Crossdating the *Titanic* Railing

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Abstract

A wood sample was given to the MAD Lab in the spring of 2012 by a documentary film crew from PBS, researching an artifact for the program *History Detectives*. The artifact was an old picture frame, made from the railing of an old ship. The railing allegedly came from either the *RMS Lusitania* or the *RMS Titanic*, both built in the early 1900s. To determine the origin of the railing, the MAD Lab compared measurements from the artifact (obtained through high-resolution scans) to chronologies from Scotland (where the *Lusitania* was built) and Ireland (where the *Titanic* was built). Based on our assessment, the last year of growth on the sample was 1907, and the wood was identified as oak (*Querus* spp.) from Ireland. The time span of the sample was 104 years across the measured paths. No bark was present on the sample, indicating that the cut date was further in the future than the determined date of 1907.

Introduction

In the spring of 2012, the Mount Allison Dendrochronology Laboratory (MAD Lab) was contacted by PBS's *History Detectives* to date and determine the origins of a picture frame, which had been brought to them by a client seeking information on the frame. This picture frame was reportedly made from a piece of railing from an old ship. As the story goes, the client's grandfather worked on a ship and befriended the ship's carpenter. This carpenter, after helping to salvage the wreckage of another ship, made the picture frame as a gift for the grandfather. However, a family controversy surrounded the artifact, as the origin of the wood was reportedly either the *RMS Titanic*, which famously sank on its maiden voyage in 1912, or the *RMS Lusitania*, which sank as a result of a torpedo attack in World War I.

The MAD Lab was asked to provide as much information as possible for a *History Detectives* documentary on the artifact, specifically, to determine whether the wood from the frame came from the *Lusitania* or the *Titanic*. Both of the ships were built in the early 1900s, with the *Lusitania*'s maiden voyage occurring in 1907, and the *Titanic*'s five years later. No bark was present on the artifact. However, one of the distinguishing features between the two ships was their location of origin, with the *Lusitania* being built near Clydebank, Scotland, and the *Titanic* constructed in Belfast, Ireland. The MAD Lab's objective, then, was to determine whether the wood came from Scotland or Ireland, and whether the age of the wood was compatible with a cut-date in the early 1900s.

Methods

In transforming the artifact from railing to picture frame, the original piece of wood had been cut and varnished. However, the end-side of the picture frame revealed a series of rings. In order to preserve the original state of the artifact, the MAD Lab could not cut or sand the piece further. Instead, the rounded end of the frame was processed with a high-resolution Epson scanner, and the resulted images digitally manipulated through Adobe Photoshop in order to strengthen contrasts and increase the visibility of the rings (see Figure 1). Once these rings were revealed, they were measured using WinDendro, a computer software program with ±0.001mm accuracy. The path of best visibility was measured independently by two researchers and these were later correlated to one another.

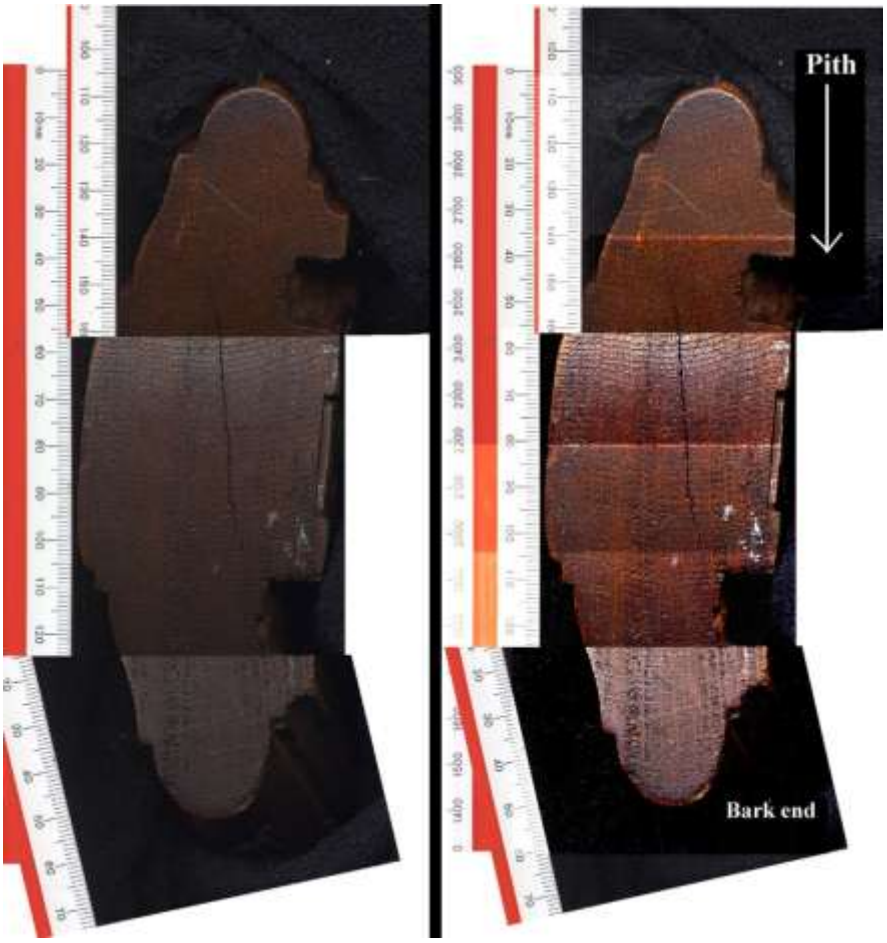

Figure 1: The rounded end of the frame, before (left) and after (right) digital manipulation. Three scans were conducted to have the wood in close contact with the scanner bed, since the end of the object was rounded.

The artifact was visually identified as oak (*Quercus spp.*), and the time-series measurements created a floating chronology which was compared to oak chronologies originating in Ireland and Scotland. These chronologies were obtained from the International Tree-Ring Data Bank (ITRDB; http://hurricane.ncdc.noaa.gov/pls/paleo/fm_createpages.treering), an online database of established chronologies from around the world. A mixed oak (*Quercus spp.*) and English oak (*Quercus robur*) master chronology was found for each country of origin, as close to the shipyard as possible (see Figure 2 and 3). The statistical cross-dating program COFECHA (Holmes, 1986a) was used to determine the strength of each chronology, and the chronologies were compared to one another by country in order to determine whether there was a strong regional signal.

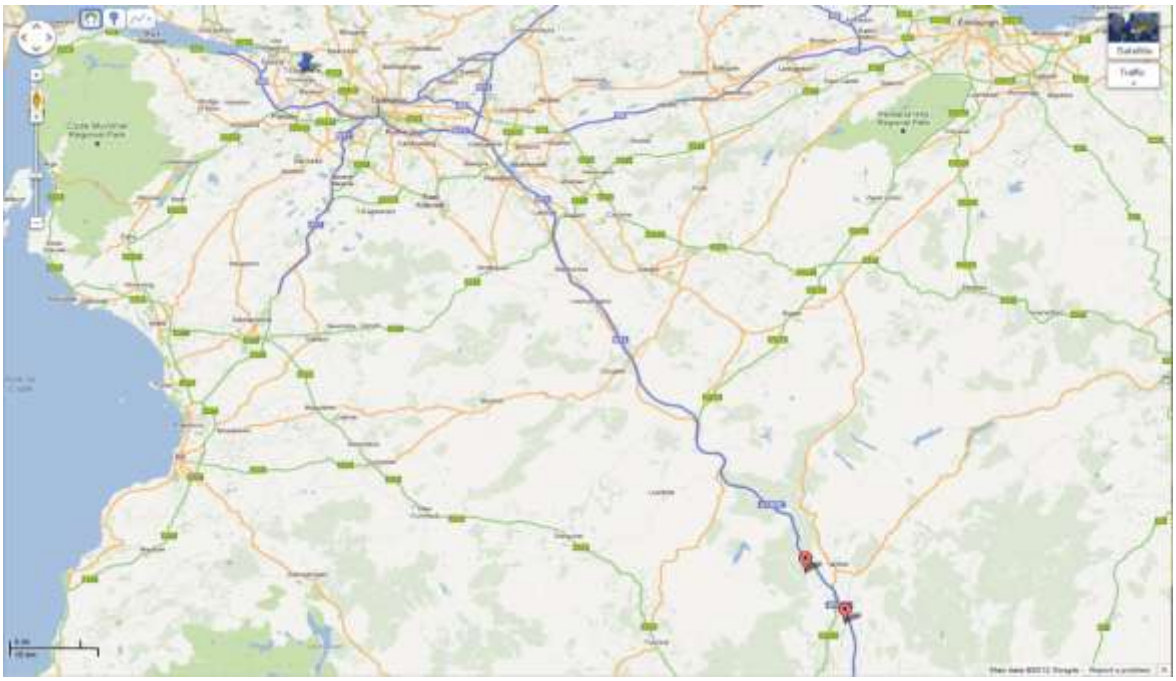

Figure 2: The sites used to develop the Scottish regional chronology (red points) and Clydebank, Scotland (blue pin), the shipyard where the *Lusitania* was built

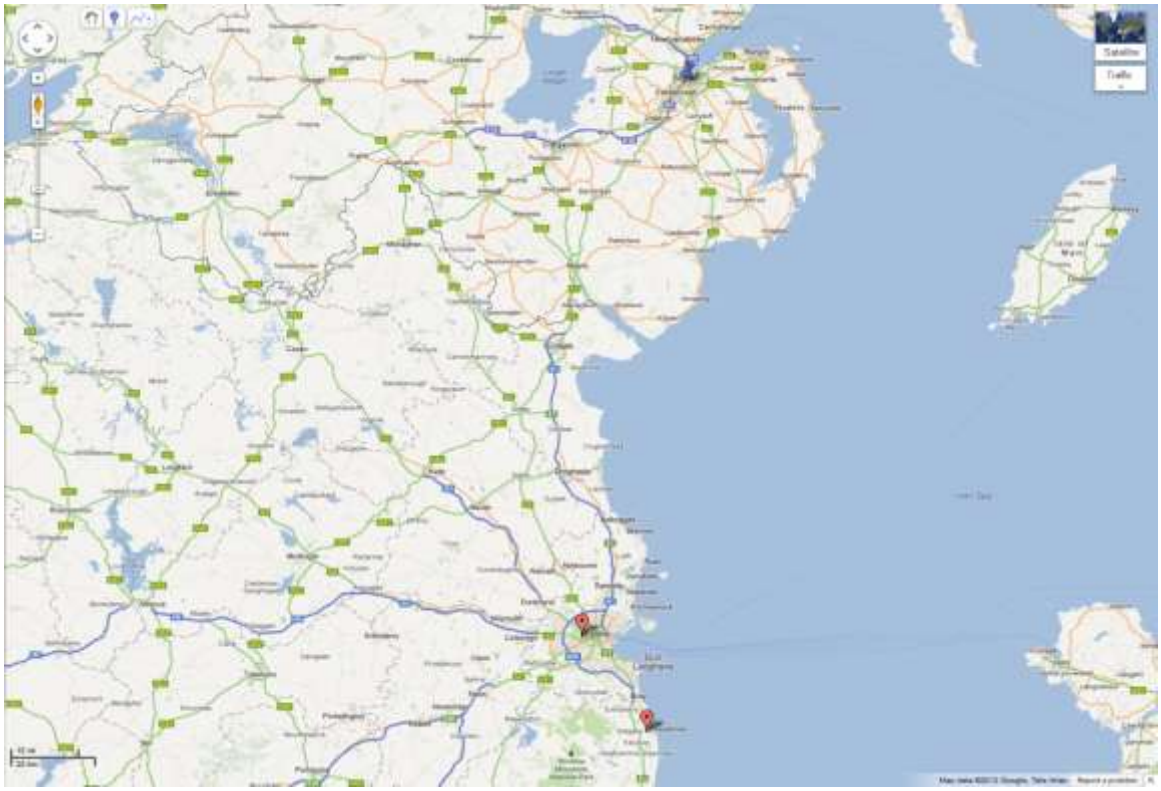

Figure 3: The sites used to develop the Irish regional chronology (red points) and Belfast (blue pin), where the *Titanic* was built.

The cross-dating program COFECHA was also used to determine the possible date and origin of the frame by comparing the floating chronology (the measurements from the frame) and each of the master chronologies. COFECHA matched the floating chronology to the master chronology at all possible dates, and provided correlation values for the best matches. A high correlation value indicates that the floating chronology corresponds well to the master chronology at a specific date. A higher correlation also indicates that the artifact shares the regional signal with the master chronology. In this case, this would also help identify the country of origin for the railing, as the wood would match to the chronology of origin.

In order to support the dates suggested by COFECHA, a visual analysis was run using the program ARSTAN (Holmes, 1986b). ARSTAN standardizes the ring width data of each chronology to a mean of one, using a negative exponential curve, and allows the detrended data to be graphed. The measurements from the frame were then visually compared to the chronologies from Scotland and Ireland.

Results and Discussion

The high resolution scans of the railing end revealed a total of 104 rings. While no bark was present, the pattern of growth (significantly tighter close to the edge) indicated the tree was close to the end of its growth. The two measurement paths, independently measured by scientists in the lab, correlated strongly with one another (0.637, based on 50-year segments), which is considered statistically significant at the 99% confidence level (all values above 0.3281). The two measurements also corresponded visually quite strongly when graphed (see Figure 4).

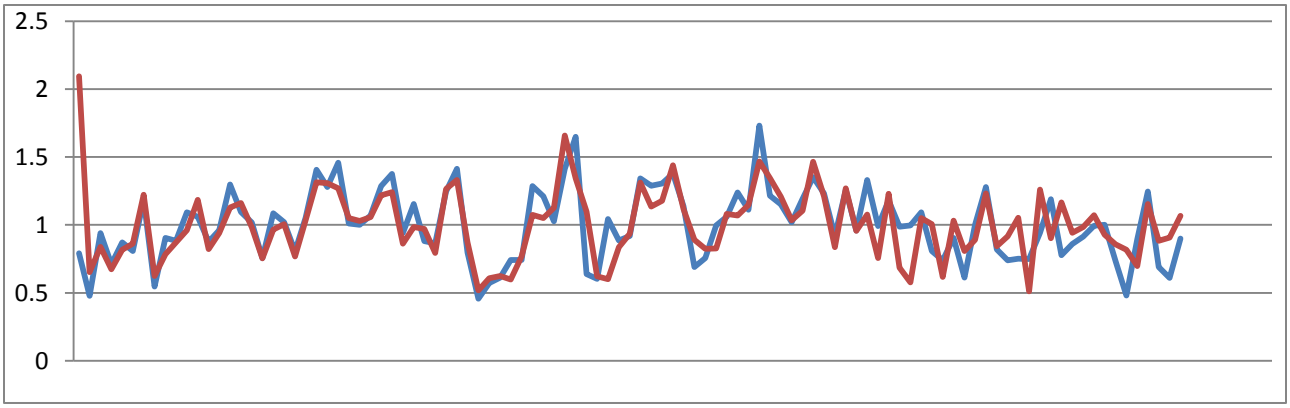

Figure 4: A comparison of the two measurement paths from the end of the railing, which correlated at 0.637.

Each of the chronologies selected from the International Tree-Ring Data Bank was cross-dated through COFECHA to ensure the strength of its correlation. All of the chronologies correlated between 0.474 and 0.596, which is considered significant above the 99% confidence level (see Table 1 for site information and correlation values).

Table 1: The site information and series intercorrelation for the master chronology sites. Note that all correlate above significant value (0.3281).

Site Name	Author	Species	Location	Country	Years	Correlation
Raemills	Baillie	*Quercus robur*	55.33 N -3.5 W	Scotland	1824-1975	0.596
Lockwood	Baillie	*Quercus spp.*	55.27 N -3.43 W	Scotland	1652-1975	0.474
Glen of the Downs	Pilcher	*Quercus robur*	53.13 N -6.08 W	Ireland	1809-1978	0.578
Phoenix Park	Brown	*Quercus spp*	53.35 N -6.32 W	Ireland	1666-2008	0.502

The chronologies were also compared by country to identify whether they displayed a regional signal. Using COFECHA and ARSTAN, the chronologies located in the same country were statistically and graphically compared to one another. The chronologies from Scotland (Raemills and Lockwood) correlated at 0.485 (significant), and the chronologies from Ireland correlated at 0.427 (also significant). When the chronologies were compared to one another across borders, the correlation values were significantly lowered, with a correlation of 0.336. This demonstrated that the oak in Ireland and Scotland did show different growth trends (see Figure 5), and that the railing frame should correlate differently to the regional chronologies, with a higher correlation to the country of its origin.

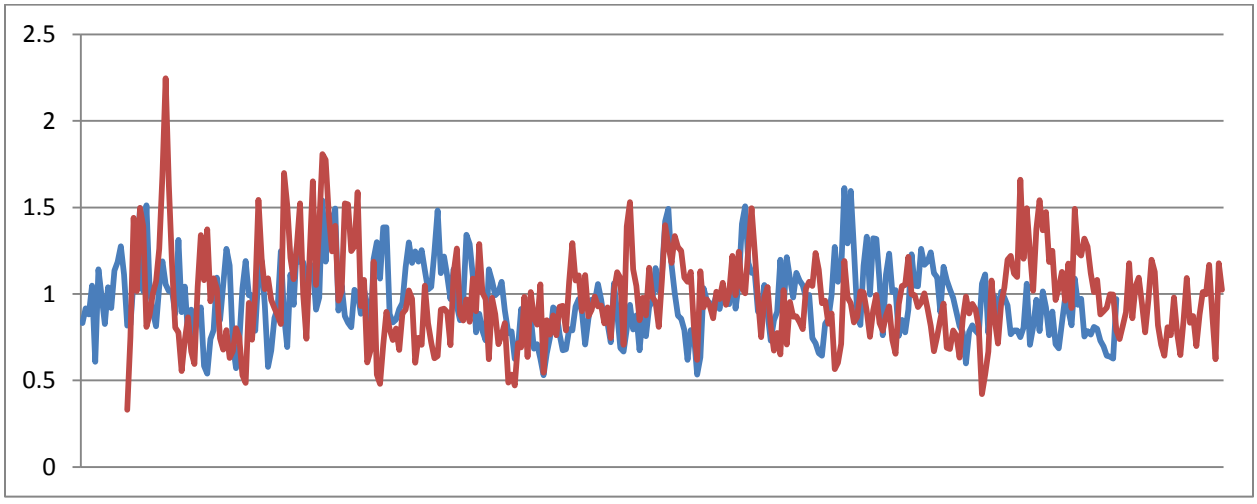

Figure 5: The growth curves of the Irish (red) and Scottish (blue) master chronologies. Note that the paths diverge radically at some points.

The independent measurements of the frame were then compared to each of the regional chronologies as floating chronologies through COFECHA. The COFECHA output recommended

a correlation with an end year of 1907 for both Scotland and Ireland. While neither correlation was considered statistically significant, the Irish chronology's correlations were significantly stronger (0.166 and 0.257) correlations for the two measurement paths) than the Scottish correlation (0.091 and 0.080 respectively). These low correlation values could be explained by the low visibility of the scanned rings, particularly closer to the end of the measurement path, where rings were visible and countable, but where accuracy in measurement was more difficult to achieve. This theory is supported by the lower correlation evident between the two independent measurements towards the end of the measurement path (see Figure 4). In order to confirm that the railing frame matched best with the Irish chronology, the measurements and chronologies were detrended through ARSTAN and compared visually. The visual analysis confirmed that the Irish chronology (see Figure 7) correlated more strongly with the railing frame than the Scottish chronology (see Figure 8). The absence of bark on the sample makes it impossible to determine the cut-date of the wood, which could be further in the future than the determined date of 1907.

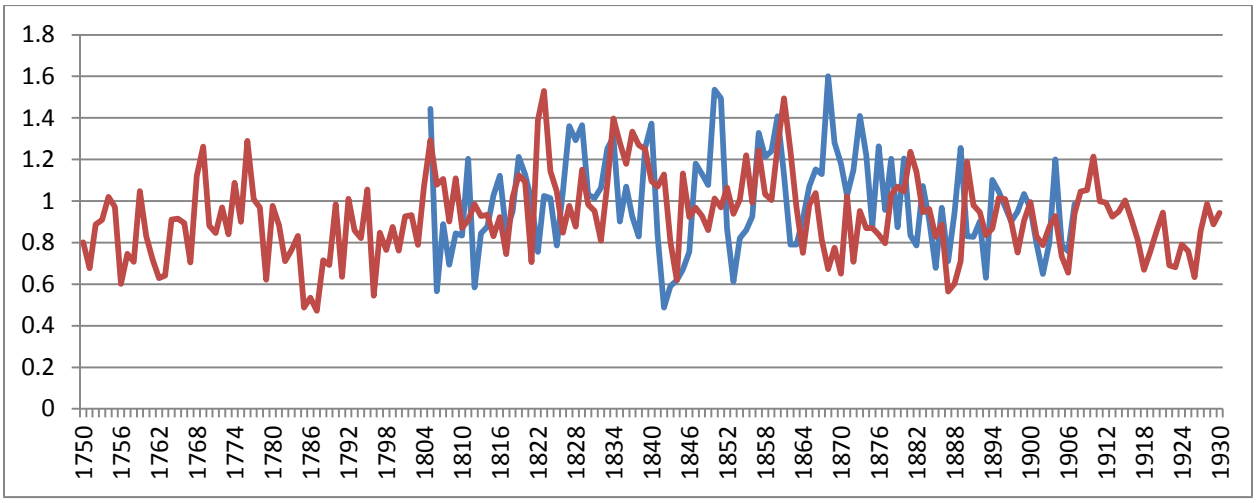

Figure 6: The frame measurement path (blue) compared to the Irish regional chronology (red), with an end-date of 1907.

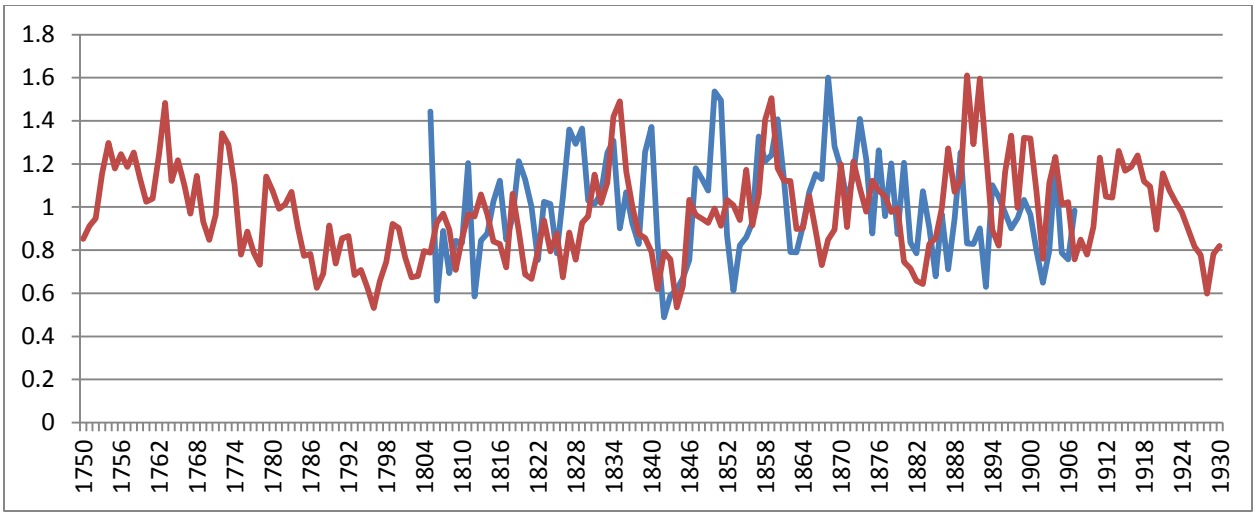

Figure 7: The frame measurement path (blue) compared to the Scottish regional chronology (red), with an end-date of 1907.

Conclusion

The high resolution scans of the picture frame revealed a total of 104 measureable rings along the side of the artifact. These rings were measured by two independent researchers and correlated with oak chronologies from Ireland and Scotland, statistically through the cross-dating program COFECHA. The ring-width measurements from the frame correlated strongest to an Irish regional chronology, with an end-date of 1907. While this date does not determine the cut-date of the wood, it is compatible with the suggestion that the railing used for the frame originated from the *RMS Titanic* rather than the *RMS Lusitania*.