CARBON DATING AND THE HOLY SHROUD

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When the exposition of the Holy Shroud was held in Turin in 1978, the feasibility of carbon dating was again broached. At that time, the Turin Authorities (scientists of European reputation) refused to permit this experimental dating method. Now, three years later, science has itself rejected the Libby test, and for clarity it can be said that not a single laboratory exists which can carbon date the Shroud with accuracy.

To substantiate those statements: Natural carbon is the result of interaction of cosmic-ray neutrons with nitrogen atoms in the upper atmosphere. Small amounts of carbon 14 are produced which rapidly oxidize and disperse into the atmosphere. Plants take up the carbon dioxide in photo-synthesis, together with a very minute quantity of radioactive carbon 14, and as this passes up the food chain, all living organisms take it in. With death, the carbon begins to decay; the longer the organism is dead, the less carbon remains. Measure the amount of carbon 14 using the known rate at which the isotope decays, and you have the age of the specimen.

That is the theory. The facts are different. First, the concentration of carbon 14 is very low (only one atom of carbon 14 for every million million of carbon 12 living tissue). Secondly, the decay rate of carbon 14 is a low energy process difficult to detect or monitor with accuracy. Then also the further difficulties of "calibrations" which are applied to offset the natural fluctuations of carbon 14 production in the atmosphere, the half-life "best figure" etc. Even the scale of the calibrations (by checking the tree rings of very ancient trees) differs slightly depending on the sample wood.

More formidable unreliability arises from the fact that the sun does not radiate energy as uniformly as was once thought. On the contrary, solar flares display the explosive force and release of high energy radiation and particles. Sunspots show the same variability in waxing and waning in eight and fifteen random cycles of years. Dr. W. Maunder of the Royal Greenwich Observatory has drawn attention to the almost total absence of sunspots from 1645 to 1715, and the consequent violent see-sawing of carbon 14 production in the earth's atmosphere. Further investigations have proved that there have been at least five long-term periods, each of the order of 100-200 years with similar characteristics. In 1976, Dr. Eddy of the American

Atmospheric Research Centre pinpointed twelve major variations in sunspot activity during the past 5,000 years, including a sunspot *MAXIMUM* period which began at about the time of Our Lord's birth. It is now known that the solar magnetic fields which cause the fluctuations reverse their polarity from cycle to cycle, each cycle being remarkably irregular. If to that we add that the magnetic field of our earth from time to time goes into reverse, at one time attracting and another repelling the incoming particles, it must surely follow that little trust can be placed in results claimed for the carbon 14 dating process.

Not only is the sun *NOT* the immutable "time-clock" it was thought to be, not only is the carbon 14 production so variable, but it is inherent in the nature of radioactivity that its decay is of a random nature! Nor do the difficulties stop there. Individual counters may have different ranges in dating: the traces of radio-activity in the materials and surroundings (e.g. in the 4-foot concrete shield for the cyclotron) etc. all have an effect on the result of the process. The Berkeley laboratory (foremost in the field of carbon 14 experiments) has refused to date a 13th-century fabric giving as its reason that once a cyclotron has been used for its dedicated purpose of atomic experiment, the chamber can never be free of atomic detritus, and false results must follow. Then too the Shroud itself will have accumulated layers of carbon 14 during the centuries of public exposition, as well as the present era. Today's level of atmospheric carbon 14 is 37% above the natural level; in 1963 it was 90% above normal in the northern hemisphere!

These then are some of the reasons why the Turin Authorities did not consider the carbon 14 analysis to be sensitive enough (only one in every ten thousand atoms of carbon 14 input are recorded) or accurate enough for the task of dating the linen.

In the same year of 1978, two important decisions were made: A. Seventeen threads and two small pieces of the linen which were removed for scientific examination in 1973 were not replaced in the sealed safe with the Shroud, but were kept in the Chapel Sacristy until either the carbon process can be improved, or some other and more scientifically precise method has been discovered. These pieces can then be used for such dating method.

B. Certain conditions were laid down for any future dating. They are that two laboratories would be involved, each using identical equipment and to each would be given three sample threads, equal in length and weight. Each thread would be identified by number only, the key being known to one person only, in Turin, until the tests were finished. One thread would be from an ancient linen of known date; the second from a modern fabric; the third from the Holy Shroud.

No laboratories have accepted the challenge as yet.

Finally, one of the most fundamental problems in the techniques established in the carbon 14 dating process over the past thirty or so years lies in the measurement over a period of time of the number of

carbon 14 decay events in the sample being dated. This means that only those atoms which fortuitously decay during the days or weeks of the monitoring are actually detected. The bulk of the carbon 14 present in the sample remains uncounted. To overcome this, it has been established in principle that it is possible to use a particle accelerator to measure, by mass spectrometry, the proportion of carbon 14 atoms present in a small *but uncontaminated* sample without waiting for the decay to declare itself. In September 1979, the British Science Research Council made a grant of £425,000 to construct at Oxford, under the aegis of Dr. E. Hall, a dedicated isotope beam facility, which should start up in the autumn of this year, 1981. A similar accelerator is being prepared for the geoscience laboratory in Arizona and it also is due to start up in the autumn.

It remains to be seen whether the problems which are inherent in the new procedures can be overcome, and whether the many difficulties outlined above can be surmounted.