

The Functional Morphology of *Neotrigonia margaritacea* (Bivalvia: Trigoniacea), with a Discussion of Phylogenetic Affinities

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ABSTRACT. *Neotrigonia margaritacea* is one of six living Australian species of the Trigoniacea, an otherwise extinct group of Mesozoic 'cockles' which dominated shallow inshore seas worldwide. The Trigoniacea have usually been grouped with the freshwater Unionacea, each within its own order, in the sub-class Palaeoheterodonta. This taxonomic decision is largely based on hinge and shell structure, but other morphological evidence does not support such a contention, *Neotrigonia* being characterised by a lack of mantle fusion and possession of 'filibranch' ctenidia, the Unionacea by well developed siphons and 'eulamellibranch' ctenidia. Such morphological discrepancies sustain lively debate in the literature, but seem to have been resolved when the ciliary pathways on the ctenidia of both groups were described to be uniquely similar.

This study re-examines living *N. margaritacea* and investigates the histology of the ctenidia in particular, and concludes that in terms of structure and ciliary pathways, *Neotrigonia* is unique, and that its affiliations lie not with eulamellibranch bivalves but with the filibranch bivalves of the Pteriomorpha.

The myophorid origin of the Trigoniacea is undisputed, as is the widely held view that the group is terminal, i.e. it has not given rise to other bivalve lineages. It is noted, moreover, that some palaeontologists regard the Palaeoheterodonta as an artificial assemblage and the conclusion of this study supports the view that the Trigoniacea and Unionacea are not closely related. I believe the Trigoniacea to represent another line of pteriomorph evolution: perhaps sharing some remote palaeotaxodont ancestor with the Unionacea, but in no greater sense than that the same ancestors are believed to be those of probably all living bivalve groups.

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The extant Trigoniacea are the living remnants of a once diverse and populous group of Mesozoic bivalves that were widely distributed in shallow seas throughout the world, and with a centre of distribution in the Tethyan realm (Stanley, 1977). Today, they survive only in the waters of the south-west Pacific and around Australia (Fleming, 1964). Six extant species are recognised (McMichael, 1956; Habe, 1985), all belonging to *Neotrigonia*. A systematic revision of the Caenozoic Trigoniidae by Darragh (1986) suggests that *Neotrigonia* evolved from *Eotrigonia* in the Oligocene or early Miocene

while *Eotrigonia* evolved from *Trigonia* s.s. in the late Cretaceous or early Tertiary. A visit to southern Australia under the auspices of the Association of Commonwealth Universities Senior Travelling Fellowship Scheme allowed examination of *N. margaritacea* (Lamarck, 1804). Because they were the most diverse and conspicuous shallow-burrowing component of near-shore marine assemblages in the Mesozoic, the Trigoniacea have received much attention from past (e.g., Lycett, 1879) and contemporary palaeontologists, e.g., Cox (1952), Fleming (1964), Newell & Boyd (1975) and Stanley