Dendrochronological dates for the Crailo House, Rensselaer, NY

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This house is located on the east side of the Hudson River in Rensselaer, Rensselaer County, New York, and is currently owned by New York State as a historic site. Local history proposed that it could be the original house in town, probably built by the van Rensselaers in the mid-1640s. There is certainly evidence within the building's architecture that any "original" part of the house was altered, more than once, but whether any part of this house was built in the 17th century was a key question for this study. Recent restoration has removed some of the key evidence needed for a complete tree-ring analysis. However, we were invited by Walter Wheeler of Hartgen Archeological Associates to date the older timbers in the building to help solve at least the question about its original construction. Mr. Paul Huey was also present on collection day.

Involved in most of the histories of the buildings that we have dated around the Albany-Schenectady area, is a claim to be the "first building" in the immediate area, putting their construction date in the mid-to-late 1600s. So far, in analysis of samples from seven buildings and the remains of an Albany fortress, I have not seen any standing building in Schenectady that survived the 1690 massacre, plus there were major fires in the 18th and 19th centuries around the whole region. Initial disappointment is inevitable in these circumstances, but the owners, historians, and archeologist are generally happy to have a more complete picture of the history of the construction of their buildings and the region. I can say that for a few houses, one or two timbers that still stand in the building had been re-used. These are posts or beams cut from trees that had been felled in the mid-to-late 1600s, occasionally with the evidence of "ghost holes" – empty holes originally gouged out for use as a mortise or other purpose but not used as such in its current position - and they are most likely survivors of the destruction of an original house or barn. It is impossible to be sure that those timbers came from an original building at the same location, but they are evidence of earlier construction in the immediate vicinity of the current structure. There are some timbers in the Crailo House that may have been re-used, but, as of this report, no definitive evidence in their tree-ring record.

At the basement level in the Crailo House, we cored 4 samples from first floor support beams in the ceiling of the main basement, plus one from the main fireplace mantle; and four samples from floor support timbers in what is now the boiler room. Six cores were taken in the attic, from dormer windows, a beam against the east wall, and two rafters in the section two stories above the boiler room. No samples were collected from main roof construction due to its known, and much later, renovation. Samples were mainly cored from timbers that still contain bark or a possible waney edge (only bark removed). All the attic dormer window beams were squared, having neither bark nor sapwood.

The samples are mainly oak (*Quercus* sp) and pitch pine (*Pinus rigida*), the main species used in construction for this area, with a few samples of eastern hemlock (*Tsuga canadensis*) and one of tamarack (*Larix laricina*). Pitch pine was used mainly in the boiler room beams and the roof rafters of the attic of the addition; the oaks were used in the main basement beams and in the short rafters in the attic dormer windows. Tamarack was used in a basement beam. Hemlocks were found only in the attic of the east addition – an east wall beam and one roof rafter.

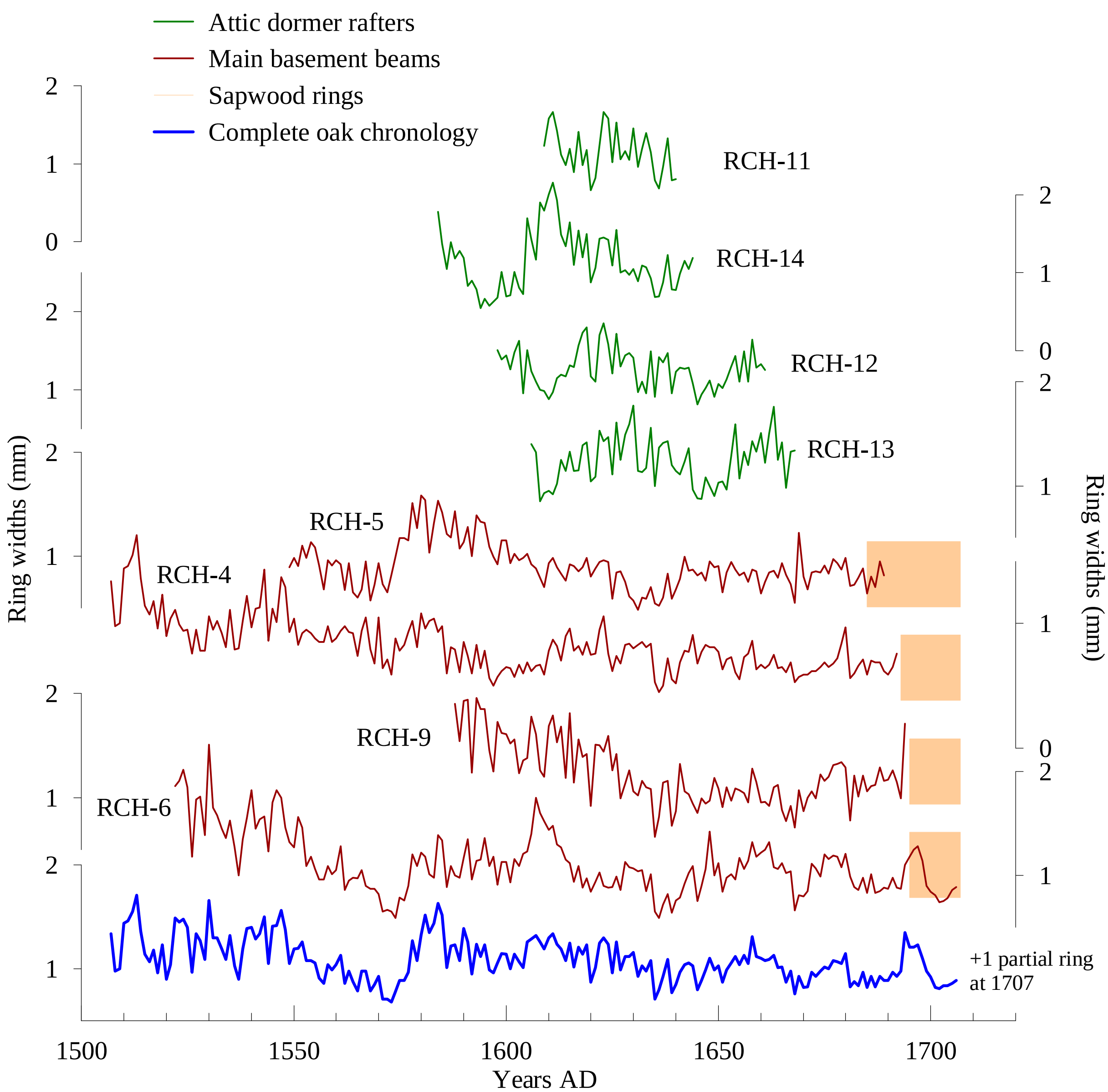
Dendrochronological methods and results

Dendrochronology is based on matching the patterns of wide and narrow annual rings in each tree-ring sequence to each other, to build a chronology by averaging the measurements of samples that securely crossdate, and to compare those chronologies with an established and calendar-dated regional chronology to find the time period in which the trees grew. Secure crossdating is accomplished by matching long ring-width patterns that are unique to a particular period, with both visual and statistical tests. This process gives us accurate dates for the whole tree-ring sequence, which includes the end date of the outer ring in each sequence; the end date helps establish the building date. The best possible scenario for establishing a building date is when the outer ring of one or more samples is from just inside the bark of its parent tree, thus the "waney edge" (only bark removed) with a ring count of over 70; the outer ring date is the year that the parent tree was felled, and that is generally the building date (in historic constructions an almost immediate use of newly-cut lumber was common; at most a few months of drying was allowed). Squaring a timber generally removes a lot of the outer rings, so the date of the outer ring from a squared beam or board may be literally decades earlier than the building date, but very often one or more of the corners of that timber may still contain the waney edge. If sapwood rings are present, but not bark or waney edge, then we can estimate a felling date, especially with oaks, for which we have an average sapwood ring count for this region. In the Crailo collection, many basement beams have at least a possible waney edge; the outer (sapwood) rings of the one beam with bark (RCH-9) were punky, but we took a small section of the outer rings along with the core of the heartwood to obtain at least a count the outer rings. Two of the sampled attic rafters were complete, albeit small, logs, but both contained less than 50 rings - those sequences are very hard to date securely.

At the lab, the samples were prepared by first gluing the cores into core-holders, then progressively sanding and polishing the transverse surface of the cores with 40- to 300-grit sandpaper. The ring-widths were measured on a moving table underneath a stereomicroscope with cross hairs, recording the widths with 0.01mm accuracy. Two readings of each core were taken, compared with each other, and reconciled for any difference greater than 3% of the ring-width. The reconciled sequences for each group of the same species were then compared with each other to determine their relative placement in time. The oaks with secure crossdates were re-dated accordingly and combined into a chronology, then compared with oak chronologies from forest and other historic buildings around the Albany-Schenectady area, and from regional chrononologies from Boston, MA, to central upstate New York, to place them in time (Figure 2). The pitch pines have one possible chronology, but that has yet to be securely dated. The hemlock samples had many breaks in the cores, a problem with very dried hemlock; they are not datable.

Results:

The Crailo oak chronology is built of samples RCH-4, 5, 6, and 9 from the main basement, and RCH-11 & 14 and 12 & 13 from squared support beams in the attic window frames (Figure 1). The chronology covers 200 years in time. There are additional, incomplete, outermost sapwood rings in two samples from the main basement, which indicate that the trees were felled during the growing season, most likely May to June of that year. The house would have been constructed soon after the felling, most likely in the summer months.



Main basement beams:
RCH-5: lintel above fireplace
RCH-4: fireplace cradle beam
RCH-9: lintel above doorway to boiler room
RCH-6: fireplace cradle beam

Attic dormer roof rafters:
RCH-11, 12, 13, and 14.
All were squared and had been burnt.
None contain any sapwood.

Figure 1. The raw measurements of the oak samples collected from the Crailo House.

The oak chronology correlates significantly with established historic oak chronologies, telling us that the trees were cut down in 1707 (Figure 2), again in the late spring-early summer months.

The tree-rings in the small rafters of the east addition's dormer windows are securely dated, but the rafters contain no waney edges or even sapwood rings. Those timbers could have been fallen, at earliest, in 1679, 10 years after the 1669 outer ring, but are more likely from long after, sometime in the 18th century, with these timbers coming from the middle of a very large log.   Huey told us that that the east section of the building was thought to have been built *ca.* 1750 - that is certainly possible – but with the small size of the rafters, re-use of timbers from an earlier building, or part of the original building that was altered when the east section was added is also possible. The latter case is also indicated because the patterns in the basement and attic sequences are close enough that the trees may have been felled in the same forest.

Statistics for matching patterns:	Crailo vs NYS oaks	Crailo vs Schenectady oaks	Crailo vs Boston oaks
Student's *t*-score	5.74	8.40	8.02
Pearson corr coeff	0.41	0.60	0.50
Trend coeff	62%	75%	67%
Overlap (years in common)	161	127	200

All are signifcant at the 0.05% level of probability

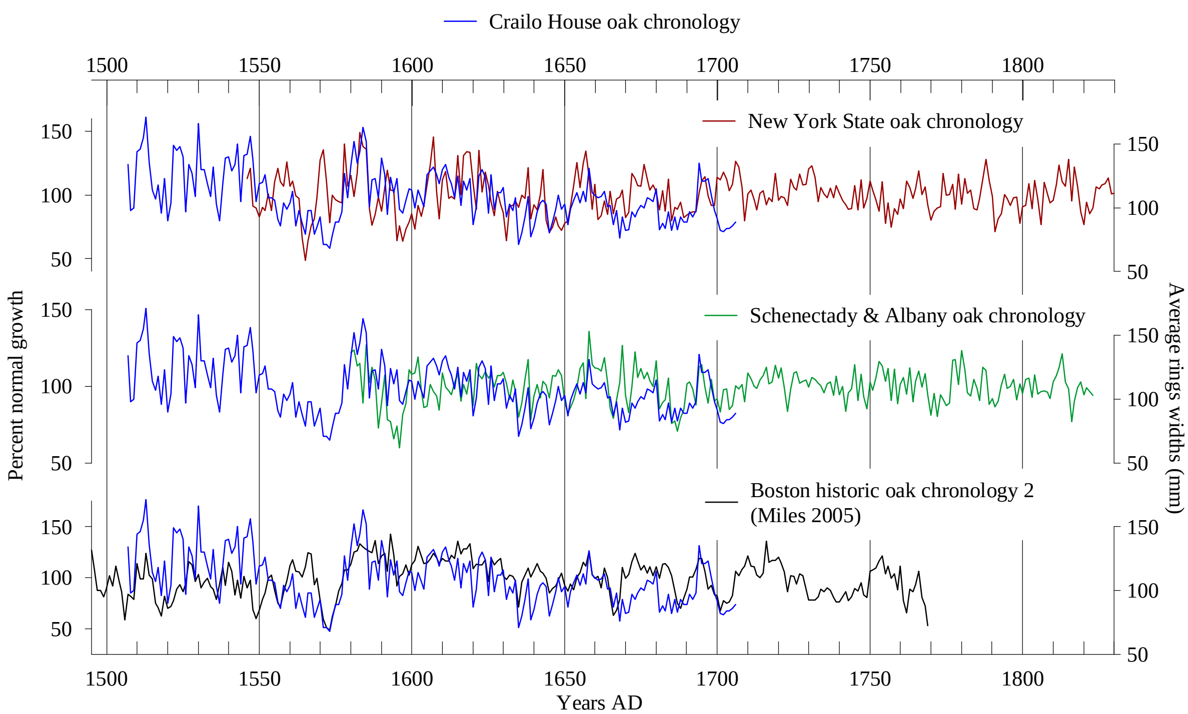


Figure 2. Shown here is the excellent visual and statistical crossdating between the Crailo oak chronology versus regional historic and modern oak chronologies, including the east-central and southeastern New York State chronology (top); the Albany-Schenectady historic oak chronology (middle) composed of tree-ring sequences in samples taken from other buildings, and a Boston historic oak chronology (Miles 2005).

The pitch pine samples, as of December 2010, are not datable. They include the 4 beams from the outer basement boiler room and one attic rafter; all are from the east addition. Unfortunately this species can be very difficult to securely crossdate; many samples are needed due to higher variability in the trees' growth patterns, a result mainly of the trees' immediate environment. Only two samples have over 70 rings, and they do not crossdate well. In order to better understand the species' growth patterns, in 2010 we collected 22 pitch pine samples from live trees at the Old Maids Wood and the Albany Pine Bush Preserve with the help of Don Rittner, and an analysis of those samples will help us to know what to look for in variations and matching patterns between trees from a known time; only then can we determine if we can securely data one or two samples. With additional work on the pitch pines, a secure date may arise; 1753 and 1776 are possible dates for those samples, but are from only possible, not secure, crossdating between the two long Crailo pitch pines and between those samples and other pitch pine data sets from around the region. The best scenario would be additional sampling at the Crailo House, focusing on the pitch pine timbers.

The tamarack and hemlocks cannot be dated due to lack of adequate existing chronologies for tamarack, and short sequences for both, and broken samples of the hemlock. Still the presence of the hemlock only in the east attic suggests a later, even 19th century, alteration.

The dendrochronological results of this building as of December 2010 indicate only the original construction date of 1707. I do wonder if the small header beams could have been a re-use of beams taken from part of the 1707 structure (or even earlier), and re-cut to be used for this purpose.

Acknowledgments: The equipment and facilities used in this research were provided by the Cornell Tree-Ring Laboratory, B48 Goldwin Smith Hall, Cornell University, Ithaca, NY; Jen Watkins, Charlotte Pearson, Peter Brewer, Bill Griggs, and Sturt Manning all helped with sample collection. Additional oak and pitch-pine tree-ring chronologies built from other buildings around the same region were provided by Ed Cook, Lamont-Doherty Earth Observatory; from Pittsfield, MA, by Bill Flynt, and a historic oak chronology for the Boston area by Dan Miles, Oxford University.

Appendix

N.B. The end dates of the samples listed below include the dates of an outer partial ring if there is a “+” present. The partial rings are not included in the complete chronology. A “B” indicates the presence of bark; “W” indicates a waney edge when only bark is removed; “v” indicates that the outer ring is within 5 years of the waney edge or bark date; “vv” indicates unknown number of rings removed; “++” indicates multiple rings present but unmeasured.

Sample Number	Description	Number of rings	Dates included

Samples from the basement section that is now the boiler room:

RCH-

1 Core from N-S floor beam, next to east wall; squared, minimum radius 12.5cm. *Pinus rigida*.

A = ±p+1 + 63+3vv

2 Core from E-W short beam south of east wall fireplace, minimum radius 16cm, waney edge; *Pinus rigida*.

A = ±p+1 +102+1W

3 Core from N-S floor beam west of, and adjacent to, RCH-2, minimum radius 17.3cm, with possible waney edge. *Pinus rigida*.

A =±p+1+48+1v

7 Core from N-S floor beam west of, and adjacent to, RCH-3, minimum radius 18cm, possible waney edge. *Pinus rigida*.

A = ±p+1+110+5vv

Sample Number	Description	Number of rings	Dates included

Samples from the main basement:

4 Core from 1st floor fireplace cradle beam, heartwood only, ends at possible HW/SW boundary, min dimension 15.6cm, *Quercus* sp.

A= 1+184+1vv 1506 – 1691+vv

5 Core from lintel beam above basement fireplace, 6 sapwood rings, min diameter 13.2cm, *Quercus* sp.

A= 1+141+1v 1548-1690+v

6 Core from 1st floor fireplace cradle beam, 11 sapwood rings, min diameter 24.2cm, *Quercus* sp.

A= 1+157+1v
B= 1+185+1v
AB=1+185+1v 1521-1707+v

8 Core from 2nd E-W beam north of fireplace, *Larix laricina*. Max diam = 17.5cm, possible waney edge

A= ±p+1+ 61+1v Not dated

9 Core from beam above door in outer wall of main basement that is now the doorway to the boiler room. Whole log, *Quercus* sp., max dimension 15cm. In a small outer section cut for sapwood information, 13 sapwood rings were counted. They could not be measured due to deterioration, but the section contained a few heartwood rings that matched the outer rings in the core. Only heartwood rings present in the measurements.

A= 1+114+13W 1580-1707++W

Attic section above boiler room. The attic had been burned at some point, but not with significant structural damage to the sampled timbers. Huey says that this section was believed to have been added sometime after 1750 [1762?].

10 Core from whole log rafter. *Pinus rigida*, max dimension 6.5cm, too few rings to date.

A= 1+ 30+1vv TFR

11 Core from a squared rafter on east side above north dormer window close to main building. *Quercus* sp, max dimension 8cm. No sapwood. Same tree as RCH-14.

A= 1+ 32+1vv

14 Core from a squared rafter on west side above north dormer window close to main building. *Quercus* sp, max dimension 8cm. No sapwood. Same tree as RCH-11.

A= 1+ 61+ 1vv
RCH 11&14= 1+ 61+1vv 1583-1645+vv

12 Core from squared rafter on east side above south dormer window. *Quercus* sp, max dimension 8.2cm. No sapwood. Same tree as RCH-13.

A= 1+ 64+1vv

13 Core from squared rafter on west side in south dormer window. *Quercus* sp, min diameter 8cm. No sapwood, from same tree as RCH-12.

A= 1+ 63+1vv

RCH 12&13 = 1+ 71+1vv 1597-1669+vv

15 Core from beam next to wide board extending out of east wall, north of chimney, in attic of addition over boiler room. *Tsuga canadensis*, max dimension 5.3cm. Three breaks in core. A= 1+42+1vv TFR

16 Core from rafter along south roof. *Tsuga canadensis*, max dimension 13cm. Too many breaks in core to be sure of order or loss of rings.

A= 1+~ 90+1vv

17 Core from complete log rafter along south roof, west of RCH-16. *Pinus rigida*.

A= 1+46v TFR