Dendroarchaeological investigation of the Sinclair Inn, Annapolis Royal, Nova Scotia

Rafter sample from the Sinclair Inn

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ABSTRACT

In the winter semester of 2005, the Mount Allison University biogeography class worked on a a project on the dating of pre-deportation buildings in an attempt to enhance the dendrochronology database of the Mount Allison Dendrochronology Laboratory and to commemorate the 250th anniversary of the deportation of 1755. The class selected the Sinclair Inn in Annapolis Royal , Nova Scotia. The Inn was selected as it provided historical and architectural significance for the time being studied and access to the site was possible. Our objectives were to determine the exact year in which both the Soullard and Skene Houses (the two portions of the main building) were built and to determine the exact date in which they were joined together to form the Sinclair Inn.

Dendrochronological analysis suggests that the age of the Sinclair Inn proposed by historians (1781) is correct. Historians suspected that the Skene house was believed to be built between 1707 and 1710. Dendrochronological analysis suggests that it was built in 1712. Likewise, the Soullard house was built in1710.

INTRODUCTION

Dendrochronology is the study and analysis of tree rings. It has become a leading technique in identifying past climatic events and dating historical structures. The concept behind dendrochronology is that tree rings are produced annually with the amount of growth being dependant on environmental conditions. Based on this, it is assumed that since trees within the same geographical area experience the same climatic conditions, they should have the same amount of growth, although different species of trees may respond differently to the same inputs. By matching the growth pattern from a tree ring chronology of a known age with the growth pattern from the logs of a building, the latter can be dated as long as the last growth ring is still present and the wood is in relatively good condition. The process is non-destructive as seen on the picture on the right and so is an excellent method to use when working with historical structures as is the case in this particular project.

The town of Annapolis Royal is located at the bottom of the Annapolis Basin, itself connected to the Bay of Fundy. It is part of Port Royal, once the first major Acadian settlement in Nova Scotia. Although the area was destroyed in 1707 when the British burned down all of the buildings (Barry Moody, personnal communication), the town was almost immediately rebuilt. Many of those later structures are thought to be still standing and among them is the Sinclair Inn which was made by the joining of two of those buildings: the Soullard house and the Skene house (Moody, 1982).

The Sinclair Inn, 2005.

The Soullard house is suspected to have been built on the current property between 25 February, 1710 and 14 September, 1714. Closer examination of this period in history suggests that the house was likely built in 1710, before the British conquest. The Skene House, which was not originally built on the current property but transferred there later, is thought to have been built during the same time, most likely between 1707 and 1710. The inn itself was probably built in 1781 on the current site by the joining of the Soullard two-story house already on the spot and the Skene one-story house which was moved (Moody, 1982). A second story was added to the Skene part and also a new roof covering both parts (http://www.annapolisheritagesociety.com/sbuildingevolution.htm).

This information suggests that the Sinclair Inn may be one of the oldest known building of frame construction still standing in Canada. Nevertheless, all the dates mentioned above from the historical interpretation of the Sinclair Inn needed further scientific support.

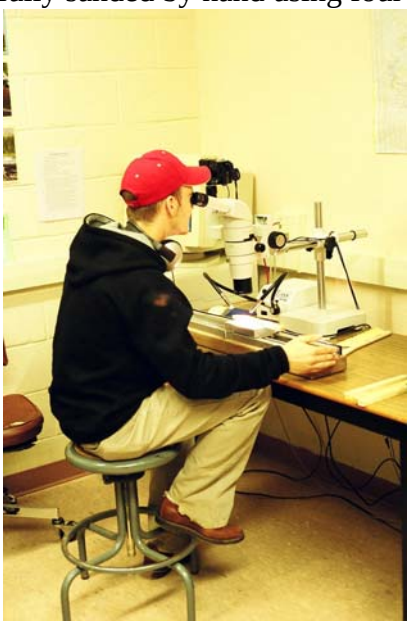
In the winter semester of 2005, the Mount Allison University biogeography class was preparing a project on the dating of pre-deportation buildings in an attempt to enhance the dendrochronology database of the Mount Allison Dendrochronology Laboratory (http://www.mta.ca/madlab/) and to commemorate the 250th anniversary of the deportation of 1755. The biogeography class obtained a grant from Leadership Mount Allison (http://www.mta.ca/leadership/index.html) to pursue its effort. The Sinclair Inn's structural, historical and architectural significance attracted our attention and it became part of our project to give scientific support to the historical interpretation of the Inn. Our objectives were to determine the exact year in which both the Soullard and Skene Houses were built and the exact date in which they were joined together to form the Sinclair Inn.

FIELDWORK AND METHODS

The fieldwork was conducted on March 5th 2005 and consisted of the sampling of the Sinclair Inn. We started by selecting suitable material and strategic beams within the inn to ensure we covered all of the different parts to be dated: structural beams from the first floor of the inn that

belong to the Soullard house and the Skene house, and wood material added when the inn was built, namely rafters and beams from the roof and the third floor (called the Sinclair additions hereafter). It is very important to find a sampling area on the wood piece that provides bark or the last growth ring as it allows for an end date to be determined.

Cores were then extracted from the selected beams using an increment borer that is inserted into the wood. The operator then took an extractor and removed the core from the borer and placed it into a clear plastic tube that was immediately labeled. A description of the area, type of wood, and setting was depicted on a log sheet. The Soullard house provided us with seven cores, the Skene house with eleven cores, but we obtained only four workable samples from the Sinclair additions. Two laths were also taken from the Soullard house. Once in the laboratory, our samples were taken from their plastic sheaths and glued onto wooden mounts. They were then carefully sanded by hand using four different grits of sandpaper. Each grit of sandpaper, from coarse to smooth, properly prepares the sample and provides the operator a much better view of the tree rings that the core presents.



Samples were then ready to be measured using a Velmex Stage System (photo right) from the Mount Allison Dendrochronology Laboratory (MAD Lab). The system is capable of measuring ring widths to a precision of a thousandth of a millimetre and

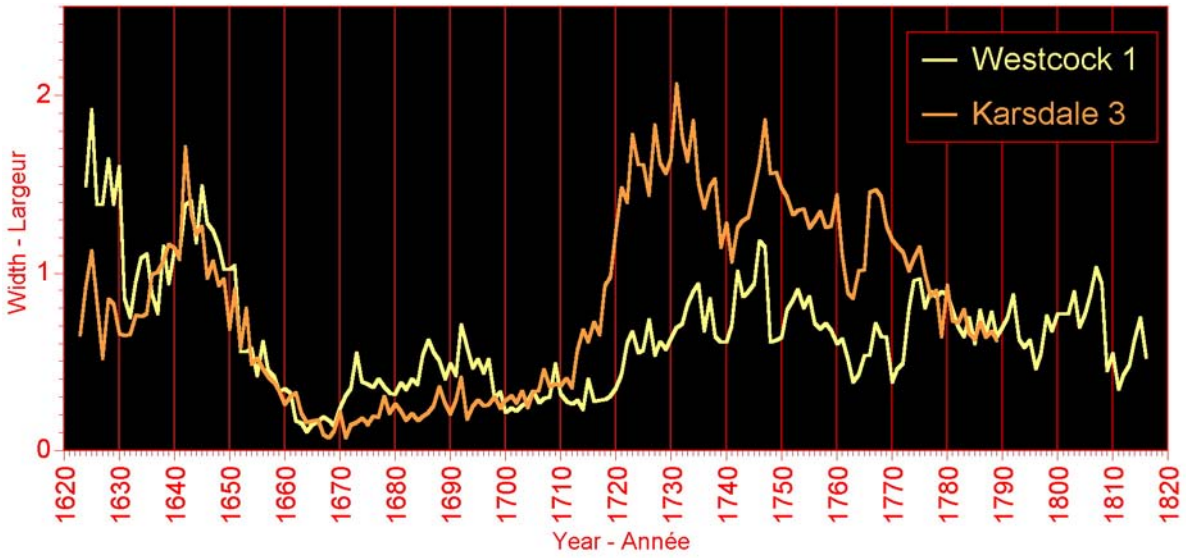
allowed us to build accurate ring-width chronologies for each sample ready to be dated or printed into graph form.

Another important step was to identify the wood from the different samples. We had to ensure that they were of the same species as the reference chronologies to be used in the dating process. Ring growth responses to environmental events are more similar within trees of the same species than between two different species. Sample determination was made possible by creating a wood identification key of coniferous trees growing in the Maritimes.

The observation of wood anatomical structures was done with a Scanning Electron Microscope (SEM, picture above) from the Mount Allison Digital Microscopy Facility (http://www.mta.ca/dmf/). In total, thirteen samples were identified, six from the Soullard house, four from the Skene house, and three from the Sinclair additions.

The last step was crossdating the Sinclair Inn samples with reference chronologies. The MAD Lab already had two chronologies available from southeastern New Brunswick that span far enough back in time to date the Sinclair Inn: the Barachois chronology (1603-1822) and the Westcock chronology (1624-1817). We also searched for a suitable building to make a local reference chronology. The Christ Church (right photo), located in Karsdale about 7 km west from Annapolis Royal was chosen and sampled. Eleven cores were retrieved, measured and compared to the New Brunswick

chronologies. The Karsdale chronology spans from 1623 to 1790 and crossdates well with the New Brunswick data as is seen in the graph below.



Wood identification of samples showed that those three reference chronologies are all from red spruce. Therefore, only red spruce samples from the Sinclair Inn were to be crossdated.

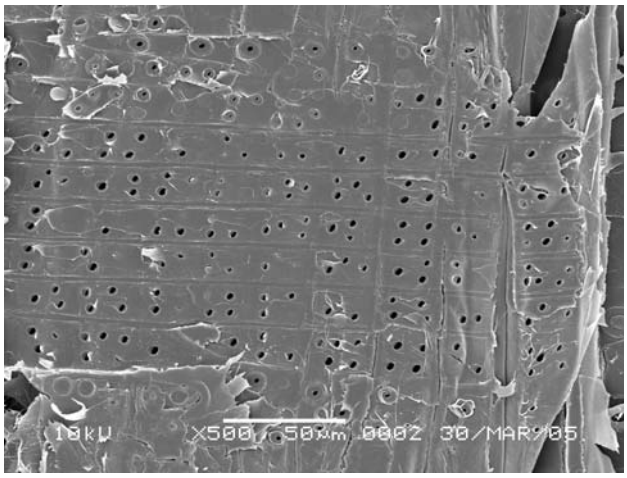
Once the reference data was established, the dendrochronological data of the Soullard house, the

Skene house and the Sinclair additions were each crossdated with these references to determine their age. This was accomplished by matching growth-curve patterns of the references with the building. A light table (photo left) was used to help visually compare our ring growth graphs by observing recognizable patterns in the tree-ring sequences through wide and narrow growth seasons. We also used COFECHA (Grissino-Mayer, 2001), a computerized software designed to crossdate dendrochronological series.

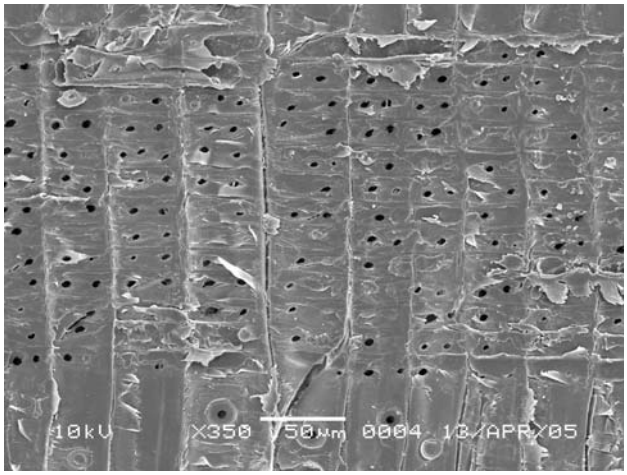
RESULTS AND DISCUSSION

Wood identification

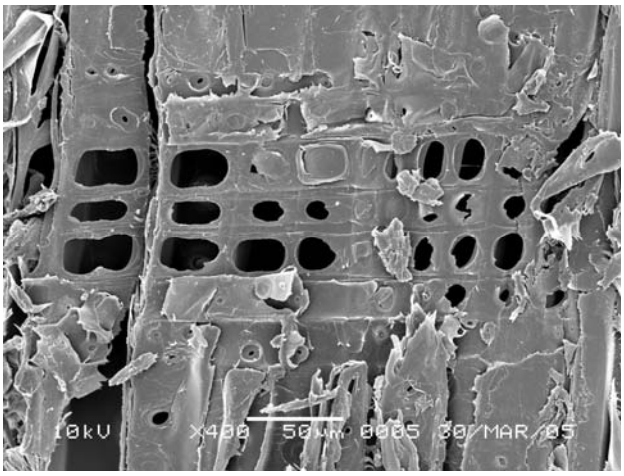
The samples collected from the Sinclair Inn are of three different species: spruce, fir and white pine (see SEM pictures below).



Radial view of a ray from a wood sample taken on a beam from the Skene house. Species is identified as spruce.



Radial view of a ray from a wood sample taken on a lath from the Soullard house. Species is fir.



Radial view of a ray from a wood sample taken on a ceiling beam from the Skene house. Species is white pine.

The trees used to build the frame of the Soullard house were mainly fir, with some spruce (Table 1). Two laths from the Soullard house were also identified and both were fir. The Skene house frame has mostly spruce, but also some beams were cut from white pine (Table 2). The wood used for the Sinclair additions were mostly spruce but also fir (Table 3). These trees were common in the region and it is not surprising that they were used as lumber.

Table 1 : Soullard house samples.

Sample	Number of rings	Last ring	Position in building	Species
05BS007	45	no	frontal beam	Fir*
05BS008	42	no	frontal beam	Fir
05BS009	84	2**	ceiling beam	Spruce
05BS010	34	yes	ceiling beam	Spruce*
05BS004	12	no	sill beam	Fir*
05BS011	71	no	ceiling beam	Spruce*
05BS012	28	no	hallway 2nd level	Fir*
05BS023	24	no	lath	Fir
05BS024	11	no	lath	Fir*

* identified with SEM
** estimated number of missing rings from the sample.

Table 2 : Skene house samples.

Sample	Number of rings	Last ring	Position in building	Species
05BS013	34	no	cellar way beam	Spruce*
05BS015	45	yes	ceiling beam	Spruce?
05BS014	28	no	wall beam	Spruce
05BS016	33	no	ceiling beam	Spruce*
05BS017	42	no	ceiling beam	White pine*
05BS018	24	no	wall beam	Spruce
05BS019	15	yes	ceiling beam	Spruce
05BS020	37	no	ceiling beam	Spruce
05BS021	20	no	ceiling beam	White pine*
05BS005	62	no	sill beam	Spruce
05BS006	55	no	sill beam	Spruce

* identified with SEM

Table 3 : Sinclair additions samples.

Sample	Number of rings	Last ring	Position in building	Species
05BS001	39	yes?	3rd level floor beam	Fir*
05BS002	37	no	3rd level floor beam	Spruce*
05BS003	60	2 or 3**	rafter	Spruce*
05BS022	29	no	3rd floor beam	Spruce

* identified with SEM
** estimated number of missing rings from the sample.

Crossdating issues

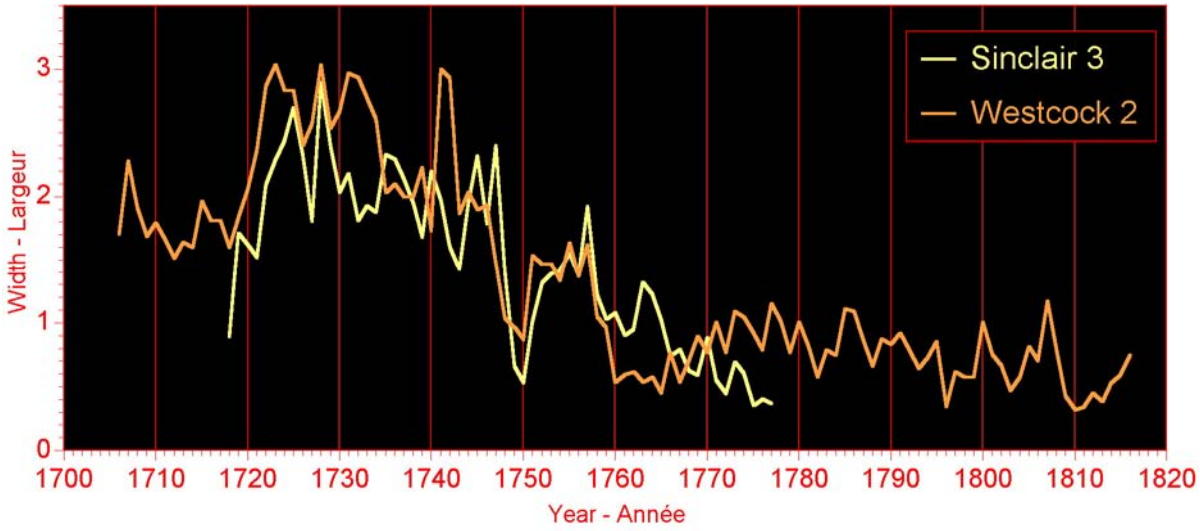
Because only spruce could be used in the crossdating process, it left us with 15 of the original 22 samples that could be dated. Fortunately, all parts of the inn had some spruce present: 3 from the Soullard house, 9 from the Skene house and 3 from the Sinclair additions. Successful crossdating depends also on (1) the presence of the last ring, (2) the length of the chronologies to be dated (over 50 rings), and (3) if the reference chronologies go far back enough in time.

(1) Nearly all the beams that were sampled still had bark or the last ring, but very often the surface of the wood was in a bad state of preservation and didn't resist the coring. Therefore, we lost those valuable last rings in many cases, but at least one sample had them preserved for each

section of the inn to allow crossdating (Tables 1, 2 and 3). (2) Another important factor was the length of the ring series: only 5 cores had over 50 rings (Tables 1, 2 and 3). (3) A last issue is that an overlapping of at least 50 years is needed to have statistical confidence in crossdating. If the age of the Soullard and the Skene houses are as old as the early 1700s, we need reference samples aged older than the 1650s. Only four samples in total from the references are that old. The other reference samples start only in the late 1600s at best. These setbacks proved major difficulties in the crossdating process.

The age of the Sinclair Inn

Albeit the difficulties encountered, the Sinclair additions correlated well with many reference samples as exemplified in the graph below.



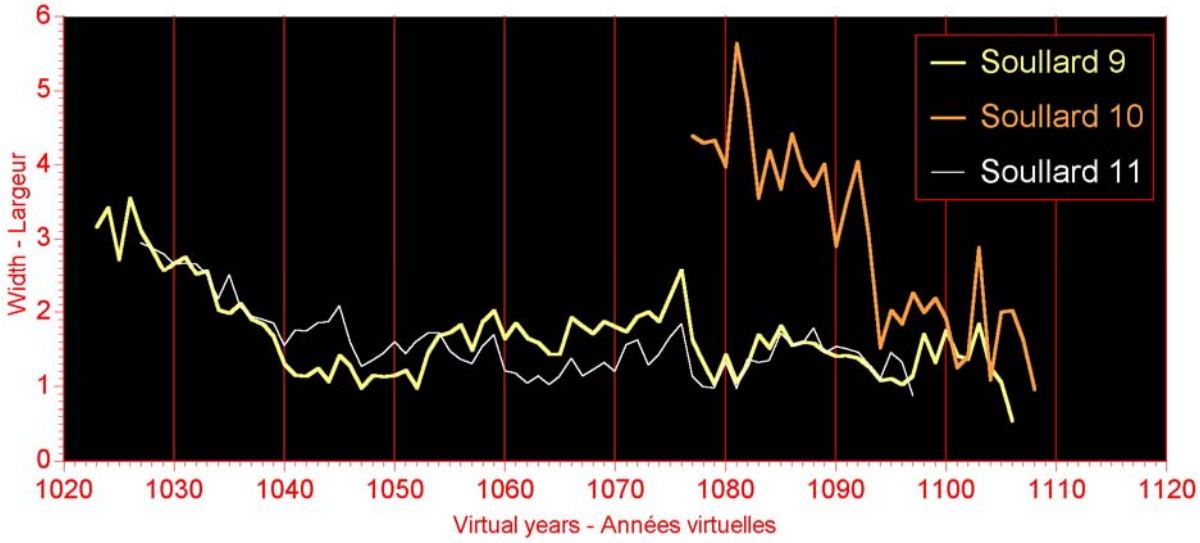
Therefore, a cutting date was established for the trees at 1780. This evaluation is in agreement with the historical interpretation of the building of the inn in 1781.

Table 4 : Crossdating results of spruce samples for the Sinclair additions.

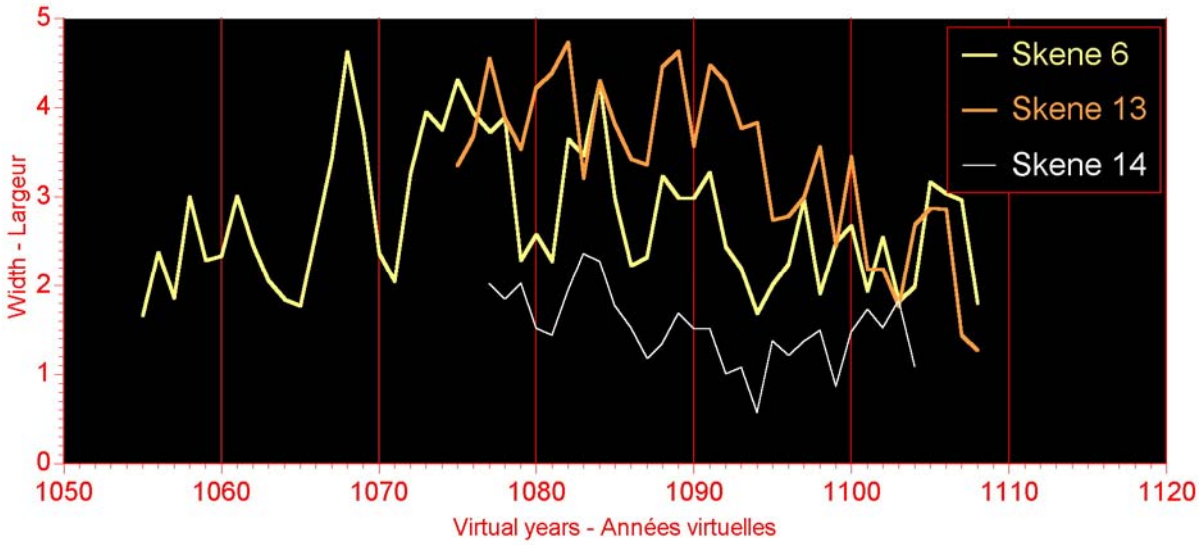
Sample	Date of last ring	Missing rings	Cut date
05BS002	1772	> 5	**> 1777**
05BS003	1777	2-3	**1779-80**

Comparisons between the Soullard house and the Skene house

Valuable information came from the comparison between the samples from both houses. As is shown in the two next graphs, spruce samples collected from the Skene house and the Soullard house correlate well with each other and show a similar growth trend. For example, samples 9 and 11 from the Soullard house remain correlated over an 80 year period. Note that sample 10 illustrates characteristics of a much younger tree, as it shows higher growth rates. Despite this, it is still correlated to the other samples as it shows similar growth patterns.

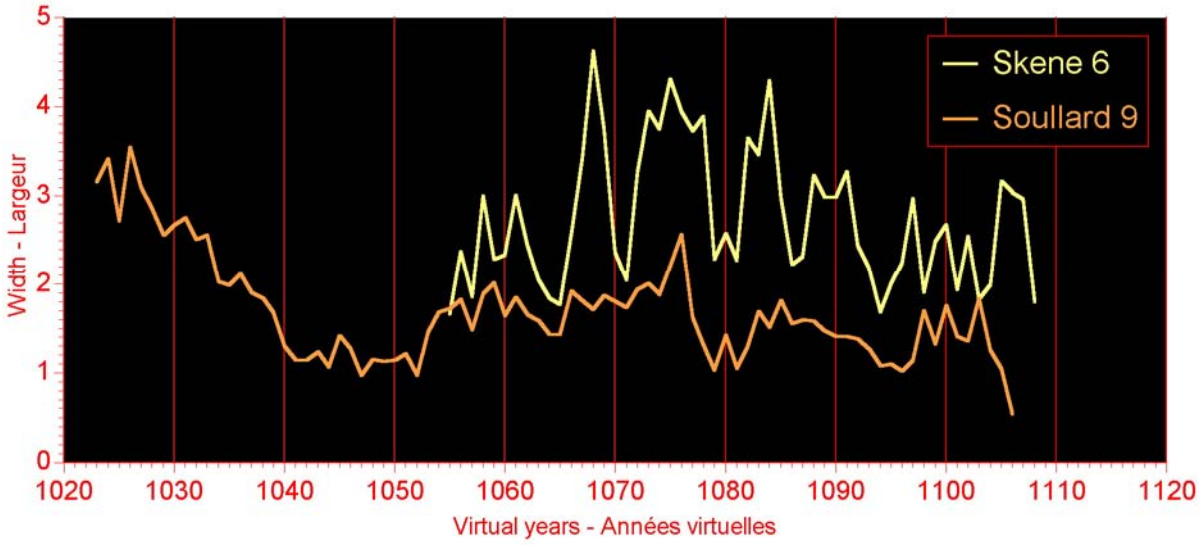


A similarly strong correlation exists between the Skene house samples.



Samples from fir and white pine also display such similarities. This strongly suggests that samples of each house are of a similar age and that no recycled material was used in building these houses.

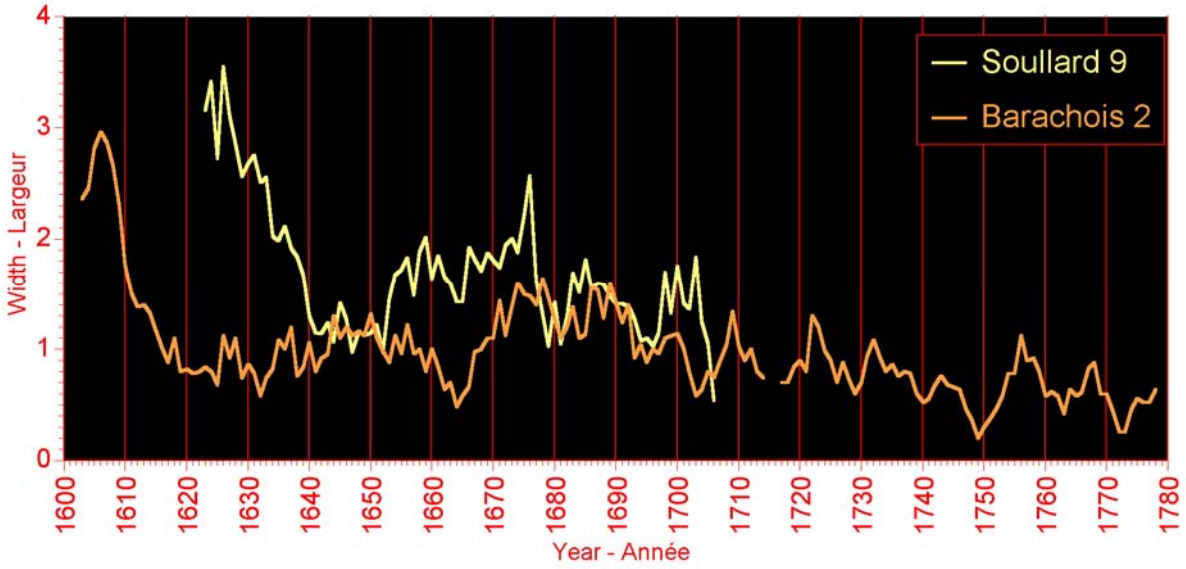
When comparing the growth patterns of the samples collected from the Skene house and the Soullard house, a positive correlation is also present. As is seen in the graph below, samples collected from the two buildings illustrate a similar growth trend and also suggest a similar age.



Sample 6 from the Skene house and sample 9 from the Soullard house are the longest samples collected. As a result, the two can be considered representational of all other samples collected at the corresponding house and as such they can be used to represent the houses against the reference chronologies.

The age of the Soullard house and the Skene house

Crossdating the Skene and Soullard houses was difficult mostly because of the limits of our reference chronologies. Correlation with the reference samples yielded several possibilities of age. Nevertheless, one possibility seemed to stand out, although we cannot discard other possibilities. The next graph illustrates that the Soullard house correlates well to the reference from 1623 to 1706. Taking into consideration that the Soullard house sample has 2 to 3 rings missing, the tree had a growth period from 1623 to 1708/1709.

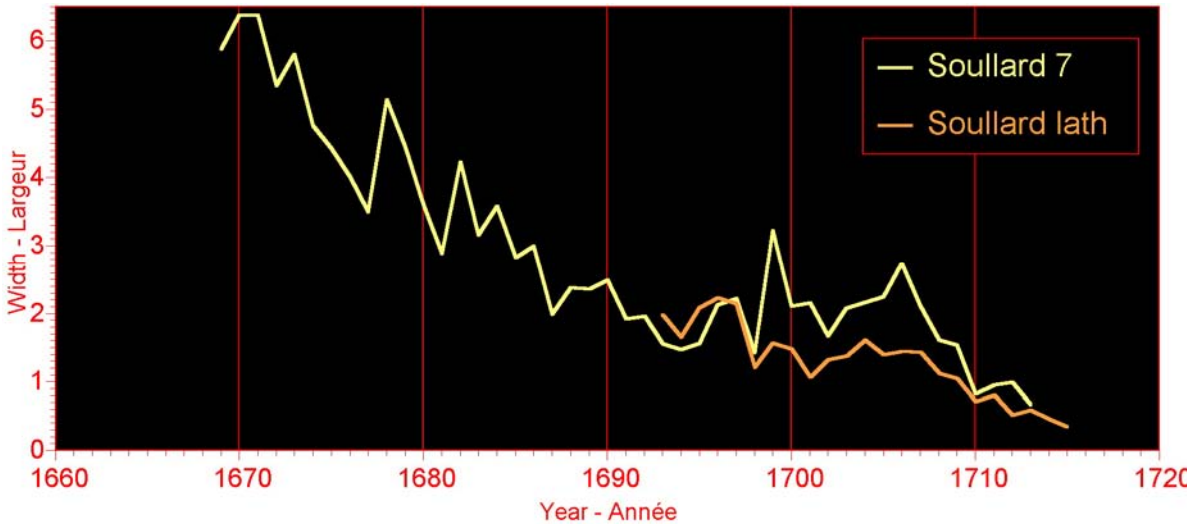


Other spruce samples collected from the Soullard house are of a similar age. As is shown in Table 5, the overall age range of when the trees were harvested is **1708 to 1709** after missing rings are taken into account.

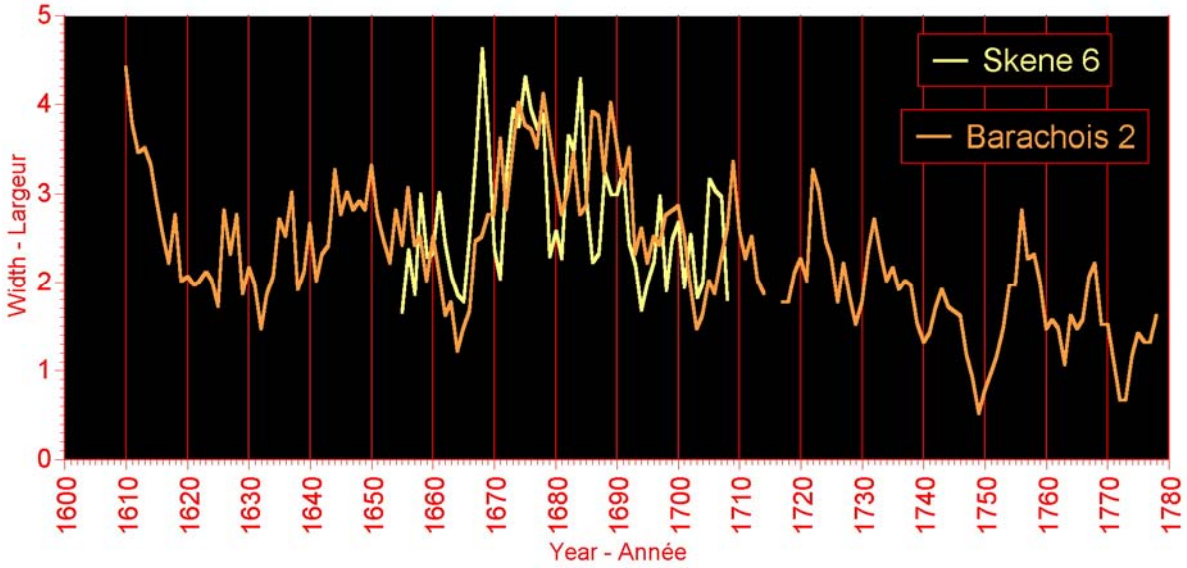
Table 5 : Crossdating results of spruce samples for the Soullard house.

Sample	Date of last ring	Missing rings	Cut date
05BS009	1706	2-3	**1708-1709**
05BS010	1708	0	**1708**
05BS011	1697	?	**?**

Two laths from the Soullard house have also been analyzed and one shows a strong correlation with one of the Soullard fir beam (graph below). The lath seems to be two years younger than the beam. (Note: Dates displayed are not necessarily correct in this case because we had no reference chronology for fir to anchor a firm date.).



The graph below displays one correlation between the Skene house and the Barachois chronology. Because the Skene house sample has 1 to 3 rings missing, the tree had a growth period from 1655 to 1708-1711.



This can be narrowed even further when considering the overall age range of all spruce samples collected from Skene house as is shown in Table 6. The age range of when the trees were harvested is **1708 to1711** after missing rings are taken into account.

Table 6 : Crossdating results of spruce samples for the Skene house.

Sample	Date of last ring	Missing rings	Cut date
05BS005	1705	?	**?**
05BS006	1708	1-3	**1709-11**
05BS013	1708	0	**1708**
05BS014	1704	?	**?**
05BS015	1711	0	**1711**
05BS016	1710	?	**?**
05BS018	not dated	?	**?**
05BS019	1708	0	**1708**

These positive correlations offer confidence in the ability to approximate the age of the houses. The last growth ring of a sample indicates when the tree was harvested. Assuming that the houses were built within 1 year after the trees were cut, we can determine the year that the house

was built. Samples collected from Soullard house illustrate that the spruce trees were harvested around 1708-1709, and so that section of the Sinclair Inn was most likely built in 1710. Similarly, samples from the Skene house show that the spruce trees were cut between 1708 and 1711, and so the house was most likely built in 1712.

CONCLUSION

Dendrochronological analysis suggests that the age of the **Sinclair Inn** proposed by historians (**1781**) is correct. Historians suspected that the **Skene house** was believed to be built between 1707 and 1710. Dendrochronological analysis suggests that it was built in **1712**. Likewise, the **Soullard house** was built between 25 February, 1710 and 14 September, 1714. Dendrochronological analysis verifies this assumption by suggesting that it was indeed built in **1710**.

It is worth noting that other positive correlations exist between the samples collected at the Sinclair Inn and the reference chronologies. These possibilities were also analyzed, and it was concluded that the correlations presented in this report appear to be the most fitting, meaning that the proposed ages of the Inn are the most probable, although more research is needed to confirm those dates. We plan to make another reference chronology from one of the several old dated buildings occurring in the area. Also, we plan to use other old houses thought to be aged around 1710 that should yield valuable data to compare with that of the Soullard and the Skene houses.

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