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Microstructures of the larval shell of a pearl oyster, *Pinctada fucata*, investigated by FIB-TEM technique

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Abstract

The structure of the larval shell of a pearl oyster, *Pinctada fucata,* has been investigated at several growing stages mainly using the focused ion beam (FIB) sample preparation technique and transmission electron microscopy (TEM). Until 12 h from fertilization, the larva does not have any calcified shells. After 18 h from fertilization, the embryo is covered with the first shell made of aragonite with the ***c***-axis normal to the shell. The cross-sectional view of the shell shows a columnar contrast, but plan-view observation revealed that the columnar contrast does not correspond to individual crystals but is related to dense polycyclic {110} twins in the aragonite crystal. After 48 h from fertilization, the larvae formed a new aragonite layer under the initial layer; a homogeneous layer with globular contrast. The ***c***-axis of the globules is normal to the shell. The orientation of the other axes is aligned locally but random in general. Additionally, larvae consisting of monolithic calcite as the inner layer were found at this stage. One to three weeks from fertilization, a new aragonite layer with a prismatic contrast is formed under the homogeneous layer. This layer consists of prismatic grains of aragonite, with their ***c***-axes parallel to the prisms. High-angle annular dark-field (HAADF) images suggest that a considerable amount of organic molecules may be contained in the homogeneous layer but not in the inner prismatic layer, implying that the texture of each layer is related to the amount of organic molecules incorporated.

Keywords: *Pinctada fucata*, larval shell, FIB-TEM, aragonite, {110} twin, HAADF