Dendrochronological Analysis of 98 Charlotte Street, Sydney, NS

Amanda B. Young and Colin P. Laroque

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Mount Allison Dendrochronology Laboratory,
Department of Geography and Environment,
Mount Allison University

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Abstract

Due to a fire that occurred at the house at 98 Charlotte Street in 2009, the structure has gone under the scrutiny of the Old Sydney Society into whether it is worth conducting renovations on the structure. This first depends on the structural stability of the building, but also on its historical significance to the region. To assist in the historical significance, the MAD Lab was contacted to attempt to date wood taken from the building. Six samples were collected by ADI Limited, samples were identified as spruce, balsam fir and hemlock, and processed following standard methods. Dendrochronological investigation indicates that 98 Charlotte Street was probably built with wood cut in 1780 and was then renovated during the mid-1800s. Further sampling is needed to positively date the house to 1780.

Introduction

In the fall of 2009 the Mount Allison Dendrochronology Lab (MAD Lab) was contacted by Peyton Chisholm of the Old Sydney Society in Sydney, Nova Scotia. The Old Sydney Society is currently in the process of having ADI Limited assess the structural soundness and historical significance of the building found at 98 Charlotte Street (Figure 1). Restoration work is necessary due to fire damage that occurred in June of 2009, however if the building is not found to be historically significant it may be torn down instead of renovated. It is believed that the south side of the building is from the late 18th century and that the north side from the mid 19th century. The Old Sydney Society is interested in having the south side of the building dated to see if it is truly built before the 1800s.

Figure 1. A line drawing of 98 Charlotte Street, provided by Peyton Chisholm.

Methods

Fourteen cores were collected by the ADI Limited team on February 19th. Due to extensive dry rot and inexperience at coring, all of the cores were broken up and in too many pieces to be used in any type of dendrochronological analysis (Figure 2). Adam Cashin of ADI Limited was able to collect six cross-sections from the structure. Three are main floor beams, two are ends of floor boards and the last a post from a section of the floor cut during renovations (Appendix I).

Figure 2. Example of a core extracted from 98 Charlotte Street cores in this condition are not able to be used for any dendrochronological analysis.

Samples were relabeled using the MAD Lab site code 10AS000. Each sample was labeled with an individual item code and taped together to maintain soundness. Samples were then sanded with progressively finer sand paper (80-400 grit) to bring out the cellular structures and annual rings of the wood. The species of each sample was determined and then recorded. Rings were counted and measured from the bark to the pith (middle) of each core sample using a Velmex measuring system with an accuracy of 0.001mm along three paths (Appendix II).

A time series of measurements from the two pieces of wood were pattern-matched to previously establish master chronologies from the area that are locked in time. Cross-dating is the practice of taking the pattern of growth from one sample and comparing it to that of another with an associated time line (Figure 3).

To assist in the cross-dating procedure, the statistical cross-dating program COFECHA (Holmes, 1986a) was used. COFECHA uses correlation values to assist in accurately dating samples. Higher correlation values indicate that the floating chronology corresponds well to the master chronology. Lower correlation values can indicate a variety of things such as ecological or climatic variation from the norm or that the sample is inaccurately dated. The floating chronologies were run against corresponding master chronologies of red spruce (*Picea rubens*) and eastern hemlock (*Tsuga canadensis*) available from the MAD Lab archives. Each of the floating and master chronologies were standardized to have a mean of one by using a negative exponential curve in the program ARSTAN (Holmes,1986b). This standardization was completed to allow samples of different ages to be compared.

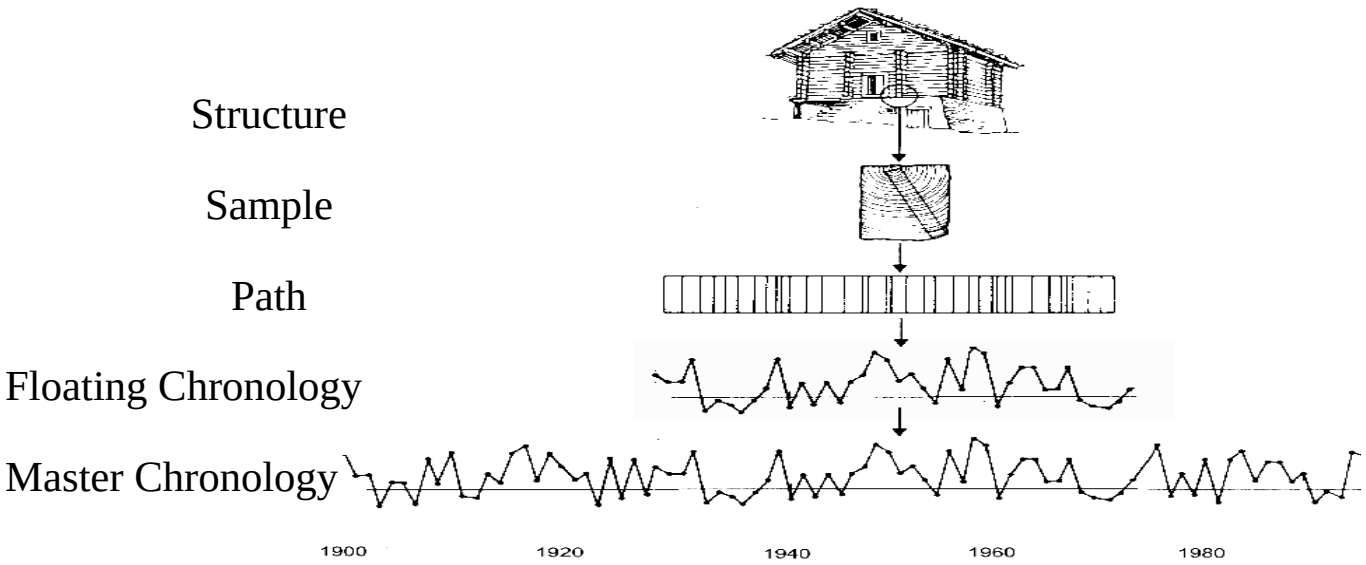


Figure 3. Example of cross-dating by using patterns from a structure (floating chronology) compared to the master chronology.

Results and Discussion

Samples were identified to species by examining cellular structures under the microscope. Three of the samples (10AS001,003, and 005) were determined to be balsam fir (*Abies balsamea*), two determined to be red spruce (*Picea rubens*) (10AS002, 004A) and one is eastern hemlock (*Tsuga canadensis*) (10AS004B) (Table 1).

Table 1. Sample location, presence of end wood and time spans for paths A and B of each sample, last year present, and species identification.

Sample	Location	End Wood		Year		Last Year	Species
		A	B	A	B		
10AS001	End of first floor beam	No	No, close	1749-1769	1750-1775	1775	Fir
10AS002	End of first floor beam	No, close	Yes	1712-1778	1712-1779	1779	Spruce
10AS003	End of first floor beam	Yes	no	1743-1780	1755-1777	1780	Fir
10AS004A	Top Layer of Floor Boards	no	no	1716-1851	1809-1862	1862	Spruce
10AS004B	Bottom Layer of Floor Boards	no		1572-1779		1779	Hemlock
10AS005	Bottom of post second floor, original exterior north wall	Yes		?		?	Fir

The range of the number of years present within the samples ranged from 20-206 years (Table 1 and 2). As expected, the shortest chronologies are all balsam fir. Balsam fir is a difficult species of wood to date, due to its complacent growth patterns and its relatively short life span. The MAD Lab has poor chronologies to use as master chronologies for dating balsam fir. However, balsam fir does respond to the environment and to insect outbreaks similarly to spruce. Thus spruce chronologies were used to attempt to date the balsam fir samples. The spruce chronologies the MAD Lab has from the Cape Breton region are not old enough to date the samples found in 98 Charlotte so a regional master chronology was used. The hemlock sample was cross-dated to an established Cape Breton hemlock chronology.

Table 2. Chronologies identified by species, number of samples per chronology, number of years in the chronology, time span, interseries correlation of each chronology, correlation to the master chronology.

	# of samples	Years	Length	Interseries Correlation	Correlation to Master
Fir	2	38	1743-1780	0.741	0.404
Spruce	2	151	1712-1862	0.475	0.317
Hemlock	1	208	1572-1779	X	0.136

End wood dates range from 1775-1862; end wood is the last year of wood produced before the tree was cut down. One sample (10AS005) was not able to be dated due to its short time span. The spruce samples correlate to the master chronology with a correlation of 0.317 and the balsam fir with 0.404. Spruce and balsam fir correlations to the master are high (Table 2), though visually they do not match well (Figure 4 B and C). Additionally, the correlation between the spruce and balsam fir samples is good 0.483. On the other hand the hemlock chronology has a low (0.136) correlation with the master hemlock chronology but visually matches well (Figure 4 A).

The question remains, when was the building constructed. All but one sample have end years occurring in the 1700s. Sample 10AS004A is the top layer of floor boards and has an end year 1862. The bottom layer of floor boards (10AS004B) had an end year of 1779, though it does not have end wood but we feel it is quite close. Two samples (10AS002 and 003) that have end wood have end years of 1779 and 1780. Due to the strong correlations and visual matches to the master chronologies it appears that the 98 Charlotte St. was built around 1780 and had new or repaired floors installed during the mid-1800s.

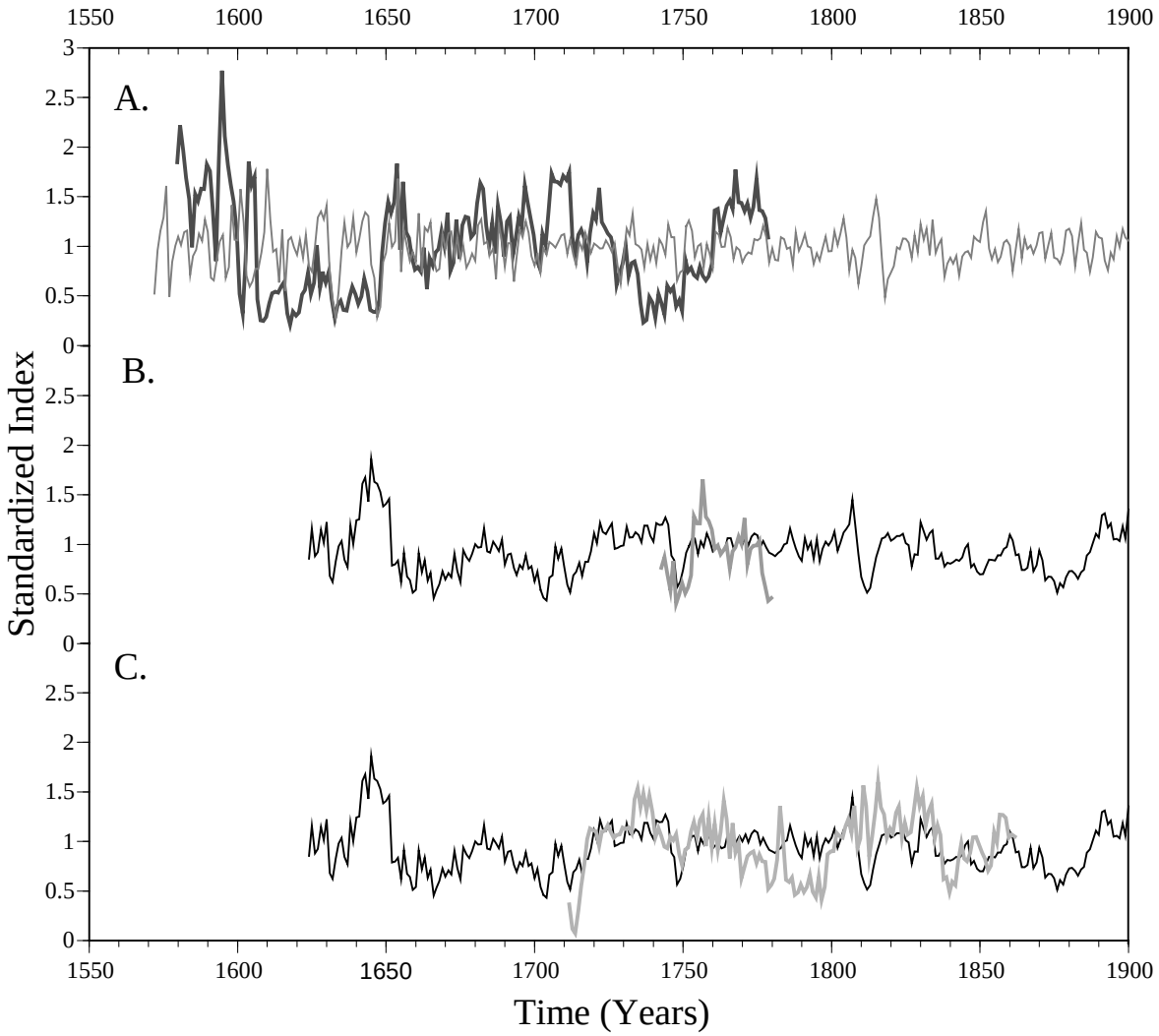


Figure 4. Comparison between master chronologies and samples taken from 98 Charlotte Street: A. Hemlock, B. Fir, and C. Spruce.

Conclusions

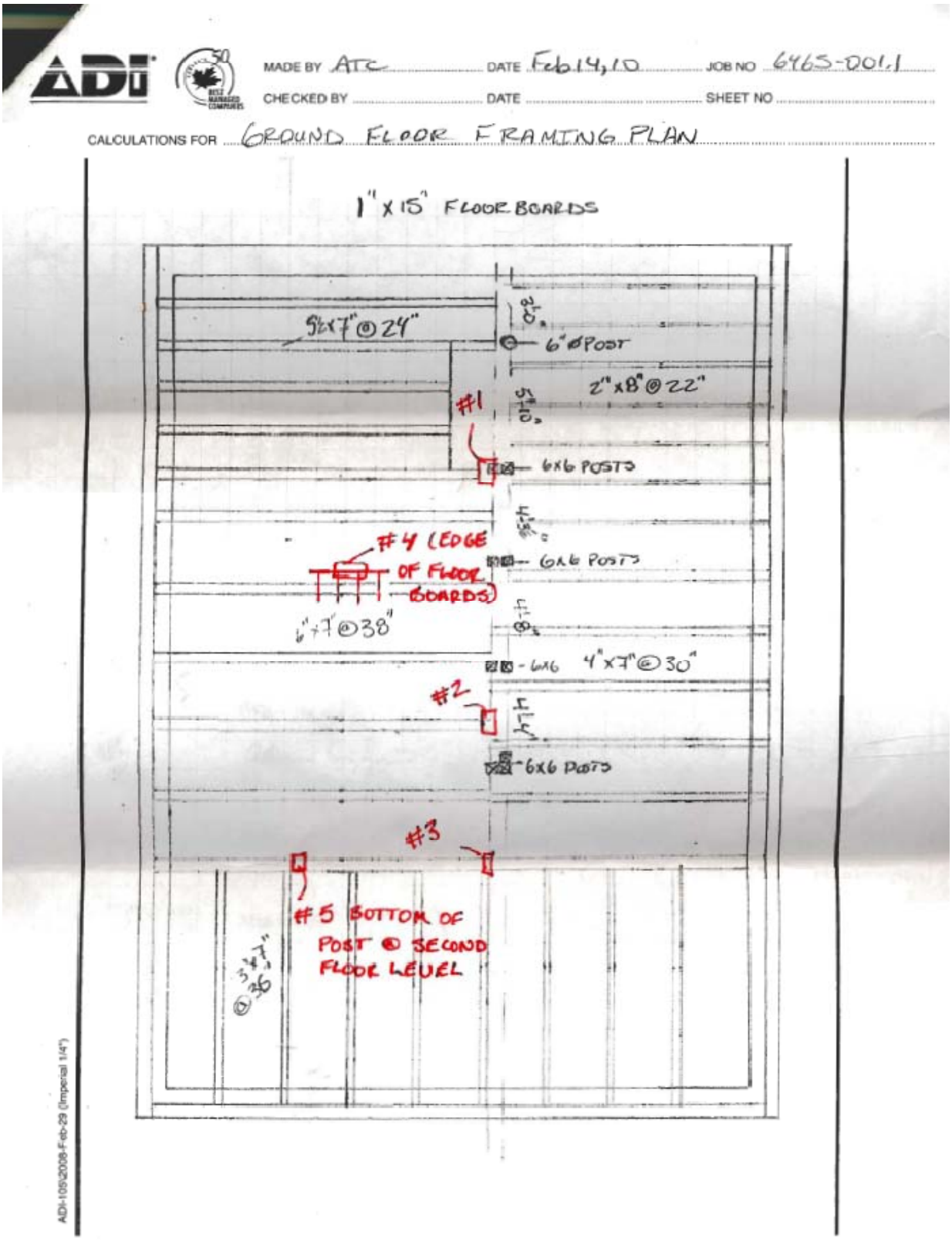
In 2009 a house fire occurred at 98 Charlotte Street. The house is now undergoing investigations to determine the historical significance of the building to decide whether renovations should occur or if the building should be torn down. Six samples were collected from 98 Charlotte Street by ADI Limited. Samples were identified as spruce, balsam fir and hemlock. Dendrochronological investigation indicates that 98 Charlotte Street was probably built in 1780 and potentially renovated during the mid-1800s. This study was performed on a low number of samples (6) where one of the samples was not able to be dated. In order to guarantee the building was built in 1780 further sampling and analysis would need to be preformed to raise the confidence level of the investigation.

References

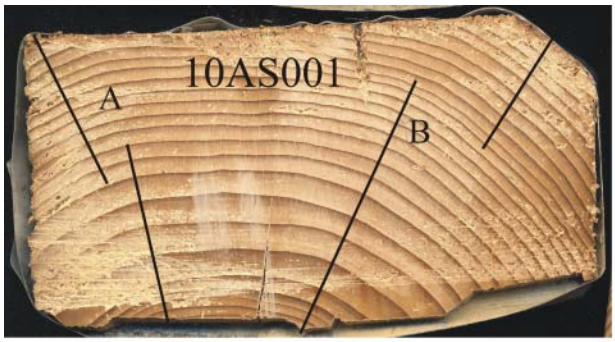
Holmes, R.L. (1986). Users manual for program COFECHA. In *Tree-ring chronologies of western North America: California, eastern Oregon, and northern Great Basin* (eds R.L. Holmes, R.K. Adams & H.C. Fritts), pp. 41-49. Laboratory of Tree-Ring Research, University of Arizona, Tucson.

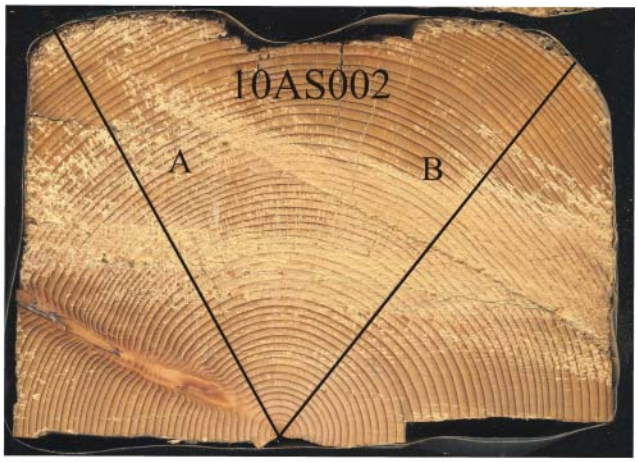
Holmes, R.L., Adams, R.K., & Fritts, H.C. (1986) Users Manual for Program ARSTAN. In *Tree-ring chronologies of western North America: California, eastern Oregon, and northern Great Basin* (eds R.L. Holmes, R.K. Adams & H.C. Fritts), pp. 50-65. Laboratory of Tree-Ring Research, University of Arizona, Tucson.

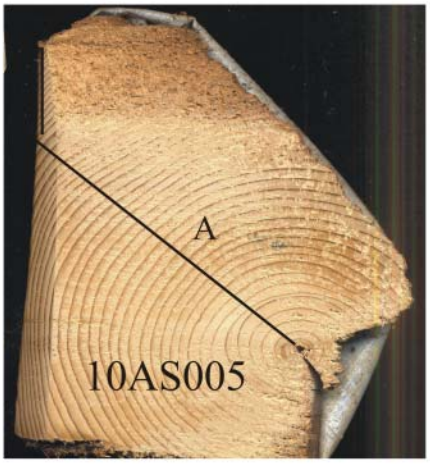
Appendix I. Floor plan of 98 Charlotte St. Samples are labeled in red and identified where they were removed.



Appendix II. Samples taken from 98 Charlotte St. with measured paths identified.







10AS004A

10AS004B