

## Art and Culture Seen in a New Light

The Australian Synchrotron is shedding new light on materials and methods used over many centuries to create valuable artworks and precious historical and cultural objects.

The conservation and restoration of cultural objects and works of art requires detailed scientific knowledge of materials, production methods and ageing processes. Synchrotron light offers unprecedented insights into every aspect of these factors and helps conservators to optimise the storage of precious objects from every historical epoch.

By providing detailed information on the chemical composition of different constituents, non-destructive synchrotron techniques can reveal original colours and subsurface layers, identify materials and degradation mechanisms, and detect previous restoration efforts.

Synchrotrons provide information not accessible by other laboratory-based methods and their brilliant, highly focused X-ray and infrared beams can analyse the smallest of samples – an essential consideration when it comes to taking samples from precious works of art. They can also be used to examine entire artifacts or works of art.

In 2008, a European synchrotron revealed unprecedented detail of an early Vincent van Gogh portrait hidden underneath the artist's *Patch of Grass* painting. In 2009, a US synchrotron peered beneath the text of a medieval prayer book to discover previously unknown writings by Archimedes.

Closer to home, CSIRO researchers Natasha Wright, David Hay and Deborah Lau are using synchrotron powder diffraction and X-ray fluorescence techniques to study the composition of artists' pigments. Their efforts will establish a library of pigment "fingerprints" to help curators, conservators and collectors answer questions about who painted a particular art work or when it

was painted.

"When you combine powerful synchrotron radiation sources with traditional X-ray and infrared techniques, you get vastly improved data in substantially shortened time-frames," Hay says. "As a scientist, it's a joy to demonstrate techniques that enable conservators to find hidden information about the art objects they are researching. Of course it would be fabulous to discover a hidden painting, but our main objective is to acquire the intimate science-based knowledge needed to effectively conserve and restore works of art."

Robyn Sloggett from the Centre for Cultural Materials Conservation in Melbourne says the synchrotron's enhanced material characterisation techniques are particularly well-suited for the complex and composite materials found in 20th century media, pigments, dyes and additives. Synchrotron data will enable conservators and restorers to develop reference tools for dating and characterising 20th century materials and assess how these materials behave in diverse Australian and South-East Asian environments.

Using the Australian Synchrotron's infrared beamline, Sloggett and her colleagues have examined indigenous Australian artworks, paintings by European artists, and 100 years of industrial paint layers from the walls of an inner-Melbourne hotel, with each individual layer incorporating pigments, binders, additives, hardeners and fillers. They also plan to use the synchrotron to investigate how binders and fillers used in some modern oil-based paints of Chinese origin might be accelerating the deterioration of artworks.



Synchrotron analysis provided valuable information on the artist's techniques to assist restoration of this important Australian portrait. W.B. McInnes (1889–1939): Sir Walter Baldwin Spencer. Oil on canvas, 213.0 x 108.5 cm, The University of Melbourne Art Collection. Gift of subscribers 1924, 1924.0002.000.000.

Alana Treasure and Dudley Creagh from the University of Canberra are using the infrared beamline to examine 19th century parchments to discover how and why iron-gall ink has degraded the collagen in some documents but not others. The work will enable other researchers to develop effective techniques for halting the degradation of documents and artworks dating from the Middle Ages to the early 20th century.

At the Western Australian Maritime Museum, materials conservation scientists recently used X-ray absorption spectroscopy at a US synchrotron to investigate the formation of sulfuric acid deep inside the wax-preserved hull timbers that are the sole remains of the *Batavia*, the ill-fated United Dutch East India Company ship that ran aground off the treacherous WA coast in 1629. The synchrotron work was part of an international investigation into similar problems in other large wooden shipwrecks housed in museums, including the *Vasa* in Sweden and the *Mary Rose* in the UK.

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