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Discoloration Range and Shroud Image Depth Values Cannot Be Satisfied by the Same Proton Energy

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Abstract

The radiative hypothesis has been revisited showing other characteristics, produced by the protons used as dyes in total disagree with the ones of the Body Image that appears on the Shroud of Turin. Our investigations highlight that for the protons to reach 3.7 cm in air, the distance that measures the range of discoloration effects, must be emitted with an energy of about 1.5 MeV using Wilson and Brobeck's empirical formula and 1.35 MeV using Bethe's. This last formula provides a result closer to reality. Bethe shows that the penetration depth is greater than that calculated empirically. Such a value of proton energy (1.35 MeV) makes it possible to satisfy the discoloration effects range for the Shroud but it is incompatible with a depth of penetration in linen that is only 200 nm. Moreover, using the same subatomic particles, we obtained on the colored linen a distribution of energy represented by regression but not linear. Thus, also the possible I(z) correlation, between color intensity and body-sheet distance, which should be due to the oxidizing action of protons, does not agree with that extracted from the Shroud of Turin.

Keywords

Shroud of Turin, Body Image Formation, Radiative Hypothesis, Proton Model, Discoloration Effects Range

1. Introduction

Currently, to find out the Shroud Body Image formation, the radiative hypothesis is the most accepted (among scholars and scientists) compared with the other hypotheses that appear in scientific literature. In fact, articles describing the irradiation of a piece of linen cloth with subatomic particles, in particular protons

are a lot. These last ones are particles that can excite or ionize the crossed matter. Moreover, it can generate scattering, to produce radiative losses (bremsstrahlung emission) or to trigger other processes [1] [2] [3] [4]. However, to affirm: "the protons ionize" it is corrected as this is how it loses most of its energy, therefore, ionizing means removing electrons from the crossed matter which oxidizes. In the case of linen, at a macroscopic level, this process manifests itself with a yellowing. Many of these papers come from the other part of the Atlantic Sea [5]-[16]. Here, it is necessary to underline that, in these processes, the results depend on the type of radiation, its energy and the characteristics of the crossed matter.

We believe that the radiative hypothesis is not able to explain the formation of the Shroud Body Image [17] [18] [19] [20]. Thus, without going into details of the above articles, we affirm the following:

1) *For a human body, even when it is in the state of a corpse, it is impossible to emit subatomic particle* (*e.g. protons*).

The knowledge acquired over time says to us that human beings can only emit thermal radiation. Physics does not accept these emissions of particles and also Theology strongly disagrees with such an event. Otherwise, we would be in front of a supernatural event (Miracle). In fact, it is unnatural thinking about these models of emission [18]. However, if so, it would be the first case in the history of humanity.

2) *The protons, even if used with the intention to hit the suitable fibrils and to produce an image like the one on the Shroud of Turin, must obey the laws of Physics.*

The above particles cannot choose the fibrils that need to be struck in order to form an image like the present one on the Shroud. Physics disagrees with desires. Therefore, it is not possible to obtain a suitable correlation between the yellowed fibrils density (or image intensity) and the body-sheet distance. Thus, another important characteristic of the Body Image on the Shroud of Turin should be absent.

3) *The problems are due to the presence of a layer of air, with variable thickness, between the body and the sheet in the no-contact regions.*

The presence of air between the body and the burial sheet, in the no-contact areas, reduces the kinetic energy value of the emitted protons. Therefore, it will not be possible to penetrate the flax up to the canonical 200 nm [21]. This problem does not exist in the contact regions. Therefore, in the no-contact regions, the above particles should provide a coloration with a reduced penetration depth. The layer of air coincides with the body-sheet distance which, as it is known, is variable. So, the thickness of the coloration is constant in the contact regions only and variable in the no-contact ones. In other words, along to way the physical state of the particles changes and the penetration depth is the smallest whereas the layer of the air is the largest. Therefore, what is written in the 1), 2) and 3) points should be sufficient to encourage and stimulate, even the most determined scientists among the ones that appreciate the radiative hypothesis, towards the abandon-

ment of this approach.

To avoid failures and to make goals in this complex research of the process that formed the Shroud Body Image, we think that it is useless to insist on the radiative hypotheses. In fact, there are more than four decades of attempts, with experimental and theoretical support, and the distance with Physics and Theology has not changed. In our opinion, with this state of affairs, these remarkable scientific abilities should head towards lines of research more suited to this type of problem.

Despite considerations, related to Physics, Logic and Theology, we see many scholars and scientists that support the radiative hypotheses that challenge the ideas of other researchers and ours own. Thus, in this paper, we decided to make other investigations that before we have not made because we were certain, and we still are, that the ones deduced by empirical formulas present in literature would have furnished reliable results [20].

2. Discoloration Effects and Shroud Image Depth

Nowadays, everyone knows that the Shroud of Turin, beyond the 2D characteristic, owns also the 3D one (**Figure 1**). Moreover, it exists a correlation between the yellowed fibrils density (or image intensity) and the body-sheet distance [22] [23] [24]. This correlation synthesizes the information on the body-sheet distance encoded in the Shroud Body Image: $I(z) = I_M (1 - z/R_0)$, where I(z) represents the image intensity value I at the z body-sheet distance, I_M the maximum value of intensity (achieved in the contact areas, only) and R_0 the distance that makes $I(R_0) = 0$. The distance z ranges between $z = 0$ and $z = R_0$. The slope of this formula is a negative constant ($dI/dz = -I_M/R_0$). Therefore, the trend is one of linear regression. To test the quality of the correlation image intensity versus body-sheet distance, it has been valued the r^2 Coefficient of determination that was only 0.60. A result that explains well the distribution of points in the I(z)-plane.

Over time this expression has undergone many criticisms. For example: 1) the measures to extract the I(z) expression were made in a small area of the Shroud,

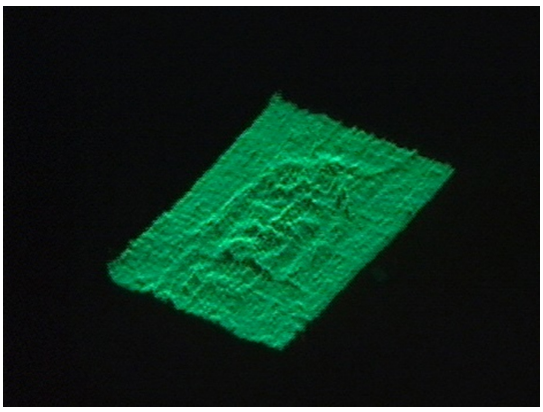

Figure 1. The Shroud face as it appears on the screen of a VP-8 Image Analyser. It is evident the 3D characteristic of the Body Image. ©1977 Barrie M. Schwortz Collection STERA Inc.

2) the obtained data appear very scattered when they are put in the (I, z)-plane.

At the first objection, we answer that the dimensions of the chosen area for the measure are not important. On the contrary, it is necessary to measure in a wide variety of z body-sheet distance values. For the second objection, we, utilizing the 13 pair of values present in the articles of Jackson *et al.*, [23] [24], have deduced a χ^2 reduced (0.53) in line with the presence of scattered data. However, linear regression is the best fit possible. Denying this, it means having an image that does not contain the encoded opportune information on the body-sheet distances. An investigation showed that the distortions are present and consistent with a draping cloth over a full three-dimensional body shape [25].

The fit was made with the image intensity data detected by Vernon Miller (Brooks Institute of Photography, CA) with a microdensitometer in 13 specific locations (points at an estimated body-sheet distance). It was also useful to estimate the range of "discoloration effects" that represents the distance at which the regression line I(z) intersects the average cloth background intensity. The above range is represented by R_0 to which the fit assigns the value of 3.7 cm. Not accepting the above function is like admitting that there is not a correct correlation between the intensity of image I and body-sheet distance z. However, we invite the readers to read the writings of Vignon [26] [27] [28] [29] and Delage [30] regarding this problem.

Now, beyond the consideration made, we have taken into account that the penetration of the protons in air must respect the R_0 value (37 mm) because it represents the range of discoloration effects deduced by the fitting procedure on the Shroud Body Image. Starting from this result, and using the range-energy empirical formula of Wilson and Brobeck [31], we calculated that the energy of the protons emitted by the corpse wrapped in the burial sheet is about 1.5 MeV. At the same time we also used the Bethe formula [32] to get a more correct distance and to make a comparison.

The result, with the Bethe calculation, is E = 1.35 MeV, which is smaller than that deduced using the empirical formula. The comparison shows that to obtain the discoloration effect range of 37 mm with the empirical formula, it is necessary to have protons with an energy that exceeds the Bethe analogue by 11%. Therefore, for us who have made a rough calculation [20] in order to deduce that protons are not the suitable choice for getting an image like the one on the Shroud, we did well.

Now, to respect the 3.7 cm of discoloration effects range, we correctly use for the energy of the protons the value deduced by Bethe: 1.35 MeV. Consequently, we ask ourselves: is this energy compatible with the penetration depth value in the linen of the Shroud in the Body Image region? We think that this value of kinetic energy does not agree with the thickness of the primary cell wall (the penetration depth) of the Shroud Body Image.

Therefore, there is the impossibility of the protons yielding an image like the one on the Shroud of Turin. In simple words, a proton with energy that satisfies

the range of discoloration effects turns out to be excessive to respect the penetration depth into the Shroud linen. On the contrary, a proton with sufficient energy to penetrate the linen until 200 nm is unable to cover the range of the effects of discoloration. In fact, the energy of proton E* necessary to penetrate, in the right way, the burial cloth is of the order of the hundred KeV.

3. Correlation I(z) in the Proton Case

Now, without taking into account that in our case it is impossible to obtain a correlation between the Intensity of colored linen and the distance between the body and the fabric, we consider protons with energy able to reach all the points where the discoloration effects appear. Therefore, we use the empirical formula of Wilson and Brobeck [31] which provides the energy loss of protons ($E(z) = 9.3 \times z^{5/9}$), where E is the protons energy and z the body-sheet distance (or the thickness of air) expressed in MeV and in meters, respectively.

The portion of energy that remained to the protons, that at the start had energy E*, is absorbed by linen at a z distance: $E(z) = E^* - 9.3 \times z^{5/9}$. This energy will produce fibrils colored with intensity proportional to itself.

Therefore, this distribution of energy on the burial sheet is different from the extracted one from the Shroud Body Image that is represented by linear function [23] [24] [33]. Unfortunately, this diversity could not be included with the other features that do not respect the Shroud's Body Image. In fact, the above function is distributed in a little range of 37 mm where the reported data are very scattered. However, this result does not favor the hypothesis radiative by protons. On the contrary, it is in line with the 1), 2) and 3) points. In the sense, it is against the above hypothesis and agrees with the affirmations described in the three points. Therefore, reading the writings of the supporters of the radiative hypothesis triggered by protons [5]-[16], it seems obvious to deduce that the attempts made for the realization of the body image (which should have all the characteristics of the one that appears on the Shroud of Turin) have been useless.

To investigate the protons in the above interactions, we used empirical formulas, like the one of William and Brobeck [31], obtaining good results. These were already sufficient to affirm that the radiative hypothesis is to be discarded [20]. In any case, we had to make, for both scientists and readers, a comparison among the values deduced by two curves of range-energy (the empiric one [31] and the other of Bethe [32]). Successively, we also compared the above values with R_0 that represents the range of discoloration effects (beyond there is no coloring on the flax fibrils). The difference between the two calculated values [31] [32] is much smaller than the one of both compared to the value of R_0. For example, with protons of 400 KeV, we have about $R_{W\&B} \approx 3.5$ mm, $R_{BETHE} \approx 6$ mm and, obviously, $R_0 = 37$ mm.

Therefore, along the body-sheet distances, the values of both range-energy curves show, at a fixed energy, small differences between them with respect to the one of both with the value of the discoloration effects. The protons are not the ap-

propriate path to arrive at the formation of an image.

4. Conclusions

For several decades, no less than four, the interest of many scholars of the radiative hypothesis as a possible mechanism of Shroud Body Image formation, has not changed. On the contrary, one gets the impression that such an interest grows. In scientific literature, on the above argument, there are many articles that show differences among them and all appear as if these writings are self-sustaining and generated by the same mechanism: the "Radiative Hypothesis".

In reality, it is not so. The readers, especially those far from the world of nuclear physics, are certainly confused among particles, electromagnetic radiations, energies of the above involved particles, wavelengths and the different, often complex, reconstructions that for us are a Miracle that has the purpose to explain another Miracle.

However, the synthesis of this puzzle can be extracted by reading the following:

1) The emission of subatomic particles (protons) by a corpse wrapped in a burial sheet is something inconceivable. It is known to all that human beings can only emit thermal radiation.

2) The particles are not able to hit the fibrils that have to produce the body image, leaving the background color for the others.

3) The layer of air present in the no-contact region acts to modify the physical state of the particles. The above layer coincides with the body-sheet distance.

4) It is possible finding the proton energy that penetrates the fibrils of linen for 200 nm. Unfortunately, the same cannot cover the range of discoloration effects and vice versa.

5) The eventual correlation between the color intensity and the body-sheet distance is not a linear regression. This point, as we have seen, is the least incisive for a critique. However, it is always contrary to the radiative hypothesis.

6) Even from a theological point of view, the content of (1) cannot be accepted. In fact, the Miracles are done only by God, the Omnipotent. They are instantaneous events, therefore, incomprehensible to the natural sciences.

For us the conclusion can only be one: it is impossible that protons of any kinetic energy value can yield an image on a linen used to experiment.

So, at this point, a question must be asked: why are there so many different visions in the scientific literature? The mechanisms for training the Body Image, that appear on the Shroud of Turin, are many and they range from the false to the Miracle, passing through the natural one. Why, after about twelve decades, are we far from a solution that could be accepted by almost everyone? In the end, the answer is only one, very simple: at the base of this puzzle there is a conflict of interest which slows down, almost blocks, the achievement of the result [34].

In other words, often the laws of natural sciences, that describe the macros-

copic and microscopic world, are abandoned and replaced by hypotheses that have no scientific support but which allow us to achieve the set objectives. We think that in these cases there is the need to obtain a result without influences due to faith or no faith. Among us researchers there is great confusion. In fact, we had already written that with this situation to researchers, and it seems to be in a Tower of Babel.

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Conflicts of Interest

Regarding the publication of this article, the Author declares no conflicts of interest.

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