J15 Dating Documents and Photographs Based Upon Atomic-Bomb Derived Radiocarbon Content

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After attending this presentation, attendees will understand how radiocarbon measurement can be applied to the authentication of documents and photographs.

This presentation will impact the forensic science community by highlighting the development of a new tool for this purpose.

The radiocarbon content of documents and photographs indicates when these media were manufactured, and thus may provide information relevant to the determination of authenticity. Since 1955, the earth's atmosphere has contained elevated levels of radiocarbon due to above- ground nuclear testing that occurred up until 1963. The elevated radiocarbon levels have been circulating through the atmosphere, the oceans, and the biosphere ever since. When detected in plant or animal tissues, elevated radiocarbon levels provide a time-stamp for organisms living in the Nuclear Age. This has been exploited for a variety of purposes including forensic dating of human remains. Paper and photographic materials are derived from plant and animal tissues. Consequently, they should also contain elevated levels of radiocarbon if produced after 1955.

The uptake of radiocarbons into known-age samples of paper and photographs has been examined in order to understand the dynamics of radiocarbon uptake. Preliminary results indicate that unambiguously elevated radiocarbon levels do not appear in paper products until around 1965. This is most likely a consequence of multiple factors: (1) the pattern of accumulation of new tissues in trees used for paper production; (2) temporal patterns of pulpwood growth and harvest; and, (3) temporal patterns of paper production, distribution and use; and other phenomena. In spite of these uncertainties, the uptake of bomb-derived radiocarbon into paper products can be applied to the authentication of dated documents. The method has been successfully used to unambiguously detect late 20th Century forgeries of early 20th Century documents and a few case studies will be presented. Establishing a higher resolution is the objective of ongoing research.

Current research is focusing on the differential measurement of radiocarbon in photographic paper and photographic emulsions. The dynamics of atmospheric radiocarbon uptake into these different components of a photograph may help to more precisely identify when the photographic paper was produced. Whereas photographic paper is derived from pulp wood (and thus from relatively long-lived trees), photographic emulsion is derived from animal gelatin, which is, conversely, produced from relatively short-lived animal species. These differences in lifespan influence the pattern of bomb-radiocarbon uptake from the environment. The uptake of bomb-derived radiocarbon into emulsion would theoretically be faster and could achieve higher levels than those found in paper, and the differential levels might improve estimates of the manufacturing date of photo paper. Preliminary measurements made on photographic papers of known age produced in the middle decades of the 20th Century bear this hypothesis out.

Clearly there are uncontrollable factors that affect the utility of this approach in real-world situations. The method indicates when paper and photographic materials were manufactured, or more precisely, when the organisms used as raw materials for them were living. It does not identify when a piece of paper was printed or written upon, or when a photographic image was produced. Nevertheless, the information can be used to answer certain types of questions regarding document or photograph authenticity.

The method has a potentially broad application in forensic science, and parallels a larger research project examining bomb-carbon uptake into human tissues for purposes of post-mortem determination of a subject's year of birth and year of death.

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