

Dating The Shroud Of Turin: Weighing All The Evidence

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Abstract

When the Carbon 14 (C14) dating of the Shroud of Turin result was announced in 1988, the tests concluded that the shroud was woven of flax whose age was estimated to be between 1260 and 1390 A.D. This result flew in the face of many expectations of authenticity but was welcomed by many as revealing the shroud to be simply inauthentic and it was then popularly heralded as a "fake." However, this rush to judgment contradicted most of the science and scholarship previously invested in the shroud. It is perhaps a measure of the respect in which C14 dating is held that the finding tended to discredit the earlier work, yet it is a questionable scientific practice to vest one kind of result with such weight as to completely discount the results of a large body of prior work. The present paper seeks a larger perspective by providing an objective account of as many factors as possible to put the issue of dating in a more complete balance. Both the positive and negative evidence for authenticity from a variety of historical, archeological, religious, and scientific domains are presented and weighed based on review of the literature. Diagrammatic forms are used to present the evidences and gain a semi-quantitative assessment of the confidence one can have in the various dating perspectives.

Introduction

The announcement of the Carbon 14 dating result on October 13, 1988 led to a frenzy of negative publicity describing the shroud as a forgery or a fake. The facts of course were rather different than the coverage that the popular press expressed. The reality, largely ignored, was that the vast majority of work that had been done on the shroud of Turin by scientists, historians, archeologists, and other scholars had almost universally suggested that it was the authentic burial shroud of Jesus of Nazareth.



Figure 1: Announcement of the C14 Date on October 13, 1988 Press Conference

The reality is that the shroud of Turin either *is* or *is not* the actual burial shroud of Jesus. A single result doesn't convincingly disprove a vast array of contrary data even if you add an exclamation point. One of the deeply troubling things about the carbon date was that the data developed by the carbon labs rather directly showed that something was seriously wrong and instead of giving that result they contrived to suppress the troubling factors and instead rather forcefully declared the shroud to be a medieval forgery. Professor Edward Hall of Oxford University went so far as to declare: "There was a million pound business in making forgeries

during the fourteenth century. Someone just got a bit of linen, faked it up and flogged it.” [1] The problem with this summary judgment is that the data set developed by the three carbon labs at Arizona, Oxford, and Zurich told a very different story from the one communicated by the carbon labs. What the carbon labs should have announced was that their testing had revealed that the samples they received were inhomogeneous and hence invalid for establishing the age of the shroud.

The Flawed Carbon Dating Process

The problem with the samples did not originate with the carbon labs however. William Meachum had warned in a submission to Archbishop Ballestrero: *"It is a very serious error indeed to proceed with C14 dating on the assumption that it is an infallible method."* [2] A protocol had been recommended by the Turin conference held in September 1986. It was advanced as a recommendation and not a binding agreement. None the less the recommendations involved more than three labs, a mix of both counter labs and AMS (Accelerator Mass Spectrometry) labs, and most importantly samples from multiple sites. The decision to limit the dating to three labs, using only the AMS method and restricting the sampling to a single highly contaminated site were all outcomes determined by a politicized and highly bureaucratic process of Byzantine proportions. Mix in a lot of backbiting and intrigue as thoroughly documented by Harry Gove [3] and William Meacham [4] and you have a recipe for disaster.

Problematical Results

Things might have gone well despite these questionable decisions. A tight grouping of results from the three labs similar to their results on the control samples would have left little room for disagreement whether the result had been favorable to authenticity or to medieval fabrication. But that was not the result.

Sample	1	2	3	4
Arizona	646 ± 31	927 ± 32	1,995 ± 46	722 ± 43
Oxford	750 ± 30	940 ± 30	1,980 ± 35	755 ± 30
Zurich	676 ± 24	941 ± 23	1,940 ± 30	685 ± 34
Unweighted mean*	691 ± 31	936 ± 5	1,972 ± 16	721 ± 20
Weighted mean**	689 ± 16	937 ± 16	1,964 ± 20	724 ± 20
X ² value (2 d.f.)	6.4	0.1	1.3	2.4
Significance *** level (%)	5	90	50	30

Figure 2: Table 2 Summary of mean radiocarbon dates and assessment of interlaboratory scatter: <https://www.shroud.com/nature.htm>

The shroud (sample 1) exhibited an anomalously high χ^2 test of 6.4 compared with the control samples. This indicated that the shroud samples were not homogeneous. But there are more significant data reduction findings which as the carbon dating results have been studied suggest order in the inhomogeneity. Three images and two analyses are worthy of attention.

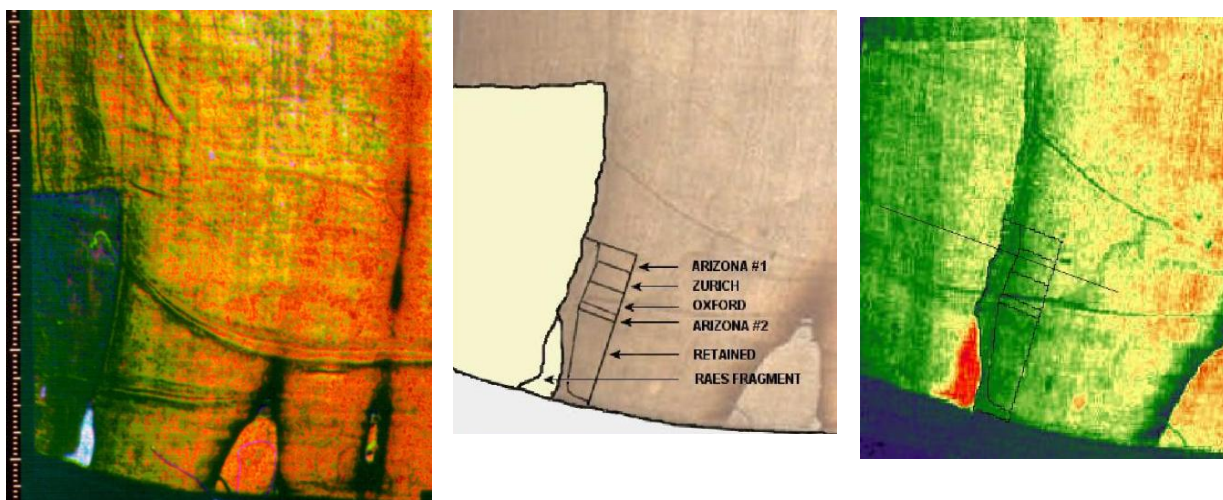


Figure 3: The images above are respectively the Blue Quad Mosaic, the UV-Fluorescent, and a false color image where the false colors map the Principle Component Analysis intensity of the UV-Fluorescent image, an analysis performed by John Morgan. ©1978 Barrie M. Schwartz Collection, STERA, Inc. , ©1978 Vernon Miller, © 2012 J.M. Morgan, III

The Blue Quad Mosaic image is a multispectral false color image which reflects the surface chemical composition of the shroud. It rather clearly shows that the sample region just to the right of the Raes patch covering the sample taken in 1973 is different from the rest of the cloth. Although more subtle, the UV-Fluorescent image taken by Vern Miller is also darker in that

region and this can be seen in both the UV-Fluorescent image as presented and in the false color image resulting from John Morgan's analysis. These images establish the poor choice of the region near the Raes sample and had there been a significant study of the site selection for the dating would likely not have been selected. But there wasn't.

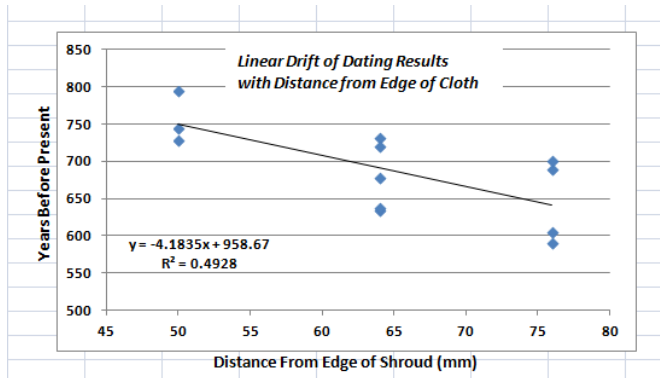


Figure 4: Linear Gradient observed by Brian Walsh [5]

Brian Walsh [5] observed that there was a linear gradient in the Carbon 14 lab results as you plotted the data from the edge of the shroud. This strongly suggests a systematic enrichment mechanism that maps to locations on the shroud as measured from the edge. The coefficient of determination, R^2 , computed to 0.4928 which means a correlation coefficient of 70.2%.

John M. Morgan III did an analysis of the UV-Fluorescence image that produced surprising results. He began the analysis to illustrate the use of techniques used by the land remote sensing community. What he discovered seems more significant than merely the illustration of the potential application of some analysis methods. Notably he showed (although it is not in his paper) that the fluorescence correlates almost perfectly with the carbon dates.

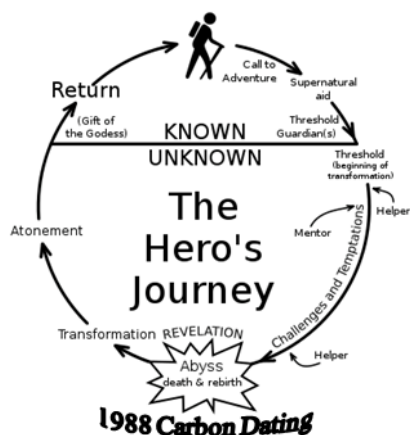
When you compare the laboratory carbon dates with the Z-Score resulting from a Principle Component Analysis (PCA) of the UV-Fluorescence data you get a coefficient of determination of 0.9986 which corresponds to a correlation coefficient of 99.93% an extraordinarily high value given that what it says is that the average carbon date is almost perfectly predicted by the UV-Fluorescence.

There is no reason to expect such a result obtained by putting data from the paper [6] into an Excel spread sheet. It suggests that fluorescence predicts carbon date. This amounts to an actual measure of contamination.

At this point the conclusion is that the Carbon Dating of 1988 is not only unreliable but indeed contains clues that point to systematic biasing factors related to position and fluorescence. Other work by Ray Rogers, John Brown, Sue Benford, Joe Marino, and more recently Pam Moon have revealed the presence of anomalous cotton, dyes, potential invisible weaving and rogue threads that suggest manipulation. [7]

The Journey to Truth

The carbon dating result of 1260-1390 with 95% probability either represents reality or it doesn't. We have many reasons to think that it is flawed but because carbon dating has such a reputation for being authoritative, the dating takes on an appearance of infallibility. The reality is that erroneous carbon dates are not a rare occurrence. Discovering the truth is fundamental to understanding. It is reasonable to ask a rather fundamental question: How do we know what is true about the Shroud of Turin? Is the shroud the work of a medieval forger or is it the burial shroud of Jesus Christ? I hope to take you on a journey as you read this paper, a journey of discovery with many mentors.



Joseph Campbell wrote a book titled "The Hero with a Thousand Faces." [8] We can liken the journey of discovery of the truth about the Turin shroud to the myth of the *hero's journey* which begins with a call to adventure and as we enter the unknown we discover that we can't do it alone. We need help in the form of helpers and mentors. The shroud is at the center of our quest for the truth. Many have sought to understand it and the 1988 Carbon Date with all the questions and doubts that it inspires appears at the nadir of our journey.

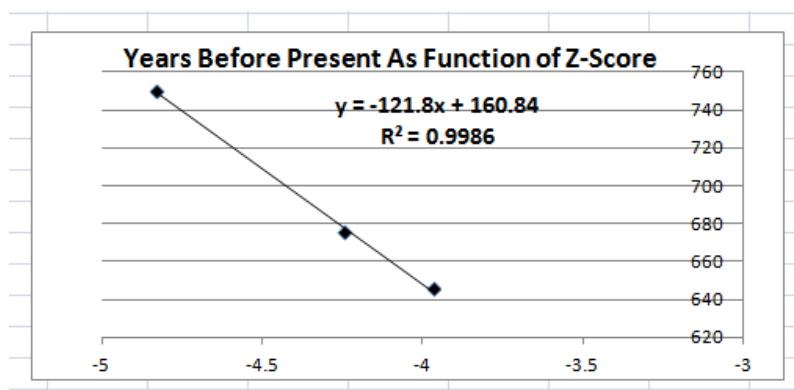


Figure 5: Nearly perfect correlation between average carbon dates and the UV-Fluorescence as measured by the PCA Z-score [6]

The conviction that carbon dating was the last word seriously crippled shroud research and transformation, if it is achieved, will not be an easy journey.

The Primacy of Story

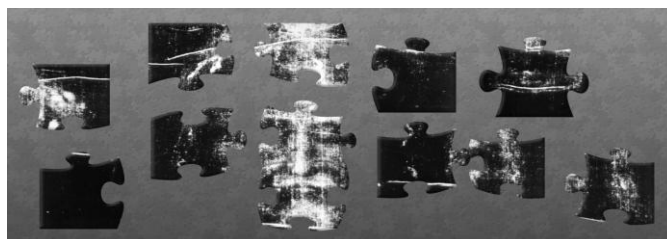
Stories come in many forms and styles and follow many rules of composition and development. Everything men and women communicate is a story of one form or another. Some stories are more convincing than others. Some are more formal than others. A science story is one set in a realm of observations and calculations and principles and is intended to confirm an understanding of reality. This is no less true of archeological stories, or history stories, eyewitness testimony, stories told through pictures in the form of art or photography, and stories of religion about transcendent realities. Each kind of story follows the rules of its kind. All stories are more or less well told, are more or less entertaining, but finally the test of story is whether the story is true. Only true stories have real value for the rest are only lies.

What is Truth?

"What is truth?", Pontus Pilate asked Jesus Christ (John 18:38). Truth is the correspondence between story and reality. At least that's a short form of what Aristotle might have said. [9] It is unlikely that we can know the entire truth about anything but we can likely know enough to discern the difference between truth and fabrication.

How do you know the truth?

To know what truth is, and to know if something is actually true are rather different problems. Typically we determine if something is true by applying various tests. I offer four: 1) Direct Observation, 2) Correct Interpretation, 3) Correspondences with other known truths, and 4) Coherence or Fit.



Direct Observation

Direct observation can be abbreviated as *witness*. There is no greater certainty available than to see things for yourself. This experience might be parsed into two aspects: 1) the factual account of what was observed, and 2) the interpretation of the observations. The first is an account of observables while the second is an interpretive inference based on existing principles or understandings. A remote account of witness is a report of testimony by a witness. This is less authoritative since the report imposes a non-witness into the information stream.

Correct Interpretation

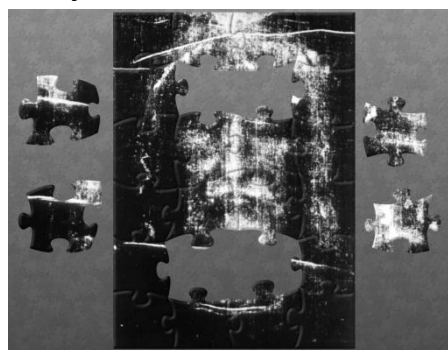
The interpretive dimension of witness has to be correct for that aspect to be authoritative. It helps to determine correctness by being as explicit as possible about the nature of the interpretation.

Correspondences with other known truths

An observation is strengthened when it is corroborated by correspondences with other observations either repeated witness or reliability of interpretive principles through their successful application in other cases that bolster their applicability to the case at hand.

Coherence or Fit

Finally when multiple observations form a self-validating mosaic such that all the pieces fit together in a supportive fashion this strengthens the case. The metaphor of the puzzle illustrated above is an example.[10]



Weighing the Evidence

Applying these four indicators of truth we will strive to decide between the two possibilities that on the one hand the shroud in the creation of a medieval forger or on the other hand it is much older than the 1988 Carbon Dating indicated and hence may well be the authentic burial shroud of Jesus Christ. It is not enough to consider only a single, possibly flawed, observation such as the carbon dating. Richard Feynman, Nobel Prize winning physicist and celebrated physics educator, makes the point when he says, "You see, if you don't have a good reason, you have to have several reasons ..." [11] It is also worth considering a point Feynman makes elsewhere in which he points out how hazardous it is to rush to judgment. Ignorance is preferable to a false answer. Feynman says[12], "I would rather have questions that can't be answered than answers that can't be questioned." Our goal then is to examine as much evidence as we can to weigh the alternatives.

The Implausibility of the Forger Hypothesis

If the shroud were actually medieval as the 1988 Carbon Data suggests then it would have to have been fabricated sometime in the interval 1260 to 1390 A.D. which nicely brackets the timeframe when it was first exhibited in Lirey, France about 1355. The problem with this as a hypothesis is that it requires a *super forger*. We'll spend a little time examining this hypothesis and showing that it implies an overwhelming cognitive and logistics load for any individual to accomplish such a feat.



Figure 6: Crown of thorns as depicted on the shroud (interpretation due to Ricci), coin of Abgar VIII (3rd century king of Edessa) note crown, typical circlet of thorns in Christian art reminiscent of the garland of laurel leaves symbolizing victory or triumph in ancient Greece and Rome

Against all Christian art tradition *super forger* created an image with a helmet of thorns as opposed to a circlet, nails through the wrists, and a myriad of scourge marks matching a Roman

instrument unused for almost a thousand years.

Super forger put serum rings around the blood stains using real blood. [13] He added burn holes to match a 12th century Hungarian manuscript.

He added rare limestone from Jerusalem on the

nose, knee, and heel. *Super forger* stitched a side strip onto the cloth with a sewing technique from the 1st century. He also added discolorations to the cloth representing a device used to display the shroud over a hundred years before in Constantinople as described by a chronicler of the 4th crusade just before the sack of Constantinople. [14] *Super forger* is just super.

Richard Feynman said if you don't have a really compelling reason for something you have to have several reasons. *Super forger* wants his fake relic to be truly remarkable so it is easier to *flog it*. A negative image, anatomically perfect blood stains, an image without pigment, but how is this possible? This is all totally implausible for an artisan of the 14th century.

He added pollens to the cloth to show it traveled from Jerusalem to Edessa to Constantinople and to France. The masterful touch was putting dirt from Jerusalem to the nose, knees and feet. He mastered ancient Roman crucifixion practices by going back in a time machine and creating a separate relic which he put in circulation from Jerusalem. Implausible? let's begin at the beginning.

A Journey Through Time

Either the shroud is the burial cloth of Jesus Christ or it was created by our *super forger* with a time machine. He created a fake so compellingly authentic that seemingly only a paranormal forger could accomplish it. What about authenticity?

Our journey begins in a first century tomb. The two most plausible crucifixion dates are April 7, 30 A.D. or April 3, 33 A.D. In 33 A.D. a lunar eclipse occurred with the "moon turning to blood" fulfilling a passage from the prophet Joel preached by Peter on Pentecost.

19 And I will show portents in the heaven above and signs on the earth below, blood, and fire, and smoky mist. 20 The sun shall be turned to darkness and the moon to blood, before the coming of the Lord's great and glorious day. (Acts 2:19-20, emphasis added)

The gospel of John describes Peter and John running to the tomb when they receive news that the body of Jesus has disappeared. They verify that the tomb is empty except for two pieces of cloth.

⁴The two were running together, but the other disciple outran Peter and reached the tomb first. ⁵He bent down to look in and **saw the linen wrappings lying** there, but he did not go in. ⁶Then Simon Peter came, following him, and went into the tomb. **He saw the linen wrappings lying there, ⁷and the cloth that had been on Jesus' head, not lying with the linen wrappings but rolled up in a place by itself.** ⁸Then the other disciple, who reached the tomb first, also went in, and **he saw and believed.** (John 20:4-8, emphasis added)

We don't know exactly what was seen such that it produced belief. But it seems clear enough that there were at least two cloths in the tomb and perhaps more. We have two rather prominent cloths at the present time: 1) the Turin shroud, and 2) the sudarium of Oviedo. There may well have been other cloths in the tomb. If Christ was carried in a cloth sling as suggested by many paintings, that may account for reports by pilgrims to Jerusalem of an eight foot "shroud" with no mention of an image. The Turin shroud is over 14 feet long. Since a cloth used as a sling would have blood smeared on it and would likely have been left in the tomb. That would account for reports of multiple shrouds in the historical record. A cap believed to cover the head of Jesus in the tomb is preserved at Cahors, France. If authentic it would explain the lack of image at the top of the head. Analyses published in 2001 by Robert Babinet claimed that the patterning of wounds on the cap's interior matched wounds visible on the Turin shroud.[15] A shroud was also destroyed by the French Revolution at Besancon.

The First Silence (33 AD to 544 AD)

What became of the two cloths after the empty tomb is uncertain. Until the Edict of Milan in February 313, Christians were a persecuted minority. The existence of a shroud bearing the image of Jesus was a secret. Discovered it would have been seized and destroyed. A burial cloth, it made one ritually unclean. An image of one who was God and Lord was both blasphemous and lawless to the Jews. After persecution ended the Christians could still not be certain it would not return. Best it be kept secret. This seems the likely reasons for the silence.

Historians seeking to explain the whereabouts of the Turin shroud prior to 544 are engaged in building a framework resting on hints and rumors and perhaps coded understandings known only to the early Christians such as those *spy clues* suggested by Rev. Albert R. Dreisbach that were in the *Hymn of the Pearl*. [16] We will give an abbreviated account of two theories offered by shroud historians.

The Abgar/Mandyllion Hypothesis of Ian Wilson

Eusebius's (c. 260-339/340) church history tells the legend of Abgar V, king of Edessa until 50 AD who wrote to Jesus asking him to come and cure him. Eusebius mentions no cloth or image.

Internal textual evidence dates the legend to the third century and likely under the reign of Abgar VIII (d. 212) Over time the legend grew, first to report a face of Christ painted in choice paints/colors [17], then later an image created by Christ himself as a moist secretion. [18]

Hidden away in the city walls over the Western gate and forgotten it was only rediscovered around 525. It was used in 544 in defense of the city against the Persians.

In 1978 Ian Wilson published his seminal book, "The Shroud of Turin: The Burial Cloth of Jesus Christ?" He identified the Shroud of Turin as the Image of Edessa, the Mandylion. In this account the shroud had been taken to Edessa by Thaddeus, a disciple of the Lord and used to cure Abgar V. The Mandylion was hidden in the walls of Edessa, forgotten, and rediscovered in 525.

The Antioch Account of Jack Markwardt

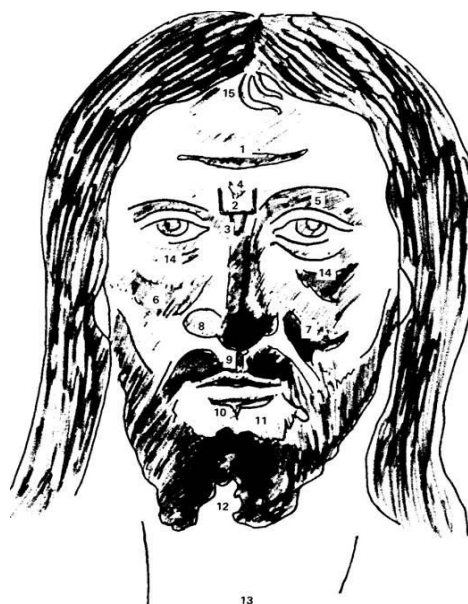
Jack Markwardt proposes that Peter had custody of the shroud and when church persecution began Peter went to Antioch. [19] There it disappeared when it was concealed to protect it and the person who hid it was martyred. Only rediscovered in the aftermath of an earthquake in 528, it was evacuated to Edessa to avoid capture by the Persian army in 540. Four years later in 544 it miraculously protected the city. Neither story is particularly convincing. However, the Mandylion is in Edessa in 544 where it remains for 400 years.

The two anchor points in these narratives are a Jerusalem tomb and the subsequent history of an image in Edessa known as the Mandylion which is said to have only shown a face of Christ and whose source is traced only in late accounts. How can we connect the Mandylion to the shroud? How could it have been misidentified for centuries?

The Vignon Markings

Paul Vignon an early scientific shroud researcher noted the sudden emergence around the sixth century of images of Christ that shared many features likely modeled on the Mandylion that matched the shroud. He made particular note of fifteen features that have come to be known as the "Vignon markings." [20]

- (1) Transverse streak across forehead,
- (2) three-sided "square" between brows,
- (3) V shape at bridge of nose,
- (4) second V within marking 2,
- (5) raised right eyebrow,
- (6) accentuated left cheek,
- (7) accentuated right cheek,
- (8) enlarged left nostril,
- (9) accentuated line between nose and upper lip
- (10) heavy line under lower lip,
- (11) hairless area between lower lip and beard,
- (12) forked beard,
- (13) transverse line across throat,
- (14) heavily accentuated owlsh eyes,
- (15) two strands of hair



A single characteristic representation of Christ beginning at the time the Mandylinion was rediscovered, sharing so many features with the shroud points to the Mandylinion and the shroud being the same object. In all Vignon identified fifteen marks he thought derived from the shroud.

The Mandylinion was commonly portrayed in landscape format, unusual for a portrait but it would be explained if it were the shroud folded so that only the face appeared.

The Sudarium of Oviedo

The sudarium of Oviedo, a small towel covered with blood, is thought to be the cloth that covered the head of Jesus as he was taken down from the cross and transported to the tomb. It has an entirely different history, yet it matches the shroud of Turin in terms of blood type and the shape of blood distributions on the cloth. [21]



Figure 7: The Sudarium of Oviedo, reverse side which was in direct contact with the face.

I used Mario Latendresse's Shroud Scope site [22] to match the scale of the facial image of the shroud and the face stain region of the sudarium and then created an outline of contrast edges and overlaid it on the sudarium image. It was a good match.



Figure 8: Using Shroud Scope to create images of the same dimensions an outline of shroud contrast gradients was traced on a transparency and overlaid on the same dimension sudarium image.

Back in the late 1990's Alan Whanger using his polarizer technique made comparisons with the shroud and other images such as coin images. He offers a short video on his site [23] which compares blood stains on the sudarium with blood stains on the shroud with significant physical correspondences. This shows a precise match between the head wounds on the sudarium and the shroud. The blood on both linens are type AB blood. Yet the two linens have not been together for at least 1400 years.

The shroud left Jerusalem no later than about 40 A.D. while the sudarium left Jerusalem in 614 A.D. The travels of the two linens did not intersect. If they exhibit corresponding marks they came from the same body.



Figure 9: The travels of the two linens, the Shroud of Turin and the Sudarium of Oviedo did not intersect once they left Jerusalem. The shroud nominally in 40 AD and the sudarium in 614 AD.

Some Ancient Witnesses

The Abgar legend developed over time. Eusebius speaks of the mission to Jesus seeking healing but doesn't mention an image. The *Doctrine of Addai* says that Jesus was painted in choice paints. Later still the image is transferred as a moist secretion by Jesus himself and described as "not made by human hands." Finally miraculous powers are attributed to the cloth and it saves the city of Edessa from conquest. Then in the sixth century a liturgy describes seeing an image of the dead and risen man on the linens.

- 4th Century — Eusebius (c. 260-340 AD)
 - relates the story of Abgar V's message to Jesus but makes no mention of an image
- Late 4th or Early 5th Century (c. 400 AD) — *Doctrine of Addai*
 - *When Hannan, the keeper of the archives, saw that Jesus spake thus to him, by virtue of being the king's painter, he took and painted a likeness of Jesus with choice paints, and brought with him to Abgar the king, his master. And when Abgar the king saw the likeness, he received it with great joy, ...*
- The Acts of Thaddaeus (Surviving Greek Text from 6th Century)
 - *... Ananias, having gone and given the letter, was carefully looking at Christ, but was unable to fix Him in his mind. And He knew as knowing the heart, and asked*

to wash Himself; and a towel was given Him; and when He had washed Himself, He wiped His face with it. And His image having been imprinted upon the linen, He gave it to Ananias ...

- 6th Century — Mozarabic Rite (Preface for Saturday of Holy Week
- *Peter ran with John to the tomb and saw the recent imprints of the dead and risen man on the linens.*
- 6th Century — Evagrius (c. 535- ?) History published about 593 AD
 - gives an account of how the image sent to Abgar saved the city during the siege of Chosroes the Persian in 544 AD

Pollen: A Silent Witness

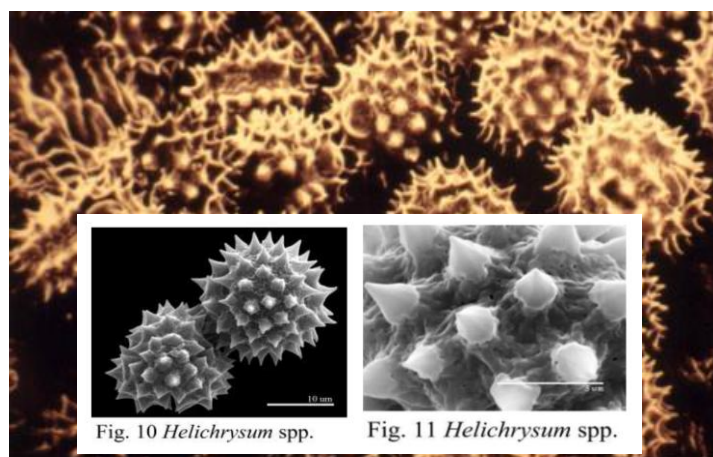
In 1973 Dr. Max Frei, a Swiss criminologist was permitted to take sticky tape samples from the shroud. He had pioneered this technique for obtaining samples at crime scenes. Pollens on the tapes placed the shroud in the Holy Land, Edessa and Constantinople. Many of the pollens were heavy, insect borne, rather than wind borne. The deposition of the pollen could be due to the manufacture of the linen, its presence in the ointments applied to the body, or from flowers laid on the shroud possibly in liturgies.

Frei identified 49 species of plants represented in the dust of the shroud [24].

- Half did not grow in Europe
- 29 were plants of the Near East
- 21 grow in the desert or the steppes
- 13 characteristic of the Negev and the Dead Sea

Dr. Marzia Boi, in her Valencia in 2012 paper [25] points out a possible misclassification by Frei of *Helichrysum* as *Gundelia tournefortii*. *Helichrysum* would likely have been deposited in oils or ointments used to prepare the body. This had been suggested by Frei when he commented:

"I leave the possibility open that a part of the pollen comes from **the manufacture of the cloth** and perhaps also **from aromatic substances such as aloe** used for the burial processes or from the wet skin of the body which was wrapped in the cloth." (emphasis added)



It is difficult to classify pollens from the same genus as these images of *Gundelia tournefortii* and *Helichrysum* make apparent.

Boi describes this possible misclassification as follows:

Figure 10: Background pollen of *Gundelia tournefortii* and foreground from Boi's paper [25] *Helichrysum spp.* The similarity is apparent.

The study of Danin et al., (1999) tests that the most common species of the 204 identified pollen in order of abundance are *Gundelia*, *Cistus*, *Cistaceae*, and *Apiaceae*. The *Gundelia* species would be erroneously identified, being *Helichrysum spp.* The unpublished identification of the most abundant pollen in the relic as *Helichrysum*, clarifies the fact that had not considered before: the possible preparation of the body and the funeral ritual with oils and ointments.

Since these are insect borne pollens they were likely deposited during linen fabrication or in unguents used to anoint the body. This possibility explains both the abundance and the type of pollen without significantly changing the conclusions drawn from the pollens of the shroud's travels.

Returning to Edessa in 544 AD

Reported in *The Ecclesiastical History of Evagrius — A History of the Church from AD 431 to AD 594* in Chapter XXVII, Evagrius describes how the image of Edessa was invoked to cause a Persian siege engine to be set on fire thus repulsing the Persian attack. Evagrius' own dates are uncertain but he is said to have been born sometime from 535-537 and his history was completed in 593 so he is contemporary with the claim of a 544 intervention by the image of Edessa, the Mandylion. Thus Evagrius places the Mandylion firmly in Edessa in 544. But what exactly is it?

The word "tetradiplon" appearing in the *Acts of Thaddeus*, a sixth century work which was cited earlier, means doubled in four (in short eight layers). With the shroud this produces a landscape aspect with the disembodied head centered roughly in the middle.

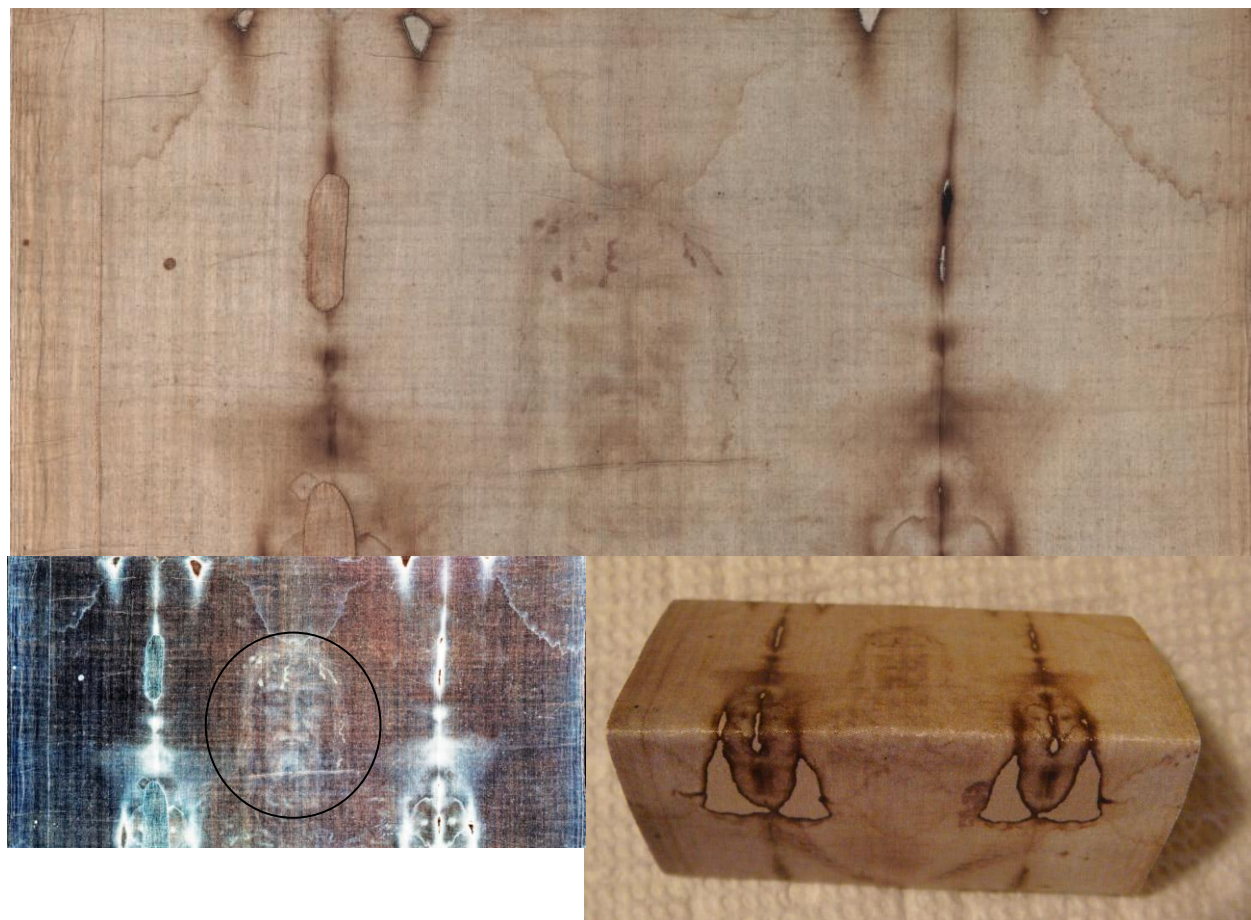


Figure 11: (top) the shroud folded as *tetradiplon* in eight layers. (bottom left) a region of slightly different luminance which could indicate display with a covering exposing only the face. (bottom right) a paper model of the shroud folded showing how it might have displayed to someone who first took it out of a framing reliquary so that the chest wound was exposed.

There seems to be a slightly faded "halo" around the head possibly because it was exhibited and exposed to light with only the head showing. A similar landscape presentation of a head painted on a wooden panel was found at the location of a Knights Templar site in Templecombe, Somerset. This is a plausible link between the Mandylion, the shroud, and the Templars. Folded in the *tetradiplon* configuration the back when the head is displayed shows the prominent chest wound which may explain our next witness.



Figure 12: Templecombe head linked to the Templars and similar in plan-form to the *tetradiplon* configuration of the shroud displayed as the Mandylion.

The Mandyllion Comes To Constantinople 944 AD

In 943 a Byzantines army came to Edessa to obtain the Mandyllion. Two hundred Muslim prisoners and a large quantity of silver were exchanged for the Mandyllion. The army returned to Constantinople in August of 944. On August 16th the arch deacon Gregory gave a sermon. He said:

The splendor has been impressed uniquely by the drops of agony sweat sprinkled from the face...These are truly the beauties that produced the coloring of Christ's imprint, which has been embellished further by the drops of blood sprinkled from his own side...blood and water there, sweat and image here.

The Mandyllion was more than just a head image.

259 years later in 1203, Robert de Clari a chronicler of the 4th crusade saw a shroud

... in which, [lit. where] Our Lord had been wrapped, which every Friday, raised itself upright, so that one could see the form of our Lord on it.

The sack of Constantinople followed and the shroud enters a second long period of silence.

A Cloth Wrapped Body

What is the shroud then? John Jackson and Eric Jumper, young Air Force Captains, conducted cloth wrapping experiments in the 1970s showing the image arose from a cloth wrapped body. Jumper was quoted as saying, "There is only one way to correctly wrap the body." [26]

Fidelity

The shroud depicts the passion of Christ, an anatomically perfect image even to fluorescent serum halos. It shows a first century Roman crucifixion with signature details of the crowning with thorns, the scourging, the nailing and a spear wound in the side.

Negative Image

Who would "fake" a negative image in the 14th or any earlier century? Artist copies of the Mandyllion transform the image into a positive. Painted shroud copies are crude and unconvincing. It shouts authenticity. It takes a particular blindness to the obvious to tenaciously subscribe to a theory of fraudulent manufacture as the evidence for authenticity transcends realistic expectations for insights beyond the range of 14th century thought that would not become possible to even articulate for over five hundred years.

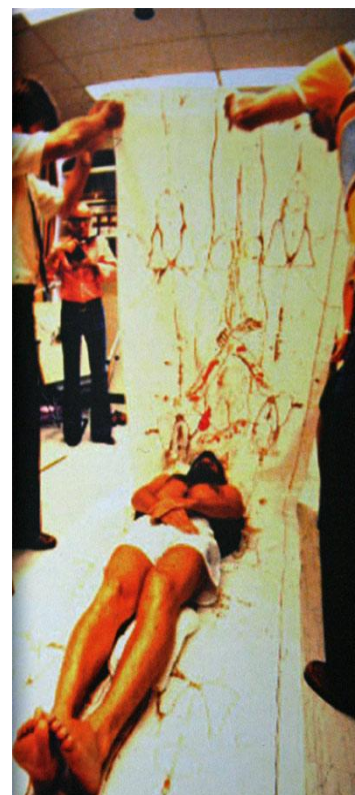


Figure 13: Example of a body wrapping experiment [26]

Dirt from Jerusalem

In 1978 the STURP scientists detected dirt on the nose, knee, and heel using reflectance spectrometry. Subsequently it was classified as a form of travertine aragonite, a rare limestone identical to that found in Jerusalem. Dr Ricardo Levi-Setti (University of Chicago) compared shroud sample with samples collected in Jerusalem using a high resolution scanning ion microprobe and observed an excellent match.

Scourging

The marks of the scourging are consistent with the design of first century flagrum. They are partially obscured on parts of the back probably due to carrying the cross beam called the *patibulum*. This blurring of some of the scourging wounds on the back indicates that the cross was carried by a man wearing a tunic which would have protected the back somewhat. Guilio Ricci depicted this in the image shown in Figure 14 at right.[27]

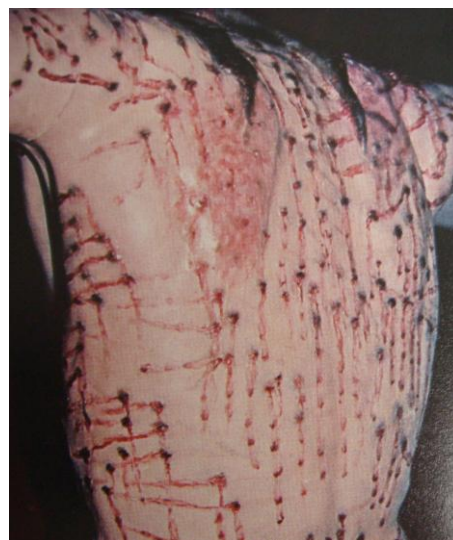


Figure 14: Crucifixion statue modeled on the shroud, depicting a reconstruction of the blurring of the scourge wounds caused by carrying the *patibulum*.

Iconoclasm and other Reasons

The reconstructed history of the shroud is fragmentary with extended periods of silence. One doesn't have to seek far for reasons. Extended periods of iconoclasm made it hazardous to expose images which might be seized and destroyed. The images in churches and monasteries have been defaced and destroyed by factional elements within Christianity and hostile elements without. During the French Revolution relics and images were seized and destroyed. The Puritans in England destroyed many images. There have been multiple arson attempts on the shroud in just the past fifty years. In the case of the sack of Constantinople in 1204 the plundering of relics was condemned by the papacy.

Melismos, Threnos, Epitaphioi

Artistic traditions emerge after the tenth century when the image of Edessa is in Constantinople and revealed as more than just a disembodied head. The coincidence in timing points to the shroud's presence as a likely cause of these traditions. Dr. Dan Scavone points out the linkage between the image of Edessa and the legends of the Holy Grail [28] and cites a 10th century text of the Abgar legend in Latin which says:

... on Easter it used to change its appearance according to different ages: it showed itself in infancy at the first hour of the day, childhood at the third hour, adolescence at the sixth hour, and the fullness of age at the ninth hour, when the Son of God came to His Passion ... and ... cross

This certainly suggests that the identity of the image of Edessa, the Mandylion, as a burial shroud was known in Edessa, or perhaps only that it was now known in Constantinople and retrogressed into the earlier setting.

The progression of images from the melismos through the variations of the threnos, epitaphioi, and then the man of sorrows that Scavone presents suggests the gradual spreading of an awareness of the real nature of the Mandylion as not merely a towel but the full burial shroud. Finally we find the image termed *The Man of Sorrows* commonly shown rising from a box-like tomb. There are many variants of this image but they commonly are shroud-like and reminiscent of Robert de Clari's account of a shroud with the figure of the Lord on it being raised up. It may also give a construction to the account from the 10th century Latin Abgar text since a progressive rising might be interpreted as a progression

from infancy through childhood and on to the Passion.

The Pray Codex (1192-1195)

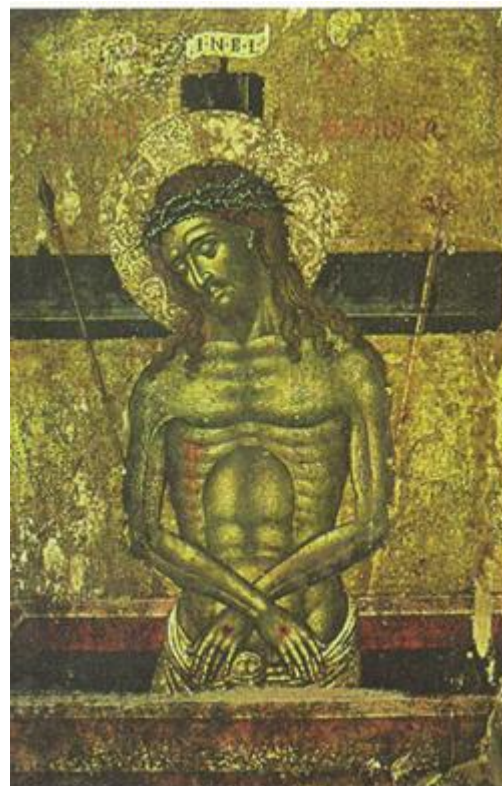
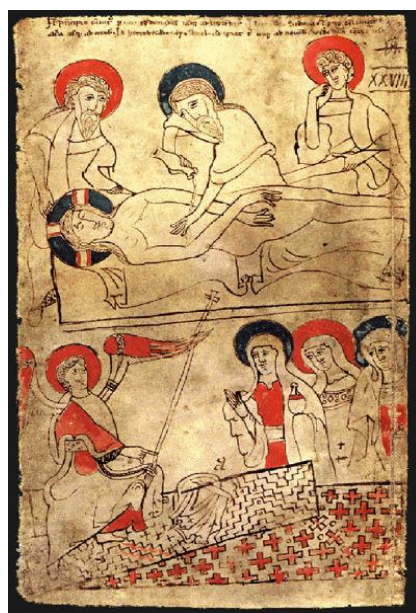


Figure 15: Typical Man of Sorrows image in a shroud-like pose rising from a box-like tomb



The Pray Codex, dating from between 1192-1195, has an illustration that shows Jesus being anointed laid out on a shroud with his arms crossed and thumbless hands. A pattern reminiscent of the herring bone weave of the shroud is seen on the detail with a set of holes matching a pattern of burn holes on the shroud commonly called "poker holes" although they might be better characterized simply as pre-1532 burn holes.

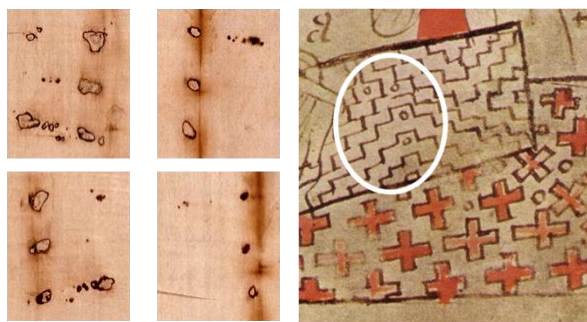


Figure 16: The Pray Codex, late 12th century, showing a shroud-like pose, a representation of the shroud's herring bone weave and a pattern of holes that duplicates the pre-1532 burn holes.

The Constantinople Device

John Jackson found a series of discolorations on the shroud which he interprets as the marks of a device used in Constantinople to raise the shroud out of a box. He reverse engineered and demonstrates the device in a BBC video. Robert de Clari reported this experience and the Man of Sorrows images may record a real memory of this Byzantine liturgy.



Figure 17: Two frames from the BBC documentary "The Shroud of Turin New Evidence." The documentary includes Dr. John Jackson pointing out discolorations that suggest marks left by a device used to raise the shroud out of a box as part of a liturgical devotion. He demonstrates the operation of the device in the documentary.

The Three Dimensional Image

Paul Vignon, one of the first scientists to study the shroud, noted a relationship between image intensity and distance and attempted to explain it with his vaporograph theory. John Jackson and his students at the Air Force



Figure 18: Three dimensional model made by cutting out microdensitometer data graphs on cardboard and assembling them.

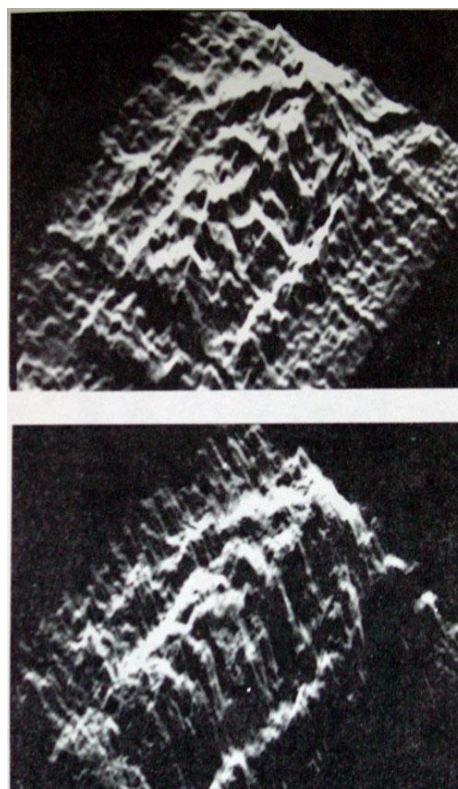


Figure 19: (top) VP-8 image analyzer image of the shroud face. (bottom) Result a matching of the measured transfer function using a diode function generator duplicating the image mechanism's effect leading to a more natural

Academy studied the three dimensional image using intensity measurements and cutting out profiles in cardboard to build up a three dimensional image. Then on February 19th 1976 John Jackson and Bill Mottern of Sandia Labs put a picture of the shroud on a VP-8 image analyzer and directly observed the three dimensional characteristic of the shroud image. This was a scientific result which put in motion the most comprehensive scientific study of the shroud ever done, the STURP work of 1978.

The Second Great Silence



Figure 20: Pilgrim's badge from Lirey exposition of the shroud about 1355 with two coats of arms, that of Geoffrey de Charny I on the left and that of his wife, Jeanne de Vergy on the right.

After the sack of Constantinople another great silence in the shroud history begins. There is some evidence that it went to Athens with Othon de la Roche who became the first Frankish Lord of Athens in 1204. He may have sent it back to France or perhaps it entered the custody of the Knights Templar and was used in their initiation rites. The story that connects the two theories has yet to be written. However there is significant evidence that both are true in some way.

The knights Templar connection is supported by the mysterious initiation rites they engaged in which suggest that the shroud may have been used by the Templars as a secret object of veneration. We only

have some testimony acquired when the Templars were being suppressed and the mysterious image painted on a wooden panel from Templecombe.

The travels of the shroud are unknown in the interval from the sack of Constantinople in 1204 except for a brief acknowledgement of its presence in Athens until the early 1350's when it appears in France when it is displayed in a small church in Lirey about 1355 the property of a well known and reverent knight named Geoffrey de Charny. In March of 1349 a fire destroyed the cathedral church at Besancon and apparently also a shroud kept there.

In April 1349 Geoffrey de Charny writes to Clement VI, the fourth Avignon Pope (1342-1352), seeking to establish a church at Lirey. Geoffrey married Jeanne de Vergy, a descendent of Othon de la Roche, around 1349 as well. Some think that our shroud was part of the dowry brought to her marriage by Jeanne de Vergy. A painting was possibly created to replace the shroud that had been at Besancon and the shroud we know of today as the shroud of Turin began being displayed in Lirey. The only account of the shroud's acquisition we have is a remark by Marguerite de Charnay, granddaughter of Geoffrey de Charny I, that it was the spoils of war.

Back to Carbon Dating

All of these examples of the witness of history, evidence of correspondence and continuity all tend to suggest that the shroud can be plausibly linked to a first century tomb that contained the body of Jesus Christ. Perhaps we should examine the carbon dating further.

There are only a few assumptions involved in carbon dating. The amount of C14 originally in the sample must be known. The sample must be representative of the item being dated. There must be no contamination or selective enrichment that would skew the date. Unless these are true the date will be in error and it is not uncommon for carbon dating to be in error. We've seen that the shroud dating of 1988 had obvious problems of homogeneity and contamination. Are there any alternatives?

Alternate Dating Possibilities

There are actually numerous dating alternatives although none is as developed or likely as precise as carbon fourteen dating. Any process that causes observable variations in linen over time can be quantified and serve as a dating mechanism.

Ray Rogers has offered the decay of vanillin in the lignon of linen showing that under normal circumstances to have a null test for vanillin implies the object is at least 1300 years old. [29] Vanillin is a compound associated with lignon at growth nodes that slowly disappears with time. The shroud proper does not give a test for vanillin while the C14 region does. This demonstrates C14 region is anomalous and the shroud is likely older than 1300 years even if stored in warm environments.

Giulio Fanti, professor of mechanical and thermal measurements at the Department of Industrial Engineering, University of Padua, together with associates, has pioneered the development of new dating methods using the aging mechanical characteristics of linen fibers to estimate their age. Three separate techniques mutually corroborate the likely first century date of the shroud.

Vatican Insider of March 26, 2013 summarized Fanti's results: [30]

"the dates given to the Shroud after FT-IR testing, is 300 BC $\pm$ 400, 200 BC $\pm$ 500 after Raman testing and 400 AD $\pm$ 400 after multi-parametric mechanical testing. The average of all three dates is 33 BC $\pm$ 250 years."

These additional four methods of dating, while less precise than the Carbon 14 dating method nevertheless demonstrate by their agreement that the shroud is likely first century and corroborate the finding that the 1988 Carbon Dating was seriously in error for reasons still not understood. [31, 32]

Weighing the Evidence

We began our journey discussing the 1988 carbon date and the nature of truth, especially the question how you tell what is true from what is not true. The tests of truth was given as direct observation (witness), correct interpretation (understanding), correspondences with other known truths (correlation and other explanatory principles), and coherence (It all fits together.). We have told a story, not without flaws, but which generally follows these principles which we can sum up with the following diagram.

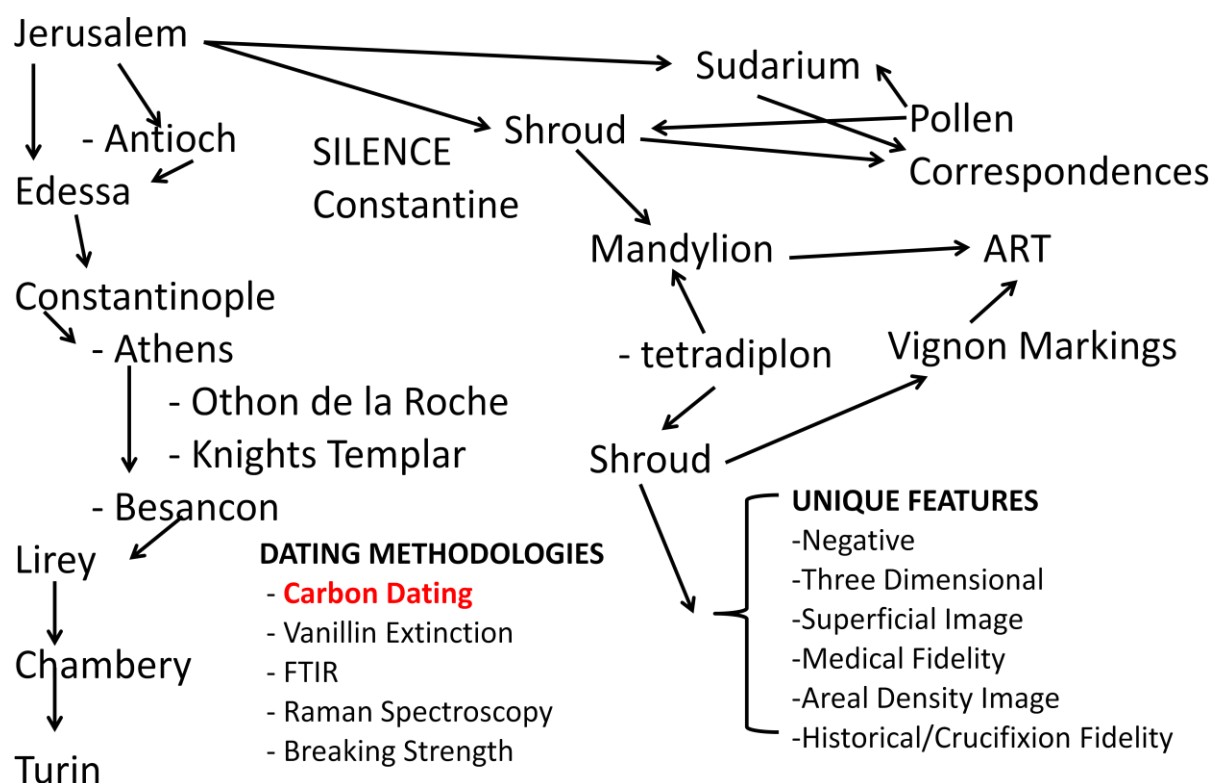


Figure 21: A Network Summary Of Our Journey. There is one anomaly in our story with is the 1988 Carbon Date. Thus the story is not complete but the preponderance of evidence and the high coherence suggests that the shroud is authentic.

Summary and Conclusions

We have touched a large proportion of the material that applies to the 1988 carbon dating as well as the journey that the shroud must have taken if it is authentic from first century Jerusalem to its appearance in Lirey, France. The shroud has been shown to be a remarkable and totally unique object with an image that is simply unexplainable as a 14th century forgery. Such a forger is quite impossible. There is little question that the carbon dating technology was professionally applied, but it depends on the sample being representative in order to be accurate in dating the cloth and there is a massive amount of evidence that the samples were not only not representative but had been modified and manipulated with intrusives, dyes, and that the dating actually follows closely the UV fluorescence. Thus the conclusions are:

- 1) The carbon dating was of samples that were not representative of the cloth as a whole and so are not appropriate for determining the cloth's age.
- 2) The preponderance of evidence not only suggests authenticity but further exposes the overwhelmingly unlikely possibility that the image could be accounted for by a forger.
- 3) Mysteries remain as to exactly how the shroud got to Edessa, and where it was between Athens and Lirey. Also the details of the skewing of the carbon date need to be further explored so that the reason for the anomalous sample can be fully discerned.

Acknowledgements

I would like to acknowledge the contribution of my wife Jessica who has supported me in my efforts relating to the shroud despite the many hours. In addition there have been numerous shroud researchers who have made my journey instructive and fun, too many to name them all. A few need some special mention. Barrie Schwartz for his friendship and many discussions. He and STERA have provided a wonderful resource for shroud research and are deserving of the greatest praise and support. Dan Scavone has been an invaluable friend and helped me understand the history better. John Jackson has been an inspiration in many ways, but especially in reinvigorating my interest in the shroud way back in 1976 and on other occasions as I've followed his research. Mario Latendresse and his Shroud Scope has provided an important tool for exploring the shroud and demonstrated how effective interactive on-line resources can be. Ian Wilson of course whose Mandylion hypothesis bridged the gap from 544 to 1204 and of course Paul Vignon whose early research on Secundo Pia's pioneering photographs got science and the shroud going. These and many other researchers, too many to name them all continue to make the study of the shroud a fascinating and insightful journey.



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Dr. Schneider holds a B.S. in Physics, most of an M.S. in Physics, an M.S. in Engineering Science and a Ph.D. in Information Technology. He became a serious student of the Shroud of Turin about 1976 when the three dimensional characteristics were discovered.

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