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Microstructure and Trace Element Composition of Organophosphatic Brachiopod Shells

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Brachiopods are marine shell-forming organisms that exist since the Cambrium. Lingulid brachiopods, specifically, possess calcium-bearing organophosphatic shells as opposed to the calcitic shells of most other brachiopod species (*craniformea* and *rhynchonelliformea*; Lowenstam 1981). Their shell morphology and ultrastructure is characterized by a hierarchical arrangement and distinct rhythmic lamination pattern of up to 40 vol% of fibrous biopolymers (chitin and collagen) intimately inter-grown with apatitic grains (Williams and Cusack, 1999; Agbaje et al., 2020).

Accretionary hard parts of marine invertebrates incorporate trace and minor elements in response to environmental parameters and physiological effects.

Here we present new insights into the microstructual architecture of organophosphatic brachiopod shells *Lingula anatina* and *Discinisca tennis* via light and scanning electron microscopy (SEM). In addition we studied their major and trace element charcteristics by using electron probe microanalysis and laser ablation-inductively coupled plasma-mass spectrometry.

The shells consist of a hierarchic arrangement of perisotracum underlain by a primary layer of constant thickness and a secondary fibrous layer that varies in thickness along the shell (Williams and Cusack, 1999). The finely laminated secondary layer is characterized by strongly mineralized layers in alternation with less mineralized layers (Schmahl et al., 2008).

We will further present trace element patterns (concentrations and element-to-calcium ratios) measured along the dorso-ventral transects that will be compared to modern calcitic brachiopods.

References: Agbaje et al. (2020), RSC Advances 10, 38456; Lowenstam (1981), Science, 211, 1126; Schmahl et al. (2008) Min. Mag. 72, 541. Williams and Cusack (1999), J. Struct. Biol. 126, 227.