



**Mount Allison  
Dendrochronology Lab**

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A Dendroarcheological Analysis of Chapel Hill Church:  
Shag Harbour, Nova Scotia

By

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# **A Dendroarcheological Analysis of Chapel Hill Church: Shag Harbour, Nova Scotia**

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### **Abstract**

Twenty-five tree-ring samples were taken from beams in Chapel Hill Church in Shag Harbour, Nova Scotia. The sampling was conducted in efforts to extend the Mount Allison Dendrochronology (MAD) Lab chronologies for southwestern Nova Scotia using historic structures. Statistical analysis was conducted on the red spruce (*Picea rubens*) samples to deduce the tree-ring growth patterns of the species for the region. Based on analysis, it was determined that the trees used in the construction of the church were felled in 1855, supporting records that the church was built by 1856.

## **Introduction**

Churches in Nova Scotia are the pride of many communities and as such have been maintained for many centuries by their parishioners. Southwestern Nova Scotia has a wealth of churches that have been built and cared for by the earliest settlers. Not only are these churches rich in cultural history, the wood used to construct them holds a wealth of information on the environment of the region up to the time of initial settlement.

Dendroarcheology is the study of tree rings taken from beams in historical structures. The purpose of this project is to understand how several tree species were growing in southwestern Nova Scotia at the time of settlement. Samples were taken from eight historical churches in the region to accomplish this goal. Master chronologies of radial growth from each tree species, at each church, were constructed, with the ultimate goal of adding growth patterns to existing regional chronologies to extend radial growth records for each tree species in the region. This method of collecting tree-rings is used in southwestern Nova Scotia because the majority of the region's old-growth forests have been cut down, and therefore shortening the length of the record accessible from live trees. Beams from historic churches provide records of tree-ring growth of what would be the region's old-growth forests, if they were standing today.

Chapel Hill Church in Shag Harbour, Nova Scotia (MAD Lab #06PS000) was one of the eight churches the Mount Allison Dendrochronology (MAD) Lab sampled in the summer of 2006 (Figure 1). According to church records, the church was constructed in 1856. Due to its age, there was potential for the tree-rings in the church beams to extend quite far into the past. With the support of the Chapel Hill Historical Society, who is responsible for the building, sampling was conducted.



**Figure 1:** Chapel Hill Church, Shag Harbour, N.S.

## **Research Methods**

Twenty-five samples were taken from a total of twenty-four beams using an increment borer (see Appendix A). The diameter of each sample is 4.3 mm, approximately the size of a pencil (Figures 2, 3). The sampling process has no negative effects on the structural integrity of the building. All of the beams sampled are located in the attic of the church, where they have not been altered since the initial construction of the church. Beams were selected for sampling according to their integrity (the absence of rot) and the presence of bark (indicating the last tree-ring has not been removed in the construction of the church).

Samples were stored in plastic straws and were transported back to the lab to be prepared for analysis. Each core was glued into a slotted mounting board. The cores were sanded using up to 600 grit sandpaper in order to ensure a clear cross-section of the rings. The cores were then measured using a 63x light microscope and the Velmex measuring system. This process produced measurements indicating the annual growth rates of the individual trees to 0.001 mm.

Prior to further analysis, it was important to determine the tree species used in the construction of the church. As all tree species have different growth responses to climatic factors, to compare growth patterns of a set of samples they must be of the same species.

Although the bark on the samples collected gave some indication that beams were red spruce (*Picea rubens*), four samples were examined using a scanning electron microscope (SEM) to confirm the identification. All samples were confirmed as to be red spruce, and it was inferred from this that all sampled beams were of the same species.

The process of analyzing archeological data requires two steps. The first is to crossdate the samples within the church to each other. This ensures that there is a significant correlation between the growth patterns of the trees within the building (representing a stand of trees that was growing together and thus should have similar growth trends). Once this was completed, the church beams were crossdated into a red spruce chronology constructed by the MAD Lab from live trees and structural samples obtained from New Brunswick and Nova Scotia.



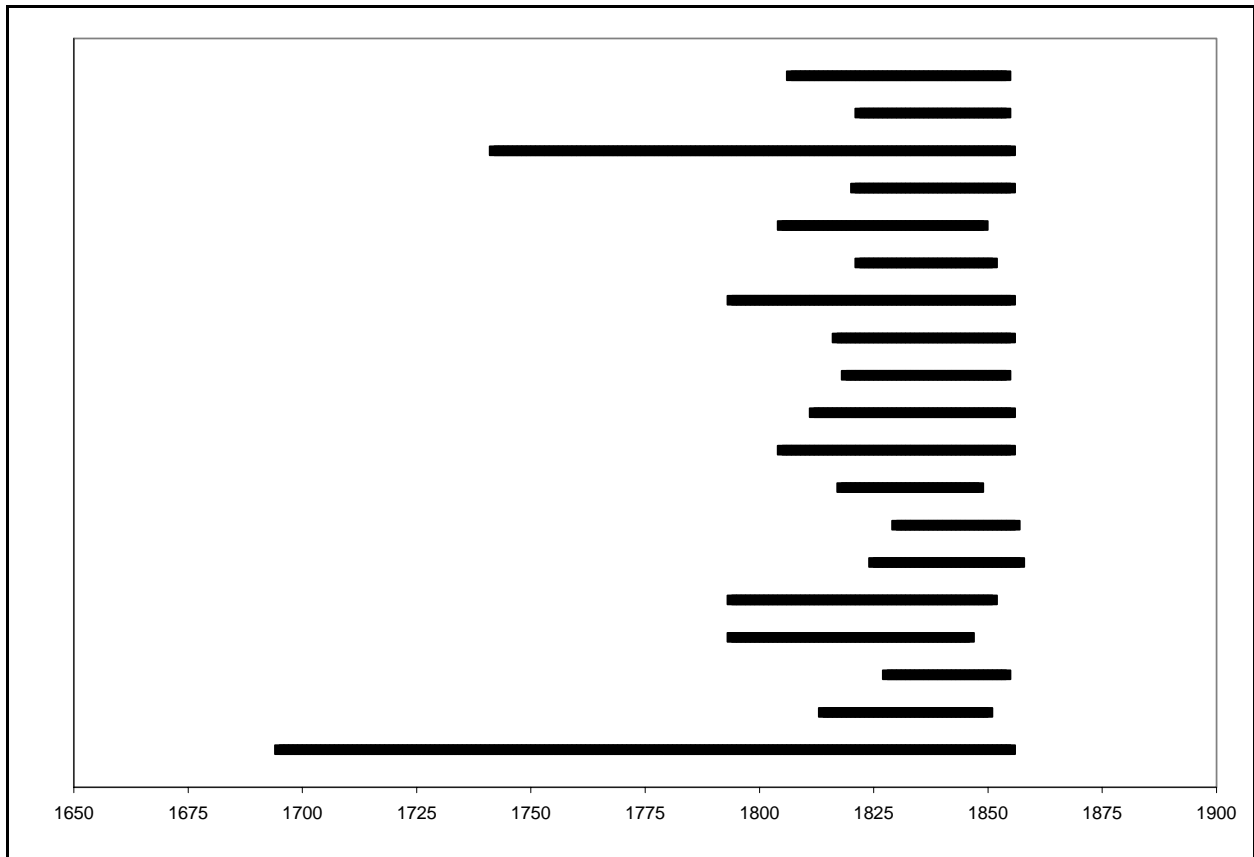
**Figure 2:** Sample extracted with an increment borer.



**Figure 3:** Collecting samples at Chapel Hill Church

**Results and Discussion**

Based on an analysis using COFECHA, it was determined that the last year of growth of the trees within the church beams was 1855 (Figure 4, Table 1). This suggests that the trees used in the construction of the church were cut down with the last growing year being 1855, approximately a year before the building was constructed. Based on construction and logistical schedules of the time, it is reasonable to believe that the trees were felled in the fall/winter of the year before construction began. This fact confirms the historical records stating that Chapel Hill Church was constructed in 1856.



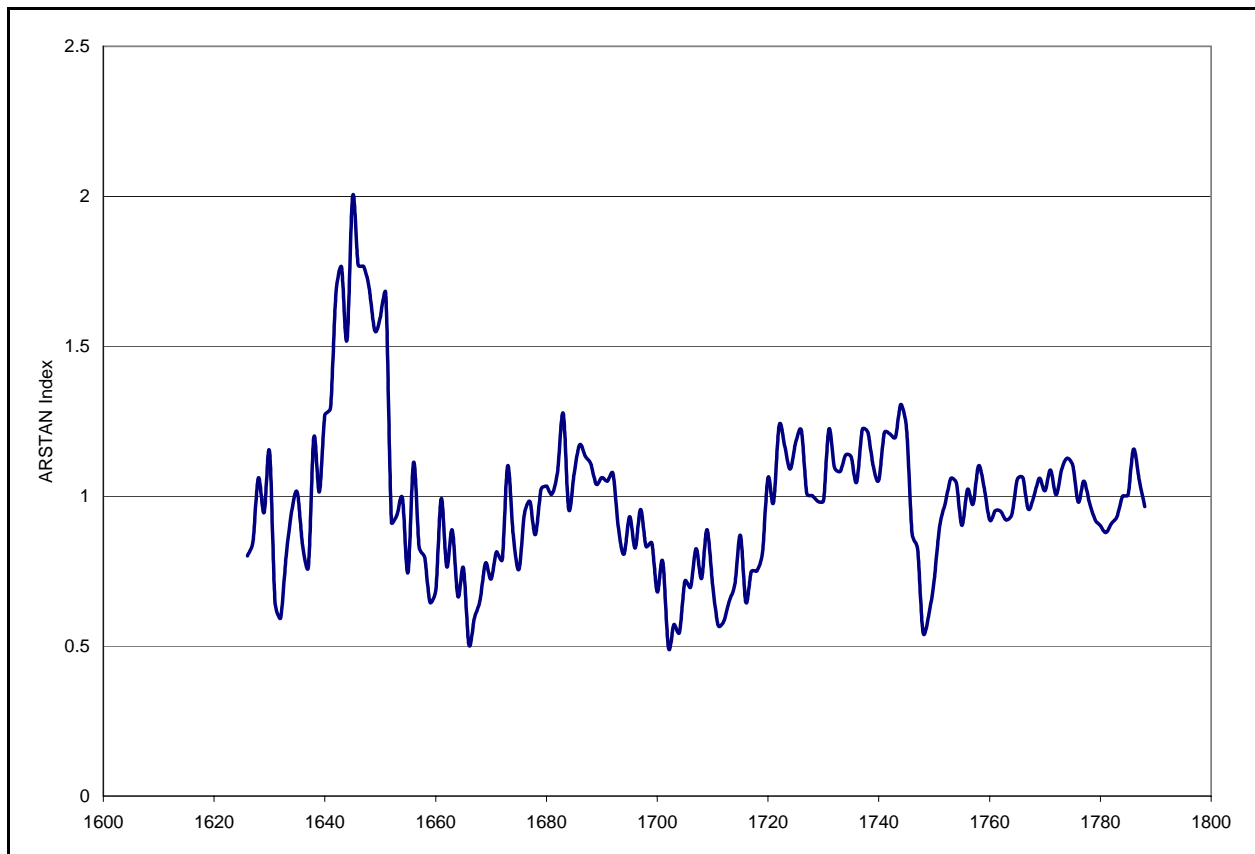
**Figure 4:** Life-spans of trees within beams of Chapel Hill Church.

<i>Sample Number</i>	<i>Location</i>	<i>Bark Condition</i>	<i>Species</i>	<i>Crossdated Interval</i>
06PS001	attic	bark present	Red spruce	1814-1850
06PS002	attic	bark present	Red spruce	1828-1854
06PS003	attic	no bark present	Red spruce	1794-1846
06PS004	attic	no bark present	Red spruce	1794-1851

06PS005	attic	bark present	Red spruce	1825-1857
06PS006	attic	bark present	Red spruce	1830-1856
06PS007	attic	bark present	Red spruce	1818-1848
06PS008	attic	no bark present	Red spruce	1805-1855
06PS009	attic	no bark present	Red spruce	1812-1855
06PS010	attic	no bark present	Red spruce	1819-1854
06PS011	attic	bark present	Red spruce	1817-1855
06PS013	attic	bark present	Red spruce	1794-1855
06PS014	attic	bark present	Red spruce	1822-1851
06PS017	attic	no bark present	Red spruce	1805-1849
06PS018	attic	bark present	Red spruce	1821-1855
06PS019	attic	bark present	Red spruce	1695-1855
06PS020	attic	bark present	Red spruce	1742-1855
06PS023a	attic	bark present	Red spruce	1822-1854
06PS023b	attic	bark present	Red spruce	1807-1854

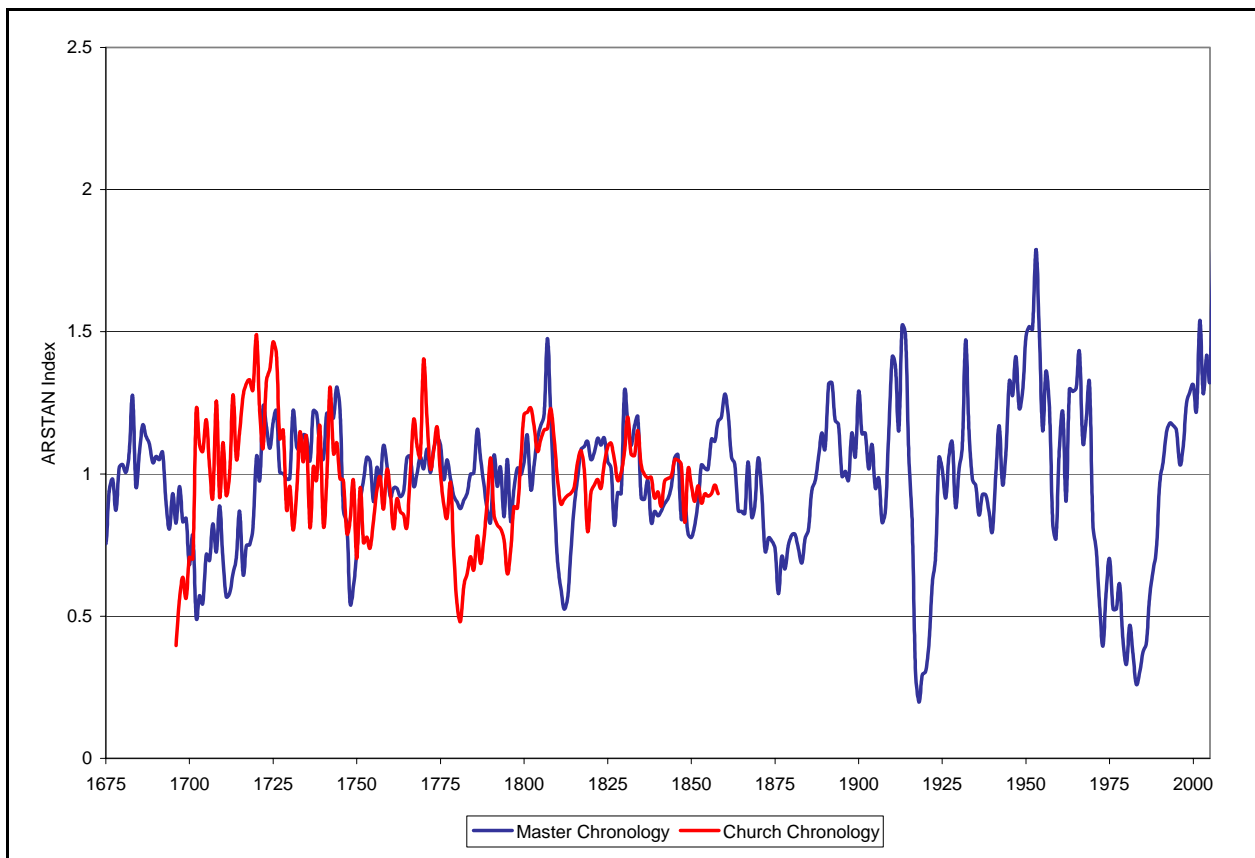
**Table 1:** Data on samples collected from beams within Chapel Hill Church.

Once the cut years of the trees were determined, it was possible to create a floating chronology for the “stand” (Figure 5). This shows the average growth patterns for all of the red spruce sampled within the beams of the church.



**Figure 5:** Floating chronology for red spruce in Chapel Hill Church.

The beams from this church effectively contribute to the two of the project’s objectives which are to increase red spruce sample depth in Nova Scotia and to create a master chronology specific to southwestern Nova Scotia (Figure 6). All beams crossdate into the live chronology with a significance ranging from 0.085-0.528 (90% confidence of significance at 0.21). Out of the fifteen samples, twelve achieve 90% significance or higher, with correlations to the live chronology above 0.21. The reason that the significance levels are not higher than 90% is likely that the live chronology is based predominately on red spruce trees growing in New Brunswick. The distance between the habitats of the live chronology and the stand that made up the church chronology may be the reason for this discrepancy.

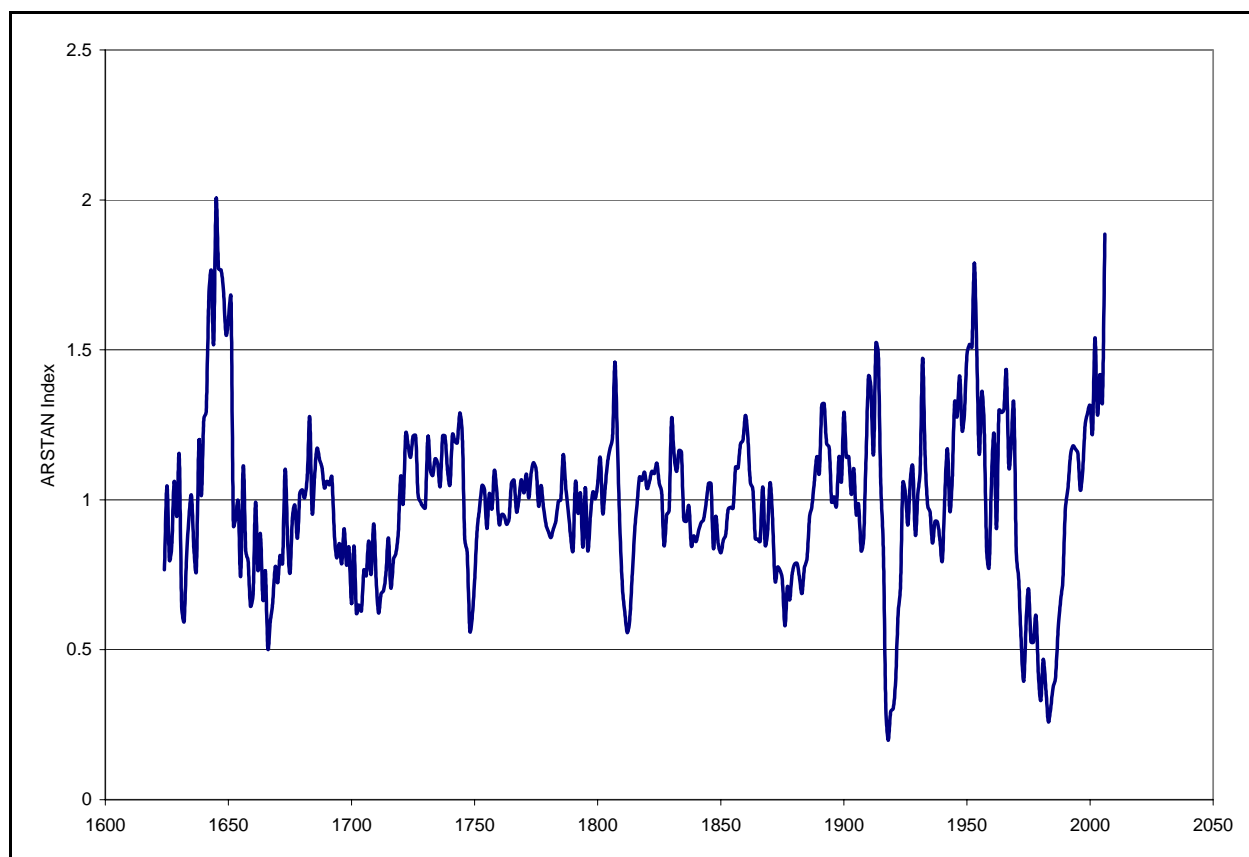


**Figure 6:** Overlap of the master and church chronologies shows similar growth patterns.

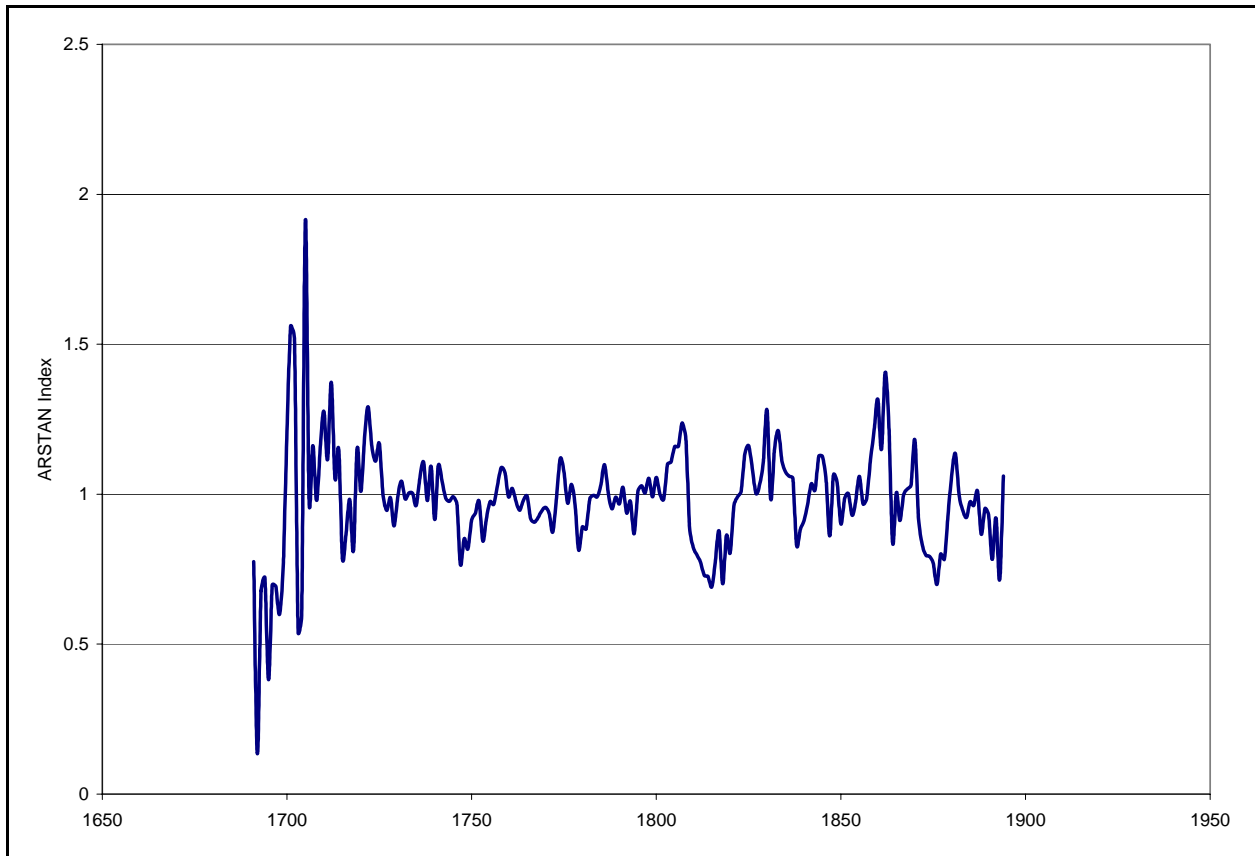
By combining the master and church chronologies, it was possible to develop a master chronology for red spruce in New Brunswick and Nova Scotia (Figure 7). The overall correlation of this chronology is 0.486, which is much higher than the 0.3281 required for 99% confidence of significance.



From the church chronology constructed from Chapel Hill Church as well as the chronologies constructed from the other churches sampled in southwestern Nova Scotia, it was possible to make a master chronology specific to the region (Figure 8).



**Figure 7:** Combined master chronology for red spruce in New Brunswick and Nova Scotia.



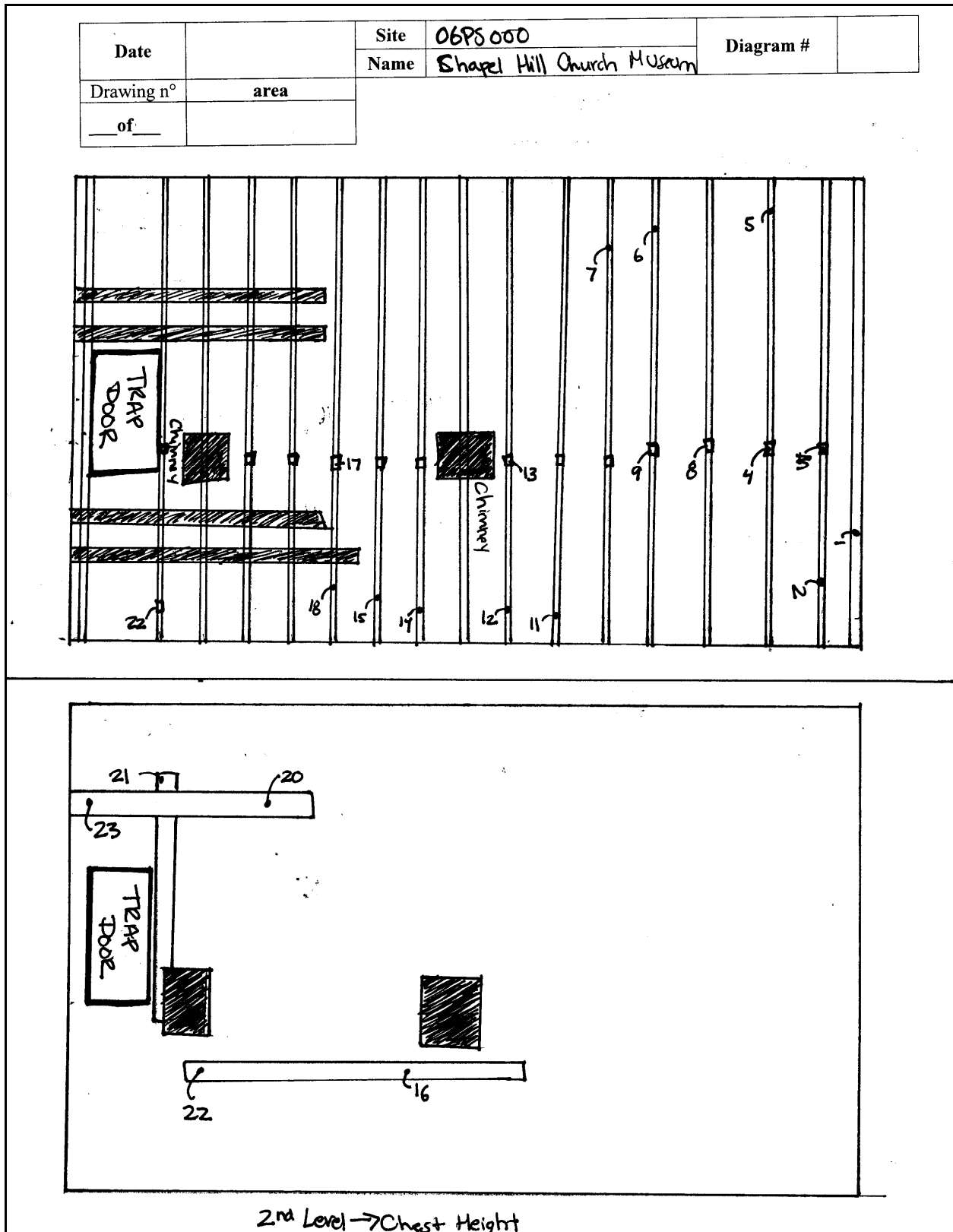
**Figure 8:** Master chronology for red spruce in southwestern Nova Scotia.

## Conclusion

The master chronology for red spruce in southwestern Nova Scotia will have a number of uses. If red spruce samples from another structure in the region are found, it will be possible to place them in this chronology and thus determine the construction date of the structure. As well, this chronology can be used to learn about climatic trends in the past, enabling us both to have a better understanding about past climates and to compare these trends to the current Atlantic climate.

We found that the wood in the this church dated to the end of the growing season of 1855 and this means that the construction date of the church of 1856 given by the parish records, is confirmed.

Appendix



Appendix A: Diagram of Chapel Hill Church attic.