## Dating of sub-fossil oaks from Smarhoń riverine sediments

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Sub-fossil oaks excavated in the vicinity of Smarhoń (Belarus) have been in the attention of scientists since the 1960s. The initial dating difficulties were caused by the lack of sufficiently precise radiocarbon dates and missing oak reference chronologies in the Baltic region. The aim of this study was to explore the tree-ring series from sub-fossil oaks found in Smarhoń riverine deposits and to construct precisely dated chronologies. The research site (Smarhoń in Belarusian language, Smurgainys in Lithuanian) is located in the Grodno district in Belarus, 85 km south-east from Vilnius and 52 km from the present state border of Lithuania. Trunks of oak were excavated in 1968–1972 during the exploitation of a gravel pit, located on the bank of the river Viliya (Neris), approximately 10 km to the east from the Smarhoń town. The trunks were found in 3-8 m depth and were of variable size; some samples exceeded 1.5 m in diameter. In total, 129 samples were obtained and 109 cross-sections are being stored in the repository of the Laboratory at present. The earlier radiocarbon datings of sub-fossil oaks already indicated that the dates are dispersed over the whole Holocene. Our investigation confirmed that the accumulation of oaks in the Viliya river valley was not a constant process, and that meandering was common for the river in the vicinity of Smarhoń. Cross-dating of the samples has indicated several periods during the Holocene with much higher numbers of accumulated oak trunks, e.g. in 4191–3830 cal BC, 1137–716 cal BC and 778–1326 AD. Radiocarbon and dendrochronological dating of 97 samples, 4 single series, 10 mean curves (containing 2-9 series) and three chronologies (10-25 series) were constructed. According to radiocarbon dating, the oldest oak grew from 5782-5612 cal BC. The longest chronology, spanning 549 years, was radiocarbon-dated to AD 810–1358. The longest gap, according to radiocarbon dates, exists between 2987 and 1137 cal BC. The best replicated chronologies show the germination and die-off phases reflecting the changes of environmental conditions. The most pronounced germination phases took place from 4191–4084 cal BC, 1137–1062 cal BC and AD 778–970. The DO phases were recorded from 3959–3830 cal BC, 848–716 cal BC, AD 1032–1089 and AD 1245–1270. The spectral analysis of the chronologies provided cycles of variable length, on average from 11 to 56. Similar cyclical components usually are typical for two or three adjacent chronologies indicating that the environmental conditions reflected in the changes of tree-ring widths repeated with the same frequency for longer time spans. The sharp growth decreases (pointer years) from AD 1000-1266 mostly coincided with periods of cold winters, e.g. from 1045-1047 and in 1125. In 1213, summer drought was responsible for the narrow tree-ring width. The longest chronology (No. 16), covering 549 years, was absolutely dated against various oak chronologies of Polish / Baltic origin (East Pomerania, Vilcuro1 and Baltic1 ) to AD 778-1326 (t=5.4, 7.0 and 8.4, respectively), and was shifted by 32 years backwards in time.