

COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

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BULLETIN No. 61.

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THE MOLLUSCAN FAUNA AND  
PROBABLE LOWER CRETACEOUS AGE  
OF THE NANUTARRA FORMATION  
OF WESTERN AUSTRALIA

BY

L. R. COX.

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*Issued under the Authority of Senator the Hon. W. H. Spooner,  
Minister for National Development.*

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*Minister:* SENATOR THE HON. W. H. SPOONER, M.M.

*Secretary:* H. G. RAGGATT, C.B.E.

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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

*Director:* J. M. RAYNER.

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*This Bulletin was prepared for the Geological Branch.*

*Chief Geologist:* N. H. FISHER

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## FOREWORD

The fossils described in this Bulletin are from the collections of the Geological Branch of the Bureau of Mineral Resources, Geology and Geophysics, Canberra. Part of the material was collected by P. A. Hoelscher and M. G. McKellar, geologists of West Australian Petroleum Pty Ltd, and part was collected by J. M. Dickins and P. J. Jones of the Bureau of Mineral Resources. At the request of West Australian Petroleum the collections were sent for examination to Dr L. R. Cox of the British Museum (Natural History), London, who is a recognized world authority on Mesozoic pelecypods and gastropods. While the collections were with him, arrangements were made for Dr Cox to describe the material.

The Bureau of Mineral Resources is particularly gratified that Dr Cox has been able to do this; his descriptions and conclusions add important data to our knowledge of the late Mesozoic faunas of Australia and their relationships with those of other parts of the world.

J. M. RAYNER, Director.

## SUMMARY

Mollusca from the Nanutarra Formation, a recently defined stratal unit cropping out along the north-eastern edge of the Carnarvon Basin of Western Australia, are described and the age of the formation is discussed. The fossils occur largely as moulds of the original shells, so that their study has been based mainly on artificially prepared casts. Of about 48 forms recorded in the paper, only one (*Pseudavicula anomala*) has been definitely referred to a previously described species, four (*Maccoyella* aff. *corbiensis*, *M.* aff. *barklyi*, *M.* aff. *moorei*, and *Modiolus* aff. *ensiformis*) have been assigned qualified identifications with known species, and 18 are described as new; the remainder have been given only generic identifications, owing to the limitations of the material. The new species are as follows:—*Nuculana hoelscheri*, *Glycymeris mckellari*, *Pacitrigonia? nanutarraensis*, *Pterotrigonia australiensis*, "*Isocyprina*" *fairbridgei*, "*Corbicellopsis*" *nanutarraensis*, *Lucina macroporum*, *Mutiella? teichertii*, *Protocardia wapeti*, *Astarte* (*Nicaniella*) *mcwhaei*, *Eriphyla playfordi*, *Pleuromya ashburtonensis*, *Panopea glaessneri*, *Corbula nanutarraensis*, *Muricotrochus? australiensis*, *Purpurina? yanreyensis*, *Procerithium* (*Rhabdocolpus*) *brunnschweileri*, and "*Acteonina*" *australiensis*.

Apart from the species of *Pseudavicula*, *Maccoyella*, and *Modiolus*, which have been identified, mostly with qualification, with Australian Lower Cretaceous species, the fossils bearing particularly on the age of the formation are those belonging to the genera *Pterotrigonia* (hitherto solely Cretaceous apart from one record from the Tithonian), *Eriphyla* (hitherto mainly Cretaceous, but known from the Upper Jurassic), *Glycymeris* (known from the Cretaceous but not from the Jurassic), and large *Panopea* (resembling several Cretaceous species and unlike any from the Jurassic). No species belongs to an exclusively Jurassic group. It is concluded that, notwithstanding palaeobotanical evidence of a Jurassic age, the Nanutarra Formation should be most probably referred to the Lower Cretaceous. It has yielded no ammonites or brachiopods.

## INTRODUCTION

The name Nanutarra Formation was assigned by Messrs. P. A. Hoelscher and M. G. McKellar, geologists of the West Australian Petroleum Pty Ltd, to a series of rocks, fossiliferous in places, which they had mapped as a unit during a survey of parts of Western Australia in or just before 1956. It was published for the first time in the work entitled *The Stratigraphy of Western Australia*, by J. R. H. McWhae et al. (1958), where the following note by the geologists in question is included (p. 93):—

‘The Nanutarra Formation is a sequence of micaceous sandstone and siltstone resting on the Precambrian rocks in the area around Nanutarra Station, after which the unit is named. The type section is 5 miles north-east of The Range Homestead (22° 14' S., 115° 28' 30" E.). The section here is 81 feet thick, and the thickest section measured is 122 feet thick.

‘The unit includes some thin ferruginous beds containing marine fossils and fossil leaves. Cox (1956b, unpublished report) has identified the following pelecypods: *Trigonia*, *Pterotrigonia*, *Eriphyla*, *Grammatodon*, *Glycimeris*, and *Venericardia*. He considers that these forms probably indicate a Lower Cretaceous age, although he does not rule out the possibility of their being Tithonian.

‘The plant fossils, which were identified by Walkom (1956d, unpublished report), include *Nilssonina*, *Otozamites* and *Elatocladus*. Dr Walkom considers that these are probably of Upper Jurassic age. In view of the conflicting evidence from the plant fossils and the pelecypods, it appears that for the present the unit is best referred to as Tithonian or Neocomian in age.

‘The Nanutarra Formation may be a marginal equivalent of part of the Learmonth Formation-Wogatti Sandstone sequence of the Cape Range-Rough Range area.’

Mr. J. M. Dickens, of the Bureau of Mineral Resources, has kindly supplied a few supplementary notes on the formation, from which the following information is quoted:—

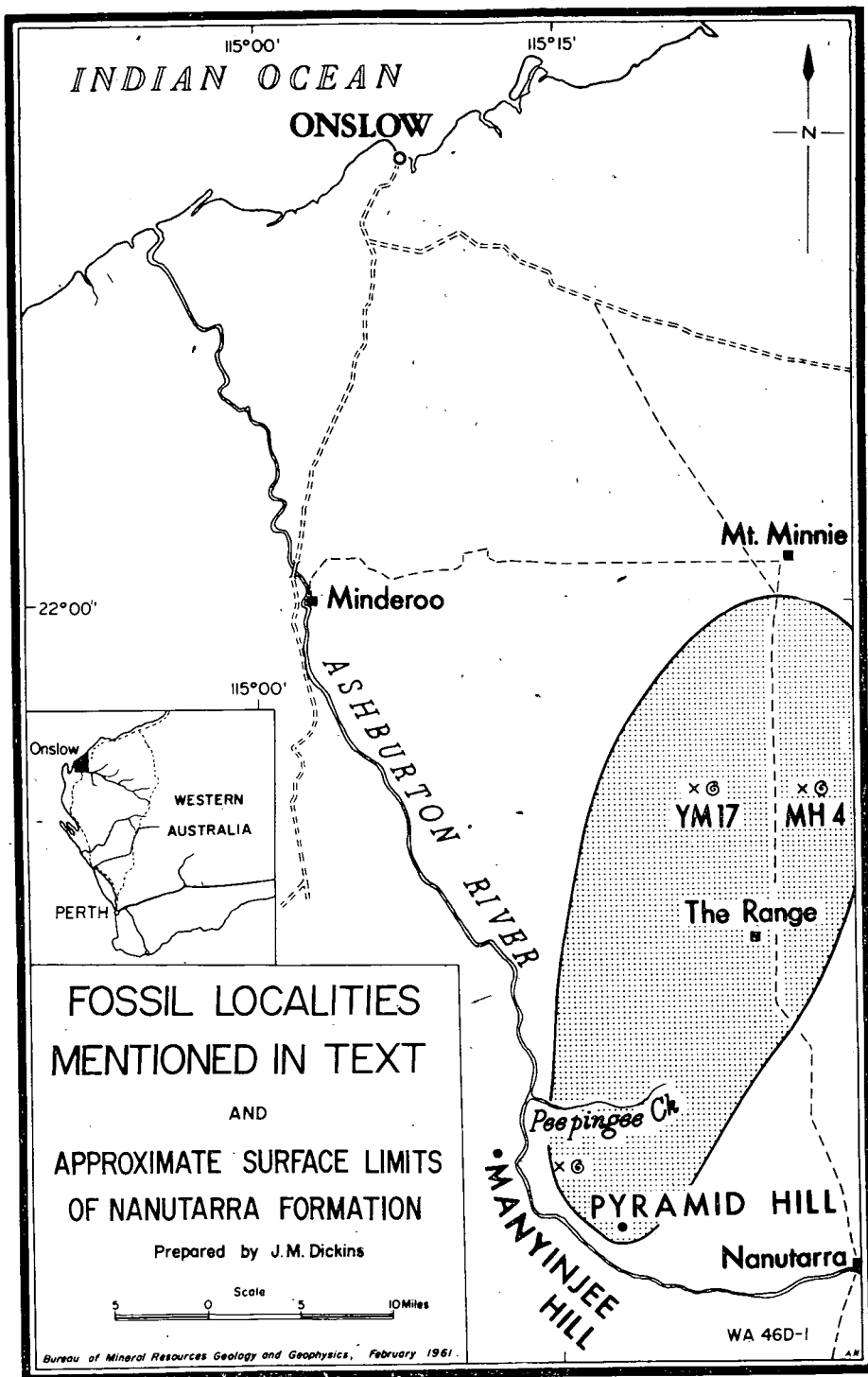
‘The formation comprises isolated mesas and low outcrops of flat-lying micaceous siltstone and sandstone along the north-eastern edge of the Carnarvon Basin, south of Onslow and east of the lower reaches of the Ashburton River. The scattered outcrop is in the main deeply weathered (“lateritized”) and occurs over an area of more than 1,000 square miles.

‘In places it rests with marked discordance on metamorphosed Precambrian rocks. Nowhere is the Nanutarra Formation seen to be overlain by younger Mesozoic rocks, but to the west, near the Ashburton River, sediments referred to the Muderong Shale, the Windalia Radiolarite and the Peepingee Greensand, of Aptian, Albian and possibly Cenomanian age, appear to be younger. The formation contains plants as well as marine fossils. Good plants and marine fossils occur not far apart and although the exact stratigraphic relationship is not clear there is no evidence to indicate the deposits are of different age.’

A collection of molluscan fossils from this formation was sent to me in 1956 by the West Australian Petroleum Pty Ltd and formed the basis of the unpublished report referred to above. This collection was later supplemented by a similar series from the Bureau of Mineral Resources, and I must thank the Chief Geologist, Dr N. H. Fisher, for arranging for this material to be sent to me. The combined collections form the basis of the present paper. All except two or three of the fossils here described come from one or other of two localities to which the reference numbers “MH 4” and “YM 17” have been assigned. These localities, marked on the accompanying sketch-map, are situated as follows:—

MH 4.—Lat. 22° 8' S., Long. 115° 26' 30" E., 8½ miles N.N.E. of The Range Homestead.

YM 17.—Lat. 22° 8' 50" S., Long. 115° 21' 50" E., 8½ miles N.N.W. of The Range Homestead.



The rock from MH 4, an iron-stained decalcified sandstone with large scattered quartz-grains, is rich in fossil mollusca, some quite large. These occur, almost entirely as internal and external moulds, and cavities represent the original shells, which have disappeared by solution. The moulds retain clear impressions of the internal features and external ornament of the shells, and from them it has been possible to make artificial squeezes reproducing the main features of the ornament. The rock from YM 17 is very similar to that from MH 4 but is richer in quartz grains. It contains a fauna consisting largely of relatively small mollusca. Some of these occur as moulds, but the actual shell of some is preserved. A few specimens of fossiliferous rock were also obtained from localities near Pyramid Hill.

The present paper is by no means exhaustive, for, besides the species here described, the material has yielded remains of other forms which are too imperfect to be worth mentioning. As it is, it has been thought undesirable to assign specific names to several of the forms described, although these may well belong to new species.

Specimens figured or specially mentioned are deposited in the collection of the Bureau of Mineral Resources. A series of duplicate specimens has been deposited in the British Museum (Natural History). Thanks are due to the Directors of the West Australian Petroleum Pty Ltd for sanctioning the publication of this paper, an outcome of exploration work carried out by the Company.

## THE FOSSILS AND GEOLOGICAL AGE OF THE NANUTARRA FORMATION

In addition to the molluscan remains which are the subject of the present paper, the Nanutarra Formation has yielded a few imperfect natural moulds of belemnite alveoli, scanty coral remains which Dr H. D. Thomas has identified as belonging to the long-ranging genus *Actinastraea*, and plant remains. No ammonites or brachiopods have been found. Dr A. B. Walkom has examined the plants, and, in an unpublished report furnished in 1956, has expressed the opinion that they are probably Upper Jurassic in age. He has more recently (*in litt.*) re-affirmed this conclusion as follows:—

‘I am still of opinion that the fossil flora of the Nanutarra formation, so far as it is known, indicates an Upper Jurassic age. It is, of course, not impossible that it may, on further information, prove to be Lower Cretaceous, but I consider that is most unlikely. The Nanutarra assemblage contains species of *Otozamites* which are not known to extend into the Cretaceous. . . . Comparison of the Nanutarra flora with the Upper Gondwana flora of India and with the Mesozoic floras of Eastern Australia and New Zealand leaves little doubt in my mind as to their Upper Jurassic age.’

We will now proceed to examine the evidence of the mollusca described in the present paper. The following is a list of the forms represented and the localities at which they were found:—

### *Bivalvia*—

- Nuculana hoelscheri* sp. nov. (YM 17)
- Grammatodon* sp. A (MH 4)
- Grammatodon* sp. B (MH 4)
- Grammatodon* sp. C (MH 4)
- Cucullaea* sp. or spp. (MH 4)
- Barbatia* sp. (MH 4)
- Glycymeris mckellari* sp. nov. (YM 17)
- Glycymeris* sp. (YM 17)
- Maccoyella* aff. *corbiensis* (Moore) (MH 4; 4½ miles N.W. of Pyramid Hill)
- Maccoyella* aff. *barklyi* (Moore) (MH 4)
- Maccoyella* aff. *moorei* (Etheridge) (MH 4; 4½ miles N.W. of Pyramid Hill)
- Maccoyella* sp. (MH 4)
- Pseudavicula anomala* (Moore) (YM 17)
- Chlamys* spp. (YM 17)
- Lima* sp. (MH 4)
- Modiolus* aff. *ensifomis* (Etheridge) (MH 4)
- Mytilus*? sp. (MH 4)
- Brachidontes* sp. (YM 17)
- Lycettia*? sp. (MH 4)
- Trigonia* sp. A (MH 4)

*Trigonia* sp. B (MH 4)  
*Pacitrigonia?* *nanutarraensis* sp. nov. (MH 4)  
*Pterotrigonia australiensis* sp. nov. (MH 4)  
 "Isocyprina" *fairbridgei* sp. nov. (MH 4)  
 "Corbicellopsis" *nanutarraensis* sp. nov. (MH 4)  
*Lucina macroporum* sp. nov. (MH 4)  
*Mutiella?* *teicherii* sp. nov. (YM 17)  
*Protocardia wapeti* sp. nov. (MH 4)  
*Protocardia* sp. (MH 4)  
*Astarte* (*Nicaniella*) *mcwhaei* sp. nov. (YM 17)  
*Eriphyla playfordi* sp. nov. (MH 4)  
*Pleuromya ashburtonensis* sp. nov. (MH 4)  
*Panopea glaessneri* sp. nov. (MH 4)  
*Teredo* sp. (MH 4)  
*Corbula nanutarraensis* sp. nov. (YM 17)

Gastropoda—

*Tectus?* sp. (MH 4)  
*Muricotrochus?* *australiensis* sp. nov. (MH 4)  
*Trochacanthus* sp. (MH 4)  
 "Patella" sp. A (MH 4)  
 "Patella" sp. B (MH 4)  
*Ostoma?* sp. (MH 4)  
*Purpurina?* *yanreyensis* sp. nov. (MH 4)  
*Procerithium* (*Rhabdocolpus*) *brunnschweileri* sp. nov. (MH 4)  
 "Aporrhais" sp. A (MH 4)  
 "Aporrhais" sp. B (MH 4)  
*Globularia* sp. A (MH 4; YM 17)  
*Globularia* sp. B (MH 4)  
 "Acteonina" *australiensis* sp. nov. (YM 17)

The above list includes at least 48 molluscan species, of which one is referred definitely to a previously described form, four are identified, with the qualification "aff.", with previously described forms, and 18 are described as new. The remainder have been identified only generically, some with a query. Several other species are represented in the material studied, but only by specimens considered too imperfect to describe. It will be seen that the great majority of the specimens come from one or other of the two localities MH 4 and YM 17, and that only one species, a naticoid form referred to *Globularia*, is common to the two.

The MH 4 assemblage is characterized by the abundance of a new species of the genus *Pterotrigonia*. This genus had a world-wide distribution throughout Cretaceous times, while its presence in Jurassic rocks has been reported only from one area, north-western India, where Spath (1931, p. 542; 1933, p. 798) has recorded its association with ammonites to which a Lower Tithonian age was assigned. Thus, while the abundance of *Pterotrigonia* affords strong evidence for considering the MH 4 assemblage to be of Cretaceous age, this evidence is not absolutely conclusive. This assemblage also includes the remarkable trigoniid described as *Pacitrigonia?* *nanutarraensis*. While future work must decide whether this form should be included in

*Pacitrignia* (a genus hitherto known only from the Upper Cretaceous) or in a genus not yet described, it can at least be said that it is much more suggestive of various groups of Trigoniidae which have been described from the Cretaceous than of any forms known from the Jurassic.

The presence of four species of the genus *Maccoyella* must be noted next. Three of them closely resemble well-known Australian species, *M. corbiensis*, *M. barklyi* and *M. moorei*, but in view of the imperfect condition of the material, it has seemed advisable to qualify the specific identifications. As the genus *Maccoyella* was, until recently, known only from rocks of Cretaceous age, its abundance in the MH 4 assemblage strongly supports the evidence of the Trigoniidae that the Nanutarra Formation belongs to the Cretaceous system. *Maccoyella* is, however, now known to occur in the Alexander Formation of Western Australia. Specimens from this formation have been recorded by Brunnschweiler (1954) as *Maccoyella* cf. *corbiensis* (Moore), while others, sent to me from the Bureau of Mineral Resources, seem indistinguishable from *M. barklyi* (Moore). Now the Alexander Formation has yielded ammonites which were recorded by Brunnschweiler (1954, p. 48) as *Virgatosphinctes* cf. *communis* Spath and *Kossmatia* sp. and considered to indicate a Kimmeridgian to early Tithonian age. In a more recent report Brunnschweiler (1960, p. 36) has admitted that these determinations were erroneous but at the same time has suggested that 'the species are more like early Perisphinctidae of Oxfordian age', thus referring them to an even earlier stage of the Jurassic. However, at the time of writing these ammonites have not been illustrated or their revised specific determinations published. Hence the questions of the geological age of the Alexander Formation and of the possible presence of *Maccoyella* in the Jurassic must be considered undecided.

The Cretaceous age of the MH 4 assemblage is also strongly suggested by the abundance of a representative of *Eriphyla*, an astartid genus which was widely distributed during the Cretaceous period. The presence of this form, however, would not preclude a late Jurassic age, as the earliest species of the genus appeared towards the close of that period. The last mollusc from the MH 4 assemblage which we need consider is the large bivalve described as *Panopea glaessneri* sp. nov.; though representatives of *Panopea* of comparable size are well known to occur in the Cretaceous, no similar species has hitherto been found in the Jurassic.

Thus, although rare occurrences of *Pterotrignia*, *Eriphyla*, and (possibly) *Maccoyella* in the Upper Jurassic can be cited the balance of the molluscan evidence undoubtedly points to the Cretaceous age of the MH 4 assemblage. As *Maccoyella* has not so far been recognized in any formation of later age than Aptian it seems improbable that this assemblage is younger than Lower Cretaceous.

The very different assemblage from the locality YM 17 consists mainly of small shells. The absence of representatives of the Trigoniidae and of the genera *Maccoyella* and *Eriphyla* may be particularly noted. One specimen has, however, been identified as *Pseudavicula anomala* (Moore), a well-known member of the Australian Lower Cretaceous fauna. The occurrence of two species of *Glycymeris* seems significant, as there is no record which can be accepted of the presence of this genus in the Jurassic, although it is well known to occur in the Cretaceous. The other forms found at YM 17, in so far as it is possible to assign definite generic identifications to them, belong to more or less long-ranging groups.

## SYSTEMATIC DESCRIPTIONS

Class BIVALVIA [LAMELLIBRANCHIA]

Subclass PROTOBRANCHIA Pelseneer

Order PALAEOTAXODONTIDA Korobkov

Family NUCULANIDAE

Genus NUCULANA Link, 1807

NUCULANA HOELSCHERI sp. nov.

(Pl. 1, figs. 1a, b)

*Specific name:* Named after Mr. P. A. Hoelscher, of the West Australian Petroleum Pty Limited, who with Mr M. G. McKellar first defined and named the Nanutarra Formation.

*Material:* The holotype only, a left valve, CPC3769.

*Description:* Of medium size for the genus, with the length (14.0 mm.) equal to seven-thirds of the height (6.0 mm.); inflation slight; umbo very obtuse, depressed, situated at the anterior two-fifths of the length; shell tapering posteriorly to a low, sub-rostrate extremity. Antero-dorsal margin sub-horizontal; postero-dorsal outline very slightly concave, sloping gently to the extremity of the shell. Ventral margin evenly and moderately strongly convex except for a small sinus at its posterior extremity, corresponding to a narrow radial sulcus on the posterior part of the flank of the shell. Lower part of anterior margin oblique, and with a very shallow sinus corresponding to an obscure radial sulcus on the anterior part of the flank. Ornament consisting of thin, but prominent, almost evenly spaced concentric ridges with broader intervals in which faint radial threads are just visible in the later growth-stages. Interior of shell not exposed.

*Remarks:* Reference of this species to *Nuculana* is necessarily tentative. Its outline is strikingly similar to that of the New Zealand Danian (Wangaloan) species *Neilo* (*Spineilo*) *elongata* (Marshall) (Finlay & Marwick, 1937, p. 17, pl. 1, figs. 4, 5), which attains a much larger size. The genus *Neilo*, however, is not known to occur in early Cretaceous or older beds, and no described species of *Palaeoneilo*, a probably related genus which ranges up from the Palaeozoic into the Mesozoic, bears any close resemblance to the new form.

*Locality:* YM 17.

Subclass PTERIOMORPHIA Beurlen.

Order EUTAXODONTIDA Grobben

Family PARALLELODONTIDAE

Genus GRAMMATODON Meek & Hayden, 1860

GRAMMATODON sp. A

(Pl. 1, fig. 2)

*Material:* The external mould of a left valve, CPC 3770.

*Description:* The valve which this mould represents was about 21 mm. long and 12 mm. high; the specimen has a broadly rounded umbonal region which is slightly

anterior to median and a rounded umbonal ridge which descends to the postero-ventral corner of the shell and borders a slightly concave posterior area. The ventral margin is symmetrical, of very feeble convexity, and almost parallel with the hinge-margin. The ornament is of rather closely and unevenly spaced radial riblets which are crossed by concentric growth-threads, producing a reticulate pattern. The specimen is more elongate than the Australian Lower Cretaceous species "*Cucullaea*" *robusta* Etheridge and its riblets are more numerous.

*Locality:* MH 4.

GRAMMATODON sp. B

(Pl. 1, figs. 4a, b)

*Material:* The external mould of the posterior part of a right valve, CPC 3771.

*Description:* The height of the specimen is 10 mm. and the original length can be estimated at about 14 mm. on the assumption that the umbo of the shell was almost median in position; it was evidently not appreciably anterior to median. The shell was sub-rectangular in shape, with the ventral margin almost parallel with the hinge-margin. A sharp carina, which runs in a curve with an upward-facing concavity from the umbo to the postero-ventral corner of the shell, separates a strongly concave posterior area, which bears only a few radial threads, from the flank, which is ornamented with closely and unevenly spaced radial riblets which are somewhat unequal in strength. There is no concentric ornament apart from some growth-rugae. This specimen evidently belonged to a different species from the one described above as *Grammatodon* sp. A as it was less elongate and more inequilateral, and its posterior area is more strongly concave.

*Locality:* MH 4.

GRAMMATODON sp. C

(Pl. 1, fig 6.)

*Material:* The internal mould of a right valve, CPC 3772.

*Description:* This internal mould, which belonged to a shell about 30 mm. long and 20 mm. high, retains impressions of the ligamental area with its chevron-shaped grooves and of elongate, sub-horizontal teeth at both ends of the hinge-line. The umbo lies at about the anterior two-fifths of the length. The asymmetrical ventral margin is strongly convex anteriorly but flattened posteriorly, the specimen thus tapering to some extent towards its posterior extremity. The posterior margin is inclined inwards towards the hinge-margin only to a slight extent. Any posterior carina or radial ribs that may have been present on the exterior of the shell are not indicated on the internal mould.

*Locality:* MH 4.

Family CUCULLAEIDAE

Genus CUCULLAEA Lamarck, 1801

CUCULLAEA sp. or spp.

(Pl. 1, figs. 3, 5)

*Material:* Two external moulds of left valves, CPC 3773, 3774.

*Description:* The more complete specimen (CPC 3773) is 29 mm. long and about 17 mm. high. The ventral margin is parallel with the hinge-margin and there is a

slightly concave posterior area bordered by a rounded carina; no traces of ornament remain on this specimen. The second mould (CPC 3774) is of a shell originally about 42 mm. long and 31 mm. high, but its posterior end is now missing. The impression of the ligamental area, with well-marked chevron-shaped grooves, is clearly preserved, but is detached from the mould of the rest of the valve. The specimen has a few irregularly distributed radial striations on the anterior part of the surface, but the remainder of the surface is smooth except for growth-rugae.

It is uncertain whether these specimens belonged to the same or to different species. Neither is referable to any species yet described from the Mesozoic of Australia, and their preservation is too imperfect for comparison to be made satisfactorily with species described from other regions.

*Locality:* MH 4.

Family ARCIDAE

Genus BARBATIA Gray, 1842

BARBATIA sp.

(Pl. 1, fig. 8)

*Material:* Two specimens; the better, consisting of the greater part of the external mould of a right valve, is registered as CPC 3775.

*Description:* The right valve, represented by its external mould, was 14 mm. high and originally, when complete, about 24 mm. long. Its outline is elongate-subrectangular, with the ventral margin and hinge-margin almost parallel. The very broadly rounded umbonal region lies at the anterior third of the length. There is no posterior carina. The ornament is of radial threads crossed by growth-rugae with no regular arrangement; three conspicuous growth-rugae correspond to distinct interruptions of growth.

This species has the shape of a typical *Barbatia*. Comparable forms occur both in the lower Cretaceous (e.g. *B. marullensis* (d'Orbigny)) and in the Jurassic (e.g. *B. pectinata* (Phillips)).

*Locality:* MH 4.

Family GLYCYMERIDAE

Genus GLYCYMERIS Da Costa, 1778

GLYCYMERIS MCKELLARI sp. nov.

(Pl. 1, fig. 7)

*Specific name:* Named after Mr M. G. McKellar, of the West Australian Petroleum Pty Ltd, who with Mr P. A. Hoelscher first defined and named the Nanutarra formation.

*Material:* The holotype, a single valve, CPC 3776, and one paratype. The shell substance is not preserved, but the holotype seems to be virtually a pseudomorph of the original shell and to bear the original surface ornament. It must, however, be remembered that in this genus erosion of the outer layer of the shell may reveal an internal structural pattern. The paratype is an internal mould.

*Description:* Of medium size (length of holotype 23.5 mm.), suborbicular, of moderate and even inflation. Umbo median, projecting slightly above the level of the hinge-margin. Anterior, ventral, and posterior margins forming an even curve, no part of which is flattened, as in some species of the genus. Ornament, as

preserved on the holotype, consisting of fine, closely arranged, obscurely serrated radial threads separated by linear intervals, some of which (alternate ones on some parts of the surface) are slightly deeper than the others. Impressions of rather numerous small taxodont teeth are preserved, somewhat obscurely, on the paratype.

*Remarks:* *G. mckellari* is an unmistakable representative of *Glycymeris*, and its presence in the fauna described is of some importance as it is very doubtful if any species belonging to this genus has hitherto been found in beds of Jurassic age. It is true that a few Jurassic species have been described under "*Pectunculus*" [= *Glycymeris*] but the generic reference is undoubtedly erroneous in most cases and most dubious in the remainder. Mlle Gillet (1924, p. 20) recognizes only one Neocomian species, *Glycymeris marullensis* (Leymerie) (see d'Orbigny, 1844, pl. 306, figs. 1-6), and this differs from the form now described in its ovate rather than orbicular outline, its stronger radial ornament, its greater inflation, and its fewer hinge-teeth.

*Locality:* YM 17.

GLYCYMERIS sp.

*Material:* One much eroded specimen, CPC 3778.

*Description:* This specimen, which is too imperfect to have a new specific name assigned to it, or even to figure, is about 20 mm. long and high, and seems slightly asymmetrical in outline. The rather narrowly curved umbo projects slightly above the hinge-margin. The ornament, preserved only on one part of the surface, consists of broad depressed radial ribs, separated by narrow, almost linear, intervals. The total number of ribs was probably about 24.

This ornament is quite different from that of *G. mckellari*, and the specimen evidently belongs to a distinct species of *Glycymeris*.

*Locality:* YM 17.

Order PTEROCONCHIDA Cox

Family OXYTOMIDAE

Genus MACCOYELLA Etheridge, 1892

MACCOYELLA aff. CORBIENSIS (Moore)

(Pl. 1, figs. 9-13)

References to descriptions of *M. corbiensis* are as follows:—

- 1870. *Avicula corbiensis* Moore, *Quart. J. geol. Soc. Lond.*, 26, p. 246, pl. 11, fig. 7.
- 1892. *Maccoyella corbiensis*; Etheridge, in Jack & Etheridge, *The Geology and Palaeontology of Queensland and New Guinea*, pp. 458, 563, pl. 22, figs. 8, 9.
- 1902. *Maccoyella corbiensis*; Etheridge, *Mem. geol. Surv. N.S.W., Palaeont.*, 11, p. 21, pl. 1, figs. 6-10.
- 1902. *Maccoyella corbiensis*; Etheridge, *Mem. Roy. Soc. S. Aust.*, 2 (1), p. 13, pl. 1, figs. 9, 10.
- 1907. *Maccoyella corbiensis*; Etheridge, *Rec. Aust. Mus.*, 6, p. 320, pl. 61, figs 1-6.

*Material:* Internal and external moulds of several left valves; also two internal moulds of right valves. The specimens figured or particularly mentioned bear the Bureau of Mineral Resources registration numbers CPC 3779-3783.

*Description:* The most complete specimens are only about 25 mm. in diameter, but a fragment which probably belongs to the same species represents a shell which was originally at least 45-50 mm. in diameter and comparable in size to the specimens described in the literature cited. The left valve is strongly convex and in the smaller specimens (Figs. 9, 11) bears a series of almost evenly spaced, narrow, serrated riblets of primary strength, with a weaker one occupying the middle of each interval. In the largest specimen (Fig. 10) the ribs, which are squarish in cross-section, spaced slightly unevenly, and alternating in breadth, are separated by slightly broader intervals. The ornament agrees fairly well with that indicated in some of the figures of *M. corbiensis* cited above, and with that of a specimen from the Rolling Downs formation of Queensland in the British Museum (Natural History).

One internal mould of a left valve (CPC 3782), which was preserved with part of the external mould of the same shell showing the ornament, is of interest as reproducing the internal features of the hinge-region. A squeeze taken from this specimen reproduces a rather deep, concave, well-undercut ligamental area, bordering the lower margin of which, on the anterior side, is a tuberculiform, tooth-like protuberance; behind this, but also anterior to the beak, is a rather deep, shapeless depression. The ligamental pit is indistinct; it is, in fact, difficult to determine its exact position. This specimen much resembles internal moulds of *Maccoyella* in the collection of the British Museum (Natural History) of the type described by Etheridge (1872, p. 339, pl. 19, fig. 3) as *Crenatula? gibbosa*, but it differs in possessing two wart-like protuberances, presumably representing muscle-scars, on the anterior side of the mould of the umbonal cavity.

The material also includes two internal moulds (one represented in Fig. 12) of feebly convex right valves which belonged to a species of *Maccoyella*, and probably the one here recorded as *M. aff. corbiensis*. The more complete of these right valves is about 34 mm. high. The large posterior and the small anterior muscle scars, joined by a broken pallial line, are well seen, as are also the anterior auricle and the byssal notch.

*Localities:* MH 4; 4½ miles N.W. of Pyramid Hill.

#### MACCOYELLA aff. BARKLYI (Moore)

(Pl. 1, fig. 14)

References to descriptions of *M. barklyi* are as follows:—

- 1870. *Avicula barklyi* Moore, *Quart. J. geol. Soc. Lond.*, 26, p. 245, pl. 11, figs. 1, 2.
- 1892. *Maccoyella barklyi*; Etheridge, in Jack and Etheridge, *The Geology and Paleontology of Queensland and New Guinea*, pp. 455, 563 (var. *mariae-buriensis*), pl. 22, figs. 1-5; pl. 42, figs. 4-6; ? pl. 23, figs. 1, 2.
- 1902. *Maccoyella barklyi*; Etheridge, *Mem. geol. Surv. N.S.W., Palaeont.*, 11, p. 17, pl. 2, figs 3-5; pl. 3, figs. 4, 5; pl. 4, figs. 3, 4.
- 1902. *Maccoyella barklyi*; Etheridge, *Mem. Roy. Soc. S. Aust.*, 2(1), p. 11, pl. 1, figs. 3-7.
- 1915. *Maccoyella barklyi*; Newton, *Proc. malac. Soc. Lond.*, 11, p. 225, pl. 6, fig. 19.

*Material:* The external mould of a left valve, CPC 3784.

*Description:* This valve, which is about 26 mm. high and strongly convex, bears unevenly arranged ribs which are stronger and less numerous than in the specimens of comparable size identified as *M. aff. corbiensis*. The ornament agrees well with that of many specimens of *M. barklyi*, but the convexity of the valve appears to be stronger than is usual in that species.

*Locality:* MH 4.

MACCOYELLA aff. MOOREI (Etheridge)

(Pl. 2, figs. 2, 3)

References to descriptions of *M. moorei* are as follows:—

1870. *Pecten fimbriatus*; Moore. *Quart. J. geol. Soc. Lond.*, 26, p. 248, pl. 11, fig. 8 (*non* Phillips, 1836, *nec* Philippi, 1844).

1892. *Pecten moorei*; Etheridge, in Jack & Etheridge, *The Geology and Palaeontology of Queensland and New Guinea*, p. 445, pl. 21, fig. 20.

*Material:* Several external moulds of portions of left valves. The two figured bear the registration numbers CPC 3785, 3786.

*Description:* The original sizes of the valves represented by this material cannot be estimated with any accuracy, but some of the specimens were evidently moderately large, possibly about 40 mm. high. The ornament consists of serrated radial riblets which are more numerous than in the specimens recorded as *M. aff. corbiensis*. The distribution of the riblets is fairly regular, weaker ones becoming intercalated midway between the primary ones during growth. These valves appear to have been less strongly convex than those recorded as *M. aff. corbiensis*. The specimens agree quite well with the figures of Moore cited above. Although Etheridge assigned the name *Pecten moorei* to the species figured by Moore, he suggested, in the explanation of his figure, that this species had probably been founded on part of the shell of a *Maccoyella*.

*Localities:* MH 4; 4½ miles N.W. of Pyramid Hill.

MACCOYELLA sp.

(Pl. 2, fig. 1)

*Material:* An external mould, CPC 3787.

*Description:* The specimen now recorded is the external mould of a strongly convex, subequilateral, ovate left valve about 40 mm. high, which bears about 12 broadly rounded, unevenly spaced ribs separated by intervals which are, on the average, of approximately the same width as the ribs and in two or three places are occupied by weaker riblets. The specimen appears to belong to the genus *Maccoyella*, but it differs from any species of the genus which has been recorded from Australia in the small number and breadth of its ribs. Except for its much larger size, it much resembles *M. incurvata* Waterhouse (1959, p. 491, figs. 1-8), recently described from New Zealand, but that species has even fewer ribs, with broader intervals between them. The geological age of *M. incurvata* is thought to be Lower Cretaceous, although the evidence for this is not at present quite conclusive.

*Locality:* MH 4.

Genus PSEUDAVICULA Etheridge, 1892

PSEUDAVICULA ANOMALA (Moore)

(Pl. 2, figs. 4a, b)

References to descriptions of *P. anomala* are as follows:—

1870. *Lucina anomala* Moore, *Quart. J. geol. Soc. Lond.*, 26, p. 251, pl. 14, fig. 4.

1892. *Pseudavicula anomala*; Etheridge, in Jack and Etheridge, *The Geology and Palaeontology of Queensland and New Guinea*, p. 450, pl. 24, figs. 6, 8, 11.

1902. *Pseudavicula anomala*; Etheridge, *Mem. Roy. Soc. S. Aust.*, 2 (1), p. 16, pl. 2, fig. 1.

1925. *Pseudavicula anomala*; Whitehouse, *Trans. Roy. Soc. S. Aust.*, 49, p. 27, pl. 1, figs. 1-3.

*Material*: A left valve, CPC 3788.

*Description*: This specimen, which clearly belongs to *P. anomala*, is 17 mm. in height. The umbo, which is level with the hinge-margin, lies at about the anterior third of the length of the shell, with the convex anterior margin extending beyond it. There is a posterior wing which is not appreciably flattened or demarcated from the body of the valve; the outer angle of this wing appears to have been slightly obtuse. The ornament is of numerous unevenly arranged, slightly unequal radial threads, and there are irregular concentric growth-corrugations.

*Locality*: YM 17.

Family PECTINIDAE

Genus CHLAMYS Röding, 1798

CHLAMYS spp.

The family Pectinidae is represented by at least three species belonging to *Chlamys* and possibly other genera. All the specimens are much too imperfect for description or illustration.

*Locality*: YM 17.

Family LIMIDAE

Genus LIMA Bruguière, 1797

LIMA sp.

(Pl. 2, figs. 5, 6)

*Material*: Two or three moulds of portions of the exterior of the shell and one internal mould. The specimens illustrated are CPC 3789 and 3790.

*Description*: The internal mould (Fig. 6) shows the approximate outline of the shell, which was rather narrow and distinctly oblique. The anterior auricle appears to have been small, the posterior auricle not greatly elongated. The convexity of the shell was relatively weak. The largest specimen, when complete, was

probably about 60 mm. high. The ornament is of numerous weak, narrow, slightly undulatory riblets which are interrupted at irregular intervals by conspicuous growth-halts. The narrow intervals between the riblets are not distinctly punctate.

*Remarks:* Among Lower Cretaceous species with comparable ornament may be cited *Lima longa* Roemer, which has been well illustrated by Woods (1904, p. 25, pl. 5, figs. 8-12) and referred to the subgenus *Acesta*. *L. longa* appears to be less oblique than the present species and to taper to a greater extent towards its dorsal margin. *Lima orbignyana* Matheron (Pictet & Campiche, 1869, p. 126, pl. 161, fig. 4) is more ovate in outline, with a shorter hinge-margin. Among Upper Jurassic species with similar ornament may be cited *Lima aequilatera* Buvignier (de Loriol, 1872, p. 371, pl. 21, fig. 6), which differs in a similar manner. No comparable species of *Lima* has been described from the Mesozoic of Australia.

*Locality:* MH 4.

Order ISOFILIBRANCHIDA Iredale

Family MYTILIDAE

Genus MODIOLUS Lamarck, 1799

MODIOLUS aff. ENSIFORMIS (Etheridge)

(Pl. 2, figs. 7a, b)

The reference to the original description of *M. ensiformis* is as follows:—

*Modiola ensiformis* Etheridge, 1902, *Mem. Roy. Soc. S. Aust.*, 2 (1), p. 22, pl. 3, figs. 8-12.

*Material:* An imperfect external mould, CPC 3791; a very imperfect internal mould may belong to the same species.

*Description:* The better of the two specimens, here illustrated, is part of the mould of a very narrow and elongate, strongly inflated *Modiolus*, the original length of which well exceeded 40 mm. The anterior end of the shell projects well beyond the beak. The specimen agrees with Etheridge's figures of the Lower Cretaceous species *M. ensiformis* except for a slight concavity of its ventral margin.

*Locality:* MH 4.

Genus MYTILUS Linnaeus, 1758

MYTILUS? sp.

(Pl. 2, fig. 10)

*Material:* Two internal moulds; the one figured bears the Bureau of Mineral Resources registration number CPC 3792.

*Description:* The larger specimen is about 57 mm. high. The outline of the shell is rhomboidal apart from the anteriorly projecting umbonal region; the straight posterior margin is parallel with the antero-ventral margin and forms an angle of about 120° with the hinge-margin. The shape is, in fact, very much like that of some species of *Isognomon*, but there is no trace of serial ligamental pits, impressions of which are usually visible on internal moulds in that genus. The pallial line, marked by a series of pustules on the internal mould, follows the angulation which in each valve separates the broad flank from the flattened antero-ventral part of the surface, which is almost perpendicular to the commissure. The inflation of the shell

is only moderate. A slight inequality of the two valves and irregularity of the commissure, which is bent to the right side along the posterior margin, are assumed to be due to distortion in fossilization.

It seems probable that these internal moulds belong to the genus *Mytilus*, although this is not altogether certain. They do not belong to any species of the genus hitherto described from the Mesozoic rocks of Australia.

*Locality:* MH 4.

#### Genus BRACHIDONTES Swainson, 1840

##### BRACHIDONTES sp.

(Pl. 2, fig. 8)

*Material:* The external mould of the greater part of a small right valve, CPC 3793.

*Description:* The specimen, which is about 7 mm. long, is mytiliform and oblique, with a sharp, subterminal umbo; the anterior margin does not bulge appreciably. The ventral part of the surface, consisting of rather more than one-third of the total area, is occupied by a small number of relatively broad, rounded, almost straight radial riblets which increase during growth both by intercalation and by dichotomy. The remainder of the surface is occupied by numerous narrower riblets which meet the uppermost riblet of the first series at an acute angle and curve round to terminate at the dorsal and posterior margins.

No species with ornament agreeing exactly with that of this specimen has been described from either the Jurassic or the Cretaceous.

*Locality:* YM 17.

#### Genus LYCETTIA Cox, 1937

##### LYCETTIA? sp.

(Pl. 2, fig. 9)

*Material:* One internal mould, CPC 3794.

*Description:* The specimen is the internal mould of an oblique, mytiliform shell, about 30 mm. long, with displaced valves. The umbones are sharp and terminal. A sharply angular ridge runs in each valve from the umbo to the antero-ventral corner of the shell, separating the broad, flattened flank of the valve from a narrow antero-ventral area which is almost perpendicular to the commissure.

*Remarks:* This specimen agrees in shape with the genus *Lycettia*, which is known to range from the Lias to high in the Jurassic, as the beds in East Africa which yielded the species *L. dalpiazii* Venzo (1949, p. 127, pl. 14, fig. 6), although considered by Venzo to be Bathonian in age, are now thought to be Kimmeridgian or even later. On the other hand, however, the specimen much resembles the genus *Cuneolus* Stephenson, 1949, which includes several Cretaceous species, such as *Mytilus lanceolatus* J. de C. Sowerby, from the Aptian and Albian of Europe, and *Dreissena tippana* Conrad, from the Upper Senonian of North America. The differences between *Lycettia* and *Cuneolus* are slight, consisting of the presence or absence of a tooth on the umbonal septum, and of possible differences in ligamental structure. They could be detected only in specimens which are much better preserved than the present internal mould. A species from the Neocomian of South Africa, *Mytilus*

*uitenhagensis* Kitchin (1908, p. 82, pl. 2, figs. 10, 11), which could belong either to *Lycettia* or to *Cuneolus*, as its internal structure is at present unknown, much resembles the Australian fossil now recorded, but is somewhat narrower in form.

*Locality:* MH 4.

Sub-class HETEROCONCHIA Hertwig

Order SCHIZODONTIDA Steinmann

Family TRIGONIIDAE

Genus TRIGONIA Bruguière, 1789

TRIGONIA sp. A

(Pl. 3, figs. 6, 7)

*Material:* Two incomplete external moulds, CPC 3795, 3796.

*Description:* These specimens reproduce the ornament of a costate trigoniid, that is, a representative of *Trigonia* s. str. Even the larger of the shells was not much more than 20 mm. long when complete. The flank bears strongly convex concentric costae which number about seven to the centimetre on the middle of the shell but become narrower and more closely spaced in the later growth-stages. They are separated by intervals of about their own width. The costae end a very short distance from the prominent marginal carina. The posterior area bears narrow serrated radial threads.

*Remarks:* This is a very typical representative of *Trigonia* s. str., a group which occurs commonly in the Jurassic and is represented by a small number of species in the Cretaceous. *T. parva* Kitchin (1903, p. 37, pl. 3, figs. 7, 8), from the Neocomian of Cutch, is smaller, with more closely spaced costae. Several Jurassic species, such as *T. pullus* J. de C. Sowerby, from the Bathonian, are very similar.

*Locality:* MH 4.

TRIGONIA sp. B

(Pl. 3, fig. 8)

*Material:* The external mould of the flank of a shell, CPC 3797.

*Description:* In this specimen the costae are broader and less regularly curved than in the form recorded above as *Trigonia* sp. A, and swell out considerably at their posterior end. The marginal carina and posterior area are not seen.

*Locality:* MH 4.

Genus PACITRIGONIA Marwick, 1932

PACITRIGONIA? NANUTARRAENSIS sp. nov.

(Pl. 3, fig. 1)

*Material:* Holotype, the external mould of a right valve, CPC 3798. No other specimens have been seen.

*Description:* Moderately large, not greatly elongated (length of holotype 75 mm., height 55 mm. +), trigonally ovate, inequilateral, moderately gibbose. Umbo rather broadly rounded, situated at about the anterior third of the length. Antero-dorsal outline convex, sloping steeply; postero-dorsal margin short, sloping gently, and meeting the short oblique posterior margin in a very obtuse angle, of about 150°.

Ventral margin strongly convex (it probably extended well below the margin of the squeeze illustrated). Posterior part of flank with a broad, rounded radial swelling, the rounded outer margin of which forms the border of a narrow, obtusely triangular posterior area which is smooth except for growth-rugae. Except in early growth-stages, the anterior third of the flank is ornamented with a few broad concentric ribs, and the posterior two-thirds with straight, oblique, depressed-convex ribs which rise steeply to the radial swelling, which they cross. The posterior end of each of the concentric ribs on the lower half of the surface tends to become detached as a broad tubercle aligned with the first oblique rib, which is itself discontinuous and extends from the radial swelling only to the middle of the flank. The oblique ribs, the next of which is also discontinuous, are very broad except for about three which occupy the postero-ventral corner of the flank and are relatively narrow; all the ribs, together with their intervals, have irregular, weak longitudinal striations. In early growth-stages the flank is ornamented with a small number of irregularly zigzagging ribs (two are visible in the holotype).

*Remarks:* This interesting species bears some resemblance to the Upper Cretaceous genus *Pacitrignia*, the type species of which, *P. sylvesteri* Marwick, is from New Zealand. The radial swelling and the oblique ribs on the posterior part of the flank are, however, very characteristic, and it is possible that the species should serve as the type of a new genus. It is to be hoped that further and more complete specimens will be found.

*Locality:* MH 4.

#### Genus PTEROTRIGONIA van Hoepen, 1929

##### PTEROTRIGONIA AUSTRALIENSIS sp. nov.

(Pl. 3, figs. 2-5)

*Material:* Holotype, the external mould of a right valve, CPC 3799; the numerous paratypes consist of similar external moulds, mostly broken, and internal moulds. The other figured specimens bear the registration numbers CPC 3800-3802.

*Description:* Subcrescentic, of medium size, with the length (c. 50 mm. in the holotype) exceeding the height (c. 40 mm.). Anterior part of shell tall and well inflated, with prominent, strongly opisthogyrous umbones placed at about the anterior quarter of the length. Posterior rostrum narrow, extended, with a pronounced sinus of the ventral margin at its proximal end. Marginal carina rounded in cross-section, strongly concave longitudinally. Posterior area narrow, smooth, transversely convex, with a deep longitudinal groove adjacent to the marginal carina. Escutcheon of moderate width, well excavated, its median part with oblique transverse costellae. Flank ornament consisting of about six prominent, nodose, rounded costae on the anterior part of the surface and of a series of about eight much narrower and weaker costae on the tapering posterior part, where they terminate some distance from the marginal carina. The uppermost four costae of the anterior series have a pronounced upward-facing convexity, and the remaining costae are straight or only slightly curved. The intervals between the costae of the anterior series are deep and of about the same width as the costae; those between the costae of the posterior series are of the same width as the costae or wider than them.

*Remarks:* *P. australiensis* is the most abundant species found at its locality. In the fairly distinct division of its costae into an anterior and a posterior series,

those of the former broad and prominent, those of the latter narrow, it resembles *P. aliformis* (Parkinson), of the Albian of Europe, but that species is less elongate and the costae on the anterior part of the shell are convex downward, rather than upward. *P. ventricosa* (Krauss), from South Africa and India, resembles the present species in the division of its costae into two series and in the curvature of those on the anterior part of the shell, but the shell is much shorter and relatively taller. *P. delafosei* (Bayle & Coquand), from the Neocomian of South America,, appears to have a relatively shorter shell than the present species, although perfect specimens have yet to be figured. *P. ventricosa*, which in South Africa is a characteristic fossil of the Neocomian Uitenhage beds, occurs in India in the Tithonian-Neocomian Umia beds, and specimens have been reported by Spath (1931, p. 542; 1933, p. 798) from the matrix of Lower Tithonian ammonites. This Indian record is the only known occurrence of *Pterotrignia*, otherwise a characteristic Cretaceous genus, in the Jurassic.

*Locality:* MH 4.

Family ARCTICIDAE [CYPRINIDAE]

Genus ISOCYPRINA Roeder, 1882

"ISOCYPRINA" FAIRBRIDGEI sp. nov.

(Pl. 3, figs. 9a, b)

*Specific Name:* Named after Professor R. W. Fairbridge in recognition of his contributions to knowledge of the geology of Western Australia.

*Material:* The holotype, CPC 3803, the internal mould of a left valve.

*Description:* The specimen is sub-rhomboidal in outline, feebly and evenly inflated, and about 22 mm. long. The umbo is broadly rounded and very slightly anterior to median, and the dorsal margins slope moderately and almost equally steeply to the extremities of the shell. The anterior end of the internal mould is subangular and almost rostrate. The anterior adductor is visible near the extremity of the mould. A study of a squeeze made from the mould suggests, however, that it does not reproduce the exact outline of the original shell, the postero-ventral and probably also the antero-ventral regions having broken or worn away before fossilization. Possibly for this reason, impressions of the posterior adductor muscle and the pallial line are not to be seen. The hinge-teeth are clearly reproduced on the squeeze. They consist, in the left valve, of a stout, triangular, slightly posteriorly directed anterior cardinal tooth (2b), a very thin posterior cardinal (4b), a very prominent, elongate anterior lateral, separated from 2b by a well-marked gap, and a short, weak posterior lateral situated a considerable distance from the cardinals. the ligament having been relatively elongate.

*Remarks:* The arrangement of its hinge-teeth does not agree with that characteristic of any described genus, so that it seems probable that the present species belongs to a new genus. It is, however, undoubtedly referable to the Arcticidae and is perhaps as closely related to *Isocyprina* as to any other described genus. Whereas the tooth 2b is robustly triangular in the present form and the anterior lateral well separated from it, in *Isocyprina* 2b is split up into two thin limbs which diverge in a chevron-like manner, and the anterior lateral is confluent with the more anterior of these limbs (see the figures given by Casey, 1952, p. 135). In the genus *Staffinella* Casey (p. 132) the tooth 2b is as robust as in the present form, but the

posterior end of the anterior lateral (partly differentiated as a tooth regarded by Casey as 2a) touches 2b; the posterior lateral tooth, moreover, is much more elongate than in the present form.

*Locality:* MH 4.

Family TANCREDIIDAE

Genus CORBICELLOPSIS Cox, 1929

"CORBICELLOPSIS" NANUTARRAENSIS sp. nov.

(Pl. 3, figs. 10 a, b)

*Material:* The holotype, CPC 3804, internal and external moulds of the same shell, both incomplete posteriorly.

*Description:* Of medium size for the genus (original length c. 50 mm., height 30 mm.), rectangularly ovate, moderately elongate, truncated obliquely posteriorly, inequilateral, umbones apparently at about the anterior third of the length; evenly but weakly inflated, without diagonal carina. Surface unornamented, bearing only irregular growth-threads. Umbonal region broadly rounded, projecting very little, if at all, above the postero-dorsal margin, which slopes very gently in a posterior direction and meets the posterior margin in an obtuse angle. Ventral margin of feeble convexity. Right valve with a very prominent, elongate posterior lateral tooth separated from the margin by a recess, and with a thick, broad, obtuse, bifid median cardinal tooth which extends to both sides of the beak and is separated by a relatively narrow, triangular, anteriorly directed recess from a narrow anterior cardinal tooth; the lower margin of the median cardinal forms a deep sinus. An anterior lateral appears to be absent, but this part of the specimen is imperfect. Pallial line simple.

*Remarks:* This species has the general outline of a *Corbicellopsis*, but its dentition differs from that of typical representatives of the genus, and, when more material is available, it will probably prove desirable to found a new genus for its reception. The broad bifid cardinal tooth in the right valve is very different from the corresponding simple cardinal tooth found in typical species of *Corbicellopsis*, and the posterior lateral tooth is much stronger and more elongate than is usual in this genus. The species seems unrelated to the Australian Cretaceous genus *Tatella*, which is stated to be without lateral teeth. It bears, however, some resemblance to "*Myacites*" *planus* Moore (1870, p. 254, pl. 12, fig. 10), an Australian Cretaceous species of unknown internal structure transferred by Etheridge, quite inappropriately, to the genus *Macrocallista* Meek. In the present form, however, the shell appears to be more inequilateral than in "*M.*" *planus* and the posterior truncation is less oblique.

In view of the clarification of many sections of the International Rules of Zoological Nomenclature at the International Zoological Congress in Copenhagen in 1953, and particularly the emphasis placed on the principle that the type species of a genus must be one of the originally included nominal species, it is evident that the contention of the late Dr W. J. Arkell (1934) that the type species of the genus *Corbicella* Morris & Lycett should be *C. complanata* Lycett cannot be upheld. As I had shown in a previous paper (Cox, 1929), the type species of *Corbicella* was *C. bathonica* Morris & Lycett, a *Quenstedtia*, so that the generic name *Corbicellopsis* should be used for the zoological genus typified by the species *Corbis laevis* J. de C. Sowerby.

*Locality:* MH 4.

Family LUCINIDAE  
Genus LUCINA Bruguière, 1797  
LUCINA MACROPORUM sp. nov.

(Pl. 4, figs. 1a, b, 2)

*Specific Name:* After *Macropus*, the generic name of the kangaroo.

*Material:* Holotype, an external mould of a left valve, CPC 3805; the paratypes consist of the external mould of part of a right valve and of about four internal moulds of right valves, of which CPC 3806 is illustrated.

*Description:* Shell suborbicular, subequilateral, of medium size, the length (originally about 22 mm. in the largest specimen) slightly exceeding the height (19 mm.); convexity slight. Ventral margin asymmetrical, its anterior part strongly convex and curved in continuity with the strongly convex anterior margin; its posterior part flattened-convex, inclined upwards to meet the more or less flattened posterior margin in a rounded-off, obtuse angle. Lunule not observed; escutcheon narrow, bordered by a sharp ridge. Surface ornamented with closely and unevenly spaced thin concentric ridges. Right valve with a strong, tuberculiform anterior lateral tooth, a moderately strong, triangular, backward-sloping posterior cardinal, and a thin anterior cardinal which is not separated from the lunular margin. Details of the dentition and of the escutcheon are clearly reproduced on a squeeze taken from one of the internal moulds, which also shows adductor scars of the usual lucinoid type very clearly.

*Remarks:* No species closely comparable to the one now described has been described previously from the Mesozoic of Australia or New Zealand. Its outline is very similar to that of a "*Lucina* sp." figured by Woods (1907, pl. 24, figs. 4, 5) from the Aptian of England.

*Locality:* MH 4.

Family FIMBRIIDAE [CORBIDAE]  
Genus MUTIELLA Stoliczka, 1871  
MUTIELLA? TEICHERTI sp. nov.

(Pl. 4, fig. 6)

*Specific Name:* Named after Dr C. Teichert in recognition of his work on the stratigraphy and palaeontology of Western Australia.

*Material:* Holotype, a right valve retaining its shell (CPC 3807). The material also includes the external mould of another right valve (CPC 3808) as well as two or three very imperfect specimens.

*Description:* Very small (length of holotype c. 5 mm.), orbicular, gibbose. Umbo median, projecting very little above the dorsal margins, and only slightly incurved to the beak. No lunule. Ornament consisting of irregularly spaced concentric ribs and of fine radial threads which override them. Hinge-structure unknown.

*Remarks:* The reference of this small species to the genus *Mutiella*, the type species of which is *Corbis rotundata* d'Orbigny (1844, p. 113, pl. 280), from the Cenomanian of France, is very tentative and based merely on a general resemblance in form and ornament. *C. rotundata* itself is a very much larger shell, but the English Albian species "*Petricola*" *canaliculata* (J. de C. Sowerby), which Woods (1907, p. 160, pl. 25, figs. 4-6) includes in *Mutiella* with a query, is intermediate

in size. So far as the general shape of the shell is concerned, there is also little difference between the present species and the genus *Sphaeriola* Stoliczka, founded on the European Bathonian species "*Cardium*" *madridi* d'Archiac, but radial ornament is absent in *Sphaeriola*.

*Locality:* YM 17.

Family CARDIIDAE

Genus PROTOCARDIA Beyrich, 1845

PROTOCARDIA WAPETI sp. nov.

(Pl. 4, figs. 3, 4a, b, 5)

*Specific Name:* After the accepted abbreviation (WAPET) of West Australian Petroleum Pty Ltd.

*Material:* The holotype (CPC 3809), consisting of the internal mould of a bivalve shell and part of the associated external mould; also numerous paratypes, mostly internal moulds of isolated valves. The paratypes in which the hinge-structure is best seen bear the registration numbers CPC 3810, 3811.

*Description:* Of medium size, suborbicular, equilateral, the length (42 mm. in the largest specimen) slightly exceeding the height; evenly and rather strongly inflated. Umbones prominent, slightly prosogyrous; no posterior ridge. Radial striations on posterior part of surface weak, not observable at all on most of the external moulds. A concentric rib marking a pronounced growth-halt may be present at a fairly early stage of growth, while irregular concentric undulations are commonly present at later growth-stages, continuing uninterruptedly from the flank on to the posterior part of the surface. Pallial line with a distinct but shallow sinus. Anterior and posterior lateral teeth strongly developed and relatively elongate, those of the left valve fitting into recesses between those of the right valve and the dorsal margins.

*Remarks:* The presence of radial striations on the posterior part of the surface, distinctly visible in the specimen CPC 3812, shows that this species should be included in *Protocardia* rather than in *Integricardium* Rollier or *Tendagurium* Dietrich.

*Locality:* MH 4.

PROTOCARDIA sp.

(Pl. 4, figs. 7a, b)

*Material:* Two broken internal moulds and a small portion of the external mould of the postero-dorsal region of another specimen. The specimen figured bears the Bureau of Mineral Resources registration number CPC 3814.

*Description:* These specimens belong to a relatively large representative of the Cardiidae, the length of the shell in the largest specimen having been originally 90-100 mm. and the height 80 mm. or more. The internal mould of the umbo is prominent, slightly prosogyrous, and just anterior to median. The small portion of an external mould which is preserved (CPC 3815) shows that the surface bore irregular concentric rugae. There is no sign of radial ornament, but the material is so limited that it cannot be assumed that the species was characterized by the absence of such ornament. There is no pallial sinus. Impressions of the hinge-teeth are not preserved in the available specimens. Although the species is probably a new one, it seems undesirable to assign a name to it until more material is available.

*Locality:* MH 4.

Family ASTARTIDAE

Genus ASTARTE J. Sowerby, 1816

Subgenus NICANIELLA Chavan, 1945

ASTARTE (NICANIELLA) MCWHAEE sp. nov.

(Pl. 4, figs. 8a, b, 9, 10)

*Specific Name:* Named after Dr J. R. H. McWhae in recognition of his contributions to geological knowledge of Western Australia.

*Material:* Several specimens, some retaining the actual shell, others external moulds; all are imperfect. The figured specimens are the holotype (CPC 3816) and two paratypes (CPC 3817, 3818).

*Description:* Small (original length of largest specimen c. 6 mm.), of feeble inflation, rectangularly ovate, length slightly exceeding height. Umbo at about the anterior quarter of the length, not incurved, level with the moderately convex postero-dorsal margin, which has a very gentle slope and meets the almost straight, sub-vertical posterior margin in an obtuse angle. Ventral margin very strongly convex. Ornament consisting of strong, regularly arranged, rounded concentric ribs separated by intervals which are narrower than the ribs in some specimens and about as wide as them in others.

*Remarks:* Chavan (1945, p. 43) founded the subgenus *Nicaniella* for the reception of the small, concentrically ribbed astartids of the Jurassic in which the right valve has only one cardinal tooth (3b), the small anterior cardinal (3a) present in most members of the family being absent. The range of the subgenus, to which the present species is referred merely on account of its external characters, appears to extend to the Upper Cretaceous. *Astarte apicalis* Moore (1870, p. 249, pl. 13, fig. 11), from the Bajocian of Western Australia, the holotype of which is in the British Museum (Natural History) (reg. no. LL 8810), is smaller (length of holotype only 3 mm.) and more trigonal than the new species, with a much more prominent umbo. No comparable species has been described previously from the Cretaceous of Australia.

*Locality:* YM 17.

Genus ERIPHYLA Gabb, 1864.

ERIPHYLA PLAYFORDI sp. nov.

(Pl. 5, figs. 1-4)

*Specific Name:* Named after Mr P. E. Playford in recognition of his contributions to knowledge of the geology of Western Australia.

*Material:* Holotype, the external mould of a right valve, CPC 3819. The numerous paratypes include both external and internal moulds, of which those illustrated bear the registration numbers CPC 3820-22.

*Description:* Suborbicular, of medium size, the height (34 mm. in a relatively large paratype, CPC 3821) very slightly exceeding the length (32.5 mm.); inflation moderately strong. Umbo not very prominent, placed at about the anterior quarter of the length and directed anteriorly. Postero-dorsal margin rather strongly convex, joining the posterior margin in an even curve which is continued by the ventral and anterior margins. Lunule and escutcheon not observed. Surface unornamented, except for irregular growth-rugae. Pallial sinus well defined. Dentition as characteristic of genus, with the left posterior lateral and right anterior lateral well developed.

*Remarks:* Few of the specimens are as large as the one of which the dimensions are quoted, the majority being about 20 mm. high. Many of the internal moulds are of isolated valves and have preserved clear impressions of the hinge-teeth. This species seems closely comparable to *E. meridiana* Woods (1917, p. 28, pl. 15, figs. 2-7), from the Upper Cretaceous of New Zealand, but its ventral margin is not quite so strongly convex as in that species and its umbo is rather more anterior. The earliest representatives of *Eriphyla* appear late in the Jurassic, but most of the known species are Cretaceous in age.

*Locality:* MH 4.

Order EUDESMODONTIDA Cox

Family HIATELLIDAE [SAXICAVIDAE]

Genus PLEUROMYA Agassiz, 1842

PLEUROMYA ASHBURTONENSIS *sp. nov.*

(Pl. 5, fig. 5)

*Specific Name:* After the Ashburton River, Western Australia.

*Material:* The holotype only, an internal mould, CPC 3823.

*Description:* Of medium size (length 48 mm., height 33 mm.), ovate-cuneiform, inequilateral, well inflated, gaping slightly at both ends. Umbones slightly prosogyrous, well incurved to the beaks, which lie at about the anterior three-fifths of the length. Postero-dorsal outline moderately convex, sloping gently to the rather abruptly rounded posterior end of the shell. Antero-dorsal outline slightly concave; anterior margin broadly rounded, continuous with the symmetrically and rather strongly convex ventral margin. Pallial sinus deep, extending anteriorly just past the middle of the length of the shell. On the internal mould the line of the commissure is interrupted dorsally, just below the umbones, by two small nicks, the posterior one projecting to the left, the anterior to the right, indicating the former existence of a tooth-like process in each valve.

*Remarks:* The ovate-cuneiform shape of this specimen is suggestive of the genus *Gresslya* and distinguishes it from most described species of *Pleuromya*, but the internal mould of the right valve does not show the groove, extending back from the umbo, which is characteristic of the former genus. The shell, moreover, did not have the posterior truncation and broad gape which are present in *Panopea*. Its internal characters appear to have agreed with those of *Pleuromya* (cf. Zittel, 1881, p. 125, text-fig. 179), and the species is, therefore, referred to that genus. Although the few species of Lower Cretaceous age which have been described under *Pleuromya* have been considered by Mlle S. Gillet (1924, p. 143) to be more correctly included in *Panopea*, it is probable that such forms as the one from Texas figured by Cragin (1905, p. 82, pl. 17, figs. 1-5; pl. 18, figs. 1-3 as *Pleuromya inconstans* Castillo & Aguilera should be retained in the former genus.

*Locality:* MH 4.

Genus PANOPEA Ménéard de la Groye, 1807

PANOPEA GLAESSNERI *sp. nov.*

(Pl. 5, fig. 7; Pl. 6, figs. 4a, b)

*Specific Name:* Named after Dr. M. F. Glaessner, of the University of Adelaide, in recognition of his many contributions to palaeontology.

*Material:* The holotype, an internal mould (CPC 3824), and about six similarly preserved but more or less broken paratypes, of which CPC 3825 is also figured.

*Description:* Large (original length of largest specimen c. 140 mm.), ovate, moderately elongate but variable in proportions, gibbose; gaping rather broadly and truncated slightly obliquely posteriorly. Umbones broadly rounded in outline, situated at about the anterior two-fifths of the length, protruding well above the hinge-margin, well incurved, almost orthogyrous. Anterior margin evenly convex, ventral margin flat or feebly convex; posterior margin straight, forming an obtuse angle, of about  $110^{\circ}$ , with the hinge-margin. Pallial sinus deep, extending to about the middle of the length of the shell.

*Remarks:* This large *Panopea* is quite unlike any described species of Jurassic age. Woods (1909, p. 221, text-fig. 27) has figured a specifically unnamed *Panopea* from the Neocomian of England nearly 140 mm. long, but it is much more elongate and inequilateral than the present species, with broader and more depressed umbones. *P. hauthali* Wilckens (1907, p. 49, pl. 9, fig. 3; also Feruglio, 1937, p. 129, pl. 15, fig. 11), from the Senonian of Patagonia, attains a length of 122 mm., but is also more elongate and inequilateral than the present species, with broader and more depressed umbones.

*Locality:* MH 4.

#### Family TEREDINIDAE

Genus TEREDO Linnaeus, 1758

TEREDO sp.

(Pl. 6, fig. 1; ? Pl. 5, fig. 6)

*Material:* Infillings of borings, preserved in a cavity representing wood that has decayed away (CPC 3826). A second group of borings, of less certain affinities, is registered as CPC 3827.

*Description:* The cavity in which the tube-like infillings are preserved has irregular longitudinal striations and clearly represents a piece of wood. The longest tube, as now preserved, is only 18 mm. in length, but the place where it entered the wood is broken away, so that originally it was evidently longer. This tube has a fairly constant diameter of about 3 mm. and a dome-like end. Two other dome-like structures of about the same diameter represent tubes which penetrated only a short distance into the wood. No trace of the original shells belonging to the boring mollusc is preserved.

The second group of infillings of borings (Pl. 5, fig. 6) is not obviously associated with traces of wood, so that it is less certain if the tubes belonged to a species of the Teredinidae. They are rather closely packed and oriented in all directions, with irregular bends, and the widest has a diameter of 10 mm.

*Remarks:* Of the very small number of Jurassic species which have been described under *Teredo*, two (*T. corallensis* Buvignier and *T. pulchella* Terquem & Jourdy) are stated to have bored into corals, and one (*T. gelyanus* Buvignier) into shells. De Loriol (1875, p. 3, pl. 11, fig. 1), however, described some claviform borings in fossil

wood from the Portlandian of Boulogne, France, under the generic name *Teredina*, a genus of the Teredinidae. There are a number of records of the occurrence of wood with *Teredo* borings in the Cretaceous.

*Locality:* MH 4.

Order ASTHENODONTIDA Dall  
Family CORBULIDAE  
Genus CORBULA Bruguière, 1797  
CORBULA NANUTARRAENSIS sp. nov.  
(Pl. 6, fig. 2)

*Material:* The holotype only, the external mould of a left valve (CPC 3828).

*Description:* Of medium size for the genus (length 9.0 mm., height 6.0 mm.), subovate, equilateral, evenly and moderately strongly inflated, not carinate posteriorly. Umbones broadly rounded, their outline continuous with the convex outline of the antero-dorsal part of the shell; postero-dorsal outline very slightly concave. Anterior margin rather narrowly convex, ventral margin moderately and symmetrically convex except for a slight sinus near its posterior extremity, corresponding to a very short, narrow, beak-like posterior rostrum. Surface smooth except for a rather conspicuous growth-halt when the shell was about three-quarters fully grown.

*Remarks:* This species is a *Corbula* of a common type likely to occur in beds of any geological age from early Jurassic onwards. No representative of the genus has been described previously from the Mesozoic of Australia.

*Locality:* YM 17.

Class GASTROPODA  
Subclass PROSOBRANCHIA Milne-Edwards  
Order ARCHAEOGASTROPODA Thiele  
Family TROCHIDAE  
Genus TECTUS Montfort, 1810  
TECTUS ? sp.  
(Pl. 6, figs. 3a, b)

*Material:* The external mould of the apical whorls of the shell (CPC 3929).

*Description:* The part of the specimen preserved is 11 mm. high and its maximum diameter is about 8 mm. The spire is very acute and slightly coeloconoid. The whorls, which are separated by deep linear sutures, are almost flat-sided, but have a broad shallow concavity at about the lower third of their height. They bear straight, narrow, not very prominent, prosocline riblets which are separated by somewhat broader intervals. Many of the riblets are in alignment from one whorl to the next, but the number to every whorl increases slightly during growth. As there is no evidence bearing on the apertural characters of this species its reference to the genus *Tectus* is merely tentative. The accepted range of *Tectus* is from the Lower Cretaceous onwards.

*Locality:* MH 4.

Genus MURICOTROCHUS Cossmann, 1918

MURICOTROCHUS? AUSTRALIENSIS sp. nov.

(Pl. 6, figs. 5, 6a-c, 7, 8)

*Material:* The holotype, an external mould (CPC 3830), and four paratypes, similarly preserved; those figured are registered as CPC 3831-3.

*Description:* Trochiform, rather small, the height (c. 11 mm. in the holotype) about equal to the diameter. Whorls low, with two prominent rounded carinae, one bordering each of the deeply impressed sutures, the lower one also forming the periphery of the last whorl. Base flattened, bearing two strong spiral ribs on its axial part. Collabral ornament absent. Apertural characters unknown.

*Remarks:* The ornament of this species resembles that of *Muricotrochus hudlestoni* Cossmann (1918, pl. 9, figs. 27-29), type species of the genus, but the shell is less elevated. Its generic affinities must be considered doubtful until its apertural characters can be more fully observed.

*Locality:* MH 4.

Family NODODELPHINULIDAE

Genus TROCHACANTHUS Dacqué, 1936

TROCHACANTHUS sp.

(Pl. 7, fig. 1)

*Material:* One specimen (CPC 3834), consisting of the external mould of the abapertural side of the shell.

*Description:* The shell was depressed-turbiniiform in shape, with the diameter (originally c. 25 mm.) exceeding the height (c. 18 mm.). The spire whorls have a carina situated very close to the lower suture and a broad, almost flat face inclined in conformity with the general slope of the spire. On the last whorl a second carina equal in prominence to the first is present a little below it and forms the margin of the base. Any finer ornament that may have been present on the shell is not preserved on the external mould. This species appears to have had the characters of *Trochacanthus* rather than of the related genus *Helicacanthus*.

*Locality:* MH 4.

Family PATELLIDAE

Genus PATELLA Linnaeus, 1758

"PATELLA" sp. A

(Pl. 7, figs. 2a, b)

*Material:* One internal mould (CPC 3835). Two other internal moulds could possibly belong to the same species but are ill-preserved.

*Description:* The best specimen is 40 mm. long, about 31 mm. broad, and 13.5 mm. high. Its outline is evenly oval. The apex, forming the highest point of the shell, lies at about the anterior two-fifths of the length, and the longitudinal profile from the apex to the anterior margin is strongly convex. It is evident from distinct traces of radial ribbing on the internal mould that the exterior of the shell bore at least 20 rather strong ribs. These did not, however, affect the even curve of the margins.

*Remarks:* The patelliform gastropods of the Jurassic with strong radial ribbing have been catalogued under the genus *Acmaea* by Haber (1932), although not on any convincing evidence. Most of them are smaller than the form now described, but "*Patella*" *fenestrae* Hudleston (1896, p. 463, pl. 42, figs. 9a, b), from the Inferior Oolite of England, is of about the same size; it differs in its higher and more conical form. No Cretaceous species at all closely comparable to the present form can be cited.

*Locality:* MH 4.

"PATELLA" sp. B  
(Pl. 7, figs. 3a, b)

*Material:* One internal mould (CPC 3836).

*Description:* This specimen is smaller than the one described above as "*Patella*" sp. A, its length being 24 mm., its breadth about 22 mm., and its height 7 mm. It is thus relatively broader and lower than "*Patella*" sp. A, and it also differs in the more anterior position of its apex, which lies at about the anterior third of the length. The longitudinal profile from the apex to the anterior margin is strongly convex and rises above the level of the apex. The specimen also bears traces of radial ribbing. The ribs apparently numbered about 12 and, although strong, did not affect the even curve of the shell margins.

*Locality:* MH 4.

Family NERITIDAE  
Genus OTOSTOMA d'Archiac, 1859  
OTOSTOMA? sp.  
(Pl. 7, figs. 4, 5)

*Material:* Four internal moulds, two associated with portions of the external mould retaining an impression of the surface ornament. The two figured bear the Bureau of Mineral Resources registration numbers CPC 3837-8.

*Description:* The diameter of the largest specimen is about 27 mm. and its height 24 mm. In all four specimens the internal partitions between the earlier whorls had evidently been resorbed, as in many Neritidae, so that these whorls are represented on the internal mould by a globular mass. In one specimen the external ornament consists of narrow, irregularly distributed, prosocline collabral ridges together with some low, amorphous, node-like elevations of the surface. In a second specimen narrow collabral ridges are present but no nodes are observable. The nature of the ornament appears to agree with that of the genus *Otostoma*, the geological range of which extends from the Upper Jurassic to the Palaeocene.

*Locality:* MH 4.

Order CAENOGASTROPODA Cox

Family PURPURINIDAE

Genus PURPURINA d'Orbigny, 1850

PURPURINA? YANREYENSIS sp. nov.

(Pl. 7, figs, 6a, b)

*Material:* The holotype only, an external mould bearing the impression of the abapertural side of the shell and of the apex (CPC 3839).

*Description:* Of medium size (height c. 18 mm., diameter c. 16 mm.), with a globose last whorl occupying over two-thirds of the total height and a low spire consisting of relatively few whorls. Whorls with a steep, feebly convex outer face and a rounded shoulder which forms the border of a rather wide, gently inclined sutural ramp; outer face of last whorl merging in a broad curve into the convex base. The mould of the median part of the latter is not preserved, but it is probable that the shell was without an umbilicus. Ornament consisting of rather narrow, prominent, rounded collabral ribs separated by slightly broader intervals. The ribs fade away at the margin of the sutural ramp but continue across all the visible portion of the base. Spiral ornament apparently absent.

*Remarks:* The reference of this species to *Purpurina* is tentative as details of the aperture are unobservable. No closely comparable species can be cited.

*Locality:* MH 4.

Family PROCERITHIIDAE

Genus PROCERITHIUM Cossmann, 1902

Subgenus RHABDOCOLPUS Cossmann, 1906

PROCERITHIUM (RHABDOCOLPUS) BRUNNSCHWEILERI sp. nov.

(Pl. 7, figs. 7a, b)

*Specific Name:* Named after Dr R. O. Brunnschweiler in recognition of his contributions to the palaeontology of Western Australia.

*Material:* The holotype only (CPC 4027), consisting of the internal and external moulds of the original shell.

*Description:* Shell about 12 mm. high, composed of feebly convex whorls with well impressed sutures. Whorls ornamented with straight, slightly prosocline, rounded transverse ribs, with spiral riblets and threads in their intervals. In the later growth stages the transverse ribs number about four to every half-whorl and are separated by slightly unequal intervals most of which are a little broader than the ribs; the latter terminate above at a strong spiral thread forming the edge of a narrow sutural ramp. The rest of the spiral ornament consists of two rounded riblets which lie at about one-third and

two-thirds of the whorl height and are weaker than the transverse ribs, together with a number of threads which are slightly unequal in strength and occupy all the rest of the surface except the sutural ramp.

*Locality:* MH 4.

Family APORRHAIIDAE

Genus APORRHAIIS Da Costa, 1778

"APORRHAIIS" sp. A

(Pl. 7, fig. 11)

*Material:* One imperfect internal mould (CPC 4022).

*Description:* This specimen represents a robust shell which was originally at least 25 mm. high. Two well separated carinae appear on the last whorl, and between them the face of the whorl is feebly concave and almost perpendicular. There is no evidence as to the nature of the labral digitations. The specimen is rather similar to an internal mould from the Albian of Switzerland figured by Pictet & Campiche (1864, pl. 91, figs 6a, b) under the name *Pterocera bicarinata* (Deshayes), but in the Swiss form the shell is even more robust.

*Locality:* MH 4.

"APORRHAIIS" sp. B

(Pl. 7, fig. 8)

*Material:* One imperfect internal mould (CPC 4023).

*Description:* This specimen, which was originally about 20 mm. high, is much more slender than the one recorded above as "*Aporrhais*" sp. A. The internal mould of its last whorl is broadly rounded in outline and bears a small number of broad, obtusely rounded, unevenly spaced axial ribs. There is no distinct evidence of such ribbing on the penultimate whorl. No closely comparable specimen is described in the literature.

*Locality:* MH 4.

Family AMPULLOSPIRIDAE

Genus GLOBULARIA Swainson, 1840

GLOBULARIA sp. A

(Pl. 7, fig. 10)

*Material:* Two internal moulds. The one figured is registered as CPC 4024.

*Description:* The larger specimen, which is figured, was originally about 45 mm. high and its maximum diameter was 26 mm. There is a tall, acute, regularly conical spire which consists of rather high flattened whorls and well exceeds the aperture in height. The last whorl is obtusely subangular at the periphery. This species is rather similar to *Globularia elegans* (J. de C. Sowerby) (1836, p. 347, pl. 23, fig. 3), from the Portland Beds of England, but has a taller spire.

*Localities:* MH 4, YM 17.

GLOBULARIA sp. B

(Pl. 7, figs. 9a, b)

*Material:* One internal mould (CPC 4025).

*Description:* In this specimen, which was originally about 30 mm. high, the spire is less acute and relatively lower than in the forms recorded above as *Globularia* sp. A, occupying about two-fifths of the total height of the shell, and the whorls are lower and more convex. At its periphery the last whorl is obtusely subangular, but less markedly so than in the first species. This form could be compared with the French Kimmeridgian species *Globularia barottei* (de Loriol) (1872, p. 112, pl. 7, figs. 14, 15), but, as in the case of the previous species, a comparable form could occur at any horizon of the Mesozoic.

*Locality:* MH 4.

Subclass OPISTHOBRANCHIA Milne-Edwards

Order TECTIBRANCHIA Cuvier

Family ACTEONIDAE

Genus ACTEONINA d'Orbigny, 1850

"ACTEONINA" AUSTRALIENSIS sp. nov.

(Pl. 7, figs. 12a-d.)

*Material:* The holotype only (CPC 4026), a specimen retaining the actual shell but with the inner lip broken away.

*Description:* Of medium size (original height c. 25 mm., diameter c. 15 mm.), ovate-conical, with a cyrtoconoid spire the height of which is rather less than the original height of the aperture. No umbilicus. Whorls feebly convex, unornamented; last whorl broadly and evenly rounded at its relatively low periphery; sutures superficial and obscure. A carina appears near the upper suture on the penultimate whorl; its distance from that suture and its prominence increase gradually during growth, so that, though at first it forms the border of a narrow, horizontal sutural shelf, it ultimately delimits a relatively broad juxta-sutural band which is inclined almost in conformity with the general outline of the last whorl. Growth-lines opisthocyrte on the juxta-sutural zone, indicating the presence of a labral sinus at the adapical end of the aperture; on the remainder of the surface the growth-lines are almost vertical. The lower part of the inner lip, as preserved, bears an oblique ridge which may have curved round to join the basal margin of the aperture. No other features of the apertural region are preserved.

*Remarks:* This species appears to belong to a new genus, which cannot, however, be described adequately until more material is studied. The carina delimiting a juxta-sutural anal fasciole which gradually increases in relative width is a very characteristic feature. Although the species is included provisionally in the opisthobranch family Acteonidae and in the genus *Acteonina*, the presence and position of the anal fasciole are suggestive of the family Itieriidae, in which, however, this band is constant in width and relatively narrow.

*Locality:* YM 17.

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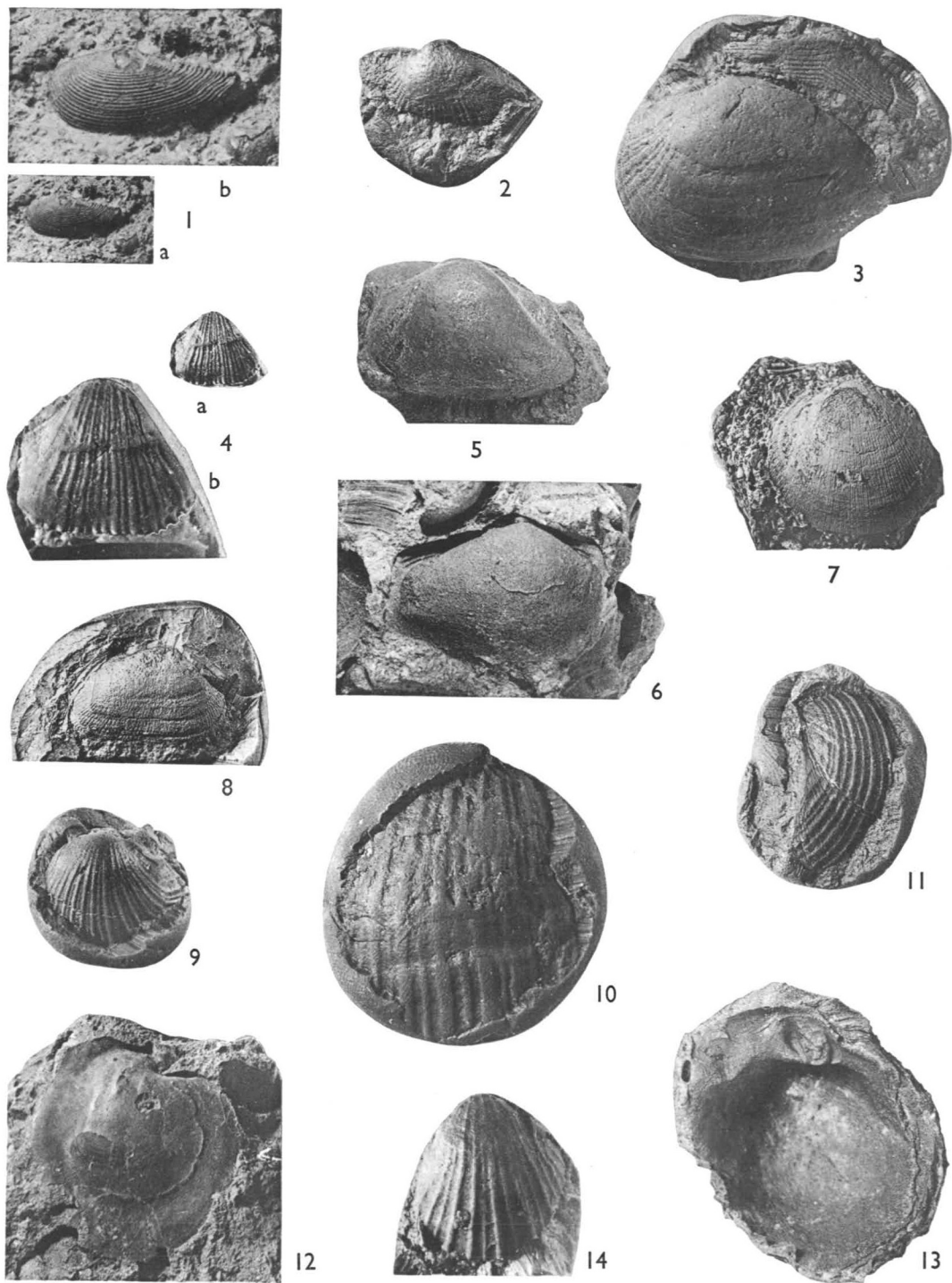
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<sup>1</sup> Trade name for a polyvinyl chloride plastic product.

<sup>2</sup> Trade name for a vulcanized rubber latex product.



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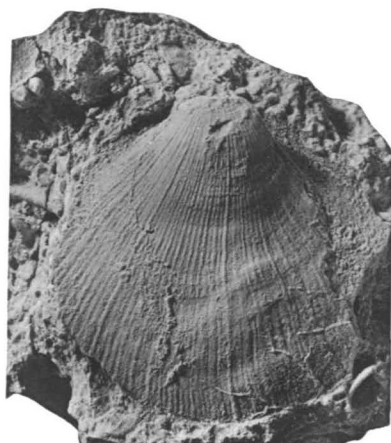
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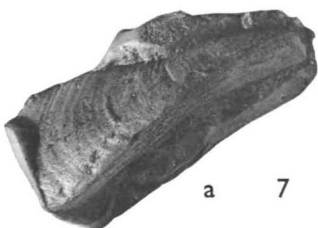
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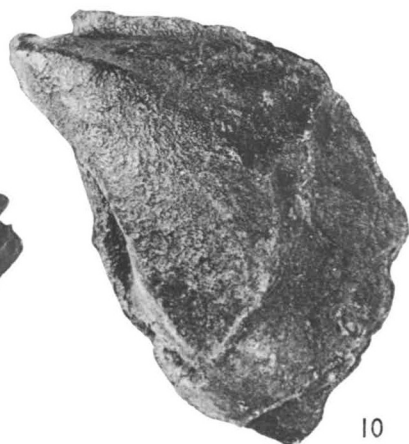
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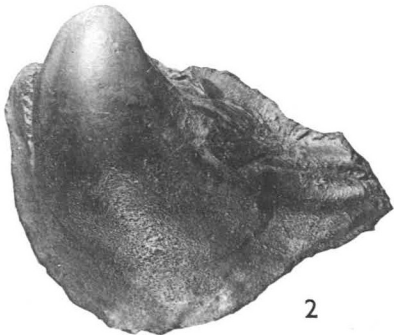
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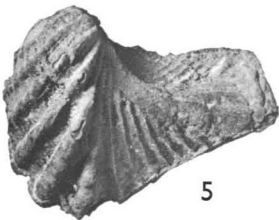
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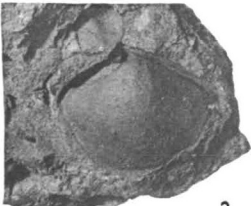
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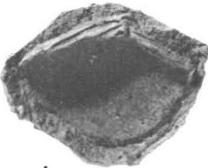
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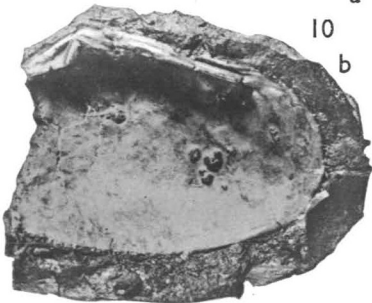


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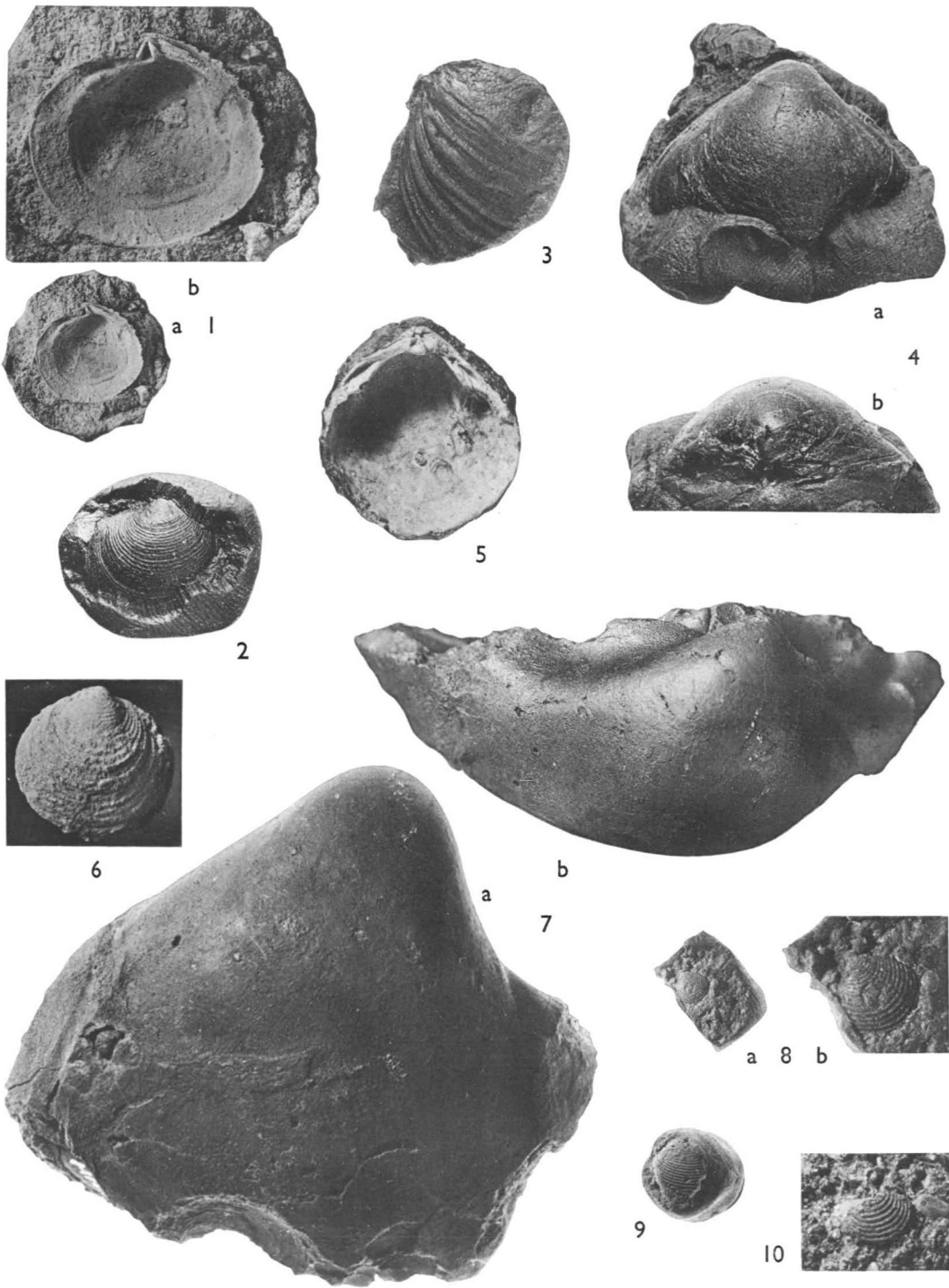


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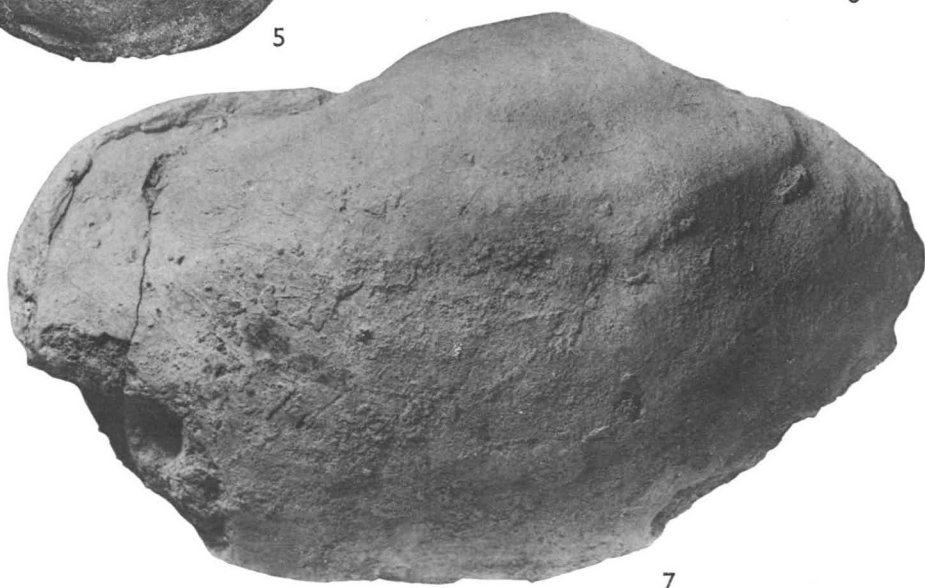
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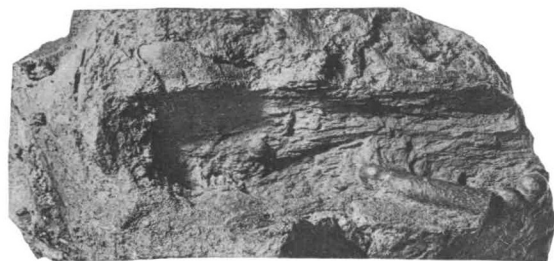
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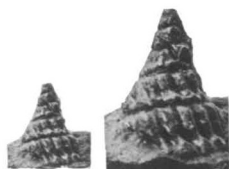
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1



2

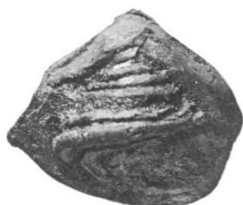


a

b



5



b

6



a



a

4



b



6c



7



8

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