Natural deviations of the radiocarbon equilibrium in the atmosphere. Finally, a scientific explanation for the mediaeval dating of the Shroud?

by *Remi Van Haelst*
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Back in the 1960's, Dr. Libby and many of his colleagues considered radiocarbon dating to be the "chronometer" of the chronology of history. All residues of once living species, as old as at least 40.000 years, would become accurately datable.

Today, in spite of the fact that the Nobel prize rewarded Dr. Libby, only the ^{14}C lobby seems to believe unconditionally in the exact working of this chronometer.

Experts like Causse, Pearson, Dennell, Meacham, van Oosterwyck, Hayes and others have warned against the overrating of the absolute value of radiocarbon dating.

In spite of the use of standard samples and modern technology, like AMS, the practical datable period is restricted to less than 2500 BC. Because of the production of ^{14}C, due to the still growing nuclear and industrial activities, the future of radiocarbon dating becomes uncertain.

One reading the specialized paper "Radiocarbon", will find an abundance of reports about erroneous radiocarbon dating. It should noted that the ^{14}C laboratories do not report, most of the time, the elimination of "outliers" or aberrant dates.

Comparison between the numbers of year rings of old trees [Californian Sequoia gigantea = Redwood and Irish "Pinus aristata" = Bristelcones) radiocarbon measurements by Damon et al (1972) indicate that from about 1000 BC to 6400 BC all any "raw", not corrected radiocarbon dates seem to be too young. A raw radiocarbon age of 6400 years results in a calibrated calendar age of about 7000 years. The calibration curve, proposed by Damon, has afterward been corrected by Pearson et al (1987). Anyway, these curves show a number or "kinks and wiggles", assumed to be due to the irregularity of sun activity, magnetic fields and other factors. Yet, the mechanisms of this and other deviations are not explained.

Recently, Dr. Richards of Bristol University declared on the BBC, that following his experiments, the equilibrium between the natural production and the decrease by disintegration of radiocarbon in the atmosphere did not exist. Any radiocarbon dating between 10.000 - 40.000 year can be between 1.000 and 5.000 years off.

About 15 year ago, scientists of Lamont University (New York) compared U/Th measurements with radiocarbon dates. They estimated the ^{14}C error to be about 3500 years for an age range of 20.000 years. (See diagram on page 4 of this paper.)

Following Causse et al (1988), the same object, dated by ^{14}C dating, may be twice as old when dated by the U/Th method..

The reason is probably the fact that counting ^{14}C becomes more correct in older samples, which implies a lower number of ^{14}C particles present. .

These findings undermine the axiom proposed by Dr. Libby and the credibility of ^{14}C dating in general. In fact, following Hassan and Robinson (1987) radiocarbon measurements are not truly dates, but only statements of probabilities.

To explain such large differences, the 14C content in the atmosphere was once much larger than in 1950. Another possibility is some fluctuations in the half-life of ^{14}C.

The half-lives of 5570 for ^{14}C, postulated by Libby, is assumed today, to be 5730 years.

Some researchers estimate the half live of ^{14}C to be about 7200 years.

The very low concentration of ^{14}C in the atmosphere, first estimated to be 1 part in 10.000.000, is now only 1 part in 100.000.000.000. A concentration very difficult to measure.

Today, the activity of 1 gram modern carbon is about 13-15 disintegrations per minute. It is clear, that one can only estimate the activity at origin.

The concentration of ^{14}C in the atmosphere was estimated to fluctuate periodically from 105 % to 95 % of the normal concentration.

Simplified : If the ^{14}C concentration was unity in 500 BC, coming from a minimum of 95 % in 4000 BC, one will reach a maximum of 105 % in the year 3000 AD.

In other words: All objects from a period of low ^{14}C concentration will be about 500 year to old and vice versa, all objects from a period of high ^{14}C concentration, will be about 500 years too young. This statement corresponds, with the warning given of Dr. Pearson, that any radiocarbon date, at 95 % probability, may be wrong by 500 years.

But following the findings of Dr. Richards, in the past, the concentration in ^{14}C may has been as high as 185 % of the standard ^{14}C activity in 1950 !

Today, due to atomic and industrial activities, the concentration of ^{14}C in the atmosphere is about 150 % of the concentration in 1950.

By playing on the "^{13}C and ^{14}C concentration at origin", one can correct any "raw" radiocarbon date, to match the historical and archeological date.

Assuming, for the era of Christ, a ^{14}C concentration at origin, of 110.5 %, may explain the mediaeval radiocarbon age of the Shroud! Based on Table 1 of the Nature report, one may estimate the mean ^{14}C concentration, measured by the labs, to be 0.8758.

Calculation of the raw radiocarbon age: 8268 x in (1.105/0.8758) = 1922.

One of the problems is that it is not possible to determine the exact ^{14}C concentration at origin or even to detect if samples are contaminated by ion exchange or contact with the environment. The only indication is the difference between the radiocarbon date and the historical and archeological evidence.

Some examples:

Roman boats found in Antwerp.

In 1910, one found in the harbor of Antwerp, TWO Roman boats.

Following the archeologists, based on the stratification and the shape of the vessels, the objects were to be dated about 300 AD. About 1960, the vessels were dated 900 AD, by experimental radiocarbon dating. An error of about 600 years!

Following the Belgian experts, these differences were due to contamination by younger carbon, present in the soil. Probably the chemical cleaning was insufficient.

Wooden objects found in Roman ruins at Gué de Plantain (Hainaut Belgium.)

Here measurements were made on 14 wood samples. Only 7 results were acceptable.

The errors pointed in different directions. Some were much too old, other much too young.

A fragment of a Roman chair, was dated 2800 BC ! An error as large as 2500 years!

Holland

A number of radiocarbon dating made by Jegersman & Van Regerteren (1971) on wooden piles, found in the ground, turned out to be function of the stratification.

The dates are given in function of the depth.

Culture "Paffrath"		Culture "Streepband"	
Real Age AD	Radiocarbon Age AD	Real Age AD	Radiocarbon Age BC.
1200-+100	1100-+55	50-+150	150-+35
" "	1130-+50	"	370-+95
" "	1190-+40	"	660-+60
" "	910-+60		
" "	810-+80		
" "	60-+55		

These large errors can only be explained by contamination by younger carbon, absorbed by the wood.

Lindow Man

Historical ages of the body: "Iron age 600-300 BC" (Exhibited in Hall 35 of the British Museum)

Radiocarbon dating

Oxford: Mean of 16 measurements ranging from 2210 to 1850.

Classic analysis = 1955-+32

Wilson-Ward = 1959-+20 Chi^2 = 37.77 >> 23.57 Reject . Rcy. = 100 AD

Harwell: Mean of 8 measurements ranging from 2450 to 1480

Classic analysis = 1725-+109

Wilson-Ward = 1764-+30 Chi^2 = 74.84 >>> 14.07 Reject. Rcy = 190 AD

Eliminating the date 2450, which is clearly an outlier.

Classis analysis = 1626-+67

Wilson-Ward = 1697-+32 Chi^2 = 31.82 >> 12.59 Reject. Rcy = 250 AD .

First one eliminated the Harwell date. Finally the British Museum decided in silence not to change the historical date. The gap between radiocarbon science and archaeology was too deep. (Examples 2 & 3 & 4 taken from the French book "Le Radiocarbone face au Linceuil de Turin" by Dr. M. Cl. Van Oosterwyck. Editor Fr.- X. de Guibert. 1999. Statistical analysis by the author)

Also it is a fact, that the ratio 98.9 % ^{12}C/1.1 % ^{13}C/ 0.0000000000 % ^{14}C absorbed via photosynthesis, by living beings, animals and plants, is NOT equal to the ratio's found in the atmosphere.

The phenomenon of "fractionation" causes a loss of 25 o/oo in ^{13}C and about the double in ^{14}C. Other corrections are the Suess and the background effect. (Dead carbon shows still some activity)

Assuming the theory of Libby to be correct, one did introduce a number of correction factors. Today, the ^{14}C standard is set at 95 % of the 1950 value.

Example:

For the 12 samples of the Shroud, one may assume a mean concentration in ^{14}C of 0.8758

The "raw" radiocarbon date = 8268 x ln(1/0.8758) = 1096.

The "calibrated" date = 8267 x ln(0.95/0.8758) = 672. A correction of 425 years.

For Oxford Delta ^{13}C = -27 o/oo. Or a correction of 4 o/oo^{14}C. This implies, that the raw Oxford date of 785, becomes 750 after the application of the Delta ^{13}C.

I asked Dr. Hedges of Oxford for his point of view, about the work of Dr. Richard.

"I know the work Dr. Richard. His findings are correct and confirm earlier work. Only the deviations found by Dr. Richards are much larger than expected.

But to conclude from this, that the Shroud of Turin is not correctly, shows little scientifically honesty. For the era 3000 BC – 1950 AD, we know, based on tree ring comparison, for each 10 years the exact concentration in ^{14}C. The deviations are here between 50-400 years"

Dr. Hedges forgets to take in account, the many erroneous dates, published in "Radiocarbon" and "Nature". Also the differences between the tree ring dates and the well-known chronology of the Egyptian Pharaoh's. Dr. Nicolas van der Merwe (Universities of van Harvard and Cape Town) reports large differences in ^{13}C concentration in leafs of the SAME tree, in the Amazon forests, in function of the height, the position of the sun and the hour of the day.

If the empirical relationship 2 x $d^{13}C = d^{14}C$ is correct, than it is clear that the ^{14}C content is NOT as constant, as presumed. It is also a fact that feeding plays an important role in the13C concentration in the bones and meat of animals. One may assume the same for plants, depending on the composition of the earth and air. This means that the isotopic composition of carbon, at the moment of death of "short living species" may be much more variable, than assumed by the experts. Note that Dr. Hedges was surprised by the errors found by Dr. Richard. One may even wonder, if the use of excellent AMS technology is justified when nobody knows for certain, the ^{14}C concentration at origin. Any lab technician is aware of the problem caused by non-representative or contaminated samples.

Dr. Woefli, (ETH. Zurich) who dated the Shroud, said once "The ^{14}C method is NOT immune to grossly inaccurate dating, when non-apparent problems exist in samples from the field. The existence of indeterminable errors occurs frequently."

ONLY in the case of the Shroud, where the ^{14}C date conflicts with practical all other evidence, the radiocarbon experts exclude any possibility of indeterminable errors.

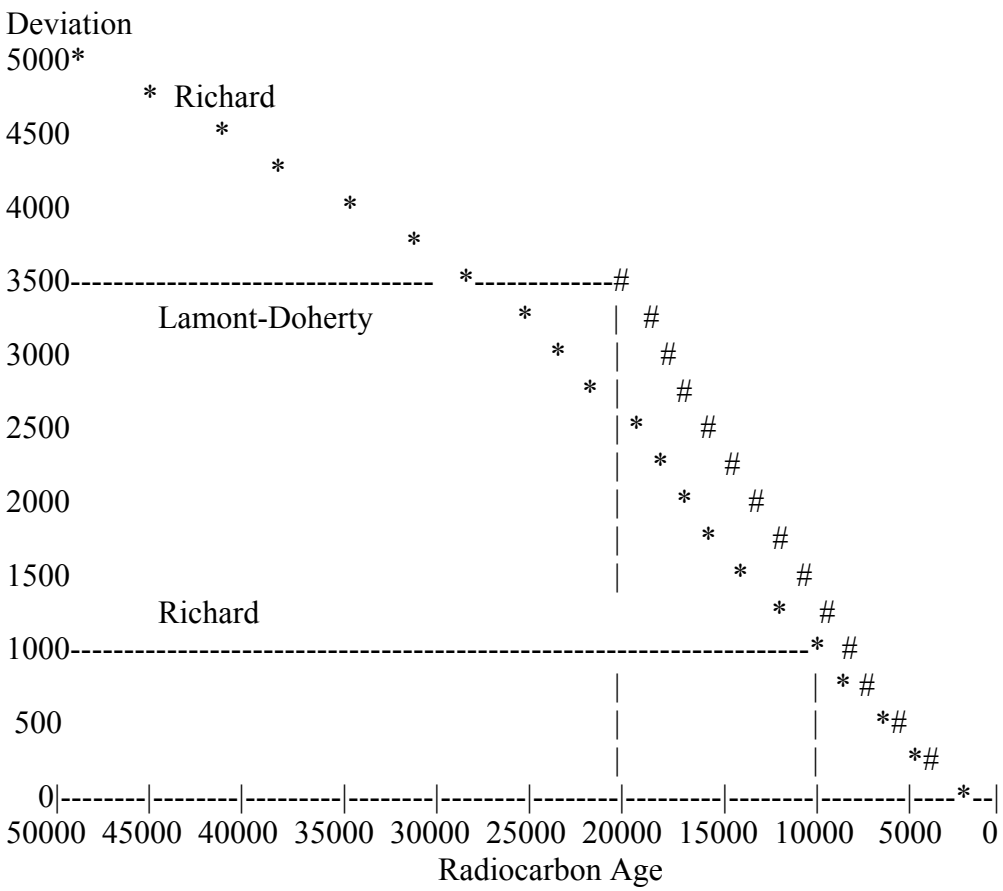

Diagram of the ratio Error/RC age.