The Shroud of Turin and the bilirubin blood stains

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1. Introduction

Prof. Pierluigi Baima Bollone has shown that the stains on the Shroud of Turin are human blood group AB. From a biochemical viewpoint, John Heller and Alan Adler have identified on the same clots not only haemoglobin but also other specific compounds of blood and, among other things, the presence of bilirubin in significant quantities. Bilirubin, a component of blood, comes from the catabolism of haemoglobin and, arriving into the liver, is poured from the liver into the bile.

The high concentration of bilirubin in the blood stains of the Shroud could find an explanation from the many traumas suffered, before his death, by the man wrapped in the Shroud. On one hand, the presence of this component enhances the presence of blood on the Shroud, on the other hand allows some researchers to assign to the bilirubin, as well as to aloes and myrrh, the unusual bright red colour taken under special circumstances by those bloodstains.

2. The effect of bilirubin

The relationship between the levels of bilirubin and the specific colour of blood remained for a long time in a state of supposition. Still in the year 2000, at the International Symposium in Turin, Baima Bollone said that "*The persistence of the red colour (of blood) may be originated from the materials used to preserve the body by corruption (preserving materials) or from the documented presence of bilirubin"*. **1**

Carlo Goldoni and Tina Grimaldi, coordinated by Mario Moroni, have carried out a series of tests in order to verify the supposed relationship between the colour of blood and the presence of bilirubin: in these experiments they artificially produced human blood clots

containing increasing amounts of bilirubin in an approximate concentration from 2 to 5 times greater than the normal physiological concentration. **2,3**

The decals were carried out on fragments of a shroud-like twilled linen cloth treated with an aqueous solution of aloe, myrrh and artificial sweat. The blood was taken from healthy donors. After having added calcium salts for the re-coagulation, they waited 4-5 hours before running the blood-cloth juxtaposition. Only in that way it was possible to obtain sharp decals with serum halos visible at the ultraviolet light.

From these decals we obtained three sets of samples with increasing concentration of bilirubin: one was maintained as it was, one was aged 10 hours in a stove at the temperature of 120°C, and one was exposed to ultraviolet radiation (365 nm) for 6 hours and kept under continuous observation.

The visual examination of the two first sets of samples was not able to catch any colour change on the many different concentrations of bilirubin. The visual inspection was confirmed by a spectrographic examination. In the third set of sample the blood stains of all decals, after 6 hours of irradiation, took a bright red colour. (Fig.1)

3. The previous observations

Coming back to the Shroud it is important to note that the bright-red colour of blood, visible on the cloth, is connected with an exposure to ultraviolet rays. This last result was in agreement with many previous observations.

The doctor of medicine Pierre Barbet**4** had noticed the intense colour "carmine-mauve" in accordance with the definition given by Vignon, while "the sun was just down in a bright but widespread lighting" that he deemed to be "ideal for making observations".

Later on, in the final report prepared by experts of the Committee established by Cardinal Michele Pellegrino, regarding the haematological investigation performed on the Shroud in the period 1969-1976, we can read the following:**5** "While the experts were intent on doing this first examination of the Holy Shroud, Antoine Legrand and Dr. Galimard, well known French scholars on the Shroud, who were purposely arrived in Turin, asked to be allowed to see the Relic.

Antoine Legrand noticed a difference from what he had the opportunity to observe during the Exposition of 1931. He was struck by the fact that it was no longer visible in a significant way the red carmine colour of the blood stains which was described by various authors. He pointed out that the previous exposition was held on the steps of the Cathedral in the open air and by the light of the sun.

Mr. Judica was invited to enlighten the Holy Shroud with the same lamp (an Osram Mittraphot lamp with a colour temperature of 3200 Kelvin) used during the examination of 1969, when that chromatic tone was noted: immediately the above mentioned tone of colour became evident".

Also one of the Authors, who participated in the private Exposition of the Scientific Symposium held in Turin on 2-5 March 2000, was very impressed by observing, at a distance of one meter, the red colour taken by the wounds of the Man of the Shroud, on the cloth spread-out without the protective glass, illuminated by a diffused natural lighting coming from the windows of the room located at the top.

In any case, if the change of colour becomes visible to sunlight, it seems reasonable to assume the occurrence of an external action that could be caused by a kind of radiation. Regarding the ultraviolet irradiations Goldoni said "In fact, it is known that the irradiation of blood with ultraviolet light transforms normal and pathological quantities of bilirubin in similar compounds such as lumirubin and isolumirubin.

4. New experiences

We have to say in advance that in order to answer the problem of the formation of the image as well as the apparent radiocarbon rejuvenation of the Shroud linen, prof. Jean Baptiste Rinaudo, of the Faculty of Medicine of Montpèllier, developed a model according to which an energy was released during the Resurrection that would have produced the disintegration of the deuterium nuclei present on the body surface and would therefore generated protons and neutrons. **6**,**7**

The first ones would be the cause of the image, the second would be the cause of an increase in the 14C content.

The research group theory, has started since many years a fruitful collaboration with prof. Rinaudo. During the experimental researches many points were achieved in favour of the initial hypothesis. A brief summary of the results obtained is shown in the report submitted to "The Third International Dallas Conference on the Shroud of Turin" held in September 2005. **8**

For that reason, it was considered that the colouring observed under special circumstances on the blood decals could have originated from a neutron irradiation of the cloth.

Therefore some blood samples with contents of bilirubin higher than the physiological limits, onceagainpreparedbyCarloGoldoni, were irradiated with neutrons. The irradiation dose was the one related to the corresponding dose of protons necessary to obtain, after heat treatment in an oven, a colour that the spectroreflectometric analysis indicated as comparable to that visible on the Shroud (2.59 x 1013 n/cm2).

Such a treatment did not cause any colour change in the blood stains. However, the following irradiation in the UV-next showed, after exposure of only 30 minutes, a sharp change towards the bright red colour regardless the bilirubin excess in each samples (Fig. 2)

Therefore we can assume that the neutron irradiation caused an upset in the blood at the molecular level that facilitates the subsequent penetration of the UV rays used after the neutron irradiation. The same physical- chemical situation could occur in the blood of the Shroud when it is exposed to sunlight (rich in UV rays) causing the transition from the rust colour, commonly seen in old blood stains, to the bright red colour.

NOTES

[1] P.L. Baima Bollone: "The forensic characteristics of the blood marks," International Scientific Symposium - "The Turin Shroud - past, present and future." Turin, 2-5 March 2000, Sindon - Effetà, 2000.

[2] C. Goldoni, T, Di Marco Grimaldi, M. Moroni: "*Sindone: raffronto tra il singolare colore delle macchie di sangue e la concentrazione di bilirubina in esso. Prime investigazion*i" (Shroud: comparison between the peculiar colour stains of blood and the concentration of bilirubin in it. First investigations) "Sindon N.S., book. n.14, December 2000, pp.131-146.

[3] Dr. Goldoni stated that in his tests he did not exceed more than five times the physiological concentration of bilirubin because "he did not feel to postulate an intense jaundice either in the Christ of the Gospels or in the Man of the Shroud." In fact, already at such a concentration limit, we have "a yellowish colour of the sclera and a yellowing of the skin" Moreover, also the blood serum "shows a peculiar greenish-yellow colouring".

[4] P. Barbet : "Le cinque piaghe di Cristo" (The five wounds of Christ) , SEI, Turin, 1940.

[5] G G. Frache, E. Mari Rizzatti, E. Mari: " *Relazione conclusiva sulle indagini d'ordine ematologico praticate su materiale prelevato dalla Sindone* " (Conclusive report on the haematological investigations

practiced on material taken from the Shroud) in ""*Osservazioni alla perizie ufficiali sulla Santa Sindone 1969-1976*" (Comments on the official expertises on the Holy Shroud), International Sindonology Centre , Turin, 1976.

6 J.B.Rinaudo: "*Image formation on the Shroud of Turin explained by a protonic model affecting the radiocarbon dating",* III International Congress on the Shroud, Turin 5-7 June 1998.

7 J.B.Rinaudo: "*Protoni e neutroni: le due chiavi dell'enigma*" (Proton and neutrons: the two keys of the enigma) IL TELO, year III, n° 2, May-August 1999.

8 M. Moroni - F. Barbesino: "*Different formation mechanisms of the bloodstains and the body image on the Shroud of Turin*", The Third International Dallas Conference on the Shroud of Turin, Dallas, Texas, September 8-11, 2005.

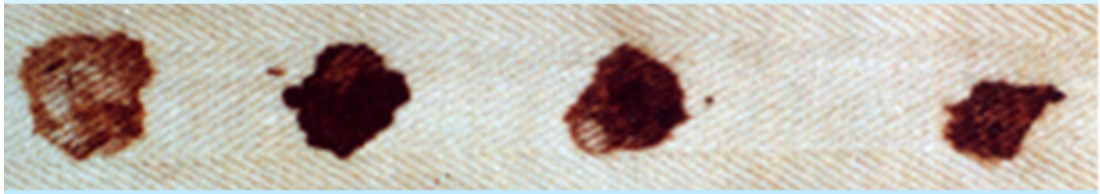
Presentation

5. Experiments with bilirubin

The decals of human blood obtained from healthy donors, having increasing amounts of bilirubin, were obtained on samples of a Shroud-like cloth treated with an aqueous solution of aloe, myrrh, artificial sweat and calcium salts.

After 4-5 hours, necessary for the re-coagulation, the blood-cloth juxtaposition was run. It was so possible to obtain sharp decals with serum halos, visible at the ultraviolet light.

Three sets of samples with increasing concentration of bilirubin were obtained.

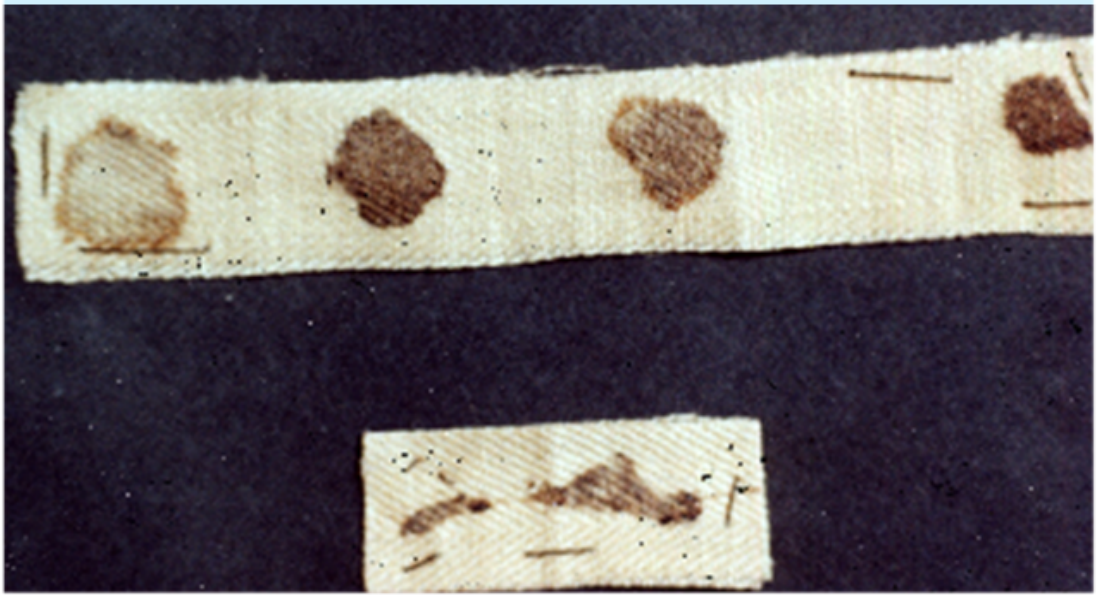


5. Experiments with bilirubin

-Set 1 as described.

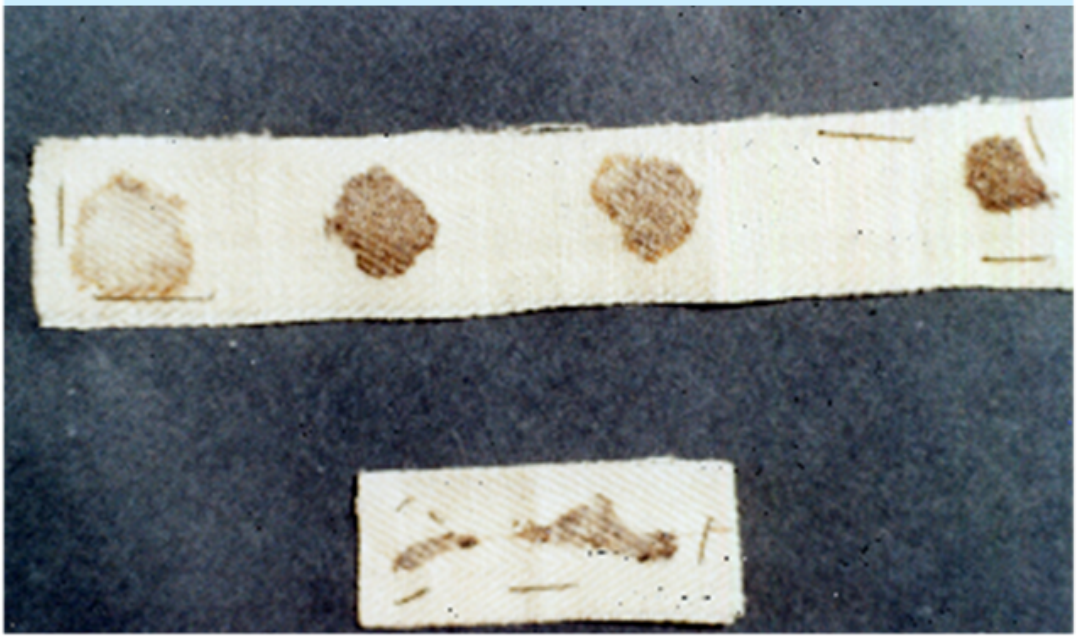
5. Experiments with bilirubin

- Set 2 was aged for 10 hours in a stove at the temperature of 120°C.



5. Experiments with bilirubin

-Set 3 was exposed to ultraviolet radiation (365 nm) for 6 hours.



5. Experiments with bilirubin

- Set 1 as described.
- Set 2 was aged for 10 hours in a stove at the temperature of 120°C
-Set 3 was exposed to ultraviolet radiation (365 nm) for 6 hours.

No color change was detected for Sets 1 and 2.
Set 3 after 6 hours of UV irradiation, took a bright red colour, but this time seemed too in excess in reference to the observations made on the Shroud.

Set 1 Set 2 Set 3

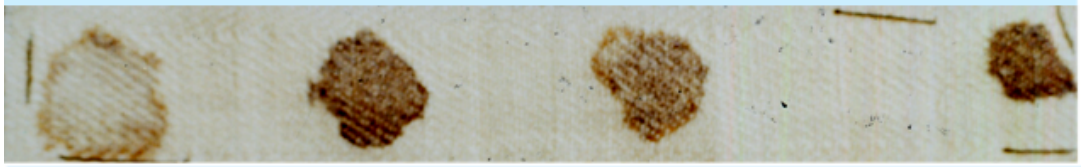
7. Experiments with neutrons and UV

Some blood samples with high contents of bilirubin, were irradiated with neutrons.

The irradiation dose was the one related to the corresponding dose of protons necessary to obtain a colour comparable to that visible on the Shroud (2.59×10^{13} n/cm^2).

Such a treatment did not cause any colour change in the blood stains.

However, the following irradiation in the UV-next showed, after exposure of only 30 minutes, a sharp change towards the bright red colour regardless the bilirubin excess in each samples. The time of 30 minutes is is in agreement with the observations made on the Shroud.



Conclusions

The **redness** of the Shroud blood has been considered also with experimental results.

The **bilirubin**, also in concentration higher than the physiological one, **does not alter the blood color**.

A previous **neutron radiation** causes a **bright red color** of the bloodstains only after the exposition to **UV rays** for few tens of minutes.

The neutron irradiation caused an upset in the blood at the molecular level. The **same** physical-chemical situation could occur in the **Shroud blood exposed to sunlight** (rich in UV rays) causing the transition from the rust colour to the bright red colour.