CRYSTALLOGRAPHIC TEXTURE OF CALCITE IN THE SHELLS OF RECENT BRACHIOPODS

A.V. Pakhnevich[1,2], D.I. Nikolayev[2] and T.A. Lychagina[2]

[1] *Borissiak Paleontological Institute of RAS, Moscow, Russia*
[2] *Joint Institute for Nuclear Research, Dubna, Russia*

E-mail: alvpb@mail.ru

Brachiopods are invertebrates whose bodies are enclosed in a bivalve shell. However, they do not belong to the Phylum Mollusca. The bivalve shell's protection arose as a result of convergent evolution, an adaptation to similar habitats. Brachiopods have been known since the early Cambrian, approximately 535 million years ago, and live in recent seas. They are filter feeders. Over millions of years of evolution, brachiopods often competed with bivalves as part of the ocean's bottom biofilter. While they were numerous in the Paleozoic era, today only about 400 species remain.

The microstructure and crystallographic texture of minerals in bivalve shells are actively studied [1], [2], [3]. However, the crystallographic texture of minerals in brachiopod shells is investigated fragmentary [4], [5]. Mostly, only data obtained using EBSD and X-ray diffraction for individual species are available. Brachiopod shells are composed of fluorapatite or calcite. Most species of brachiopods have shells made of calcite. This same mineral is also common in the shells of many bivalves.

We studied the crystallographic texture of calcite in brachiopod shells using several species of recent brachiopods. Measurements were conducted at the Frank Neutron Physics Laboratory of the Joint Institute for Nuclear Research (Dubna, Moscow Region) using the SKAT instrument situated at the beamline 7A-2 at the IBR-2 pulsed reactor. We analyzed valves of the recent brachiopod *Neothyris lenticularis* from empty shells collected off the coast of New Zealand, *Coptothyris adamsi* from Peter the Great Bay (Russia), and *Liothyrella neozelanica* and *Terebratella sanguinea* from the coast of New Zealand, South Island, and the Doubtful Sound Biological Station (New Zealand). All studied brachiopods belong to the order Terebratulida. Multiple brachiopod valves were glued together.

Our study confirmed that all valves are composed of calcite. The global crystallographic texture of calcite in brachiopod shells was measured for the first time. The obtained calcite pole figures differed from those measured using EBSD in all previously studied brachiopods [6]. The contour pattern of the pole figures (0006) and (10–14) replicates the shell shape, as previously observed in the pole figures of aragonite in the nacreous layer of bivalve valves or in the case of foliated calcite in the fossil Jurassic bivalve *Gryphaea dilatata*. This is the first time that similarity in the contour patterns of pole figures corresponding to different crystallographic directions has been noted. The pole figure (0006) easily distinguishes between the ventral and dorsal valves. The pole density in this figure is low, ranging from 1.95 to 5.10 mrd. This parameter in the pole figure (10-14) is also low, at 1.37 to 1.63 mrd. Peaks in the pole density are located in the center of the pole figures or can be extended in various directions. Example of the pole figures is presented in figure 1.

The crystallographic texture of calcite in brachiopod shells belonging to the same family varies and depends on the shell shape.

Thus, calcite crystals in the shells of recent brachiopods are characterized by a weak ordering. The isoline pattern follows the shape of the valves. Crystallographic texture features do not depend on the family of studied brachiopods.

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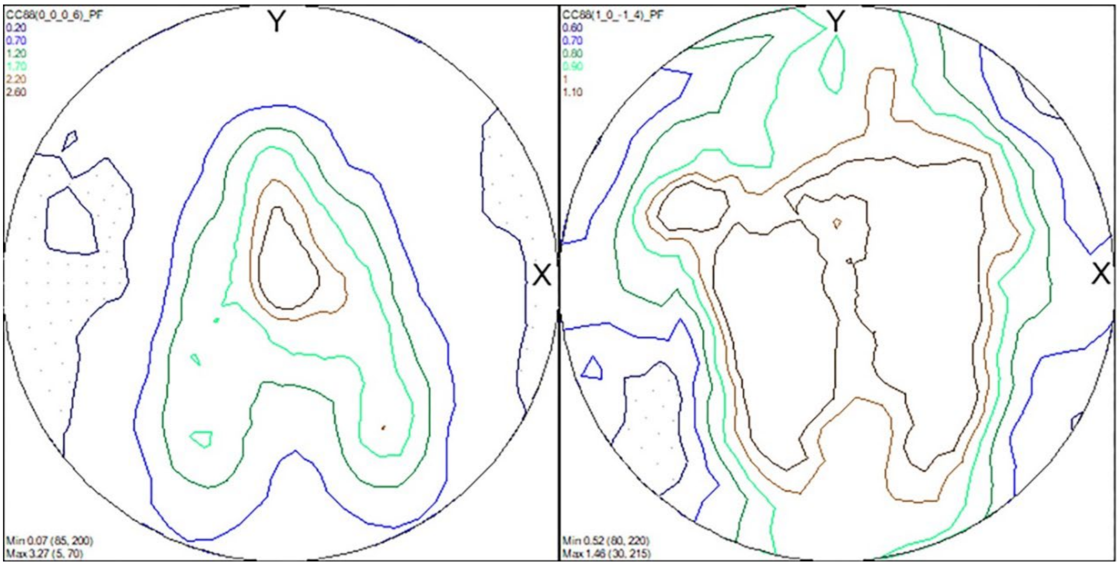

Fig. 1. Calcite pole figures in the dorsal valves of the brachiopod *Neothyris lenticularis*, New Zealand coast.