

Does the Shroud body image show any physical evidence of Resurrection?

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SUMMARY

The many peculiar characteristics of the Turin Shroud body image are considered in this paper. Many processes of image formation are briefly considered and it is underlined the impossibility of science to explain an image formation mechanism capable to contemporarily satisfy all the evidenced characteristics.

A strictly scientific analysis then leads to the conclusion that the image could not exist, but anyone can observe it.

Taking a separation from scientific and religious points of view, there are considered other possibilities in a metaphysical point of view: no contradictions to the hypothesis of the Resurrection are found.

-1) INTRODUCTION

The Turin Shroud (TS) is a linen sheet 4.37 m long and 1.11 m large that bears the image of a scourged, crowned with thorns and crucified man (Jumper 1984, Adler 1996). There are also impressed many marks due to blood, fire, water and folding that partially disturb the observation of the double body image (front and back).

After scientific analysis of the TS in 1978, the STURP (Shroud of TURin Research Project) (Jumper 1984, Schwalbe 1982) concluded that the body image on it cannot be explained scientifically, and that a likely explanation consists of stating that the image formed as if it was caused by exposure to a short-lived but intense source of energy coming from the body covered by the TS itself.

The body image: is extremely superficial; was chemically caused by oxidation and dehydration of the cellulose fiber; is yellow in color, has chromatic uniformity, has three-dimensional (3D) features.

Individual 10 to 20 micrometer diameter fibers, on the tops of the linen threads, are darkened in random places to produce the image. This has been likened to a random halftone process, but there is no ink or dye, only dehydrated cellulose provides the chromophore. In darker areas of the image there are more of these elements. The resulting body image is shown by the VP-8 scanning densitometer (Jackson 1984) to have the proper anatomical shape.

Still another feature of this image is that it does not fluoresce when exposed to ultraviolet light, as would a scorch. The darkened sections seem to run for some length along the fiber. This can suggest the energy that dehydrated the linen fiber moved as normal electromagnetic radiation along the fiber until it was expended.

The bloodstains, transposed to the linen fabric by fibrinolysis, were impressed on the TS before the body image formed, since there is no body image under them; the processes of redissolving and transposition of blood in a damp environment may occur after a period of 10 hours; the body of the Man remained in the TS for less than 40 hours, because no signs of putrefaction can be found.

Many experimental tests have been carried out on linen fabrics in order to obtain results empirically similar to those of the body image of the TS. Although good experimental results have been obtained, in the sense that, at first sight, the image of the face is similar to that of the TS Man, until now no experimental test has been able to reproduce all the qualities found in the image.

The Man of the TS was not completely in a supine position but, according to the *rigor mortis* which began after his death for crucifixion, had his head tilted forwards (Basso 2000), his knees slightly bent, and his feet extended as a result of nailing.

The hypothesis now practically accepted by the entire scientific world is that the image is not a painting (Fanti 1999), since the scientists of the STURP showed the absence of paint pigments in quantities sufficient to explain the presence of an image (Jackson 1990). However, some doubts remain regarding the characteristics of the Man who was enveloped in the TS. Some distortions in the body image are evident, e.g., points corresponding to the hands and calves, which exclude any kind of photographic procedure used to obtain the image.

The goal of the present paper is the following: try to understand how the TS body image was formed; in particular discuss if any characteristics are scientifically unexplainable and hypothetically congruous with the event that Christian faith names Resurrection. This discussion has the scope to clarify the scientific position in reference to both the group of scientists that affirm the *null* correspondence between the TS and the Resurrection and to the group of scientists that affirm that the TS *is* the physical sign of the Christ Resurrection.

-2) CHARACTERISTICS OF THE BODY IMAGE

The body image of the TS shows physical and chemical characteristics that presently science is able to explain if considered each one, but it is not able to explain contemporarily; they are the following (Jackson 1990, Fanti 1999, Moran 2001, Damon 2002).

-A) *From a physical and chemical point of view the body image:*

- 1) is **chemically** due to a molecular change of the cloth cellulose, in particular a conjugated carbonyl structure associated with dehydration. There is also a lack of pyrolytic products as would be expected from high temperature cellulose degradation;
- 2) is chemically, thermally and water **stable** and cannot be dissolved bleach or changed by standard chemical agents (except by diimide that is hydrogen peroxide with hydrazine);
- 3) there is no **cementation** signs and no pigments (except perhaps a minimal quantity due to the contact with painted copies);
- 4) is extremely **superficial**, since only the first 4-6 fibers with respect to the 80-120 typical of a linen thread, are responsible of the image;
- 5) does **not fluoresce** like singeing;
- 6) is yellow in color and has **chromatic uniformity** with variations of less than 2%, since the *chiaroscuro* effect is caused by a different number of yellowed fibers per unit of surface, so that this is an image with 'areal' and not 'chromatic' density;
- 7) directly correspond to a **body enveloped** in the sheet: anthropometric indexes are compatible with that of a man whose race is the nearest to the actual Semitic (Fanti 1999) and some cylindrical distortions (shoulders) are compatible with a man laid (over the TS) on a soft or curved bed (Fanti 2001); the enveloped body was a **corpse** because of the separated blood that came out from the side wound;
- 8) no evidences **putrefaction** signs in particular around the lips; this implies that the man was enveloped in the sheet for no more than about 40 hours; the lack of liquid in image formation indicates that the body was quite dry (Rogers 2002);
- 9) shows a different **tensile strength**: it is much higher in a non-image-fiber than in a image-fiber because it took less force to pull adhesive tapes from image area during STURP analysis (Rogers 2002);
- 10) is characterized by fibers in which the **medullas** are not affected by the image-forming process (Rogers 2002).

-B) *From an optical point of view:*

- 1) the body image has **three-dimensional (3D) features** which are consistent with the relation linking the distance between TS and enveloped body, see Figure 1. As a result, a **3D** reconstruction of the body can be made. Both the frontal and dorsal image intensity varies inversely with the cloth distance. Some researcher states that shading does not prove body-cloth separation, but this is proved by a real draping around a corpse: for example the zones around the nose and eyes are very hard to put in contact with a cloth;

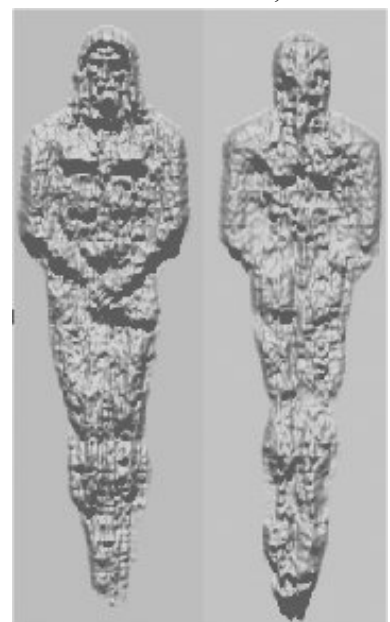


Figure 1: 3D features of the front and back image after cleaning and reconstruction (Fanti 2001).

- 2) the body image is **well resolved**; the resolution is of the order of 1 cm (for example the lips on the face); instead the resolution of the bloodstains is of the order of a millimeter (for example the scratches in the scourge wounds);
- 3) the maximum **luminance** level of the **front** image and that of the **back** image (face excluded) are compatible within an uncertainty of 5%. This means that the back image is not influenced by the body weight;
- 4) the maximum **luminance** level of the **head** image (front) is 10 % and more higher than that of the whole body image. This fact can lead to a hypothesis of an extra energy coming out of the head;
- 5) **side images** surrounding the front and back body images, including the region between the front and back of the head, are missing;
- 6) the body image is generally coherent with a **vertical projection** of the corresponding human body as the TS was draped naturally over a body shape lying in the supine position; however other models are under consideration (Fanti 2001);
- 7) the image is **non-directional** in the sense that no shadowing due to a light source is evident;
- 8) some **distortions** due to enveloping are evident in correspondence of the hands, shoulders and calves;



Figure 2: Mark Evans 1978, body Image (nose ME-29, 36x) kindly furnished by Barrie Schwartz.

- 9) the color of the **image-areas** has a **discontinuous distribution** on the entire facing surface (Rogers 2002), see Figure 2;
 - 10) optical microscope analysis **clearly distinguishes imaged from non-imaged fibers**. As shown in Figure 3, non-image fiber is clearly more transparent than a image fiber. The image fibers have a more abraded surface than the non-image ones;
 - 11) the body image has **not well defined contours**, i.e. in correspondence of an image edge, the rate of change of luminance level is relatively very low: contours are shaded also along a distance of 1 cm. As a result, the body image is visible only if an observer is at about 2 m or higher of distance from the TS.
- C) Other:**

- 1) the red stains are composed of human **blood** (AB group); the bloodstains have well defined contours without any sign of sliding between cloth and corpse, so it is now not explainable how a man that go out of the TS can leave imprints such those;
- 2) **bloodstain formation process** is different from the body image one and it happened **before the body image** was formed because no image exists below the bloodstains. There are two different draping configurations: the first in time is the natural draping when blood stains occurred, the second when the body image formed and corresponds to some TS areas flattened (face);



Figure 3. Two sharply terminated image fibers. The individual image fibers have very sharp boundaries at their ends across the 15-micron diameter of the fibers. At the boundary between the image fiber and the clear fiber, there is a sharp change. The imaged areas of the fibers are brittle and are cracked because Frei used his fingernail to crease the sticky tape sharply on the cloth (1978 Frei sample slide 4bd).

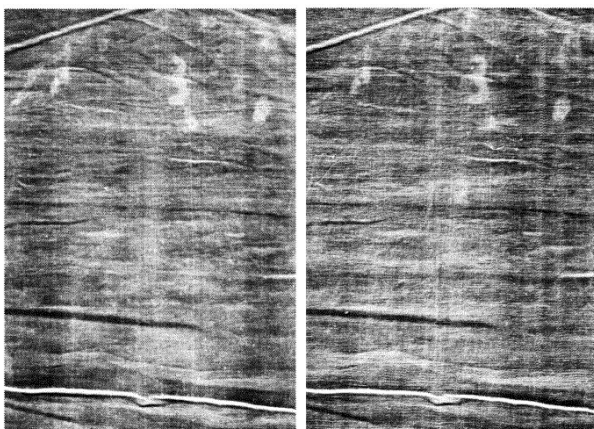


Figure 4. Contrast enhanced photos of the front and back face of the TS obtained by the second author, processed starting from the scanning performed by P. Soardo (Soardo 2001). The processing of these images was kindly allowed by Mons. G. Ghiberti. On the back side of the face

some image characteristics such as the zone around the eyes and perhaps the nose appear.

-3) From the scanned photo of the front and back face made by P. Soardo (Soardo 2000), the second author, informed by M. Salcito (Salcito 2001), noted that some image characteristics such as the zone around the eyes and perhaps the nose also seems to appear on the back side of the face, see Figure 4. The stain under the right eye can correspond to the “strange stain in the right eye socket” detected by A. Guerreschi (Guerreschi 2000). This result has to be verified with further studies. For example it must be excluded that the image on the back is due to light transmitting through the cloth even if this fact is not evidenced in other face areas (lips for example). It must also be certain that stains from the body do not penetrated the cloth, even if the zone around the eyes is a non-contact zone between skin and sheet. If the existence of some body images will be confirmed only on the backside of the frontal body image, J. Jackson’s speculation (Jackson 1990) should be verified;

-4) A photo of some fibers, coming from the arm area, showed (Moran 1999) individual image fibers had very sharp boundaries at their ends. At 200x magnification it is seen that these fibers are very uniformly darkened about 30% over the natural color of the non-imaged fiber. At the boundary between image and clear **fiber**, there is a **sharp change**; they have been abruptly chemically altered. There is no gradual edge as expected from a shadow mask or external light source. The first author suggested that the image could be formed when a high-energy particle struck the fiber and released radiation. If the fiber acts as a light pipe, this energy moved out through the fiber until it encountered a discontinuity, then it dispersed. Two of such sections are shown in Figure 3. To confirm this evidence it must be studied more deeply the possible kind of energy source and considered other specimens of image-fiber, but until now no new test are allowed.

-3) POSSIBLE FORMATION MECHANISMS OF THE BODY IMAGE

It is obviously difficult, if not impossible, to make a laboratory copy of the TS that satisfies all the characteristics evidenced, but some researchers proposed many hypothesis of image formation and carried out many experimental tests (Jackson 1990). The most interesting and innovative hypotheses (Fanti 1999) are here considered and discussed.

-A) Artist intervention

Some researchers hypothesized that an artist constructed the image artificially by different means. Among them the following are considered:

-1) **Painting** (McCrone 2000) but this is inconsistent with the characteristics discussed in items A1,2,3,4,6,7,9,10; B1,2,4,5,6,7,8,9,10,11; C2,4 of §2.

-2) **Modified carbon-dust technique** (Craig 1994) but this is inconsistent with the characteristics discussed in items A4,7,9,10; B1,4,5,6,8,10,11; C2,4 of §2.

-3) **Technique involving a bas-relief** singeing (Ashe 1966, Delfino Pesce 2000) or rubbing a sheet on a bas-relief treated with iron oxide and sulfuric acid (Nickell 1997); but this is inconsistent with the characteristics discussed in items A4,5,7,10; B3,4,9,10,11; C2,4 of §2.

All the following hypotheses consider the body enveloping.

-B) Diffusion mechanism

A **diffusion mechanism** was proposed by Vignon, Adgè and Imbalzano but this is inconsistent with the characteristics discussed in items A4,6,7,8,9; B3,4,5,9; C4 of §2.

-C) Direct contact

A **direct contact** was proposed by many researchers such as Volkringer, Judica Cordiglia., Romanese., Rodante, and Pellicori, but this is inconsistent with the characteristics discussed in items A4,9; B1,3,5,10,11; C4 of §2.

In order to satisfy item B1 of §2 the radiation mechanism was proposed.

-D) Natural radiation source

It was proposed a **natural mechanism** of radiation connected with earthquakes (De Liso 2002). It was detected that a variation of the electromagnetic field, also connected to a radon emission, is responsible of image formation of objects situated in linen sheet placed among two gneiss plates that can act as a condenser. The formed image is inconsistent with the characteristics discussed in items A4; B3,4,9,10; C4

of §2, but, if confirmed, it could be the first experimental test capable to physically show the characteristic discussed in items B5,6 of §2.

-E) Radiation source coming from within the body

To explain all the characteristics discussed in §2, the presence of a **radiation source** coming from within the enveloped body was supposed by de Malijay, Jackson., Rodante, Judica Cordiglia., Golikov and Lindner.

Many sources of energy are supposed by the various researchers; for example a nuclear irradiation, that causes acid oxidation of the superficial fibers of a linen sheet, was hypothesized (Rinaudo 1998 and Accetta 2001).

The hypothesis of a radiation (perhaps comprising a visible light) is the most reliable for the authors because satisfies all the items of §2, but presently is not completely sustainable because no experimental tests are able to reproduce the whole peculiar characteristics detected. For now, a miracle must be involved to explain all the characteristics of the TS. In particular a wide-range-spectrum source of light coming from the body could be catalyzed by the aloe mixture in the cloth to form the conjugated carbonyl structure of the fibers associated with dehydration.

Regarding item B5 of §2, the side images are absent because the Man of the TS was not wrapped but enveloped and flowers could be put around him (Fanti 2001).

Regarding item B9 of §2, the color of the image-areas is not equally distributed on the surface, but this can be due to the non-uniform distribution of the catalyst on the fibers.

Even if it could be possible to test components of a unexplainable phenomena, obviously hypotheses that involve scientifically unexplainable phenomena cannot be rejected, but go out from the scientific field and therefore cannot become a theory.

-G) Mixed mechanisms

Some researchers (Scotti, De Salvo and German) proposed the hypothesis of many mechanisms affecting the body image formation. For example someone states that a diffusion mechanism can act in parallel with a direct contact and perhaps also with radiation. This statement perhaps arises from the detection that only a radiation source coming from within the body can completely explain the image formation, but no one has been able to simulate this source in the laboratory. So, as the body image exists, it can be alternatively supposed that it is due to many different causes acting together.

Recently it was proposed (Rogers 2002) the following hypothesis: “The finished cloth was washed in *Saponaria officinalis* and laid out to dry. Starch fractions, linen impurities and *Saponaria* residues concentrated at the evaporating surface. The cloth was used to wrap a dead body. Ammonia and sebaceous components of sweat together with early amine decomposition products reacted rapidly with reducing saccarides on the cloth in Maillard reaction. The color developed slowly as Maillard compounds decomposed into caramelized polysaccharides” but this is inconsistent with the characteristic discussed in item B1 of §2 and can be questionable with items A4, 6, 8 and B3 of §2. Furthermore experimental results have to confirm this hypothesis.

In the experience of the authors, a solution to a not-well-understood problem can be reached by hypothesizing the presence of many different causes acting together, but frequently this solution hides the incapability to reach the problem essence. Then by applying the principle of minimum assumption, or Occam’s razor, the situation can be simplified, and only the most important facts are highlighted:

- according to items A4 and B1 of §2 a burst of radiant energy might be involved in the body image formation process to explain the acting-at-distance phenomenon and the superficiality of the image;
- according to items A7 of §2 a corpse was enveloped in a sheet;
- aloe on the TS, the presence of which was independently detected by different researchers, acts as catalyst in the oxidation of linen fibers;
- wide spectrum light including UV such as sunlight (as other sources as soft X-rays or protons) causes an oxidation and dehydration of the linen fibers; this reaction is accelerated if a linen sheet is wetted in an aloe solution.

The simpler hypothesis that follow is that of a man, enveloped in a sheet wetted in an aloe solution, emitted an energy like a wide spectrum light.

If the most reliable hypothesis is accepted, another important question arises: what caused the radiation source? Many scientists tried to find natural sources of energy to explain the evidence, but until now no convincing solution were found.

At this point someone may ask the following question. *Is the most reliable formation mechanism of the body image scientifically explainable?* And then, coming out from the scientific field: *is the hypothesized source of energy coming from within the body correlabile to the Resurrection?*

-4) PROPOSAL FOR NEW TESTS

Now the Scientific Method calls for new tests to confirm the details leading to these hypotheses, but it is difficult for two reasons:

- Because many researchers proposed new test on the TS, but until now they are not allowed; for example the Shroud Atlas Group proposed a new series of tests to build up a big multiresolution and multispectral atlas of the TS (Fanti 2000).
- It is not easy to propose to test something that is at the boundary of science. Perhaps the exhaustive scientific demonstration of something correlated with faith will not be possible, but some tests can clarify the position assumed by the authors and by a wide scientific community.

To show that the hypothesis about the burst of energy coming from within the body is the best, the following points are to be verified.

1. Tests aimed to surely prove that all the hypotheses of image formation are excluded, except radiation.
2. Test aimed to prove that a natural radiation is to be excluded. For example the conditions defined by De Liso (De Liso 2002) can be reproduced in laboratory with electromagnetic fields higher to verify items A4 and B9 of §2
3. Theoretical, numerical and experimental simulation turned to show that really the energy comes from the skin level of the corpse and the relative image formed on the sheet is comparable to that of the TS.
4. Test to show of which kind is the energy radiation: wide-band light, narrow-band light, UV, X-rays, proton, neutron or other types.
5. Test to confirm the effect of a radiant energy exposure; for example, if a neutron source of energy is supposed, a nuclear change of atomic components must be supposed. For example it could be interesting to measure the percentage of ^{40}Ca converted in ^{41}Ca by a hypothetical flux of neutrons. A photo of the TS made by a X-ray sensitive film, can inform about the possible presence of a radioactive body image impressed in the sheet, but presently this test is difficult to realize because it should be necessary to put the TS into a deep cave or gallery for a long time (months).

The scientific investigation on the TS is therefore not easy and immediately conclusive, but, if the TS waited for about 19 centuries before to be photographed for the first time, some centuries can pass before to have some accurate results.

-5) DISCUSSION

It is necessary to **separate scientific from religious** aspects in the study about the TS to have reliable results.

5.1) From a scientific point of view. STURP (Jumper 1984) unequivocally showed that the body image has unique characteristics not presently reproducible. Furthermore from microscopic analysis of TS fibers, taken by Max Frei in 1978 the first author hypothesized an energy burst, due to the state transformation of the body, of the order of 0.1 ns that caused the emission of high energy particles that struck the linen fibers and induced heating, along the fiber, just as light travels in the optical fiber.

It is also known that the 3D characteristic of the body image lead to the hypothesis of a radiation as a cause of the formation image because an agent acting at a distance with decreasing intensity is, almost by definition, radiation (Gonella 1984).

The fact that the body image penetrates into the cloth to a depth of no more than a few linen fibers on the crowns of the threads, suggests the hypothesis of a burst of energy.

Aloe has a catalytic effect if an electromagnetic field (as the light) acts on a linen sheet and an image forms on it.

Well defined contour of blood stains lead to think that there were no movements between corpse and TS after the deposition into the tomb: a non scientific explanation of this can be the body disappearance due to an unknown phenomenon.

Gonella wrote: “We know of no mechanism by which a human body could bring about at distance on the fibrils the chemical change that constitutes the TS image”.

Science has also verified: that blood was impressed on the TS before the body image and that the fibrinolysis process lasted 10-40 hours; that the human body was enveloped for a time of not more than 40 hours because no putrefaction evidences were found.

Some researcher make only reference to the known sources of energy (gravitation, electromagnetism, strong and weak nuclear forces) to try to explain the evidence, but it must noted that it is not possible to state that everything has been invented now.

Finally, no one could explain how a “dead” body could generate heat or light. Science can go no further. From a scientific point the body image is unexplainable. Science bases itself on the verifiability criterion but truth is not exclusively identifiable with everything can be verified. Therefore, science must respect the existence of other different competence fields, as those of philosophy and theology (Malantrucco 2002).

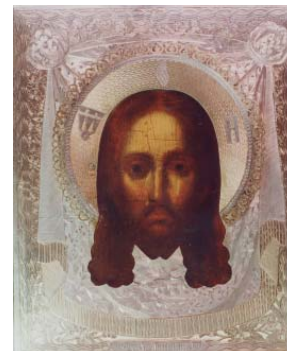


Figure 5: Mandylion

5.2) From a theological point of view Resurrection is only a sign of Jesus divinity that does not constrain to believe.

The hypothesis of the Resurrection as the cause of the body image formation on the TS is independent on the faith in Jesus as God (Malantrucco 2002).

As underlined by O. Petrosillo, the Medical Commission of the Holy See, during a beatification or canonization, does not speak of “miracle” (this is further done by theologians) if it is asked for a scientific evaluation of a recovery. It limits to the declaration if the recovery is explainable or not, on the basis of the scientific knowledge. The TS is not completely scientifically explainable.

All the results obtained from the TS completely agree with the Gospels and furnishes more details (i.e. scourging). In addition Old and New Testament very frequently refer to **light**.

For example (Luke 9:29) Jesus **Transfiguration** is reported as a prelude of the Resurrection “As he was praying, the appearance of his face changed, and his clothes became as bright as a flash of lightning”. Light is the term most associated with God in the Eastern Church, even more so than love, power or wisdom (Damon 2002).

According to E. Lindner (Lindner 2000) the TS can be considered as a “scientific Gospel”; the author writes: “He took on human nature and so it would be a serious scientific and methodological fault if one was to ignore it”.

Furthermore Eastern Church venerates the Mandylion, Image of Christ *Achiropita* Made-Not-With-Hands, see Figure 5, that can be the image of the TS shown at Edessa in the firsts centuries.

At **Pentecost** in Acts (2:1-13) it is written: “ When the day of Pentecost came, they (Apostles) were all together in one place. ... They saw what seemed to be tongues of fire that separated and came to rest on each of them. All of them were filled with the Holy Spirit and began to speak in other tongues as the Spirit enabled them. ... The crowd came together in bewilderment, because each one heard them speaking in his own language. ... Amazed and perplexed, they asked one another, "What does this mean?" Some, however, made fun of them and said: "They have had too much wine."

The same behavior of people during the Pentecost miracle seems to be manifested by some skeptical researchers when studying the TS. According to Fanti (Fanti 1999) there are many evidences that lead to the TS authenticity, but there is no one “unquestionable proof” of its authenticity perhaps because God wants to let anyone free to think and to act in accordance to his own free-will.

5.3) From a more general point of view.

At the end of this discussion it is shown that science postulates the following aspects in the Resurrection hypothesis: a burst of energy that can be wide-range-light, UV, soft x-rays or other (perhaps not discovered for now) that came from within the corpse.

The faith explains this stating that Jesus Christ was able to show himself wrapped by a source of energy manifested as light emanated during the Transfiguration.

Is perhaps the TS image a scientific result of the Resurrection of Christ?

There is a problem with scientists when a non-scientifically explainable phenomenon arises, namely the Resurrection of Jesus Christ.

Furthermore it is philosophically important to recognize that the **reproduction** of a “perfect” image would not prove how this image on the TS was produced.

After the blood soaked into the TS as it enveloped the dead body, an extremely fast and intense source of energy (light) can be imagined and modeled by science to be correlated to the Resurrection that may have caused the body image and propelled the bloody scabs of the scourging, nailing and lance to be fastened to the cloth in the unique way that they are.

Then, from a **positivistic** (materialistic) point of view, that reduces all the knowledge to what is detectable, the body image is not explainable but exists. From a more general, **metaphysical** point of view, also including the theological one (even if a sure demonstration is not possible for now) as all signs are directed in a unique direction, so the Resurrection hypothesis seems for the authors the most reliable.

-6) CONCLUSIONS

This work analyses many peculiar characteristics of the TS body image that are not simple to reproduce and not possible for now to contemporarily reproduce. No one has been able to find a technological solution able to reproduce all the characteristics.

The discussion of many interesting but not conclusive processes of image formation are briefly considered underlining the impossibility of science to explain an image formation mechanism capable to contemporarily satisfy all the evidenced characteristics.

It is then shown that a strictly scientific analysis only leads to the conclusion that the image could not exist, but anyone can observe it. A more general, metaphysical point of view is then used to try to explain the evidence. Obviously the scientific aspects are considered separately from other, religious, points of view in order to clearly show to the reader to which point can arrive science and to which does not.

The authors then conclude that, from a more general point of view, there are no contradictions to the hypothesis of the Resurrection as TS body image formation cause, even if many scientific aspects must be for now postulated.

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