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AIC CCM PAINTINGS SYMPOSIUM

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14th AICCM Paintings Special Interest Group Symposium

National Portrait Gallery, Canberra

26 - 28 October 2016

Dating Henry: Non-destructive dendrochronological dating of a 16th-century panel painting based upon x-ray fluorescence

Lightning talk

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Background and Methods: During the 15th to 17th centuries quarter-sawn oak panels were widely used throughout the low countries of Western Europe as a substrate for painted artworks. One virtue of the quarter-sawing technique is that the consequent panels often preserve tree-ring sequences that are visible on their upper and lower edges. These sequences allow the age and provenance of the timber panels to be determined (e.g. Haneca et al. 2009, Bridge 2012) which can, in turn, contribute significantly towards interpretation of the associated artwork. However, identification and measurement of tree rings often requires resurfacing of the panel edges to remove paint or treatments applied during the completion of the artwork itself or its subsequent conservation. The resurfacing process physically modifies the panel and risks damaging the artistic work. From this perspective, development of a non-destructive technique that permits tree-ring identification and measurement without physically altering the painting would be an important advance.

In a recent study, Dredge et al. (2015) described examination of a panel based portrait of Henry VIII, held by the Art Gallery of NSW (AGNSW), using x-ray fluorescence. X-ray fluorescence uses tuneable synchrotron radiation to excite photon flux from selected elements. Because x-ray scattering of synchrotron radiation at high excitation energies is sensitive to the composition of wood cell walls, x-ray scatter mapping is useful for non-destructive analyses of wood structure (Müller 2008). Consistent with this observation, Dredge et al. (2015) reported that x-ray scatter mapping of the AGNSW Henry VIII portrait, conducted at 18.5 keV, revealed structural features of the underlying oak panels. Comparison with microscopic digital imagery of the lower panel edges revealed that the apparent structural variation within the scatter map corresponded with annual tree-ring boundaries.

We hypothesised that measurements derived from 18.5 keV x-ray scatter mapping of the AGNSW Henry VIII portrait had the potential to generate dateable tree-ring width series. To test our hypothesis, we measured the assumed tree-ring widths within the x-ray scatter map along multiple paths using digital images captured via microscopy and the tree-ring measurement program, WinDendro, to establish a 'floating' Henry VIII chronology. We then objectively cross-dated a composite of these paths against existing regional oak tree-ring chronologies for continental Europe (Hamburg) and England to determine the most-recent calendar year in our measurement series and estimate the time of felling of the source tree. We then correlated the dated Henry VIII chronology against site-specific chronologies to identify a likely provenance of the panel timber.

Results and Conclusions: We compiled an 81 year-long tree-ring width series from nine measurement paths in the central left portion of the portrait. Masking by overlying paint and poor image resolution prevented ring-width measurement elsewhere. Statistically-significant dating was achieved against the English, but not Hamburg, regional chronology. The last-formed tree ring in our series corresponds with a calendar year of 1480AD (Figure 1). When estimates of years included within the sapwood and time taken to pre-condition the panel are added to this calendar date, we conclude that work on the panel is likely to have commenced during 1500-1540AD. This dating is consistent with the assumed date of completion (c. 1535; see Dredge et al, 2015). Variation in the strength of our dating against local English chronologies suggests that the panel timber originated in the southern county of Surrey, Sussex or Hampshire. Broadly, our work leads us to conclude that dateable tree-ring series are obtainable from x-ray scatter maps of quarter-sawn oak panels. This technique has the potential to revolutionise dating of panel paintings worldwide.

References:

Bridge, M 2012, 'Locating the origins of wood resources: a review of dendroprovenancing'. *Journal of Archaeological Science*, vol. 39, pp. 2828-2834.

Dredge, P., S. Ives, D. L. Howard, K. M. Spiers, A. Yip, and S. Kenderdine, 2015, 'Mapping Henry: Synchrotron-sourced X-ray fluorescence mapping and ulta-high-definition scanning of an early Tudor portrait of Henry VIII'. *Applied Physics A,* vol. 121, pp. 789-800.

Haneca, K., K. Čufar, and H. Beeckman. 2009, 'Oaks, tree-rings and wooden cultural heritage: a review if the main characteristics and applications of oak dendrochronology in Europe'. *Journal of Archaeological Science* vol. 36, pp. 1-11.

Müller, M, 2008, 'Synchrotron radiation x-ray scattering techniques for studying the micro- and nano-structure of wood and the relation to the mechanical properties'. *Materials Science Forum*, vol. 599, pp. 107-125.

Acknowledgements: This research is partly based upon x-ray fluorescence microscopy carried out at the Australian Synchrotron, Clayton, Victoria. Access to the Australian Synchrotron was facilitated by the NSW Industry Synchrotron Access Scheme and funded by the NSW State Government Office of Science and Research. We wish to thank Dr Kristof Haneca (Flemish Heritage Institute) and Dr Karl-Uwe Heussner (Deutsches Archäologisches Institut Zentral) for their insights during discussions at the outset of this research.

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