

## **NEW ANTIFOULING PRODUCTS FOR IN SITU CONSERVATION OF ARCHAEOLOGICAL ARTIFACTS LOCATED IN UNDERWATER ENVIRONMENT**

**Ricca, M.<sup>1\*</sup>; Rovella, N.<sup>1</sup>; Comite, V.<sup>1</sup>; Crisci, G.M.<sup>1</sup>; Macchia, A.<sup>2</sup>; Ruffolo, S.A.<sup>1</sup>;  
La Russa, M.F.<sup>1</sup>**

<sup>1</sup> *Department of Biology, Ecology, Earth Sciences, University of Calabria, Via Pietro  
Bucci, Arcavacata di Rende (CS), Italy*

<sup>2</sup> *Youth in Conservation of Cultural Heritage, YOCOCU, Largo dei Quintili, 21, Rome,  
Italy*

Presentation preference: Poster

Topic: TECHNIQUES

This research is part of the national project entitled COMAS (Planned COnservation, “in situ”, of underwater archaeological artefacts), concerning the degradation phenomena occurring during the permanence of archaeological items in underwater environment and their conservation in situ by means of new methodological approaches. In particular, the first topic of this study is to evaluate the rate and type of biological activity on marble stone specimens in seawater that, as well known, it changes according to the colonized substrate features. The second aim was to study the growth and the differences in biocolonization on treated stone materials and it is intended as a contribution to understand both the degradation forms resulting from biological activity and to test new protective products for the conservation of such materials, by using nanotechnology. Regarding nanotechnology, nanomaterials with antimicrobial and photocatalytic features were selected and undergone to experimental procedures with the aim of making antifouling products suitable for the protection of stone materials in underwater environment.

For the first time, nanomaterials (nano-powdered TiO<sub>2</sub>, ZnO and Ag) were dispersed in siloxane wax (used as binder) in order to make possible the application of the products in underwater environment.

The experimental procedure was set up in the underwater archaeological park of Baia (Naples, Italy) in the area of the *Villa con ingresso a protiro*, on marble test-pieces, in order to compare the variation of biomass at increasing intervals of permanence in marine environment after being treated with different antifouling products. Laboratory procedures with the aim of assessing some specific properties of nanomaterials/binder mixtures as inhibitors of the marine biomass and their relation with the lithotype were carried out. In particular: colorimetric and contact angle measurements in addition with biological tests were performed. Later, several marble specimens were treated, anchored to a sample holder and immersed in the marine area of Baia. All samples were placed simultaneously and at increasing time intervals, some specimens were recovered and subjected to investigations. In particular, transmitted light optical microscopy and scanning electron microscopy (SEM) coupled with microanalysis (EDS) were used to study the biological colonization and the interactions with treated stone specimens, assessing the permanence of the antifouling products dispersed in wax and their effectiveness over time.

\* Corresponding author: M. Ricca [michela.ricca@unical.it](mailto:michela.ricca@unical.it)