A Dendrochronological Analysis
of the

John Tullar House

South Egremont, Massachusetts

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Introduction

This is the final report on the dendrochronological analysis of the John Tullar House, located on 25 Sheffield Road, South Egremont, Berkshire County, Massachusetts 01258. In an effort to confirm the construction history of this house, Architectural History Consultant Walter Wheeler, Box 1413, Troy, NY 12181-1413, requested that dendrochronologists William Callahan and Dr. Edward Cook perform a tree-ring analysis of its structural timbers. Together with Mr. Wheeler, Callahan visited the house on 23 April, 2005, and collected wood core samples for dendrochronological analysis of the timbers. Of the 10 samples acquired and analyzed, 9 were Northern Pitch Pine (Pinus rigida) and 1 was White Pine (Pinus strobus). Every effort was made on site to locate bark or waney edges on the sampled timbers in order to ascertain an absolute cutting date (or dates) of the trees used in the construction.

Dendrochronological Analysis

Dendrochronology is the science of analyzing and dating annual growth rings in trees. Its first significant application was in the 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 to archaeological dating. Douglass established the connection between annual ring width variability and annual climate variability, which allows for the precise dating of wood material (Douglass 1909, 1920, 1928; Stokes and Smiley 1968; Fritts 1976; Cook and Kariukstis 1990). The dendrochronological methods first developed by Douglass have evolved and been employed throughout North America, Europe, and much of the temperate forest zones of the globe (Edwards 1982; Holmes 1983; Stahle and Wolfman 1985; Cook and Callahan 1992, Krusic and Cook 2001). In Europe, where the dendrochronological dating of buildings and artifacts has long been a routine professional support activity, the success of tree-ring dating in historical contexts is noteworthy (Baillie 1982; Eckstein 1978; Bartholin 1979; Eckstein 1984).

The wood samples collected from the John Tullar House were processed in the Tree-Ring Laboratory by Dr. Edward Cook, following well-established dendrochronological methods. The samples were carefully glued onto grooved mounts and sanded to a high polish to reveal the annual tree rings clearly. The rings widths were measured under a microscope to a precision of ±0.001 mm. The cross-dating of the obtained measurements utilized the COFECHA computer program (Holmes 1983), which employs a sliding correlation to identify probable cross-dates between tree-ring series. In all cases, the robust non-parametric Spearman rank correlation coefficient was used for determining cross-dating. Experience has shown that for trees growing in the northeastern United States, this method of cross-dating is superior to the traditional skeleton plot technique (Stokes and Smiley 1968). It is also very similar to the highly successful CROS program employed by, for instance, Irish dendrochronologists to cross-date European tree-ring series (Baillie 1982).

COFECHA is used to first establish internal or relative cross-dating amongst the individual timbers from the site. This step is critically important because it locks in the relative positions of the timbers to each other, and indicates whether or not the dates of those specimens with outer bark rings are consistent. Subsequently, the internally cross-dated series are each compared with independently established tree-ring master chronologies compiled from living trees and dated historical tree-ring material. All of the "master chronologies" are based on completely independent tree-ring samples.

In the John Tullar House study, a regional composite master dating chronology from living trees and historical structures in the Deerfield area of northwest Massachusetts was referenced primarily. This historical master covers the period 1526-1992 A.D. All dating results were verified finally by comparison with other independent dating masters from surrounding areas in New York, New Jersey, and central Pennsylvania. In each case, the dating as reported here was verified as correct.

Results and Conclusions

The results of the dendrochronological dating of the John Tullar House timbers are summarized in **Table 1** and **Figure 1**. A total of 10 pine samples were analyzed in the laboratory, with 8 of the 10 samples providing firm dendrochronological dates. To achieve this success required attention during analysis to the previously recorded structural context of the samples (see **Table 1**). The contextual association of samples from within the house, the redundancy of the indicated relative cross-datings, and the existence of bark/waney edges demonstrating cutting year, provide the essential constraints necessary for establishing cross-dating within the site.

The strength of the cross-dating of the pine samples is indicated by the Spearman rank correlations in column 7 of **Table 1**. These correlations, produced by the COFECHA program, indicate how well each sample cross-dates with the mean of the others in the group. These individual correlations vary slightly in statistical strength, but all are in the range that is expected for correctly cross-dated timbers from buildings in the eastern US. Of the 8 pitch pine samples that cross-dated well between themselves, and also dated well against the local pine historical dating master (see **Table 1**, column 6), 4 had bark edge at the time of sampling; 1 additional bark edge sample was of White Pine, and is undated.

From the dates that were achieved, there emerged clear indications of an intrinsic construction period that produced the John Tullar House. The samples from the house indicate a construction phase sometime after the end of the year 1758. The last annual ring in the four dated barked timbers cut in 1757 (3 samples – JTHEMA08, 09, 10 - from roof framing) and 1758 (1 sample - JTHEMA02 - from cellar joists) is complete, which means that the trees were cut, respectively, during seasonal growth dormancy in the late autumn/early-winter of 1757/1758 or late winter/early-spring of 1758/1759. Those four samples that were dated, but where wane edge was lacking, support the post-1758 date. Two (JTHEMA01, 02) were cut in some indeterminable year after 1745, and the remaining two (JTHEMA04, 05) were cut in some indeterminable year after the early part of the 1700's. Of these four, three (JTHEMA01, 04, 05) were heavily chamfered floor joists from the cellar, the chamfering precluding any possibility of assigning an absolute date. Because of breaks and other physical degradation on the outer portion in the fourth sample (JTHEMA03, also from a cellar floor joist), it was impossible to date more than the inner portion of the core, although it likely maintained a wane edge.

Table 1. Dendrochronological dating results for all samples taken from the John Tullar House, South Egremont, Massachusetts. 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 other samples of the same species, in this case pitch pine (*Pinus rigida*), except for JTHEMA07 (white pine). If the outermost recovered +BE ring is completely formed, it is indicated as "comp", meaning that the tree was felled in the dormant season following that last year of growth. If the +BE ring is not completely formed, it is indicated as "inc", meaning that the tree was felled during the active growing season of that year of growth. Those with questionable felling dates due to sapwood degradation and/or bad breaks/possible lost rings are indicated by "?".

ID	SPECIES	DESCRIPTION	WANEY	RINGS	DATING	CORREL
JTHEMA01	Pitch Pine	Floor joist in cellar, 1st from west wall, chamfered	-BE	154	1592 1745	0.41
JTHEMA02	Pitch Pine	Floor joist in cellar, 2nd from west wall, bark present at sampling	+BE comp	76	1683 1758	0.50
JTHEMA03	Pitch Pine	Floor joist in cellar, 3rd from west wall, bad breaks in core	BE??	62	1686 1747	0.59
JTHEMA04	Pitch Pine	Floor joist in cellar, 4th from west wall, chamfered?	BE??	71	1646 1716	0.54
JTHEMA05	Pitch Pine	Floor joist in cellar, 5th from west wall, chamfered	-BE	58	1643 1700	0.46
JTHEMA06	Pitch Pine	Floor joist in cellar, 6th from west wall, chamfered	-BE	46	No Date	-.--
JTHEMA07	White Pine	Floor joist in cellar passageway – "First Addition"	+BE	75	No Date	-.--
JTHEMA08	Pitch Pine	Rafter in attic, east end, north side of pair marked with "X"	+BE comp	175	1583 1757	0.45
JTHEMA09	Pitch Pine	Rafter in attic, west end, north side of pair marked with "IIII"	+BE comp	85	1673 1757	0.53
JTHEMA10	Pitch Pine	Rafter in attic, west end, south side of pair marked with "IIII"	+BE comp	120	1638 1757	0.51

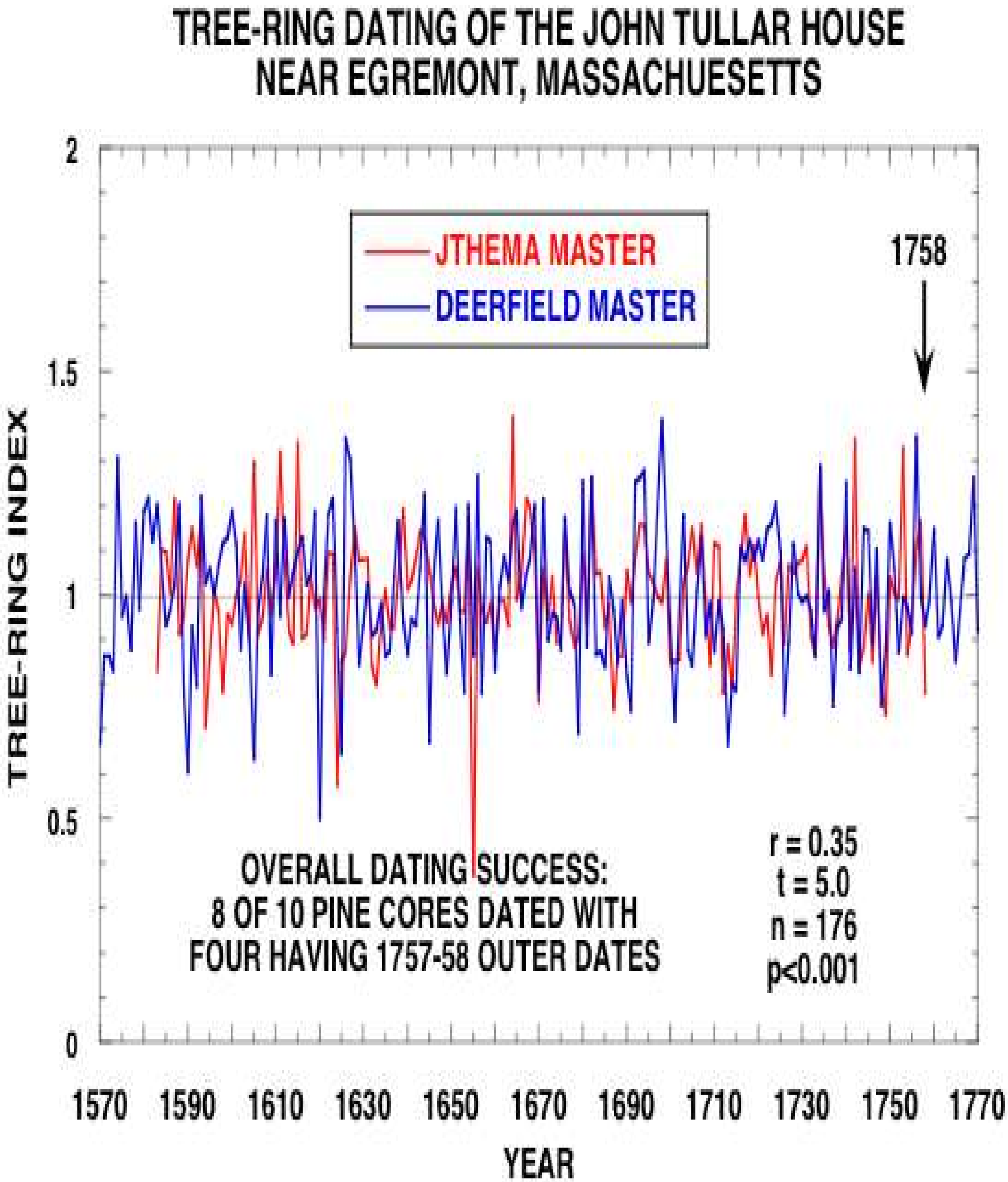

Figure 1. Comparison of the cross-dated pine master chronology for the John Tullar House, South Egremont, Berkshire County, Massachusetts, with the best regional pine dating master, developed from living trees and historical structures in the Deerfield region of northwestern Massachusetts. The Spearman rank correlation between the series (r=0.35) is significant (p<0.001) with an overlap of 176 years.

The reliability of the pine dating is succinctly illustrated in **Figure 1**. It shows the mean of the "internal" pine chronology developed from the 8 dated John Tullar House Pitch Pine samples compared with the local, independently dated pine historical dating master from Deerfield in northwestern Massachusetts.

The "r-factor” is the Spearman rank correlation coefficient, a measure of relative agreement between two groups of measurements or data. It can range from -1 (perfect opposite agreement) to +1 (perfect direct agreement). The "t-value" is Student's distribution test for determining the unique probability distribution for “r-factor”, i.e. the likelihood of its value occurring by chance alone. As a rule, a t=3.5 has a probability of about 1 in 1000 or 0.001 of being invalid. Higher “t” values indicate increasingly stronger statistical certitude.

The t-statistic (t=5.0) associated with the correlation between these two series (r=0.35) is significant ($p<0.001$) for a 176-year overlap. For that reason, there can be no doubt that the pine dates presented here are very strongly valid, and that the statistical chance of the cross-dates being incorrect is much less than 1 in 1000.

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Edward Cook was born in Trenton, New Jersey, in 1948. He received his PhD. from the Tucson Tree-Ring Laboratory of the University of Arizona in 1985, and has worked as a dendrochronologist since 1973. Currently director of the Tree-Ring Laboratory at the Lamont-Doherty Earth Observatory of Columbia University, he has comprehensive expertise in designing and programming statistical systems for tree-ring studies, and is the author of many works dealing with the various scientific applications of the dendrochronological method.

William Callahan was born in West Chester, Pennsylvania, in 1952. After completing his military service he moved to Europe, receiving his MA from the University of Stockholm in 1979. He began working as a dendrochronologist in Sweden in 1980 at the Wood Anatomy Laboratory at the University of Lund, and returned to the United States in 1998. A former associate of Dr. Cook at the Tree-Ring Laboratory of Lamont-Doherty, he has extensive experience in using dendrochronology in dating archaeological artifacts and historic sites and structures.

Some regional historical dendrochronological projects completed by the authors:

Abraham Hasbrouck House, New Paltz, NY
Carpenter’s Hall, Philadelphia, PA
Christ’s Church, Philadelphia, PA
Conklin House, Huntington, NY
Customs House, Boston, MA
Daniel Pieter Winne House, Bethlehem, NY
Ephrata Cloisters, Lancaster County, PA
Fawcett House, Alexandria, VA
Gadsby's Tavern, Alexandria, VA
Gilmore Cabin, Montpelier, Montpelier Station, VA
Gracie Mansion (Mayor’s Residence), New York, NY
Hanover Tavern, Hanover Courthouse, VA
Harriton House, Bryn Mawr, PA
Hollingsworth House, Elk Landing, MD
Independence Hall, Philadelphia, PA
John Browne House, Forest Hills, NY
Log Cabin, Fort Loudon, PA
Lower Swedish Log Cabin, Delaware County, PA
Morris Jumel House, Jamaica, NY
Old Swede’s Church, Philadelphia, PA
Panel Paintings, National Gallery, Washington, DC
Pennock House & Barn, London Grove, PA
Powell House, Philadelphia, PA
Spangler Hall, Bentonville, VA
St. Peter’s Church, Philadelphia, PA
Strawbridge Shrine, Westminster, MD
Thomas & John Marshall House, Markham, VA
Varnum’s HQ, Valley Forge, PA
William Garrett House, Sugartown, PA
Yew Hill, Fauquier County, Virginia