IS IT REALLY A FAKE?

The carbon-dating tests on the Turin Shroud that were reported in 1988 aroused worldwide interest. John Tyrer poses some textile questions that remain after these tests.

In October, 1988, the results of carbon-14 dating tests on the piece of cloth that has become known as the Turin Shroud (which many believe to be the burial linen of Jesus Christ) were announced. For these tests, a small strip of linen (7 cm x 1 cm) was taken from one end of the Shroud. This was divided between three laboratories (in Oxford, Zurich, and Arizona), all committed to carrying out identical tests by the accelerated-mass-spectrometer method. They claimed to have arrived at a mediaeval date (1230-1390 AD) for the origin of the Shroud. Thus the Shroud was condemned by the media as an artistic forgery when, in fact, it has yet to be conclusively proved that the hand of an artist was involved in producing the Image.

The folding of the Shroud in 1532 AD

It is known that, in 1532 AD, the Shroud was being kept inside a silver reliquary, in a chapel at Chambery in the South of France. A severe fire broke out in the building, and the intense heat melted a corner of the casket and burnt and scorched the folded linen within it, to produce the now-familiar pattern of burns and markings.

By using a model of the Shroud, it has been shown experimentally how it must have been interfolded into layers to form a package inside the reliquary at the time when the silver melted and fell onto it during the conflagration. It has been found that the burn holes and scorchings can be graded in descending size from the top layer. This experiment showed how the Shroud would appear to have been formed into 48 layers and that the area from which the 1988 carbon-14 test strip was to be cut would have been deep inside this'package', 21 layers from the top. In addition, water stains that soaked through the layers and carried tide markings fit the same scheme of foldings, indicating that they are associated with the water used to douse the fire. It is interesting that these tide markings show up pronouncedly in X-ray photographs, which suggests that they have been caused by rust, perhaps from an iron container or bucket.

At later dates, patches over the burn holes and a backing of buckram were added to strengthen and repair the Shroud.

Contaminants in the Shroud

Close examination has shown that the Shroud contains various kinds of contaminants that include organic carbon compounds, for example, microscopical fungi, insect debris, and pollens. These are not only on the surface but are also embedded into the fabric and yarn structures. There are, in addition, likely to be deposits of smoke from the fire and hydrocarbons from the vapours of candles. In places, the Shroud carries lines of sewing threads, apparently from the mediaeval period, used for strengthening and repairing it.

Because of the fire and the melting of the silver casket, the heat inside would have been intense, and a temperature in the region of 900°C (the temperature of molten silver alloy) would probably have been reached. In these circumstances, natural moisture in the Shroud, perhaps together with dousing water, would turn into steam, in places to superheat. Any contaminants on or embedded in the fabric structure would be dissolved and forced into the yarn construction, conditions in which they would react chemically with the molecular structure of the fibres of the flax.

Problems in the cleansing of specimens before carbon-dating

Contaminants on the surface of the cloth, within the interlacements of the weave, on the surface of the yarns, and even within their twisted structures can be removed with suitable surfactants and ultrasonic treatments. At fibre-molecular level, however, the problem of contaminants presents specific difficulties.

The fine structures of flax fibres are built up from macromolecules, which are of very great length relative to their diameter. They are linked together by valency bonds to form the fibre, much as individual fibres are arranged in a yarn.

Along their length, the individual fibres are envisaged as consisting of zones of crystallinity (micelles), which gradually fade into regions of lower crystallinity and ultimate amorphousness. It would appear that these amorphous regions are the main determining factors of, for intance, the receptivity of dyes. Since dyes are, in effect, contaminants, it would follow that other contaminating molecules can also enter and link chemically into the fine structure through what are envisaged as 'pores' in the fibre. In fact, Evans[1] suggests that these are like 'trap doors'. Boulton, Delph, Fothergill, and Morton[2] have indicated that these regions have sorptive capacity for water, which results in osmotic forces tending to cause the molecular chains of the fine structure to move apart. In so doing, the molecular network is expanded, and the 'trap doors' are opened to the entry of other molecules. In this way, organic molecules containing carbon would become part of the flax-fibre chemistry and would be impossible to remove by surfactants and ultrasonic cleansing treatments. More drastic methods to remove the contaminants so as to obtain a pure specimen would inevitable destroy the flax fibre themselves.

In a sense, as a result of the fire in 1532 AD and while in an interfolded state, the Shroud has been steamed, stewed, and baked, together with its carbon-containing contaminants. The temperature would rise and fall and ascend to and decend from around 900°C , and it would vary from place to place in the reliquary and according to the foldings of the Shroud. For these reasons, the Shroud cannot be accepted as a chemically homogeneous and uniform object. In fact, it was described by Ray Rogers and other observers of the American STURP team at the 1978 examination as having a 'faintly mottled appearance'. Perhaps this itself is a visual indication of the Shroud's chemical variability.

It should be noted that the effects of the addition of more recent carbon-14 into the molecular structure would not be appreciated as a significant alteration in the stiffness and draping properties of the linen, any more than occurs when a cloth is dyed or, indeed, overdyed.

Paul C Maloney, research archaeologist with Ancient Near Eastern Researchers, Quakertown, USA, has reported that, in radiocarbon technology, 10% of modern carbon-14 levels left on or in a sample being tested can skew the result by as much as 1000 years[3].

An earlier `secret' carbon-dating'

In a press release issued recently, William Meacham, archaeologist of the University of

Hong Kong, indicated that an American team that had examined the shroud in 1978 had removed a single thread. This was divided into two and later tested at the University of California's nuclear-accelerator facility[4]. The two parts of the thread gave dates of 200 AD and 1000 AD, respectively. These findings were not published at the time because carbon-14 testing did not then have the approval of the ecclesiastical authorities.

This problem of more recent contaminants affecting the carbon date recorded for archaeological specimens is now being considered by archaeologists themselves. The following cases are of interest in this respect.

(1) The dates that have been suggested for Lindow Man (now a famous Mancunian) are controversial. The problem here may be that the remains of `Pete Marsh' have been partly absorbed by the marsh, and the marsh has been partly absorbed into `Pete' (not a case of ashes to ashes but of Pete to peat!).

(2) The bones of one of the Manchester Museum mummies appear to be 800 - 1000 years older than her bandages. Although there is speculation that she may have been rewrapped at a later date, the question is still open that the resins and unguents used in the mummification may have affected the carbon dates recorded.

Results to be treated with reserve

As far as the Shroud is concerned, I cannot but conclude that the results of the 1988 carbon-dating tests must be treated with reserve, because the carbon-14 content could have been `topped up' with contaminants of organic origin that were in it by the time of the 1532 fire. This would falsify the results, so that the Shroud may very well be very much older than has been suggested.

In these circumstances, bearing in mind the earlier `secret' testing, and the controversial dates accorded to various other archaeological specimens, it would be prudent at present to remain less than scientifically confident that the true age of this linen has finally been resolved.

Further work to try to date the Shroud by other means should now be given serious consideration, because present carbon-dating procedures would seem to be inappropriate. The findings of any such research must be of particular interest to archaeologists in general.

References

(1) J G Evans. `The Fine Structure of Fibres in Relation to Dyeing and Finishing', Chapter 15 in `Fibre Science' (edited by J M Preston), the Textile Institute, Manchester, 2nd edition, 1953, p.300.

(2) J Boulton, A E Delph, F Fothergill, and T H Morton. J. *Text. Inst*, 1933, **24**, p.113.

(3) *Science News*, 1988,**134**, 339.

(4) Agence France-Presse. Despatch of 14 November, 1988, reported in English language newspaper in Hong Kong.

Until his retirement, John Tyrer was a member of the staff of AMTAC Laboratories, Altrincham, UK An earlier article that he wrote on the Turin Shroud appeared in Textile Horizons, *1981,**1**, December, 20.*

Schematic diagram of Turin shroud, showing method of folding