PATTERNS OF LOOP DEVELOPMENT IN POST-PALEOZOIC TEREBRATULID BRACHIOPODS AND THEIR EVOLUTIONARY SIGNIFICANCE

MACKINNON, David I., Department of Geology, University of Canterbury, Christchurch, New Zealand.

Studies of loop ultrastructure reveal much about both the processes and patterns of loop growth in brachiopods. Such studies also provide useful insight into evolutionary relationships between various main loop-bearing brachiopod taxa. At least five different loop types, two short-looped and three long-looped, are recognisable in Cenozoic Terebratulida.

Loop development in short-looped forms is relatively unspectacular and of limited value for evolutionary studies. It consists of the growth of either an undulating transverse ribbon extending between two short crura (in the Family Terebratulidae) or, where crural processes are united (as in most Cancellothyrididae), a ring. In all short-looped forms the loop is derived from, and hence supported solely by, the crura throughout ontogeny.

The early stages of loop development in the great majority of post-Paleozoic long-looped brachiopods are similar. A septal pillar, located centrally in the dorsal valve floor, appears generally very early in ontogeny. Rudimentary descending branch elements are generated both from the crura and the flanks of the septal pillar. Rudimentary ascending elements develop at either the ventral or posteroventral edge of the septal pillar and consist firstly of an inverted or steeply inclined and continuously expanding cone or hood which, through resorption of its posteriorly located apex, becomes transformed into a ring. Further growth sees firstly the fusion of the anterior extremeties of adjacent ascending and descending loop elements followed by their progressive anterolateral separation from the septal pillar.

Contrasting modes of growth characterise the later stages of loop development in the three main groups of long-looped brachiopods. In Dallinidae, ascending and descending elements detach from the septum to give rise to a long, reflected loop supported only by the crura. In Terebratellidae, a pair of narrow, laterally directed but anteriorly migrating struts anchor the the descending branches to the median septum. These struts, in structural continuity with the median septum, are built up entirely from secondary layer fibres. In Laqueidae, in addition to a pair of septal struts, a pair of anterolaterally migrating vertical bands spanning the gap between adjacent ascending and descending branches provide further support. Unlike the septal struts but like the remaining ascending and descending loop elements, the vertical bands are constructed from both primary and secondary shell layers. Growth line discordancies at the junctions between the vertical bands and contiguous ascending and descending elements indicate the structural integrity of the vertical bands.