



## Two new species and a new subspecies of *Tetraclitella* (Cirripedia: Thoracica) from the Cainozoic of Australia and New Zealand and a consideration of the significance of tubiferous walls

JOHN S. BUCKERIDGE

Earth & Oceanic Systems Research Group, RMIT University, Melbourne, VIC 3001, Australia. E-mail: john.buckeridge@rmit.edu.au

### Abstract

A tubiferous cirripede *Tetraclitella judiciae* sp. nov., previously known only from two isolated and incomplete shell wall plates identified as *Tetraclitella* sp. cf. *T. purpurascens* (Wood, 1815), is described from the early Miocene of Victoria, Australia; a further taxon, *Tetraclitella purpurascens miocenica* subsp. nov., occurs in the late Miocene-Pliocene of Victoria, and specimens from the early Miocene of New Zealand, previously recorded as *Tetraclitella* sp. cf. *T. purpurascens* (Wood, 1815) are redesignated as *Tetraclitella nodicostata* sp. nov. *Tetraclitella* is the first cirripede genus known to have had tubiferous walls. Incorporation of chitinous stringers within the shell wall of early tetraclitids (e.g. *Epopella*) may have facilitated the development of the tubiferous shell wall, which permitted sessile barnacles to maximise the shell strength to calcite ratio: in doing so, these chitinous stringers not only reduced the diversion of energy required to extract calcium carbonate from seawater, but improved the effectiveness of the shell wall in resisting predators. It is also argued here that the presence of chitin within the shell increased resistance to both corrosion and corrosion, the latter becoming an increasing problem for calcareous shelled organisms following a drop in the pH of seawater after the Palaeocene-Eocene Thermal Maximum.

**Key words:** Tubiferous barnacles, Sessilia, early Miocene, Australasia, oceanic pH

### Introduction

The Tetraclitidae is a global family of intertidal and upper subtidal barnacles that are found in temperate and tropical waters. Most tetraclitid barnacles possess tubiferous shell walls comprising four plates. The earliest known tetraclitid cirripedes were described in Buckeridge (1983) from the Eocene of New Zealand. Although these early forms were not tubiferous, the structure of the shell wall facilitated the development and inclusion of chitinous stringers (e.g. in the lower Miocene *Epopella eoplicata* Buckeridge, 1983).

The earliest known tubiferous tetraclitids, recorded in Buckeridge (1983) as *Tetraclitella* sp. cf. *T. purpurascens* (Wood, 1815) and *Tesseroplax maorica* Buckeridge, 1983, occur in the early Miocene Cape Rodney Formation of North Auckland, New Zealand. The first Australian records, known hitherto as incomplete and isolated shell plates from the late Miocene of Victoria, were listed together in Buckeridge (1983, 1985) as *Tetraclitella* sp. cf. *T. purpurascens* (Wood, 1815). However, the taxonomic status of these provisional placements can now be clarified following the discovery of further, more complete material from Victoria and a subsequent revision of the living Australasian tetraclitelline barnacles by Foster and Anderson (1986).

Two living species of *Tetraclitella* from Australasia were proposed in Foster and Anderson (1986): *Tetraclitella purpurascens* and *Tetraclitella depressa*. As Woods' 1815 material (described by him as *Lepas purpurascens*) was from Australia only and is now not known to occur outside southern Australia, the name *Tetraclitella purpurascens* pertains to the Australian taxon.