

# DENDROARCHAEOLOGICAL INVESTIGATIONS IN THE ANNAPOLIS REGION, NOVA SCOTIA



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MAD Lab Report 2006-06

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## **Abstract**

This research project was carried out to determine the date of construction of structures located in the Annapolis Region, northwestern Nova Scotia. Confident terminal dates were found for timbers from all five sites, and dates of construction were extrapolated from this information. Some of these dates confirmed or corroborated estimates while others were different than expected, allowing a more informed appraisal of the historical value of each building. Data from the analysis strengthened and extended local red spruce chronologies but also provided the start to a new balsam fir chronology for the 1700s.

The dates of construction of the buildings are:

1- Holy Trinity Church, Middleton	
Main building (start of construction)	1789
Sanctuary (preliminary data)	1850
2- Adams-Ritchie House, Annapolis Royal	1748
3- Bonnett House, Annapolis Royal	1772-73
4- Douwe Ditmars House, Clementsport	
Older section	1784-85
Later section	1810
5- Barry Moody House, Port Royal	
Older section	1779
Later section	1817

## **Introduction**

Dendroarchaeology is the application of tree ring analysis to the dating of old buildings made of wood. It has two great advantages: 1) it causes little damage to the structure since it consists of extracting a small core with an increment borer that leaves a hole only a few millimeters in diameter, and 2) it yields a date with a precision of 1 year, vastly superior than many assessments made through historical interpretation. It is a well known technique but has been hardly employed in the Atlantic provinces of Canada although many areas hold prominent historical buildings that have yet to be dated.

The Annapolis region, located along the Bay of Fundy of Nova Scotia, is such an area as it was colonized by the Europeans as early as 1605. Several old buildings are still standing, many having heritage status. While historical research has been conducted to age them it remained arduous to confirm an alleged date of construction: written records are often insufficient, oral histories are difficult to assess, and architectural styles can be poor indicators. Thus, several important structures remained inadequately dated and the Annapolis Heritage Society sought ways to substantiate the age of valued historical buildings.

The Mount Allison Dendrochronology Laboratory was approached by the heritage society a few years ago to study the Sinclair Inn, a prominent historical building that was being renovated and converted into a museum. After a lengthy process of developing reference tree-ring chronologies for the region, it was successfully dated through dendroarchaeological techniques (Robichaud *et al.*, 2005). Given this success and the fact that useful reference chronologies were made available, several other buildings were proposed for a dendrochronological assessment. Those buildings are:

- The Holy Trinity Church in Middleton, chosen to strengthen the regional reference chronology;
- The Adams-Ritchie House located in Annapolis Royal;
- The Bonnett House, also located in Annapolis Royal;
- The Douwe Ditmars House in nearby Clementsport;
- The Barry Moody House in Port Royal.

## **Fieldwork and laboratory analysis**

Sampling of all buildings was carried out in August 2005. Core samples were taken using manual increment borers on beams that displayed the last growing ring of a sample. Samples were placed in plastic straws, labeled and taken back to the lab. Their position in the building was also mapped. The cores were glued on grooved wooden mounting canes to facilitate sanding of the samples. Mounted cores were progressively sanded with sandpaper of increasingly fine grain to expose the annual ring-growth patterns. The annual rings were measured using a 24 inch movable Velmex stage hooked up to a digital encoder

with an accuracy of a 1/1000 mm. Raw data was captured by J2X software and put into standard tree-ring decadal format. Ring-width data was crossdated with the Karsdale Christchurch regional reference chronology using the software COFECHA (Grissino-Mayer, 2001). We also visually tested pattern matching of line graphs of all series with the graphic software DeltaGraph®

During the mounting process any excess portions of core samples were taken for wood identification using a scanning electron microscope (SEM) from the Mount Allison Digital Microscopy Facility (Figure 1). The SEM enabled precise wood



Figure 1: Scanning electronic microscope.

identification through the recognition of species-specific cell features and structures. A total of 16 samples were analyzed.

The identification of the wood was important because different species have different growth reactions to climatic variables. When the species is known, it allows us to crossdate the samples with the proper reference chronology and produce more accurate results.

## **Results**

It is important to note that the dates presented here correspond to the felling of trees (cut dates) and not the construction of the buildings. It is generally assumed that the construction date is a year or two later than the cut dates. Also, some samples didn't have the last growth ring present for different reasons (beam did not retain it, perimeter wood was deteriorated, etc.) and so does not represent a cut date. However, they are valuable because they help corroborate the whole dendrochronological assessment being made.



Figure 2: Holy Trinity Church, Middleton, Nova Scotia.

### *1. Holy Trinity Church, Middleton*

Excellent historical accounts allow us to know the precise date of construction for this building (Figure 2), which makes it ideal material to enhance our reference tree-ring chronology for the region. According to Duffus *et al.* (1982), the work began in 1789 and the church was ready to serve by 1791 although it was not entirely finished.

Wood identification analysis indicated that most of the wood is red spruce from the anatomical structure and bark samples taken from the beams, but some hemlock was also identified (Table 1). The latter could not be dated because reference chronologies for hemlock were not yet developed at the time of analysis. The Holy Trinity spruce tree-ring data was compared to the Karsdale (Christchurch) spruce reference chronology (Figure 3) developed earlier (Robichaud *et al.*, 2005). Our dendrochronological analysis clearly indicates that the trees used for the building of Holy Trinity were cut after the growing season of 1788 and before the growing season of 1789. The rings were complete (with the late wood fully formed) and cut dates are concentrated in 1788 (Table 1). The sanctuary located at the back of the church was apparently built later and one sample (05BMS019) seems to indicate it was constructed in the mid-1800s, although further analysis is needed to support this.

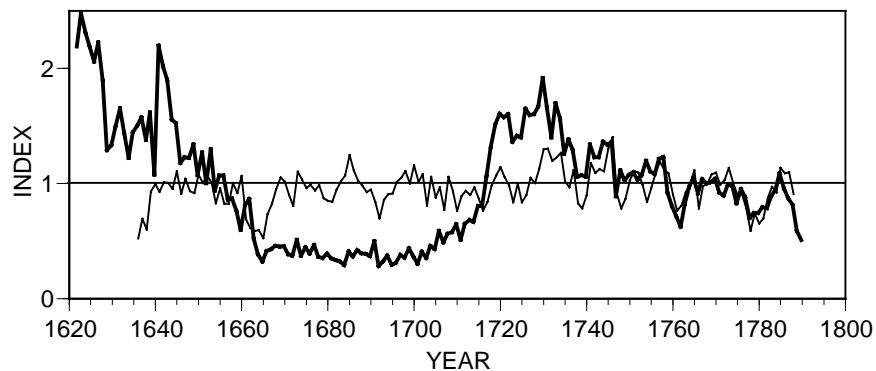


Figure 3: Comparison of the Karsdale standardized chronology (thicker line) with the Middleton standardized chronology. The two curves illustrate a close agreement between themselves, especially in the more recent part.

Table 1: Tree-ring dating results – Holly Trinity Church, Middleton.

<i>Sample ID</i>	<i>species</i>	<i>Sample location</i>	<i>Last growth ring</i>	<i>Date of last ring</i>	<i>Cut date</i>
05BMS001	red spruce	attic-west wall support beam	present	1788	1788
05BMS002	hemlock	attic-west wall support beam	present	not dated	
05BMS003	red spruce	attic-north rafter	present	1788	1788
05BMS004	red spruce	attic-south roof support post	present	1788	1788
05BMS005	red spruce	attic-south roof support post	absent*	n/a	n/a
05BMS006	red spruce	attic-centre post	present	1788	1788
05BMS008	red spruce	attic-north roof support beam	present	1788	1788

05BMS009	red spruce	attic-floor, north “walking” beam	present	1787	1787
05BMS010	red spruce	attic-floor, south “walking” beam	present	1788	1788
05BMS011	hemlock	attic-south rafter	present	not dated	
05BMS012	red spruce	attic-south rafter	present	1788	1788
05BMS013	hemlock	attic-north roof support post	present	not dated	
05BMS014	hemlock	attic-east wall main beam (XII)	present	not dated	
05BMS015	hemlock	attic-post, sanctuary	present	not dated	
05BMS016	hemlock	attic-roof beam, sanctuary	present	not dated	
05BMS017	red spruce	attic-east wall, centre post	present	1788	1788
05BMS018	hemlock	attic-roof beam, sanctuary	absent	not dated	
05BMS019	red spruce	attic-floor beam, sanctuary	present	1849?	
05BMS020	red spruce	attic-north roof mid-beam	absent	1782	?
05BMS021	red spruce	attic-floor, north “walking” beam	present	1788	1788
05BMS022	red spruce	attic-north rafter (VIII)	present	1788	1788

\* defective sample; not processed

## 2. Adams-Ritchie House, Annapolis Royal



Figure 4: The Adams-Ritchie House, now Leo’s Café.

On the Adams-Ritchie site located at 222 St. George Street in Annapolis Royal there is a two storey structure used now as a commercial space known as Leo’s Café (Figure 4). The lower part is our point of interest because it is thought to have belonged to John Adams, a Bostonian that participated in the capture of Port-Royal in 1710 and whose house was built on that very space as a

single storey wattle and daub construction circa 1713. Another hypothesis is that it was built later, after the French and Mi’kmaq successive attacks of 1744-46 when many buildings were destroyed (Dunn, 2004) including the John Adams house that was knocked down by the English army so the enemy could not use it as a firing point. A new building would then have been erected at the same place

sometime after 1746. The controversy needed to be settled so proper interpretation could be made on the structure's historical significance.

Seven samples were taken on ceiling beams and six were in workable shape. Wood identification revealed all were spruce. The tree-ring data from those samples were compared to the Karsdale chronology and the “new” Middleton reference chronology and the wood was successfully dated (Figure 5). Results indicate that the house was built in 1747 or after, supporting the second hypothesis for the origin of the structure (Table 2).

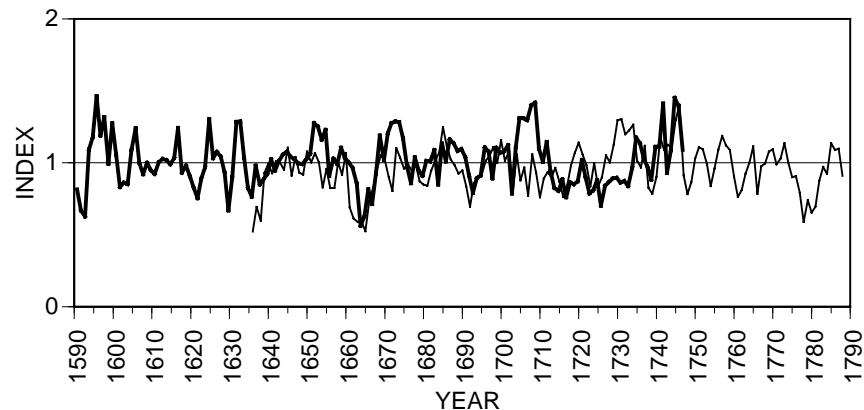


Figure 5: Comparison of the Adams-Ritchie standardized tree-ring chronology (thicker line) with the “new” Middleton reference chronology.

Table 2: Tree-ring dating results – Adams-Ritchie House, Annapolis Royal.

<i>Sample ID</i>	<i>species</i>	<i>Sample location</i>	<i>Last growth ring</i>	<i>Date of last ring</i>	<i>Cut date</i>
05BIS001	spruce	ceiling	absent	1746	?
05BIS002	spruce	ceiling	present	1747	1747
05BIS003	spruce	ceiling	present	1747	1747
05BIS004	spruce	ceiling	absent	1736	?
05BIS005	spruce	ceiling	present	1747	1747
05BIS006	spruce	ceiling	*	n/a	n/a
05BIS007	spruce	ceiling	absent	1740**	?

\* defective sample; not processed

\*\* low correlation with reference chronology

### 3. Bonnett House, Annapolis Royal

The house located at 158 St. George Street is made of several sections (Figure 6). The front part is the oldest and is yet another structure whose age is difficult to assess. Historical documents and architectural characteristics indicate that it is “old”, but the exact age was not known. According to the notes communicated to



us by the Annapolis Heritage Society (Wayne Morgan, personal communication, 2006) it could have been built by Pardon and Hannah Saunders as early as the 1760s. The Saunders property comprised a larger lot than the one occupied today by the Bonnett House and spanned to the properties next door. The



Figure 6: The Bonnett House.

Saunders property was purchased by Frederick Davoue in 1783 and it comprised a building that could be the same structure as the one of interest here or it could be the building next door which is also very old. Davoue divided the property in three lots and later sold 158 St. George to David Bonnett who was to become a prominent business man in Annapolis Royal and after whom the house is named.

The beams that were sampled were almost all spruce except for one that was white pine (Table 3). All samples including the pine were compared to the reference chronologies and were crossdated successfully. Results summarized in Table 3 indicate that most beams are dated in the early 1770s, but two from the basement are of an earlier age and could be recycled wood from an older building.

Table 3: Tree-ring dating results – Bonnett House, Annapolis Royal

<i>Sample ID</i>	<i>species</i>	<i>Sample location</i>	<i>Last growth ring</i>	<i>Date of last ring</i>	<i>Cut date</i>
05BJS001	white pine	first floor, ceiling	present	1769**	1769?
05BJS002	spruce	first floor, ceiling	present	1772	1772
05BJS003	spruce	first floor, ceiling	present	1772	1772
05BJS004	spruce	basement, ceiling	present	1771	1771
05BJS005	spruce	basement, ceiling	absent	1763	?
05BJS006	spruce	basement, ceiling	absent	1768	?
05BJS007	spruce	basement, ceiling	*	n/a	n/a
05BJS008	spruce	basement, ceiling	absent	1770	?
05BJS009	spruce	basement, ceiling	absent, but very close	1762	?
05BJS010	spruce	basement, ceiling	present	1764	1764

\* defective sample; not processed

\*\* low correlation with reference chronology (different species)

#### 4. Douwe Ditmars House, Clementsport

This building is in fact made of four sections of different ages: the central “A” part is the oldest, the southern “B” part was added later, the northern “C” section is an

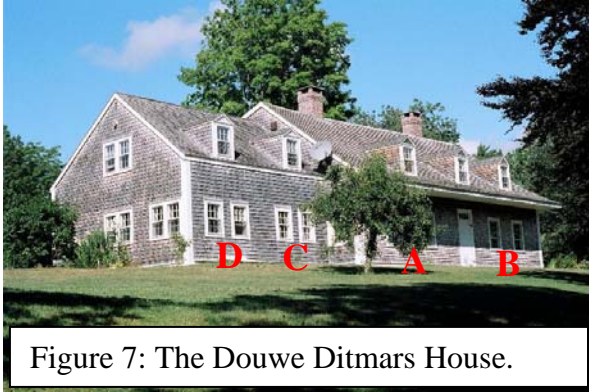


Figure 7: The Douwe Ditmars House.

even later addition on which was adjoined a “D” section in 1998 by the present owners (Figure 7). We concentrated our analysis on the “A” and “B” sections. The age of the oldest part (“A”) is problematic. It is not certain if it originated from a structure moved from Fort Ann where it was possibly built before the 1730s or if it was constructed by the Loyalist refugee Douwe Ditmars between

1786 and 1789. The age of the “B” part is unknown except that it is newer than the “A” part.

From the eight beams sampled from the “A” section of the house, half were spruce and the other half were fir (Table 4). All samples including the fir (Figure 8) were crossdated with the spruce reference chronologies and an age of 1784 resulted from the analysis. Sample 05BKS008 is interesting because it was not damaged during the coring and its last ring was not fully formed suggesting that the tree was cut during the summer.

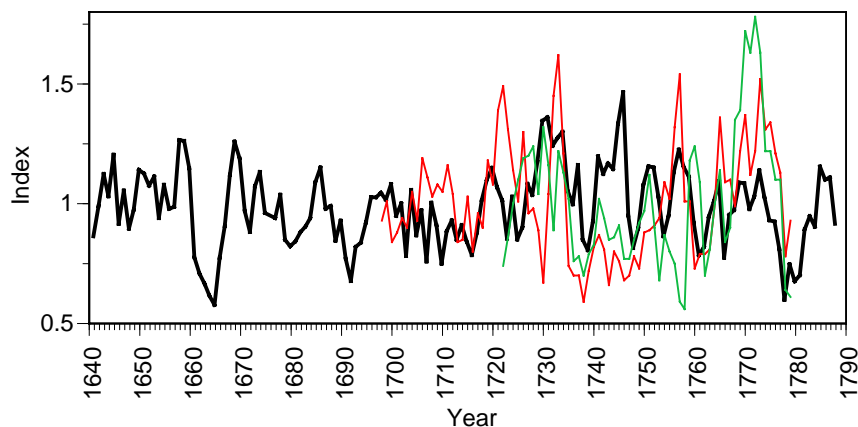


Figure 8: Comparison of a curve from a fir sample (in green) and a spruce sample (in red). Both are from the Ditmars House and show a very good match. They were successfully crossdated with reference chronologies (in black).

As for part “B”, all were spruce but we lost the last rings on most samples because the wood of outer portion of the beams was weak and could not resist the insertion of the coring tool. Nevertheless, two samples had the last ring and were dated at 1808 and 1809. Many of the other samples have near that age and support a similar cut date.

Table 4: Tree-ring dating results – Douwe Ditmars House, Clementsport

<i>Sample ID</i>	<i>species</i>	<i>Sample location</i>	<i>Last growth ring</i>	<i>Date of last ring</i>	<i>Cut date</i>
Original "A" section of house (centre)					
05BKS006	spruce	first floor, ceiling	present; 3-5 last rings damaged	1779	1782-84
05BKS007	spruce	first floor, ceiling	absent	1777	?
05BKS008	spruce	first floor, ceiling	present	1784	1784
05BKS011	fir	rafter	present	1784	1784
05BKS012	fir	rafter	absent	1775	?
05BKS013	spruce	rafter	absent	1772	?
05BKS014	fir	rafter	absent	1774	?
05BKS016	fir	rafter	five rings missing	1779	1784
Later "B" section of house (south)					
05BKS001	spruce	first floor, ceiling	absent	1805	?
05BKS002	spruce	first floor, ceiling	absent but close	1807	?
05BKS003	spruce	first floor, ceiling	absent	1794	?
05BKS004	spruce	first floor, ceiling	absent	1799	?
05BKS005	spruce	first floor, ceiling	absent	1806	?
05BKS015	spruce	rafter	present	1809	1809
05BKS017	spruce	rafter	absent	1803	?
05BKS018	spruce	rafter	absent	1808	?
05BKS019	spruce	rafter	present	1808	1808

### 5. Barry Moody House, Port Royal

At the time of the writing of this report, little information was available on this house (Figure 9). It is suspected that it was built as early as the 1760s by the Planters that arrived from New England after the Deportation of the Acadians.



Figure 9: The Barry Moody House.

Two rooms apparently of different ages were available for testing.

Room 1 beams were a mix of spruce and fir (Table 5). The fir data from the Douwe Ditmars house was used to crossdate the fir samples from this building and all were successfully dated. The spruce samples proved difficult to date because of the small number of rings (average 41 years) but

after thorough analysis they were all dated as well. Results indicate a cluster of cut dates around 1776-1778 (Table 5).

From room 2, we had only four samples but they were all spruce. Their longer time span (82 yrs average) and distinct patterns compared to room 1 indicated a different age. After analysis, we found a younger age of 1816 (Table 5).

Table 5: Tree-ring dating results – Barry Moody House, Port-Royal

<i>Sample ID</i>	<i>species</i>	<i>Sample location</i>	<i>Last growth ring</i>	<i>Date of last ring</i>	<i>Cut date</i>
Room 1 (east)					
05BLS001	spruce	first floor, ceiling	absent	1772	?
05BLS002	spruce	first floor, ceiling	present	1777	1777
05BLS003	fir	first floor, ceiling	present	1776	1776
05BLS004	spruce	first floor, ceiling	absent but very close	1776	?
05BLS005	spruce	first floor, ceiling	absent	1775	?
05BLS006	spruce	first floor, ceiling	present	1778	1778
05BLS007	spruce	first floor, ceiling	absent	1772	?
05BLS008	fir	first floor, ceiling	present	1778	1778
05BLS009	fir	first floor, ceiling	present	1777	1777
05BLS010	fir	first floor, ceiling	absent but very close	1775	?
Room 2 (west)					
05BLS011	spruce	first floor, ceiling	absent	1812	?
05BLS012	spruce	first floor, ceiling	absent but very close	1814	?
05BLS013	spruce	first floor, ceiling	absent but very close	1813	?
05BLS014	spruce	first floor, ceiling	present	1816	1816

### **Discussion and conclusion**

The interpretation of dendroarchaeological dates can be highly problematic when the terminal ring of samples is absent (Nash, 2002), but in our study, although it was partly a problem for some sites, sufficient terminal dates were available to ensure precise dating of the buildings. Also, as stated earlier, cutting dates can only be considered as minimal construction dates, i.e. indicating the earliest possible dates when the buildings were erected. From our experience and as is generally known, the time lapse between cut dates and the true beginning of the construction of a structure might be a single season, or a year in most cases, but it can be up to four years and more in others. As a rule, one or two years can realistically be added to the cutting date to assess the year the construction was completed on the structure.

Table 6 below summarizes the results of the tree-ring analysis made on the five structures that were studied. It also confirmed that the construction of the Holy

Trinity Church began in 1789. The felling of trees preceded the early construction stages by only a year or two. The sanctuary's structural beams were made mostly of hemlock and could not yet be dated, but one was of spruce wood and suggests an age of 1850. It is also confirmed that the Adams-Ritchie House was erected shortly after the 1744-46 attacks which dismisses the other hypothesis. The Bonnett House was built in the early 1770s and therefore most probably belonged to the Saunders family. Interestingly, two beams seemed to be recycled wood, possibly coming from an earlier building from around 1764. As for the Douwe Ditmars House, it is apparent that the wood used for the construction of the old section of the house was cut as early as during the summer of 1784. The "B" section of the house was built later most probably in 1810. The Barry Moody House is slightly older and was built at the end of the 1770s. The other room was added to the house after 1816.

Table 6: Estimated construction dates from the dendroarchaeological study of the five buildings sampled in the Annapolis region.

<b>Building [Site ID]</b>	<b>Estimated date before analysis</b>	<b>Range of cut dates</b>	<b>Estimated date of construction</b>
Holy Trinity Church, Middleton, NS [05BMS]	1) Main structure: 1789-91 2) Sanctuary: unknown	1) 1787-88 2) 1849?	1) 1789 (start of construction) 2) 1850?
Adams-Ritchie House, Annapolis Royal, NS [05BIS]	1713 or >1746	1747	1748
Bonnett House, Annapolis Royal, NS [05BJS]	1760s or 1784	1771-72	1772-73
Douwe Ditmars House, Clementsport, NS [05BKS]	1) Part A: <1730 or 1786-89 2) Part B: unknown	1) 1784 2) 1808-09	1-1784-85 2-1810
Barry Moody House, Port Royal, NS [05BLS]	1) Room 1: >1760s? 2) Room 2: unknown	1) 1776-78 2) 1816	1) 1779 2) 1817

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## **Acknowledgments**

We wish to thank the following groups and persons for their contribution to this work:

- The Annapolis Heritage Society, especially Wayne Morgan who piloted us to all the sites and provided us with valuable historical facts on the buildings.
- The owners or caretakers of the buildings: Sylvester Atkinson, Barry Moody, Leslie Langille, Karen Allen, Paula Buxton, and Paul Buxton.
- Bernard LeBlanc, curator of the Musée Acadien (Université de Moncton), who supplied us with historical and architectural information.
- Jim Ehrman, SEM operator of the Mount Allison Digital Microscopy Facility.
- The Marjorie Young Bell Faculty Fund, Mount Allison University.
- NSERC provided partial funding through the MAD Lab.
- Janice Saulnier and Marie-France Robichaud helped in the sampling of the buildings.