

Siluro-Devonian invertebrate faunas from the Bogan Gate-Trundle-Mineral Hill area of central New South Wales

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Abstract – Late Silurian (Pridoli) to Early Devonian (Emsian) fossils are described from the Bogan Gate-Trundle-Mineral Hill area of central New South Wales. The oldest assemblage, from the Pridoli to Lochkov Cookeys Plains Formation (Derriwong Group), includes the stromatoporoid *Plexodictyon conophoroides*, a rugose coral *Tryplasma* sp., tabulate corals *Favosites tripora*, *Squameofavosites bryani* and *Heliolites daintreei*, the trilobite *Batocara* sp., and brachiopods *Howellella*, *Retziella* and a new species, *Strophodonta trundlense*. Restricted to the Early Devonian part of the Derriwong Group is the brachiopod *Isorthis* (*I.*) *alpha*. Pragian to early Emsian species documented from the Trundle and Yarra Yarra Creek Groups include the brachiopod *Spinella pittmani*, and from the Connemarra Formation, the trilobite *Crotalocephalus regius* has been identified.

INTRODUCTION

Fossils from the Bogan Gate-Trundle area (Figure 1) were first noted by Etheridge (1894). In a series of papers, Dun (1895, 1898, 1900, 1904) described rugose and tabulate corals, stromatoporoids, spiriferid and rhynchonellid brachiopods from Siluro-Devonian strata adjacent to the Fifield-Trundle road, and north of Trundle. Etheridge (1921) mentioned *Plexodictyon* from the Trundle area. Raggatt (1937) surveyed the area geologically and provided some fossil lists; Sherrard (1967) described tentaculitids from Localities II, IX and XIII (see Appendix for locality details).

The present work aims to analyse the biostratigraphic distribution of the faunal assemblages, supported by descriptions of the more representative fossils. Additional significant elements of the accompanying fauna are illustrated in order to provide data for subsequent biogeographic and palaeoecologic study.

STRATIGRAPHIC CONTEXT

Sherwin (1996) revised the Late Silurian to Early Devonian stratigraphy of the Trundle-Mineral Hill district, shown here (Figure 2) in the form of a composite stratigraphic column representing the eastern and the western parts of the area between Trundle and Mineral Hill, north of the Sydney-Broken Hill railway line (Figure 1). Biostratigraphic control is provided by conodonts (Pickett 1971; Pickett and Ingpen 1990; Pickett and McClatchie 1991). Macrofossils described herein occur mostly in the Late Silurian to early Early Devonian Cookeys Plains Formation (Derriwong Group), in

the upper portion of the Troffs Formation (Trundle Group) and the Jerula Limestone Member of the Gleninga Formation (Yarra Yarra Creek Group), the latter both late Early Devonian (Late Pragian–Early Emsian) in age.

FAUNAL DISTRIBUTION

See Appendix for full locality data.

Cookeys Plains Formation

Derriwong Group (Pridoli to Lochkov): Age control is available from conodont assemblages from the following localities: Loc. X: Pridoli (Pickett and Ingpen 1990); Loc. XX (= Loc. 12 of Pickett and McClatchie, 1991): Late Silurian *eosteinhornensis* Zone; Loc. 407: Late Silurian *crispa* Zone (Pickett and Ingpen 1990). The age of strata at other localities is extrapolated on the basis of similarities in macrofaunal content with those found in association with these conodonts. This formation is characterised by *Plexodictyon conophoroides*, *Favosites tripora*, and *Ancillotoechia dunii* (see Figure 3).

Yarrabandai Formation

Upper Derriwong Group (Early Devonian): The fauna occurs only at Loc. 760, SW of The Troffs. It does not contain fossils restricted specifically to it (see Figure 3).

Connemarra Formation

Lower part of Trundle Group (late Lochkovian to middle Pragian): Fauna of this formation occurs mainly in horizons assigned to the *pesavis* Zone and perhaps also in the *sulcatus* Zone (Sherwin 1996).

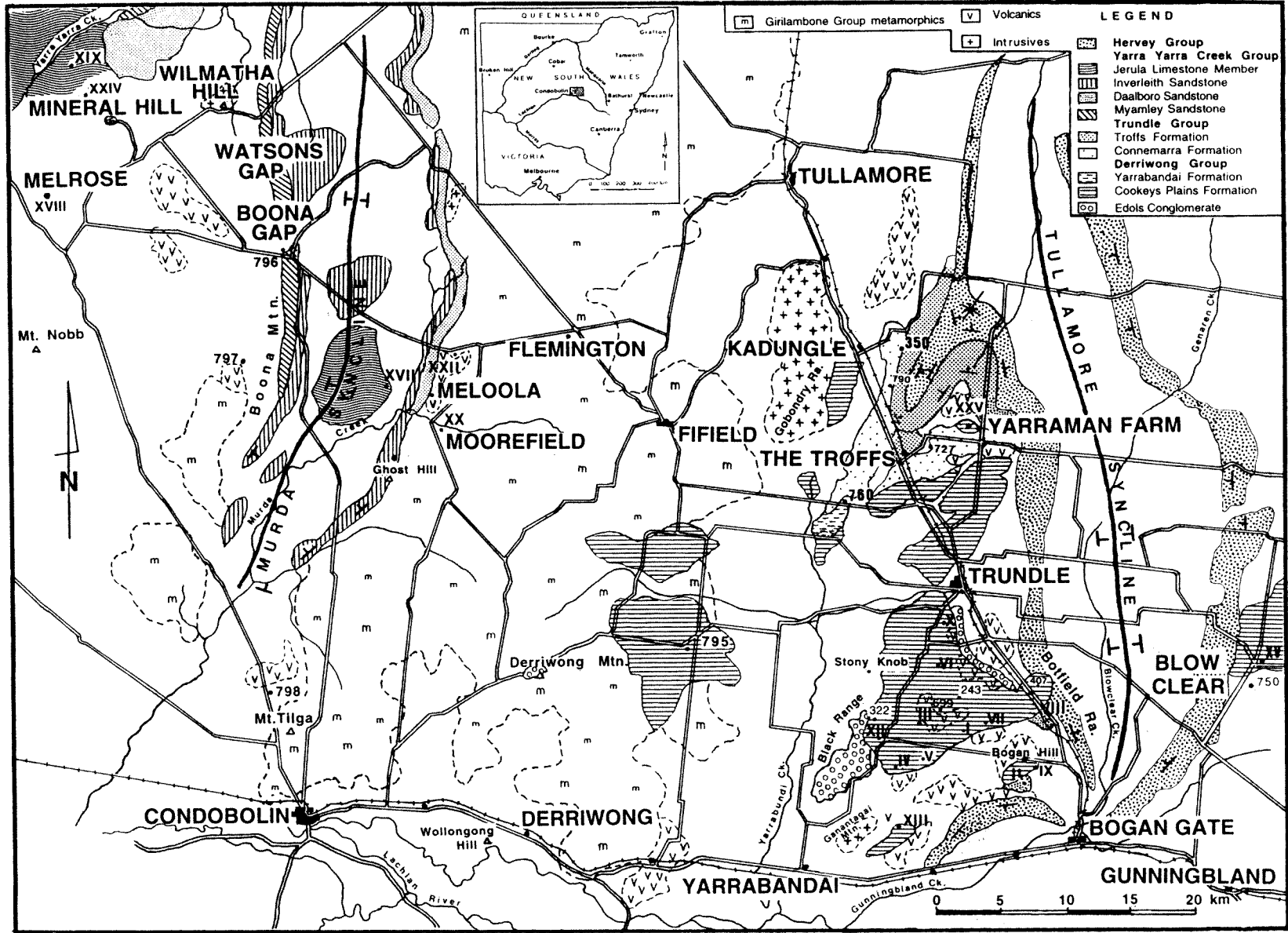


Figure 1 Simplified locality and schematic geological map of the Trundle-Condobolin-Mineral Hill area of Central Western New South Wales showing the occurrence of the more important fossil localities. Based on the Narromine 1:250,000 Geological Map (Sherwin 1996), and on the Forbes 1:250,000 Geological Map (Brunker 1968).

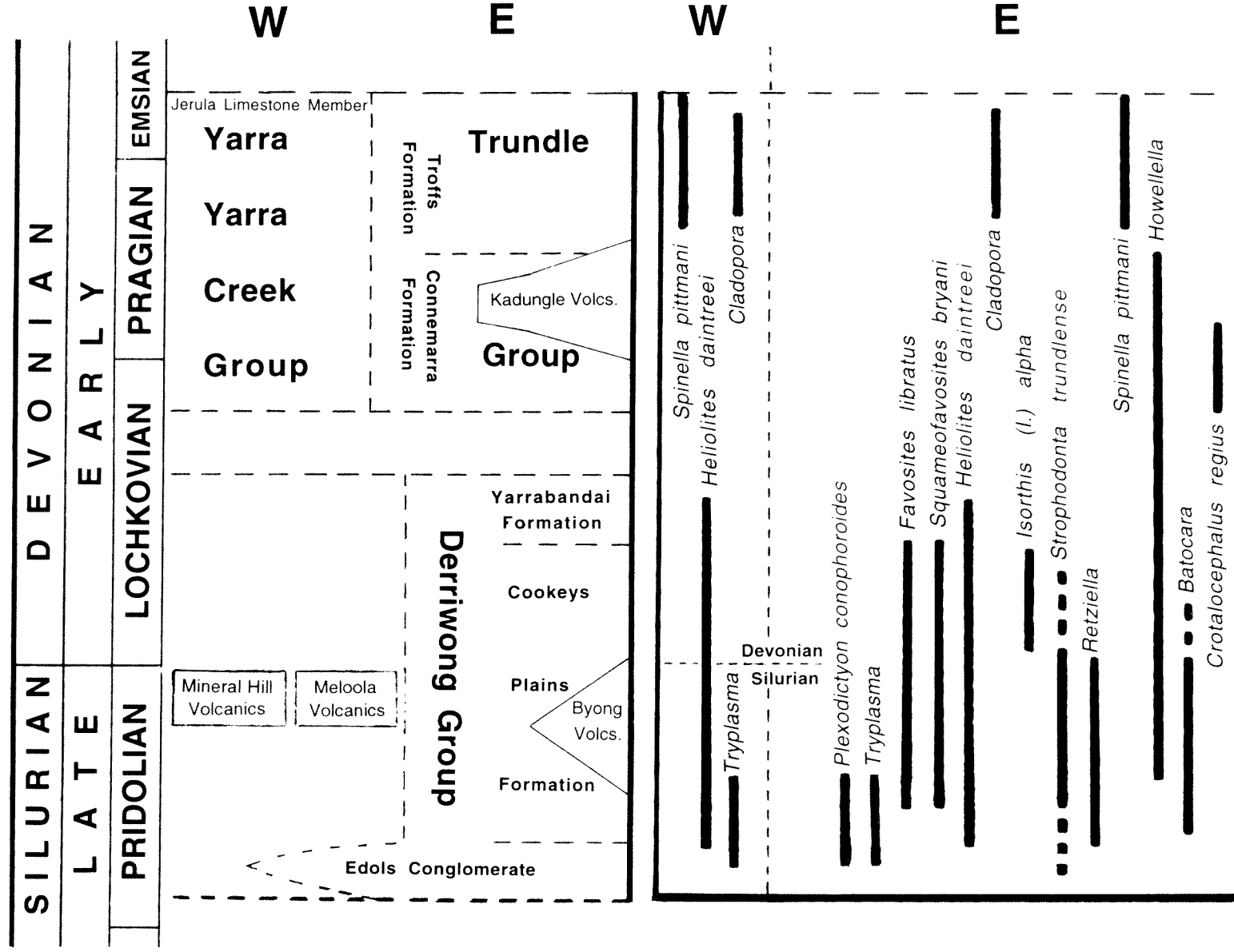


Figure 2 A schematic composite stratigraphic column depicting stratigraphy in the Mineral Hill–Murda Syncline area in the west, the Tullamore Syncline area in the east and showing ranges of representative fossils. Based on Sherwin (1996).

between the paralaminae, the present material appears identical with *P. conophoroides* (Etheridge 1921). The laminae in the type species, *P. katriense* Nestor, 1966 are fewer in number: about 16–18 in 5 mm.

Material and stratigraphic occurrence

Etheridge's type locality (here Loc. X) was discussed by Pickett and Ingpen (1990: 11). All specimens are from Cookeys Plains Formation.

Loc. I: F.69167; Loc. VI-N: F.83264, F.83285; Loc. VII: F.87676, F.87847; Loc. VIIIb: F.87084 (*Tryplasma* embedded in *Plexodictyon*), Loc. X (the type locality, near "Myola" Homestead; *crispa* Zone): F.69170, F.69172, (Figure 4.1–2), F.82966, F.82969, F.83223–F.83224, F.83232, F.83266, and *Heliolites* encrusting *Plexodictyon* in F.83222 (Figure 11.3); Loc. XXIII: F.84065; Loc. 407 (*crispa* Zone): F.69161, F.69173.

RUGOSE CORAL

Genus *Tryplasma* Lonsdale, 1845

Tryplasma sp. cf. *T. derrengullenense* Etheridge, 1907

Figures 4.6–7

cf. *Tryplasma derrengullenense* Etheridge 1907: 88, plate XXII, figures 5–8.

cf. *T. derrengullenense* Etheridge: Hill 1940: 407, plate XII, figure 16.

Description

Small, solitary corallum with long, cylindrical to turbinate stem and funnel- or bell-shaped, deep calyx; stem diameter varying between 2 and 5 mm, calyx diameter 7 to 12 mm. Epitheca is delicate and thin. Tabulae vary in density (with spacing from 0.5–2 mm), complete and almost horizontal. There are up to 25 septa, of two orders (major septa more numerous than the short, spinose minor ones).

Remarks

Most of the diagnostic properties of this species can be seen on the present material, but serial sections failed to reveal the full septal structure. For this reason the present material is referred tentatively to *T. derrengullenense*. However, the dimension cited above, and the deep calyx with its bell shape suggest this species and differentiate it from species like *T. wellingtonensis* Etheridge and *T. lonsdalei* Etheridge which do not possess a deep calyx; and from *T. columnaris* Etheridge, which has long, cylindrical corallites, though much larger in diameter (25 mm).

Material and stratigraphic occurrence

The specimens below are from Cookeys Plains Formation.

Loc. I: F.69298, F.69314, F.69541, F.70107, F.82943c, F.83244, F.83432, F.83950, F.83999, F.84006, F.89770; Loc. VI-N: F.39657, F.69628; Loc. VI-S: F.69726; Loc. X: F.39658, F.69542, F.82388, F.82444, F.82964, F.83103, F.83108, F.83221, F.89478; Loc. XX: F.69729, F.69956, F.83121; Loc. 419: F.63709, F.69209, F.83444; Loc. 699: F.70071, F.83125, F.84586.

TABULATE CORALS

Genus *Favosites* Lamarck, 1816

Favosites tripora (Walkom, 1911)

Figures 6.1–8 and 7.3

Favosites tripora Walkom 1911: 700, plates XXX, figure 2; XXXI, figure 1.

Favosites gothlandicus Lamarck forma *multipora* Lonsdale; Jones 1936: 12, plate 1, fig 8–12.

Favosites librata Jones 1937: 87, plate 11, figures 3–6.

Favosites richardsi Jones 1937: 89, plate 12, figures 2–3.

Favosites gothlandicus Lamarck; Jones 1937: 86, plate 11, figures 1–2.

Favosites goldfussi d'Orbigny; Hill 1954: 113, plate 8, figures 19–20.

Favosites gothlandicus Lamarck; Philip 1962: 139, plate 11, figures 1–2.

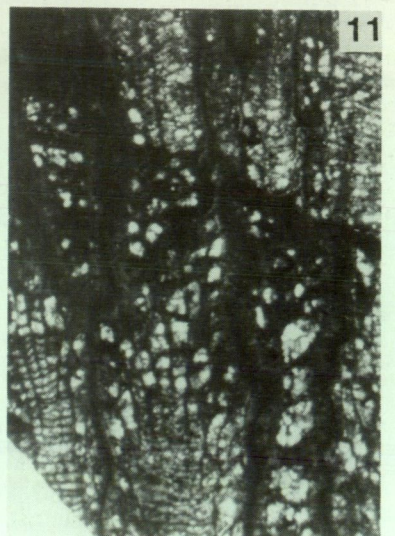
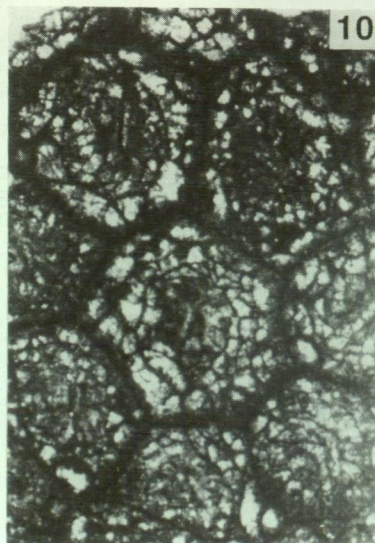
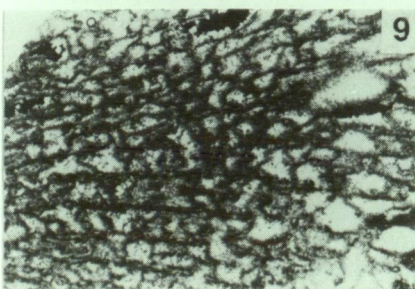
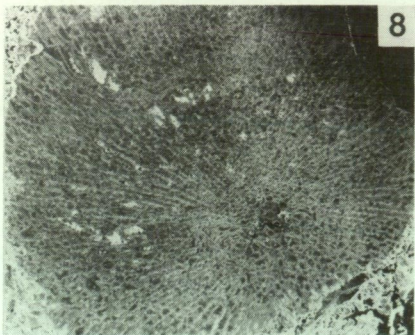
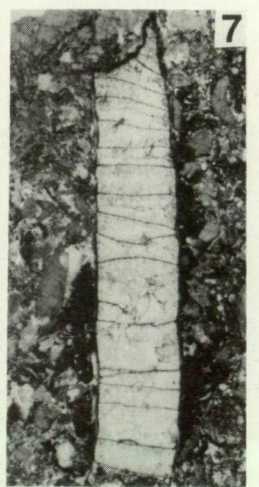
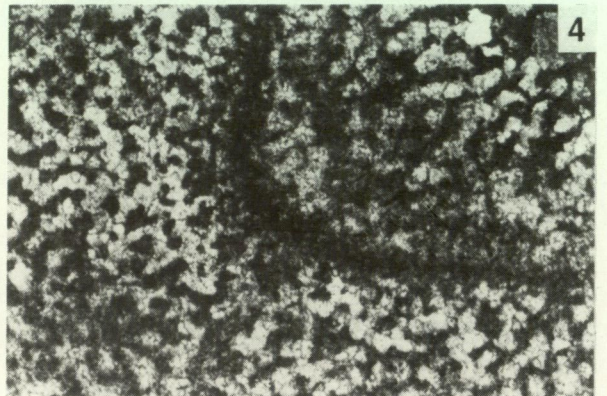
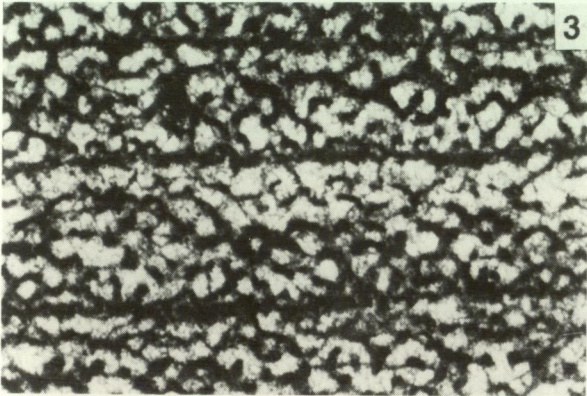
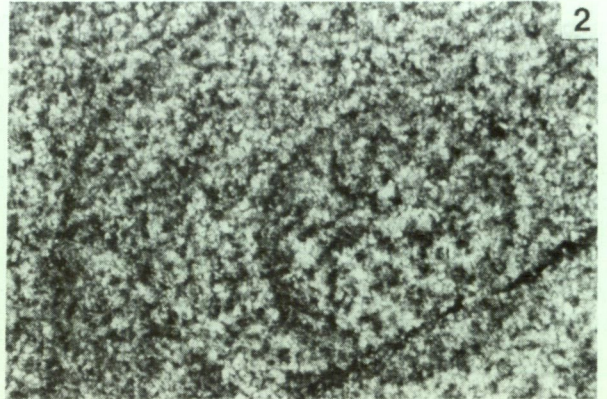
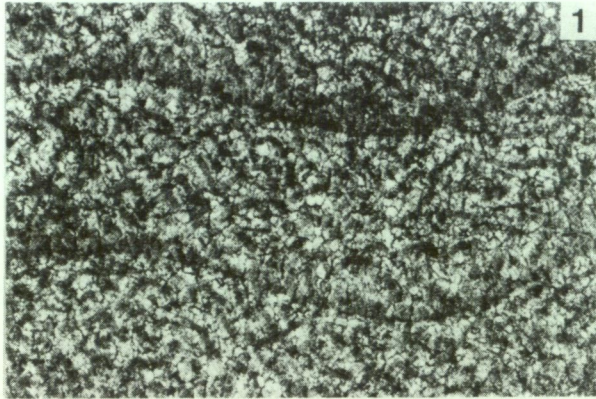
Favosites sp. cf. *F. goldfussi* d'Orbigny; Jell and Hill 1969: 19, plate 6, figures 1–2.

Description

Favosites with massive corallum, hemispherical, globular; corallites mostly hexagonal (sometimes 5- or 7-sided), with diameter 2.5–4 mm (mostly near the maximum; young individuals may be less than 1 mm). Wall of corallite moderately thin (on average 0.15 mm), but can range in thickness from 0.05 to 0.23 mm. Septa and septal spines mostly present. Tabulae complete, horizontal and often very numerous, ranging from 5 to 8 per 1 mm. Mural pores are arranged in 2 or 3 rows; when biserial they are in alternating rows, sometimes opposite on one face, while the triserial ones are aligned horizontally in straight lines; they are usually circular in longitudinal-section, the diameter being 0.2–0.3 mm.

Remarks

Many specimens described from eastern Australian localities have been assigned to *F. tripora*, *F. gothlandicus*, *F. goldfussi*, and *F. richardsi*. In the present work these are considered as variants of the single revised species, *F. tripora* (see Figures 5–7); the *Favosites* populations representing one single, strongly variable species, with different ecological



Synonyms of *Favosites tripora*

Species	Corallite diameter in mm	Wall of corallite	Tabulae spacing per mm	Septal spines	Mural pores (no. of rows)
<i>F. librata</i> Jones, 1937	2 - 3.0	thin	1 complete, horizontal	sharp	2
<i>F. gothlandicus</i> Lamarck, Philip, 1962	2 - 5.0	very thin	1 - 2 complete, horizontal	—	2
<i>F. goldfussi</i> d'Orbigny, Hill, 1954	2 - 3.0	moderately thick	1 - 2 complete, horizontal	blunt curved upward slightly	2 alternating sometimes 3
<i>F. richardsi</i> Jones, 1937	2 - 4.0	thin	1 - 2 complete, horizontal	short, stout	3
<i>F. tripora</i> Walkom, 1911	2.5 - 3.0	thin	2	short	3

Figure 5 Comparison of diagnostic morphological features of synonyms of *Favosites tripora*.

niches, growth stages and environmental conditions in the life of individual colonies; this becomes evident if the synonyms are compared in a tabulated form, as in Figure 5.

The thin-sections housed in the University of Queensland collection have not been checked: but Walkom's illustrations show no mural pores, so the triserial nature of *F. tripora* cannot be established. However, Walkom (1911) maintains that *F. tripora* from his locality is closely allied to *F. gothlandicus*, associated with *F. tripora* in the same horizon, the only difference being the preponderance of triserial mural pores over biserial, and the more closely spaced tabulae, in *F. tripora*. Except a specimen (A.M.4037) from Loomberah, Queensland, the Australian *F. gothlandicus* material differs markedly from *F. gothlandicus* from the Island of Gotland, Sweden (Tripp 1933): its tabulae are quite distantly spaced, about 1 mm between two tabulae, it has rudimentary septal spines, thicker walls (0.10–0.20 mm) and 1 to 3 rows of mural pores, 0.2 mm in diameter, and distance between rows being 0.20–

0.50 mm (e.g. F.94266 from Gotland).

Jones (1937: 89) stated that *F. librata* and *F. richardsi* are the "most nearly related...of the Australian forms" (of *Favosites*), despite their allocation to two different species: they in fact represent the two ends of the spectrum in the Australian *Favosites* material. Furthermore, Etheridge (1899) virtually synonymised *F. goldfussi* with *F. gothlandicus* in the Australian material.

Another species, *F. allani*, differs from *F. tripora* in having smaller corallites, by possessing numerous, horizontally directed septal spines, having wider tabular spacing (1 per 2 or 3 mm) (see Figure 6.7–8 and Figure 7.4) and developing uniserial as well as biserial mural pores.

Material

Specimens (all thin-sectioned) have been found in the following localities:

Loc. I: F.69506, F.69516, F.69540, F.69719, F.83291;
Loc. VI-N: F.39649, F.39651, F.69554, F.69556,

Figure 4 All from Cookeys Plains Formation. 1, 2, *Plexodictyon conophoroides* (Etheridge). Vertical and tangential sections respectively of specimen F.69172, from Loc. X; x10. 3, 4, *Ecclimadictyon* sp. Vertical and tangential sections respectively of F.83230, from Loc. X; x10. 5–7, *Tryplasma* sp. cf. *T. derringullenense* Etheridge. 5, transverse section of F.83432, from Loc. I; x10. 6, longitudinal section showing recrystallised septa and dissepiments in the calyx region of F.83444, from Loc. 419; x4. 7, longitudinal section of the corallite of specimen F.83103 from Loc. X; x3. 8–9, *Cyathophyllum* sp. 8, cellulose acetate peel of transverse section, F.69548 from Loc. I; x1. 9, close-up of peel, showing details of septa and dissepiments, x3. 10–11, ?*Carlinastraea* sp. Transverse and longitudinal sections respectively of F.84284 from Loc. 699; x5.

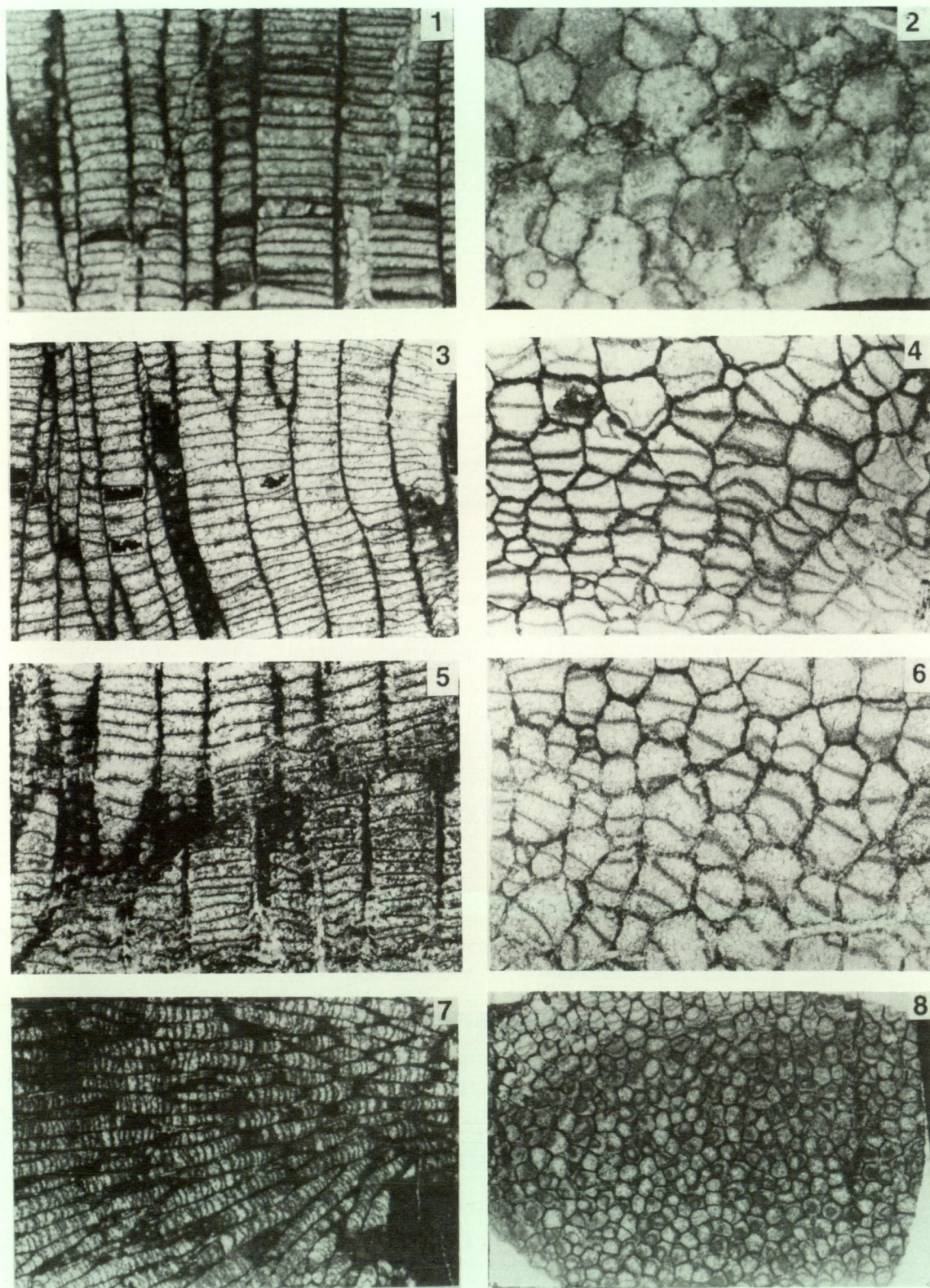


Figure 6 All from Cookeys Plains Formation. 1-6, *Favosites tripora* (Walkom). 1-2, longitudinal and transverse sections respectively of F.82438 from Loc. X; x2. 3-4, longitudinal and transverse sections respectively of F.82449 from Loc. X; x2. 5-6, longitudinal and transverse sections of F.82447 from Loc. X; x2. 7-8, *Favosites allani* Jones. Longitudinal and transverse sections respectively of F.82448 from Loc. X; x2.

F.69560; Loc. VII: F.83138-F.83139, F.84123; Loc. VIIb: F.39650, F.69650, F.70070, F.89756; Loc. X: F.69410, F.69416, F.69421, F.82386, F.82394, F.82438, F.82440, F.82972, F.84065; Loc. XV: F.69324, F.69332, F.69558, F.69581; Loc. XXII: F.84051; Loc. 243: F.84285.

Range

- (1) Late Silurian, based on the conodont-dating of Loc. X by Pickett (1971); also cf. Pickett and McClatchie (1991), all from Cookeys Plains Formation, Derriwong Group; and,
- (2) Early Devonian at Loc. VIIIb in the Connemarra Formation (Trundle Group).

Genus *Squameofavosites* Chernyshev, 1941

Squameofavosites bryani (Jones, 1937)

Figures 7.1-2

Synonymy

See Philip (1960): 197-198.

Description

Corallites are 5 to 7-sided and relatively narrow (1 mm wide), with sharp-edged, tongue-like septal squamulae and spines; densely spaced tabulae (3-4

per mm), uniserial mural pores with an average diameter of 0.2 mm.

Remarks

Specimens of this species from the Early Devonian Murrumbidgee Group at Taemas, NSW, have an average corallite diameter of 1.4 mm, 1.0 to 1.2 mm (between opposite walls) for the holotype and the paratype; 1 to 1.23 mm in specimens from Wellington area of NSW (Jones 1944); 1.25 mm for Clermont (Queensland) specimens and 0.82 to 1.23 mm for specimens from the Devonian Point Hibbs Limestone of Tasmania (Jell and Hill 1970), in which the corallite wall is rather thick. In *S. bryani* from the Devonian Ukalunda Formation of Queensland (Jell and Hill 1969), the septal squamulae are not so long and there are also some discrete septal spines, sharply pointed, in the longitudinal section. A few specimens from Loc. VI-N, displaying narrower corallites (diameter 0.5 - 0.8 mm) and blunt septal spines, may be *S. nitidus*.

Material

S. bryani occurs at three localities: Locs. I, VI-N and XX. The specimens are: Loc. I: F.69511, F.69516; Loc. VI-N: F.69552-F.69553, F.69557, F.69561, F.69563, F.69582, F.69584, F.83262, F.83287-F.83290; Loc. XX: F.63708, F.69320.

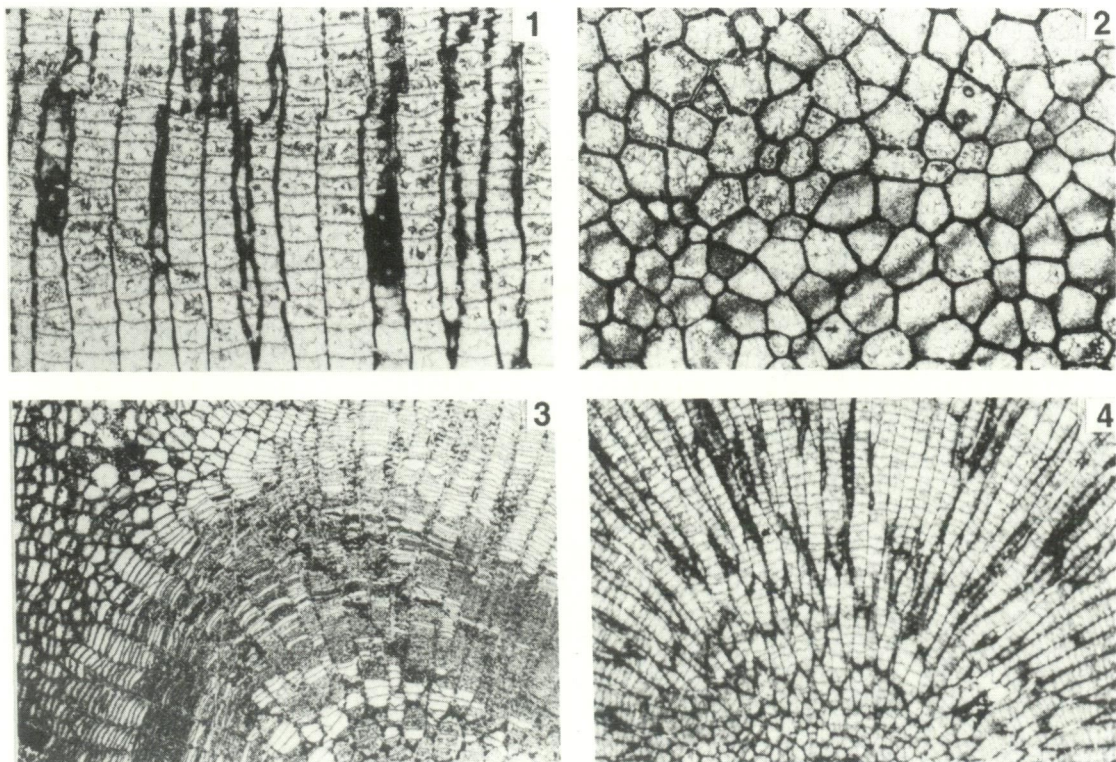
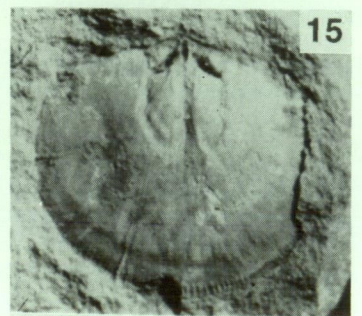
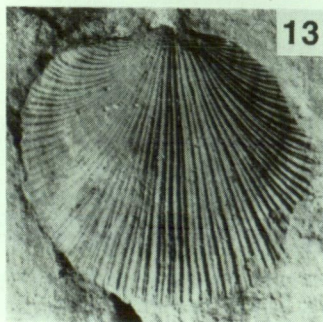
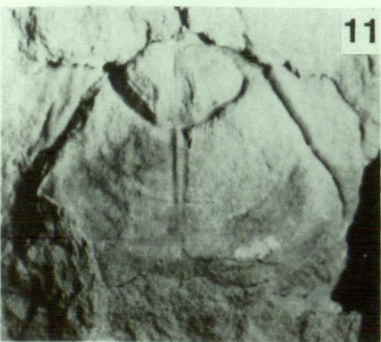
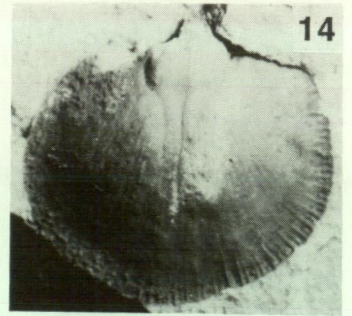
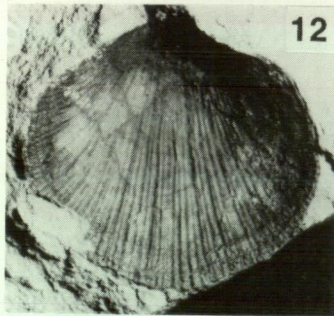
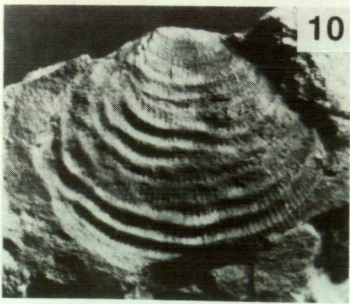
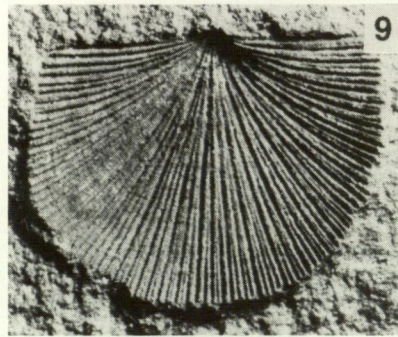
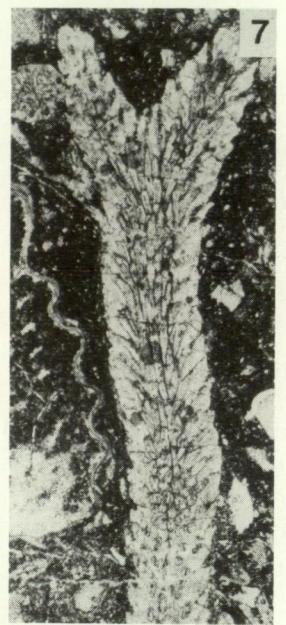
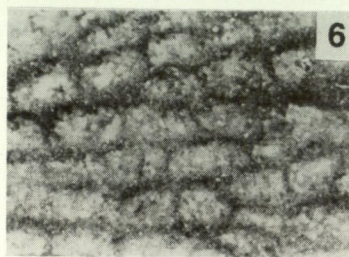
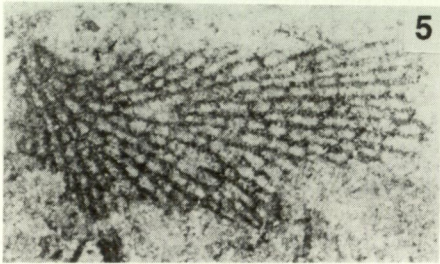
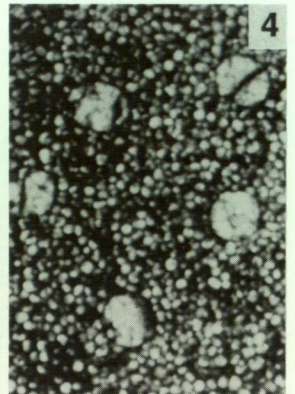
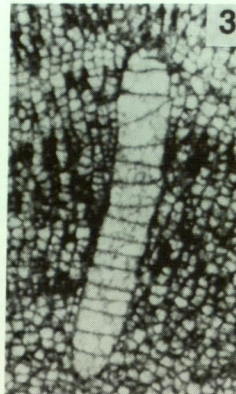
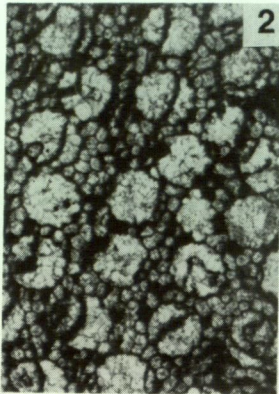
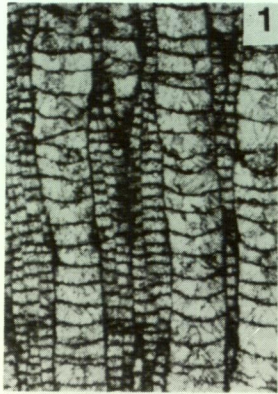


Figure 7 1, 2 from Cookeys Plains Formation; 3, 4 from Connemarra Formation. 1-2, *Squameofavosites bryani* (Jones). Longitudinal and transverse sections of F.84291 from Loc. X; x2. 3, *Favosites tripora* (Walkom). Oblique longitudinal section of a radiating colony, F.70070 from Loc. VIIIb; x2. 4, *Favosites allani?* Jones. Longitudinal section of F.89756 from Loc. VIIIb; x2.



Genus *Heliolites* Dana, 1846

Heliolites daintreei Nicholson and Etheridge, 1879
Figures 8.1–2

Synonymy

For synonymy and diagnosis see Hill (1940, 1954) and Lee and Noble (1988).

Description

The tabularium (corallite) diameter varies from 1.3 to 1.8 mm. Corallite spacing is 0.5–1.5 mm. It is surrounded by 15 uniformly polyhedral tubuli (0.2–0.5 mm thick). The 12 short lamellar septa with long spines curved upwards, are aligned in vertical direction adaxially and tend to be swollen near the apices; tabulae are moderately dense (11–12 per 5 mm), flat and regularly horizontal; tabularia and tubuli are thin-walled.

Remarks

Amongst other species known from Australia, *H. interstinctus* (Linnaeus) has non-spinose septa, whereas the type species, *H. porosus* (Goldfuss), has thick vertical walls for both the tabularia and the tubuli, the latter being rather small.

Material and stratigraphic occurrence

All the specimens of *H. daintreei* occur in the Cookeys Plains Formation. Loc. I: F.69527; Loc. VI-N: F.50089; Loc. VII: F.50090, F.87677; Loc. X (near "Myola" Homestead; in the *crispa* Zone): F.69549, F.70026–28, F.70031, F.70034–35, F.82444, F.83018, F.83222 (encrusting *Plexodictyon*, Figure 11.3), F.83231, F.84399, F.84408, F.86421; Loc. XV: F.82918; Loc. XXII: F.86334; Loc. XXIV: F.83949.

BRACHIOPODA**Genus *Isorthis* Kozłowski, 1929**

Isorthis (Isorthis) alpha (Gill, 1949)
Figures 8.12–15

Cariniferella alpha Gill 1949: 95, plate III, figures 1, 6, 7.

Isorthis alpha (Gill): Talent 1963: 57, plate 24, figures 14–19; plate 25, figures 1–15; plate 26, figures 1–14; plate 27, figures 1–15; plate 28, figure 41; plate 29, figures 19, 20.

Isorthis spp. A–D, Talent 1965: 22, plate 10, figures 1–6.

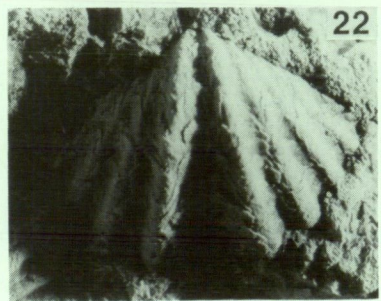
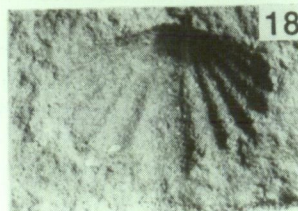
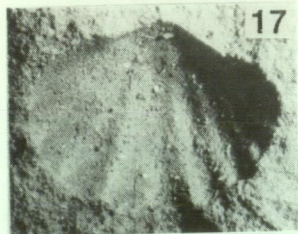
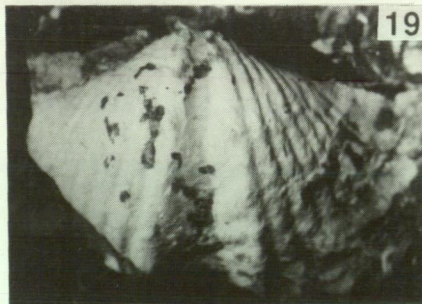
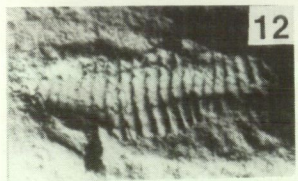
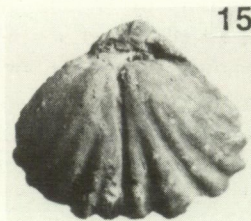
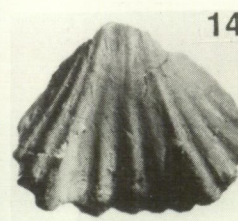
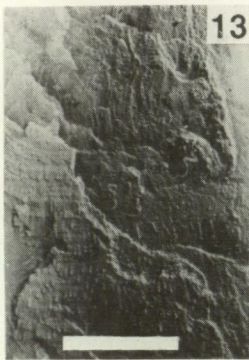
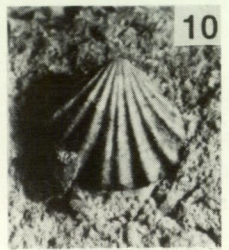
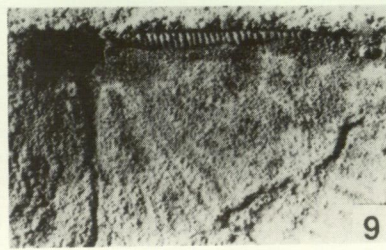
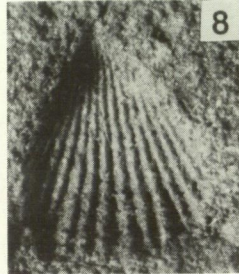
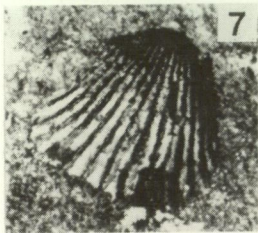
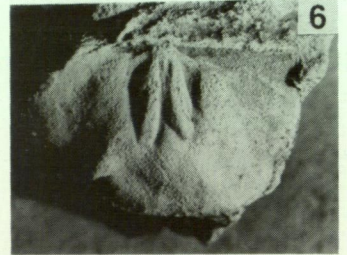
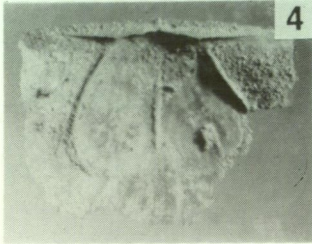
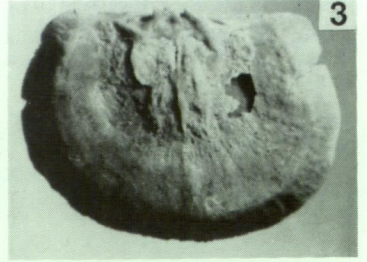
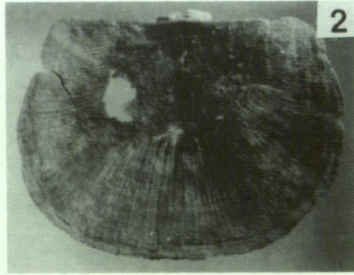
Description

Outline of shell subcircular, subequally- to ventribiconvex; the width is a little greater than the length. Sculpture consists of subequal, bifurcating costellae, 14–22 per 5 mm, and faint concentric growth lines mainly near the anterior margin. The short hinge line reaches over half of the valve width. The pedicle valve is mainly convex over the midline, and flattens out on the lateral slopes; the diductor muscle scars are faintly visible on either side of the median septum impression, which runs almost the full length of the valve, reaching the anterior edge. In the brachial valve the cardinal process is small relative to the size of the valve; the adductor muscle scar impressions are lobe-shaped, extending anteriorly about one-third the length of the valve interior. A very shallow sulcus appears at the anterior end of the brachial valve, and as a result the anterior commissure is weakly sulcate.

Remarks

The present material has been allocated to the Victorian Early Devonian species, *Isorthis alpha* (Gill 1949; Talent; 1963, 1965) being close in internal and external characteristics (discounting the tectonic deformation in Talent's very variable specimens), and having the same size range: W=5–12 mm, L=4–10 mm. It is different from *Isorthis (Protocortezorthis)* of The Meadows locality SW of Cobar, NSW, described by Sherwin (1995) because it has larger adductor muscle fields in the brachial valve, extending half the length of the valve, and by being considerably larger in size: the average brachial valve W = 22 mm, L = 15 mm, compared with the average values of the present material: W = 10 mm, L = 8 mm. *Isorthis spedeni* Chatterton from the Early Devonian Warroo Limestone of the Taemas-Cavan area (SW of Yass, NSW) is more elliptical, with 15–

Figure 8 1–7, 9 from Cookeys Plains Formation; 8, 10–15 from Connemarra Formation. 1–2, *Heliolites daintreei* Nicholson and Etheridge. Longitudinal and transverse sections respectively of F.83231, Loc. X; x4. 3–4, *Pseudoplasmopora* sp. Longitudinal and transverse sections respectively of F.69668, Loc. XX; x4. 5–6, "*Fenestella*" sp. cf. "*F. yassensis* Ross. 5, obverse view of a colony, F.69693, Loc. 419; x4. 6, enlargement of colony, F.69696, Loc. 419; obverse view, x12. 7, *Cladopora* sp. Longitudinal section of F.69749, Loc. XX; x4. 8, *Leptaena* sp. Internal mould of pedicle valve showing hinge line, muscle scars and median ridge, F.83520, Loc. VIIIA; x2. 9, *Schuchertella* sp. External view of pedicle valve of F.69572, Loc. IX; x2. 10, *Leptaena* sp. External mould of pedicle valve, F.70086, Loc. VIIIA; x2. 11, *Leptaena* sp. Internal mould of pedicle valve of F.70118, Loc. VIIIA; x2. 1. 12–15, *Isorthis (Isorthis) alpha* (Gill). 12, external mould of pedicle valve, F.70099, Loc. VIIIA; x2. 13, external mould of brachial valve, F.70097, Loc. VIIIA; x2.3. 14, internal mould of pedicle valve, F.70098, Loc. VIIIA; x2. 15, internal mould of brachial valve, F.70100, Loc. VIIIA; x2.



17 costellae per 5 mm, and with prominent fold and sulcus (Chatterton 1973). *Isorthis allani* (Shirley) in the Early Devonian Maradana Shale of NSW (Savage 1974), is somewhat smaller than the present material, with average dimensions W=11 mm, L=10.3 mm. *Isorthis festiva* Philip is unequally biconvex and has a more prominent fold and sulcus than the present material.

Material and stratigraphic occurrence

Isorthis (Isorthis) alpha occurs mainly in a pale yellow siltstone horizon near the top of Cookeys Plains Formation, Derriwong Group, at Loc. VIIIa. The specimens are from Loc. VIIIa: F.70092-F.70101, F.70121; and from Loc. 750: F.69297.

Genus *Strophodonta* Hall, 1850

Strophodonta trundlense sp. nov.

Figures 9.2–5

Types

Holotype is F.100733 (a brachial valve); paratypes are: F.100734-F.100735 (brachial valves); F.100736-F.100738 (pedicle valves), from Loc. XXV (Yarraman Farm); additional specimens are F.70150, F.70159, F.70161, F.70164, F.70169, from Loc. VI.

Diagnosis

A species of *Strophodonta* with a relatively small, semielliptical, concavo-convex shell with sculpture of weak concentric growth-lines superimposed on radial costellae. The pedicle valve has a short median ridge, shorter than the prominent diductor scars, and a narrow interarea. Brachial valve with strong and broad cardinal process and median septum. The straight, incompletely denticulated hinge line extends about 2/3 from the centre of the posterior edge of the shell.

Description

Relatively small shell is semielliptical, somewhat wider than long, in lateral profile concavo-convex. Sculpture consists of radial, somewhat coarse and uniformly equidistant costellae, both first- and second order, as well as costae; however, there are no wide, flat interspaces between costellae. Superimposed on the radial costellae there are weakly developed, concentric growth-lines. The straight, long hinge line is denticulate for half its length with denticles replacing teeth and sockets. Medium shell size (F.100738) is: W=20 mm, L=15 mm. The largest specimen (holotype; F.100733) has the dimensions W=25 mm, L=18 mm.

In the pedicle valve interior, the short median ridge extends half-way to anterior margin; the musculature consists of prominent diductor muscle scar lobes with muscle-bounding ridges, enclosing and surrounding the much smaller, lance-shaped adductor muscle scars (see Figure 9.5); the diductor muscle scars extend about 80% towards the anterior margin (faintly perceivable in Figure 9.3). There is a narrow, flat interarea with faint denticulation along half the valve length. The hinge teeth are present in one specimen, the paratype F.100741. In the absence of the deltidial plates, it cannot be ascertained, whether the delthyrium is closed. The convexity of the pedicle valve is considerable.

In the brachial valve interior, a strong, bilobed cardinal process projects some distance (with elevation up to almost 1 mm) into the umbonal region of the pedicle valve; below and anterior to the cardinal process are the small adductor muscle scars; there is also a weak median septum. The brachial valve is only slightly convex; however, one of them (F.100733, the holotype) has a resupinate profile. Socket plates are developed vestigially in three specimens, F.100733–100735 (paratypes).

◀ **Figure 9** 1–10, 14–18 from Cookeys Plains Formation; 11, 12 from Connemarra Formation; 13, 19, 20 from Troffs Formation; 21, 22 from Yarrabandai Formation. **1**, *Strophodonta* sp. External mould of brachial valve of F.87672, from Loc. VI; x2. **2–5**, *Strophodonta trundlense* sp. nov. **2**, **3**, **5**, External and two internal views respectively of silicified brachial valve of holotype, F.100733 from Loc. XXV; x2.5, x2.5, x6 respectively. **4**, internal view of pedicle valve showing muscle scars and cardinal area of paratype, F.100737, from Loc. XXV, Cookeys Plains Formation; x2.2. **6**, *Shaleria* sp. Internal view of pedicle valve, F.84401, Loc. I; x2.4. **7**, **8**, *Hebetoechia* sp. **7**, internal mould of pedicle valve, F.83356 from Loc. 727; x2. **8**, external cast of pedicle valve, F.83534 from Loc. 727; x2. **9**, *Strophodonta* sp. Internal mould of brachial valve showing enlargement of cardinal area of F.94269 from Loc. VII; x4. **10**, *Retzia* sp. External view of cast of pedicle valve, F.83166; Loc. XV; x2. **11**, *Atrypa* sp. cf. *A. reticularis* (Linné). External mould of incomplete pedicle valve, F.70109, from Loc. VIIIa; x 2.1. **12**, *A. sp. cf. A. reticularis*. Impression of anterior commissure of F.83415 from Loc. VIIIa; x 2.1. **13**, *Spinella pittmani* (Dun). View of the sulcus of pedicle valve showing enlargement of the spine base "droplets", F.82902?, from Loc. 350; x15. **14–16**, *Ancillotoechia dunii* (Gürich). Pedicle valve, brachial valve and lateral profile, respectively, of F.69523, Loc. I; x3.1. **17**, *Retziella* sp. cf. *R. capricornae* McKellar. External view of cast of pedicle valve of F.83448, Loc. 763; x4. **18**, *Retziella* sp. External mould of brachial valve of F.83447, Loc. 763; x4. **19–20**, *Spinella pittmani*. **19**, external view of pedicle valve of lectotype, F.83175, Loc. 350; x2. **20**, external view of brachial valve of syntype, F.94268, Loc. 350; x1.2. **21–22**, *Howellella* sp. cf. *H. jaqueti* Dun. **21**, external view of brachial valve, F.69522, Loc. 760; x5. **22**, external view of pedicle valve, F.69522, Loc. 760; x5.

Remarks

Strophodonta trundlense is readily distinguished from other species of *Strophodonta* by the combination of characteristics including: relatively small size, prominent, oval diductor muscle scars in the pedicle valve enveloping an elongate-oval adductor muscle field, strong cardinal process in the brachial valve (width: 1.4 mm, height: 0.8 mm); only weakly developed concentric growth lines, and hinge line not fully denticulated.

Stropheodonta limbimura Talent from the Early Devonian Mount Ida Formation of the Heathcote district of Eastern Victoria lacks a sculpture of uniformly equidistant cotellae, without flat interspaces between them, has more elongate oval diductor muscle field in the ventral valve, its lateral ridge posteriorly abutting directly onto the hinge line in the cardinalia and extends anteriorly to the same extent as the median ridge; however, the maximum shell size is similar: L = 24 mm, W = 32 mm. On the other hand, the 15 species of *Strophodonta* described by Mitchell (1923) from the Late Silurian Hume Group beds of the Yass area have been shown to belong to other genera.

The type species, *Strophodonta demissa* (Conrad) of Middle Devonian age from the Hamilton Group of New York State, USA (Conrad 1842), superficially resembles the present material; however, its average size is larger: W = 43 mm, L = 37 mm; its diductor muscle field is considerably smaller: extending anteriorly only halfway along the length of the pedicle valve.

Specimens referred to *Strophodonta* sp. (Figure 9.1, 9) mainly from Locs. VI and XII are about 50% larger than *S. trundlense*, with a size range of W=15–35 mm, and L=14–20, otherwise the valves are similarly semicircular to semielliptical; the interior exhibits characteristic mantle canals, which form an anterior marginal strip about 3 mm wide, though pallial markings are not evident; muscle scars cannot be perceived because of the poor preservation; the hinge line is denticulated about 2/3 of the width (see Figure 9.9).

Material and stratigraphic occurrence

The type locality is at Loc. XXV, Yarraman Farm, 12 km N of Trundle. The type specimens F.100728–F.100742 are all silicified shells. *Strophodonta* sp. (Figure 9.1 and 9) occurs at the following localities: Loc. I: F.70119; Loc. 240: F.83132; Loc. VII: F.94269; Loc. VI: F.69302, F.69304, F.69308, F.69400, F.69550, F.69588–89, F.70090–91, F.70145–46, F.70148–49, F.70158, F.70160, F.70162–63, F.70168, F.70171–74, F.83265, F.83953, F.84401, F.87671, F.88767, F.89495; Loc. XII: F.69397–99, F.70135–36, F.70170, F.83146, F.89477, F.89499; Loc. XIV: F.70137, F.70142; Loc. 500: F.70157, F.70165, F.70167, F.83233.

Range

Late Silurian (Pridoli; in the lower part of Cookeys Plains Formation, Derriwong Group) as indicated by the association with *Batocara* (Locs. VI and XII).

Genus *Retziella* Nikiforova, 1937

?*Retziella* sp. cf. *R. capricornae* (McKellar, 1969)

Figures 9.17–18

Retziella capricornae (McKellar); Sherwin 1995: 85, Figure 18, A–E.

Description

The subequally biconvex shell is relatively small: brachial valve W: 12 mm, L = 10 mm, H: 3 mm, pedicle valve W: 7 mm, L = 8 mm, and H: 2.5 mm. The weak pedicle sulcus is smooth, lacking plication; the equally weak brachial fold has a medial groove. The fold in the brachial valve is flanked by 5 or 6 strong, slightly angular ribs (plicae), with well-rounded furrows between them. The sulcus in the pedicle valve is flanked by 4–7 ribs, which tend to get progressively weaker towards the outer edge. Growth lines or other surface sculpture have not been observed.

Remark

The presence or absence of a median septum and septalium cannot be established (hence the uncertainty about the generic assignment), as the interiors of the valves are not available. Sherwin (1995) placed some species of *Molongia* including his material from the Cobar area, in *Retziella*; he also referred the Eastern Australian species, *M. elegans capricornae* from Queensland (McKellar 1969) and the Canberra area (Strusz 1984) to *Retziella*. This was considered necessary by Sherwin as a result of a review of the Retziellidae by Rong *et al.* (1994), in which *Molongia* was restricted to the type species, *M. elegans* Mitchell. Sherwin's material (*Retziella capricornae* and *Retziella* sp.) from The Meadows locality near Cobar shows some difference from specimens occurring in the Cookeys Plains Formation, because Sherwin's *Retziella capricornae* specimens have additional features for valve interiors, which the present material lacks; however, both sets of material lack the median septum and septalium, which are considered to be characters distinguishing *Retziella* Nikiforova from *Molongia* Mitchell (Rong *et al.* 1994). There are no statistically meaningful populations of specimens in either collection for comparison.

Material and stratigraphic occurrence

This brachiopod occurs in friable siltstones and

Measurements in mm	<i>S. buchanensis</i>	<i>S. yassensis</i>	<i>S. pittmani</i>
No. of plications	12	10	8
Shell length (L)	19.6	15.0	18.3
Shell width (W)	27.9	19.4	27.6
W/L	1.42	1.29	1.54
Tear-shaped spine bases in fold and sulcus	not aligned	aligned in radiating lines	not aligned

Figure 10 Comparison of the number of plications, shell length and width, width to length ratio and alignment or otherwise of external ornament in three species of *Spinella* from southeastern Australia.

sandstones of the Cookeys Plains Formation (hence the rather poor state of preservation of the specimens) at the following localities: Loc. VII: F.83303; Loc. IX: F.82993; Loc. XII: F.83446, F.83825; Loc. 763: F.70064, F.70066, F.83447, F.83449, F.83579, F.84273, F.84274.

Genus *Spinella* Talent, 1956

Spinella pittmani (Dun, 1904)

Figures 9.19–21

Spirifera pittmani Dun 1904: 320, plate LXI, figures 4, 4a, 4b.

Spirifer pittmani Raggatt 1937: 93.

Spinella pittmani (Dun); Földvay 1969: 167, plate 63–67.

Types

Lectotype (in the absence of a holotype): F.83175, and syntype F.94268, (see Figures 9.19–20).

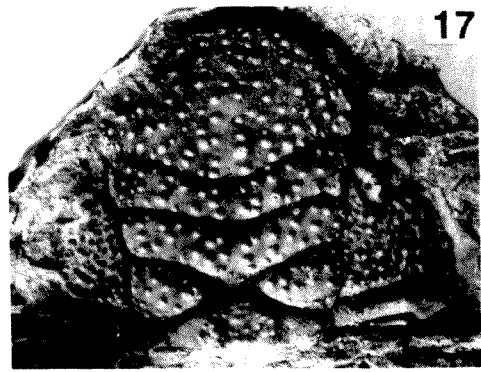
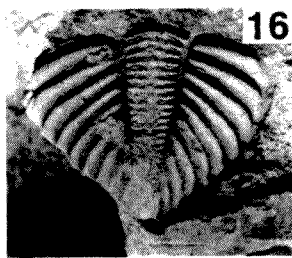
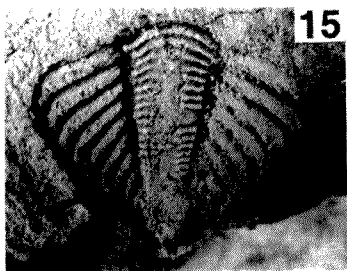
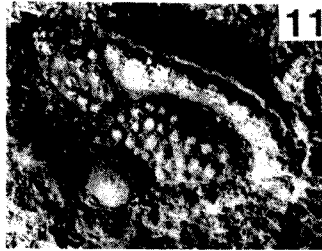
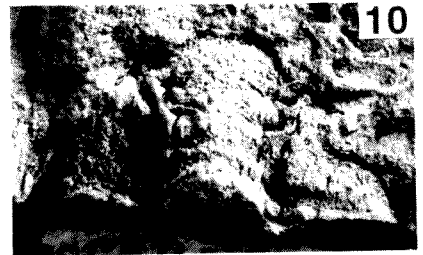
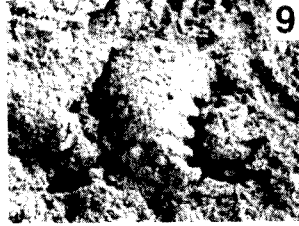
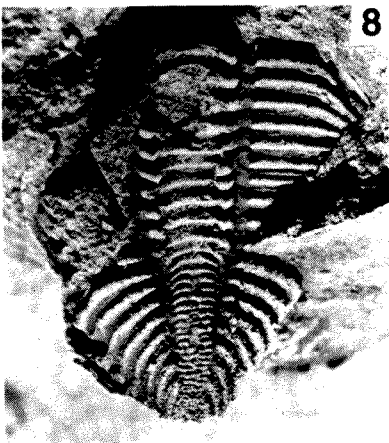
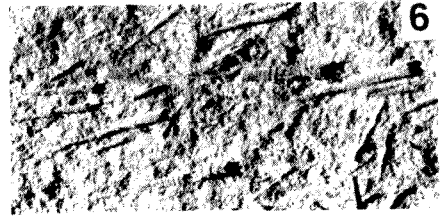
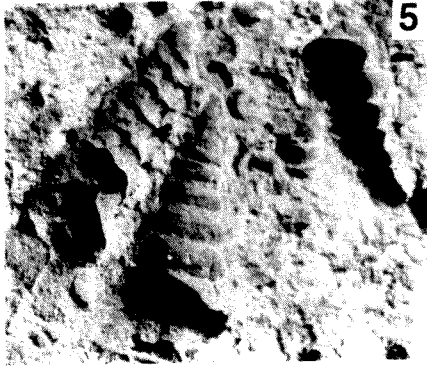
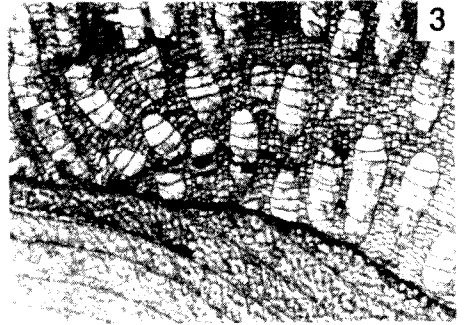
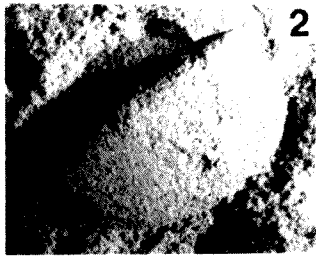
Description

Medium to large shell; average $W=27.6$ mm and $L=18.3$ mm ($W/L=1.5$). The pedicle sulcus and brachial fold are unplicated; towards the anterior end of the valves there are very fine growth lines on which in the pedicle sulcus there are faint traces of tear-shaped spine bases without radial arrangement (Figure 5, fig 13). Height of fold and sulcus shows

considerable range of variation. The lateral slope has 8 to 12 thin, rounded plications with angular grooves between them, with the distinctness and size of the plications tending to decrease towards the cardinal extremities. Beak is strongly incurved and the hinge line is close to the greatest width of the shell. The shells give a satisfactory picture of the shell sculpture. The few internal moulds (e.g. on specimen F.83153) exhibit some of the internal features, such as the cardinal area; the natural random sections and calcining occasionally exhibit features, such as the spiralium, the jugal process and the ridges extending from the cardinalia.

Remarks

The combination of characteristics of this species places it clearly in the genus *Spinella* (see Figure 10) as defined by Talent (1963). The allied species *S. yassensis* from the Emsian Taemas Formation (Murrumbidgee Group), differs from *S. pittmani* in the following characteristics. Its sulcus has a median fold, and the tear-shaped spine bases are radially arranged. The shape and size as well as the ratio of the valve-width to valve-length ($W/L = 2.1$) and the number of ribs on one side of the pedicle valve (on average: 9) indicates only a slight overlap of this species with *S. buchanensis*, which also has "ostiolate" non-plicated median sulcus and fold, but the tear-shaped spine bases are not arranged radially (as in *S. pittmani*). The differences between *S. yassensis* and *S. buchanensis* were discussed by



Strusz *et al.* (1970). The distinction between *S. pittmani* and *S. yassensis* is best seen on plots of shell length (L) against shell width (W), as discussed by Földvary (1969). Another Victorian species, *S. maga* Talent, has more ribs than any of the other three species of *Spinella* in south-eastern Australia, according to Talent (1956). Several preempted mentions (i.e. *nomen nudums*) were made of the recombination of *pittmani* with the genus *Spinella*, as in Packham (1969), Webby (1972) and Sherwin (1992; 1996).

Material and stratigraphic occurrence

S. pittmani occurs in two different stratigraphic units: (i) in the Troffs Formation, for example, 2.4 km NE of The Troffs, N of Trundle, NSW (*vide* Webby 1972); also an isolated sandstone outcrop of the Troffs Formation at Loc. II, 6 km NW of Bogan Gate; and (ii) in the Jerula Limestone Member of the Gleninga Formation, Yarra Yarra Creek Group in the Mineral Hill area. All these units are considered to be of Pragian to early Emsian age (Sherwin (1980; 1992)).

The type locality of *S. pittmani* is W of The Troffs about 12 km NW of Trundle, and 1.6 km E of Por. 13, Par. Gillenbine according to Dun (1904). Although a rather vague locality definition, this may be 1.6 km S of Kadungle. In the Trundle-Kadungle area, as well as in the area between Yarra Yarra Ck. (N of Mineral Hill) and Condobolin there are several localities where *S. pittmani* occurs, including:

Loc. II: F.69479, F.69490, F.69492-93, F.69678, F.69679, F.69680, F.83210, F.83213. Loc. XVI (or 350; the Kadungle locality): F.69179, F.69181, F.69184, F.69186, F.69192, F.69202, F.69204, F.69207, F.69208, F.69333, F.69335, F.69337, F.69591, F.69593, F.69613-14, F.69623-26, F.82901-02, F.82984, F.83035, F.83039, F.83064, F.83077, F.83079, F.83149, F.83150, F.83152-53, F.83155-59, F.83164, F.83175-80, F.94268; Loc. XVII: F.69334, F.69336, F.69338-39, F.82999, F.83188, F.83540; Loc. XVIII: F.83003-05, F.83218-19; Loc. XIX (= Loc. 794): F.83017, F.83101, F.83102, F.83124, F.83220; Loc. 713: F.69195 (shell

sections in rock matrix); Loc. 776 (The Troffs loc.): the supposed type locality, with Emsian conodonts (Pickett 1971); Loc. XXIV: F.88730, F.88828.

Range

Early Devonian (Late Pragian to Early Emsian), in the *sulcatus*, *kindlei*, *pireneae* and *dehiscens* conodont zones (Sherwin 1992; 1996), in the Troffs Formation (eastern part of the area), and in the Gleninga Formation (northwestern part of the area).

Genus *Howellella* Kozłowski, 1946

Howellella sp. cf. *H. jaqueti* Dun, 1898

Figure 9.22

cf. *Spirifera jaqueti* Dun 1898: 166, plate 17, figures 2, 12-14, 17.

cf. *Spirifer jaqueti* (Dun); Gürich 1901: 503, plate 18, figures 13-14.

Description

Biconvex shell of transversely oval, rounded outline (W/L = 1.4) with 4 to 7 lateral plicae (5 being the most frequent), deep and rounded sulcus in the ventral valve and strong, rounded fold in the dorsal valve; hinge line straight, extending to the full width of the shell (W = 10-15 mm; L = 7-10 mm, av. W/L = 1.66); micro-sculpture not observed.

Remarks

Lack of internal features prevents a definite assignment of the present material to *H. jaqueti*. However, the external features do render it comparable with this species, as shown also by its measurements here. The dimensions of *H. sp. cf. jaqueti* are: (pedicle valve) W = 15.8 mm, L = 9.2 mm with W/L-index of 1.72; (brachial valve) W = 15.5 mm, L = 9.2 mm, and W/L = 1.69; the number of plicae in both valves is 6 on average. The external characteristics of *H. sp. cf. jaqueti* are very close to those of *Howellella* (*s. s.*). The type species from Gotland, *H. elegans* (Muir-

Figure 11 1, 4, 17 from Connemarra Formation; 2, 3, 5-16 from Cookeys Plains Formation. 1, *Tellinopsis* sp. External mould of F.87083 from Loc. VIIIb; x3. 2, *Goniophora* (*G.*) sp. Internal mould of F.69383 from Loc.727; x2. 3, *Heliolites* sp. Section through a heliolitid (upper half of photo) encrusting a stromatoporoid: F.83222 from Loc. X; x2. 4, *Murchisonia* (*M.*) sp. External mould of F.70116 from Loc. VIIIa; x2. 5, *Loxonema* sp. external moulds of F.69528 from Loc. 500; x2. 6-7, *Tentaculites* sp. cf. *T. chapmani* Sherrard. 6, aligned external moulds indicative of current direction, F.82401, Loc. XIII; x1. 7, enlargement of an external mould of F.82406 from Loc. XIII; x4.1. 8-16, *Batocara* sp. cf. *B. mitchelli* (Foerste). 8, internal mould of thorax and pygidium of F.70037a from Loc. I; x2.5. 9, internal mould of cephalon of young individual, F.70089 from Loc. VII; x3. 10, Internal mould of trilobite cephalon, F.70039 from Loc. VI; x1.8. 11, Latex cast of internal mould of partial trilobite cephalon, from F.70040, Loc. VI; x1.8. 12, Latex cast of internal mould of trilobite cephalon and thorax, F.89490 from Loc. I; x1.8. 13, Internal mould of glabella of a trilobite cephalon, F.70037c from Loc. I; x4. 14, Internal mould of trilobite pygidium with 5 axial tubercles, F.63690, from Loc. I; x3. 15, Internal mould of trilobite pygidium, F.70037b from Loc. I; x3. 16, Internal mould trilobite pygidium, F.84279c from Loc. I; x1.5. 17, *Crotalocephalus regius* Földvary. Latex cast of internal mould of portion of cephalon, holotype F.67298, from Loc. 750; x1.8.

Wood) is also comparable with the present species externally, its dimensions being $W = 12$ mm, $L = 9.5$ mm; however it has only 3 lateral plicae (a strong difference from *H. sp. cf. jaqueti*), fimbriate micro-sculpture, and an age range barely reaching the Ludlovian. *H. nucula* (Barrande) from the Early Ludlow Yarralumla Formation of the Canberra area (Strusz 1984) is half the size of *H. sp. cf. H. jaqueti* from the present area: its dimensions being $L = 5$ mm, and $W = 10$ mm, with fimbriate micro-sculpture, but it has only 2 plicae on the lateral slope. *H. nucula australis* Savage from Early Devonian beds of the Manildra area of NSW is close to *H. nucula*, but its globose shell is unusually small ($W = 5$ mm, $L = 4$ mm) and the maximum width is just posterior of mid-length according to Savage. *H. pyramidalis* McKellar is least like *H. sp. cf. jaqueti* because of its small size: holotype pedicle valve $W = 4.6$ mm, $L = 4.3$ mm, while the paratype brachial valve $W = 4.3$ mm, $L = 3.3$ mm; also there are only 2 or 3 plicae on the lateral slope.

Material and stratigraphic occurrence

The type locality for *H. jaqueti* is the White Cliffs Opal Fields (Gürich 1901). *H. sp. cf. H. jaqueti* occurs mainly at Loc. 760, NW of Trundle, with a few occurrences also at Locs. 727, 763, 790, and at Loc. XII, with the following specimens: F.69294, F.69342, F.69518–20, F.69568, F.69629–34, F.69642, F.70053–54, F.70063, F.70065–66, F.82914–16, F.83022, F.83024–25, F.83168, F.83171, F.83192–95, F.83197–99, F.83294, F.84017–19, F.84052–54, F.84110.

TRILOBITES

Genus *Batocara* Strusz, 1980

Pacificurus Ramsköld 1986: 380.

Type species

Encrinurus bowningi Foerste 1888.

Remarks

Edgecombe and Chatterton (1990) suggested that *Pacificurus* Ramsköld might belong to *Batocara* Strusz. Holloway (1994) synonymised the two genera, and this is followed herein.

Batocara sp. cf. B. mitchelli (Foerste, 1888)

Figures 11.8–16

cf. *Encrinurus mitchelli* (Foerste); Strusz 1980, 23, with full synonymy (pp. 23–24).

cf. *Pacificurus mitchelli* (Foerste); Edgecombe and Chatterton 1990, 3–4.

cf. *Batocara mitchelli* (Foerste); Holloway 1994, 255–56.

Description

Cephalon (one near-complete cranidium, F.70039, Figure 11.10) is densely covered by coarse tubercles, but it shows traces of the facial suture. 12 tubercles are present on the anterior cranial border. The glabella is fairly long, widening anteriorly and it is gently convex; $L/W = 1.2–1.3$. L1 is prominent, S1 is transverse; 3 glabellar furrows (S1–S3) and the occipital furrows are situated on each side of the glabella. The eyes are not stalked, placed opposite L2. The librigenal field is relatively large, densely covered with tubercles, librigenal lateral border bears a single row of 5 or 6 large, circular tubercles. Eye is undefined. Genal spine is much reduced, almost non-existent.

Thorax of 2 incomplete specimens, consists of 9 segments, with prominent lateral tubercles from L3 to L9.

Pygidium is relatively long, $L/W=1$, though in one specimen (F.70038) it is wider than long: $W=20$ mm, $L=16$ mm. All the other specimens are comparatively narrow and distinctly triangular (tapering) with at least 25 rachial rings. The pygidial rachis (about 33% of the pygidial width anteriorly) shows 5 or 6 prominent median (sagittal) tubercles, anteriorly appearing from L3, faintly visible on F.63690 (Figure 11.14). About 10 pleurae (or ribs) are present. There is no mucro.

The carapace is about 40 mm long, compared with the holotype, which is 32.8 mm long.

Remarks

The material is closely comparable to *Batocara mitchelli* (Foerste) described by Strusz (1980) from numerous Late Silurian localities in the Yass district, and the Australian Capital Territory. Since the specimens lack some diagnostic characters, and because of poor preservation, they are only tentatively referred to this species.

The present material also shows similarity in form and measurements to a specimen assigned to *E. mitchelli* by Fletcher (1975) from the Early Devonian of the Cobar area. Fletcher also figured a pygidium of *E. sp. cf. E. silverdalis* (Etheridge and Mitchell) which is similar to a pygidium of the present material, though there are only 4 median tubercles on Fletcher's specimen.

Material

Loc. I: F.63690, F.70037a,b, F.84279c and F.89490; Loc. VI: F.70038–40, F.70045–46, F.70058, F.82979, F.84279d, F.87372, F.88857, F.89472, F.89480; Loc. VII: F.70089a,b, F.88725 and F.88851; Loc. XII: F.70043–44.

Genus *Crotalocephalus* Salter, 1864*Crotalocephalus regius* Földvary, 1970

Figure 11.17

Crotalocephalus sculptus Etheridge and Mitchell 1917: 492, plate 25, figures 4–8.**Diagnosis (revised)**

Glabella with inflated frontal lobe and subparallel sides; transglabellar furrows gently V-shaped; eyes close to the glabella, in line with S2. S3 curved backwards axially so as to join the occipital furrow (S4). Tubercles well developed. Fine tubercles absent along the edges of the furrows. Fixigenae large and deeply pitted; narrower than the occipital ring.

Remarks

Crotalocephalus regius differs from *C. struszi* Chatterton and Wright 1986 in having a smaller distance between the eyes and the glabella, and also by the fact that the very fine tubercles along the edges of the furrows are not preserved in *C. regius*, and the sculpture seems to be denser; the transglabellar furrows are perhaps a little less deflected posteriorly, and thus S3 does not quite join the occipital furrow, but this latter criterion provides almost no difference between the two species. According to Strusz (1964) the two figures of Etheridge and Mitchell (1916; plate 25, figure 8 and plate 26, figure 11) depict two different species, one of which is *Crotalocephalus sculptus* Etheridge and Mitchell, whereas the other one he identified as *C. packhami*, considering it sufficiently distinct. Two poorly preserved glabellar portions of cephalons from the Early Devonian described and figured from the Cobar area by Fletcher (1975) as *C. silverdalensis*, is similar to the present material. *Crotalocephalus* sp. described by Talent (1963) from the Devonian of Eastern Victoria on basis of a juvenile specimen appears to be closest to *C. silverdalensis*. *Crotalocephalus oxinus* Holloway and Neil has distinctly different cranial dimensions and shape: in this species the frontal glabellar lobe is relatively shorter, while S3 is somewhat less oblique. The cheeks are wider and the tuberculation is less prominent. Holloway and Neil (1982) consider *C. sculptus* and *C. silverdalensis* to be "synonymous and not very similar to *C. oxinus*".

Material and stratigraphic occurrence

The only specimen (holotype) is F.67298, from Loc. 750 in the lower portion of the Connemarra Formation.

Range

Early Devonian (late Lochkovian to early Pragian), as indicated by conodonts (Pickett 1971).

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APPENDIX

Locality Data

The position of the fossil localities (Figure 1) is given using portion- and parish maps, and also by grid reference (= GR) on 1:50,000 topographic maps of Bogan Gate 8431-I and IV (= BG), Fifield 8332-II and III (= FI), Trundle 8432-II and III (= TR), and Tullamore 8432-I and IV (= TU). Abbreviations: Co. = County; Par. = Parish; Por. = Portion; HS = Homestead; Loc. = Locality; Mtn. = Mountain; Mt. = Mount.

- Loc. I:** 13 km SSE of Trundle and NW of Bogan Gate; 1.6 km NW of Gosper's HS; south-central part of Por. 17, Par. Botfields, Co. Cunningham; GR 567730E 6345240N, BG.
- Loc. II:** 7 km NW of Bogan Gate; 17 km SE of Trundle; boundary between Pors. 37 and 114, Par. Gunningbland 1.4 km S of E-W road to Black Range, GR 570120E 6341820N, BG.
- Loc. III:** 12 km S of Trundle; NW corner of Por. 94, Par. Botfields, Co. Cunningham; GR 562500E 6345710N, BG.
- Loc. IV:** 1.8 km S of E-W road from Bogan Gate; west-central boundary between Pors. 19 and 21, Par. Cookeys Plains, Co. Cunningham; GR 560480E 6342700N, BG.
- Loc. V:** 12 km S of Trundle, GR 565120E 6345180N, BG.
- Loc. VI:** 8 km S of Trundle, GR 564410E 6350620N, TR.
- Loc. VI-N:** 7 km S of Trundle; E part of Por. 6, Par. Botfields, Co. Cunningham; GR 64600E 6351310N, TR.
- Loc. VI-S:** 9 km S of Trundle; SE corner of Por. 7, Par. Botfields, Co. Cunningham, GR 564220E 6349100N, TR.
- Loc. VII:** 12 km SSE of Trundle; 1.6 km S of Botfields T.S.; E-half of Por. 30, Par. Botfields, Co. Cunningham; GR 568290E 6346300N, BG.
- Loc. VIII:** 2.5 km SE of Botfield Railway Station (now abandoned); NW corner of Por. 75, Par. Botfields, Co. Cunningham; GR 572480E 6346640N, BG.

- Loc. IX: 16 km SSE of Trundle, on Bogan Hill, S of E-W road, GR571120E 6343190N, BG.
- Loc. X: 5 km SW of Trundle; W-part of Por. 161, Par. Trundle, Co. Cunningham; near "Myola" HS; GR 564400E 6354700N, TR.
- Loc. XI: 8.5 km SW of Botfield Railway Station, GR 567100E 6344950N, BG.
- Loc. XII: 14 km SSW of Trundle at NE-foot of Black Range, GR 559720E 6345610N, BG.
- Loc. XIII: 27 km W of Bogan Gate, E of Ganantagai Mtn., GR 560660E 6337890N, BG.
- Loc. XIV: 1.9 km E of N-S road, GR 560410E 6344030N, BG.
- Loc. XV: 24 km E of Trundle; Middle of Por. 26 and SW-corner of Por. 27, Par. Milpose, Co. Ashburnham; GR 588610E 6350320N, TR.
- Loc. XVI: 2.4 km NE of Kadungle on the western limb of the Troffs synclinal nose, GR 560020E 6376520N, TU.
- Loc. XVII: 3 km NW of "Meloola" HS; 35 km N of Condobolin, GR 521880E 6372800N, FI.
- Loc. XVIII: "Melrose" HS (formerly a hotel), 54.5 km N of Condobolin, GR 500963 1:250,000 Nymagee Sheet.
- Loc. XIX: Robert Staniford's HS, near Yarra Yarra Ck., 64 km N of Condobolin; also designated as Loc. 794, GR 501980, Nymagee Sheet.
- Loc. XX: (= Loc. 789) "Moorefield" Station; 33 km N of Condobolin, E of the road, GR 524510E 6369720N, FI.
- Loc. XXI: Trundle area generally, grid ref. for Trundle; GR 566310E 6356870N, TR.
- Loc. XXII: 38 km NNE of Condobolin, 2.4 km NW of Old School (removed in the early 1980s); 4 km NNE of "Meloola" HS; GR 525540E 6374830N, FI.
- Loc. XXIII: 4 km SW of Trundle, W of Loc. X, W of N-S road from Yarrabandai to Trundle, GR 564100E 6354600N, TR.
- Loc. XXIV: Mineral Hill locality; 56 km N of Condobolin, 2 km N of Mineral Hill Mine (Triako Resources Ltd. and Cyprus Mines Corporation; closed down in 1990), 0.5 km N of old "Bogong" HS, S of E-W-running fence.
- Loc. XXV: Yarraman Farm, 6 km ENE of The Troffs, Par. Plevna, Co. Cunningham, GR 566510E 6369200N, TR.
- Loc. 100: (=L3) 563650E 6374410N, BG.
- Loc. 240: Immediately E of Loc. VI-S, SE corner of Por. 22, Par. Botfields, Co. Cunningham; GR565670E 6348670N, TR.
- Loc. 243: SW corner of Por. 101, Par. Botfields, Co. Cunningham; GR56613E 6348780N, TR.
- Loc. 322: 14.5 km SW of Trundle, at NE-foot of Black Range, WNW of Bogan Gate; GR 558490E 6346400N, BG.
- Loc. 350: 5 km E of Kadungle, on "Glendale" Property; GR 561220E 6375930N, TR.
- Loc. 407: 0.8 km NE of Botfield Railway Station, 11 km SE of Trundle; S part of Por. 76, Par. Botfields, Co. Cunningham; GR 571680E 6348680N, TR.
- Loc. 419: E slope of Bogan Hill; 13.5 km NW of Bogan Gate; GR 571260E 6348090N, BG.
- Loc. 500: 2.8 km SSW of Trundle, off the N-S road from Yarrabandai to Trundle, GR 564130E 6354300N, TR.
- Loc. 699: 6.4 km WSW of Botfield Railway Station, and 11.2 km S of Trundle; SW corner of Por. 4, Par. Botfields, Co. Cunningham; Carne and Jones (1919) locality; GR 564300E 6347510N, BG.
- Loc. 710: 2 km NNE of The Troffs, GR 571942, Narrromine Sheet.
- Loc. 727: 1 km W of Corbett's HS, 2 km ENE of The Troffs, in creek bed; GR 563100E 6368310N, TR.
- Loc. 750: 24 km ESE of Trundle, 1.6 km S of Loc. XV; GR 588590E 6348730N, TR.
- Loc. 760: 11 km NW of Trundle, 16 km ESE of Fifield, off (mainly N of) the road from Trundle to Fifield; in Pors. 11 and 28, Par. Gillenbine; GR 557520E 6363560N, TR.
- Loc. 763: 8 km NW of Trundle; GR 560610E 6362560N, TR.
- Loc. 794: Yarra Yarra Ck., N of Mineral Hill; 9.5 km NW of Wilmatha Hill; 64 km N of Condobolin; GR 501980, 1:250,000 Nymagee Sheet.
- Loc. 795: A.J. Anderson's HS; Por. 9, Par. Murrumbogie, 33 km N of Ootha, N.S.W.; GR 543320E 6352540N, FI.
- Loc. 796: Boona Gap, N of Condobolin, GR 513430E 6383230N, Boona Sheet 1:50,000.
- Loc. 797: 1 km SSE of "Nobelar" HS; GR 508000E 6374400N, FI.
- Loc. 798: (Loc. 15): 3 km NNW of Mt. Tilga and NNW of Condobolin, E of the road to Mineral Hill, little S of the entrance to "Flowerdale" HS, GR 510890E 6348790N, FI.