

**RESEARCH ARTICLES (4)**  
**THE MYSTERY OF THE INVISIBLE PATCH**

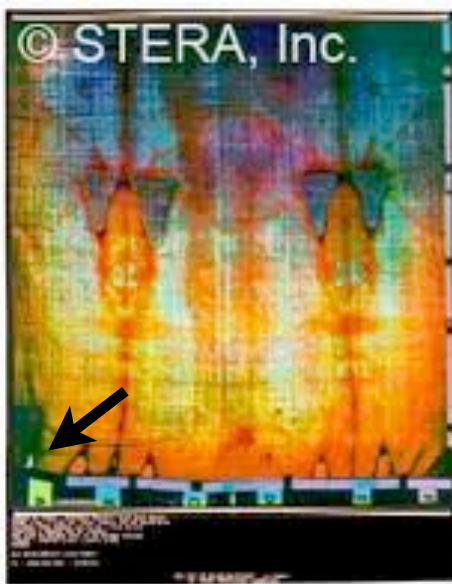
**Hugh Farey**

The 1988 radiocarbon dating of the Shroud to the turn of the 13th/14th centuries was a severe blow to those who had become convinced that it was authentic. The forensic studies of Pierre Barbet, the chemical investigations of the STURP team, the historical researches of Ian Wilson and the palynological discoveries of Max Frei had loaded the scales so heavily in favour of authenticity that it seemed almost inconceivable that anything other than a 1st century radiocarbon date was possible. And so, when three laboratories on two continents had completed their tests and published their results in one of the most prestigious scientific journals (1), it took a while for everybody to get their breath back.

But back it came, and with it a series of determined attempts to discredit the dating. The dating procedure was deeply flawed, there was deliberate fraud by the Catholic Church, the British Museum, or the laboratories; or the samples were too small or contaminated by a bio-plastic film, or neutron radiation, or carbon monoxide, or anything that might make a product from the 1st century appear to be a thousand years younger. These were all examined carefully, not least by people earnestly hoping they were true, and all found wanting. The medieval date remained secure.

But there was one idea which has found considerable support. In 2000, building on a suspicion first voiced some years earlier, Joe Marino and Sue Benford suggested that although the dating itself had been impeccable, the area from which the dating samples had come was not representative of the original cloth, having been so extensively repaired in the 16th century that only 30% of the original material remained in the samples (2)(3). This idea has gained considerable support, and is currently the strongest, perhaps the only, weapon in the anti-radiocarbon armoury. However, it suffers from a major difficulty: how do you demonstrate the presence of something apparently invisible?

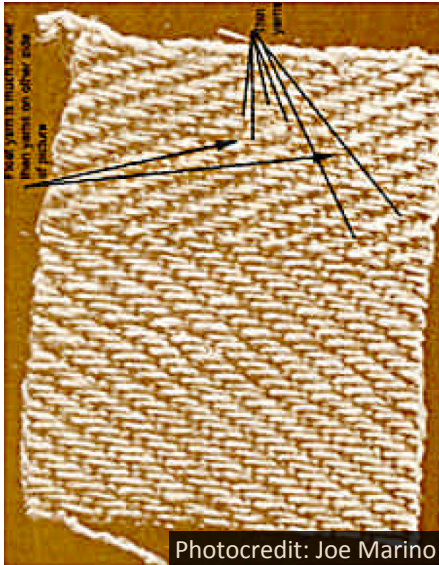
Benford and Marino's first approach was to use some almost neglected results from the 1978 STURP investigation, namely the so-called "quad-mosaic images," two of which are shown below. Although they are in colour, they were made by exposing black-and-white film through different coloured filters, reprocessing the results onto colour film, and combining the films. It was hoped (and confidently declared) that "the color images should be interpreted as a chemical composition map."



(Photos, as you can see, from STERA, Inc.)

The radiocarbon area is indicated by the black arrow on the first picture, and, being green, is supposed to represent a different chemical composition from the orange colour of its surround. That this is nonsense can clearly be seen by observing the other colours on this photo, and also by noticing that exactly the same distribution of colours appears on the next photo along, as they do, in fact, in all these "quad mosaic" images. The colour is fairly obviously much more to do with the light source than it has to do with the material of the Shroud.

The next attempt to recognise invisible weaving was to try to observe it on close-up photos. These were of rather poor quality at the time, but nevertheless evinced remarkably confident confirmations of its presence from several expert tailors. This image (below), purportedly a photograph of the sample sent to the Zurich laboratory, illustrates the findings of the Albany International Research Company, and does indeed



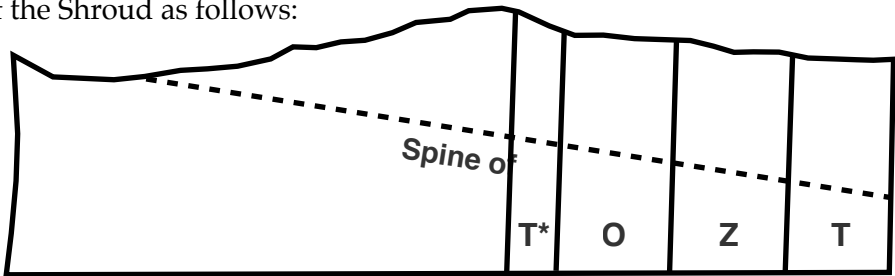
I have printed this photo this way up so as to maintain the orientation of all the illustrations in this article. The arrows on the photo point out particularly thin threads observed above the 'spine' of the herringbone weave.

show that the warp threads on one side of the 'spine' of this section of herringbone weave do indeed seem to vary in thickness more than the threads on the other side. Another photo (below), this time of a piece of the Tucson sample that was not tested, comes from the 'irregular' side of the 'spine,' and also shows variability of thread thickness.



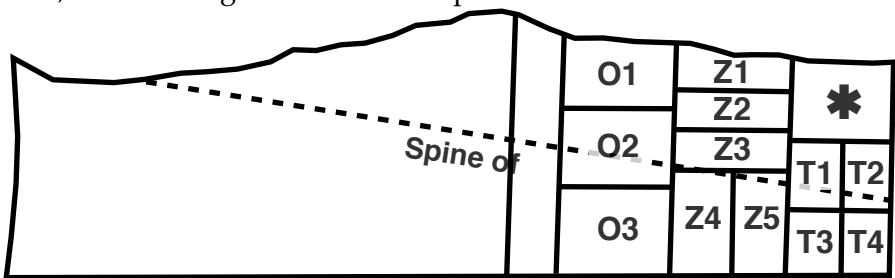
However, more extensive studies of the rest of the Shroud show that the threads all over it are fairly variable in size.

Benford and Marino entered deeper waters when they speculated about the way the 'patch' would have affected the radiocarbon dating. Obviously, the more 16th century material there was, the later the date would appear, and indeed, the averages of the three dates from the Oxford, Zurich and Tucson labs quoted in the journal Nature did show progressive ages (750, 676 and 646 years BP respectively). Benford and Marino interpreted these as deriving from samples cut from the slice taken off the Shroud as follows:



Reserve, Tucson (not used for dating), Oxford, Zurich, Tucson

This makes good sense, provided the individual samples tested contained appropriate proportions of new to old material. Actually, the individual labs did not divide their samples so cleanly. Oxford cut theirs into 3, Zurich into 5 or 6, and Tucson into 5. The exact configuration is not known, but this diagram illustrates a possible one:



The area marked with an asterisk is the untested piece of the Tucson sample photographed by Barrie Schwartz (opposite).

Clearly, by cutting up the samples, the dates derived from each one would no longer be expected to be a combination of 1st and 16th century material, except in the few cases where the spine of the herringbone passes through the subsample. The others would be either pure 1st or pure 16th century. This is not what the actual radiocarbon dates show.

Support for the patch hypothesis came, however, from an unexpected quarter. Ray Rogers, who was at first contemptuous of it, nevertheless tested it scientifically by examining some associated threads under a microscope, and to his surprise, identified several anomalies which, he thought, demonstrated that they were not consistent with the rest of the Shroud (4). Firstly, he found a considerable amount of cotton woven among the threads associated with the radiocarbon area, and secondly, he found that the threads he examined appeared to be coated with a colouring agent, which he imagined might have been applied to achieve consistent colour across the interwoven area. Thirdly, he found vanillin among the threads, which he thought should have deteriorated completely in 2000 year old flax, and had not been detected by the 1978 STURP investigations.

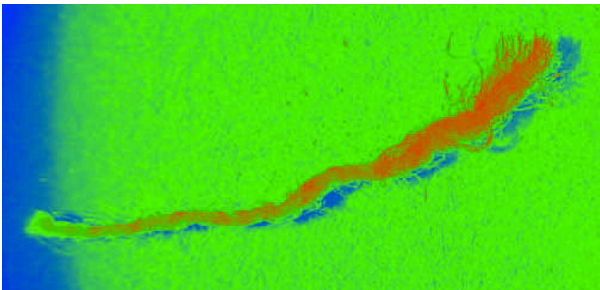
Some of Rogers's threads were subsequently examined by other scientists, with distinctly contradictory results. Giulio Fanti estimated the proportion of cotton to flax in a thread he examined at about 2% (5). Thibault Heimburger estimated it at about 15% (6), while Robert Villarreal found his sample to be entirely cotton (7). These results are inconsistent, and throw doubt on the provenance of the threads, and on the conclusions drawn from them. They do not reliably demonstrate medieval reweaving, although some sort of contamination seems possible. It is worth mentioning in this context the statistical analysis of Riani, Atkinson et al. (8), who determined that there was an age gradient of some kind across the radiocarbon sample, although they did not dispute the general medieval finding. John Brown also confirmed the presence of cotton and a coating of contaminant by Scanning Electron Microscope (9).

Another consideration lies in how the patch, or rewoven threads, might be attached to the rest of the shroud. There is, clearly, no obvious

join, no overlap between two pieces of material, and no extra stitching. It appeared that either the new threads had been carefully interwoven among the ends of the old, or they had literally been combined in some kind of micro-splice. The photo of a 1cm length of a single thread below was adduced to suggest how the splices may have been performed. It was claimed that the two ends were different materials on the basis of their colour, and the fact that one end was unravelled.

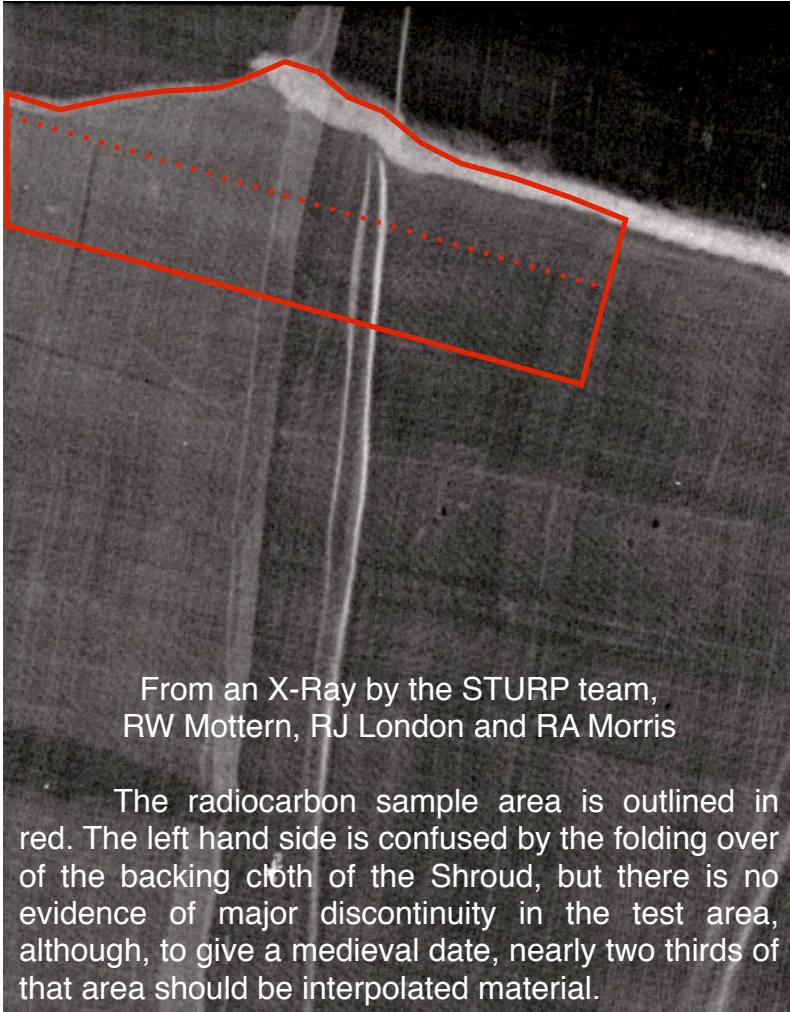


Enhancing the colours appeared to give some credibility to this idea, although the variation could just as easily be caused by the reflective sheen of the fibres, which are clearly brighter on the light-source side, and the unravelling an artefact of the preparation of the thread. The idea that a couple of threads no more than 250  $\mu\text{m}$  in diameter could be trimmed to invisibility before being twisted together is fairly far-fetched anyway.



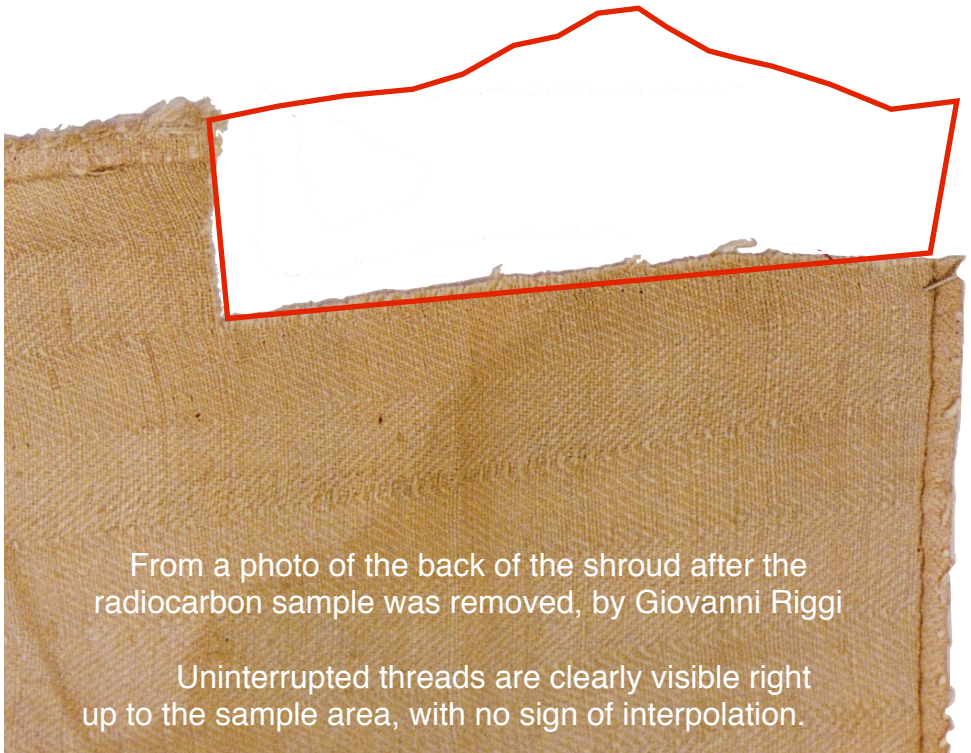
Another purported "splice" was discovered by Robert Villarreal, of the Los Alamos laboratories, when a shred of thread fell apart during preparation. However, this discovery turned out to be a mixed blessing for the interweave hypothesis. Firstly there was no intermingling of the two threads - they were simply butted together, and apparently glued - and then Villarreal found that both ends were cotton. The whole point of the splice hypothesis is that the new cotton was mingled with the old flax, not that it was joined to itself!

With the splice hypothesis looking increasingly unstable, the other way in which new threads could be added to a threadbare patch would be by careful interweaving of the new alongside the old for a centimetre or so, and then extending beyond the old into the space to be repaired. If this were so, careful study of the material would show the doubled threads. No such area has been found. In fact, individual threads can be followed fairly consistently from the body of the Shroud up to and across the radiocarbon area, using various photos, as follows:



From an X-Ray by the STURP team,  
RW Mottern, RJ London and RA Morris

The radiocarbon sample area is outlined in red. The left hand side is confused by the folding over of the backing cloth of the Shroud, but there is no evidence of major discontinuity in the test area, although, to give a medieval date, nearly two thirds of that area should be interpolated material.



It would be wrong to say that there is no evidence that the radiocarbon corner of the Shroud has suffered from contamination which makes it untypical of the cloth as a whole. Although the proportion of cotton found is too inconsistent to be diagnostic, and there is certainly no visible evidence, Ray Rogers's discovery of vanillin is significant, and may have wider implications for non-destructive textile dating than the Shroud. The discovery of madder root pigment, and the statistically determined age gradient of Riani and Atkinson are suggestive. Nevertheless, it cannot be said there is sufficient evidence of the contamination that would be required to falsify the 13th/14th century date determined by the radiocarbon laboratories, for the patch hypothesis to be accepted without serious reservations.



References for 'The Mystery of the Invisible Patch'

- 1) *Radiocarbon Dating of the Shroud of Turin*, Damon et al., Nature, 1989, at <http://www.shroud.com/nature.htm>
- 2) *Evidence for the Skewing of the C-14 Dating of the Shroud of Turin due to Repairs*, Joe Marino and Sue Benford, 2000, at <http://www.shroud.com/pdfs/marben.pdf>
- 3) *Discrepancies in the Radiocarbon Dating Area of the Turin Shroud*, Sue Benford and Joe Marino, Chemistry Today, 2008, at <http://www.shroud.com/pdfs/benfordmarino2008.pdf>
- 4) *Studies on the Radiocarbon Sample from the Shroud of Turin*, Ray Rogers, Thermochemica Acta, 2005, at <http://www.metalog.org/files/shroud/C14.pdf>
- 5) at <http://www.shroud.com/pdfs/fantir7appendix.pdf>
- 6) *Cotton in Raes/Radiocarbon Threads: The Example of Raes #7*, Thibault Heimburger, 2009 at <http://www.shroud.com/pdfs/thibault7part1.pdf> et seq.
- 7) *Shroud of Turin Ohio State University Villarreal Lecture*, on [www.YouTube.com](http://www.YouTube.com)
- 8) *Regression Analysis with Partially Labelled Regressors: Carbon Dating the Shroud of Turin*, Marco Riani, Christopher Atkinson et al., Statistical Computing, 2012.
- 9) *Microscopical Investigation of Selected Raes Threads from the Shroud of Turin*, John L. Brown, 2005 at <http://www.shroud.com/pdfs/brown1.pdf>