PLANICARDINIA, A NEW SEPTATE DALMANELLID BRACHIOPOD FROM THE LOWER DEVONIAN OF NEW SOUTH WALES

by N. M. SAVAGE

ABSTRACT. *Planicardinia* is described as a new genus of septate dalmanellid occurring in deposits of probable early Siegenian age in New South Wales. The new genus, known only by the type species *Planicardinia carroli* sp. nov., is placed in the Mystrophoridae together with the genera *Mystrophora*, *Kayserella*, and *Hypsomyonia*. It is the earliest known representative of the family and its presence at this horizon indicates that the origins of the group are at least as old as the early lower Devonian.

SEPTATE dalmanellid brachiopods have received considerable attention since 1953 when Havlíček described the new Middle Devonian genus *Prokopia*. In 1955 Cooper re-examined the Middle Devonian forms *Kayserella* and *Mystrophora* and proposed the new Middle and Upper Devonian genera *Phragmophora*, *Hypsomyonia*, and *Monelasmina*. More recently Johnson (1966) described the new genus *Vallomyonia* from the Middle Devonian of Nevada and Johnson and Talent (1967*a*) described the new genus *Muriferella* from the late Lower Devonian of south-east Australia, Nevada, and Arctic Canada.

The new genus described herein is from the early Siegenian Mandagery Park Formation near Manildra, New South Wales, where it occurs infrequently in a large silicified brachiopod fauna (Savage 1967, 1968). It is the earliest known representative of the Mystrophoridae and is therefore of particular interest. Little is known of the phylogeny or origin of this family and the new genus does not directly throw new light on the problem of a possible precursor. However it does show that a highly specialized mystrophorid existed in the middle Lower Devonian and that the ancestral forms of the family can be expected in even older strata.

Attempts to classify septate dalmanellid genera have resulted in several different schemes which disagree markedly. Nevertheless most authors believe the group to be polyphyletic with septate dorsal valves evolving independently in more than a single lineage. Cooper (1955) referred *Mystrophora* and *Kayserella* to the Mystrophoridae, *Phragmophora* and *Hypsomyonia* to the Onniellidae, and *Monelasmina* to the Schizophoriidae. Wright (in Moore 1965) proposed that *Kayserella*, *Prokopia*, *Monelasmina*, and *Phragmophora* be grouped into a new family, the Kayserellidae, with *Hypsomyonia* the sole member of another new family, the Hypsomyoniidae, leaving *Mystrophora* the only remaining member of the Mystrophoridae. Johnson (1966) and Johnson and Talent (1967*a*) referred the new genera *Vallomyonia* and *Muriferella* to the Schizophoriidae. These latter authors discuss possible phylogenetic relationships in some detail (1967*a*, pp. 44–6) and it is clear that they envisage three distinct groups. The genera *Muriferella*, *Vallomyonia*, *Monelasmina*, and *Hypsomyonia* are all placed in the subfamily Draboviinae together with *Salopina* which is suggested as a possible ancestor, *Prokopia* and *Phragmophora* are separated as a second lineage, and a third group consists of *Mystrophora*, *Kayserella*, and the new genus described herein (see Johnson and Talent 1967*a*, p. 46).

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It seems very probable that *Planicardinia* is closely related to *Mystrophora* and to *Kayserella*. The three genera have a number of features in common, of which most notable is the possession of a cruralium in the dorsal valve. Cooper (1955, p. 47) does not appear to have been convinced that the small cruralium in *Kayserella* was the sole attachment surface for the dorsal adductor muscles. Furthermore, Wright (1965, in Moore, p. H338) refers to the cruralium as a septalium and suggests that the adductor muscles were attached to the valve floor. However, Biernat (1959, p. 38) has demonstrated that some Polish specimens of *Kayserella* possess a cruralium extending half the length of the dorsal valve (Biernat 1959, pl. iii, fig. 7) and it now seems probable that this structure was a functional muscle platform.

Hypsomyonia appears to be more closely related to *Mystrophora* than to *Muriferella* and *Monelasmina*. It has a large elevated cruralium which clearly functioned as a muscle attachment surface and a typical mystrophorid pentagonal outline with an emarginate anterior margin. *Hypsomyonia* has therefore been assigned herein to the *Mystrophoridae*.

It is probable that additional material will eventually be found which will indicate the true relationships of the various septate dalmanellids. Meanwhile any classification is likely to be only tentative. It appears to the author that the septate genera with a cruralium form a distinct phylogenetic group and the classification below differs from that of earlier authors in this respect.

SYSTEMATIC DESCRIPTION

Phylum BRACHIOPODA
Suborder DALMANELLOIDEA
Superfamily DALMANELLACEA Schuchert 1913
Family MYSTROPHORIDAE Schuchert and Cooper 1931

Revised diagnosis. Small, ventribiconvex, dorsally sulcate Dalmanellacea with a long apsacline or anacline ventral interarea and a shorter anacline or hypercline dorsal interarea. Both the delthyrium and notothyrium are open. The ornamentation is costellate to subfascicostellate. The dorsal interior has a high median septum supporting a large cruralium, a bilobed cardinal process, and ventrally or ventro-laterally elongate brachiophores. The ventral interior has a short, wide muscle field with the adductor scars not enclosed by the diductor scars.

Genera included:
Mystrophora Kayser, 1871
Planicardinia gen. nov.
Kayserella Hall and Clarke, 1892
Hypsomyonia Cooper, 1955

Genus PLANICARDINIA nov.

Type species. Planicardinia carroli sp. nov.

Diagnosis. A plano-convex mystrophorid with an anacline ventral interarea and a hypercline dorsal interarea. Heavy triangular teeth are supported by strong dental

lamellae. The dorsal interior has a small bilobed cardinal process, ventrally elongate brachiophores and a vertical spoon-shaped cruralium supported on a variable median septum.

Discussion. Known only by the type species, *Planicardinia* most closely resembles the Western European Middle Devonian genus *Mystrophora*, particularly in the features of the dorsal interior. Comparison with the type species of *Mystrophora* (Cooper 1955, pl. 11, figs. 45–9) shows a marked similarity in the form of the ventrally elongate brachiophores with a crescentic cross-section and the high spoon-shaped cruralium. The ventral interior of *Planicardinia* also closely resembles that of *Mystrophora* with a similar short thickened muscle field. However, the shell shape of *Planicardinia* is distinctive with the anacline ventral interarea and hypercline dorsal interarea together forming a prominent part of the dorsal surface of the plano-convex shell. Another difference is in the orientation of the cruralium which in *Planicardinia* is inclined almost normal to the dorsal valve floor, a feature clearly related to the extreme curvature of the ventral umbo which necessitates adductor muscles positioned almost parallel to the commissural plane (text-fig. 1). The ventral 'median septum' in *Mystrophora*, described and figured by Cooper (1955, pl. 11, fig. 50), has been observed in only a single specimen where it showed as a narrow slit in the internal filling of a calcined specimen. This slit probably represents the position of the high dorsal septum extending to the floor of the ventral valve.

Hypsomyonia is easily distinguished from *Planicardinia* for it possesses a much less curved ventral umbo and an interarea which is apsacline and not anacline. Internally the brachiophores are more laterally directed so that they almost parallel the hinge line and the cruralium is more gently inclined.

Kayserella is also very distinct from *Planicardinia* externally. Like *Hypsomyonia* it has posteriorly directed interareas and a less rounded outline. Internally the dorsal median septum is longer and the cruralium is much smaller and less upright. In addition, the brachiophores are much shorter.

Planicardinia carroli sp. nov.

Plate 122

Material. The species occurs very infrequently and only 16 specimens have been recovered from several thousand shells dissolved from a silicified limestone horizon. Of these 2 are complete shells with the valves conjoined, 8 are ventral valves, and 6 are dorsal valves. The specimen numbers used are those of the Palaeontology Collection, Department of Geology and Geophysics, University of Sydney. Specimen SU 19540 is designated the holotype. Other illustrated specimens are paratypes.

Description. Exterior. The shell is subcircular to subpentagonal in outline with the greatest width at about midlength. The cardinal margins are very obtuse and the anterior margin is emarginate to slightly rounded. In lateral profile the shell is plano-convex (Pl. 122, fig. 25).

The ventral valve is strongly convex with the umbo swollen and prominent. The beak is erect or incurved and appears to be commonly resorbed by the pedicle (Pl. 122, fig. 15). A long concave interarea is anacline and has an apical angle of about 130°.

The delthyrium, which has a width of about one-quarter that of the hinge-line, includes an angle of about 35°.

The dorsal valve is transversely oval to pentagonal in outline and planar or weakly convex. In the mature dorsal valves there is a distinctive convexity at the valve margin (Pl. 122, fig. 10). The umbo is poorly differentiated and the small distinct beak is postero-dorsally directed (Pl. 122, fig. 25). A long, slightly concave, hypercline interarea makes a very obtuse angle with the valve surface. (Pl. 122, fig. 25). It has an apical angle of about 150°. The notothyrium is open and includes an angle of about 50°.

A low broad sulcus in the dorsal valve extends from the beak to the gently sulcate anterior commissure. No distinct fold is present in the ventral valve. The surface is costellate with about thirty-four costellae 2 mm. from the dorsal beak. The costellae increase chiefly by intercalation.

Interior of ventral valve. In the ventral interior a broad, deep delthyrial cavity is bounded by short vertical dental lamellae which diverge anteriorly at about 40° (Pl. 122, fig. 26). The anterior edges of the lamellae recede slightly and meet the strongly curved valve floor at about one-sixth the distance from the beak. Deep lateral umbonal cavities are present. The teeth are strong and pointed with a triangular profile (Pl. 122, fig. 15). A short sub-triangular muscle field is slightly elevated on the thickened floor of the delthyrial cavity but individual scars have not been observed (Pl. 122, figs. 14, 26).

Interior of dorsal valve. The dorsal interior has a small bilobed cardinal process set deeply in the apex of the notothyrium. The brachiophores are ventrally elongate and blade-like, diverging from the valve floor at about 50° and continuous with the margins of the notothyrium for part of their length (pl. 122, figs. 7, 10). They are crescentic in cross-section and bluntly pointed. The sockets are deeply excavated into the posterior of the brachiophore bases just ventral to the interarea margin (Pl. 122, figs. 10, 21).

EXPLANATION OF PLATE 122

Planicardinia carrolli sp. nov.

Figs. 1–5. Ventral, dorsal, anterior, posterior, and lateral views of complete specimen SU 22665. Note the dorsally directed interareas and the strongly convex ventral valve (fig. 5) (×6·5).

Figs. 6–11. Ventral, dorsal, postero-dorsal, antero-ventral, lateral, and postero-ventral views of the isolated mature dorsal valve SU 19541 showing the very high brachiophores (fig. 10), large spoon-shaped cruralium, and the small bilobed cardinal process (fig. 9) (×6·5).

Figs. 12–14. Antero-dorsal, ventral, and dorsal views of broken ventral valve SU 22666. Note the deep, lateral, umbonal cavities and the elevated muscle-field (×6·5).

Figs. 15–17. Dorsal, ventral, and lateral views of ventral valve SU 19542 showing the resorbed beak, strong triangular teeth (fig. 15), and external ornament (×6·5).

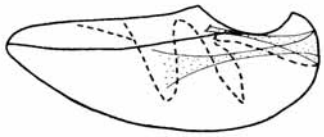
Figs. 18–21. Ventral, dorsal, antero-ventral, and lateral views of mature dorsal valve SU 22667. Fig. 18 shows the spoon-shaped form of the cruralium and the degree to which the median septum has been almost totally resorbed (×6·5).

Figs. 22–5. Posterior, dorsal, anterior, and lateral views of complete specimen SU 19540 (holotype) showing the large dorsally directed interareas (fig. 23), the strongly convex ventral valve (fig. 25), and the gently sulcate anterior commissure (×6·5).

Fig. 26. Antero-dorsal view of broken ventral valve SU 19543. Note the strong dental lamellae and the thickened muscle area (×6·5).

Figs. 27–32. Ventral, dorsal, postero-ventral, antero-ventral, lateral, and posterior views of the young dorsal valve SU 19544 showing the relatively larger median septum extending into the cruralium (fig. 27), and sockets excavated into the bases of the brachiophores (fig. 29) (×8).

A high, almost vertical cruralium arises close to the brachiophore bases and extends anteriorly to about half the valve length. The spoon-shaped cruralium is supported by a high median septum which extends a little into the cruralium cavity and in young forms has a maximum elevation near the anterior valve margin (Pl. 122, figs. 18, 27, 31). The septum is much shorter in mature specimens (Pl. 122, figs. 8, 18). Adductor muscles were presumably attached to the inner surface of the cruralium but distinct scars have not been observed in the few specimens available.



TEXT-FIG. 1. *Planicardinia carroli* gen. et sp. nov. Sketch to illustrate the position of the cruralium, brachiophores, and dental lamellae within a complete shell and the probable position of the adductor and diductor muscles.

The interior of both valves usually reflects the external costellation.

Measurements (in mm.)

		Length	*Width*	*Thickness*
SU 19540	Complete shell	4·2	4·3	2·1
SU 19541	Dorsal valve	3·6	6·1	—
SU 19542	Ventral valve	4·6	5·1 (est.)	—
SU 19544	Dorsal valve	1·5	2·6	—

Ontogeny. The very few specimens of this species include a young dorsal valve and two mature dorsal valves. In the mature specimens the median septum appears to be partly resorbed both anterior and posterior of the almost vertical cruralium, but in the young specimen it extends anteriorly almost to the valve margin and posteriorly well into the cruralium cavity (Pl. 122, figs. 27, 29). Another feature of the mature specimens is the extreme ventral elongation of the brachiophores and cruralium which greatly exceeds that in the small form (Pl. 122, figs. 10, 21). The large spoon-shaped cruralium seems to be deeply resorbed in one of the mature specimens by the two principal trunks of the lemniscate *vascula media* (Pl. 122, figs. 8, 11).

Occurrence. The species occurs in the silicified limestone horizon at the base of the Mandagery Park Formation 3 miles south of the town of Manildra, New South Wales, at Locality 1 of Savage (1968).

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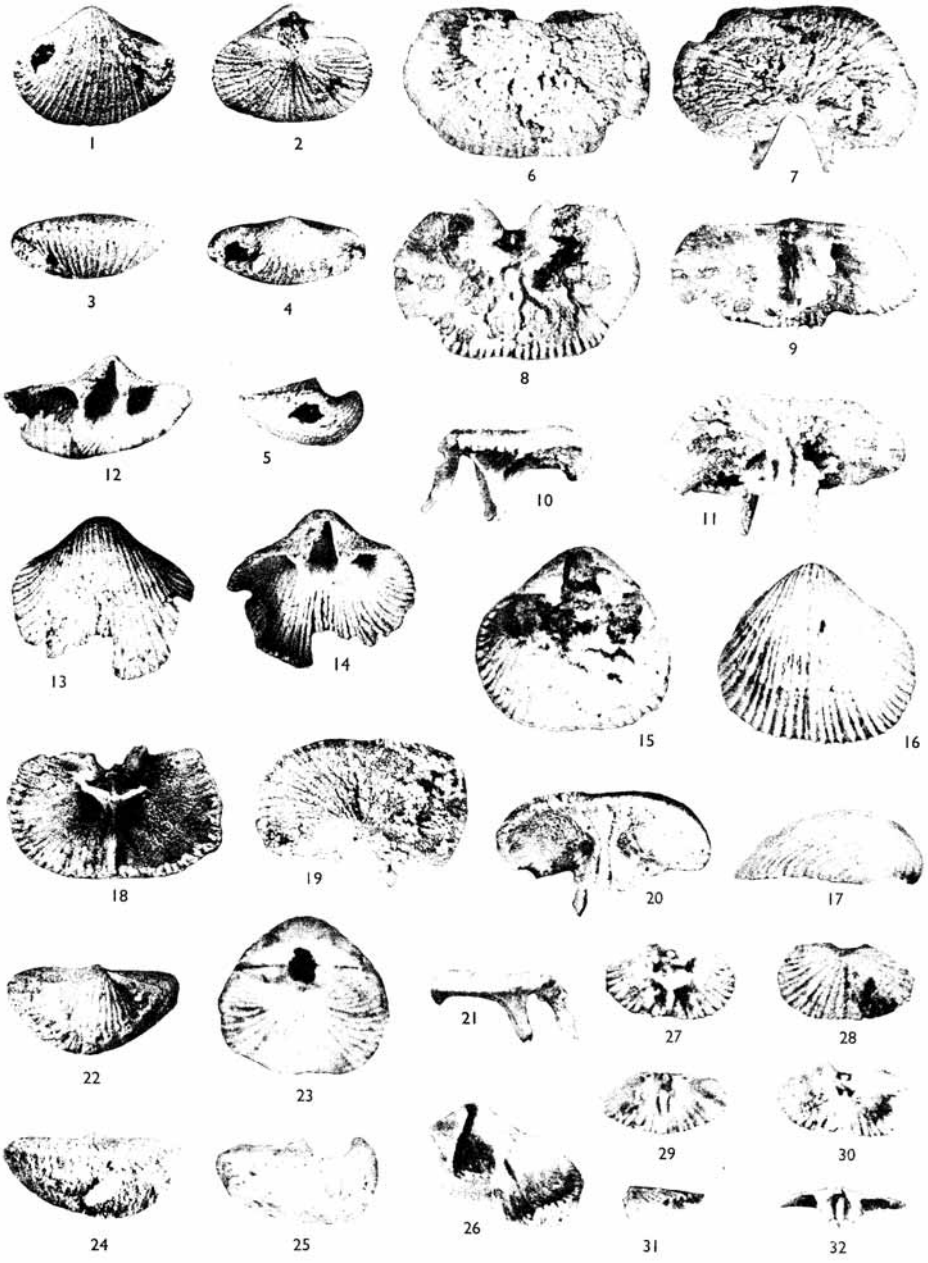

SAVAGE, *Planicardinia*