

Press Release

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The chemical refinement of radiocarbon dating

Exposing modern forgers

Zurich, 3 June 2019

Researchers at ETH Zurich have developed a process that can provide conclusive evidence with regard to modern fakes of paintings, even in cases where the forger recycled older canvases. This verification process requires less than 200 micrograms of paint.

Art forgeries have been around since ancient times. However, the art market is booming and commercialisation has increased apace. As a result, some people are tempted to copy historical paintings in the hope of making a “quick buck”. These fakes are most easily detected if it can be established that the materials used are more recent than the date of the painting.

That is why, in an attempt to conceal the fake more effectively, modern forgers often use old materials or opt to paint over older artworks. The notorious Han Van Meegeren (1889-1947), who specialised in forging Vermeer paintings, was known to scrape the paint off old pictures and re-use it, thereby creating the illusion of a naturally aged painting.

Chemical processes extend radiocarbon dating

Established in the 1940s, radiocarbon dating – also referred to as carbon-14 dating – can be used to identify forgeries. It is based on the fact that ^{14}C atoms decay at a constant rate. The age of a sample can be determined by establishing the ratio of ^{12}C to ^{14}C atoms in the sample and comparing it to reference values. On several occasions, the ETH Laboratory of Ion Beam Physics in Zurich has caused a stir on the international stage by using this method to confirm or disprove the authenticity of historical artefacts.

However, radiocarbon dating has one major drawback: the sample may be falsified by the use of old materials, which is difficult to detect using this method. Laura Hendriks, a doctoral candidate in both the group headed by Prof. Hans-Arno Synal at the Laboratory of Ion Beam Physics and the group led by Prof. Detlef Günther at the Laboratory of Inorganic Chemistry, has now come up with an elegant solution to this problem. She is publishing the new process in the *PNAS* journal today.

The first step is to find an ideal sampling location that contains only inorganic pigments. Using chemical methods, the sample is then purified until only 10 micrograms of pure carbon are left, which can

then be radiocarbon dated. “We combined the well-known physical method with chemical methods to obtain a clear result,” Hendriks says.

Binding agents give the game away

For the publication, Hendriks tested her method on a famous case: Robert Trotter painted a picture in American primitive style folk art, signed it “Sarah Honn” and dated it “May 5, 1866 A.D.” At his subsequent trial, Trotter admitted to having painted the Sarah Honn fake in 1985.

The ETH researchers analysed two microsamples from this painting: a fibre from the canvas and a paint particle weighing less than 200 micrograms. “Thanks to new developments in the Laboratory of Ion Beam Physics, we can now measure significantly smaller samples than in the past,” Hendriks explains. Although the dating of the canvas was consistent with its attribution in the 19th century, the dating of the paint revealed the forger’s scheme. Even if forgers use old paint particles as a disguise the pigments are mixed within a binding agent and this one carries the truth as it must be fresh for application. The ETH researchers are now able to turn this particular factor to their advantage.

The wrong oil

Analysing the binder is a complex undertaking due to the heterogeneous paint mixture. Nonetheless, in this case, the results are clear: the oil used as binder contains an excess of ^{14}C , which is characteristic of the 20th century. The deployment of nuclear weapons led to a dramatic increase in the ^{14}C concentration in the atmosphere, meaning that samples from this time can be dated with great precision. The seeds used to produce the binding agent were harvested between 1958-1961 or 1983-1989. This contradicts the date on the canvas and proves that the picture was painted after 1950 – leaving no doubt that it is a modern fake. “This case study allows us to validate our method,” Hendriks says.

Admittedly, the jury is out as to whether the new method will enable authorities to track forgers down as a matter of course. Finding a suitable sample is not a straightforward task and requires the combination of other spectroscopic analytical tools, which demands both for time and money. Nevertheless, regardless of the technical details, the new process is likely to attract a great deal of interest in the art world, as it has the potential of validating the authenticity of famous paintings.

Further information

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