Mount Allison
Dendrochronology Lab

Albro's Brick Warehouse Tree-ring Measurements and Crossdating

Jason Maillet, Cecilia Jennings, Emily Hogan,
Bryan J. Mood, and Colin P. Laroque

MAD Lab Report 2012-06

Mount Allison University, Department of Geography and the Environment
Mount Allison Dendrochronology Lab

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Abstract

In the spring of 2012 the MAD Lab was contracted to examine the back section of the Albro's Brick Warehouse in Halifax, Nova Scotia to help determine the date of construction using dendroarchaeological methods. Samples were taken in various sections of the building and were crossdated with a regional master chronology. End dates were given to 11 of the 13 samples, the two remaining samples were unable to be crossdated. Results place the cut dates of the wood used in the construction of Albro's Brick Warehouse to about 1861. A cut date of 1733 was found in the single library sample from an adjacent building.

Introduction

In the spring of 2012 the Mount Allison Dendrochronology Laboratory (MAD Lab) was contracted by Laura DeBoer, an urban archeologist, to help assess the construction date of Albro's Brick Warehouse on Lower Water St. in Halifax, Nova Scotia. This building, alongside the previously dated Robertson Store (Robichaud *et al*. 2011) were once a vital part of Halifax's shipping and ship building heritage. These buildings are now a part of the Maritime Museum of the Atlantic.

Methods

Thirteen samples were extracted from rearmost sections of the Albro's Brick Warehouse on April 23, 2012 (Figure 1 and 2). The extracted samples were glued to slotted mounting boards and then sanded with progressively finer sandpaper grit: 80, 120, 220, 320, and 400 grit. In the end, the samples were very smooth and radial cell structure was clearly visibly under a microscope (Figure 3). Each sample's radial growth was then measured using a Velmex stage system with a 63X microscope, to a precision of 0.001 mm.

The samples were visually identified as being red spruce (*Picea rubens*) and so were compared with the regional red spruce master chronology from Nova Scotia available from the MAD Lab archive. The regional chronology is composed of over 200 red spruce trees spanning 1624-2006.

The best placement for the time series was decided by interpreting statistical outputs from the program COFECHA (Holmes, 1986; Grissino-Mayer, 2001). Each individual tree-ring series and the master chronology were standardized using ARSTAN (Holmes *et al*., 1986) and a negative exponential curve. The standardized chronology of each was then graphed for visual comparison with the standardized regional master according to the best crossdating possibilities suggested by COFECHA.

Once final placement was decided, the series was included in the master chronology it was originally compared to and then reassessed with COFECHA to ascertain the statistical strength of its placement within the chronology.

Figure 1: Coring one of the ceiling beams in the ground floor warehouse.

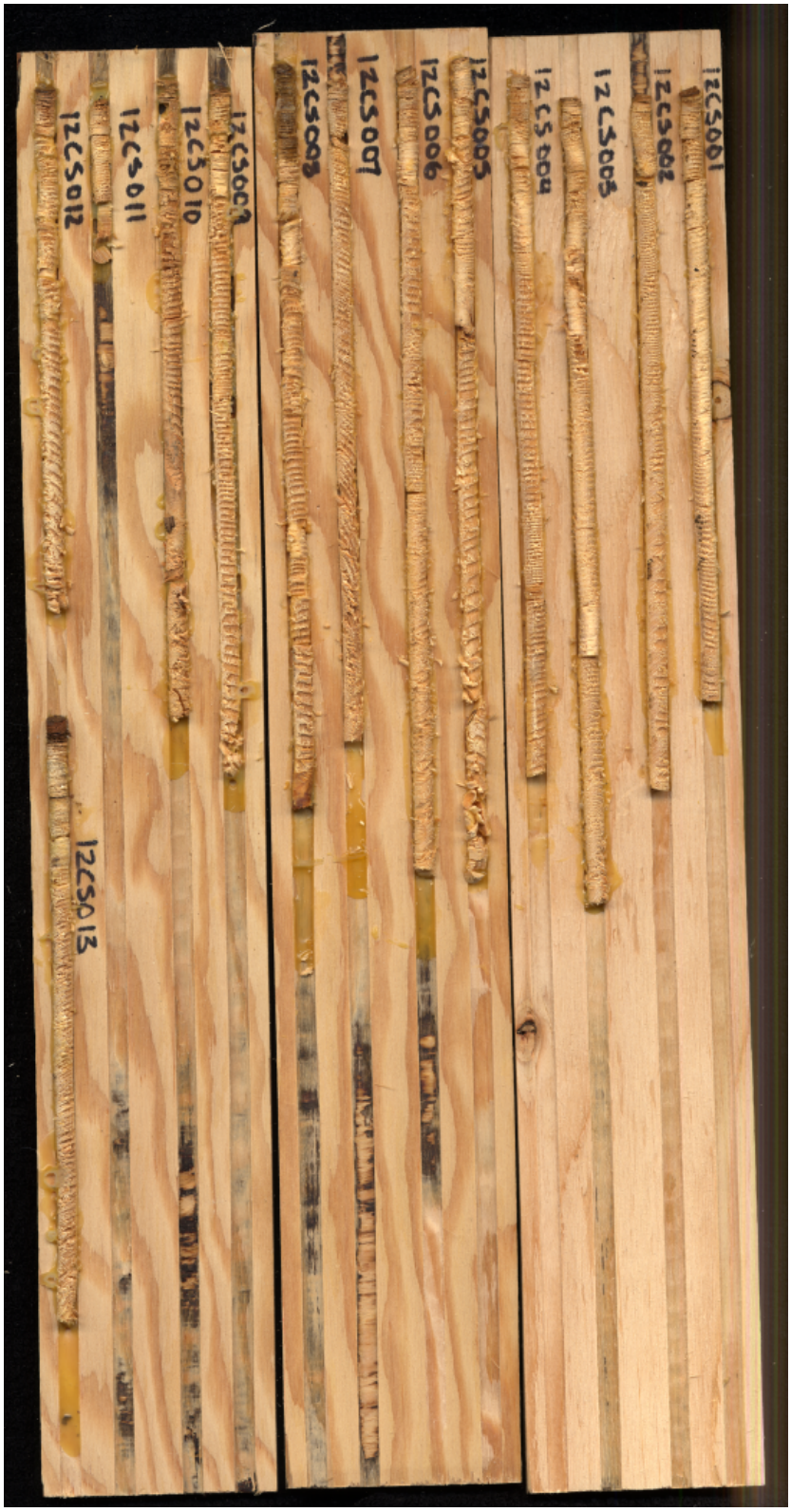

Figure 2: The thirteen samples on slotted mounting boards before sanding. Annual-growth rings are not clearly visible at this stage.

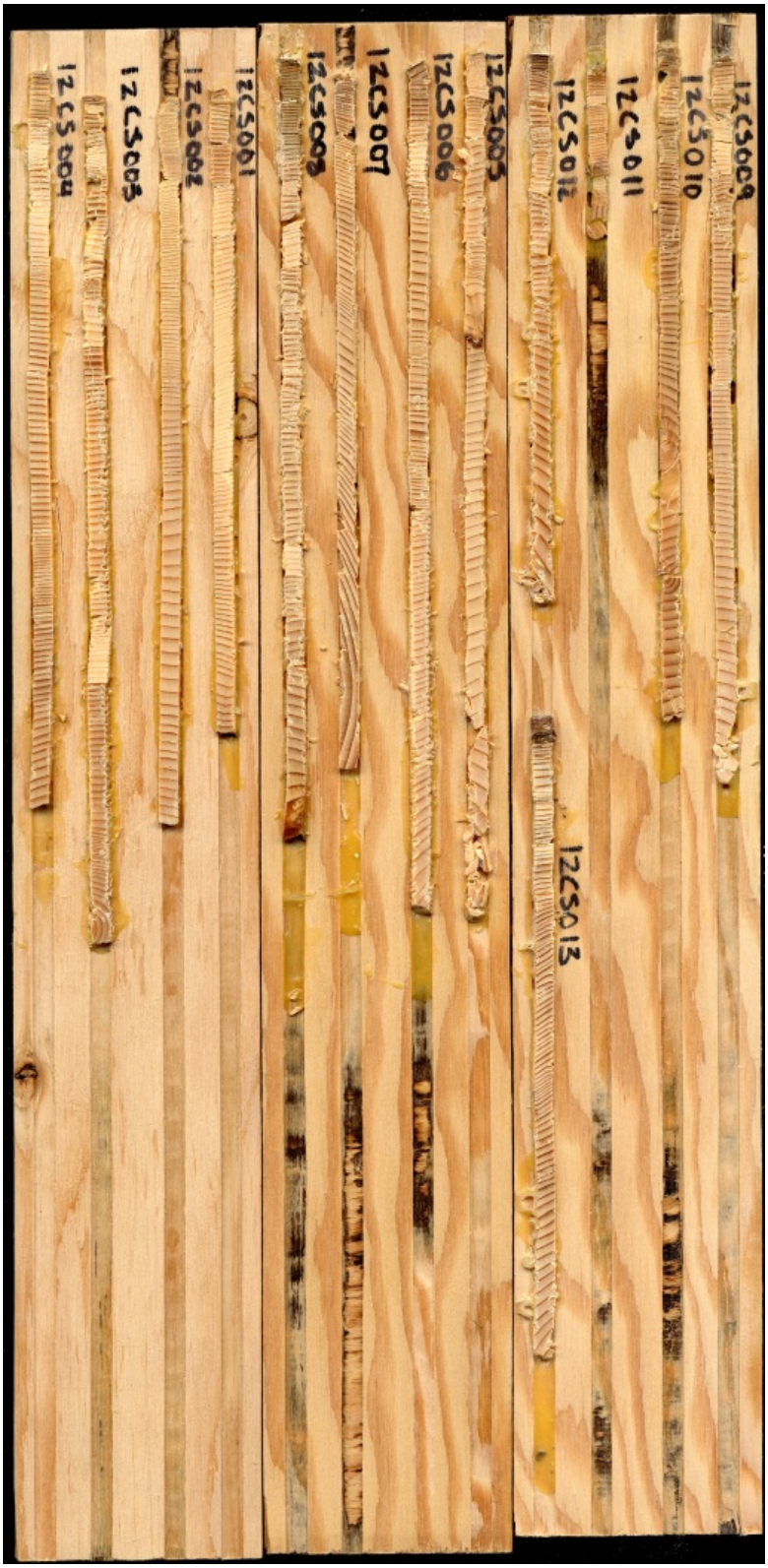

Figure 3: The thirteen samples on slotted mounting boards after sanding. Annual-growth rings are more clearly visible after sanding.

Results and Discussion

A total of 13 samples were taken but four (12CS904, 12CS908, 12CS910 and 12CS911) were excluded from the final chronology due to the deteriorated state of these cores (Table 1). The nine remaining cores were crossdated and correlated to the regional master chronology (Figure 4).

Table 1: Albro's Brick Warehouse samples, with their end dates, presence/absence of bark, date of last ring and established cut date if possible.

Sample ID	Location	Bark Present	Date of Last Ring	Cut Date
12CS901	Ground Floor Workshop	No	1858	
12CS902	Ground Floor Workshop	No	1855	
12CS903	Ground Floor Workshop	No	1855	
12CS904*	2nd Floor Exhibition	No	1853*	
12CS905*	2nd Floor Exhibition	No	1860*	
12CS906	2nd Floor Exhibition	Yes	1861	1861
12CS907*	2nd Floor Exhibition	No	1863	
12CS908*	2nd Floor Exhibition	not dated*	not dated*	
12CS909	3rd Floor Office Area	Yes	1861	1861
12CS910*	3rd Floor Office Area	No	1838*	
12CS911*	3rd Floor Office Area	not dated*	not dated*	
12CS912*	3rd Floor Office Area	No	1902	
12CS913	3rd Floor Library	Yes	1733	1733

* = See specific notes in Table 2

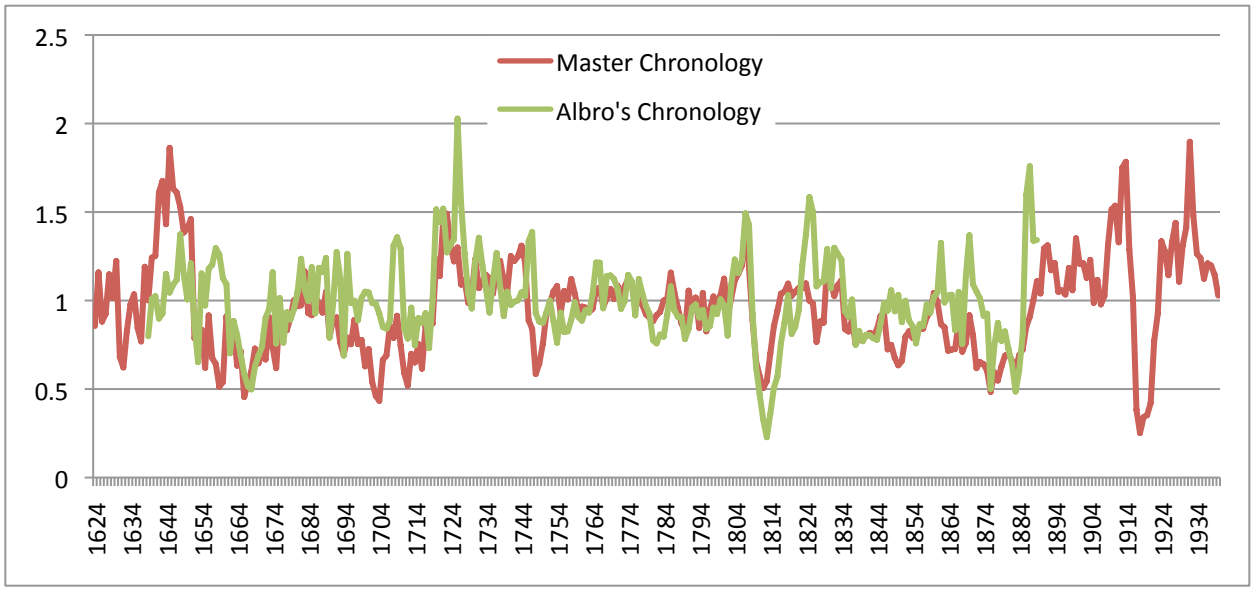

Figure 4: Standardized chronology for all samples taken from Albro's Brick Warehouse (12CS900) crossdated and matched with a regional red spruce master chronology.

Of the samples that could not be successfully crossdated above the 99% statistical significance (Table 2), three (12CS904, 12CS905, and 12CS910) individual samples were visually assessed to check for their "best fit" position of their growth pattern in time. Usually issues associated with specific wood characteristics displayed in the cores drove this weakened significance (Table 2). Sample 12CS904 (Figure 3 and Figure 5), demonstrated a visual end date of 1853. We were unable to crossdate it originally because of the fragmented nature of the core at the beginning of the sample near the bark. We could not originally statistically crossdate sample 12CS905 (Figure 3 and Figure 6) because of a large gap in the ring pattern caused by the growth of a branch a third of the way down the core. In the end after visual crossdating, the sample indicated a cut date of 1860. Because of a branch and many segments, sample 12CS910 (Figure 3 and Figure 7) could not be crossdated, yet this sample demonstrated a visual end date of 1838 when we reanalyzed it. Although these patterned end dates were not as statistically significant as the other samples, visual pointer years assisted us in deriving approximate end dates that visually fit very well with other sample dates in the group. Sample 12CS913 , the sample from the adjacent building library, was successfully crossdated with the same regional red spruce master chronology and displayed a cut date of 1733(Figure 8). This date precedes every other sample in the study by over a century.

Table 2: Specific notes regarding alternative dating methods

12CS904	Unable to statistically match with master chronology, sample is multi-segmented; some rings are reversed and may be in the wrong order. Did a visual comparison using a common narrowing in the growth signal to get a tentative end date of 1853.
12CS905	Sample was quite broken up; there was also a large section that was disturbed by branch growth. Did a visual comparison using a common narrowing in the growth signal to get a tentative end date of 1860.
12CS907	Excluded a small segment (5 rings) near the last growth year, these rings were reversed and may be in the wrong order. The continuous segment following the reversed rings was dated to 1858, adding these 5 rings bring us to a final date of 1863.
12CS908	This sample was extremely segmented with 4 reversed sections of rings, no continuous segment was long enough to measure and attribute a proper end date. No dating was possible with this sample.
12CS910	Extremely broken sample with 5 reversed sections. Also disturbed by branch growth. Did a visual comparison using a common narrowing in the growth signal to get a tentative end date of 1838.
12CS911	Partial sample taken, too short to conclusively date.
12CS912	Excluded a segment (13 rings) near the last growth year, this segment contained a reversed portion and may be in the wrong order. The continuous segment following the reversed rings was dated to 1889, adding these 13 excluded rings bring us to a final date of 1902.

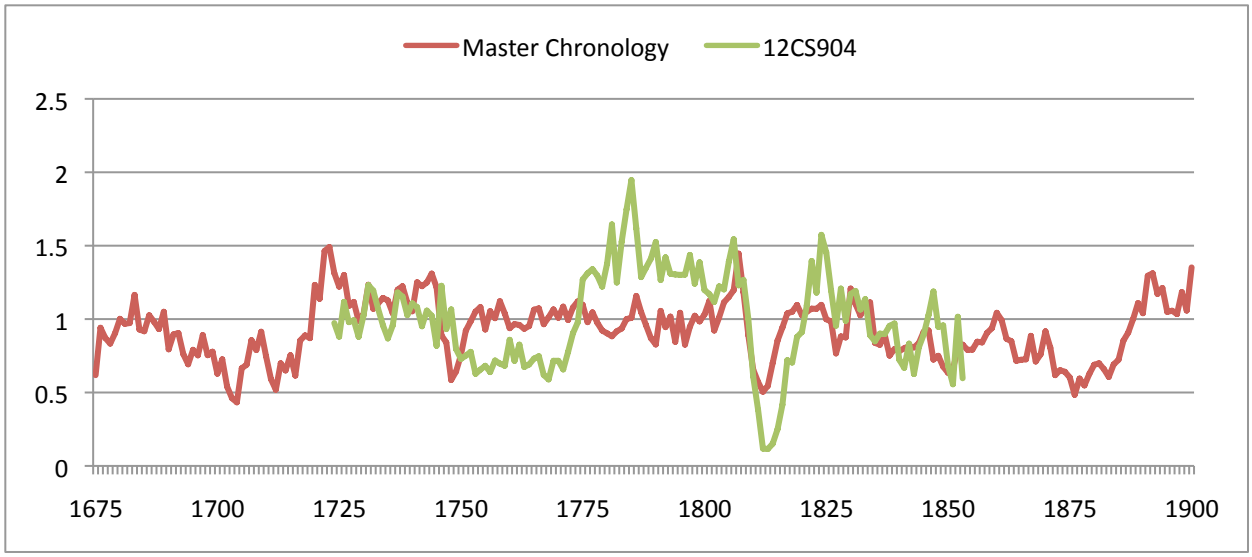

Figure 5: Single standardized series (12CS904) taken from Albro's Brick Warehouse pattern matched to the regional red spruce master chronology for visual crossdating. The end date of this sample is 1853.

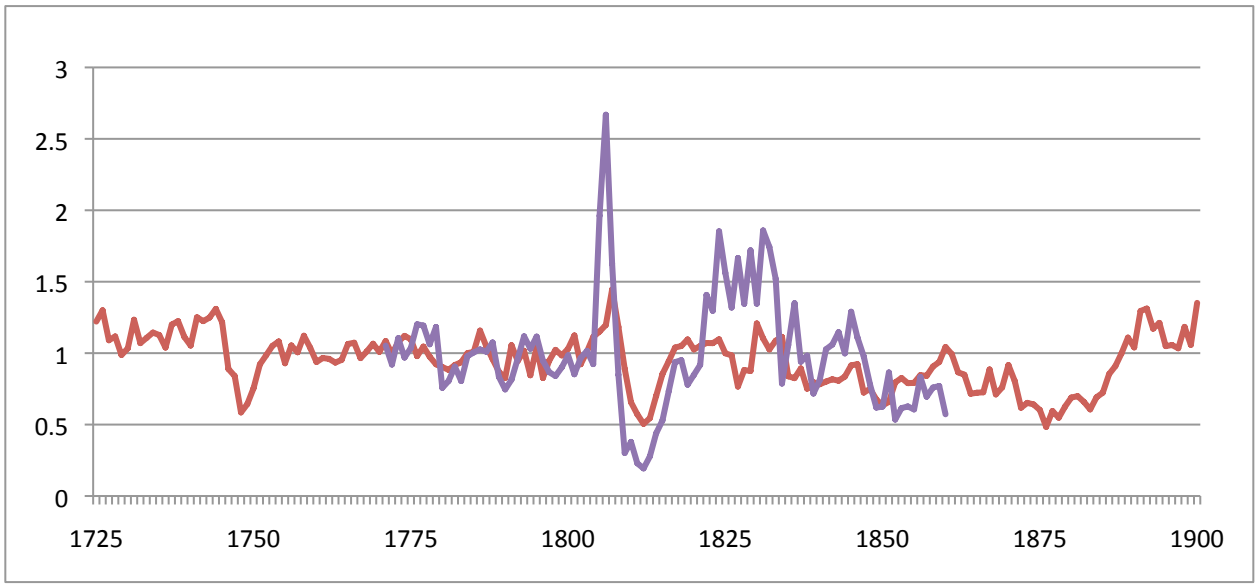

Figure 6: Single standardized series (12CS905) taken from Albro's Brick Warehouse pattern matched to the regional red spruce master chronology for visual crossdating. The end date of this sample is 1860.

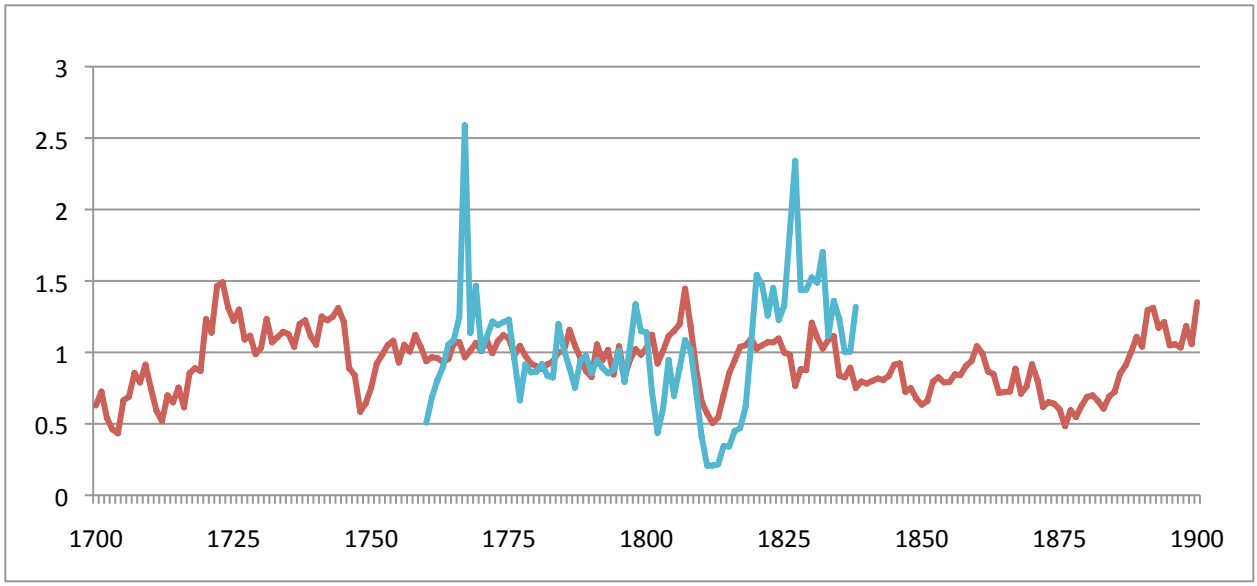

Figure 7: Single standardized series (12CS910) taken from Albro's Brick Warehouse pattern matched to the regional red spruce master chronology for visual crossdating. The end date for this sample is 1838.

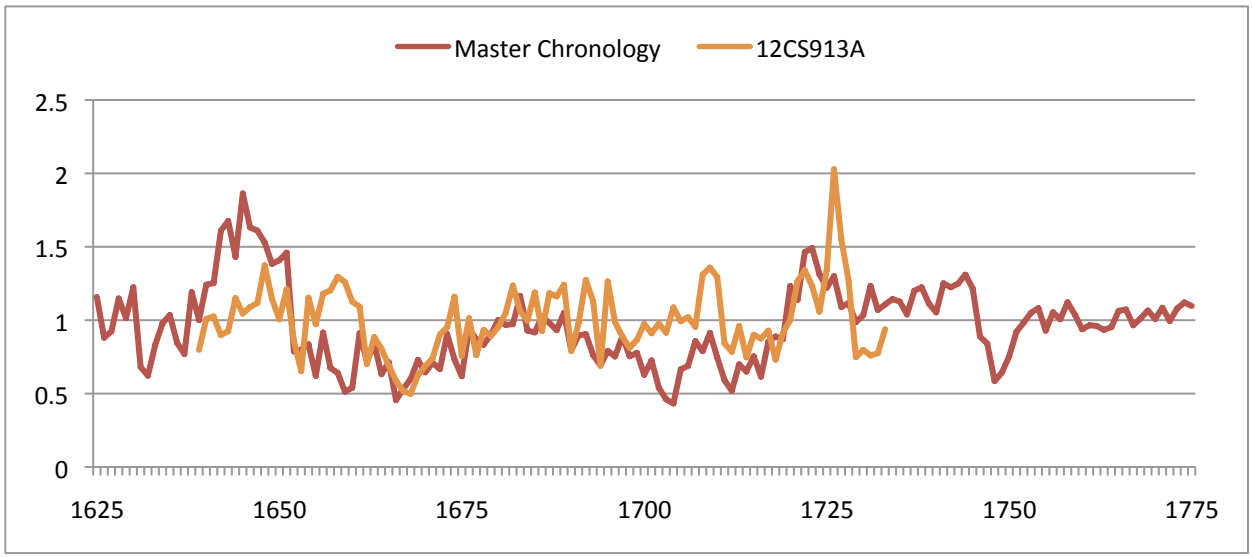

Figure 8: Single standardized series (12CS910) taken from Albro's Brick Warehouse crossdated with the regional red spruce master chronology. The end date for this sample is 1733.

Table 1 lists the locations and associated dates of the last rings that were found. Samples from the ground and first floor were dated and illustrate a cluster of dates around the early 1860s. A cut date of 1861 was attributed to 12CS906 which still had bark attached to the last growth ring and this is likely the time of all cutting for all of these logs. This evidence likely places construction of the back portion of the first two floors in and around 1861 to 1863 (allowing for the time form cutting to construction). Samples taken from third floor revealed a much larger range. The cut date of 12CS909 was 1861which would match the construction of this floor around the same time as the rest of back portion of the building. However, 12CS912 was part of the dimensional lumber that was cut down after the turn of the century in the early 1900's, and this wood was perhaps used to reconstruct the extra ~two foot roof section of the building at this time. Sample 12CS913, taken from the library on the third floor established a cut date of 1733, much earlier than any of the previous attributed dates, but perhaps fitting for this sample as it was in another building from another time period.

Conclusion

Analysis of the back of the Albro's Brick Warehouse indicates that it was built with wood that was cut around 1861, with the majority of the construction likely following in 1862 or 1863. A more recent date of 1902 was established from the small upright post within the uppermost ceiling of the top office floors. This information derived from sample 12CS912 indicates that there was additional support added to change the roof from the original 1861 beams after this time. The 1733 date is an anomaly in this group, but this is not surprising as it was from a different structure, probably created in a different time from the rest of the material sampled for this project.

References

Grissino-Mayer, H.D. (2001) Evaluating crossdating accuracy: a manual and tutorial for the program COFECHA. *Tree-Ring research, 57*, 205-221.

Holmes, R.L. (1986). User's manual for program COFECHA. In *Tree-ring chronologies of western North America: California, eastern Oregon, and northern Great Basin* (eds R.L. Holmes, R.K. Adams & H.C. Fritts), pp. 41-49. Laboratory of Tre-ring Research, University of Arizona, Tucson.

Holmes, R.L., Adams, R.K., and Fritts, H.C. (1986) Tree-ring chronologies of Western North America: California, Eastern Oregon and Northern Great Basin, with procedures used in the chronology development work, including users manuals for computer programs COFECHA and ARSTAN. *Chronology Series VI*. Laboratory of Tree-Ring Research, University of Arizona, Tucson.