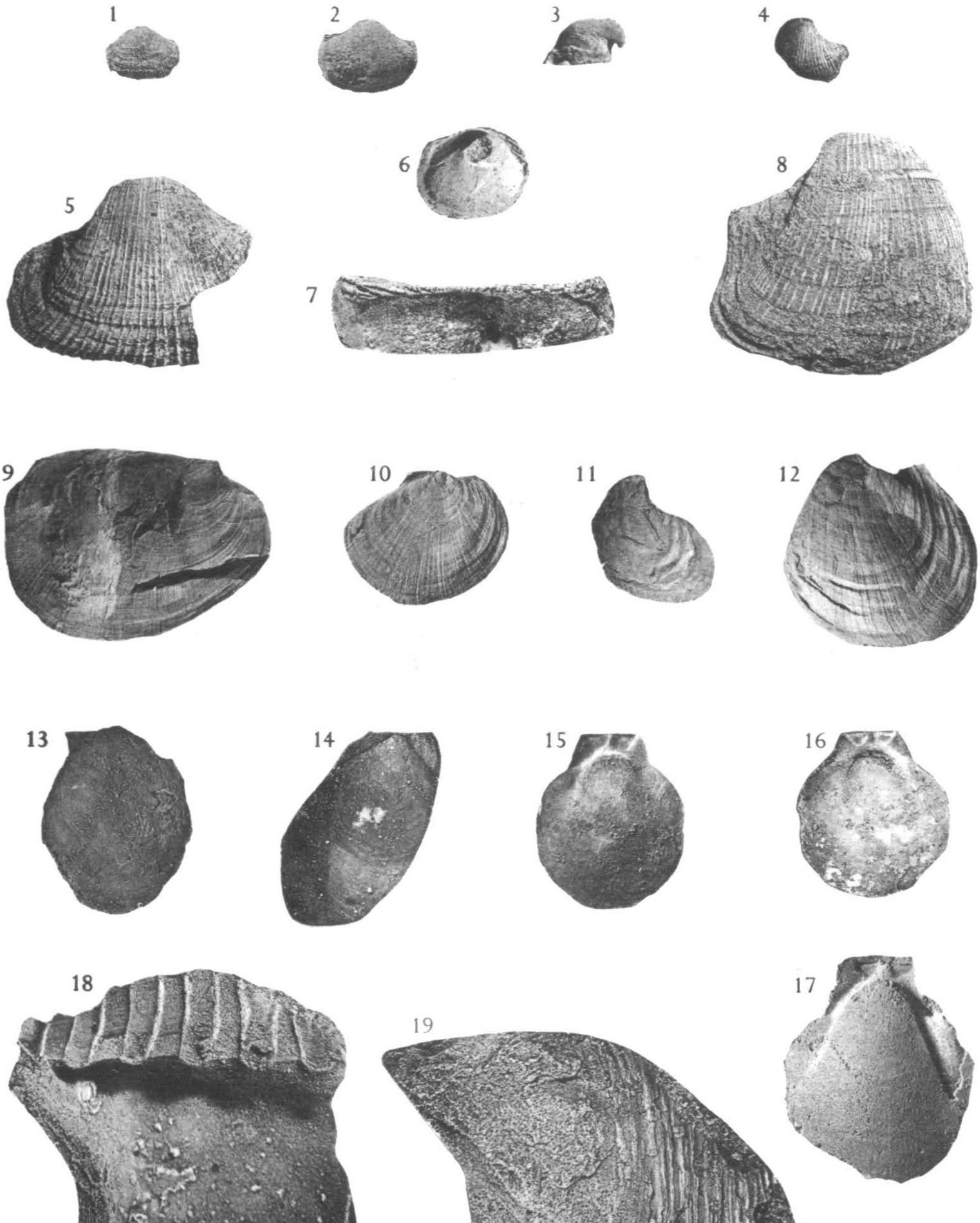

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19

PLATE 2

FIGS		PAGE
1–9.	*Camptonectes magnificus* sp. nov.	85
	1, 2. Shell impression and latex cast respectively of external aspect of young right valve. CPC 4966. Locality TT35.	
	3, 4. Juvenile specimens, CPC 4968, 4969 respectively. Locality TT35.	
	5. Distal portion of right valve. CPC 4965. Locality TT5.	
	6. Latex reproduction of centro-ventral portion of right valve. CPC 4964. Locality TT49.	
	7. Paratype CPC 4758. Latex reproduction of anterior portion of right valve. Locality TT35.	
	8. Holotype CPC 4756. Latex cast of dorsally incomplete external impression of left valve. Locality TT45.	
	9. Paratype CPC 4757. Latex copy of dorsal portion of right valve. Locality TT55. Late Neocomian.	
10	*Entolium* sp.	83
	Latex mould of external impression of right valve. CPC 5051. Locality TT21. Aptian.	

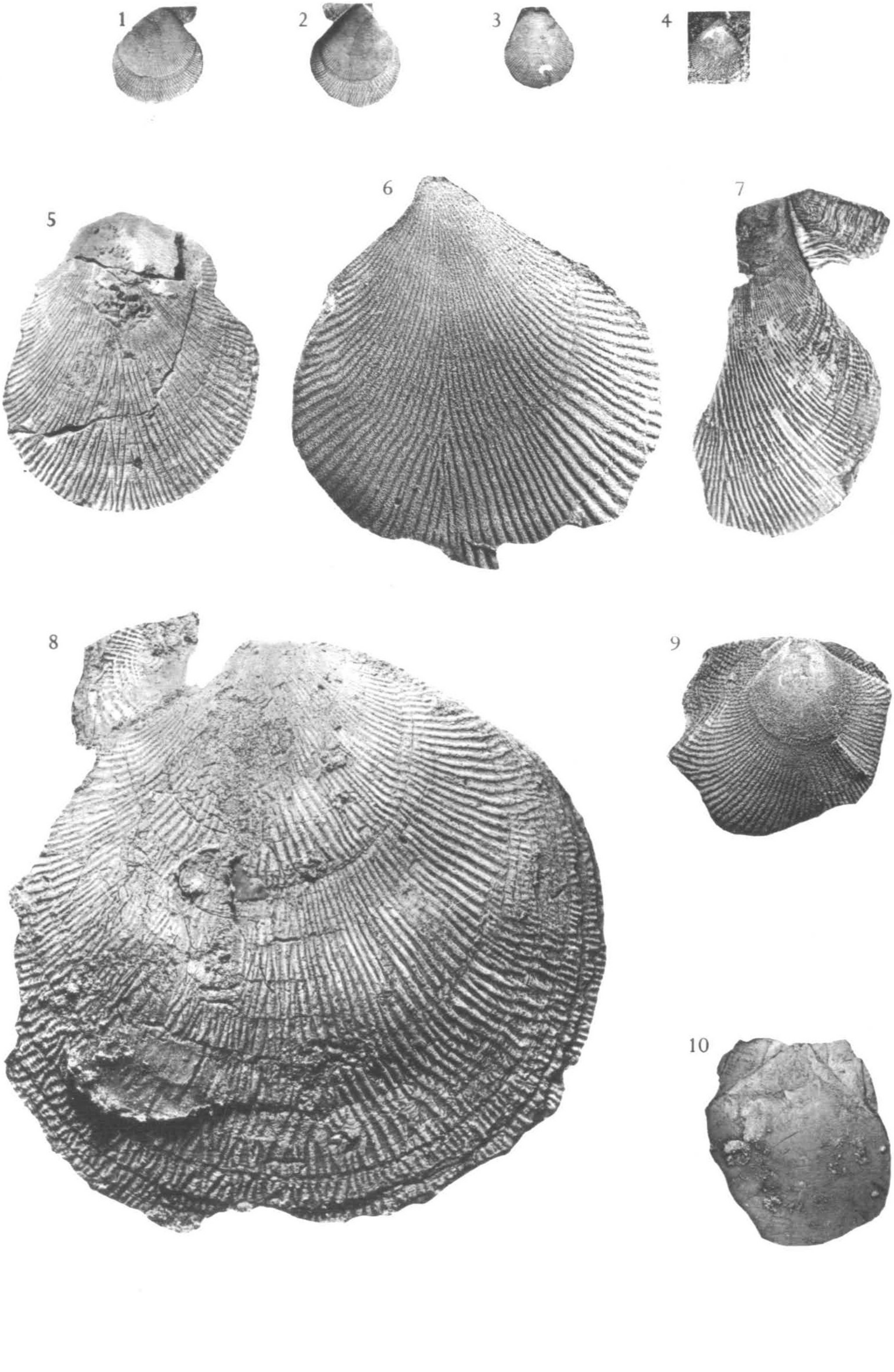

1
2
3
4
5
6
7
8
9
10

PLATE 3

Figs		Page
1, 2, 5.	*Camptonectes*(?) *mainoruensis* sp. nov.	86
	1. Latex cast of external impression of latero-dorsal portion of shell. CPC 4973. 2. Latex copy of mid-ventral portion of shell. CPC 4974. 5. Holotype CPC 4759. Latex cast of external impression of distal portion of shell. Locality TT6. Late Neocomian.	
3, 4, 7, 8, 11	*Camptonectes youngensis* sp. nov.	87
	3, 4. Latex reproductions showing external and internal aspects of left valve. CPC 4975. 7. Holotype CPC 4761. Latex cast of external impression of right valve. 8. Latex cast of internal impression of right valve. CPC 5031. 11. Latex copy showing dorsal portion of right valve. Note posterior ear and well developed ribbing. CPC 4977. Locality TT35. Late Neocomian.	
6, 10.	Ostreidae gen. et sp	92
	6. Latex copy of fragment of lateral portion of shell. CPC 4979. 10. Latex cast of external impression of incomplete valve. CPC 5050. Locality TT35. Late Neocomian.	
9.	*Camptonectes dunni* sp. nov.	84
	Holotype CPC 4760. Latex cast of external impression of right valve. Locality TT55. Late N ocomian.	

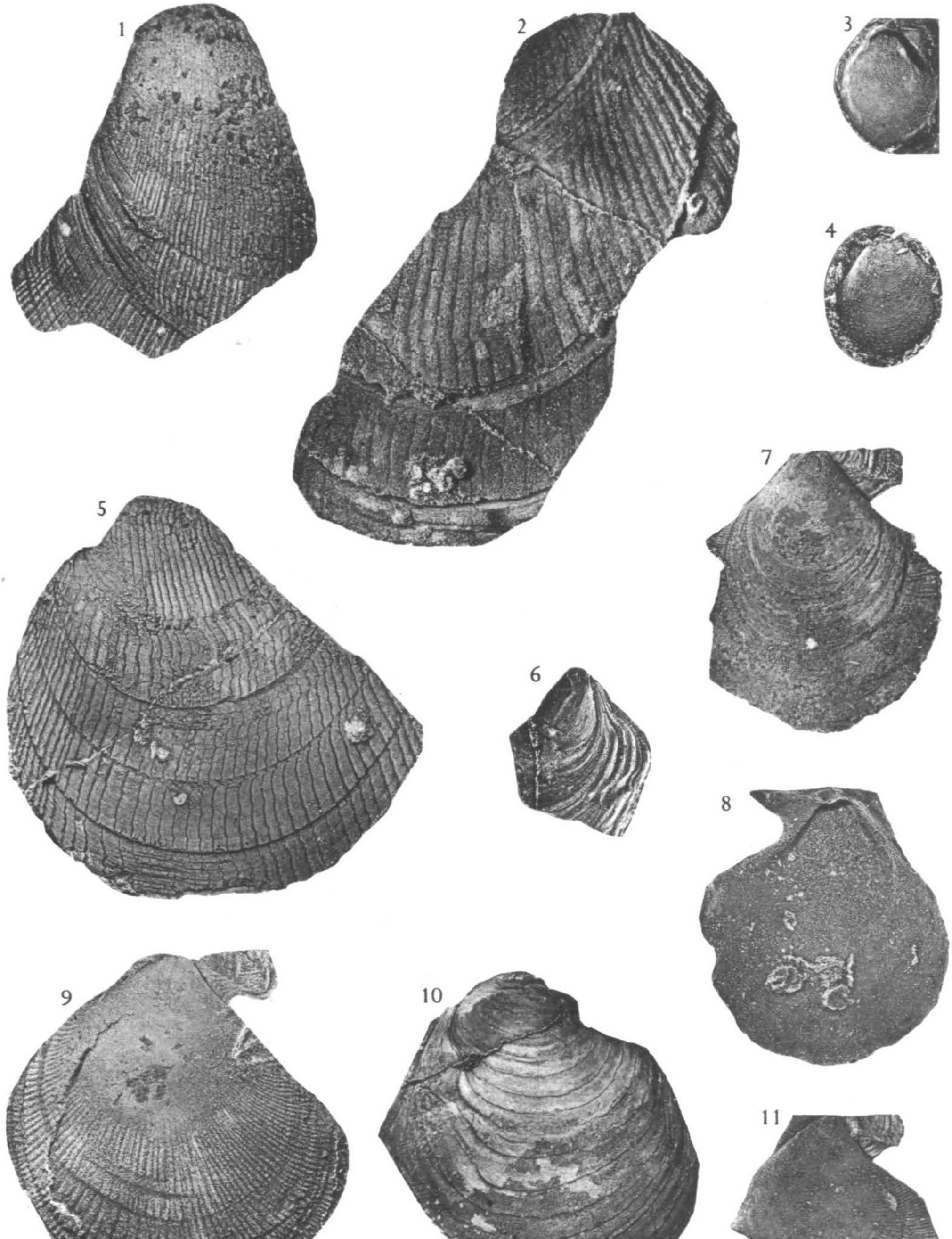

1
2
3
4
5
6
7
8
9
10
11

PLATE 4

Figs		Page
1-3.	*Neithea* sp. cf. *N. occidentalis* (Conrad, 1855)	88
	1. Right valve. CPC 4980. 2. Latex cast of incomplete impression of right valve of large specimen. CPC 4981. 3. Latex cast of incomplete external impression of left valve. CPC 4982. Locality TT6. Late Neocomian.	
4.	*Lima* sp. nov.	90
	Latex cast of dorsally incomplete external impression of right valve. CPC 4988. Locality TT49a. Late Neocomian.	
5-7, 8, 9	*Lima hossfeldi* sp. nov.	89
	5. Holotype CPC 4983. External impression of right valve. Locality TT64. 6. Latex cast of incomplete external impression of left valve. CPC 4944. Locality TT6. 7. Internal cast of right valve. CPC 4957. Locality TT6. ?8. Latex cast of incomplete external impression of left valve CPC 4806. Locality TT55. ?9. Internal cast of left valve. CPC 4978. x½. Locality TT55. Late Neocomian.	
10.	*Lima missiona* sp. nov.	89
	Holotype CPC 4984. Latex ca st of incomplete external impression of right valve. Locality TT45. Late Neocomian.	
11.	*Ostrea* sp. A	91
	Latex cast of internal impression of left valve. CPC 4986. Locality TT64. Late Neocomian.	
12.	*Ostrea* sp. B	92
	Latex cast of internal impression of right valve. CPC 4985. Locality TT35. Late Neocomian.	
13.	*Ostrea woolnoughi* sp. nov.	91
	Latex cast of external aspect of valve. CPC 4987. Locality TT6. Late Neocomian.	

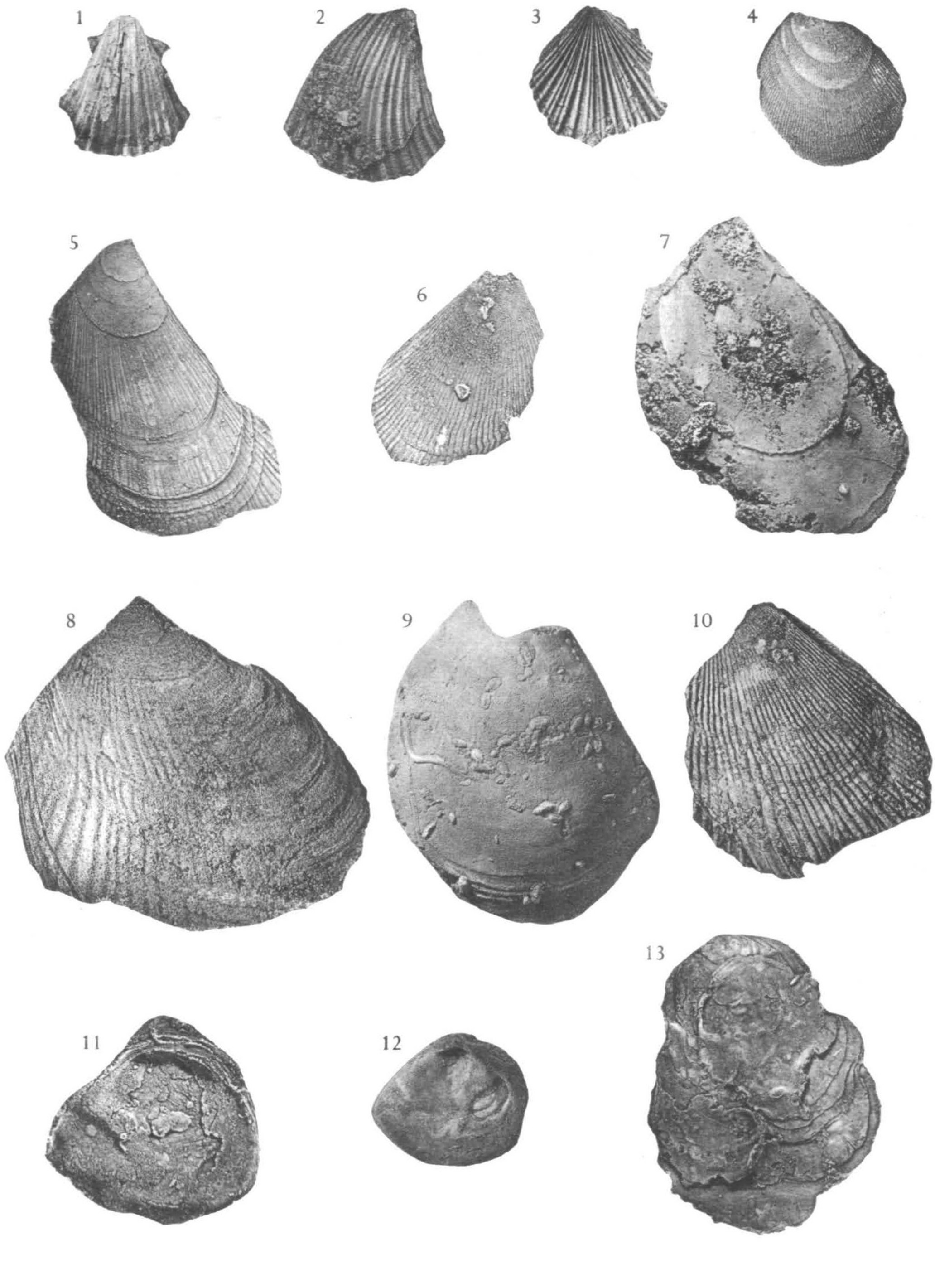

1
2
3
4
5
6
7
8
9
10
11
12
13

PLATE 5

Figs		Page
1–5.	*Pseudavicula dickinsi* sp. nov.	80
	1. Holotype CPC 4746. Latex cast of external impression of dorsal portion of right valve. 2. Latex cast of external impression of right valve. CPC 4936. 3. Latex cast of external impression of left valve. CPC 4937. 4. Paratype CPC 4747. Internal mould of right valve. 5. Latex cast of internal impression of right valve. CPC 4938. Locality TT35. Late Neocomian.	
6–11.	*Exogyra australiana* sp. nov.	92
	6. Latex cast of external impression of left valve with elongate attachment scar. CPC 4999. 7. Holotype CPC 5025. Latex cast of external impression of left valve. 8. Latex cast of external impression of left valve. CPC 5000. 9. Paratype CPC 5029. Latex cast of internal impression of right valve. 10. Paratype CPC 5001. Internal cast of left valve. 11. Latex cast of CPC 5001. Locality TT35. Late Neocomian.	
12.	*Mytilus*(?) sp.	94
	Latex cast of external impressions of two specimens CPC 4946. Late Neocomian. Locality TT64.	
13.	*Modiolus*(?) *katherineus* sp. nov.	95
	Holotype CPC 4745. Latex cast of external impression of left valve. Locality TT35. Late Neocomian.	
14.	*Modiolus*(?) *browni* sp. nov.	94
	Holotype CPC 4935. Latex cast of external impression of right valve. Locality TT64. Late Neocomian.	
15.	*Brachidontes*(?) *voiseyi* sp. nov.	95
	Holotype CPC 4934. Latex cast of external impression of right valve. Locality TT64. Late Neocomian.	
?16,	*Exogyra travesi* sp. nov.	93
17–20.	?16. Latex cast of internal impression of proximal portion of right valve. CPC 4970. 17. Paratype CPC 4992. Latex cast of internal impression of right valve. 18. Holotype CPC 4993. Latex cast of incomplete external impression of left valve. 19. Latex cast of poorly preserved right valve. CPC 4994. 20. Latex cast of strongly incurved left valve. CPC 4995. Locality TT66. Late Noecomian.	
21–23.	*Plicatula townleyi* sp. nov.	90
	21. Holotype CPC 4989. Latex cast of external impression of left valve. 22. Immature specimen. CPC 4990. 23. Paratype CPC 4991. Latex cast of internal impression of right valve. Locality TT64. Neocomian.	

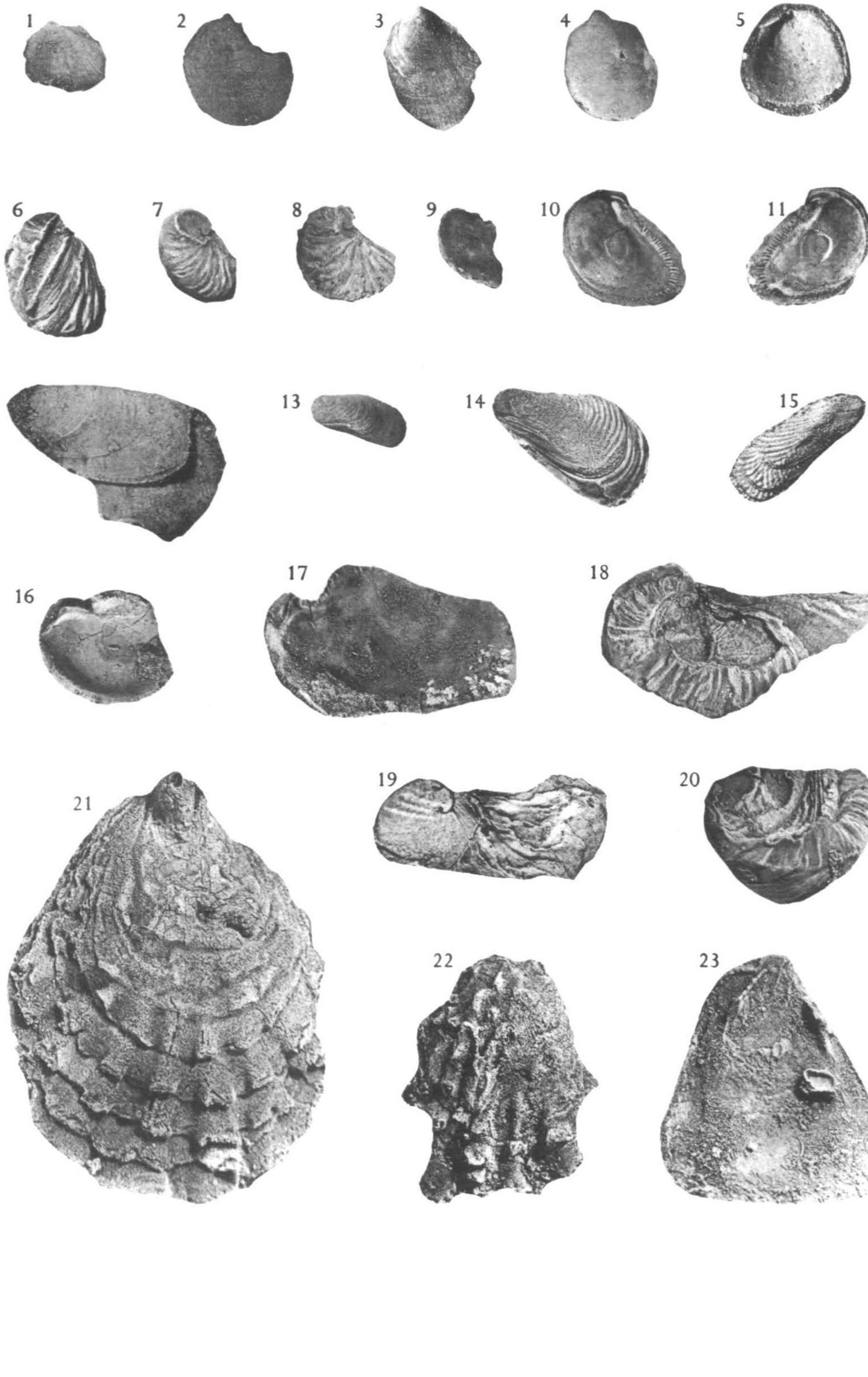

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

PLATE 6

FIGS | | PAGE

1–11 *Maccoyella corbiensis* (Moore, 1870) **74**

1. Latex copy of proximal portion of left valve. Specimen with well developed posterior ear. CPC 4960. Locality TT6.
2. Latex reproduction showing dorsal aspect of left valve. Specimen with incipient secondary ribbing. CPC 4961. Locality TT6.
3. Dorsal view of internal cast of left valve. CPC 4962. Locality TT6.
4. Latex cast of proximal portion of interior of left valve. CPC 4958. Locality TT35.
5. Dorsal view of latex reproduction of right valve. CPC 4955. Locality TT35.
6. External aspect of distal portion of left valve. CPC 4953. Locality TT35.
7. Anterior view of CPC 4953.
8. Latex cast of external impression of right valve. Incomplete. CPC 4954. Locality TT35.
9. Latex copy showing internal view of right valve. CPC 4955. Locality TT35.
10. Latex cast of external impression of left valve. This specimen is devoid of secondary ribbing. CPC 4956. Locality TT35.
11. Incomplete right valve and portion of left valve. Right valve twisted out of position. CPC 4959. Locality TT35. Late Neocomian.

12. *Maccoyella mullamanensis* sp. nov. **77**

Holotype CPC 4947. Latex cast of internal impression of left valve. Locality TT66. Late Neocomian.

13. *Maccoyella* sp. **79**

Latex cast of external impression of right valve. CPC 4945. Locality TT68. Late Neocomian.

14–17. *Maccoyella neocomiana* sp. nov. **77**

14. Latex cast of incomplete external impression of left valve. Specimen somewhat crushed. CPC 4952. Locality TT39. Late Neocomian.
15. Holotype CPC 4751. Latex cast of external impression of left valve (incomplete). Locality TT55. Late Neocomian.
16. Paratype CPC 4752. Latex cast of external aspect of right valve. x5. Locality TT55. Late Neocomian.
17. Internal aspect of left valve. CPC 4951. Locality TT55. Late Neocomian.

18–22. *Maccoyella transitoria* sp. nov. **78**

18. External aspect of left valve. Immature specimen showing shape of posterior ear. CPC 4950. Locality TT56.
19. Paratype CPC 4750. External aspect of right valve. Immature specimen dorsally incomplete. Locality TT56.
20. Anterior view of holotype.
21. Holotype CPC 4748. External aspect of left valve. Locality TT56.
22. Paratype CPC 4749. Latex cast of internal impression of right valve. Locality TT57. Neocomian–Aptian.

23. *Maccoyella* sp. indet. **79**

Latex cast of incomplete external impression of right valve. CPC 4949. x$\frac{1}{2}$. Locality TT21. Aptian.

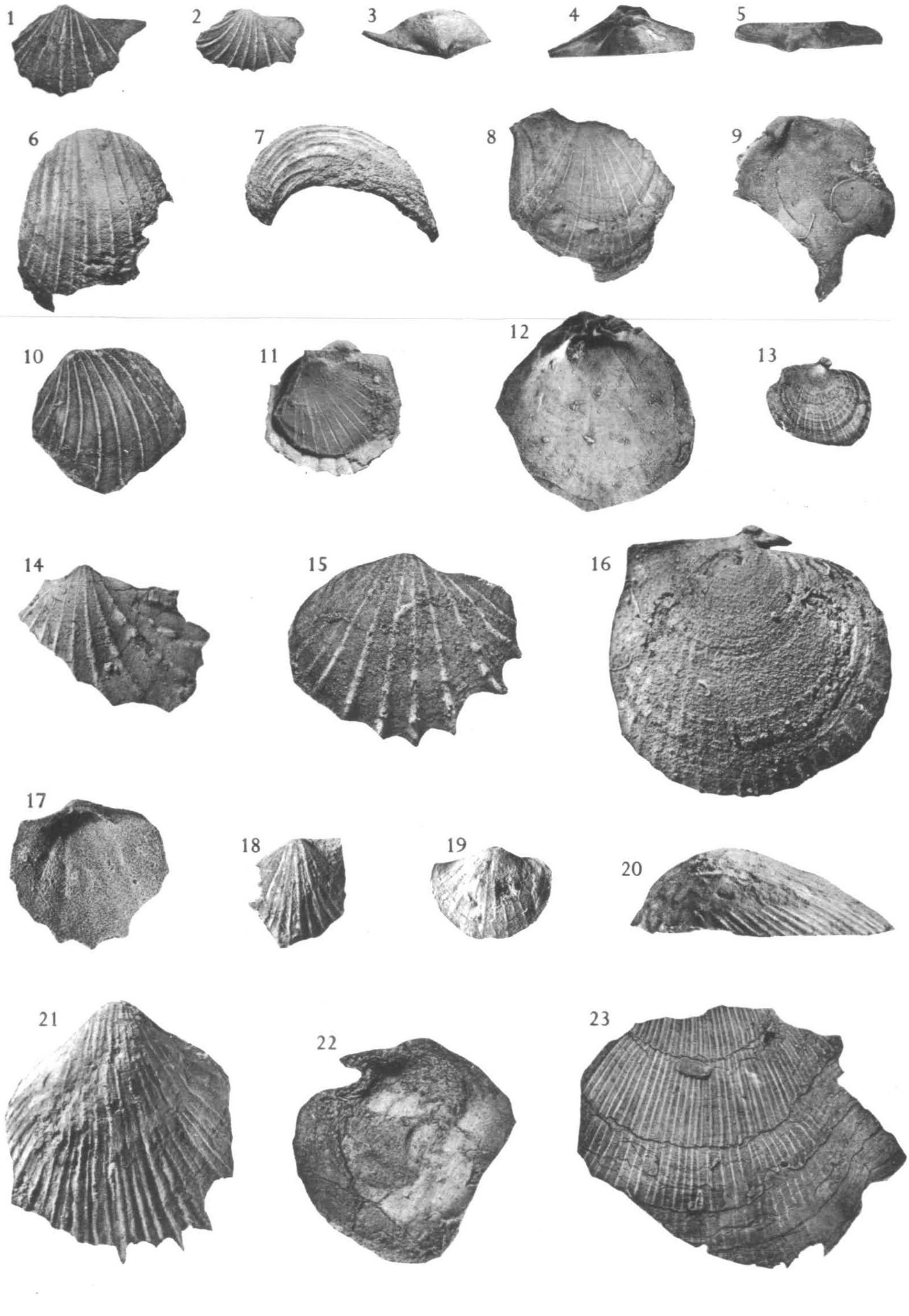

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

PLATE 7

FIGS — PAGE

1\. *Trigonia(?) marumbiana* sp. nov. 96
Holotype CPC 5002. Postero-ventrally incomplete latex reproduction of left valve. Locality TT64. Late Neocomian.

2\. *Trigonia vertistriata* Skwarko, 1963 97
Paratype CPC 4646. Latex cast of incomplete external impression of left valve. Locality TT35. Late Neocomian.

3\. *Trigonia(?)* sp., Skwarko, 1963 97
Latex cast of external impression of left valve. CPC 4661. Locality TT42. Late Neocomian.

4\. *Nototrigonia aberrata* Skwarko, 1963 100
Holotype CPC 4925. Latex cast of posteriorly incomplete external impression of left valve. Locality TT35. Late Neocomian.

5\. *Nototrigonia crescenta* Skwarko, 1963 101
Holotype CPC 4660. Latex cast of external impression of dorsal portion of right valve. Locality TT35. Late Neocomian.

6\. *Nototrigonia yeuralba* Skwarko, 1963 100
Holotype CPC 4663. Latex cast of incomplete external impression of left valve. Locality TT49. Late Neocomian.

7, 9, 10. *Nototrigonia nimbosa* sp. nov. 101
7\. Paratype CPC 5007. Latex cast of external impression of area.
9\. Holotype CPC 5006. Latex cast of external impression of left valve.
10\. Holotype. Latex cast of external impression of right valve. Locality TT66. Late Neocomian.

8\. *Nototrigonia(?)* sp. nov., Skwarko, 1963 101
Latex cast of incomplete external impression of left valve. CPC 4923. Bathurst Island. Cenomanian.

11, 14. *Pterotrigonia (Rinetrigonia) capricornia* Skwarko, 1963 99
11\. Latex cast of external impression of right valve. CPC 5003.
14\. Latex cast of incomplete internal impression of right valve. CPC 5004. Locality TT65. Late Neocomian.

12\. *Iotrigonia (Zaletrigonia) hoepeni* Skwarko, 1963 98
Latex cast of external impression of juvenile specimen. CPC 4927. Locality TT65. Late Neocomian.

13\. *Nototrigonia* sp. cf. *N. cinctuta* (Etheridge Jnr, 1902) 101
Latex cast of external impression of left valve. CPC 4921. Locality TT21. Aptain.

15\. *Opisthotrigonia roperi* Skwarko, 1963 100
Latex cast of external impression of left valve. Holotype CPC 4662. Locality TT42. Late Neocomian.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

PLATE 8

Figs		Page
1, 2.	*Nototrigonia aberrata* Skwarko, 1963	100
	1. Hypotype CPC 5009. Latex cast of external impression of right valve.	
	2. Hypotype CPC 5008. Latex cast of external impression of left valve. Locality TT64 Late Neocomian.	
3, 4, 8, 9.	*Eriphyla(?) bauhiniana* sp. nov.	104
	3. Holotype CPC 5042. Latex cast of external impression of left valve. Locality TT21. Aptian.	
	4. Paratype CPC 5014. Cast of inside of left valve. Locality TT35. Late Neocomian.	
	8. Latex cast of external impression of right valve. Locality TT68. Late Neocomian. CPC 5015.	
	?9. Impression of inside of right valve. CPC 5043. Locality TT35. Late Neocomian.	
5–7.	*Nototrigonia(?) walkeri* sp. nov.	103
	5. Paratype CPC 5010. Latex cast of distally incomplete external imperssion of left valve.	
	6. Paratype CPC 5011. Latex cast of incomplete external impression of right valve.	
	7. Holotype CPC 5012. Latex cast of external impression of incomplete young specimen. Locality TT65. Late Neocomian.	
10.	*Nototrigonia ponticula* Skwarko, 1963	102
	Externo-internal impression of left valve. CPC 5005. Locality TT46. Late Neocomian.	
11.	*Cyrenopsis(?)* sp. nov.	105
	Latex cast of incomplete external impression of left valve. CPC 5013. Locality TT65. Late Neocomian.	
12, 14, 15.	*Cyprina lateralis* sp. nov.	108
	12. Holotype CPC 4762. Latex cast of external impression of right valve.	
	14. Paratype CPC 4763. Latex reproduction of hinge of right valve.	
	15. Dorso-lateral view of latex copy of left valve with prominent posterior ridge. CPC 4764. Locality TT35. Late Neocomian.	
13.	*Austrotrigonia prima* Skwarko, 1963	104
	Holotype CPC 4667. Latex cast of external impression of left valve. Locality TT55. Late Neocomian.	

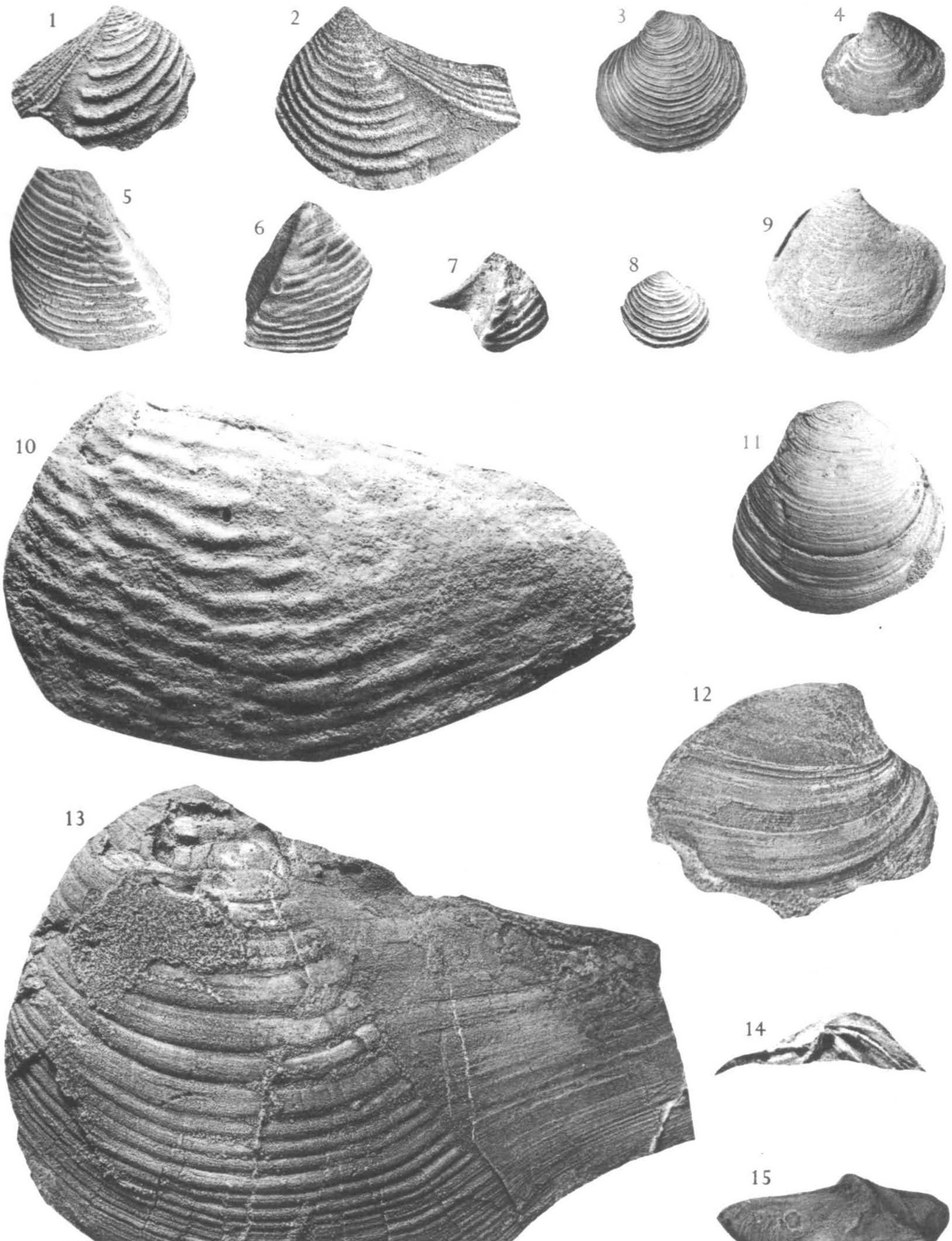

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

PLATE 9

Figs		Page
1–5, 8.	*Epicyprina aboriginea* sp. nov.	106
	1. Paratype CPC 4765. Latex copy of left valve hinge. 2. Latex copy of hinge of left valve of immature specimen. CPC 5023. 3. Holotype CPC 4766. Latex copy of hinge of right valve. 4. Internal cast of right valve with prominent pallial line and sinus. x½ CPC 5021. 5. Holotype, internal cast of right valve. 8. Latex cast of external impression of left valve. CPC 5022. Locality TT35. Late Neocomian.	
6, 7, 9.	*Epicyprina australiana* sp. nov.	108
	6. Holotype CPC 4767. Latex reproduction of hinge of right valve. 7. Holotype. Latex reproduction of hinge of left valve. 9. Holotype. Dorsal view of internal cast of both valves. Locality TT35. Late Neocomian.	


1
2
3
4
5
6
7
8
9

PLATE 10

FIGS		PAGE
1, 2.	*Venilicardia(?) parsonsia* sp. nov.	109
	1. Paratype CPC 5033. Latex cast of impression of inside of right valve.	
	2. Holotype CPC 5032. Latex cast of external impression of right valve. Locality TT65. Late Neocomian.	
3, 4.	*Venilicardia* sp. nov.	110
	3. Holotype CPC 5027. Latex cast of impression of inside of right valve.	
	4. Paratype CPC 5026. Latex cast of impression of inside of left valve. Locality TT35. Late Neocomian.	
5–9.	(?)*Tatella*(?) *aptiana* Whitehouse, 1925	111
	5. Internal cast of right valve. CPC 5016. Locality TT21	
	6. Internal cast of left valve. CPC 5018. Locality TT21.	
	7. Dorsal view of internal cast of both valves. CPC 5017. Locality 7721. Aptian.	
	8. Internal cast of uncrushed young specimen. CPC 4967. Locality TT49a.	
	9. Incomplete external impression of left valve. x2. CPC 4768. Locality TT49a. Late Neocomian.	

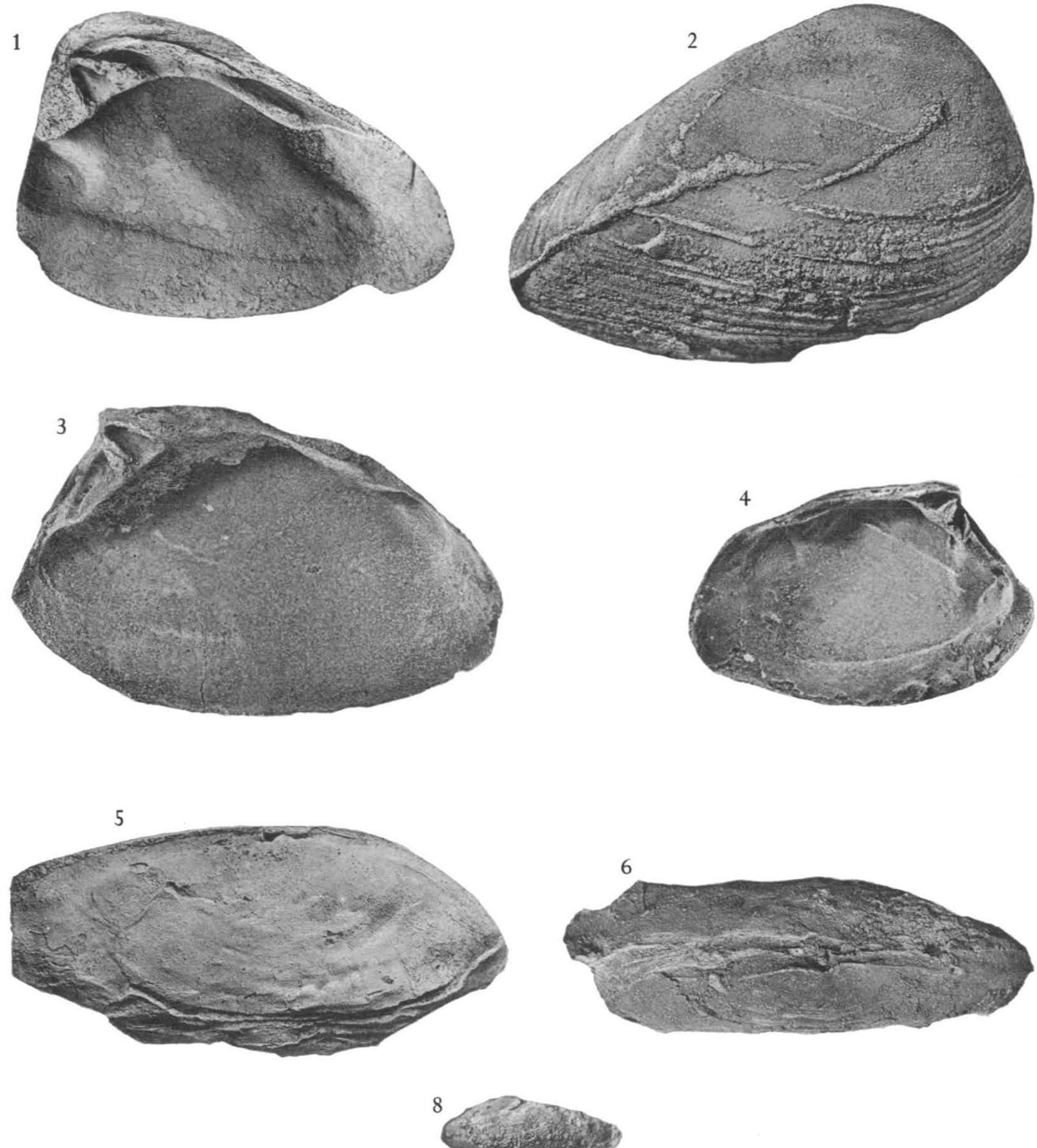

1
2
3
4
5
6
7
8
9

PLATE 11

Figs		Page
1–6.	*Paraesa neocomiana* sp. nov.	113
	1. Holotype CPC 4769. Interno-external cast of right valve. 2. Paratype CPC 4770. Latex cast of internal impression of right valve. 3. Paratype CPC 4771. Dorsal view of latex cast of external impression of both valves. 4. Internal cast of left valve. CPC 5034. 5. Latex cast of external impression of right valve. CPC 4972. 6. Latex cast of external impression of left valve. CPC 4935. Locality TT35. Late Neocomian. not 4935	
7–10.	*Pelecypod genera indet.*	119
	7. Paratype CPC 4772. Latex cast of external impression of left valve. 8. Latex cast of external impression of proximal portion of right valve. CPC 5036. 9. Latex cast of incomplete internal impression of left valve. CPC 4773. 10. Internal cast of left valve. CPC 5037. Locality TT35. Late Neocomian.	
11–13.	*Paraesa antichthona* sp. nov.	112
	11. Paratype CPC 5028. Latex cast of internal impression of left valve. 12. Holotype CPC 5030. Latex cast of internal impression of right valve. 13. Paratype CPC 5019. Latex cast in dorsal view of external impression of proximal portion of right valve. Locality TT65. Late Neocomian.	
14, 15.	(?)'*Macrocallista*' *plana* (Moore, 1870)	113
	14. Incomplete external impression of left valve. CPC 4996. 15. Incomplete external impression of left valve. CPC 5024. Locality TT20. Aptian.	

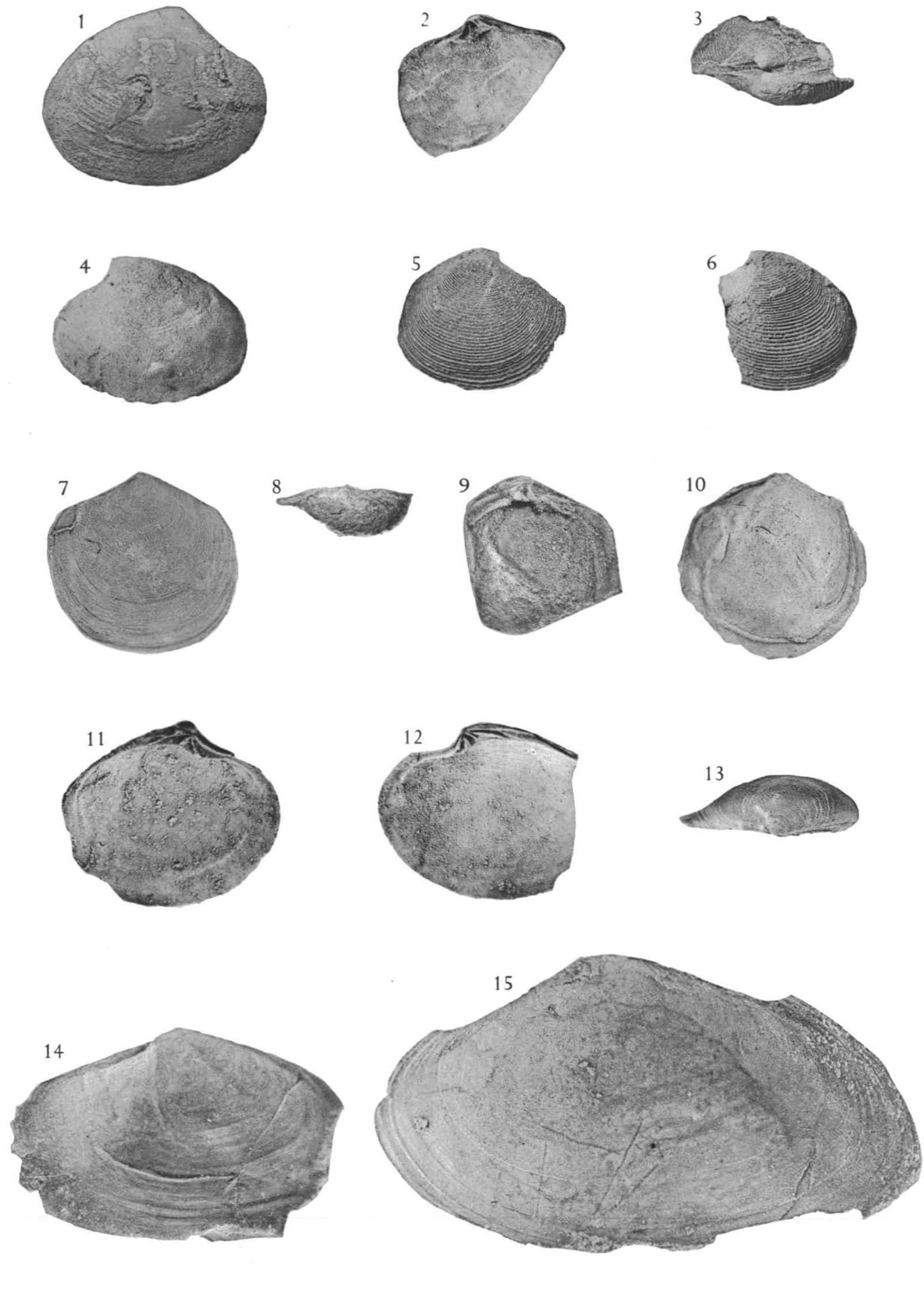

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

PLATE 12

Figs		Page
1–4.	*Panopea rosia* sp. nov.	115
	1. Internal cast of left valve. CPC 4774. 2. Holotype CPC 4775. Dorsal view of internal cast of both valves in position. 3. Anterior view of holotype (internal cast) in position. 4. Paratype CPC 4776. Latex cast of incomplete external impression of both valves. Locality TT35. Late Neocomian.	
5, 6.	*Panopea* sp. aff. *P. aramacensis* (Etheridge Jnr, 1892)	113
	5. Holotype CPC 4963. External impression of portion of valve. 6. Paratype CPC 4948. External view of portion of valve. Locality TT35. Late Neocomian.	
7, 8.	*Panopea yiyintyia* sp. nov.	116
	7. Holotype CPC 4777. Latex cast of incomplete external impression of right valve. 8. Holotype. Dorsal view of internal cast of both valves in position. Locality TT55. Late Neocomian.	
9, 10.	*Panopea* sp. cf. *P. sulcata* Etheridge Snr, 1872	115
	9. External aspect of right valve. CPC 4778. 10. Dorsal view of CPC 4778. Locality TT57. Neocomian–Aptian.	
11, 12.	*Panopea* sp. cf. *P. maccoyi* (Moore, 1870)	114
	11. Externo-internal cast of right valve. CPC 5039. 12. External (?externo-internal) aspect of left valve. CPC 5040. Locality TT57. Neocomian–Aptian.	

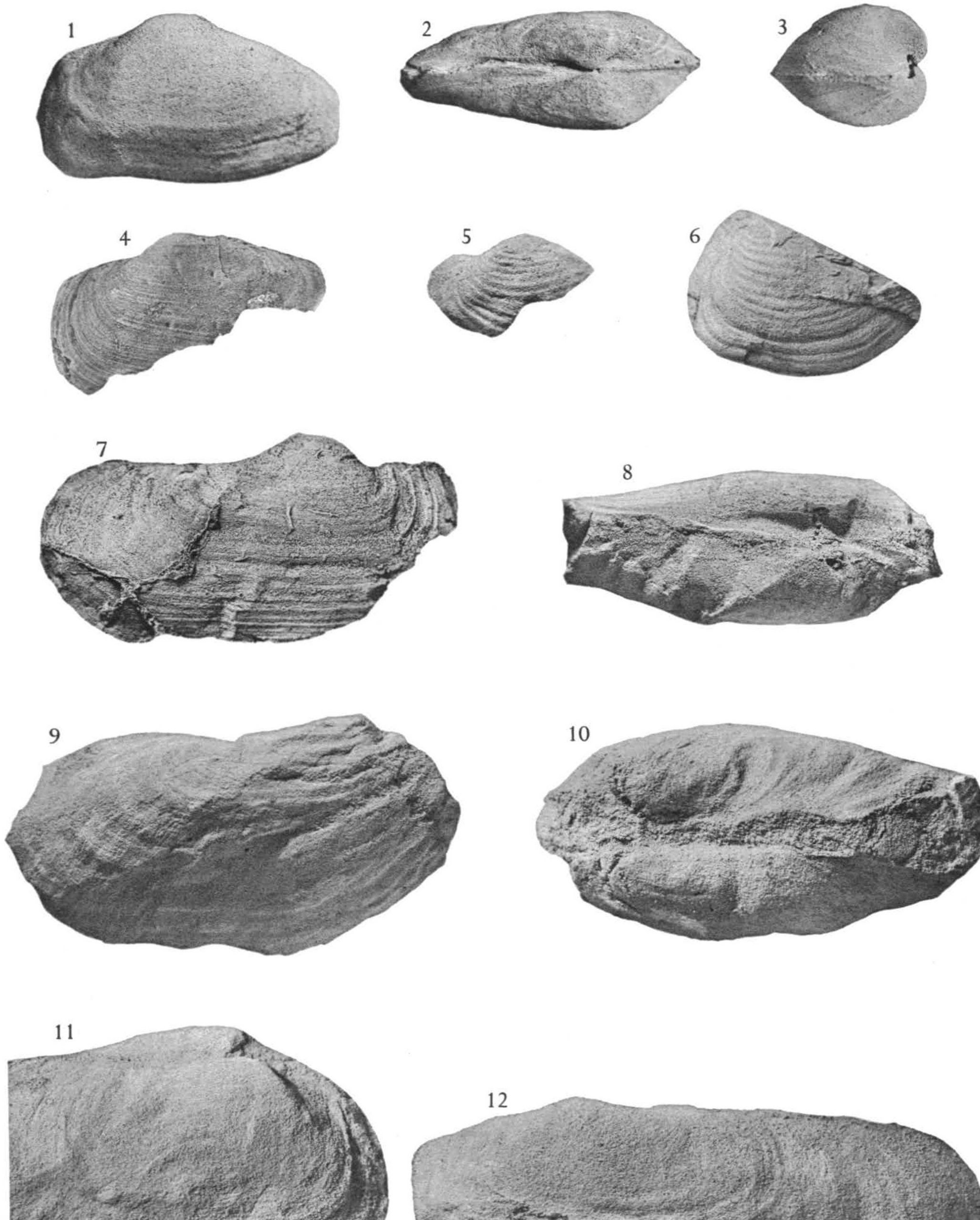

1
2
3
4
5
6
7
8
9
10
11
12

PLATE 13

Figs		Page
1, 2.	*Lucina* sp. aff. *Lucina* sp., Woods, 1907	111
	1. Internal cast of right valve. CPC 4779. 2. Internal cast of left valve. CPC 5044. Locality TT35. Late Neocomian.	
3.	(?)*Thracia primula* Hudleston, 1890	117
	External impression of left valve. CPC 5041. Locality TT20. Aptian.	
4, 5.	Genus indet. sp. nov.	118
	4. Latex cast of internal impression of right valve. CPC 4780. 5. Latex cast of external impression of left valve. CPC 4781. Locality TT21. Aptian.	
6, 8.	*Fissilunula clarkei* (Moore, 1870)	106
	6. Dorsal view of internal cast of left valve. CPC 5038. 8. Lateral view of internal cast of CPC 5038. Locality TT31. Aptian.	
7.	*Diodora*(?) sp. indet.	119
	Dorsal view of internal cast. CPC 4782. Locality TT55. Late Neocomian.	
9.	*Trachynerita*(?) sp.	121
	Interno-external mould of a crushed specimen. CPC 4783. Locality TT35. Late Neocomian.	

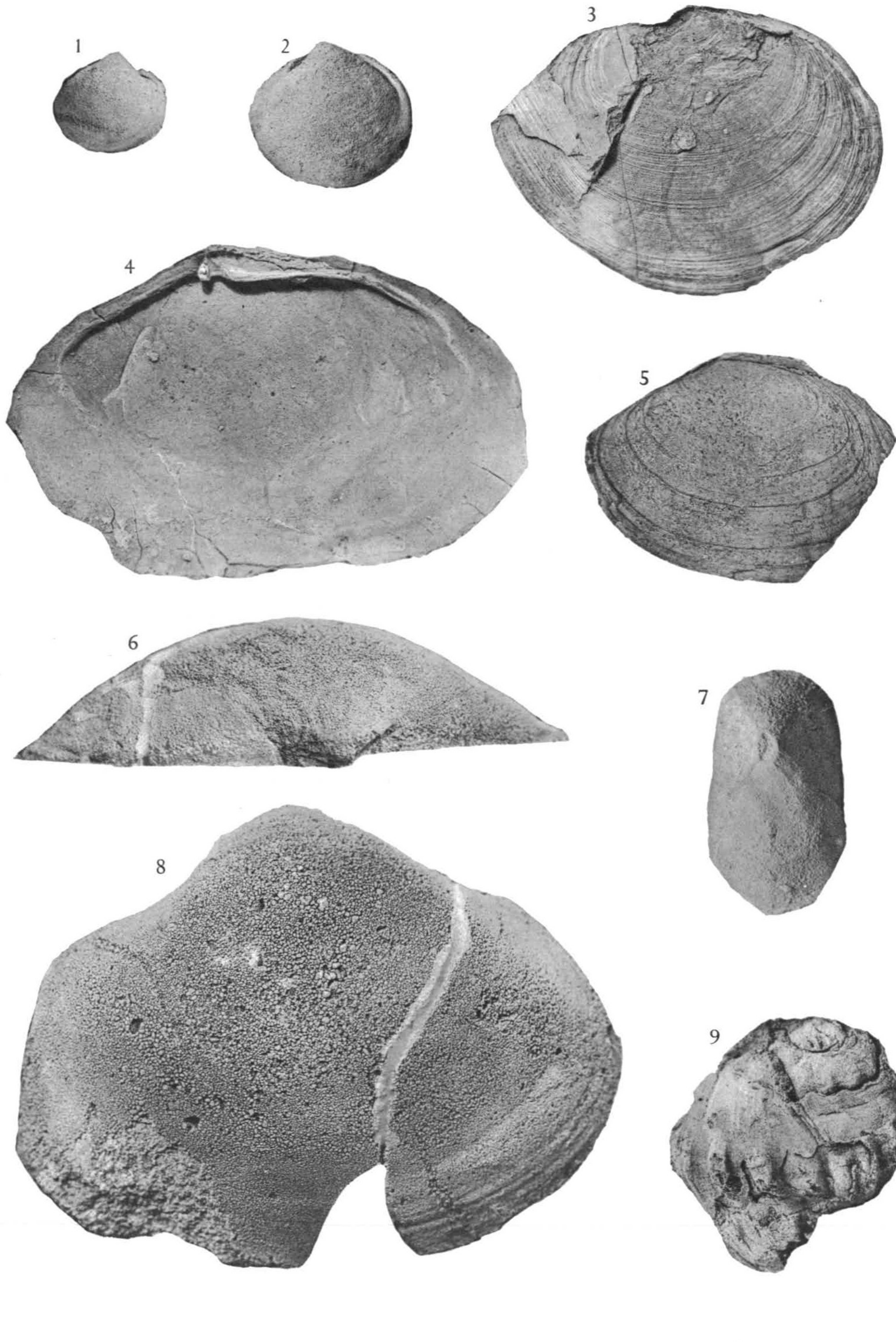

1
2
3
4
5
6
7
8
9

PLATE 14

Figs		Page
1, 2.	*Cinulia* sp. cf. *C. hochstetteri* Moore, 1870	122
	1. Latex cast of external impression. CPC 5046. 2. Dorsally incomplete internal cast. CPC 5047. Locality TT35. Late Neocomian.	
3.	*Natica* sp.	
	Internal cast. CPC 5045. Locality TT49a. Late Neocomian.	
4, 5,	*Neritokrikus tuberosus* gen. et sp. nov.	121
9.	4. Paratype CPC 4784. Relatively undistorted internal cast. 5. Paratype CPC 4785. Latex cast of posterior portion of external impression of shell. 9. Holotype CPC 4786. Latex cast of external impression of anterior portion of shell. Locality TT20. Aptian.	
6.	(?)*Purpurina* sp.	121
	Latex cast of external impression of incomplete shell. CPC 5020. Locality TT49a. Late Neocomian.	
7, 8.	*Pleurotomaria*(?) sp. B.	122
	7. Lateral view of internal cast CPC 5049. 8. Lateral view of CPC 5049. Locality TT35. Late Neocomian.	
10.	*Diodora*(?) *galea* sp. nov.	119
	Holotype CPC 4787. Latex cast of external impression of shell. Locality TT55. Late Neocomian.	
11.	*Cellana*(?) *carpentariana* sp. nov.	120
	Holotype CPC 4788. Latex cast of external impression of shell. Locality TT55. Late Neocomian.	
12.	*Pleurotomaria*(?) sp. A	122
	Distorted internal cast of shell. CPC 5048. Locality TT35. Late Neocomian.	
13.	*Australiceras* sp. nov. aff. *A. jacki* (Etheridge Jnr, 1880)	123
	Somewhat distorted internal cast of specimen. CPC 4789. Locality TT17. Late Neocomian.	

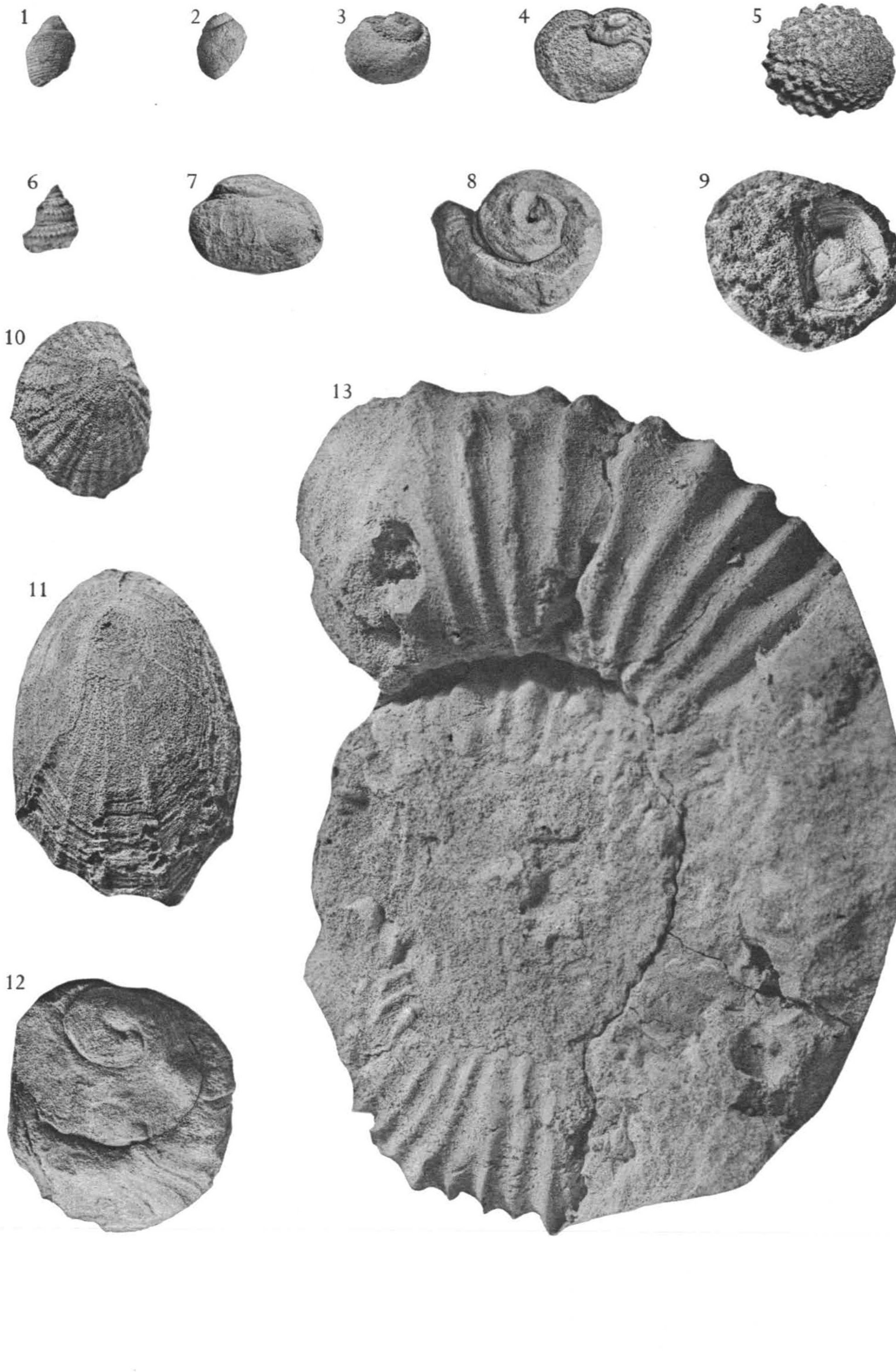
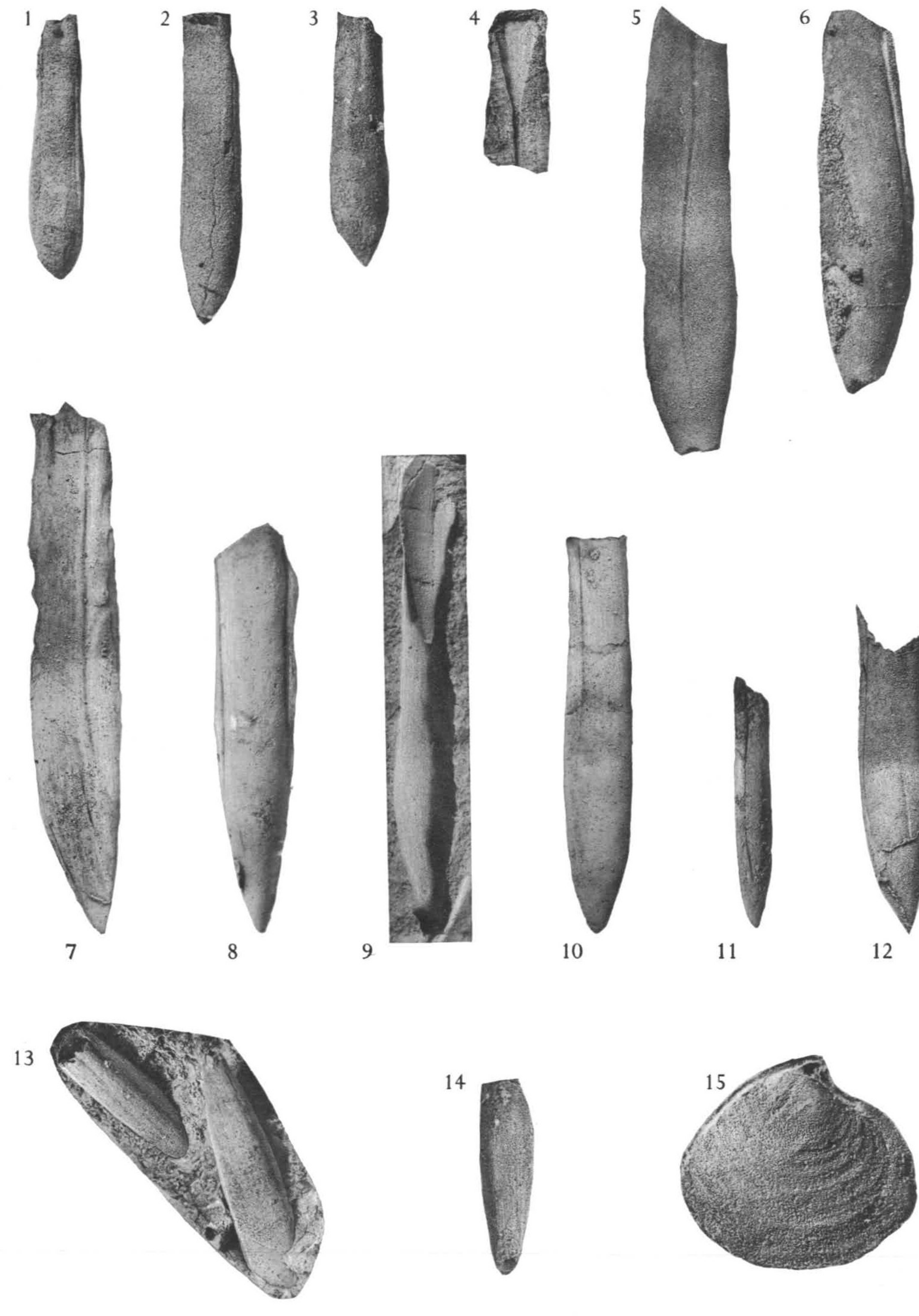

1
2
3
4
5
6
7
8
9
10
11
12
13

PLATE 15

Figs		Page
1–6, 12.	*Dimitobelus(?) youngensis* sp. nov.	125
	1. Holotype CPC 4790. Latex reproduction of an immature specimen showing both grooves.	
	2, 3, 12. Latex reproductions of specimens showing shape of the new species; CPC 4791, 4803 and 4804 respectively.	
	4. Latex reproduction of broken specimen showing alveolus. CPC 4792.	
	5. Latex reproduction of a mature specimen with one groove showing. CPC 4793.	
	6. Paratype CPC 4794. Latex reproduction of mature specimen showing characteristic bulge and one of two grooves. Locality TT55. Late Neocomian.	
7–11.	*Peratobelus(?) bauhinianus* sp. nov.	124
	7. Holotype CPC 4795. Latex reproduction of mature specimen showing shape and grooves. Locality TT20.	
	8. Paratype CPC 4796. Latex reproduction of incomplete specimen showing both grooves. Locality TT21.	
	9. Cavity after belemnite showing shape of alveolus. CPC 4797. Locality TT20	
	10. Latex reproduction of less attenuated specimen. CPC 4798. Locality TT21.	
	11. Latex reproduction of immature specimen. CPC 4799. Locality TT20. Aptian.	
13, 14.	*Dimitobelus canhami* (Tate, 1879)	124
	13. Latex reproduction of two specimens inclined to each other. CPC 4800.	
	14. Latex reproduction of immature specimen. CPC 4801. Locality TT60. Albian.	
15.	*Eriphyla(?) bauhiniana* sp. nov.	104
	Internal cast of right valve showing dentition. CPC 4802. x2. Locality TT35. Late Neocomian.	


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15