

Analysis and Conservation of Waterlogged Wooden Objects from the Early Medieval Archaeological Site of Czerwno.

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Abstract: The following paper concerns the analyses of archaeological wood from excavations carried out in the medieval archeological site of Czerwno and the examination of *in situ* environment – especially analyses of soil samples and of the microbiological destructive factor. The main purpose of the research work is to determine the state of preservation of the relicts of historic, medieval wooden construction which is a part of the communication system of the Czerwno settlement complex.

Keywords: waterlogged archaeological wood, chemical analyses, physical analyses, wood conservation, environment analysis, archeological site of Czerwno;

INTRODUCTION

The early medieval archeological site of Czerwno is located in the administrative district of Lublin Voivodeship, Tomaszów Lubelski County, in the Community of Tyszowce. Relicts of the burgwall and other constructions presented at the site (Photo 1) are alleged to be the capital city of *Grody Czerwieńskie* [Kuśnierz 2003]. Since 2012, archaeological surveys have been conducted in the flood-meadows situated to the north of the burgwall, on plot number 23/1 in local land record [Solecki et al 2012, 2013, 2014]. The main purpose of this interdisciplinary research project, which combines archaeology, analyses and conservation of archaeological wood and analyses of the environment, is to determine the state of preservation of the relicts of an early medieval wooden structure which is a part of the communication system of the Czerwno settlement complex. The function of the structure – a pier or a bridge – will be determined during the course of the research. Two meliorations of the Huczwa river carried out in the 20th century [Archive of WZMiUW Lublin] and almost certainly, climate change resulted in the subsidence of the peatbog leading to the construction becoming visible in the turf (Photo 2). The state of preservation of wooden relics depends more on the conditions in which they were kept until the moment of their discovery, than on the duration of their deposition in archaeological layers. The type of wood used and the conditions the objects were in have a considerable impact on their degradation.

Of considerable significance to the speed and scale of decay of wood tissue is the type of environment and its pH value, oxygenation, moisture, temperature, the presence of microorganisms, and sometimes seasonal changes in conditions. The process of wood degradation proceeds more slowly under anaerobic conditions, occurring in swamps and peatbogs [Aniszewski, Witomski 2013].



Photo 1. Archeological site of Czermno, visible relicts of the burgwall and construction of a pier or a bridge on plot number 23/1, M. Aniszewski.



Photo 2. One of the oak piles visible in the turf, M. Aniszewski.

MATERIALS AND METHODS

In order to determine the state of preservation of the structure, physical and chemical examinations are being carried out on wood samples taken from trial pits located close to constructional elements of the historic pier/bridge (Photo 3).



Photo 3. One of the opened trial pits - visible are a few oak piles, relicts of the early medieval construction, M. Aniszewski.

Wood samples were obtained from piles, according to stratigraphy of this part of the site, which was established during archaeological works. To determine the basic technical parameters of wood, the analyses are being conducted for: absolute moisture content, maximum moisture content, density, linear shrinkage, resistance of the compressive strength along the fibers, Brinell's hardness. Chemical analyses are carried out for: non-structural substance content, cellulose content, lignin content, content of the substances soluble in 1% sodium hydroxide, alpha-cellulose content, holocellulose content and ash content. The values obtained will be subsequently compared with test results for modern wood, available in written sources as well as with the parameters of native wood acquired near the archeological site of Czermno. Physical and chemical research of historic and native wood is conducted at the Department of Wood Technology at Warsaw University of Life Sciences. In order to identify the nature of the environment, examination of soils samples is being carried out for: classification and typology, pH value, chemical compounds and oxygenation which are conducted at the Department of Soil Science, Erosion and Land Conservation at The Institute of Soil Science and Plant Cultivation in Puławy. The presence of microorganisms in historic wood and its typology is analyzed in the laboratory of the Autonomous Department of Microorganisms' Biology at the Faculty of Agriculture and Biology at Warsaw University of Life Sciences.

Apart from the archaeological work and analyses, all wooden artifacts uncovered during the excavations, such as fragments of the pier construction or tools, were conserved. For that purpose the "freeze-drying" method was used (Photo 4).



Photo 4 One of the wooden artifacts after conservation using the freeze-drying method, P. Kobek.

RESULTS AND DISSCUSION

The microscopic images unambiguously confirmed the assumption based on the macroscopic characteristics of the material, that the samples extracted from the construction elements were in fact oak wood (*Quercus sp.*, Photo 5).



Photo 5. The microscopic image of one of the piles with clearly visible oak wood characteristics, A. Jankowska.

Selected fragments collected from the remains of the construction have been dated using the radiocarbon method [Archive of LDB]:

TABLE 1. List of calibrated radiocarbon dates obtained from oak piles.

TRIAL PIT NUMBER	SAMPLE NUMBER	WOOD SPECIES	CONSTRUCTION ELEMENT	PERIOD
W1/2012	MKL-1416	OAK	PILE	975-1155 calAD probability 95,4%
W2/2012	MKL-1629	OAK	PILE	1021-1155 calAD probability 95,4%
W3/2013	MKL-1841	OAK	PILE	1038-1213 calAD probability 95,4%
W4/2014	MKL-2373	OAK	PILE	776-982 calAD probability 95,4%

Absolute dating, which can be provided by dendrochronology, was unobtainable due to the small cross sections of the piles and a deficiency of the proper amount of tree rings (Photo 6), resulting in the lack of possibility to match the ring sequences with a dendrochronological local scale and obtaining certain results [Krapiec, Zielski 2009]. Chemical and physical research of wood, analyses of soils from the Czerarno site and microbiological test are under way.



Photo 6. Cross section of one of the piles obtained from the remains of the historic construction, P. Kobek.

CONCLUSION

The chemical and physical test results of historic wood from the archeological site of Czerarno obtained until now indicate that its state of preservation depends on the localization of trial pits in the area of archeological recognition and varies depending on the stratigraphic layers. Nonetheless, various parameters of the archeological wood under examination did not diverge substantially from the values determined for modern material of this species. This was the result of the deposition of the wood in anaerobic layers which preserved it from most destructive degradation agents. Final conclusions pertaining to the state of preservation, taking the environmental and microbiological context into account, will be published after all laboratory analyses planned for spring 2016 are completed.

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Streszczenie: *Badanie i konserwacja mokrego drewna wykopaliskowego z wczesnośredniowiecznego stanowiska archeologicznego w Czermnie.* Głównym celem badawczym prowadzonych prac jest określenie stanu zachowania i wskazanie zagrożeń dla drewnianych reliktyw wczesnośredniowiecznego pomostu/mostu, znajdujących się na stanowisku archeologicznym w Czermnie (działka 23/1) – woj. lubelskie, powiat tomaszowski, gmina Tyszowce. Fragmenty konstrukcji w wyniku osiadania torfowisk są częściowo widoczne w warstwie darni. W celu pobrania odpowiednich próbek drewna wykonano sondáže archeologiczne, w których odsłonięto przekroje konstrukcji. Badany pomost był elementem systemu komunikacyjnego tamtejszego grodziska. W celu określenia stanu zachowania jego reliktyw prowadzone są analizy chemiczne i fizyczne, badania makro i mikroskopowe, a także badania środowiska, w którym znajduje się zabytkowy pomost – analizy mikrobiologiczne oraz gleboznawcze. Badania drewna wraz z kontekstem stratygraficznym oraz analizą mikrobiologiczną i gleboznawczą pozwolą na określenie wpływu poszczególnych typów gleb na degradację tkanki drzewnej oraz umożliwią wskazanie zagrożeń dla reliktyw zabytkowej konstrukcji. Do celów porównawczych pozyskano również próbki natywnego, współczesnego drewna dębu pochodzące z drzew rosnących w okolicy stanowiska archeologicznego Czermnno. Unikalną cechą prowadzonych badań jest ich szeroki, interdyscyplinarny charakter, łączący różne dziedziny nauki – archeologię, technologię drewna, mikrobiologię i gleboznawstwo.

Słowa kluczowe: mokre drewno archeologiczne, analizy chemiczne, badania fizyczne, konserwacja drewna, badania środowiska, stanowisko archeologiczne Czermnno.

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