

DENDROCHRONOLOGICAL RESEARCH IN TRANSYLVANIA

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Dendrochronology is the science that deals with the analysis of the annual rings of trees, which now has several separate branches pursued by foresters, geologists and environmental researchers. The primary use of dendrochronology in archeological and historic preservation research is to determine the historical dating of wooden finds as well as old wooden elements, structures and furnishings. Great numbers of historic wooden structures and furnishings have survived in Transylvania, so this area is particularly promising for dendrochronological research. The old structures provide a wide range of sources for the collection of samples, and with the aid of these data sets the dates for a relatively large number of wooden structures and furnishings of unknown age can be determined or made more precise. At the same time, there is a serious case for the taking of dendrochronological samples in heritage preservation, since due to the neglect of the stock of historic structures and the disregard for historic preservation regulations the groups of buildings available for research are constantly disappearing or their structural elements are being replaced for no reason.

The methods of dendrochronology are based on the principal that in the temperate zone, trees of the same species living in a given geographical area will grow annual rings of similar width due to the same environmental influences. On the basis of the data sets gained from measuring the sequence of annual rings, so-called chronologies that are precise to the year can be developed in which the origin of each and every annual ring is known. With the aid of these, wooden archeological finds (e.g. corduroy roads or well elements), or wooden structures (roof structures or belfries) and wooden objects (pews, panel paintings or coffered ceilings) of unknown age can be dated to within a half a year, so dendrochronology is the most precise method of dating known today (Fig. 1). Naturally for this to be true a set of requirements must be

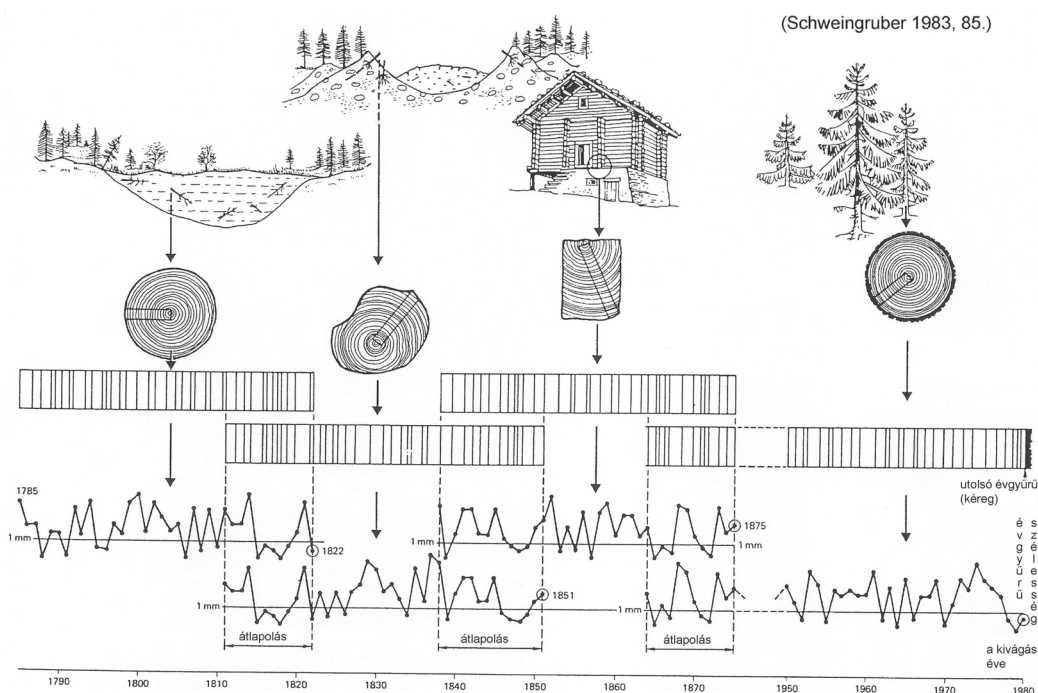


Fig. 1: The principle of dendrochronological overlapping, on the basis of Schweingruber, Fritz Hans: *Der Jahrring* (Bern-Stuttgart: Verlag Paul Haupt, 1983), 85.

fulfilled, since the features of the data sets can be influenced by the characteristics of the trees' habitat, the timber trade, woodworking and the method of use. There can be phases in the sampling, the measurement of the annual rings and their analysis that can affect the results. In the case of wooden structures, the sampling is performed with a 25 mm diameter hole saw, which does not affect the statics of the elements. We measure the width of the annual rings on the drilled core (Figs 2–3). When analyzing works of art the sequence of annual rings is recorded with a non-invasive digital microscope.

Due to nearly a half a century of prior research in Western Europe, dendrochronological analysis and dating have become a part of everyday practice in archeological and historic building research. The success of this method there may be best exemplified by the precise dating to the specific year of ancient wooden pile structures, or by determining the former habitat of the wood used. However, the use of dendrochronology in Eastern Europe is still today only at its inception. There are several reasons for this. In Hungary, due to its turbulent historic circumstances, particularly the Mongol Invasion (1241–1242) and the Ottoman Turkish occupation of the 16th–17th century, a large proportion of medieval buildings have been destroyed, and in the case of surviving monuments their most delicate parts, the wooden structures and furnishings, have not survived to the 20th century. At the same time, due to climatic conditions and soil composition, wooden objects that land up under the ground disappear essentially without a trace. The majority of exceptions to this consist only of wooden elements that have been preserved under water.

In Hungary András Grynaeus began to use dendrochronology for archeological dating in a wider range of instances. After nearly two decades of gathering data it is possible to date wooden objects from the Roman Age up to the modern day with ever greater probability on the basis of dated or floating chronologies covering several centuries.

During the Middle Ages, Transylvania, which is located in the eastern half of the Carpathian Basin, belonged to Hungary. However, following the world wars it became a part of Romania, and so its contemporary historic and archeological research differs significantly from the areas to the west. In Romania, and therefore Transylvania, until recently dendrochronology was only used for forestry and climatic history research. The first successful steps in connection with history were made by Ólafur Eggertsson and Alexandru Baboș, who compiled a five hundred year oak chronology in 1997 during the course of their research on the wooden churches of the Maramureș region. However, there was no continuation from this research.

Within the territory of Romania, the greatest number of historic wooden structures and wooden furnishings has survived in Transylvania. For just this reason Transylvania is a particularly promising area for dendrochronological research. The old structures provide a wide range of sources for sampling, and with the data sets developed in this way the dates for a relatively large number of wooden structures and wooden furnishings of unknown age can be determined or made more precise. At the same time, there is a serious case for the taking of dendrochronological samples in heritage preservation, since due to the neglect of the stock of historic structures and the disregard for historic preservation regulations the groups of buildings available for research are constantly disappearing or their structural elements are being replaced for no reason.



Fig. 2: Drilling of a core sample from the roof structure of the Lutheran church in Sebeș

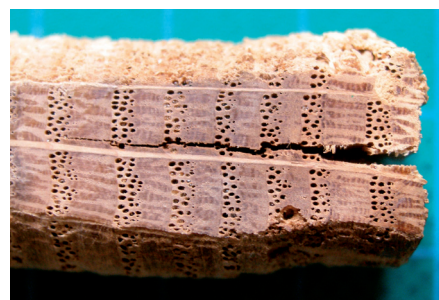


Fig. 3: Oak core sample dated to the winter of 1494/1495 from the roof structure of the choir of the Unitarian church in Dârjiu



Fig. 4: View of the roof structure in Sibiu

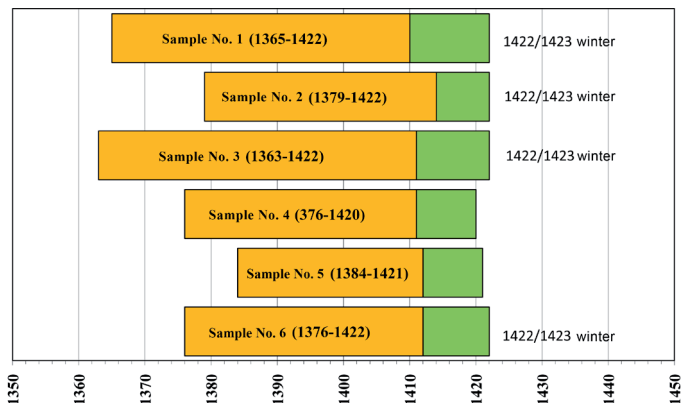


Fig. 5: Chronological order of the samples from the roof structure above the choir in the Reformed church in Cetatea de Baltă (with designations of when the trees were felled)

We have continued the systematic gathering and analysis of dendrochronological samples within the framework of a Hungarian Scientific Research Fund grant between 2003 and 2007, as an independent workshop (Transylvanian Dendrochronological Laboratory – Miercurea Ciuc) between 2007 and 2012, and then from 2012 again with the support of the Hungarian Scientific Research Fund.¹

The Transylvanian dendrochronological research is organized into three main topic areas. First we should mention the analysis of historic Transylvanian roof structures and wooden elements from historic buildings. During our work to this point we have been able to identify several medieval roof structures and alterations from the 14th–16th centuries for buildings that were of an unknown age or that had been improperly dated. For example, we determined that the earliest elements of the roof structure of the Lutheran church in Sibiu, which was constructed over several periods, were from fir trees felled in the winter of 1338/39 (Fig. 4). The earliest roof structure dated by us was the structure above the choir of the Reformed church in Cetatea de Baltă, which was constructed of oak felled in the winter of 1422/23 (Fig. 5). Further roof structures were successfully dated to the Middle Ages at the Lutheran churches



Fig. 6: The altarpiece from Sândominic

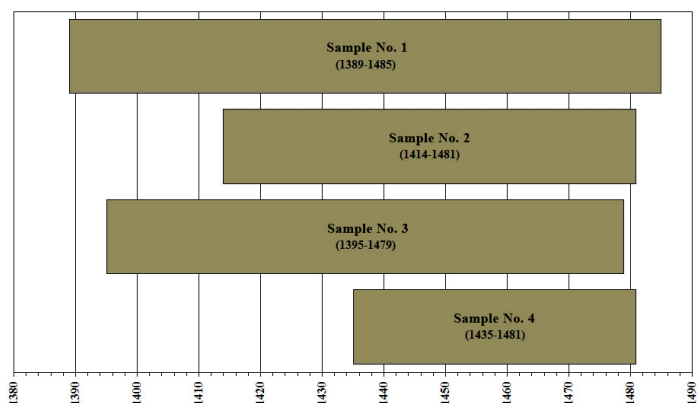


Fig. 7: The dating of the panel of the altarpiece from Sândominic

¹ Hungarian Scientific Research Fund program between 2003 and 2007: Dendrochronological research in Transylvania (F043167), Hungarian Scientific Research Fund research for the years 2012–2015: Dendrochronological research of historic Transylvanian wooden structures and wooden furnishings (K100983).



Fig. 8: Dated elements from the western bell tower in Drăușeni

of Brădeni, Saschiz and Drăușeni, the Unitarian church of Dârjiu and the Reformed church of Târgu Mureș² (Fig. 8). In addition to the dating of the various wooden structures, wooden elements and architectural periods the dendrochronological data help in recognizing that a significant portion of the “Gothic” bell towers in the Csíkszék region were actually built in the early modern period.³

One of our most important outcomes was that on the basis of nearly twenty dendrochronological datings it can now be stated with great certainty that the roof structures of Transylvanian churches were in certain cases constructed in quite archaic forms. So-called Romanesque or Gothic type roof structures were made in many places even in the 17th–18th centuries, so in the dating of the structures typology can only be utilized by itself with uncertainty.

Another pillar of the research is comprised of the analysis and dating of wooden furnishings. Besides the determination of the date made on the Baroque altar in Lăzarea⁴, the analysis of the altarpiece in Sândominic brought important results. In addition to its more precise dating, it was also possible to determine that despite the fact art historical literature hypothesized that this panel painting was an import from Salzburg, it was made from local, Transylvanian wood⁵ (Figs 6–7).

² Botár, István – Grynaeus, András – Tóth, Boglárka: „Új” módszer a történelmi faszervezetek keltezéséhez (“New” Method for the Dating of Historic Wooden Structures). In: *Transsylvania Nostra* 2/8 (2008/4), 10–14; Botár, István – Grynaeus, András – Tóth, Boglárka: Dendrokronológiai vizsgálatok és építéstörténelmi megfigyelések a székelyderzsi unitárius templom épületegyüttesében (Dendrochronological Analysis and Architectural History Observations on the Building Complex of the Unitarian Church of Dârjiu). In: *Transsylvania Nostra* 7/26 (2013/2), 2–26; Botár, István – Grynaeus, András – Tóth, Boglárka – Walgraffe, Denis: Dendrokronológiai vizsgálatok a marosvásárhelyi vártemplomban (Dendrochronological Analysis of the Fortified Church of Târgu Mureș). Prior to publication in the *Marisia* 2013 volume (Târgu Mureș).

³ http://www.academia.edu/4167605/Kozepkori_templomtoronyok_a_Csiki-medenceben._A_szekelyfoldi_dendrokronologiai_kutatasok_elso_eredmenyei

⁴ Gyergyószárhegy-plébániatemplom: http://csikimuzeum.ro/docs/2010_Muzeum_evkonyv.pdf

⁵ http://www.academia.edu/4166899/A_CSIKSZENTDOMOKOSI_MARIA_MEGKORONAZASA_TABLAKEP_DENDROKRONOLOGIAI_VIZSGALATA

The third objective is the dating of wooden archeological finds, which to this point has been hindered by the lack of samples coming from archeological excavations. Due to successful collaboration, it was possible to date several elements from Timișoara Castle, and we were able to date roadbed foundations in downtown Bucharest to the beginning of the 18th century.⁶ The ongoing analysis of the Roman Age wooden finds at the Brukenthal Museum in Sibiu appears promising. Particularly in the case of this latter archeological source group it has become apparent that the success of our work would have been unimaginable without the help of international contacts and colleagues, since the only possibility for the dating of presently floating data sets lies in their comparison with chronologies from neighboring or even more distant areas. The lower limit of our present – fir and oak – chronologies is the 13th–14th centuries, but it is our hope that in the not too distant future dendrochronology may have the last word in dating wooden finds from Árpád Age earthworks or from the Migration Period.

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⁶ <http://www.mcajournal.ro/pdf/mca2007/10.pdf>