Tree-Ring Dating Results for

Burling Slip Timbers

Lower Manhattan, New York City

By

Edward R. Cook

and

Dario Martin Benito

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Introduction

In April 2010, members of the Lamont-Doherty Earth Observatory Tree-Ring Laboratory (TRL) accompanied Molly McDonald, Senior Archaeologist and Architectural Historian, AKRF, on a visit to the newly excavated Burling Slip site near the South Street Seaport Museum in Lower Manhattan. This site was being prepared for the construction of the Burling Slip Imagination Playground. During the initial excavation phase a substantial number of wharf pilings and timbers were encountered, which were thought to have possibly been part of the original Burling Slip prior to it being buried in landfill. Because of the potential historical significance of the timbers, Molly McDonald contacted the TRL on behalf of AKRF to determine the feasibility of dating some of the timbers using tree-ring dating techniques. The April visit proved highly successful and some major timbers were sampled. Subsequently, additional ones were collected and a total of seven (7) samples were brought to the TRL for analysis. The results of those analyses are reported on here.

Tree-Ring Analysis Results

The seven samples collected at Burling Slip were slowly dried prior to analysis. Slow drying was necessary to avoid rapid shrinking, splitting, and cracking that could impair the tree-ring analysis of the samples. Due to the waterlogged nature of the samples, this process took several weeks to complete. After the samples were sufficiently dried, they were carefully sanded with progressively finer grits to reveal the fine details of the annual tree rings. This process revealed that all seven samples were from locally available conifer species: eastern hemlock (*Tsuga canadensis*; 5 samples), pitch pine (*Pinus rigida*; 1), and eastern white pine (*Pinus strobus*; 1). Only hemlock provided multiple samples for comparison, which generally improves the likelihood of dating archaeological tree-ring samples of unknown site origin. However, this case we were also able to produce tree-ring dates for the two pine species as well.

Figure 1 shows photographs of the seven sanded conifer samples. Please refer to **Table 1** for identifying the samples in the photographs. The photos reveal one of the problems in interpreting the outer-ring dates of these tree-ring samples. Ideally, we want to date the year in which the trees were felled for use in the construction of the Burling Slip because the felling date would probably not preceed construction by more than 1-2 years. But to do so with certainty requires that the bark (or waney) edge (+BE) of the sample be present. The photographs indicate that three of the samples were heavily squared off (BS1, BS6, BS7) prior to use. In that case, only by chance might there still be a waney edge present at one of the corners of the timbers. The other four samples all show signs of curvature that is indicative of the outer surface of a tree. Yet because of the long period of submersion, only two samples had unequivocal waney edges (BS2 and BS4). This limits the precise dating of the Burling Slip and in fact has revealed a conundrum. More samples would have better constrained the results reported on here.

After the samples were sanded to a high polish, the tree rings along two radii of each sample were carefully measured to ±0.001mm precision and dated with available tree-ring dating masters for the appropriate species. The defacto standard computer program used in tree-ring research for doing this was program COFECHA (Holmes, 1983). This work was conducted by TRL post-doctoral fellow Dario Martin Benito. **Table 1** provides the tree-ring dating results. All of the samples had at least 100 annual rings in them, which is often regarded as the desirable minimum for achieving cross dating for tree species in the eastern United States.

The dating results are presented here with minimal archaeological interpretation on our part because that is not our field of expertise. The strongest evidence for a felling date prior to construction can be found in the eastern hemlock samples: 1825 for BS2 (+BE), followed closely by 1823 for BS6 (-BE) and 1816 for BS7 (-BE). The latter two are likely to be the same as BS2 because of lost outer rings. The pitch pine sample BS1 may also be from the 1825 felling period because its outer date (1793) and squared off form could have resulted in that many rings being lost. Some of the other dates are harder to explain and interpret however. For example, hemlock samples BS3 and BS5 have much earlier outer dates (1724 and 1760, respectively) that are inconsistent with an 1825 felling period date and neither shows strong evidence of being squared off. The white pine sample BS4 also has a waney edge, yet dates to 1720. Do these earlier dates suggest an earlier period of construction or reuse of timbers? These results point in either of those directions, but the number of samples is too limited to draw any firmer conclusions beyond this level of speculation.

To emphasize the strength of the tree-ring dates reported here for eastern hemlock, a comparison is shown between the Burling Slip hemlock master (mean of the five series) and a northern Hudson Valley eastern hemlock chronology based on living trees and independent archaeological samples. The Spearman rank correlation between the two series ($r=0.58$) is highly significant ($p<<0.001$) with an overlap of 317 years and a t-statistic of 12.5. This extremely strong match suggests that the origin of the hemlock logs used in the Burling Slip was from the northern Hudson Valley and the logs were most likely floated down to New York City. The two other Burling Slip timbers (pitch pine and white pine – not shown) also dated against northern Hudson Valley tree-ring masters of the same species, which essentially verifies this interpretation of the most likely origin of the wood recovered from the Burling Slip excavation.

Reference

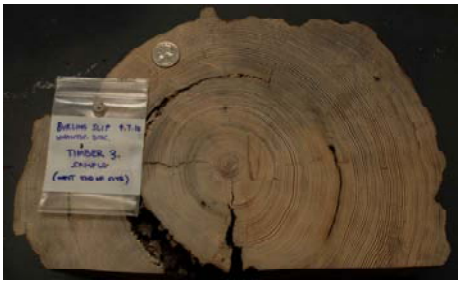
Holmes, R.L. 1983. Computer assisted quality control in tree-ring dating and measurement. *Tree-Ring Bulletin* 43:69-78.

Table 1. Dendrochronological dating results for all samples taken from the excavated wharf at Burling Slip site, New York City. For WANEY, +BE means the bark edge was present or thought to be recovered at the time of sampling; -BE means that the bark edge was not recovered or was completely missing on the timber. All correlations are Spearman rank correlations of each radius (**Correl1**and **Correl2**) series against the master chronology of their species. **Correl** is for the mean of the two radii. See **Figure 1** for photographs of these samples and **Figure 2** for a summary plot of the dating results for the five eastern hemlock samples.

Sample	Species	Number of rings	Waney	First ring	Last ring	Correl1	Correl2	Correl
BS1	Pitch pine	73-108	-BE / squared	1686	1793	0.418	0.282	0.350
BS2	Hemlock	112-112	+BE	1714	1825	0.62	0.571	0.595
BS3	Hemlock	205-230	-BE	1495	1724	0.608	0.606	0.607
BS4	White pine	84-89	+BE	1631	1720	0.48	0.416	0.448
BS5	Hemlock	150-154	-BE	1607	1760	0.574	0.521	0.547
BS6	Hemlock	301-305	-BE / squared	1509	1823	0.538	0.554	0.546
BS7	Hemlock	120-127	-BE / squared	1674	1816	0.485	0.394	0.439

BS1

BS2



BS3

BS4

BS5

BS6

BS7

Figure 1. Photographs of the seven Burling Slip wood samples dated by tree-ring analysis. Refer to **Table 1** for the wood species and dates of the samples.

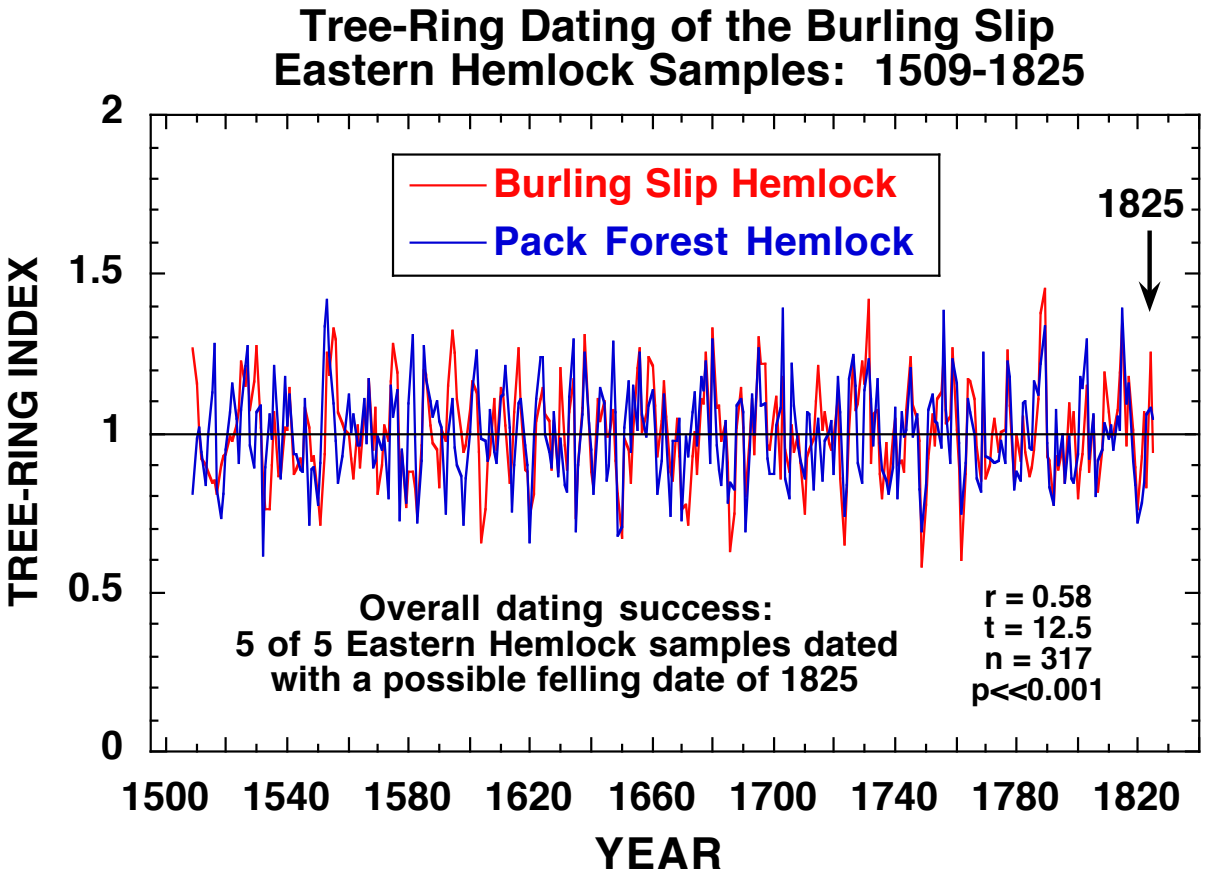


Figure 2. Comparison of the cross-dated eastern hemlock master chronology for the Burling Slip against a northern Hudson Valley eastern hemlock chronology based on living trees and independent archaeological samples. The Spearman rank correlation between the series ($r=0.58$) is highly significant ($p<<0.001$) with an overlap of 317 years and a t-statistic of 12.5. This extremely strong match suggests that the origin of the hemlock logs used in the Burling Slip was from the northern Hudson Valley and the logs were most likely floated down to New York City. The two other Burling Slip timbers (pitch pine and white pine – not shown) also dated against northern Hudson Valley tree-ring masters of the same species, which essentially verifies this interpretation of the origin of the wood.