

NATURAL FACTORS AFFECTING THE APPARENT RADIOCARBON AGE OF TEXTILES (1)

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INTRODUCTION

The results of the radiocarbon dating of the Shroud of Turin were reported in *Nature* (16 Feb., 1989) indicating a date between 1260-1390 with at least 95% confidence. (1) But the accuracy (though not the laboratory precision) of these results have been questioned by several researchers.

A computer programmed statistical analysis using the χ^2 with a test value of 8.56 showed beyond any doubt that the maximum value for the three laboratories with 95% confidence is 5.99 (2). In the case of such high χ^2 test values it is recommended that conclusions be postponed in order to obtain better samples and to conduct new tests (3). Research by Drs. D. A. Kouznetsov and his colleagues (4, 5, & 6) and L. A. Garza-Valdes and his colleagues (7) show that the isotopic and chemical composition of carbon in linen fabric can be modified by natural processes other than radioactive decay. Such processes were noted earlier by Wigley-Muller (8). Although the results by Kouznetsov have been negatively evaluated by Jull, et al, of the Arizona AMS laboratory (9) our own work confirms the results of the statistical evaluation and suggests that the content of ^{14}C may not be the same over the whole surface of the Shroud.

Inspired by the writings of Count Antoine de LaLaing (10), who noted back in 1503 that the Shroud was boiled in oil and tested by fire, and by de Chifflet (1624) and the Venerable Bede, both of whom described the same ordeal by fire ordered by the 4th Caliph Muawiyah in 675 (11) we decided to reconstruct these two tests to simulate the historical model as closely as possible: We chose to duplicate the Chambery fire of 1532 in which the Shroud was damaged and to test the idea that the Shroud was boiled in oil.

EXPERIMENTAL

We prepared a wooden box with a silver lined cover. Modern linen was prepared folded 48 times the same way the Shroud was folded during the Chambery fire. Three pieces of modern linen (not radiocarbon dated) were also prepared. Sample A was used as a control sample. Sample B was placed between layers 21 and 24 of the folded linen. Sample C was first boiled in mineral oil with a very low ^{14}C content at 170 C for 90 minutes. Then it was removed from the heat and cleansed thoroughly to eliminate all deposits of oil.

Samples B and C were placed between layers 21 and 24 of the folded linen exactly at the same place from which the Shroud sample for radiocarbon dating was taken on 21 April, 1988. We took care to avoid direct contact between the samples and the wooden box. After the linen was placed in the box the cover was closed and placed in a furnace and heated till a maximum temperature of 170 C was reached at the place where the samples were placed. Then molten silver droplets were dripped onto the linen. Following this the box was taken out of the furnace and the hot linen was quenched with water.

1 At the request of the authors, this article has been edited for publication by Paul C. Maloney, Gen. Proj. Dir. of ASSIST.

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RESULTS

The three samples were sent to three high quality AMS radiocarbon dating laboratories for blind testing. All of them cleaned the samples following the standard acid-alkaline-acid pretreatment. The reported results are as follows:

Sample	Lab.	Code	Signed	% ¹⁴ C	Age
A	Oxford	OxA 5283	Cl. Owen	155.62 ± 0.75	Post-1950 AD
B	Miami	Beta 87708	H. Darden	157.9 ± 0.6	Post-1950 AD
C	Toronto	TO 5208	R. Beukens	98.56 ± 0.6	120 ± 50 rcybp ²

COMMENTS

Because we were surprised by the high percentage level for samples A and B we further consulted with Oxford. They confirmed that these results were normal for modern linen.

The fire experiment shows a small but significant increase of 1.47 % in ¹⁴C. Although this change is too small to explain the 16% shift in ¹⁴C, it does indicate that heat induced changes in isotopic composition are experimentally observed confirming the claim made by Kouznetsov.

The boiled-in-oil experiment showed a large and significant decrease of ¹⁴C of about 36%. Such a large difference cannot be explained by the assumption that the Toronto sample was not properly cleaned. The mechanism of the processes involved are not yet understood and need further research.

CONCLUSION

The results of these experiments, tested blind by three independent high standard laboratories show clearly that a single correct radiocarbon date does not necessarily warrant a correct calendar age. It should also be borne in mind that the measurement was made on organic material and that this cannot be regarded as a guarantee of the article's date of manufacture.

Additionally, it should be noted that the undetected presence of contaminants may affect a radiocarbon result given in good faith. For example, the Oxford Radiocarbon laboratory takes no responsibility for financial loss incurred through an erroneous report given (12). No method is immune to errors due to non-apparent problems with the samples.

More specifically, a single radiocarbon dating result, in contradiction to all the results of an interdisciplinary examination, cannot be regarded as conclusive evidence for a mediaeval date for the Shroud of Turin.

2 Radiocarbon years before present.

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3 See also papers presented by Prof. Jouvenoux, E. Brunati, and R. van Haelst in A.-A. Upinsky (Ed.). L'Identification Scientifique de l'Homme du Linceul Jésus Nazareth: Actes du Symposium Scientifique International. Rome 1993 Paris: François-Xavier Guibert (1995), pp. 189-205, 207-218, & 349-357 respectively.