INVESTIGATION OF SEVERAL MOLLUSCK SHELLS FROM DANUBE DELTA AND CONSTANTA BLACK SEE SHORE BY MEANS OF SMALL-ANGLE NEUTRON SCATTERING AND ION BEAM ANALYSIS METHODS

Maria Bălăşoiu[1,2], Dmytro Soloviov[2,3], Dmitry Nikolayev[2], Tatiana Lychagina[2], Nikolai Lizunov[2], Ana Pantelică[1], Dan Pantelică[1], Diana Maria Mihai[1], Ibram Orhan[4], Marius Belc[5], Mirela Mihaela Bratu[5], Liviu Miron[6] and Alexandra-Maria Bălăşoiu-Găină[2,7]

[1]*Horia Hulubei National Institute of Physics and Nuclear Engineering, Magurele, Romania*
[2]*Joint Institute for Nuclear Research, Dubna, Russian Federation*
[3]*Institute for Safety Problems of Nuclear Power Plants, NAS of Ukraine, Kyiv, Ukraine*
[4]*"Danube Delta" National Institute for Research and Development, Tulcea, Romania*
[5]*University Ovidius of Constanta, Constanta, Romania*
[6]*Iasi University of Life Sciences, Iasi, Romania*
[7]*West University of Timisoara, Timisoara, Romania*

E-mail: masha.balasoiu@gmail.com

Humanity has consciously used biological materials such as bone, ivory and shells, since prehistoric times due to their special physical and chemical properties. The composite nature of biological materials at the nanolevel, in combination with a specific structural hierarchy up to the macroscopic level, provides them with exceptional properties [1].
Understanding the microstructure of the water mollusk shells is nowadays of great importance due to the fact that this structure may consist in a model for innovative nanostructured materials in various domains. The micro-structure of the shell is based on the "bricks and mortar" pattern, specific for the molluscan exoskeleton. "The bricks" consist in polygonal aragonite tablets in the case of the nacre or in calcite tablets, joined together by the matrix proteins synthetized by these organisms ("the mortar"). These proteins have special properties; the bio-activity studies performed on human fibroblasts, stroma cells and mouse pre-osteoblasts show the nacre soluble matrix ability to induce the cell differentiation to the osteoblast phenotype. Also the alkaline phosphatase activity rise and bone nodules are formed in the presence of the shell matrix proteins. The structure and functions of these proteins are poorly known till now. As consequence, the understanding of the microstructure and the synthesis process of the molluscan shell is of big importance in order to create new biomimetic materials with applicationsfor example,in the medical domains [2].Structural investigation of biogenic materials, can lead to the development of new synthetic strategies for controlling mineral morphologies [3].
Small-angle neutron scattering method is largely usedin the studies of biominerals and biomineralization processes [4, 5]. In the present work, we explore the potential utility of small-angle neutron scattering (SANS) for investigating and ultimately differentiating the structure of mollusk shells based on species and locality of origin. The measurements have been accomplished at the YuMO instrument in function at the IBR-2 reactor.
For composition determination of the samples, the proton induced X-ray Emission (PIXE), proton induced gamma-ray emission (PIGE) and Rutherford backscattering spectrometry (RBS) measurements with alpha beam on thick samples have been performed at the 3MV Tandetron of IFIN-HH, Magurele [6].
Earlier at FLNP JINR have started investigations on the crystallographic texture of bivalve shells [7, 8, 9]. It was observed that the shells of mollusk species of the genus *Mytilus* consist of two phases, calcite and aragonite. It was concluded that the nature of the global textures of different phases in the same shells is different [8]. In addition, it was found that during the growth of the shell of some species (Sinanodonta woodiana), the crystallographic directions, a and b, of aragonite are reoriented and the strength of the texture increases [9].

Investigations of bivalve shells from the Gulf of Saldanha (South Africa) showed the existence of some correlation between the crystallographic texture and composition with respect to a number of chemical elements [10].

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