Initial Analysis of the Basque Boat Hull: Wood Identification and Tree-Ring Measurements

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Abstract

Remnants of a Basque boat hull washed ashore near Tracadie Beach in eastern New Brunswick in 2008. A piece of this boat was taken to the New Brunswick Archaeological Services due to its potential historical significance. The Mount Allison Dendrochronology Lab (MAD Lab) was contacted to assess and process the sample collected of the boat, in order to determine if the boat was old enough to be considered historically significant. The piece of the boat sampled by the MAD Lab was determined to be birch (*Betula* sp) through Scanning Electron Microscope (SEM) investigation. The sample could not be dated even though it had an average age of 131 years with a correlation between paths of 0.756. This is due to the established chronologies of birch not being long enough to date the piece of the boat.

Introduction

In 2008 a partial hull of a boat washed ashore near Tracadie Beach, eastern New Brunswick. The New Brunswick Archaeological Services was contacted about the hull due to the appearance of it being quite old (Figure 1). The hull consisted of about 10 cross beams attached to planks with wooden pegs. It also contained wrought iron double spiked nails for side to side nail joinery. The cross-beams are approximately 2 metres long and bent in the middle in order to shape the hull. The shape of the cross-beams was perhaps prepared by steaming the wood. One of the cross-beams was taken to the Archeological Services office in Fredericton, New Brunswick. Due to the construction style of the boat hull, it is thought to perhaps be of Acadian origin, but built in the Basque fashion.

On December 17th, 2008 members of the Mount Allison Dendrochronology Lab (MAD Lab) visited Brent Suttie of the New Brunswick Archeological Services in Fredericton, New Brunswick. The Archeological Services wanted a portion of the boat hull to be dated using dendrochronological analysis. Dating the hull requires a sufficient number of tree rings present in the cross-beam and a chronology composed of the same species to lock the date in time. The initial analysis of the Basque boat cross beam was conducted in two steps. The first step was to identify the species of the wood used to build the hull, the second was to measure the rings of the beam and to attempt cross-dating it to the available chronologies composed of the same species.

Figure 1. Image of the Basque boat hull as it came ashore near Tracadie Beach, NB.

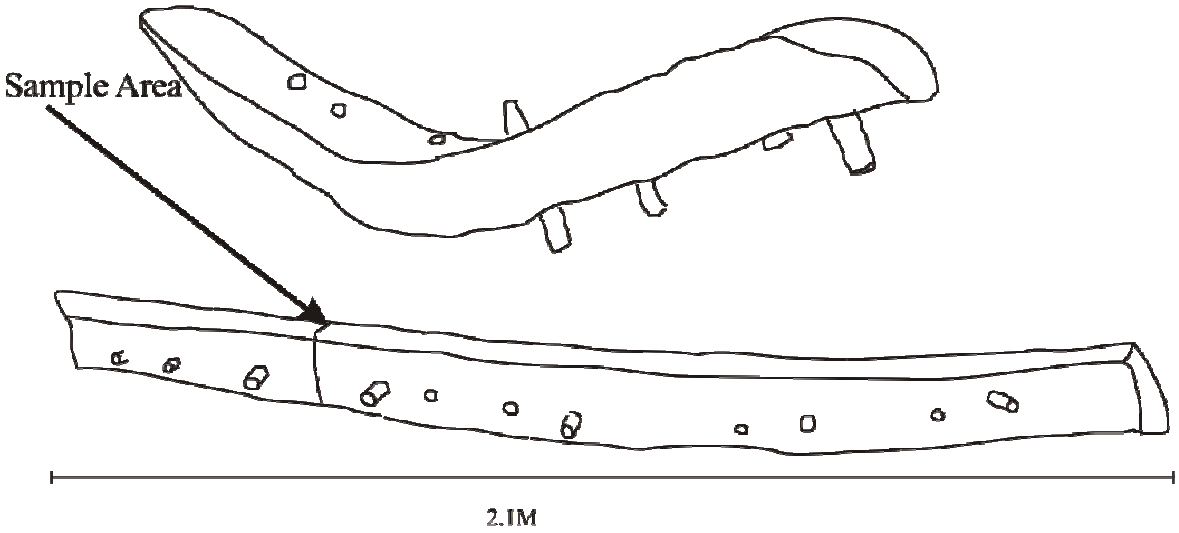

Figure 2. Line diagram of where the sample was taken from the hull of the Basque boat.

Methods

The cross-beam from the Basque boat was investigated to identify if there was outer wood (having the last growth ring before felling) present and where the wood was closest to the pith. A suitable section was identified 46 cm from the end of the beam (Figure 2). The beam was wrapped in plastic wrap and tapped at the location identified in order to stabilize the wood in case of additional breakage during the cutting procedure. This spot was then sawn removing the end with a reciprocating saw (Figure 3). Upon visual inspection, roughly 100 rings were present.

Figure 3. Sampling the cross-beam of the Basque boat with a reciprocating saw.

Species identification

From the portion of the cross-beam a small fragment of wood was removed to be used for wood identification. Smaller pieces were then cut from the fragment with a razor blade on a wooden block under a dissecting microscope to expose the tangential and radial sections of the wood (Figure 4). The best pieces were glued on a metal stub and taken to the Mount Allison Digital Microscopy Facility (http://www.mta.ca/dmf/), where they were prepared for viewing under a Scanning Electron Microscope (SEM).

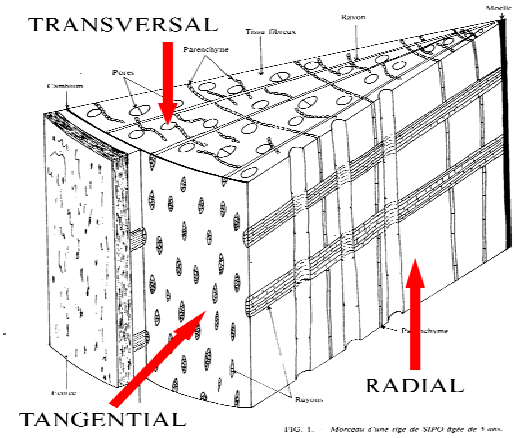

Figure 4. A cross section of a log illustrating the radial and tangential faces of the wood.

Measurements

The sample taken from the cross-beam was prepared for measurements by first cutting the nearest 5cm from where the piece was identified to have the best chance of having outer wood and closest to the pith. This sample being removed from the beam was sanded with progressively finer sanding paper (80-400grit) to bring out the cellular structures and annual rings of the wood. Rings were counted and measured along two paths from the center of the sample using a Velmex measuring system with an accuracy of 0.001mm. Measurement paths were run through the most structurally sound portions of the sample (Figure 5).

Figure 5. Image of the sample taken from the Basque boat (08BMS00).

A time series of measurements from the cross-beam were correlated to each other thereby creating floating chronologies (chronologies that are not attached to a specific period of time). The floating chronologies were then cross-dated to a previously establish master chronology that was locked in time from the area. Cross-dating is the practice of taking the pattern of growth from one sample and comparing it to that of another (Figure 6).

To assist in the cross-dating procedure, the statistical cross-dating program COFECHA was used (Holmes, 1986a). 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 master chronologies available from the MAD Lab archive.

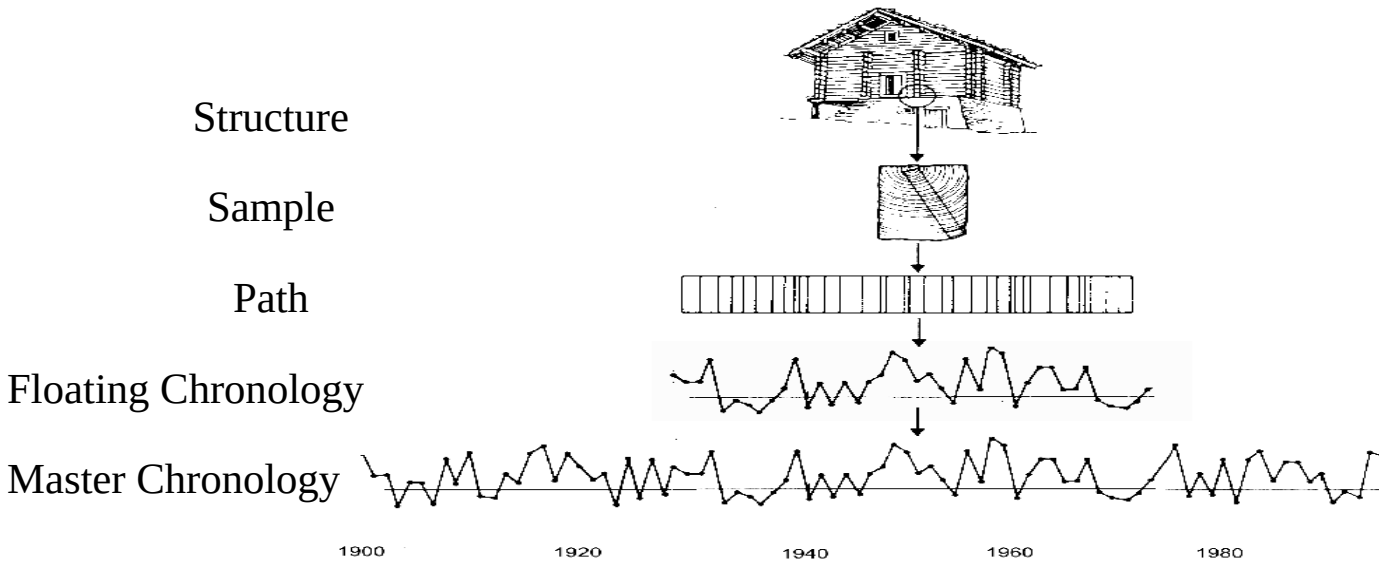

Figure 6 - Example of cross-dating by using patterns from a structure (floating chronology) compared to a master chronology.

Results and Discussion

Species Identification

Observations of anatomical structures revealed characteristics typical of birch (*Betula* sp.). Through SEM analysis, features specific to birch could be detected. Radial views depict vessels with scalariform perforation plates and covered with very small pits (Figure 7A). Scalariform perforation plates are found in birches while oaks and maples have simple perforation plates. Scalariform perforation plates have vertical bars across the opening while simple perforation plates do not have the bars (Figure 7B). Birches typically have 10-15 perforation bars, though they are also known to have 25 or more. Small pits on the vessels are also distinguishing characteristics of birch; other eastern hardwoods are not known to have these pits. The pits found on this sample were organized with empty 'N' shaped spaces between groups of pits (Figure 7C).

Though no tangential samples were examined with SEM analysis, we can still examine woods characteristics. The transverse view (cross-section) of the wood shows that it is diffuse porous meaning there are pores found scattered throughout each ring not just in the early wood. Pores can be found in groups of 2-4 cells (Figure 7D). Another characteristic was that the wood was stained in a dark shade due to having been submerged in salt water for many years. We have seen similar discolorations in birch wood from portions of an ocean going boat (MAD Lab Report 2009-12, Theresa E. Connor). Different species of birch cannot be distinguished anatomically.

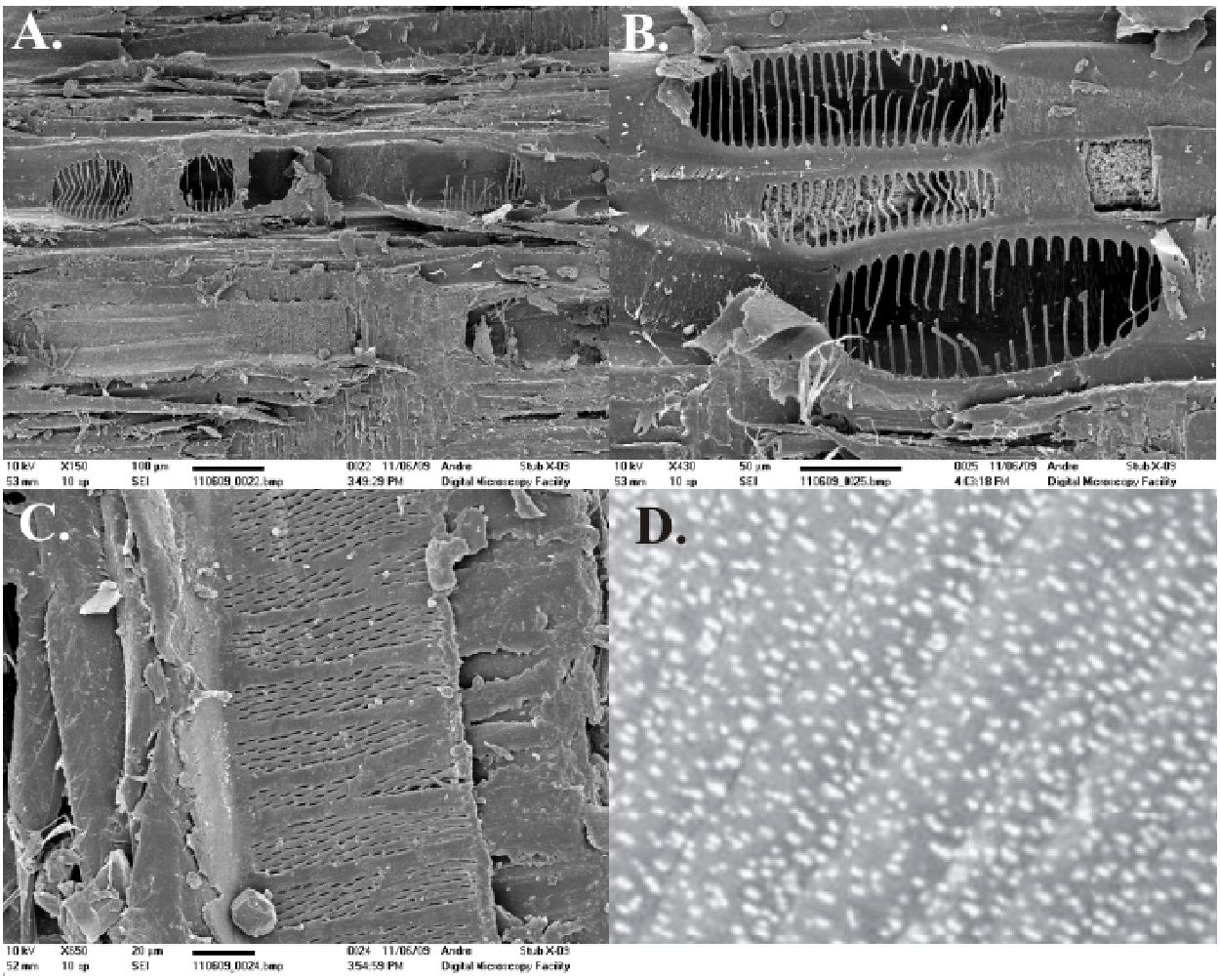

Figure 7: (A) Radial view at 150X showing a general outlook of the sample. Vessels of relatively small size with sclariform perforation plates are clearly visible. (B) Radial view at 430X with a close-up of perforation plates. The number of bars helps determining the type of wood. (C) Radial view at 650X with a close-up of a vessel with the numerous and tiny pits typical of the *Betula* genus. (D) Zoomed in of Transverse view showing numerous diffuse pores.

Measurements

The average number of rings found in the two paths taken is 131 years (122-140) (Table 1). The number of rings is a minimum; additional rings may have been worn or cut off in the construction of the boat. The outer rings of the sample were distorted and hard to see thus not measured. The average ring width of the two paths is 0.765 mm (0.733-0.803) (Figure 8) which is smaller than the average widths of most living chronologies (Table 2). The difference in size of ring widths suggests that the wood from the boat did not grow in the same time period, location or forest structure than the master chronologies. The correlation between the two paths taken from the sample is 0.756.

Table 1. Number of years and correlation values of the two paths taken from the cross-beam of the Basque Boat (08BMS00).

Series	# of Years	Correlation
08BMS01A	122	0.756
08BMS01B	140	0.756

Table 2. Number of cores, interval of time series, mean series correlation values, mean age and average widths (mm) of the four potential master chronologies.

Series	# of Cores	Interval	Correlation	Mean Age	Avg. Width (mm)
08BILE00	39	1842-2008	0.497	134.1	1.23
08CNLE00	36	1769-2008	0.423	136	0.93
07CXLE00	39	1834-2007	0.516	95.3	1.38
07RLE00	39	1801-2006	0.512	112.9	1.21

Having determined that the species of wood used to construct the cross-beams of the Basque boat was birch, master chronologies of four birch plots (Table 2) from New Brunswick were compared to that of the floating chronology. However, the patterns of ring width growth do not overlap. This indicates that the boat is older than 1830, due to a 50 year overlap needed to cross-date the boat. The actual date of construction cannot be detected at this time.

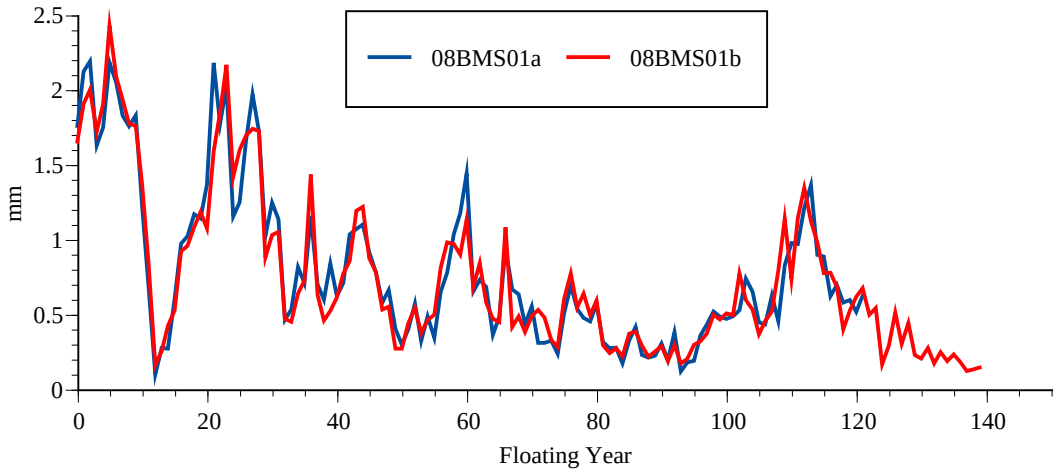

Figure 8. Graph of the two measurement paths taken from the cross-beam of the Basque boat.

Conclusion

Our analysis determined through visual observations and SEM analysis that birch (*Betula* sp.) was used to create the cross-beams of the Basque boat. Measurements of the beam have an average length of 131 years and correlation of 0.756. Attempts to cross-date the sample did not succeed due to the established master chronologies not having sufficient length. Selectively sampling for old birch may lead to establishing a sufficiently long chronology to date the cross-beam of the Basque boat, and so the pattern of radial growth will be kept on file until such time as a suitable host chronology can be found to date the beam structure.

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.

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