Tree-Ring Dating of the Cahn House New Paltz, New York

By

Paul J. Krusic
William E. Wright
Edward R. Cook

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Introduction

The Cahn House is one of Historic New Paltz's larger stone and timber frame buildings. It is also the most contemporary building in New Paltz, NY to be successfully dated by dendrochronological techniques. In this regard, the Cahn House represents a valuable contribution to the construction of a New Paltz Oak Master Dating Chronology (NPOMC). Prior to the examination of the Cahn House the temporal coverage of the previous NPOMC spanned the period of 1449 (Jean Hasbrouck) to 1799 (LeFevre House). New tree-ring information from the Oak timbers in the Cahn House have added an additional 17 years to extant NPOMC producing a new 368 year master chronology covering the years 1449 to 1816. Thus, the information recovered from the Cahn House represents a significant contribution to the overall development of the NPOMC.

Similar to most of the buildings so far examined by dendrochronological methods in New Paltz, the Cahn House is very well preserved. The samples collected from the home's timber frames were well in tact and their resulting measurements showed strong inter-sample coherency. However, unlike most of the formerly examined New Paltz houses, the resulting dates from the Cahn House samples revealed two, maybe three, construction periods. Two of the three possible construction periods correspond well to the physical expansion of the house. A possible explanation for the less then clear 3rd construction period is that reused timbers were used, primarily in the basement, during the original frame construction.

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).

Between the fall of 2003, and spring of 2004, Edward R. Cook, Paul J. Krusic, and William E. Wright visited the Cahn house and conducted the dendrochronological sampling that is the basis of this report. A total of 18 oak cores were collected from major timbers in all major sections of the basement and attic (Figure 1). Considerable care was taken to locate and collect wood samples with remnant bark (or wany) edges in order to determine the exact year in which the trees were cut. This provides the most precise estimate of the construction date of the building in question.

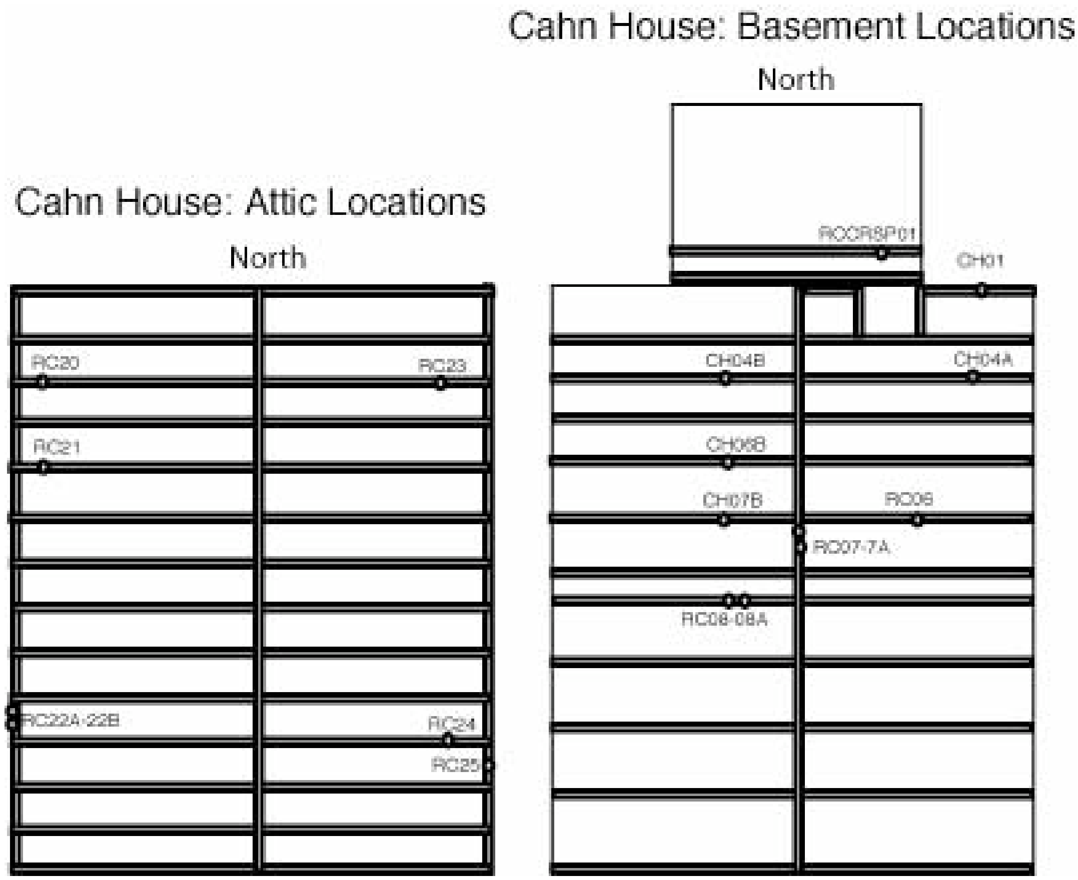

Figure 1. Locations of timbers sampled in the Cahn House, New Paltz, New York. Eighteen increment cores were collect. Sixteen of which were datable by dendrochronological techniques.

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).

The program COFECHA was used to first establish internal or relative cross-dating among the Cahn house timbers. This step is critically important because it locks in the relative positions of the timbers between each other and indicates whether or not the dates of those specimens with outer bark rings are consistent. Having done this, the internally cross-dated Cahn House series were compared with the independently established New Paltz Oak Master tree-ring chronology (NPOMC), a composite chronology build from dated oak construction material collected from historic buildings in New Paltz. The results from this second COFECHA run are given in Table 1 and graphically shown in Figure 2. Note the three discreet "end date" clusters with the following terminal dates: 1739, 1774, and 1816. The usual interpretation is that these dates reflect three periods of construction of the Cahn House shortly after those terminal dates. We do not claim that this is the only interpretation (e.g., some timbers could have been reused from earlier buildings), but are unable to offer any alternative explanation based on the dendrochronological analyses presented here.

Table 1. Correlation between Cahn House, sampled, timbers and the New Paltz Oak Master Chronology (NPOMC).

Seq.	Series	Interval	#Yrs.	#Segmt.	#Flags	Corr.w/Master
1	CH07B	1625-1734	110	11	0	0.409
2	CH06B	1633-1739	107	11	0	0.587
3	CH04B	1622-1737	116	13	0	0.647
4	CH04A	1617-1724	108	10	0	0.507
5	CH01	1679-1706	28	1	0	0.706
6	RC07A	1780-1816	37	1	0	0.706
7	RC08	1751-1810	60	1	0	0.521
8	RCA20	1734-1771	38	1	0	0.607
9	RCA21	1720-1769	50	1	0	0.559
10	RC06	1701-1773	73	4	0	0.478
11	RC09	1749-1816	68	4	0	0.716
12	RCA22A	1646-1771	126	15	0	0.491
13	RCA22B2	1681-1774	94	8	0	0.484
14	RCA23	1722-1774	53	1	0	0.654
15	RCA24	1721-1774	54	1	0	0.589
16	RCCRSP	1736-1815	80	6	0	0.546

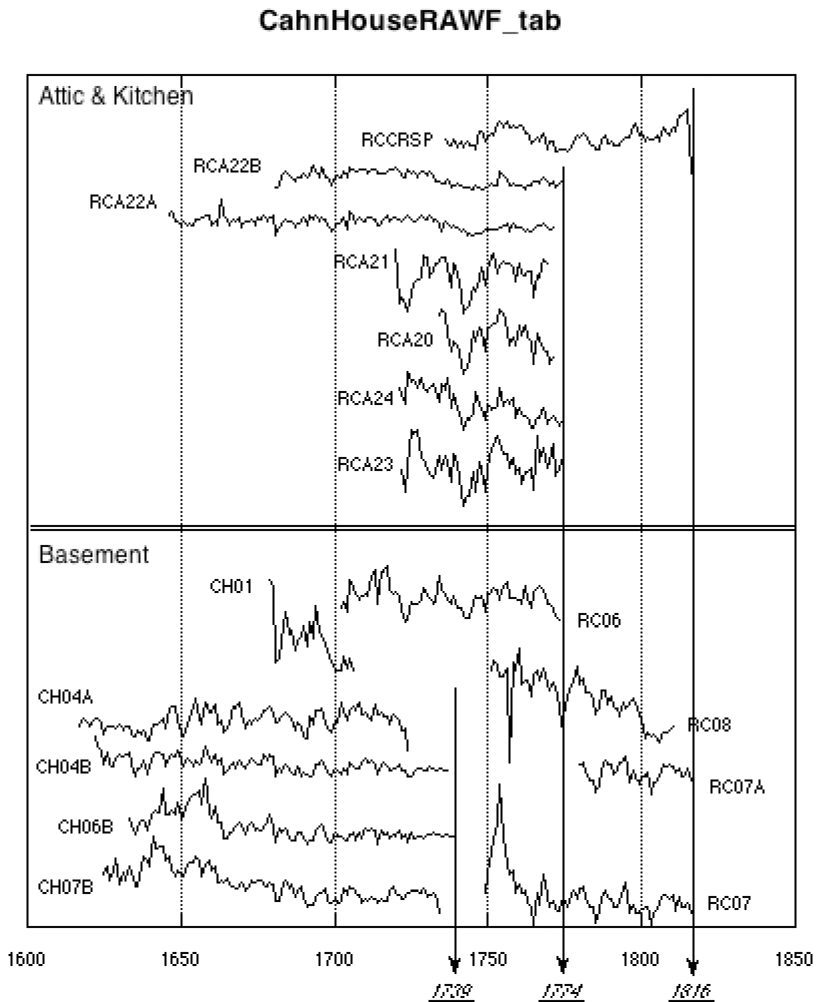

Figure 2. The individual, cross-dated, Cahn House oak samples plotted in their relative dating position over time. The order of the samples, from top to bottom, corresponds to the samples physical location in the home.

Once again the statistical program COFECHA was used to confirm the significance of the independent dating derived for the individual samples. In this second examination all the Cahn House samples were used to build a temporary "Cahn House" chronology. This temporary, Cahn House chronology is compared to the extant NPOMC to validate the correct positioning, in time, of the two chronologies (Figure 3).

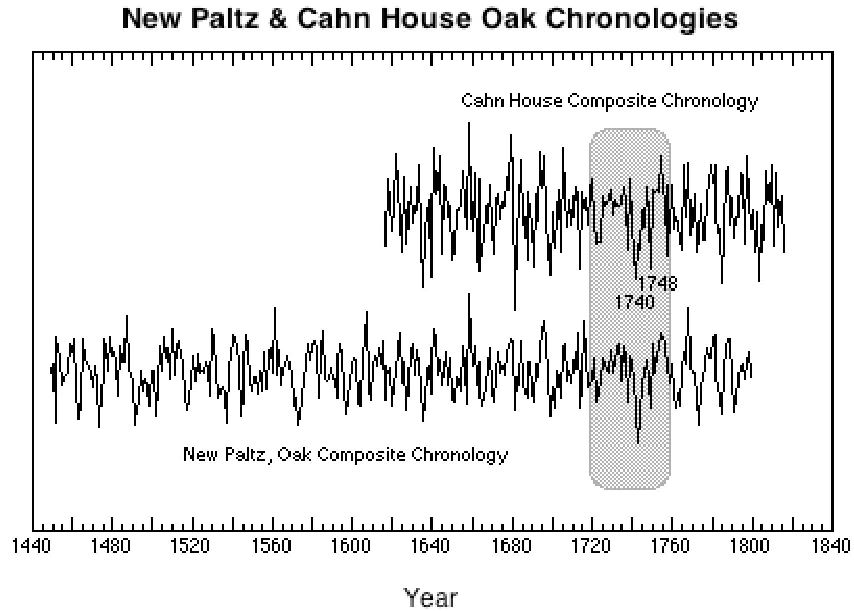

Figure 3. Comparing the current New Paltz Oak Master Chronology and the new Cahn House Oak chronology. Common patterns of ring-width variation are clearly visible. Significant years within the common period are 1748 and 1740 both very dry years in New York.

Results

Tree-ring evidence from the sampled Cahn House oak timbers suggests the current roof was pitched between 1774 and 1775 (e.g.,RCA20-24). Exactly which year is unclear, but what we do know is that the trees used to support the roof were felled in the early summer of 1774. This is due to the impartial ring (not measured) found on many of the attic timbers. The amount of wood grown before the tree was killed is that proportional to what an oak growing today would have grown by June under average growing conditions.

The trees used for the kitchen floor support beams were felled in 1816 suggesting the annex was built forty-two years later (e.g., RCCRSP). At the same time, we suspect some additional support was given to the first floor, in the basement of the original house (e.g., RC07/7A, RC08). In addition to these two definite dates, there is a third coincidence in time that defies a simple solution. Either there was a previous dwelling, maybe smaller in size, built on the site in 1739 (e.g., CH04A/B, CH06B, CH07B, and CH04A) or these four sample's earlier death dates represent the use of recycled timbers during the real 1774 construction, or the later 1816 remodeling. Without further sampling or independent historical information, we cannot be sure.

Discussion

There is always some doubt with any archaeological interpretation of natural evidence, and without the quantity of written documents that we keep today, reconstructing human activities from non-human records is always subject to some doubt. For example, the dates presented in this analysis only provide the year trees were felled. This is not the same as providing the year a frame was raised. We often say wood was not left around a long time before shaping into timbers, and that there is a period of time when it is left to season or dry prior to construction. But this assumption is mostly based on modern post and beam construction habits, not necessarily from any written description from the times. As a rule of thumb, we say the dendrochronological death dates achieved by dendrochronological methods are typically within a year of construction.

The quality of dating control in Cahn House samples is very high. As shown in Figure 3, there are many significant pointer years, during the common period of both chronologies. These pointer years are both consistent in time and magnitude. “Pointer years” are years during which all trees growing under a similar climate express the same biological response to their climate. Particularly obvious similarities are found between 1720 and 1760. 1740 and 1748 were particularly dry years in New England and especially New York (Figure 4).

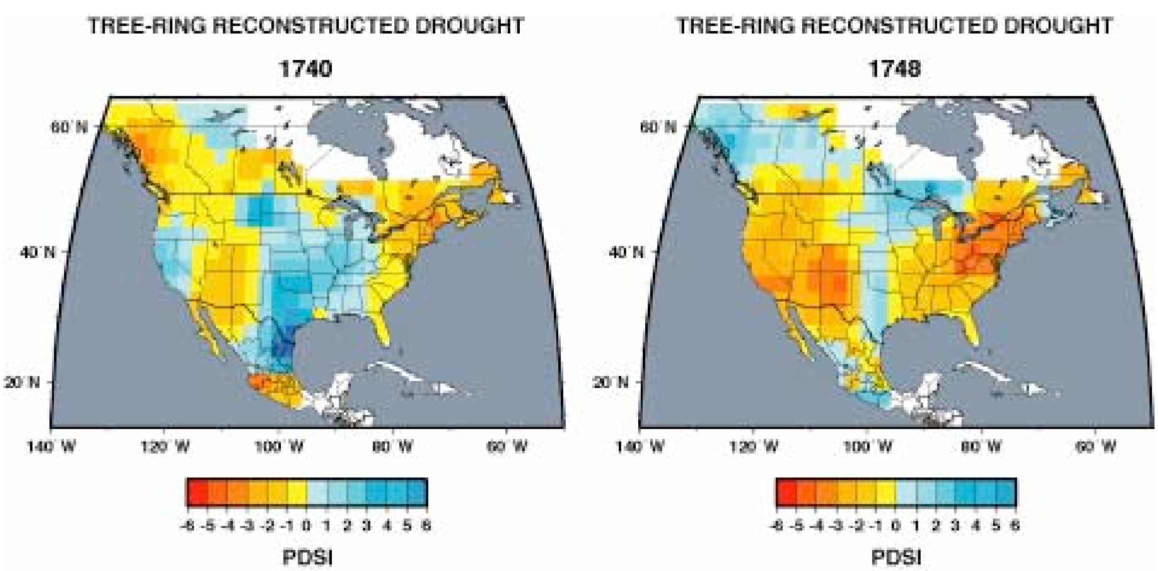

Figure 4. North American, tree-ring reconstructed drought (PDSI) for the years 1740 and 1748, where a low PDSI value represents a measure of high drought conditions (from Cook, E.R., and P.J. Krusic. The North American Drought Atlas: *A History of Meteorological Drought Reconstructed from 835 Tree-Ring Chronologies for the past 2005 Years*. NSF-Digital Publication, 2004).

The current, updated New Paltz Oak Master Chronology now reflects the addition of these Cahn House samples. Currently the NPOMC extends from 1449 to 1816. The quality of the dated measurements in this chronology is also very high, thus providing a strong means by which to date most any oak building in the lower Hudson River Valley. The current New Paltz master chronology contains information from 54 oak samples with a mean series intercorrelation of 0.592. This level of correlation is remarkably strong considering the random nature in which the samples were collected. The strength of the agreement suggests that all the trees used in New Paltz construction came from the same region, or very nearby forests.

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