

EARLY ORDOVICIAN ORTHIDE BRACHIOPODS FROM THE DIGGER ISLAND FORMATION, WARATAH BAY, VICTORIA

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Abstract

Laurie, J.R., 1987. Early Ordovician orthide brachiopods from the Digger Island formation, Waratah Bay, Victoria. *Mem. Mus. Vict.* 48: 101-106.

Two new species of orthide brachiopod are described from the Digger Island Formation, Waratah Bay. *Finkelburgia lindneri* sp. nov. is the first substantiated record of the genus in Australia, while correlations based on associated trilobite and conodont faunas make *Archaeorthis waratahensis* sp. nov. the oldest known occurrence of the genus.

Introduction

Digger Island is a small stack situated on the western side of Waratah Bay, about 1.5 km south of Walkerville, south Gippsland. It constitutes the type locality of the Digger Island Formation (Lindner, 1953: 80), a sequence of fossiliferous yellow-brown, grey and grey-green shale, mudstone and calcareous shale and thin-bedded limestone.

Lindner (1953: 81) listed Singleton's manuscript names for the formation but no formal descriptions were published; hence the names remain nomina nuda. More recently, Jell (1985) has described in detail the trilobite fauna and summarised the stratigraphy and locality information. As the brachiopods described herein are associated with the main trilobite fauna the reader is referred to this work for detailed stratigraphic information.

The genus *Finkelburgia* is known from rocks of Late Cambrian to Early Ordovician (Late Canadian) age in China, North America and USSR. The genus was recorded from the Early Ordovician of Tasmania by Corbett and Banks (1974) but these specimens were subsequently referred to *Apheoorthis* by Laurie (1980). To the author's knowledge, there is thus no previous substantiated record of this genus in Australia.

The genus *Archaeorthis* is found in the USSR, Europe and North America in rocks of Middle to Late Canadian age. Hence, if correlations made by Jell (1985: 55-56) are correct, then the

presence of *Archaeorthis waratahensis* represents the oldest record of the genus thus far. Jell (1985) considered that the Digger Island Formation fauna was best correlated with the *Kainella meridionalis* zone of Argentina, based on the presence in both of the trilobites *Micragnostus hoeki*, *Shumardia erquensis*, *Leiostegium douglasi* and similar species of *Australoharpes*, *Pseudokainella* and *Onychopyge*.

Plectorthacea Schuchert, 1929

Finkelburgiidae Schuchert & Cooper, 1931

Finkelburgia Walcott, 1905

Type species. Finkelburgia finkelburgi Walcott, 1905.

Finkelburgia lindneri sp. nov.

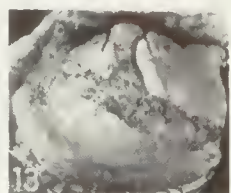
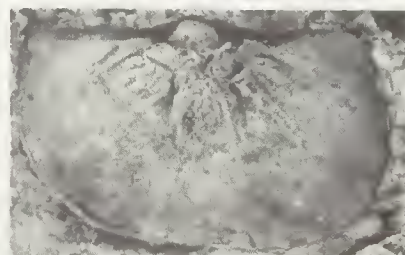
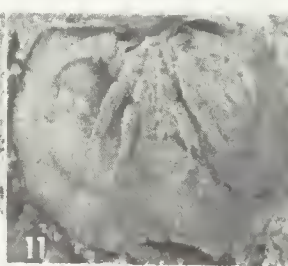
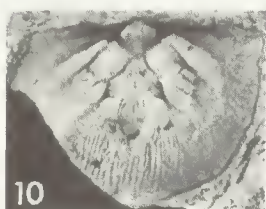
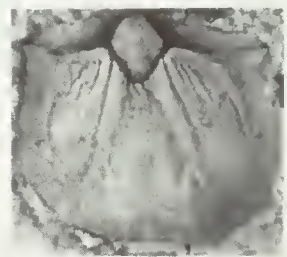
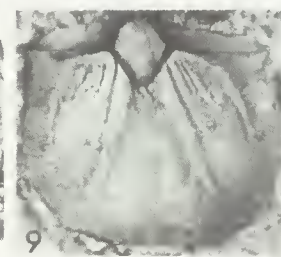
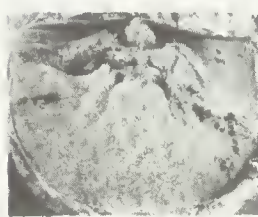
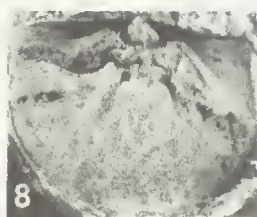
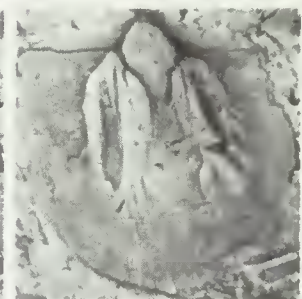
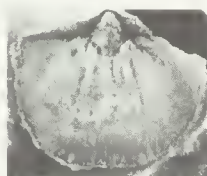
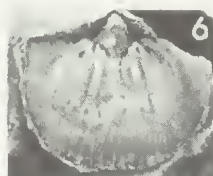
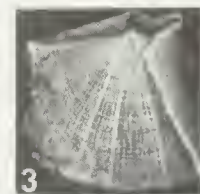
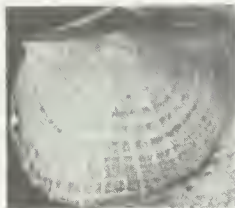
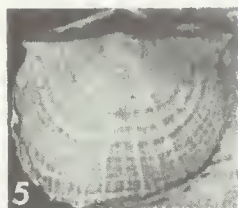
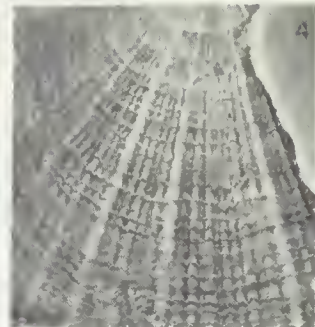
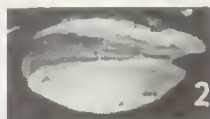
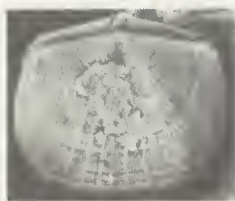
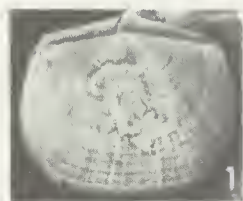
Plate 1, figures 1-13

Material examined. Holotype. NMV P71323, conjoined valves illustrated in Plate 1, figs. 1, 2.

Paratypes. NMV P71324-71332.

Type locality. NMV PL184, from the decalcified mudstone in the middle of the Digger Island Formation, on the northern and western sides of Digger Island. See Jell (1985: 53-54) for further locality information.

Diagnosis. Large *Finkelburgia* commonly with small ears, well-developed lamellae growth lineation intersecting unequally multicostellate ornament, elongate rhombic pseudospondylium and



short, broad, ventral median septum. Cardinal process absent.

Description. Shell large with ventral valve averaging about 90% as long as wide, dorsal valve 77% as long as wide; subequally biconvex, holotype 60% as thick as long, subquadrate to subpentagonal, maximum width being at about midlength, hingeline averaging 90% maximum width. Anterior to hingeline, lateral margins are variably concave, giving rise to similarly developed, though always small, ears. Ventral valve moderately convex, with maximum convexity occurring in anterior half; lateral slopes slightly flattened. Dorsal valve moderately convex with maximum convexity near midlength; in some specimens sulcate posteriorly, in other nonsulcate. External ornament very unequally multicostellate, costellae rounded, clearly developed. At 5.0 mm from beak, about 22 costellae within 5.0 mm, of which 3-5 are very strongly accentuated. An irregularly spaced, finely lamellose growth lineation intersects costellation. Ventral interarea planar to slightly concave, apsacline to orthocline, about 16% as high as wide. Dorsal interarea planar, anacline, about half as high as ventral. Notothyrium fairly narrow.

Teeth large, boss-like, supported by short dental plates which converge ventrally, coalescing with callus to form a narrow, rhombic pseudospondylium occupying about 30% of valve length. Median septum short, broad. Adductor scars large, subtriangular, extending well beyond small, semioval diductor scars. Vascular system

with two strongly impressed, weakly to moderately divergent vascula media, variable lobate anterior portions of the vascula genitalia (gonocoels) and variably arcuate posterior portions of the vascula genitalia.

Brachiphores short, divergent, bounding semiellipsoidal sockets. Brachiphore plates converge dorsally onto valve floor, bounding short, anteriorly constricted, subtriangular notothyrial platform. Cardinal process absent. Dorsal muscle field variable in shape, averaging about 85% as long as wide and extending about 36% of valve length. Posterior adductors large, subquadrate, located immediately anterior to brachiphores, impressed strongly posteromedially and raised laterally. Anterior scars small, triangular, raised anterolaterally on small platforms which give rise to short anterolaterally directed ridges. Vascular systems with strong, slightly divergent vascula media which branch at a varying length anteriorly. Vascula myaria strong, straight, moderately divergent. Vascula genitalia with a well developed single posterior trunk and with the gonocoels not impressed or as small lobate impressions located anterolaterally of the posterior adductor scars.

Etymology. After A. W. Lindner, who undertook the first detailed study of the geology of the type area.

Remarks. This species is unusual for a representative of this genus in being so large, in lacking any semblance of a cardinal process and in having a very broad ventral median ridge. Such properties clearly differentiate it from most previously known species of the genus. Perhaps the most similar species is proportions and internal structure is *F. roanokensis* Young, 1956. This species is only slightly more than half the size of *F. lindneri*, is lightly more transverse, has a wider notothyrial platform and, although having a radial ornament of similar density, does not have the lamellose concentric ornament characteristic of the new species.

The ventral interior of the new species is also similar in appearance to *F. philipsburgensis* Ulrich & Cooper, 1938 but, apart from being somewhat smaller, the species is too poorly known to allow further comment.

Plate 1. *Finkelburgia lindneri* sp. nov. All 2 × except fig. 4 (5 ×); all stereo pairs except figs. 2-4, 13; all natural moulds except where noted.

Figs. 1, 2. Holotype, latex replica of conjoined valves, dorsal and lateral views respectively, NMV P71323.

Figs. 3, 4. Paratype, latex replica of conjoined valves, dorsal view and detail of ornament respectively, NMV P71324.

Fig. 5. Paratype, latex replica of dorsal valve exterior, NMV P71325.

Fig. 6. Paratype, juvenile ventral interior, NMV P71326.

Fig. 7. Paratype, large ventral interior, NMV P71327.

Fig. 8. Paratype, dorsal interior, NMV P71328.

Fig. 9. Paratype, ventral interior, NMV P71329.

Fig. 10. Paratype, dorsal interior, NMV P71330.

Fig. 11. Paratype, dorsal interior, posterior margin damaged, NMV P71331.

Fig. 12. Paratype, large dorsal interior, NMV P71332.

Fig. 13. Small ventral interior, NMV P71333.

Orthacea Woodward, 1852**?Nanorthidae Havlicek, 1977**

Remarks. Havlicek (1977: 59) erected the Nanorthidae for the genera *Archaeorthis*, *Nanorthis* and *Trondorthis*, but noted their similarity to genera of the Ranorthidae Havlicek, 1949. He differentiated them from members of this family by the "orthoid pattern of the dorsal muscle field, absence of fulcral plates, and [their] fairly narrow notothyrial chamber". In his diagnosis and subsequent discussion, considerable emphasis is placed upon the style of dorsal musculature. Unfortunately this varies considerably within a genus and even within a species. Such variation can be seen by comparing the various published dorsal interiors of *Eodolmanella socialis* (Barrande) (Havlicek, 1977, plate 10: compare fig. 14, in which the dividing ridges between anterior and posterior adductors are nearly colinear, with fig. 10 in which these same ridges converge posteriorly at an angle of about 90°).

Furthermore, while the dorsal musculature of species of *Nanorthis* appears to vary little from the transversely divided type noted by Havlicek (1977: 59) in specimens illustrated by Ulrich & Cooper (1938: plate 12, fig. F-22), that of some species of *Archaeorthis* (e.g. *A. glomerata*, Ulrich & Cooper, 1938: plate 13, fig. B-5; *A. elongata*, Ulrich & Cooper, 1938: plate 13, fig. F-28 and *A. biconvexa*, Cooper, 1956: plate 31, fig. B-7) appear to have the ridges separating anterior from posterior scars converging posteriorly at an angle of about 135°, similar to the species described below. Such variations indicate that the classification of *Nanorthis*, *Ranorthis*, *Archaeorthis* and their relatives requires further investigation.

Archaeorthis Schuchert & Cooper, 1931

Type species. *Orthis electra* Billings, 1865.

Archaeorthis waratahensis sp. nov.

Plate 2, figures 1-14

Material examined. Holotype. NMV P71338, ventral interior illustrated in Plate 2, fig. 5.

Paratypes. NMV P71334-7, P71339-47.

Type locality. NMV PL184, from the decalcified mudstone in the middle of the Digger Island Formation, on the northern and western sides of Digger Island. See Jell (1985: 53-45) for detailed locality information.

Diagnosis. Moderately sized, ventribiconvex, sulcate *Archaeorthis* with fine fascicostellate ornament, a short, broad ventral muscle field and a weakly developed premuscle callosity which only appears late in ontogeny.

Description. Shell up to 11.3 mm wide with ventral valve averaging 78% as long as wide, dorsal valve 73% as long as wide. Shell ventribiconvex, subquadrate, maximum width being at about midlength. Hingeline averages 86% of maximum width with cardinal extremities obtuse to narrowly rounded. Ventral valve moderately convex with maximum convexity occurring in posterior half. In anterior view, lateral slopes are strongly flattened, with midportion of valve narrowly arched, carinate in some smaller specimens. Dorsal valve weakly convex with maximum convexity in posterior half, usually with well developed, though shallow V-shaped sulcus. External ornament fascicostellate, costellae rounded with about 18 costellae occurring within 5.0 mm at 5.0 mm from beak. Ventral interarea planar, apsacline, about 17% as high as wide, with open delthyrium. A single specimen (plate 2, fig. 3) exhibits what appears to be apical resorption in the ventral valve. Dorsal interarea planar, anacline, less than half as high as ventral; notothyrium broad, open.

Teeth plate-like, supported by short dental plates laterally bounding short subtriangular muscle field which extends anteriorly about 25% of valve length and is about as wide as long. Adductor scar is broad, subtriangular, raised anteriorly with a convex anterior margin, extending beyond narrowly triangular diductors. Anterior to adductors in larger specimens is a low, short, indistinct, premuscle callosity (plate 2, figs. 5, 8). Vascula media long, narrow, divergent (plate 2, figs. 6-8).

Brachioophores short and widely divergent, bounding semiellipsoidal sockets which are underlain by variably developed socket pads. Notothyrial cavity deep, platform low, variable

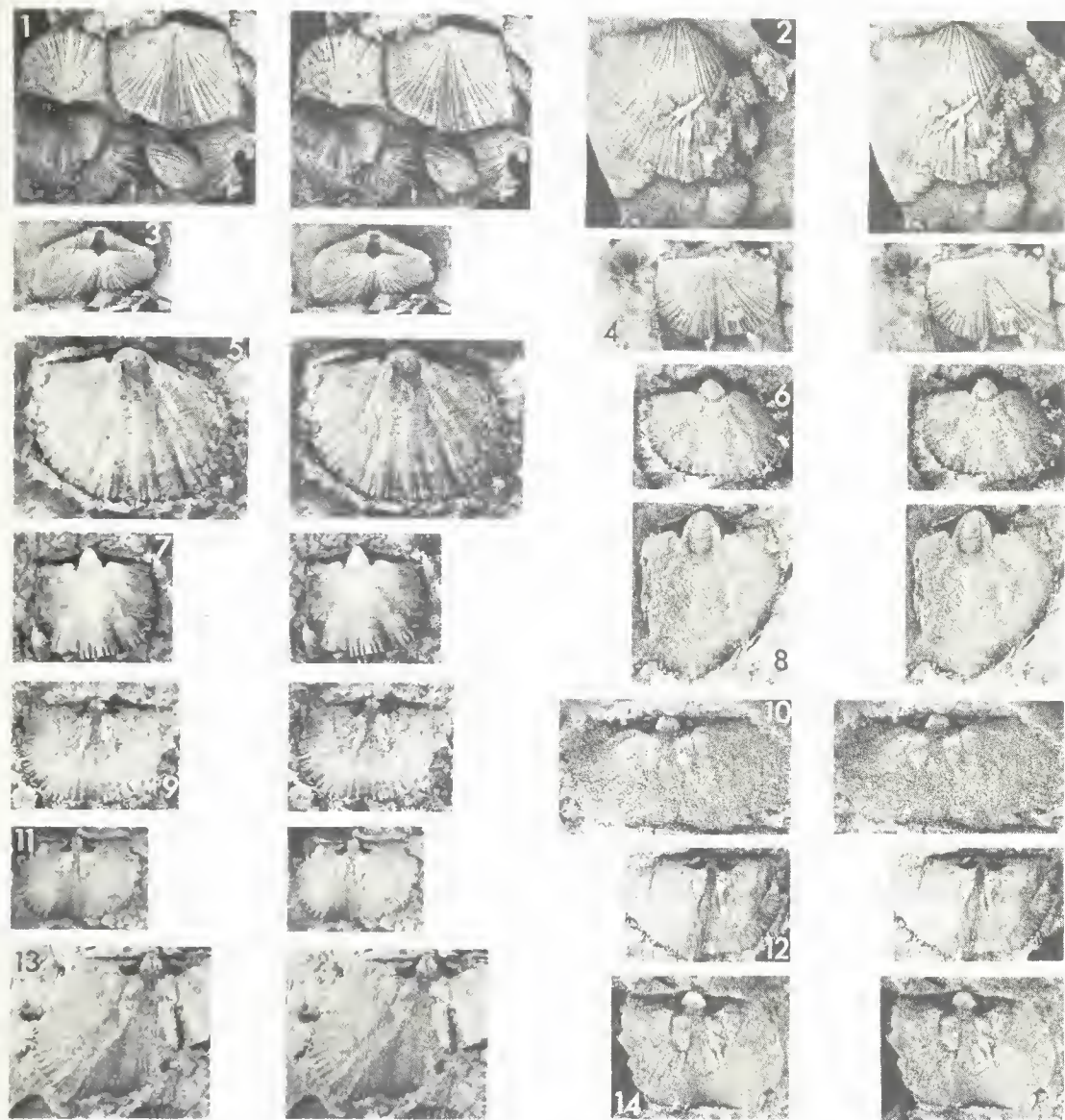


Plate 2. *Archaeorthis waratahensis* sp. nov. All 3 ×; all stereo pairs; all natural moulds except where noted.

Fig. 1. Paratype, latex replica of adjacent (L to R) ventral and dorsal valve exteriors, NMV P71334.

Fig. 2. Paratype, latex replica of large ventral exterior, NMV P71335.

Fig. 3. Paratype, posterodorsal view of latex replica of conjoined valves, NMV P71336.

Fig. 4. Paratype, latex replica of dorsal exterior, NMV P71337.

Fig. 5. Holotype, large distorted ventral interior, NMV P71338.

Fig. 6. Paratype, small distorted ventral interior, NMV P71339.

Fig. 7. Paratype, small ventral interior, NMV P71340.

Fig. 8. Paratype, large distorted ventral interior, NMV P71341.

Fig. 9. Paratype, dorsal interior, NMV P71342.

Fig. 10. Paratype, large distorted dorsal interior, NMV P71343.

Fig. 11. Paratype, small dorsal interior, NMV P71344.

Fig. 12. Paratype, dorsal interior, NMV P71345.

Fig. 13. Paratype, large broken dorsal interior, NMV P71346.

Fig. 14. Paratype, dorsal interior, NMV P71347.

in shape but usually broadly triangular with anterior constriction. Cardinal process absent. Dorsal muscle field usually well impressed, about 85% as wide as long, extending anteriorly about 47% of valve length. Posterior adductors subrhomboidal. Located immediately anterior to brachiphores. Anterior scars small, subtriangular, separated from posterior scars by narrow ridges which converge posteriorly at about 135°. Vascular system not well impressed, but where visible in some specimens, pairs of slightly divergent vascula media and strongly divergent vascula myaria can be observed as well as pair of canals arising near the brachiphore bases and extending laterally nearly parallel to the hinge (plate 2, figs. 12, 14).

Etymology. Pertaining to the locality in Waratah Bay.

Remarks. This species is about average size for a representative of *Archaeorthis* but is distinctive in having a fine fascicostellate ornament and a poorly developed premuscle callosity which is only evident late in ontogeny. It is most similar to *A. glomerata* Ulrich & Cooper, 1936 in this respect but the ornament of the latter is somewhat coarser (13 costellae per 5 mm whereas *A. waratahensis* has 18). *A. glomerata* also differs in having a relatively longer and much narrower ventral muscle field (about 60% as wide as long, whereas that of *A. waratahensis* is equidimensional).

Acknowledgements

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