Dendrochronological Analysis

of the

Bevier-Elting House
New Paltz, New York

By

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Introduction

This is the final report on the dendrochronological analysis of the Bevier-Elting House, one of six early colonial houses owned and operated as historical house museums by the Huguenot Historical Society located in New Paltz, New York. The Bevier-Elting House is thought to have a rather complex construction history. This is indicated by the following quote from the Huguenot Historical Society website http://www.hhs-newpaltz.net/tours_education/tour_bevier_elting.htm: "The Bevier-Elting House began as the one-room home of Louis and Marie Bevier, and its orientation to the street is reminiscent of northern European town architecture. Louis' son Samuel inherited the house in 1720 and enlarged it in two phases (1720 and 1735), creating a basement kitchen with a unique subcellar during the first phase. It was sold to Josiah Elting (son of Roelof Elting and Sara DuBois, daughter of Patentee Abraham DuBois) in 1760 for use as a home and store by his son Roelof, and it remained in the Elting family until donated to the Society in 1963. The house is currently interpreted as a mid to late 18th century family home." Thus, there may have been 3 or more periods of construction, e.g. pre-1720, 1720, and 1735.

In an effort to understand the construction history of the Bevier-Elting House more completely, Mr. William Callahan visited it on May 3, 2004 to collect wood core samples from selected timbers throughout the building for dendrochronological analysis. In all, he took samples from 18 timbers, but 5 had to be discarded due to very poor quality. Of the 13 recovered and analyzed samples, 8 were from oak and 5 were from pine.

Every effort was made to locate a bark or waney edge to sample in order to obtain a cutting date for the timber used in construction. This was not always possible due to construction practices of the day that sometimes removed the bark and shaped the timber for use. Even when a waney edge was found, it was not always possible to preserve it in the sample because the timber surface was in a degraded or "punky" state. This is a common problem in old houses, especially in sub-surface rooms such as cellars that tend to be damp. As a check, Bill always put a pink chalk coating on the surface where he cored each timber. Recovered cores with pink chalk on the outermost end were, therefore, the ones most likely to have had their waney edges preserved. When pink chalk was not present on the end of the recovered core sample, this indicated that some outer rings were lost. As will be seen, this was a problem with several of the sampled timbers from the Bevier-Elting House.

Dendrochronological Analysis

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).

The wood core samples collected from the Bevier-Elting House 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 then sanded to a high polish to reveal the annual tree rings clearly. The rings were then 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 use COFECHA to first establish internal or relative cross-dating amongst 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 these "dating masters" are based on completely independent tree-ring samples.

Results and Conclusions

The results of the dendrochronological dating of the Bevier-Elting House timbers are summarized in **Table 1** and **Figure 1**. A total of 13 samples were analyzed, with 6 of the 8 oak samples providing firm dendrochronological dates. The strength of cross-dating of the oak samples is indicated in column 7 of **Table 1** by the Spearman rank correlations. These correlations, produced by the COFECHA program, indicate how well each sample cross-dates with the mean of the others in the group. These correlations vary a bit, but all are in the range that one expects for correctly cross-dated timbers from buildings in the eastern US. The two oak samples that did not cross-date were either short (BEHNY04 with only 66 years) or possibly a relatively recent replacement of unknown origin (BEHNY08; interpretation by Bill Callahan). Of the six series that did cross-date well amongst themselves and also dated well against the local oak historical dating master (see **Table 1**, column 6), the first three, all from joists near the west wall of the cellar, had waney edges that all produced the same cutting date of 1731. This date is very consistent with a period of construction thought to have occurred in 1720 or and 1735. The tree-ring dates support one such period that probably occurred shortly after 1731. The remaining three outer tree-ring dates, none with waney edges, come from 1st-floor joists near the east wall of the house. These three outer dates, 1676, 1716, and 1691, all predate the 1731 date. However, each has an unknown number of missing outer rings, which makes it impossible to know if this portion of the house truly predates the 1731 portion.

Three of the five pine samples cross-dated amongst themselves (see **Table 1**, column 7) and produced an 89 year long floating (i.e., undated) tree-ring chronology. All attempts to cross-date this series against all available pine dating masters in the region failed. Therefore, we are unable to say anything about the dates of the pine timber samples from the Bevier-Elting House.

The reliability of the oak dating is succinctly illustrated in **Figure 1**. It shows the mean oak chronology developed from the six Bevier-Elting timbers compared against the local oak historical dating master, based mainly on tree-ring samples collected from other Huguenot Historical Society houses. The t-statistic (t=9.3) associated with the correlation between these two series (r=0.56) is highly significant (p<<0.001) with a 190 year overlap. There is no doubt that the oak dates presented here are correct. How they are interpreted is up to others.

Table 1. Dendrochronological dating results for all samples taken from the Bevier-Elting House. For WANEY, +BE means the bark edge was present and recovered and –BE means that bark edge was either not present or not recoverable. All correlations are Spearman rank correlations of each series against the mean of all of the others of the same species (oak or pine).

ID	SPECIES	DESCRIPTION	WANEY	RINGS	DATING	CORREL
BEHNY01	OAK	Joist, west end of cellar above dirt floor, 2nd joist from west wall	+BE	98	1634 1731	0.55
BEHNY02	OAK	Joist, west end of cellar above dirt floor, 1st joist from west wall	+BE	110	1622 1731	0.51
BEHNY03	OAK	Sill above west wall of cellar	+BE	62	1670 1731	0.41
BEHNY04	OAK	Center joist in "root cellar" under middle room, (new/replaced timber? Hewn, yet suspiciously "clean")	-BE	66	NO DATE	-.--
BEHNY05	OAK	1st joist from east wall (fireplace wall), center room, 1st floor over "root cellar"	-BE	57	1620 1676	0.66
BEHNY06	OAK	2nd joist from east wall (fireplace wall), center room, 1st floor over "root cellar"	-BE	98	1619 1716	0.57
BEHNY07	OAK	3rd joist from east wall (fireplace wall), center room over "root cellar"	-BE	150	1542 1691	0.57
BEHNY08	OAK	3rd joist from west wall in dirt floor cellar (fireplace in floor above, joist provides connection to 4 oak supports for fireplace), hewn but looks suspiciously new – suspect is reused or modern timber	+BE	145	NO DATE	-.--
BEHNY09	PINE	3rd ceiling joist from west wall, front room ground floor, BE?? = close	-BE	85	NO DATE	0.38*
BEHNY10	PINE	2nd ceiling joist from west wall, front room ground floor, +BE? = close	-BE	103	NO DATE	-.--
BEHNY11	PINE	3rd ceiling joist from west wall, front room ground floor, BE??	-BE	83	NO DATE	0.46*
BEHNY12	PINE	1st ceiling joist from east wall, center room, just east of outer door frame, BE??	-BE	79	NO DATE	0.29*
BEHNY13	PINE	2nd ceiling joist from east wall, center room, just west of outer door frame	-BE	46	NO DATE	-.--

*Correlations only for best relative cross-dating between series. No absolute dendro dates are implied.

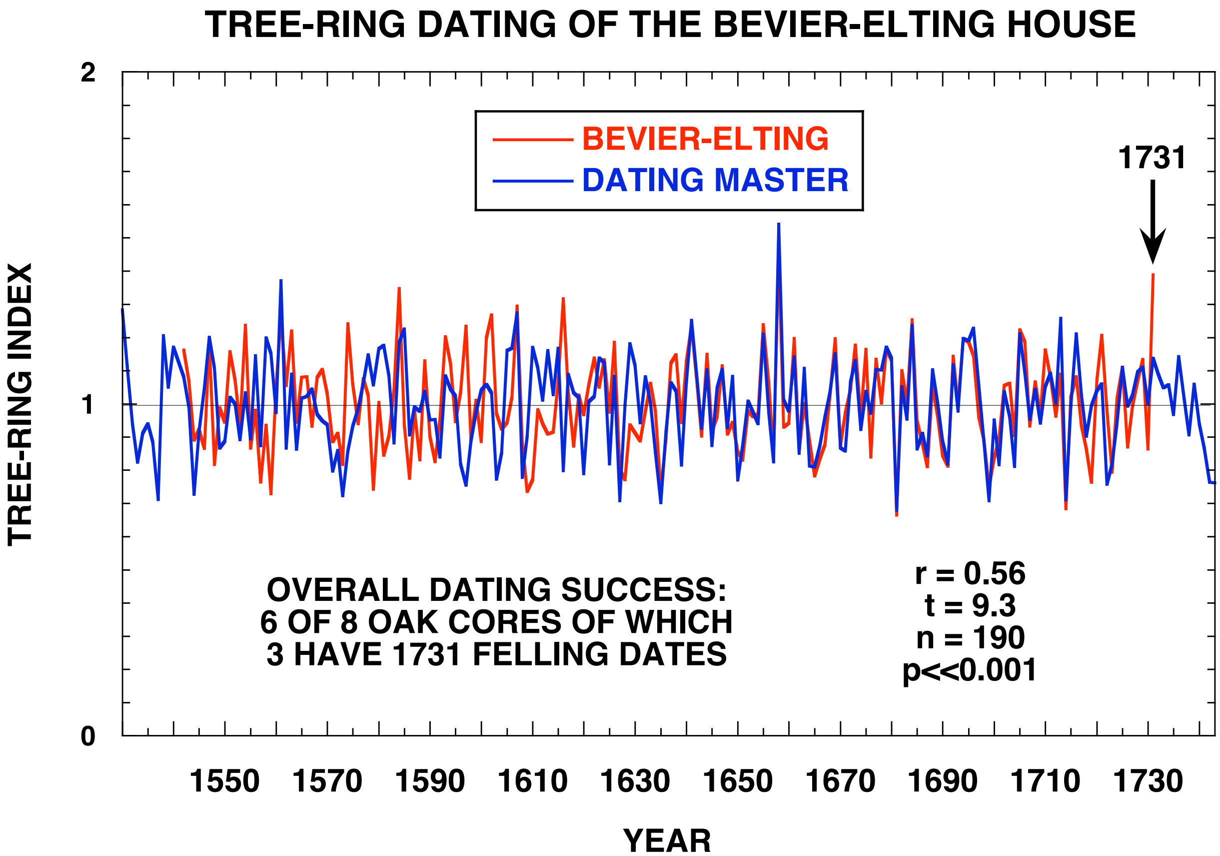

Figure 1. Comparison of the Bevier-Elting House cross-dated oak master chronology with the best regional dated oak historical master developed from other buildings in and near New Paltz, New York. The correlation between the series (r=0.56) is highly significant (p<<0.001) with an overlap of 190 years.

C. Conclusions

The dendrochronological analysis of the Bevier-Elting House has been partly successful. The 1731 date, for three of the six dated oak timbers, is solid and should help in the interpretation of this house's construction history. The lack of waney edges for the remaining three dated oak samples limits their usefulness. How their dates might be interpreted beyond the limits of this study is up to others. If any additional oak timbers with waney edges can be found or uncovered in the house, important new dating results might be possible.

The failure of the pine samples to cross-date with any available historic dating master is a common theme now for houses in the New Paltz region. The reason for this is still unclear. If this problem can be solved, a whole series of new dates may emerge from the samples already collected.

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