VirtualArch

Visualize to Valorise – For a better utilisation of hidden archaeological heritage in Central Europe

O.T1.3. Regional strategy for the pilot region 7 – Medieval harbour Puck, Pomerania (PL)

Project

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	3. Museum of Natural History, Vienna, Austria (AT)
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Output

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Statement of originality

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

1. Description of pilot site – submerged medieval harbour in the Puck Bay

The pilot archaeological site studied as a part of VirtualArch in Poland is the remains of the harbour in the Puck Bay. They are located about a kilometer on the NW from the center of today's city of Puck. Like many spectacular and valuable archaeological sites, it was also discovered by chance in 1977 thanks to a group of diving enthusiasts.

The site was covered by systematic excavations shortly after the discovery. The first research was conducted by Wiesław Stępień (until 1984), then it was resumed by the Central Maritime Museum (1990s) in cooperation with the Department of Underwater Archeology of the Nicolaus Copernicus University. The division of the site area into sectors was made, as well as a sketch of the site together with documented remains (horizontal constructions, el. vertical, fascine, stones, and more) was prepared. The most valuable finds from this time of research include four discovered boat wrecks. The 90s under the auspices of CMM brought changes in the form of the demarcation of a new geodetic grid, another registration of relics lying on the bottom, as well as a strong emphasis on environmental research for the reconstruction of the landscape from the Middle Ages. Work on documentation and raising of wrecks has also been intensified.

With the current state of knowledge, the area of the harbour is about 16 ha, while accurate documentation of the site is still about 30% of this area. Nearly 7.5 thousand vertical construction elements were documented and hundreds of other elements prepared by human hand in the times of the functioning of the medieval harbour. The most suggestive, however, is the slightly larger perspective in which the lines of arranged wooden elements and unnatural concentrations of stones allow to sketch likely spatial arrangement of the harbour.
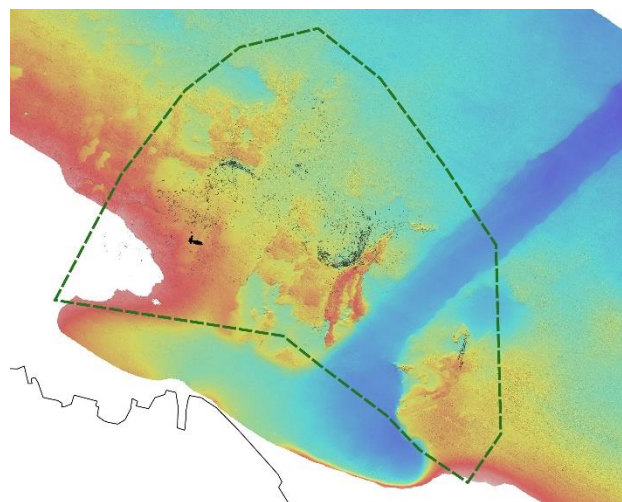

Fig. 1. The protected area of the site (bathymetric map)

2. Aims and results achieved through visualization

Underwater archaeological heritage has always been perceived as an extremely difficult material to present to a wide audience. On the one hand, this is due to the historic structures being deposited at the bottom of the water reservoir, and on the other due to the low effectiveness of traditional forms of presentation such as drawing or photo. It is for these reasons that the goal of our work has been to prepare visualization materials that are a realistic reflection of the functioning of the harbour in Puck using the latest and attractive forms of communication.

A multi-beam sonar was used, to scan the entire area of the archaeological site (see Fig. Above). The data collected in this way allows the visualization of harbour's relics on a macro scale, additionally giving the possibility to include paleogeographic observations such as the variability of the shore of the Puck Bay compared to the current state.

The above imaging is supplemented with scans using parametric sub-bottom profiler (SBP). With the help of this innovative technique, it has become possible to observe sediments in a way impossible to obtain by conventional methods, because using non-destructive scanning we have the opportunity to analyse structures under the surface of the sea floor. The team of researchers from the Centre for Underwater Archaeology recorded, among others one of the boat wrecks and the paleochannel of the Płutnica River, which was an important element of the natural environment for the early Middle Ages community.

An orthophotomap is a set of data on a similar scale that is made for the needs of the project. It was made at the most convenient time, i.e. before the underwater vegetation blooms. This made it possible to observe archaeological structures as well as peat ranges at the bottom of the Puck Bay. Due to the high degree of similarity to commonly available satellite images (geoportals, navigation applications), the orthophotomap is a persuasive visualization tool of the hidden archaeological heritage for a wider audience.

Models of objects and artifacts lying under water were also made during the project. This work required extensive experience of the underwater photographer, high precision, and skills while so-called post-processing. High-resolution 3D models have been prepared based on hundreds of photos taken from different perspectives underwater. The visualization aspect is in this case literally "at the
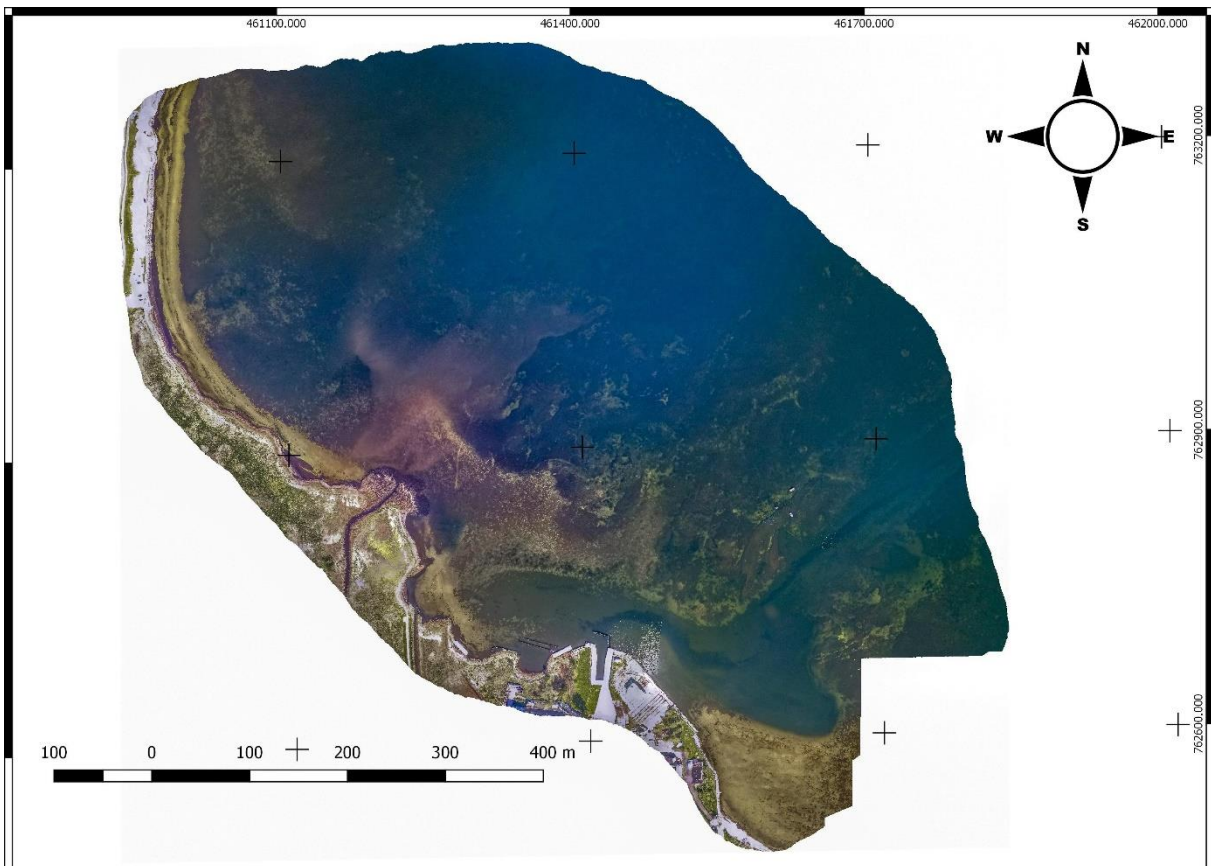

Fig. 2. The orthophotomap of the site – one of the spatial datasets obtained during project
(prepared by P. Stencel)

Fig. 3. Artifacts excavated from the archaeological site in Puck Bay.

fingertips" of the recipient who can reach the past using the VR / AR application. Using this technique, we have prepared 5 models of structures with varying degrees of behavior and different functions in the past. 3D models of these remnants, presented in the right way, can perfectly visualize the scale and durability of the constructions of Puck harbour builders.

Many unique movable monuments have been excavated for over 40 years of research on the harbour in Puck, which is another material for visualization. Their models were prepared based on photos taken during several digitization sessions at The Florian Ceynowa Museum of the Puck Region. These are ceramic vessels, horn tools, or a complete dugout. Models of such objects are valuable material supplementing the image of the medieval port on a micro scale. Thanks to these activities we have ready 3D models that can be used to make replicas in 3D printing technology. Such replicas are excellent, physical material for presentation to a wide audience, especially during meetings with stakeholder groups such as children at school or local authorities.

We publish the results of our visualization works in 3D on the Sketchfab, the most popular database of 3D models on the web. It is possible to "move" to the bottom surface of the Puck Bay, as well as contact with artifacts (using appropriate VR goggles) in addition to viewing models on a computer screen.

The biggest challenge related to the visualization of relics in the Bay of Puck was the attempt to prepare an animated film, which is based on the results of our research presented above. The idea behind the film's production was to balance archaeological data with an artistic vision of life in the Middle Ages. The main goal was, in turn, to reach the widest possible audience, which is really achieved when showing the film during the presentations of the project results.

3. Relations with stakeholders

As part of the project, we have prepared several meetings with various stakeholder groups. High school students from Puck had the opportunity to take part in a lecture presenting the underwater position in Puck comprehensively. After the lecture, a discussion was opened during which high school students showed considerable interest, especially in issues related to the preparation of 3D data, as well as the possibilities of archaeological data applications in computer games.

The meeting with professionals - underwater archaeologists from NMM took a slightly different form. It was a kind of discussion panel, with the exchange of specific experiences concerning diving, activities on relics underwater, as well as the interpretation of data from non-invasive scans. The meeting was also extended to include a field trip to the harbour, where the possibilities of visualizing underwater heritage on the shore of the Puck Bay were discussed.

Fig. 4. Meetings with stakeholders.

It is hard to estimate which meeting was more important. Each group of recipients should be treated with the same care, but the content transmitted during meetings must be carefully prepared for a specific group. It is also certain that the effort to organize meetings will be well utilized in understanding the further spread of information about hidden heritage. Past actions have shown that the appropriateness of such meetings is fully justified, which should also be taken into account in future projects.