

The original presence of burial ointments on the Turin Shroud

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ABSTRACT. The research of aromas and burial ointments on the Shroud of Turin, by microchemical and spectroscopic measurements, has furnished various results. Therefore, we investigated the effects that the above substances, if present, could have produced on the body image characteristics. In this way, the displayed differences in the attenuation effects related to the formation of the back part and the front part of the body image could be a sign of the presence of aromas and/or burial ointments.

I. INTRODUCTION

When a team of scientists and support technicians known as the Shroud of Turin Research Project (STURP) and a group of Italian researchers performed, independently, experiments on the Shroud (October 1978 in Turin), they also investigated aromas and burial ointments [1-5]. In fact, the original presence of these substances should, stimulating the degradation of the cellulose, have contributed to the body image formation.

The Turin Shroud (see Fig.1), as it is known, is an ancient linen cloth (4.36 m long × 1.10 m wide) that shows the front and back images of a scourged and crucified male [1,6]. In fact, in opportune zones over and near the body image, there are bloodstains. Moreover, burned and scorched areas and “water marks” are present on the linen.



Figure 1 The front and back images on the Linen of Turin

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Today, many people believe it to be the burial cloth of Jesus of Nazareth (the Shroud man appears with intact legs [7] and wounds to the forehead, nape, feet and chest and scourge marks everywhere). Others, from results of the 1988 ^{14}C dating [8], are sure that it is a mediaeval forgery.

The history of the Shroud of Turin is confirmed from about 1350, when it was in the possession of Geoffrey I family, count de Charney in Lirey. In 1452, the above cloth was ceded to Ludovico I, duke of Savoy. Successively, in 1502, the Savoy family placed it in the "Saint Chapelle" of Chambéry where a fire, in 1532, damaged it in some part without remedy. In 1578, Emanuele Filiberto duke of Savoy transferred it in Turin where, in 1694, has been placed in the Guarini's chapel. From 1983, because of the desire of Umberto II of Savoy, the Shroud has been the property of the Roman Catholic Church and the Archbishop of Turin is its custodian [9-12].

From 1898, the year of the first photograph of the Turin Shroud that marks the start of scientific research, many results have been obtained and can be briefly reassumed in the following statements:

- a)* the body image is the result of some uneven cellulose surface processes (dehydration, oxidation and conjugation) with a formation mechanism that remains unknown [13,14];
- b)* these chemical processes yielded a body image that can be described as a negative in the photographic sense [1,2];
- c)* the above image has high resolution with the intensity values of the front part correlated, by regression line, to the cloth-body distance expected by wrapping volunteer human subjects in a full scale model of the Shroud [15];
- d)* the bloodstains are made of blood and serum with bile pigments presence [2,13,14,16];
- e)* the proteins and the serum distributions are in line with a cloth used to wrap a wounded human body [2,13,14,16];
- f)* the bloodstains were on the Shroud before the body image [17];
- g)* the heavy elements present on the linen do not show concentration differences between image (non-blood) and off-image areas [18];
- h)* the high concentration of iron in the bloodstains is explained from iron porphyrin compound presence [13,14,18];

- i) the burns and scorches are due to the combustion of linen (in 1532) at high temperature in a limited oxygen environment [13,14];
- j) the “water marks” derive from the extinguishing of the 1532 fire [13,14];
- k) the patches and the Holland cloth, that were sewn (in 1534) by the Poor Clare Nuns of Chambéry to repair the damage caused in the above cited fire [19], were (in 2002) removed [20];
- l) the off-image area is made up of yellowed surface fibrils of linen that are less degraded than the image area ones [13,14];
- m) the pollen identified on the cloth comes from various different plants native to central Europe, Palestine and the Constantinople region [21]; very interesting is the presence of the *Gundelia tournefortii* (27,3% of the total), *Zygophyllum dumosum* Boiss, *Cistus creticus* and *Capparis aegyptia* pollens that grow in Near Eastern areas, only [22, 23];
- n) the search for the aromas and burial ointments furnished contradictory results [2-5];
- o) the “loam image” agrees with the hypothesis that the Shroud is a cloth of Near Eastern that wrapped a wounded human body [17, 24];
- p) the presence and details of coins over the eyes of the “Shroud man” (two lepton coins of Pontius Pilate, both minted in A.D. 29) are confirmed [25];
- q) the radiocarbon dating by accelerator mass spectrometry in laboratories at Arizona, Oxford and Zurich provides evidence that the linen of the Shroud is mediaeval [8]. Recently, has been showed that the radiocarbon sample was not part of the original cloth of the Shroud of Turin [26]; moreover, the lack of vanillin in the lignin of the above Linen indicates a much older age than the reported one [26, 27];
- r) in the linen (*Linum usitatissimum*) are presents traces of cotton (*Gossypium herbaceum*) [28];
- s) the VP-8 analysis shows that the frontal maximum relief amplitude are roughly the same as the general dorsal amplitudes [15];
- t) the average value of the cloth-body distance related to the front part of the body image is greater than the one related to the back part of the same image [19];
- u) the recent discovery of the double superficiality of the frontal image of the Turin Shroud is not sure [29-30].

Now, as one can see from scientific literature, nevertheless the work of various teams of scientists and technicians, the formation mechanism of the body image has still not been detected, the radiocarbon dating did not agree with both the presence of the two Pontius Pilate lepton coins and the lack of the vanillin in the lignin presents in the flax of the Shroud and the search for burial ointments has not furnished definite results.

II. ON THE PRESENCE OF THE BURIAL OINTMENTS.

In this work, we want to investigate on the original presence of aromatic substances: the visual microscopic and SEM examination of fibrils and particles removed from the Shroud by means of adhesive tapes in the search for the aromas and burial ointments (for example: aloe and myrrh) furnished, in line with the thermic instability of these organic materials, negative results [2]. Moreover, the body image intensity does not appear altered in proximity to the burned areas (due to the 1532 Chambéry fire) as it should have been if the density of the above image was due to the presence of aromas and burial ointments too.

On the contrary, two Italian scientists by immunofluorescence technique have detected, from a fragment of thread removed from the Linen of Turin, the presence of aloe and myrrh [3].

Finally, a STURP member *et al.* [4,5] analysing the samples vacuumed from the space between the back-side of the Shroud and the Holland cloth found the compounds of some elements that could reveal the original presence of *Natron*, a substance anciently used for the dehydration of corpses.

Now, because the research with microchemical and spectroscopic measurements has furnished various results, it is necessary to investigate by detecting the possible presence of aromas and/or burial ointments from the effects (if they are detectable) that have been produced on the linen or on the body image characteristics.

In this way, we affirm that the regression line is well represented by a linear function type:

$$I(z)=I_M(1-z/R_0)$$

where z is the cloth-body distance valued for each point of the Shroud surface as described in the $c)$ point, I_M the image intensity in the contact points and R_0 the cloth-body distance that makes $I=0$ [31]. A similar equation can be written for the superficial fibril density. Obviously, the field of z variability is: $0 \leq z \leq R_0$. The above function does not describe the degradation effects known as cloth background intensity. Consequently,

in each point of the Shroud the image intensity is the sum of the background and of the contribution $I(z)$ related to the body shape presence:

$$I_{TOT}(z) = I_B + I_M (1-z/R_0)$$

where I_B is the average cloth background intensity [32]. Thus, taking into account that the statement of the *s*) point means that $(I_M)_{back} \approx (I_M)_{front}$ and that $dI/dz = -(I_M/R_0)$, we think that the differences in the intensities of the superficial discoloration are due to attenuation effects.

We do not know if a regression line exists as correlation between I and z for the back part of the body image. This occurs because the expected cloth-body distances are small owing to compression of the body on the cloth [15] and it is very difficult to evaluate them and the correlated change of intensity.

Now, because the back part and the front part of the body image have the same characteristics, we think that such a correlation exists. In fact, nothing contradicts this hypothesis.

Thus the image intensity degrades from the areas of contact, where $(I_M)_{front} \approx (I_M)_{back}$, towards the background value through cloth-body distances that are different. As appears in Fig.2, in line with the statement of the *t*) point, the distance that changes $I(z)$ from I_M to background value related to the front part of the body image $((R_0)_{front})$ is greater than the one related to the back part $((R_0)_{back})$. In the figure, these regression lines are represented with solid and dash-dotted lines, respectively. Consequently, the above $I(z)$ function has for the back part a slope $(dI/dz = -I_M/ (R_0)_{back})$ that in absolute value is greater than the one of the front part $(dI/dz = -I_M/ (R_0)_{front})$ showing attenuation effects that are more intense relatively to the back part of the body image. Here, it is opportune to underline that the dash-dotted line $(I(z) = I_M(1-z/(R_0)_{back}))$ has been represented in Fig.2 with a $(R_0)_{back}$ arbitrary value.

Now, why should these effects be more marked in the Shroud region where the back image lies? This, that is a discrepancy in the knowledge of the above Linen [33, 34], must be resolved. The difference, remembering that in the contact points of both back part and front part of the body image it is $I = (I_M)_{front} \approx (I_M)_{back}$, is certainly due to the interposed material between the Shroud and the human body shape: with only air we should have the same slope. Therefore, it is necessary to think of a different material than air. Today, remembering also that the Shroud of Turin is a burial cloth, the only possible answer is related to the original presence of aromas and/or burial ointments because in

ancient times these organic materials were used in solution (watery or greasy) or more simply in dust form. In such a case these substances would not have contributed to the body image formation but, due to their different distribution between the front part and the back part of the human body shape, they would have modified differently the attenuation effects.

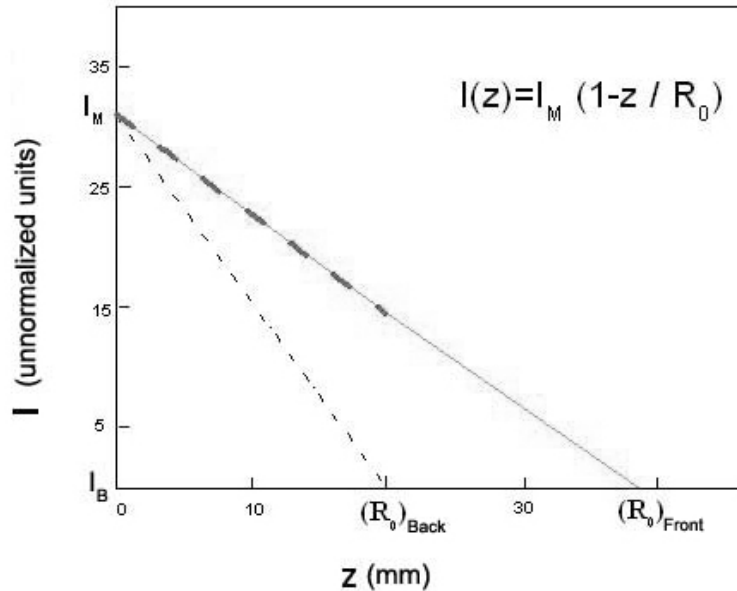


Figure 2. Intensity of the Shroud body image *versus* the cloth-body distance. Solid line: measured $I(z)$ correlation for the front part of the body image [15]. Dashed and dash-dotted lines represent the hypothesized correlations for the back part with the same $(-I_M / (R_0)_{\text{front}})$ and different $(-I_M / (R_0)_{\text{back}})$ slope with respect to the front part of the body image, respectively. The zero in the unnormalized units of I coincides with the average cloth background intensity.

Today, we know the $I(z)$ function (and its slope) relating to the front part of the body image because it was deduced by fitting procedure on the data obtained using a microdensitometer in 13 image locations at estimated z values [14,15,35]. For the back part of the body image the hypothesis of a regression line is reasonable while we are not sure of the slope. The only alternative hypothesis, even if it is less probable, appears in Fig.2. Here, this function, represented with a dashed line, is the same as the front part one in the range $0 \leq z < (R_0)_{\text{back}}$ and it has the $I=0$ value for $z = (R_0)_{\text{back}}$.

In such a case we cannot justify the presence of aromas and/or burial ointments but we cannot exclude it because we should have the same attenuation effects, that could be due to the same front/back distribution of the above organic materials. However, we think that of the two hypothesis the more probable is the one that foresees for the back part of

the body image an $I(z)$ represented by a regression line with a different slope (dash-dotted line in Fig.2). In fact, in the Shroud back regions which concerns us rapid changes do not appear in the I distribution values. The abrupt changes in the image intensity that are visible on the Shroud (for example, at the sides of the face) are due to the different lots of thread used in the manufacture of the cloth [19,14].

III. CONCLUSIONS.

As it is known, the open questions on the Shroud of Turin are various and contribute to debate that has continued for tens of years. Today, some of these problems seem to be far from being resolved. Relatively to the matter which concerns us, we think that, due to their thermic instability, on the Shroud there are not traces directly rivelable of aromas and/or burial ointments [2]. Therefore, it is necessary to deduce their presence from the effects produced on the cellulose discoloration distribution. This is what we have done versus the original presence of these substances. In fact, in any two areas at equal distance z_0 , one in the front and the other in the back part of the Shroud body image, we did not deduce the same value of the image intensity because it is: $I(z_0)_{\text{front}} > I(z_0)_{\text{back}}$.

These front/back differences can be well explained with the presence of aromas and/or burial ointments. In any case, it is very important to measure the intensity distribution I on the Shroud to confirm the obtained result for the front part of the body image and to deduce the true slope for the back part of the body image.

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