Tree-Ring Dating of the Dismantled Timbers of the Daniel Pieter Winne House, Bethlehem, New York

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Introduction

Through an agreement between Walter R. Wheeler, Architectural Historian, of the Hartgen Archeological Associates of Rensselaer, NY, and Dr. Edward R. Cook and William J. Callahan, a dendrochronological analysis was conducted in December, 2003, on the timber remains of the dismantled Daniel Pieter Winne House. This building was originally located west of the present site of the extant Pieter Winne House, west of the junction of Rt 9W and Creble Road, in Bethlehem, NY, approximately 10 miles south of Albany, NY. At the time of the study the loose timbers were stored on the site of the Pieter Winne House. Determination of the structural provenience of the various timbers was provided by Walter R. Wheeler.

One room from the original Daniel Pieter Winne House was removed and delivered for exhibition in the Metropolitan Museum of Art in New York City, NY. The timbers of this exhibition piece are not included in this investigation.

The purpose of the study was to determine the construction date of this house traditionally associated with Daniel Pieter Winne, son of Pieter Winne. A total of 10 oak cores were collected from the timbers for analysis in the laboratory. Of all the sampled structural timbers, 9 of the oak samples could be confidently cross-dated by dendrochronological methods. This is a very high success rate. The one undated sample had relatively few rings, a condition that precluded dating with statistical certainty.

Methodology

Dendrochronology is the science of dating and analyzing annual growth rings in trees. Its first significant application was in the archaeological dating of ancient Indian pueblos of the southwestern United States (Douglass 1921, 1929). Andrew E. Douglass is considered the “father” of dendrochronology, and his numerous early publications concentrated on the application of tree-ring data for archaeological dating. Douglass established scientifically the connection between annual ring width variability and annual climate conditions which is necessary for precisely dating wood materials (Douglass 1909, 1920, 1928; Stokes and Smiley, 1968; Fritts, 1976; Cook and Kariukstis, 1990). Since 1921 the dendrochronological method, first developed by Douglass, has been perfected and employed throughout North America, Europe, and in much of the temperate forest zones of the globe (Edwards 1982; Heikkenen and Edwards 1983; Holmes, 1983; Stahle and Wolfman 1985). In Europe, where the dating of buildings and artifacts has become as much a professional support service as it is a science, the successful utilization of the dendrochronological method for the dating of historical objects is extensive. (Baillie, 1982; Eckstein, 1978; Eckstein, 1984).

During the initial stage of the study of Daniel Pieter Winne House, a total of 10 wood cores were extracted using Bartholin Increment Bores by William Callahan from the loose timbers of the dismantled building. These specialized bore bits were developed by Danish dendrochronologist Thomas Bartholin for dendrochronological field sampling. All of the samples were oak (Quercus sp.). Considerable care was taken to locate and take samples from positions with bark edges (sometimes known as “wany edges”) in order to determine the exact year in which the trees were cut. This allows the most precise date of construction of the house in question.

The wood samples were processed in the laboratory by Dr. Edward Cook, following well-established dendrochronological methodology. At the Lamont-Doherty Tree-Ring Laboratory the cores were carefully glued onto grooved mounting blocks. The samples were sanded to a high polish to reveal the annual tree rings, and the rings were then measured to a precision of ±0.001 mm. The cross-dating procedure utilized the COFECHA computer program (Holmes, 1983), which employs a sliding correlation method to identify probable cross-dates between tree-ring series. Experience has demonstrated that this method of cross-dating is superior to that based on the skeleton plot method (Stokes and Smiley, 1968) for trees growing in the northeastern United States. The COFECHA program is very similar to the highly successful CROS program used by, among others, Irish dendrochronologists to cross-date European oak tree-ring series (Baillie, 1982).

For the Daniel Pieter Winne House project, the first step was to use COFECHA to discern the internal or relative cross-dating alignment among the samples from the individual timbers. This step is critically important because it locks in the relative positions of the timbers with each other, and indicates whether or not the dates of those specimens with outer or bark rings are consistent. Upon completion of this stage, the internally cross-dated series were compared with multiple, independently established historical dating masters developed from old living trees and historical structures from the geographical vicinity.

Results

The results of the dating of the individual samples is shown in Table 1 below. Whenever possible, samples were obtained from timbers with clear bark or supposed bark edges. Table 1 contains a column with the heading "BARK (Y/N)". Only those timbers with a "Y" have outer dates that may be interpreted as likely cutting or near-cutting dates of the timbers. In this case, all but one of the dated timbers had certain or likely bark edges, which greatly simplified the interpretation of the dates.

Table 1. Tree-ring dates of the individual sampled timbers from the Daniel Pieter Winne House.

DANIEL PIETER WINNE HOUSE TREE-RING DATING RESULTS							
#	SAMPLE	DESCRIPTION	FIRST YEAR	LAST YEAR	YEARS	CORRELATION	BARK (Y/N)
1	DWHNY01	Hearth support face beam	1647	1750	104	0.53	Y
2	DWHNY02	Hearth support trimmer	1619	1750	132	0.46	Y
3	DWHNY03	Hearth support face	1659	1750	92	0.34	Y
4	DWHNY04	Hearth support trimmer	1622	1750	129	0.38	Y
5	DWHNY05	Basement girder, front room (?)	1622	1750	129	0.40	Y
6	DWHNY06	Basement girder, front room (?)	1597	1750	154	0.56	Y
7	DWHNY07	Basement girder, front room	undated	undated	44	N/A	
8	DWHNY08	Basement girder	1618	1747	130	0.27	Y ??
9	DWHNY09	Basement girder	1646	1748	103	0.40	Y
10	DWHNY10	Basement girder	1668	1718	51	0.49	N

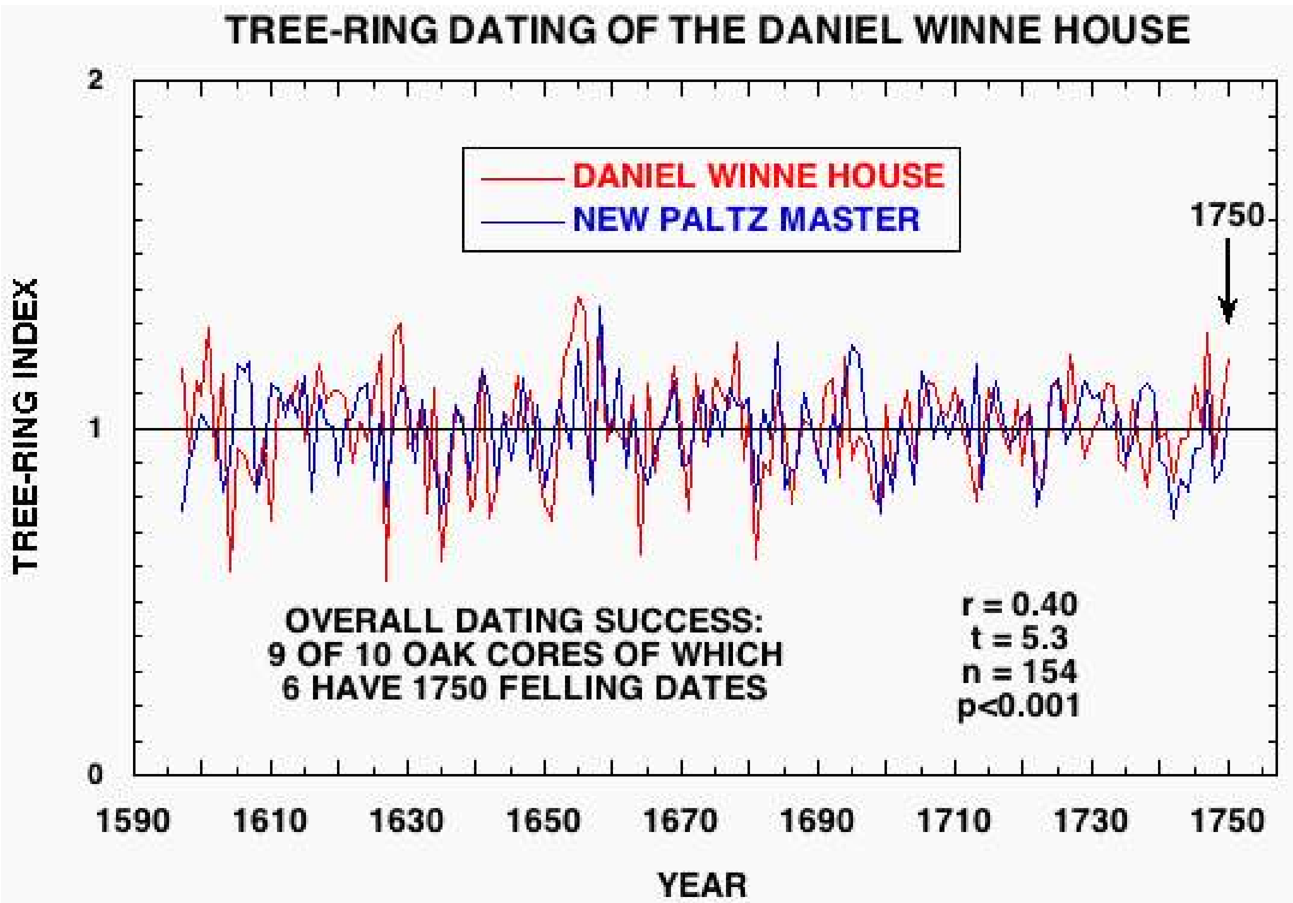
The “CORRELATION” of each sample refers to how well that individual measurement series correlates with an average series of all the others in its group. As such, it is a calculation of the cross-dating between the individual timbers. Correlations above 0.50 indicate that the cross-dating among the timbers is extremely strong. The “BARK (Y/N)” column indicates, as best can be determined by field and laboratory examination, if the bark edge was present (Y) or absent (N). Only those timbers with a “Y” should be used to determine the absolute construction date of the structure of the Daniel Pieter Winne House from which the sample was taken. Samples marked with “?” indicate some uncertainty in assessing the presence of the bark edge.

The "r" is the simple correlation coefficient. It is a measure of relative agreement between two groups of measurements or data, ranging from -1 (perfect, but opposite, agreement) to +1 (perfect direct agreement). In the plot of the Daniel Pieter Winne House tree-ring chronology with the master dating chronology (Figure 1), the correlation (r) is positive, as it must be to support the claim that the compiled Daniel Pieter Winne chronology cross-dates or agrees in a positive sense with the dating master at the indicated placement in time. Furthermore, no other placements of the Daniel Pieter Winne chronology along the master dating chronology had an r-factor higher than those specified.

The "t-value" (Student's t-distribution) demonstrates the statistical validity of the cross-dating, a unique probability distribution for r that indicates the likelihood that its value may have occurred by chance alone. As such it can be considered as a measure of confidence. Generally, a t=3.5 has a probability of about 1 in 1000 (or 0.001) of being statistically spurious. The t-value reported (=5.3) for the compiled Daniel Pieter Winne chronology cross-dates is significantly in excess of 3.5, which means that the chance of the cross-dates being invalid is much less than 1 in 1000.

Figure 1 below illustrates the cross-dating of the Daniel Pieter Winne House oak chronology against the best and most local historical dating master. The compiled Daniel Pieter Winne House oak chronology correlates significantly ($p<0.001$) with the New Paltz NY oak dating master. This means that there is far less than one chance in 1000 that the overall dating of the Daniel Pieter Winne House samples is spurious. The t-factor value (=5.3) indicates an extremely strong correlation with this master chronology.

Figure 1. Comparison of the compiled Daniel Pieter Winne House oak chronology with the independently dated historical oak chronologies from the region of New Paltz, NY



Conclusion

Examination of the dates in Table 1 reveals an extremely secure felling date for the trees used to construct the Daniel Pieter Winne House: 1750. This date represents a cutting of the timbers after the conclusion of the 1750 growing season, i.e. during the autumn of 1750 or the early spring of 1751. It is likely that the construction of the building occurred immediately or very soon thereafter.

Selected References

Baillie, M.G.L. 1982. *Tree-Ring Dating and Archaeology*. Croom Helm, London and Canberra. 274 pp.

Cook, E.R. and L. Kariukstis, eds. 1990. *Methods of Dendrochronology: Applications in the Environmental Sciences*. Kulwer, The Netherlands.

Douglass, A.E. 1909. Weather cycles in the growth of big trees. *Monthly Weather Review* 37(5): 225-237

Douglass, A.E. 1920. Evidence of climate effects in the annual rings of trees. *Ecology* 1(1):24-32

Douglass, A.E. 1928. Climate and trees. *Nature Magazine* 12:51-53

Douglass, A.E. 1921. Dating our prehistoric ruins: how growth rings in trees aid in the establishing the relative ages of the ruined pueblos of the southwest. *Natural History* 21(1):27-30

Douglass, A.E. 1929. The secret of the southwest solved by talkative tree-rings. *National Geographic Magazine* 56(6):736-770.

Eckstein, D. 1978. Dendrochronological dating of the medieval settlement of Haithabu (Hedeby). In: *Dendrochronology in Europe*, (J. Fletcher, ed.) British Archaeological Reports International Series 51: 267-274

Eckstein, D. 1984. *Dendrochronological Dating (Handbooks for Archaeologists, 2).* Strasbourg, European Science Foundation.

Edwards, M.R. 1982. Dating historic buildings in lower Maryland through dendrochronology. In: *Perspectives in Vernacular Architecture*. Vernacular Architecture Forum.

Fritts, H.C. 1976. *Tree Rings and Climate.* Academic Press, New York. 567 pp.

Heikkenen, H.J. and M.R. Edwards. 1983. The years of construction and alteration of two buildings, as derived by the key-year dendrochronology technique. In*: Conservation of Wooden Monuments*., (R.O. Byrne, J. Lemire, J. Oberlander, G. Sussman and M. Weaver eds.) ICOMOS Canada and the Heritage Foundation, Ottawa: 173-185.

Holmes, R.L. 1983. Computer assisted quality control in tree-ring dating and measurement. *Tree-Ring Bulletin* 43:69-78

Krusic, P.J. and E.R. Cook. 2001. *The Development of Standard Tree-Ring Chronologies for Dating Historic Structures in Eastern Massachuesetts: Completion Report*. Great Bay Tree-Ring Laboratory, May 2001, unpublished report.

Stahle, D.W. and D. Wolfman. 1985. The potential for archaeological tree-ring dating in eastern North America. *Advances in Archaeological Method and Theory* 8: 279-302.

Stokes, M.A. and T.L. Smiley. 1968. *An Introduction to Tree-Ring Dating*. University of Chicago Press, Chicago 110 pp.