

Organic Inorganic Interfaces in Biominerals: Unveiling the complex structure of two calcitic biomineral models the red coral *Corallium rubrum* and the Mediterranean fan mussel *Pinna nobilis*.

Benazir KHURSHID

Ligne ANATOMIX, Synchrotron SOLEIL, Gif sur Yvette et BIOGEOSCIENCES, UBFC, Dijon

Vendredi 16 décembre 2022 – 9h45
Amphithéâtre SOLEIL

Biominerals are organo-minerals structures produced by living systems. Since the Cambrian, they contribute to the adaptation of living organisms to different environments by fulfilling a variety of combined functions that go along with adapted morphologies. One of the aims of biomineralization is to understand how organisms "sculpt" these complex morphologies, at nano and molecular scales. The aim of this PhD work was to understand the complex relationships between the organic and mineral phases. To this end, I studied two calcitic biomineral models: 1) the red coral *Corallium rubrum* and 2) the prismatic shell of the Mediterranean fan mussel *Pinna nobilis*. My work deals with two different - but complementary - approaches to understand the complex mechanism of biomineralization: one is based on physio-chemical characterization, the other, on biochemical and proteomic analysis of the organics contained in the biomineral.

For physio-chemical characterization, I have used three different imaging techniques available at Synchrotron-SOLEIL: X-ray microtomography, Deep-UV luminescence imaging and at last, secondary harmonic generation (SHG) microscopy for analyzing the red coral. These combined high-resolution techniques illustrate different facets of the structural complexity of this model. In parallel, the organic matrix contained in the calcitic prismatic shell layer of the fan mussel *Pinna nobilis* was biochemically characterized. In addition, the whole set of prism-associated proteins was obtained by proteomics. Furthermore, I analyzed more specifically one 11KDa protein named accripin11, to understand its role in the prism formation process. Finally, I developed a novel technique in biomineralization - based on AFM imaging with antibody-functionalized tips - that allowed localizing accripin11 on the surface of the shell prisms with a nanometric resolution. In summary, my work contributes to the advancement of imaging tools to observe biominerals and to better understand the distribution of organics in these complex structures. It represents one of the few attempts to bridge the gap between biology and physics in biomineralization studies.

Les membres du jury sont :

Pr. Ingrid M. WEISS, Université de Stuttgart, Allemagne
Dr. Joël GAUTRON, INRAE, Nouzilly
Dr. Sylvie TAMBUTTE, Centre Scientifique de Monaco
Pr. Antonio CHECA, Université de Grenade, Espagne
Dr. Daniel VIELZEUF, CINA, Université d'Aix-Marseille
Dr. Jonathan PERRIN, Scientifique, Synchrotron SOLEIL, Saint-Aubin
Dr. Frédéric MARIN, Biogéosciences, Université de Bourgogne - Franche-Comté

rapporteuse
rapporteur
examinatrice
examineur
examineur
co-directeur de thèse
directeur de thèse



Vous êtes cordialement invités au pot qui suivra

SYNCHROTRON SOLEIL
L'Orme des merisiers - Saint-Aubin - 91190 GIF S/YVETTE
www.synchrotron-soleil.fr/fr/evenements
CONTACT : sandrine.vasseur@synchrotron-soleil.fr

THÈSE