Poster Presentation

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Microstructure and crystallographic texture of Ranella Olearia Shell

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Molluscs are soft-bodied animals, that why many of them invented complex strategies for protecting themselves [1]. One of these strategies consists in creating a rigid biomineral called mollusc shell. Mollusc shells are complex biocomposites of mineral and organic material (5% in volume) with high mechanical performances, compared to the geological mineral. Mollusc shells are mainly made of calcite and aragonite crystalline polymorphs of calcium carbonate. This organic part behaves as nanometer growth-control of the inorganic crystals. This has stimulated chemists and materials scientists to design materials with a microstructure similar to that of nacre. To achieve this, understanding the microstructure of the nacre at various scales is certainly the key [2]. In this work we made use of the Combined Analysis [3] to determine the structure and preferred orientations of constituting aragonite crystallites of the Ranella olerea shell (fig. 1a) layers using scanning electron microscopy and X-rays diffraction. SEM analyses (fig. 1b) show the presence of an inner layer composed of Radial Lamellar, an intermediate comarginal crossed lamellar layer and an outer crossed lamellar layer. The refinement of X-ray diffraction diagrams gives the textures of the three layers, their respective aragonite unit-cell distortions, and the macroscopic elastic tensor of their mineral parts. The textures of the three layers were found to be of high level, especially for the inner layer. Both intermediate and outer layers exhibit regular texture patterns for crossed lamellae with a split of the c-axis component around the normal to the shell. An anisotropic unit-cell distortion is quantified for the three layers which is attributed to the combined effects of inter- and intra-crystalline macromolecules. The simulation of the macroscopic elastic tensor shows that the strong orientations present in the successive layers give an optimisation in terms of rigidity and shear resistance.

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Figure 1a: The *Ranella olearea* shell.

Figure 1b: Cross-section SEM image of the fractured shell at the location indicated in G, M and N indicate the Growth, Margin and Normal directions, respectively.

Keywords: Biomineralisation, Ranella olerea olerea shell, combined method analysis