Tree-Ring Dating of the Terwilliger House Near New Paltz, New York

By

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Introduction

Among the early homes owned by the Huguenot Historical Society is the Terwilliger House, which is understood to have been built in 1738 by Evert Terwilliger and his wife Sarah Freer. This house is presently closed for restoration and is being evaluated by historical architects Ted Bartlett and Neil Larson. As part of this process, dendrochronologists Edward Cook and Paul Krusic were brought in to provide a tree-ring analysis of major structural timbers in the basement and ground floor of the house. The purpose was to provide an independently determined date for the construction of the house and to clear up some architectural ambiguities with respect to the basement timbers.

The supporting oak joists in the basement are massive, squared-off oak logs with wany edges still remaining at some locations. The ground floor rooms have large squared-off pine joists with no certain evidence of any wany edges. This style of construction with massive exposed joists of oak in the basement and pine in the ground floor rooms is identical to other early houses that we have analyzed for the Huguenot Historical Society.

Methods

Dendrochronology is the science of dating and analyzing annual growth rings in trees. Its first significant application was in the archaeological dating of the 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 the connection between annual ring width variability and annual climate variability, which is responsible for the establishment of precisely dated wood material (Douglass 1909, 1920, 1928; Stokes and Smiley 1968; Fritts 1976; Cook and Kariukstis 1990). Since 1921, dendrochronological methods, first developed by Douglass, have been perfected and employed throughout North America, Europe, and much of the temperate forest zones of the globe (Edwards 1982; Heikkenen and Edwards 1983; Holmes 1983; Stahle and Wolfman 1985; Krusic and Cook 2001). In Europe, where the dating of buildings and artifacts is as much a profession as a science, the history of tree-ring dating is tremendous (Baillie 1982; Eckstein 1978; Eckstein 1984).

Earlier this year, Edward R. Cook and Paul J. Krusic visited the Terwilliger House and conducted the dendrochronological sampling that is the basis of this report. The procedures we followed were identical to those used to successfully date the Jean and Abraham Hasbrouck houses, and the Dubois Fort. Six (6) oak joists with accessible wany edges were sampled in the basement. This proved to be a challenge because of the generally degraded quality of the sapwood (dryrot due to cellar dampness, powerpost beetle attack), which made the recovery of the actual wany edges extremely difficult. When it was not possible to save the degraded sapwood of a given log during coring (often after several attempts at different locations), a small wedge of wood was cut from the side of the core hole to recover the sapwood and bark edge. Even this proved to be impossible for 2 of the 6 sampled beams after repeated attempts. Five (5) pine timbers were also cored from ground floor rooms. In no case could we find evidence for wany edges on the pine timbers due to excessive milling. We were also unable to find any cross-dating between the pine and oak tree rings in the house. Finally, none of the sampled pine timbers from the Terwilliger House cross-dated with any of the pine timbers from the Jean and Abraham Hasbrouck houses, even though there should have been ample overlap of the pine tree-ring series between the houses. This negative result was totally unexpected and extremely disconcerting. For now, it must remain unexplained. As Isaac Newton liked to say, when confronted with an unexplainable phenomenon, *"Hypotheses non fingo"* (I frame no

hypotheses). Therefore, the Terwilliger House pine timbers have not contributed anything useful to the dating of this house and we only report here on the oak basement joist results.

The wood core samples were processed following well-established methods of dendrochronology. They were taken to our Tree-Ring Lab where they were carefully glued onto grooved mounting sticks. The wood cores were than sanded to a high polish to reveal the annual tree rings clearly. The rings were than measured to a precision of ±0.001 mm. The actual cross-dating procedure involved the use of a computer program called COFECHA (Holmes 1983), which uses a sliding correlation method to identify probable cross-dates between tree-ring series. Experience has shown that this method of cross-dating is superior to that based on the skeleton plot method (Stokes and Smiley 1968) for oaks growing in the northeastern United States. It is also very similar to the highly successful CROS program used by Irish dendrochronologists to cross-date European oak tree-ring series (Baillie 1982).

We used COFECHA to first establish internal or relative cross-dating among the house 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 bark rings are consistent. Having done this, we compared the internally cross-dated series with independently established tree-ring chronologies from old living trees and historical tree-ring material. All of the "dating masters" used are completely independent of the samples taken from the Dubois Fort.

Results and Conclusions

The results of the dendrochronological dating of the Terwilliger House oak timbers is summarized in **Figures 1** and **2** with details on the dating of each timber given in **Table 1**. Based on dendrochronological analysis, the Terwilliger House constructed from trees cut in late 1738 or early 1739 before the trees began growing in the Spring (the outermost 1738 ring was complete). This result is highly consistent with interpreted historical information concerning the probable construction of the house. The 1755 date for one oak timber close to the basement stairs may indicate a later bit of construction. That joist appears to be out of place with respect to the spacing of the other basement joists.

The crossdating with the historical dating master is extremely strong and effectively identical to that based on oak timbers from the Jean and Abraham Hasbrouck houses and the Dubois Fort. Therefore, all four structures appear to have been constructed using the same source of oak timbers in the local region.

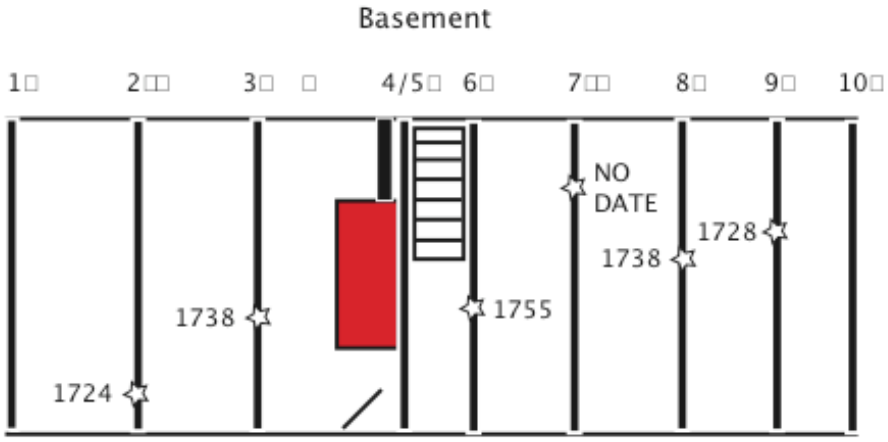

Figure 1. The sampling locations of the timbers in the basement of the Terwilliger House in New Paltz, New York (not drawn to scale). Dates are included for those timbers that were successfully dated using tree-ring analysis. The 1738 and 1755 dates are wany edge or cutting dates. Timber #7 could not be successfully dated because of too few rings.

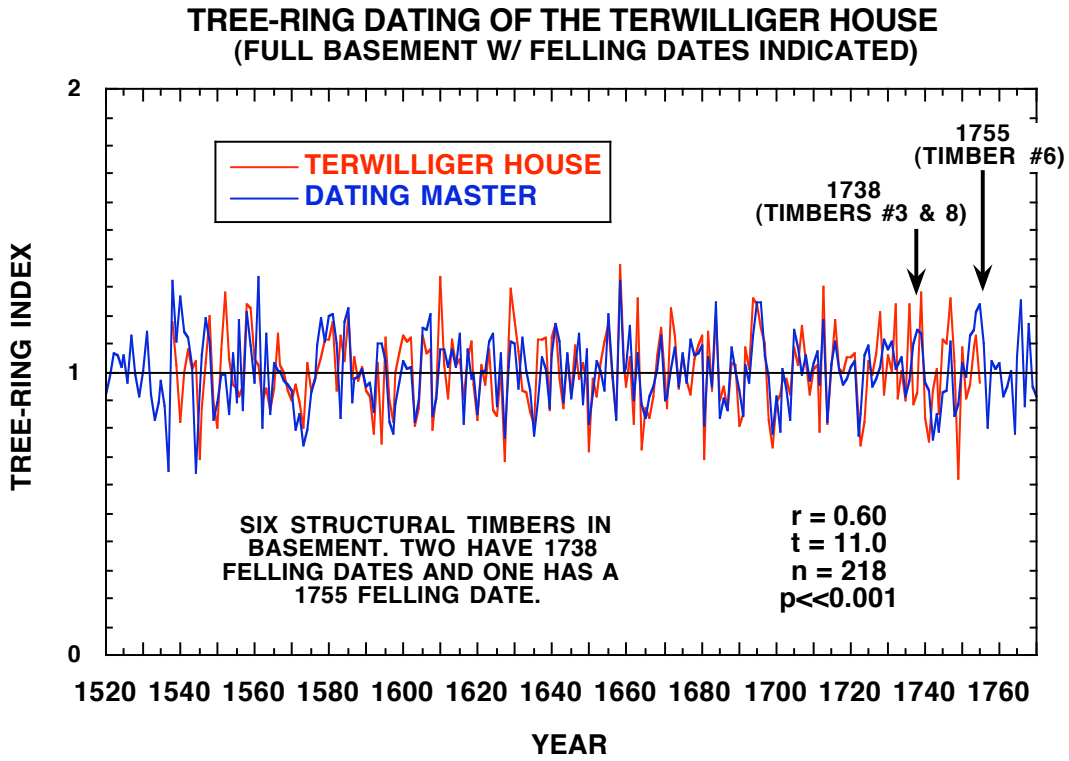

Figure 2. Comparison of the Terwilliger House historical oak chronology with the New Paltz oak dating master derived from the Jean and Abraham Hasbrouck houses and the Dubois Fort. The oak dating master was in turn independently dated against a regional oak master. This result indicates that the Terwilliger House was constructed from trees cut in 1738 or early 1739 (dependiing. The two oak series have an extremely high correlation that is significant at much less then the 0.001 level, or 1 in 1000 of being wrong. With a correlation of 0.60 between the two series, it is almost certain that the trees came from the same general wooded area as well.

Table 1. OAK TREE-RING DATES FOR THE TERWILLIGER HOUSE.
See Figure 1 for the precise sample locations.

ID	DESCRIPTION	# SAMP	RINGS	DATING	BARK EDGE
CELLAR JOISTS					
TH02	CELLAR JOIST #2	3	167	1558-1724	NO
TH03	CELLAR JOIST #3	2	173	1566-1738	YES
TH06	CELLAR JOIST #6	1	149	1607-1755	YES
TH07	CELLAR JOIST #7	2	62	NO DATE	YES
TH08	CELLAR JOIST #8	2	109	1630-1738	YES
TH09	CELLAR JOIST #9	2	191	1538-1928	NO

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.