

Mineralogical characterization of calcite in the prismatic layer of pearl oyster

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It is known that most of biominerals are not pure inorganic crystals but those containing a considerable amount of biomolecule, which alters morphology and mechanical properties of the crystals. In the present study, we have investigated calcite in the prismatic layer of pearl oyster (*Pinctada fucata*), which is the most intensively studied bivalve species, using various techniques in order to understand the influence of the intra-crystalline biomolecule to the structure of prismatic calcite.

The amount of the intra-crystalline organic substance was estimated ca. 2 wt.% using TG-DTA analysis. As the thickness of the prismatic layer increases, irregularly curved sub-grain boundaries are formed in the calcite prism. High-resolution TEM observation did not find any organic films at the boundaries. Electron backscatter diffraction (EBSD) indicated that the calcite crystal changes the orientation by ~15 degrees across the boundaries. It was also found that calcite crystals without the sub-grain boundaries in the initial prismatic layer have gradual change of the crystal orientation up to ~25 degrees across the crystal. XRD analysis of the calcite crystals indicated that the peak width of the reflections in the pattern is explained partly by lattice strain. TEM bright-field imaging showed mottled contrast in the calcite crystal which must correspond the lattice strain.

These crystallographic features of prismatic calcite must be related to the intra-crystalline macromolecule. Probably the sub-grain boundaries are also formed by the interaction between the crystal and the macromolecule during crystal growth of calcite.