

SUMMARY

Mollusc shells are the only biomineralizing invertebrates that create an aragonitic crossed lamellar structure. The shell of *Patella crenata* from the Canary Islands, Fuerteventura, consists of both calcitic and aragonitic crossed lamellar layers. Between the outer calcitic crossed lamellar layers and the inner aragonitic material exists a ring-shaped ribbon of the attachment area of the retractor muscle; the myostracum which mainly consists of aragonite. The inner aragonitic crossed lamellar layer was found to contain prismatic intercalations with some content of organic material. No detailed studies on structural and orientational features within the lamellae of the calcitic and aragonitic material on a local length scale are known. Hence, inelastic light scattering techniques and X-ray diffraction was used in order to study the local and macroscopic structural characteristics of the shell of *Patella crenata*.

Some information on the biomineralization process, including the deposition of protein sheets, phase control in material chemistry and models of oscillatory zoning are available. Bandel and Geldmacher (1996) showed that the calcitic crossed lamellar layers of *Patella crenata* contain Mg, Fe, Zn, Mn, Co, and Cd while the aragonite layers preferentially contain Sr, Br, and Pb. The spatial chemical analysis of the distribution of Sr in the aragonitic lamellae and of Mg in the calcitic lamellae confirms significant zoning. Up to now nanometer-scale features of the crossed lamellar structure of the aragonitic material were not well understood. Therefore in this work, spectroscopic, diffraction and high-resolution electron microscopy studies were performed in order to correlate macroscopic and microscopic qualities and to determine the size of the smallest well-organized clusters in the shell.

The aim in this work is to elucidate on different lengths scales topological and orientational features of the crossed lamellar structure of the shell of *Patella crenata* in order to better understand the relationship between local structural characteristics and macroscopic physical properties as well as aspects of the biomineralization process.