COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

BULLETIN No. 67

AUSTRALIAN MESOZOIC TRIGONIIDS

BY

S. K. SKWARKO

Issued under the Authority of Senator the Hon. Sir William Spooner,
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Minister: SENATOR THE HON. SIR WILLIAM SPOONER, K.C.M.G., M.M.

Secretary : SIR HAROLD RAGGATT, C.B.E.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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SUMMARY

One new genus, one new subgenus, and sixteen new species of Australian Mesozoic trigoniids are described and discussed and some of the already known Australian forms are redescribed.

The three new species of subfamily Trigoniinae are *Trigonia*(?) *miriana* sp.nov. from the Campanian—Maestrichtian Miria Marl of the Carnarvon Basin, Western Australia, and T. *vertistriata* sp.nov. and *Trigonia*(?) sp.nov. from the Neocomian beds of the Northern Territory. *Trigonia moorei* Lycett, 1870, the long-known Jurassic trigoniid from Western Australia, is redescribed.

Of the Megatrigoniinae, a new species of *Iotrigonia*, *I. stanwellensis* sp.nov.' is derived from the Neocomian beds of Stanwell, eastern Queensland ; the only other known Australian member of this genus, *I. limatula* Whitehouse, 1946, also comes from Stanwell. A new subgenus of *Iotrigonia*, *Zaletrigonia*, includes the Northern Territory *I.* (Z.) *hoepeni* sp.nov., and is closely related to *Iotrigonia* van Hoepen, 1929 ; it is distinguished mainly because of its shape, and also because it lacks a tendency for its subradial riblets to unite ventrally in a V-pattern in the mature forms. *I.* sp.cf. *I.* (Z.) *hoepeni* sp.nov. is reported from the vicinity of Wrotham Park, Queensland.

Australian Vaugoniinae include the Neocomian *Apiotrigonia* sp.cf. *A. minor* (Yabe & Nagao), 1925, and the Aptian *A.* sp.nov. cf. *A. nankoi* Nakano, 1957, from Dampier Peninsula, Western Australia.

A new Australian species of Pterotrigoniinae, *P.* (*Rinetrigonia*) *capricornia* sp.nov. from the Neocomian strata of the Northern Territory, is closely related to the Western Australian *P.* (*R.*) *australiensis* Cox, 1961, and to the South African and Indian *P.* (*R.*) *ventricosa* (Krauss), 1847, both of Neocomian age.

A new subfamily of the Trigoniidae, subfamily Nototrigoniinae, is separated from subfamily Trigoniinae Kobayashi, 1954 to include all the new and already known species of *Nototrigonia* Cox, 1952 em., as well as the new Australian genus *Austrotrigonia* gen.nov., *Pleurotrigonia* van Hoepen, 1929, *Opisthotrigonia* Cox, 1952, *Pacitrigonia* Marwick, 1932 and *Eselaevitrigonia* Kobayashi & Mori, 1954. *Sphenotrigonia* Rennie, 1936, may also belong to this subfamily.

Genus *Opisthotrigonia* is reported for the first time from Australia. The two species now known from this continent are O. *nasuta* (Etheridge, Snr.), 1872 and O. *roperi* sp.nov.

The typically Australian genus *Nototrigonia* Cox, 1952, includes seven species. *N. cinctuta* (Etheridge, Jnr.), 1902, is redescribed and the diagnosis of the genus *Nototrigonia* amended to allow inclusion of six new Australian members which are new species. The Nototrigoniinae are subdivided into three groups :—

(1) Cinctuta Group, named after *N. cinctuta*, includes Australian species *N.*sp. cf. *N. cinctuta* (Etheridge Jnr), 1902, *N. minima* sp.nov., *N. crescenta* sp.nov., and *Nototrigonia* (?) sp.nov., and also South American Upper Cretaceous *N. hanetiana* (d'Orbigny), 1842 and possibly *N. ecplecta* (Wilckens), 1905—all these have the anterior portion of the flank diagonally ribbed with irregular costae.

(2) Yeuralba Group, named after *N. yeuralba* sp.nov. is characterized by concentric or subconcentric ribbing on the mature portion of the disc, and includes this species and *Nototrigonia*(?) *aberrata* sp.nov.

(3) Ponticula Group, named after *N. ponticula* sp.nov., its only member, is distinguished by mixed oblique and concentric ribbing on the disc, and lack of radial ribbing on the mature portion of the area.

A new genus, *Austrotrigonia* gen.nov., is described ; its type species is *A. prima* sp.nov. which is represented in the Neocomian Beds of the Northern Territory and possibly in eastern Australia (Stanwell area).

The relationship of *Pacitrigonia* Marwick, 1932 and *Nototrigonia* Cox, 1952 is discussed. *Pacitrigonia* is included in Nototrigoniinae.

The first members of Myophorellinae to be reported in Australia are *Myophorella* sp.nov. (?) juvenile, from the Windalia Radiolarite, (Lower Cretaceous) of the Carnarvon Basin, Western Australia, and *M.* (*Myophorella*) *australiana* sp.nov. from Aptian strata at Maryborough, Queensland.

A Trigoniid gen. et sp. of unknown subfamilial affinity, from the Roma Formation of the Great Artesian Basin, is also described.

INTRODUCTION

Systematic collecting in the Neocomian strata of the Northern Territory during the 1960 and 1961 field seasons has yielded, among other molluscan species, ten new trigoniids.

Four of these show marked generic similarities with Cox's *Nototrigonia*, which hitherto has included only the type species *N. cinctuta* (Etheridge Jnr), 1902, and indicate that the genus must be revised. It is opportune to describe other species of hitherto unknown Australian trigoniids which have been collected over the past years by geologists of the Bureau of Mineral Resources and are lodged in the Commonwealth Palaeontological Collection, Canberra. These include two Western Australian and two Queensland species. The Geological Survey of Queensland has generously submitted its trigoniids for study.

The following are the known Australian Mesozoic trigoniids together with their age and distribution. Species marked with an asterisk are described in the present paper (see next page).

	Mid Jura.	Neo.	Apt.	Alb.	Ceno.	Tur.	Con.	San.	Camp.	Mae.	Dan.
Trigonia moorei	—										
Trigonia(?) miriana									—	—	
Trigonia vertistriata		—									
Trigonia(?) sp.nov.		—									
Trigonia sp. A		—									
Trigonia sp. B		—									
Laevitrigonia lineata			—	—							
Iotrigonia stanwellensis		—									
Iotrigonia limatula		—									
I. (Zaletrigonia) hoepeni		—									
I. (Zaletrigonia) cf. hoepeni		—									
Apiotrigonia cf. minor		—									
A. sp.nov. cf. A. minor var. nankoi			—								
Pterotrigonia (Rinetrigonia) australiensis		—									
P. (R.) capricornia		—									
Pterotrigonia (Rinetrigonia) sp.		—									
Opisthotrigonia nasuta			—								
Opisthotrigonia roperi		—									
Nototrigonia cinctuta			—	—							
Nototrigonia cf. cinctuta			—								
Nototrigonia minima			—	—							
Nototrigonia crescenta		—									
Nototrigonia(?) sp.nov.					—						
Nototrigonia yeuralba		—									
Nototrigonia(?) aberrata		—									
Nototrigonia ponticula		—									
Pacitrigonia(?) nanutarraensis		—									
Austrotrigonia prima		—									
Myophorella sp.nov.? juv.			—								
M. (Myophorella) australiana			—								
Trigoniid gen.et.sp.			—								

TABLE 1

KNOWN TIME RANGES OF AUSTRALIAN MESOZOIC TRIGONIIDS

Family TRIGONIIDAE Lamarck, 1819
Subfamily Trigoniinae Kobayashi, 1954 em. Nakano, 1961 em.

Genus *Trigonia* Bruguière, 1789
Subgenus *Trigonia*

Trigonia moorei Lycett, 1870*	Bajocian, W.A.
T. (?) *miriana* sp.nov.*	Campanian to Maestrichtian, Carnarvon Basin, W.A.
T. *vertistriata* sp.nov.*	Neocomian, N.T.
T. (?) sp.nov.*	,, ,,
T. sp. A, Cox, 1961	Neocomian, Carnarvon Basin, W.A.
T. sp. B, Cox, 1961	,, ,, ,, ,,

Subfamily Frenguelliellinae Nakano, 1960
Genus *Laevitrigonia* Deeke, 1925 em. Lebküchner, 1932

Laevitrigonia lineata (Moore), 1870	Lower Cretaceous, Qld. and S.A.

Subfamily Megatrigoniinae van Hoepen, 1929
Genus *Iotrigonia* van Hoepen, 1929

Iotrigonia stanwellensis sp.nov.*	Neocomian, E. Qld.
I. *limatula* Whitehouse, 1946	,, ,, ,,
I. sp.cf. I. *limatula* Whitehouse, 1946	,, ,, ,,

Subgenus *Zaletrigonia* subgen.nov.*

I. (*Zaletrigonia*) *hoepeni* sp.nov.*	Neocomian, N.T.
I. (*Zaletrigonia*) sp.cf. I. (Z.) *hoepeni* sp.nov.*	,, E. Qld.

Subfamily Vaugoniinae Kobayashi, 1954
Genus *Apiotrigonia* Cox, 1952

Apiotrigonia sp. cf. A. *minor* (Yabe & Nagao), 1925	Neocomian, Dampier Peninsula, W.A.
A. sp.nov. cf. A. *minor* var. *nankoi* Nakano, 1957	Aptian, Dampier Peninsula, W.A.

Subfamily Pterotrigoniinae van Hoepen, 1929, em. Nakano, 1960
Genus *Pterotrigonia* van Hoepen, 1929
Subgenus *Rinetrigonia* van Hoepen, 1929

P. (*Rinetrigonia*) *australiensis* Cox, 1961	Neocomian, Carnarvon Basin, W.A.
P. (*Rinetrigonia*) *capricornia* sp.nov.*	Neocomian, Lower Aptian, N.T.
P. (*Rinetrigonia*) sp. Whitehouse, 1946	Neocomian, E. Qld.

Subfamily Nototrigoniinae nov.
Genus *Opisthotrigonia* Cox, 1952

O. *nasuta* (Etheridge Snr), 1872	Aptian, Qld and N.S.W.
O. *roperi* sp.nov.	Neocomian, N.T.

Genus *Nototrigonia* Cox, 1952 em.

1. *Cinctuta Group:*	
Nototrigonia cinctuta (Etheridge Jnr), 1902*	L. Cretaceous (Aptian-Albian), Qld, S.A.
N. sp.cf. N. *cinctuta* (Etheridge, Jnr.), 1902*	Aptian, N.T.
N. *minima* sp.nov.*	L. Cretaceous (Aptian-Albian), Qld.
N. *crescenta* sp.nov.*	Neocomian, N.T.
N. (?) sp.nov.*	Cenomanian, Bathurst Island, N.T.
2. *Yeuralba Group:*	
N. *yeuralba* sp.nov.*	Neocomian, N.T.
N. (?) *aberrata* sp.nov.*	Neocomian, N.T.
3. *Ponticula Group:*	
Nototrigonia ponticula sp.nov.*	Neocomian, N.T.

Genus *Austrotrigonia* gen.nov.*

Austrotrigonia prima sp.nov.*	Neocomian, N.T.

Genus *Pacitrigonia* Marwick, 1932

Pacitrigonia (?) *nanutarraensis* Cox, 1961	Neocomian, Carnarvon Basin, W.A.

Subfamily Myophorellinae Kobayashi, 1954

Genus *Myophorella* Bayle, 1878

Myophorella sp.nov.(?) juvenile*	L. Cretaceous, W.A.

Subgenus *Myophorella*

Myophorella (*Myophorella*) *australiana* sp.nov.*	Aptian, Qld.

Incertae sedis

Trigoniid gen. et sp.	Aptian, Roma, Qld.

The addition of new forms brings the total number of Australian Mesozoic trigoniids to ten genera, three subgenera, and thirty-one species (six unnamed), of which only one species, *T. moorei* Lycett, 1870, is not from Cretaceous strata.

The description of a new species of *Iotrigonia, I. stanwellensis* sp.nov., strengthens Whitehouse's (1946) correlation of the fossiliferous bed at Stanwell in eastern Queensland with the Uintenhage and Oomia Beds of South Africa and India respectively. Occurrences of *P.* (*Rinetrigonia*) *australiensis* Cox, 1961, in the Lower Cretaceous (Neocomian) sediments of the north-west Carnarvon Basin, Western Australia, the presence of *Apiotrigonia* sp. cf. *A. minor* (Yabe & Nagao), 1925, and *A.* sp.nov.aff. *A. minor* var. *nankoi* Nakano, 1957, in the Dampier Peninsula, Western Australia, and the occurrence of *P.* (*R.*) *capricornia* sp.nov. and *I.* (*Z.*) *hoepeni* sp.nov. in the Neocomian Beds of the Northern Territory give evidence for widespread though marginal marine incursions of the Australian continent at about the same time as similar events in India and Africa and in the other parts of the Indo-Pacific region.

Particularly in Japan, where trigoniid faunas both in Jurassic and Cretaceous times have been much more prolific than in Australia, individual species, because of their geographical distribution and rapid morphological changes with time, have acquired the status of key species and horizon markers. As the investigation of the Australian Mesozoic sequence continues more trigoniids will probably be found ; initial results encourage one to think that they will prove useful for lateral correlation and as time markers. Evidence in the Northern Territory suggests that at least one trigoniid, *P.* (*R.*) *capricornia*, which is relatively abundant in Neocomian strata, persists upwards, in decreasing numbers, no farther than the lowest Aptian beds in that area in an apparently continuous sequence. At least one Aptian—Albian trigoniid from Queensland and South Australia, *N. cinctuta*, probably represented in the Northern Territory by *N.* sp.cf. *N. cinctuta*, first appears in Northern Territory assemblages with a marked Aptian aspect and is absent in apparently conformably underlying strata which contain exclusively Neocomian fossils. Thus, the upper limit of *P.* (*R.*) *capricornia* and the lower limit of *N. cinctuta* seem to be fixed, and this knowledge, once confirmed, may be profitably used for dating in the future.

Lower Cretaceous sediments in Australia, however, have been laid down in a number of widely scattered areas (e.g., Laura Basin and Stanwell area in Queensland ; Great Artesian Basin in Queensland, New South Wales and South Australia ; Carnarvon and Perth Basins and Dampier Peninsula in Western Australia ; the northern portion of the Northern Territory), and although sedimentation may have begun in several places at about the same time—probably at the beginning of Lower Cretaceous—fauna cannot have migrated much, if at all, and so faunas similar at the specific level are likely to be scarce. Also, of course, there may be larger differences in time between individual incursions in different parts of the continent than has been suspected in the past.

PREVIOUS WORK ON AUSTRALIAN TRIGONIIDS

Until comparatively recently only four trigoniids were known from the Australian Mesozoic strata : *Trigonia moorei* Lycett, 1870, from the Middle Jurassic beds of Western Australia, *T. nasuta* Etheridge, Snr., 1872, from the Aptian-Upper Albian strata of Queensland and New South Wales, and *T. cinctuta* Etheridge, Jnr., 1902, and *T. lineata* Moore, 1870 from Aptian-Albian strata of Queensland and South Australia. *T. moorei* probably belongs in the subfamily Trigoniinae, though its sulcus is perhaps a little more developed than usually in the species of that subfamily. Cox (1952) made *T. cinctuta* the type species of his *Nototrigonia*. *T. nasuta* is here included in the genus *Opisthotrigonia* Cox, 1952. *T. lineata* has been placed in *Laevitrigonia* Deecke, 1925 em. Lebkuchner, 1932, by Kobayashi & Mori (1954).

In 1946 Whitehouse described *Iotrigonia limatula*, *Pisotrigonia* sp., and *Indotrigonia* (?) sp., from the Neocomian beds of eastern Queensland. Cox (1952) included *Pisotrigonia* in the genus *Pterotrigonia* van Hoepen, 1929. Trigoniid specimens closely resembling Whitehouse's *Indotrigonia*(?) sp. were recently found in Neocomian strata in the Northern Territory and a new generic name, *Austrotrigonia* is proposed for these.

Brunnschweiler (1951) identified *Iotrigonia* sp.aff. *I. limatula* Whitehouse, 1946, from Neocomian beds of Dampier Peninsula, Western Australia, and in 1957 described I. sp.nov.aff. *I. limatula* from the same area ; but in 1960 he included both these forms in the genus *Apiotrigonia* Cox, 1952, as A. sp.cf. A. *minor* (Yabe & Nagao), 1925. In the 1960 paper he also describes A. sp. nov.cf. A. *minor* var. *nankoi* Nakano, 1957, from Aptian strata of the Dampier Peninsula.

Dickins (1960) provisionally identified *Iotrigonia* sp.nov. and Trigoniidae gen. et sp. from Mount Drummond 1:250,000 Sheet area, Northern Territory. He dated these as probably of Neocomian age. The *Iotrigonia* sp.nov. is probably a juvenile form of I. (Z.) *hoepeni* sp.nov. and Trigoniidae gen. et sp. is *Austrotrigonia prima* sp.nov.

Finally, Cox (1961) described *Trigonia* sp.A and T.sp.B, *Pacitrigonia*(?) *nanutarraensis*, and *Pterotrigonia australiensis* from the Neocomian Nanutarra Formation of the Carnarvon Basin, Western Australia.

This modest list of known Australian trigoniids is here supplemented by one new genus, one new subgenus and sixteen new species, which are described below.

Many of the specimens on which descriptions of genera and species have been based have been distorted by compaction of sediment and it is not advisable to record their accurate dimensions as many of them would be misleading. An idea of the order of size can be gained from the study of plates, on many of which fossils are reproduced at natural size.

Notes on Subfamily Groupings of some Trigoniidae

The last few years have seen an even greater activity in the work on the family Trigoniidae Lamarck, 1819. Cox's (1952) classification of the family into genera, which was followed by Kobayashi's (1954) separation of the subfamily Trigoniinae, created a great deal of interest and was quickly followed by Savaliev's (1958) modification of this subfamily. Savaliev erected Laevitrigoniinae, in which he included members of the Kobayashi's *Laevitrigonia* section of the Trigoniinae together with *Quoiecchia* Crickmay, 1930, *Nipponitrigonia* Cox, 1952, and *Geratrigonia* Kobayashi, 1954.

More recently Nakano (1961) amended Kobayashi's Trigoniinae and reduced the number of member genera from 13 to 10. He grouped these into three sections, which differed substantially from those of Kobayashi. In 1960 he also erected a new subfamily Frenguelliellinae in which he included all the members but one (the genus *Quoieccia* Crickmay, 1930) of the Laevitrigoniinae Savaliev, 1958, together with four additional genera *Frenguelliella* Leanza, 1942, *Latitrigonia* Kobayashi, 1957, *Ibotrigonia* Kobayashi, 1957, and *Rutitrigonia* van Hoepen, 1929.

A detailed resume of the recent work on Trigoniinae can be found in the comprehensive paper by Nakano (1961). The recent examination of the Australian trigoniids shows that none of the three versions of the subdivision of some Trigoniidae need necessarily hold the final answer, and more investigation and thought will be needed before a satisfactory subdivision is evolved.

In this paper a new subfamily, Nototrigoniinae is erected at the expense of the previous subdivision, because a conspicuous, and probably significant, feature of some trigoniid shells, the ' pre-carinal depression ', has been overlooked in past classifications. This paper may contribute towards a more satisfactory subdivision of the Trigoniidae.

The new subfamily consists of the following genera :—

Subfamily Nototrigoniinae nov.

Genus *Nototrigonia* Cox, 1952 em.
Genus *Pleurotrigonia* van Hoepen, 1929.
Genus *Opisthotrigonia* Cox, 1952.
Genus *Eselaevitrigonia* Kobayashi & Mori, 1954.
Genus *Pacitrigonia* Marwick, 1932.
?Genus *Austrotrigonia* nov.
?Genus *Sphenotrigonia* Rennie, 1936.

All these have in common three main characters of shell morphology used as criteria for subdivision. These are :—

(1) The area relatively narrow and radially striated at least in the early stages of the shell's growth.
(2) Disc ornamented with concentric, subconcentric, or oblique costae.
(3) Wide triangular sulcus between the disc and the area.

The first two characteristic features suggest, as pointed out by Kobayashi (1954) for the genus *Nototrigonia*, that the subfamily was originally derived from the Trigoniinae. The presence in all genera of a wide and often deep sulcus separates them from the Trigoniinae and points to a distinct tendency of growth. The sulcus in some forms may be so shallow as to be quite flat, as in *N. ponticula*, *Austrotrigonia prima* sp.nov., and, possibly, in *Sphenotrigonia frommurzei* Rennie, 1936.

No definite radial ribbing has been observed on the area in *Austrotrigonia* perhaps because only the distal portion of the area is available for examination.

SYSTEMATIC DESCRIPTIONS

Family TRIGONIIDAE Lamarck, 1819

Subfamily TRIGONIINAE Kobayashi, 1954 em. Nakano, 1961 em.

(= PLEUROTRIGONIINAE van Hoepen, 1929)

At present five species of " Costatae " are known from Australian Mesozoic strata. Only three carry specific names. All but one are of Lower Cretaceous age.

Trigonia moorei Lycett from Jurassic strata of the Greenough River District, Western Australia, was originally described by Lycett in Moore (1870) and reference to its morphology, affinities and occurrence can be found under the following authors : Lycett, Etheridge Jnr, Sussmilch, and Whitehouse (for references to these authors, see synonymy list under *T. moorei*). Tenison Woods remarked that some of the specimens of *T. moorei* have been erroneously referred to *T. costata* Parkinson by Clarke, Glauert and Maitland. *T. moorei* is re-described below.

Recently Cox (1961) figured and briefly described two species, *Trigonia* sp.A and *Trigonia* sp.B, from the Neocomian (Lower Cretaceous) Nanutarra Formation of Carnarvon Basin, Western Australia. His specimens were few and incomplete. No further material is available from this area.

Three specimens of Trigoniinae from the Miria Marl (Upper Cretaceous) of the Carnarvon Basin were recently examined, and are described, as *Trigonia* (?) *miriana* sp.nov., below.

Finally, during recent collecting in the hitherto unsampled Neocomian strata of the Northern Territory, several specimens of another species of Trigoniinae were obtained ; they are described as *Trigonia vertistriata* sp.nov.

Genus TRIGONIA Bruguière, 1789

Type species: *Venus sulcata* Hermann, 1781.

Synonyms: *Lyridon* Sowerby, 1823 ; *Lyriodon* Bronn, 1834 ; *Lyrodon* Goldfuss, 1837.

Subgenus TRIGONIA

Synonyms: Group Costatae Agassiz, 1840 em. Lycett, 1872 ; Group Byssiferae Lycett, 1872 ; *Lyriodon* Rollier, 1912.

TRIGONIA MOOREI Lycett, 1870

(Pl. 1, fig. 1)

1867 *Trigonia costata* Parkinson; Clarke, *Quart. J. geol. Soc. Lond.*, 23, 7–11.
1870 *Trigonia moorei* Lycett ; in Moore, *Quart. J. geol. Soc. Lond.*, 26, 254, pl. 14, figs. 9, 10.
1877 ,, ,, Lycett ; *Palaeontogr. Soc. Monogr.* 4, 151, text-fig.
1904 ,, ,, Lycett ; Etheridge Jnr, *Rec. Aust. Mus.* 5 (4) pl. 27, figs. 3, 4.
1910 ,, ,, Lycett ; Etheridge Jnr, *Bull. geol. Surv. W. Aust.*, 36, 36, pl. 4.
1912 ,, ,, Lycett ; Sussmilch, *An Introduction to the geology of New South Wales*, 127, fig. 64.
1924 ,, ,, Lycett ; Whitehouse, *J. Roy. Soc. W. Aust.*, 11 (1), 4.
?1936 ,, ,, Lycett ; Wandel, *Neues Jb. Miner*, beil. –Bd.75, Abt. b.
1954 *Frenguelliella moorei* (Lycett) ; Kobayashi & Mori, *Jap. J. Geol. Geogr.*, 25 (3–4), 164.

Material: Two left and three right valves from the Geraldton District, Western Australia. Bajocian.

Figured Material: Pl. 1, fig. 1. C.P.C. 4913, Commonwealth Palaeontological Collection, housed in the Bureau of Mineral Resources, Canberra.

Diagnosis: Tubercles on the marginal carina are a continuation of the disc costae, but are separated from them by a sulcus which is unusually wide for Trigoniinae. There is a variable, sometimes marked, tendency for transverse costation on the area. Lycett's original description of this species contains its differential diagnosis.

Descriptions: Shell of medium size, inequilateral, subequivalve, subquadrate, moderately inflated. Umbo narrow, well defined, acute, slightly opisthogyrous, markedly incurved. Anterior shell margin evenly and gently convex, curvature greatest in antero-ventral part of shell ; postero-dorsal shell margin slightly

convex ; free margin of area s-shaped, dorsal portion gently concave, ventral portion convex. Siphonal angle broad. Disc occupies about half shell surface, ornamented with prominent, concentric, plain costae originating near antero-dorsal shell margin and much more convex proximally than distally. Ribs narrow, but of high relief, deviate slightly from each other posteriorly, their distal extremities terminating in a straight or slightly curved line ; extremities separated from marginal carina by conspicuous wide sulcus striated with growth rugae. Marginal carina a well-marked ridge ornamented with very prominent tubercles similar to flank costae. Area wide, ornamented with eight subparallel radial riblets grouped in two sets of four, separated by a more prominent groove ; riblets of low relief, but carry conspicuous tubercles which seem to be aligned both radially and transversally ; tubercles tend to join together to form transverse ridges, especially in more mature portion of shell. Area separated by inconspicuous carina from escutcheon but ornament is identical and continuous ; plane of escutcheon much more steeply inclined to commissure than that of area.

Discussion: In spite of considerable variation in the width of the sulcus, prominence of the marginal carina and development of the transverse costation on the area, our specimens closely resemble other specimens of *T. moorei* described in the past from the Geraldton area.

In 1954 Kobayashi & Mori chose figure 10 accompanying Lycett's original description of *T. moorei* as the lectotype. This specimen differs from the other, in figure 9, in possessing distinct radial ribbing on the area. Only transverse ribbing seems to be present on the area of the specimen in figure 9, and this led Kobayashi & Mori to suggest that it belongs to the genus *Frenguelliella* Leanza, 1942.

Recent examination of a number of specimens of *T. moorei* from Western Australia has revealed that they have a tendency towards transverse costation on the area. This is brought about by transverse joining of nodules on the radial ribs, and specimens have been examined in which this transverse jointing completely replaced radial ribbing in the distal portion of the area. No specimens entirely devoid of radial ribbing have, however, been encountered.

TRIGONIA (?) MIRIANA sp.nov.

(Pl. 1, figs. 2, 3)

Material: Two valves joined together, and one internal cast of a left valve and another of a right valve. Locality, Miria Marl, Carnarvon Basin, Western Australia. Campanian to Maestrichtian. The description of the locality was lost in a fire at the Bureau of Mineral Resources in 1953.

Holotype: C.P.C. 4643 (Pl. 1, figs. 2, 3).

Diagnosis: Persistent tuberculation of both the concentric and radial costae coupled with the quadrate shape and the excessively developed sulcus is diagnostic and distinguishes this shell from the hitherto described forms.

Description: Shell small, quadrate, very inflated. Umbones narrow, convex, inflated, acute, orthogyrous, incurved. Anterior, posterior, and dorsal shell margins almost straight ; antero-ventral margin strongly curved. Disc occupies less than half shell surface, ornamented with numerous concentric tubercular costae apparently following lines of growth. Ribs narrow-crested, terminate posteriorly in a straight line which marks anterior boundary of sulcus.

Interspaces wide. Tubercules sharply pointed. Sulcus very wide for subgenus, concave-bottomed ; posterior sulcus boundary marked by prominent, sharp-crested marginal carina slightly convex anteriorly. Area very wide, with regular subparallel radial ribs running along entire length. Areal ribs less tuberculate than those on disc, but similar in low relief and wide interspaces. Escutcheon steeply inclined to commissure, concave, separated from area by escutcheon carina, ornamented with faint radial riblets.

Remarks: Although most of the actual shell material is missing from our specimens enough remains to allow reconstruction. The sulcus is much wider than encountered in Trigoniinae and may be regarded as a nototrigonian feature. The overall shape of T. (?) *miriana*, however, as well as its very broad area distinguishes it from the Nototrigoniinae, and the new species probably belongs to a new genus.

TRIGONIA VERTISTRIATA sp.nov.

(Pl. 1, figs. 4–6)

Material: Three external and one internal impression of the right valve ; two external and one internal impression of the left valve. All specimens obtained from locality T.T. 35*, Northern Territory. Neocomian.

Types: Holotype C.P.C. 4644 (pl. 1, fig. 4), Paratypes C.P.C. 4645 (pl. 1, fig. 5), and C.P.C. 4646 (pl. 1, fig. 6).

Diagnosis: The distinguishing aspect of T. *vertistriata* sp.nov. is the persistent transverse striation on the ventral walls of concentric costae, at right angles to their length ; the anterior wall of the marginal carina is similarly striated. These features distinguish the new species from previously described Trigoniinae.

Description: Shell small, inequilateral, subequivalve, strongly produced posteriorly, subcrescentic, inflated. Umbo narrow, convex, acute, opisthogyrous, sharply pointed, incurved. Anterior shell margin evenly rounded ; postero-dorsal margin concave ; posterior margin straight or gently convex. Disc ornamented with thirteen or more prominent, parallel, concentric costae of moderately high relief. Ribs originate at anterior shell margin and cover whole disc (right valve) or extend only as far as narrow sulcus (left valve) ; ventral walls of costae of right valve evenly striated at right angles to their length ; interspaces three to four times as wide as ribs. Moderately deep and narrow sulcus in left valve, bound anteriorly by evenly aligned posterior extremities of concentric costae, and posteriorly by marginal carina. Marginal carina in same plane as area, but higher than plane of sulcus. Anterior wall of carina serrated. Area wide, inclined away from plane of disc to commissure, ornamented with eight subparallel radial riblets in two sets of four separated by wider interspace. Radial riblets have serrated edges. Escutcheon carina not conspicuous. Escutcheon inclined more steeply than area to commissure ; ornamented with numerous rows of very small sharply pointed tubercles.

TRIGONIA (?) sp.nov.

(Pl. 1, fig. 7)

Material: A single incomplete external impression of the left valve. Locality, T.T. 42, Northern Territory. Neocomian.

Figured Specimen: C.P.C. 4661 (pl. 1, fig. 7).

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* See " Locality Index ", p. 41.

Description: Shell small, inequilateral, subquadrate, moderately inflated. Umbo strongly inflated, slightly opisthogyrous, plunges steeply towards commissure. Anterior shell-margin slightly convex dorsally, almost straight ventrally ; ventral margin broadly and evenly arched as far as marginal carina ; postero-dorsal margin gently and evenly concave ; posterior margin (i.e. free margin of area) straight, forming obtuse rounded angles with postero-dorsal and ventral shell-margins. Disc inflated, proportionally broad, occupying half of shell surface, ornamented with oblique, subparallel ribs. Costae originate at anterior shell margin and run obliquely across disc as wavy prominent ridges, slightly convex upwards proximally and concave upwards distally ; irregularly thinned, but towards posterior extremities widen rapidly and regularly to about twice anterior width; terminate abruptly with rectangular endings in an even line convex towards anterior shell margin. Termination of interspaces marked by slight step-down towards sulcus in dorsal portion of shell and by low ridge in ventral portion. Interspaces broadly U-shaped, of irregular width. Sulcus moderately wide, depressed below plane of disc dorsally, but ventrally rising until almost uniplanar with disc ; ornamented with two radial costae : one near-central, originating close to dorsal margin dividing it into two subequal portions ; other visible only in ventral portion of sulcus and located anteriorly. Growth-lines better accentuated on sulcus than on disc. Marginal carina prominent, ornamented with regularly spaced nodules. Area much larger than sulcus, proximally almost normal to plane of commissure, but angle of inclination decreases ventrally ; ornamented with at least ten fine radial striae, as well as concentric growth-lines and growth rugae. Area separated from escutcheon by nodular escutcheon carina. Escutcheon about half as big as area, oriented a little more steeply towards commissure ; ornamented with fine radial striae.

Discussion: *Trigonia*(?) sp.nov. may not belong to *Trigonia* s.s. as it has a nototrigonian character in the " cinctuta " type of oblique wavy ribbing on the disc. The lack of the rostrate shape and a wide sulcus, as well as a wider and more densely lined area, distinguish the new species from the Nototrigoniinae.

Trigonia (?) sp.nov. may possibly be an aberrant form. Because of its poor preservation it is safer to withhold a new name.

Subfamily FRENGUELLIELLINAE Nakano, 1960

Genus LAEVITRIGONIA Deecke, 1925 em. Lebküchner, 1932

Type species: *Trigonia gibbosa* Sowerby, 1821.

Synonyms: Group *Laeves* Agassiz, 1840, pars ; Subgroup *Gibbosa* Lycett, 1872–1879 ; Group Gibbosae Bigot. 1893.

LAEVITRIGONIA LINEATA (Moore), 1870

1864 *Myophoria* sp., McCoy, *Trans. Roy. Soc. Vic.* 6, 44.
1870 *Trigonia lineata* Moore ; *Quart. J. Geol. Soc. Lond.* 26, 255, pl. 13, fig. 12.
1879 ,, ,, Moore ; Lycett, *Palaeontogr. Soc. Monogr.* 5, 224.
1884 ,, ,, Moore ; Tenison Woods, *Proc. Linn. Soc. N.S.W.*, 8 (2), 239.
1892 ,, ,, Moore ; Etheridge Jnr, *in* Jack & Etheridge, The Geology and Palaeontology of Queensland and New Guinea, 470.

1902 *Trigonia lineata* Moore ; Etheridge Jnr, *Mem. Roy. Soc. S. Aust.*, 2 (1), 28, pl. 3, figs. 25, 26.

1954 *Laevitrigonia lineata* (Moore); Kobayashi & Mori, *Jap. J. Geol. Geogr.*, 25 (3–4), 158

Laevitrigonia lineata (Moore), 1870, is known from several specimens from the Lower Cretaceous strata of Wallumbilla, Queensland, and Lake Eyre Basin, South Australia. Moore was the first to describe this species, though McCoy earlier referred the same specimens to *Myophoria*. Lycett, Tenison Woods, and Etheridge, briefly discussed affinities of the species, and finally Etheridge redescribed it from additional material from the Lake Eyre Basin. Kobayashi & Mori (1954) suggested the inclusion of *T. lineata* in the genus *Laevitrigonia*.

Subfamily MEGATRIGONIINAE van Hoepen, 1929
(= RUTITRIGONIINAE van Hoepen, 1929)

Only one specimen of *Iotrigonia, I. limatula* Whitehouse, 1946, derived from Lower Neocomian beds at Stanwell, eastern Queensland, has been hitherto reported from Australia.

A trigoniid from the Lower Neocomian strata of the Dampier Peninsula was referred by Brunnschweiler (1951) to *Iotrigonia* as I. sp. aff. *I. limatula* Whitehouse, 1946 ; in 1957 he referred another, I. sp.nov.aff. *I. limatula* Whitehouse, 1946, to this genus, but at a later date (1960) both these forms were included by him in *Apiotrigonia* Cox, 1952, as A. sp.cf. A. *minor* (Yabe & Nagao), 1925.

Further collecting at Stanwell has yielded a single specimen of a new species of *Iotrigonia*. A rubber impression of this form has been kindly supplied by the University of Queensland and its description appears below under *Iotrigonia stanwellensis* sp.nov.

A new subgenus of *Iotrigonia, Zaletrigonia,* is described from the Neocomian strata of the Northern Territory. Its type species is *I. (Zaletrigonia) hoepeni* subgen. et sp.nov.

An *Iotrigonia* sp.cf. I. (Z.) *hoepeni* sp.nov. from the vicinity of Wrotham Park, Queensland, has been kindly loaned by the Queensland Geological Survey.

Genus IOTRIGONIA van Hoepen, 1929

Type species: *Iotrigonia crassitesta* van Hoepen, 1929.

Synonyms: Group *Trigonia V-scriptae* Kitchin, 1903 ; Group *Trigonia vau* Sharpe, 1856, Kitchin, 1903.

IOTRIGONIA STANWELLENSIS sp.nov.
(Pl. 1, fig. 8)

Material: An incomplete external impression of a right valve. Locality, Portions 128 and 129, Parish of Stanwell, Queensland. Neocomian.

Holotype: F.13335 (Pl. 1, fig. 8). University of Queensland Collection, housed in the Department of Geology, University of Queensland.

Diagnosis: The concentric ribbing is unusually strongly developed ; the transverse ribs are flat and wide in the medial portion of the shell, rounded in cross-section in the anterior and posterior portion of the shell : interspaces of the concentric costae cut across transverse costae.

These features distinguish the new species from the previously described Australian and overseas species of *Iotrigonia*.

Description: Shell about 10 cm. long and 6 cm. high, trigonal in outline, evenly inflated, inequilateral, produced anteriorly and more strongly posteriorly. Umbo probably obtuse, well marked, orthogyrous. Antero-dorsal and postero-dorsal shell margins slightly concave ; ventral margin broadly convex ; anterior, posterior, and dorsal margins tightly arched. Well developed concentric costae over whole shell surface, best developed in antero-ventral portion, and transverse costae in antero-dorsal and posterior portions. Concentric ribs compound, each divided longitudinally by a shallow groove into two secondary riblets of unequal width, the dorsal one wider ; each primary rib separated from its neighbour by a deeper, V-shaped, narrow interspace. Interspaces cut across transverse ribs. Transverse ribs originate apparently at dorsal shell-margin ; those in anterior portion of shell narrower than those in posterior half, but parallel to each other and inclined slightly postero-ventrally ; foremost ribs in posterior of shell thickest, diverge slightly from each other ; those in front point antero-ventrally and join with anterior ribs to produce the V-ribbing characteristic of genus. Anterior transverse ribs reach only half-way down shell; in posterior extend right down to ventral margins ; but overall length of transverse ribs about the same over the entire shell.

Subgenus ZALETRIGONIA nov.

Type species: I. (Zaletrigonia) hoepeni sp.nov.

Diagnosis: Zaletrigonia subgen.nov. is proposed to include forms closely related to *Iotrigonia* which are broadly trigonal to subquadrate in shape, and in which the two sets of subradial ribs on the flank are inconspicuous in the early growth stages of mature specimens, and are quite independent from each other in the later growth-stages. These two sets of ribs are united at their bases in a V-shape in the immature portion of the shell, suggesting basic genetic relationship with *Iotrigonia*.

Differential Diagnosis: The new subgenus can be distinguished from the broadly trigonal to subovate members of *Iotrigonia*, e.g. *I. crassitesta* van Hoepen, 1929, by its greater relative height, more inequilateral outline, and in the detail of subradial ribbing. The rather similarly ribbed members of *Iotrigonia*, e.g. *I. jakshysaurensis* (Luppov), 1932 are, on the other hand, strongly lunate shells.

Zaletrigonia is monotypic and its type species, *I.* (Z.) *hoepeni*, is known from the Neocomian strata of the Northern Territory, and possibly from the Wrotham Park area, north-eastern Queensland.

IOTRIGONIA (ZALETRIGONIA) HOEPENI sp.nov.

(Pl. 1, figs. 10–14)

Material: Seven external impressions of the right valve and four of the left valve ; three internal impressions of the left valve and two of the right valve. Many of the specimens are incomplete : their posterior parts in particular are missing or badly preserved. Localities, T.T.52(?), T.T.55, T.T.65, Northern Territory. Neocomian.

Types: Holotype C.P.C. 4647 (Pl. 1, fig. 13) ; Paratypes C.P.C. 4648 (Pl. 1, fig. 11) and C.P.C. 4649 (Pl. 1, fig. 14).

Description: Shell medium to large, strongly inequilateral, produced posteriorly, broadly trigonal to subquadrate, strongly inflated. Umbones wide, orthogyrous. Marginal carina broadly rounded. Escutcheon carina not observed. Antero-dorsal shell margin almost straight or very gently convex ; antero-ventral margin strongly convex ; ventral margin broadly arched ; postero-dorsal margin almost straight or gently concave ; posterior shell margin tightly rounded. Flank occupies most of shell surface ; ornamented with sub-concentric ribs and two sets of sub-radial costae. Sub-concentric ribs more prominent and better developed than sub-radial costae and cover almost entire distal portion of flank ; originate at anterior shell margin, strongly arched at first, straighten out rapidly in posterior portion of shell ; parallel to growth-lines ; greatest relief in anterior and middle portion of shell ; indistinct posteriorly ; distribution and in cross-section irregular ; most ventral costae split up into numerous growth-rugae. Sub-radial ribbing originates as sub-concentric or possibly concentric ribbing on umbo. The ten nearest costae simply and evenly curved. V-shape begins to form on eleventh rib and increases progressively in depth in next five ribs, after which the arms of V separate at base. This gives rise to two sets of sub-radial costae, one anterior to the other. Anterior ribs longer than posterior ribs, round crested and virtually parallel to each other ; run obliquely from antero-dorsal shell margin, covering most of umbo. Posterior costae relatively thick and broaden distally ; diverge from each other so that each successive rib becomes oriented farther towards ventral shell margin ; each slightly longer than its predecessor. First eighteen ribs on umbo are continuous over flank and marginal carina and extend on to escutcheon. Distal portion of marginal carina, area, and escutcheon are ornamented with fine growth-lines only.

Remarks: Plate 1, figure 12 represents a small partly crushed specimen with a markedly attenuated subrostrate posterior portion of the shell. It is probably an immature form of *I.* (Z.) *hoepeni* sp.nov.

Text figure 1 represents well preserved juvenile specimens which show the detail of ribbing on the proximal portion of the shell.

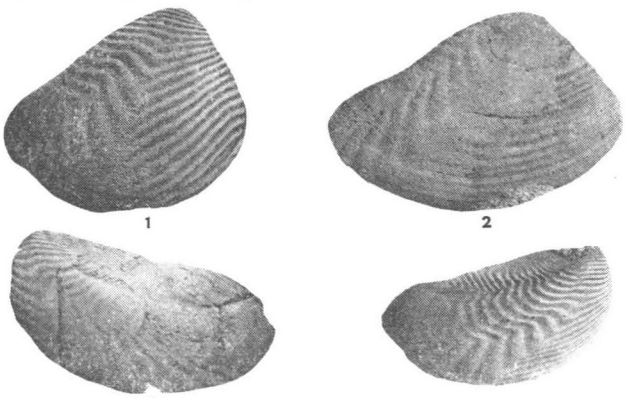

FIG 1.—Rubbers of immature specimens of *I. (Z.) hoepeni* sp. nov. showing detail of ornament on the proximal portion of the shell.
1—C.P.C. 4927, lateral view of a well ribbed right valve.
2—C.P.C. 4928, lateral view of a poorly ribbed right valve.
3—C.P.C. 4929, postero-dorsal view of a left valve.
4—Postero-dorsal view of C.P.C. 4927.
All specimens from locality T.T. 65. Neocomian. × 1.

IOTRIGONIA sp.cf.I. (ZALETRIGONIA) HOEPENI sp.nov.
(Pl. 1, fig. 9)

The single incomplete specimen of *Iotrigonia* from the Neocomian strata of Normanby River, near Wrotham Park, Queensland, resembles I. (*Zaletrigonia*) *hoepeni* sp.nov. from the Neocomian beds of the Northern Territory. In both forms the anterior transverse costae are virtually parallel to each other and are comparatively thin ; posterior transverse costae in the Queensland form broaden rapidly distally and are quite robust—somewhat more robust than in the Northern Territory specimens, which, however, have been compressed. There is no tendency in the Queensland specimen for the two sets of transverse costae to unite ventrally to form a V-pattern, and this is one of the distinguishing features of the new subgenus *Zaletrigonia*.

Subfamily VAUGONIINAE Kobayashi, 1954
Genus APIOTRIGONIA Cox, 1952

Type species: *Trigonia sulcataria* Lamarck, 1819.

Synonyms: Subgroup *pennata* Lycett, 1872 ; Subgroup Pennatae Packard, 1921.

For notes on Australian trigoniids referred in the past to subfamily Vaugoniinae, see page 11.

Subfamily PTEROTRIGONIINAE van Hoepen, 1929
(= Group Scabrae Agassiz, 1840)
Genus PTEROTRIGONIA van Hoepen, 1929

Type species: *Pterotrigonia cristata* van Hoepen, 1929.

Synonyms: Subgroup *aliformis* Lycett, 1872 ; Group *T. caudata* Agassiz, after Gillet, 1924 ; Group *T. aliformis* Parkinson, after Gillet, 1924 ; Group *T. ventricosa* Krauss, after Gillet, 1924 ; *Acanthotrigonia* van Hoepen, 1929 ; *Ptilotrigonia* van Hoepen, 1929 ; *Notoscabrotrigonia* Dietrich, 1933.

Kobayashi & Nakano (1957) proposed a tentative classification of van Hoepen's subfamily Pterotrigoniinae, in which *Rinetrigonia* van Hoepen, 1924 (= *Pisotrigonia* van Hoepen, 1929) was made a subgenus of *Pterotrigonia* van Hoepen, 1929. Earlier, Cox (1952) placed *Rinetrigonia* in synonymy with *Pterotrigonia*. *Trigonia ventricosa* Krauss, 1942, is a typical *Rinetrigonia*.

The first record of Pterotrigoniinae in Australia was by Whitehouse (1946) who described some fragmentary material from Lower Neocomian beds at Stanwell, eastern Queensland, as *Pisotrigonia* sp. The genus *Pisotrigonia* van Hoepen, 1929, has since been placed within the genus *Pterotrigonia* by Cox (1952). Whitehouse's figures of the Queensland form are poor, and no satisfactory material is available for refiguring, but the shell may be a *Rinetrigonia*. Examination of growth stages in additional Pterotrigoniinae from Western Australia and from the Northern Territory (see below) suggests that Whitehouse's figures 2 and 3 may represent two distinct species, figure 3 having closer affinities with the new species described below from the Northern Territory.

In 1961 Cox described *P. australiensis* from Lower Cretaceous or Upper Jurassic (now regarded as Neocomian) strata of the Nanutarra Formation of the north-east Carnarvon Basin, Western Australia. Cox's species may also belong to *Rinetrigonia*.

In the following pages one new species, *P.* (*R.*) *capricornia*, is described. It has very marked similarities with *T. ventricosa*, and consequently is included with *Rinetrigonia*.

Subgenus RINETRIGONIA van Hoepen, 1929

Type species: *Trigonia ventricosa* Krauss, 1847.
Synonym: *Pisotrigonia* van Hoepen, 1929.

PTEROTRIGONIA (RINETRIGONIA) CAPRICORNIA sp.nov.
(Pl. 2, figs. 2–8)

Material: Numerous internal and external impressions of both valves. Most specimens are incomplete and more or less distorted. Localities, T.T. 35, 45, 49, 55, 57, 65, 67, Northern Territory. Neocomian beds and beds with a mixed Neocomian and Aptian fauna.

Types: Holotype C.P.C. 4652 (Pl. 2, fig. 2). Paratypes C.P.C. 4653 (Pl. 2, fig. 3), C.P.C. 4654 (Pl. 2, figs. 5, 6) and C.P.C. 4655 (Pl. 2, fig. 8).

Diagnosis: The new species is distinguished by the combination of features listed in differential diagnosis below.

Differential Diagnosis: *P.* (*R.*) *capricornia* sp.nov. can be distinguished from its closest Australian ally, *P.* (*R.*) *australiensis* Cox, 1961, by its narrower, more attenuated, less strongly inflated anterior portion of the shell ; by less opisthogyrous umbones which are less incurved in the mature specimens ; by a more angular marginal carina, which is similar to that of *P.* (*R.*) *australiensis* but lacks the two parallel longitudinal ridges which border the mid-carinal groove, one on each side ; by its areal ribs which are of higher relief, especially in the juvenile specimens.

From *P.* (*R.*) *ventricosa* (Krauss), 1842, the new species can be distinguished by the posterior costae, which are less numerous in *ventricosa*—this wider spacing results in broader interspaces and allows greater flexibility in the growth of posterior costae ; and by the more widely spaced rib-tubercles.

Whitehouse's *Rinetrigonia* sp. from Stanwell cannot be referred to *P.* (*R.*) *capricornia* as its ribs are more widely spaced and the umbo seems to be more pointed.

Description: Shell medium to large, equivalve, strongly inequilateral, subcrescentic, strongly inflated anteriorly. Umbones very prominent, strongly inflated, attenuated, protruding, somewhat incurved, opisthogyrous. Flank constitutes major portion of shell surface ; bound by evenly concave marginal carina on postero-dorsal margin ; anterior margin slightly convex ; antero-ventral margin strongly convex ; ventral margin broadly arched ; postero-ventral margin strongly rounded. Maximum tumidity in anterior portion of shell, decreasing posteriorly rapidly at first, then more gradually. Ornamentation of flank of about fifteen radiating costae. Six, located in anterior portion of shell, rounded in cross-section, of high relief and strongly nodose ; grow obliquely across umbo antero-ventrally, obliquity decreasing in each succeeding rib. Remaining costae less prominent, of lower relief, dorsal portions rounded or angular in cross-section with V-shaped interspaces ; nodules, where present, confined to distal extremities and less well developed than on anterior ribs. Posterior ribs originate at, or close to, marginal carina, and proceed towards

ventral margin in straight or gently sinuous lines. Thickness of all costae increases distally ; all ribs subparallel to each other, tending to diverge distally—anterior ribs rather rapidly, posterior ribs very gradually. Interspaces usually flat-bottomed and as broad as costae in mature specimens, but several times broader in young forms. Hind-most ribs tend to originate progressively farther from marginal carina, becoming prominent only close to ventral shell margin. Marginal carina prominent, regularly concave in longitudinal section, acutely angular in transverse section, longitudinally bisected by narrow, shallow groove dividing flank from area. Area concave in both transverse and longitudinal section twisted around somewhat in anterior region to follow umbonal incurving. Ornamentation of diagonal ribs originating at marginal carina and proceeding a little way backwards and upwards and into commissure. Although more numerous and more closely spaced than flank ribs, some of areal ribs seem to be continuous with flank ribs. Areal ribs of mature specimens nodular and often considerably disjointed ; more prominent and continuous in young specimens.

Remarks: Like the recently described *P.* (*R.*) *australiensis* Cox, 1961, from the Nanutarra Formation of the north-east Carnarvon Basin, Western Australia (for comparison, see Pl. 2, fig. 1) *P.* (*R.*) *capricornia* sp.nov. is one of the most common and spectacular fossils in the assemblage in which it occurs.

Among overseas species the one most similar to the new species is *P.* (*R.*) *ventricosa* (Krauss), 1842, from the Valanginian of South Africa and Tithonian to Neocomian of India (Oomia beds of Cutch). The new species is even more closely related to it than to *P.* (*R.*) *australiensis*.

Subfamily NOTOTRIGONIINAE nov.

A new subfamily of the Trigoniidae, subfamily Nototrigoniinae, is here proposed to include trigoniids with unusually well developed triangular sulcus, obliquely or concentrically ornamented disc, and at least incipient radial ornament on the narrow area. The shell is always strongly produced posteriorly. The subfamily includes *Nototrigonia* Cox, 1952 em., *Pleurotrigonia* van Hoepen, 1929, *Opisthotrigonia* Cox, 1952, *Eselaevitrigonia* Kobayashi & Mori, 1954, *Pacitrigonia* Marwick, 1932, and probably *Austrotrigonia* gen.nov.; *Sphenotrigonia* Rennie, 1936, may also belong to the family.

Nototrigoniinae range from Tithonian to Upper Senonian.

Genus OPISTHOTRIGONIA Cox, 1952

Type species: *Trigonia retrorsa* Kitchin, 1903.

Opisthotrigonia was erected by Cox in 1952 to include the sickle-shaped sulcate trigoniids which were strongly produced posteriorly and which had prominently opisthogyrous beaks. Its two closest allies were regarded as *Laevitrigonia* Lebküchner 1932, and *Nototrigonia* Cox, 1952. From *Laevitrigonia* the new genus can be readily distinguished by its markedly produced posterior portion. The features previously regarded as distinctive between *Opisthotrigonia* and *Nototrigonia* were the sickle-shaped outline, opisthogyrous beak, and a smooth area, all in *Opisthotrigonia*. More recently, however, Nakano (1961) has found radial striations on the proximal portion of the area of *Opisthotrigonia*, while examination of *O. curvata* Aitken, 1961 (from the Tithonian of Southern Tanganyika) convincingly reveals that the extension of the sub-oblique flank costae from the disc on to the sulcus is an intraspecific feature.

Opisthotrigonia has not previously been reported from Australia, but at least two species have recently been noted in the Cretaceous strata of this country. One is O. *roperi* sp.nov., from the Neocomian beds of the Northern Territory, the other is a well known Australian trigoniid, T. *nasuta* Etheridge Snr, 1872.

The original description of T. *nasuta* was based on some internal casts from Corporation Quarry, Maryborough, eastern Queensland. This was supplemented later by Tenison Woods and Etheridge Jnr, (see synonymy list) who described better material from New South Wales. Recently collected material from the type locality has been kindly made available by the Geological Survey of Queensland, and has revealed features which are characteristic of *Opisthotrigonia.*

Amendments to Diagnosis: The study of the Australian species of *Opisthotrigonia* and their comparison with Indian and South African forms invites certain amendments to Cox's original diagnosis and to Nakano's subsequent diagnosis of the genus.

Both these authors noted a well defined marginal carina. However, in O. *roperi*, O. *nasuta*, and in overseas forms, the area is quite indistinct. Nakano observed radial riblets on the area of T. *retrorsa*—these riblets are also present in both Australian species, but they are conspicuously absent from the distal portion of the area in all known species of *Opisthotrigonia.* The combination of wavy diagonal riblets on the proximal portion of the disc in the Australian species is not found in the overseas forms and may be a specific feature.

These features are particularly useful in distinguishing between species of *Opisthotrigonia* and *Nototrigonia* if the overall shape of a specimen is altered by post-depositional movements. In *Nototrigonia* the marginal carina in particular is very distinct throughout its length (except in old or abraded specimens) because in many species it is marked by a prominent radial rib.

The present known range of *Opisthotrigonia* is from Tithonian to Aptian.

OPISTHOTRIGONIA NASUTA (Etheridge Snr), 1872

(Pl. 3, fig. 7 ; Pl. 4, figs. 1–6)

1872 *Trigonia nasuta* Etheridge Snr, *Quart. J. geol. Soc. Lond.*, 28, 339, pl. 19, figs. 2, 2a.

1883 *Trigonia mesembria* Tenison Woods, *Proc. Linn. Soc. N.S.W.*, 8 (2), 237, 238, pl. 12, figs. 1–3.

1892 *Trigonia* sp.ind. Etheridge Jnr, in Jack & Etheridge, The geology & palaeontology of Queensland and New Guinea, pl. 26, fig. 5.

1902 *Trigonia nasuta* Etheridge Snr ; Etheridge Jnr, *Mem. geol. Surv. N.S.W., Palaeont.* 11, 25, 26, Pl. 5, figs. 1–3.

1911 ,, ,, Etheridge Snr ; Sussmilch, An Introduction to the Geology of New South Wales, 127, fig. 64.

Material: Two external and four internal impressions of the right valve, and four external and seven internal impressions of the left valve ; many specimens are crushed and incomplete. All specimens but one derived from Corporation Quarry, Maryborough, Queensland. Maryborough Formation, Aptian.

Figured specimens: F.3607 (Pl. 4, fig. 1) ; F.3611 (Pl. 4, fig. 3) ; F.3597b (Pl. 4, fig. 4) ; F.3604 (Pl. 4, fig. 2) and F.3605 (Pl. 4, fig. 5), F. 3597a (Pl. 4, fig. 6). Geological Survey of Queensland.

Diagnosis: The diagnostic feature of O. *nasuta* is the combination of fine diagonal ribbing on the proximal portion of the disc, and equally fine concentric and regular ribbing on the remaining portion of the disc.

Differential Diagnosis: O. *nasuta* is very similar to another Australian *Opisthotrigonia*, O. *roperi* sp.nov., described from the Neocomian strata of the Northern Territory. Indeed, the only differences between the two species are the concentric ribbing on the disc, which in O. *nasuta* is much finer, and individual costae which are of more constant width than in the Northern Territory forms.

O. *nasuta* can be distinguished from O. *curvata* Aitken, 1961, from the Tithonian beds of South Africa, by the absence of the flattened frontal face, by the presence of diagonal wavy proximal costation on the disc and by thinner subconcentric costae.

Description: Shell about 70 mm. long and 50 mm. high, equivalve, inequilateral, rostrate, sickle-shaped. Umbo slightly obtuse, angular, opisthogyrous, slightly incurved. Anterior and ventral shell margins evenly convex ; postero-dorsal margin concave ; free margin of sulcus gently convex ; distal margin of area almost straight. Disc large, ribbed with diagonal and concentric costae ; diagonal riblets fine and wavy, limited to proximal portion of disc ; concentric costae regularly arched, narrow, sharp-ridged, separated by comparatively wide interspaces ; terminate on posterior margin of discs, each with a small swelling. Sulcus very wide, rather shallow, striated with concentric parallel growth-lines. Marginal carina sharply angular proximally but poorly defined distally. Area narrow, widens very gradually distally ; faint radial riblets present on proximal portion of area ; distally ornamented with growth-lines only. Escutcheon carina ill-defined. Escutcheon wide, striated with growth-lines.

OPISTHOTRIGONIA ROPERI sp.nov.

(Pl. 3, figs. 12, 13)

Material: One internal and three external impressions of the left valve. Locality, T.T. 42, Northern Territory. Neocomian.

Holotype: C.P.C. 4662 (Pl. 3, fig. 12, 13).

Diagnosis: The diagnostic feature of O. *roperi* is the combination of fine diagonal ribbing on the proximal portion of the disc with coarse, irregular, concentric ribbing on the remainder of the disc.

Differential Diagnosis: The new species closely resembles *Austrotrigonia prima* sp. nov. in the type of concentric ornamentation, in the lack of ribbing on the ventral portion of the area, and in the attenuation of the posterior portion of the shell; the two forms can be distinguished by their different shapes, and by the lack of diagonal ribbing on the proximal portion of *A. prima*. The much coarser ribbing on the distal portion of the disc distinguishes O. *roperi* from O. *nasuta* (Etheridge Snr), 1872.

O. *roperi* differs from O. *curvata* Aitken, 1961, from the Tithonian strata of Southern Tanganyika, in the lack of swellings on the distal extremities of disc costae, which are also coarser.

Description: Shell 8 cm. long and about 5·5 cm. high, moderately inflated, inequilateral, strongly rostrate posteriorly, crescentic in outline. Umbo opisthogyrous, rather depressed. Antero-dorsal and antero-ventral shell margins broadly convex ; postero-dorsal margin gently concave ; postero-ventral margin virtually straight ; free margin of area strongly convex. Disc moderately in-

flated. Proximal portion of disc ornamented with fine, irregular, diagonal, wavy riblets. Distally, ornamented with well developed concentric ribs which follow lines of growth ; they originate at anterior shell margin and run at first towards ventral shell margin, but with a decisive later dorsal swing ; width increases posteriorly ; terminate abruptly in well defined line slightly convex towards anterior of shell ; well marked tendency for ribs to decrease in width as the shell grows, but many individual exceptions ; many of proximal concentric ribs are rectangular, both in plan and in cross-section, i.e. broad and flat-crested ; some rounded in cross-section ; those close to ventral shell margin narrow and irregularly spaced. Interspaces generally broad and flat-bottomed where surrounding ribs are rectangular, but narrow and U-shaped where ribs are rounded. Sulcus broad, at lower plane than disc, with concave surface in proximal portion and flat surface distally ; ornamented with growth-lines and with irregular projection of ribs and interspaces, which are of less amplitude than on disc. Area very narrow proximally, but widening gradually distally ; at about same plane as disc but set off from it at small angle ; steeply inclined to the commissure proximally, less inclined distally ; dorsal portion ornamented with four identical radial riblets of small relief, ventral portion with well-marked growth-rugae only ; the first areal riblet, which occupies position of marginal carina, separates area from sulcus in proximal portion of shell, but elsewhere boundary between sulcus and area not very distinct. Area separated from escutcheon by prominent radial groove. Escutcheon probably concave, ornamented entirely with growth-lines.

Genus NOTOTRIGONIA Cox, 1952 em.

Type species: Nototrigonia cinctuta (Etheridge Jnr), 1902.

Amended Diagnosis: Shell of varying size, strongly produced posteriorly, made up of three distinct portions :—

(1) A well inflated disc which is ribbed with regular concentric or irregular oblique costae, or a combination of both ;

(2) An unusually wide, flat or impressed triangular sulcus which is usually devoid of radial ribbing, and

(3) Comparatively narrow area which is inclined to the commissure away from the flank, and is usually ornamented with four, sometimes six or rarely eight radial riblets ; these riblets are usually divided into two equal sets by a deeper radial groove, and are separated from the sulcus by a more or less prominent marginal carina; radial riblets may be absent from the mature portion of the area.

Age: Nototrigonia is known from the Neocomian, Aptian, Upper Albian and Cenomanian strata of Australia and Upper Senonian of South America.

For convenience of treatment all the known species of *Nototrigonia* are classified into three groups :—

(1) *The Cinctuta Group* includes all species whose disc is diagonally ribbed with irregular, frequently interrupted costae. Australian species included in this Group are N. *cinctuta* (Etheridge Jnr), 1902, N. sp.cf. N. *cinctuta* (Etheridge Jnr), 1902, N. *minima* sp.nov., N. *crescenta* sp.nov., and *Nototrigonia* (?) sp.nov. ; there are also South American N. *hanetiana* (d'Orbigny), 1842 and possibly N. *ecplecta* (Wilckens), 1905. The typical form is N. *cinctuta*.

(2) *The Yeuralba Group* includes species with concentrically ribbed disc, though in some species proximal costae may be oblique. Species included are *N. yeuralba* sp.nov. and N.(?) *aberrata* sp. nov. The typical form is *N. nasuta.*

(3) *The Ponticula Group* is distinguished by the lack of distinct radial ribbing on the mature portion of the area, and by mixed oblique and concentric ribbing on the disc. Only one species is included in this Group, *N. ponticula* sp.nov.

Discussion: The diagnosis of Cox's genus *Nototrigonia* has had to be broadened in order to allow for the variation in the shell characters exhibited by species included in this genus since its erection. In 1952, Cox made the Lower Cretaceous Australian species *Trigonia cinctuta* Etheridge Jnr, 1902, the type for his new genus *Nototrigonia.* He used Etheridge's original figure (1902, pl. 4, fig. 4), which shows the exterior aspect of the left valve, to describe and illustrate his new genus. No additional species were referred to *Nototrigonia.*

Apart from this left valve, and a matrix cast tentatively referred to the species (both from near Lake Eyre, South Australia), the form has only been recorded once from Australia. In 1907 Etheridge figured and briefly described an incomplete right valve from the ' Rolling Downs Formation ' (Lower Cretaceous) of south central Queensland. An internal cast of the left valve described by the same author (1892, p. 567) as *Trigonia* sp.ind., and later thought by him to belong to *T. cinctuta,* may be *Trigonia nasuta* Etheridge Snr, 1872.

Among recently collected fossils from Aptian strata of the Northern Territory, a number of specimens of a trigoniid have many similarities with the figured *T. cinctuta* ; others from the Aptian and Albian beds of Queensland and Neocomian beds of the Northern Territory possess characters which suggest Cox's *Nototrigonia*—if the definition of the genus is broadened. In none of the forms examined, however, was the area nearly on the same plane as the flank as suggested by Etheridge's figure, and stated in Cox's definition of the genus. This anomaly led to re-examination of the type, which was kindly lent to me for the purpose by Dr M. F. Glaessner of the Department of Geology, University of Adelaide. The area is in fact strongly inclined away from the anterior portion of the shell and dips towards the commissure. *N. cinctuta,* the type, is redescribed in the following pages. Individual descriptions and consideration of new species of Nototrigoniinae has led to the redefinition of Cox's genus *Nototrigonia.*

In Nototrigoniinae the flank is comparatively large and can be readily subdivided for descriptive purposes into two portions, the anterior ribbed inflated portion, and the generally smooth, usually depressed, posterior portion. In the descriptions these are most conveniently referred to as " disc " and " sulcus " respectively (see text fig. 2).

Cinctuta Group

NOTOTRIGONIA CINCTUTA (Etheridge Jnr), 1902

(Pl. 3, figs. 1, 2)

1902 *Trigonia cinctuta* Etheridge Jnr, *Mem. Roy. Soc. S. Aust.,* 2 (1), 28–30, pl. 4, figs. 4–6, ?7.

1907 *Trigonia cinctuta* Etheridge Jnr ; Etheridge Jnr, *Rec. Aust. Mus.,* 6 (5), 322, pl. 60, fig. 9.

1952 *Nototrigonia cinctuta* (Etheridge Jnr) ; Cox, *Proc. malac. Soc. Lond.*, 29 (2), 62, pl. 4, fig. 2.

1961 *Nototrigonia cinctuta* (Etheridge Jnr) ; Nakano, *J. Sci. Hiroshima Univ. Ser.* C., 4 (1), 87, pl. 8, fig. 15.

Material: Single left valve from Lake Eyre Basin, South Australia. Lower Cretaceous (Aptian, Albian).

Holotype: T.1318A (pl. 3, figs. 1, 2) Geology Department, University of Adelaide.

Diagnosis: The combination of the obliquely and rather irregularly ribbed disc, wide and concave sulcus, and an inclined narrow area ornamented throughout its length with radial costae, are the diagnostic features of N. *cinctuta.*

Differential Diagnosis: Diagonal ribbing on the disc of N. *cinctuta* distinguishes it from Australian species of *Nototrigonia* which are included in the Yeuralba Group. Differences between N. *cinctuta* and N. *minima*, its closest Australian ally, are listed in the differential diagnosis of N. *minima* (p. 29). A species closely similar to N. *cinctuta* is N. *hanetiana* (d'Orbigny), 1842, from the Upper Senonian of Chile, but the two species can be distinguished by the detail of ribbing on the discs and orientation of the free margin of the area. In the Chilean species, the ribbing is coarser, and individual ribs thicken distally, while the free margin of the area is oriented in the antero-dorsal direction.

Description: Shell 52 mm. long and 38 mm. high, inequilateral, produced posteriorly, subrostrate, wide anteriorly, tapering towards the posterior, moderately and evenly inflated. Umbo rather wide, distinct, slightly opisthogyrous,

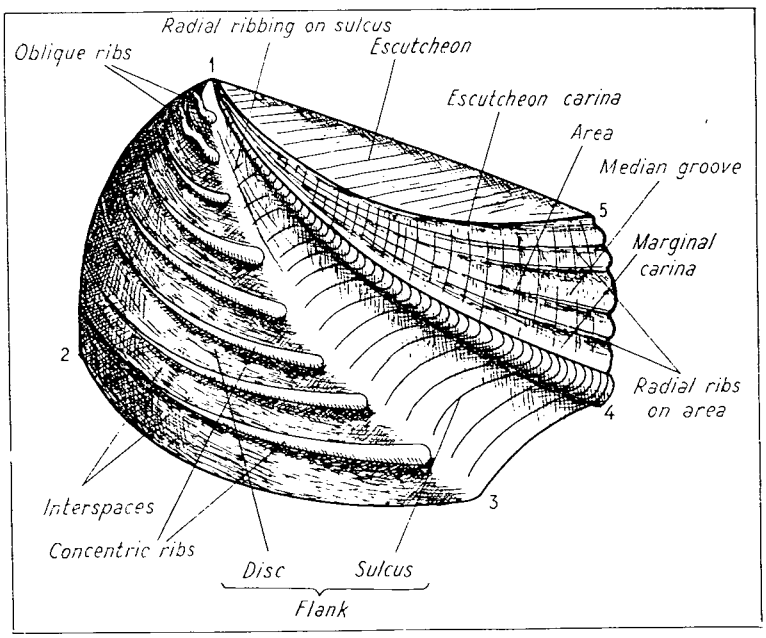

Figure 2.—Descriptive terminology used for *Nototrigoniinae*. 1-2 Anterior margin; 2-3 Ventral margin; 3-4 Free margin of the sulcus; 4-5 Free margin of the area; 5-1 Dorsal margin. (Figure diagrammatic.)

somewhat incurved. Antero-dorsal and ventral margins of flank gently and evenly convex ; antero-ventral shell margin more strongly arched ; postero-dorsal margin almost straight ; free margin of area almost straight ; free margin of sulcus sigmoidal, with concave portion anterior to convex portion. Disc relatively large, ornamented with growth-lines and with sinuous diagonal ribs which transgress growth-lines. Ribs originate at anterior shell margin and run irregularly but parallel to each other backwards and downwards ; ribs very narrow, of small relief, separated by flat-bottomed interspaces several times their breadth ; posterior rib extremities swollen into prominent tubercles which terminate in an even line, slightly convex anteriorly, running diagonally across shell, marking anterior limit of sulcus. Sulcus wide, anterior margin well below surface of flank, rising gradually posteriorly and passing insensibly into ill-defined marginal carina at about same level as flank. Surface of sulcus lined with prominent growth-lines. Area narrower than sulcus, inclined to commissure ; ornamented with growth-lines and six faint radial riblets, the first forms the rounded and indefinite marginal carina, and the last the dorsally concave escutcheon carina. Escutcheon longitudinally and transversally concave, ornamented only with growth-lines.

NOTOTRIGONIA sp.cf. N. CINCTUTA (Etheridge Jnr), 1902
(Pl. 3, figs. 3–5)

Material: Nine external impressions of the left valve, four of the right valve. Locality, T.T.21, Northern Territory. Aptian.

Figured specimens: C.P.C. 4919 (Pl. 3, fig. 3), C.P.C. 4920 (Pl. 3, fig. 4) and C.P.C. 4921 (Pl. 3, fig. 5).

Differential Diagnosis: In spite of the flattening by compaction which has affected all our specimens, N. sp.cf. N. *cinctuta* is very similar to N. *cinctuta* (Etheridge Jnr), 1902. The Northern Territory specimens differ from the southern and eastern forms in a somewhat greater tendency for the transverse costae to be disjointed and offset, a slightly wider spacing of oblique ribs, and more marked radial striation on area. These differences may, however, be due to lateral compression on compaction of sediments, as well as intraspecific variation.

Description: Shell of medium size, inequilateral, produced posteriorly and probably subrostrate, moderately inflated with greatest convexity centred in posterior portion of disc. Umbones orthogyrous or very slightly opisthogyrous, angular. Anterior shell margin and ventral margin of disc broadly and uniformly arched ; postero-dorsal shell margin slightly concave ; remaining shell margin not observed. Disc ornamented with sub-oblique ribs of ' cinctuta ' type. Ribs narrow, sinuous, originate at anterior shell margin and run parallel to each other, and initially parallel to growth striae ; distally cutting obliquely and unevenly across growth-lines, curl upwards at distal extremities, terminating with an upward direct swelling ; fluctuation in direction of growth and of relief in posterior portions brings about discontinuity or complete disappearance. Interspaces always several times broader than ribs. Disc separated from area by moderately impressed broad sulcus whose ornamentation is limited to growth-lines. Area very narrow, attenuated, set off at low angle from flank, separated by inconspicuous marginal carina ; carina similar to remaining four riblets grouped into two sets of two with a broader intervening space. Escutcheon smooth, dipping steeply towards commissure, distinct from area.

NOTOTRIGONIA MINIMA sp.nov.

(Pl. 3, figs. 8–11)

Material: Fourteen complete or incomplete external impressions of the right valve and two of the left valve. Two internal impressions of the left valve and two of the right valve. Source area, the western margin of the Great Artesian Basin, south-western Queensland. Aptian and Albian (Lower Cretaceous).

Types: Holotype C.P.C. 4656 (Pl. 3, fig. 10). Paratypes C.P.C. 4657 (Pl. 3, fig. 8), C.P.C. 4658 (Pl. 3, fig. 9), C.P.C. 4659 (Pl. 3, fig. 11).

Diagnosis: The diagnostic feature of *N. minima* is the combination of the following characters : small size, diagonal ribbing on the disc, a wide sulcus which is radially striated in the right valve, and a very prominent marginal carina.

Differential Diagnosis: *N. minima* is a species of the Cinctuta Group closely similar to *N. cinctuta* (Etheridge Jnr), 1902, from which it can be distinguished by : the presence of radial ribbing on the escutcheon ; a distinct and very prominent marginal carina ; radial striations on the sulcus of the right valve (as, however, no complete right valve of *N. cinctuta* has been described, the possibility of radial ribbing on its sulcus remains) ; and its small size.

In spite of these differences, however, the possibility that *N. minima* is a juvenile *N. cinctuta* cannot be altogether ruled out.

Description: Shell up to 30 mm. long and 17 mm. high, moderately inflated, subrhomboidal or subrostrate, strongly inequilateral, produced posteriorly, apparently equivalve. Umbones convex, broad, prominent, slightly opisthogyrous, a little rounded and incurved, somewhat depressed. Flank occupies considerable portion of shell surface ; regularly convex, ornamented with about a dozen prominent, flexible, oblique costae which originate at regularly convex anterior margin and run diagonally postero-ventrally, transgressing concentric growth-lines and terminating in straight or gently convex row of swelled endings ; ribs subparallel, rounded in cross-section, increase slightly in breadth and spread apart very slightly distally. Interspaces flat-bottomed and two to three times as broad as ribs. Sulcus conspicuous and relatively broad, depressed below plane of disc, with flat or concave surface ; in right valve, sulcus ornamented with ten thin, well defined radial threads with weakly serrated crests ; sulcus of left valve has no radial ornament ; its only lineation is fine growth-lines. Marginal carina prominent, thick, well developed, usually with irregularly nodose surface. Area about as wide as sulcus, steeply inclined to commissure and away from plane of flank, ornamented with four radial threads grouped into two sets of two, separated by somewhat wider interspace. Escutcheon almost as wide as area, dips away steeply to commissure, ornamented with numerous and closely and evenly spaced radial threads finer than those of area. Position of escutcheon carina marked by change in inclination of area to escutcheon. Interior shell features similar to those of *N. cinctuta*.

NOTOTRIGONIA CRESCENTA sp.nov.

(Pl. 4, fig. 8)

Material: Three external impressions of a right valve, all ventrally incomplete. Locality T.T.35, Northern Territory. Neocomian.

Holotype: C.P.C. 4660 (Pl. 4, fig. 8).

Diagnosis: *N. crescenta* is a species of the Cinctuta Group with tuberculation on the radial costae of the area.

Differential Diagnosis: The closest relative of the new species is *N.* sp.cf. *N. cinctuta* (Etheridge Jnr), 1902, from which it can be distinguished by the tuberculation of the radial ribs on the area, as well as by the more crescentic shape of the area.

Description: Shell about 35 mm. long, very inequilateral, strongly produced posteriorly, rostrate. Umbo moderately inflated, acute, opisthogyrous, a little depressed. Anterior shell margin very slightly convex; postero-dorsal margin concave ; posterior margin convex ; ventral margin broadly convex. Disc moderately inflated, ornamented with diagonal costae which originate at anterior shell margin and run postero-ventrally. Costae uninterrupted, narrow, sharp ridged, posteriorly rapidly increasing in breadth. Interspaces 4–6 times as broad as costae. Sulcus deep, relatively wide, evenly concave, acutely triangular, widening rapidly ventrally. Area narrow, crescentic, almost uniplanar with disc, ornamented with fine radial subparallel tubercular riblets ; foremost rib, constituting margin of carina, thicker than others, but in same plane ; remaining four ribs of equal size, grouped into two pairs of two, separated by wider interspace. Interspaces wider than the riblets. Uppermost radial rib occupies position of escutcheon carina. Escutcheon a little wider than area, concave longitudinally and transversally, faintly striated with diagonal riblets.

NOTOTRIGONIA (?) sp.nov.
(Pl. 3, fig. 14)

Material: A single incomplete impression of a left valve. Locality T.T.50, Bathurst Island, Northern Territory. Cenomanian.

Figured Specimen: C.P.C. 4923 (Pl. 3, fig. 14).

Description: Disc ornamented with tubercular oblique costae. Ribs narrow, consisting of continuous or subcontinuous rows of elongate tubercles, which diverge distally. Interspaces five or six times wider than ribs, flat or concave-bottomed, striated with fine concentric growth-lines. Sulcus broad, concave, gradually broadening ventrally, striated with growth-lines. Marginal carina very prominent, sharp-ridged, tuberculate. Area dipping steeply to commissure.

Remarks: Although incomplete, the shell is of importance since it is the only post-Albian *Nototrigonia* known from Australia. It is possible that the sulcus is not truly triangular as in pre-Cenomanian Australian Nototrigoniinae, but is open at the top as in most New Zealand specimens referred to *Pacitrogonia hanetiana* (d'Orbigny), 1842 ; nevertheless, its sides do converge dorsally and are not parallel. Although the Australian specimen definitely represents a hitherto undescribed species it cannot be named because of its poor preservation.

Yeuralba Group

NOTOTRIGONIA YEURALBA sp.nov.
(Pl. 3, fig. 6)

Material: A single incomplete external impression of the right valve. Locality T.T.49 Northern Territory. Neocomian.

Holotype: C.P.C. 4663 (Pl. 3, fig. 6).

Diagnosis: In most of the individual characters *N. yeuralba* sp.nov. is a typical *Nototrigonia* of the Nasuta Group. It is distinguished by a combination of regular concentric ribbing on the disc, faint longitudinal striations in the sulcus, and unprotruding though well marked marginal carina.

Differential Diagnosis: *N. yeuralba* sp.nov. differs from its closest relative, *N. minima* sp.nov., in the concentric ribbing on the disc, in the much finer marginal carina, and in regular and closely spaced ribbing on the narrow area.

Description: Shell small, 27 mm. long and 17 mm. high, subrostrate, strongly produced posteriorly, moderately well inflated. Umbo prominent and slightly obtuse, slightly opisthogyrous, somewhat depressed. Antero-dorsal and antero-ventral shell margins gently convex, their contact obtusely angular and rounded ; postero-dorsal and postero-ventral shell margins broadly and gently concave ; posterior margin, i.e. free margin of area, complexly flexed. Disc moderately large, ornamented with concentric sharp-ridged costae which begin at antero-dorsal margin, run at first rather steeply backwards and downwards, then less steeply, and terminate in well marked line which marks anterior margin of sulcus. Sulcus triangular and broad, with a concave bottom, depressed below plane of disc ; faint radial ribbing. Junction of sulcus with area sharply angular and well marked, although radial rib forming marginal carina no higher than others on area. Area flat, and steeply inclined. Eight straight, subparallel radial areal riblets separated from each other by shallow grooves ; grouped into two sets of four, separated by a deeper groove. Escutcheon distinct, at a greater angle to commissure than area, but without distinct escutcheon carina ; contains a number of closely spaced very fine radial riblets with serrated edges.

Remarks: Although part of the proximal portion of the figured specimen is missing the fossil was originally collected whole and the nature of the portion now missing was noted.

NOTOTRIGONIA(?) ABERRATA sp.nov.

(Pl. 5, fig. 5)

Material: A single posteriorly incomplete external impression of the left valve. Locality T.T.35. Neocomian.

Holotype: C.P.C. 4925 (Pl. 5, fig. 5).

Diagnosis: Disc relatively large, with subconcentric rigid costae which increase in breadth and diverge from each other distally. Sulcus relatively narrow ; area wide.

Differential Diagnosis: Features listed under the diagnosis distinguish the new species from other described species of *Nototrigonia.*

Description: Shell of medium size, strongly produced posteriorly. Umbo obtuse but narrowing rapidly, pointed. Disc large, ornamented with subconcentric rigid costae which increase in breadth and diverge from each other distally. Sulcus relatively narrow, shallow, striated with concentric growth-lines. Area relatively wide, separated from sulcus by a thick and conspicuous but plain marginal carina ; ornamented with six radial riblets arranged in two sets of three, separated by deeper and wider interspace. Shell produced antero-ventrally, forming a sharp angle in periphery, but this is probably an aberrant feature.

Ponticula Group

NOTOTRIGONIA PONTICULA sp.nov.

(Pl. 5, figs. 1–4)

Material: One internal and one external impression of the left valve ; four incomplete external impressions of the right valve. Localities, T.T.35 and T.T.46, Northern Territory. Neocomian.

Figure 3.—Reconstruction of *Nototrigonia ponticula* sp. nov. × 1.

Types: Holotype, C.P.C. 4664 (Pl. 5, fig. 1), Paratypes C.P.C. 4665 (Pl. 5, fig. 4), C.P.C. 4666 (Pl. 5, fig. 3).

Diagnosis: *N. ponticula* sp.nov. is the only member of the Ponticula Group. Its diagnostic features are the combination of oblique and concentric ribbing on the disc, the wide flat sulcus, the area lacking radial ribbing on its mature portion, and lack of a distinct marginal carina.

Description: Shell large, 10 cm. long and 6 cm. high, inequilateral, very strongly produced posteriorly. Umbo broad, pointed, moderately inflated, slightly opisthogyrous, very slightly obtuse. Anterior shell margin uniformly convex; ventral margin broadly and gently arched; postero-dorsal margin slightly concave; postero-ventral margin almost straight. Flank irregularly ribbed anteriorly, plain posteriorly; occupies large portion of shell surface. Disc ornamented with no less than fourteen long sub-concentric or oblique costae of moderate relief and rounded in cross-section; costae originate at anterior shell margin, where their relief is greatest, and are immediately strongly flexed, first ventrally then dorsally, after which they continue posteriorly parallel or sub-parallel to each other, either in open concentric fashion following the growth-lines or in irregular, interrupted, oblique fashion transgressing growth lines, or both. Costae in posterior portion of disc generally more irregular than in anterior portion.

Interspaces flat-bottomed and usually broader than ribs. Sulcus very wide, about one-half breadth of disc, uniplanar with disc; flat and unornamented except for parallel growth-lines. No definite marginal carina observed; its position taken by a broad flexure in shell surface which marks passage from plane of flank to plane of area, which is inclined at a moderate angle to commissure. Area moderately large, ornamented with incremental lines. Escutcheon dipping steeply to commissure; its surface not visible.

Genus AUSTROTRIGONIA nov.

Type species: Austrotrigonia prima sp.nov.

Diagnosis: Shell very inequilateral, broad and gently rounded anteriorly, strongly produced and attenuated posteriorly. Umbones slightly opisthogyrous. Disc concentrically ribbed. Sulcus very wide, flat, striated with irregular continuations of ribs from the disc. Area very narrow, with no obvious radial lineations. Sulcus, area, and escutcheon ornamented with growth lines only.

Neocomian of Northern Territory and (?) eastern Queensland.

AUSTROTRIGONIA PRIMA sp.nov.

(Pl. 6, figs. 1–3, ?4)

?1946 *Indotrigonia*(?) sp., Whitehouse, *Proc. Roy. Soc. Qld,* 57 (2), 12, 13, pl. 1, figs. 4a. b, 6, text fig.

Material: Seven incomplete external impressions, four of right valve and three of left valve ; four incomplete internal impressions, two of the right valve and two of the left valve. All specimens compressed to some degree. Locality, T.T.55, Northern Territory, Neocomian ; (?) Stanwell area, eastern Queensland, Neocomian.

Types: Holotype C.P.C. 4667 (Pl. 6, fig. 1). Paratype C.P.C. 4668 (Pl. 6, fig. 2).

Diagnosis : *A. prima* sp.nov. is the type species for the monotypic *Austrotrigonia* gen.nov. Its diagnosis therefore coincides with that of the genus.

Description: Shell medium to large, very inequilateral, broad and well developed anteriorly, strongly produced and attenuated posteriorly. Umbo wide, slightly opisthogyrous. Antero-dorsal shell margin almost straight or broadly convex ; antero-ventral and ventral margin of disc broadly and uniformly rounded; postero-dorsal and postero-ventral margins straight or very gently concave. Disc large, rather weakly inflated, its limits well marked by strongly developed ribs. Ribs prominent, sub-concentric, parallel growth-lines, begin at anterior shell margin ; in distal portion of shell they are narrow and convex in cross-section ; proximal ribs wide, flat-topped, and with rather prominent dorsal edge ; all ribs broaden very slightly posteriorly and all terminate abruptly, with rectangular or subrounded extremities aligned in a regular and well defined margin. Interspaces narrower than ribs in proximal portion of shell, usually wider in distal portion of shell ; in cross section, in some specimens V-shaped anteriorly and narrow U-shaped posteriorly ; in others fairly broadly U-shaped throughout. Sulcus flat, shallow, broad, ornamented with growth-lines. In some specimens costae and interspaces continue from area into sulcus, but much less prominent there. Marginal carina not well defined. Area apparently ornamented only by growth-lines. Escutcheon carina and escutcheon not observed.

Discussion: Whitehouse (1946) described two incomplete specimens of a single species of *Indotrigonia* (?) from the Neocomian bed of Stanwell, eastern Queensland. Although this material was poorly preserved, as can be inferred from his photographs (in addition, pl. 1, fig. 6 is probably somewhat misleading), his restoration on page 12 demonstrates very definite similarities to forms currently described from the Northern Territory. The Northern Territory and Stanwell specimens appear to belong to the same genus and possibly to the same species, even though the Stanwell shell is not as high as the Northern Territory specimens.

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The Stanwell form was regarded by Whitehouse as having greatest affinities with genus *Indotrigonia* Dietrich, 1933, the type species of which is *T. smeei* J. de C. Sowerby, from the Oomia Beds of Cutch. The comparison of our Northern Territory forms with *T. smeei* and *T. beyschlagi* Muller (*T. crassa* Kitchin), the best known species of *Indotrigonia*, brings out some important differences, particularly in the ornamentation. In both overseas forms strongly developed ribbing continues over the entire shell surface. The Northern Territory specimens and probably the Queensland form belong to a hitherto undescribed genus to which the name *Austrotrigonia* is here given. Especially in the ornamentation of the disc, and in the continuation of the concentric ribbing, though less pronounced, into the sulcus, *A. prima* sp.nov. is regarded as possibly an end product of a progressive increase in the width of the sulcus to the point where the marginal carina and even the area are ' engulfed ' by it. Because of this, a generic rather than subgeneric distinction from *Nototrigonia* is considered more justified. The South African Neocomian *Sphenotrigonia* Rennie, 1936, may have reached a similarly extreme stage of development but possibly along different lines.

Genus PACITRIGONIA Marwick, 1932

Type species: Pacitrigonia sylvestri Marwick, 1932.

Only a single Australian trigoniid has been referred to *Pacitrigonia* Marwick, 1932: in 1961 Cox described *Pacitrigonia(?) nanutarraensis* from Neocomian beds of the Carnarvon Basin, Western Australia. Its very characteristic ribbing suggested to Cox, however, that possibly a new genus should be erected when more complete material became available.

The typically South Pacific Upper Cretaceous trigoniids which in the past have been grouped under the generic name of *Pacitrigonia* Marwick, 1932, are at present being revised by C. A. Fleming, of the New Zealand Geological Survey, and only a brief note on their relationship to Nototrigoniinae is warranted here.

Marwick in 1932 erected a new genus *Pacitrigonia* in which he included the Chilean *T. hanetiana* d'Orbigny, 1842, and the New Zealand specimens referred by Woods (1917) to this species, the South Patagonian *T. ecplecta* Wilckens, 1907, and the type species, *P. sylvestri* Marwick, 1932* Wood's specimens of *T. hanetiana* were derived from three New Zealand localities, and almost certainly belong to more than one species—as pointed out by Marwick (1932, p. 508). *T. hanetiana* does not seem to be represented in New Zealand at all. Unfortunately, the South American and New Zealand trigoniids, which have been generously made available for my use by Dr Fleming, allow only limited conclusions to be drawn.

Perhaps the most important question which the examination of these specimens has raised is the relationship of *Pacitrigonia* Marwick, 1932, to *Nototrigonia* Cox, 1952. Comparison of the holotypes of these genera reveals a marked similarity in the presence of the diagonally ribbed disc, wide sulcus, and narrow area. In his description of *P. sylvestri*, Marwick made no mention of radial ribbing on the area, and indeed, re-examination of the holotype confirms its absence. The holotype, however, is not a well preserved specimen. The only

* Nakano (1961) included two more species in this genus : ' *Trigonia* ' *papuana* Glaessner, 1958, from the Cenomanian of New Guinea and *Trigonia regina* Wilckens, 1910, from the Upper Cretaceous of Seymour Island, Antarctica. It is felt, however, that too little is known of ' *T.*' *papuana* to justify its inclusion in *Pacitrigonia*.

other specimens of *P. sylvestri* available to me are a rubber mould of a reasonably well preserved proximal portion of the right valve from an unknown New Zealand locality and a cast of a topotype; here once again there is no evidence of radial ribbing on the area (see text-fig. 4). Future examination of additional material from New Zealand may reveal the presence of this important feature, in which case past inclusion of *Pacitrigonia* in the Trigoniinae by Kobayashi (1954), Savaliev (1958), and Nakano (1961) will be justified, and *Nototrigonia* will become a synonym of the earlier established *Pacitrigonia*. In the present paper, however, *Pacitrigonia* is included in the subfamily Nototrigoniinae nov. on the assumption that it once did possess radial ribbing for reasons discussed below.

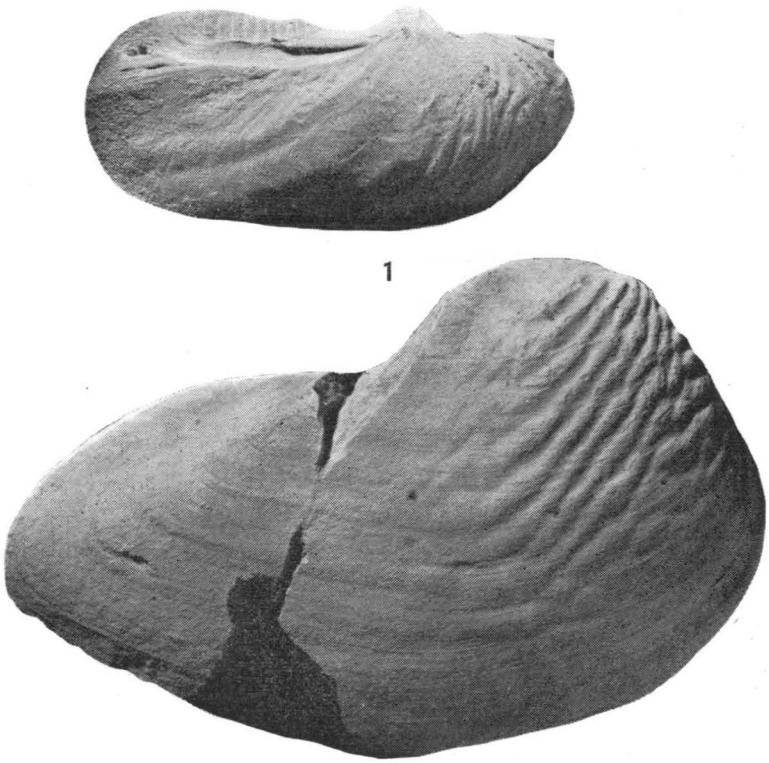

Figure 4.—*Pacitrigonia sylvestri* **Marwick, 1932.**

1 — **Rubber of an impression of the proximal portion of the right valve. Dorsal view. Locality not known.**

2 — **Plaster cast of a broken right valve. Lateral view. Topotype. Canterbury, New Zealand. Maestrichtian (Haumurian).** × **1.**

The second problem is the relationship of New Zealand specimens identified as '*P. hanetiana* (d'Orbigny), 1842', by Woods (1917) to the genus *Nototrigonia*, to the type species of *Pacitrigonia*, *P. sylvestri* Marwick, 1932, and finally to the South American *T. hanetiana* d'Orbigny, 1842. New Zealand specimens of '*P. hanetiana*' can be split up into two groups: the first group comprises those which bear striking resemblance to Australian Nototrigoniinae

(especially those included in the Cinctuta Group) ; the second group are less obviously similar. The three rubber and two plaster casts of ' *P. hanetiana* ' in my possession fall into the earlier category (see text-fig. 5). All five have diagonally ribbed wide disc and radially ribbed area. On closer examination,

1 2

Figure 5.—*Pacitrigonia hanetiana* **(d'Orbigny), 1842.**
1 — **Plaster cast of paralectotype. Quiriquina, Chile. Upper Senonian.**
2 — **Plaster cast of a left valve. Amuri Bluff, New Zealand. Campanian.** × **1.**

however, important differences between these and the Nototrigoniinae are revealed. In all five specimens the area is considerably wider, and whereas the number of radial riblets on the area of *Nototrigonia* is usually limited to four, the number in the New Zealand specimens seems to be persistently greater. The shape of the sulcus is also different. In Nototrigoniinae the sulcus is broadest distally and narrows upwards usually quite rapidly, coming to a point in the proximal extremity of the shell. In most specimens of ' *P. hanetiana* ', on the other hand, the sulcus is open at the top and broadens only very slightly distally. It would seem, therefore, that although obviously closely related to *Nototrigonia,* these specimens of the Upper Cretaceous ' *P. hanetiana* ' from New Zealand are distinct and may be grouped as a new subgenus of *Nototrigonia.* On the other hand, the presence of distinct radial ribbing on its area suggests that in the present state of knowledge, ' *P. hanetiana* ' cannot be included with Marwick's *Pacitrigonia.* The same is true of the South American *T. hanetiana* d'Orbigny, 1842. Of the two plaster casts of this species in my possession one is a paralectotype proximally incomplete, and the other is a proximal fragment of the shell. Radial ribbing on the area can be discerned, and sufficient is seen of both the area and the sulcus to suggest that this species should be referred to *Nototrigonia.* Apart from concentric ribbing in antero-ventral portion of the shell there is little to distinguish this species from *N. cinctuta* (Etheridge Jnr), 1902 (see p. 26).

I have no specimens of *T. ecplecta* Wilckens, 1907 or of *T. regina* Wilckens, 1910 for comparison.

Subfamily MYOPHORELLINAE Kobayashi, 1954

Genus MYOPHORELLA Bayle, 1878

Type species: *Myophorella nodulosa* Bayle, 1878.

MYOPHORELLA sp.nov.(?) juvenile

(Pl. 5, figs. 6, 7)

Material: Two incomplete external impressions of the left valve from Windalia Radiolarite, Carnarvon Basin, Western Australia. Lower Cretaceous. The exact description of locality was lost in the 1953 Bureau of Mineral Resources fire.

Figured Specimens: C.P.C. 4650 (Pl. 5, fig. 6), C.P.C. 4651 (Pl. 5, fig. 7).

Description: Shell small, moderately inflated, very inequilateral, strongly produced posteriorly, subcrescentic. Umbo somewhat inflated, attenuated, acute and well defined, opisthogyrous. Anterior, posterior, and ventral shell margins regularly convex but with greatest convexity in antero-ventral portions ; dorsal margin gently concave. Flank large, occupies greater portion of shell surface, ornamented with ribs which originate at dorsal margin of flank. Three proximal costae thin, subconcentric, branching ; give rise posteriorly to tubercules not aligned in any obvious pattern. Next three or four ribs originate at posterior margin of beak as very thin riblets and run ventrally and postero-ventrally, thickening very rapidly ; first discontinuous distally, giving place to regularly distributed tubercles ; interspaces slightly narrower than ribs but width not regular. Remaining costae originate at postero-dorsal flank margin and run postero-ventrally subparallel to each other ; somewhat sinuous and irregular in direction of growth but uniformly thin throughout length ; tend to bifurcate distally. Interspaces up to three or four times wider than costae, flat. No prominent marginal carina. Area ornamented with prominent and sharp-edged widely separated riblets, usually a continuation of flank costae, but oriented at right angles to them. Escutcheon concave longitudinally and transversely smooth. Interior aspect of shell and hinge pattern not observed.

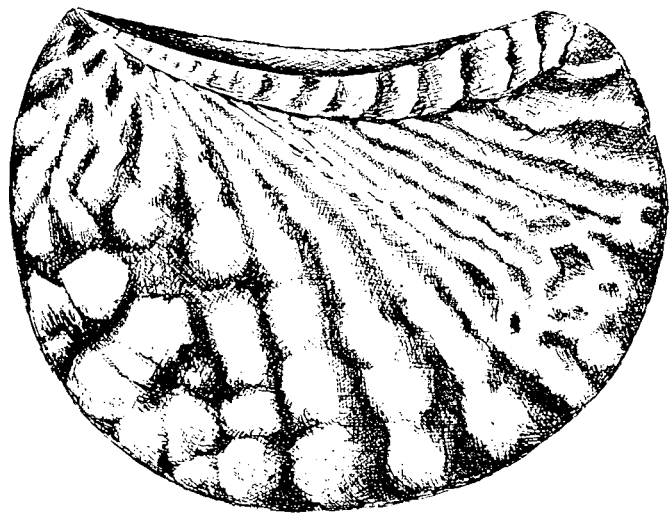

Figure 6.—Reconstruction of *Myophorella?* sp. nov.? juvenile. × 5½.

Remarks: The two fragments of *Myophorella* sp.nov.? are probably those of juvenile forms. Evidence for this is seen in the tuberculation on the anterior portion of the flank, which, like the lack of arrangement of tubercles, is regarded as a sign of immaturity. Since the nature of the anterior costae in mature specimens is unknown, the fossil can be assigned neither to a species nor to a subgenus.

Subgenus MYOPHORELLA

MYOPHORELLA (MYOPHORELLA) AUSTRALIANA sp.nov.

(Pl. 5, figs. 8–11)

Material : Two internal impressions of the right valve, one of the left valve ; one anteriorly incomplete external impression of the left valve. All specimens from Corporation Quarry, Maryborough, Queensland. Maryborough Formation, Aptian.

Types: Holotype F.3593, GSQ (Pl. 5, fig. 9) ; paratype F.3592, GSQ (Pl. 5, fig. 8).

Diagnosis: The distinctive features are the sparse but well developed flank ribbing and the type of ornamentation of the area.

Differential Diagnosis: The new species belongs to the subgenus *Myophorella*. From other subgenera of *Myophorella* Bayle, 1878, it can be distinguished by the lack of an angular bend in the flank costae, by the presence of transverse ribbing in the proximal portion of the area and tubercular ornament in the distal portion of the area, by the wide spacing of flank costae, and finally by the narrow prominent umbo.

Description: Shell about 40 mm. long and 32 mm. high, subcrescentic in outline, moderately inflated. Umbo narrow, opisthogyrous. Anterior, antero-dorsal and antero-ventral shell margin evenly convex ; postero-dorsal margin concave, free margin of area straight or very slightly convex ; sharply defined. Flank ribbing consists of radial to subradial prominent tubercular costae, rigid but gently flexed, rather widely spaced, with interspaces open U-shaped and a little broader than the ribs. Area broad, widening rapidly distally, striated with fine transverse growth-lines, ornamented proximally, with transverse costae, with tubercles distally. Ribs very coarse and well pronounced close to marginal carina and escutcheon carina, but very fine between the two. Distally, costae become disjointed, giving rise to haphazardly oriented small tubercles. Area divided by shallow median groove into two subparallel portions. Escutcheon apparently smooth apart from growth striae.

INCERTAE SEDIS

TRIGONIID gen. et sp.

(Pl. 6, fig. 5)

Material: Proximally incomplete right valve. Locality : Gammies Plain, near Roma, Queensland. Roma Formation, Aptian.

Colln. L. C. Ball.

Figured Specimen: F.2559, GSQ (Pl. 6, fig. 5).

Description: Shell 32 mm. long and 26 mm. high, trigonally ovate, inequilateral, moderately and evenly inflated. Umbo broad, very slightly opisthogyrous, placed anteriorly. Anterior, antero-ventral, and ventral shell margins

regularly arched with greatest convexity in antero-ventral portion; postero-dorsal margin very slightly concave; junction between postero-ventral and postero-dorsal margins obtusely angular. Disc ornamented with numerous, wavy, subconcentric costae of low relief, separated by flat-bottomed interspaces of about same width as costae. Disc separated from marginal carina by shallow and narrow sulcus, concentrically striated by growth-lines. Marginal carina obtuse or rounded. Area not very wide, moderately steeply inclined to commissure, striated by concentric growth-lines; very faint radial ribbing on area.

Discussion: The Trigoniid gen. et sp. may belong to the Trigoniinae. This is suggested by the radial ribbing on the area as well as by the overall shape of the shell. The ribbing on the disc, however, though fundamentally concentric is somewhat irregular and not typical of *Trigonia* s.s.; similarly the radial ribbing on the area is unusually faint.

ACKNOWLEDGEMENTS

I wish to thank Dr C. A. Fleming, Senior Palaeontologist, New Zealand Geological Survey, Professor Dorothy Hill of the University of Queensland, Dr M. F. Glaessner of the University of Adelaide, and Mr J. T. Woods of the Queensland Geological Survey for making available for my use material from their collections.

GLOSSARY OF NEW NAMES

aberrata, Nototrigonia (L. *aberrans,* wandering), refers to the aberrant characters of the shell.
australiana, Myophorella, from Australia.
AUSTROTRIGONIA (fem. gender), prefix " AUSTRO " from Australia.
capricornia, Pterotrigonia (Rinetrigonia), from the Tropic of Capricorn.
crescenta, Nototrigonia (L. *cresco,* grow), refers to its crescentic shape.
hoepeni, Iotrigonia (Zaletrigonia), after the late E. C. N. van Hoepen.
minima, Nototrigonia (L. *minimum,* least), the smallest of the known Nototrigoniinae.
miriana, Trigonia(?), from the Miria Marl, Carnarvon Basin, W.A.
ponticula, Nototrigonia (L. *pontis,* bridge), referring to the nature of the disc costae.
prima, Austrotrigonia (L. *primus,* first), the first member of the new genus.
roperi, Opisthotrigonia, from Roper River, N.T.
stanwellensis, Iotrigonia, from Stanwell, eastern Queensland.
vertistriata, Trigonia (L. *verticalis,* upright, L. *stria,* furrow, line), referring to the vertical striations on costae.
yeuralba, Nototrigonia, from Yeuralba, N.T.
ZALETRIGONIA (fem. gender), prefix " ZALE " from Greek : surge of the sea.

APPENDIX

KEY TO THE NORTHERN TERRITORY FOSSILIFEROUS LOCALITY NUMBERS

T.T.21 : Bauhinia Downs 1 : 250,000 Sheet area, Borroloola 1-mile Sheet ; 1 mile west of Ryan Bend Waterhole on Batten Creek ; about 20 miles at 255° from Borroloola.

T.T.35 : Mount Young 1 : 250,000 Sheet area ; 1½ miles south-east of Rosey Creek Homestead (abandoned).

T.T.42 : Roper River 1 : 250,000 Sheet area, Port Roper 1-mile Sheet ; 4 miles south-east of Murrenjerro Waterhole.

T.T.45 : Urapunga 1 : 250,000 Sheet area, Urapunga 1-mile Sheet ; about 2 miles north of the Roper Valley Road, about 18 miles east of the Roper River Mission.

T.T.46 : Urapunga 1 : 250,000 Sheet area, Urapunga 1-mile Sheet ; about 14½ miles east of the Roper River Mission.

T.T.49 : Katherine 1 : 250,000 Sheet area, Katherine River 1-mile Sheet ; 1·2 miles north off the edge of the plateau, in cliffs facing Katherine River across main Yeuralba Mine Road.

T.T.50 : Melville Island 1 : 250,000 Sheet area ; cliff section between Marialampi Point and Pouplimadourie Creek ; southern coast of Bathurst Island.

T.T.52 : Mount Drummond 1 : 250,000 Sheet area, Waterfall Creek 1-mile Sheet ; 12 miles north-west or west-north-west of Mitchebo Waterhole, in the headwaters of Fishhole Creek.

T.T.55 : Mount Young 1 : 250,000 Sheet area, 15/84 1-mile Sheet ; on both sides of a creek on the western edge of Yiyintyi Range ; 20 miles north-north-east of Rosey Creek.

T.T.57 : Mount Young 1 : 250,000 Sheet area ; 15/97 1-mile Sheet ; 11 miles at 188° from Rosey Creek.

T.T.65 : Blue Mud Bay 1 : 250,000 Sheet area ; 30·6 miles at 260° from the northern tip of Fowler Island. Run 5A Ph. 5108.

T.T.67 : Blue Mud Bay 1 : 250,000 Sheet area ; Walker River. Run 10 Ph. 5153.

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PLATE 1

All figures are reproduced at natural size, and all photographs taken in lateral view unless otherwise specified.

Page

FIG. 1 — *Trigonia moorei* Lycett, 1870 13
Right valve. Geraldton District, Western Australia. Middle Jurassic. C.P.C. 4913.

FIGS. 2, 3. — *Trigonia(?) miriana* sp.nov. 14
2. Holotype, C.P.C. 4643 ; left valve, most shell material abraded away.
3. Dorsal view of holotype.
Miria Marl, Carnarvon Basin, Western Australia. Campanian to Maestrichtian.

FIGS. 4–6. — *Trigonia vertistriata* sp.nov. 15
4. Holotype, C.P.C. 4644. Latex mould of an external impression of right valve.
5. Paratype, C.P.C. 4645. Internal mould of right valve.
6. Paratype, C.P.C. 4646. Latex mould of an incomplete external impression of left valve.
Locality T.T.35, Northern Territory. Neocomian.

FIG. 7 — *Trigonia(?)* sp.nov. 15
Latex mould of external impression of left valve. C.P.C. 4661. Locality T.T.42, Northern Territory. Neocomian.

FIG. 8 — *Iotrigonia stanwellensis* sp.nov. 17
Holotype, F.13335 UQGD. Latex mould of an external impression of the right valve. Stanwell, eastern Queensland. Neocomian.

FIG. 9 — *Iotrigonia* sp.cf. I. (Z.) *hoepeni* sp.nov. 20
Proximal portion of the left valve F.3613 GSQ. Wrotham Park area, Queensland. Neocomian.

FIGS. 10–14. — *Iotrigonia (Zaletrigonia) hoepeni* sp.nov. 18
10. Latex mould of an external impression of proximal portion of the right valve. C.P.C. 4914.
11. Paratype, C.P.C. 4648. Latex mould of external aspect of right valve. Figs. 10, 11 are from locality T.T.55, Northern Territory.
12. Latex mould of external impression of left valve. Juvenile. C.P.C. 4915. Locality T.T.52, Northern Territory.
13. Holotype, C.P.C. 4647. Latex mould of external aspect of anterior portion of left valve.
14. Paratype, C.P.C. 4649. Internal mould of right valve x $\frac{1}{2}$. Figs. 13, 14 are from locality T.T.55 Northern Territory. Neocomian.

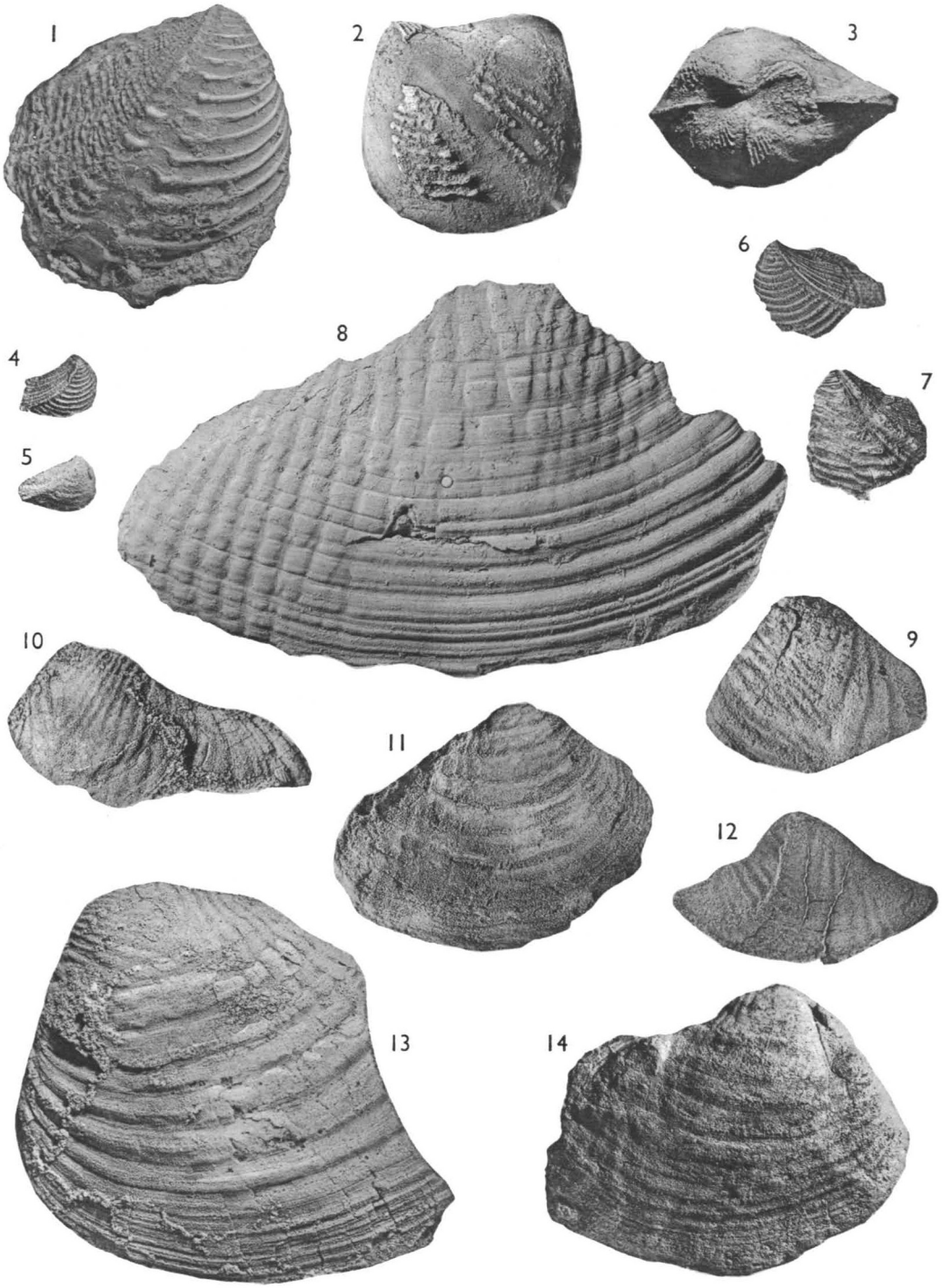
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PLATE 2

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FIG. 1. *Pterotrigonia (Rinetrigonia) australiensis* Cox, 1961 22
Latex mould of external aspect of a right valve. C.P.C. 4916. Nanutarra Formation, Carnarvon Basin, Western Australia.

FIGS. 2x8. *Pterotrigonia (Rinetrigonia) capricornia* sp.nov. 21
2. Holotype, C.P.C. 4652. Latex mould of external aspect of right valve.
3. Paratype, C.P.C. 4653. Latex mould of external aspect of left valve ; immature specimen.
4. Latex mould of external aspect of shell in dorsal view showing escutcheons and umbo. C.P.C. 4917.
5. Paratype, C.P.C. 4654. Anterior view of internal mould of bivalve.
6. Paratype, C.P.C. 4654. Lateral view of internal cast of right valve.
7. Latex mould of external aspect of left valve ; juvenile. C.P.C. 4918.
8. Paratype, C.P.C. 4655. Internal mould of left valve.
Locality T.T.35. Northern Territory. Neocomian.

FIG. 9. *Pterotrigonia (Rinetrigonia)* sp. Whitehouse, 1946 20
Latex mould of the external impression of a small portion of the left valve. F.39380, UQGD. Stanwell, Queensland. Neocomian.

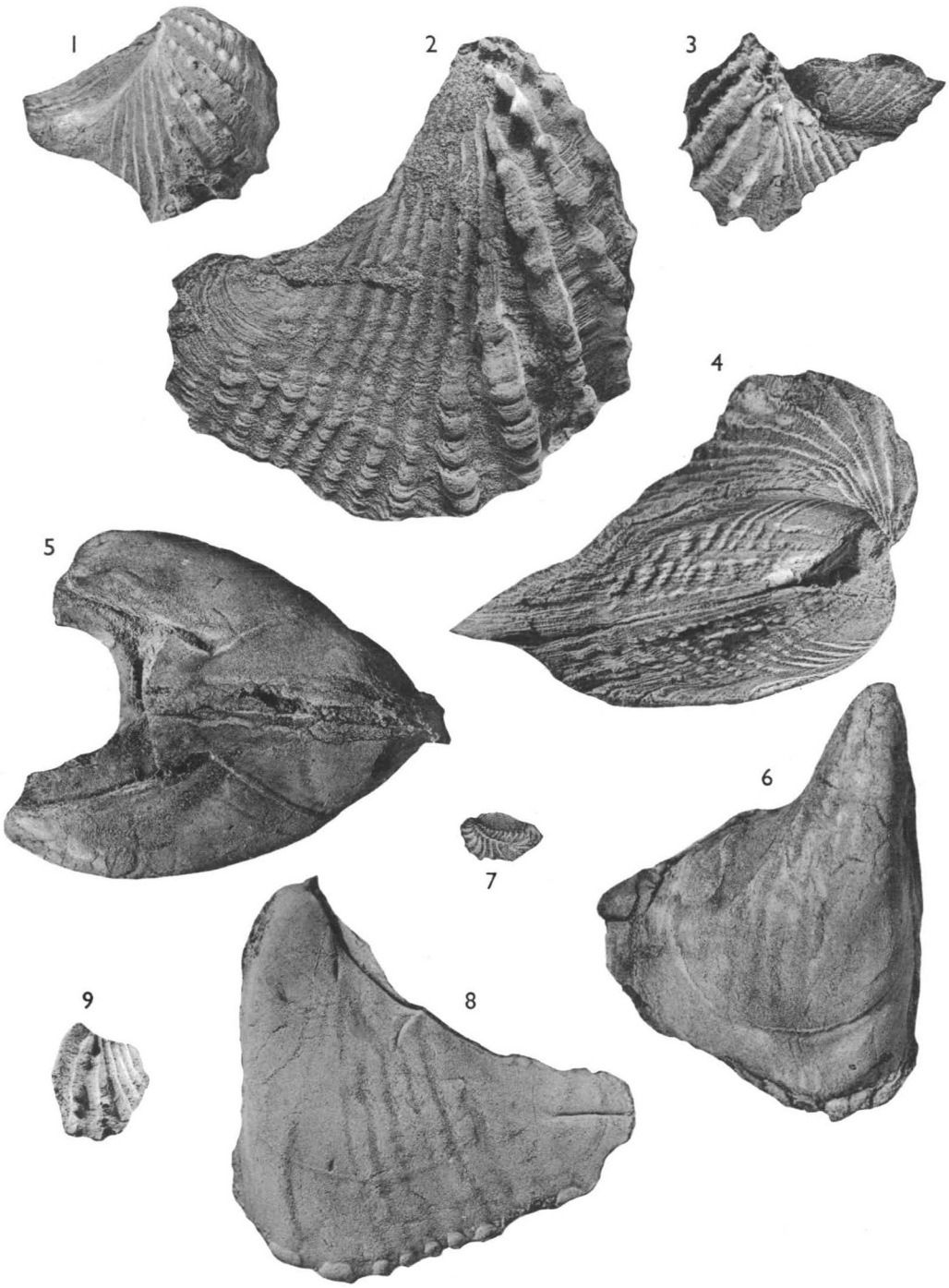
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PLATE 3

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FIGS. 1, 2. *Nototrigonia cinctuta* (Etheridge Jnr), 1902 26
1. Holotype, No. T.1318A, UAGD. External aspect, left valve.
2. Dorsal view of holotype.
Lake Eyre Basin, South Australia. Aptian and Albian.

FIGS. 3–5. *Nototrigonia* sp.cf. *N. cinctuta* (Etheridge Jnr), 1902 28
3. Latex mould of external impression of left valve. Specimen posteriorly incomplete. C.P.C. 4919.
4. Latex mould of external impression of right valve. Specimen incomplete postero-ventrally. C.P.C. 4920.
5. Latex mould of an external impression of left valve. C.P.C. 4921.
Locality T.T.21, Northern Territory. Aptian.

FIG. 6. *Nototrigonia yeuralba* sp.nov. 30
Holotype, C.P.C. 4663. Latex mould of external impression of right valve. Specimen proximally incomplete. Locality T.T.49, Northern Territory. Neocomian.

FIG. 7. *Opisthotrigonia nasuta* (Etheridge Snr), 1872 23
Latex mould of external impression of left valve. Specimen anteriorly incomplete. C.P.C. 4922. Herrods Tank, Boulia Area, south-west Queensland. Aptian.

FIGS. 8–11. *Nototrigonia minima* sp.nov. 29
8. Paratype, C.P.C. 4657. Latex mould of external aspect of right valve. Specimen incomplete antero-dorsally.
9. Paratype, C.P.C. 4658. Latex mould of internal aspect of left valve.
10. Holotype, C.P.C. 4656. Latex mould of external aspect of left valve.
11. Paratype, C.P.C. 4659. Latex mould of internal impression of right valve.
South-west Queensland. Aptian and Albian.

FIGS. 12, 13. *Opisthotrigonia roperi* sp.nov. 24
12. Holotype, C.P.C. 4662. Latex mould of external impression of left valve.
13. Internal cast of holotype.
Locality T.T.42, Northern Territory. Neocomian.

FIG. 14. *Nototrigonia(?)* sp.nov. 30
Latex mould of incomplete external impression of left valve. C.P.C. 4923. Bathurst Island, Northern Territory. Cenomanian.

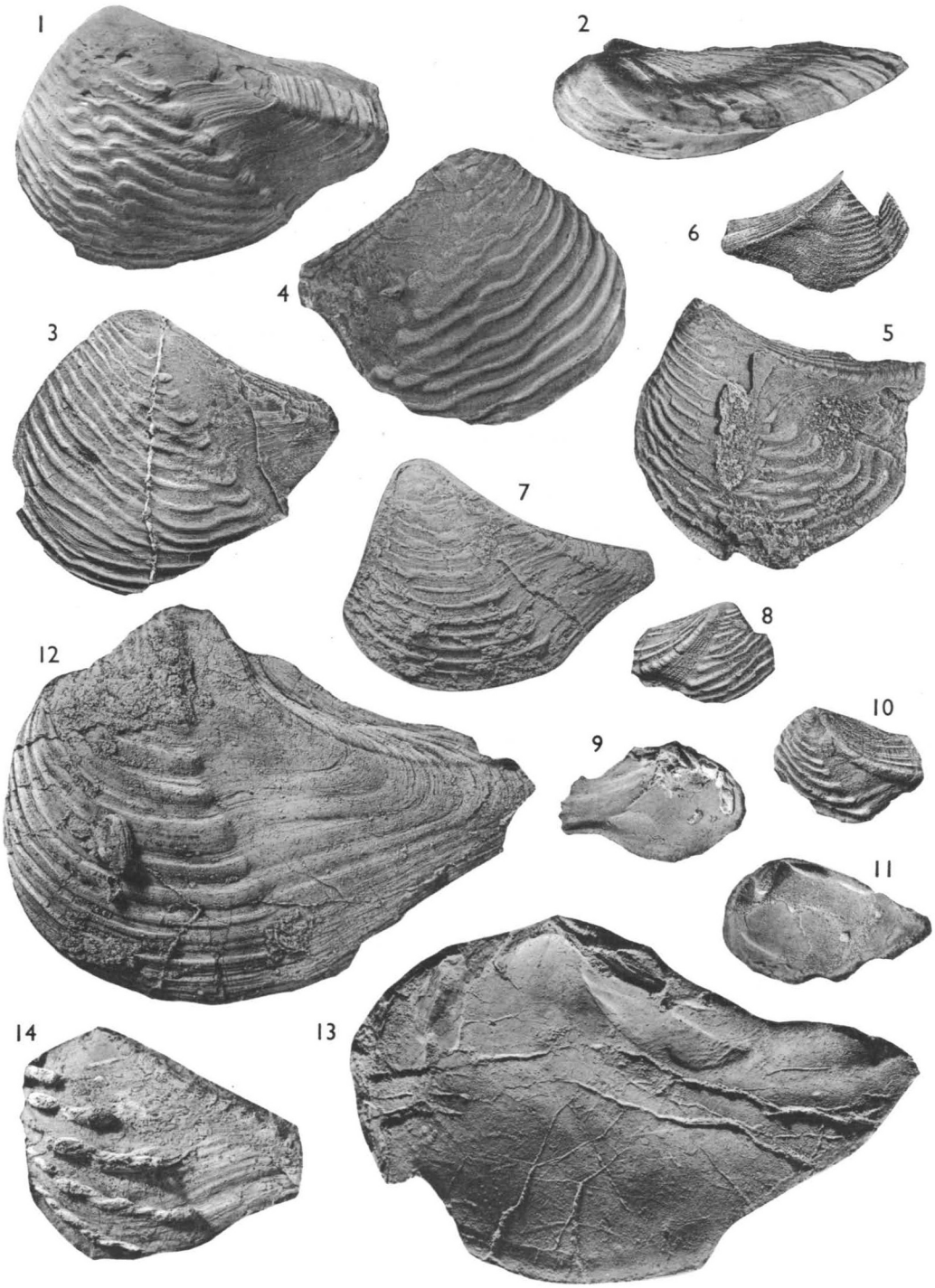
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PLATE 4

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FIGS. 1–6. *Opisthotrigonia nasuta* (Etheridge Snr), 1872 23

1. Latex mould of an external impression of the left valve. F.3607 GSQ.
2. Internal mould of right valve. F.3604 GSQ.
3. Latex mould of external impression of left valve. F.3611 GSQ. Specimen crushed.
4. Latex mould of external impression of dorsal aspect of both valves in position. F.3597b GSQ.
5. Internal mould of right valve. F.3605 GSQ.
6. Dorsal view of internal mould of both valves in position. F.3597a GSQ.

Corporation Quarry, Maryborough, Queensland. Aptian.

FIG. 7. *Nototrigonia* sp.ind.

Internal mould of right valve. F.3612 GSQ. Wrotham Park area, Blackdown Formation, Queensland. Aptian.

FIG. 8. *Nototrigonia crescenta* sp.nov. 29

Holotype, C.P.C. 4660. Latex mould of external impression of dorsal portion of right valve. Locality T.T.35, Northern Territory. Neocomian.

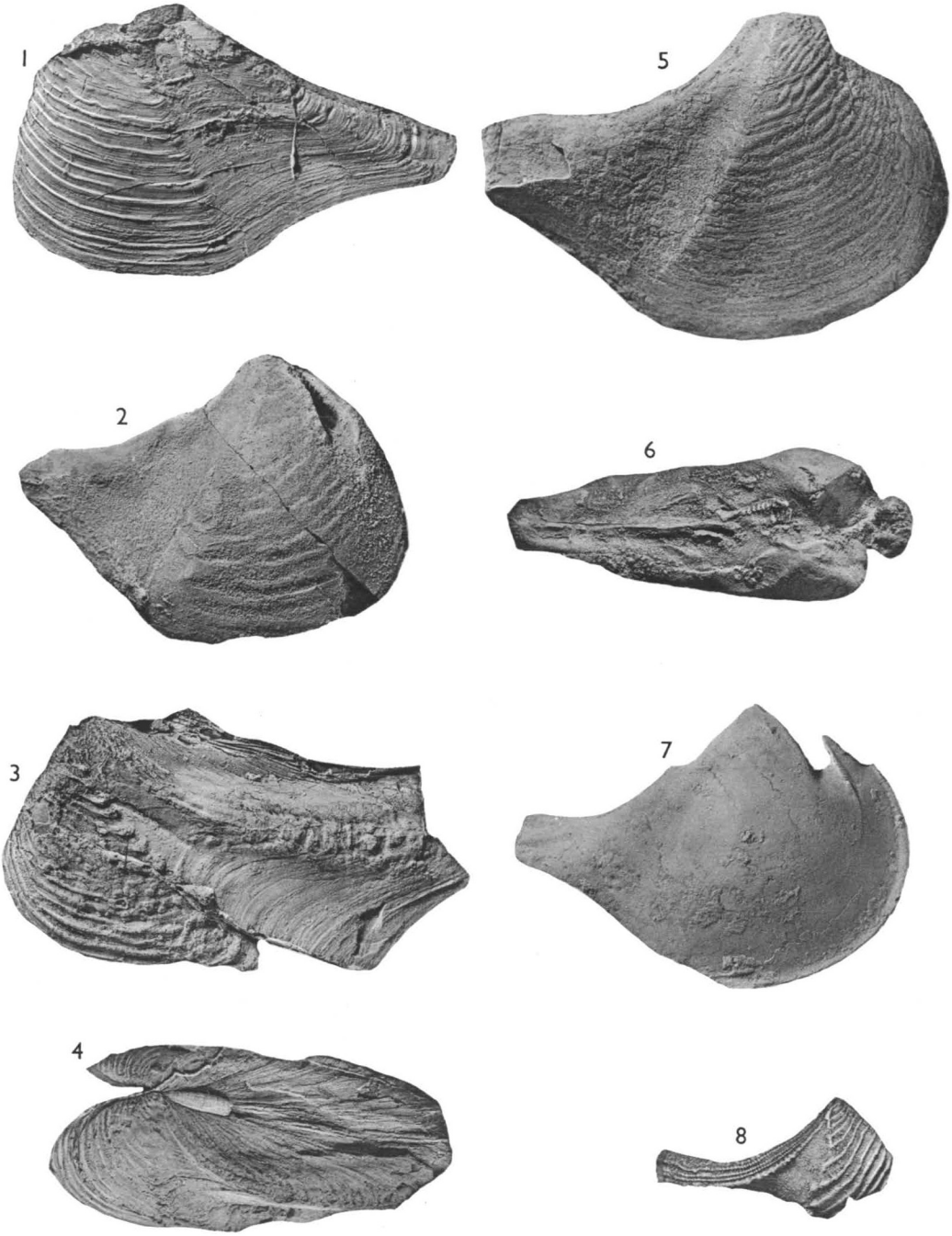
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PLATE 5

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FIGS. 1–4. *Nototrigonia ponticula* sp.nov. 31

1. Holotype, C.P.C. 4664. Internal mould of left valve.
2. Latex mould showing fragmentary external impression of disc. C.P.C. 4924.
3. Paratype, C.P.C. 4666. Latex mould of incomplete external impression of right valve.
4. Paratype, C.P.C. 4665. Latex mould of portion of external aspect of right valve. Locality, T.T.35, Northern Territory. Neocomian.

FIG. 5. *Nototrigonia(?) aberrata* sp.nov. 31

Holotype, C.P.C. 4925. Latex mould of posteriorly incomplete external impression of left valve. Locality T.T.35, Northern Territory. Neocomian.

FIGS. 6–7. *Myophorella* sp.nov.(?) juvenile 37

6. C.P.C. 4650. Latex mould of external aspect of incomplete left valve.
7. C.P.C. 4651. Latex mould of external aspect of incomplete left valve.

Windalia Radiolarite, Carnarvon Basin, Western Australia. Lower Cretaceous.

FIGS. 8–11. *Myophorella* (*Myophorella*) *australiana* sp.nov. 38

8. Paratype, F.3592, GSQ. Latex mould of external impression of posterior portion of shell.
9. Holotype, F.3593 GSQ. External impression of left valve.
10. Incomplete external impression of right valve, F.3591 GSQ.
11. Latex mould of juvenile left valve, F.3595 GSQ. Corporation Quarry, Maryborough, Queensland. Aptian.

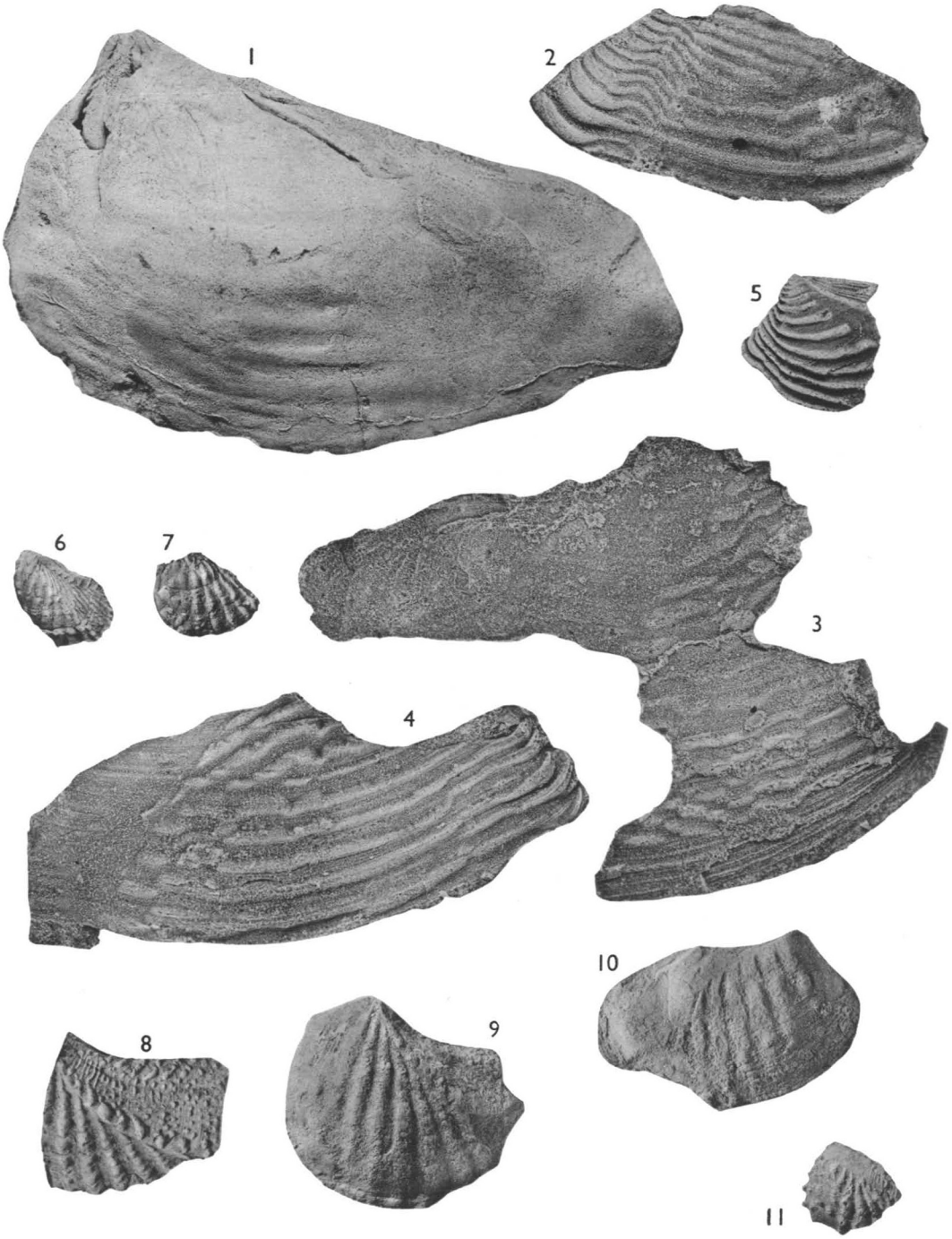
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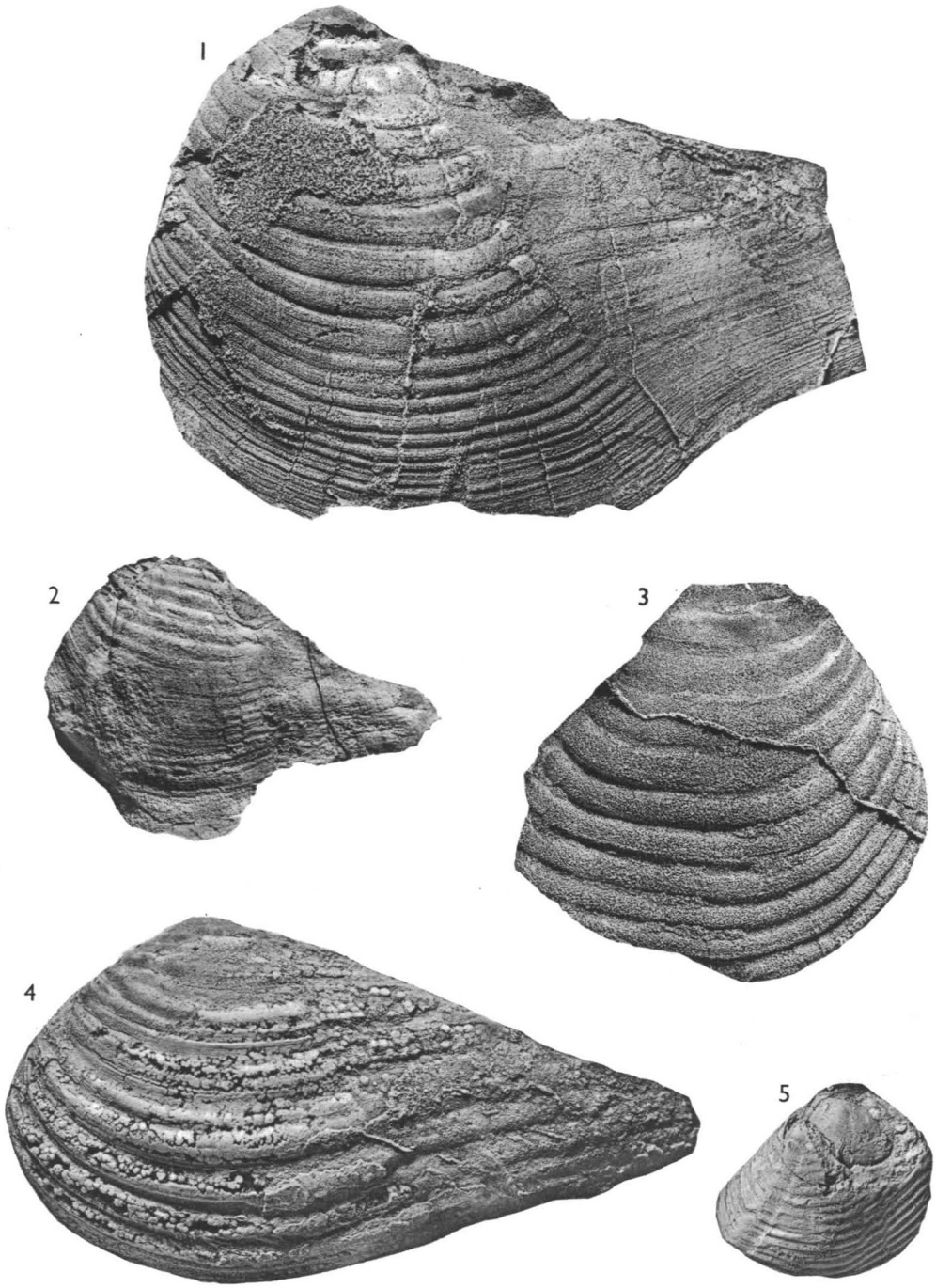
PLATE 6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