



Dendrochronology, Inc.

P.O. Box 293, Blacksburg, Virginia 24063

Peter J.J. Egan, Ph.D., President

FINAL REPORT

THE YEAR OF CONSTRUCTION OF THOMAS SLAVE CHAPEL BY KEY-YEAR DENDROCHRONOLOGY

SUBMITTED BY:

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October 2003
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ABSTRACT

**THE YEAR OF CONSTRUCTION OF THOMAS SLAVE CHAPEL
AS DERIVED BY KEY-YEAR DENDROCHRONOLOGY**

The last year of tree growth for the historic structure, Thomas Slave Chapel, was 1876, as derived by key-year dendrochronology.



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THE YEAR OF CONSTRUCTION OF THOMAS SLAVE CHAPEL AS DERIVED BY KEY-YEAR DENDROCHRONOLOGY*

This study dates the last year of tree growth of the timbers used in the construction of Thomas Slave Chapel, by using Dendrochronology, Inc.'s key-year dating technique.

I. DESCRIPTION OF STUDY AREA:

Thomas Slave Chapel is located in Bedford County, Virginia. Within this study area is one predominant physiographic region – the southern Appalachian ridges and valleys. The geological materials are predominantly underlain in the valleys by limestone and shales on the ridges by sandstones and shales.

The major forest type is oak-hickory with common associates including southern yellow pine, tulip-poplar and gum. Although the composition of tree species within a given forest stand varies widely with soils and past land use, the oaks are the most widely distributed hardwood; pure stands of Virginia pine also occur.

The annual precipitation ranges from 41 to 45 inches per year; the soils usually return to field capacity during the winter, and the annual potential evapotranspiration throughout the study area ranges between 22 and 28 inches. The area is well known for occasionally extreme moisture deficits and excesses.

*U. S. Patent No. 4,373,393

II. AREA KEY-YEAR PATTERN:

The development of the area's tree-ring pattern for a given tree genera is a computerized analysis of the number of trees from a given site expressing relative growth differences in a given year, especially the key years in which a significant number of the trees coincide regarding relative growth. The development of the area key-year pattern has been achieved by non-parametrical testing (Chi-square and Kappa) for the year of best fit for the key-year pattern from currently living trees and historical structures. (Heikkenen, 1984; Heikkenen and Edward, 1984; and McCrae, 1995)

The area oak, pine and tulip-poplar tree-ring patterns from currently growing trees and historic structures have been derived from previous studies in Virginia, Colonial Williamsburg, the Western Shore of Maryland, and the lands bordering the Chesapeake Bay. The pine key-year pattern for Southeast Virginia was used to align the tree-ring pattern from the Thomas Slave Chapel.

III. SAMPLING PROCEDURES:

The dating of the timbers from Thomas Slave Chapel was based on wood samples removed by boring and sawing. The boring of samples was accomplished by means of a hollow cutting tube on an electric drill. The outside diameter of the tube is approximately 0.5 inches; the core sample is approximately 0.4 inches. The length of the core is proportionate to the maximum dimension of the structural timber (on the radius from outside edge toward timber's center).

Wood samples were also obtained by sawing the ends of exposed timbers; the thickness of said samples being 0.5 inches. Suitable timbers occurred where joists were notched for placement in sills. The sampling did not impair either the structural strength or the historical character of the timbers.

IV. ANALYSIS:

The analyses of the cores and disks involved the laboratory preparation of these samples by sawing, sanding, oiling, measuring each annual ring of each sample, and presenting the data in a form suitable for computerized analyses.

The measurement of the widths of the annual rings was done with a dendrochronometer developed by Dendrochronology, Inc. This machine has a movable stage (24" linear displacement) on which the wood sample is placed. The stage is hand moved, either forward or reverse (accuracy .01 mm). The prepared wood specimens were examined under binocular magnification (variable, 10 – 100X) under direct light. When the width of an annual ring had been traversed, the distance was concomitantly measured, then entered into the computer data bank. This dendrochronometer was unique regarding the linear displacement, variable magnification, and lighting. The automatic recording of the data eliminates human error regarding the transfer of data and the year of occurrence of the tree ring.

The development of the area's tree-ring pattern for a given tree genera is a computerized analysis of the number of trees from a given site expressing growth differences in a given year, especially the key years in which a significant number of trees coincide regarding relative growth: growth for a given year being greater or less than the preceding year. The development of the area pattern was achieved by nonparametrical testing (Chi-square and Kappa) for the year of best fit of the ring pattern from currently living trees and historical structures.

Dendrochronology, Inc.'s technique has provided the area key-year pattern common to the entire study area extending from present back through the 17th century.

V. SAMPLING:

Thomas Slave Chapel, was sampled on July 11-13, 2003. A total of 11 samples were removed from the timbers framing the first floor and roof.

The samples were mostly southern yellow pine and two were oak. The presence of wane, number of years and those used to construct the key-year pattern are given in the index.

VI. KEY-YEAR PATTERNS:

The key-year pattern (KY) derived from the timbers of Thomas Slave Chapel, has a sample size of 9, and at a probability level of $p = .13$ a length of 41 years, with a total of 18 KY, 7 + KY and 11 - KY (TSC4).

VII. LAST YEAR OF TREE GROWTH:

The last year of tree growth for the timbers was derived by aligning the KY pattern (TSC4, $n = 11$, $p = .05$) with the area pine KY pattern (CPZ 10). The year of best fit was 1876, having a highly significant Chi-square value of $X^2 = 8.6$. The timbers used to construct Thomas Slave Chapel, were hewed and sawed from trees felled after the growing seasons of 1875 and 1876.

LITERATURE CITED

Heikkenen, H. J. 1984. "Tree Ring Patterns: A Key-Year Technique for Crossdating," *Journal of Forestry*, Vol. 82, No. 5:302-305.

Heikkenen, H. J. and M. R. Edwards. 1984. "A New American Dendrochronological Technique and Its Application in Dating Historic Structures in Maryland," Bulletin: The Association for Preservation Technology, vol. XV, No. 3:3-25.

McCrae, W. J. 1995. "Dendrochronology: A New Research Tool." North Carolina Preservation. Number 99:2-7.

SITE: Thomas Slave Chapel

DATE: July 11-13, 2003

NAME: H. A. Beard, Jr.
H. J. Heikkinen

FILE	SPECIES	TYPE	MEMBER	WANE	Y	X ²	USED	COMMENTS
TC 01	Pine	D	Rafter	+	23		+	
TC02	P	D	Rafter	=	22		+	
TC03	P	S	Joist	+	41		+	
TC04	P	S	Joist/Rafter	+	22	+		
TC05	P	S	Joist	+	46		+	
TC06	P	S	Joist	+	40		+	
TC07	P	S	Joist	+	--		--	
TC08	P	S	Joist	+	--		--	
TC09	P	S	Joist	+	40		+	
TC10	Oak	S	Joist	+	50		--	
TC11	O	S	Joist	+	--		--	