

The criticality of synchrotron techniques in developing new conservation strategies to characterise and stabilise marine archaeological artefacts

E. J. Schofield¹

¹Mary Rose Trust, HM Naval Base, College Road, Portsmouth, PO1, 3LX, e.schofield@maryrose.org

Marine archaeological artefacts exhibit properties which differ from their original material due to a combination of degradation, the incorporation of foreign species from the seawater, and their experience post-excavation. These induce chemical, biological and mechanical changes which fundamentally change the material and its stability. Displaying these artefacts is only possible when we understand the material properties, which in turn gives us the ability to develop new and tailor-made conservation treatments.

This talk will focus on two particularly challenging materials to conserve; marine archaeological wood and iron [1]. Both were recovered, in abundance, from the *Mary Rose*, Henry VIII's warship which was recovered in 1982 after 437 years under the seabed. Foreign species lodged in the materials can have a deleterious effect when the material is dry. In the case of marine archaeological iron this is the presence of chlorine from the salt in seawater [2], whereas in the wood it is due to deposits present from the seawater (e.g. S, Fe, Zn) and corroded artefacts [3]. Synchrotron based x-ray analysis has been critical in glean information on the degradation processes at play and the products formed. It has allowed the tracking of these species as they chemically transform over time and determining how they are distributed throughout the artefacts. An overview will be given of the suite of techniques used, our present understanding of the degradation mechanisms at play and the new targeted conservation treatments currently being developed.

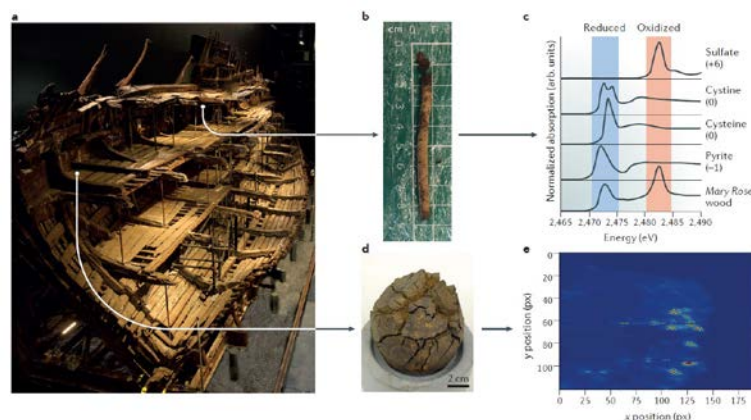


Figure 1: The Mary Rose hull (a) sampled (b) to record the change in sulfur using x-ray absorption Spectroscopy (c) and a cannonball (d) used to map Cl via x-ray fluorescence mapping (e)

References

- [1] Schofield, E. J., "Illuminating the past: X-ray analysis of our cultural heritage" *Nat. Rev. Mater.* 3, 285-287, 2018
- [2] Simon, H., Cibin, G., Robbins, P., Day, S., Tang, C., Freestone, I., and Schofield, E. "A Synchrotron-Based Study of the *Mary Rose* Iron Cannonballs" *Angewandte Chemie International Edition*, 57(25), Pages 7390-7395, 2018
- [3] Schofield, E. J., Sarangi, R., Mehta, A., Jones, A. M. and Chadwick, A. V. "Nanotechnology and Synchrotron light in the service of Henry VIII: preserving the *Mary Rose*" *Materials Today*, Vol 14 (7-8) Pages: 354-358 2011