PERMIAN PELECYPODS NEWLY RECORDED FROM EASTERN AUSTRALIA

by J. M. DICKINS

ABSTRACT. *Atomodesma* (*Atomodesma*) *bisulcata sp.* nov., *Pseudomyalina* sp., and *Oriocrassatella queenslandica* sp. nov. are described from Queensland, and Etheridge jun.'s figured specimen of *Sanguinolites concentricus* (Etheridge sen.) is referred doubtfully to *Pyramus*. *Atomodesma* (*Aphanaia*) is recorded from Queensland and *Schizodus* from Queensland and New South Wales. *Atomodesma*, *Pseudomyalina*, and *Oriocrassatella* have not previously been described from Eastern Australia. On the basis of the pelecypod fauna the Cattle Creek Formation of Queensland is regarded as most likely of early Artinskian (Lower Permian) age and the Crocker Formation, which is considered to be the equivalent of the Mantuan *Productus* Bed, is regarded as of Kungurian to Kazanian age.

DURING an examination of the collections of the Geological Museum of the University of Queensland, Brisbane, several genera or subgenera hitherto unrecognized in Eastern Australia, were identified. They are of importance for the correlation of the Permian rocks of Queensland, particularly of the Bowen Basin, with those of Western Australia and elsewhere. The genera or subgenera described are *Atomodesma* (*Atomodesma*), *Pseudomyalina*, and *Oriocrassatella*. *Schizodus* (*sensu lato*), although it has not so far been described, is represented in Queensland and New South Wales by a number of species, but they require an extensive study which is outside the scope of this paper. In addition *Atomodesma* (*Aphanaia*), which occurs in New South Wales, is also found in Queensland, but the specimens are fragmentary and are not described here. Because of its possible relationship to *Oriocrassatella*, the figured specimen of *Sanguinolites concentricus* (Etheridge sen.) (1872, p. 328, pl. 13, fig. 2), Etheridge jun. (1892, p. 281, pl. 43, fig. 7) is refigured and described.

PERMIAN ROCKS IN QUEENSLAND AND WESTERN AUSTRALIA

The succession in the Springsure (eastern) area of the Bowen Basin, taken from Hill (1957), is shown in the accompanying text-figure and is tabulated below. Earlier accounts include Hill (1955) and Webb (1956). Hill (1957, p. 12) says, 'the successive rich marine faunas, Dilly, Cattle Creek, Ingelara and Mantuan must form the standard for the correlation of the entire Queensland Permo-Carboniferous'.

8. *Bandanna Formation* — 1,000 feet
   Shale, sandstone, calcareous sandstone and sandy limestone, with coal and oil shale seams and plant fossils.
7. *Mantuan* PRODUCTUS *Bed* — 100 feet
   Limestone to calcareous sandstone, with brachiopods, bryozoans and corals.
6. *Catherine Sandstone* — 400–700 feet
   Sandstone and occasional calcareous sandstone; with brachiopods and plants.
5. *Ingelara Formation* — 90–500 feet
   Shale, sandstone, thin bands of limestone, with a rich marine fauna.
4. *Aldebaran Sandstone* — 1,500–2,500 feet
   Sandstone with quartz pebbles, intercalated shale and clay, no fossils recorded.

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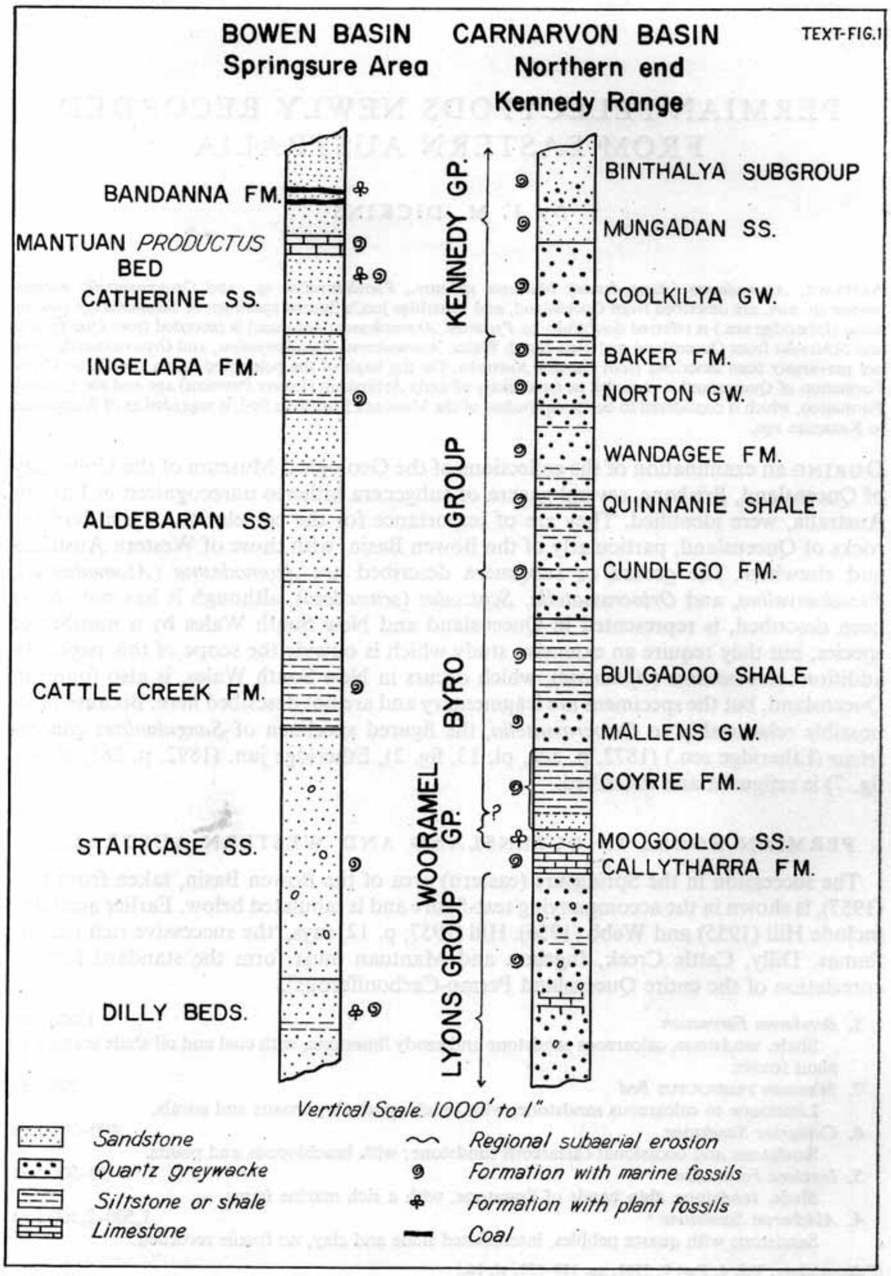


TEXT-FIG.1
BOWEN BASIN
Springsure Area
CARNARVON BASIN
Northern end
Kennedy Range
BANDANNA FM.
MANTUAN PRODUCTUS BED
CATHERINE S.S.
INGELARA FM.
ALDEBARAN SS.
CATTLE CREEK FM.
STAIRCASE SS.
DILLY BEDS.
KENNEDY GP.
BYRO GROUP
WOORAMEL GP.
LYONS GROUP
BINTHALYA SUBGROUP
MUNGADAN SS.
COOLKILYA GW.
BAKER FM.
NORTON GW.
WANDAGEE FM.
QUINNANIE SHALE
CUNDLEGO FM.
BULGADOO SHALE
MALLENS GW.
COYRIE FM.
MOOGOOLOO SS.
CALLYTHARRA FM.
Vertical Scale 1000' to 1"
Sandstone
Quartz greywacke
Siltstone or shale
Limestone
Regional subaerial erosion
Formation with marine fossils
Formation with plant fossils
Coal

TEXT-FIG. 1

3. *Cattle Creek Formation* 500 feet in surface outcrop
Shale, marl, marly limestones, with a rich marine fauna.
2. *Staircase Sandstone* 1,600 feet
Sandstone with quartz conglomerate and clay. Brachiopods, pelecypods, and gastropods.
1. *Dilly Beds* 2,000 feet exposed
Sandstone, shale, mudstone, calcareous sandstone with marine fossils and some plants.

Hill (1955) correlated the beds at Mount Britton (Homevale Beds) approximately with the Cattle Creek Formation.

Webb (1956) extended the Cattle Creek Formation downward from subsurface evidence and the Cattle Creek Formation of Webb may include the Staircase Sandstone and the Dilly Beds or part of the Dilly Beds of Hill.

The succession at the northern end of the Kennedy Range in the Carnarvon (northwest) Basin, Western Australia, is derived from Condon (1954) and McWhae, Playford, Lindner, Glenister, and Balme (1958), somewhat modified by later work (see Konecki, Dickins, and Quinlan 1959).

14. *Binthalya Subgroup* 1,725 feet
Quartz sandstone and quartz greywacke, with a poor marine fauna.
13. *Mungadan Sandstone* 184 feet
Quartz sandstone, with a poor marine fauna.
12. *Coolkilya Greywacke* 625 feet
Predominantly quartz greywacke, with many marine fossils; mainly molluscs and brachiopods. [The 'greywackes' in the succession are in fact all quartz greywackes (defined by Condon (1953, p. 9) as an arenite 'composed of more than 50% quartz, 10–30% fine-grained matrix, and 0–20% feldspar').]
These three subdivisions are placed in the Kennedy Group.
11. *Baker Formation* 210 feet
Siltstone and quartz greywacke.
10. *Norton Greywacke* 250 feet
Predominantly quartz greywacke.
9. *Wandagee Formation* 545 feet
Siltstone and quartz greywacke, with a very rich marine fauna in places.
8. *Quinnanie Shale* 85 feet
Shale and thin quartz greywacke.
7. *Cundlego Formation* 700 feet
Quartz greywacke and siltstone, with some calcareous beds.
6. *Bulgadoo Shale* 500 feet
Siltstone, carbonaceous shale, and thin quartz greywacke.
5. *Mallens Greywacke* 300 feet
Predominantly quartz greywacke.
4. *Coyrie Formation* 500 feet
Siltstone and quartz greywacke.

The above seven formations, together with the top of the Coyrie Formation, are placed in the Byro Group.

In the top part of the Coyrie Formation and the other formations of the Byro Group, marine fossils are well represented and in places rich faunas are present. Fossils include brachiopods, bryozoans, foraminifera, ostracods, corals, trilobites, pelecypods, gastropods, a few ammonoids, blastoids, crinoids, and shark and fish remains. Wood and leaves also occur. In the lower part of the Coyrie Formation marine fossils are poorly represented or absent.

3. *Moogooloo Sandstone* 122 feet
   Mainly quartz sandstone. Marine fossils poorly represented. [Name proposed by Condon (in McWhae *et al.* 1958, p. 66) to replace the Wooramel Sandstone as previously used by him in the Carnarvon Basin proper. The bottom arenaceous part of the Coyrie Formation and the Moogooloo Sandstone together represent the Wooramel Group of the Byro area.]
2. *Callytharra Formation* 250–400 feet
   Limestone, quartz greywacke and siltstone, with a rich marine fauna throughout.
1. *Lyons Group* ?3,700 feet
   Silty and sandy 'tillite', quartz greywacke and siltstone, boulders beds, marine fossils in places.

The Norton Greywacke appears to be the same formation as the Nalbia Sandstone of Teichert (1950; 1952) and the Baker Formation is apparently the bottom part of Teichert's Coolkilya Sandstone. Teichert (1957) and McWhae *et al.* (1958, p. 69) have suggested that the name Norton Greywacke is a synonym of Nalbia Greywacke.

McWhae *et al.* (1958, p. 67) have also suggested a return to the use of Teichert's (1950, p. 1791) name 'Coyrie Shale' for the upper argillaceous part of the Coyrie Formation placed in the Byro Group and that the arenaceous bottom part of the Coyrie Formation placed in the Wooramel Group be named as a separate formation.

In the Fitzroy Basin of Western Australia the lower marine beds of the Liveringa Formation (Lightjack Member) are correlated with the Baker Formation and Coolkilya Greywacke and are considered to be of Upper Artinskian to Kungurian age (see Thomas and Dickins 1954). The upper marine beds (Hardman Member) of the Liveringa Formation are considered to be of Upper Permian (possibly Tatarian) age. The lower and upper marine beds are separated by a plant-bearing sequence.

Correlation. The ages of the Western Australian formations have been discussed by, *inter alia*, Thomas and Dickins (1954). Among the forms which first appear in the Callytharra Formation and its equivalents are *Atomodesma*, *Pseudomyalina*, and *Oriocrassatella.* On the other hand some genera, notably *Eurydesma*, have only been found in the Lyons Group (Dickins 1957). But in Queensland the beds at Mt. Britton, *Atomodesma* (= *Aphanaia*) and *Pseudomyalina* occur with *Eurydesma*; and in the Springsure area, *Pseudomyalina* and *Oriocrassatella*[1] occur in strata mapped as Dilly Beds which certainly are not as young as the Cattle Creek Formation in the restricted sense of Hill. An advanced species of the *Aviculopecten subquinquelineatus* line has been found in the outcropping Cattle Creek beds and the beds at Mt. Britton: in the Carnarvon Basin species of this type have not been found below the Byro Group.

This evidence on the whole suggests that the Cattle Creek Formation is of the same age as, or more likely slightly younger than, the Callytharra Formation which is generally regarded as lowermost Artinskian (see Thomas and Dickins 1954) though it may possibly be uppermost Sakmarian. So the Cattle Creek Formation is almost certainly early Artinskian. Other authors (Maxwell 1954; Hill 1955) have reached the same general conclusion although Hill suggested a slightly older age.

If the Cattle Creek Formation is Artinskian, this supports a previous suggestion (Dickins 1957, p. 18) that *Eurydesma* may have slightly different ranges in different places; it survived longer in Queensland than in Western Australia.

[1] Maxwell (1959) records *Schizodus* and *Oriocrassatella* from the Rands and Burnett Formations of the Yarrol Basin, which he refers to the Upper Carboniferous and Lower Permian (Sakmarian) respectively.

The correlation of the Ingelara Formation is considered in detail in the following paper; it is correlated with the upper part of the Byro Group (Cundlego–Baker Formations) on the evidence of *Platyteichum* and *Glyptoleda* and is considered to be of late Artinskian age.

An *Atomodesma* with two anterior grooves, *A. bisulcata* sp. nov. was found in beds in the Crocker Formation, which are considered (S. S. Derrington, pers. comm.) to be the equivalent of the Mantuan *Productus* Bed. A species with one anterior groove, *A. exarata* Beyrich, is found in the Baker and Coolkilya Formations of the Carnarvon Basin and the lower marine beds (Lightjack Member) of the Liveringa Formation in the Fitzroy Basin (Dickins 1956); and an undescribed form with three grooves is present in the upper marine beds (Hardman Member) of the Liveringa Formation. A two-grooved form might be expected to occur between the Lightjack and Hardman Members, thus suggesting the Crocker Formation is Kungurian to Kazanian in age. Two-grooved forms, indeed, have already been recorded from the Basleo Beds of Timor (Wanner 1922). The Basleo Beds appear to be of Kazanian age (see Ruchencev 1956, table 4). Popov (1957) also records a two-grooved *Atomodesma* from north-eastern Siberia which he refers to *A. variabilis* Warner 1922 and considers to be from beds of Kazanian age.

Campbell (1959, p. 341, 342) has reached the same conclusion for the age of the uppermost marine beds in the Bowen Basin, Queensland.

SYSTEMATIC DESCRIPTIONS

Family MYALINIDAE Frech

Genus ATOMODESMA Beyrich 1864

Type species. Atomodesma exarata Beyrich (1864, p. 71, pl. 3, figs. 4*a*, *b*) by subsequent designation of Wanner (1922, p. 63).

Discussion. The relationship of *Atomodesma* to *Posidionella* de Koninck 1885 from the Carboniferous and *Aphanaia* de Koninck 1877, *Maitaia* Marwick 1935, *Kolymia* Licharew 1941, and *Intodesma* Popov 1958, is rather unsatisfactorily understood. It is proposed discussing this in detail elsewhere but the following comments seem pertinent here. In 1956 (p. 23) I proposed that *Aphanaia* be placed in synonymy with *Atomodesma*. Later Waterhouse (1958) showed that, as in *Maitaia*, specimens of *Atomodesma* from Timor, including *A. exarata*, had more than one groove on the ligament area; accordingly he placed *Maitaia* in synonymy with *Atomodesma*, and left the position of *Aphanaia* unresolved until it was found whether or not it had an umbonal septum. I have now examined specimens of the type species, *Aphanaia mitchelli* (M'Coy), in the Australian Museum, Sydney, and an umbonal septum is present. Waterhouse (1959) proposes that *Aphanaia* and *Kolymia* be regarded as subgenera of *Atomodesma*, and places *Maitaia* and *Intodesma* in synonymy with *Aphanaia*. He regards the longitudinal grooves in the ligament area as formed by strongly developed growth ridges, and not as analogous with the ligament grooves of *Myalina*. I agree with this interpretation and Waterhouse's proposal to regard *Aphanaia* and *Kolymia* as subgenera of *Atomodesma*. The species described below has two anterior grooves or plications and is placed in the subgenus *Atomodesma*.

Atomodesma (Atomodesma) bisulcata sp. nov.

Plate 17, figs. 15–19

Diagnosis. Of medium size, distinguished by two anterior grooves and the elongation at about right angles to the hinge-line.

Description. Holotype (impression of a right valve). The shell is oval elongated normal to the hinge-line. The anterior-ventral part extends for a considerable distance in front of the umbo. (This feature does not show in the other specimens which are, however, considerably smaller.) A marked feature is the strong development of two anterior grooves which are shallow in the middle part of the shell and become deeper towards the margin; the posterior groove is the deeper. The umbo is not preserved. No posterior groove or sulcus is visible. The concentric furrows and rugae are well marked and fairly regular. The ligamental structure is not shown.

Paratype A, a right valve, shows the umbo and two anterior grooves. In Paratype B, also a right valve, the umbo is missing. The posterior of the anterior grooves is distinct, but, as might be expected in a young shell, the front groove is poorly developed.

Dimensions (in mm.)

	Length	*Height*	*Width*
Holotype (QUM F27,124) .	31	40	11
Paratype A (QUM F27,121) .	17	19	5
Paratype B (QUM F27,122) .	12	14	4

Occurrence. The material consists of four specimens from a single locality, 6·5 miles south of Tolmies (abandoned); it was collected by S. S. Derrington and D. M. Traves of Mines Administration Pty. Ltd. from 15–20 feet above the base of the Crocker Formation (Derrington and Morgan 1959). This formation is considered by the Mines Administration geologists to be the equivalent of the Mantuan *Productus* Bed. The fossils are contained in a white to grey medium to coarse-grained quartz sandstone which has some kaolinized feldspar grains.

Discussion. Two-grooved forms have been recorded from Timor, where Wanner (1922) assigns specimens from Basleo and 'Abbang von Niki Niki gegen Noil Fatoe' to *A. variabilis* Wanner 1922, and specimens from Noil Mahatissa to *A. elongata* Wanner 1922. Although Wanner considers *A. elongata* to be of Lower Triassic age this seems unlikely (see Dickins 1956, p. 25). The Queensland species differs considerably in shape from the Timor species which are all obliquely elongated. In the elongation of the shell, however, it is similar to *Atomodesma mitchelli* (M'Coy) 1847, Dickins (1956, pl. 4, fig. 1) from the Permian of New South Wales. The age of the Queensland species is considered to be Kungurian or Kazanian.

Genus PSEUDOMYALINA Dickins 1956

Type species. *Pseudomyalina obliqua* Dickins (1956, p. 26, pl. 3, figs. 1–7) by original designation (ibid., p. 25).

Pseudomyalina sp.

Plate 16, figs. 11–12

Description. Two specimens are figured. One shows the shape and the other is a fragmentary individual showing the hinge structure and the external ornament. In the first specimen the elongation is only slightly oblique to a line at right angles to the hinge; in shape it is not unlike species of *Atomodesma* (*Aphanaia*), but the beak and the umbonal fold are turned over towards the front, so that the anterior margin is concave inwards below the beak to an extent not known in *Atomodesma*, where the anterior margin immediately below the beak is usually straight or convex. The second specimen is the umbonal part of an external impression; five longitudinal grooves are visible on the flattish ligament area of the right valve. On the left valve, distinct radial ornament is developed in addition to the concentric growth ornament. Two orders of radial ribbing are formed, either by subdivision or intercalation.

Dimensions (in mm.)

	Length	*Height*	*Thickness*
Figured Specimen A, left valve (QUM F27,405) . .	65	59	11

Occurrence. Figured Specimen A, KOE6, Orion Creek, 6 miles west of the Springsure–Rolleston Road, Springsure 4-mile map sheet 643,978, mapped as Dilly Beds, but may be equivalent of the lower part of the Staircase Sandstone (D. Hill, pers. comm.). Figured Specimen B (QUM F21,006), Homevale Bed 9, ½ mile east of Homevale Station, Mt. Britton 1-mile map sheet 200,198 (from unpublished work of Campbell and Tweedale; G. W. Tweedale, pers. comm.).

Discussion. Pseudomyalina is represented in the collection in Queensland only by a few fragmentary specimens, so that the species cannot be accurately described or compared with Western Australian species. In *Pseudomyalina* the prisms which make up the outer shell layer are readily visible to the naked eye, whereas in specimens of *Atomodesma* I have examined, they are hardly visible. This may be useful for distinguishing shell fragments of the two genera.

Family CRASSATELLIDAE Dall
Genus ORIOCRASSATELLA Etheridge jun. 1907

Type species. Oriocrassatella stokesi Etheridge jun. (1907, p. 9, pl. 6, figs. 2–5) by monotypy.

Synonym. Procrassatella Yakovlev 1928 (type species *Schizodus planus* Golovkinsky (1868, p. 358, pl. 3, figs. 21–23) by monotypy).

Discussion. Since I gave additional information on *Oriocrassatella* (Dickins 1956, p. 32) Newell (1958) has discussed in detail the character of *Oriocrassatella* and its relationship to *Procrassatella*. After Newell's analysis I have no hesitation in placing *Procrassatella* in synonymy with *Oriocrassatella*. For convenience Newell's diagnosis (1958, p. 6) is reproduced:

'Lenticular, ovoid to elongate, crassatelliform, unornamented shells without well-defined lunule and escutcheon; ligament furrow opisthodetic, internal, separated by a heavy septum from a triangular resilifer; 3*a* and 4*b* narrow.

Dental formula:

AI3a—3b—rsl—PIII

AII—2—4b rsl PII'

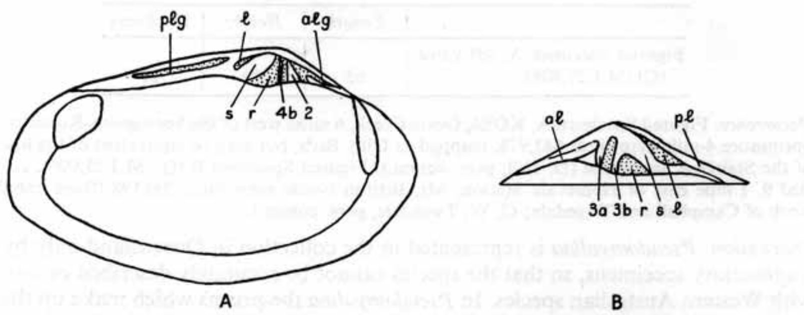
3a may be poorly developed or possibly absent altogether in some specimens and AI and AII poorly developed.

Oriocrassatella queenslandica sp. nov.

Plate 16, figs. 3–10

Diagnosis. Shell rather elongated, anterior and posterior lateral teeth well developed; septum separating ligament from resilium very heavy. Scar of the posterior adductor muscle high on the posterior umbonal ridge.

Description. Compared with other species these shells are rather elongated. The external ornament is composed of concentric growth-lines; low concentric rugae separated by shallow furrows are developed, especially towards the back. The growth-lines are evenly rounded except towards the back where they bend sharply over the posterior umbonal



TEXT-FIG. 2. *Oriocrassatella queenslandica* sp. nov. Diagrammatic restoration ×1 approx. A, Hinge and musculature of left valve. B, Hinge of right valve. *plg*, groove for posterior lateral tooth; *l*, ligament; *s*, septum; *r*, resilium; *alg*, groove for anterior lateral tooth; *al*, anterior lateral; *pl*, posterior lateral; 2, 3*a*, 3*b*, and 4, cardinal teeth.

ridge and run towards the cardinal margin, forming a posterior truncation of the shell. Internally the anterior adductor muscle is oval, elongated in a dorso-ventral direction. The posterior muscle is also oval but less elongated; the direction of elongation is at only a slight angle to the posterior part of the cardinal margin and almost parallel to the low umbonal ridge which runs down from the umbo towards the junction of the ventral and posterior margins.

The left valve shows distinct grooves for the reception of an anterior and posterior lateral tooth of the right valve. The septum separating the ligament from the resilium

EXPLANATION OF PLATE 16

Figs. 1–2. *Pyramus? concentricus* (Etheridge sen.) 1872, ×1, Geol. Surv. of Qld. F1557. 1, Lateral view. 2, Dorsal view.

Figs. 3–10. *Oriocrassatella queenslandica* sp. nov., ×1. 3–4, Holotype, Queensland University Museum (QUM) F26,795, front and lateral view. 5, Paratype D, QUM26,853, latex impression of hinge. 6, Paratype C, QUM26,790, internal impression showing muscle scars and pallial line. 7–8, Paratype A, QUM F26,794, dorsal and lateral views. 9–10, Paratype B, QUM F26,786, latex impression of hinge, and lateral view.

Figs. 11–12. *Pseudomyalina sp.*, ×1. 11, Figured Specimen B, QUM F21,006, plasticine impression showing lateral view of dorsal part of left valve and ligament area of right valve. 12, Figured specimen A, QUM F27,405, lateral view of a left valve.

is very thick. The posterior cardinal tooth is distinct and separated from the anterior cardinal tooth by a groove for the posterior cardinal tooth of the right valve. The anterior cardinal is incompletely preserved but was probably bifid as in other species. In the right valve, two cardinal teeth are also visible, the anterior of which is poorly differentiated from the front part of the cardinal plate. During the growth of the shell the ligament moved from an external to an internal position as shown by the nymph formed by the top part of the septum. The species has the full dentition found in '*Procrassatella*'.

Dimensions (in mm.)

	Length	*Height*	*Width*
Holotype (QUM F26,795) .	56 approx.	39	7
Paratype A (QUM F26,794) .	64	37	8
Paratype B (QUM F26,786) .	62 approx.	42	5
Paratype D (QUM F26,853) .	50	34 approx.	8 approx.

Occurrence. Holotype and Paratypes A and B, KOE6, Orion Creek, 6 miles west of the Springsure–Rolleston road, Springsure 4-mile map sheet 643,978. Paratype C (QUM No. 26,790), KOE 5, Orion Creek, 5 miles west of Springsure–Rolleston road, Springsure 4-mile map sheet 645,978. KOE6 is stratigraphically lower than KOE5 and both are mapped as Dilly Beds but may be from the equivalent of the lower part of the Staircase Sandstone (D. Hill, pers. comm.). Paratype D, E. A. Webb Collection outcrop 464, 3 miles east-north-east of Birralee Hill, in the Glendoo Sandstone, the marine member of the Collinsville Coal Measures.

Discussion. *Oriocrassatella queenslandica* is readily separable from *O. stokesi* by its greater transverse elongation, the heavier septum which separates the ligament from the resilium, and the higher position of the posterior adductor muscle. The Queensland species also appears to be rather different from *Oriocrassatella brenensis* (Reed) (1932, p. 58, pl. 7, figs. 1 and 2) and *O. intermedia* (Reed) (1932, p. 59, pl. 7, figs. 3–5; pl. 8, fig. 8) from the Permian of Kashmir, but *O. lapidaria* Reed (1932, p. 57, pl. 7, fig. 7) has similar dimensions and apparently the posterior muscle is in a similar position. Reed's material, however, does not allow a reliable comparison.

Family ?EDMONDIIDAE King 1849

Genus PYRAMUS Dana July 1847

Type species. *Pyramus myiformis* Dana (1847, p. 57; 1849, p. 697, pl. 6, figs. 4*a*–*c*) by subsequent designation of Newell (1956, p. 10).

Synonyms. *Pyramia* Dana (1849, p. 695), variant spelling of *Pyramus*; *Clarkia* de Koninck (1877, p. 128), based on same type species.

Family position. Newell (1956) proposed placing *Pachydomus Morris* 1845 (= *Megadesmus* Sowerby 1838), *Myonia* Dana 1847, *Pyramus* Dana 1847, in the family Pachydomidae. He regards *Astartila* Dana 1847 as a synonym of *Pachydomus*, *Maeonia* Dana 1849 and *Pachymyonia* Dun 1932 as synonyms of *Myonia*, and *Notomya* M'Coy November 1847, *Pyramia* Dana 1849, and *Clarkia* de Koninck 1877 as synonyms of *Pyramus*. He discusses the ligamental structure and draws the important conclusion that all are burrowing forms. Many of them do not seem to differ sufficiently from the Edmondiidae to be placed in a separate family, but *Pyramus* is rather transversely elongated and the hinge appears to be rather different from that of *Edmondia* so that it has only been tentatively placed in this family.

Discussion. Notomya is more robust and has a more distinctly developed umbo, and the muscle scars are more strongly marked than in *Pyramus*; and for the present Newell's proposal to regard *Notomya* as a synonym of *Pyramus* is not followed. Similarly it is not proposed to regard *Astartila* as a synonym of *Pachydomus* (= *Megadesmus*).

Pyramus? concentricus (Etheridge sen.) 1872

Plate 16, figs. 1–2

1872 *Edmondia concentrica* Etheridge sen., p. 328, pl. 13, fig. 2.
1892 *Sanguinolites concentricus* Etheridge jun., p. 281, pl. 43, fig. 7.

Description of Etheridge jun.'s figured specimen. As can be seen from the photograph the figure is accurate. Only concentric ornament is present, made up of growth-lines which are more distinctly developed at regular intervals, forming the 'band-like zones' described by Etheridge sen. The change of direction of the growth-lines at the posterior ventral angle is less sharp than that characteristic of *Oriocrassatella*, so that posterior truncation is absent. A slight ridge runs from the umbo to the posterior-ventral angle with a shallow sulcus running to the ventral margin in front of the ridge.

Dimensions (in mm.)

	Length	*Height*	*Width*
Geological Survey of Queensland No. F1557 . .	58	28	6

Occurrence. Gasworks, Gympie, Queensland. Permian.

Discussion. In addition to Etheridge jun.'s specimen, other specimens of this species from Gympie are in the collections of the Geological Survey of Queensland. None of those seen, however, showed any additional features. There is little doubt that Etheridge sen.'s specimen, which also came from Gympie, belongs to the same species; the associated fauna indicates that the beds are of Permian age. Although Reed (1932, p. 58) suggests that *P. concentricus* may belong to *Oriocrassatella*, the considerable transverse elongation, the more central position of the umbo, and the roundness of the posterior margin afford evidence against this conclusion; it appears more likely to belong to *Pyramus*.

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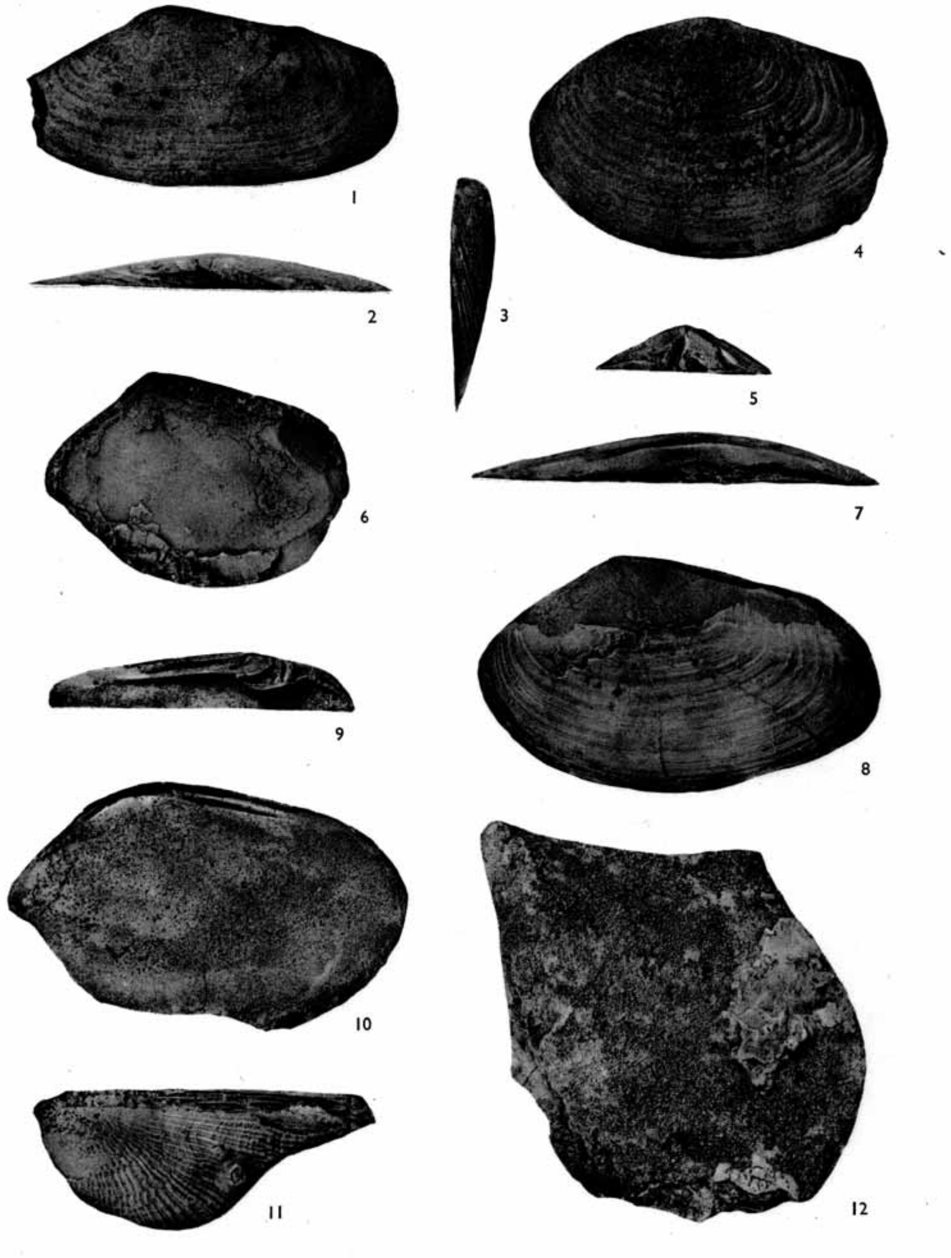

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