



**Mount Allison
Dendrochronology Lab**

**IDENTIFICATION OF THE WOOD REMNANTS FROM THE PETITCODIAC
RIVER ABOITEAUX: SEM ANALYSIS AND MICROGRAPHS**

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ABSTRACT

As part of an investigation on archaeological resources conducted by AMEC in the Petitcodiac River area in 2010, seven pieces of wood were sent to the Mount Allison Dendrochronology Laboratory (MAD Lab) for a dendroarchaeological assessment that was conducted in winter 2011. Species identification of the samples was also conducted using external features such as bark and ring aspects but uncertainties remained. Therefore more sophisticated methods of wood identification are presented in this report.

SEM analysis was performed on the seven samples and illustrated that three samples were previously correctly identified, whereas four were not, for various reasons such as absence of normally observable features, wood decay and other wood alterations. The MAD Lab is currently developing a protocol for wood identification of indigenous conifers from the Maritime with systematic use of external features on sanded cross sections along with complementary use of SEM imagery in problematic cases. This should help in future assessment of wood species for archaeological and ecological purposes.

INTRODUCTION

As part of the rehabilitation of the Petitcodiac River, an investigation on archaeological resources was conducted by AMEC in the area, more specifically on physical remnants of aboiteaux and associated drainage structures. From their findings, AMEC sent seven pieces of wood to the Mount Allison Dendrochronology Laboratory (MAD Lab) for a dendroarchaeological assessment (Kershaw *et al.*, 2011). One aspect of the analysis was species identification of the samples which was done visually using external features such as bark and ring aspects of the subfossil samples. Uncertainties with some poorly degraded samples were noted, therefore it was planned to later use more sophisticated methods of wood identification on these samples. The results of the latter are presented in this report.

WOOD ANALYSIS

A small piece of wood was cut out of each of the seven samples. Smaller fragments were cut with a razor blade on a wooden block under a dissecting microscope to expose the tangential and radial sections of the wood. The best fragments were glued on two separate metal stubs 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).

Since the samples had been previously sanded for tree-ring measurements, the cross-sections were well exposed and displayed the cellular arrangements of the wood. Therefore, we also observed cross-section diagnostic features of the wood under a dissecting microscope.

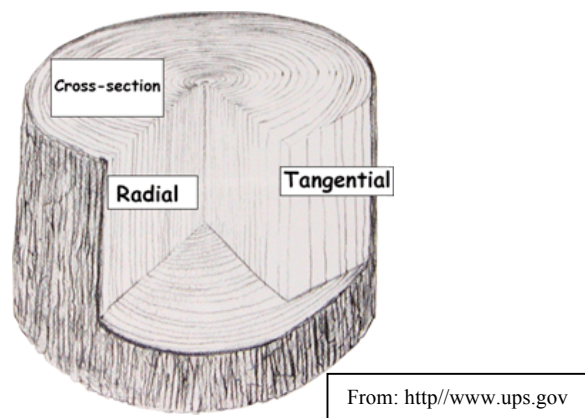


Figure 1: A diagram illustrating the various views of the wood. In this analysis we cut the wood in tangential and radial directions for analysis of the unknown wood species.

Sample 11AD001 – wooden stake

The cross-section of this sample shows gradual early wood/late wood transition. Resin ducts seemed absent, but SEM analysis revealed small resin ducts on the tangential section (Figure 2, right). The radial view (Figure 2, left) displays a ray with parenchyma cells having small piceoid, cupressoid and taxodioid pits; the ray is bordered by transverse tracheids. Together, these characteristics point towards spruce. Because there are more than one row of transverse tracheids in the rays, and they have more than one row of bordered pits within the cells, we suggest it is red or black spruce (*Picea* cf. *rubens* or *mariana*) and exclude white spruce (*Picea glauca*). The fact that the sample doesn't have obvious resin ducts on the sanded cookie probably led to the previous conclusion of it being balsam fir (which doesn't have resin ducts; it also doesn't have transverse tracheids in the rays which can only be seen at very high magnification).

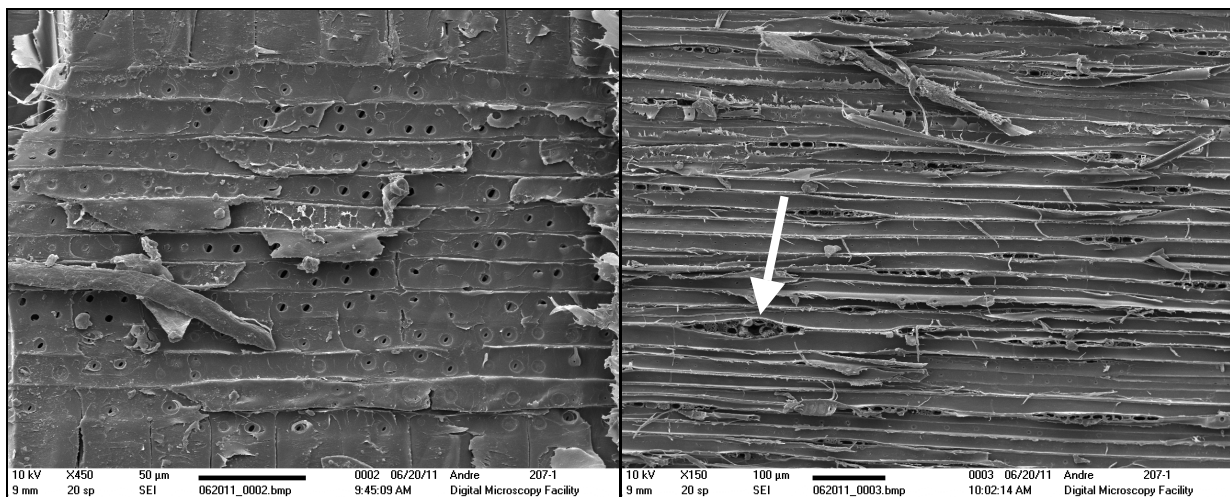


Figure 2: Micrographs of sample 11AD001. Left – radial view of a ray. Right – general view of a tangential section. The white arrow indicates a resin duct.

Sample 11AD002 - wooden stake

This sample had a similar aspect as 11AD001 and also had the same anatomical features on the cross-section: gradual early wood/late wood transition and no visible resin ducts. SEM analysis illustrated the same anatomical characteristics as sample 1 (Figure 3). Here again, it was mistaken for balsam fir for the same reasons but again proved to be spruce (*Picea* cf. *rubens* or *mariana*).

Sample 11AD003 - sluice

The cross-section of this sample showed obvious large size resin ducts typical of pine species. Early wood/late wood transition is gradual which points toward white pine (*Pinus strobus*). This is further confirmed with the SEM analysis where the radial view illustrates rays with large window like pinoid pits and large resin ducts in the tangential view (Figure 4). The wood is partially decayed. Former identification was correct by affirming it was pine. White pine sluices were found at Grand-Pré and were dated around 1690 (Robichaud and Laroque, 2008; Robichaud *et al.*, 2009).

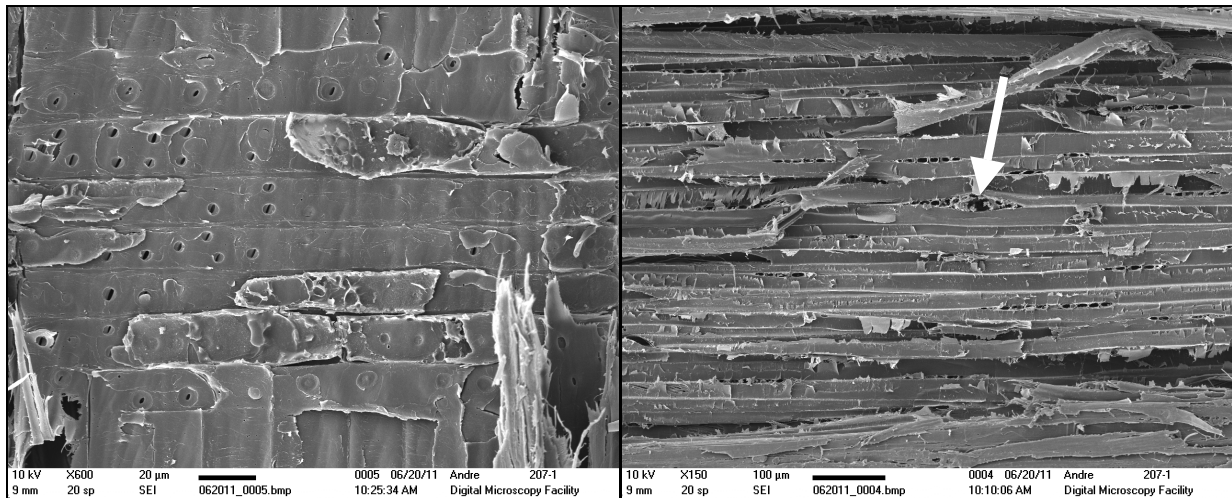


Figure 3: Micrographs of sample 11AD002. Left – radial view of a portion of a ray with transverse tracheids. Right – general view of a tangential section with a resin duct (white arrow).

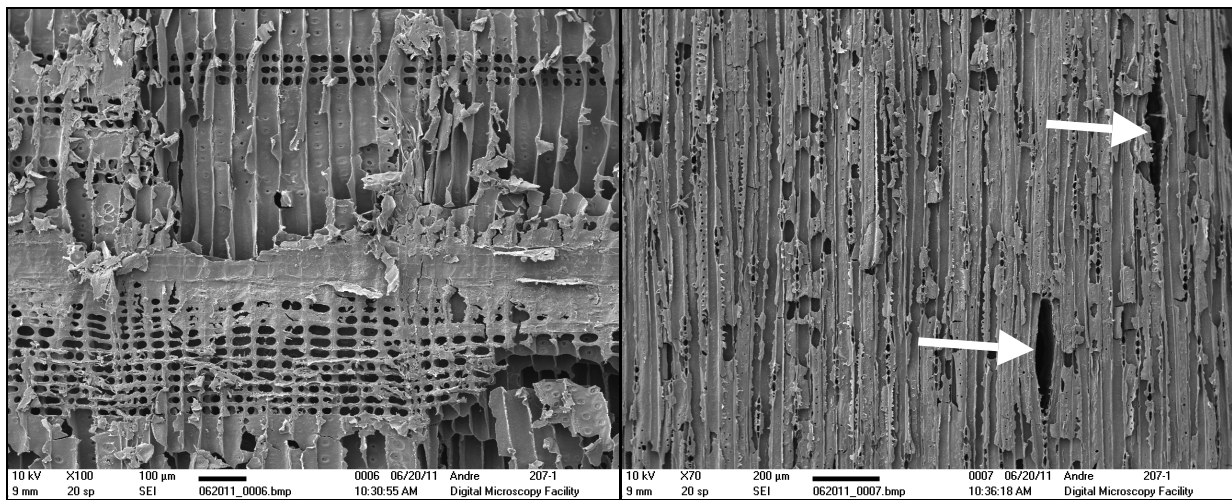


Figure 4: Micrographs of sample 11AD003. Left – radial view. Right – general view of a tangential section with partly decayed large size resin ducts (white arrows).

Sample 11AD004 – unidentified

The outer aspect of this sample led us to think at first that it was red spruce. SEM analysis and a closer look at the cross-section suggest it is otherwise. The cross-section does show resin ducts, but the early wood/late wood transition is abrupt. Additionally, the SEM images illustrate pine like features on both the radial and the tangential views (Figure 5). Therefore, we conclude that it is red pine (*Pinus resinosa*). Note that this species is uncommon in the numerous structures the MAD Lab surveyed throughout the Maritimes.

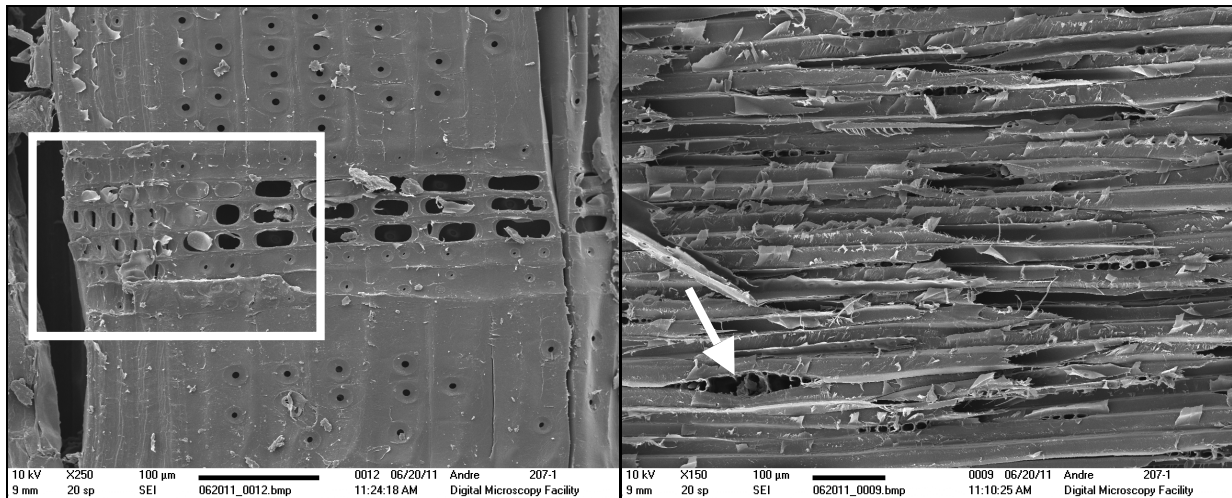


Figure 5: Micrographs of sample 11AD004. Left –radial view of a ray with large pinoid pits. Note that the abrupt early wood/late wood transition is visible here as the size of the cells decrease sharply (white box). Right – general view of a tangential section with one large size resin duct (white arrow).

Sample 11AD005 – part of a small log associated with an aboiteau

A cross-section of this sample illustrated no resin ducts and a gradual early wood/late wood transition. SEM analysis confirmed the absence of resin ducts (Figure 6, right). Moreover, rays had no transverse tracheids (Figure 6, left). The height of the rays (easily over 10 to 15 cells in the observed fragment) also discards the possibility of eastern white cedar (which usually have ray heights under six cells) which means the sample is balsam fir (*Abies balsamea*). Thus, it was initially identified correctly.

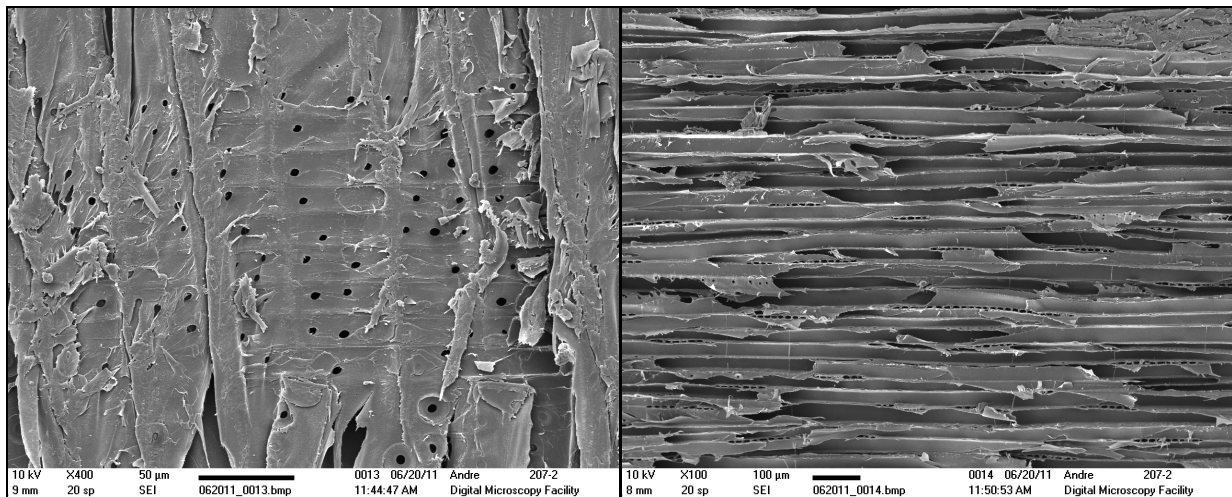


Figure 6: Micrographs of sample 11AD005. Left –radial view of a portion of a ray without transverse tracheids. Right – general view of a tangential section; no resin ducts were found throughout the sample.

Sample 11AD006 – squared wood piece

This sample was also correctly identified. The cross-section and the SEM images (Figure 7) all point out towards red or black spruce.

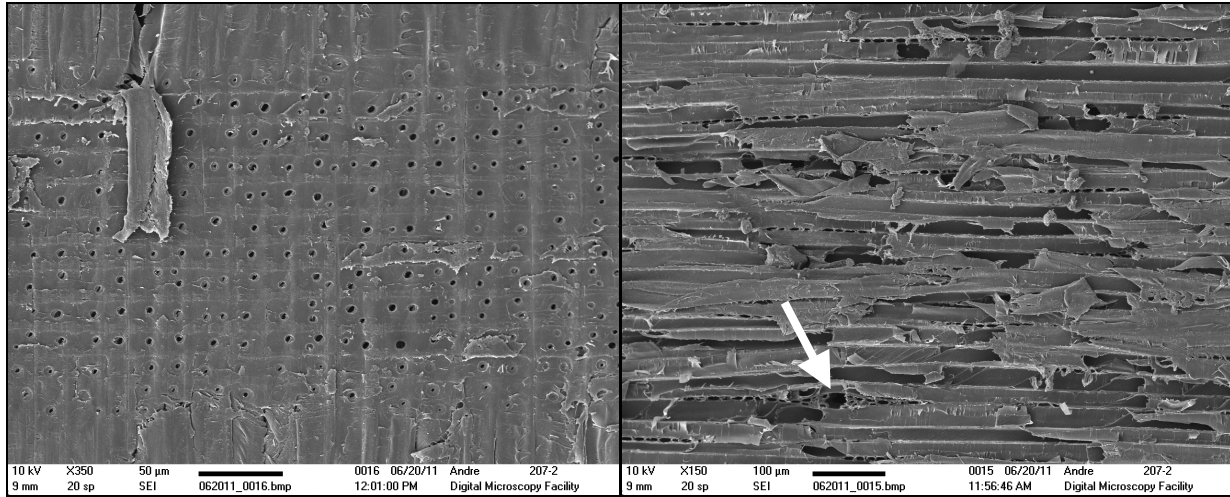


Figure 7: Micrographs of sample 11AD006. Left – radial view; the ray is bordered by transverse tracheids. Right – general view of a tangential section with a small resin duct (white arrow).

Sample 11AD007 – board with peg

The cross-section of this sample had no resin ducts. Thus, it was initially thought to be fir. However, other features disprove this assessment. First, the early wood/late wood transition although gradual in many rings is abrupt in several other rings. Furthermore, the late wood has black cell walls and is thick in many rings. This is often seen in hemlock but rarely in fir. Nevertheless, more evidence was needed to confirm this assumption. SEM analysis confirms the absence of resin ducts and also shows transverse tracheids in rays (Figure 8) which exist in hemlock but not in fir. Therefore, the sample can only be hemlock (*Tsuga canadensis*).

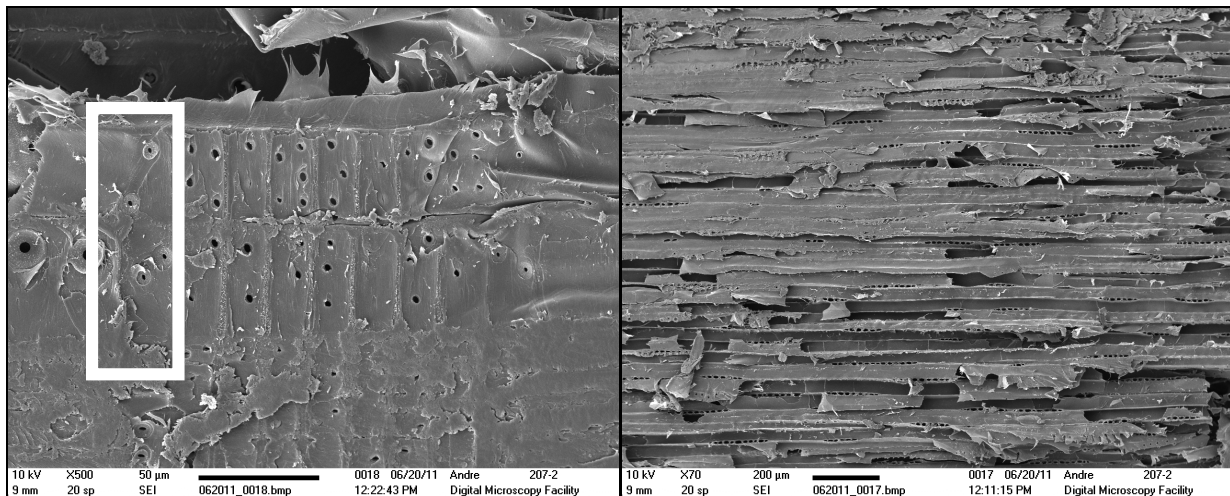


Figure 8: Micrographs of sample 11AD007. Left – portion of a ray bordered by transverse tracheids (white rectangle). Right – general view of a tangential section. No resin ducts were found either here or on the cross-section.

CONCLUSION

Wood determination of artifacts is an important procedure in archaeology. Identifying wood with the sole use of external features, although valuable, can also be problematic. That is why the MAD Lab will often support its identification assessments by using other methods such as observation of a well sanded wood piece under a dissecting microscope and the use of SEM. In this particular case, three samples were previously correctly identified whereas four were not for various reasons (Table 1).

Table 1: Species identification from the previous report and from this study

Sample #	Previous interpretation	This report
11AD001	balsam fir	spruce
11AD002	balsam fir	spruce
11AD003	pine	white pine
11AD004	red spruce	red pine
11AD005	balsam fir	balsam fir
11AD006	spruce	spruce
11AD007	balsam fir	hemlock

The MAD Lab is currently developing a protocol for wood identification of indigenous conifers from the Maritime with systematic use of external features on sanded cross sections along with complementary use of SEM in problematic cases. This should help in future assessment of wood species for archaeological and ecological purposes.

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