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# Crystalline organization of the fibrous prismatic calcitic layer of the mussel Mytilus

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The outer layer of the members of the genus Mytilus is made of long, slender fibres of calcite (about 1-2 $\mu$m wide and hundreds of $\mu$m long), which reach the internal shell surface at an angle. This microstructure has been called fibrous calcitic and its organization, crystallography and relationships to the organic phase are poorly known. We have studied the outer calcitic layer of mussel Mytilus by means of optical and electron microscopy (SEM and TEM), XRD and AFM. All data together imply that such a layer is extremely well ordered both from the morphological and crystallographic viewpoints. XRD pole figures show discrete 001 and 104 maxima, indicating a well defined sheet texture. In living animals an organic layer, with a fibrous aspect, carpets the inner shell surface. TEM sections of the decalcified material show that the organic layer is mainly proteinaceous and internally banded, and it fills all the spaces left between the growing calcite fibres. Each calcitic fiber is a monocrystal with three well developed {104} rhombohedral faces at its growth end. One of such faces is directly in contact and strictly parallel to the organic layer and to the shell surface. AFM experiments consisting in submerging shell fragments in supersaturaturated solutions with respect to calcite indicate that the calcitic fibres of the shell can easily regrow across the organic membrane, which thus seems to be permeable to ions. In this way, calcitic prisms are able to grow despite the existence of the intermediate membrane in the living animal. The organic surface membrane is most probably also responsible for the high degree of ordering of the fibrous calcitic layer. The orientation of a (104) rhombohedral surface parallel to the protein layers might be determined by similarities in the distribution of charges. This is one of the very few cases in which the influence of the organic matter on the organization of microstructures can be inferred.