

The School of Nihilism
Module 2 – *Measurement*

People unfamiliar with scientific methods will often scoff at surprising or counter-intuitive conclusions reached by researchers. How can they know that?! They must be wrong! And therefore all science is dismissed in favor of opinion, conspiracy, or superstition. In fact many novel and creative methods have been devised to accurately measure time and substances that were previously thought impossible to calculate.



For example, one difficulty in archeological research is determining the age of pottery or bricks in buildings. And of course knowing the date of construction or manufacturing is needed to place the objects in proper historical context. But how can we tell the age if the pottery has been removed from surrounding objects and we then lack any references? Now with the advent of sensitive measurement tools we can actually heat the clay and measure the amount of water removed, thereby determining the age of the object. The following article explains this remarkable measurement method:

Ancient clay has internal clock

A new way of dating archaeological objects has been found, using water to unlock their "internal clocks".

Fired clay ceramics start to react chemically with atmospheric moisture as soon as it is removed from the kiln.

Researchers believe they can pinpoint the precise age of materials like brick, tile and pottery by calculating how much its weight has changed.

The team from Edinburgh and Manchester universities hope the method will prove as significant as radiocarbon dating.

Edinburgh University's Christopher Hall explained: "Almost every archaeological site has old bits of old pot but there's no good method to date it."

Radiocarbon dating, used for bone or wood, cannot be used for ceramic material because it does not contain carbon.

Their new rehydroxylation dating method, reported in Proceedings of the Royal Society A, measures the amount of water the material has "recombined with".

Professor Hall, who described the advance as "very exciting", said it would plug a "yawning gap in the dating methods for ceramics".

He and his team, from the universities of Edinburgh and Manchester and the Museum of London, were able to date brick samples from Roman, medieval and modern periods with remarkable accuracy.



They have established that their technique can be used to determine the age of objects up to 2,000 years old but believe it has the potential to be used to date samples around 10,000 years old.

Researchers are now planning to look at whether the new dating technique can be applied to earthenware, bone china and porcelain.

"The recombination goes on for several thousands of years," said Professor Hall.

"And what's strange about it is that it abides by a precise physical law.

"If we can work out how much moisture has been taken up, we can estimate the age of the sample."

Extreme heat

Dr Moira Wilson from Manchester University led the research. She said the technique could also be "turned on its head and used to establish the mean temperature of a material over its lifetime".

"If a precise date of firing were known, this could potentially be useful in climate change studies."

The technique involves measuring the mass of a sample and then heating it to around 500C in a furnace. This removes the water that has combined with it over its lifetime.

The sample is then weighed in a "super-accurate" device, known as a microbalance, to determine the precise rate at which the material will combine with water over time.

Using the time law, it is possible to extrapolate the data to calculate the time it will take to regain the mass lost on heating - revealing the sample's age.

The researchers applied this technique to a range of brick and tile samples.

They have calculated that a Roman brick sample with a known age of about 2,000 years was 2,001 years old. A further sample with a known age of between 708 and 758 years was calculated to have an age of 748 years.

The researchers also tested a 'mystery brick', with the real age only revealed to them once they had completed their process. The known age was between 339 and 344 years - and the new technique suggested the brick was 340 years old.

The team also found that ceramic objects have their internal date clocks reset if they are exposed to temperatures of 500C.

Bombing raids

Used on medieval brick from Canterbury, the technique repeatedly dated the sample as being 66 years old.

Further investigation revealed that Canterbury was devastated by incendiary bombs and fires during World War II bombing raids in 1942.

The intense heat generated by the bombing had reset the dating clock by, in effect, re-firing the bricks.

The results also proved accurate enough to show that a brick sample from the King Charles building in Greenwich came from reconstruction carried out in the 1690s, and not from the original building which was constructed between 1664 and 1649.

Professor Hall said: "This new technique could allow us to discover a great deal about ancient artefacts by pinpointing their age and, as we have shown in our experiments, it is also useful in determining the age of modern materials.

"We believe the method will become standard practice."

While he pointed out that its accuracy would need to be validated many times, he added that it is much cheaper and simpler than current available methods.

