New technologies and tools to map and protect underwater treasures

March 2 2016

Our seas and oceans are home to a tremendous amount of archaeological sites and artefacts. These invaluable witnesses to history are often difficult to locate, and even then experts are still faced with the question of whether to conserve them in situ or bring them to the surface. The SASMAP project has developed tools and technologies that will help solve both conundrums.

The value of underwater cultural heritage no longer needs to be proven. According to UNESCO estimates, some 3 million ships wrecks are spread across the world's ocean floors. And that's without counting submerged heritage sites: In Denmark alone, where the 'UNESCO Scientific Colloquium on the Access to Underwater Cultural Heritage' will take place from 8 to 9 June 2016, around 20 000 sites can be found. It therefore comes as no surprise that the National Museum of Denmark, as coordinator of the SASMAP project, set out to help archaeologists to better map and protect these hidden treasures.

The SASMAP concept was born from two main observations. The first one is that the huge potential of underwater cultural heritage is in contrast with how it is undervalued. The Vasa Museum in Sweden, for instance, attracts as many as 1 million visitors per year largely thanks to its huge Swedish warship of 1626 that was recovered in 1961.

The second one, and the most important, is that excavation is not always the most realistic and preferable option. As pointed out on the SASMAP website, 'a single large wooden wreck, such as the Mary Rose in the UK,

has to date cost ca. 80 million Euros to raise, conserve and exhibit, whereas the physical in situ preservation of a similar sized wreck in Sweden cost around EUR 0.07 million'. Sometimes bringing such cultural heritage back to the surface can also damage it beyond repair.

Dr David Gregory, coordinator of SASMAP, explains how the project's tools and technologies will help archaeologists in their quest to locate and analyse heritage sites, but also to decide on the best conservation option.

What are the main problems related to locating and conserving underwater sites?

I will try and answer this question in two parts. Firstly, the issue of locating, and secondly, matters relating to conservation. Locating sites is generally difficult as sites are underwater and this makes diver-based searches far more labour-intensive and expensive. These operations are often hampered by poor visibility and arduous working conditions. Furthermore, even though one often has the picture of a shipwreck sitting on the seabed, prehistoric remains and landscapes are often buried, and so are more ancient shipwrecks. This has been solved with an increased use of acoustic survey techniques that can very accurately predict, record and model what is lying on the seabed and within the seabed. A new type of acoustic device that can look into the seabed in 3D has also been developed within the project and is already being taken up by other marine researchers, not just archaeologists but also geologists, etc.

Now in terms of conservation, there are two aspects to consider—one is what is called in situ preservation, that is to say locating, documenting, protecting and monitoring sites where they lie on the seabed. This approach is very much the current ethos within maritime archaeology

both at a European level and internationally—there are several treaties which argue for this approach. However, sometimes in situ preservation is not appropriate as sites are at risk of being damaged by natural processes. Wherever possible, it would be best to excavate the items, bring them safely to the surface and conserve them for storage and display in e.g. Museums. The SASMAP project looked at both aspects of conservation.

How do the SASMAP tools help overcome these problems?

The SASMAP project was very holistic in its approach. The idea was to develop various tools to locate sites using desk-based models. This was facilitated on two sites, one in Denmark where submerged prehistoric remains can be found and one in Greece, for submerged classical remains. We established where the sites may be located before sending divers to verify our findings and starting to make an appropriate plan for the management of these sites.

The main question was, if we want to leave a site where it is what are the likely natural threats to it? These could for example be the effects of currents that can relatively quickly wash away covering and protecting sediments, leading to the loss of finds or an entire site. It may be that exposed parts of wrecks or sites are threatened by damaging organisms such as shipworms (see www.wreckprotect.eu – a further FP7 project looking into protection of underwater cultural heritage) that in the right conditions can quickly eat wood. The project partners developed tools that could assess the open seawater environment and burial environment in order to classify whether the site environment was conducive to preservation or not.

These tools included a remote data logging device which could collect

water quality parameters such as salinity, temperature, depth, dissolved oxygen and current strength; and three diver-held devices: a data logger measuring various parameters within sediments, another that was developed to take sediment samples from the seabed for further analysis in lab conditions, and a third one that was used to assess the state of deterioration of wood underwater, in situ.

What can be done to protect these sites?

Even when kept in situ the sites often need to be protected. One way this was investigated was the development and use of artificial sea grass, which helps stop underwater currents from removing sediments.

Now if it is decided to excavate artefacts, they are often very fragile and can easily be broken on the way to the surface and during transport back to the laboratory. Methods were developed to consolidate sediments around artefacts (those found in sand are often difficult to excavate safely as the sand simply falls away). This was achieved by using environmentally-friendly polymers that effectively turn the water in the sand into a thick gel which can be easily removed once in the laboratory. Another method entailed what is termed block lifting, that is to say where artefacts encapsulated in thick sediments, such as clay, are lifted as a block and can then be excavated back in the laboratory under safe, controlled conditions.

One of the project's initial goals was to help improve legislation. How?

In Europe the majority of underwater archaeological investigations and excavations are carried out as a result of subsea development. That is to say when a pipeline, wind farm, cable or any other structure is to be placed on the seabed.

We hoped to improve legislation by creating two generic guidelines which explain the process of what is called developer-lead archaeology and how the various stakeholders can approach this. Very often project managers working on such projects may not be archaeologists or geologists so we wanted to simply show how this can be done. A second contribution was to provide case studies and examples of how this can be achieved practically by drawing from the results of SASMAP.

The developer-lead process falls under the Treaty of Valletta, which concerns the management of cultural heritage. In situ preservation is generally the preferred option, but often it can be a case of out of sight, out of mind.

What did you learn from testing your tools and methods in Denmark and Greece?

The two main sites were in Denmark and Greece but various tools were also tested in Italy and the Netherlands. The open water data logger was tested in the Netherlands and was superb at assessing the strength of currents over a wreck which was being protected using the artificial sea grass mats developed in the project. Both systems worked very well.

In Denmark the sediment/seabed logger, sediment coring device and wood tester were all tested and proved very successful at assessing the various environments and materials.

The 3D sub bottom profiler, which can look into the seabed, was validated in Denmark, Greece and the Netherlands but was most successfully used outside of the project by Belgian geologists who were very interested in the development of the equipment and used it to help locate the remains of Roman and medieval fish traps.

The project was completed in August. Are you still working on it?

Yes very much so! As coordinator I am currently finalising the comments from our final review and the finances of the project. Scientifically, we are waiting for final approval of our guidelines by reviewers and the Commission before publishing, and the consortium is working on the publication of numerous popular and scientific articles. We are also looking into the possibility of publishing a more synthetic book on the overall results of the project and management of underwater cultural heritage.

What are the main target markets for your project and when/how can they hope to benefit from its results?

It is certainly hoped that the underwater cultural heritage community will adopt both the general and holistic approach developed within SASMAP. But also, as the project was focused on supporting SMEs, we hope that our four partner SMEs will benefit from the project.

The market potential reaches far beyond archaeology and can impact marine sciences and ocean exploration in general. Several of the products are already on the market and others are close to that, which is a fantastic achievement.

More information: Project website: sasmap.eu/typo3temp/tx_ncstati … asmap.eu//index.php/

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