

# **Chronological History of the Evidence for the Anomalous Nature of the C-14 Sample Area of the Shroud of Turin**

**By Joseph G. Marino and Edwin J. Prior  
©2008 All Rights Reserved**

## **Introduction**

There has been much discussion in the past few years of the theory that the 1988 Carbon-14 dating of the Shroud of Turin, performed at labs in Oxford in England, Zurich in Switzerland and Tucson in the United States, was invalid because the sample tested was not truly representative of the main cloth, possibly due to an “invisible reweave.” What is the evidence for this claim? First of all, are there any indications that the Shroud has been repaired at all? Second, are there any indications that the specific area from which the C-14 sample was taken is different in any way from the main part of the cloth? Third, could the Shroud have been “invisibly rewoven?” Fourth, to be thorough, we will look at some important points of the C-14 process, specifically, a) the need to exercise caution in giving too much importance to it as an individual test; b) the method’s limitations; and c) the need to place the test in a multi-disciplinary context. The C-14 aspects also give important historical background information leading up to the 1988 testing. These will be listed together in an appendix. We have decided that the best way to look at the data pertaining to all of this is in an informal, chronological bullet form. Each entry will contain the following information:

- 1) Entry number (entries for the main section and appendix will be numbered separately)
- 2) Date: when the evidence was published or released
- 3) Data category
  - a. General possibility of repairs
  - b. Evidence of anomalous nature of C-14 corner
  - c. Possibility or direct evidence of invisible reweaving
  - d. C-14 aspects (In separate appendix)
- 4) Evidence: the specific data
- 5) Source for the Evidence
- 6) Comments: by the authors of this article

**Entry: #1**

**Date: 1976**

**Data Category:** General possibility of repairs

**Evidence:** Enzo Delorenzi, a member of the Turin Commission that studied the Shroud in 1969 and 1973, wrote: "...I should like to mention the impression I received during the course of my examination, namely, that more pairs of hands have carried out the darning than is suggested in the historical records (the four Clarissas of Chambery, the Blessed Valfre and the Princess Clotilde)."

**Source:** Delorenzi, Enzo: 1976. "Observations on the Patches and Darns in the Holy Shroud." In Doyle, E., M.Green, Fr., & V. Ossola (Trans.) Report of Turin Commission on the Holy Shroud (pp. 108-123). Unpublished. Translation of La S. Sindone: Ricerche e studi della Commissione di Esperti nominata dall'Arcivescovo di Torino, Card. Michele Pellegrino, nel.

**Comments:** This indicates that the Shroud could have received undocumented repairs in its history. The report describes various documented repairs in the C-14 sample area, including a repair by the Poor Clare Nuns in 1973 after the Raes sample extraction (piece extracted by Belgian textile expert Gilbert Raes). These repairs may or may not have appeared in part or in whole in the adjacent sample used for the C-14 test in 1988. The person responsible for extracting this sample, Italian scientist Giovanni Riggi, never mentions these threads as specifically being eliminated from the sample. However, a drawing by Riggi (found in Bonnet-Eymard, Bruno, "The Carbon 14 Dating," *Catholic Counter-Reformation in the 20<sup>th</sup> Century*, April 1991, No.238, pg. 2), and a statement by Riggi demonstrate some recognition that darning may have overlapped part of the sample and that he attempted to cut a portion of the threads out. (See entry number 8 in this section.)

**Entry: #2**

**Date: 1976**

**Data Category:** Evidence of anomalous nature of C-14 corner & Possibility or direct evidence of invisible reweaving

**Evidence:** Textile expert Gilbert Raes of Belgium, who extracted a sample in 1973 for analysis, wrote in his report that he found *cotton*. Raes also noted, "The thread used for sewing the two pieces [designated "Piece 1" and "Piece 2"] together is...twisted in an S-direction, whereas the individual threads are twisted in a Z-direction.

**Source:** Raes, Gilbert. "Appendix B – Analysis Report: Pl. II-III—Subject: Examination of the 'Sindone'". In Doyle, E., M.Green, Fr., & V. Ossola (Trans.) Report of Turin Commission on the Holy Shroud (pp. 108-123), 1976. Unpublished. Translation of La S. Sindone: Ricerche e studi della Commissione di Esperti nominate dall'Arcivescovo di Torino, Card. Michele Pellegrino, nel.

**Comments:** The Raes sample is highly significant due to its thorough examination and adjacent location to the C-14 sample area. Given the stark differences between yarns found in the Raes'

Pieces 1 and 2, combined with the existence of the sewing thread, which connected the two disparate materials, Benford and Marino hypothesize that Piece 2 was the original Shroud material/seam and Piece 1 was a cotton-containing patch made to resemble the original Shroud cloth. (See: “Surface Chemical Analysis of the Shroud of Turin Identifies Discrepancies in Radiocarbon Dating Region” by M. Sue Benford and Joseph Marino, presented at the “The Shroud of Turin: Perspectives on a Multi-Faceted Enigma” conference in Columbus, Ohio on August 14-17<sup>th</sup> 2008, which will be accessible online at [www.ohioshroudconference.com](http://www.ohioshroudconference.com) by January 1, 2009). Each piece exhibits different characteristics, such as cotton content, lignin content at the growth nodes, and thread size, suggesting two different origins of the yarns. The continuous, fully-observable sewing thread represents a significant change of technique, and suggests this section of thread, which incorporated the Raes sample and C-14 sample areas, was applied from the top instead of the reverse of the cloth. This further implies the two sections of sewing threads (C-14 region versus main Shroud) were applied at different times and by different artisans with the main Shroud stitching possibly from the same time period as a cloth from Masada in Israel, dated to BC 40 to AD 73 [M. Flury-Lemberg, Mechthild, *Sindon N.S. Quad.* 16 (Dec 2001., pg. 60)]. Raes himself would not commit in his report to a specific time period for the origin of the cloth. Regarding the S-direction versus the Z-direction, Raes is referring to the connection between the fabric and the seam; the two different twists indicate the existence of two different kinds of cloth. (See entry number 13 in this section.)

**Entry: #3**

**Date: 1981**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** Shroud of Turin Research Project (STURP) member Joan Janney remarked at the STURP New London, Connecticut symposium held on October 10-11 that “STURP found *cotton* spun into the linen threads in the Raes Corner/radiocarbon sample area of the Shroud.”

**Source:** Maloney, Paul C. “What Went Wrong With the Shroud’s Radiocarbon Date? Setting it all in Context.” Talk given at the “The Shroud of Turin: Perspectives on a Multi-Faceted Enigma” conference in Columbus, Ohio on August 14-17<sup>th</sup> 2008, which is scheduled to be accessible online at [www.ohioshroudconference.com](http://www.ohioshroudconference.com) by January 1, 2009.

**Comments:** Maloney had attended the New London symposium and heard Janney make this remark. He confirmed the observation with STURP documenting photographer Barrie Schwartz. This is consistent with what others noted about cotton in this area of the cloth.

**Entry: #4**

**Date: 1981**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** According to archaeologist Paul Maloney, Walter McCrone had sent him in 1981 several Kodak transparencies of photos he took of Shroud linen fibers. “On those slides, McCrone had written the following note: madder rose, linen fiber, medium (blue) sample 3 CB”

and sample 3-AB. McCrone was referring to photomicrographs made on STURP sticky tape samples 3-CB and 3-AB which came from the blood flow across the back nearest the side-strip side of the Shroud and directly adjacent to that flow on linen, itself. It was on that side where someone would have been working their repairs if the re-weave theory is held to be correct. McCrone, of course, due to his belief that the Shroud was painted by an artist, was trying to prove that the Shroud had been in an artist's studio."

**Source:** Maloney, Paul C. "What Went Wrong With the Shroud's Radiocarbon Date? Setting it all in Context." Talk given at the "Shroud of Turin: Perspectives on a Multi-Faceted Enigma" conference in Columbus, Ohio on August 14-17<sup>th</sup> 2008.

**Comments:** Regarding the presence of madder rose on the cloth, Maloney says, "There is now a new way of looking at the presence of that madder rose. Although this is some distance from the "Raes Corner" such trace amounts can now be conjectured to explain the dye that was used, along with the aluminum mordant and the gum Arabic as a binder to create the wash to finish the re-weave. Thus, it may now be seen not as a contaminant from an artist's studio, but rather a contaminant from the weaver's workshop."

**Entry: #5**

**Date: 1985**

**Data Category:** General possibility of repairs

**Evidence:** Gillian Eastwood, specialist in Near Eastern archaeological textiles, commenting on the fact that the C-14 sample was next to a sidestrip on the Shroud, told author Ian Wilson that "The existence...of some form of end or selvedge needs to be determined and properly documented. Similarly the published works concerning the Shroud make no reference to the type of seam used....It many have constituted an original extension, *or it may derive from a later repair....(italics added).*"

**Source:** Wilson, Ian. "British Proposals for a Fresh Study of the Shroud of Turin." *Shroud Spectrum International*, No. 16 (September 1985), pg. 14.

**Comments:** Many researchers believe that the sidestrip is part of the original cloth but Eastwood includes the possibility of it resulting from a repair.

**Entry: #6**

**Date: 1986**

**Data Category:** General possibility of repairs

**Evidence:** Italian author Richard Gervasio identified various researchers who identified various anomalies that suggest that undocumented repairs were made on the Shroud.

**Source:** Gervasio, Richard. “La Struttural Tessile Della Sindone.” In *La Sindone: Nuovi studie e recherché*, Atti del II Congresso Nazionale di Stuudi sulla Sindone GTrani. Milano: Edizione Paoline, 1986, pp. 264 and 268 [Privately translated.]

**Comments:** Given the possible connection with Jesus, it certainly would not be surprising if there were various undocumented repairs of the Shroud, done by the owners of the Shroud as well as under the auspices of various Church authorities.

**Entry: #7**

**Date: 1988**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** Edward Hall, head of the Oxford lab, noted odd fibers in the C-14 sample. Hall enlisted the opinion of Peter South of Derbyshire lab, who concluded, “the rogue fibers were fine dark yellow strand *cotton...and may have been used for repairs in the past*” (italics added).

**Source:** “Rogue Fibers found in the Shroud.” *Textile Horizons*, December 1988, pg. 13.

**Comments:** This is another indication that even experts were acknowledging that the area was apparently not homogeneous. The finding of the cotton was even mentioned in the famous *Nature* article, which claimed with 95% certainty that the Shroud was medieval. (See entry number 31 of Appendix.)

**Entry: #8**

**Date: 1988**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** Giovanni Riggi di Numana, who actually cut the Shroud C-14 sample used in the testing, remarked that “*fibers of other origins had become mixed up with the original fabric*” (italics added).

**Source:** Riggi di Numana, Giovanni. *Rapporto Sindone*. Milano: 3M Edizioni. 1988. English translation by John D’Arcy, unpublished).

**Comments:** It is clear that Riggi should have halted proceedings to ask the scientists for advice.

**Entry: #9**

**Date: 1988**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** Textile expert John Tyrer wrote: “The area involved is very small relative to the whole of the Shroud, as well as being close to a join that may contain a selvedge—something to be avoided even in routine textile testing.”

**Source:** Tyrer, John. "Textile Questions that Remain Following the Carbon Dating Test." *Shroud Spectrum International*, Sept./Dec.1988, Volume 7, pg. 14.

**Comments:** This is another indication that the C-14 sample site area chosen should have been avoided.

**Entry: #10**

**Date: 1988**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** Association of Scientists and Scholars International for the Shroud of Turin, LTD (ASSIST) released a statement: "The carbon date obtained by three labs for a sample taken from the Shroud of Turin may not prove the medieval date of this cloth. This is the position of the Association of Scientists and Scholars International for the Shroud of Turin, LTD, (ASSIST). Given the unanswered questions about contamination on and in the cloth, the nature of the sample itself, the lack of controls from the Shroud, and the accumulation of evidence which has supported a case for its antiquity, the ASSIST group believes a date for the Shroud in the medieval time frame is not yet scientifically tenable. ASSIST believes further carbon tests are necessary."

**Source:** ASSIST Press release of October 14, 1988.

**Comments:** Using Ockham's Razor, the principle that states that "All other things being equal, the simplest solution is the best," an invisible reweaving of the C-14 corner is the simplest and best solution.

**Entry: #11**

**Date: 1988**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** Dr. Stuart Fleming, formerly of the Oxford Laboratory for Archaeology and University of Pennsylvania, stated that a restorer "*could certainly have re-woven a damaged edge to a standard not visible to the naked eye*" (italics added).

**Source:** As cited in William Meacham's, "Comments on the British Museum's Involvement in Carbon Dating the Turin Shroud." Unpublished manuscript, 1988. Reproduced in Meacham's book: The Rape of the Turin Shroud: How Christianity's most precious relic was wrongly condemned and violated. Lulu.com, 2005, pp. 94-96.

**Comments:** Here is a textile expert already stating that an invisible reweave is plausible.

**Entry: #12**

**Date: 1988**

**Data Category:** Possibility or direct evidence of invisible reweaving (& C-14 aspects)

**Evidence:** Archaeologist Bill Meacham put out a press release, disputing the results, in which he stated, “It is also possible that this area was re-woven by a medieval restorer, since it is just next to a selvage edge and side panel that were added to the Shroud at some time after its original manufacture. The Shroud may not be one homogeneous cloth as far as its chemistry is concerned. We already know of significant variations from one point to another, and the radiocarbon content likewise may vary significantly.” Meacham recommended that 5 or 6 sites be used in order to make an accurate determination about the cloth’s age. He also pointed out that “archaeologists who make frequent use of C-14 results are accustomed to samples occasionally giving aberrant results, and would normally not attach much importance to a single date.”

**Source:** Press Release from William Meacham on October 14, 1988. Reproduced in Meacham’s book: The Rape of the Turin Shroud: How Christianity’s most precious relic was wrongly condemned and violated. Lulu.com, 2005, pp. 102-103.

**Comments:** Meacham was very perceptive early on regarding the possibility of a reweave. Clearly, more importance than was warranted was given to the weight of the AD 1260-1390 dates assigned to the Shroud by the 3 universities. In the release, Meacham also cited “a letter he had just obtained that was written by one of the labs’ directors to the British Museum in January of this year, in which the current C-14 project was described as ‘a rather shoddy enterprise ... which the British Museum may live to regret.’”

**Entry: #13**

**Date: 1989**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** Gilbert Raes indicates he believes the Oxford C14 *cotton* he examined is inside the threads.

**Source:** Raes, Gilbert. “The History of the Sample taken on 24<sup>th</sup> November 1973, the Problem of the Sidestrip and Fibres of Cotton found on the Sample delivered to the Oxford Laboratory.” Presentation at CIELT Paris Symposium, September 7<sup>th</sup>-8<sup>th</sup>, 1989.

**Comments:** The authors Marinelli and Petrosillo noted in their book, The Enigma of the Shroud: A Challenge to Science, San Gwann, Malta, Publishers Enterprises Group, 1996, pg. 63, that the samples had weighed twice as much as expected. A blend of linen and cotton threads could explain the higher weight.

**Entry: #14**

**Date: 1989**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** Jacque Evin, a French C-14 expert, who was involved in the 1988 C-14 dating, when asked about the possibility of a reweave at the CIELT Paris Symposium on September 7<sup>th</sup>-8<sup>th</sup> 1989, remarked, “*I quite agree that the labs did not take the weaving techniques into account and they did not date the threads per se. . . . Thus, if the weave was rewoven with threads from modern restoration, this would be reflected in more modern results*” (italics added).

**Source:** Videotape belonging to one of the authors (Marino) of a question and answer session at the CIELT Paris Symposium.

**Comments:** Evin clearly acknowledges the possibility of a reweave in the C-14 sample area.

**Entry: #15**

**Date: 1991**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** Belgian chemist Remi Van Haelst, analyzing the C-14 data released after the testing, pointed out that statisticians indicate that to pass the Chi Square test, which determines comparability of two or more disparate samples, the calculated value should be lower than 6. The Chi Square value for the Shroud is 6.4.

**Source:** Van Haest, Remi: “Radiocarbon Data Indeed Manipulated.” *Shroud News*, December 1991, no. 68, page 5.

**Comments:** The 6.4 value for the Shroud means that the *subsamples cannot be considered identical* (italics added), or rather, from the same representative sample.

**Entry: #16**

**Date: 1996**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** “The widely reported ‘95% chance that the Shroud was made between 1260 and 1390 A.D.’ sounds impressive, but it is the result of statistical sleight of hand. . . . It all amounts to internal massaging of numbers which hides certain warning signals. In fact the wide range of dates among the three labs obtained in the Shroud sample as compared to the much narrower range in the three control samples indicates that the Shroud test gave an anomalous result. The report in *Nature* hints at the problem when it notes (in table 2) that there is only a 5% probability of attaining by chance ‘a scatter among the three dates as high as that observed, under the assumption that the quoted errors reflect all sources of random variation.’ In plain English this means that all the statistical manipulation in the world can’t get rid of the fact that the range of dates is much too large to be accounted for by the expected errors built into radiocarbon



dating...And since the samples were taken from the same tiny area, the range of dates most probably means that all you have to do is go one or two millimeters up the sample, closer to a scorch mark, or perhaps within an area containing a restoration thread or two, to throw off your results a couple of hundred years or more—perhaps much more.”

**Source:** Case, T.W. The Shroud of Turin And The C-14 Dating Fiasco: A Scientific Detective Story. Cincinnati: White Horse Press, 1996, pp.32-33.

**Comments:** Although it's clear that “a restoration thread or two” would not have accounted for the approximate 1,200 year difference needed to bring the dating to a 1<sup>st</sup> century range, a 16<sup>th</sup> century patch certainly would have.

**Entry: #17**

**Date: 1996**

**Data Category:** Evidence of anomalous nature of C-14 corner and C-14 aspects

**Evidence:** Even though Riggi had given assurances that the excised C-14 samples given to the labs were free of foreign threads, The University of Arizona, one of the laboratories that performed the Shroud C-14 dating, documented *both red silk and blue satin in its sample*.

**Source:** Petrosillo, Orazio and Marinelli, Emanuela. The Enigma of the Shroud: A Challenge to Science. San Gwann, Malta: Publishers Enterprises Group, 1996, pg. 86.

**Comments:** The University of Arizona lab had conducted 8 separate C-14 tests on the Shroud samples they had been given. But there was such a wide variance in the computed dates, the team in Arizona combined the data to produce 4 results, thus eliminating the more outlying dates (possibly they did so at the request of the British Museum, which was overseeing the tests). As noted above, Van Haelst documented that the results failed to meet the minimum statistical standards of the Chi-Square test. Questions to ask about the Arizona results are: Why the wide variance in the dates? Was it because of testing errors? Or was it because the sample was not sufficiently homogeneous?

**Entry: #18**

**Date: 1996**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** Adler, in discussing a graph that illustrates the absorbance patterns of image, non-image, radiocarbon warp, waterstain, scorch, and serum single fiber samples, writes, “*The patterns...are all distinguishably different from one another, clearly indicating differences in their chemical composition* (italics added). In particular the radiocarbon samples are not representative of the non-image samples that comprise the bulk of the cloth. In fact, the radiocarbon fibers appear to be an exaggerated composite of the waterstain and scorch fibers, thus confirming the physical location of the suspect radiocarbon site and demonstrating that it is not typical of the non-image sections of the main cloth...”

**Source:** Adler, Alan D. "Updating Recent Studies on the Shroud of Turin." In M.V. Orna (Ed.), *Archaeological Chemistry: Organic, inorganic and biochemical analysis* (pg. 225) *ACS Symposium Series*, vol. 625, 1996. Washington, DC: American Chemical Society.

**Comments:** Adler was very clear that the C-14 area of the Shroud was different than the main part of the Shroud. (See also entry numbers 19, 22, 24 and 29 in this section.)

**Entry: #19**

**Date: 1996**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** STURP chemist Alan Adler in an interview states: "So you can talk all you want about how reproducible the date is, but you can't talk about how accurate it is. You have no way of knowing if the area you took the C14 sample from represents the whole cloth. That's an area which has obviously been repaired. There's cloth missing there. It's been rewoven on the edge. They even cut part of it off, because it was obviously rewoven on the edge. *The simplest explanation why the date may be off is that it's rewoven cloth there* (italics added). And that's not been tested."

**Source:** Case, T.W. *The Shroud of Turin And The C-14 Dating Fiasco: A Scientific Detective Story*. Cincinnati: White Horse Press, 1996, pg. 73.

**Comments:** Adler asserts very strongly here that the C-14 area was rewoven.

**Entry: #20**

**Date: 1998**

**Data Category:** General possibility of repairs and Possibility or direct evidence of invisible reweaving

**Evidence:** The custodian of the Shroud's current scientific advisor, Professor Piero Savarino, co-authored a booklet on the Shroud before he was appointed advisor to Cardinal Poletto of Turin. In the 1998 booklet, he stated that the 1988 C-14 testing *might have been erroneous due to "extraneous thread left over from 'invisible mending' routinely carried out in the past on parts of the cloth in poor repair"* (italics added). Savarino went on to emphasize: "...if the sample taken had been the subject of 'invisible mending' the carbon-dating results would not be reliable. What is more, the site from which the samples actually were taken does not preclude this hypothesis" (italics added).

**Source:** Savarino, P. and Barberis, B. *Shroud, Carbon Dating and Calculus of Probabilities*. London: St. Paul's, 1988, pp.21-22

**Comments:** Savarino's use of the phrase "invisible mending" probably does not refer to the technical procedure proposed by Benford and Marino but these passages show that even the Turin authorities are acknowledging that numerous repairs have been made on the Shroud

throughout the centuries. One can only hope that the Turin authorities will take Adler's advice and allow new direct examinations of the cloth, especially a dating test.

**Entry: #21**

**Date: 1998**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** Dr. Alan Whanger and Mary Whanger wrote regarding the seam cut as part of the C-14 sample, "the extra threads extending out from it were part of the sample which was tested."

**Source:** Whanger, Mary and Alan, The Shroud of Turin: An Adventure of Discovery. Franklin: Providence House Publishers, 1998, pg. 110.

**Comments:** These are published comments pertaining to the informal observations from 1989 at the Paris symposium. (See also entry number 36 in this section.)

**Entry: #22**

**Date: 1998**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** Adler writes, "A recent investigation comparing STURP sticky tape sample fibers with those of the radiocarbon sample by Fourier Transform Infrared Microspectrophotometry and also Scanning Electron Microprobe Spectroscopy *demonstrated a clear difference in the chemical composition of the radiocarbon fibers from those of the various types of Shroud fibers* (italics added). (Note that this calls into question the accuracy of the radiocarbon date)." Adler also found large amounts of aluminum in yarn segments from the radiocarbon sample, up to 2%, by energy-dispersive x-ray analysis."

**Source:** "Concerning the Side Strip on the Shroud of Turin" by Alan D. Adler and Mary Whanger, <http://www.shroud.com/adler2.htm>

**Comments:** The aluminum finding is significant because *it has not been found anywhere else on the Shroud*. This paper was originally presented at the Nice Symposium in 1997 hosted by the French Shroud group "C.I.E.L.T." (Centre International D'Etudes Sur Linceul De Turin).

**Entry: #23**

**Date: 1999**

**Data Category:** Possibility or direct evidence of invisible reweaving and & General possibility of repairs

**Evidence:** "It was determined that there was statistically significant ( $P > 98.8\%$ ,  $r^2 = 0.49$ ) inverse linear relationship between the date measured and the distance from the sample to the edge of the cloth. This finding indicated that there was an apparent gradient of radiocarbon measured on the

Shroud sample with higher levels of  $^{14}\text{C}$  measured at increasing distance from the edge of the Shroud linen based on the sample measured.”

**Source:** Walsh, Bryan. “The 1988 Shroud of Turin Radiocarbon Tests Reconsidered” in Proceedings of the 1999 Shroud of Turin International Research Conference--Richmond Virginia. Richmond: Magisterium Press, 2000, pg. 340.

**Comments:** The Benford/Marino proposed patch correlates very closely to the angle as shown in the graph representation of the data outlined by the Walsh illustration. Both can be seen in figure 3 at <http://www.shroud.com/pdfs/marben.pdf>. The variable radiocarbon dates “across the fabric” Walsh found in his paper are *consistent with what would be expected if a portion of the samples included the “original” Shroud adjacent to more recent reweave material*. Regarding various other theories that have been advanced to explain why the C-14 dating might have been in error, the hypotheses of generalized ionizing radiation, thermal effects, environmental carbon monoxide enrichment, deliberate tampering or substitution of the samples, and bioplastic coating, as is the premise that the cloth itself, is, *in toto*, medieval is incapable of reconciling the precise, statistically-determined angular skewing of the dates corresponding with the individual laboratories, with reference to the location of the subsamples received. (See also entry number 28 in this section.)

**Entry: #24**

**Date: 2000**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** Adler and 2 co-authors state in the introduction: “...Unfortunately, a detailed protocol for sampling the cloth to assure both precision and accuracy recommended by a convened meeting of consultants was not followed. Only a single sample *was taken from a rewoven edge* (italics added) in a waterstained area a few inches from one of the burn marks incurred in the historically recorded 1532 fire. This location was near the bottom of the frontal body image on the edge where a large section of cloth is missing below the seamed so-called side strip. No historic record exists accounting for this missing material and how or when this damage occurred. *The nature and/or extent of the repairs undertaken here are also unknown. Therefore, the possibility exists that this selvage edge might be linen not original to the Shroud. The selection of this single suspicious sample site is a sufficient reason to doubt the accuracy of the radiodate* (italics added). This spectroscopic investigation was therefore undertaken to determine whether any evidence can be obtained to support such doubts.” When discussing the actual findings, they write, “...The peak patterns and relative intensity patterns in other regions of the spectra are also *consistent with the conclusion that the spectral patterns of these fibers are all distinguishably different from one another. Note this is specifically true for the radiocarbon fibers and the non-image fibers from the bulk of the cloth, thereby demonstrating that the area selected for the radiocarbon sampling is atypical and is not clearly representative of the rest of the Shroud*” (italics added).

**Source:** Adler, Alan D, Russell Selzer and Frank DeBlase. “Further Spectroscopic Investigations of Samples of the Shroud of Turin” in The Shroud of Turin: Unraveling the

Mystery. Proceedings of the 1998 Dallas Symposium, pp. 166, 167 (1<sup>st</sup> italicized quote) and 176 (2<sup>nd</sup> italicized quote).

**Comments:** (See also entry numbers 18, 19, 22 and 29 in this section.)

**Entry: #25**

**Date: 2000**

**Data Category:** Evidence of anomalous nature of C-14 corner & General possibility of repairs

**Evidence:** Thomas Ferguson & Co. Ltd, world-renowned makers of Double Damask Linen, was blindly shown a photograph of the Zurich C-14 sample. They believed that the sample was “*touched up to prevent unraveling*” (italics added) They further observed “We have to say that we see the twill pattern clearly on both sides, but still there is *something different left versus right*” (italics added).

**Source:** Ferguson & Co., Ltd. (Co. Down Ireland): Personal communication to M.Sue Benford and Joseph Marino, June 6, 2000 (<http://www.shroud.com/pdfs/marben.pdf>).

**Comments:** This analysis is significant inasmuch as the reviewers were blinded to the fact that the photograph was from the Shroud, which would eliminate any Shroud bias, pro or con.

**Entry: #26**

**Date: 2000**

**Data Category:** Possibility or direct evidence of invisible reweaving and & General possibility of repairs

**Evidence:** European-trained weaver David Pearson, owner of the French Tailors in Columbus, Ohio, was blindly shown photographs of the Zurich and uncut C-14 samples. He stated, “there is no question that there is different material on each side—it is definitely a patch.” Pearson stated that medieval European weavers would typically try to match the original cloth and then hand-stitch approximately ½ inch of new material into the old, *such that it was invisible* to all but the trained eye. This would ensure the long-term integrity of the material, while maintaining aesthetic consistency throughout the fabric.

**Source:** French Tailors (Columbus, Ohio): Personal communication to M.Sue Benford, June 21, 2000 (“Evidence For The Skewing of the C-14 Dating of the Shroud of Turin” by Joseph G. Marino and M. Sue Benford, <http://www.shroud.com/pdfs/marben.pdf>).

**Comments:** Pearson immediately recognized the disparate weave pattern and differences in thread size. Pearson was trained in Europe and explicitly states that invisible reweaving is “definite.” As the Savoy family owned the Shroud in the 16<sup>th</sup> century and had access to skilled European weavers, there is no doubt that they had the means to have a very thorough repair performed on the Shroud.

**Entry: #27**

**Date: 2000**

**Data Category:** Evidence of anomalous nature of C-14 corner & Possibility or direct evidence of invisible reweaving

**Evidence:** Louis Harner of Albany International, which does consulting, research, development, and manufacturing services related to paper, fibers, textile materials, and their composites, was also blindly shown the photograph of the Zurich C-14 sample and said “*the float is different on either side of the sample*” (italics added). It forms a thick/thin, thick/thin pattern on the right side, whereas the left is much more consistent throughout.

**Source:** Albany International Research Company (Mansfield, Massachusetts): Personal communication to M.Sue Benford and Joseph Marino, July 20 and August 2, 2000 (“Evidence For The Skewing of the C-14 Dating of the Shroud of Turin” by Joseph G. Marino and M. Sue Benford, <http://www.shroud.com/pdfs/marben.pdf>).

**Comments:** The thick/thin, thick thin pattern on the right side is probably due to the fact that each side of the pattern was woven independently, possibly corroborating David Pearson’s belief that part of the sample was a patch.

**Entry: #28**

**Date: 2000**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** Ronald Hatfield, a scientist at Beta Analytic, the world’s largest radiocarbon dating service, performed a theoretical C-14 calculation that supports the theory of a 16<sup>th</sup> century patch. A merging of threads from AD 1500 into a 2,000 year old piece of linen would augment the C-14 content, such that a 60/40 ratio of new material to old, determined by mass, would result in a C-14 age of approximately AD 1210.

**Source:** Beta Analytic Laboratories (Miami, Florida): Personal communication to M.Sue Benford and Joseph Marino June 9, 2000 (“Evidence For The Skewing of the C-14 Dating of the Shroud of Turin” by Joseph G. Marino and M. Sue Benford, <http://www.shroud.com/pdfs/marben.pdf>).

**Comments:** The Hatfield calculation correlates very closely with the Oxford mean date of AD 1200 as reported in Nature and with the observed ratio of original versus medieval material in the C-14 sample. See figure 3 at “Evidence For The Skewing of the C-14 Dating of the Shroud of Turin” by Joseph G. Marino and M. Sue Benford, [www.shroud.com/pdfs/marben.pdf](http://www.shroud.com/pdfs/marben.pdf) .

**Entry: #29**

**Date: 2000**

**Data Category:** Evidence of anomalous nature of C-14 corner & General possibility of repairs

**Evidence:** Adler writes, "...a radiocarbon dating examination was authorized and carried out in 1988. As this examination assigned a 14<sup>th</sup> century date to the Shroud, it only exacerbated the polemics. Unfortunately, the protocol recommended by a convened panel of experts for the taking of proper cloth samples for the radiocarbon analysis was not followed. Only a single sample was taken and that was from a most unsuitable location, i.e., from the edge of a bounded waterstained scorch area *where evident repairs had been made*. Therefore while this dating study can claim good precision for its reported date, it cannot assign any accuracy to the Shroud's historical date as it is not clearly established that the location sampled is typical of the rest of the cloth. In order to check this point, *fibers from the radiocarbon samples show a distinctly different spectrum and therefore it can be inferred that their composition is not typical of the rest of the cloth*. Why this is so is not entirely clear, *but it does establish the fact that the accuracy of the radiocarbon date can be questioned on the basis of direct experimental evidence* (italics added). Many theories and explanations have been advanced to attempt to resolve the dating inconsistencies but the matter can really only be resolved by further experimental investigation of cloth samples from the Shroud itself.

**Source:** Adler, Alan. D. "Chemical and Physical Aspects of the Sindonic Images" in *The Orphaned Manuscript: A Shroud Spectrum International Special Issue.* Torino: Effata Editrice, 2002, pg. 25.

**Comments:** (See also entry numbers 18, 19, 22 and 24 in this section.)

**Entry:** #30

**Date:** 2002

**Data Category:** Evidence of anomalous nature of C-14 corner & Possibility or direct evidence of invisible reweaving

**Evidence:** Ray Rogers and Anna Arnoldi, revealed that *ultraviolet photography and spectral analysis showed that the area from which the samples were taken was chemically unlike the rest of the cloth*. In that area, *madder root dye and an aluminum oxide mordant (a reagent that fixes dyes to textiles) were found, but these do not appear to be present elsewhere on the Shroud*. Rogers also revealed the existence of a splice in one of the Raes threads, which comes from an area right next to the C-14 sample area. He wrote "Raes thread #1 shows distinct encrustation and color on one end, but the other end is nearly white. The photograph was taken on a 50% gray card for color comparison. Fibers have popped out of the central part of the thread, and the fibers from the two ends point in opposite directions. *This section of yarn is obviously an end-to-end splice of two different batches of yarn. No splices of this type were observed in the main part of the Shroud.*"

**Source:** "Scientific Method Applied To The Shroud of Turin: A Review" by Raymond N. Rogers and Anna Arnoldi, [www.shroud.com/pdfs/rogers2.pdf](http://www.shroud.com/pdfs/rogers2.pdf)

**Comments:** The finding of the madder root dye and the aluminum oxide mordant that fixes dyes to textiles is consistent with Adler's finding of aluminum. (See entry number 22 in this section.) These findings were the preliminary work by Rogers, which culminated in a 2005 peer-



reviewed article published in *Thermochimica Acta*. (See entry number 37 in this section.) If there is a splice in the Raes samples, it obviously leaves open the strong possibility that there were splices in the actual C-14 sample area.

**Entry: #31**

**Date: 2002**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** Marino and Benford had submitted to the journal *Radiocarbon* the paper they presented at the Sindone 2000 Congress in Orvieto, Italy where they first presented their reweave theory. Since accepting it would have been an admission that key elements had been overlooked before and during the C-14 testing, the paper was, not surprisingly rejected. The paper was resubmitted to them after evidence was found by Ray Rogers that the C-14 sample area was chemically different from the main part of the Shroud, cited above. .

**Source:** “Textile Evidence Supports Skewed Radiocarbon Date of Shroud of Turin” by M. Sue Benford and Joseph G. Marino, <http://www.shroud.com/pdfs/textevid.pdf>

**Comments:** No response was received from *Radiocarbon* after the paper was resubmitted with the corroborating evidence from Rogers’ data. Clearly, with the solid data put forth by Rogers, some sort of response was warranted.

**Entry: #32**

**Date: 2002**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** Robert Buden, President of Tapestries & Treasures. Tapestries & Treasures ([www.tapestries4less.com](http://www.tapestries4less.com)) produces, imports, exports, and distributes high-quality, historical tapestries to clients throughout the world, including 16<sup>th</sup> Century pieces, wrote “The questions posed to me were: Is there such a thing as invisible weaving? Had weavers mastered repair techniques by the 16<sup>th</sup> Century? If the repair is invisible, then how do you know it is there? Next it was explained to me that these questions were asked in accordance to the Shroud of Turin and its repairs....Did weavers of the 16<sup>th</sup> Century possess the skill to ‘invisibly repair’ textiles? Most definitely. Would the restoration of a Holy Relic like the Shroud of Turin be assigned to a novice or the finest craftsmen in the land? I think the latter. Was budget a concern for the Church or its noble owner at the time? Most likely not. Is it plausible that the Shroud of Turin received the best care to insure it would last many more years as an icon to faithful and that fibers extracted by scientists for testing were removed from repaired areas and not from the original fabric? Retesting of additional areas will confirm this.”

**Source:** “Historical Support of a 16<sup>th</sup> Century Restoration in the Shroud C-14 Sample Area by M. Sue Benford and Joseph G. Marino, with special contribution by Robert Buden, President, Tapestries & Treasures,” <http://www.shroud.com/pdfs/histsupt.pdf>



**Comments:** Buden concluded, “If you wish to see first hand, or not see, repair work done to tapestries - I suggest you visit a major museum and study the medieval tapestries to find the repairs. If you are unable to locate any such repairs, arrange to meet with the textile curator. While waiting, study the quality of the 16<sup>th</sup> Century tapestries, they are amazingly tight and fine. The curator may be able to point out where repairs have been performed on the medieval tapestries. Whether you can spot them or not may depend on the keenness of your eye and your level of knowledge in textile restoration.

Now that you have personally witnessed the skills of 16th Century weavers, ask yourself - could similar repair techniques have been used on the Shroud of Turin in the 16th Century?” According to one author, “During the sixteenth century the beautiful industry of tapestry-making reached almost its highest point of perfection” (Tremayne, E.E. The First Governess of the Netherlands: Margaret of Austria. New York: G.P. Putnam’s Sons, London: Methuen & Co., 1908, pg. 283). Between about 1520-1560 between 30 and 40 master weavers were prominently known throughout France (per Campbell, Thomas P. Tapestry in the Renaissance: Art and Magnificence. New Haven and London: Yale University Press, 2002, pg. 30. Campbell (personal communication, May 17, 2002) told Benford that the “. . .the sixteenth century weavers were magicians.” Campbell’s assessment of the weavers leaves open the definite possibility that it was rewoven.” Campbell also has stated in his personal communication to Benford that “All of the major European courts had teams of skilled weavers and embroiderers who were employed in the repair of high-quality textiles.”

**Entry: #33**

**Date: 2004**

**Data Category:** Evidence of anomalous nature of C-14 corner & Possibility or direct evidence of invisible reweaving

**Evidence:** Ray Rogers used a mass spectrometer to study the impurities on a number of samples that had been taken from the Shroud. Most of the structural materials and probable impurities in Shroud samples were carbohydrates, and he wanted to see if there were traces of other materials. Rogers concluded that *the Raes sample* (which was right next to the C-14 sample) *contained pentose-sugar units, unique among all of the Shroud samples—no other area showed this pentose pyrolysis signal—and that it confirmed his earlier identification of a gum coating on the Raes threads.*

**Source:** Pyrolysis/Mass Spectrometry Applied To The Shroud Of Turin by Raymond N. Rogers, <http://www.shroud.com/pdfs/rogers4.pdf>

**Comments:** The samples were run at the Midwest Center for Mass Spectrometry (MCMS), University of Nebraska-Lincoln. This is a National Science Foundation “Center of Excellence,” and it ranks among the foremost facilities in the world.

**Entry: #34**

**Date: 2004**

**Data Category:** Evidence of anomalous nature of C-14 corner & Possibility or direct evidence of invisible reweaving

**Evidence:** [Verbatim text of Appendix as cited below in this entry's "Source section":] The following contains the earliest summarizing communiqué by the late Ray Rogers to the Shroud Science Group regarding the splice implying an invisible reweave: I have included it here because it should be on the historical record as a significant contribution to the debate related to the "invisible reweave". This email was in response to doubts and views expressed by some members of the Shroud Science Group over whether or not the 'invisible reweave' is the explanation for the radiocarbon dating results. This communiqué was dated March 05, 2004, 2:30 AM.

"In English we have a saying: 'We will agree to disagree.' With regard to the validity of the radiocarbon sample, we will have to do exactly that—for now."

"1) I agree that the uv-fluorescence photograph alone does not prove anything. A fluorescence spectrum may allow identification of some chemical species, but a lack of fluorescence does not. All the photograph indicates is that the entire area around the Raes sample and the radiocarbon sample shows an anomaly. It is probably the same anomaly all over the area. The important fact is that it is not the only piece of evidence.

"2) I agree that the traces of cotton would not prove anything. However, I believe that important amounts of cotton exist in the sampling area. There is a big difference in importance between a few foreign cotton fibers found on the outside of a sample and cotton mixed throughout the sample. I have found copious amounts of cotton at the core of all of the yarn segments I have dissected.

"3) I agree that the sampling area certainly looked a lot like the rest of the cloth. However, on closer, careful inspection, it does not resemble the rest of the cloth in many ways. For example, it is coated with a unique gum/dye/mordant layer. That is only observed with proper microscopy technique, but it is very easy to see with a microscope.

"4) I agree that it is quite difficult to observe any difference in the sampling area by looking at it in reflected light. I believe it was manipulated to match the main part of the cloth, but that is no proof. However, a completely independent analysis by pyrolysis/mass spectrometry found anomalous amounts of furfural being produced from the sampling area. No other area of the Shroud gave the same results. There must be a reason. The most probable reason is the pyrolysis of a pentosan plant gum, exactly what Prof. Brown and I see with other tests.

"5) I agree that I do not see any evidence for an "invisible" (or French) reweave by observations with reflected light. I do, however, see an end-to-end splice that was very obscure among the Raes threads. We have not seen any similar feature anywhere else in the Shroud. Is such a feature part of the French reweaving process? Incidentally, one end of the splice had a different chemical composition than the other.

"When I consider all of the evidence that the anomalously low-fluorescence area of the cloth also has anomalous features and chemical composition, I have to conclude that a terrible mistake was

made in choosing that area for the radiocarbon sample. It is the combination of pieces of evidence that must be considered.

“Would you agree that a careful analysis of a documented sample from the middle of the radiocarbon sample could solve our problem and lead to complete agreement? Perhaps we could petition for such a sample.”

**Source:** Maloney, Paul C. “What Went Wrong With the Shroud’s Radiocarbon Date? Setting it all in Context.” Appendix I: Ray Rogers’ email regarding the splice.

Talk given at the “The Shroud of Turin: Perspectives on a Multi-Faceted Enigma” conference in Columbus, Ohio on August 14-17<sup>th</sup> 2008, which is scheduled to be accessible online at [www.ohioshroudconference.com](http://www.ohioshroudconference.com) by January 1, 2009.

**Comments:** One can again only hope that based on all the evidence raised by Rogers and on the advice of Adler, the Turin authorities would allow additional testing regarding the validity of the C-14 sample.

**Entry: #35**

**Date: 2004**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** Lloyd Currie, a highly-regarded specialist in the field of C-14 dating and a National Institute of Standards and Technology Fellow Emeritus authored a paper in which he dismissed the 1532 fire heat-effect, contamination, and “bioplastic coating” theories that had been advanced to explain why the radiocarbon results had not dated the Shroud as first century—but recognized the possibility that the C-14 sample had been taken from a rewoven area.

**Source:** Currie, Lloyd A. “The Remarkable Metrological History of the Radiocarbon Dating [II],” *Journal of Research of the National Institute of Standards and Technology*, 109:2:185-217. Accessible at <http://hbar.phys.msu.ru/gorm/dating/histC14.pdf>.

**Comments:** Curry also faulted Turin for failure to use multiple samples in the C-14 procedure.

**Entry: #36**

**Date: 2005**

**Data Category:** Evidence of anomalous nature of C-14 corner & General possibility of repairs

**Evidence:** Researchers Alan and Mary Whanger write “Wondering how such an erroneous dating could have happened, we obtained a copy of the videotape of the taking of the single specimen. On examining the videotape in detail frame by frame, we noted that the sample contained the seam and that, as the sample was pulled taut and cut, there were many weft threads that stood out very prominently from the seam extending across the sample used for the radiocarbon dating and into the Shroud fabric as far as 1½ inches (3.5 cm). These threads appeared to be very stiff, and it occurred to us immediately that this area had been rewoven,

repaired, or reinforced. We unofficially presented this finding and our interpretation of it at the Shroud Conference in Paris in 1989. We published these findings in 1998.” On the basis of examination of radiographs of the Shroud, they go on to say: “We think that the two corners (the MC [Missing corners] areas) were already damaged and possibly partially missing before the seam was put in. They may have been removed at the time the seam was put in as part of the process of repairing and strengthening the Shroud, and to make the areas neater (as well as to provide a source of relics). We suspect that the corners were damaged during ostensions (public displays) when the Shroud was always held up by the same edge, thus putting stress on the same side and especially on the corners. The fabric immediately adjacent to the two MC areas likely was damaged or weakened also, *and so meticulous repair and reweaving of these areas may have been done to restore the general appearance and to prevent further damage* (italics added). Our observations of the radiographs indicate that possible repairs or reweaving (other than the stitches and patches around the scorched and burned areas) were essentially limited to these two corner areas next to the sites of the MCs.”

“...we examined in detail the area of the C14 specimen on the radiographs. An irregular band of threads with increased radiodensity and extending variably about 5/8 inch (1.7 cm) into the Shroud fabric is noted immediately adjacent to much of the length of the seam that borders the frontal MC. In a close-up view of the area where the Raes sample and the single C14 sample were taken, irregularities in some of the weave pattern can be noted on the Shroud fabric adjacent to the seam. There is significant variability in the radiodensity of both warp and weft threads in this area. Some of the threads angulate, and the continuity of a few seems to be broken. This area is denser and the 3:1 herringbone weave pattern is much less obvious than in the nearby body of the Shroud fabric. Our conclusion is that the radiographs are strongly suggestive of significant alterations in the threads and weave of the Shroud fabric in the area from which the C14 specimen was taken, thus casting major doubts on the validity of the radiocarbon dating.”

**Source:** “*Excerpt from Radiological Aspects of the Shroud of Turin*” by Alan D. Whanger, M.D. and Mary Whanger, <http://www.shroud.com/pdfs/whanger.pdf>

**Comments:** The Whangers presented this paper at the 2005 Dallas International Shroud conference.

**Entry:** #37

**Date:** 2005

**Data Category:** Evidence of anomalous nature of C-14 corner & Possibility or direct evidence of invisible reweaving

**Evidence:** Ray Rogers’ peer reviewed paper in the world-renowned journal *Thermochimica Acta* is published. Rogers writes: “The presence of alizarin dye and red lakes in the Raes and radiocarbon samples indicates that the color has been manipulated. Specifically, the color and distribution of the coating implies that repairs were made at an unknown time with foreign linen dyed to match the older original material. Such repairs were suggested by Benford and Marino.” Rogers concluded “Pyrolysis-mass-spectrometry results from the sample area coupled with microscopic and microchemical observations prove that the radiocarbon sample was not part of

the original cloth of the Shroud of Turin. The radiocarbon date was thus not valid for determining the true age of the shroud.” Rogers also noted regarding one of his chemical analyses, “The Raes threads, the Holland cloth, and all other medieval linens gave the test for vanillin wherever lignin could be observed on growth nodes. The disappearance of all traces of vanillin from the lignin in the shroud indicates a much older age than the radiocarbon laboratories reported.”

**Source:** Rogers, R.N. Studies on the Radiocarbon Sample of the Shroud of Turin. *Thermochimica Acta*, Vol. 425, No. 1/ 2, 20 January 2005, pp. 192-193. Accessible at <http://www.shroud.it/ROGERS-3.PDF>

**Comments:** Regarding the findings by Benford and Marino, Rogers said “I believed that it would be easy to completely refute them. It is highly embarrassing that I could not. This is the first time I have had to present information that seemed to support what I consider to be the ‘lunatic fringe.’ However, an ethical scientist absolutely must publish accurate information no matter what the emotional implications” (as cited in “Ghiberti’s pronouncement on my analyses by Raymond N. Rogers, <http://www.shroud.it/ROGERS-5.PDF>). In order to see Ray Rogers defend his conclusions against professional American skeptic Joe Nickell, go to: [www.csicop.org/specialarticles/shroud.html](http://www.csicop.org/specialarticles/shroud.html) .

Physicist and artist Isabel Piczek wrote “It is not good enough just to look (with the naked eye) for a re-woven patch. It is an *invisible* reweave, which requires microscopic and microchemical analysis (to discover). Rogers’ paper has to be accepted. New discoveries always cause lots of controversy, but (Roger’s report) should be trusted because it was published in a peer-reviewed journal (as cited by Muldoon, Shena. “Was the Dating a Hoax?” *Inside the Vatican*, 13:2 [March 2005], pg. 25). Even after this data was released, Turin’s Monsignor Giuseppe Ghiberti told an Italian newspaper, “I am astonished that an expert like Rogers could fall into so many inaccuracies in his article.” However, a short time after that, The Diocesan Commission for the Holy Shroud released another statement, saying that the study of Rogers was “very interesting” and would be the basis for a future study “on the chemical characteristics of the cloth and its possible inhomogeneity” (as cited in Muldoon, Shena. “Was the Dating a Hoax?” *Inside the Vatican*, 13:2 [March 2005], pg. 25.) It cannot be emphasized enough that insofar as he was the only person to have access to main Shroud samples and samples from the C-14 sample area, Roger’s judgment should carry enormous weight. To see Rogers’ impressive resume, go to: <http://www.shroud.com/pdfs/rogersresume.pdf> .

**Entry: #38**

**Date: 2005**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** Microscopist John L. Brown, formerly Principal Research Scientist at the Georgia Tech Research Institute’s Energy and Materials Sciences Laboratory, independently confirmed many of Rogers’ findings. Of one particular set of microscopic images, Brown wrote, “This would appear to be obvious evidence of a medieval artisan’s attempt to dye a newly added repair region of fabric to match the aged appearance of the remainder of the Shroud.”

**Source:** “Microscopical Investigation of Selected Raes Threads From the Shroud of Turin” by John L. Brown, [www.shroud.com/pdfs/brown1.pdf](http://www.shroud.com/pdfs/brown1.pdf)

**Comments:** Brown worked independently and with different methods than Rogers, including use of a scanning electron microscope.

**Entry: #39**

**Date: 2005**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** In response to a claim by textile expert, Mechthild Flury-Lemberg, who claimed in a personal communication to Benford and Marino in November 2000 that an “invisible reweave” was technically impossible, they contacted the president and owner of Without A Trace, Inc. ([www.withoutatrace.com](http://www.withoutatrace.com)) in Chicago, IL, Mr. Michael Ehrlich. Mr. Ehrlich’s response to Flury-Lemberg’s statement was that the modern-day, time-saving technique for large repairs, called “Inweaving,” would indeed be invisible from the surface but easily recognizable from the back as she claimed. However, the technique used in 16<sup>th</sup> Century Europe, called “French Weaving,” is an altogether different technique from Inweaving. French Weaving, now only done on small imperfections due to its extensive cost and time, results in both front and back side “invisibility.” Erlich also wrote, “Today, there is a modern, time-saving technique called ‘inweaving’ that would be invisible from the surface, but easily recognizable from the back. However, the technique used in sixteenth century Europe called “French weaving” is an entirely different matter. French weaving involves a tedious thread-by-thread restoration that is, indeed, invisible. Sixteenth century owners of the Shroud certainly had enough material resources and weeks of time at their disposal to accomplish the task

**Source:** Personal communication to M.Sue Benford and Joseph Marino, 2005 and Balsiger, David W. and Michael Minor. The Case for Christ’s Resurrection. Orlando: Bridge-Logos, 2007, pg. 159.

**Comments:** Benford and Marino visited several Savoy palaces in Italy in 2000; given how opulent, lavish, and ornate the palaces were, there is absolutely no doubt that the Savoys, who owned the Shroud in the 16<sup>th</sup> century, had all of the means to perform a thorough, invisible reweaving of the Shroud. Flury-Lemberg also claimed (Flury-Lemberg. Mechthild, Sindone 2002. Torino: ODPF, 2003, pg.60) that an invisible reweave would be visible on the backside of a garment.

However, historical evidence demonstrates that it was not only possible for medieval weavers and embroiderers to invisibly mend textiles such that they were not top-side detectable, but it is also recognized that they could choose whether or not to permit their handiwork from being detected. “Historically, reweaving was not carried out through a support fabric and was often executed so skillfully that it is not always recognizable as a later addition, although differences in the rate of dye fading have often revealed its presence . . . Evidence of reweaving would now [16<sup>th</sup> Century] usually be left deliberately visible on the reverse of the tapestry by the presence of the warp ends and knots” (Lennard, F and Hayward, M. *Tapestry Conservation: Principles and Practice*. Burlington, Massachusetts: Butterworth-Heinemann, 2006, pg. 6.) As this passage



infers, skillful medieval weavers could choose whether or not to leave evidence of their work on the back side of a fabric. Although a less-than-conventional restoration practice, it is known that in early part of the 16<sup>th</sup> Century the art of “reversing” was practiced such that tapestries could be viewed intact from either side of the cloth. “In August 1524 Wolsey’s Wardrobe of the Beds . . . ‘were shorne and new dressed on the wrong side’ . . .” (Lennard, F and Hayward, M. *Tapestry Conservation: Principles and Practice*. Burlington, Massachusetts: Butterworth-Heinemann, 2006, pg. 16.). Reversing resulted in the lack of any telltale signs of a back-side repair.

**Entry: #40**

**Date: 2008**

**Data Category:** Evidence of anomalous nature of C-14 corner

**Evidence:** One of the numerous scientific tests conducted in 1978 by STURP included “Spectrally-resolved Quad-Mosaic Photography” (*Operations Test Plan for Investigating the Shroud of Turin by Electromagnetic Radiation at Varying Wavelengths*. Shroud of Turin Research Project, Inc., 1978). This study, utilizing state-of-the-art NASA technology of the time, was designed to generate color discriminability products capable of conducting a chemical distribution analysis of the surface of the linen cloth. According to the STURP researchers in charge of this study, “The generation of color products was considered the most important image processing task. From a color enhanced, relative color display, the color of different features of the image can be compared” (see: C. Avis C, D. Lynn, J. Lorre, S. Lavoie, J. Clark, E. Armstrong, J. Addington. *IEEE 1982 Proceedings of the International Conference on Cybernetics and Society*. October 554-558 (1982).

**Source:** See references cited for this entry above in the “Evidence” section above and “Comments” section below.

**Comments:** The quad-mosaic photo of the C-14 area shows a greenish hue surrounding the Raes fragment, a very different color from the orange and yellow of the main body of the Shroud. Had this photo been examined before the 1988 dating, it should have been pretty obvious that this area was anomalous. This photo has been published publicly for the first time in Benford, M.S. and Joseph G. Marino, “Discrepancies in the radiocarbon dating area of the Turin shroud,” *Chemistry Today*, 26:4 (Jul/Aug 2008), pp. 6-7 and can also be found in “Surface Chemical Analysis of the Shroud of Turin Identifies Discrepancies in Radiocarbon Dating Region” by M. Sue Benford and Joseph Marino, presented at the “The Shroud of Turin: Perspectives on a Multi-Faceted Enigma” conference in Columbus, Ohio on August 14-17<sup>th</sup> 2008, which will be accessible online at [www.ohioshroudconference.com](http://www.ohioshroudconference.com) by January 1, 2009.

**Entry: #41**

**Date: 2008**

**Data Category:** Evidence of anomalous nature of C-14 corner & Possibility or direct evidence of invisible reweaving

**Evidence:** Robert Villarreal, an analytical chemist from Los Alamos Laboratories, who had been given Raes samples from Ray Rogers, presented new evidence at an international Shroud conference based on his work with 8 other researchers. Villarreal had studied a spliced fiber from the Raes sample (Thread #1) at Ray Rogers' request. The 2 ends of the fiber appeared to be different in color and amounts of coating. Rogers had asked if Villarreal could use his highly sensitive lab instrumentation to analyze the thread. In addition, Villarreal was also asked (by Rogers' colleague Barrie Schwartz of STURP and Benford) to analyze two other threads (Threads #7 & 14) from John Brown's lab in Marietta, Georgia. Sadly, Rogers died before the work was completed. Villarreal primarily used a Time-of-Flight Secondary Ion Mass Spectrometry (ToF-SIMS) and a Fourier Transform Infrared Spectroscopy (FTIR) with Reflectance Mode Capability.

The ToF-SIMS results showed that the spectra from the two ends were similar to cotton rather than linen (flax). After several scans of individual fibers from Thread #1, the FTIR data demonstrated that the 2 ends were *definitely cotton and not linen* (flax). The crust appeared to be an organic-based resin, perhaps a terpene species, with cotton as a main sub-component. *The final results of the FTIR analysis on all three fibers taken from the Raes sampling area (adjacent to the C-14 sampling corner) led to identification of the fibers as cotton and definitely not linen (flax).*

**Source:** Analytical Results On Thread Samples Taken From The Raes Sampling Area (Corner) Of The Shroud Cloth by Robert Villarreal with Barrie Schwartz and M. Sue Benford. Presented at "The Shroud of Turin: Perspectives on a Multi-Faceted Enigma" conference in Columbus, Ohio on August 14-17<sup>th</sup> 2008, which will be accessible online at [www.ohioshroudconference.com](http://www.ohioshroudconference.com) by January 1, 2009.

**Comments:** Villarreal pointed out that one of the first rules of radiocarbon dating is that any sample analyzed to characterize an area or population must necessarily be representative of the whole. Villarreal's analyses of the 3 thread samples taken from the Raes and C-14 sampling corner led him to conclude that this was not the case.

**Entry: #42**

**Date: 2008**

**Data Category:** Evidence of anomalous nature of C-14 corner & Possibility or direct evidence of invisible reweaving

**Evidence:** Independent researcher, Dr. Thibault Heimburger, M.D. performed analyses on one of the threads that had been in the possession of Robert Villarreal. His conclusions: Gilbert Raes (*in*: "La S. Sindone"-Supplemento Rivista Diocesana Torinese, gennaio 1976) found "traces" of cotton in both warp and weft threads in one of the two parts of his sample in 1973: the part pertaining to the main Shroud (piece 1). He found no cotton at all in piece 2 (the "side strip").

\_\_\_\_\_ . The number of reversals observed in the cotton fibers is low, probably consistent with the number of reversals found by Raes (roughly 8 per cm.), corresponding to the type "Herbaceum". Raes#7 matches all the characteristics described by Gilbert Raes for a weft thread of piece 1.



Ray Rogers found many cotton fibers in the Raes threads and only traces of cotton among several hundred surface fibers on the sticky-tapes taken from the surface of the Shroud. Recently, the LANL analyzed 27 fibers from Raes #1, 7 and 14 and found only cotton spectra leading to the conclusion that: “the results of the FTIR analysis on all three threads taken from the Raes sampling area (adjacent to the C-14 sampling corner) led to identification of the fibers as cotton and definitely not linen (flax)”.

This careful study of several dozens of fibers at high magnification shows that there are both linen and cotton fibers in Raes#7. Many fibers are strongly colored and encrusted.

The observation of groups of 20-30 fibers shows that cotton and linen tends to be gathered (this may explain the results of LANL). Often the fibers are packed at one end and further divide.

**The observation of about 50-70 surface fibers shows clearly that Raes#7 is a true weft thread of piece 1 of the “Raes sample” and does contain roughly 15-35% of cotton, supporting Ray Rogers’ claims.** (emphasis in original)

The simple observation with a binocular magnifying glass (or even a microscope) of the threads does not allow the finding of cotton among linen fibers. **ONLY** the separation of many individual fibers makes it possible to recognize the nature of the fibers. It was never done during the sampling of the C-14 area adjacent to the Raes sample nor, as it seems, by the laboratories.

The 3 glass-sides will be soon sent for UVRRS studies.

UVRRS studies will be used to:

- 1) Confirm and obtain a better quantification of both species by quick scanning all the available fibers: cotton does not contain lignin contrary to linen. UVRRS can detect lignin specifically with a very high sensitivity (0.1% wght).
- 2) Semi-quantitative comparison of the amount of lignin (1600 cm<sup>-1</sup> aromatic ring peak intensity) between the linen fibers of Raes#7 and the linen fibers of the main Shroud (from the “so-called-Riserva”).

**Source:** Heimburger, Thibault, “High Magnification Microscopy Studies of Surface Fibers from Raes # 7, [www.shroud.com/pdfs/thibault02.pdf](http://www.shroud.com/pdfs/thibault02.pdf).

**Comments:** Raes Thread #7 was obtained by Dr. Heimburger directly from Robert Villarreal (Los Alamos National Laboratory) during the conference on the Turin Shroud in Columbus, Ohio in August 2008, in the presence of Barrie Schwartz, Sue Benford and Joseph Marino (and documented by photographs by Barrie Schwartz). Heimburger’s report will be published on [www.shroud.com](http://www.shroud.com) around late January 2009. In an email to me, Sue Benford and Barrie Schwartz on 20 November, Heimburger, after examining the sample in a polarizing light microscope, wrote “I can now confirm with absolute certainty that there are cotton fibers in the thread....on the ‘internal layer’ I can say that I see clearly bundles of 5-10 cotton fibers at least in 2 directions and some individual cotton fibers...I would say finally that Raes 7 does contain about 10% of cotton, perhaps more in the external layer. But, most importantly, it is absolutely sure that most of the cotton fibers are gathered together in bundles mixed with linen fibers inside the whole thread. Ray [Rogers] was absolutely right but now we can describe more clearly the structure of Raes 7 and I can show not only individual fibers but also the groups of fibers. Raes 7 is definitely a ‘metis,’ ...i.e, a thread intentionally spun with linen and cotton.”

**Entry: #43**

**Date: 2008**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** Book titled: Frenway System of French Reweaving. Cover page says: “Detailed and complete instructions in the art of French Invisible Reweaving.”

**Source:** <http://www.shrouduniversity.com/textiles.php> .

**Comments:** Although some people scoffed at the idea that a technique called “invisible reweaving” could even exist, this book (1962) was discovered independently by 2 members of the Shroud Science Internet Group within 10 days of each other. Needless to say, this book proves that the technique does indeed exist. As of this writing, the first 55 pages of the book are accessible at the site listed. Presumably, the remainder of the book will be available at some point in the future.

**Entry: #44**

**Date: 2008**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** In a story released by the University of Arizona, one of the 3 labs to date the Shroud, they showed magnified fibers from the cloth. The caption read, “Polarized Light Microscopy was used to confirm that the *major* fiber content of the sample is linen (our emphasis).”

**Source:** Art and Science Converge in State Museum Exhibit, by University Communications, November 3, 2008. Accessible at <http://uanews.org/node/22384> .

**Comments:** The fact that the word “major” is used in conjunction with the fiber content means that something besides linen was found there, perhaps some cotton? Arizona was contacted for additional pictures but to date there has been no response.

## CONCLUSION:

**Entry: #45**

**Date: 2008**

**Data Category:** Possibility or direct evidence of invisible reweaving

**Evidence:** “The Quad-Mosaic images, radiographic findings, textile evidence from the adjacent Raes sample, blinded-expert analysis of the Zurich C-14 sub-sample, and independent microscopic confirmation of surface contaminants in the Holland cloth/C-14 region supports (Ray) Rogers’ assertion that a surface dye was added to the Shroud in the area of the 1988 radicarbon sampling to disguise an undocumented repair...Also consistent with the data is the hypothesis that the person(s) responsible...also extracted a small section of main Shroud cloth

directly adjacent to the side seam and missing ventral corner, e.g., the C-14 sampling area...To hide the extraction, the missing material would have been patched and surface dyed, along with the newer backing material, such that it would not have been detected. Starch, which was identified in this area, was routinely used by medieval restorers to disguise invisible mending...”

**Source:** Benford M.Sue and Marino Joseph G. “Discrepancies in the radiocarbon dating area of the Turin shroud, “*Chemistry Today* (26:4, Jul/Aug 2008), pp. 8-9.

**Comments:** *Chemistry Today* is a peer-reviewed journal based in Milan, Italy ([www.chemistry-today.com](http://www.chemistry-today.com)). This summary shows the strength of the claim that the C-14 sample used in the 1988 testing was NOT representative of the main cloth and thus was NOT valid for determining the true age of the cloth.

## APPENDIX: C-14 ASPECTS

**Entry: #1**

**Date: 1965**

**Evidence:** Robert Stuckenrath, one of the early pioneers of C-14 dating, pointed out, “The date of a sample whose provenience is in doubt is worse than useless—it is misleading.”

**Source:** Stuckenrath, Robert, Jr., “On the Care and Feeding of Radiocarbon Dates,” *Archaeology*, 18:281 (1965)

**Comments:** The Shroud dating may be a classic example of this statement.

**Entry: #2**

**Date: 1973**

**Evidence:** Professor Cesare Codegone, a physicist from Turin, when discussing the possibility of C-14 dating, stated, “the sacred linen has undergone vicissitudes which could have altered its composition [and which] give rise to grave uncertainties.”

**Source:** As cited in Meacham, William, “Radiocarbon Measurements and the Age of the Turin Shroud: Possibilities and Uncertainties” in *Turin Shroud: Image of Christ?* Hong Kong: Cosmos Printing Press Ltd, 1987, pg. 45. Available at [www.shroud.com/meacham.htm](http://www.shroud.com/meacham.htm).

**Comments:** This could possibly be one of the first published statements that indicate that known events like the 1532 fire or possible unknown events could have thrown off the C-14 dating.”

**Entry: #3**  
**Date: 1977**

**Evidence:** Monsignor Jose Cottino, spokesman for the Turin authorities, when asked about the possibility of C-14 dating, commented "...the cloth had been handled so much, and been in and out of at least two fires, that its carbon content might very well have been affected under such adverse conditions. Carbon 14 is good for objects that have been protected in the earth or in caves, but not for the shroud."

**Source:** As cited in Wilcox, Robert, Shroud (New York: Macmillan, 1977), pg.17

**Comments:** This makes the valid point that C-14 generally works better on objects that haven't been exposed to the environment. Although Cottino stated in 1977 that the Shroud was not a suitable object for C-14 dating, considerable advances were made in the C-14 field by the time of the Shroud dating in 1988, although needless to say, there were still an abundance of problems as shown by all the entries in this appendix.

**Entry: #4**  
**Date: 1982**

**Evidence:** A C-14 project had twenty different labs each date eight samples from one tree. The results revealed an "existence of systematic bias and unexplained variability."

**Source:** International Study Group, "An Inter-Laboratory Comparison of Radiocarbon Measurements in Tree Rings, *Nature* 298:619 (1982).

**Comments:** According to C-14 expert Reidar Nydal, who wrote about this story the following year in "Optimal Number of Samples and Accuracy in Dating Problems." *PACT*, 8:107 (1983), the main reason for using more than one sample...is generally to get some idea of the magnitude of other sources of error rather than purely statistical ones." This clearly indicates that problems of unknown origins can surface in C-14 testing.

**Entry: #5**  
**Date: 1983**

**Evidence:** C-14 scientist W.G. Mook cites the need "for relating radiocarbon dates with ages obtained by other independent physical dating methods."

**Source:** Mook, W.G., "C-14 Calibration Curves Depending on Sample Time-Width," *PACT* 8:518 (1983)

**Comments:** C-14 needs to be evaluated in a multi-disciplinary context, not in isolation from other data.

**Entry: #6**  
**Date: 1983**

**Evidence:** French C-14 scientist Jacques Evin, who took part in the C-14 dating, wrote, “It is evident that the samples to be dated should contain carbon. However, the mere presence of this chemical element is not sufficient to produce a valid result. After many years of C-14 dating it has been shown that *numerous results are in error or are erroneously interpreted, often because of lack of knowledge about the value of the material selected for dating* (italics added).

**Source:** Evin, Jacques, “Materials of Terrestrial Origin Used for Radiocarbon Dating,” *PACT*, 8:235 (1983).

**Comments:** Despite Evin’s comment, the authorities didn’t adequately consider the potential problems of the C-14 sample area.

**Entry: #7**  
**Date: 1983 and 1984**

**Evidence:** Robert Otlet of Harwell had suggested in 1982 that the British Museum supervise an inter-laboratory comparison between 6 labs being considered for the C-14 Shroud testing by providing them with samples of known dates. These tests were carried out in 1983 and 1984

**Source:** Sox, David. The Shroud Unmasked. Hampshire: The Lamp Press, 1988, pg. 94

**Comments:** See separate entries for 1985 when results were discussed at a meeting in Trondheim, Norway and under 1986, when findings from this intercomparison was actually published in a journal. (See entry numbers 9 and 13 in this section.)

**Entry: #8**  
**Date: 1984**

**Evidence:** Rev, Robert Wild, S.J., a Jesuit historian who believes that the Shroud is a fourteenth century forgery, wrote that “test results showing a late date would be attributed to contamination, a not unreasonable suggestion in the light of everything the shroud has been through.”

**Source:** “Wild, Robert A, S.J., “The Shroud of Turin: Probably the Work of a 14<sup>th</sup> Century Artist or Forger,” *Biblical Archaeology Review*,” 10(2):38 (1984).

**Comments:** Recent studies seem to show that contamination is likely not able to cause an approximate 1,200 year gap needed to bridge the AD 1260-1390 dates of the C-14 results and a 1<sup>st</sup> century date if the Shroud is the burial cloth of Jesus. However, an invisible reweave can easily explain the gap.

**Entry: #9**  
**Date: 1985**

**Evidence:** At a radiocarbon conference held in Trondheim, Norway in June 1985, the following points were agreed upon regarding the Shroud C-14 testing:

1. The British Museum would be the coordinating institution, and “guarantor” of the tests.
2. The “good offices” of STURP would be used to arrange for appropriate samples to be removed.
3. The British Museum would provide two additional samples both of whose age were known (+ or – 150 years or better). All three samples, including that from the shroud, would be unraveled and the threads cut into short lengths to render them as indistinguishable as possible.
4. The British Museum would obtain written agreement not to reveal results to anyone other than designated officials of the museum.
5. The six laboratories would use whatever methods they chose for preparing the samples for measurement, but detailed description of procedure and how they calculated their mean values and their uncertainties would be carefully recorded.
6. Results would be sent to the Vatican and Archbishop of Turin. A press release would be issued only when Turin and the Vatican had received the results.

**Source:** Sox, David. The Shroud Unmasked. Hampshire: The Lamp Press, 1988, pg. 96

**Comments:** Not all points were followed. STURP was eventually eliminated from involvement. Results also got leaked before the official announcement. See also entry number 13 in this section.

**Entry: #10**  
**Date: 1986**

**Evidence:** The original C-14 date obtained for one artifact...was in error by almost 26,000 years.

**Source:** Nelson, D.E. “New Dates on Northern Yukon Artifacts: Holocene Not Upper Pleistocene.” *Science*, 232:249 (1986)

**Comments:** Although extreme and probably somewhat rare in the enormity of the error, this is an example of how much C-14 dating can be off.

**Entry: #11**  
**Date: 1986**

**Evidence:** Archaeologist William Meacham quotes William Libby, the inventor of the C-14 method as saying, “There are no absolute dates.”

**Source:** As cited in Meacham, William, “On Carbon Dating the Turin Shroud,” *Shroud Spectrum International* 5(2):20 (1986)

**Comments:** Meacham also commented in “Radiocarbon Measurements and the Age of the Turin Shroud: Possibilities and Uncertainties” in *Turin Shroud: Image of Christ?* Hong Kong: Cosmos Printing Press Ltd, 1987, pg. 42, that there many misconceptions among journalists, the general public, and even among social and physical scientists. He emphasized that among specialists who use the method often, it is *not* considered as a test that can be accepted as absolute for every sample that is measured.

**Entry: #12**

**Date: 1986**

**Evidence:** Archaeologist William Meacham stated, “Regardless of the C-14 result, evidence from other sources would of course remain of considerable importance in the overall evaluation of the age and origin of the relic.”

**Source:** Meacham, William, “On Carbon Dating the Turin Shroud,” *Shroud Spectrum International*, 5(2):24 (1986)

**Comments:** Meacham was one of the few who warned about relying too heavily on the C-14 dating results while downplaying evidence from other sources, which appears to be exactly what has happened in the media and among the general public in the case of the Shroud.

**Entry: #13**

**Date: 1986**

**Evidence:** A dry run test in preparation for the 1988 C-14 dating was held in 1983 and 1984 by the British Museum. The museum provided six different labs (all of which would be formally recommended to the authorities to participate in the Shroud test) with several samples of linen of known date. An intercomparison of results between six labs had been suggested, because, in anticipation of the Shroud testing, “it’s generally agreed that any such measurement ought not to be undertaken by a single laboratory, *or even by the use of a single technique*” (italics added).

**Source:** R. Burleigh, M. Leese and M. Tite. “An Intercomparison of Some AMS Labs and Small Gas Counter Labs.” *Radiocarbon*, 28:571 (1986).

**Comments:** It had been originally proposed that 2 different methods of C-14 dating AMS (the only one ultimately used) and proportional counter be used on the Shroud. The latter was not used as it would have required too large of a sample. Because only 1 of the methods was used, it was imperative that the procedures used in the AMS method were rigorous. Although the labs may have accurately dated the pieces they were given, it can be argued based on the data presented in this paper that the test could have been performed more stringently. Burleigh’s report indicated that all of the labs apparently produced a wrong date on one of the samples, and

another sample was issued to replace that one. The dry run showed again how questionable dates often surface in C-14 results.

**Entry: #14**

**Date: 1987**

**Evidence:** Archaeologist William Meacham writes the year before the C-14 test that “it would be one further piece of evidence to be evaluated in the light of the total complex of data about the shroud.”

**Source:** Meacham, William, “Radiocarbon Measurements and the Age of the Turin Shroud: Possibilities and Uncertainties” in Turin Shroud: Image of Christ? Hong Kong: Cosmos Printing Press Ltd, 1988, pg. 44. Available at: [www.shroud.com/meacham.htm](http://www.shroud.com/meacham.htm).

**Comments:** In the case of the Shroud, Meacham again warned that the C-14 dating has to be judged in light of other scientific, medical, historical, and biblical knowledge.

**Entry: #15**

**Date: 1987**

**Evidence:** Although the planning meeting held in Turin in 1986 had recommended at least 7 labs to be used to date the Shroud, only 3 were chosen. The representatives of the seven labs, fearful of the ramifications of reducing the number of labs from 7 to 3, wrote a letter to Cardinal Ballestrero, custodian of the Shroud on July 1, 1987, saying “As participants in the workshop who devoted considerable effort to achieve our goal we would be irresponsible if we were not to advise you that this fundamental modification in the proposed procedures may lead to failure.” In December 1987, the representatives of the 3 labs that were chosen, wrote “As you are aware, there are many critics in the world who will scrutinize these measurements in great detail. The abandonment of the original protocol and the decision to proceed with only three laboratories will certainly enhance the skepticism of these critics.”

**Source:** As cited in Anderson, Ian, “Vatican Undermines Tests on Turin Shroud.” *New Scientist*, January 21, 1988, pg. 22.

**Comments:** The representatives of the labs themselves, including even the labs ultimately chosen, were not even pleased with the final protocol. The decision has been severely criticized by many, as the representatives had predicted.

**Entry: #16**

**Date: 1987**

**Evidence:** At a pre-test planning meeting in 1986 between the Turin authorities, representatives of various labs and C-14 experts, the following points were decided upon:



1. A minimum amount of cloth will be removed, which is sufficient (a) to ensure a result that is scientifically rigorous and (b) to maximize the credibility of the enterprise to the public.
2. The samples should be taken from an unobtrusive part of the Shroud, and from a portion which is not likely to yield other useful information. The samples should not include charred material. In addition to the Shroud samples, the British Museum will also prepare and provide two control samples for each laboratory.
3. For logistic reasons, samples for radiocarbon dating will be taken from the Shroud immediately prior to a series of other experiments planned by other groups. Selection of this material to be removed will be the responsibility of Madame Flury-Lemberg.
4. Seven samples containing a total of 50mg of carbon will be taken from the shroud . . . these shroud samples will be distributed to the seven laboratories in such a way as to ensure that the seven laboratories are not aware of the identification of their individual sample. This distribution will be the responsibility of the following three certifying institutions: the Pontifical Academy of Sciences, the British Museum and the Archbishop of Turin.
5. The taking of samples will be done so that representatives from the seven laboratories will have complete knowledge of the process.
6. At this time, a date will be chosen for submission of experimental results from the seven laboratories to the following three analyzing institutions: the Pontifical Academy of Sciences, the British Museum, and the Metrological Institute of Turin, "G. Colonnetti."
7. The cost of the experiments and the analyses will be borne by the participating institutions.
8. Samples from the Shroud will be taken by May 1987. It is hoped that the final result will be available by Easter of 1988.
9. The Archbishop of Turin will issue a press release concerning this Turin workshop.

**Source:** Gove, Harry. "Turin Workshop on Radiocarbon Dating the Turin Shroud." *Nuclear Instruments and Methods in Physics Research*, 1987, B29:193-195 and Sox, David, The Shroud Unmasked. Basingstroke, Hampshire: The Lamp Press, 1988, pp.108-109.

**Comments:** Point no.3 is significant in several respects. STURP had wanted to do the C-14 test in the context of multi-disciplinary testing, which is what is being alluded to by "series of other experiments planned by other groups." Unfortunately, only the C-14 test was done and no other testing was done. Flury-Lemberg supposedly was to select and even cut the sample, yet when the actual sample-taking took place, officials argued for an hour where to take the sample from and the sample was cut, not by Flury-Lemberg, but by Italian scientist Giovanni Riggi di Numana. Flury-Lemberg, according to Gove's book Relic, Icon or Hoax: Carbon Dating the Turin Shroud (Bristol: Institute of Physics Publishing: London, pg. 155) believed only 1 sample was needed to be taken because the cloth was the same everywhere. Given that other experts had noted various repairs on the Shroud, this does not seem to have been a wise assertion. Point no.4: Many people believe, based on this point, that the protocol called for seven samples from seven different sites on the Shroud. Bill Meacham, a participant in the meeting, says that there was only to be one sampling site (see: "How the Carbon Dating Went Wrong, <http://shroud.wikispaces.com/CARBON.14.DATING> ). Also, just as STURP's multi-

disciplinary testing plan was eliminated, the Pontifical Academy of Sciences' role in the C-14 testing was eliminated. (See entry #29 in this section.)

**Entry: #17**

**Date: 1988**

**Evidence:** Author Nick Rufford reported, “previous carbon dating tests on other relics have produced anomalies. Attempts by two laboratories to discover the age of Lindow Man—the ancient corpse found preserved in a British peat marsh—in 1984—resulted in dates four centuries apart...Another laboratory in Tucson, which is participating in the shroud tests, dated a Viking cow horn in 2006, 18 years in the future.”

**Source:** Rufford, Nick, “Vatican Steels Itself for ‘Fake’ Result.” *London Times*, August 7, 1988, pp. 1 and 3.

**Comments:** This once again shows how questionable dates often surface in C-14 results.

**Entry: #18**

**Date: 1988**

**Evidence:** Anna Hulbert of Oxfordshire, England, a specialist in the conservation of medieval paintings, stated, “Carbon dating, like X-rays or any other analytical technique, should be regarded as one tool among many. It is chiefly useful in the dating of undisturbed archaeological material. In the case of the Shroud, one should calculate carefully whether any of its known wanderings or adventures, such as the 1532 fire, could give a distorted reading to whatever date the radiocarbon laboratories come up with.”

**Source:** As cited in Jennings, Peter, “Art Historian Not Convinced Shroud is a Fake,” *Our Sunday Visitor*, October 23, 1988, pg. 24.

**Comments:** Although research has long been done trying to show that the 1532 fire could have caused a distorted reading, there has been no compelling evidence that it did. One of the “adventures” posited by Hulbert, however, could have been an invisible reweave.

**Entry: #19**

**Date: 1988**

**Data Category:** C-14 aspects

**Evidence:** The Zurich lab, one of the 3 to date the Shroud, was off by 1,000 years in the dry run because of improper pretreatment cleaning and also dated a 50 year old tablecloth to 350 years.

**Source:** As cited in Sox, David, The Shroud Unmasked. Basingstroke, Hampshire: The Lamp Press, 1988, pp. 118-119 and 138 respectively.

**Comments:** This once again shows how questionable dates often surface in C-14 results. Sox also says in this book (pg. 138): Wolfli decided to halve each of his samples. This was in case he needed to do further testing. He said the condition he gave for being involved in the first place was having enough sample material with which to work. *If anything went wrong*—as it had with the inter-lab comparison of 1982—Wolfli wanted another try (italics added).

**Entry: #20**

**Date: 1988**

**Evidence:** Harry Gove, inventor of the C-14 method used to date the Shroud, commented: “If there were some reason why the carbon-14 content in that particular piece was contaminated, it’s inaccurate. All of the labs used the same cleaning technique, and if there’s some kind of contaminant that was not taken care of, it would give the same answer to all three labs, and all three would be wrong.”

**Source:** As cited in Clark, Kenneth, “Carbon Tests Prove Shroud Is Not Burial Cloth of Jesus.” *Chicago Tribune*, January 17, 1988, pp.1-2.

**Comments:** Gove’s basic point holds if the sample was from a rewoven sample instead of the sample having been contaminated. This points out the danger of having only chosen one sample site instead of multiple sites.

**Entry: #21**

**Date: 1988**

**Evidence:** Willy Wolfli, who had been head of the Zurich lab at the time of the C14 dating, said “The existence of significant indeterminate errors can *never* be excluded from any age determination. No method is immune from giving *grossly* incorrect datings when there are non-apparent problems with samples originating in the field. The results illustrated [in paper referred to by Wolfli] show that this situation occurs *frequently*.” (All italics added by Meacham.)

**Source:** As cited in Meacham, William, “Turin Shroud Carbon Dating,” unpublished manuscript, 1988.

**Comments:** This is another indication of the general problems inherent in all C-14 datings.

**Entry: #22**  
**Date: 1988**

**Evidence:** Archaeologist Eugenia Nitowski stated, “In any form of inquiry or scientific discipline, it is the weight of evidence which must be considered conclusive. In archaeology, if there are ten lines of evidence, carbon dating being one of them, and it conflicts with the other nine, there is little hesitation to throw out the carbon date as inaccurate due to unforeseen contamination. The Shroud should not be given less than standard procedure...”

**Source:** Press Release of “Environmental Study of the Shroud of Jerusalem” on October 15, 1988.

**Comments:** This again points out the need for the Shroud to be considered only in a multi-disciplinary context.

**Entry: #23**  
**Date: 1988**

**Evidence:** Vittorio Marcozzi, Professor of Anthropology at the Pontifical Gregorian University, stated “Those who have studied the Shroud during the last 90 years, since the amateur photographer Pia discovered that there was a negative image on the cloth, do not have doubts about the small trustworthiness of these results.”

**Source:** As cited in Pennisi, Mirella, “Anger, Doubts, Disappointment,” *30 Days in the Church and the World* 1(7):73 (1988).

**Comments:** This reflects the common opinion that the Shroud most likely is an ancient burial cloth and that the AD 1260-1390 results from the C-14 test do not correlate well with the rest of the accumulated data.

**Entry: #24**  
**Date: 1988**

**Evidence:** Robert Hedges, one of the scientists from the Oxford lab that dated the Shroud, when asked how confident he was of being able to establish the Shroud’s age, admitted, “I wouldn’t put my life on it.”

**Source:** As cited in Glass, Robert, “Modern Technology May Finally Fix Age of the Shroud of Turin.” *Chicago Sun-Times*, April 8, 1988, pg.4

**Comments:** It’s not clear from the context why Hedges made this statement, but it is certainly interesting nonetheless.

**Entry: #25**

**Date: 1988**

**Evidence:** Dr. Garman Harbottle of the Brookhaven C-14 lab in Upton, New York, wrote, “The original protocol was pretty fail-safe. I think this way will be chancy As an experiment goes, it is not very well drawn up. If you do an experiment like this, you should do it right....With only three pieces of data, the project is fraught with danger. Even if it goes well, skeptics will have a field day. They can say the church had a chance to rig the results. If there is a problem, the whole thing will be a fiasco. They can lose more reputation than they gain. It’s a wild scientific problem these fellows have gotten into, a win-or-lose proposition.”

**Source:** As cited in Kava, Brad, “Scientist Protests Vatican Changes in Shroud Testing,” *Corpus Christi Caller-Times*, April 23, 1988, pg. 14A.

**Comments:** Harbottle expressed similar sentiments to Marino in an 1988 personal communication: writing “no matter what date is obtained, there will be many, skeptics or devout, who will be disappointed. They have already at hand more than sufficient ammunition to attack any date they do not like.” He concluded, “we have then, in my opinion, a shakey experiment, badly designed, innocent of peer-review, and having a reasonable chance of failing to produce a result convincing everyone, for all time, of the truth.”

**Entry: #26**

**Date: 1988**

**Data Category:** C-14 aspects

**Evidence:** Robert Otlet of Harwell, one of the four labs that was considered but was dropped, remarked “I think it’s as much a catastrophe as it would be if you allowed bulldozers to go over an archaeological site before you’ve examined it.” Otlet also remarked that the changing of the original protocol would lead to a “scientific catastrophe” because “the results on the issue of the shroud’s historical provenance would be wide open to criticism.”

**Source:** As cited in Glass, Robert, “Modern Technology May Finally Fix Age of the Shroud of Turin.” *Chicago Sun-Times*, April 8, 1988, pg.4.

**Comments:** Although these comments could easily be considered sour grapes, there is plenty of other evidence that no one in the C-14 community was pleased with the final protocol carried out by the Turin authorities. Otlet went so far as to say (Wright, Pearce, “New Dispute on Dating Tests, *London Times*, January 16, 1988, pg. 3) that changes made to the original protocol were done by “someone in Italy obstructing the true path of science.”

**Entry: #27**  
**Date: 1988**

**Data Category:** C-14 aspects

**Evidence:** Paul Damon, head of the Tucson lab at the University of Arizona, one of the 3 to have dated the Shroud, wrote, “When you’re doing research, you always have that thing that doesn’t fit: ‘What did we do wrong? Could we have mixed the samples? Was there an error in the lab? You can’t do that with something like the shroud. You’ve got to get it right the first time. I would prefer seven labs to three for a number of reasons....”

**Source:** As cited in Clark, Kenneth R., “Shroud of Turin Controversy Resumes,” *Chicago Tribune*, January 17, 1988, pg. 4.

**Comments:** This is another clear indication of the difficulty of producing rigorous results in C-14 datings.

**Entry: #28**  
**Date: 1988**

**Data Category:** C-14 aspects

**Evidence:** The archbishop of Turin had suggested that the 3 labs that were chosen were picked because of their experience but even Rev. David Sox, who had long suspected the Shroud was a medieval forgery, acknowledged that one of the labs rejected, Harwell in England, had more experience than the other 6 considered labs combined.

**Source:** As quoted in “Dating the Shroud,” *The Tablet*, January 30, 1988, pg. 115.

**Comments:** Meacham writes at “How the Carbon Dating Went Wrong,” <http://shroud.wikispaces.com/CARBON.14.DATING> that “The reduction of the number of labs from seven to three was of little significance,” but there is little doubt that the controversy over the number of labs involved in the dating did not help matters.

**Entry: #29**  
**Date: 1988**

**Evidence:** The Pontifical Academy of Science, the scientific body connected with the Roman Catholic Church and which has a high reputation in the world of science, was excluded from official participation in the C-14 testing.

**Source:** Gove, H.E., “Radiocarbon-Dating the Shroud” (letter), *Nature* 333:110 (1988)

**Comments:** Meacham, in his “The Rape of the Turin Shroud: How Christianity’s most precious relic was wrongly condemned and violated” (Lulu.com, 2005, pg. 82), wrote “It is interesting to note that the Vatican did finally decide that the role of the Pontifical Academy of Sciences ended with the Turin Conference, and all future decisions regarding research and testing of the Shroud would be made by the Archbishop of Turin. Chagas [who had chaired the 1986 meeting] had wrongly interpreted his brief, and had made a mess of it as regards the perceived “threat” posed by STURP’s proposed testing. He was removed from the fray by the Vatican.” There is no doubt that having the Academy involved would have lessened the controversy of the whole C-14 dating process.

**Entry: #30**  
**Date: 1988**

**Evidence:** Luigi Gonella, the scientific advisor to the Cardinal of Turin, complained “The carbon 14 testing has become a circus because of unprofessional conduct (as cited in Morgan, Rex, “World Reaction to Carbon Dating a Farce,” *Shroud News*, October 1988, No. 49, pg.13). Gonella stated that the scientists questioned the objectivity of the Church and demanded that they be personally present when the samples were taken “for fear that “Church officials might substitute samples from an older cloth” (as cited in Feuerherd, Peter, “Shroud Expert from Turin Hits Scientists’ Methods,” *The [Albany] Evangelist*, October 20, 1988, pg. 8A. The leaking of information in August 1988, several months before the official announcement in October, indicated to Gonella that the labs were only interested in advertising their involvement in the dating project, and their attitude of mistrust and suspicion, “gave us the sad impression that we were taken for a ride.” “We didn’t know anything. [The scientists] kept the press informed without informing us,” he added. Gonella was upset that some of these scientists were making theological statements debunking the value of the shroud. It was clear that the skeptical had as much an investment in the results going one way as the devout had them in going the other. Professor Edward Hall, who was to say that anyone who still believed the Shroud to be authentic was a “flat-earther,” was quoted as saying “If the image turns out to be His Nibs, some of us will need to revise our opinions about an awful lot of things.”

**Source:** See citations in “Evidence” section above.

**Comments:** The labs had been upset with the Turin authorities and it is obvious that the Turin authorities were also not pleased with the laboratories. Clearly, the process was fraught with political complications.

**Entry: #31**  
**Date: 1989**

**Evidence:** Report by the C-14 labs: “Radiocarbon Dating of the Shroud of Turin.”

**Source:** <http://www.shroud.com/nature.htm>

**Comments:** This is the official paper by the labs, in which they concluded “The results of radiocarbon measurements at Arizona, Oxford and Zurich yield a calibrated calendar age range with at least 95% confidence for the linen of the Shroud of Turin of AD 1260 - 1390 (rounded down/up to nearest 10 yr). These results therefore provide conclusive evidence that the linen of the Shroud of Turin is mediaeval.” Given all the other material presented here, a 95% confidence level is simply not warranted. Perhaps that figure can now be turned around to assert that there is at least 95% confidence that the AD 1260-1390 date ascribed to the Shroud is *wrong*.