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# Dendrochronological Analysis of Five Historical Structures In Southwestern Ohio Franklin

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# Initial Dendrochronological Analysis of Five Historical Structures In Southwestern Ohio Franklin

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**Objective:**
To provide a calendar date for the felling of timber from five historical structures using dendrochronology and to develop a ring-width tree-ring chronology from the timber used in the construction of the structures. The ring-width data will be added to the northeastern Ohio database, thus expanding the databank farther into southwestern Ohio. Data will contribute to the understanding of past climate variability over the past six centuries. All logs are archived at the Wooster Tree Ring Lab, housed in the Department of Geology, The College of Wooster.

**Methods and Analyses**:
Thirty series were measured from 19 wood cross sections from five structures (Tables 1 - 5). The cores were prepared and sanded, annual rings were counted, measured to the nearest 0.001 mm, and then crossdated using standard dendrochronological techniques (Stokes and Smiley, 1968) (Fig. 1). Multiple series are measured from each sample to determine annual ring correlation along differing cross sectional radii. All series from a site are then crossdated against each other, developing a "floating" site chronology before crossdating with the calendar dated northeastern Ohio regional series. Crossdating is strong with a regional master chronology from NE Ohio as well as with the more local southwestern Glen Helen chronology (ITRDB).

Series were successfully calendar dated but only two of the series, representing two cross sections from Bellbrook (BB2B, BB3B; Table 5) provided true outer rings (cut dates), important in dating the year of felling (Fig. 2). The other four series from this structure do not have true outer rings, but are all four are within a few years at most of 1851. Visual examination of the four cross-sections, and location along the sapwood, suggest that the true outer ring was extremely close to the documented last year of measurement. Based on the two cross sections, BB2B (1645 - 1851) and BB3B (1637 - 1859), and on cross section visual assessment, we suggest that felling for Bellbrook was in 1851. Furthermore, the wood was cut in winter, after the tree had stopped growing for the year. Figure 3 indicates the end of annual growth for the year 1850 with a dark line forming along the transition from the sapwood to the bark.

The sites together create a 204-year chronology spanning 1611 – 1851 AD. The data from the five structures are instrumental in expanding our strong northeastern regional chronology into the surrounding regions of Ohio. The positive outcome of these five structures suggest further enquiry into the southwest as a potential location for chronology extension.

**Graphs:**

Individual ring-width data from the series of the five southwestern Ohio sites were developed into a master chronology (Figs. 3 & 4). Location in forest and the health of surrounding trees influence the growth of an individual tree and the width of a ring. Detrending by "smoothing" removes the influence of growth function from a ring's width.

We are pleased to note that both raw-width data and detrended data have similar features and share a number of narrow ring calendar dates. In both, 1699 and 1816 are two of the narrowest rings for years with a significant number of series (late 1600s - 1850). 1816 is a recognized internationally as the "Year without a Summer" following the 1815 Tambora eruption (Rampino et al., 1988). 1699 is the narrowest ring found in northeastern Ohio and correlates with a large-scale volcanic event (D'Arrigo, 1999). both NE and SW Ohio have a narrow 1839 ring.

**Table 1. Ward Barn**

| Sample | Inner Ring | Outer Ring | Number of Rings |
|---|---|---|---|
| WB1 | 1714 | 1843 | 129 |
| WB2A | 1725 | 1838 | 113 |
| WB2B | 1730 | 1843 | 113 |
| WB3B | 1758 | 1838 | 80 |
| WB4A | 1710 | 1834 | 124 |
| WB4B | 1710 | 1843 | 133 |
| WB5A | 1688 | 1831 | 143 |
| WB5B | 1688 | 1838 | 150 |
| WB6A | 1748 | 1846 | 98 |
| WB6B | 1748 | 1849 | 101 |
| WB7A | 1718 | 1828 | 110 |
| WB7B | 1717 | 1850 | 133 |
| WB8A | 1690 | 1833 | 143 |
| WB8B | 1692 | 1842 | 150 |
| WB9 | 1736 | 1806 | 70 |
| WB10A | 1745 | 1839 | 94 |
| WB10B | 1755 | 1848 | 93 |

**Table 2. Mid Miami Valley Barn**

| Sample | Inner Ring | Outer Ring | Number of Rings |
|---|---|---|---|
| MV1A | 1701 | 1812 | 111 |
| MV1B | 1700 | 1801 | 101 |

**Table 3. Franklin Log Post Office**

| Sample | Inner Ring | Outer Ring | Number of Rings |
|---|---|---|---|
| PO1 | 1655 | 1802 | 147 |
| PO2 | 1638 | 1787 | 149 |
| PO3 | 1658 | 1800 | 142 |
| PO4 | 1611 | 1771 | 160 |

**Table 4. Bruckner Wall**

| Sample | Inner Ring | Outer Ring | Number of Rings |
|---|---|---|---|
| BW1 | 1711 | 1807 | 96 |

**Table 5. Bellbrook**

| Sample | Inner Ring | Outer Ring | Number of Rings | Outer Ring Present |
|---|---|---|---|---|
| BB1A | 1695 | 1850 | 155 | |
| BB1B | 1694 | 1850 | 156 | |
| BB2A | 1646 | 1849 | 203 | |
| BB2B | 1645 | 1851 | 206 | Yes |
| BB3A | 1638 | 1843 | 205 | |
| BB3B | 1637 | 1850 | 213 | Yes |

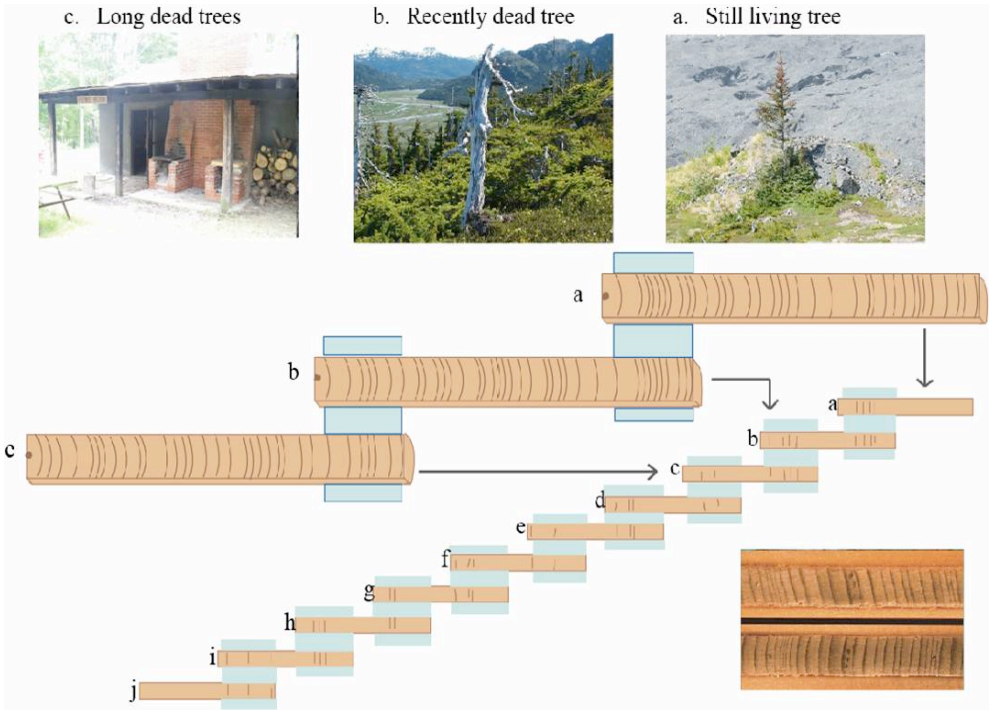


**Figure 1**: Dendrochronological principle of crossdating used for all site studies. Crossdating allows the crossover and linking of rings from many cores that span similar years, creating a continuous annual record covering more years than a single core could provide.

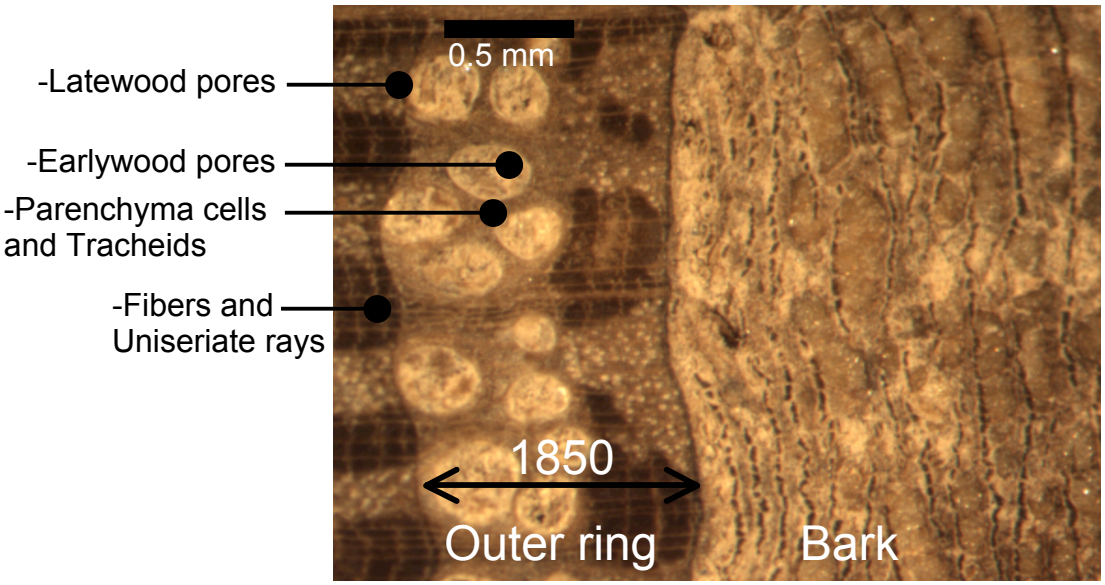


**Figure 2**: Outer ring, bark boundary from Bellbrook's BB3B. The final annual ring of growth for the tree was in the winter of 1850 – 1851 as the ring is complete with earlywood and latewood, representing an entire season of growth.

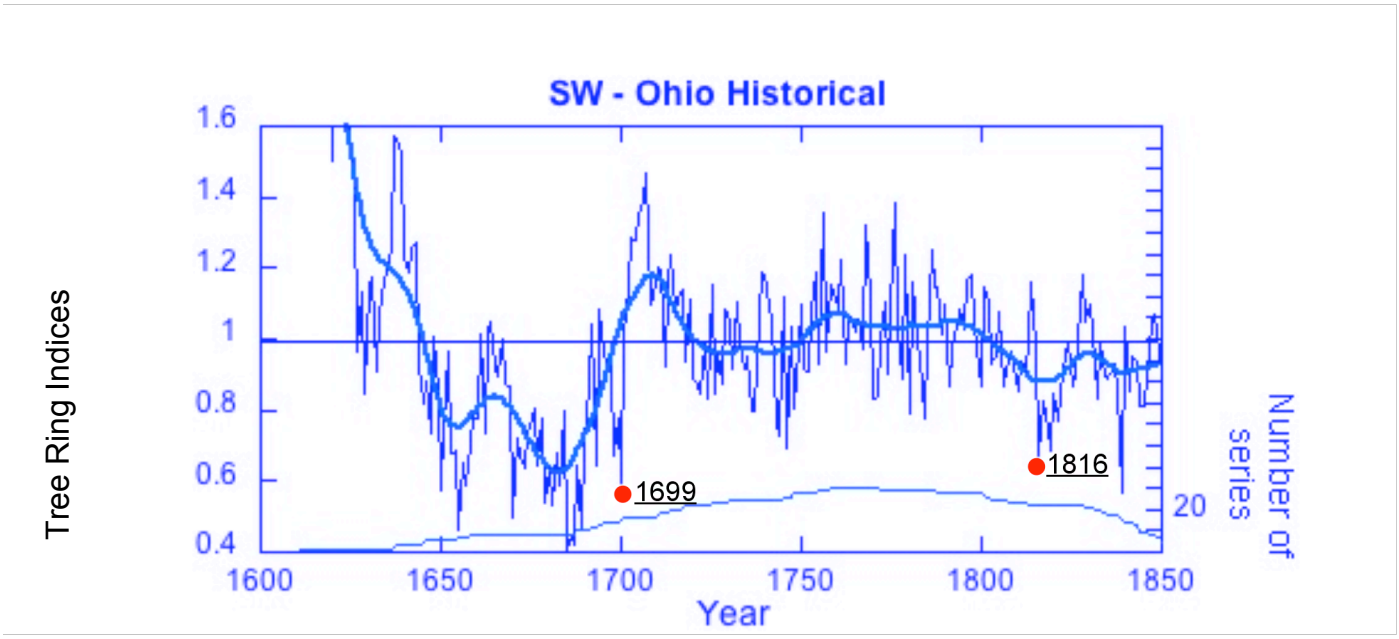


**Figure 3**: Graph of Southwest Ohio annual raw ring-width data with time. Large juvenile width is noted in the initial decades of growth. After narrow rings 1699 and 1816, there is a ramping up of width in succeeding years.

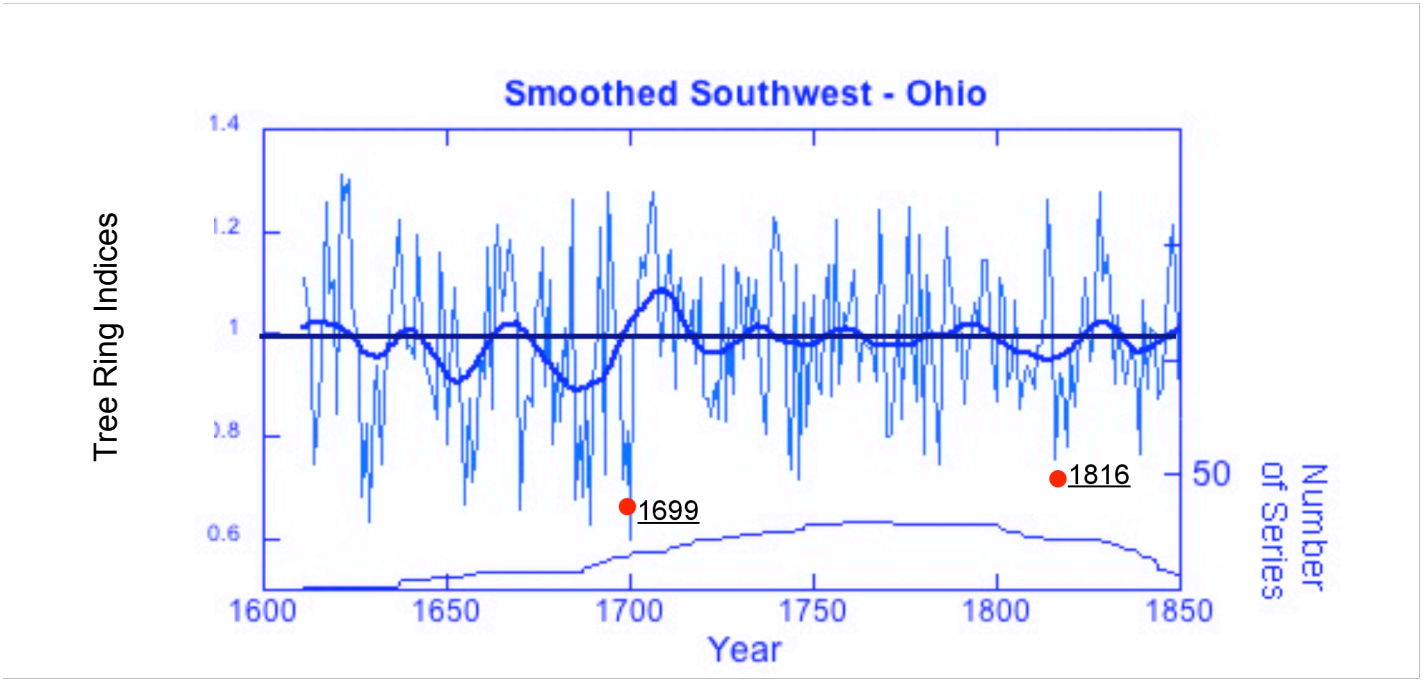


**Figure 4**: Smoothed, or detrended graph of Southwest Ohio annual ring-width data. Note the decreased number of width indices in the 1600s early years of growth.

**Reference:**

D'Arrigo, R. D., and G. C. Jacoby, 1999, Northern North American tree-ring evidence for regional temperature change after major volcanic events. *Climate Change* 41:1-16.

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Rampino, M. R., S. Self, and R. B. Stothers, 1988, Volcanic Winters. *Annual Review of Earth and Planetary Sciences* 16:73-99.