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Dendrochronological investigation on historical English oak (*Quercus robur* L.) in Lithuania and Latvia: problems and potential

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Introduction

Investigations on historical oak wood in the West Europe enabled to construct ultra-long chronologies for different site conditions and regions and to reconstruct large-scale climate changes during the Holocene (Jansma 1995, Leuschner et al. 2000, Leuschner & Delorme 1988, Pilcher et al. 1984, Schmidt 1973, Spurk et al. 1998). However, studies of oak tree rings in the Baltic States have so far produced very limited results. The main reason for this is the fairly rare occurrence of historical oak wood in the territory of the Baltic States. During the past two millennia, the extent of oak forest has been considerably reduced, not only because of climatic deterioration (e.g., the Little Ice Age from the 13th/14th to the 19th century), but mainly because of the rapid destruction of oak forests (clearance for agriculture of the most fertile forest lands, and the very frequent fires that followed; cutting of oak timber for shipbuilding, wood for barrels and other kinds of wood products, and for export in large quantities). Thus, the historical oak wood from the Baltic has in many cases been used for buildings, ships, furniture and works of art produced in Western European countries. Apart from this, part of the historical oak timber has been destroyed or has remained undated after being discovered in the course of archaeological excavations undertaken at the time when dendrochronological dating had not yet begun in the Baltic States. However, in recent years it has proved possible to find historical oak wood in relatively small amounts in both Lithuania and Latvia. The aim of this work is to introduce with current results on tree rings dating of historical oak wood in the both Baltic States and to discuss the main factors limiting current achievements together with the potencies for the future investigations.

State of investigations

Dendrochronological investigations on tree rings of subfossil oaks in Lithuania began in 1968. One of the most important is collection of about 100 subfossil oak samples from Smurgainiai gravel pit – Neris riverine sediments (at present belongs to Byelorussia close to Lithuanian border) collected during the Soviet period, mainly in 1968-1972 (Vitas 2004, Битвинскас et al. 1978) (Fig. 1).

Figure 1: Sampling locations on historical oak timber in Baltic region: 1 – Smurgainiai, 2 – Vilnius, 3 – Klaipėda, 4 – Telšiai, 5 – Biržai, 6 – Riga, 7 – Seda river.

The first radiocarbon dating in the Soviet period was performed in Ural Pedagogical Institute and Tbilisi University (Битвинскас et al. 1978). Part of the samples (cross-sections) was re-dated at the group of Radiocarbon in the Botanical Institute of Lithuania and later by the Laboratory of Dendroclimatochronology by using counter LSC - 1220 "Quantulus". Dendrochronological dating enabled to construct 10 floating chronologies comprising of approximately 100 samples (Fig. 2). Oaks from the oldest chronology grew approximately 5300-5500 BC. The longest gap between chronologies is around 2800-1380 BC. Bigger number of trees in chronologies is directly connected to wider tree rings, e.g. in 4700-3800 BC and 700BC-300 AD. The chronology from the youngest period is absolute dated to 778-1325 AD against oak chronology from Eastern Pomerania (Tomasz Wazny).

Bog oaks are also found in northern Lithuania in the past, but the number of wood samples obtained is small compared to material from Smurgainiai (Fig. 1). Six oak wood samples were found in peatbog near Biržai (Pukienė 2003a, 2003b, 2004). Dendrochronological dating enabled to construct two floating chronologies dated by radiocarbon to: 4400-4600 BC and 5000-5100 BC. Chronology of 4400-4600 BC approximately match the dates of the second oldest floating chronologies from Smurgainiai. Oak sample found in bog near Telšiai is much younger (radiocarbon dated to 3300-3500 BC) (Fig. 2).

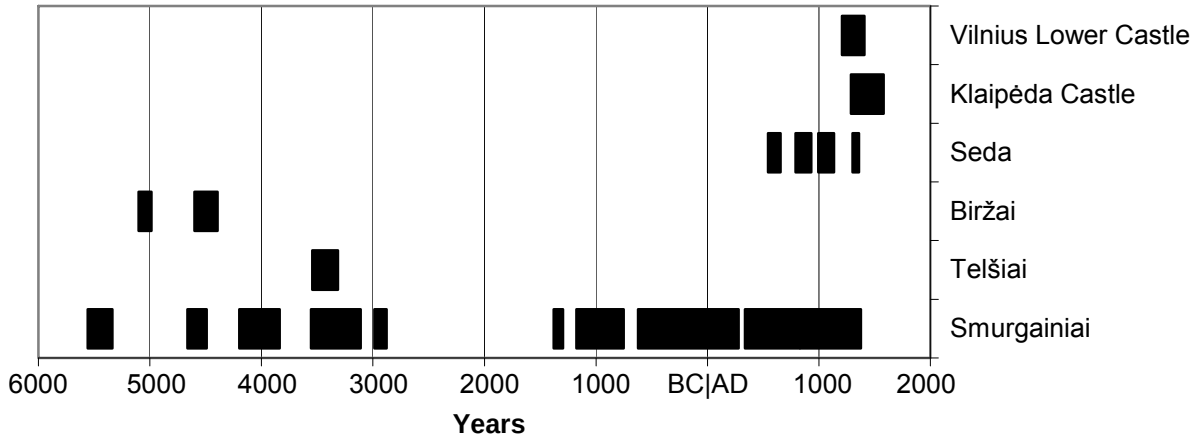

Figure 2: Historical chronologies of oak tree-rings derived from findspots in Lithuania and Latvia.

In Latvia, in contrast to Lithuania, most such finds are ancient oaks that had died naturally. The findspots of historical oak wood in the area of present-day Latvia are very widely dispersed. At several locations in Latvia, trunks of various-sized oaks that had died naturally have been found in peat deposits in bogs and at the sites of former river meanders. Geological and radiocarbon dating has shown that some of the oldest oaks grew at 6000–7000 BP. These have not been dendro-dated so far, mainly because there has not been sufficient interest or funding.

Exceptional in this regard are: (i) oak trunks from river Seda (northern Latvia) dated by radiocarbon to 500-1300 AD (Fig. 1, 2). This age is almost covered by the youngest oak chronology from Smurgainiai (778-1325 AD) and (ii) oak piles discovered in the second half of the 20th century in the 13th–14th century revetments along the Rivers Daugava and Rīdzene in Riga (Fig. 1). Unfortunately, archaeologists have so far not taken an interest in dating the trunks of oaks that had died naturally, and they are too young to shed light on topical issues in geology. Thus, the dating of these historical oak trunks has so far not been financially supported, and they have remained undated. It must be admitted that, along with the loss of these oak trunks, we have unfortunately lost information that would be useful for reconstructing past climatic conditions and answering questions relating to dendroprovenancing.

Discussion and Conclusions

Due to anatomical features, comparatively long age of trees and prevalence in bogs, and river sandy deposits wood of English oak is perfect source for long-term chronologies in West Europe. Because of sparse number of findings with oak wood in Lithuania the radiocarbon dating have gained greater importance in dendrochronological investigations compared to Western Europe. The absolute dating of oak samples from older periods is impeded by available small number of dated oak chronologies. One of the most important is chronology compiled by Tomasz Wazny from Eastern Pomerania (725-1985 AD). This chronology was successfully used for dating the youngest chronology from Smurgainiai sandy river deposits. In the Soviet period for a long existed incorrect opinion (probably because of the lack of contacts with western scientists) that pine wood is much more suitable in dendrochronological research, while oak wood is of lower importance. Therefore, oak wood from bog excavations sometimes was left at the findspots.

Oak chronologies from Smurgainiai might be used for absolute dating of historical oak trunks found in the Baltic area in the future. There is high chance that oak material from Seda River (northern Latvia) may be successfully dated against Smurgainiai chronologies. Therefore, dendro-dating of oak samples from Seda River seems to be promising for the future.

Dating of oak tree rings from buildings is more promising because of available reference chronologies compared to older material from bogs. Unfortunately, there is also very little oak wood preserved in standing structures from the Historical Era. In large measure, this can be explained in terms of the rapid reduction of oak forest during the 2nd millennium AD. In the past, a considerable quantity of oak timber was also exported to Western Europe. A proportion of the structural timbers of oak recovered in the course of earlier archaeological excavation were not dendro-dated. The chances are promising that the study of oak wood from buildings will permit us to compile chronologies by extending the series based on living oaks. Since the stocks of historical oak wood are gradually being lost, there is a pressing need for dendrochronological study of this material.

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