Annals of Warsaw University of Life Sciences – SGGW
Forestry and Wood Technology No 74, 2011: 115-119
(Ann. WULS-SGGW, Forestry and Wood Technology 74, 2011

Identification research on charcoals and the imprint on concrete element from an Novae archeological excavation site in north Bulgaria

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Abstract: *Identification research on charcoals from an Novae archeological excavation site in north Bulgaria.* In this paper an attempt of identifications of charcoals being remains of the roof elements of the bath built in first century in Novae was taken. On the basis of an analysis of macroscopic and microscopic construction, it can be of stated that charcoals had come into existence from oak wood (*Quercus* sp.) with narrow annual ring. Conducted examinations are confirming the possibility of the successful botanical identification of charcoals from archaeological finds.

Keywords: charcoals, archeological excavation, Novae.

INTRODUCTION

Wood along the time undergoes the decay as a result of the impact of biotic and abiotic various factors (Ważny 2003). In the long term wood can survive only in the constantly dry or extremely wet environment (conditions, in which micro-organisms can't develope) (Vorreiter 1949, Sheffer 1972, Holz 1981, Feist 1983, Kozakiewicz and Matejak 2006). For example according to Nödlinger (1860) the permanence of the used oak wood in the open air amounts to 100 years what is confirmed by more contemporary data: according to Kollmann and Côte (1968) from 50 up to 120 years, and according to Krzysik (1978) up to 120 years.

Remains coming from European excavations of wood are usually included in two kinds of finds, that is:

- not-charred wood of kinds of the great natural permanence (oak, ash, elm, pine, larch),
- charred wood of previously mentioned kinds, as well as wood of kinds demonstrating the low natural permanence, but being able to survive in the form of charcoals (Dzbeński 1977).

Finds of the second kind often constitute only remains of wood material in shallowly put cultural layers, where the materials of the organic origin are undergoing the fast disintegration as a result of activity of micro-organisms. Seemingly carbonification of wood is destructive in but in fact it is immunizing them against the destructive action of biotic factors and saving the internal structure characteristic of the particular kind (Dzbeński and Kozakiewicz 2002). Time of charred wood, that is already invulnerable to the biotic decomposition residence in deeper soil layers isn't outweighing (Dzbeński and Kraińska 1988).

In the opposition to wood kept in the form brought closer to the primitive figure, the identification of charred wood is connected with difficulties of a technical nature. Charred wood is keeping its primitive structure, but on account of the significant brittleness carrying the machined microscope preparations is seriously hampered out. In such material, it is possible so to take into account only features of its outside structure, visible in the reflected light on fracture, but they are often insufficient for making the completely sure identification of the botanical kind. In singletons i.e. when they have fragments of wood at their disposal charred not completely, it is possible to apply the technique of sinking samples in binders merging the weakened tissue, which after this treatment is suitable for a cutting of preparations. Microscope preparations observed in the undergoing lighting often reveal details

of the internal structure of material, constituting the ground for making the completely sure identification (Dzbeński and Umgelter 1974).

In spite of the significant degree work difficulty, in general the identification of charred wood is possible. It was stated on the example of samples of charred wood coming from excavations for example in Woryty (Dzbeński and Umgelter 1974), Radzików (Dzbeński 1977), Mierzanowice, Wojciechowice and Silice (Dzbeński and Kraińska 1985), Grodzisk and Izdebki (Dzbeński and Kraińska 1986), Haćki (Dzbeński and Kraińska 1991), Krosno (Dzbeński and Kraińska 1992), as well as in Grodziszcz Mazowiecki (Dzbeński and Kozakiewicz 1997).

MATERIALS AND METHODS

Material for examinations was hand over by the testing centre above the Antique of South-east Europe of the Warsaw University, and constituted charcoals (about mass 40 g) - in the form of several dozens of small pieces, the more biggest a shape simillar to cubes about the side of the 20 mm.

This material came from the ancient town Novae located the Danube in north Bulgaria (near the contemporary city Svištov). In Roman and Byzantine times i.e. since the half of 1. century A.C., Novae town was an important military centre, and since 4. century A.C. also a centre civil in the Mezja Bottom province. Archaeological examinations in Novae are being conducted since 1960.

Charcoals were found in layer from first century A.C., where remnants of nonburnt ceiling joists were found. These elements came from the roof of the legionary bath. In 99 or 100 A.C. the bath was taken to pieces in order to build a hospital. Elements from the previous object (of bath) which weren't suitable for next application were burned. Delivered quoin originally created one object, with evident cross-section similar to square about the side from 20 up to 25 cm.

The scope of research included macroscopic and microscopic observation with use of enlarging magnifying glasses and the electronic TPL USB microscope 1.3 MPix constructed by the Bresser company. Chosen images of areas of examined coal have been saved in the form of digital photographies which were compared with gathered templates in WTD SGGW in Warsaw (collection of a few thousand macroscopic samples of wood and microscope preparations presenting basic anatomical sections along with identification keys).

On the basis of data concerning range and appearance of chosen species of trees in Europe supplementing analysis, concerning the probability of exploiting the given kind of wood in Novae in and A.C, has been made.

RESULTS

Evident macroscopic features let to the statement that all fragments of charcoals come from one kind of wood, that is the oak (*Quercus* sp.). The identification of the wood of the oak is sure, because, this kind is demonstrating explicit reconnaissance features even in charred samples.

The structure of wood is ring-pours – it has clenched segments of big vessels in earlywood. Because of large diameters (from 0.1 up to 0.4 mm), vessels of the earlywood are visible macroscopically too. Latewood vessels arranged in radial pattern, often forking training camps creating the picture relating to the latewood in the form of brighter "fiery tongues". Wide rays are well visible in all three anatomical section (numerous small uniseriate rays, appearing also in the oak wood, aren't visible macroscopically). Amongst the wood of kinds from the mild climate zone only an oak wood is characterized by such a set of features.

Unfortunately, it is hard to distinguish reconnaissance features individual kinds of the oak wood, amongst oaks growing in Europe even with microscopic methods.

The widest area of appearing (most numerous appearing) in Europe has a European oak *Quercus robur* L. and *Quercus petraea* Liebl., and then downy oak (*Quercus pubescens* Wild.), Turkey oak (*Quercus cerris* L.), Hungarian oak (*Quercus frainetto* Ten.), holm oak (*Quercus ilex* L.) and cork oak (*Quercus suber* L.). Taking into consideration habitat requirements and reaches, all these kinds could be potential donors of wood kept in the form of charcoals found on the Novae area, however a European oak is most probable (fertile areas of the river valley and useful sort of trunks).

Annual rings of charcoals are narrow - widths from 2.5 up to 0.5 mm (taking into account c 30 % volume reduction of wood during the coalification, primal material also had to be narrow ring). Tracking the uneven surface of visible annual excesses in coal it is possible to approximately say that they rose from the fragment of wood distant by the c 10 cm from the core of the primeval trunk of the tree (it is approximated evaluation because during the thermolysis wood is undergoing quite strong deformations).

Additional examinations of the carbon content in charcoals would let for estimating the temperature their formation happened in which in first century A.C.. For example the carbon content on the level of the 70 % would indicate coalifications to the temperature c 250 ^{o}C, and 90 % to the temperature of row 500 ^{o}C (Kozakiewicz and Dzbeński 1997).

CONCLUSION

On the basis of the analysis of the micro- and macrostructure it can be stated, that charcoals found in the cultural layer from first century A.C in Novae. came into existence from oak wood (*Quercus* sp.). Considering availability and appearing of oaks it is most probably European oak (*Quercus robur* L.).

Conducted examinations are confirming the possibility of the successful botanical identification of charcoals from archaeological finds. In some cases recognizing wood based only on its imprints on other materials is also possible. Analysis of this type is supplementing details about finds and allows for the fuller inference about the culture of bygone eras.

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Streszczenie: *Badania identyfikacyjne węgli drzewnych ze stanowiska archeologicznego Novae w północnej Bułgarii* W płytko położonych warstwach gleby drewno ulega szybkiemu rozkładowi na skutek oddziaływania mikroorganizmów. Na tego typu stanowiskach archeologicznych często jedyną pozostałością po dawnej materii drzewnej są węgle drzewne, które powstały setki lat emu. Węgle, dzięki temu że zachowują strukturę drewna, są cennym materiałem wykopaliskowym pozwalającym na wnioskowanie o kulturze materiałoznawczej minionych epok. W niniejszej pracy dokonano identyfikacji węgli drzewnych stanowiących pozostałość elementów dachu łaźni wzniesionej w I w.n.e. w Novae - miejscowości położonej nad Dunajem w północnej Bułgarii w okolicy współczesnego miasta Svištov. Novae w czasach rzymskich i bizantyjskich tj. od połowy I w.n.e. było ważnym centrum militarnym, a od IV w.n.e także centrum cywilnym w prowincji Mezja Dolna. Badane węgle powstały przy przebudowie łaźni na szpital (niepotrzebne elementy palono). Są one pozostałością belek dębowych (*Quercus* sp.). Widoczne na przekrojach poprzecznych słoje roczne są wąskie o szerokości od 2,5 do 0,5 mm (uwzględniając ok. 30 % zmniejszenie objętości drewna podczas uwęglania, pierwotny materiał też musiał być wąskosłoisty).

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