

## The MaTaCoS Project: New Perspective in the Conservation of Underwater Cultural Heritage

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### Abstract

MaTaCoS project aims to improve the conservation of underwater cultural heritage by new methods, technologies and tools suitable for the underwater environment. Main objective is the protection and enhancement of underwater archaeological artifacts in accordance with UNESCO 2001 (UNESCO Convention on the Protection of the Underwater Cultural Heritage, November 2, 2001), raising the awareness and tourism attractiveness in UCH sites, and supporting their preservation in situ.

### INTRODUCTION

This work is part of a research project called MaTaCoS (Advanced materials and technologies applied to the conservation of underwater cultural heritage) funded by the Italian Ministry of Economic Development (MISE), concerning development of innovative tools and methods for the protection of Underwater Cultural Heritage, with particular regard to cleaning and consolidating procedures to be carry out directly in situ.

In recent decades, interest in studying degradation phenomena occurring on archaeological sites located in underwater environment considerably increased. Different studies are focused both on the degradation phenomena on the stone materials located in underwater environment and on innovative approaches for their cleaning and protection. As is well known, one of the most damage of submerged artifacts is due to biological colonization (bio-fouling) which develops differently according to environmental conditions. The project is focused on: a) the study and characterization of archaeological materials and degradation forms in a selected Underwater Cultural Heritage (UCH) pilot site; b) the realization of electrical mechanical tools suitable for cleaning in situ; c) the testing of innovative mortars, to be applied directly in situ, for preventing the biological growth. In this way, nanomaterials with antimicrobial property, consolidating power and acceptable environmental impacts will be tested, both in laboratory and in situ.

In addition, the project will develop a monitoring system based on the acquisition of images and environmental parameters (such as temperature, pH, illuminance, etc.), both to validate the efficacy of the products against biological activity and to be proposed as an adoptable solution for the UCH sites management.

The S. Marinella underwater archaeological site (Rome, Italy) was chosen as pilot site for MaTaCoS project (Figure 1).

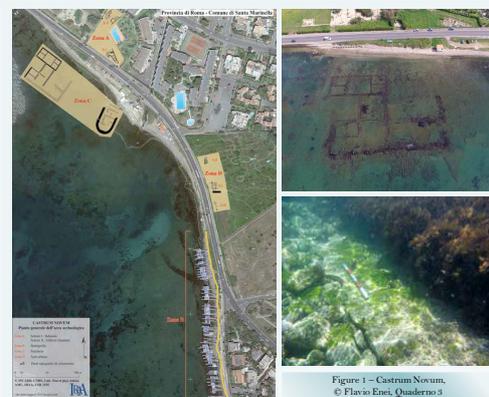


Figure 1 – Castrum Novum, © Flavio Enzi, Quaderno 5

### MATERIALS AND METHODS

After sampling, for a complete characterization of selected archaeological fragments, different and complementary techniques will be undertaken in order to: a) define the mineral-petrographic features; b) investigate their state of conservation. In particular, analytical methods include: observations under a stereomicroscope, polarising optical microscopy (POM) on thin and stratigraphic sections, X-ray powder diffraction analysis (XRPD).

After characterization of archaeological materials and decay, the cleaning of the submerged site will be carried out by using specific and mechanical tools specially developed taking into account the type of materials and degradation forms.

In a second analytical step, mortar test-pieces will be produced in laboratory by using different raw materials and by adding nanomaterials. They will be anchored to a sample holder and immersed in the archaeological area of S. Marinella in order to monitor the biological growth at increasing time intervals of permanence in seawater. Monitoring (both images and environmental parameters) will be ensured thanks to the use of specially made in situ probes and tools

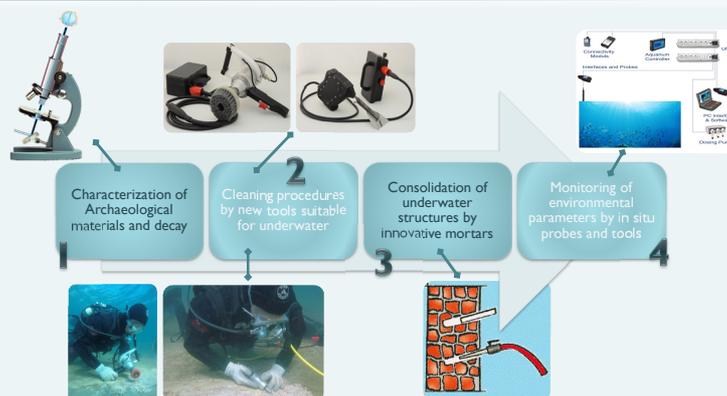


Figure 2 – Main stages of MaTaCoS Project

### EXPECTED RESULTS

The project results are expected to play a significant role in the cultural heritage research field and have a great impact on the preservation of submerged sites. In particular, the new tools and product developed during the project will allow conservators and restorers to use such innovative materials and tools to protect cultural heritage from underwater environments. In particular, as far as concern the instruments suitable for cleaning, we expect to develop tools suitable for the different materials and able to remove even the most persistent encrustations, without damaging the archaeological substrate.

With regard to laboratory and on-site tests by using mortar specimens, we expect to develop an underwater mortar with high consolidating power able to minimizing biological growth on archaeological structures. The effectiveness of mortars over time will be evaluated thanks to the monitoring system that will be installed in the pilot site.

### CONCLUSION

MaTaCoS project represents a milestone for the development of innovative solutions for preservation, cleaning and monitoring of UCH, by proposing novel methodological approach based on the use of nanotechnology and tools to be used directly in situ.

### ACKNOWLEDGEMENTS

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