The direct attachment of P. crystallina to hydraulic engineering installations and wooden piles was not observed. It is possible that this is due to the fact that Ptygura is encountered only in the early stages of formation of fouling biocoenoses.

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THE USE OF AGE TAGS OF SHELLS TO DETERMINE GROWTH OF THE MUSSEL Crenomytilus grayanus

V. N. Zolotarev and N. I. Selin

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ANIMAL GROWTH

The internal shell structure of the bivalve mollusk Crenomytilus grayanus, collected one year after intravitam tagging, is studied. During the year there was observed invagination of the inner aragonite part of the shell in the outer calcite part. This confirms the possibility of using similar structural tags to determine the age of mollusks.

Analysis of the inner structure of mollusk shells has come into wide use in recent years in determining the age and growth patterns of these crustaceans. For this purpose periodic invaginations of the outer prismatic layer into the inner aragonite layer were proposed. The conclusion on the yearly formation of the tags was drawn up on the basis of analysis of the shell structure of specimens collected at different seasons of the year (Zolotarev, 1974). A number of investigators have used this method to determine the age of mollusks (Kartavtsev, 1976; Sveshnikov and Kutishchev, 1976; Birman, 1977, and others), but more exacting proof of the annual periodicity of structural age tags is needed.

For this reason we conducted additional investigations of the yearly cycle of changes in the relations of the basic layers of shells. In Vityaz' Bay (Peter the Great Bay, Sea of Japan) at a depth of 8 m there was collected one druse of Crenomytilus grayanus and on May 12, 1976 in adult individuals with shells 9.0-14.0 cm high, notches were made on the posterior margin of the valves. The depth of the notch did not exceed 1.5 mm. Within one year (May 30, 1977) the mollusks were recovered and their shells cleared of soft tissues and foulings. The valves were cut with a diamond saw along a line leading from the top to the posterior margin. The surfaces of the sections were ground up and processed in 3% hydrochloric acid for 10-15 sec in order to see the differences between the structures of the basic layers more clearly.

In all the mollusks investigated the shell at the site of the notch was partially regenerated with the formation of a protrusion 1 mm high and after this grew to 0.3-3.4 mm. The position of the shell margin at the time of tagging was indicated on the outer surface of the valves by a thin concentric line reflecting the short-term lag in growth. This was most distinct near the notch. At a distance of more than 1 cm from the tag the line was much less visible, caused in all likelihood by the shorter lag in growth away from the traumatic section of the mantle.

In radial sections of the valves there were visible periodic invaginations of the inner aragonite layer of the shell in the outer calcite layer, which is typical for Crenomytilus grayanus. Pale zones of growth 0.02-0.2 mm thick could be differentiated at the outer layer near the posterior margin of the shell against a brown-gray or violet-gray background. They stretched from the clear-cut concentric rings at the outer surface of the valves to the bases of the wedges of the mother-of-pearl layer and could be traced in it lying parallel with the inner surface of the shell (Fig. 1).

Laboratory of Paleoecology, Institute of Marine Biology, Far East Science Center, Vladivostok 690022.
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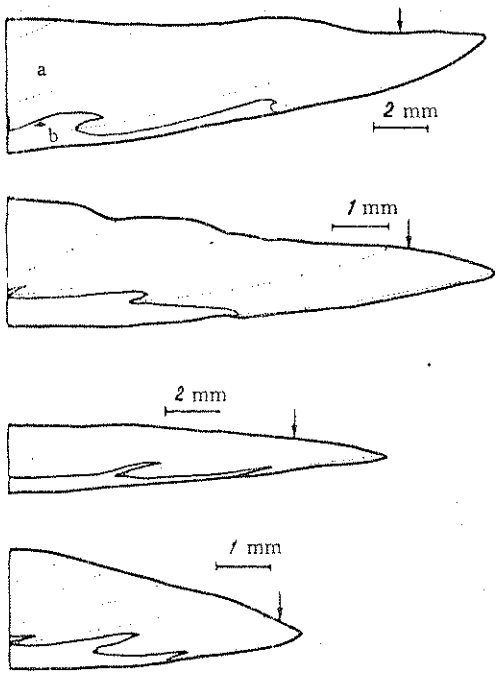

Fig. 1. Relation of outer prismatic (a) and inner aragonite (b) layers in the shells of Crenomytilus grayanus collected within a year after their intravitam tagging. Arrows indicate tagged sections.

At the time of tagging there formed at the posterior margin of the shells discernible invagination of the mother-of-pearl layer in the prismatic layer and the growth of layers with the basic tint of shell substance. In the course of the year after tagging there had formed in all the mollusks investigated a wedge of mother-of-pearl layer invaginated in the prismatic layer, and another pale zone of growth had appeared. The inner surface of the valves reached the base of this wedge.

The changes in relations of the basic layers and their reciprocal invaginations occur as a result of the periodic fluctuations in width of the mantle section secreting the outer prismatic layer. This layer was at its maximal thickness at the moment preceding tagging (Fig. 1). By May, 1976, it had become smaller and continued to decrease in the process of growth of every mollusk. Having reached the minimum, the thickness of the outer layer grew and by the time of recovery of the mollusks had again become maximal. The lag of linear growth connected with tagging was not reflected in the relation of the basic layers.

Analysis of the shell structure revealed that in Crenomytilus grayanus invagination of the inner aragonite part of the valves in the outer calcite part takes place once a year, in the summer-fall period. The pale zones of growth corresponding to the sections with maximum thickness of the outer layer form in the winter. The data obtained confirm the yearly periodicity of changes in the relations of layers which was established earlier in this species by other methods (Zolotarev, 1974; Zolotarev and Ignat'ev, 1977) and provide the basis for further determinations of the age and yearly increments of mollusks by the structural peculiarities of their shells.

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