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Crystal morphology and hybrid fibre composite architecture of modern calcitic brachiopod shells

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We have investigated the texture and shell microstructure of juvenile, adolescent and adult forms of the modern brachiopod *Notosaria nigricans* with electron backscattering diffraction (EBSD). We examine textural and microstructural features of calcite biomineralization in the course of ontogenetic development. Based on the size and morphology of calcite crystals the shell of *Notosaria nigricans* is structured into two main layers which each consist of sublayers. The primary layer on the outside of the shell shows an outer sublayer composed of nanosized crystallites and an inner sublayer with micrometer sized crystallites. The primary layer is followed inward by a secondary shell layer composed of fibrous calcite crystals. The crystallographic texture of both shell layers is a strong fiber texture. Calcite c-axes is perpendicular (to 22˚ subperpendicular) to the shell vault and rotates with the curvature of the shell. Accordingly, the calcite c-axis is perpendicular (to slightly inclined) to the morphological fiber axis. In juvenile as well as in adult *Notosaria nigricans* there is a slight inclination in c-axis orientation between the shell sublayers. The distinct microstructural and textural features of different parts of the shell suggest different regimes of physiological control of biomineralization. This conclusion is entirely in concert with conclusions deduced from stable isotope distribution patterns in modern calcitic brachiopods, where in specialized structures of the shell such as the hinge, brachidium,

muscle scars or the primary layer, ^{18}O and ^{13}C are usually depleted due to biological fractionation effects.