The hi-tech archaeological scientists

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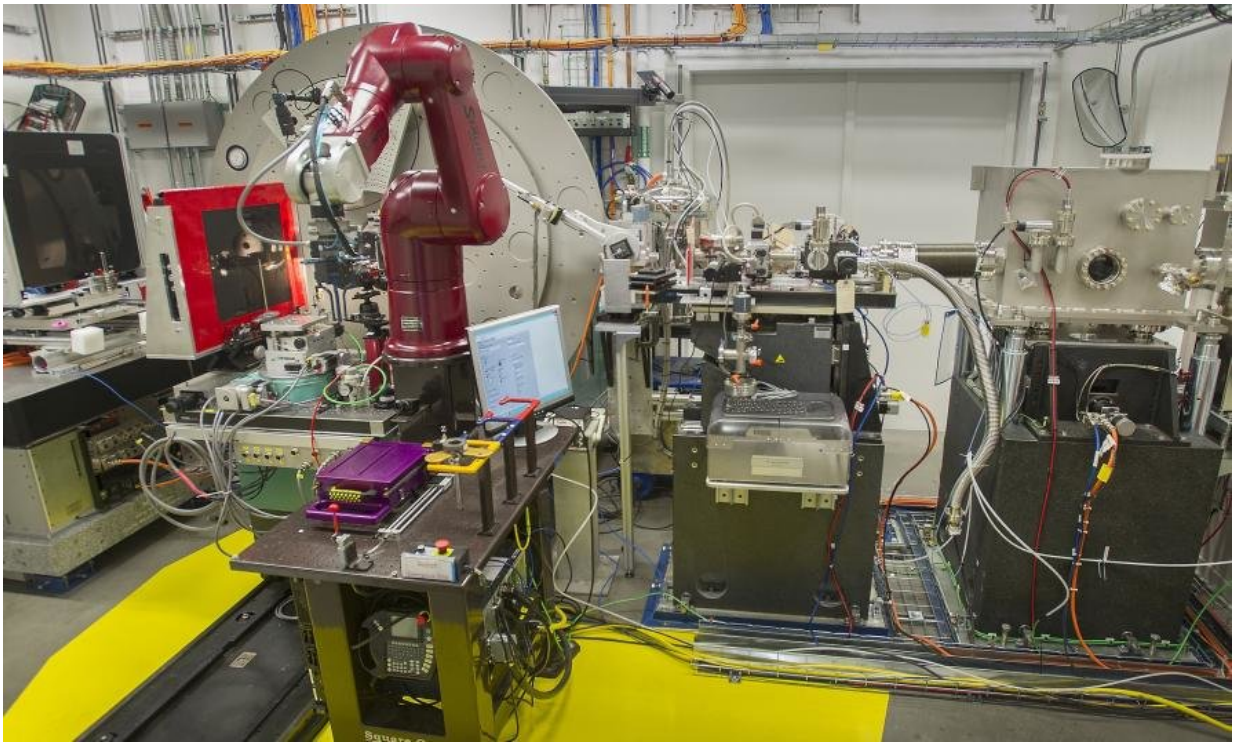

Advances in technologies like the powder x-ray diffraction are impacting on archaeology. Credit: Flickr/ Brookhaven National Laboratory

The lone fedora-clad archaeologist armed only with his trusty whip on a swashbuckling adventure to discover ancient relics from lost civilizations makes for a great movie plotline, but archaeology doesn't really work that way.

In reality, major discoveries are more likely the result of years of painstaking searching, sifting, cataloguing and interpretation by a team of archaeologists, local experts and, increasingly, scientists.

In modern archaeology, evening discussions at field camps are more likely to turn to the latest advances in powder x-ray diffraction or Fourier-transform infrared spectroscopy.

"You could define archaeological science as the application of methods from the physical and biological sciences to archaeological problems and from there to the grand history of humankind on Earth," says Professor Andy Gleadow, leader of the Kimberley Rock Art Dating Project.

Since the 1950s, archaeological science has gradually emerged as a separate but complementary discipline to archaeology, with an ever-expanding range of analytical methods needing advanced specialist skills.

"There are important opportunities for archaeological science in Australia at the moment, where the field is not as highly developed as it is in some other parts of the world, particularly in Europe," says Professor Gleadow.

The field of archaeological science in Australia has received a major boost following donations from the Kimberley Foundation, philanthropist and University of Melbourne Chancellor Allan Myers, and the Mindaroo Foundation, for a Professorial Chair in Archaeological Science at the University of Melbourne.

The Chair will be based in the School of Earth Sciences, where Professor Gleadow leads a team of scientists who are adapting existing geological dating techniques and advanced materials analysis to archaeological studies.

Traditional Owners Ernie 'Chubby' Boona in Khaki and Scotty Unghango working with Damien Finch. Credit: Supplied with permission of the Traditional Owners and the Balanggarra Aboriginal Corporation

For her PhD, Dr Helen Green used uranium-thorium dating techniques to measure the age of stalagmites in caves to better understand past climates. This dating method establishes the time of origin of a mineral sample by the rate of radioactive decay of uranium to thorium. Now, as a post-doctoral research fellow, Dr Green has adapted this technique to date the rock art of the Kimberley region, in remote far north-west Australia.

Before she began this project, this kind of dating had never been done on the kinds of rocks found in the Kimberley.

"This technique was tried and tested in calcium carbonate, but in the Kimberley, it's all sandstone," she says.

Dr Green has perfected a new method for dating mineral samples accumulating on sandstone surfaces. With permission from the local Indigenous people, she takes small mineral samples from both the top and from underneath the rock art for dating.

The resulting dates 'bracket' the age of the painting.

"Bracketing gives us maximum and minimum ages, which are only useful if you can do it on a grand scale, if you can get hundreds of them," says Professor Gleadow.

"Then you start to get the basis of a statistical relationship."

"And it all depends critically on all the work that's been done previously by archaeologists who have worked out a relative age sequence for the rock art, where the styles of the art change through time, and one style is painted on top of another.

Dr Helen Green in front of Gwion figures on Balanggarra land in the Drysdale River region of the Kimberley. Credit: Traditional Owners and the Balanggarra Aboriginal Corporation

"So, there's that positional relationship that tells you the relative sequence, but it doesn't tell you anything about absolutely how old they are, so our job is try to put an absolute time scale on it."

PhD student Damien Finch is also dating the rock art, but using a completely different kind of sample.

"In the Kimberley there's these little mud wasps," says Mr Finch.

"They build mud nests on the rock walls and these nests contain small amounts of charcoal, which we can date using radiocarbon dating."

Professor Gleadow is keen for scientists expert in dating to be closely involved in every aspect of the research, from locating and sampling suitable materials, through to analysis in the laboratory. He says scientists need to really understand what they are collecting because of the sheer complexity of getting true dates and the many things that can go wrong.

"If you haven't done the hard yards to really understand what that material is, and how it got there, how stable it is and all these other aspects, you are wasting your time.

Mr Finch has found that the charcoal used to date mud wasp nests is often already old before being added to the nest (up to 1000 years old), so any dates from these nests need to be adjusted using advanced statistical techniques to take this into account.

Dr Green says in the past archaeologists had unrealistic expectations of how easily and precisely the scientists can date things, and are surprised when things don't go to plan.

The stump of a mineralised mud wasp nest built on top of a Gwion painting, many thousands of years ago. Credit: Damien Finch

But she says that since she has been working side-by-side with them the mutual understanding has grown.

"They have a much better understanding of the issues we have to overcome," she says.

"And we can see first-hand the value of the archaeologist's expertise in identifying rock art styles and the deep cultural understanding that allows us to develop collaborations with the Traditional Owners and Aboriginal Corporations."

"The two sides coming together is quite a cool thing."

Professor Gleadow says the Kimberley Rock Art Dating project has been tremendously successful in developing new approaches for dating rock art.

"It's an astonishingly difficult thing to do - certainly the most challenging and difficult research I've ever undertaken."

Provided by University of Melbourne