October 22, 1963

Dr. G. C. Amstutz
Professor of Geology
University of Missouri
Rolla, Missouri

Dear Dr. Amstutz:

Thank you for your interesting letter of October 15. The separates of my last article have not yet arrived, but you shall receive one when they become available. Enclosed is an earlier article on a similar problem.

No attempt has been made to study the orientation of the aragonite crystallites in the oyster, although I have been thinking about doing that. However, there are electronmicroscope studies of the aragonitic muscle pad in Nautilus. Because the latter is a mollusk too and the muscles of both forms are presumably homologous, one might expect similar features in both, Crassostrea and Nautilus. Compare Grégoire, Charles, 1962, on submicroscopic structure of the Nautilus shell: Inst. Royal Sci. Nat. Belgigue Bull., v. 38, no. 49, 71 p.

It is generally assumed that the nature of the conchiolin determines which allomorph of calcium carbonate is deposited in the shell. When the calcium carbonate crystals begin to form they are growing on a substrate of conchiolin and ultimately each crystal is completely enveloped by conchiolin deposited concomitantly. The electrical charges and their distribution on the surface of the conchiolin form an automation command pattern, so to say, that determines how the various ions of the calcium carbonate have to arrange themselves as they settle on the conchiolin substrate. The conchiolin base layer of the valve in Crassostrea is deposited by the epithelium of the mantle lobe, but no such epithelium intervenes between valve and adduction muscle. The latter is attached directly to the valve. This situation seems to be the reason why calcite and aragonite can be deposited side by side.

All mollusks have aragonite muscle pads, provided they have a calcium-carbonate shell at all. That means the aragonite muscle pads in the oysters are primitive inherited features, whereas the calcitic shell of the oysters is not the primitive condition but was developed as a special oyster innovation after the end of the Permian. I suspect calcite is more suitable than aragonite as a shell constituent in the conditions under which oysters grow, but aragonite is more suitable than calcite where tensile stress is more or less constant as at the place of muscle insertion. For this reason the primitive inherited aragonite pad was retained by the immediate ancestors of the oysters while the rest of the shell changed over to calcite. The question is why is aragonite more suitable than calcite where tension is present while the crystals grow (muscle Pad) or where compression is present (resilium). Do you have any suggestions? How about ease of cleavage?

With best wishes

Sincerely yours,

H. B. Stenzel

HBS:elh

Enclosure: Article on aragonite

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