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Mapping of recent brachiopod microstructure: a tool for environmental and climate studies

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The shells of brachiopods are considered excellent archives of proxies for palaeoenvironment reconstructions. In fact, their biominerals when preserved in the fossil record have considerable potential for extending the climate and environmental record in the geological past. However, their use as fossil archives requires an understanding of how recent shells maintain or change their morphostructure and geochemistry in response to climate, environmental pressures or even ontogenetic/species-specific variation.

Here, we focus on the morphology and size of the basic structural units (the fibres within the secondary layer) of several extant brachiopod taxa, to understand their growth program and ontogenetic variation, and if and how they are affected by different environmental conditions. Twenty-nine specimens of six recent brachiopod species [*Notosaria nigricans* (Sowerby, 1846), *Liothyrella neozelanica* (Thomson, 1918), *Liothyrella uva* (Broderip, 1833), *Magasella sanguinea* (Leach, 1814), *Gryphus vitreus* (Born, 1778), *Calloria inconspicua* (Sowerby, 1846)] were chosen for shell microstructural analysis using scanning electron microscopy. The morphology and size of each fibre in the shells of these specimens (600 fibres in ventral valves and 587 fibres in dorsal valves) were described using six parameters [Max and Min ferret (caliper diameter, i.e. longest/shortest distance between any two parallel tangents on the fibre), Area, Perimeter, Convex area and Convex perimeter]. Based on the statistical analysis of these data, we conclude that: 1) There is no significant difference in the shape and size of the fibres between ventral and dorsal valves of specimen's; 2) there is an ontogenetic trend in the shape and size of the fibres, as they invariably become wider and flatter with increasing age, that is from the external posterior part to the internal anterior part of each valve. This has important implications in comparative studies of fossil shells; 3) when comparing two species of the same genus living in different environmental conditions (e.g., *Liothyrella uva* and *Liothyrella neozelanica)*, the fibres of *Liothyrella uva* are narrower and rounder than those of *Liothyrella neozelanica*, a difference that can be related to environmental differences of their habitats.